FANUC Robot series

R-30*i*B/R-30*i*B Plus CONTROLLER

MAINTENANCE MANUAL

MAREBCNTR04121E REV. I

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This equipment generates, uses, and can radiate radiofrequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J and Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of the equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measure may be required to correct the interference.

FANUC conducts courses on its systems and products on a regularly scheduled basis at the company's world headquarters in Rochester Hills, Michigan. For additional information contact

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For customer assistance, including Technical Support, Service, Parts & Part Repair, and Marketing Requests, contact the Customer Resource Center, 24 hours a day, at 1-800-47-ROBOT (1-800-477-6268). International customers should call 011-1-248-377-7159.

Send your comments and suggestions about this manual to:
product.documentation@fanucamerica.com

Patents

One or more of the following U.S. patents might be related to the FANUC products described in this manual.

FANUC America Corporation Patent List

4,630,567 4,639,878 4,707,647 4,708,175 4,708,580 4,942,539 4,984,745 5,238,029 5,239,739 5,272,805 5,293,107 5,293,911 5,331,264 5,367,944 5,373,221 5,421,218 5,434,489 5,644,898 5,670,202 5,696,687 5,737,218 5,823,389 5,853,027 5,887,800 5,941,679 5,959,425 5,987,726 6,059,092 6,064,168 6,070,109 6,086,294 6,122,062 6,147,323 6,204,620 6,243,621 6,253,799 6,285,920 6,313,595 6,325,302 6,345,818 6,356,807 6,360,143 6,378,190 6,385,508 6,425,177 6,477,913 6,490,369 6,518,980 6,540,104 6,541,757 6,560,513 6,569,258 6,612,449 6,703,079 6,705,361 6,726,773 6,768,078 6,845,295 6,945,483 7,149,606 7,149,606 7,211,978 7,266,422 7,399,363

FANUC CORPORATION Patent List

4,571,694 4,626,756 4,700,118 4,706,001 4,728,872 4,732,526 4,742,207 4,835,362 4,894,596 4,899,095 4,920,248 4,931,617 4,934,504 4,956,594 4,967,125 4,969,109 4,970,370 4,970,448 4,979,127 5,004,968 5,006,035 5,008,834 5,063,281 5,066,847 5,066,902 5,093,552 5,107,716 5,111,019 5,130,515 5,136,223 5,151,608 5,170,109 5,189,351 5,267,483 5,274,360 5,292,066 5,300,868 5,304,906 5,313,563 5,319,443 5,325,467 5,327,057 5,329,469 5,333,242 5,337,148 5,371,452 5,375,480 5,418,441 5,432,316 5,440,213 5,442,155 5,444,612 5,449,875 5,451,850 5,461,478 5,463,297 5,467,003 5,471,312 5,479,078 5,485,389 5,485,552 5,486,679 5,489,758 5,493,192 5,504,766 5,511,007 5,520,062 5,528,013 5,532,924 5,548,194 5,552,687 5,558,196 5,561,742 5,570,187 5,570,190 5,572,103 5,581,167 5,582,750 5,587,635 5,600,759 5,608,299 5,608,618 5,624,588 5,630,955 5,637,969 5,639,204 5,641,415 5,650,078 5,658,121 5,668,628 5,687,295 5,691,615 5,698,121 5,708,342 5,715,375 5,719,479 5,727,132 5,742,138 5,742,144 5,748,854 5,749,058 5,760,560 5,773,950 5,783,922 5,799,135 5,812,408 5,841,257 5,845,053 5,872,894 5,887,122 5,911,892 5,912,540 5,920,678 5,937,143 5,980,082 5,983,744 5,987,591 5,988,850 6,023,044 6,032,086 6,040,554 6,059,169 6,088,628 6,097,169 6,114,824 6,124,693 6,140,788 6,141,863 6,157,155 6,160,324 6,163,124 6,177,650 6,180,898 6,181,096 6,188,194 6,208,105 6,212,444 6,219,583 6,226,181 6,236,011 6,236,896 6,250,174 6,278,902 6,279,413 6,285,921 6,298,283 6,321,139 6,324,443 6,328,523 6,330,493 6,340,875 6,356,671 6,377,869 6,382,012 6,384,371 6,396,030 6,414,711 6,424,883 6,431,018 6,434,448 6,445,979 6,459,958 6,463,358 6,484,067 6,486,629 6,507,165 6,654,666 6,665,588 6,680,461 6,696,810 6,728,417 6,763,284 6,772,493 6,845,296 6,853,881 6,888,089 6,898,486 6,917,837 6,928,337 6,965,091 6,970,802 7,038,165 7,069,808 7,084,900 7,092,791 7,133,747 7,143,100 7,149,602 7,131,848 7,161,321 7,171,041 7,174,234 7,173,213 7,177,722 7,177,439 7,181,294 7,181,313 7,280,687 7,283,661 7,291,806 7,299,713 7,315,650 7,324,873 7,328,083 7,330,777 7,333,879 7,355,725 7,359,817 7,373,220 7,376,488 7,386,367 7,464,623 7,447,615 7,445,260 7,474,939 7,486,816 7,495,192 7,501,778 7,502,504 7,508,155 7,512,459 7,525,273 7,526,121

Conventions

⚠WARNING

Information appearing under the "WARNING" caption concerns the protection of personnel. It is boxed and bolded to set it apart from the surrounding text.

⚠CAUTION

Information appearing under the "CAUTION" caption concerns the protection of equipment, software, and data. It is boxed and bolded to set it apart from the surrounding text.

Note Information appearing next to NOTE concerns related information or useful hints.

• Original Instructions

Thank you very much for purchasing FANUC Robot.
Before using the Robot, be sure to read the "FANUC Robot SAFETY HANDBOOK (B-80687EN)" and understand the content.

The products in this manual are controlled based on Japan's “Foreign Exchange and Foreign Trade Law". The export from Japan may be subject to an export license by the government of Japan. Further, re-export to another country may be subject to the license of the government of the country from where the product is re-exported. Furthermore, the product may also be controlled by re-export regulations of the United States government.
Should you wish to export or re-export these products, please contact FANUC for advice.

The products in this manual are manufactured under strict quality control. However, when using any of the products in a facility in which a serious accident or loss is predicted due to a failure of the product, install a safety device.

In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible".

Safety

FANUC America Corporation is not and does not represent itself as an expert in safety systems, safety equipment, or the specific safety aspects of your company and/or its work force. It is the responsibility of the owner, employer, or user to take all necessary steps to guarantee the safety of all personnel in the workplace.

The appropriate level of safety for your application and installation can be best determined by safety system professionals. FANUC America Corporation therefore, recommends that each customer consult with such professionals in order to provide a workplace that allows for the safe application, use, and operation of FANUC America Corporation systems.

According to the industry standard ANSI/RIA R15-06, the owner or user is advised to consult the standards to ensure compliance with its requests for Robotics System design, usability, operation, maintenance, and service. Additionally, as the owner, employer, or user of a robotic system, it is your responsibility to arrange for the training of the operator of a robot system to recognize and respond to known hazards associated with your robotic system and to be aware of the recommended operating procedures for your particular application and robot installation.

Ensure that the robot being used is appropriate for the application. Robots used in classified (hazardous) locations must be certified for this use.

FANUC America Corporation therefore, recommends that all personnel who intend to operate, program, repair, or otherwise use the robotics system be trained in an approved FANUC America Corporation training course and become familiar with the proper operation of the system. Persons responsible for programming the system–including the design, implementation, and debugging of application programs–must be familiar with the recommended programming procedures for your application and robot installation.

The following guidelines are provided to emphasize the importance of safety in the workplace.

CONSIDERING SAFETY FOR YOUR ROBOT INSTALLATION

Safety is essential whenever robots are used. Keep in mind the following factors with regard to safety:

- The safety of people and equipment
- Use of safety enhancing devices
- Techniques for safe teaching and manual operation of the robot(s)
- Techniques for safe automatic operation of the robot(s)
- Regular scheduled inspection of the robot and workcell
- Proper maintenance of the robot

Keeping People Safe

The safety of people is always of primary importance in any situation. When applying safety measures to your robotic system, consider the following:

- External devices
- Robot(s)
- Tooling
- Workpiece

Using Safety Enhancing Devices

Always give appropriate attention to the work area that surrounds the robot. The safety of the work area can be enhanced by the installation of some or all of the following devices:

- Safety fences, barriers, or chains
- Light curtains
- Interlocks
- Pressure mats
- Floor markings
- Warning lights
- Mechanical stops
- EMERGENCY STOP buttons
- DEADMAN switches

Setting Up a Safe Workcell

A safe workcell is essential to protect people and equipment. Observe the following guidelines to ensure that the workcell is set up safely. These suggestions are intended to supplement and not replace existing federal, state, and local laws, regulations, and guidelines that pertain to safety.

- Sponsor your personnel for training in approved FANUC America Corporation training course(s) related to your application. Never permit untrained personnel to operate the robots.
- Install a lockout device that uses an access code to prevent unauthorized persons from operating the robot.
- Use anti–tie–down logic to prevent the operator from bypassing safety measures.
- Arrange the workcell so the operator faces the workcell and can see what is going on inside the cell.
- Clearly identify the work envelope of each robot in the system with floor markings, signs, and special barriers. The work envelope is the area defined by the maximum motion range of the robot, including any tooling attached to the wrist flange that extend this range.

- Position all controllers outside the robot work envelope.
- Never rely on software or firmware based controllers as the primary safety element unless they comply with applicable current robot safety standards.
- Mount an adequate number of EMERGENCY STOP buttons or switches within easy reach of the operator and at critical points inside and around the outside of the workcell.
- Install flashing lights and/or audible warning devices that activate whenever the robot is operating, that is, whenever power is applied to the servo drive system. Audible warning devices shall exceed the ambient noise level at the end–use application.
- Wherever possible, install safety fences to protect against unauthorized entry by personnel into the work envelope.
- Install special guarding that prevents the operator from reaching into restricted areas of the work envelope.
- Use interlocks.
- Use presence or proximity sensing devices such as light curtains, mats, and capacitance and vision systems to enhance safety.
- Periodically check the safety joints or safety clutches that can be optionally installed between the robot wrist flange and tooling. If the tooling strikes an object, these devices dislodge, remove power from the system, and help to minimize damage to the tooling and robot.
- Make sure all external devices are properly filtered, grounded, shielded, and suppressed to prevent hazardous motion due to the effects of electro–magnetic interference (EMI), radio frequency interference (RFI), and electro–static discharge (ESD).
- Make provisions for power lockout/tagout at the controller.
- Eliminate *pinch points*. Pinch points are areas where personnel could get trapped between a moving robot and other equipment.
- Provide enough room inside the workcell to permit personnel to teach the robot and perform maintenance safely.
- Program the robot to load and unload material safely.
- If high voltage electrostatics are present, be sure to provide appropriate interlocks, warning, and beacons.
- If materials are being applied at dangerously high pressure, provide electrical interlocks for lockout of material flow and pressure.

Staying Safe While Teaching or Manually Operating the Robot

Advise all personnel who must teach the robot or otherwise manually operate the robot to observe the following rules:

- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.
- Know whether or not you are using an intrinsically safe teach pendant if you are working in a hazardous environment.

- Before teaching, visually inspect the robot and work envelope to make sure that no potentially hazardous conditions exist. The work envelope is the area defined by the maximum motion range of the robot. These include tooling attached to the wrist flange that extends this range.
- The area near the robot must be clean and free of oil, water, or debris. Immediately report unsafe working conditions to the supervisor or safety department.
- FANUC America Corporation recommends that no one enter the work envelope of a robot that is on, except for robot teaching operations. However, if you must enter the work envelope, be sure all safeguards are in place, check the teach pendant DEADMAN switch for proper operation, and place the robot in teach mode. Take the teach pendant with you, turn it on, and be prepared to release the DEADMAN switch. Only the person with the teach pendant should be in the work envelope.

WARNING

Never bypass, strap, or otherwise deactivate a safety device, such as a limit switch, for any operational convenience. Deactivating a safety device is known to have resulted in serious injury and death.

- Know the path that can be used to escape from a moving robot; make sure the escape path is never blocked.
- Isolate the robot from all remote control signals that can cause motion while data is being taught.
- Test any program being run for the first time in the following manner:

WARNING

Stay outside the robot work envelope whenever a program is being run. Failure to do so can result in injury.

  - Using a low motion speed, single step the program for at least one full cycle.
  - Using a low motion speed, test run the program continuously for at least one full cycle.
  - Using the programmed speed, test run the program continuously for at least one full cycle.
- Make sure all personnel are outside the work envelope before running production.

Staying Safe During Automatic Operation

Advise all personnel who operate the robot during production to observe the following rules:

- Make sure all safety provisions are present and active.

- Know the entire workcell area. The workcell includes the robot and its work envelope, plus the area occupied by all external devices and other equipment with which the robot interacts.
- Understand the complete task the robot is programmed to perform before initiating automatic operation.
- Make sure all personnel are outside the work envelope before operating the robot.
- Never enter or allow others to enter the work envelope during automatic operation of the robot.
- Know the location and status of all switches, sensors, and control signals that could cause the robot to move.
- Know where the EMERGENCY STOP buttons are located on both the robot control and external control devices. Be prepared to press these buttons in an emergency.
- Never assume that a program is complete if the robot is not moving. The robot could be waiting for an input signal that will permit it to continue its activity.
- If the robot is running in a pattern, do not assume it will continue to run in the same pattern.
- Never try to stop the robot, or break its motion, with your body. The only way to stop robot motion immediately is to press an EMERGENCY STOP button located on the controller panel, teach pendant, or emergency stop stations around the workcell.

Staying Safe During Inspection

When inspecting the robot, be sure to

- Turn off power at the controller.
- Lock out and tag out the power source at the controller according to the policies of your plant.
- Turn off the compressed air source and relieve the air pressure.
- If robot motion is not needed for inspecting the electrical circuits, press the EMERGENCY STOP button on the operator panel.
- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.
- If power is needed to check the robot motion or electrical circuits, be prepared to press the EMERGENCY STOP button, in an emergency.
- Be aware that when you remove a servomotor or brake, the associated robot arm will fall if it is not supported or resting on a hard stop. Support the arm on a solid support before you release the brake.

Staying Safe During Maintenance

When performing maintenance on your robot system, observe the following rules:

- Never enter the work envelope while the robot or a program is in operation.
- Before entering the work envelope, visually inspect the workcell to make sure no potentially hazardous conditions exist.

- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.
- Consider all or any overlapping work envelopes of adjoining robots when standing in a work envelope.
- Test the teach pendant for proper operation before entering the work envelope.
- If it is necessary for you to enter the robot work envelope while power is turned on, you must be sure that you are in control of the robot. Be sure to take the teach pendant with you, press the DEADMAN switch, and turn the teach pendant on. Be prepared to release the DEADMAN switch to turn off servo power to the robot immediately.
- Whenever possible, perform maintenance with the power turned off. Before you open the controller front panel or enter the work envelope, turn off and lock out the 3–phase power source at the controller.
- Be aware that when you remove a servomotor or brake, the associated robot arm will fall if it is not supported or resting on a hard stop. Support the arm on a solid support before you release the brake.

WARNING

Lethal voltage is present in the controller WHENEVER IT IS CONNECTED to a power source. Be extremely careful to avoid electrical shock. HIGH VOLTAGE IS PRESENT at the input side whenever the controller is connected to a power source. Turning the disconnect or circuit breaker to the OFF position removes power from the output side of the device only.

- Release or block all stored energy. Before working on the pneumatic system, shut off the system air supply and purge the air lines.
- Isolate the robot from all remote control signals. If maintenance must be done when the power is on, make sure the person inside the work envelope has sole control of the robot. The teach pendant must be held by this person.
- Make sure personnel cannot get trapped between the moving robot and other equipment. Know the path that can be used to escape from a moving robot. Make sure the escape route is never blocked.
- Use blocks, mechanical stops, and pins to prevent hazardous movement by the robot. Make sure that such devices do not create pinch points that could trap personnel.

WARNING

Do not try to remove any mechanical component from the robot before thoroughly reading and understanding the procedures in the appropriate manual. Doing so can result in serious personal injury and component destruction.

- Be aware that when you remove a servomotor or brake, the associated robot arm will fall if it is not supported or resting on a hard stop. Support the arm on a solid support before you release the brake.
- When replacing or installing components, make sure dirt and debris do not enter the system.
- Use only specified parts for replacement. To avoid fires and damage to parts in the controller, never use nonspecified fuses.
- Before restarting a robot, make sure no one is inside the work envelope; be sure that the robot and all external devices are operating normally.

KEEPING MACHINE TOOLS AND EXTERNAL DEVICES SAFE

Certain programming and mechanical measures are useful in keeping the machine tools and other external devices safe. Some of these measures are outlined below. Make sure you know all associated measures for safe use of such devices.

Programming Safety Precautions

Implement the following programming safety measures to prevent damage to machine tools and other external devices.

- Back–check limit switches in the workcell to make sure they do not fail.
- Implement ‘‘failure routines” in programs that will provide appropriate robot actions if an external device or another robot in the workcell fails.
- Use *handshaking* protocol to synchronize robot and external device operations.
- Program the robot to check the condition of all external devices during an operating cycle.

Mechanical Safety Precautions

Implement the following mechanical safety measures to prevent damage to machine tools and other external devices.

- Make sure the workcell is clean and free of oil, water, and debris.
- Use DCS (Dual Check Safety), software limits, limit switches, and mechanical hardstops to prevent undesired movement of the robot into the work area of machine tools and external devices.

KEEPING THE ROBOT SAFE

Observe the following operating and programming guidelines to prevent damage to the robot.

Operating Safety Precautions

The following measures are designed to prevent damage to the robot during operation.

- Use a low override speed to increase your control over the robot when jogging the robot.
- Visualize the movement the robot will make before you press the jog keys on the teach pendant.
- Make sure the work envelope is clean and free of oil, water, or debris.
- Use circuit breakers to guard against electrical overload.

Programming Safety Precautions

The following safety measures are designed to prevent damage to the robot during programming:

- Establish *interference zones* to prevent collisions when two or more robots share a work area.
- Make sure that the program ends with the robot near or at the home position.
- Be aware of signals or other operations that could trigger operation of tooling resulting in personal injury or equipment damage.
- In dispensing applications, be aware of all safety guidelines with respect to the dispensing materials.

NOTE: Any deviation from the methods and safety practices described in this manual must conform to the approved standards of your company. If you have questions, see your supervisor.

ADDITIONAL SAFETY CONSIDERATIONS FOR PAINT ROBOT INSTALLATIONS

Process technicians are sometimes required to enter the paint booth, for example, during daily or routine calibration or while teaching new paths to a robot. Maintenance personnel also must work inside the paint booth periodically.

Whenever personnel are working inside the paint booth, ventilation equipment must be used. Instruction on the proper use of ventilating equipment usually is provided by the paint shop supervisor.

Although paint booth hazards have been minimized, potential dangers still exist. Therefore, today's highly automated paint booth requires that process and maintenance personnel have full awareness of the system and its capabilities. They must understand the interaction that occurs between the vehicle moving along the conveyor and the robot(s), hood/deck and door opening devices, and high–voltage electrostatic tools.

CAUTION

Ensure that all ground cables remain connected. Never operate the paint robot with ground provisions disconnected. Otherwise, you could injure personnel or damage equipment.

Paint robots are operated in three modes:

- Teach or manual mode
- Automatic mode, including automatic and exercise operation
- Diagnostic mode

During both teach and automatic modes, the robots in the paint booth will follow a predetermined pattern of movements. In teach mode, the process technician teaches (programs) paint paths using the teach pendant.

In automatic mode, robot operation is initiated at the System Operator Console (SOC) or Manual Control Panel (MCP), if available, and can be monitored from outside the paint booth. All personnel must remain outside of the booth or in a designated safe area within the booth whenever automatic mode is initiated at the SOC or MCP.

In automatic mode, the robots will execute the path movements they were taught during teach mode, but generally at production speeds.

When process and maintenance personnel run diagnostic routines that require them to remain in the paint booth, they must stay in a designated safe area.

Paint System Safety Features

Process technicians and maintenance personnel must become totally familiar with the equipment and its capabilities. To minimize the risk of injury when working near robots and related equipment, personnel must comply strictly with the procedures in the manuals.

This section provides information about the safety features that are included in the paint system and also explains the way the robot interacts with other equipment in the system.

The paint system includes the following safety features:

- Most paint booths have red warning beacons that illuminate when the robots are armed and ready to paint. Your booth might have other kinds of indicators. Learn what these are.

- Some paint booths have a blue beacon that, when illuminated, indicates that the electrostatic devices are enabled. Your booth might have other kinds of indicators. Learn what these are.
- EMERGENCY STOP buttons are located on the robot controller and teach pendant. Become familiar with the locations of all E–STOP buttons.
- An intrinsically safe teach pendant is used when teaching in hazardous paint atmospheres.
- A DEADMAN switch is located on each teach pendant. When this switch is held in, and the teach pendant is on, power is applied to the robot servo system. If the engaged DEADMAN switch is released or pressed harder during robot operation, power is removed from the servo system, all axis brakes are applied, and the robot comes to an EMERGENCY STOP. Safety interlocks within the system might also E–STOP other robots.

WARNING

An EMERGENCY STOP will occur if the DEADMAN switch is released on a bypassed robot.

- Overtravel by robot axes is prevented by software limits. All of the major and minor axes are governed by software limits. DCS (Dual Check Safety), limit switches and hardstops also limit travel by the major axes.
- EMERGENCY STOP limit switches and photoelectric eyes might be part of your system. Limit switches, located on the entrance/exit doors of each booth, will EMERGENCY STOP all equipment in the booth if a door is opened while the system is operating in automatic or manual mode. For some systems, signals to these switches are inactive when the switch on the SOC is in teach mode.
- When present, photoelectric eyes are sometimes used to monitor unauthorized intrusion through the entrance/exit silhouette openings.
- System status is monitored by computer. Severe conditions result in automatic system shutdown.

Staying Safe While Operating the Paint Robot

When you work in or near the paint booth, observe the following rules, in addition to all rules for safe operation that apply to all robot systems.

WARNING

Observe all safety rules and guidelines to avoid injury.

WARNING

Never bypass, strap, or otherwise deactivate a safety device, such as a limit switch, for any operational convenience. Deactivating a safety device is known to have resulted in serious injury and death.

WARNING

Enclosures shall not be opened unless the area is known to be nonhazardous or all power has been removed from devices within the enclosure. Power shall not be restored after the enclosure has been opened until all combustible dusts have been removed from the interior of the enclosure and the enclosure purged. Refer to the Purge chapter for the required purge time.

- Know the work area of the entire paint station (workcell).
- Know the work envelope of the robot and hood/deck and door opening devices.
- Be aware of overlapping work envelopes of adjacent robots.
- Know where all red, mushroom–shaped EMERGENCY STOP buttons are located.
- Know the location and status of all switches, sensors, and/or control signals that might cause the robot, conveyor, and opening devices to move.
- Make sure that the work area near the robot is clean and free of water, oil, and debris. Report unsafe conditions to your supervisor.
- Become familiar with the complete task the robot will perform BEFORE starting automatic mode.
- Make sure all personnel are outside the paint booth before you turn on power to the robot servo system.
- Never enter the work envelope or paint booth before you turn off power to the robot servo system.
- Never enter the work envelope during automatic operation unless a safe area has been designated.
- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.
- Remove all metallic objects, such as rings, watches, and belts, before entering a booth when the electrostatic devices are enabled.
- Stay out of areas where you might get trapped between a moving robot, conveyor, or opening device and another object.
- Be aware of signals and/or operations that could result in the triggering of guns or bells.
- Be aware of all safety precautions when dispensing of paint is required.
- Follow the procedures described in this manual.

Special Precautions for Combustible Dusts (Powder Paint)

When the robot is used in a location where combustible dusts are found, such as the application of powder paint, the following special precautions are required to insure that there are no combustible dusts inside the robot.

- Purge maintenance air should be maintained at all times, even when the robot power is off. This will insure that dust can not enter the robot.
- A purge cycle will not remove accumulated dusts. Therefore, if the robot is exposed to dust when maintenance air is not present, it will be necessary to remove the covers and clean out any accumulated dust. Do not energize the robot until you have performed the following steps.

1. Before covers are removed, the exterior of the robot should be cleaned to remove accumulated dust.
2. When cleaning and removing accumulated dust, either on the outside or inside of the robot, be sure to use methods appropriate for the type of dust that exists. Usually lint free rags dampened with water are acceptable. Do not use a vacuum cleaner to remove dust as it can generate static electricity and cause an explosion unless special precautions are taken.
3. Thoroughly clean the interior of the robot with a lint free rag to remove any accumulated dust.
4. When the dust has been removed, the covers must be replaced immediately.
5. Immediately after the covers are replaced, run a complete purge cycle. The robot can now be energized.

Staying Safe While Operating Paint Application Equipment

When you work with paint application equipment, observe the following rules, in addition to all rules for safe operation that apply to all robot systems.

WARNING

When working with electrostatic paint equipment, follow all national and local codes as well as all safety guidelines within your organization. Also reference the following standards: NFPA 33 Standards for Spray Application Using Flammable or Combustible Materials, and NFPA 70 National Electrical Code.

- **Grounding**: All electrically conductive objects in the spray area must be grounded. This includes the spray booth, robots, conveyors, workstations, part carriers, hooks, paint pressure pots, as well as solvent containers. Grounding is defined as the object or objects shall be electrically connected to ground with a resistance of not more than 1 megohms.
- **High Voltage**: High voltage should only be on during actual spray operations. Voltage should be off when the painting process is completed. Never leave high voltage on during a cap cleaning process.
- Avoid any accumulation of combustible vapors or coating matter.
- Follow all manufacturer recommended cleaning procedures.
- Make sure all interlocks are operational.

- No smoking.
- Post all warning signs regarding the electrostatic equipment and operation of electrostatic equipment according to NFPA 33 Standard for Spray Application Using Flammable or Combustible Material.
- Disable all air and paint pressure to bell.
- Verify that the lines are not under pressure.

Staying Safe During Maintenance

When you perform maintenance on the painter system, observe the following rules, and all other maintenance safety rules that apply to all robot installations. Only qualified, trained service or maintenance personnel should perform repair work on a robot.

- Paint robots operate in a potentially explosive environment. Use caution when working with electric tools.
- When a maintenance technician is repairing or adjusting a robot, the work area is under the control of that technician. All personnel not participating in the maintenance must stay out of the area.
- For some maintenance procedures, station a second person at the control panel within reach of the EMERGENCY STOP button. This person must understand the robot and associated potential hazards.
- Be sure all covers and inspection plates are in good repair and in place.
- Always return the robot to the ‘‘home’’ position before you disarm it.
- Never use machine power to aid in removing any component from the robot.
- During robot operations, be aware of the robot’s movements. Excess vibration, unusual sounds, and so forth, can alert you to potential problems.
- Whenever possible, turn off the main electrical disconnect before you clean the robot.
- When using vinyl resin observe the following:
  - Wear eye protection and protective gloves during application and removal.
  - Adequate ventilation is required. Overexposure could cause drowsiness or skin and eye irritation.
  - If there is contact with the skin, wash with water.
  - Follow the Original Equipment Manufacturer’s Material Safety Data Sheets.
- When using paint remover observe the following:
  - Eye protection, protective rubber gloves, boots, and apron are required during booth cleaning.
  - Adequate ventilation is required. Overexposure could cause drowsiness.
  - If there is contact with the skin or eyes, rinse with water for at least 15 minutes. Then seek medical attention as soon as possible.
  - Follow the Original Equipment Manufacturer’s Material Safety Data Sheets.

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to ensure the safe use of the robot.
Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.
For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipments installed in a work cell.
In addition, refer to the “FANUC Robot SAFETY HANDBOOK (**B-80687EN)**”.

1 DEFINITON OF USER

The user can be classified as follows.

Operator:
- Turns robot controller power ON/OFF
- Starts robot program from Contact your local FANUC representative

Programmer:
- Operates the robot
- Teaches robot inside the safety fence

Maintenance engineer:
- Operates the robot
- Teaches robot inside the safety fence
- Maintenance (repair, adjustment, replacement)

- An operator cannot work inside the safety fence.
- A programmer, teaching operator, and maintenance engineer can work inside the safety fence. The working activities inside the safety fence include lifting, setting, teaching, adjusting, maintenance, etc.
- To work inside the fence, the person must be trained on proper robot operation.

During the operation, programming, and maintenance of your robotic system, the programmer, teaching operator, and maintenance engineer should take additional care of their safety by using the following safety precautions.

- Use adequate clothing or uniforms during system operation
- Wear safety shoes
- Use helmet

2 NOTATION OF “WARNING”, “CAUTION” and “NOTE”

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "**WARNING**" or "**CAUTION**" according to its severity. Supplementary information is indicated by "**NOTE**". Read the contents of each "**WARNING**", "**CAUTION**" and "**NOTE**" before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

- Check this manual thoroughly, and keep it handy for the future reference.

3 USER SAFETY

User safety is the primary safety consideration. Because it is very dangerous to enter the operating space of the robot during automatic operation, adequate safety precautions must be observed.
The following lists the general safety precautions. Careful consideration must be made to ensure user safety.

(1) Have the robot system users attend the training courses held by FANUC.

FANUC provides various training courses. Contact our sales office for details.

(2) Even when the robot is stationary, it is possible that the robot is still in a ready to move state, and is waiting for a signal. In this state, the robot is regarded as still in motion. To ensure user safety, provide the system with an alarm to indicate visually or aurally that the robot is in motion.
(3) Install a safety fence with a gate so that no user can enter the work area without passing through the gate. Install an interlocking device, a safety plug, and so forth in the safety gate so that the robot is stopped as the safety gate is opened.

The controller is designed to receive this interlocking signal of the door switch. When the gate is opened and this signal received, the controller stops the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type). For connection, see Fig. 3 (b).

(4) Provide the peripheral equipments with appropriate earth (Class A, Class B, Class C, and Class D).
(5) Try to install the peripheral equipments outside the robot operating space.
(6) Draw an outline on the floor, clearly indicating the range of the robot operating space, including the tools such as a hand.
(7) Install a mat switch or photoelectric switch on the floor with an interlock to a visual or aural alarm that stops the robot when a user enters the work area.
(8) If necessary, install a safety lock so that no one except the user in charge can turn on the power of the robot.

The circuit breaker installed in the controller is designed to disable anyone from turning it on when it is locked with a padlock.

(9) When adjusting each peripheral equipment independently, be sure to turn off the power of the robot.
(10) Operators should be ungloved while manipulating the operator panel or teach pendant. Operation with gloved fingers could cause an operation error.
(11) Programs, system variables, and other information can be saved on memory card or USB memories. Be sure to save the data periodically in case the data is lost in an accident. (refer to Controller OPERATOR'S MANUAL.)
(12) The robot should be transported and installed by accurately following the procedures recommended by FANUC. Wrong transportation or installation may cause the robot to fall, resulting in severe injury to workers.
(13) In the first operation of the robot after installation, the operation should be restricted to low speeds. Then, the speed should be gradually increased to check the operation of the robot.
(14) Before the robot is started, it should be checked that no one is inside the safety fence. At the same time, a check must be made to ensure that there is no risk of hazardous situations. If detected, such a situation should be eliminated before the operation.
(15) When the robot is used, the following precautions should be taken. Otherwise, the robot and peripheral equipment can be adversely affected, or workers can be severely injured.
- Avoid using the robot in a flammable environment.
- Avoid using the robot in an explosive environment.
- Avoid using the robot in an environment full of radiation.
- Avoid using the robot under water or at high humidity.
- Avoid using the robot to carry a person or animal.
- Avoid using the robot as a stepladder. (Never climb up on or hang from the robot.)
- Outdoor
(16) When connecting the peripheral equipments related to stop (safety fence etc.) and each signal (external emergency, fence etc.) of robot, be sure to confirm the stop movement and do not take the wrong connection.
(17) When preparing footstep, please consider security for installation and maintenance work in high place according to Fig. 3 (c). Please consider footstep and safety belt mounting position.

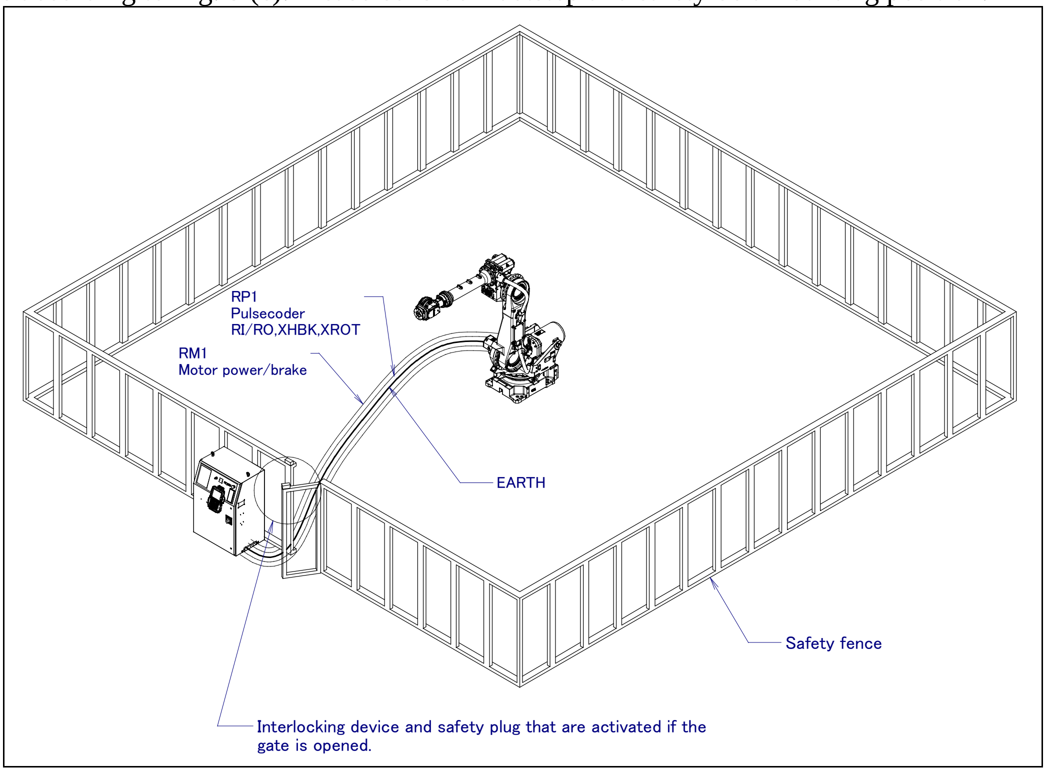
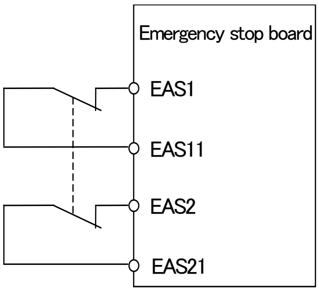


Fig. 3 (a) Safety fence and safety gate

⚠WARNING
When you close a fence, please confirm that there is not a person from all directions of the robot.



(Note)
Connect EAS1 and EAS11, EAS2 and EAS21.
Terminals EAS1,EA11,EAS2,EAS21 are on the emergency stop board.

Fig.3 (b) Limit switch circuit diagram of the safety fence

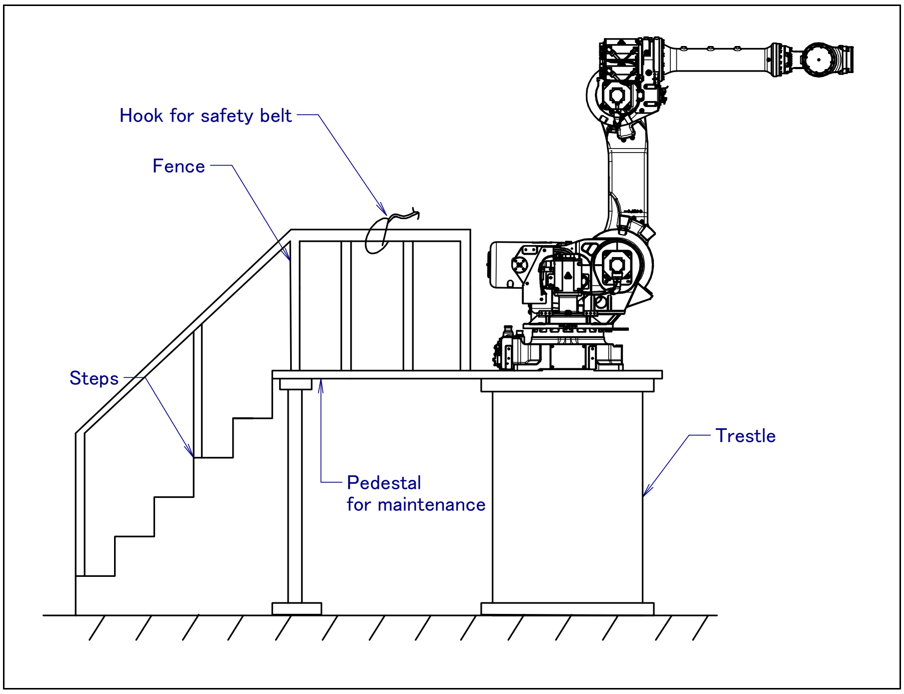


Fig. 3 (c) Pedestal for maintenance

3.1 OPERATOR SAFETY

The operator is a person who operates the robot system. In this sense, a worker who operates the teach pendant is also an operator. However, this section does not apply to teach pendant operators.

(1) If you do not have to operate the robot, turn off the power of the robot controller or press the EMERGENCY STOP button, and then proceed with necessary work.
(2) Operate the robot system at a location outside of the safety fence
(3) Install a safety fence with a safety gate to prevent any worker other than the operator from entering the work area unexpectedly and to prevent the worker from entering a dangerous area.
(4) Install one or more necessary quantity of EMERGENCY STOP button(s) within the operator’s reach in appropriate location(s) based on the system layout.

The robot controller is designed to be connected to an external EMERGENCY STOP button. With this connection, the controller stops the robot operation (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type), when the external EMERGENCY STOP button is pressed. For connection, see Fig.3.1.

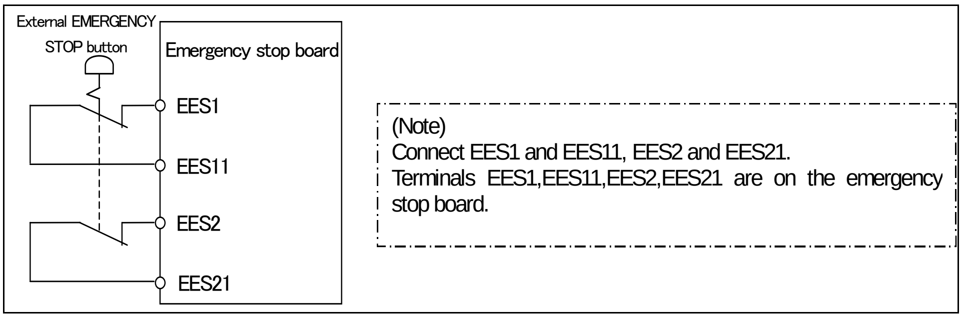


Fig. 3.1 Connection Diagram for External Emergency Stop Button

3.2 SAFETY OF THE PROGRAMMER

While teaching the robot, the operator must enter the work area of the robot. The operator must ensure the safety of the teach pendant operator especially.

(1) Unless it is specifically necessary to enter the robot work area, carry out all tasks outside the area.
(2) Before teaching the robot, check that the robot and its peripheral devices are all in the normal operating condition.
(3) If it is inevitable to enter the robot work area to teach the robot, check the locations, settings, and other conditions of the safety devices (such as the EMERGENCY STOP button, the DEADMAN switch on the teach pendant) before entering the area.
(4) The programmer must be extremely careful not to let anyone else enter the robot work area.
(5) Programming should be done outside the area of the safety fence as far as possible. If programming needs to be done in the area of the safety fence, the programmer should take the following precautions:
- Before entering the area of the safety fence, ensure that there is no risk of dangerous situations in the area.
- Be prepared to press the emergency stop button whenever necessary.
- Robot motions should be made at low speeds.
- Before starting programming, check the entire system status to ensure that no remote instruction to the peripheral equipment or motion would be dangerous to the user.

The operator panel is provided with an emergency stop button and a key switch (mode switch) for selecting the automatic operation mode (AUTO) and the teach modes (T1 and T2). Before entering the inside of the safety fence for the purpose of teaching, set the switch to a teach mode, remove the key from the mode switch to prevent other people from changing the operation mode carelessly, then open the safety gate. If the safety gate is opened with the automatic operation mode set, the robot stops (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type). After the switch is set to a teach mode, the safety gate is disabled. The programmer should understand that the safety gate is disabled and is responsible for keeping other people from entering the inside of the safety fence.

The teach pendant is provided with an enable/disable switch, DEADMAN switch as well as an emergency stop button. These button and switch function as follows:

(1) Emergency stop button: Causes the stop of the robot (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type) when pressed.
(2) DEADMAN switch: Functions differently depending on the teach pendant enable/disable switch setting status.
  (a) Disable: The DEADMAN switch is disabled.
  (b) Enable: Servo power is turned off when the operator releases the DEADMAN switch or when the operator presses the switch strongly.

Note) The DEADMAN switch is provided to stop the robot when the operator releases the teach pendant or presses the pendant strongly in case of emergency. The R-30*i*B/R-30*i*B Plus employs a 3-position DEADMAN switch, which allows the robot to operate when the 3-position DEADMAN switch is pressed to its intermediate point. When the operator releases the DEADMAN switch or presses the switch strongly, the robot stops immediately.

Based on the risk assessment by FANUC, number of operation of DEADMAN SW should not exceed about 10000 times per year.

The operator's intention of starting teaching is determined by the controller through the dual operation of setting the teach pendant enable/disable switch to the enable position and pressing the DEADMAN switch. The operator should make sure that the robot could operate in such conditions and be responsible in carrying out tasks safely.

The teach pendant, operator panel, and peripheral device interface send each robot start signal. However the validity of each signal changes as follows depending on the mode switch of the operator panel, the teach pendant enable/disable switch and the remote condition on the software.

Mode	Teach pendant enable/disable switch	Software remote condition	Teach pendant	Operator panel	Peripheral device
AUTO mode	On	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed
	Off	Local	Not allowed	Allowed to start	Not allowed
		Remote	Not allowed	Not allowed	Allowed to start
T1, T2 mode	On	Local	Allowed to start	Not allowed	Not allowed
		Remote	Allowed to start	Not allowed	Not allowed
	Off	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed

T1,T2 mode: DEADMAN switch is effective.

(6) To start the system using the Contact your local FANUC representative, make certain that nobody is the robot work area and that there are no abnormal conditions in the robot work area.
(7) When a program is completed, be sure to carry out a test operation according to the procedure below.
  (a) Run the program for at least one operation cycle in the single step mode at low speed.
  (b) Run the program for at least one operation cycle in the continuous operation mode at low speed.
  (c) Run the program for one operation cycle in the continuous operation mode at the intermediate speed and check that no abnormalities occur due to a delay in timing.
  (d) Run the program for one operation cycle in the continuous operation mode at the normal operating speed and check that the system operates automatically without trouble.
  (e) After checking the completeness of the program through the test operation above, execute it in the automatic operation mode.
(8) While operating the system in the automatic operation mode, the teach pendant operator should leave the robot work area.

3.3 SAFETY OF THE MAINTENANCE ENGINEER

For the safety of maintenance engineer personnel, pay utmost attention to the following.

(1) During operation, never enter the robot operating space.
(2) A hazardous situation may arise when the robot or the system, are kept with their power-on during maintenance operations. Therefore, for any maintenance operation, the robot and the system should be put into the power-off state. If necessary, a lock should be in place in order to prevent any other person from turning on the robot and/or the system. In case maintenance needs to be executed in the power-on state, the emergency stop button must be pressed.
(3) If it becomes necessary to enter the robot operating space while the power is on, press the emergency stop button on the operator box or operator panel, or the teach pendant before entering the range. The maintenance worker must indicate that maintenance work is in progress and be careful not to allow other people to operate the robot carelessly.
(4) When entering the area enclosed by the safety fence, the worker must check the whole robot system in order to make sure no dangerous situations exist. In case the worker needs to enter the safety area whilst a dangerous situation exists, extreme care must be taken, and whole robot system status must be carefully monitored.
(5) Before the maintenance of the pneumatic system is started, the supply pressure should be shut off and the pressure in the piping should be reduced to zero.
(6) Before the start of maintenance work, check that the robot and its peripheral equipments are all in the normal operating condition.
(7) Do not operate the robot in the automatic operation while anybody is in the robot operating space.
(8) When you maintain the robot alongside a wall or instrument, or when multiple users are working nearby, make certain that their escape path is not obstructed.
(9) When a tool is mounted on the robot, or when any movable device other than the robot is installed, such as belt conveyor, pay careful attention to its motion.
(10) If necessary, have a user who is familiar with the robot system stand beside the operator panel and observe the work being performed. If any danger arises, the user should be ready to press the EMERGENCY STOP button at any time.
(11) When replacing a part, please contact your local FANUC representative. If a wrong procedure is followed, an accident may occur, causing damage to the robot and injury to the user.
(12) When replacing or reinstalling components, take care to prevent foreign material from entering the system.
(13) When handling each unit or printed circuit board in the controller during inspection, turn off the circuit breaker to protect against electric shock.
If there are two cabinets, turn off the both circuit breaker.
(14) A part should be replaced with a part recommended by FANUC. If other parts are used, malfunction or damage would occur. Especially, a fuse that is not recommended by FANUC should not be used. Such a fuse may cause a fire.
(15) When restarting the robot system after completing maintenance work, make sure in advance that there is no person in the operating space and that the robot and the peripheral equipments are not abnormal.
(16) When a motor or brake is removed, the robot arm should be supported with a crane or other equipment beforehand so that the arm would not fall during the removal.
(17) Whenever grease is spilled on the floor, it should be removed as quickly as possible to prevent dangerous falls.
(18) The following parts are heated. If a maintenance user needs to touch such a part in the heated state, the user should wear heat-resistant gloves or use other protective tools.
- Servo motor
- Inside the controller
- Reducer
- Gearbox

－ Wrist unit

(19) Maintenance should be done under suitable light. Care must be taken that the light would not cause any danger.

(20) When a motor, reducer, or other heavy load is handled, a crane or other equipment should be used to protect maintenance workers from excessive load. Otherwise, the maintenance workers would be severely injured.

(21) The robot should not be stepped on or climbed up during maintenance. If it is attempted, the robot would be adversely affected. In addition, a misstep can cause injury to the worker.

(22) When performing maintenance work in high place, secure a footstep and wear safety belt.

(23) After the maintenance is completed, spilled oil or water and metal chips should be removed from the floor around the robot and within the safety fence.

(24) When a part is replaced, all bolts and other related components should put back into their original places. A careful check must be given to ensure that no components are missing or left not mounted.

(25) In case robot motion is required during maintenance, the following precautions should be taken :

- Foresee an escape route. And during the maintenance motion itself, monitor continuously the whole robot system so that your escape route will not become blocked by the robot, or by peripheral equipment.
- Always pay attention to potentially dangerous situations, and be prepared to press the emergency stop button whenever necessary.

(26) The robot should be periodically inspected. (Refer to the robot mechanical manual and controller maintenance manual.) A failure to do the periodical inspection can adversely affect the performance or service life of the robot and may cause an accident

(27) After a part is replaced, a test execution should be given for the robot according to a predetermined method. (See TESTING section of “Controller operator’s manual”.) During the test execution, the maintenance worker should work outside the safety fence.

4 SAFETY OF THE TOOLS AND PERIPHERAL DEVICES

4.1 PRECAUTIONS IN PROGRAMMING

(1) Use a limit switch or other sensor to detect a dangerous condition and, if necessary, design the program to stop the robot when the sensor signal is received.

(2) Design the program to stop the robot when an abnormal condition occurs in any other robots or peripheral devices, even though the robot itself is normal.

(3) For a system in which the robot and its peripheral devices are in synchronous motion, particular care must be taken in programming so that they do not interfere with each other.

(4) Provide a suitable interface between the robot and its peripheral devices so that the robot can detect the states of all devices in the system and can be stopped according to the states.

4.2 PRECAUTIONS FOR MECHANISM

(1) Keep the component cells of the robot system clean, operate the robot where insulated from the influence of grease, water, and dust.

(2) Don’t use unconfirmed liquid for cutting fluid and cleaning fluid.

(3) Adopt limit switches or mechanical stoppers to limit the robot motion, and avoid the robot from collisions against peripheral devices or tools.

(4) Observe the following precautions about the mechanical unit cables. Failure to follow precautions may cause mechanical troubles.

- Use mechanical unit cable that have required user interface.

- Do not add user cable or hose to inside of mechanical unit.
- Please do not obstruct the movement of the mechanical unit when cables are added to outside of mechanical unit.
- In the case of the model that a cable is exposed, please do not perform remodeling (Adding a protective cover and fix an outside cable more) obstructing the behavior of the outcrop of the cable.
- When installing user peripheral equipment on the robot mechanical unit, please pay attention that equipment does not interfere with the robot itself.

(5) The frequent power-off stop for the robot during operation causes the trouble of the robot. Please avoid the system construction that power-off stop would be operated routinely. (Refer to bad case example.) Please perform power-off stop after reducing the speed of the robot and stopping it by hold stop or cycle stop when it is not urgent. (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type.)
(Bad case example)
- Whenever poor product is generated, a line stops by emergency stop and power-off of the robot is incurred.
- When alteration is necessary, safety switch is operated by opening safety fence and power-off stop is incurred for the robot during operation.
- An operator pushes the emergency stop button frequently, and a line stops.
- An area sensor or a mat switch connected to safety signal operates routinely and power-off stop is incurred for the robot.
- Power-off stop is regularly incurred due to an inappropriate setting for Dual Check Safety (DCS).

(6) Power-off stop of Robot is executed when collision detection alarm (SRVO-050) etc. occurs. Please try to avoid unnecessary power-off stops. It may cause the trouble of the robot, too. So remove the causes of the alarm.

5 SAFETY OF THE ROBOT MECHANISM

5.1 PRECAUTIONS IN OPERATION

(1) When operating the robot in the jog mode, set it at an appropriate speed so that the operator can manage the robot in any eventuality.
(2) Before pressing the jog key, be sure you know in advance what motion the robot will perform in the jog mode.

5.2 PRECAUTIONS IN PROGRAMMING

(1) When the work areas of robots overlap, make certain that the motions of the robots do not interfere with each other.
(2) Be sure to specify the predetermined work origin in a motion program for the robot and program the motion so that it starts from the origin and terminates at the origin.
Make it possible for the operator to easily distinguish at a glance that the robot motion has terminated.

5.3 PRECAUTIONS FOR MECHANISMS

(1) Keep the work areas of the robot clean, and operate the robot in an environment free of grease, water, and dust.

5.4 PROCEDURE TO MOVE ARM WITHOUT DRIVE POWER IN EMERGENCY OR ABNORMAL SITUATIONS

For emergency or abnormal situations (e.g. persons trapped in or pinched by the robot), brake release unit can be used to move the robot axes without drive power.
Please refer to this manual and mechanical unit operator’s manual for using method of brake release unit and method of supporting robot.

6 SAFETY OF THE END EFFECTOR

6.1 PRECAUTIONS IN PROGRAMMING

(1) To control the pneumatic, hydraulic and electric actuators, carefully consider the necessary time delay after issuing each control command up to actual motion and ensure safe control.
(2) Provide the end effector with a limit switch, and control the robot system by monitoring the state of the end effector.

7 STOP TYPE OF ROBOT

The following three robot stop types exist:

Power-Off Stop (Category 0 following IEC 60204-1)

Servo power is turned off and the robot stops immediately. Servo power is turned off when the robot is moving, and the motion path of the deceleration is uncontrolled.
The following processing is performed at Power-Off stop.

- An alarm is generated and servo power is turned off.
- The robot operation is stopped immediately. Execution of the program is paused.

Controlled stop (Category 1 following IEC 60204-1)

The robot is decelerated until it stops, and servo power is turned off.
The following processing is performed at Controlled stop.

- The alarm "SRVO-199 Controlled stop" occurs along with a decelerated stop. Execution of the program is paused.
- An alarm is generated and servo power is turned off.

Hold (Category 2 following IEC 60204-1)

The robot is decelerated until it stops, and servo power remains on.
The following processing is performed at Hold.

- The robot operation is decelerated until it stops. Execution of the program is paused.

> ⚠ **WARNING**
> The stopping distance and stopping time of Controlled stop are longer than the stopping distance and stopping time of Power-Off stop. A risk assessment for the whole robot system, which takes into consideration the increased stopping distance and stopping time, is necessary when Controlled stop is used.

When the E-Stop button is pressed or the FENCE is open, the stop type of robot is Power-Off stop or Controlled stop. The configuration of stop type for each situation is called *stop pattern*. The stop pattern is different according to the controller type or option configuration.

There are the following 2 Stop patterns.

Stop pattern	Mode	E-Stop button	External E-Stop	FENCE open	SVOFF input
A	AUTO	P-Stop	P-Stop	C-Stop	C-Stop
	T1	P-Stop	P-Stop	-	C-Stop
	T2	P-Stop	P-Stop	-	C-Stop
C	AUTO	C-Stop	C-Stop	C-Stop	C-Stop
	T1	P-Stop	P-Stop	-	C-Stop
	T2	P-Stop	P-Stop	-	C-Stop

P-Stop: Power-Off stop
C-Stop: Controlled stop
-: Disable

⚠ **WARNING**
In this manual, the term “Emergency-stop” is used for the stop by above safety signals. Please refer to above table for actual stop type.

The following table indicates the Stop pattern according to the controller type or option configuration.

Option	Stop pattern
Standard	A
Controlled stop by E-Stop (A05B-2600-J570)	C

The stop pattern of the controller is displayed in "Stop pattern" line in software version screen. Please refer "Software version" in operator's manual of controller for the detail of software version screen.

"Controlled stop by E-Stop" option

"Controlled stop by E-Stop" option (A05B-2600-J570) is an optional function. When this option is loaded, the stop type of the following alarms becomes Controlled stop but only in AUTO mode. In T1 or T2 mode, the stop type is Power-Off stop which is the normal operation of the system.

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel E-stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant E-stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.

Controlled stop is different from Power-Off stop as follows:

- In Controlled stop, the robot is stopped on the program path. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path.
- In Controlled stop, physical impact is less than Power-Off stop. This function is effective for systems where the physical impact to the mechanical unit or EOAT (End Of Arm Tool) should be minimized.
- The stopping distance and stopping time of Controlled stop is longer than the stopping distance and stopping time of Power-Off stop, depending on the robot model and axis. Please refer to the operator's manual of a particular robot model for the data of stopping distance and stopping time.

When this option is loaded, this function can not be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

> ⚠ **WARNING**
> The stopping distance and stopping time of Controlled stop are longer than the stopping distance and stopping time of Power-Off stop. A risk assessment for the whole robot system, which takes into consideration the increased stopping distance and stopping time, is necessary when this option is loaded.

8 WARNING & CAUTION LABEL

(1) Step-on prohibitive label

Fig.8 (a) Step-on prohibitive label

Description

Do not step on or climb the robot or controller as it may adversely affect the robot or controller and you may get hurt if you lose your footing.

(2) High-temperature warning label

Fig.8 (b) High-Temperature warning label

Description

Be cautious about a section where this label is affixed, as the section generates heat. If you must touch such a section when it is hot, use a protective provision such as heat-resistant gloves.

(3) High-voltage warning label

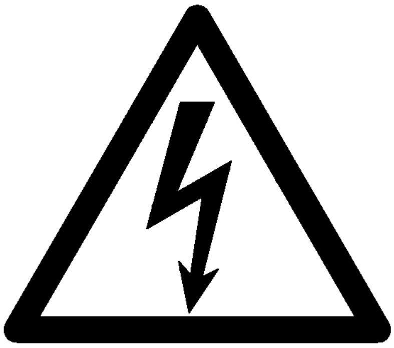


Fig.8 (c) High-voltage warning label

Description

A high voltage is applied to the places where this label is attached.

Before starting maintenance, turn the power to the controller off, and turn the circuit breaker off to avoid electric shock hazards. Take additional precautions with the servo amplifier and other equipment, because high-voltage remains in these units for a certain amounts of time

PREFACE

This manual describes the following models (R-30*i*B/R-30*i*B Plus controller).

Model	Abbreviation	
FANUC Robot R-2000*i*B/165F	R-2000*i*B/165F	R-2000*i*B
FANUC Robot R-2000*i*B/210F	R-2000*i*B/210F	
FANUC Robot R-2000*i*B/250F	R-2000*i*B/250F	
FANUC Robot R-2000*i*B/125L	R-2000*i*B/125L	
FANUC Robot R-2000*i*B/175L	R-2000*i*B/175L	
FANUC Robot R-2000*i*B/185L	R-2000*i*B/185L	
FANUC Robot R-2000*i*B/165R	R-2000*i*B/165R	
FANUC Robot R-2000*i*B/200R	R-2000*i*B/200R	
FANUC Robot R-2000*i*B/170CF	R-2000*i*B/170CF	
FANUC Robot R-2000*i*B/100P	R-2000*i*B/100P	
FANUC Robot R-2000*i*B/100H	R-2000*i*B/100H	
FANUC Robot R-2000*i*B/150U	R-2000*i*B/150U	
FANUC Robot R-2000*i*B/200T	R-2000*i*B/200T	
FANUC Robot R-2000*i*B/220U	R-2000*i*B/220U	
FANUC Robot R-2000*i*B/210WE	R-2000*i*B/210WE	
FANUC Robot R-2000*i*B/210FS	R-2000*i*B/210FS	
FANUC Robot R-2000*i*B/220US	R-2000*i*B/220US	
FANUC Robot R-2000*i*C/125L	R-2000*i*C/125L	R-2000*i*C
FANUC Robot R-2000*i*C/165F	R-2000*i*C/165F	
FANUC Robot R-2000*i*C/165R	R-2000*i*C/165R	
FANUC Robot R-2000*i*C/210F	R-2000*i*C/210F	
FANUC Robot R-2000*i*C/210R	R-2000*i*C/210R	
FANUC Robot R-2000*i*C/210L	R-2000*i*C/210L	
FANUC Robot R-2000*i*C/270F	R-2000*i*C/270F	
FANUC Robot R-1000*i*A/80F	R-1000*i*A/80F	R-1000*i*A
FANUC Robot R-1000*i*A/100F	R-1000*i*A/100F	
FANUC Robot R-1000*i*A/80H	R-1000*i*A/80H	
FANUC Robot R-1000*i*A/120F-7B	R-1000*i*A/120F-7B	
FANUC Robot M-10*i*A	M-10*i*A	M-10*i*A
FANUC Robot M-10*i*A/6L	M-10*i*A/6L	
FANUC Robot M-10*i*A/7L	M-10*i*A/7L	
FANUC Robot M-10*i*A/8L	M-10*i*A/8L	
FANUC Robot M-10*i*A/10S	M-10*i*A/10S	
FANUC Robot M-10*i*A/10M	M-10*i*A/10M	
FANUC Robot M-10*i*A/10MS	M-10*i*A/10MS	
FANUC Robot M-10*i*A/12	M-10*i*A/12	
FANUC Robot M-10*i*A/12S	M-10*i*A/12S	
FANUC Robot M-20*i*A	M-20*i*A	M-20*i*A
FANUC Robot M-20*i*A/10L	M-20*i*A/10L	
FANUC Robot M-20*i*A/12L	M-20*i*A/12L	
FANUC Robot M-20*i*A/20T	M-20*i*A/20T	
FANUC Robot M-20*i*A/20M	M-20*i*A/20M	
FANUC Robot M-20*i*A/20MT	M-20*i*A/20MT	
FANUC Robot M-20*i*A/35M	M-20*i*A/35M	
FANUC Robot M-20*i*A/35MT	M-20*i*A/35MT	
FANUC Robot M-20*i*B/25	M-20*i*B/25	M-20*i*B

Model	Abbreviation	
FANUC Robot ARC Mate 100*i*C FANUC ROBOWELD 100*i*C	ARC Mate 100*i*C	ARC Mate 100*i*C
FANUC Robot ARC Mate 100*I*c/6L FANUC ROBOWELD 100*i*C/6L	ARC Mate 100*i*C/6L	
FANUC Robot ARC Mate 100*i*C /7L	ARC Mate 100*i*C/7L	
FANUC Robot ARC Mate 100*i*C /8L	ARC Mate 100*i*C/8L	
FANUC Robot ARC Mate 100*i*C/10S	ARC Mate 100*i*C/10S	
FANUC Robot ARC Mate 100*i*C/12	ARC Mate 100*i*C/12	
FANUC Robot ARC Mate 100*i*C/12S	ARC Mate 100*i*C/12S	
FANUC Robot ARC Mate 120*i*C FANUC ROBOWELD 120*i*C	ARC Mate 120*i*C	ARC Mate 120*i*C
FANUC Robot ARC Mate 120*i*C/10L FANUC ROBOWELD 120*i*C/10L	ARC Mate 120*i*C/10L	
FANUC Robot ARC Mate 120*i*C/12L	ARC Mate 120*i*C/12L	
FANUC Robot ARC Mate 120*i*C/20T	ARC Mate 120*i*C/20T	
FANUC Robot M-710*i*C/70	M-710*i*C/70	M-710*i*C
FANUC Robot M-710*i*C/70T	M-710*i*C/70T	
FANUC Robot M-710*i*C/50	M-710*i*C/50	
FANUC Robot M-710*i*C/50S	M-710*i*C/50S	
FANUC Robot M-710*i*C/50T	M-710*i*C/50T	
FANUC Robot M-710*i*C/50E	M-710*i*C/50E	
FANUC Robot M-710*i*C/50H	M-710*i*C/50H	
FANUC Robot M-710*i*C/45M	M-710*i*C/45M	
FANUC Robot M-710*i*C/20L	M-710*i*C/20L	
FANUC Robot M-710*i*C/20M	M-710*i*C/20M	
FANUC Robot M-710*i*C/12L	M-710*i*C/12L	
FANUC Robot M-2*i*A/3S	M-2*i*A/3S	M-2*i*A
FANUC Robot M-2*i*A/3SL	M-2*i*A/3SL	
FANUC Robot M-2*i*A/6H	M-2*i*A/6H	
FANUC Robot M-2*i*A/6HL	M-2*i*A/6HL	
FANUC Robot M-2*i*A/3A	M-2*i*A/3A	
FANUC Robot M-2*i*A/3AL	M-2*i*A/3AL	
FANUC Robot M-3*i*A/6A	M-3*i*A/6A	M-3*i*A
FANUC Robot M-3*i*A/6S	M-3*i*A/6S	
FANUC Robot M-3*i*A/12H	M-3*i*A/12H	
FANUC Robot M-410*i*B/140H	M-410*i*B/140H	M-410*i*B
FANUC Robot M-410*i*B/160	M-410*i*B/160	
FANUC Robot M-410*i*B/300	M-410*i*B/300	
FANUC Robot M-410*i*B/450	M-410*i*B/450	
FANUC Robot M-410*i*B/700	M-410*i*B/700	
FANUC Robot M-410*i*C/185	M-410*i*C/185	M-410*i*C
FANUC Robot M-410*i*C/315	M-410*i*C/315	
FANUC Robot M-410*i*C/500	M-410*i*C/500	
FANUC Robot M-420*i*A	M-420*i*A	
FANUC Robot M-421*i*A	M-421*i*A	

Model	Abbreviation	
FANUC Robot M-430*i*A/2P	M-430*i*A/2P	M-430*i*A
FANUC Robot M-430*i*A/2PH	M-430*i*A/2PH	
FANUC Robot M-430*i*A/4FH	M-430*i*A/4FH	
FANUC Robot M-900*i*A/260L	M-900*i*A/260L	M-900*i*A
FANUC Robot M-900*i*A/350	M-900*i*A/350	
FANUC Robot M-900*i*A/150P	M-900*i*A/150P	
FANUC Robot M-900*i*A/200P	M-900*i*A/200P	
FANUC Robot M-900*i*A/400L	M-900*i*A/400L	
FANUC Robot M-900*i*A/600	M-900*i*A/600	
FANUC Robot M-900*i*B/280	M-900*i*B/280	M-900*i*B
FANUC Robot M-900*i*B/360	M-900*i*B/360	
FANUC Robot M-900*i*B/700	M-900*i*B/700	
FANUC Robot M-900*i*B/400L	M-900*i*B/400L	
FANUC Robot M-900*i*B/280L	M-900*i*B/280L	
FANUC Robot M-2000*i*A/900L	M-2000*i*A/900L	M-2000*i*A
FANUC Robot M-2000*i*A/1200	M-2000*i*A/1200	
FANUC Robot M-2000*i*A/1700L	M-2000*i*A/1700L	
FANUC Robot M-2000*i*A/2300	M-2000*i*A/2300	
FANUC Robot F-100*i*A	F-100*i*A	
FANUC Robot F-200*i*B	F-200*i*B	
FANUC Robot CR-35*i*A	CR-35*i*A	

TABLE OF CONTENTS

II. CONNECTIONS

APPENDIX

I. MAINTENANCE

1 OVERVIEW

This manual is applied to the R-30*i*B/R-30*i*B Plus controller (called R-30*i*B/R-30*i*B Plus).

R-30*i*B/R-30*i*B Plus has different controller depending on the required standards.

NRTL controller: To meet UL/CSA standard
CE controller: To meet Machinery Directive, Low voltage Directive, EMC Directive to cover the requirement of CE mark
CE/NRTL controller: To meet both CE standard and UL/CSA standard.

This manual covers these controllers of the R-30*i*B/R-30*i*B Plus.
The difference of NRTL, CE and CE/NRTL controller from the Basic controller is small as shown in Table 1 (ex. EMC parts, Breakers).
And the specific descriptions of the CE and NRTL controllers are noted in this manual.

Table 1. Applied standards

	Functional safety	EMC Standard	Robot Standard Electrical Standard	Requirement	Difference
Basic controller	ISO 13849-1 IEC 61508	-	-	-	-
NRTL controller		-	UL1740 CAN/CSA Z434 NFPA79	UL standard CSA standard •USA and Canada	•UL listed main breaker •E-stop unit with UL listed breaker •600V input circuit for Canada
CE controller		EN 55011 EN 61000-6-2 EN 61000-6-4	EN/ISO 10218-1 EN 60204-1	CE Marking •Europe	•Noise filter •EMC Cabinet •Shielded cable
CE/NRTL controller			UL1740 CAN/CSA Z434 NFPA79 EN/ISO 10218-1 EN 60204-1	CE Marking •Europe UL standard CSA standard •USA and Canada	•Noise filter •EMC Cabinet •Shielded cable •UL listed main breaker •E-stop unit with UL listed breaker •600V input circuit for Canada can not be supported.

This manual describes the maintenance and connection of R-30*i*B/R-30*i*B Plus.

・Maintenance Part: Troubleshooting, and the setting, adjustment, and replacement of units
・Connection Part: Connection of R-30*i*B/R-30*i*B Plus to the robot mechanical unit and peripheral devices, and installation of the controller

> ⚠ **WARNING**
> Before you enter the robot working area, be sure to turn off the power to the controller or press the EMERGENCY STOP button on the operator's panel or teach pendant.
> Otherwise, you could injure personnel or damage equipment.

2 CONFIGURATION

2.1 EXTERNAL VIEW OF THE CONTROLLER

The appearance and components might differ slightly depending on the controlled robot, application, and options used.
Fig.2.1 (a) shows an external view of two R-30*i*B/R-30*i*B Plus controller cabinet variations.
Fig.2.1 (b) to (g) show the construction of the R-30*i*B/R-30*i*B Plus controller.
Fig.2.1 (h) to (k) show the external view of the operator's panel and teach pendant.

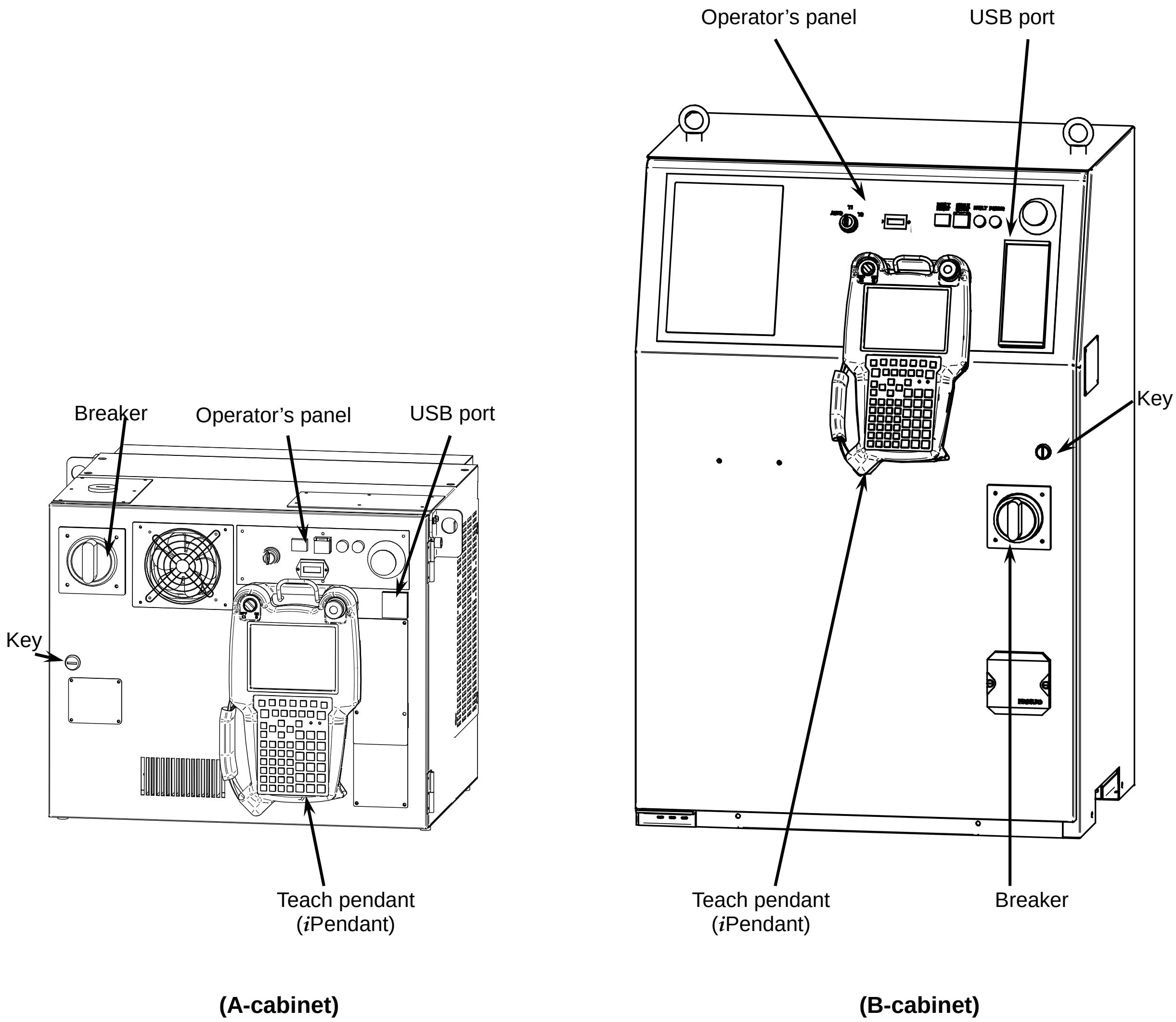


Fig.2.1 (a) External view of the R-30*i*B/R-30*i*B Plus controller

> **NOTE**
> Be sure to lock the key.

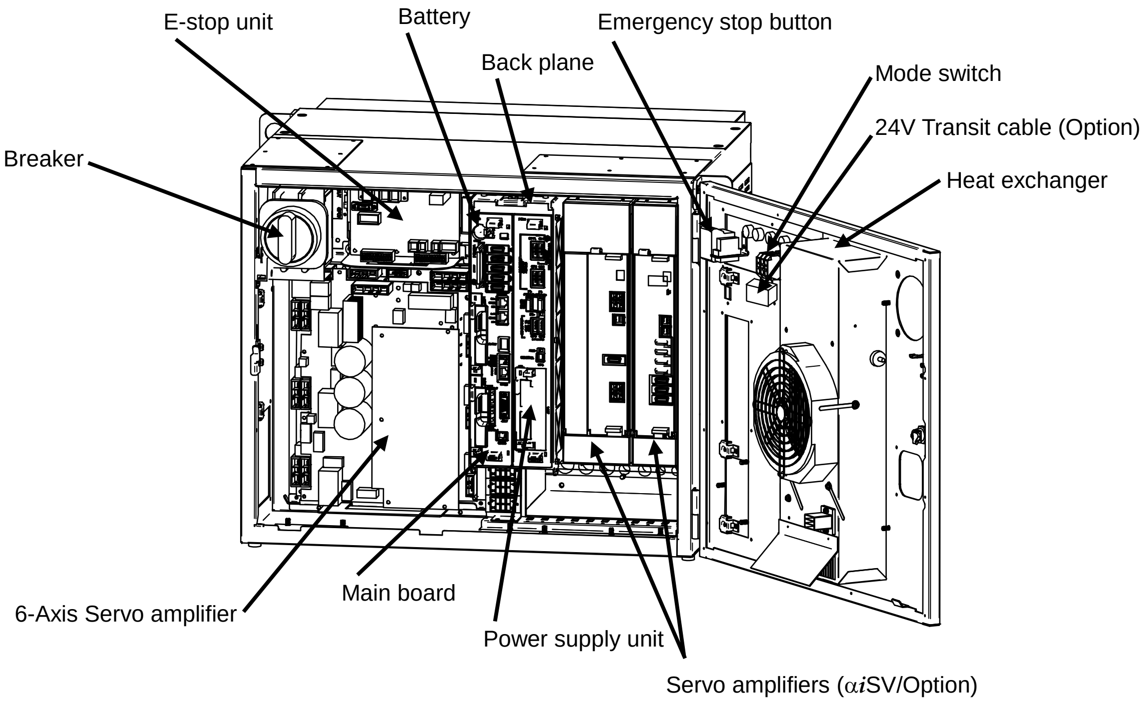


Fig.2.1 (b) R-30*i*B/R-30*i*B Plus A-cabinet interior (Front)

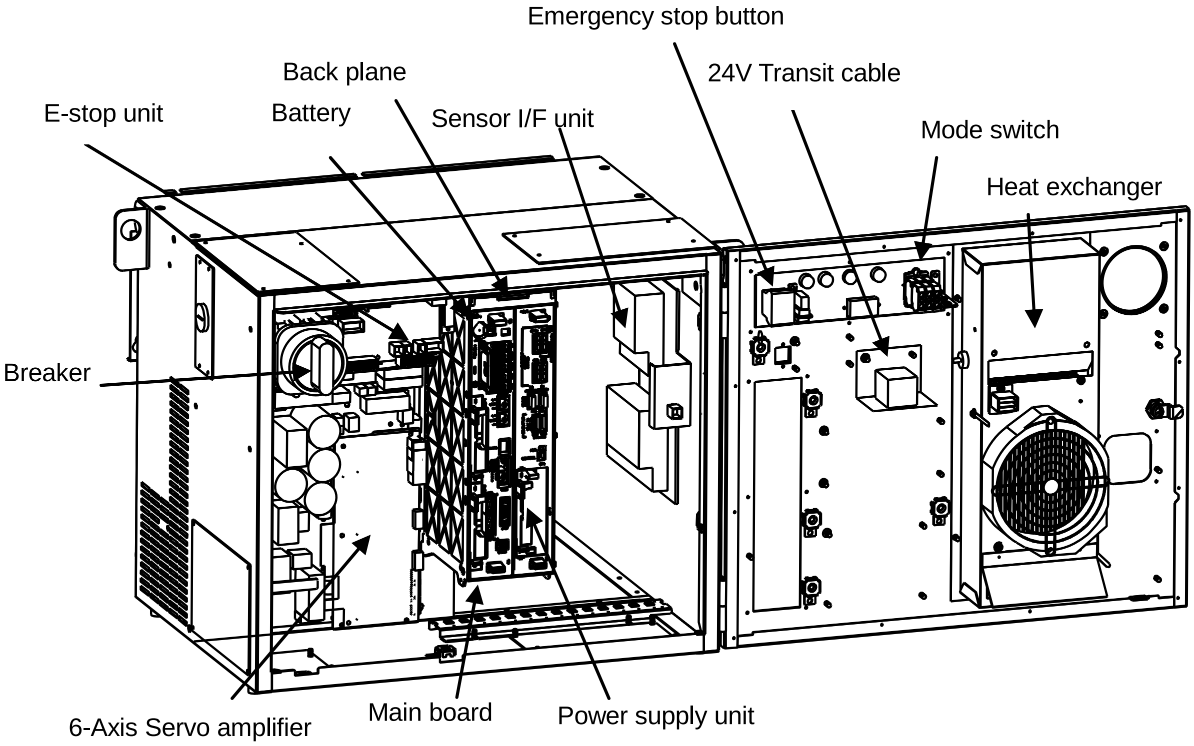


Fig.2.1 (c) R-30*i*B/R-30*i*B Plus A-cabinet interior (Front) (CR-35*i*A)

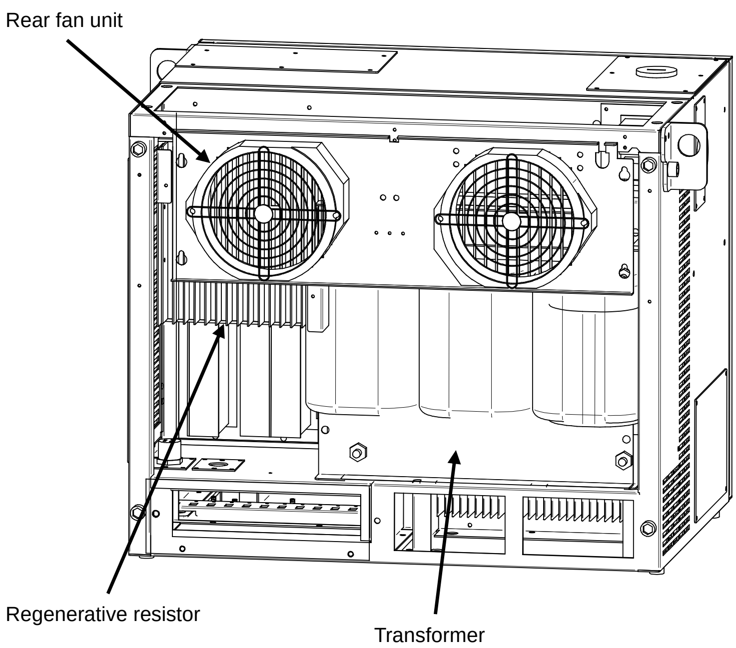


Fig.2.1 (d) R-30*i*B/R-30*i*B Plus A-cabinet interior (Rear)

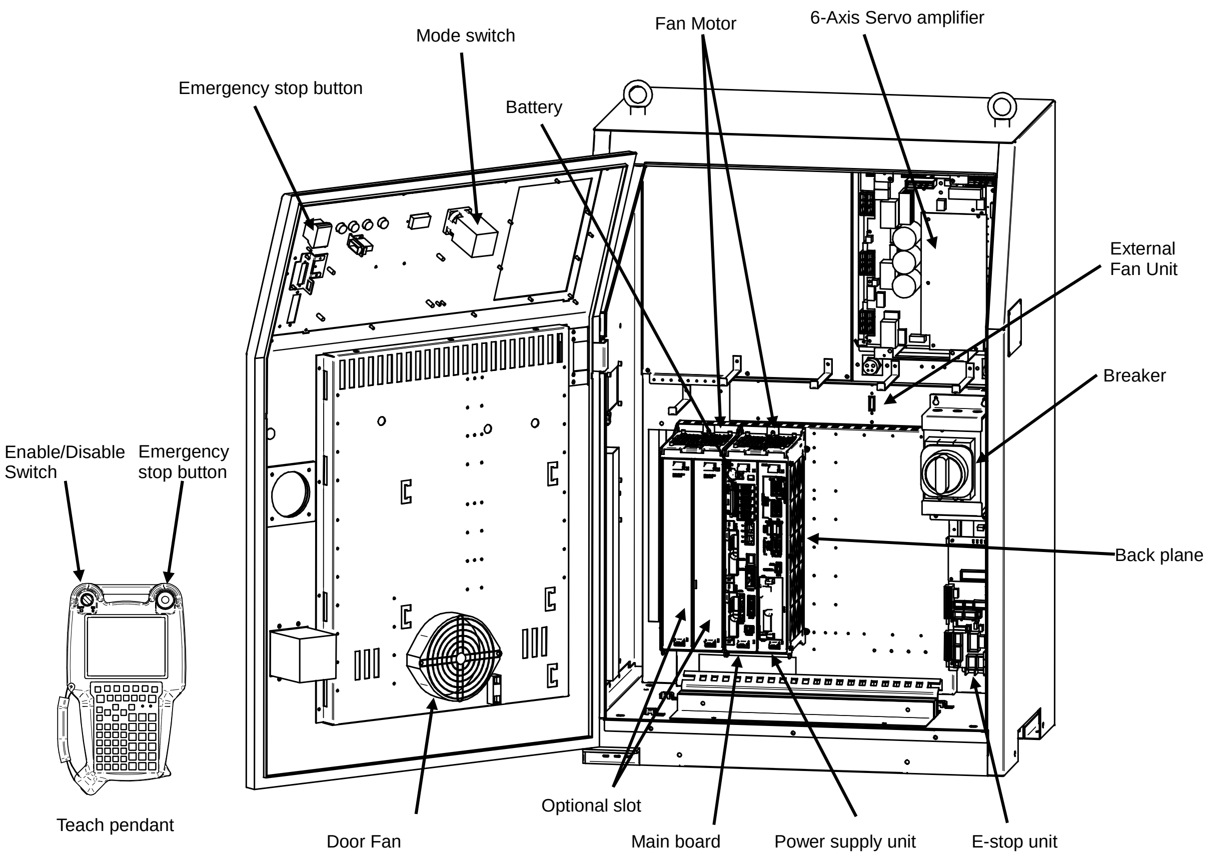


Fig.2.1 (e) R-30*i*B/R-30*i*B Plus B-cabinet interior (Front)

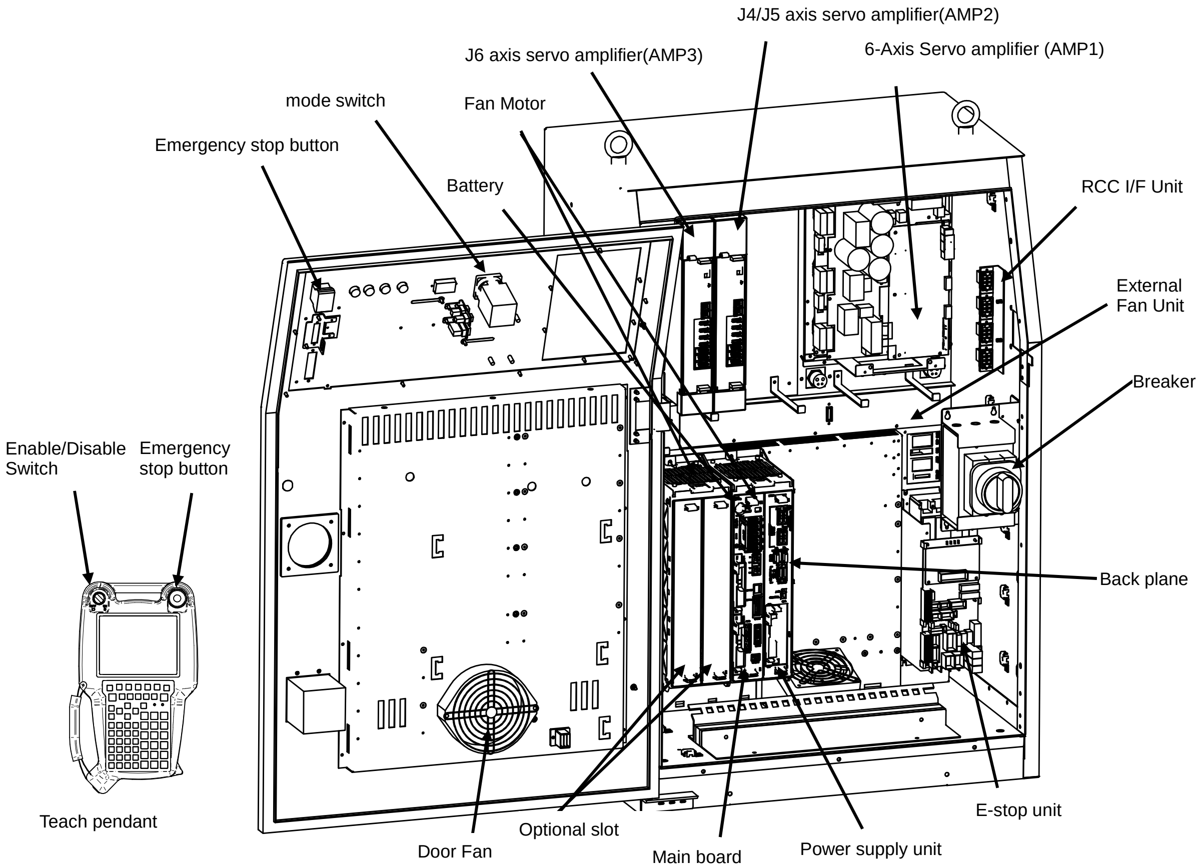


Fig.2.1 (f) R-30*i*B/R-30*i*B Plus B-cabinet interior (Front)
(M-900*i*A/400L, M-900*i*A/600, M-900*i*B/700, M-900*i*B/400L)

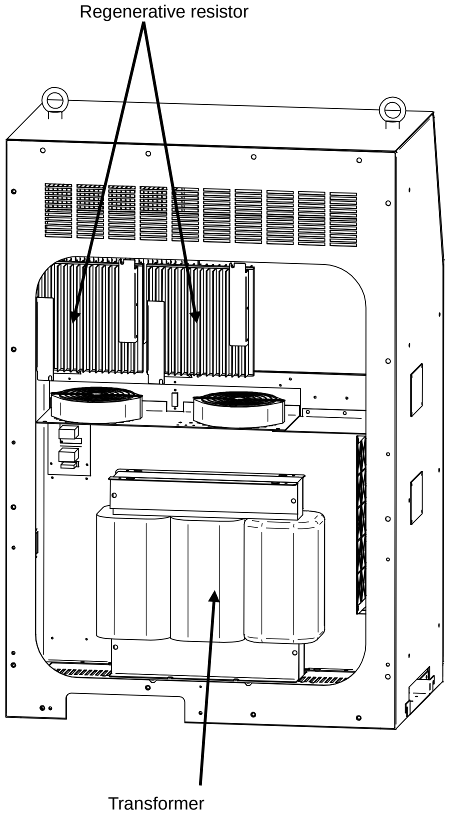


Fig.2.1 (g) R-30*i*B/R-30*i*B Plus B-cabinet interior (Rear)

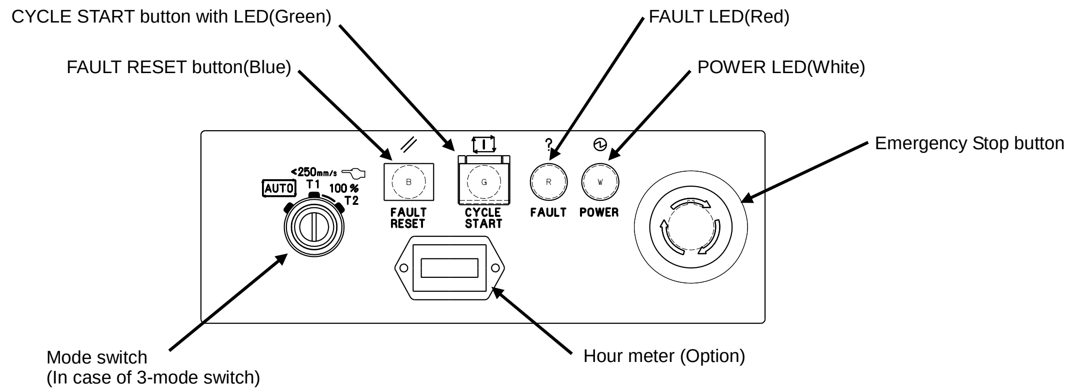


Fig.2.1 (h) R-30*i*B/R-30*i*B Plus A-cabinet operator's panel

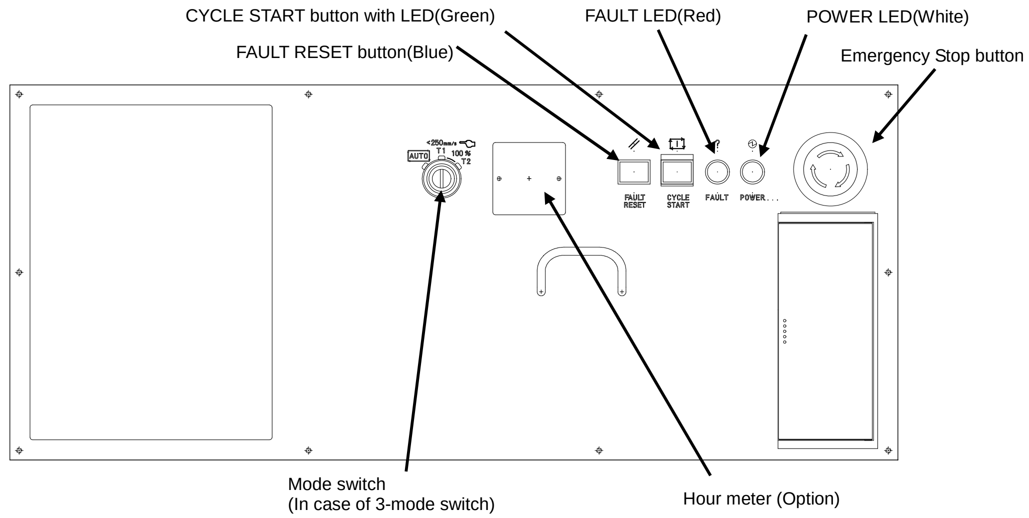


Fig.2.1 (i) R-30*i*B/R-30*i*B Plus B-cabinet operator's panel

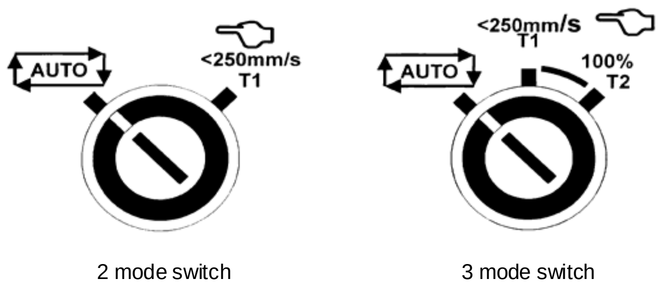


Fig.2.1 (j) Mode switch

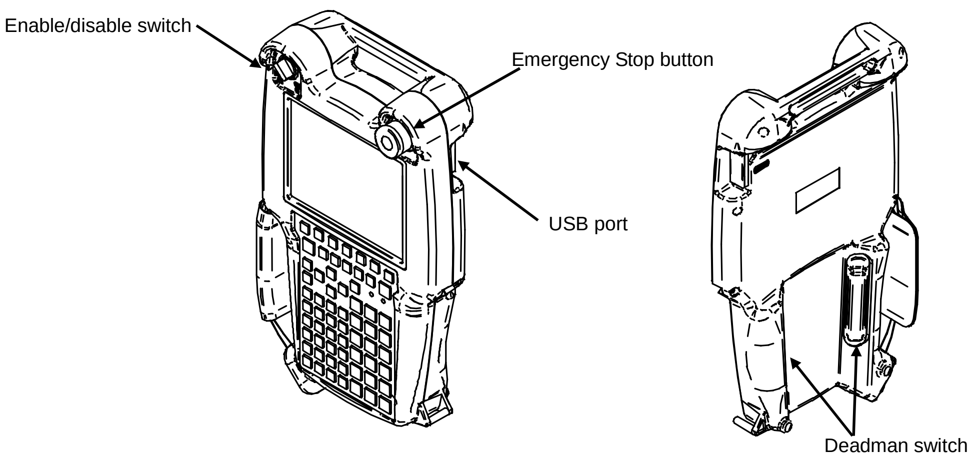


Fig.2.1 (k) Teach pendant (*i*Pendant)

2.2 COMPONENT FUNCTIONS

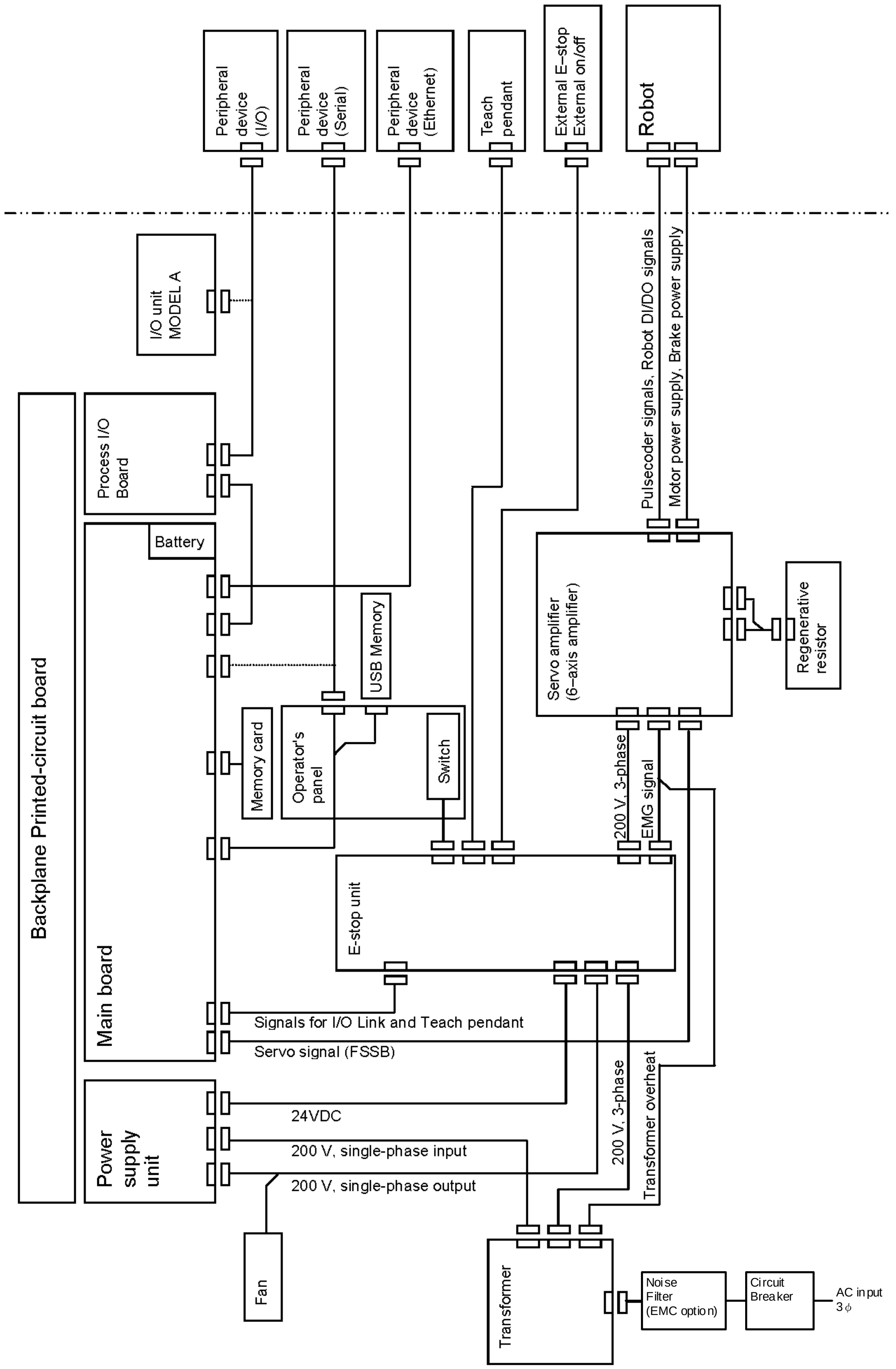


Fig.2.2 Block diagram of the R-30*i*B/R-30*i*B Plus

- Main board
  The main board contains a microprocessor, its peripheral circuits, memory, and operator's panel control circuit. The main CPU controls servo mechanism positioning.
- I/O printed circuit board, FANUC I/O Unit MODEL-A
  Various types of printed circuit boards are provided for applications including a process I/O board. The FANUC I/O unit MODEL-A can also be installed. When it is used, various I/O types can be selected. These are connected with FANUC I/O Link.
- E-stop unit
  This unit controls the emergency stop system of the robot controller. It also has user interface terminals of safety relevant signals, external on/off signals etc.
- Power supply unit
  The power supply unit converts the AC power to various levels of DC power.
- Backplane printed circuit board
  The various control printed circuit boards are mounted on the backplane printed circuit board.
- Teach pendant
  All operations including robot programming are performed with this unit. The controller status and data are indicated on the liquid-crystal display (LCD) on the pendant.
- 6-Axis Servo amplifier
  The servo amplifier controls servomotor, Pulsecoder signal, brake control, overtravel and hand broken.
- Operator's panel
  Buttons and LEDs on the operator's panel are used to start the robot and to indicate the robot status. The panel has an USB interface for the serial interface to an external device.
- Transformer
  The supply voltage is converted to an AC voltage required for the controller by the transformer.
- Fan unit, heat exchanger
  These components cool the inside of the controller.
- Circuit breaker
  If the electric system in the controller malfunctions, or if abnormal input power causes high current in the system, the input power is connected to the circuit breaker to protect the equipment.
- Regenerative resistor
  To discharge the counter electromotive force from the servomotor, connect a regenerative resistor to the servo amplifier.

2.3 CHECKS AND MAINTENANCE

Daily maintenance and periodic maintenance/inspection ensure reliable robot performance for extended periods of time.

(1) Daily maintenance
Before operating the system each day, clean each part of the system and check the system parts for any damage or cracks. Also, check the following:
(a) Before operation
Check the cable connected to the teach pendant for excessive twisting. Check the controller and peripheral devices for abnormalities.
(b) After operation
At the end of operation, return the robot to the specified position, and then turn off the controller. Clean each part, and check for any damage or cracks. If the ventilation port of the controller is dusty, clean it.

(2) Check after one month
Check that the fan is rotating normally. If the fan has dirt and dust built up, clean the fan according to step (d) described below for inspection to be performed every 6 months.

(3) Periodic inspection performed every six months
Please refer to the Section 7.5, and then remove any dirt and dust from the inside of the transformer compartment. Wipe off dirt and dust from the fan and transformer.

(4) Battery daily check
Replace the battery on the front panel of the main board every 4 years. Please refer to the Section 7.12.

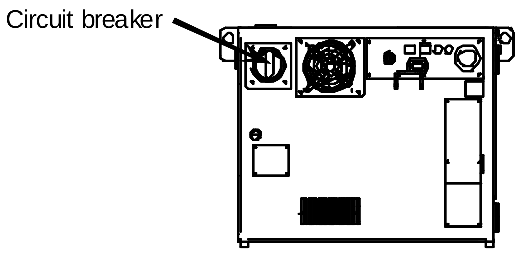
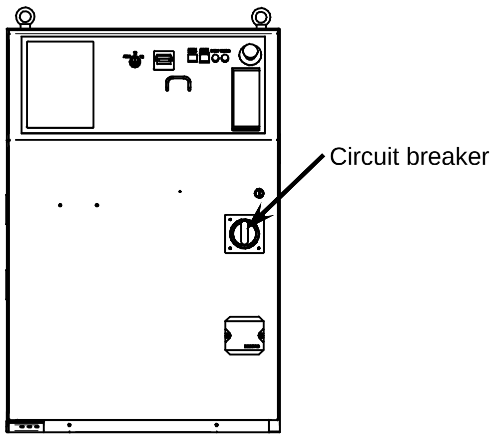
(5) Maintenance tools
The following maintenance tools are recommended:
(a) Measuring instruments
AC/DC voltmeter (A digital voltmeter is sometimes required.)
Oscilloscope with a frequency range of 5 MHz or higher, two channels
(b) Tools

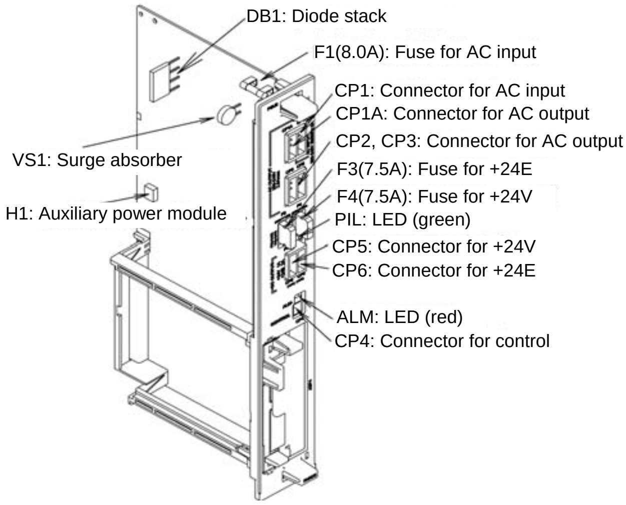
Cross-head screwdrivers:	Large, medium, and small
Straight-head screwdrivers:	Large, medium, and small
Nut driver set (Metric)	
Pliers	
Cutting pliers	
Diagonal cutting pliers	

3 TROUBLESHOOTING

This chapter describes the checking method and corrective action for each alarm code indicated if a hardware alarm occurs. Refer to the OPERATOR’S MANUAL (ALARM CODE LIST) (B-83284EN-1) for a list of alarms.

3.1 POWER CANNOT BE TURNED ON

Check and Corrective action		Figure
(Check 1)	Check that the circuit breaker is on and has not tripped.	
(Corrective action)	a) If circuit breaker is OFF. Turn on the circuit breaker. b) If the circuit breaker has tripped, find the cause by referencing the total connection diagram presented in the appendix.	

<table>
<tr><th colspan="2">Check and Corrective action</th><th>Figure</th></tr>
<tr><td>(Check 2)</td><td>Check whether the LED (ALM: red) on the power supply unit is on.</td><td rowspan="5">
</td></tr>
<tr><td>(Corrective action 1)</td><td>If the LED (ALM:red) on the power supply unit is off, see Check 3.

If the LED (ALM:red) on the power supply unit is on, verify that the +24V external connection cable is not connected to 0V or ground.

If the problem still exists even though it does not have ground fault, check the power supply unit using the following procedure:

a) Check Fuse F4.
If the fuse is blown, see Corrective action 4.
b) Fuse F4 is not blown.
The power supply unit, main board or process I/O printed circuit board may be faulty.
c) Replace the power supply unit.
d) If a system using the process I/O printed circuit board, replace the process I/O printed circuit board.
e) See Corrective action 3.</td></tr>
<tr><td>(Corrective action 2)</td><td>If the power supply unit is not faulty, replace the emergency stop board.</td></tr>
<tr><td>(Corrective action 3)</td><td>Before executing this action, perform a complete controller back up to save all your programs and settings.

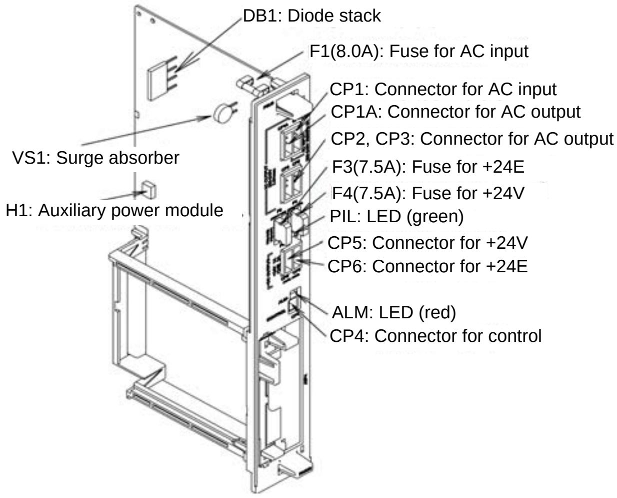
If the emergency stop board is not faulty, replace the Main board.</td></tr>
<tr><td>(Corrective action 4)</td><td>Causes of blown fuse F4 and corrective action.

The device connected to connector CP5 of the power supply unit may be faulty.

Find the cause by referencing the total connection diagram presented in the appendix.

If no device is connected to CP5 or the connected device is normal, the +24 V power used in a printed circuit board connected to the backplane is faulty.

See Corrective action 3.</td></tr>
</table>

<table>
<tr><th colspan="2">Check and Corrective action</th><th>Figure</th></tr>
<tr><td>(Check 3)</td><td>Check whether the LED (PIL: green) on the power supply unit is on.</td><td rowspan="3">
</td></tr>
<tr><td>(Corrective action1)</td><td>If the LED (PIL: green) is on, - See Corrective action 3.

If the LED (PIL: green) is not on, 200 VAC is not supplied to the power supply unit. Check whether 200 VAC is supplied to power supply unit. Check the voltage between the 1 pin and 2 pin of the CP1 connector.

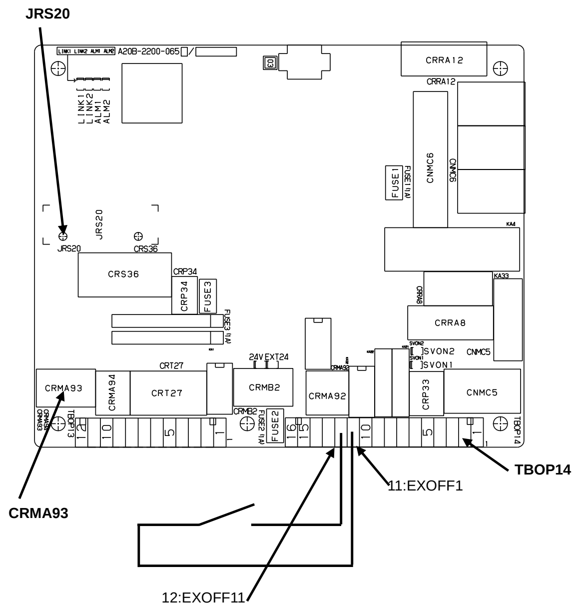
If 200 VAC is not supplied, Check the primary input voltage to the controller is within the rated voltage and phase of the primary input voltage is not lack. If there is no problem, the fuse in the transformer may have blown.

Before you start to replace the transformer, turn off the circuit breaker. Replace the transformer.

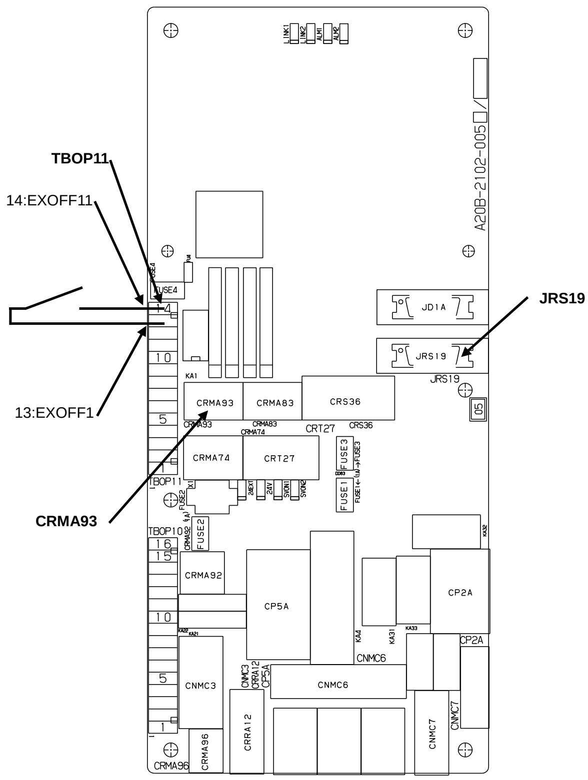
If 200 VAC is supplied, It is likely that fuse F1 in the power supply unit has blown. Find the cause of the blown fuse.

Before you start troubleshooting, turn off the circuit breaker.
a) If fuse F1 has blown, see Corrective action 2.
b) If fuse F1 has not blown,
Replace the power supply unit.</td></tr>
<tr><td>(Corrective action 2)</td><td>Causes of blown fuses F1 and corrective action
a) Check the units (fans), printed-circuit board and cables connected to the CP2 and CP3 connectors of the power supply unit to see if there is any short circuit.
b) Replace the power supply unit.</td></tr>
</table>

Check and Corrective action		Figure
(Corrective action 3)	Check whether the connector (JRS19) on the main board or the connector (JRS19 or JRS20) on the emergency stop board is connected properly.	
(Corrective action4)	Check whether the EXOFF1 and EXOFF11 signals are connected on the terminal block on the emergency stop board. If the external ON/OFF switch is used, verify that the ON/OFF switch is functioning properly. a) If the external ON/OFF function is not used, connect terminal EXOFF1 and EXOFF11. b) If the external ON and OFF lines are already used, check the mating contacts and the cable.	
(Corrective action 5)	Check whether the jumper connector of the CRMA93 is connected to the emergency stop board.	



A-cabinet



B-cabinet

3.2 ALARM SCREEN

The alarm screen displays only the alarm conditions that are currently active. If an alarm reset signal is input to reset the alarm conditions, the alarm screen displays the message "PAUSE or more serious alarm has not occurred."

The alarm screen displays only the alarm conditions (if any) that occur after the most recently entered alarm reset signal. To erase all alarm displays from the alarm screen, press the CLEAR key (+ shift) on the alarm history screen.

The alarm screen is intended to display PAUSE or alarms that are more serious. It will not display WARN, NONE, or a reset. It is possible to disable PAUSE and some of the more serious alarms from being displayed by setting the $ER_NOHIS system variable appropriately.

If two or more alarms have occurred, the display begins with the most recent alarm.

Up to 100 lines can be displayed.

If an alarm has a cause code, it is displayed below the line indicating the alarm.

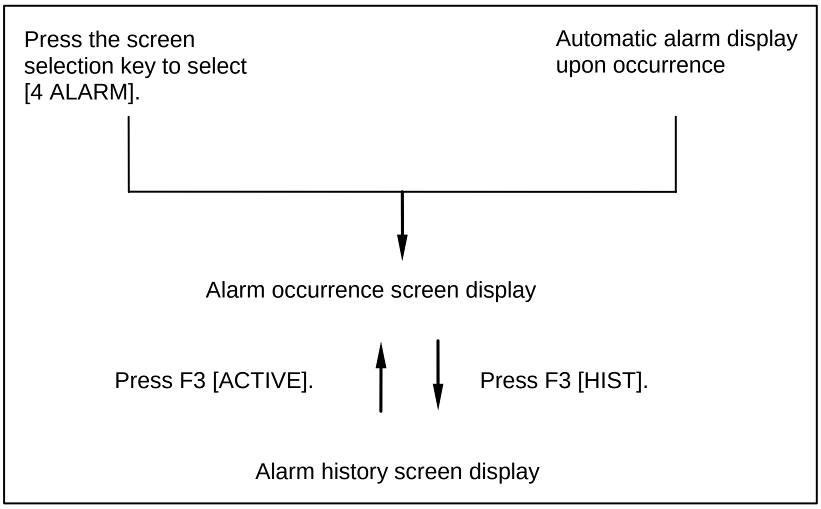


Fig.3.2 Alarm screen and alarm history screen display procedure

Displaying the alarm history/alarm detail information

Step

(1) Press [MENU] key to display the screen menu.

(2) Select [ALARM].
You will see a screen similar to the following.
If an alarm has occurred, however, the alarm screen appears automatically.

```
INTP-224 (TEST1, 6)Jump label failed
MEMO-027 Specified line does not exis JOINT   30%
Alarm : Active
                                        1/2
     1 INTP-224 (TEST1, 6) Jump label faile
       MEMO-027 Specified line does not exi
[ TYPE ] [ VIEW ]   HIST   RES_1CH
```

Alarm detail code

(3) To display the alarm history screen, press F3, [HIST].
Press F3 [ACTIVE] again, the alarm screen appears.

```
Alarm : Hist
                                           1/25
     1 INTP-224 (TEST1, 6) Jump label faile
     2 R E S E T
     3 SRVO-007 External emergency stop
     4 SRVO-001 Operator panel E-stop
     5 R E S E T
     6 SRVO-001 Operator panel E-stop
     7 SRVO-012 Power failure recovery
     8 INTP-127 Power fail detected
     9 SRVO-047 LVAL alarm (Group:1 Axis:5)
    10 SRVO-047 LVAL alarm (Group:1 Axis:4)
    11 SRVO-002 Teach pendant E-stop
[ TYPE ] [ VIEW ]  ACTIVE  CLEAR  DETAIL
```

NOTE
The latest alarm is assigned number 1. To view messages that are currently not on the screen, press the F5, DETAIL, and then press the right arrow key.

(4) To display the alarm detail screen, press F5, [DETAIL].

```
Alarm : Hist
     DETAIL Alarm
     INTP-224 (TEST1, 6) Jump label failed
     MEMO-027 Specified line does not exist
     STOP.L    21-NOV-11 12:16
     Alarm : Hist
       1 INTP-224 (TEST1, 6) Jump label faile
       2 R E S E T
       3 SRVO-007 External emergency stop
       4 SRVO-001 Operator panel E-stop
       5 R E S E T
       6 SRVO-001 Operator panel E-stop
       7 SRVO-012 Power failure recovery

    [ TYPE ] [ VIEW ]  ACTIVE   CLEAR   DETAIL
```

(5) To return to the alarm history screen, press the PREV key.

(6) To delete all the alarm histories, press and hold down the SHIFT key, then press F4, [CLEAR].

NOTE

When system variable $ER_NOHIS = 1, NONE alarms or WARN alarms are not recorded. When $ER_NOHIS=2, resets are not recorded in the alarm history. When $ER_NOHIS=3, resets, WARN alarms, and NONE alarms are not recorded.

The following map indicates teach pendant operations used to check an alarm.

- 4 ALARM
  - F1 [TYPE]
    - Alarm : Active
      - F1 [TYPE]
      - F3 HIST
        - Alarm : HIST
          - F1 [TYPE]
          - F3 [ACTIVE]
          - F4 CLEAR
          - F5 HELP
            - DETAIL Alarm
              - F1 [TYPE]
              - F3 [ACTIVE]
              - F4 CLEAR
              - F5 HELP

3.3 STOP SIGNALS

The stop signal screen indicates the state of signals related to stop.
To be specific, the screen indicates whether each stop signal is currently on. This screen is for viewing only and therefore you cannot change the state of any stop signal on this screen.

Table 3.3 Stop signals

Stop signal	Description
Operator's panel emergency stop	This item indicates the state of the emergency stop button on the operator's panel. If the EMERGENCY STOP button is pressed, the state is indicated as "TRUE".
Teach pendant emergency stop	This item indicates the state of the emergency stop button on the teach pendant. If the EMERGENCY STOP button is pressed, the state is indicated as "TRUE".
External emergency stop	This item indicates the state of the external emergency stop signal. If the EMERGENCY STOP signal is asserted, the state is indicated as "TRUE".
Fence open	This item indicates the state of the safety fence. If the safety fence is open, the state is indicated as "TRUE".
DEADMAN switch	This item indicates whether the DEADMAN switch on the teach pendant is grasped correctly. If the teach pendant is operable, and the DEADMAN switch is grasped correctly, the state is indicated as "TRUE". If the DEADMAN switch is released or is grasped tightly when the teach pendant is operable, an alarm occurs, causing the servo power to be switched off.
Teach pendant operable	This item indicates whether the teach pendant is operable. If the teach pendant is operable, the state is indicated as "TRUE".
Hand broken	This item indicates the state of the hand safety joint. If the hand interferes with a workpiece or anything like this, and the safety joint is opened, the state is indicated as "TRUE". In this case, an alarm occurs, causing the servo power to be switched off.
Robot overtravel	This item indicates whether the current position of the robot is out of the operation range. If any robot axis goes out of the operation range beyond the overtravel switch, the state is indicated as "TRUE". In this case, an alarm occurs, causing the servo power to be switched off.
Abnormal air pressure	This item indicates the state of the air pressure. The abnormal air pressure signal is connected to the air pressure sensor. If the air pressure is not higher than the specified value, the state is indicated as "TRUE".

Step

(1) Press [MENU] key to display the screen menu.
(2) Select STATUS on the next page.
(3) Press F1, [TYPE] to display the screen switching menu.
(4) Select Stop Signal. You will see a screen similar to the following.

```
STATUS Stop Signal
         SIGNAL NAME          STATUS   1/12

      1 SOP E-Stop:            FALSE
      2 TP E-STOP:             FALSE
      3 EXT E-STOP:            FALSE
      4 Fence Open:            FALSE
      5 TP Deadman:            TRUE
      6 TP Enable:             TRUE
      7 Hand Broken:           FALSE
      8 Overtravel:            FALSE
      9 Low Air Alarm:         FALSE
     10 Belt Broken:           FALSE
     11 SVOFF Input:           FALSE
     12 Non Teacher Enb. Dev.: FALSE

   [ TYPE ]
```

3.4 MASTERING

Mastering is needed if:
(1) The SRVO-062 BZAL or SRVO-038 pulse mismatch alarm occurs, or
(2) The Pulsecoder is replaced.
Item (1) requires quick mastering, while item (2) requires single axis or fixture position mastering.
The mastering procedure is described below. For details, refer to an applicable maintenance manual of mechanical unit or Mastering chapter of the Appendix B of the OPERATOR'S MANUAL (BASIC OPERATION) (B-83284EN).

Condition

System variable $MASTER_ENB must be set to 1 or 2.

```
SYSTEM Variables

     272  $MASTER_ENB        1
```

Step

(1) Press [MENU] key.
(2) Select SYSTEM.
(3) Press F1, TYPE.
(4) Select Master/Cal you will see a screen similar to the following.
(5) Move the robot by jog feed to the mastering position. Release the brake on the manual brake control screen if necessary.

```
SYSTEM Master/Cal
                              TORQUE = [ON ]
     1 FIXTURE POSITION MASTER
     2 ZERO POSITION MASTER
     3 QUICK MASTER
     4 QUICK MASTER FOR SINGLE AXIS
     5 SINGLE AXIS MASTER
     6 SET QUICK MASTER REF
     7 CALIBRATE

      Press 'ENTER' or number key to select.

   [ TYPE ]   LOAD   RES_PCA          DONE
```

> **NOTE**
> Mastering cannot be performed until the axis is rotated enough to establish a pulse.

(6) Select "1 FIXTURE POSITION MASTER" and press the F4 key (yes). Mastering data is set.

```
SYSTEM Master/Cal
                              TORQUE = [ON ]
      1 FIXTURE POSITION MASTER
      2 ZERO POSITION MASTER
      3 QUICK MASTER
      4 QUICK MASTER FOR SINGLE AXIS
      5 SINGLE AXIS MASTER
      6 SET QUICK MASTER REF
      7 CALIBRATE
      Robot Mastered! Mastering Data:
        <-3105333> <-13216881> <22995280>
        <-1354153> <0> <0>

   [ TYPE ]   LOAD   RES_PCA            DONE
```

(7) Select "7 CALIBRATE" and press the F4 key (yes). Calibration is performed.
Alternatively, to perform positioning, turn the power off, and then turn it on again. Calibration is performed whenever the power is turned on.

```
SYSTEM Master/Cal
                              TORQUE = [ON ]
      1 FIXTURE POSITION MASTER
      2 ZERO POSITION MASTER
      3 QUICK MASTER
      4 QUICK MASTER FOR SINGLE AXIS
      5 SINGLE AXIS MASTER
      6 SET QUICK MASTER REF
      7 CALIBRATE
      Robot Calibrated! Cur Jnt Ang(deg):
         <   0.0000> <  24.6528> < -94.2241>
         <   0.0000> < -85.7759> <   0.0000>

   [ TYPE ]   LOAD   RES_PCA            DONE
```

(8) Press F5 "DONE", after mastering.
(9) Restore the brake condition to its original condition.

3.5 TROUBLESHOOTING USING THE ERROR CODE

SRVO-001 Operator panel E-stop

(Explanation) The emergency stop button on the operator's panel was pressed.

(Action 1) Release the emergency stop button pressed on the operator's panel.

(Action 2) Check the wires connecting between the emergency stop button and the emergency stop board (CRT27) for continuity. If an open wire is found, replace the entire harness.

(Action 3) Check the wires connecting the teach pendant to the emergency stop board (CRS36) for continuity. If an open wire is found, replace the entire harness.

(Action 4) With the emergency stop in the released position, check for continuity across the terminals of the switch. If continuity is not found, the emergency stop button is broken. Replace the emergency stop button or the operator's panel.

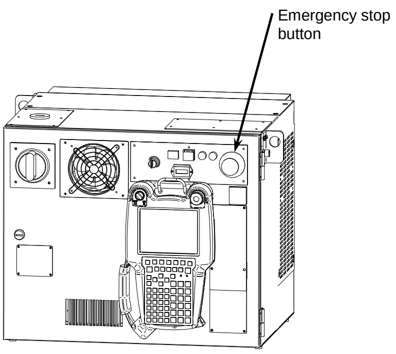
(Action 5) Replace the teach pendant.

(Action 6) Replace the emergency stop board.

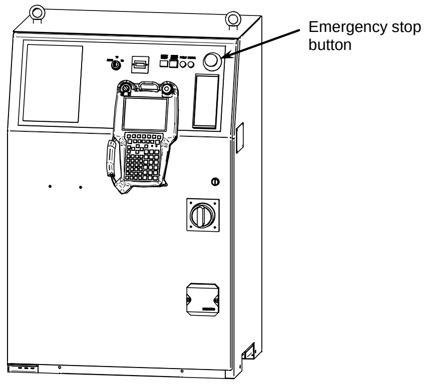
Before executing the (Action 7), perform a complete controller back-up to save all your programs and settings.

(Action 7) Replace the main board.

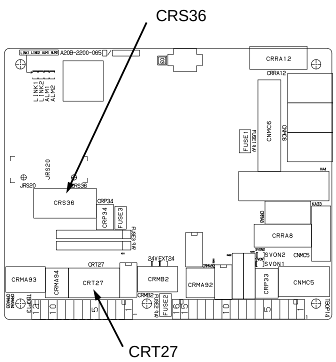
NOTE
If SRVO-001 is issued together with SRVO-213, a fuse may have blown. Take the same actions as for SRVO-213.



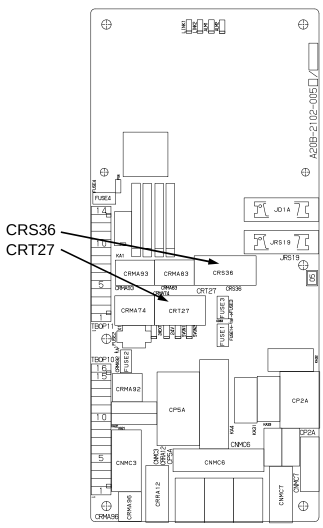
(A-cabinet)



(B-cabinet)



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

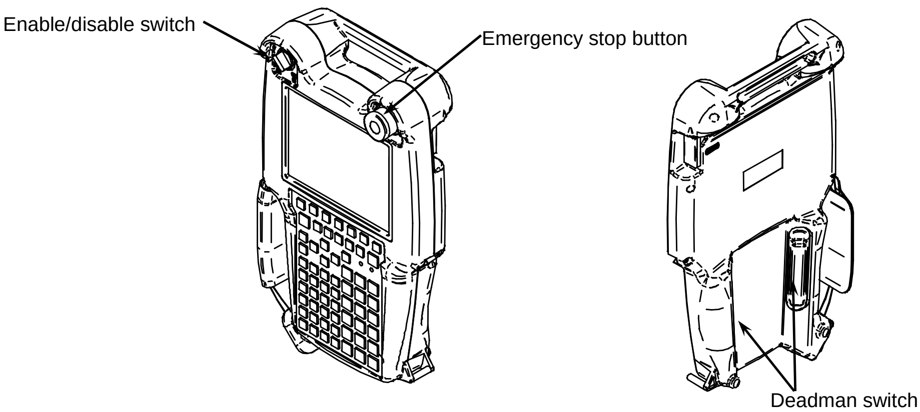
Fig.3.5 (a) SRVO-001 Operator panel E-stop

SRVO-002 Teach pendant E-stop

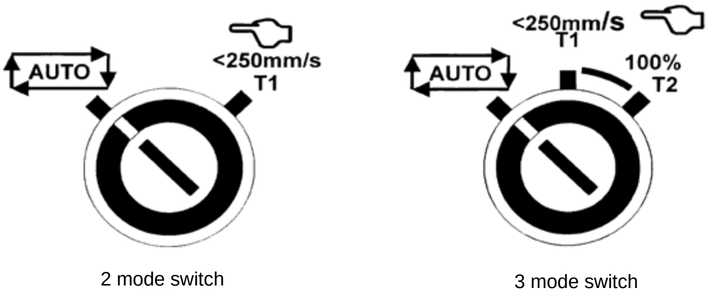
(Explanation) The emergency stop button on the teach pendant was pressed.
(Action 1) Release the emergency stop button on the teach pendant.
(Action 2) Replace the teach pendant.

SRVO-003 DEADMAN switch released

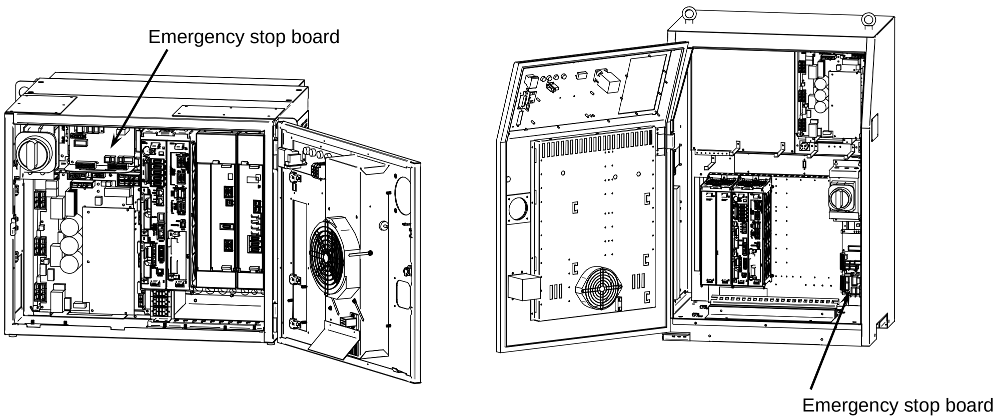
(Explanation) The teach pendant is enabled, but the DEADMAN switch is not pressed. Alternatively, the DEADMAN switch is grasped strongly.
(Action 1) Check the intermediate position of the DEADMAN switch on the teach pendant.
(Action 2) Check that the mode switch on the operator's panel and the enable/disable switch on the teach pendant are at the correct positions.
(Action 3) Replace the teach pendant.
(Action 4) Check the mode switch connection and operation. If trouble is found, replace the mode switch.
(Action 5) Replace the emergency stop board.



(Teach pendant)



(Mode switch)



(A-cabinet) **(B-cabinet)**

Fig.3.5 (b) SRVO-002 Teach pendant E-stop / SRVO-003 DEADMAN switch released

SRVO-004 Fence open

(Explanation) In the automatic operation mode, the safety fence contact connected to EAS1-EAS11 or EAS2-EAS21 of TBOP13(A-cabinet) or TBOP11(B-cabinet) is open.

(Action 1) When a safety fence is connected, close the safety fence.

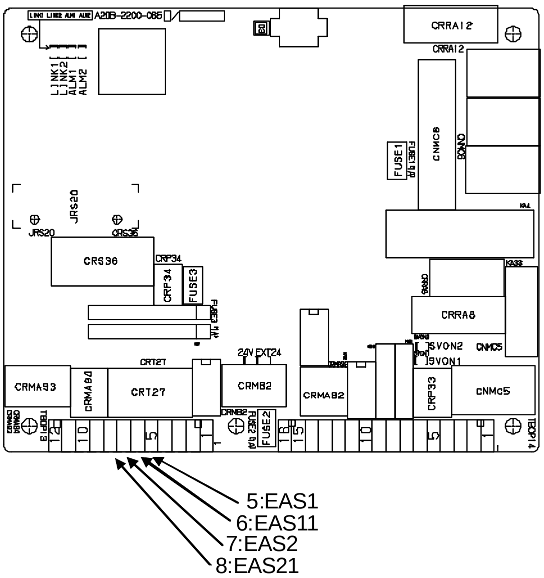
(Action 2) Check the cables and switches connected between EAS1 and EAS11 and between EAS2 and EAS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board.

(Action 3) If the safety fence signal is not used, make a connection between EAS1 and EAS11 and between EAS2 and EAS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board.

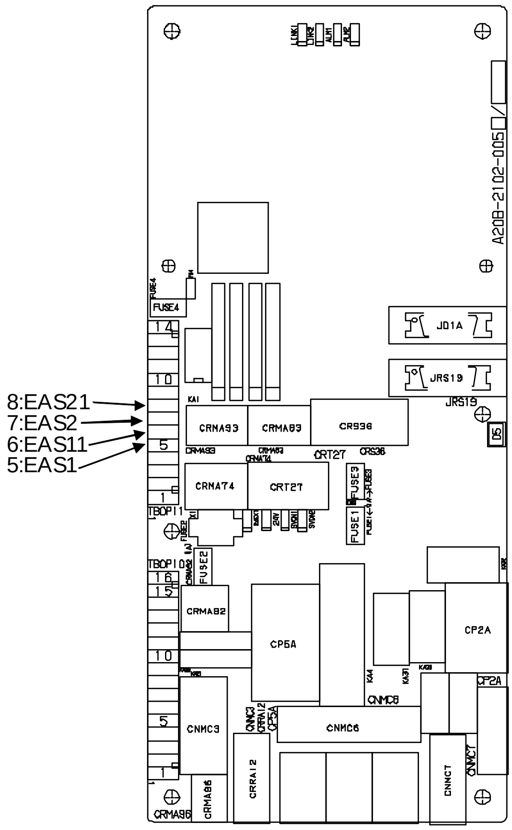
(Action 4) Check the mode switch. If trouble is found, replace the mode switch.

(Action 5) Replace the emergency stop board.

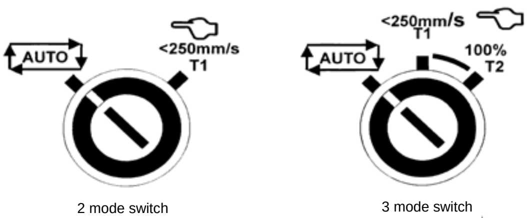
NOTE
If SRVO-004 is issued together with SRVO-213, a fuse may have blown. Take the same actions as for SRVO-213.



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)



(Mode switch)

Fig.3.5 (c) SRV0-004 Fence open

> ⚠ **WARNING**
> In a system using the safety fence signal, it is very dangerous to disable the signal when a connection is made between EAS1 and EAS11 and between EAS2 and EAS21. Never make such an attempt. If a temporary connection is needed for operation, separate safety measures must be taken.

SRVO-005 Robot overtravel

(Explanation) The robot has moved beyond a hardware limit switch on the axes.

(Action 1)
1) Select [System OT release] on the overtravel release screen to release each robot axis from the overtravel state.
2) Hold down the shift key, and press the alarm release button to reset the alarm condition.
3) Still hold down the shift key, and jog to bring all axes into the movable range.

(Action 2) Replace the limit switch.

(Action 3) Check the FS2 fuse on the 6-axis servo amplifier. If the SRVO-214 fuse blown alarm is also generated, the fuse (FS2) has blown.

(Action 4) Check the EE connector.

(Action 5) Replace the 6-axis servo amplifier.

(Action 6) Verify the following for connector RP1 at the base of the robot:
1) There are no bent or dislocated pins in the male or female connectors.
2) The connector is securely connected.

Then verify that connectors CRF8 and CRM68 on the 6-axis servo amplifier are securely connected. Also, verify that the robot connection cable (RMP1) is in good condition, and there are no cuts or kinks visible. Check the internal cable of the robot for a short circuit or connection to ground.

> **NOTE**
> It is factory-placed in the overtravel state for packing purposes.
> If the Overtravel signal is not in use, it may have been disabled by short-circuiting in the mechanical unit.

SRVO-006 Hand broken

(Explanation) The safety joint (if in use) might have been broken. Alternatively, the HBK signal on the robot connection cable might be a ground fault or a cable disconnection.

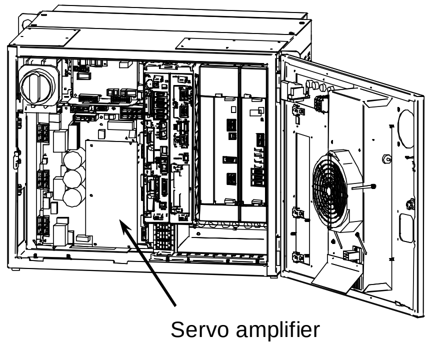
(Action 1) Hold down the shift key, and press the alarm release button to reset the alarm condition. While still holding down the shift key, jog the tool to the work area.
1) Replace the hand broken device.
2) Check the hand broken cable.

(Action 2) Replace the 6-axis servo amplifier.

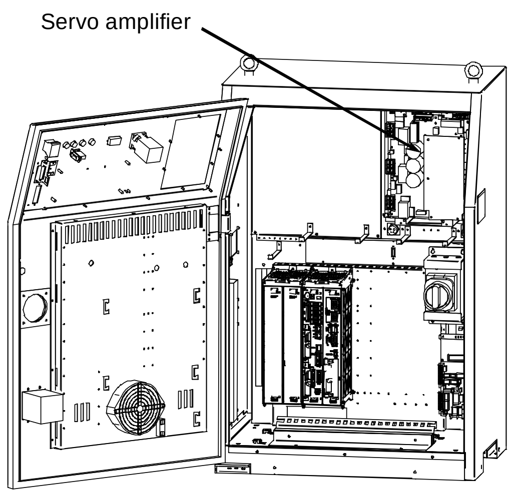
(Action 3) Verify the following for connector RP1 at the base of the robot:
1) There are no bent or dislocated pins in the male or female connectors.
2) The connector is securely connected.

Then verify that connectors CRF8 and CRM68 on the 6-axis servo amplifier are securely connected. Also, verify that the robot connection cable (RMP1) is in good condition, and there are no cuts or kinks visible. Check the internal cable of the robot for a short circuit or connection to ground.

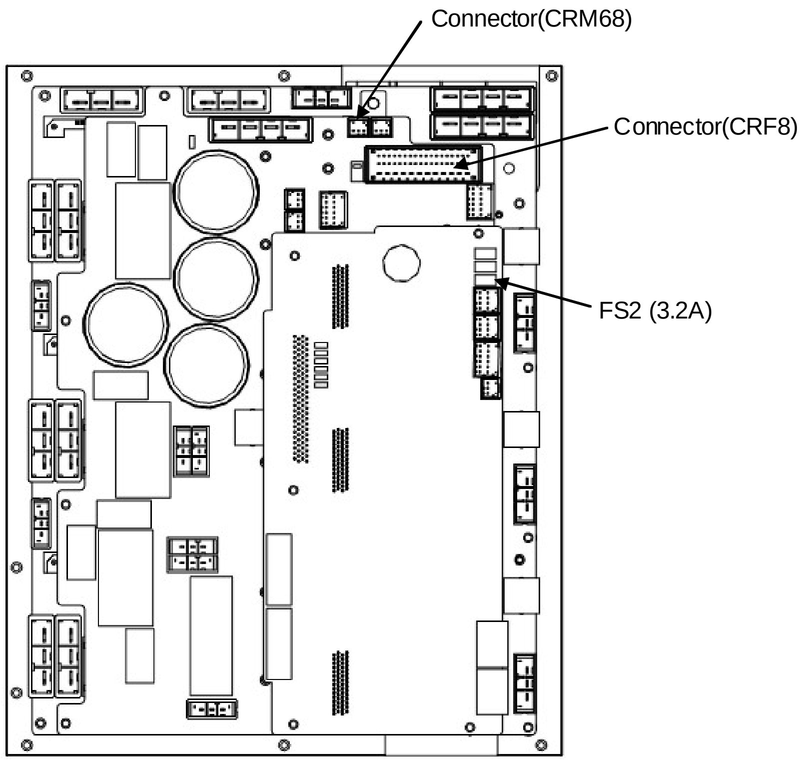
> **NOTE**
> If the Hand broken signal is not in use, it can be disabled by software setting.
> Refer to Subsection 5.5.3 in CONNECTIONS to disable the Hand broken signal.



(A-cabinet)



(B-cabinet)



(Servo amplifier)

Fig.3.5 (d) SRVO-005 Robot overtravel
SRVO-006 Hand broken

SRVO-007 External emergency stops

(Explanation) On the terminal block, TBOP13(A-cabinet) or TBOP11(B-cabinet) of the emergency stop board, no connection of external emergency stop is made between EES1 and EES11, EES2 and EES21.

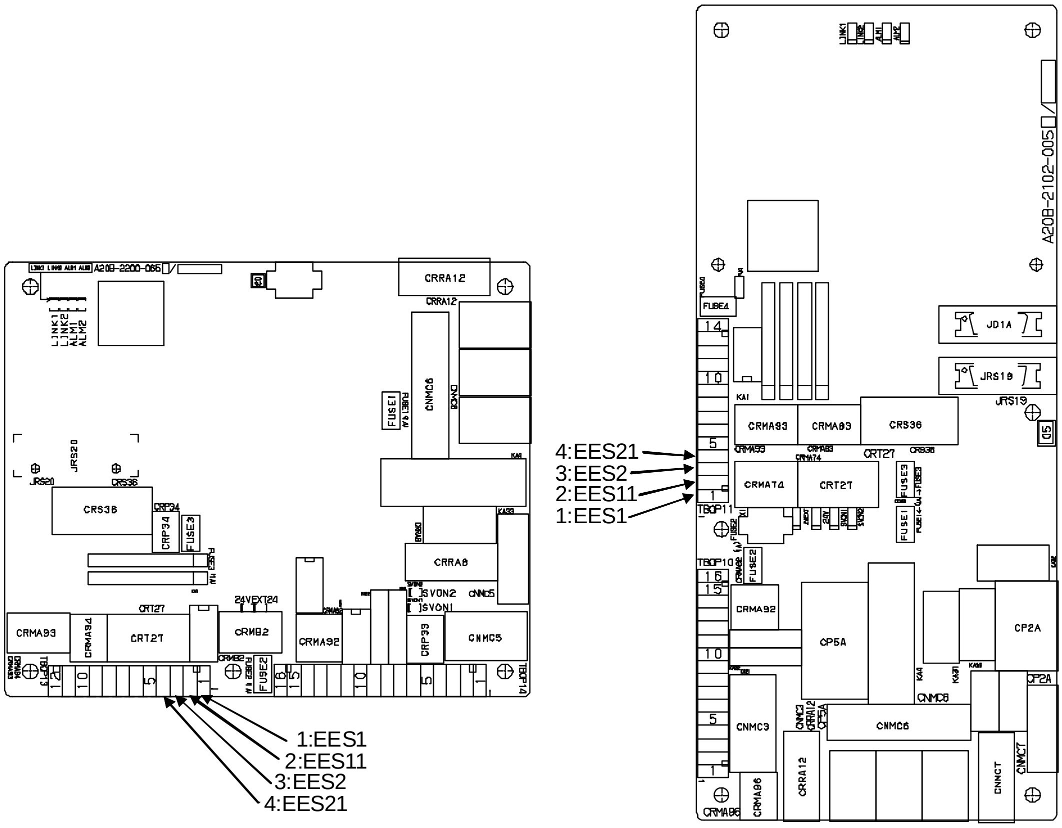
(Action 1) If an external emergency stop switch is connected, release the switch.

(Action 2) Check the switch and cable connected to EES1-EES11 and EES2-EES21 on TBOP13(A-cabinet) or TBOP11(B-cabinet).

(Action 3) When this signal is not used, make a connection between EES1 and EES11, EES2 and EES21.

(Action 4) Replace the emergency stop board.

> **NOTE**
> If SRVO-007 is issued together with SRVO-213, a fuse may have blown. Take the same actions as for SRVO-213.



(Emergency stop board/A-cabinet) **(Emergency stop board/B-cabinet)**

Fig.3.5 (e) SRVO-007 External-emergency stops

> ⚠ **WARNING**
> In a system using the external emergency stop signal, it is very dangerous to disable the signal when a connection is made between EES1 and EES11 and between EES2 and EES21. Never make such an attempt. If a temporary connection is needed for operation, separate safety measures must be taken.

SRVO-009 Pneumatic pressure alarm

(Explanation) Abnormal air pressure was detected. The input signal is located on the EE interface of the robot. Refer to the manual specific to your robot model.

(Action 1) If an abnormal air pressure is detected, check the cause.

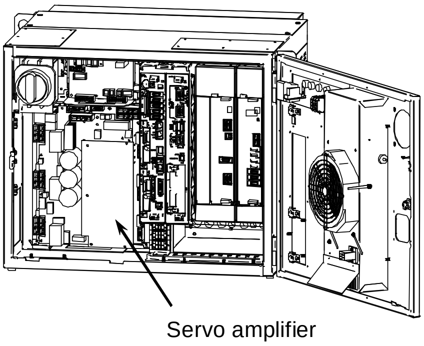
(Action 2) Check the EE connector.

(Action 3) Check the robot connection cable (RP1) and the mechanical unit cable of the robot for a ground fault or a cable disconnection. If a fault or a disconnection is detected, replace the cable.

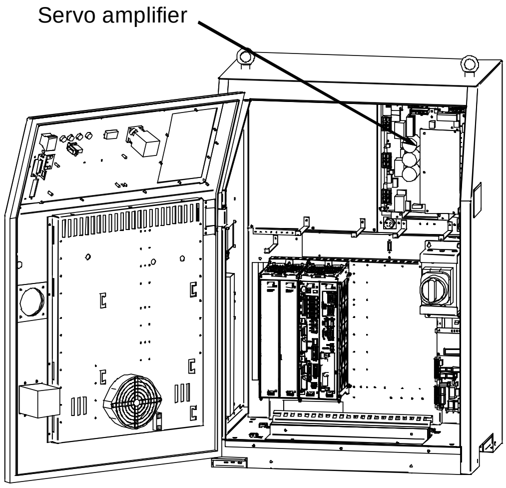
(Action 4) Replace the 6-axis servo amplifier.

(Action 5) Replace the internal cables of the robot.

> **NOTE**
> Pneumatic pressure alarm input is on the EE interface of robot. Please refer to the manual of your robot.



(A-cabinet)



(B-cabinet)

Fig.3.5 (f) SRVO-009 Pneumatic pressure alarm

SRVO-014 Fan motor abnormal (n), CPU STOP

(Explanation) When a fan motor stops on the backplane, the TP shows the following message. One minute from the occurrence of the alarm, the robot stops and cannot be operated from the TP. The robot can be recovered by replacing the faulty fan motor. The number in the bracket indicates which fan is abnormal.

(1): fan above the slot1
(2): fan above slot2
(3): both fans

(Action 1) Check the fan motor and its cables. Replace them if necessary.

(Action 2) Replace the backplane.
Before executing the (Action 3), perform a complete controller back up to save all your programs and settings.

(Action 3) Replace the main board.

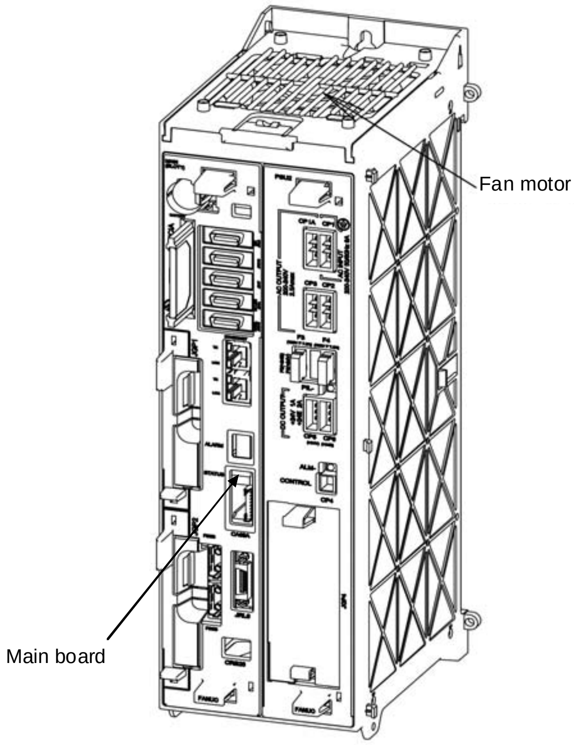


Fig.3.5 (g) SRVO-014 Fan motor abnormal (n), CPU STOP

SRVO-015 System over heat

(Explanation) The temperature in the controller exceeds the specified value. In one minutes from occurring of alarm, robot stops and cannot be operated from TP.

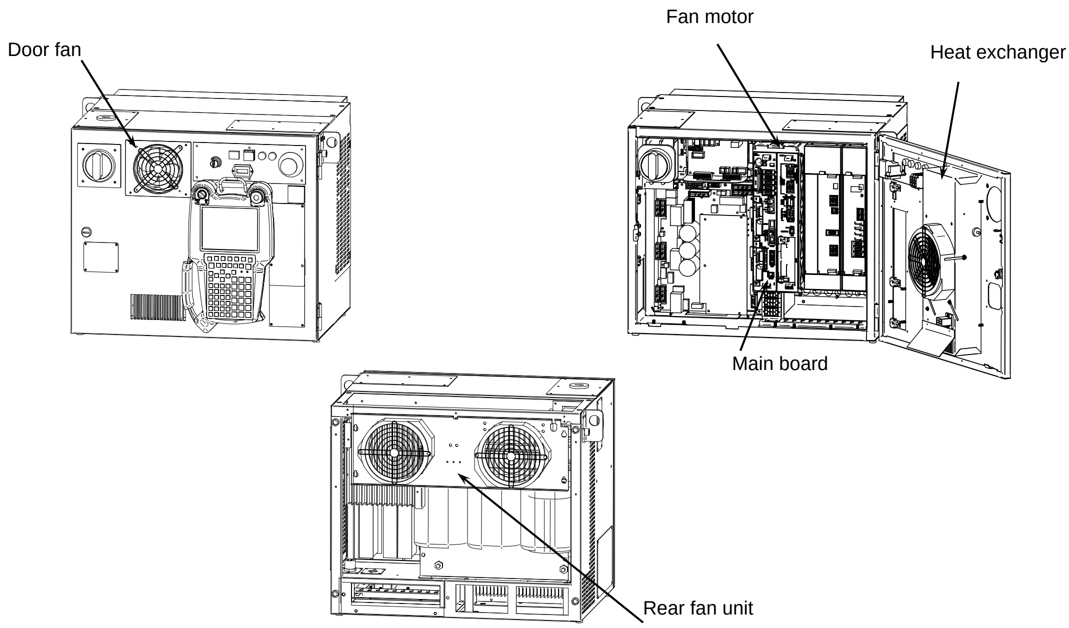
(Action 1) If the ambient temperature is higher than specified (45°C), cool down the ambient temperature.

(Action 2) If the fan motor is not running, check it and its cables. Replace them if necessary.

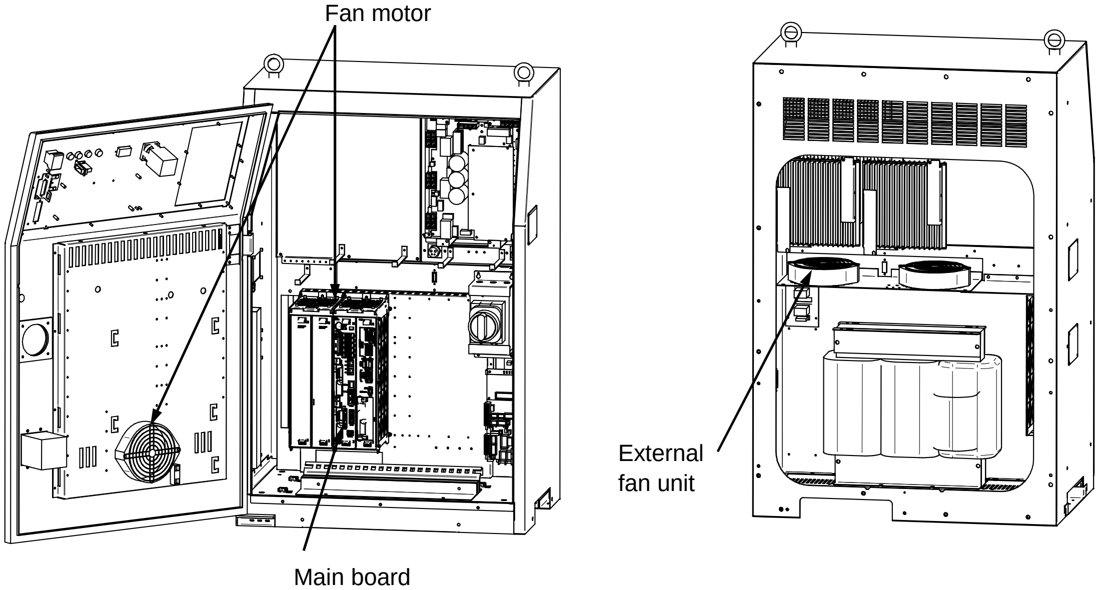
Before executing the (Action 3), perform a complete controller backup to save all your programs and settings.

(Action 3) Replace the main board. (The thermostat on the main board may be faulty.)

> **NOTE**
> The controller will stop operation after 1 minutes of this alarm.



(A-cabinet)



(B-cabinet)

Fig.3.5 (h) SRVO-015 System over heat

SRVO-018 Brake abnormal (Group: i Axis: j)

(Explanation) An excessive brake current is detected. The ALM LED on the 6-axis servo amplifier is lit.

(Action 1) Check the robot connection cable (RM1,RMP) and the internal cable of the robot and motor brakes connected to CRR88 connector on the 6-axis servo amplifier.
If a short-circuit or grounding fault is found, replace the failed part.

(Action 2) Check the cables and motor brakes connected to CRR65A, CRR65B connector on the 6-axis servo amplifier. If a short-circuit or grounding fault is found, replace the failed part.

(Action 3) Replace the 6-axis servo amplifier.

> ⚠ **CAUTION**
> This error can be caused by the optional brake release unit if the on/off switch is left in on position while the operator attempts to jog the robot. To recover, turn the brake release unit off and cycle the controller power.

SRVO-021 SRDY off (Group: i Axis: j)

(Explanation) The HRDY is on and the SRDY is off, although there is no other cause of an alarm. (HRDY is a signal with which the host detects the servo system whether to turn on or off the servo amplifier magnetic contactor. SRDY is a signal with which the servo system informs the host whether the magnetic contactor is turned on.)
If the servo amplifier magnetic contactor cannot be turned on when directed so, it is most likely that a servo amplifier alarm has occurred. If a servo amplifier alarm has been detected, the host will not issue this alarm (SRDY off). Therefore, this alarm indicates that the magnetic contactor cannot be turned on for an unknown reason.

(Action 1) Make sure that the emergency stop board connectors CRRA8(A-cabinet) or CP2A(B-cabinet), CRMA92, CNMC5(A-cabinet), or CNMC7(B-cabinet), and CRMA91(6-axis amplifier) are securely attached to the servo amplifier.
In case of using aux. axis amplifier, make sure that the connectors CXA2A (6-axis amplifier) or CXA2B (aux. axis amplifier) are securely attached to the servo amplifier.

(Action 2) It is possible that a momentary power loss occurred due to an intermittent connection. Check related cables.

(Action 3) Replace the E-stop unit.

(Action 4) Replace the servo amplifier.

SRVO-022 SRDY on (Group: i Axis: j)

(Explanation) When the HRDY is about to go on, the SRDY is already on. (HRDY is a signal with which the host directs the servo system whether to turn on or off the servo amplifier magnetic contactor. SRDY is a signal with which the servo system informs the host whether the magnetic contactor is turned on.)

(Action 1) Replace the servo amplifier with the alarm message.

SRVO-023 Stop error excess (G:i A:j)

(Explanation) When the servo is at stop, the position error is abnormally large.
Check whether the brake is released through the clack sound of the brake or vibration.

In case the brake is not released.

(Action 1) If the brake is not released, check the continuity of the brake line in the robot connection cable and the mechanical unit cable.

(Action 2) If a cable disconnection is not found, replace the 6-axis servo amplifier or the servo motor.

In case the brake is released.

(Action 1) Check whether an obstacle inhibits robot motion.

(Action 2) Make sure that connectors CNJ1A-CNJ6 are securely attached to the 6-axis servo amplifier.

(Action 3) Check the continuity of the robot connection cable and the internal robot power cable.

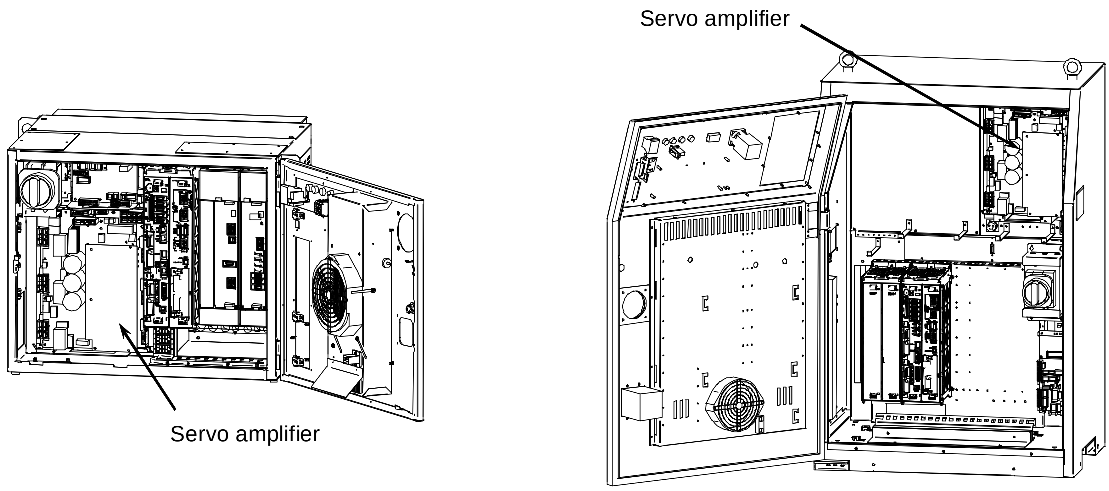
(Action 4) Check to see if the payload is greater than the rating. If greater, reduce it to within the rating. (If the load is too great, the torque required for acceleration / deceleration becomes higher than the capacity of the motor.
As a result, the motor becomes unable to follow the command signal, and an alarm is issued.)

(Action 5) Check that the input voltage to the controller is within the rated voltage and no phase is missing. And check that the setting of the transformer is correct.
Check each phase of the voltage feeding the CRR38A or CRR38B connector of the three-phase power (200 VAC) input to the 6-axis servo amplifier. If it is 210 VAC or lower, check the line voltage. (If the voltage input to the servo amplifier becomes low, the torque output also becomes low. As a result, the motor may become unable to follow the command, hence possibly causing an alarm.).

(Action 6) Replace the servo amplifier.

(Action 7) Replace the motor of the alarm axis.

NOTE
Incorrect setting of the brake number causes this alarm.



(A-cabinet) **(B-cabinet)**

Fig.3.5 (i) SRVO-018 Brake abnormal
SRVO-021 SRDY off
SRVO-022 SRDY on
SRVO-023 Stop error excess

SRVO-024 Move error excess (G:i A:j)

(Explanation) When the robot is running, its position error is greater than a specified value ($PARAM _ GROUP. $MOVER _ OFFST). It is likely that the robot cannot follow the speed specified by program.

(Action 1) Take the same actions as SRVO-023.

SRVO-027 Robot not mastered (Group: i)

(Explanation) An attempt was made to calibrate the robot, but the necessary mastering had not been completed.

(Action) Check whether the mastering is valid. If the mastering is invalid, master the robot.

> ⚠ **WARNING**
> If the position data is incorrect, the robot or additional axis can operate abnormally, set the position data correctly. Otherwise, you could injure personnel or damage equipment.

SRVO-030 Brake on hold (Group: i)

(Explanation) If the temporary halt alarm function is enabled ($SCR.$BRKHOLD ENB=1), SRVO-030 is issued when a temporary halt occurs. When this function is not used, disable the setting.

(Action) Disable [Servo-off in temporary halt] on the general item setting screen [6 General Setting Items].

SRVO-033 Robot not calibrated (Group: i)

(Explanation) An attempt was made to set up a reference point for quick mastering, but the robot had not been calibrated.

(Action) Calibrate the robot.

1. Supply power.
2. Set up a quick mastering reference point using [Positioning] on the SYSTEM Master/Cal menu.

SRVO-034 Ref pos not set (Group: i)

(Explanation) An attempt was made to perform quick mastering, but the reference point had not been set up.

(Action) Set up a quick mastering reference point on the SYSTEM Master/Cal menu.

SRVO-036 Inpos time over (G:i A:j)

(Explanation) The robot did not get to the effective area ($PARAM _ GROUP.$ STOPTOL) even after the position check monitoring time ($PARAM _ GROUP. $INPOS _ TIME) elapsed.

(Action) Take the same actions as for SRVO-023 (large position error at a stop).

SRVO-037 IMSTP input (Group: i)

(Explanation) The *IMSTP signal for a peripheral device interface was input.

(Action) Turn on the *IMSTP signal.

SRVO-038 Pulse mismatch (Group: i Axis: j)

(Explanation) The pulse count obtained when power is turned off does not match the pulse count obtained when power is applied. This alarm is asserted after replacing the Pulsecoder, or after replacing the battery used to back up Pulsecoder data, or after loading back up data to the Main Board.

Check the alarm history.

(Action 1) If the brake number is set to non-brake motors, this alarm may occur. Check the software setting of the brake number.

(Action 2) In case the robot has been moved by using the brake release unit while the power is off or when restoring the back-up data to the main board, this alarm may occur. Remaster the robot.

(Action 3) If the robot moved because the brake failed, this alarm may occur. Check the cause of the brake trouble. Then remaster the robot.

(Action 4) Replace the Pulsecoder and master the robot.

SRVO-043 DCAL alarm (Group: i Axis: j)

(Explanation) The regenerative discharge energy was too high to be dissipated as heat. (To run the robot, the servo amplifier supplies energy to the robot. When going down the vertical axis, the robot operates from the potential energy. If a reduction in the potential energy is higher than the energy needed for acceleration, the servo amplifier receives energy from the motor. A similar phenomenon occurs even when no gravity is applied, for example, at deceleration on a horizontal axis. The energy that the servo amplifier receives from the motor is called the regenerative energy. The servo amplifier dissipates this energy as heat. If the regenerative energy is higher than the energy dissipated as heat, the difference is stored in the servo amplifier, causing an alarm.)

(Action 1) This alarm may occur if the axis is subjected to frequent acceleration/deceleration or if the axis is vertical and generates a large amount of regenerative energy.
If this alarm has occurred, relax the service conditions.

(Action 2) Check fuse FS3 in the 6-axis servo amplifier. If it has blown, remove the cause, and replace the fuse. One of the probable causes of a blown fuse is a ground fault in the servo amplifier for the auxiliary axis.

(Action 3) The ambient temperature is excessively high. Or the regenerative resistor can't be cooled effectively. Check the external fan unit, and replace it if it stops. Clean up the fun unit, the regenerative resistor and the louver if they are dirty.

(Action 4) Make sure that the 6-axis servo amplifier CRR63A and CRR63B connectors are connected tightly. Then detach the cable from CRR63A and CRR63B connectors on the Servo amplifier, and check for continuity between pins 1 and 2 of the cable-end connector. If there is no continuity between the pins, replace the regenerative resistor.

(Action 5) Make sure that the 6-axis servo amplifier CRRA11A and CRRA11B are connected tightly, then detach the cables from CRRA11A and CRRA11B on the servo amplifier and check the resistance between pins 1 and 3 of each cable end connector. If the resistance is not 6.5Ω, replace the regenerative resistor. CRRA11B may not be used depending on the robot model.

(Action 6) Replace the 6-axis servo amplifier.

SRVO-044 DCHVAL%s alarm (G:i A:j)

(Explanation) The DC voltage (DC link voltage) of the main circuit power supply is abnormally high.

(Action 1) Check that the input voltage to the controller is within the rated voltage. And check that the setting of the transformer is correct.

(Action 2) Check the three-phase input voltage at the 6-Axis servo amplifier. If it is 240 VAC or higher, check the line voltage. (If the three-phase input voltage is higher than 240 VAC, high acceleration/deceleration can cause in this alarm.)

(Action 3) Check that the load weight is within the rating. If it is higher than the rating, reduce it to within the rating. (If the machine load is higher than the rating, the accumulation of regenerative energy might result in the HVAL alarm even when the three-phase input voltage is within the rating.)

(Action 4) Make sure that the 6-Axis servo amplifier CRRA11A and CRRA11B are connected tightly, then detach the cables from CRRA11A and CRRA11B on the servo amplifier and check the resistance between pins 1 and 3 of each cable end connector. If the resistance is not 6.5Ω, replace the regenerative resistor. CRRA11B may not be used depending on the robot model.

(Action 5) Replace the 6-Axis servo amplifier.

(Action 6) Replace the Power Supply(α*i*PS).

SRVO-045 HCAL alarm (Group: i Axis: j)

(Explanation) Abnormally high current was detected in the main circuit of the servo amplifier.

(Action 1) Turn off the power, and disconnect the power cable from the 6-Axis servo amplifier indicated by the alarm message. (And disconnect the brake cable (CRR88 on the servo amplifier) to avoid the axis falling unexpectedly.) Supply power and see if the alarm occurs again. If the alarm occurs again, replace the servo amplifier.

(Action 2) Turn off the power and disconnect the power cable from the servo amplifier indicated by the alarm message, and check the insulation by measuring between U, V, or W and the GND line. If there is a short-circuit, replace the power cable.

(Action 3) Turn off the power and disconnect the power cable from the servo amplifier by the alarm message, and measure the resistance between their U and V, V and W and W and U with an ohmmeter that has a very low resistance range. If the resistances at the three places are different from each other, either the motor or the power cable is defective. Check each item in detail and replace it if necessary.

SRVO-046 OVC alarm (Group: i Axis: j)

(Explanation) This alarm is issued to prevent the motor from sustaining thermal damage that might occur when the root mean square current, calculated within the servo system, is out of the allowable range.

(Action 1) Check the operating condition for the robot and relax the service condition if possible. If the load or operating condition has exceeded the rating, reduce the load or relax the operating condition to meet the rating.

(Action 2) Check whether the voltage input to the controller is within the rated voltage and also check whether the voltage set for the transformer of the controller is correct.

(Action 3) Check whether the brake of the corresponding axis is released.

(Action 4) Check whether there is a factor that has increased the mechanical load on the corresponding axis.

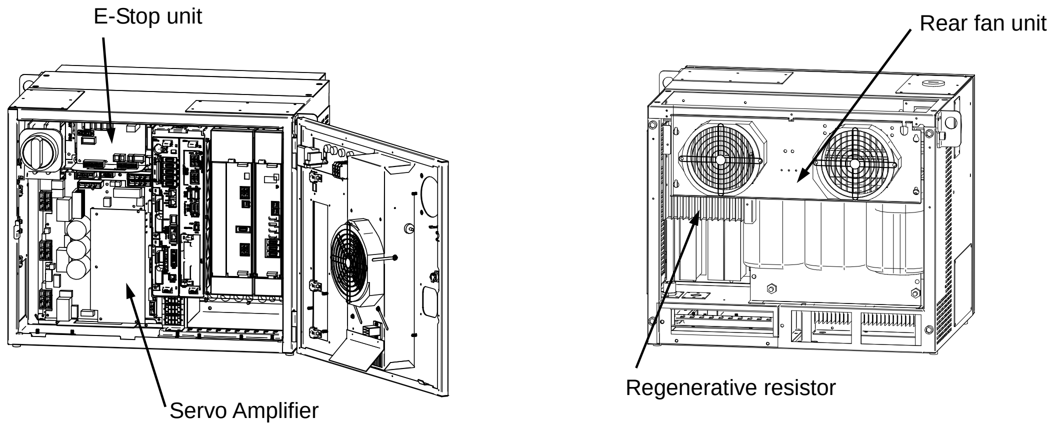
(Action 5) Replace the servo amplifier.

(Action 6) Replace the motor of the corresponding axis.

(Action 7) Replace the E-stop unit

(Action 8) Replace the motor power line (robot connection cable) of the corresponding axis.

(Action 9) Replace the motor power line and brake line (internal cable of the robot) of the corresponding axis.



(A-cabinet)

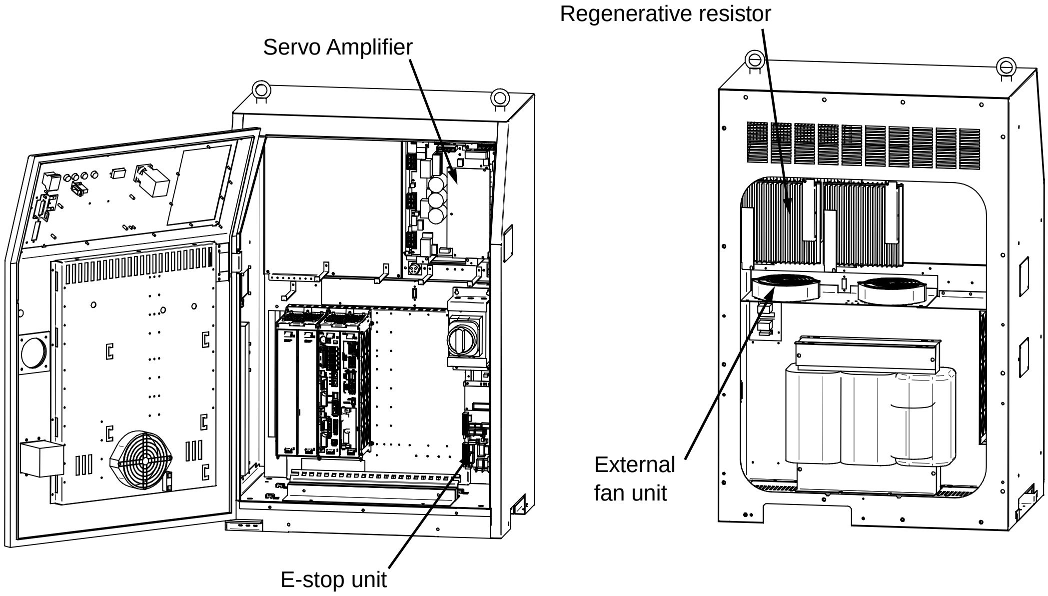


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Fig.3.5 (j) SRVO-043 DCAL alarm / SRVO-044 DCHVAL alarm
SRVO-045 HCAL alarm / SRVO-046 OVC alarm

Reference

Relationships among the OVC, OHAL, and HC alarms

- Overview

This section points out the differences among the OVC, OHAL, and HC alarms and describes the purpose of each alarm.

- Alarm detection section

Abbreviation	Designation	Detection section
OVC	Overcurrent alarm	Servo software
OHAL	Overheat alarm	Thermal relay in the motor Thermal relay in the servo amplifier Thermal relay in the separate regenerative resister
HC	High current alarm	Servo amplifier

- Purpose of each alarm

1) HC alarm (high current alarm)
   If high current flows in a power transistor momentarily due to abnormality or noise in the control circuit, the power transistor and rectifier diodes might be damaged, or the magnet of the motor might be degaussed. The HC alarm is intended to prevent such failures.
2) OVC and OHAL alarms (overcurrent and overload alarms)
   The OVC and OHAL alarms are intended to prevent overheat that may lead to the burnout of the motor winding, the breakdown of the servo amplifier transistor, and the burnout of the separate regenerative resistor.
   The OHAL alarm occurs when each built-in thermal relay detects a temperature higher than the rated value. However, this method does not perfectly prevent these failures. For example, if the motor frequently starts and stops, the thermal time constant of the motor, which has a large mass, becomes higher than the time constant of the thermal relay, because these two components are different in material, structure, and dimension. Therefore, if the motor continues to start and stop within a short time as shown in Fig. 3.5 (k), the temperature rise in the motor is steeper than that in the thermal relay, thus causing the motor to burn before the thermal relay detects an abnormally high temperature.

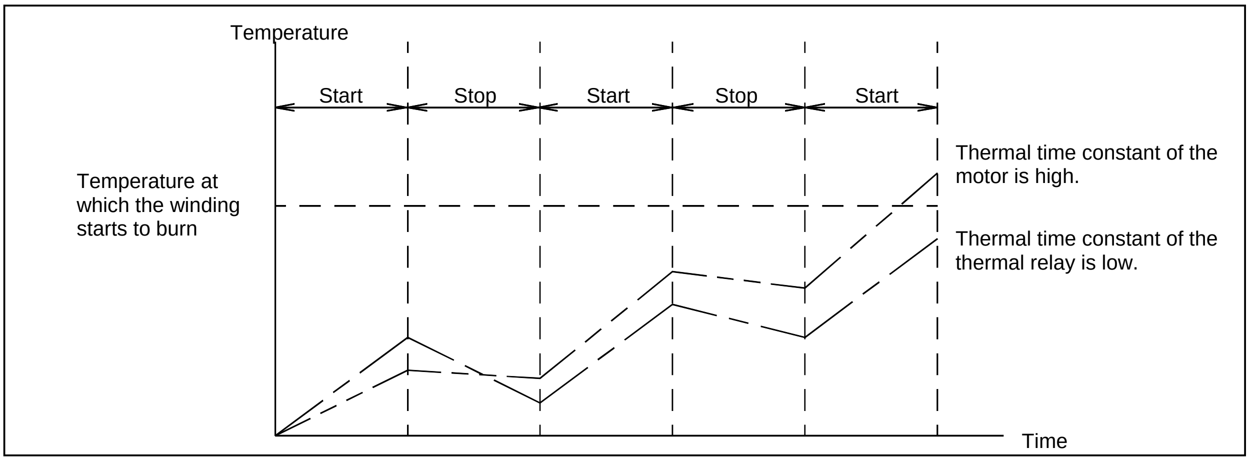


Fig.3.5 (k) Relationship between the temperatures of the motor and thermal relay on start/stop cycles

To prevent the above defects, software is used to monitor the current in the motor constantly in order to estimate the temperature of the motor. The OVC alarm is issued based on this estimated temperature. This method estimates the motor temperature with substantial accuracy, so it can prevent the failures described above.

To sum up, a double protection method is used; the OVC alarm is used for protection from a short-time overcurrent, and the OHAL alarm is used for protection from long-term overload. The relationship between the OVC and OHAL alarms is shown in Fig.3.5 (l).

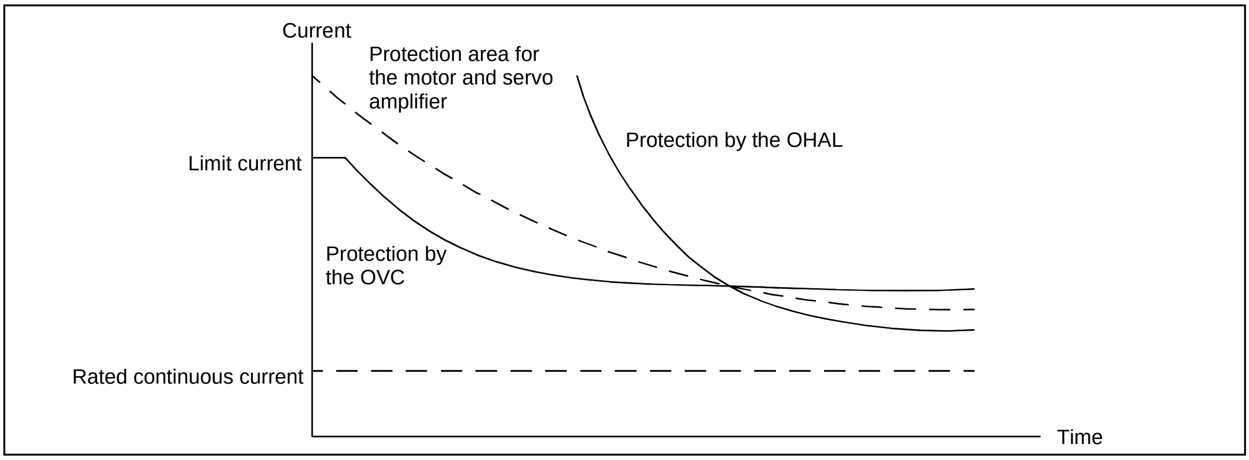
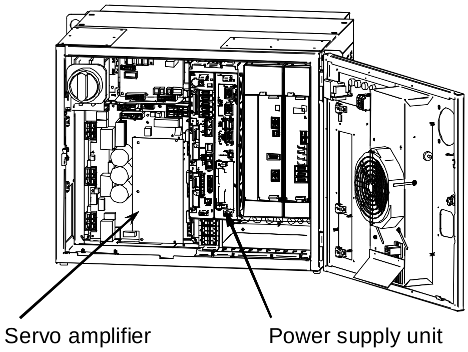


Fig.3.5 (l) Relationship between the OVC and OHAL alarms

> **NOTE**
> The relationship shown in Fig.3.5 (l) is taken into consideration for the OVC alarm. The motor might not be hot even if the OVC alarm has occurred. In this case, do not change the parameters to relax protection.

SRVO-047 LVAL alarm (Group: i Axis: j)

(Explanation) The control power supply voltage (+5 V, etc.) supplied from the power supply circuit in the servo amplifier is abnormally low.
(Action 1) Replace the servo amplifier.
(Action 2) Replace the power supply unit.



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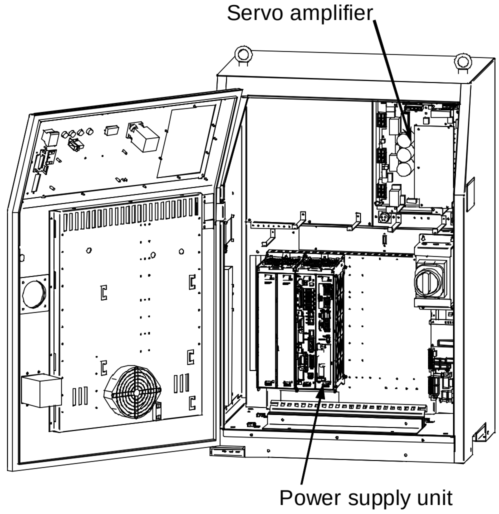


(B-cabinet)

Fig.3.5 (m) SRVO-047 LVAL alarm

SRVO-049 OHAL1 alarm (G: i A: j)

(Explanation) The thermostat in the transformer activated.

(Action 1) Check whether the fan is stopped and also check whether the vent is clogged. If necessary, clean or replace them.
(Action 2) If SRVO-049 is issued when the robot operating condition is severe, check the robot operating condition then relax the condition when possible.
(Action 3) Check that a connection is made between the transformer connector CPOH and the servo amplifier CRMA91.
(Action 4) Check whether no phase occurs.
(Action 5) Replace the E-stop unit.
(Action 6) Replace the servo amplifier.
(Action 7) Replace the transformer.

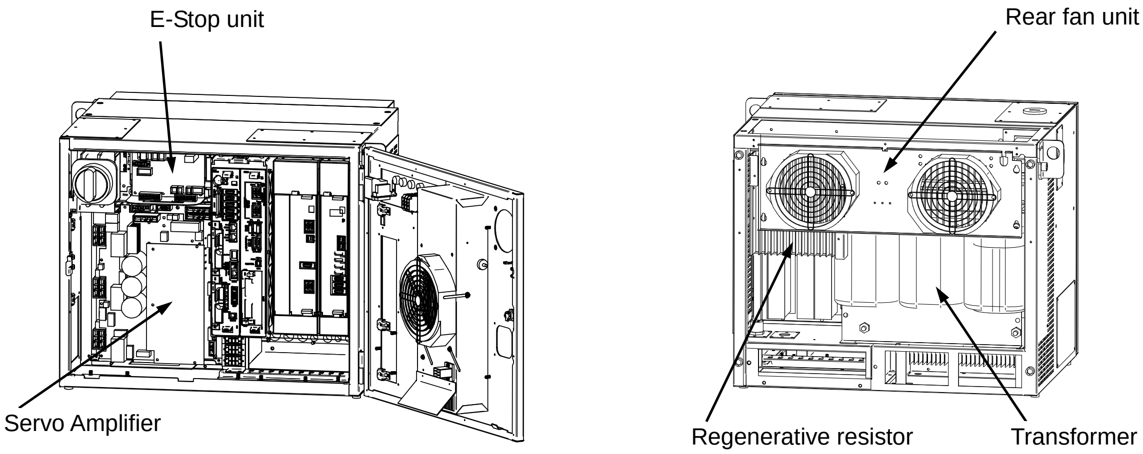
SRVO-050 Collision Detect alarm (Grp:i Ax:j)

(Explanation) The disturbance torque estimated by the servo software is abnormally high. (A collision has been detected.)

(Action 1) Check whether the robot has collided and also check whether there is a factor that has increased the mechanical load on the corresponding axis.
(Action 2) Check whether the load settings are valid.
(Action 3) Check whether the brake of the corresponding axis is released.
(Action 4) If the load weight exceeds the rated range, decrease it to within the limit.
(Action 5) Check whether the voltage input to the controller is within the rated voltage and also check whether the voltage set for the transformer of the controller is correct.
(Action 6) Replace the servo amplifier.
(Action 7) Replace the motor of the corresponding axis.
(Action 8) Replace the E-stop unit.
(Action 9) Replace the motor power line (robot connection cable) of the corresponding axis.
(Action 10) Replace the motor power line and brake line (internal cable of the robot) of the corresponding axis.

SRVO-051 CUER alarm (Group: i Axis: j)

(Explanation) The offset of the current feedback value is abnormally high.
(Action) Replace the servo amplifier.



(A- cabinet)

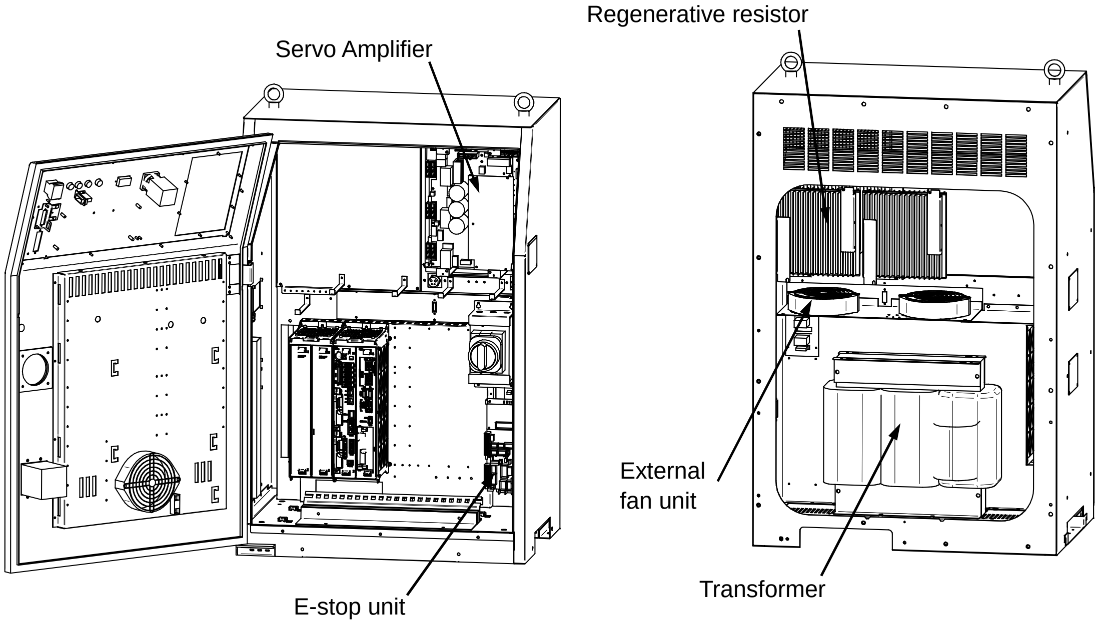


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Fig.3.5 (n) SRVO-049 OHAL1 alarm
SRVO-050 Collision Detect alarm
SRVO-051 CUER alarm

SRVO-055 FSSB com error 1 (G: i A: j)

(Explanation) A communication error has occurred between the main board and servo amplifier.
(Action 1) Check the optical fiber cable between the axis control card on the main board and servo amplifier. Replace it if it is faulty.
(Action 2) Replace the axis control card on the main board.
(Action 3) Replace the servo amplifier.

SRVO-056 FSSB com error 2 (G: i A: j)

(Explanation) A communication error has occurred between the main board and servo amplifier.
(Action 1) Check the optical fiber cable between the axis control card on the main board and servo amplifier. Replace it if it is faulty.
(Action 2) Replace the axis control card on the main board.
(Action 3) Replace the servo amplifier.

SRVO-057 FSSB disconnect (G:i A: j)

(Explanation) Communication was interrupted between the main board and servo amplifier.
(Action 1) Check whether fuse (F4) in the power supply unit has blown. If the fuse has blown, check and correct the cause then replace the fuse.
(Action 2) Check whether fuse (FS1) in the 6-Axis servo amplifier has blown. If the fuse has blown, replace the 6-Axis servo amplifier including the fuse.
(Action 3) Check the optical fiber cable between the axis control card on the main board and servo amplifier. Replace it if it is faulty.
(Action 4) Replace the axis control card on the main board.
(Action 5) Replace the servo amplifier.
(Action 6) Check that the robot connection cable (RP1) is in good condition, and there are no cuts or kinks visible. Check the internal cable of the robot (Pulsecoder cable) for a short circuit or connection to ground.
Before continuing to the next step, perform a complete controller back up to save all your programs and settings.
(Action 7) Replace the main board.

SRVO-058 FSSB init error (yy)

(Explanation) Communication was interrupted between the main board and servo amplifier.
(Action 1) Check whether fuse (F4) in the power supply unit has blown. If the fuse has blown, check and correct the cause, then replace the fuse.
(Action 2) Check whether fuse (FS1) on the 6-Axis servo amplifier has blown. If the fuse has blown, replace the servo amplifier including the fuse.
(Action 3) Turn off the power and disconnect the CRF8 connector on the 6-Axis servo amplifier. Then check whether this alarm occurs again. (Ignore the alarm SRVO-068 because of disconnecting the CRF8 connector.)
If this alarm does not occur, the robot connection cable (RP1) or the internal cable of the robot (Pulsecoder cable) may be short-circuited to ground. Check the cables and replace it if necessary.

(Action 4) Check whether the LED (P5V and P3.3V) on the 6-Axis servo amplifier is lit. If they are not lit, the DC power is not supplied to the servo amplifier.
Make sure the connector CP5 on the power supply unit and the connector CXA2B on the 6-Axis servo amplifier are connected tightly. If they are connected tightly, replace the 6-Axis servo amplifier.

(Action 5) Check the optical fiber cable between the axis control card on the main board and servo amplifier. Replace it if it is faulty.

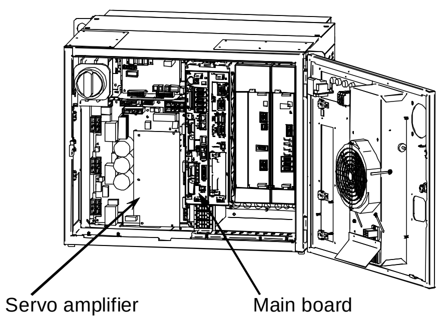
(Action 6) Replace the axis control card on the main board.

(Action 7) Replace the 6-Axis servo amplifier.

(Action 8) If the other units (the servo amplifier for the auxiliary axis and the line tracking board) are connected in the FSSB optical communication, disconnect these units and connect only 6-Axis servo amplifier for the robot. Then turn on the power. If this alarm does not occur, search the failed unit and replace it.

Before executing the (Action9), perform a complete controller back up to save all your programs and settings.

(Action 9) Replace the main board.



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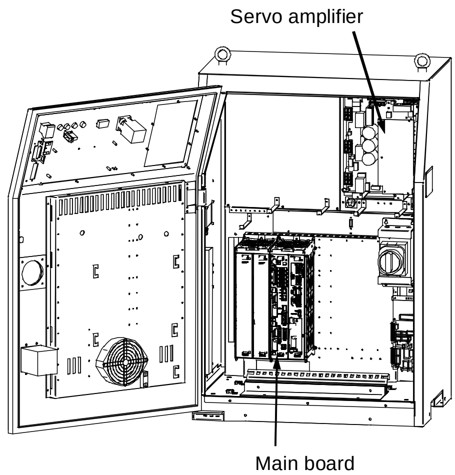

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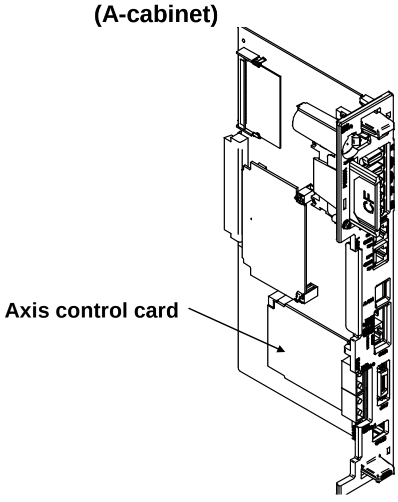
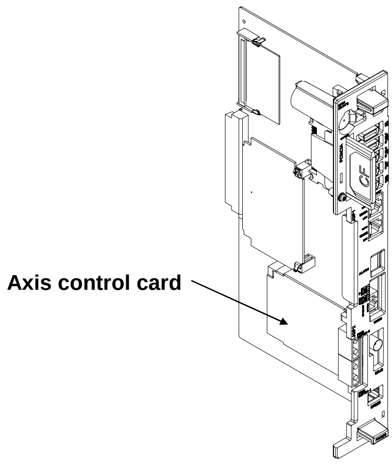


(R-30*i*B Main board)



(R-30*i*B Plus Main board)

Fig.3.5 (o) SRVO-055 FSSB com error 1
SRVO-056 FSSB com error 2
SRVO-057 FSSB disconnect
SRVO-058 FSSB init error

SRVO-059 Servo amp init error

(Explanation) Servo amplifier initialization is failed.

(Action 1) Check the optical fiber cable between the axis control card on the main board and servo amplifier. Replace it if it is faulty.

(Action 2) Turn off the power and disconnect the CRF8 connector on the 6-Axis servo amplifier. Then check whether this alarm occurs again. (Ignore the alarm SRVO-068 because of disconnecting the CRF8 connector.)
If this alarm does not occur, the robot connection cable (RP1) or the internal cable of the robot (Pulsecoder cable) may be short-circuited to the ground. Check the cables and replace it if necessary.

(Action 3) Check whether the LED (P5V and P3.3V) on the 6-Axis servo amplifier is lit. If they are not lit, the DC power is not supplied to the servo amplifier.
Make sure the connector CP5 on the power supply unit and the connector CXA2B on the 6-Axis servo amplifier are connected tightly. If they are connected tightly, replace the 6-Axis servo amplifier.

(Action 4) Replace the servo amplifier.

(Action 5) Replace the line tracking board (If installed).

(Action 6) Replace the Pulsecoder.

SRVO-062 BZAL alarm (Group: i Axis: j)

(Explanation) This alarm occurs if battery voltage for Pulsecoder absolute-position backup cannot be detected.
A probable cause is a broken battery cable or no batteries in the robot.

(Action 1) Replace the battery in the battery box of the robot base.

(Action 2) Replace the Pulsecoder with which an alarm has been issued.

(Action 3) Check whether the mechanical unit cable for feeding power from the battery to the Pulsecoder is disconnected or grounded. If an abnormality is found, replace the cable.

> ⚠ **CAUTION**
> After correcting the cause of this alarm, set the system variable ($MCR.$SPC_RESET) to TRUE, then turn on the power again. Mastering is needed.

SRVO-064 PHAL alarm (Group: i Axis: j)

(Explanation) This alarm occurs if the phase of the pulses generated in the Pulsecoder is abnormal.

(Action) Replace the Pulsecoder with which an alarm has been issued.

> **NOTE**
> This alarm might accompany the DTERR, CRCERR, or STBERR alarm. In this case, however, there may be no actual condition for this alarm.

SRVO-065 BLAL alarm (Group: i Axis: j)

(Explanation) The battery voltage for the Pulsecoder is lower than the rating.

(Action) Replace the battery.
(If this alarm occurs, turn on the power and replace the battery as soon as possible. A delay in battery replacement may result in the BZAL alarm being detected. In this case, the position data will be lost. Once the position data is lost, mastering will become necessary.)

SRVO-067 OHAL2 alarm (Grp:i Ax:j)

(Explanation) The temperature inside the Pulsecoder or motor is abnormally high, and the built-in thermostat has operated.

(Action 1) Check the robot operating conditions. If a condition such as the duty cycle and load weight has exceeded the rating, relax the robot load condition to meet the allowable range.
(Action 2) When power is supplied to the motor after it has become sufficiently cool, if the alarm still occurs, replace the motor.

SRVO-068 DTERR alarm (Grp:i Ax:j)

(Explanation) The serial Pulsecoder does not return serial data in response to a request signal.
(Action 1) Make sure that the robot connection cable (RP1) connector (CRF8) of 6-Axis servo amplifier and the connector (motor side) are connected tightly.
(Action 2) Check that the shielding of the robot connection cable (RP1) is grounded securely in the cabinet.
(Action 3) Replace the Pulsecoder.
(Action 4) Replace the servo amplifier.
(Action 5) Replace the robot connection cable (RM1, RP1).
(Action 6) Replace the internal cable of the robot (for the Pulsecoder, motor cable).

SRVO-069 CRCERR alarm (Grp:i Ax:j)

(Explanation) The serial data has disturbed during communication.
(Action) See actions on SRVO-068

SRVO-070 STBERR alarm (Grp:i Ax:j)

(Explanation) The start and stop bits of the serial data are abnormal.
(Action) See actions on SRVO-068

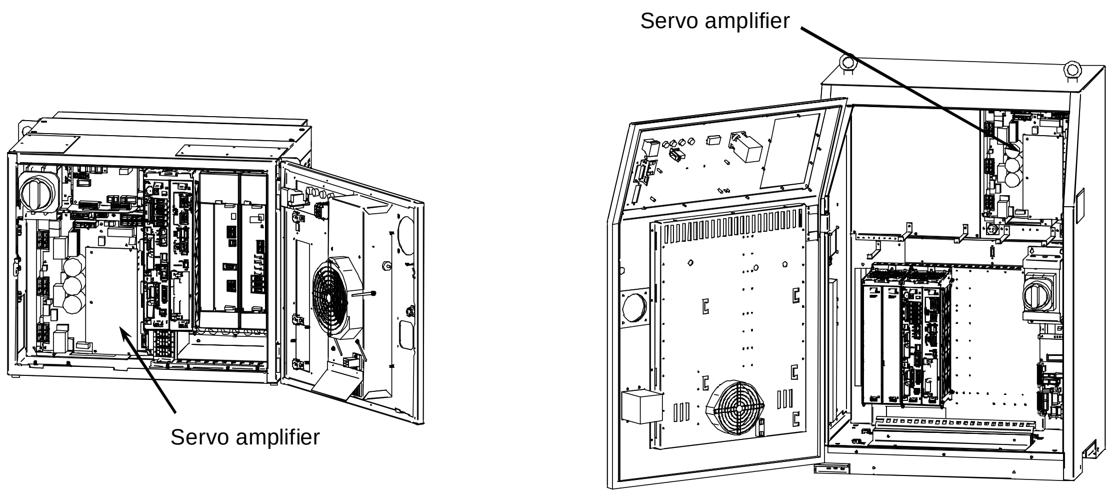


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Fig.3.5 (p) SRVO-059 Servo amp init error
SRVO-070 STBERR alarm

SRVO-071 SPHAL alarm (Grp:i Ax:j)

(Explanation) The feedback speed is abnormally high.
(Action) Action as same as the SRVO-068.

> **NOTE**
> If this alarm occurs together with the PHAL alarm (SRVO-064), this alarm does not correspond to the major cause of the failure.

SRVO-072 PMAL alarm (Group: i Axis: j)

(Explanation) It is likely that the Pulsecoder is abnormal.
(Action) Replace the Pulsecoder and remaster the robot.

SRVO-073 CMAL alarm (Group: i Axis: j)

(Explanation) It is likely that the Pulsecoder is abnormal or the Pulsecoder has malfunctioned due to noise.
(Action 1) Check whether the connection of the controller earth is good. Check the earth cable connection between controller and robot connection cables are connected securely to the grounding plate.
(Action 2) Reinforce the earth of the motor flange. (In case of Auxiliary axis)
(Action 3) Reset the Pulse count.
(Action 4) Replace the Pulsecoder.
(Action 5) Replace the robot connection cable (RM1, RP1).
(Action 6) Replace the internal cable of the robot (for the Pulsecoder, motor cable).

SRVO-074 LDAL alarm (Group: i Axis: j)

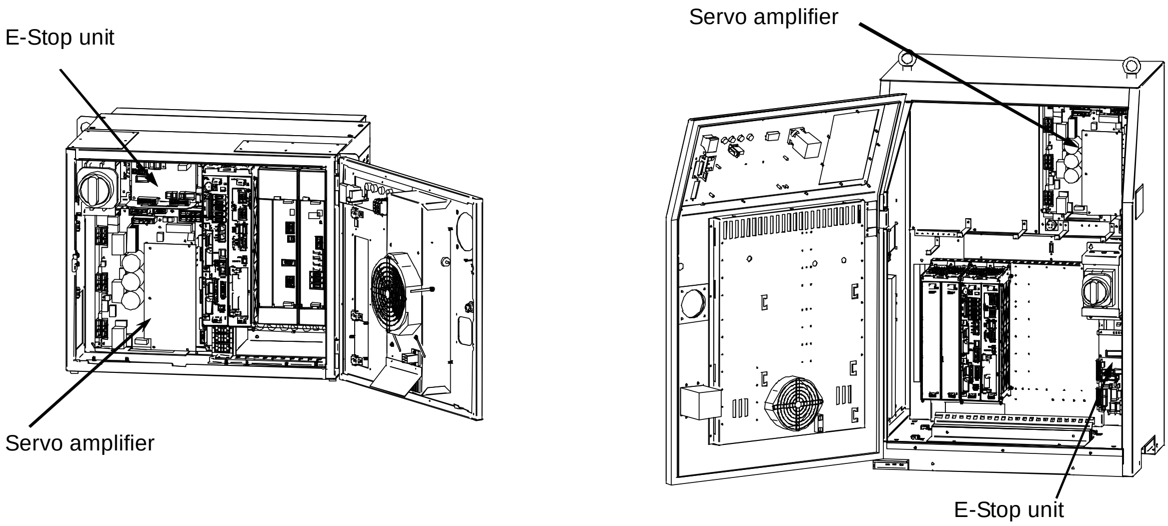
(Explanation) The LED in the Pulsecoder is broken.
(Action) Replace the Pulsecoder, and remaster the robot.

SRVO-075 Pulse not established (G: i A: j)

(Explanation) The absolute position of the Pulsecoder cannot be established.
(Action) Reset the alarm, and jog the axis on which the alarm has occurred until the same alarm will not occur again.

SRVO-076 Tip Stick Detection (G: i A: j)

(Explanation) An excessive disturbance was assumed in servo software at the start of operation. (An abnormal load was detected. The cause may be welding.)
(Action 1) Check whether the robot has collided. Or check whether the machinery load of the corresponding axis is increased.
(Action 2) Check whether the load settings are valid.
(Action 3) Check whether the brake of the corresponding axis is released.
(Action 4) Check whether the load weight is within the rated range. If the weight exceeds the upper limit, decrease it to the limit.
(Action 5) Check whether the voltage input to the controller is within the rated voltage and also check whether the voltage set for the transformer of the controller is correct.
(Action 6) Replace the servo amplifier.
(Action 7) Replace the corresponding servo motor.
(Action 8) Replace the E-stop unit.
(Action 9) Replace the power cable of the robot connection cable in which the corresponding axis is connected.
(Action 10) Replace the internal cable of the robot (power/brake) in which the corresponding axis is connected.



(A-cabinet) **(B-cabinet)**

Fig.3.5 (q) SRVO-076 Tip Stick Detection

SRVO-081 EROFL alarm (Track enc: i)

(Explanation) The pulse counter for line tracking has overflowed.
(Action 1) Check whether the condition of the line tracking exceeds the limitation.
(Action 2) Replace the Pulsecoder.
(Action 3) Replace the line tracking board.

SRVO-082 DAL alarm (Track encoder: i)

(Explanation) The line tracking Pulsecoder has not been connected.
(Action 1) Check the connection cable at each end (the line tracking board and the motor side)
(Action 2) Check whether the shielding of the connection cable is connected securely to the grounding plate.
(Action 3) Replace the line tracking cable.
(Action 4) Replace the Pulsecoder.
(Action 5) Replace the line tracking board.

SRVO-084 BZAL alarm (Track enc: i)

(Explanation) This alarm occurs if the backup battery for the absolute position of the Pulsecoder has not been connected. See the description about the BZAL alarm (SRVO-062).

SRVO-087 BLAL alarm (Track enc: i)

(Explanation) This alarm occurs if the voltage of the backup battery for the absolute position of the Pulsecoder is low. See the description about the BLAL alarm (SRVO-065).

SRVO-089 OHAL2 alarm (Track enc: i)

(Explanation) The motor has overheated. When power is supplied to the Pulsecoder after it has become sufficiently cool, if the alarm still occurs. See the description about the OHAL2 alarm (SRVO-067).

SRVO-090 DTERR alarm (Track enc: i)

(Explanation) Communication between the Pulsecoder and line tracking board is abnormal. See the SRVO-068 DTERR alarm.
(Action 1) Check the connection cable at each end (the line tracking board and the Pulsecoder)
(Action 2) Check whether the shielding of the connection cable is connected securely to the grounding plate.
(Action 3) Replace the Pulsecoder.
(Action 4) Replace the line tracking cable.
(Action 5) Replace the line tracking board.

SRVO-091 CRCERR alarm (Track enc: i)

(Explanation) Communication between the Pulsecoder and line tracking board is abnormal.
(Action) Action as same as the SRVO-090.

SRVO-092 STBERR alarm (Track enc: i)

(Explanation) Communication between the Pulsecoder and line tracking board is abnormal.
(Action) Action as same as the SRVO-090.

SRVO-093 SPHAL alarm (Track enc: i)

(Explanation) This alarm occurs if the current position data from the Pulsecoder is higher than the previous position data.
(Action) Action as same as the SRVO-090.

SRVO-094 PMAL alarm (Track enc: i)

(Explanation) It is likely that the Pulsecoder is abnormal.
(Action) Replace the Pulsecoder.

SRVO-095 CMAL alarm (Track enc: i)

(Explanation) It is likely that the Pulsecoder is abnormal or the Pulsecoder has malfunctioned due to noise. See the description about the CMAL alarm (SRVO-073).
(Action 1) Reinforce the earth of the flange of the Pulsecoder.
(Action 2) Reset the Pulse count.
(Action 3) Replace the Pulsecoder.

SRVO-096 LDAL alarm (Track enc: i)

(Explanation) The LED in the Pulsecoder is broken. See the description about the LDAL alarm (SRVO-074).

SRVO-097 Pulse not established (Enc: i)

(Explanation) The absolute position of the Pulsecoder cannot be established. See the description about (SRVO-075). Pulse not established.
(Action 1) Reset the alarm, and jog the axis on which the alarm has occurred until the same alarm does not occur again. (Jog one motor revolution)

SRVO-105 Door open or E-Stop

(Explanation) The cabinet door is open.

- When the door switch is not mounted skip Action 1 and 2 and start from Action 3

(Action 1) When the door is open, close it.
(Action 2) Check the door switch and door switch connection cable. If the switch or cable is faulty, replace it.
(Action 3) Check that the CRMA92, CRMA94(A-cabinet), CRMA74(B-cabinet) connectors on the E-STOP unit and CRMA91 on the servo amplifier are connected securely.
(Action 4) Replace the emergency stop board.
(Action 5) Replace the 6-Axis servo amplifier.

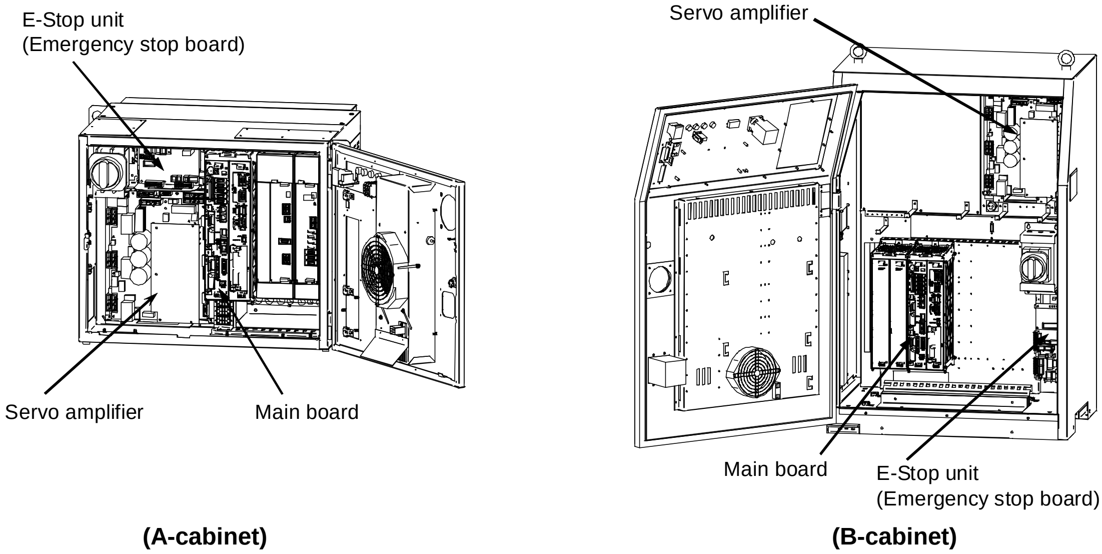


Fig.3.5 (r) SRVO-105 Door open or E-stop

SRVO-123 Fan motor rev slow down (i)

(Explanation) The rotation speed of fan motor is slow down.

(Action 1) Check the fan motor and its cables. Replace them if necessary.
(Action 2) Replace the backplane unit.
Before executing the (Action 3), perform a complete controller back up to save all your programs and settings.
(Action 3) Replace the main board.

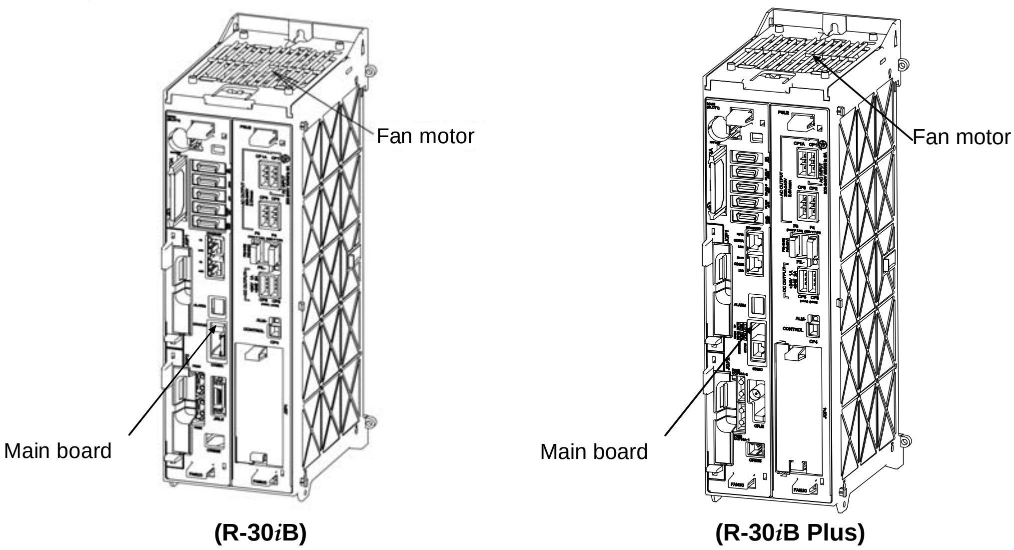


Fig.3.5 (s) SRVO-123 Fan motor rev slow down (i)

SRVO-130 OHAL1(PS) alarm (G: i A: j)

(Explanation) Heat sink temperature of the main circuit of the Power Supply(α*i*PS) is abnormally high.
(Action 1) Check the rotation of the cooling fan of the Power Supply(α*i*PS).
(Action 2) Decrease the duty cycle of operation. (Decrease override)
(Action 3) Replace the Power Supply(α*i*PS).

SRVO-131 LVAL%s alarm (G: i A: j)

(Explanation) Control supply voltage in the Power Supply(α*i*PS) is abnormally low.
(Action 1) Replace the Power Supply(α*i*PS).
(Action 2) Replace the servo amplifier.
(Action 3) Replace the Power Supply Unit.

SRVO-133 FSAL(PS) alarm (G: i A: j)

(Explanation) The cooling fan for the Control circuit of the Power Supply(α*i*PS) stopped.
(Action 1) Check the status of the cooling fan. And replace it if it was abnormal.
(Action 2) Replace the Power Supply(α*i*PS).

[Regenarative resistor]

SRVO-134 DCLVAL alarm (G: i A: j)

[Power supply regeneration]

SRVO-134 DCLVAL(PS) alarm (G: i A: j)

(Explanation) The DC voltage (DC link voltage) of the main circuit power supply for the servo amplifier is abnormally low.

(Action 1) It is possible that an instant disconnection of power source causes this alarm. Check whether an instant disconnection occurred.
(Action 2) Check the input voltage to the controller is within the rated voltage. And check the setting of the transformer is correct.
(Action 3) Modify the program in order that robot and the auxiliary axis do not accelerate simultaneously in the system with the auxiliary axis.
(Action 4) Replace the E-stop unit.
(Action 5) Replace the servo amplifier(6-Axis amplifier).
(Action 6) Replace the Power Supply(α*i*PS).

SRVO-136 DCLVAL alarm (G: i A: j)

(Explanation) The DC voltage (DC link voltage) of the main circuit power supply for the servo amplifier(α*i*SV) is abnormally low.
(Action 1) Check the wiring of the servo amplifier (α*i*SV).
(Action 2) Replace the servo amplifier (α*i*SV) that is indicated by the alarm message.

SRVO-156 IPMAL alarm (G: i A: j)

(Explanation) Abnormally high current flowed through the main circuit of the servo amplifier.

(Action 1) Turn off the power, and disconnect the power cable from the servo amplifier indicated by the alarm message. (And disconnect the brake cable (CRR88 on the servo amplifier) to avoid the axis falling unexpectedly.) Turn on the power, and if the alarm occurs again, replace the servo amplifier.

(Action 2) Turn off the power and disconnect the power cable from the servo amplifier indicated by the alarm message, and check the insulation of their U, V, W and the GND lines each other. If there is a short-circuit, replace the power cable.

(Action 3) Turn off the power and disconnect the power cable from the servo amplifier by the alarm message, and measure the resistance between their U and V, V and W and W and U with an ohmmeter that has a very low resistance range. If the resistances at the three places are different from each other, the motor, the power cable is defective. Check each item in detail and replace it if necessary.

SRVO-157 CHGAL alarm (G: i A: j)

(Explanation) The capacitor on the servo amplifier was not charged properly within the specified time when the servo power is on.

(Action 1) Check the input voltage to the controller is within the rated voltage and phase is not lack. And check the setting of the transformer is correct.

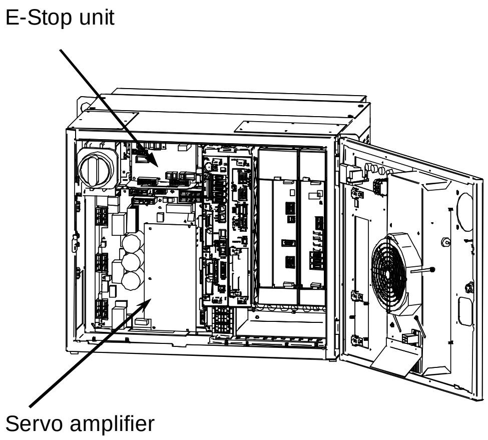
(Action 2) Check that the circuit breaker of the E-Stop unit is on and has not tripped.

(Action 3) Make sure that the servo amplifier CRRA12 and emergency stop board CRRA12 connector are connected tightly. If α***i***PS is used, make sure that the α***i***PS CRRA12 connector is connected tightly.

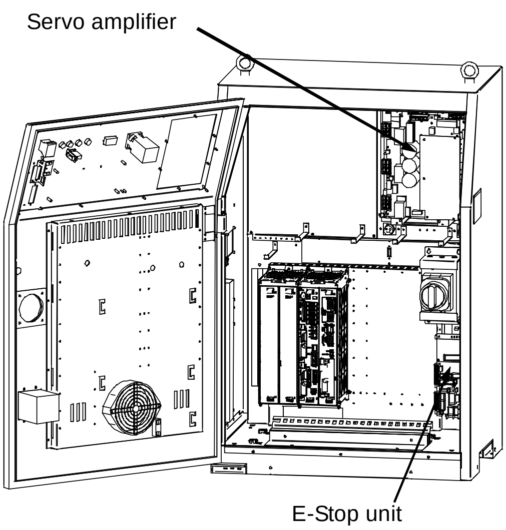
(Action 4) Replace the E-stop unit.

(Action 5) Replace the 6-Axis servo amplifier.

(Action 6) Replace the α***i***PS.



(A-cabinet)



(B-cabinet)

Fig.3.5 (t) SRVO-136 DCLVAL alarm
SRVO-156 IPMAL alarm
SRVO-157 CHGAL alarm

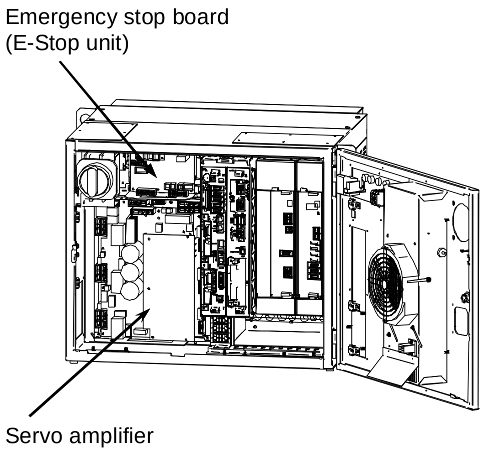
SRVO-204 External (SVEMG abnormal) E-stop

(Explanation) The switch connected across EES1 – EES11 and EES2 – EES21 on the TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board was pressed, but the EMERGENCY STOP line was not disconnected.

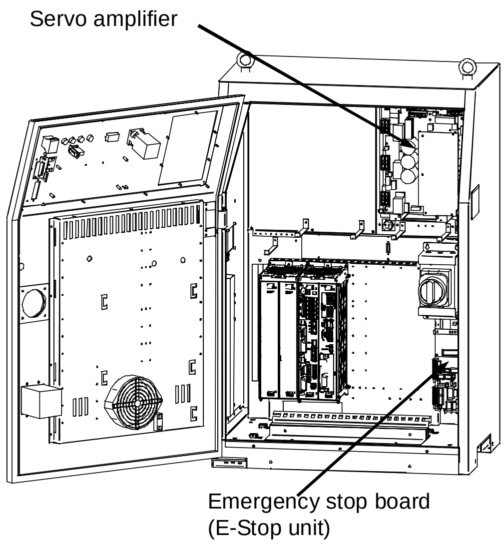
(Action 1) Check the switch and cable connected to EES1 – EES11 and EES2 – EES21 on the TBOP13(A-cabinet) or TBOP11(B-cabinet). If the cable is abnormal, replace it.

(Action 2) Replace the emergency stop board.

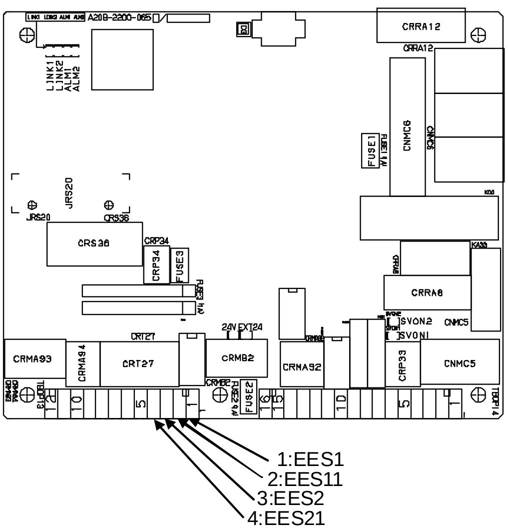
(Action 3) Replace the 6-Axis servo amplifier.



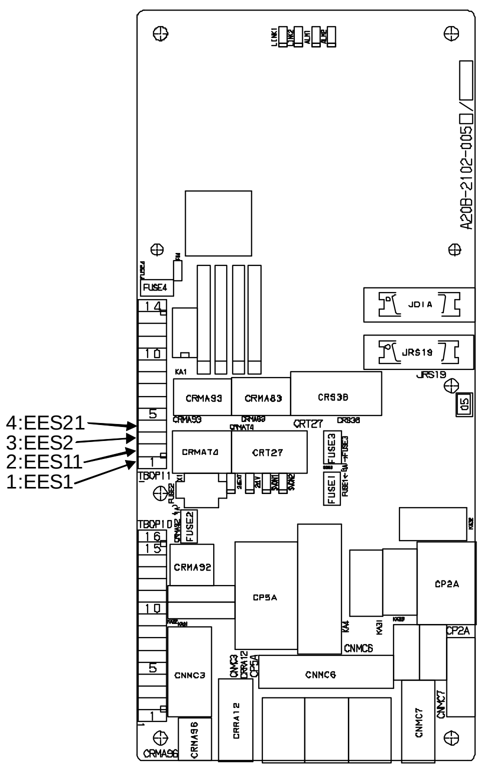
(A-cabinet)



(B-cabinet)



(A-cabinet/Emergency stop board)



(B-cabinet/Emergency stop board)

Fig.3.5 (u) SRVO-204 External (SVEMG abnormal) E-stop

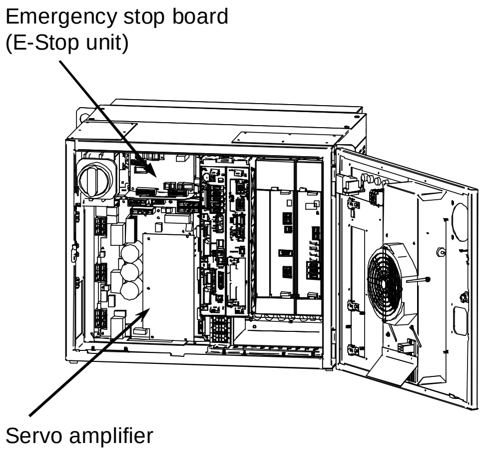
SRVO-205 Fence open (SVEMG abnormal)

(Explanation) The switch connected across EAS1 – EAS11 and EAS2 – EAS21 on the TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board was opened, but the EMERGENCY STOP line was not disconnected.

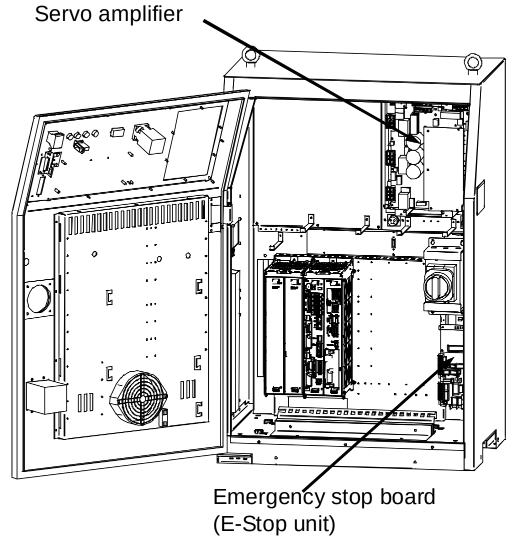
(Action 1) Check the switch and cable connected to EAS1 – EAS11 and EAS2 – EAS21. If the cable is abnormal, replace it.

(Action 2) Replace the emergency stop board.

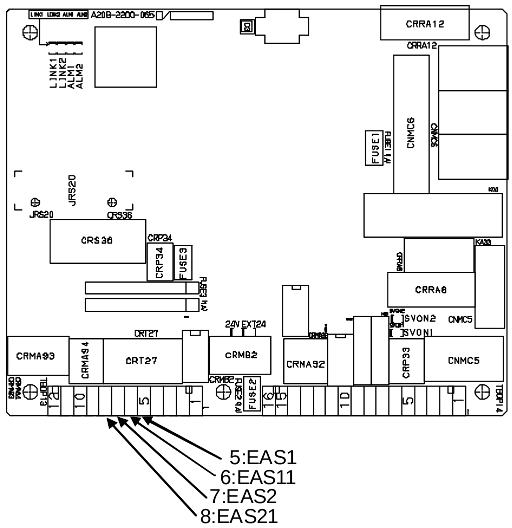
(Action 3) Replace the 6-Axis servo amplifier.



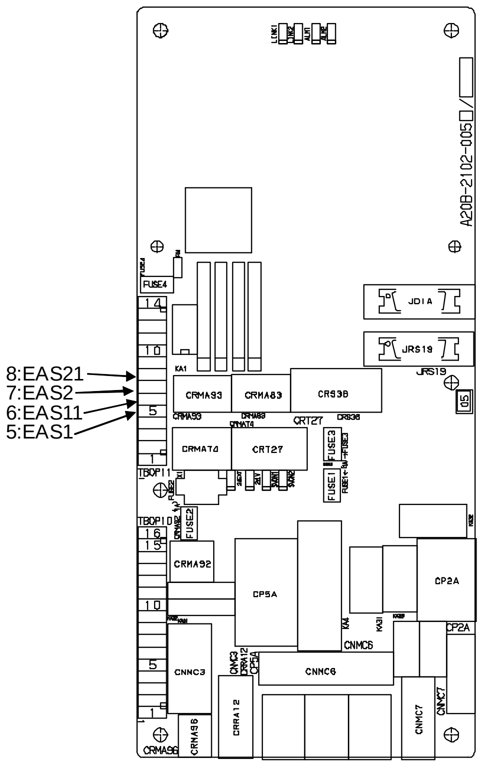
(A-cabinet)



(B-cabinet)



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

Fig.3.5 (v) SRVO-205 Fence open (SVEMG abnormal)

SRVO-206 Deadman switch (SVEMG abnormal)

(Explanation) When the teach pendant was enabled, the DEADMAN switch was released or pressed strongly, but the emergency stop line was not disconnected.

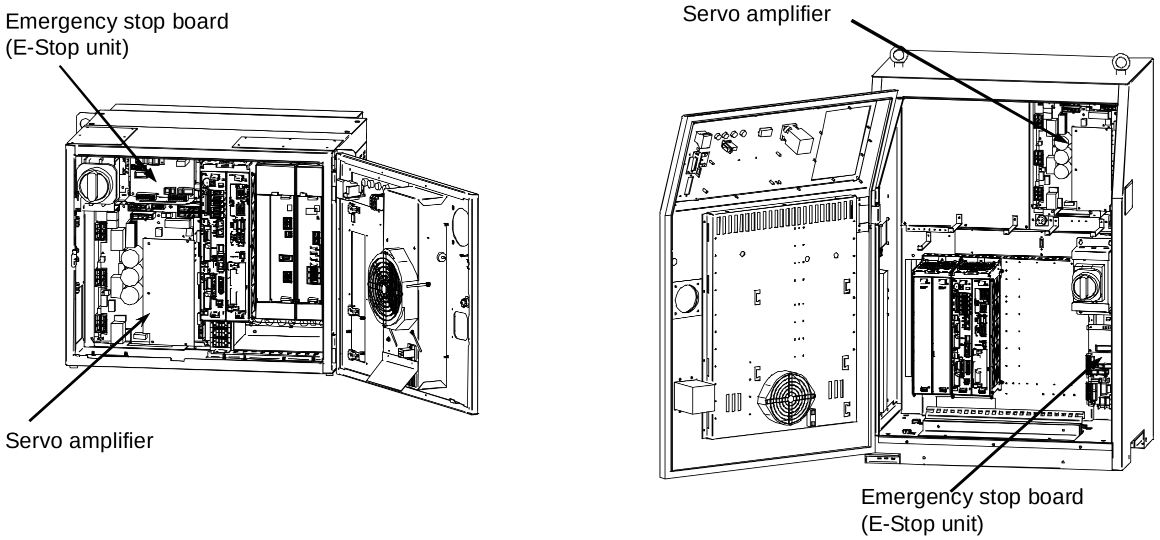
(Action 1) Replace the teach pendant.

(Action 2) Check the teach pendant cable. If it is inferior, replace the cable.

(Action 3) Replace the emergency stop board.

(Action 4) When the NTED signal is used, check whether the cabling of the signal connected to the emergency stop board is correct.

(Action 5) Replace the 6-Axis servo amplifier.



(A-cabinet) **(B-cabinet)**

Fig.3.5 (w) SRVO-206 DEADMAN switch (SVEMG abnormal)

SRVO-213 E-STOP Board FUSE2 blown

(Explanation) A fuse (FUSE2) on the emergency stop board has blown, or no voltage is supplied to EXT24V.

(Action 1) Check whether the fuse (FUSE2) on the emergency stop board has blown. If the fuse has blown, 24EXT may be short-circuited to 0EXT. Take Action 2. If fuse (FUSE2) has not blown, take Action 3 and up.

(Action 2) Disconnect the connection destinations of 24EXT that can cause grounding then check that the fuse (FUSE2) does not blow. Disconnect the following on the emergency stop board then turn on the power:

- CRS36
- CRT27
- TBOP13(A-cabinet) or TBOP11(B-cabinet) : EES1, EES11, EAS1, EAS11, EGS1, EGS11

If the fuse (FUSE2) does not blow in this state, 24EXT and 0EXT may be short-circuited at any of the connection destinations above. Isolate the faulty location then take action.

If the fuse (FUSE2) blows even when the connection destinations above are detached, replace the emergency stop board.

(Action 3) Check whether 24 V is applied to between EXT24V and EXT0V of TBOP14(A-cabinet) , TBOP10(B-cabinet). If not, check the external power supply circuit.

If no external power supply is used, check whether the terminals above are connected to the INT24V and INT0V terminals, respectively.

(Action 4) Replace emergency stop board .

(Action 5) Replace the teach pendant cable.

(Action 6) Replace the teach pendant.
(Action 7) Replace the operator's panel cable(CRT27).

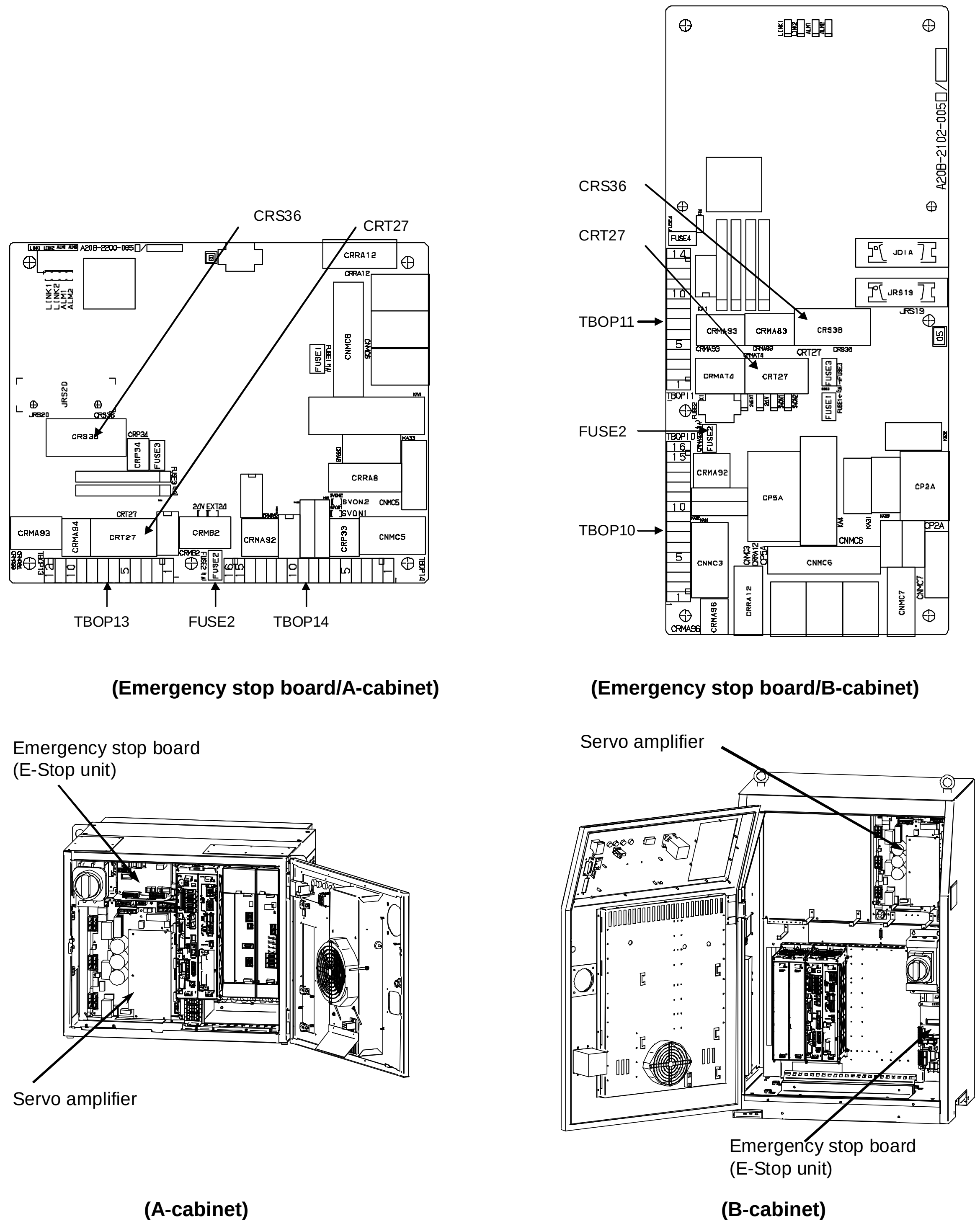


Fig.3.5 (x) SRVO-213 E-STOP Board FUSE2 blown

SRVO-214 6ch amplifier fuse blown (R: i)

(Explanation) A fuse (FS2 or FS3) in the 6-Axis servo amplifier has blown.
(Action 1) A fuse is blown, eliminate the cause, and then replace the fuse. (See Section 3.6)
(Action 2) Replace the 6-Axis servo amplifier.

SRVO-216 OVC (total) (Robot: i)

(Explanation) The current (total current for six axes) flowing through the motor is too large.
(Action 1) Slow the motion of the robot where possible. Check the robot operation conditions. If the robot is used with a condition exceeding the duty or load weight robot rating, reduce the load condition value to the specification range.
(Action 2) Check the input voltage to the controller is within the rated voltage and no phase is lack. And check the setting of the transformer is correct.
(Action 3) Replace the 6-Axis servo amplifier.

SRVO-217 E-STOP Board not found

(Explanation) The emergency stop board is not found when the controller power is turned on.
(Action 1) Check whether fuse (FUSE1) on the emergency stop board has blown. If the fuse has blown, check and correct the cause then replace the fuse.
(Action 2) Check the cable between emergency stop board and main board. Replace them if necessary.
(Action 3) Replace the E-STOP unit.
Before executing the (Action 4), perform a complete controller back-up to save all your programs and settings.
(Action 4) Replace the main board.

SRVO-221 Lack of DSP (G: i A: j)

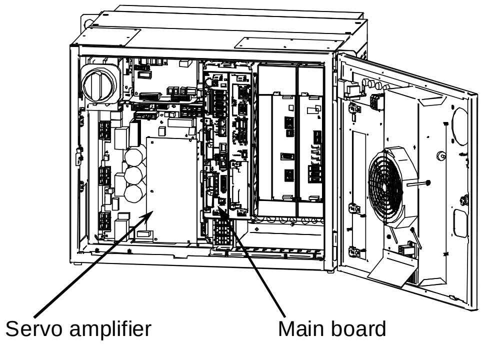
(Explanation) A controlled axis card corresponding to the set number of axes is not mounted.
(Action 1) Check whether the set number of axes is valid. If the number is invalid, set the correct number.
(Action 2) Replace the axis control card with a card corresponding to the set number of axes.

SRVO-223 DSP dry run (a,b)

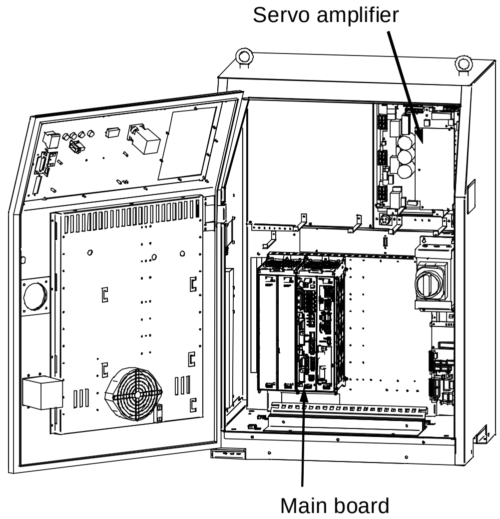
(Explanation) A servo DSP initialization failure occurred due to hardware failure or wrong software setting. Then, the software entered DSP dry run mode. The first number indicates the cause of the failure. The second number is extra information.
(Action) Perform an action according to the first number that is displayed in the alarm message.
1: This is a warning due to $scr.$startup_cnd=12.
2,3,4,7: Replace a servo card.
5: Invalid ATR setting. Software axis config (FSSB line number, hardware start axis number, amplifier number, and amplifier type) might be wrong.
6: SRVO-180 occurs simultaneously. Controllable axis does not exist on any group. Execute aux axis setting to add axis at controlled start.
8,10: SRVO-058 (FSSB init error) occurs simultaneously. Follow the remedy of SRVO-058.
9: There is no amplifier that is connected to the servo card.

- Check the hardware connection.
- Check the optical fiber cable.
- In case of using aux. axis amplifier, make sure that the connectors CXA2A (6-axis amplifier) or CXA2B (aux. axis amplifier) are securely attached to the servo amplifier.
- Check whether the servo amplifier power is supplied.
- Check whether the fuse on the servo amplifier has blown.
- Replace the optical fiber cable.
- Replace the servo amplifier

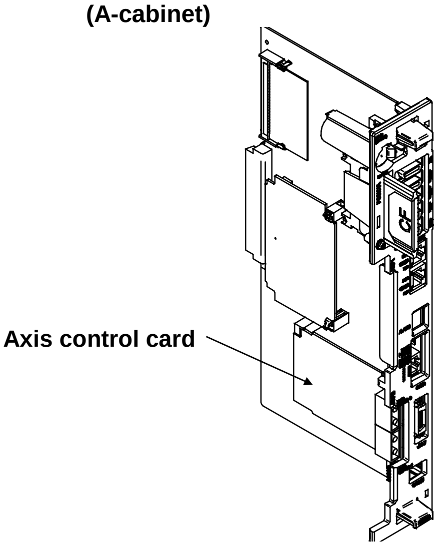
11: Invalid axisorder setting. Non-existing axis number is specified. Software axis config (FSSB line number) might be wrong or auxiliary axis board is necessary.
12: SRVO-059 (Servo amp init error) occurs simultaneously. Follow the remedy of SRVO-059.
13,14,15: Document the events that led to the error, and contact your FANUC technical representative.



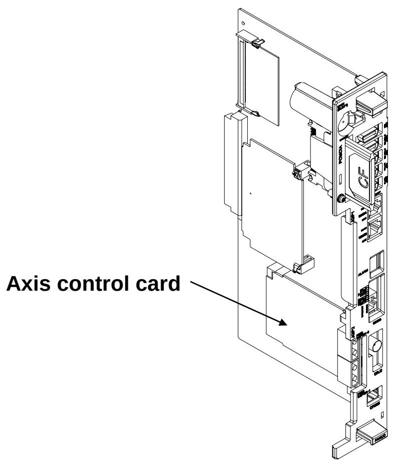
(A-cabinet)



(B-cabinet)



(R-30*i*B Main board)



(R-30*i*B Plus Main board)

Fig.3.5 (y) SRVO-214 6ch amplifier fuse blown (Panel PCB)
SRVO-216 OVC (total)
SRVO-221 Lack of DSP
SRVO-223 DSP dry run (%d,%d)

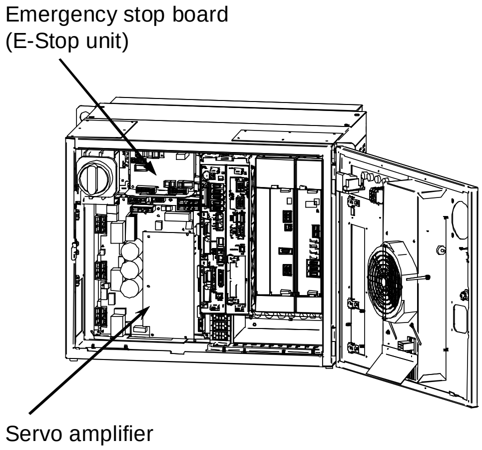
SRVO-230 Chain 1 abnormal a, b
SRVO-231 Chain 2 abnormal a, b

(Explanation) A mismatch occurred between duplicate safety signals.
SRVO-230 is issued if such a mismatch that a contact connected on the chain 1 side (between EES1 and EES11, between EAS1 and EAS11, between EGS1 and EGS11, and so forth) is closed, and a contact on the chain 2 side (between EES2 and EES21, between EAS2 and EAS21, between EGS2 and EGS21, and so forth) is open occurs.
SRVO-231 is issued if such a mismatch that a contact on the chain 1 side is open, and a contact on the chain 2 side is closed occurs.
If a chain error is detected, correct the cause of the alarm then reset the alarm according to the method described later.

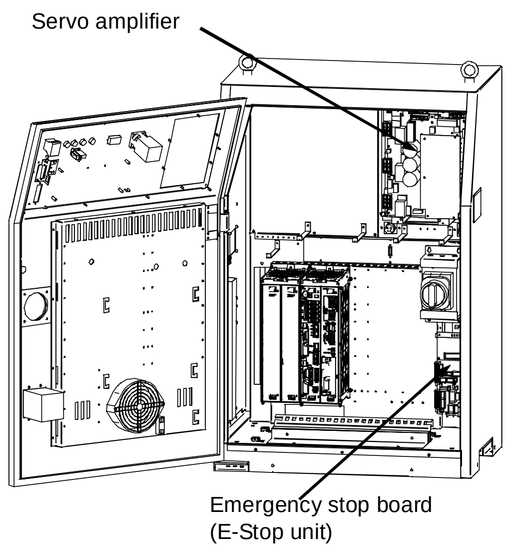
(Action) Check the alarms issued at the same time in order to identify with which signal the mismatch occurred.
SRVO-266 through SRVO-275 and SRVO-370 through SRVO-385 are issued at the same time. Take the action(s) described for each item.

⚠ WARNING
If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

⚠ CAUTION
1. The state of this alarm is preserved by software. After correcting the cause of the alarm, reset the chain error alarm according to the chain error reset procedure described later.
2. Until a chain error is reset, no ordinary reset operation must be performed. If an ordinary reset operation is performed before chain error resetting, the message "SRVO-237 Chain error cannot be reset" is displayed on the teach pendant.



(A-cabinet)



(B-cabinet)

Fig.3.5 (z) SRVO-230 Chain 1 (+24V) abnormal a, b
SRVO-231 Chain 2 (0V) abnormal a, b

Alarm history display method

1. Press the screen selection key on the teach pendant.
2. Select [4 ALARM] on the teach pendant.
3. Press F3 [HIST] on the teach pendant.

Chain error reset procedure

> ⚠ **CAUTION**
> Do not perform this operation until the cause of the alarm is corrected.

<Method 1>

1. Press the emergency stop button.
2. Press the screen selection key on the teach pendant.
3. Select [0 NEXT PAGE] on the teach pendant.
4. Press [6 SYSTEM] on the teach pendant.
5. Press [7 SYSTEM SETTING] on the teach pendant.
6. Find "28" Chain Error Reset Execution.
7. Press F3 on the teach pendant to reset "Chain Error".

<Method 2>

1. Press the screen selection key on the teach pendant.
2. Select [4 ALARM] on the teach pendant.
3. Press F4 [CHAIN RESET] on the teach pendant.

SRVO-232 NTED input

(Explanation) In the teach mode, the NTED signal connected to the connector (CRMA96) on the emergency stop board was placed in the open state.
(Action 1) Check the operation of the device connected to NTED.
(Action 2) Replace the teach pendant.
(Action 3) Replace the teach pendant cable.
(Action 4) Replace the emergency stop board
(Action 5) Check the mode switch and its cable. Replace them if a defect is found.

SRVO-233 TP OFF in T1, T2

(Explanation) Teach pendant is disabled when the mode switch is T1 or T2.
Or controller door is opened.
(Action 1) Enable the teach pendant in teaching operation. In other case the mode switch should be AUTO mode.
(Action 2) Close the controller door, if open.
(Action 3) Replace the teach pendant.
(Action 4) Replace the teach pendant cable.
(Action 5) Replace the mode switch.
(Action 6) Replace the emergency stop board.
(Action 7) Replace the 6-Axis servo amplifier.

SRVO-235 Short term Chain abnormal

(Explanation) Short term single chain failure condition is detected.

- Cause of this alarm is;
  - Half release of DEADMAN switch
  - Half operation of emergency stop switch.

(Action 1) Cause the same error to occur again, and then perform resetting.
(Action 2) Replace the emergency stop board.
(Action 3) Replace the 6-Axis servo amplifier.

SRVO-251 DB relay abnormal (G: i A: j)

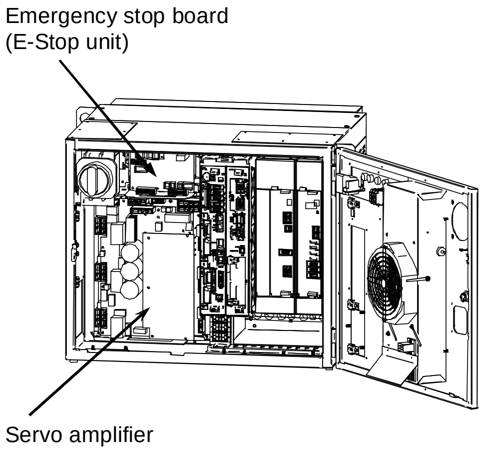
(Explanation) An abnormality was detected in the internal relay (DB relay) of the servo amplifier.
(Action 1) Replace the servo amplifier.
(Action 2) Replace the E-stop unit.

SRVO-252 Current detect abnl (G: i A: j)

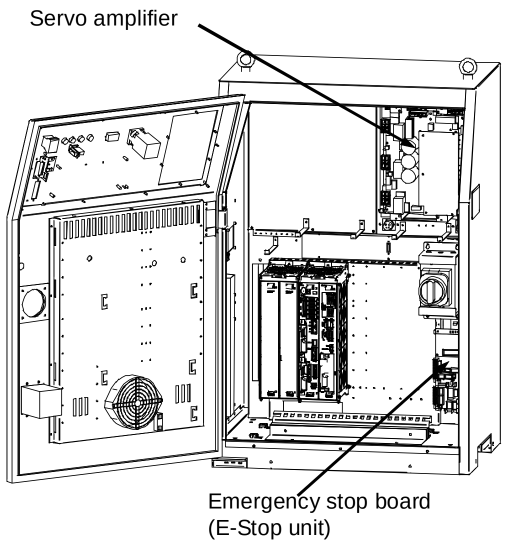
(Explanation) An abnormality was detected in the current detection circuit inside the servo amplifier.
(Action) Replace the servo amplifier.

SRVO-253 Amp internal over heat (G: i A: j)

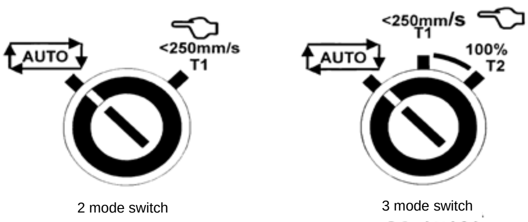
(Explanation) An overheat was detected inside the servo amplifier.
(Action) Replace the servo amplifier.



(A-cabinet)



(B-cabinet)



(Mode switch)

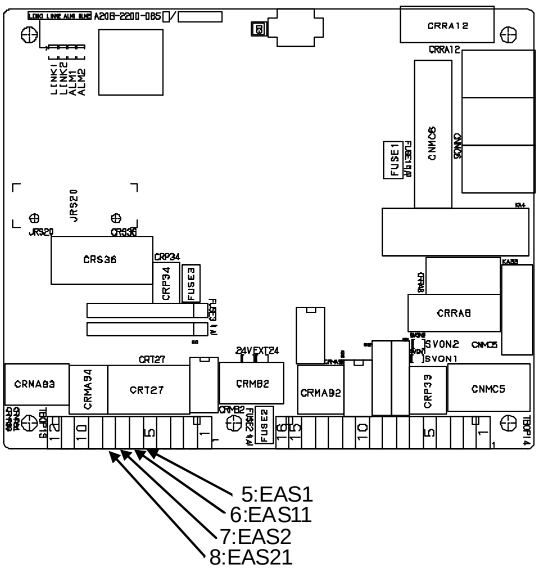
Fig.3.5 (aa) SRVO-232 NTED input
SRVO-233 TP OFF in T1, T2
SRVO-235 Short term Chain abnormal
SRVO-251 DB relay abnormal
SRVO-252 Current detect abnl
SRVO-253 Amp internal over heat

SRVO-266 FENCE1 status abnormal
SRVO-267 FENCE2 status abnormal

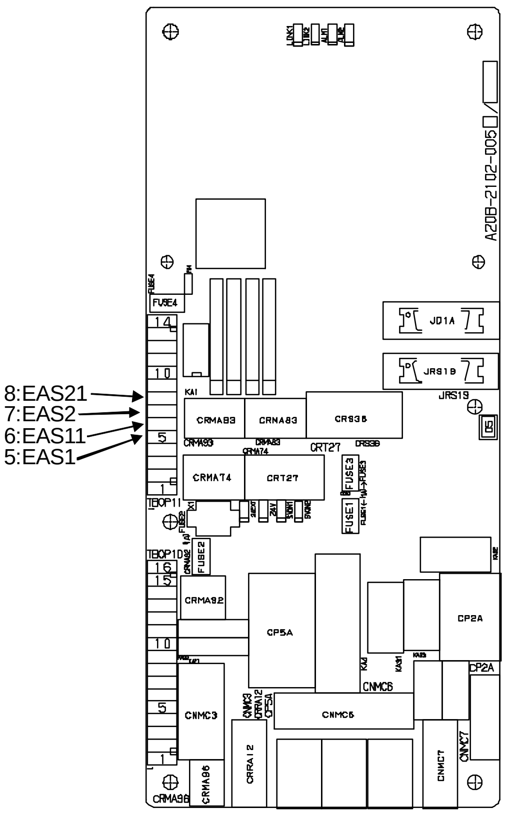
(Explanation) A chain alarm was detected with the EAS (FENCE) signal.
(Action 1) Check whether the circuitry connected to the dual input signal (EAS) is faulty.
(Action 2) Check whether the timing of the dual input signal (EAS) satisfies the timing specification
(See Subsection 3.2.5, Table 3.2.5 in CONNECTIONS).
(Action 3) Replace the emergency stop board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

Fig.3.5 (ab) SRVO-266 FENCE1 status abnormal
SRVO-267 FENCE2 status abnormal

SRVO-268 SVOFF1 status abnormal
SRVO-269 SVOFF2 status abnormal

(Explanation) A chain alarm was detected with the EGS (SVOFF) signal.

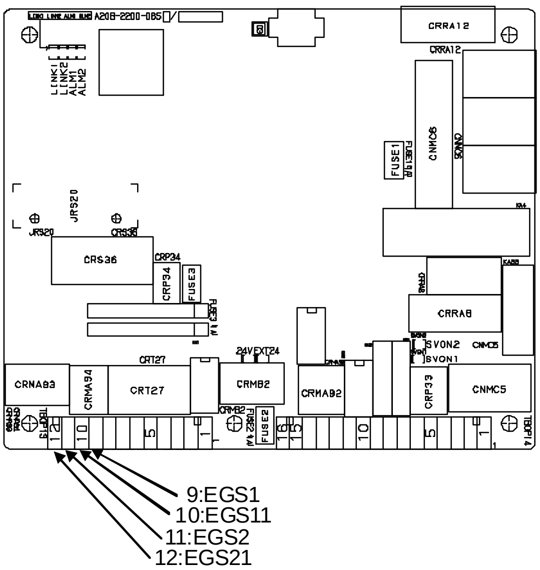
(Action 1) Check whether the circuitry connected to the dual input signal (EGS) is faulty.

(Action 2) Check whether the timing of the dual input signal (EGS) satisfies the timing specification
(See Subsection 3.2.5, Fig 3.2.5(c) in CONNECTIONS).

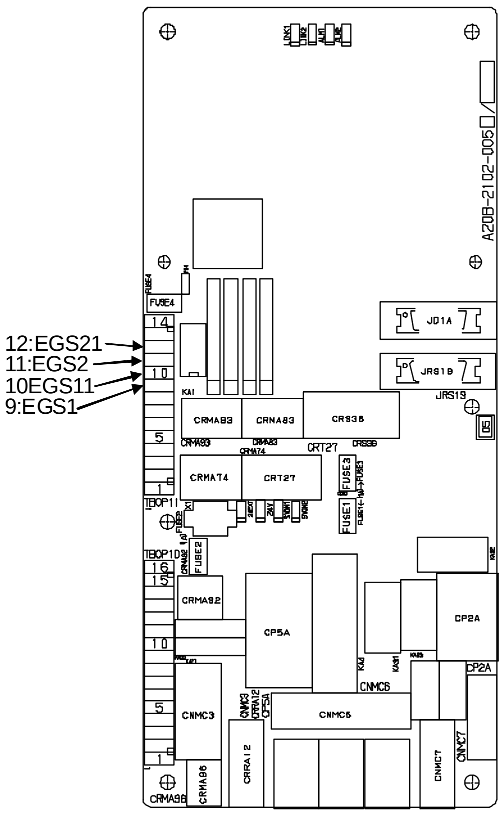
(Action 3) Replace the emergency stop board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

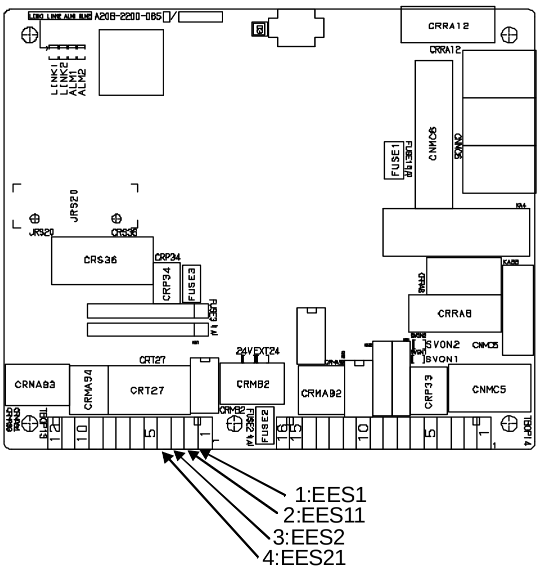
Fig.3.5 (ac) SRVO-268 SVOFF1 status abnormal
SRVO-269 SVOFF2 status abnormal

SRVO-270 EXEMG1 status abnormal
SRVO-271 EXEMG2 status abnormal

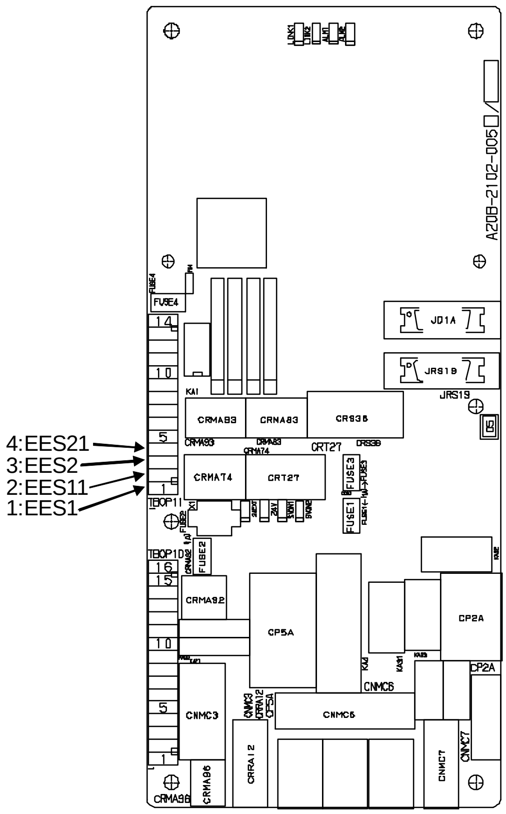
(Explanation) A chain alarm was detected with the EES (EXEMG) signal.
(Action 1) Check whether the circuitry connected to the dual input signal (EES) is faulty.
(Action 2) Check whether the timing of the dual input signal (EES) satisfies the timing specification
(See Subsection 3.2.5, Fig 3.2.5(c) in CONNECTIONS).
(Action 3) Replace the teach pendant cable.
(Action 4) Replace the teach pendant.
(Action 5) Replace the emergency stop board.
(Action 6) Replace the emergency stop switch on the operator's panel.
Before executing the (Action 7), perform a complete controller back-up to save all your programs and settings.
(Action 7) Replace the main board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

Fig.3.5 (ad) SRVO-270 EXEMG1 status abnormal
SRVO-271 EXEMG2 status abnormal

SRVO-274 NTED1 status abnormal
SRVO-275 NTED2 status abnormal

(Explanation) A chain alarm was detected with the NTED signal.

(Action 1) This alarm may be issued when the DEADMAN switch is pressed to a proper position or is operated very slowly. In such a case, release the DEADMAN switch once completely then press the DEADMAN switch again.

- When the NTED signal is not used, skip Action 2 and 3 and go to Action 4

(Action 2) Check whether the circuitry connected to the dual input signal (NTED) is faulty.

(Action 3) Check whether the timing of the dual input signal (NTED) satisfies the timing specification (See Subsection 3.2.5, Fig 3.2.5(c) in CONNECTIONS).

(Action 4) Replace the teach pendant cable.

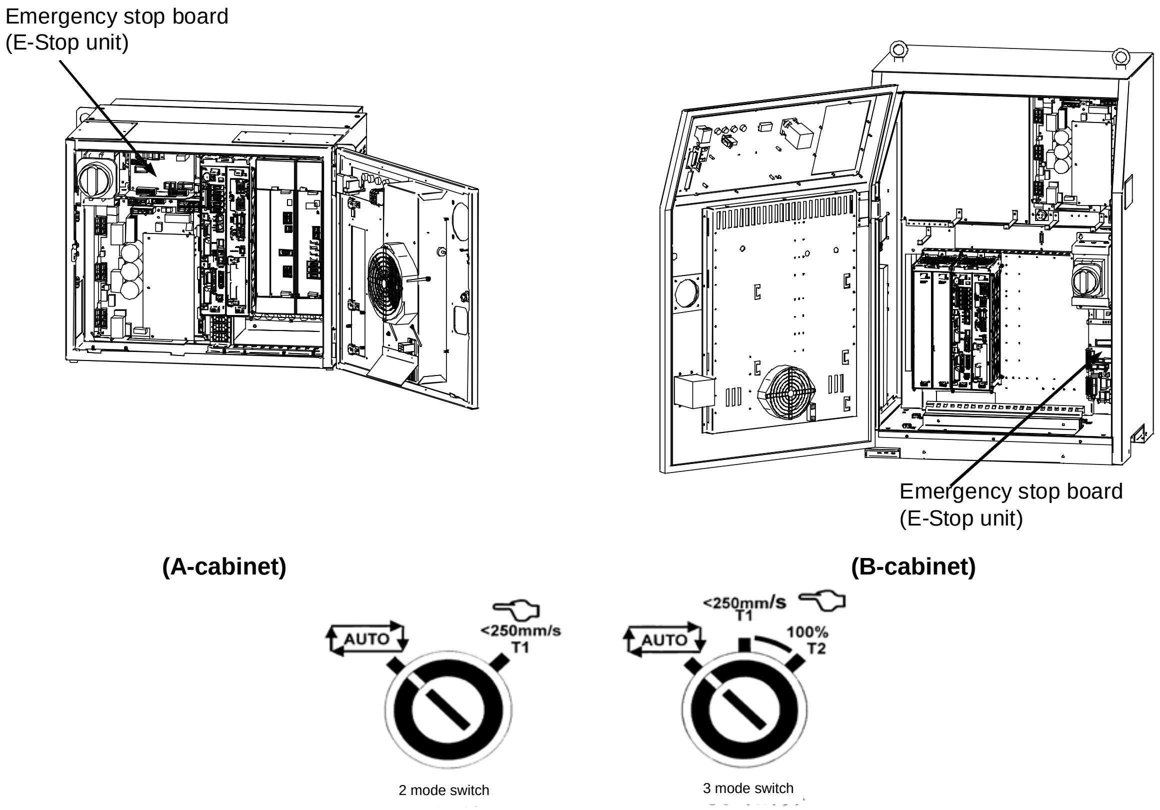
(Action 5) Replace the teach pendant.

(Action 6) Replace the emergency stop board.

(Action 7) Replace the mode switch on the operator's panel.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.



(Mode switch)

Fig.3.5 (ae) SRVO-274 NTED1 status abnormal
SRVO-275 NTED2 status abnormal

SRVO-277 Panel E-stop (SVEMG abnormal)

(Explanation) The emergency stop line was not disconnected although the emergency stop button on the operator's panel was pressed.
(Action 1) Replace the emergency stop board.
(Action 2) Replace the 6-Axis servo amplifier.

SRVO-278 TP E-stop (SVEMG abnormal)

(Explanation) The emergency stop line was not disconnected although the emergency stop button on the teach pendant was pressed.
(Action 1) Replace the teach pendant.
(Action 2) Replace the teach pendant cable.
(Action 3) Replace the emergency stop board.
(Action 4) Replace the 6-Axis servo amplifier.

NOTE
This alarm may be issued if the emergency stop button is pressed very slowly.

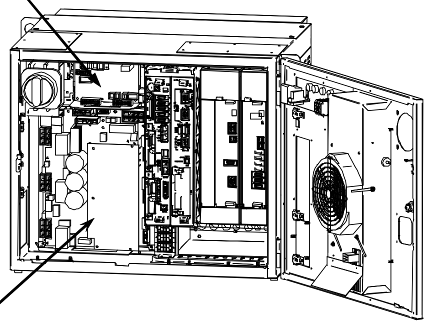
SRVO-280 SVOFF input

(Explanation) The external contact connected to EGS1-EGS11 or EGS2-EGS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board is open.
(Action 1) If external circuitry is connected to EGS1-EGS11 or EGS2-EGS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board, check the external circuitry.
(Action 2) If this signal is not used, make a connection between EGS1 and EGS11 and between EGS2 and EGS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board.
(Action 3) Replace the emergency stop board.

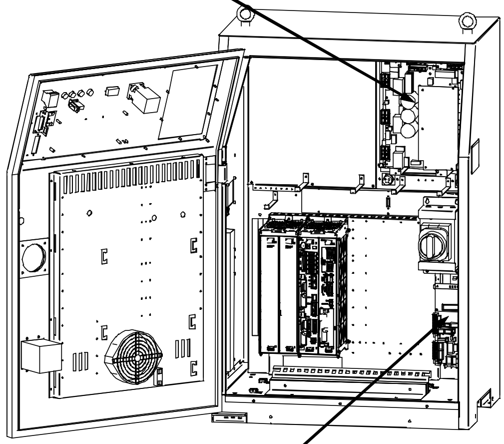
⚠ WARNING
In a system using the SVOFF signal, it is very dangerous to disable the signal when a connection is made between EGS1 and EGS11 and between EGS2 and EGS21 of TBOP13(A-cabinet) or TBOP11(B-cabinet). Never make such an attempt. If a temporary connection is needed for operation, separate safety measures must be taken.

SRVO-281 SVOFF input (SVEMG abnormal)

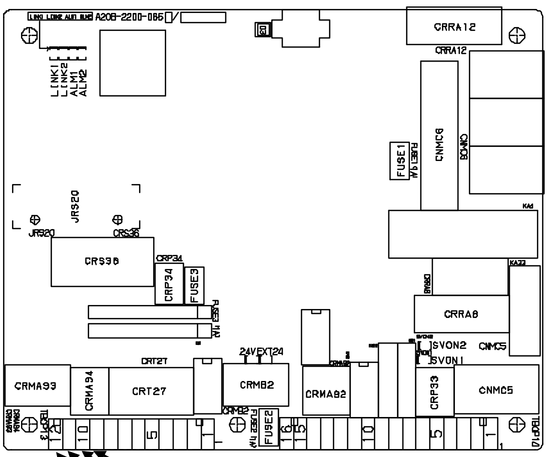
(Explanation) The emergency stop line was not disconnected although the contact connected between EGS1 and EGS11 or between EGS2 and EGS21 of the terminal block TBOP13(A-cabinet) or TBOP11(B-cabinet) on the emergency stop board was open. The emergency stop circuit is faulty.
(Action 1) Check the switch and cable connected to EGS1-EGS11and EGS2-EGS21 on TBOP13(A-cabinet) or TBOP11(B-cabinet). If the cable is abnormal, replace it.
(Action 2) Replace the emergency stop board.
(Action 3) Replace the 6-Axis servo amplifier.



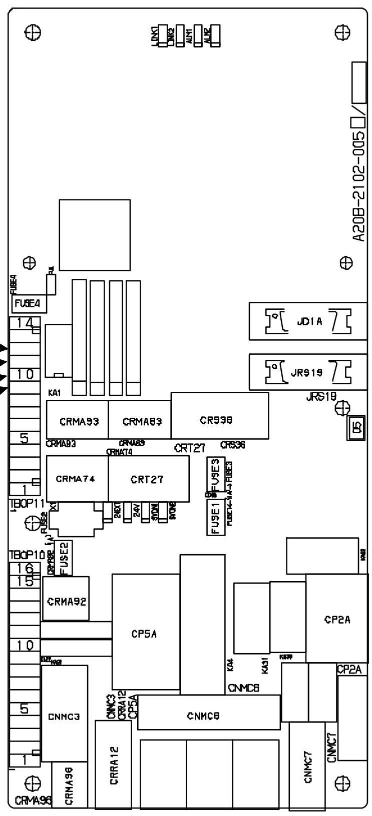
(A-cabinet)



(B-cabinet)



(Emergency stop board/A-cabinet)



(Emergency stop board/B-cabinet)

Fig.3.5 (af) SRVO-277 Panel E-stop (SVEMG abnormal)
SRVO-278 TP E-stop (SVEMG abnormal)
SRVO-280 SVOFF input
SRVO-281 SVOFF input (SVEMG abnormal)

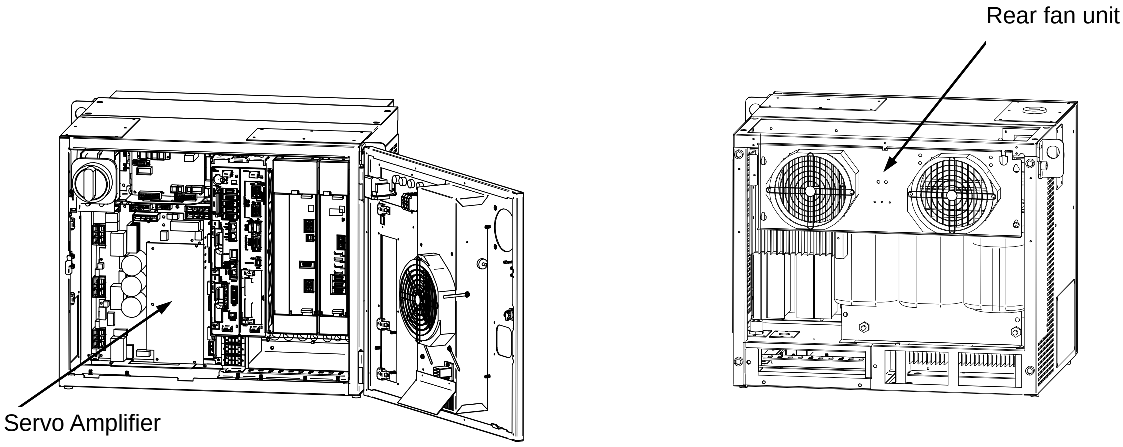
SRVO-291 IPM over heat (G:i A:j)

(Explanation) IPM on the servo amplifier is overheated.

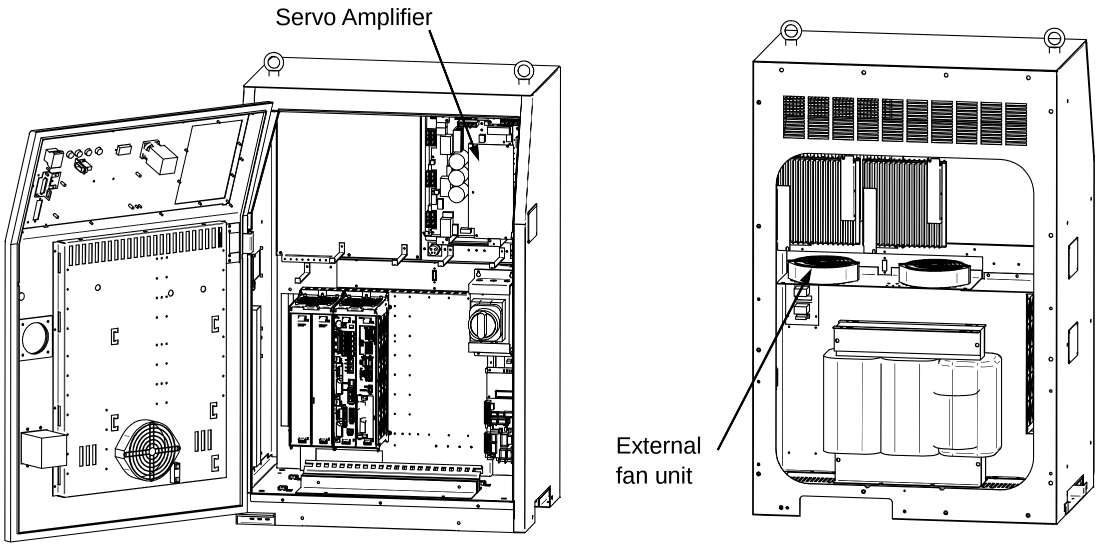
(Action 1) Check whether the fan for cabinet ventilation is stopped and also check whether the vent hole is clogged. If necessary, clean or replace them.

(Action 2) If SRVO-291 is issued when the robot operating condition is severe, check the robot operating condition then relax the condition when possible.

(Action 3) If SRVO-291 is issued frequently, replace the servo amplifier.



(A-cabinet)



(B-cabinet)

Fig.3.5 (ag) SRVO-291 IPM over heat

SRVO- 293 HCAL(PS) alarm (G: i A: j)

(Explanation) The Power Supply(α***i***PS) or the servo amplifier is faulty.

(Action 1) Replace the servo amplifier(6-axis amplifier,α***i***SV).

(Action 2) Replace the Poewr Supply(α***i***PS).

SRVO- 295 AMP com error (G: i A: j)

(Explanation) A communication error occurred in the 6-axis amplifier or between the Power Supply(α*i*PS) and the servo amplifier.

(Action 1) Replace the 6-axis amplifier.
(Action 2) Replace the cable for communication the Power Supply(α*i*PS) and servo amplifier.
(Action 3) Replace the Power Supply(α*i*PS).
(Action 4) Replace the servo amplifier(α*i*SV).

SRVO- 297 Improper input power (G: i A: j)

(Explanation) The 6-axis servo amplifier or the power supply(α*i*PS) has detected the input voltage phase lack.
(Action 1) Check the input voltage of the controller whether phase is not lack.
(Action 2) Make sure that the 6-axis servo amplifier CRRA12 and emergency stop board CRRA12 connector are connected tightly. If the power supply(α*i*PS) is installed, make sure that the power supply(α*i*PS) CRRA12 connector is connected tightly.
(Action 3) Measure the secondary voltage between each phase at the main breaker, if phase loss is detected, replace the main breaker.
(Action 4) Measure the secondary voltage between each phase at the transformer, if phase loss is detected, replace the transformer.
(Action 5) Replace the E-stop unit.
(Action 6) Replace the 6-axis servo amplifier.
(Action 7) Replace the power supply(α*i*PS).

SRVO-300 Hand broken/HBK disabled
SRVO-302 Set Hand broken to ENABLE

(Explanation) Although HBK was disabled, the HBK signal was input.
(Action 1) Press RESET on the teach pendant to release the alarm.
(Action 2) Check whether the hand broken signal is connected to the robot. When the hand broken signal circuit is connected, enable hand broken.
(See Subsection 5.5.3 in CONNECTIONS)

SRVO-335 DCS OFFCHK alarm a, b

(Explanation) A failure was detected in the safety signal input circuit.
(Action 1) Replace the emergency stop board.
(Action 2) In case of B-cabinet, replace the optional safety I/O board.

SRVO-348 DCS MCC OFF alarm a, b

(Explanation) A command was issued to turn off the magnetic contactor, but the magnetic contactor was not turned off.
(Action 1) This action is applicable to the B-Cabinet only.
If a signal is connected to the E-stop unit CRMA74, check whether there is a problem in the connection destination.
(Action 2) This action is applicable to the B-Cabinet only.
Check whether the FUSE4 on emergency stop board. If the fuse is blown, see Article 3.6.(3) .
(Action 3) This action is applicable to the A-cabinet and B-cabinet.
Replace the E-stop unit (included the magnetic contactor).
(Action 4) This action is applicable to the A-cabinet and B-cabinet.
Replace the 6-Axis servo amplifier.

SRVO-349 DCS MCC ON alarm a, b

(Explanation) A command was issued to turn on the magnetic contactor, but the magnetic contactor was not turned on.
(Action 1) Replace the E-stop unit (included the magnetic contactor).
(Action 2) Replace the 6-Axis servo amplifier.

SRVO-370 SVON1 status abnormal
SRVO-371 SVON2 status abnormal

(Explanation) A chain alarm was detected with the emergency stop board internal signal (SVON).
(Action) Replace the emergency stop board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.

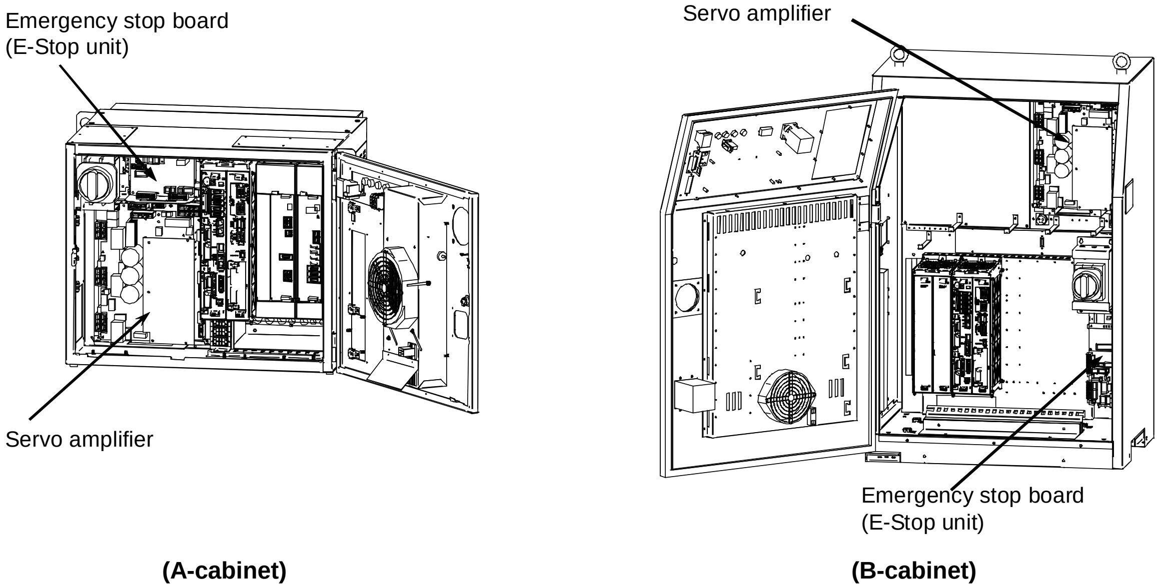


Fig.3.5 (ah) SRVO-335 DCS OFFCHK alarm a, b
SRVO-348 DCS MCC OFF alarm a, b
SRVO-349 DCS MCC ON alarm a, b
SRVO-370 SVON1 status abnormal
SRVO-371 SVON2 status abnormal

SRVO-372 OPEMG1 status abnormal
SRVO-373 OPEMG2 status abnormal

(Explanation) A chain alarm was detected with the emergency stop button on the operator's panel.
(Action 1) Replace the emergency stop board.
(Action 2) Replace the teach pendant cable.
(Action 3) Replace the teach pendant.
(Action 4) Replace the emergency stop button on the operator's panel.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

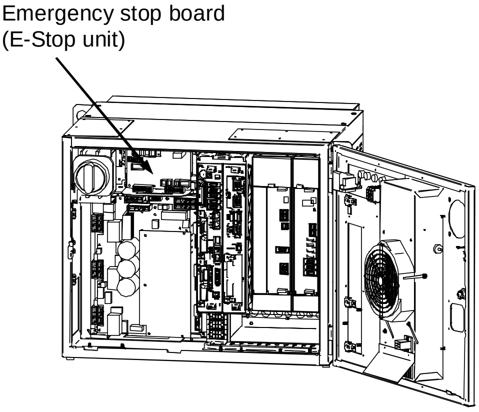
> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.

SRVO-374 MODE11 status abnormal
SRVO-375 MODE12 status abnormal
SRVO-376 MODE21 status abnormal
SRVO-377 MODE22 status abnormal

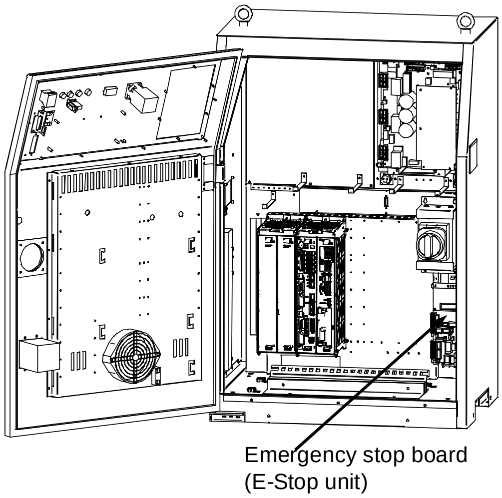
(Explanation) A chain alarm was detected with the mode switch signal.
(Action 1) Check the mode switch and its cable. Replace them if a defect is found.
(Action 2) Replace the emergency stop board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

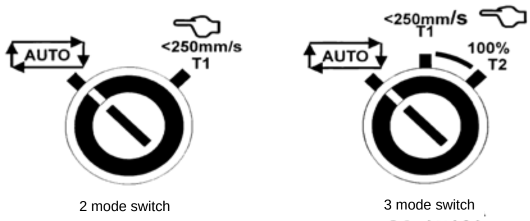
> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.



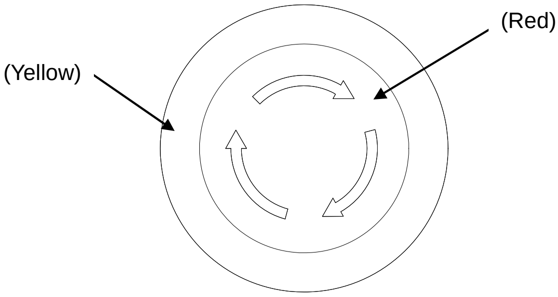
(A-cabinet)



(B-cabinet)



(Mode switch)



(Emergency stop button)

**Fig.3.5 (ai) SRVO-372 OPEMG1 status abnormal
SRVO-373 OPEMG2 status abnormal
SRVO-374 MODE11 status abnormal
SRVO-375 MODE12 status abnormal
SRVO-376 MODE21 status abnormal
SRVO-377 MODE22 status abnormal**

SRVO-378 SFDIxx status abnormal

(Explanation) A chain alarm was detected with the SFDI signal. xx shows signal name.

(Action 1) Check whether the circuitry connected to the dual input signal (SFDI) is faulty.

(Action 2) Check whether the timing of the dual input signal (SFDI) satisfies the timing specification. (See Subsection 3.2.5, Fig 3.2.5(c) in CONNECTIONS).

(Action 3) In case of B-cabinet, replace the optional safety I/O board.

(Action 4) Replace the emergency stop board.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

> **NOTE**
> For the procedure of recovery from this alarm, see the descriptions of SRVO-230 and SRVO-231.

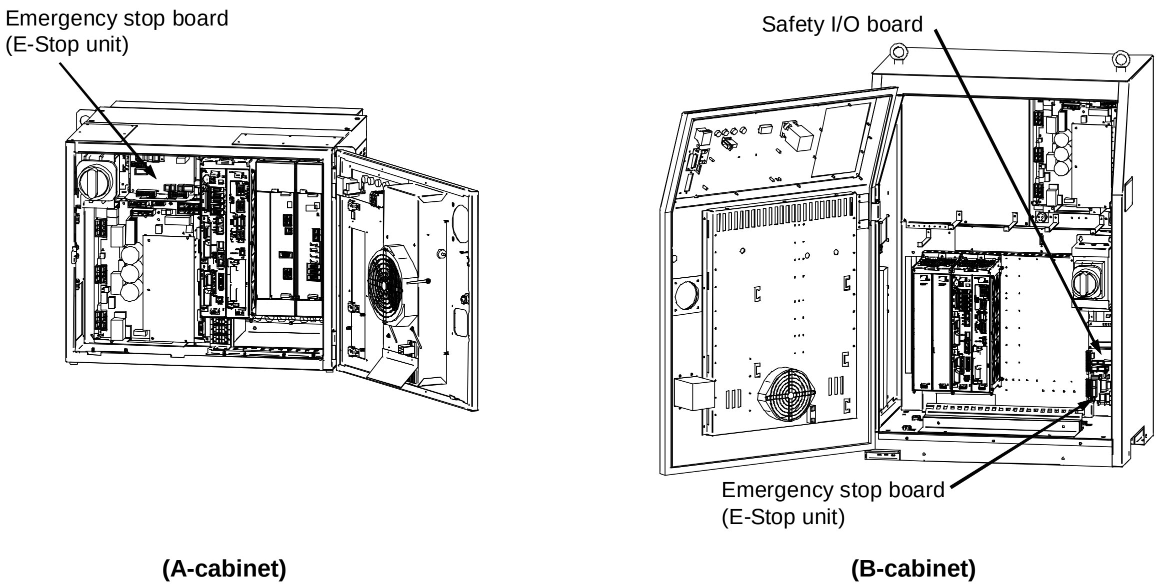


Fig.3.5 (aj) SRVO-378 SFDIxx status abnormal

SRVO-450 Drvoff circuit fail (G: i A: j)

(Explanation) The two drive off inputs are not in the same status.

(Action 1) Check the line of the two drive off inputs.

(Action 2) Make sure that the connector CRMB16 (6-axis amplifier) is securely attached to the servo amplifier.

(Action 3) Replace the servo amplifier(6-axis servo amplifier,αiSV).

SRVO-451 Internal S-BUS fail (G: i A: j)

(Explanation) An error is found in the serial bus communication in the servo amplifier.

(Action 1) Replace the servo amplifier(6-axis servo amplifier,αiSV).

SRVO-452 ROM data failure (G: i A: j)

(Explanation) An error is found in the ROM data in the servo amplifier.

(Action 1) Replace the servo amplifier(6-axis servo amplifier,αiSV).

SRVO-453 Low volt driver (G: i A: j)

(Explanation) Driver supply voltage in the servo amplifier is low.
(Action 1) Replace the servo amplifier(6-axis servo amplifier,α*i*SV).

SRVO-454 CPU BUS failure (G: i A: j)

(Explanation) An error was found in CPU bus data in the amplifier.
(Action 1) Replace the servo amplifier(6-axis servo amplifier,α*i*SV).

SRVO-455 CPU watch dog (G: i A: j)

(Explanation) An error occurred in CPU operation in the amplifier.
(Action 1) Replace the servo amplifier(6-axis servo amplifier,α*i*SV).

SRVO-456 Ground fault (G: i A: j)

(Explanation) An error is found in the motor current detection data in the servo amplifier.
(Action 1) Replace the servo amplifier(6-axis servo amplifier,α*i*SV).

SRVO-457 Ground fault(PS) (G: i A: j)

(Explanation) Ground fault occurs in the motor power line.
(Action 1) Check the ground fault of the motor and the motor power cable.
(Action 2) Replace the Power Supply(α*i*PS).
(Action 3) Replace the servo amplifier(6-axis servo amplifier, α*i*SV).

SRVO-458 Soft thermal(PS) (G: i A: j)

(Explanation) The root-mean-square current value which is calculated internally by the Power Supply (α*i*PS) exceeds the maximum permissible value.
This alarm is issued to protect the Power Supply (α*i*PS) from damage of thermal destruction.
Probable cause:
1. Overload
2. External force to the robot
3. Disconnection of the brake cable
4. Insufficient torque by low voltage of power supply
5. Brake failure (includes mis-setting of brake number for auxiliary axis)
6. Aux. brake unit failure for aux. axis
7. Power Supply(α*i*PS) failure
8. Amplifier failure

(Action 1) Check whether the duty and applied load exceed the rating. If so, reduce the duty or applied load.
(Action 2) Check whether the robot is pushed or pulled by external force. If so, remove the external force to the robot or modify the taught point.
(Action 3) Check whether the brake cable/connector are connected correctly.
(Action 4) Measure the supplied voltage. Then, check whether the voltage is matched to the controller specification.
(Action 5) Check whether the motor brake is released properly when Reset or the robot moves. First of all, check whether the setting of brake number is correct when this alarm occurs on auxiliary axis.
(Action 6) When this alarm occurs on the auxiliary axis which brake is controlled by the aux. brake unit, check the fuse on the aux. brake unit.
(Action 7) Replace the Power Supply(α*i*PS).
(Action 8) Replace the servo amplifier (6-axis servo amplifier, α*i*SV).

SRVO-459 Excess regeneration2%s (G: i A: j)

(Explanation) An error is found in the discharge circuit in the 6-axis amplifier.
(Action 1) Replace the 6-axis servo amplifier.

SRVO-460 Illegal parameter%s (G: i A: j)

(Explanation) An error is found in the setting of the parameters in the Power Supply(α*i*PS) or 6-axis amplifier.
(Action 1) Replace the Power Supply(α*i*PS).
(Action 2) Replace the 6-axis servo amplifier.

SRVO-461 Hardware error%s (G: i A: j)

(Explanation) An error is found in the circuit in the Power Supply(α*i*PS) or 6-axis amplifier.
(Action 1) Replace the Power Supply(α*i*PS).
(Action 2) Replace the 6-axis servo amplifier.

SRVO-477 Calibration data error

(Explanation) The force sensor calibration data are wrong.
(Action) Please load correct force sensor calibration data and apply them again.

SRVO-478 Temperature difference too large

(Explanation) The force sensor temperature difference is too large.
(Action) Please make sure that the environment temperature does not change greatly, and then restart the controller.
If the error is not cleared, document the events that led to the error and contact your FANUC technical representative.

SRVO-479 Temperature changes too fast

(Explanation) The force sensor temperature changes too fast.
(Action) Please make sure that the environment temperature does not change greatly, and then restart the controller.
If the error is not cleared, document the events that led to the error and contact your FANUC technical representative.

SRVO-480 FORCE alarm %x,%x

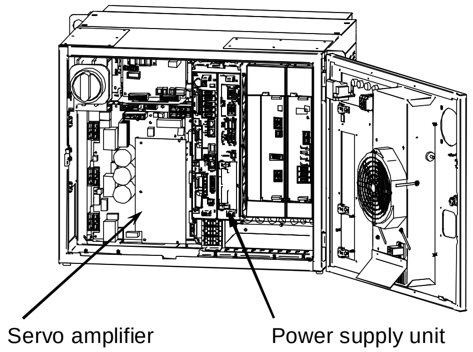
(Explanation) Force sensor error.
(Action1) Restart the controller.
(Action2) Replace the sensor cable.
If the error is not cleared, document the events that led to the error and contact your FANUC technical representative.

3.6 FUSE-BASED TROUBLESHOOTING

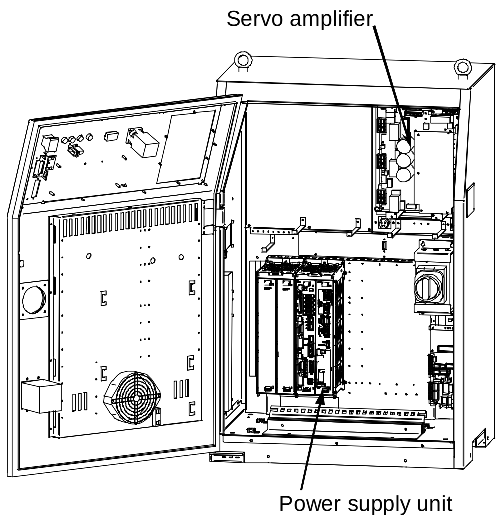
This section describes the alarms and symptoms generated and actions required when the fuses installed on the printed circuit boards and units have blown.

(1) When the fuses of the power supply unit have blown
F1: Fuse for AC input (A60L-0001-0450#8R0)
F3: Fuse for +24 E (A60L-0001-0046#7.5)
F4: Fuse for +24 V (A60L-0001-0046#7.5)

Name	Symptom observed when fuse has blown	Action
F1	The LED (PIL: Green) of the power supply unit does not light, and the power cannot be turned on.	1 Check the units (fans), printed-circuit board and cables connected to the CP2 and CP3 connectors of the power supply unit to see if there is any short circuit. 2 Replace the power supply unit.
F3	The teach pendant displays “SRVO-217 E-STOP Board not found” or “PRIO-091 E-Stop PCB comm. Error ”	1 Check the printed circuit boards, units, and cables using +24 E according to the power supply system diagram. Replace a faulty printed circuit board, unit or cable if any. 2 Replace the power supply unit.
F4	The power, when turned on, is immediately turned off. At this time, the LED (ALM: Red) lights.	1 Check the printed circuit boards, units, servo amplifier and cables using +24 V according to the power supply system diagram. Replace a faulty printed circuit board, unit, servo amplifier or cable if any. The LED of ALM is turned off by pressing the OFF button once. 2 Replace the power supply unit.



(A-cabinet)



(B-cabinet)

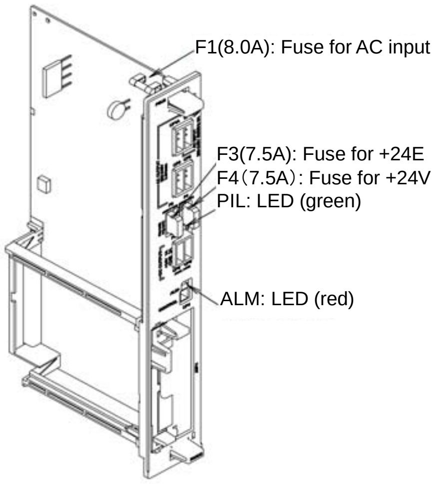


Fig.3.6(a) Fuse on the Power supply unit

(2) Main board fuse (R-30*i*B Plus)
FU1:For protecting the +24E output for vision
(This fuse is installed on the R-30*i*B Plus main board.)

Name	Symptom observed when fuse has blown	Action
FU1	+24E used for vision is not output.	1 Check +24E used by the vision for a ground fault. 2 Check the cables connecting to the vision camera and the related parts for an abnormaly. 3 Replace the main board.

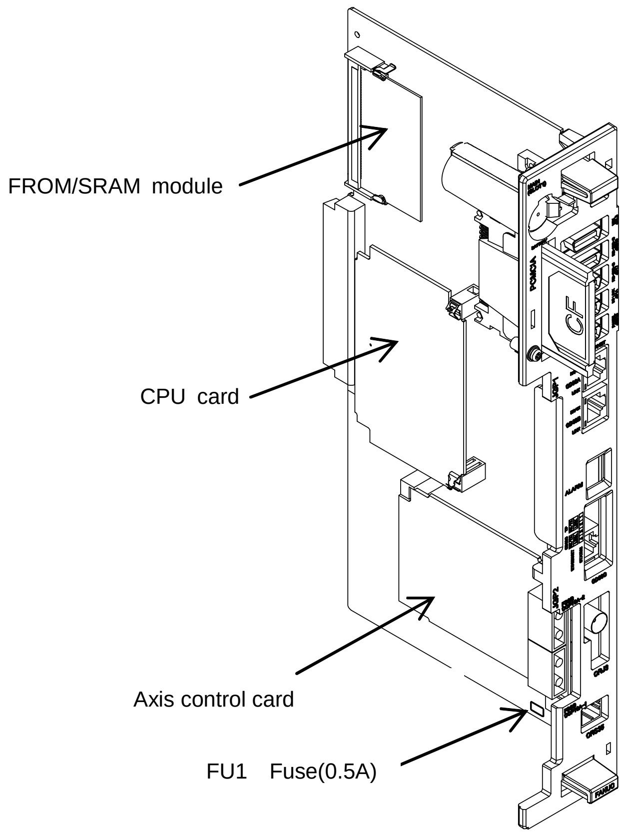


Fig.3.6(b) R-30*i*B Plus Main board

(3) Servo amplifier fuse
FS1: For generation of the power to the amplifier control circuit (A60L-0001-0290#LM32C)
FS2: For protection of the 24V output to the end effector, XROT, and XHBK (A60L-0001-0290#LM32C)
FS3: For protection of the 24V output to the regenerative resister (A60L-0001-0290#LM32C)

Name	Symptom observed when fuse has blown	Action
FS1	All LEDs on the servo amplifier go out. The FSSB disconnection or initialization alarm is displayed on the teach pendant.	Replace the servo amplifier.
FS2	The 6ch amplifier fuse blown (SRVO-214), Hand broken (SRVO-006), and Robot overtravel (SRVO-005) are displayed on the teach pendant.	1 Check +24VF used by the end effector for a ground fault. 2 Check the robot connection cable and the robot's internal cable. 3 Replace the servo amplifier. 4 In case of M-3*i*A, check the fan motor inside the robot (option).
FS3	The 6ch amplifier fuse blown (SRVO-214), DCAL alarm (SRVO-043) are displayed on the teach pendant.	1 Check the regenerative resister, and replace it if required. 2 Replace the servo amplifier.

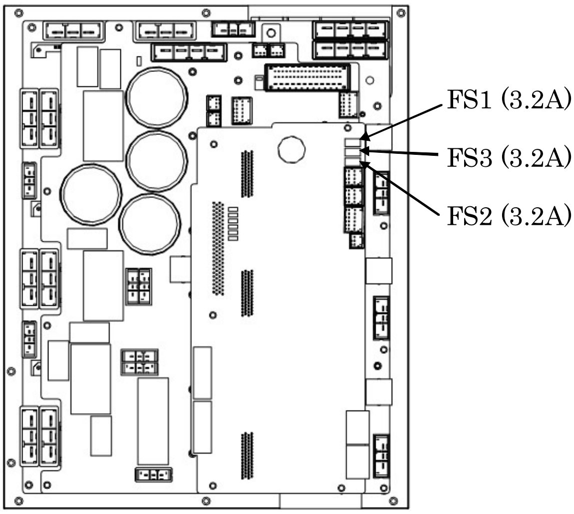
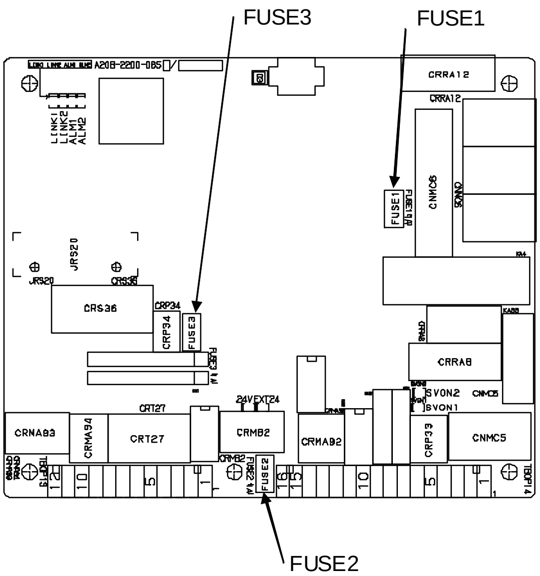


Fig.3.6(c) Fuse on the Servo amplifier

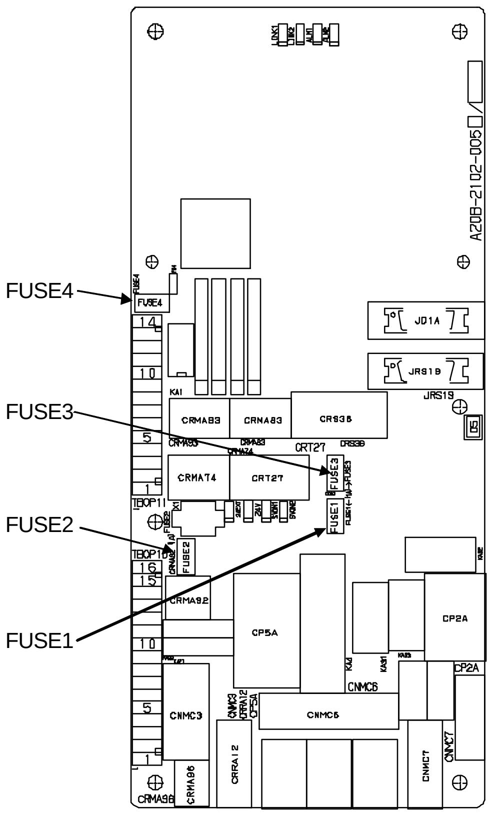
(4) Emergency stop board fuses
FUSE1: For internal power supply circuit (A60L-0001-0290#LM10C)
FUSE2: For +24EXT line (emergency stop line) protection (A60L-0001-0290#LM10C)
FUSE3: For teach pendant power supply circuit (A60L-0001-0290#LM10C)
FUSE4: For SFDI protection (B-cabinet only) (A60L-0001-0290#LM10C)

Name	Symptom observed when fuse has blown	Action
FUSE1	The teach pendant displays "SRVO-217 E-STOP Board not found" or "PRIO-091 E-Stop PCB comm. Error ".	1 Check the cable between emergency stop board and main board. Replace them if necessary. 2 Replace the E-STOP unit. Before executing the (Action 3), perform a complete controller back-up to save all your programs and settings. 3 Replace the main board.

Name	Symptom observed when fuse has blown	Action
FUSE2	The teach pendant displays “SRVO-213 E-STOP Board FUSE2 blown”	1 If an alarm is issued when the fuse has not blown, check the voltages of EXT24V and EXT0V (TBOP14 for A-cabinet or TBOP10 for B-cabinet). If EXT24V or INT0V is not used, check the jumper pin between EXT24V and INT24V or between EXT0V and INT0V. 2 If the FENCE, SVOFF, and EXEMG are used, these signals may be connected to 0V or ground. Check these cables. 3 Replace the operator’s panel cable(CRT27). 4 Replace the emergency stop board. 5 Replace the teach pendant cable. 6 Replace the teach pendant.
FUSE3	The display on the teach pendant disappears.	1 Check the teach pendant cable for a fault, and replace it if required. 2 Check the teach pendant for a fault, and replace it if required. 3 Replace the emergency stop board.
FUSE4	(B-cabinet only) The teach pendant displays “SRVO-348 DCS MCC OFF Alarm”	1 Check the SFDI cable connections, and replace it if required. 2 Check the operator’s panel cable (CRT27), and replace it if required. 3 Replace the E-STOP unit.



(A-cabinet)



(B-cabinet)

Fig.3.6 (d) Fuse on the Emergency stop board

(5) Fuse on the process I/O board JA,JB

FUSE1: Fuse for +24E (A60L-0001-0046#2.0)

Name	Symptom observed when fuse has blown	Action
FUSE1	The LED (ALM-2 or FALM) on the process I/O board lights, and an alarm such as IMSTP input is output on the teach pendant. (The display data depends on state of peripheral equipment connection.)	1 Check if the cables and peripheral equipment connected to the process I/O board are normal. 2 Replace the process I/O board.

Fuse location is common to JA and JB. The following is figure of JA.

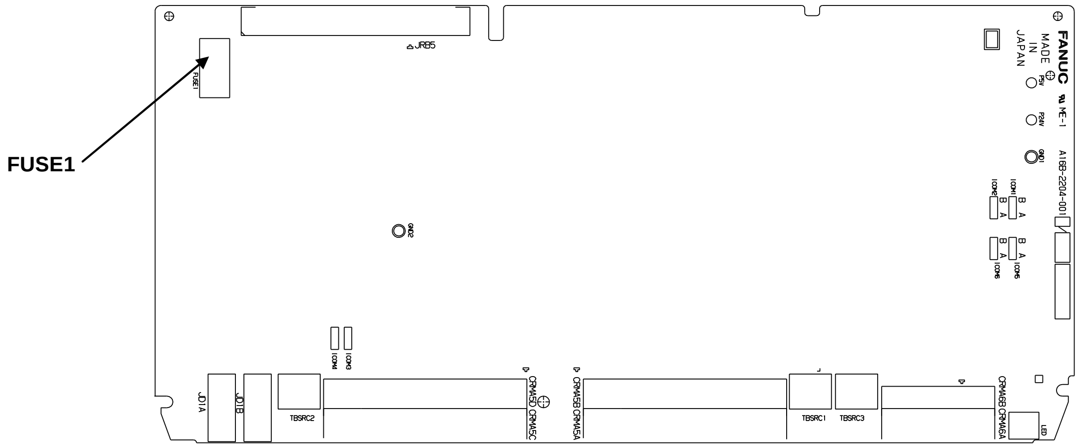


Fig.3.6 (e) Fuse on the Process I/O board JA,JB

(6) Fuse on the process I/O MA,MB

FUSE1: Fuse for +24E (A60L-0001-0046#1.0)

Name	Symptom observed when fuse has blown	Action
FUSE1	The LED (ALM1 or FALM) the process I/O board lights.	1. Check if the cables and peripheral devices connected to the process I/O board are normal. 2. Replace the process I/O board.

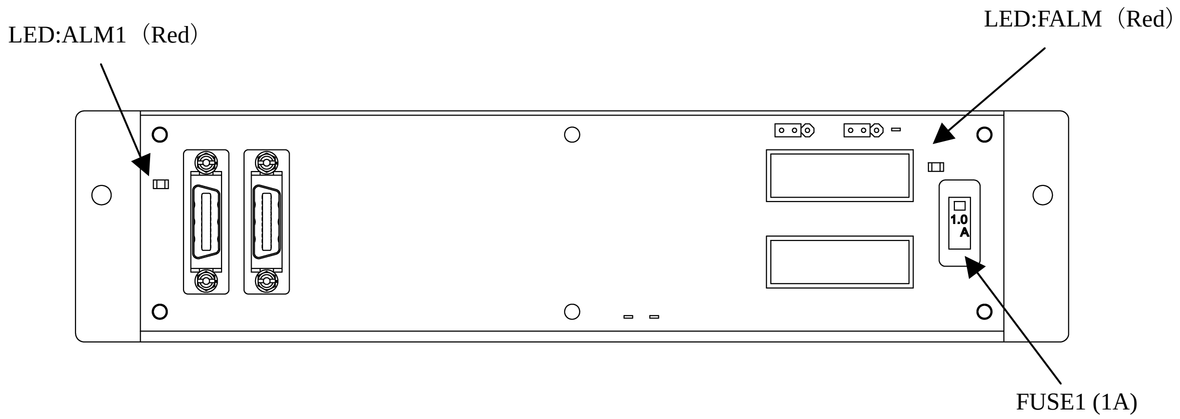


Fig.3.6 (f) Fuse on the process I/O board MA

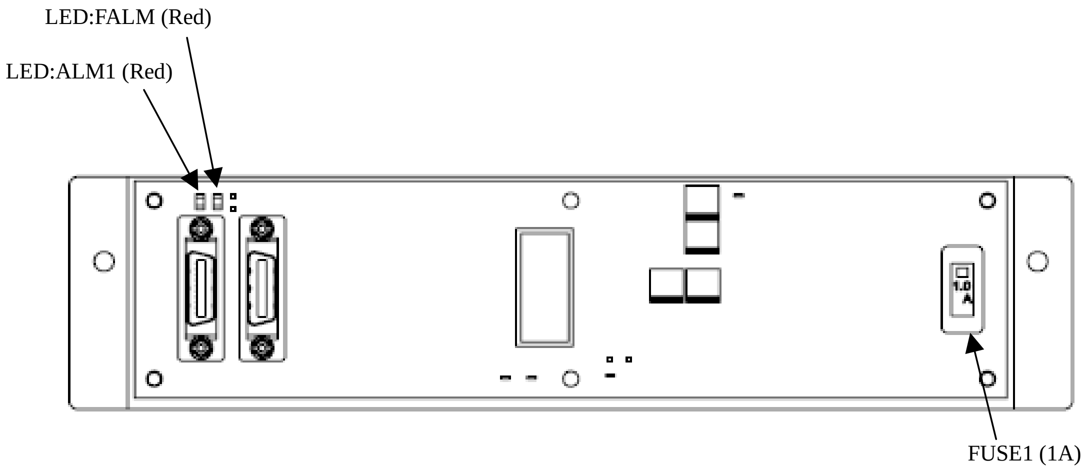


Fig.3.6 (g) Fuse on the process I/O board MB

(7) Fuse on the sensor I/F unit for CR-35*i*A
FUSE: For internal power supply circuit (A60L-0001-0290#LM20)

Name	Symptom observed when fuse has blown	Action
FUSE	The LED of the sensor I/F unit lights.	1. Check if the cables and peripheral devices connected to the sensor I/F unit are normal. 2. Replace the sensor I/F unit.

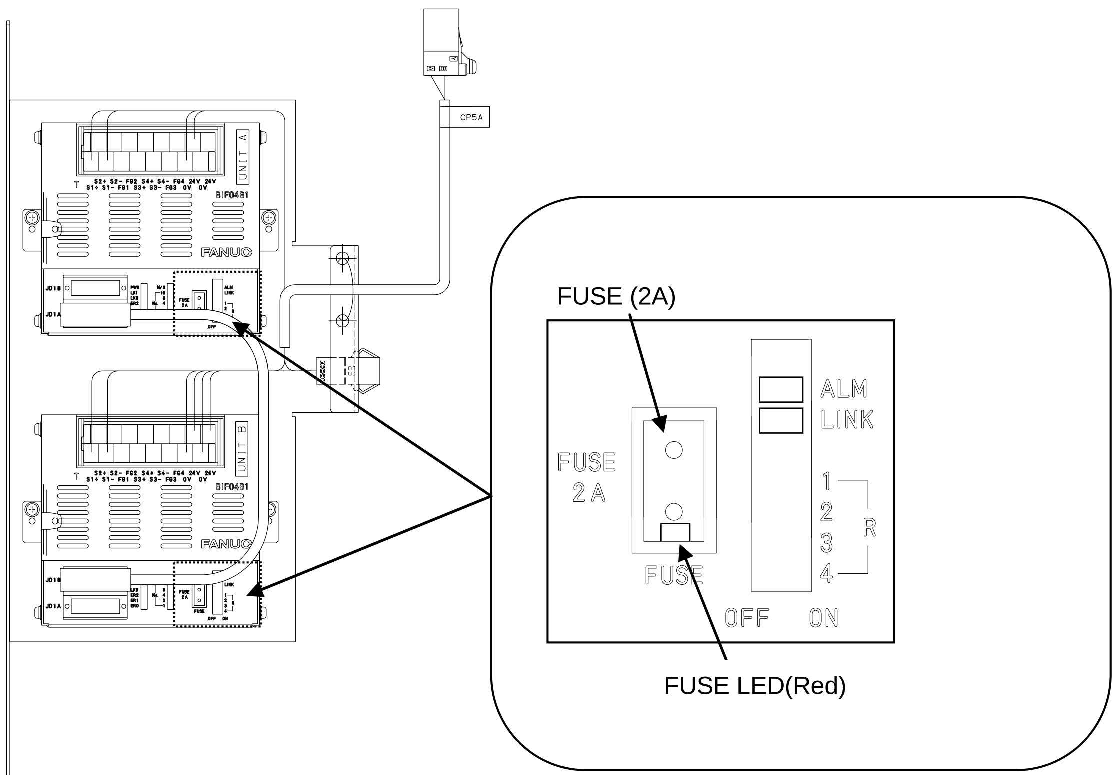
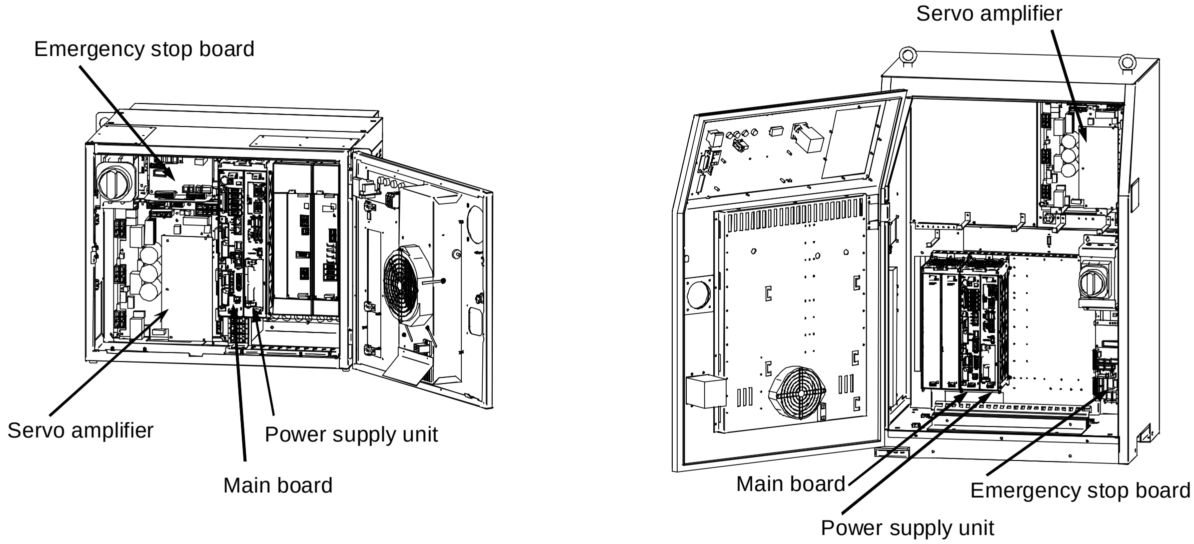


Fig.3.6 (h) Fuse on sensor I/F unit for CR-35*i*A

3.7 TROUBLESHOOTING BASED ON LED INDICATIONS

The printed circuit boards and servo amplifier are provided with alarm LEDs and status LEDs. The LED status and corresponding troubleshooting procedures are described below.



(A-cabinet) **(B-cabinet)**

Fig.3.7 Troubleshooting based on LED indication

3.7.1 Troubleshooting Using the LEDS on the Main Board

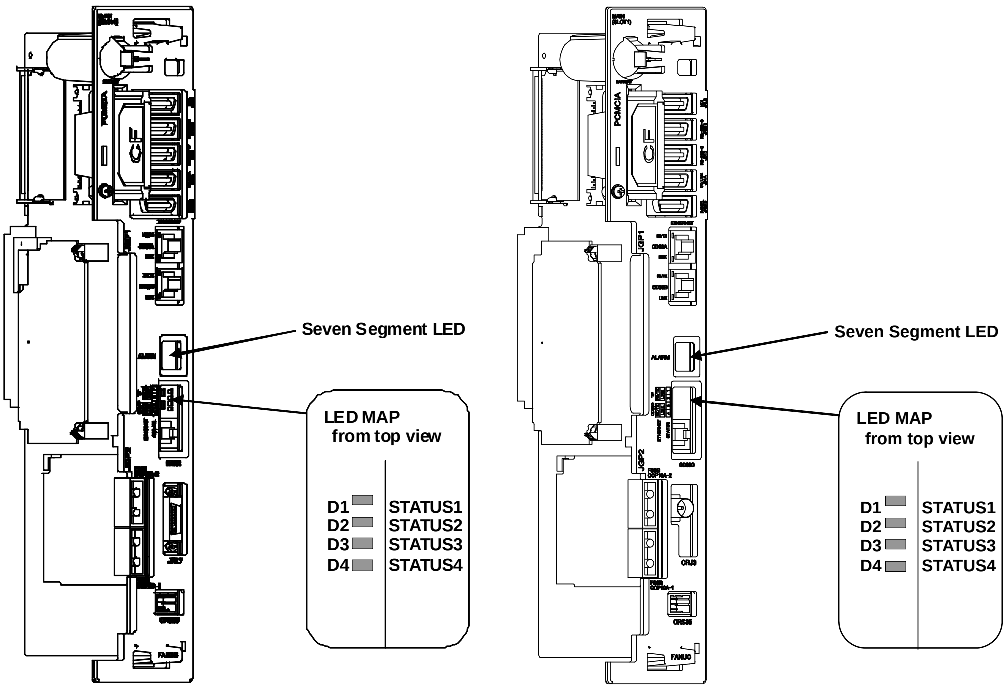
(1) Troubleshooting using the status display LED
To troubleshoot an alarm that arises before the teach pendant is ready to display, check the status LEDs (green) on the main board at power-on. After power-on, the LEDs light as described in steps 1 to end, in the order described. If an alarm is detected, the step in which the alarm occurred can be determined from which LEDs are lit.

Step	LED	Action to be taken
1: After power-on, all LEDs are lit.	■ D1 ■ D2 ■ D3 ■ D4	[Action1] Replace the CPU card. * [Action2] Replace the main board.
2: Software operation start-up.	□ D1 □ D2 □ D3 □ D4	[Action1] Replace the CPU card. * [Action2] Replace the main board.
3: The initialization of dram on the CPU card is completed.	□ D1 □ D2 □ D3 ■ D4	[Action1] Replace the CPU card. * [Action2] Replace the main board.

Step	LED	Action to be taken
4: The initialization of DPRAM on the communication IC is completed.	□ D1 □ D2 ■ D3 □ D4	[Action1] Replace the CPU card. * [Action2] Replace the main board. * [Action3] Replace the FROM/SRAM module.
5: The initialization of the communication IC is completed.	□ D1 □ D2 ■ D3 ■ D4	[Action1] Replace the CPU card. * [Action2] Replace the main board. * [Action3] Replace the FROM/SRAM module.
6: The loading of the basic software is completed.	□ D1 ■ D2 □ D3 □ D4	* [Action1] Replace the main board. * [Action2] Replace the FROM/SRAM module.
7: Basic software start-up.	□ D1 ■ D2 □ D3 ■ D4	* [Action1] Replace the main board. * [Action2] Replace the FROM/SRAM module. * [Action3] Replace the power supply unit.
8: Start-up of communication with the teach pendant.	□ D1 ■ D2 ■ D3 □ D4	* [Action1] Replace the main board. [Action2] Replace the FROM/SRAM module.
9: The loading of optional software is completed.	□ D1 ■ D2 ■ D3 ■ D4	* [Action1] Replace the main board. [Action2] Replace the process I/O board.
10: DI/DO initialization	■ D1 □ D2 □ D3 □ D4	[Action1] Replace the FROM/SRAM module. [Action2] Replace the main board.
11: The preparation of the SRAM module is completed.	■ D1 □ D2 □ D3 ■ D4	[Action1] Replace the axis control card. * [Action2] Replace the main board. [Action3] Replace the servo amplifier.
12: Axis control card initialization	■ D1 □ D2 ■ D3 □ D4	[Action1] Replace the axis control card. * [Action2] Replace the main board. [Action3] Replace the servo amplifier.
13: Calibration is completed.	■ D1 □ D2 ■ D3 ■ D4	[Action1] Replace the axis control card. * [Action2] Replace the main board. [Action3] Replace the servo amplifier.

Step	LED	Action to be taken
14: Start-up of power application for the servo system	■ D1 ■ D2 □ D3 □ D4	* [Action1] Replace the main board.
15: Program execution	■ D1 ■ D2 □ D3 ■ D4	* [Action1] Replace the main board. [Action2] Replace the process I/O board.
16: DI/DO output start-up.	■ D1 ■ D2 ■ D3 □ D4	* [Action1] Replace the main board.
17: Initialization is terminated.	■ D1 ■ D2 ■ D3 ■ D4	Initialization has ended normally.
18: Normal status	☆ D1 ☆ D2 ■ D3 ■ D4	Status LEDs 1 and 2 blink when the system is operating normally.

* If the main board or FROM/SRAM module is replaced, the contents of memory (parameters, specified data, etc.) will be lost. Before you replace the unit, therefore, make a backup copy of the data.
If an alarm is issued, data backup may be disabled. So, back up the contents of memory routinely.



(R-30*i*B main board) **(R-30*i*B Plus main board)**

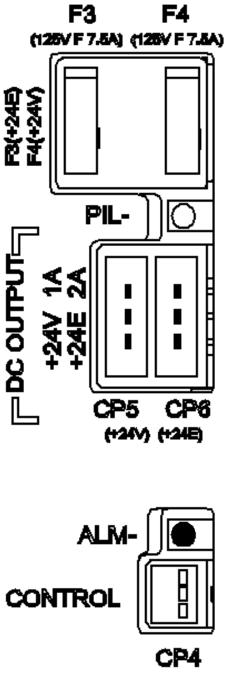
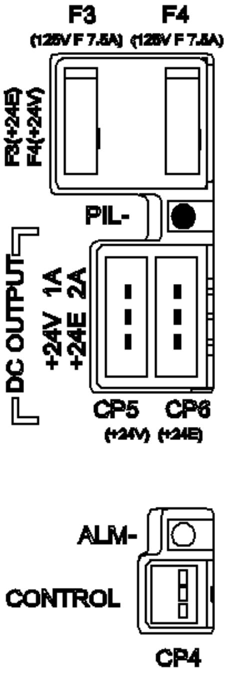
Fig.3.7.1 LED on the main board

(2) TROUBLESHOOTING BY 7-SEGMENT LED INDICATOR

7-segment LED indicator	Description
0.	[Description] A parity alarm condition has occurred in DRAM on the CPU card installed on the main board. [Action1] Replace the CPU card. * [Action2] Replace the main board.
1.	[Description] A parity alarm condition has occurred in SRAM on the FROM/SRAM module installed on the main board. [Action1] Replace the FROM/SRAM module. * [Action2] Replace the main board.
2.	[Description] A bus error has occurred in the communication controller. * [Action] Replace the main board.
3.	[Description] A parity alarm condition has occurred in DRAM controlled by the communication controller. * [Action] Replace the main board.
5.	[Description] A servo alarm condition has occurred on the main board. [Action1] Replace the axis control card. * [Action2] Replace the main board. [Action3] If an option board is installed, replace the option board.
6.	[Description] The SYSEMG alarm has occurred. [Action1] Replace the axis control card. [Action2] Replace the CPU card. * [Action3] Replace the main board.
7.	[Description] The SYSFAIL alarm has occurred. [Action1] Replace the axis control card. [Action2] Replace the CPU card. * [Action3] Replace the main board. [Action4] If an option board is installed, replace the option board.
8.	[Description] 5V is supplied to Main board. Above alarms do not occur.

* If the main board or FROM/SRAM module is replaced, the contents of memory (parameters, specified data, etc.) will be lost. Before you replace the unit, therefore, make a backup copy of the data.
If an alarm is issued, data backup may be disabled. So, back up the contents of memory routinely.

3.7.2 Troubleshooting by LEDs on Power Supply Unit

LED indication	Failure description and required measure
	[Description] When ALM LED (red) turned on, power supply alarm has occurred. [Action1] Check fuse F4 (+24V) on the power supply unit, and replace it if it has blown. [Action2] Check the printed-circuit boards powered by the DC power supplies (+5V, 15V, and +24V), the relevant units, and cables, and replace them if defective. [Action3] Replace the power supply unit.
	[Description] If the PIL LED (Green) does not light, the power supply unit has not been supplied with 200 VAC. [Action1] Check fuse F1 on the power supply unit, and replace it if it has blown. For detailed causes of fuse blown out, please refer to Section 3.6. [Action2] Replace the power supply unit.

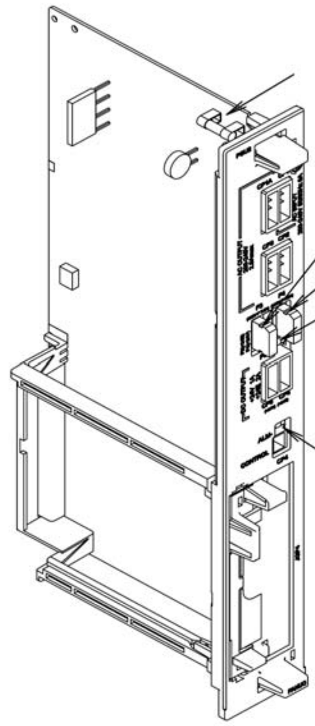
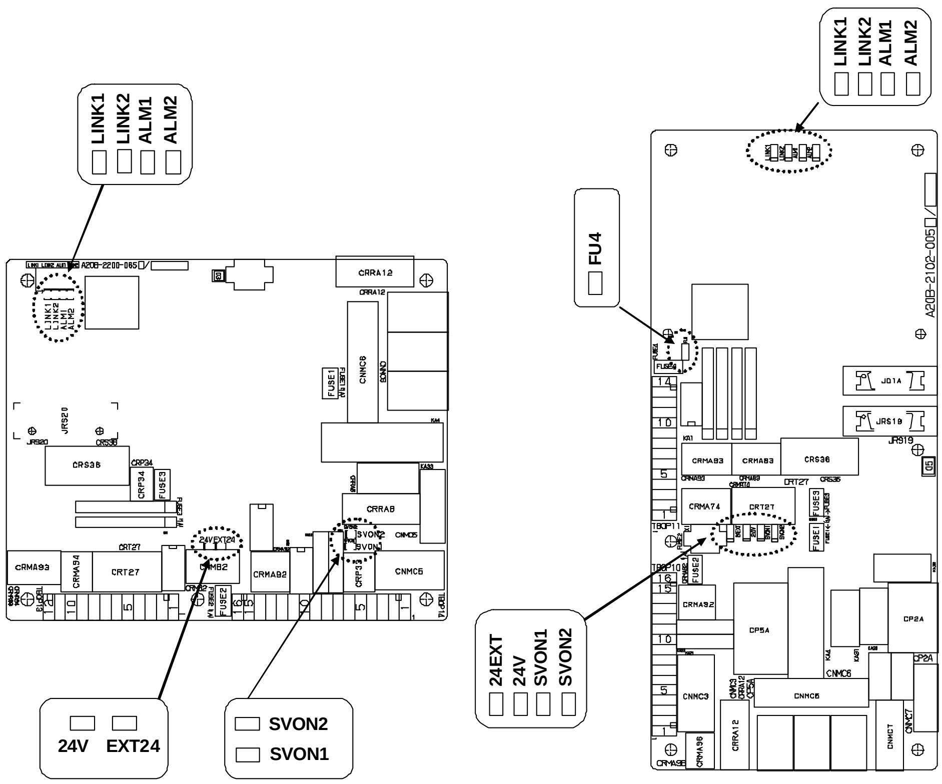


Fig.3.7.2 LEDs on the power supply unit

3.7.3 Troubleshooting by LED on the Emergency Stop Board

LED indication	Failure description and required measure
FU4 (Red) (B-cabinet only)	[Description] When the LED (red) turned on, the fuse FU4 is blown. 24V for safety DI signal(SFDI) is not supplied. [Action1] Check the connection of SFDI on Safety I/O board. [Action2] Check the operator's panel cable (CRT27), and replace it if required. [Action3] Replace the E-STOP unit.
24V (Green)	[Description] When the LED does not light, the +24V power for the teach pendant and internal circuit is not supplied. [Action1] Check the CRP33(A-cabinet) or CP5A(B-cabinet) connector and check that 24 V is supplied. When 24 V is not supplied, check CP6 connector and fuse F3 of power supply unit. [Action2] Replace the emergency stop board.
EXT24/24EXT (Green)	[Description] When the LED (green) does not light, the EXT24V power for emergency stop circuit is not supplied. [Action1] Check the voltages of EXT24V and EXT0V (TBOP14 for A-cabinet or TBOP10 for B-cabinet). If +EXT24V or EXT0V is not used, check the jumper pin between EXT24V and INT24V or between EXT0V and INT0V. [Action2] If the FENCE, SVOFF, and EXEMG is used, these signals may be connected to 0V or ground. Check these cables. [Action3] Replace the emergency stop board. [Action4] Check the teach pendant cable, and replace it if required. [Action5] Check the teach pendant, and replace it if required. [Action6] Check the operator's panel cable (CRT27), and replace it if required.
SVON1/SVON2 (Green)	[Description] These LEDs (green) indicate the status of SVON1/SVON2 signals from the emergency stop board to the servo amplifier. When the SVON1 and SVON2 (green) turned on, the servo amplifier is ready to energize.

LED indication	Failure description and required measure
LINK1/LINK2 (Green)	[Description] Please see the Section 3.9. The operation mode is "I/O Link *i* ". If LINK1 or LINK2 state is "Blink (1:1 at high speed)", communication is at halt because of an alarm. [Action1] Identify the cause according to the states of the red LED "ALM" stated below or information displayed on the TP screen.
ALM1/ALM2 (Red)	[Description] Please see the Section 3.9. The operation mode is "I/O Link *i* ". [1] If the ALM1 or ALM2 state is "Steadily ON", hardware may be defective. [Action1] Check the cable between the main board and the emergency stop boards, and replace it if necessary. [Action2] Replace the emergency stop board. [Action3] Replace the main board. [2] If the ALM1 or ALM2 state is "Blink (1:1)", the communication between the emergency stop board and a unit connected to I/O Link ***i*** (E-STOP unit) to the E-STOP unit is stopped, or there may be noise around the cable. [Action1] Check the communication cable between the emergency stop board and the unit connected to I/O Link ***i*** (E-STOP unit), and replace it if necessary. [Action2] Replace the unit connected to I/O Link ***i*** (E-STOP unit). [Action3] Replace the emergency stop board [3] If the ALM1 or ALM2 state is "Blink (3:1)", a unit connected to I/O Link ***i*** (E-STOP unit) to the E-STOP unit may have power failure. [Action1] Check fuse on a unit connected to I/O Link ***i*** (E-STOP unit) to the E-STOP unit, and replace it if it has blown. [Action2] Replace the unit connected to I/O Link ***i*** (E-STOP unit). [Action3] Replace the emergency stop board.

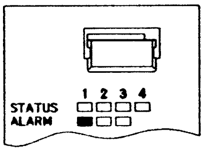
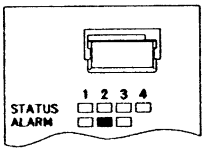


(A-cabinet) **(B-cabinet)**

Fig.3.7.3 LEDs on the emergency stop board

3.7.4 Troubleshooting by Alarm LEDs on the Process I/O Board

Process I/O JA,JB

LED	Description and action to be taken
	[Description] A communication alarm occurred between the main board and process I/O board. [Action1] Replace the process I/O board. * [Action2] Replace the main board. [Action3] Replace the I/O link connection cable.
	[Description] A fuse on the process I/O board is blown. [Action1] Replace the blown fuse on the process I/O board. [Action2] Examine the cables and peripheral devices connected to the process I/O board. Replace any failed components. [Action3] Replace the process I/O board.

* If the main board or FROM/SRAM module is replaced, the contents of memory (parameters, specified data, etc.) will be lost. Before you replace the unit, therefore, make a backup copy of the data.
If an alarm is issued, data backup may be disabled. Therefore, back up the contents of memory routinely.

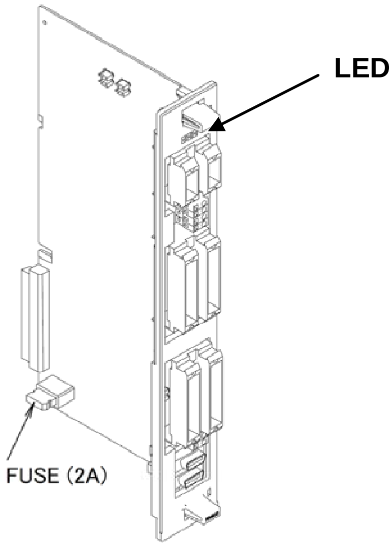


Fig.3.7.4 (a) LEDs on the Process I/O board JA/JB

Process I/O MA,MB

LED	Color	Description
ALM1	Red	[Explanation] An alarm was issued during communication between the main board and the process I/O board. [Measure 1] Replace the process I/O board. [Measure 2] Replace the I/O link connection cable. [Measure 3] Replace the main board.
FALM	Red	[Explanation] The fuse on the process I/O board was blown. [Measure 1] Replace the fuse on the process I/O board. [Measure 2] Check the cables and peripheral units connected to the process I/O board and replace the defective units. [Measure 3] Replace the process I/O board.

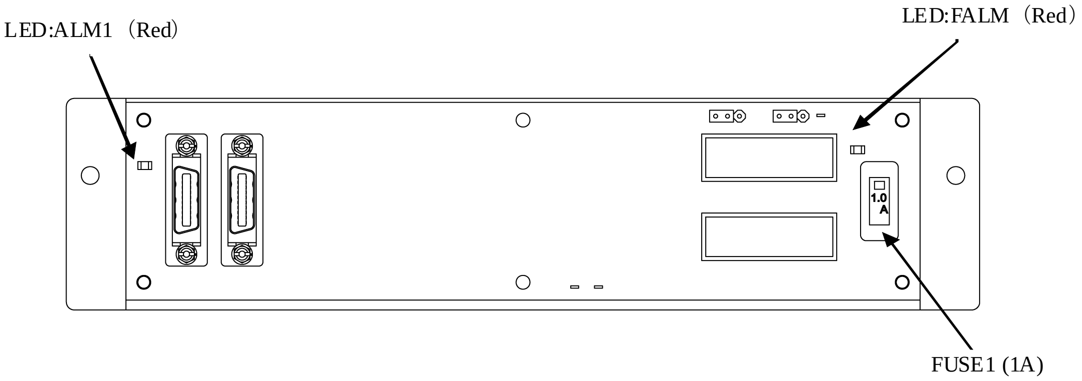


Fig.3.7.4 (b) LEDs on the process I/O board MA

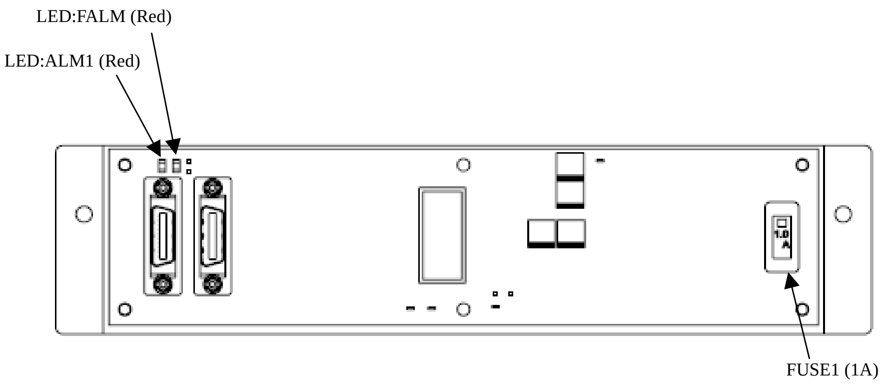


Fig.3.7.4 (c) LEDs on the process I/O board MB

3.7.5 Troubleshooting by LEDs on the 6-Axis Servo Amplifier

The 6-Axis servo amplifier has alarm LEDs. Troubleshoot the alarm indicated by the LEDs, referring also to the alarm indication on the teach pendant.

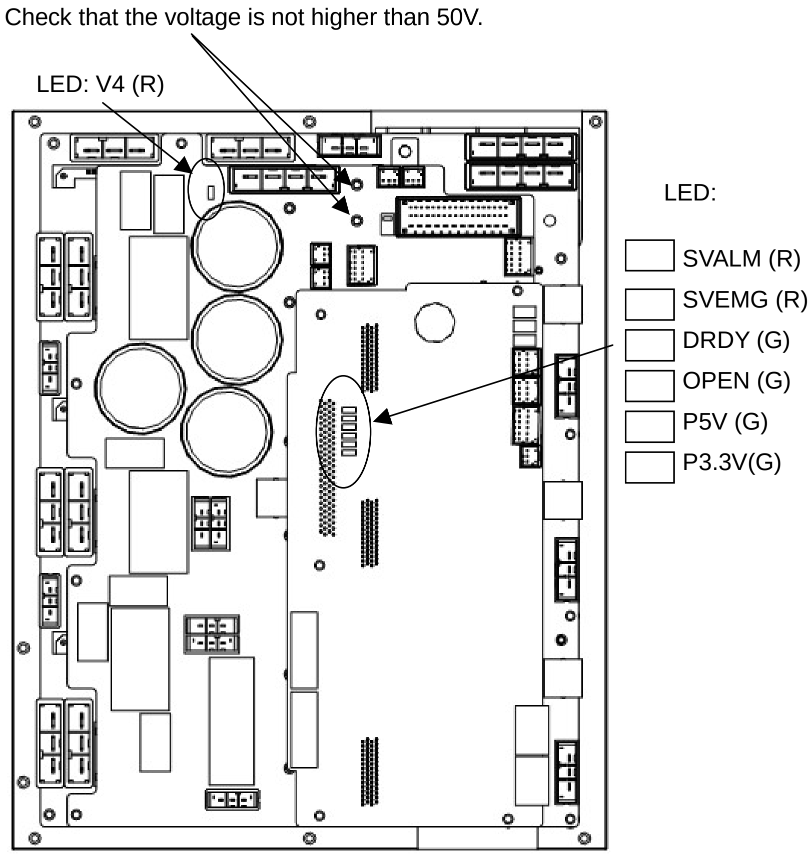


Fig.3.7.5 LEDs on the 6-Axis servo amplifier

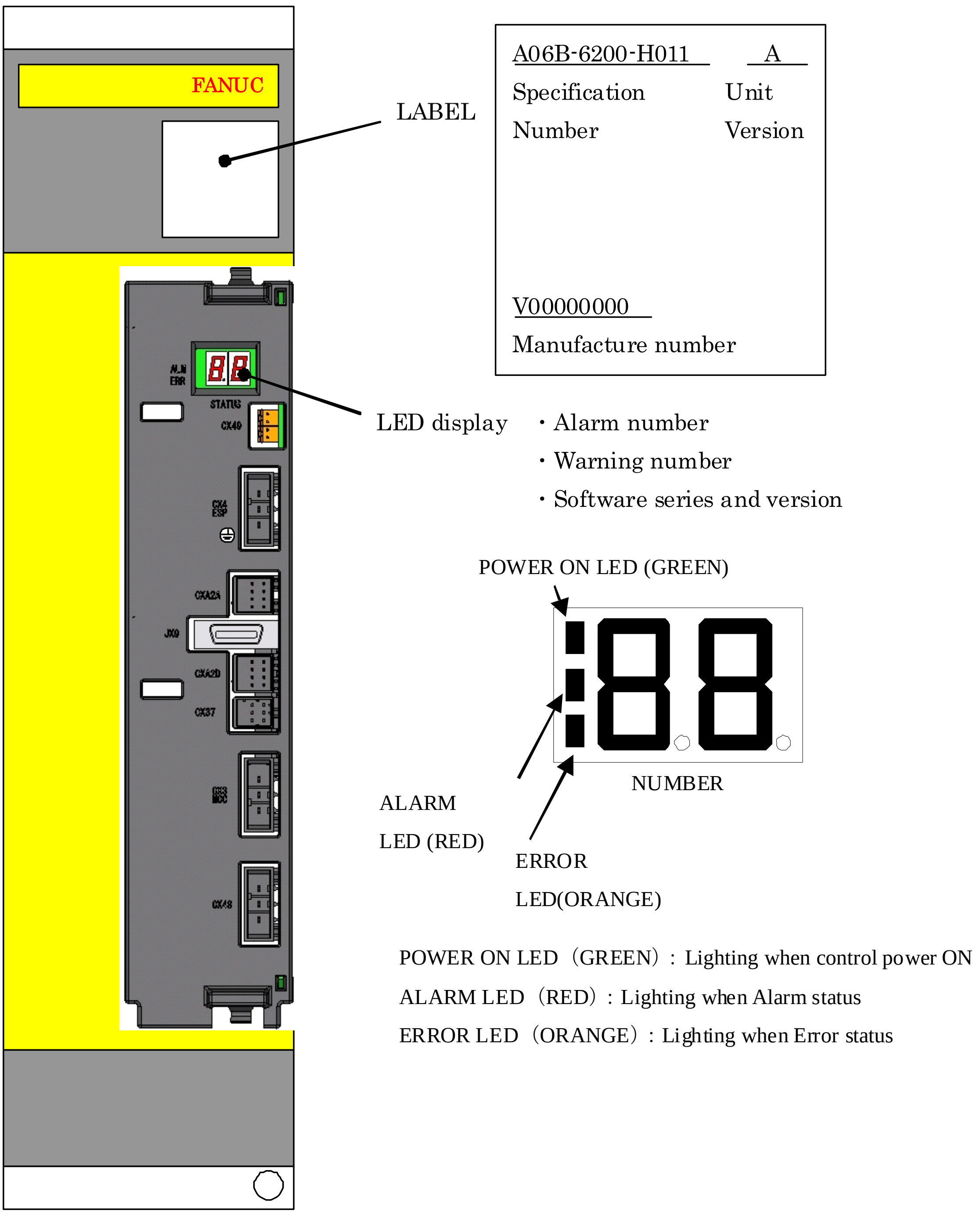
> ⚠ **WARNING**
> Before touching the 6-Axis servo amplifier, check the DC link voltage with the screws located above the LED "V4". By using a DC voltage tester, check that the voltage is 50 V or less.

LED	Color	Description
V4	Red	Lights when the DCLINK circuit inside the servo amplifier is charged to reach the specified voltage. If the LED does not light after pre-charge is finished: [Action 1] The DC Link may be short-circuited. Check for connection. [Action 2] The charge current control resistor may be defective. Replace the emergency stop unit. [Action 3] Replace the servo amplifier.
ALM	Red	Lights when the servo amplifier detects an alarm. If the LED lights when there is no alarm condition in the machine: [Action] Replace the servo amplifier. If the LED does not light when there is an alarm condition in the machine: [Action] Replace the servo amplifier.

LED	Color	Description
SVEMG	Red	Lights when an emergency stop signal is input to the servo amplifier. If the LED lights when the machine is not at an emergency stop: [Action] Replace the servo amplifier. If the LED does light when the machine is at an emergency stop: [Action] Replace the servo amplifier.
DRDY	Green	Lights when the servo amplifier is ready to drive the servo motor. If the LED does not light when the motor is activated: [Action] Replace the servo amplifier.
OPEN	Green	Lights when the communication between the servo amplifier and the main board is normal. If the LED does not light: [Action 1] Check for the connection of the FSSB optical cable. [Action 2] Replace the servo card. [Action 3] Replace the servo amplifier.
P5V	Green	Lights when the power supply circuit inside the servo amplifier outputs a voltage of +5 V normally. If the LED does not light: [Action 1] Check the robot connection cable (RMP1) to see if there is a ground fault in the +5V wire. [Action 2] Replace the servo amplifier.
P3.3V	Green	Lights when the power supply circuit inside the servo amplifier outputs a voltage of +3.3 V normally. If the LED does not light: [Action] Replace the servo amplifier.

3.7.6 Troubleshooting by LEDs on the α*i*PS

The α*i*PS has alarm LEDs. Troubleshoot the alarm indicated by the LEDs, referring also to the alarm indication on the teach pendant.



Detail of LED Display of α*i*PS

ALARM LED	ERROR LED	STATUS LED	Contents
		LED is off	Control power has not been supplied. Fault of hardware.
		Number / alphabet	The software series/edition is displayed at 4 sessions for about 4 seconds after the power is turned on. First 1 sec: Upper 2 digits of the software series Second 1 sec: Lower 2 digits of the software series Third 1sec : Upper 2 digits of software version Forth 1sec : Lower 2 digits of software version Example) In case of Software serie/version 9G00/01.0 9 G → 0 0 → 0 1 → _ 0
		– – Blink	Serial communication with the servo or spindle amplifier is being established
		– – Lighting	Serial communication with the servo or spindle amplifier is established
		00 Blink	Start up main power (Precharging)
		00	Ready main power
Lighting		Number 01 to	Alarm status
		Number 01to	Warning status

LED	Description
01	PS Overcurrent
02	PS internal fan failure
03	PS overload
04	PS low volt. DC link
05	PS pre-charge failure
06	PS low volt. control
07	PS over volt. DC link
10	PS external fan failure
14	PS improper Input power
15	PS soft thermal
24	PS hardware error

3.7.7 Troubleshooting by LEDs on the Sensor I/F Unit for CR-35*i*A

The sensor I/F unit for the I/O Link *i* only has the following LEDs to indicate the communication status of the I/O Link *i*.

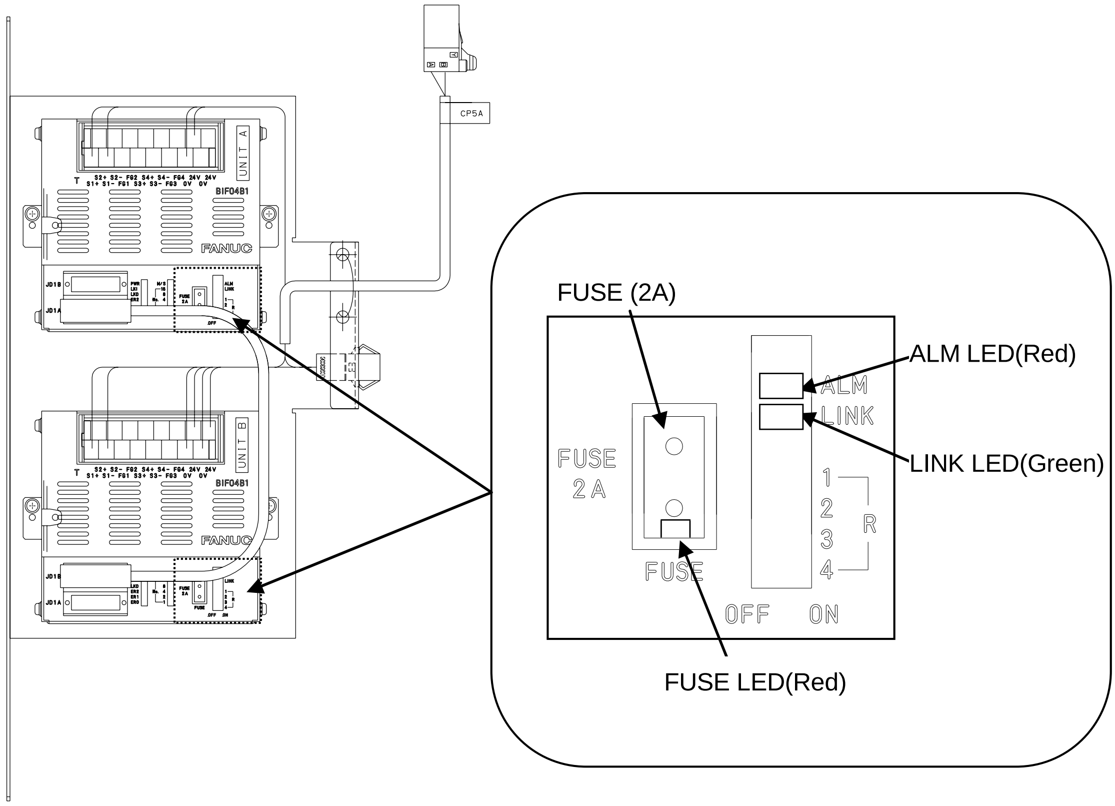


Fig.3.7.7 LEDs on the sensor I/F unit for CR-35*i*A

- FUSE LED
  Lights when the fuse blows.
  Remove the cause of the blown fuse, and the replace the fuse.
- LINK LED
  The LINK LED indicates the group communication status as described below.

Operation mode	LED Indications	Meaning	Remarks
I/O Link ***i***	OFF	Power OFF	
	ON	Power ON	
	Blink (1:1)	Communication in progress Standard	ON = approx. 0.5 sec OFF = approx. 0.5 sec
	Blink (3:1)	Communication in progress (Dual check safety in use)	ON = approx. 1.5 sec OFF = approx. 0.5 sec
	Blink (1:1 at high speed)	Communication not in progress Watch-dog alarm occurrence	ON = approx. 0.25 sec OFF = approx. 0.25 sec

· ALM LED
The ALM LED indicates the types of I/O Link *i* alarms as described below.

Operation mode	LED Indications	Meaning	Remarks
I/O Link ***i***	OFF	Normal state or power OFF	
	ON	Occurrence of any of a parity alarm, external input alarm, and dual check safety alarm	
	Blink (1:1)	Broken wire between the group of interest and a group subsequent to it	ON = approx. 0.5 sec OFF = approx. 0.5 sec
	Blink (3:1)	Power failure (including instantaneous power failure) in a group subsequent to the group of interest	ON = approx. 1.5 sec OFF = approx. 0.5 sec
	Blink (1:3)	Status alarm	ON = approx. 0.5 sec OFF = approx. 1.5 sec
	Blink (1:1 at high speed)	Alarm occurred due to a command from the master	ON = approx. 0.25 sec OFF = approx. 0.25 sec

3.8 MANUAL OPERATION IMPOSSIBLE

The following explains checking and corrective action required if the robot cannot be operated manually after the controller is turned on:

(1) Check and corrective action to be made if manual operation is impossible

(Check 1) Check whether the teach pendant is enabled.
(Corrective action)
Turn on the teach pendant "enable".

(Check 2) Check whether the teach pendant is handled correctly.
(Corrective action)
To move an axis by manual operation, press the axis selection key and shift key at the same time.
Set the override for manual feed to a position other than the FINE and VFINE positions.

(Check 3) Check whether the ENBL signal of the peripheral device control interface is set to on.
(Corrective action)
Place the peripheral device control interface in the ENBL status.

(Check 4) Check whether the HOLD signal of the peripheral device control interface (hold status). (Check whether the hold lamp on the teach pendant is on.)
(Corrective action)
Turn off the HOLD signal of the peripheral device control interface.

(Check 5) Check whether the previous manual operation has been completed.
(Corrective action)
If the robot cannot be placed in the effective area because of the offset of the speed command voltage preventing the previous operation from being completed, check the position deviation on the status screen, and change the setting.

(Check 6) Check whether the controller is in the alarm status.
(Corrective action)
Release the alarm.

(2) Check and corrective action to be taken if the program cannot be executed

(Check 1) Check whether the ENBL signal for the peripheral-device control interface is on.
(Corrective action)
Put the peripheral-device control interface in the ENBL state.

(Check 2) Check whether the HOLD signal for the peripheral-device control interface is on. Also check whether the HOLD lamp on the teach pendant is on.
(Corrective action)
If the HOLD signal of the peripheral device control interface is on, turn it off.

(Check 3) Check whether the previous manual operation has been completed.
(Corrective action)
If the robot cannot be placed in the effective area because of the offset of the speed command voltage, which prevents the previous operation from being completed, check the position deviation on the status screen, then change the setting.

(Check 4) Check whether the controller is in the alarm status.
(Corrective action)
Release the alarm.

3.9 LEDS ON UNITS SUPPORTING I/O Link *i*

3.9.1 Meanings of LEDs on Units Supporting I/O Link *i*

The standard I/O Link *i* incorporates three LEDs, “LINK” (green), “ALM” (red), and “FUSE” (red) for each unit separately. These LEDs indicate the states of the units.
The following table lists the ON/OFF states of the LEDs and their meanings.

LED ON/OFF state	ON and OFF duration
Steadily OFF	
Steadily ON	
Blink (1:1)	ON = approx. 0.5 sec, OFF = approx. 0.5 sec
Blink (3:1)	ON = approx. 1.5 sec, OFF = approx. 0.5 sec
Blink (1:3)	ON = approx. 0.5 sec, OFF = approx. 1.5 sec
Blink (1:1 at high speed)	ON = approx. 0.25 sec, OFF = approx. 0.25 sec

LED「LINK」(green)

The “LINK” (green) LED indicates the state of communication. The following table lists the meanings of LED states.

Operation mode	LED state	Meaning	Fault location and action
Common	OFF	Power OFF	
	ON	Power ON (before communication start)	
	Blink (1:1 at high speed)	Communication at halt	Communication is at halt because of an alarm. Identify the cause according to the states of the red LED stated below or information displayed on the CNC screen.
I/O Link	Blink (1:3)	Communication in progress	
I/O Link *i*	Blink (1:1)	Communication in progress	
	Blink (3:1)	Communication in progress (Dual check safety in use)	

LED「ALM」(red)

The “ALM” (red) LED indicates an alarm in the unit of interest or a unit subsequent to it. The following table lists the meanings of LED states.

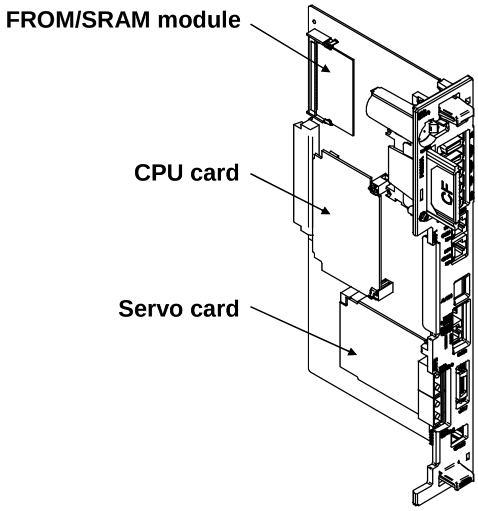
Operation mode	LED state	Meaning	Fault location and action
Common	OFF	Normal state or power OFF	
I/O Link	ON	Alarm	It is likely that the hardware may be defective. Replace the unit.
I/O Link i	ON	Alarm	It is likely that the hardware may be defective. Replace the unit.
	Blink (1:1)	Broken wire between the unit of interest and a unit subsequent to it	Check for a defective cable or a poor cable connection between JD1A on the unit of interest and JD1B on a unit subsequent to that unit. Alternatively, it is likely that there may be noise. Check to see if there is noise around the cable.
	Blink (3:1)	Power failure (including instantaneous power failure) in a unit subsequent to the unit of interest	Identify and remove the cause of a power failure in a unit subsequent to the unit of interest.
	Blink (1:3)	Status alarm	A status alarm, such as a DO ground fault, has occurred. Identify and remove the cause of the alarm.

4 PRINTED CIRCUIT BOARDS

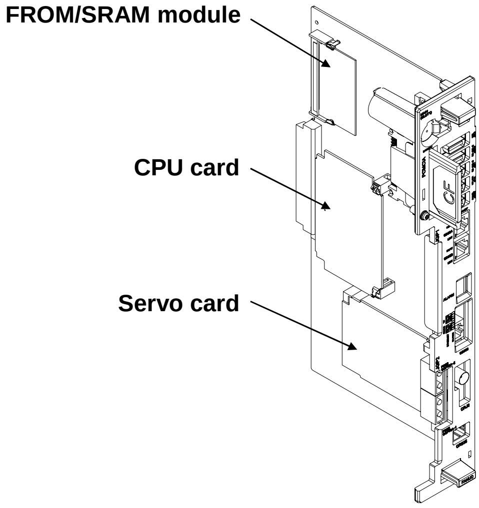
The printed circuit boards are factory-set for operation. Usually, you do not need to set or adjust them. This chapter describes the standard settings and adjustment required if a defective printed circuit board is replaced. It also describes the test pins and the LED indications.
The controller printed circuit board includes the main unit printed circuit board and one or more cards or modules installed horizontally to the main-unit printed-circuit board.
These PC boards have interface connectors, LED indicators, and a plastic panel at the front. At the rear, there is a backplane connector.

4.1 MAIN BOARD

Card and Modules



(R-30*i*B Main board)



(R-30*i*B Plus Main board)

Fig.4.1 Main board

Name	Ordering Specification	Board Specification	Note
Main board	A05B-2600-H001	A16B-3200-0730	Standard
		A16B-3200-0780	
	A05B-2600-H002	A16B-3200-0731	Option (Force sensor)
		A16B-3200-0781	
	A05B-2600-H003	A16B-3200-0732	Option (Force sensor) (High speed com. CPU)
		A16B-3200-0782	
	A05B-2600-H004	A16B-3200-0800	Standard For I/O Link *i* slave
	A05B-2600-H005	A16B-3200-0801	Option (Force sensor) For I/O Link *i* slave
	A05B-2600-H006	A16B-3200-0802	Option (Force sensor, High speed) For I/O Link *i* slave

Name	Ordering Specification	Board Specification	Note
Main board	A05B-2670-H001 (R-30*i*B Plus)	A16B-3200-0810	Standard For I/O Link *i* slave
	A05B-2670-H002 (R-30*i*B Plus)	A16B-3200-0811	Option (Force sensor) For I/O Link *i* slave
	A05B-2670-H003 (R-30*i*B Plus)	A16B-3200-0812	Option (Force sensor, High speed) For I/O Link *i* slave
CPU card	A05B-2600-H020	A20B-3300-0686 A17B-3301-0106	Standard / SDRAM 32Mbyte
	A05B-2600-H021	A20B-3300-0687 A17B-3301-0107	Standard / SDRAM 64Mbyte
	A05B-2600-H022	A20B-3300-0688 A17B-3301-0108	Standard / SDRAM 128Mbyte
	A05B-2600-H023	A20B-3300-0683 A17B-3301-0103	High speed / SDRAM 32Mbyte
	A05B-2600-H024	A20B-3300-0684 A17B-3301-0104	High speed / SDRAM 64Mbyte
	A05B-2600-H025	A20B-3300-0685 A17B-3301-0105	High speed / SDRAM 128Mbyte
	A05B-2600-H026	A17B-3301-0109	Standard / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2600-H027	A17B-3301-0110	Standard / SDRAM 64Mbyte For I/O Link *i* slave
	A05B-2600-H028	A17B-3301-0111	Standard / SDRAM 128Mbyte For I/O Link *i*slave
	A05B-2600-H029	A17B-3301-0112	High speed / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2600-H030	A17B-3301-0113	High speed / SDRAM 64Mbyte For I/O Link *i* slave
	A05B-2600-H031	A17B-3301-0114	High speed / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2670-H020 (R-30*i*B Plus)	A17B-3301-0250	Standard /DRAM 1GB For I/O Link *i* slave
Axis control card	A05B-2600-H040	A20B-3300-0664 A20B-3300-0774	6-axis
	A05B-2600-H041	A20B-3300-0663 A20B-3300-0773	12-axis
	A05B-2600-H042	A20B-3300-0662 A20B-3300-0772	18-axis
	A05B-2600-H043	A20B-3300-0661 A20B-3300-0771	24-axis
	A05B-2600-H044	A20B-3300-0660 A20B-3300-0770	36-axis
	A05B-2670-H040 (R-30*i*B Plus)	A20B-3300-0819	6-axis
	A05B-2670-H041 (R-30*i*B Plus)	A20B-3300-0818	12-axis
	A05B-2670-H042 (R-30*i*B Plus)	A20B-3300-0817	18-axis
	A05B-2670-H043 (R-30*i*B Plus)	A20B-3300-0816	24-axis
	A05B-2670-H044 (R-30*i*B Plus)	A20B-3300-0815	36-axis

Name	Ordering Specification	Board Specification	Note
FROM/SRAM module	A05B-2600-H060	A20B-3900-0283	FROM 32M/ SRAM 1M
		A20B-3900-0297	
	A05B-2600-H061	A20B-3900-0284	FROM 32M/ SRAM 2M
		A20B-3900-0298	
	A05B-2600-H062	A20B-3900-0285	FROM 32M/ SRAM 3M
		A20B-3900-0299	
	A05B-2600-H063	A20B-3900-0286	FROM 64M/ SRAM 1M
	A05B-2600-H064	A20B-3900-0287	FROM 64M/ SRAM 2M
	A05B-2600-H065	A20B-3900-0288	FROM 64M/ SRAM 3M
	A05B-2600-H066	A20B-3900-0280	FROM 128M/ SRAM 1M
	A05B-2600-H067	A20B-3900-0281	FROM 128M/ SRAM 2M
	A05B-2600-H068	A20B-3900-0282	FROM 128M/ SRAM 3M
	A05B-2600-H069 (R-30*i*B Plus)	A20B-3900-0293	FROM 256M/SRAM 1M
	A05B-2600-H070 (R-30*i*B Plus)	A20B-3900-0295	FROM 256M/SRAM 2M
	A05B-2600-H071 (R-30*i*B Plus)	A20B-3900-0296	FROM 256M/SRAM 3M

⚠CAUTION

If I/O Link *i* slave is being used, the combinations of the mainboard, CPU card, and software is limited as shown below.

[Main board (For I/O Link *i* slave)] + [CPU card (For I/O Link *i* slave)]
+ [Software (V8.30P14 or later)]

Except for the above condition, the system does not work correctly as follows.

a) [Main board] + [CPU card (For I/O Link *i* slave)]
Neither the function of I/O Link slave nor I/O Link *i* slave work correctly. And the alarm regarding I/O Link or I/O Link *i* occur on the master side.
And in case the software version is not correct, system does not work correctly.

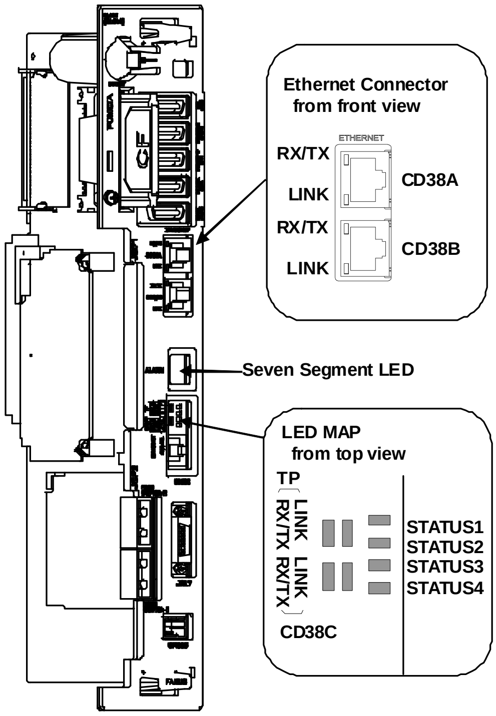
b) [Main board (For I/O Link *i* slave)] + [CPU card]
Neither the function of I/O Link slave nor I/O Link *i* slave work correctly, and the alarm regarding I/O Link or I/O Link *i* occurs on the master side.

In case of using the R-30*i*B Plus, the combination of the specification of mainboard, CPU card and software is limited as below.

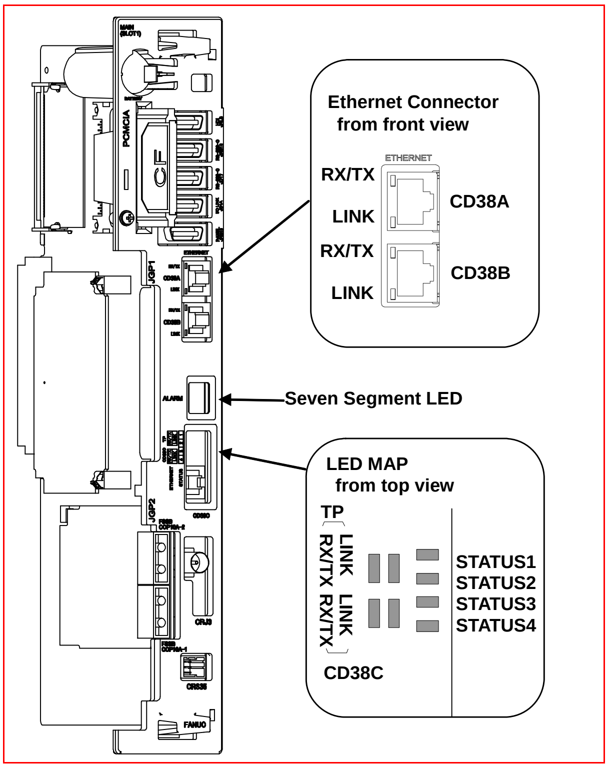
[Main board (R-30*i*B Plus)] + [CPU card (R-30*i*B Plus)]
+ [Software (V9.00P03 or later)]

Except for the above condition, the system does not work correctly. And CPU card (R-30*i*B Plus) may be broken.

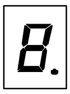
LEDs



(R-30iB main board)



(R-30iB Plus main board)

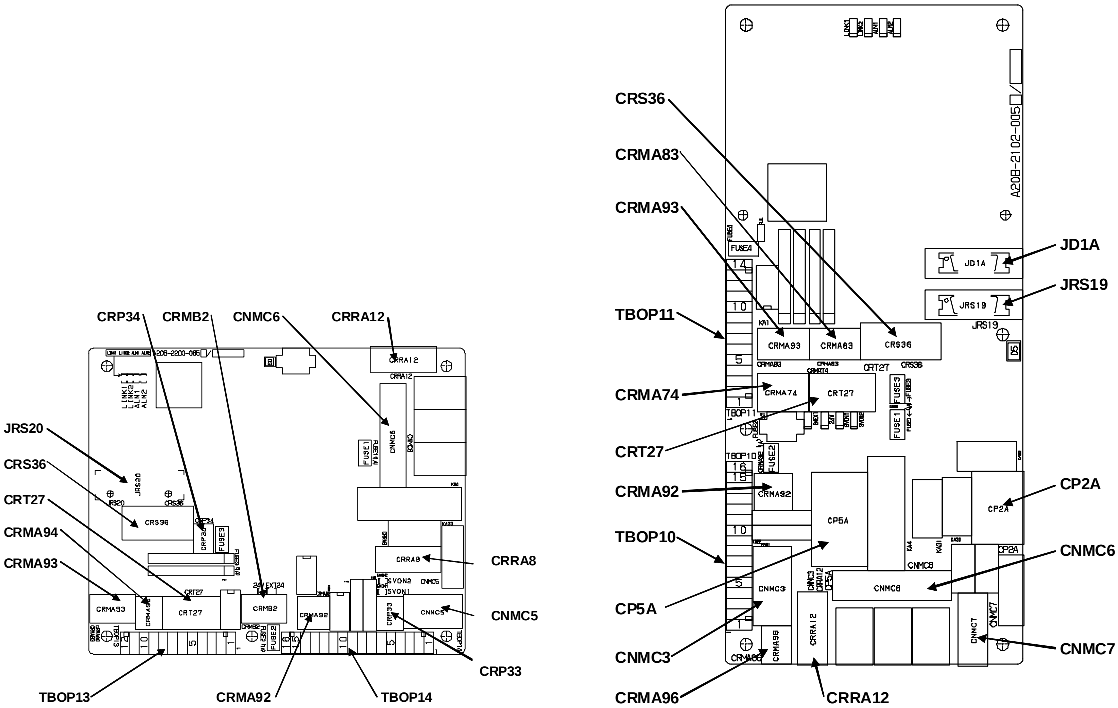
Seven segment LED	Description
	When the alarm condition has occurred in the main board, this LED is turned on. Please see the Section 3.7.TROUBLESHOOTING BASED ON LED INDICATIONS.

ETHERNET CONNECTOR LED	Color	Description
RX/TX	Green	Blink during data transmission
LINK	Green	Light when a link is established

STATUS LED	Color	Description
STATUS1	Green	These LEDs show the operating status of the system. Please see the Section 3.7.TROUBLESHOOTING BASED ON LED INDICATIONS.
STATUS2	Green	
STATUS3	Green	
STATUS4	Green	

ETHERNET LED	Color	Description
TP_RX/TX	Green	Blink during data transmission of Ethernet TP
TP_LINK	Green	Light when a link of Ethernet TP is established
CD38C_RX/TX	Green	Blink during data transmission of CD38C
CD38C_LINK	Green	Light when a link of CD38C is established

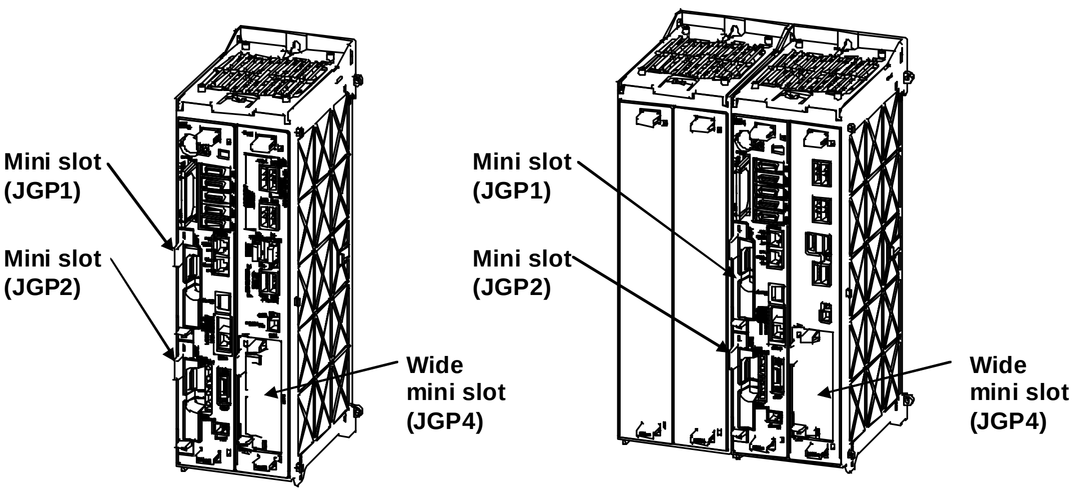
4.2 EMERGENCY STOP BOARD A-cabinet:A20B-2200-0650/B-cabinet:A20B-2102-0050



(A-cabinet) (B-cabinet)

Fig.4.2 Emergency stop board

4.3 BACKPLANE



(2 slot) (4 slot)

Fig.4.3 Backplane

Name	Ordering Specification	Parts number	Board specification
2 slot backplane	A05B-2600-H080	A05B-2600-C001	A20B-2004-0980

Name	Ordering Specification	Parts number	Board specification
4 slot backplane	A05B-2600-H081	A05B-2600-C002	A20B-2004-0990

4.4 PROCESS I/O BOARD JA (A16B-2204-0010)

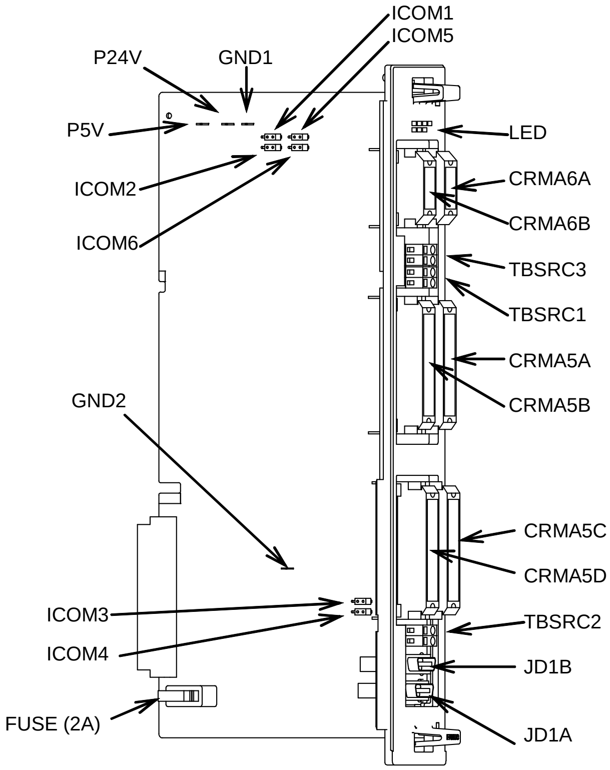


Fig.4.4 (a) Process I/O Board JA (Total edition 04A or earlier)

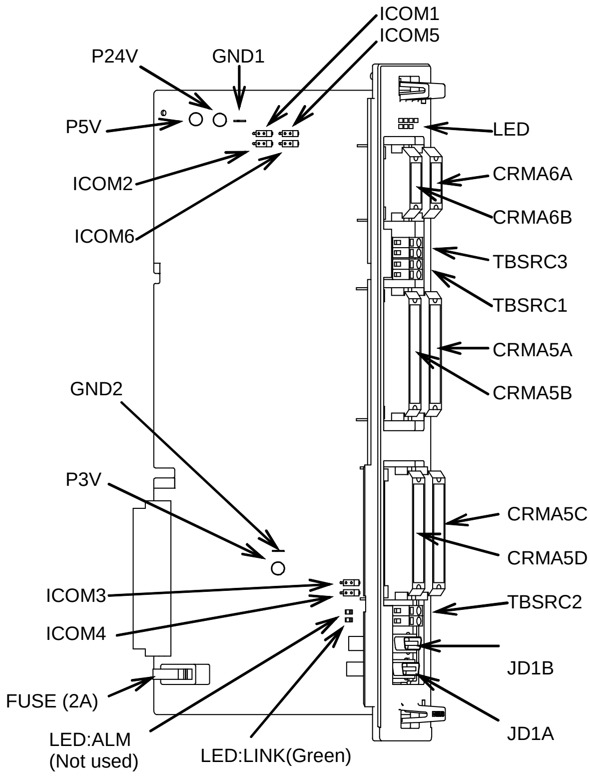


Fig.4.4 (b) Process I/O Board JA (Total edition 05B or later)

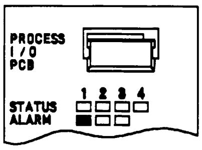
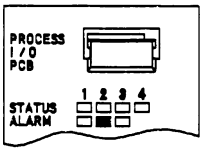
(1) Test pins

Name		Use
P24V	+24V	For measuring the DC supply voltage
P5V	+5V	
GND1	GND	
GND2	GND	
P3V (Total edition 05B or later)	+3.3V	

(2) Settings

Name		Standard setting	Description
ICOM1	UDI1 to 20 (Connector CRMA5A)	Side A	Set the common voltage Side A: +24 V common Side B: 0 V common
ICOM2	UDI21 to 40 (Connector CRMA5B)		
ICOM3	UDI41 to 60 (Connector CRMA5C)		
ICOM4	UDI61 to 80 (Connector CRMA5D)		
ICOM5	UDI81 to 88 (Connector CRMA6A)		
ICOM6	UDI89 to 96 (Connector CRMA6B)		

(3) Meaning of LEDs

	Color	Description
	Red	A communication alarm occurred between the main board and process I/O board.
	Red	A fuse (FUSE 1) in the process I/O board blew.
LINK (Total edition 05B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 05B or later)	Red	Not used

4.5 PROCESS I/O BOARD JB (A16B-2204-0011)

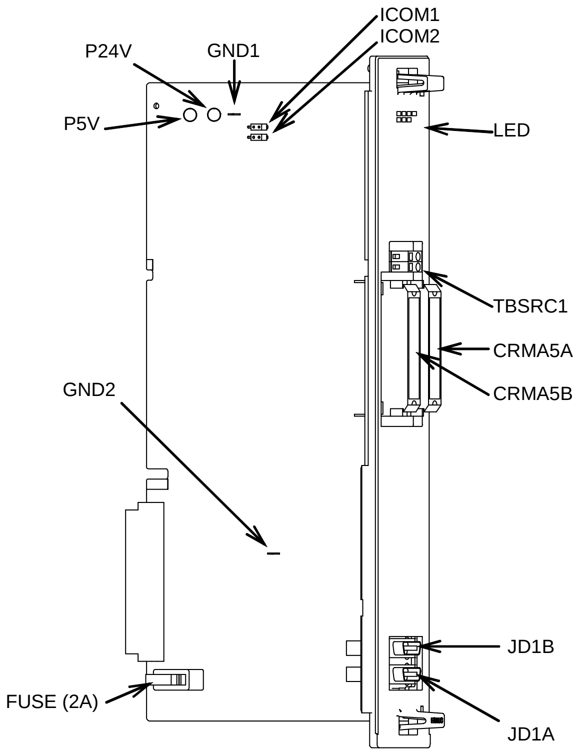


Fig.4.5 (a) Process I/O Board JB (Total edition 04A or earlier)

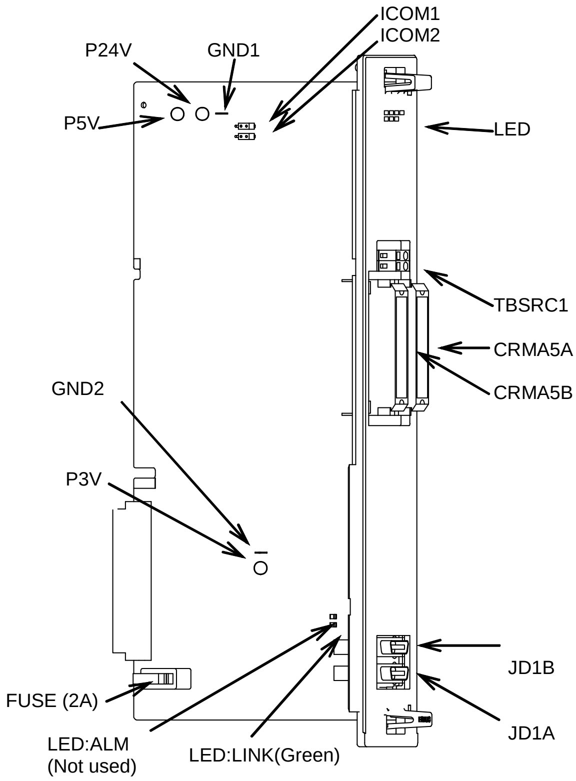


Fig.4.5 (b) Process I/O Board JB (Total edition 05B or later)

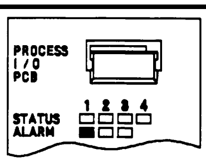
(1) Test pins

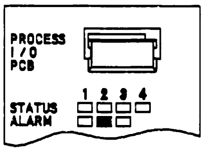
Name		Use
P24V P5V GND1 GND2 P3V (Total edition 05B or later)	+24V +5V GND GND +3.3V	For measuring the DC supply voltage

(2) Settings

Name		Standard setting	Description
ICOM1	UDI1 to 20 (Connector CRMA5A)	Side A	Set the common voltage Side A: +24 V common Side B: 0 V common
ICOM2	UDI21 to 40 (Connector CRMA5B)		

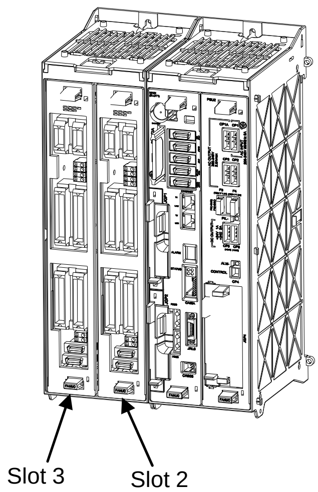
(3) LEDs

	Color	Description
	Red	A communication alarm occurred between the main board and process I/O board.

	Color	Description
	Red	A fuse (FUSE 1) in the process I/O board blew.
LINK (Total edition 05B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 05B or later)	Red	Not used

NOTE

Installation of Process I/O board JA, JB
1st Process I/O board is installed to slot 3, and 2nd Process I/O board is installed to slot 2.
If both Process I/O board JA and JB are installed, Process I/O board JA is installed to slot 2, and Process I/O board JB is installed to slot 3.



4.6 PROCESS I/O BOARD MA (A20B-2004-0380, A20B-2004-0381)

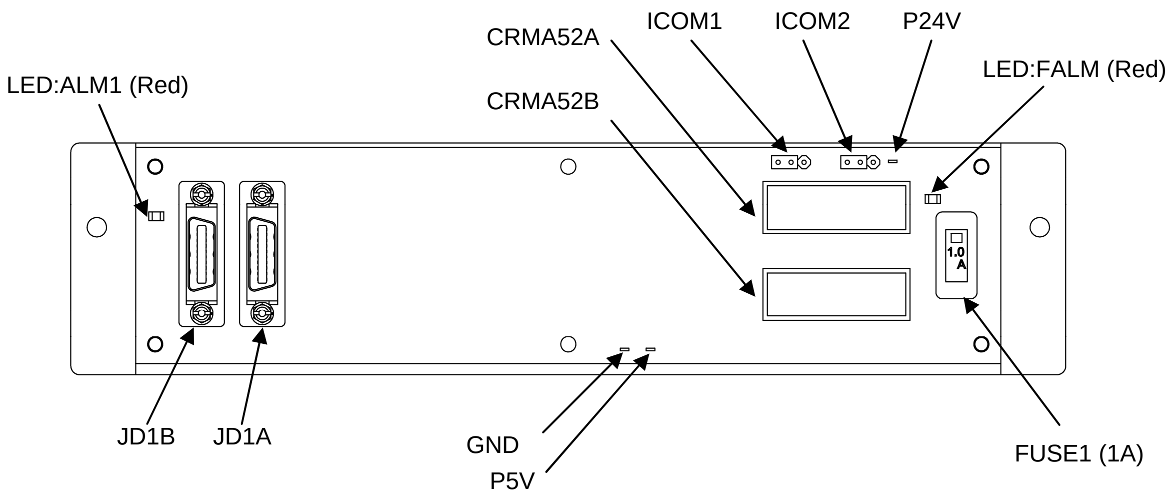


Fig.4.6 (a) Process I/O Board MA (Total edition 02A or earlier)

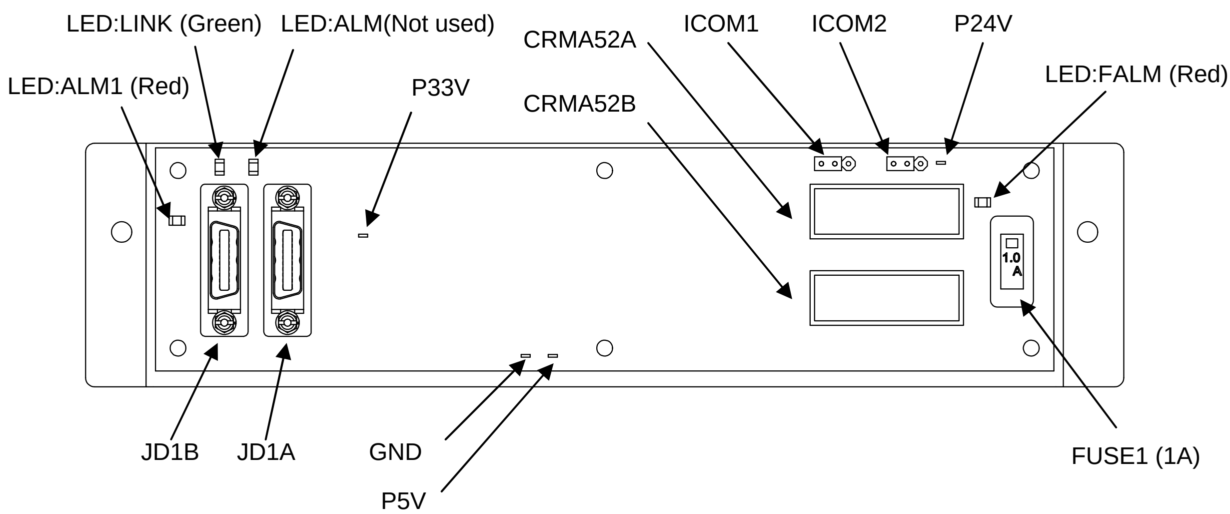


Fig.4.6 (b) Process I/O Board MA (Total edition 04B or later)

(1) Test pins

Name		Use
P24V	+24V	For measuring the DC supply voltage
P5V	+5V	
GND	GND	
P33V (Total edition 04B or later)	+3.3V	

(2) Settings

Name		Standard setting	Description
ICOM1	UDI1- 10 (Connector CRMA52A)	Side A	For common voltage setting Side A: +24V common Side B: 0V common
ICOM2	UDI11- 20 (Connector CRMA52B)		

(3) LEDs

Name	Color	Description
ALM1	Red	A communication alarm occurred between the main board and process I/O board.
FALM	Red	The fuse (FUSE1) on the process I/O board has blown.
LINK (Total edition 04B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 04B or later)	Red	Not used

4.7 PROCESS I/O BOARD MB (A20B-2101-0730, A20B-2101-0731)

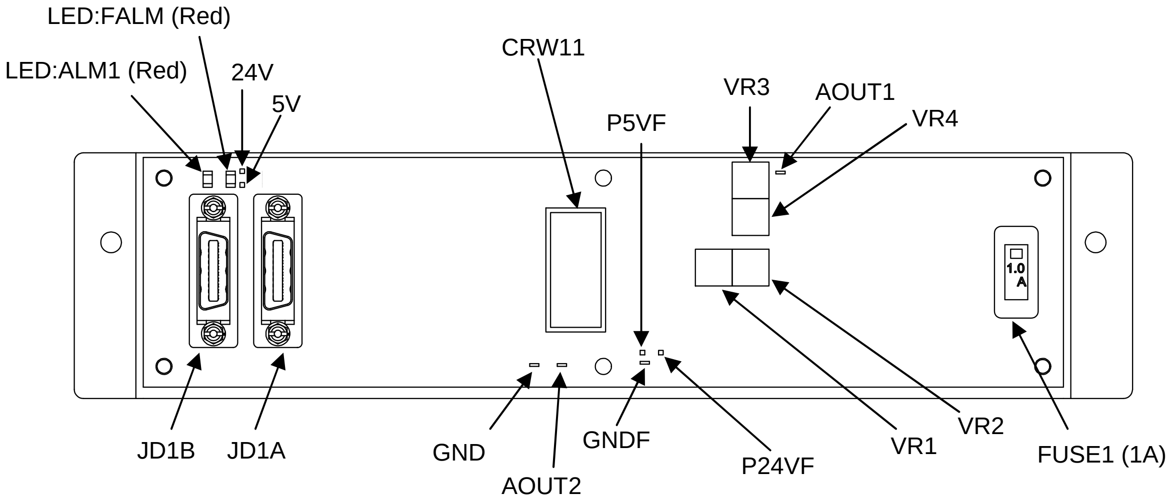


Fig.4.7 (a) Process I/O Board MB (Total edition 02A or earlier)

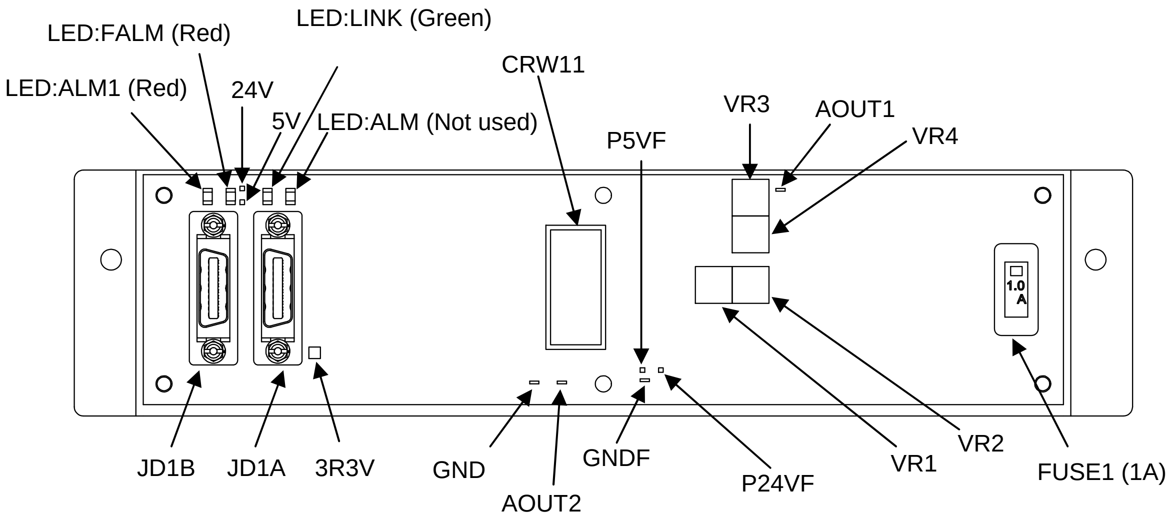


Fig.4.7 (b) Process I/O Board MB (Total edition 04B or later)

(1) Test pins and pads

Name		Use
24V 5V GND 3R3V (Total edition 04B or later)	+24V +5V GND +3.3V	For measuring the DC supply voltage
P24VF P5VF GNDF	+24V +5V GND	D/A converter power supply
AOUT1 AOUT2	Channel 1 Channel 2	For analog output signal (D/A) voltage measurement

(2) Adjustment

VR1/VR2 Channel 1 gain and offset adjustment

Connect the “+” and “-” terminals of a digital voltmeter, respectively, to the AOUT1 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT[1]=3413, using a robot program. While observing the voltage at the AOUT1 check pin with the digital voltmeter, adjust potentiometers VR1 and VR2 for 15.0V.

VR3/VR4 Channel 2 gain and offset adjustment

Connect the “+” and “-” terminals of a digital voltmeter, respectively, to the AOUT2 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT[2]=3413, using a robot program. While observing the voltage at the AOUT2 check pin with the digital voltmeter, adjust potentiometers VR3 and VR4 for 15.0V.

(3) LEDs

Name	Color	Description
ALM1	Red	A communication alarm occurred between the main CPU and process I/O board.
FALM	Red	The fuse (FUSE1) on the process I/O board has blown.
LINK (Total edition 04B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 04B or later)	Red	Not used

4.8 PROCESS I/O BOARD KA (A20B-2101-0560)

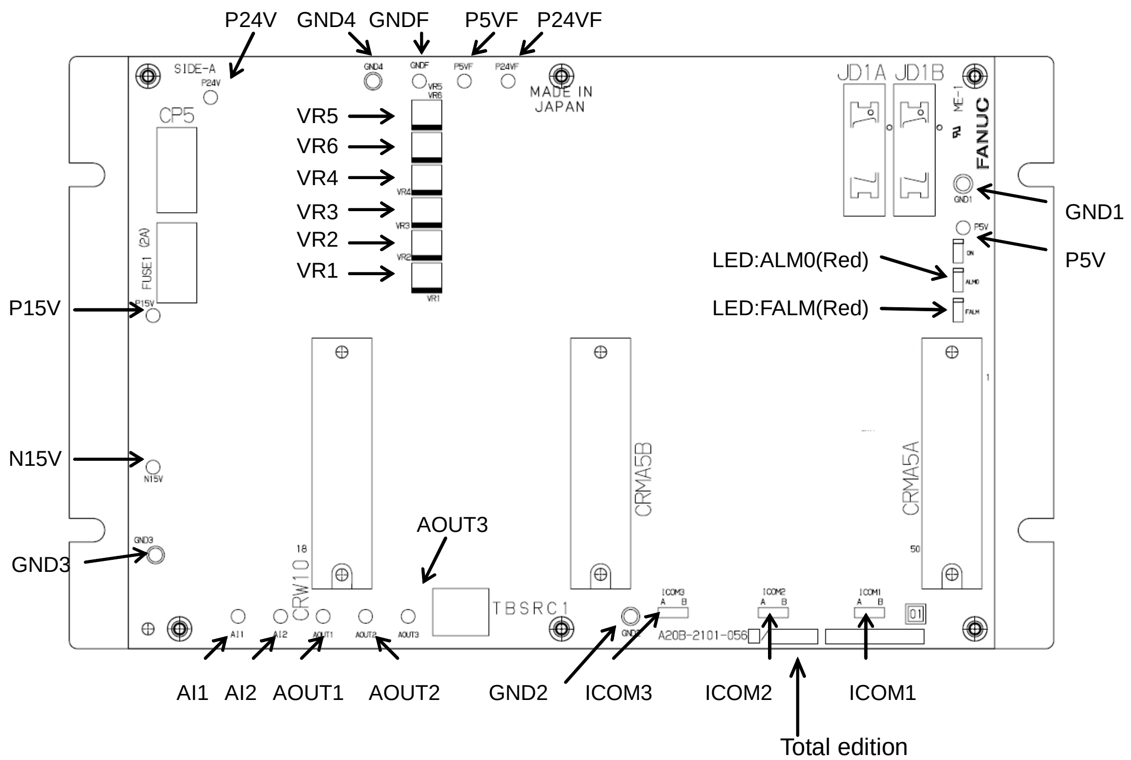


Fig.4.8 (a) Process I/O Board KA (Total edition 02A or earlier)

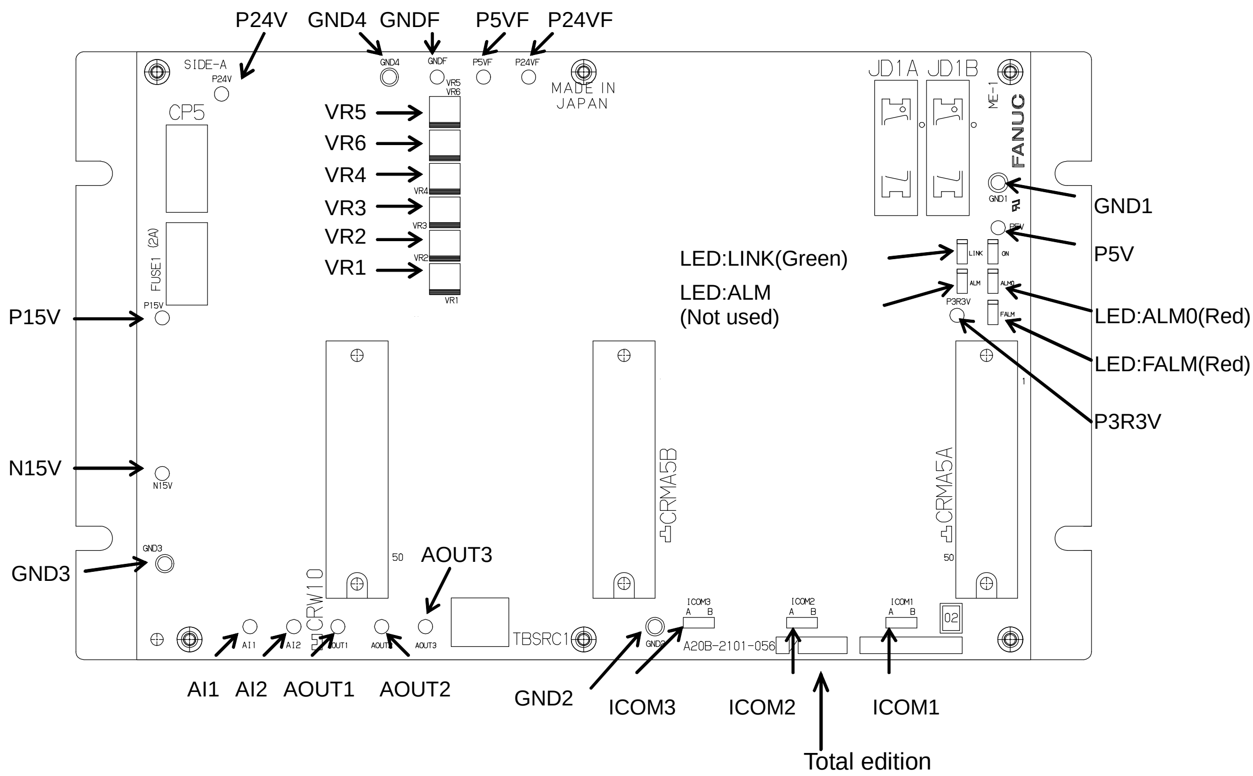


Fig.4.8 (b) Process I/O Board KA (Total edition 03B or later)

(1) Meanings of check pins

Name		Use
P24V P5V P15V N15V GND1 GND2 GND3 GND4 P3R3V (Total edition 03B or later)	+24V +5V +15V -15V GND GND GND GND +3.3V	For DC power measurement
P5VF P24VF GNDF	+5V +24V GND	D/A converter power supply
AI1 AI2	Channel 1 Channel 2	For analog input signal (A/D) voltage measurement
AOUT1 AOUT2 AOUT3	Channel 1 Channel 2 Channel 3	For analog output signal (D/A) voltage measurement

(2) Setting

Name		Standard setting	Use
ICOM1	UDI1 to 20 (Connector CRMA5A)	Side A	For common voltage setting Side A: +24 V common Side B: 0 V common
ICOM2	UDI21 to 40 (Connector CRMA5B)		
ICOM3	WI01 to 08 (Connector CRW10)		

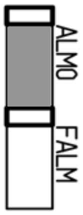
(3) Adjustment

VR1/VR2: Channel 1 gain and offset adjustment
Connect the "+" and "-" terminals of a digital voltmeter, respectively, to the AOUT1 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT [1]=3413, using a robot program. While observing the voltage at the AOUT1 check pin with the digital voltmeter, adjust potentiometers VR1 and VR2 for 15.0 V.

VR3/VR4: Channel 2 gain and offset adjustment
Connect the "+" and "-" terminals of a digital voltmeter, respectively, to the AOUT2 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT [2]=3413, using a robot program. While observing the voltage at the AOUT2 check pin with the digital voltmeter, adjust potentiometers VR3 and VR4 for 15.0 V.

VR5/VR6: Channel 3 gain and offset adjustment
Connect the "+" and "-" terminals of a digital voltmeter, respectively, to the AOUT3 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT [3]=3413, using a robot program. While observing the voltage at the AOUT3 check pin with the digital voltmeter, adjust potentiometers VR5 and VR6 for 15.0 V.

(4) Meaning of LEDs

	Color	Meaning
	Red	A communication alarm occurred between the main CPU and the process I/O board.
	Red	The fuse (FUSE1) on the process I/O board has blown.
LINK (Total edition 03B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 03B or later)	Red	Not used

(5) Correspondence between driver ICs and DO signals

Driver IC specification: DRV1, DRV2: A76L-1151-0167
DV1: A76L-1151-0070

Driver IC name	DO signal name
DRV1	CMDENBL, SYSRDY, PROGRUN, PAUSED HELD, FAULT, ATPERCH, TPENBL BATALM, BUSY, ACK1/SNO1, ACK2/SNO2 ACK3/SNO3, ACK4/SNO4, ACK5/SNO5, ACK6/SNO6

Driver IC name	DO signal name
DRV2	ACK7/SNO7, ACK8/SNO8, SNACK, RESERVED DO01, DO02, DO03, DO04 DO05, DO06, DO07, DO08 DO09, DO10, DO11, DO12
DV1	DO13, DO14, DO15, DO16 DO17, DO18, DO19, DO20

4.9 PROCESS I/O BOARD KB (A20B-2101-0561)

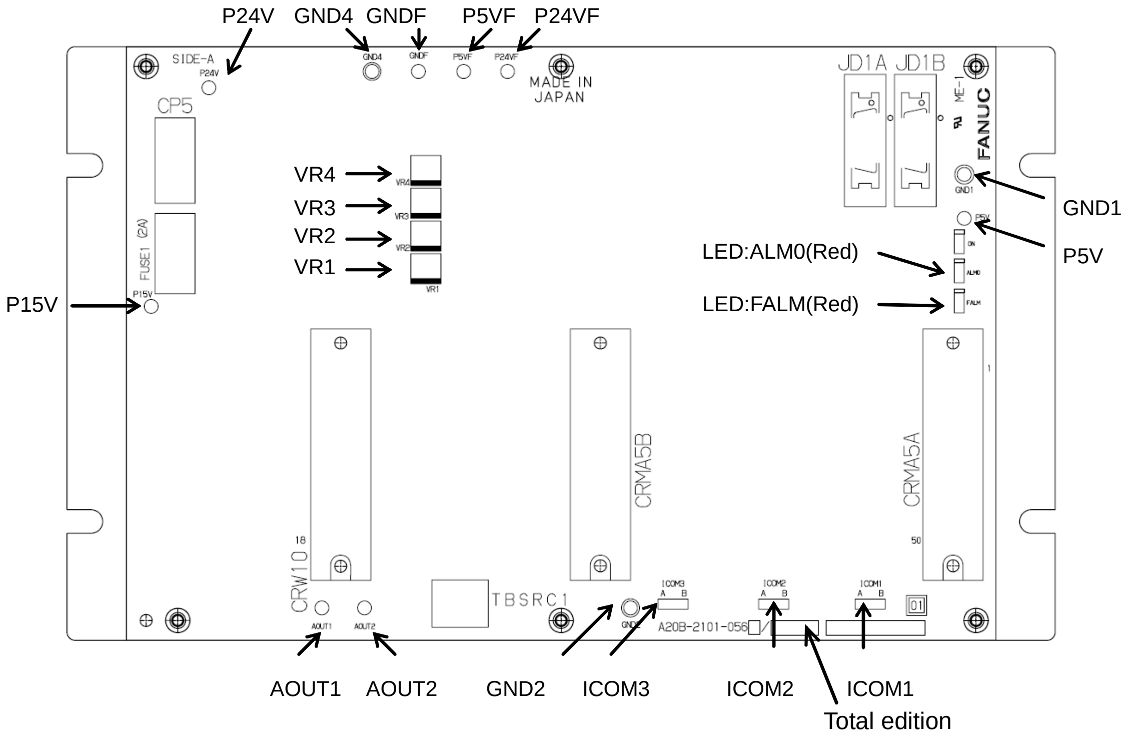


Fig.4.9 (a) Process I/O Board KB (Total edition 02A or earlier)

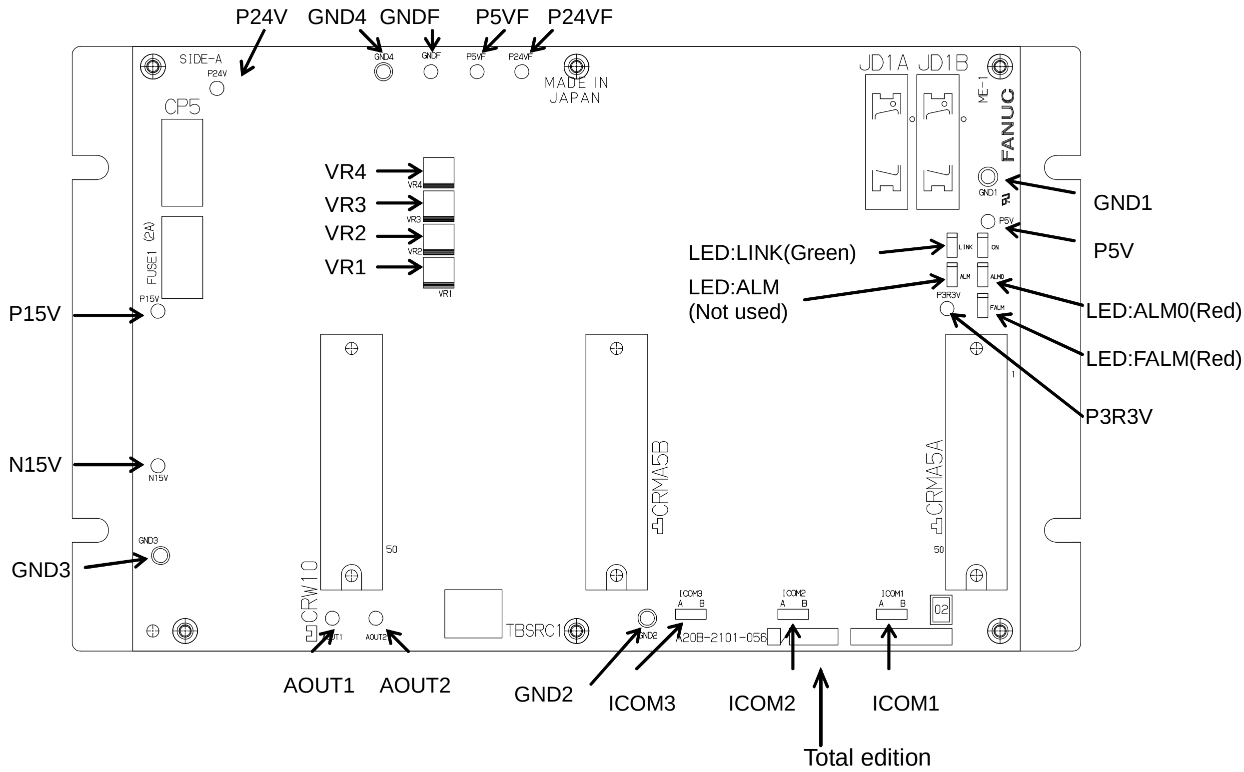


Fig.4.9 (b) Process I/O Board KB (Total edition 03B or later)

(1) Meanings of check pins

Name		Use
P24V P5V GND1 GND2 GND3 GND4 P3R3V (Total edition 03B or later)	+24V +5V GND GND GND GND +3.3V	For DC power measurement
P5VF P24VF GNDF	+5V +24V GND	D/A converter power supply
AOUT1 AOUT2	Channel 1 Channel 2	For analog output signal (D/A) voltage measurement

(2) Setting

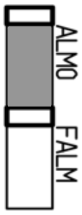
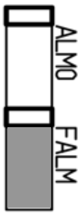
Name		Standard setting	Use
ICOM1	UDI1 to 20 (Connector CRMA5A)	Side A	For common voltage setting Side A: +24 V common Side B: 0 V common
ICOM2	UDI21 to 40 (Connector CRMA5B)		
ICOM3	WI01 to 08 (Connector CRW10)		

(3) Adjustment

VR1/VR2: Channel 1 gain and offset adjustment
Connect the "+" and "-" terminals of a digital voltmeter, respectively, to the AOUT1 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT [1]=3413, using a robot program. While observing the voltage at the AOUT1 check pin with the digital voltmeter, adjust potentiometers VR1 and VR2 for 15.0 V.

VR3/VR4: Channel 2 gain and offset adjustment
Connect the "+" and "-" terminals of a digital voltmeter, respectively, to the AOUT2 check pin and the GNDF check pin (not a general ground point). From the teach pendant, execute AOUT [2]=3413, using a robot program. While observing the voltage at the AOUT2 check pin with the digital voltmeter, adjust potentiometers VR3 and VR4 for 15.0 V.

(4) Meaning of LEDs

	Color	Meaning
	Red	A communication alarm occurred between the main CPU and the process I/O board.
	Red	The fuse (FUSE1) on the process I/O board has blown.
LINK (Total edition 03B or later)	Green	Blink (1:3) Communication in progress ON = approx. 0.5 sec, OFF = approx. 1.5 sec
		Blink (1:1) Communication not in progress ON = approx. 0.25 sec, OFF = approx. 0.25 sec
ALM (Total edition 03B or later)	Red	Not used

(5) Correspondence between driver ICs and DO signals

Driver IC specification: DRV1, DRV2: A76L-1151-0167
DV1: A76L-1151-0070

Driver IC name	DO signal name
DRV1	CMDENBL, SYSRDY, PROGRUN, PAUSED HELD, FAULT, ATPERCH, TPENBL BATALM, BUSY, ACK1/SNO1, ACK2/SNO2 ACK3/SNO3, ACK4/SNO4, ACK5/SNO5, ACK6/SNO6
DRV2	ACK7/SNO7, ACK8/SNO8, SNACK, RESERVED DO01, DO02, DO03, DO04 DO05, DO06, DO07, DO08 DO09, DO10, DO11, DO12
DV1	DO13, DO14, DO15, DO16 DO17, DO18, DO19, DO20

5 6-AXIS SERVO AMPLIFIERS

The servo amplifiers are factory-set for operation. Usually, you do not need to set or adjust them.
This chapter describes the standard settings and adjustment required if a defective servo amplifier is replaced. It also describes the use of test pins and meanings of the LED indications.

Table 5(a) Servo amplifier specification (Resistor discharge)

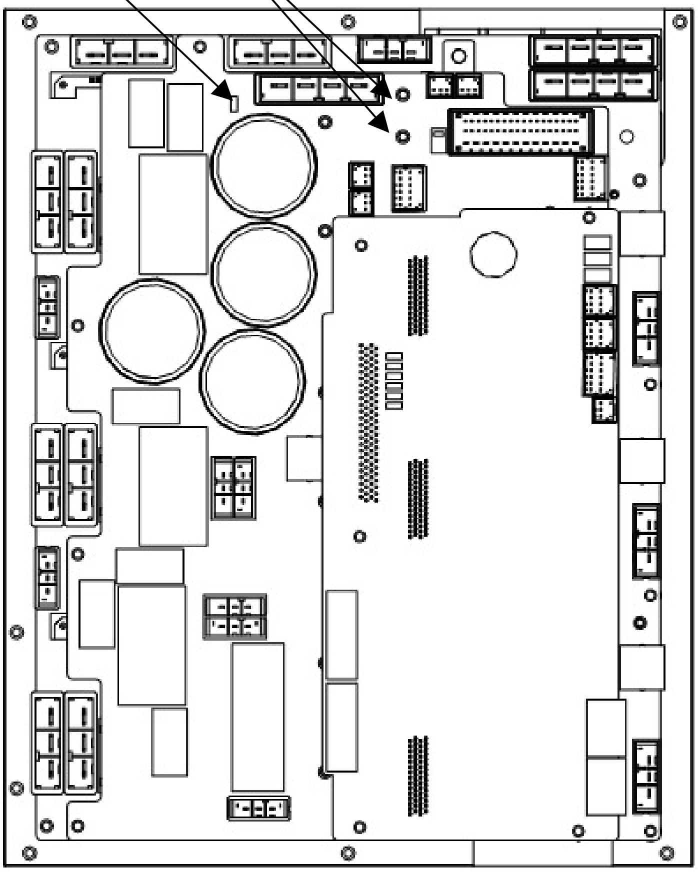
ROBOT	SERVO AMPLIFIER	DISCHARGE REGISTOR	
		A-CABINET	B-CABINET
M-900*i*A/400L,600 M-900*i*B/700,360,400L,280L	A06B-6400-H101(AMP1) A06B-6240-H209(AMP2) A06B-6240-H105(AMP3)		A05B-2603-C100
R-2000*i*B/200T,220U,220US M-900*i*A/260L,350 M-410*i*B, M-410*i*C	A06B-6400-H101	A05B-2601-C102	A05B-2603-C100
M-900*i*A/150P	A06B-6400-H101		A05B-2603-C100
R-2000*i*B/100P	A06B-6400-H102		A05B-2603-C100
R-1000*i*A(Except /80H,120F-7B) R-2000*i*B (Except /200T,220U,220US,100P) M-710*i*C(Except /50H) M-20*i*A M-20*i*B ARC Mate 120*i*C CR-35*i*A	A06B-6400-H102	A05B-2601-C100	A05B-2603-C100
R-2000*i*C/125L/165F/210F	A06B-6400-H002	A05B-2601-C100	A05B-2603-C100
R-2000*i*C/210L/270F	A06B-6400-H101	A05B-2601-C102	A05B-2603-C100
R-2000*i*C/165R/210R	A06B-6400-H102	A05B-2601-C100	A05B-2603-C100
M-420*i*A, M-421*i*A M-710*i*C/50H, R-1000*i*A/80H	A06B-6400-H102	A05B-2601-C102	A05B-2603-C100
M-2*i*A	A06B-6400-H002	A05B-2601-C100	
M-3*i*A	A06B-6400-H102	A05B-2601-C100	
ARC Mate 100*i*C M-10*i*A F-200*i*B	A06B-6400-H003	A05B-2601-C100	A05B-2603-C100
M-430*i*A/4FH	A06B-6400- H004(AMP1) A06B-6240-H201(AMP2)	A05B-2601-C100	A05B-2603-C100
M-430*i*A/2P,2PH	A06B-6400- H004(AMP1) A06B-6240-H301(AMP2)	A05B-2601-C100	A05B-2603-C100
M-900*i*A/200P	A06B-6400-H101(Main,AMP1) A06B-6400-H101(2nd,AMP1)		A05B-2603-C100
M-2000*i*A	A06B-6400-H101(Main,AMP1) A06B-6240-H106(Main,AMP2) A06B-6400-H101(2nd,AMP1) A06B-6240-H106(2nd,AMP2)		A05B-2603-C100
R-1000*i*A/120F-7B	A06B-6400-H101(AMP1) A06B-6240-H106(AMP2)	A05B-2601-C102	A05B-2603-C100

Table 5(b) Servo amplifier specification (Power supply regeneration)

<table>
<tr><th rowspan="2">ROBOT</th><th rowspan="2">SERVO AMPLIFIER</th><th rowspan="2">POWER SUPPLY</th><th colspan="2">REGENERATIVE REGISTOR</th></tr>
<tr><th>A-CABINET</th><th>B-CABINET</th></tr>
<tr><td>M-900iA/400L,600
M-900iB/700,360,400L</td><td>A06B-6400-H101(AMP1)
A06B-6240-H209(AMP2)
A06B-6240-H105(AMP3)</td><td>A06B-6200-H037</td><td></td><td>A05B-2603-C101</td></tr>
<tr><td>R-2000iB/200T,220U,220US
M-900iA/260L,350,150P
M-410iB, M-410iC</td><td>A06B-6400-H101</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>R-1000iA
(Except 120F-7B)
R-2000iB
(Except /200T,220U,220US)
M-710iC
M-420iA, M-421iA</td><td>A06B-6400-H102</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>R-2000iC/125L/165F/210F</td><td>A06B-6400-H002</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>R-2000iC/210L/270F</td><td>A06B-6400-H101</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>R-2000iC/165R/210R</td><td>A06B-6400-H102</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>M-2iA</td><td>A06B-6400-H002</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td></td></tr>
<tr><td>M-3iA</td><td>A06B-6400-H102</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td></td></tr>
<tr><td>M-900iA/200P</td><td>A06B-6400-H101(Main,AMP1)
A06B-6400-H101(2nd,AMP1)</td><td>A06B-6200-H015</td><td></td><td>A05B-2603-C101</td></tr>
<tr><td>M-2000iA</td><td>A06B-6400-H101(Main,AMP1)
A06B-6240-H106(Main,AMP2)
A06B-6400-H101(2nd,AMP1)
A06B-6240-H106(2nd,AMP2)</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
<tr><td>R-1000iA/120F-7B</td><td>A06B-6400-H101(AMP1)
A06B-6240-H106(AMP2)</td><td>A06B-6200-H015</td><td>A05B-2601-C101</td><td>A05B-2603-C101</td></tr>
</table>

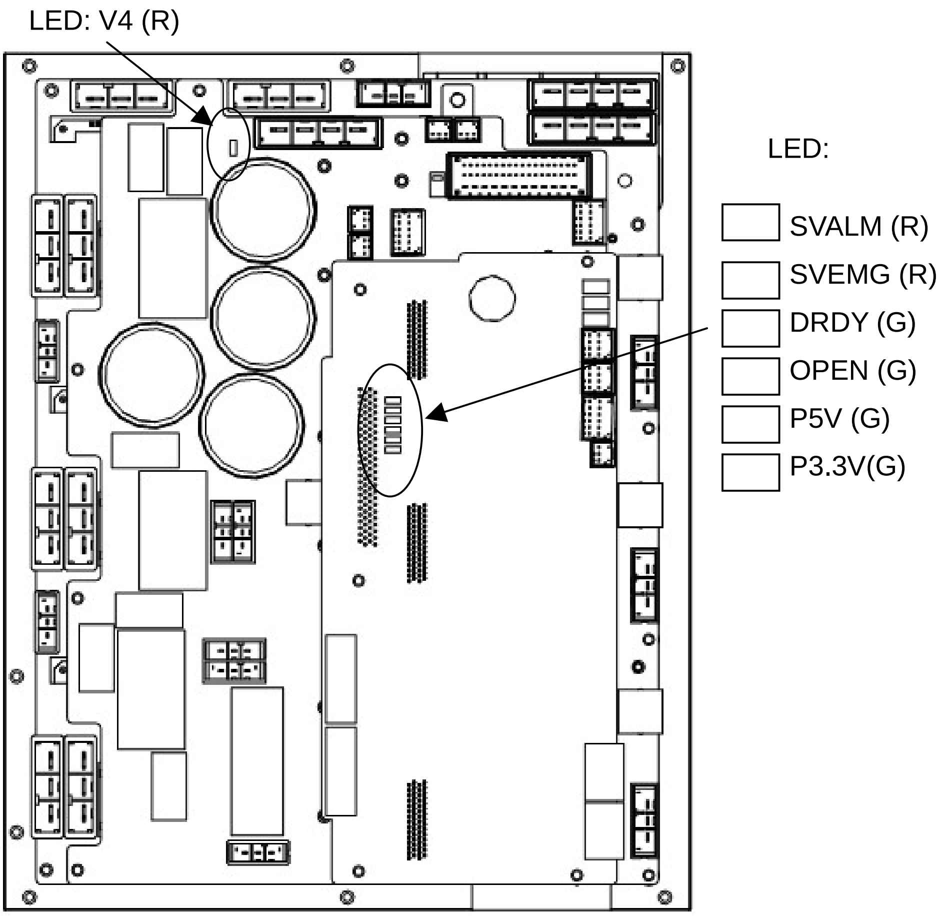
Check that the voltage is not higher than 50V.

LED：V4（red）



> ⚠ **WARNING**
> Before touching the servo amplifier, for example, for maintenance purposes, check the voltage at the screw above the LED “V4” with a DC voltage tester to see if the remaining voltage is not higher than 50V.

5.1 LEDS OF 6-AXIS SERVO AMPLIFIER



LED	Color	Description
V4	Red	Lights when the DCLINK circuit inside the servo amplifier is charged to reach a specific voltage.
SVALM	Red	Lights when the servo amplifier detects an alarm.
SVEMG	Red	Lights when an emergency stop signal is input to the servo amplifier.
DRDY	Green	Lights when the servo amplifier is ready to drive the servo motor.
OPEN	Green	Lights when the communication between the servo amplifier and the main board is normal.
P5V	Green	Lights when the power supply circuit inside the servo amplifier outputs a voltage of +5 V normally.
P3.3V	Green	Lights when the power supply circuit inside the servo amplifier outputs a voltage of +3.3 V normally.

5.2 SETTING OF 6-AXIS SERVO AMPLIFIER

Table 5.2 Settings

Name	Standard setting	Description
COM1	Side A	Robot Digital Input (RI) device common voltage. Side A: +24V common Side B: 0V common

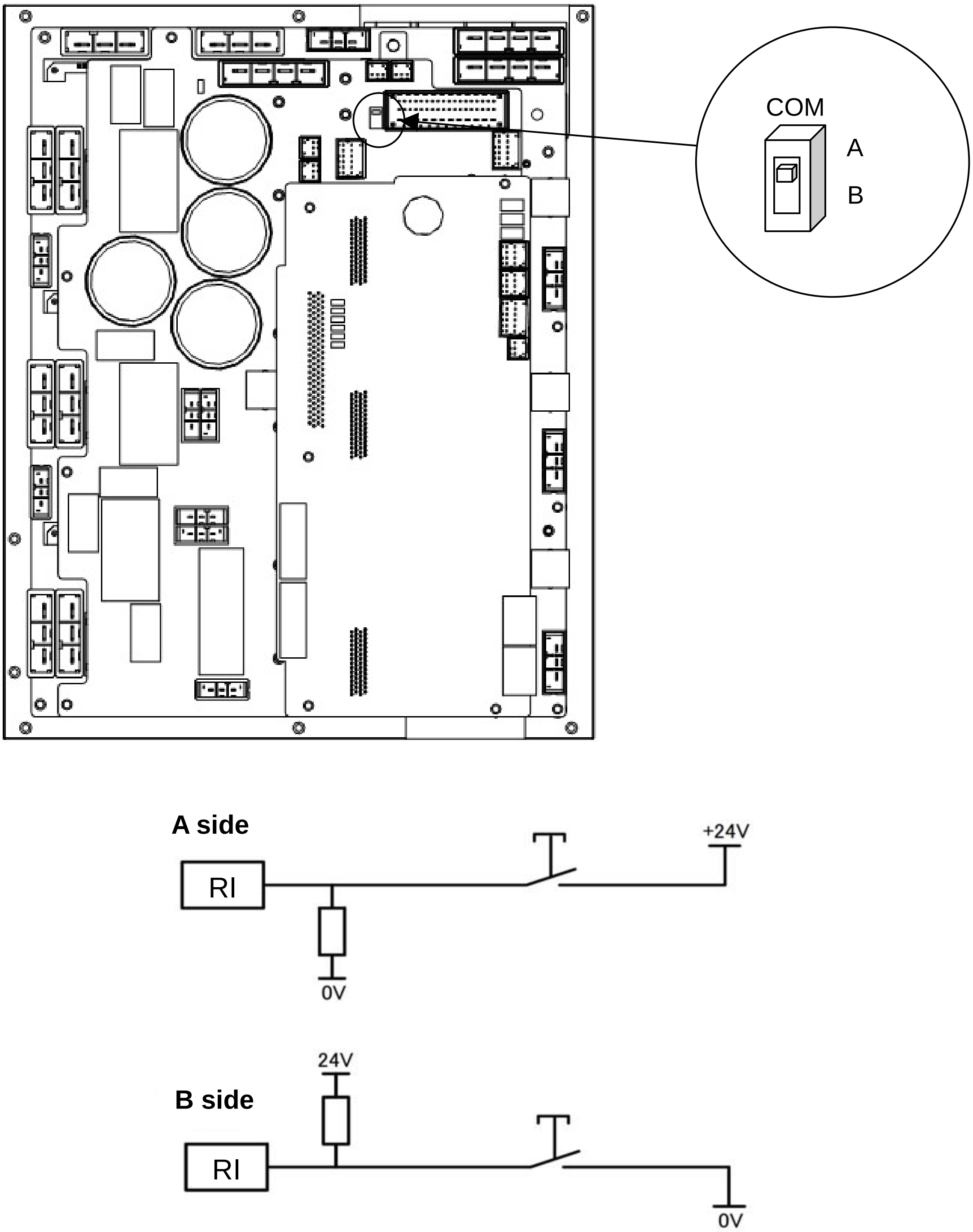


Fig.5.2 Circuit based on jumper pin location or setting of switch

5.3 6-AXIS SERVO AMPLIFIER SPECIFICATIONS

SPECIFICATIONS TABLE：（A06B-6400-H***）

UNIT		A06B-6400-H101	A06B-6400-H102	A06B-6400-H002
INPUT RATINGS	VOLTAGE	AC200 to AC240V (+10% / -15%), 50/60Hz, 3phase		
	POWER CAPACITY	5.6KVA	5.1KVA	5.1KVA
OUTPUT RATINGS	MAXIMUM OUTPUT	240V to		
	CURRENT：J1	160Ap / 36.5Arms	80Ap / 23.0Arms	80Ap / 23.0Arms
	CURRENT：J2	160Ap / 36.5Arms	80Ap / 23.0Arms	80Ap / 23.0Arms
	CURRENT：J3	160Ap / 36.5Arms	80Ap / 23.0Arms	80Ap / 23.0Arms
	CURRENT：J4	40Ap / 13.4Arms	40Ap / 13.4Arms	40Ap / 13.4Arms
	CURRENT：J5	40Ap / 13.4Arms	40Ap / 13.4Arms	40Ap / 13.4Arms
	CURRENT：J6	40Ap / 13.4Arms	40Ap / 13.4Arms	40Ap / 13.4Arms
	TOTAL CURRENT	125Arms	90Arms	90Arms

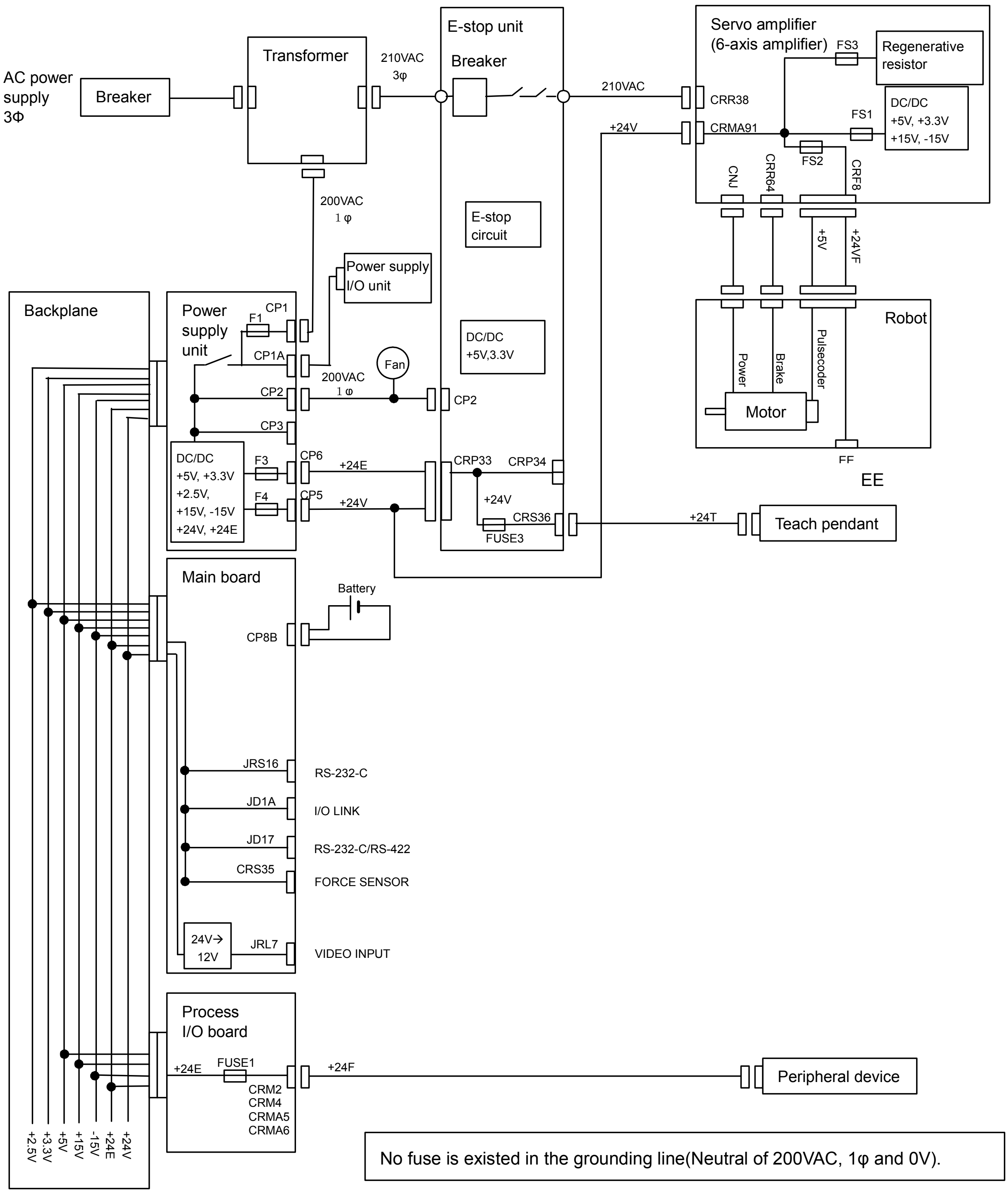
UNIT		A06B-6400-H003	A06B-6400-H004
INPUT RATINGS	VOLTAGE	AC200 to AC240V (+10% / -15%), 50/60Hz, 3phase	
	POWER CAPACITY	2.7KVA	2.0KVA
OUTPUT RATINGS	MAXIMUM OUTPUT	240V to	
	CURRENT：J1	40Ap / 13.4Arms	20Ap / 6.5Arms
	CURRENT：J2	40Ap / 13.4Arms	20Ap / 6.5Arms
	CURRENT：J3	20Ap / 6.5Arms	20Ap / 6.5Arms
	CURRENT：J4	20Ap / 6.5Arms	20Ap / 6.5Arms
	CURRENT：J5	20Ap / 6.5Arms	20Ap / 6.5Arms
	CURRENT：J6	20Ap / 6.5Arms	20Ap / 6.5Arms
	TOTAL CURRENT	52.8Arms	39Arms

UNIT		A06B-6400-H005
INPUT RATINGS	VOLTAGE	AC200 to AC240V (+10% / -15%), 50/60Hz,3/1phase
	POWER CAPACITY	1.3/1.4 (3/1phase)
OUTPUT RATINGS	MAXIMUM OUTPUT	240V to
	CURRENT：J1	20Ap / 3.6Arms
	CURRENT：J2	20Ap / 3.6Arms
	CURRENT：J3	20Ap / 3.6Arms
	CURRENT：J4	20Ap / 3.6Arms
	CURRENT：J5	10Ap / 2.0Arms
	CURRENT：J6	10Ap / 2.0Arms
	TOTAL CURRENT	18.4Arms

6 POWER SUPPLY

Setting and adjustment of the power supply is factory-set for operation. Usually, you do not need to set or adjust it.

6.1 BLOCK DIAGRAM OF THE POWER SUPPLY



No fuse is existed in the grounding line(Neutral of 200VAC, 1φ and 0V).

Fig.6.1 (a) Block diagram of the power supply (R-30*i*B)

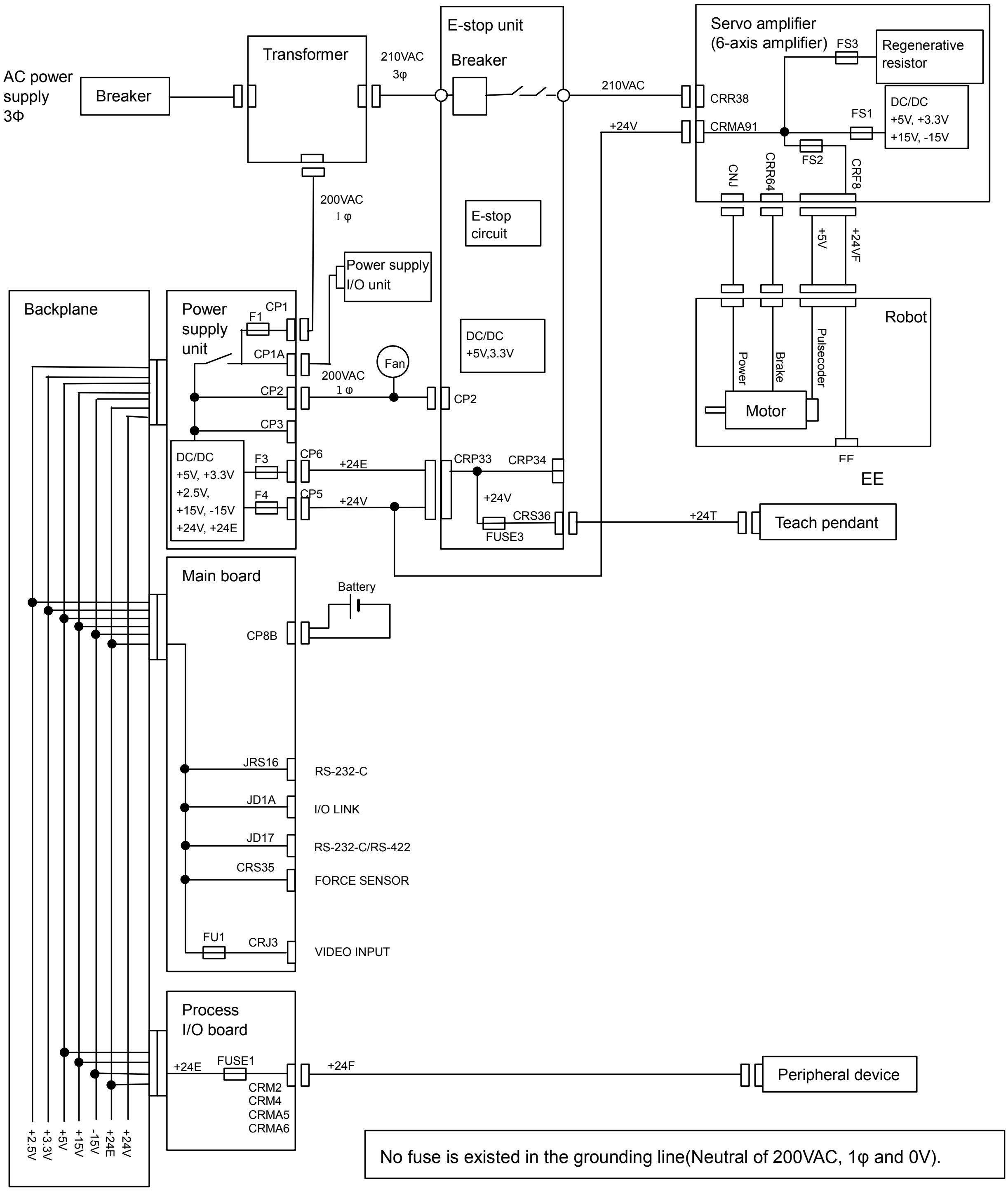


Fig.6.1 (b) Block diagram of the power supply (R-30*i*B Plus)

6.2 TRANSFORMER

Select a transformer and tap according to the supply voltage. Select a transformer tap based on the rated voltage.

A-cabinet

	Rated voltage	Transformer specification			
		13.0KVA	10.5KVA	7.5KVA	3KVA
TYPE E	500 to 575		A80L-0028-0024#A	A80L-0026-0040#A	A80L-0024-0028
	440 to 500				
	380 to 415				
TYPE D	200 to 230		A80L-0028-0027#A	A80L-0026-0041#A	A80L-0024-0029
	380 to 400				

B-cabinet

	Rated voltage	Transformer specification			
		13.0KVA	10.5KVA	7.5KVA	3KVA
TYPE E	500 to 575	A80L-0028-0025	A80L-0028-0024	A80L-0026-0040	A80L-0024-0028
	440 to 500				
	380 to 415				
TYPE D	200 to 230	A80L-0028-0028	A80L-0028-0027	A80L-0026-0041	A80L-0024-0029
	380 to 400				

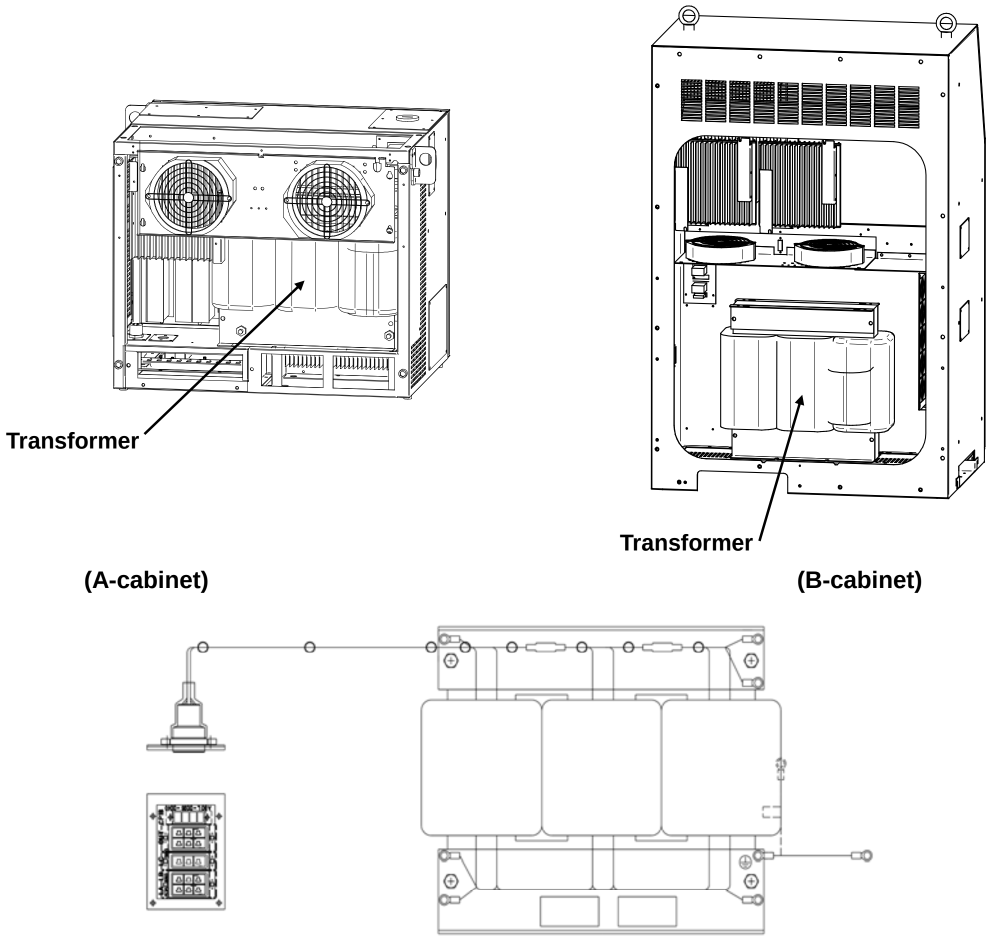
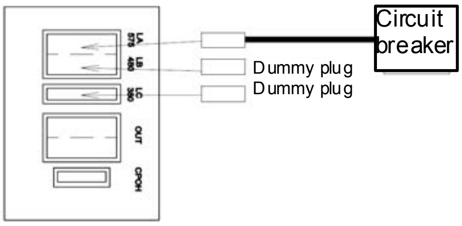


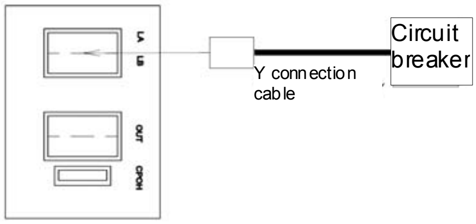
Fig.6.2 (a) Transformer mounting locations and structure

Cabinet side connector

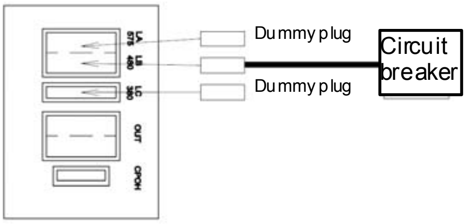
1. TYPE E (500V-575V)



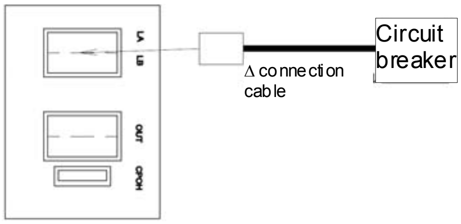
4. TYPE D (380V-400V)



2. TYPE E (440V-500V)



5. TYPE D (200V-230V)



3. TYPE E (380V-415V)

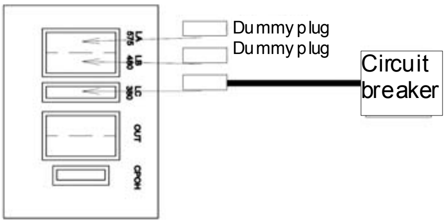


Fig.6.2(b) Setting the input voltage

1	Type E: 500-575V	Insert the connector connected to the circuit breaker into connector LA and the dummy plug into connectors LB and LC.
2	Type E: 440-500V	Insert the connector connected to the circuit breaker into connector LB and the dummy plug into connectors LA and LC.
3	Type E: 380-415V	Insert the connector connected to the circuit breaker into connector LC and the dummy plug into connectors LA and LB.
4	Type D: 380-400V	Insert the Y connection cable connected to the circuit breaker into connectors LA and LB.
5	Type D: 200-230V	Insert the Δ connection cable connected to the circuit breaker into connectors LA and LB.

> ⚠**CAUTION**
> The secondary voltage of the transformer depends on the cable connection between a breaker and a transformer. Be careful to choose the correct connection if maintenance is necessary.

6.3 CHECKING THE POWER SUPPLY UNIT (A16B-2203-0910)

The power supply unit need not be set or adjusted.

Table 6.3 Rating of the Power supply unit

Output	Rated voltage	Tolerance
+5V	+5.1V	±3%
+3.3V	+3.3V	±3%
+2.5V	+2.5V	±3%
+24V	+24V	±5%
+24E	+24V	±5%
+15V	+15V	±10%
-15V	-15V	±10%

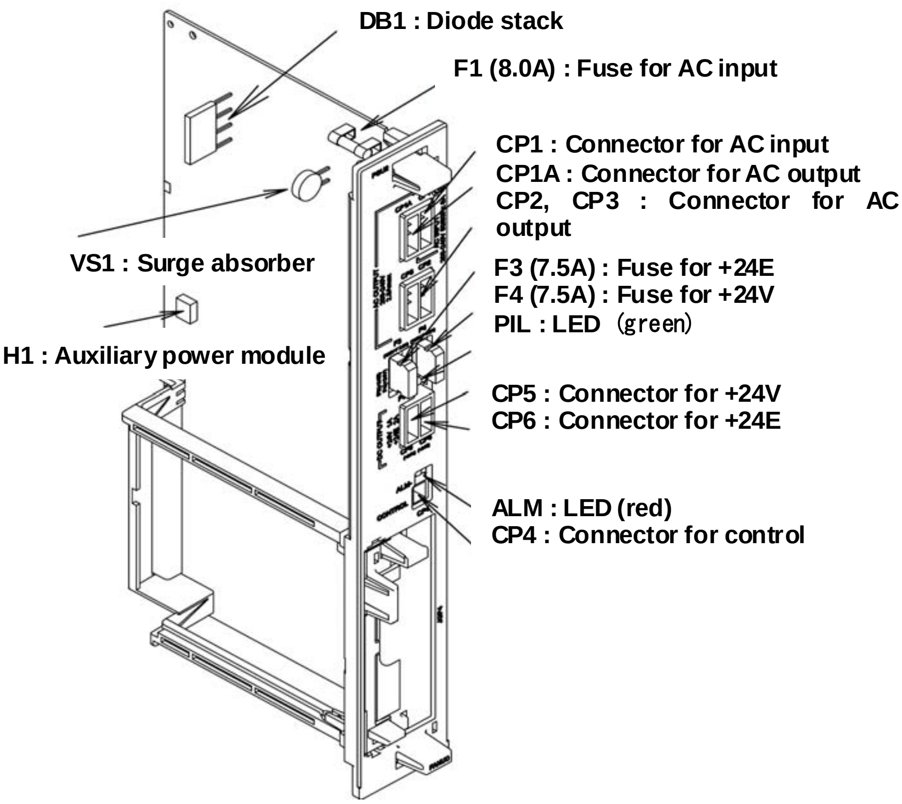


Fig.6.3 Interface of the power supply unit

7 SENSOR I/F UNIT FOR CR-35*i*A

Specification of sensor I/F unit: A05B-2600-C320

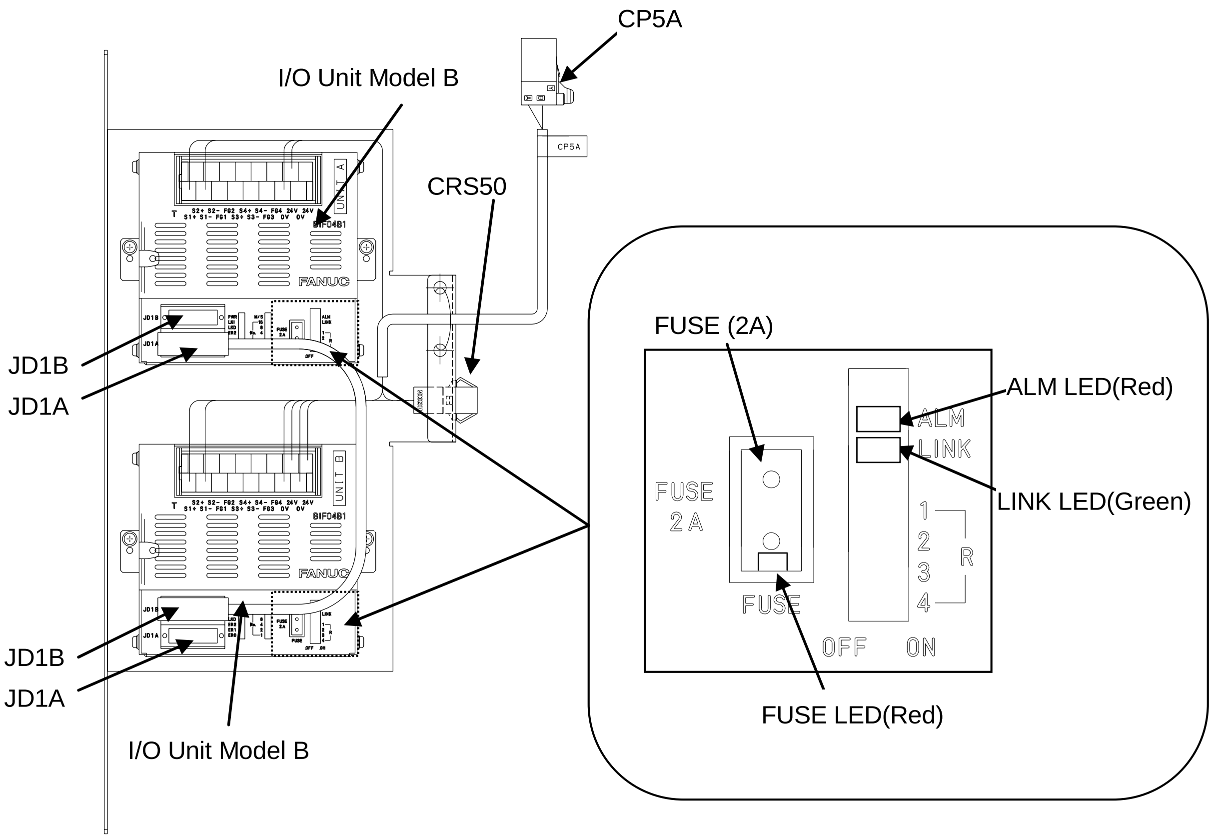


Fig.7 Sensor I/F unit for CR-35*i*A

8 REPLACING UNITS

This section explains how to replace each unit in the control section.

> ⚠ **WARNING**
> Before you start to replace a unit, turn off the controller main power. Also keep all machines in the area of the controller switched to off. Otherwise, you could injure personnel or damage equipment.

> ⚠ **WARNING**
> Before replacing components, read and follow procedures in the robot or controller-specific maintenance manual to understand replacement procedures. Performing an incorrect replacement procedure can lead to an unpredictable accident, resulting in breakage in the robot or personal injury.

> ⚠ **WARNING**
> When a heavy component or unit is to be handled, provide the workers with a crane or the like so as not to apply excessive loads to the workers. Note that incorrect handling can cause serious injury to the workers.

> ⚠ **CAUTION**
> Components in the controller heat up, so care should be taken. When you have to touch a heated component, use appropriate protective equipment such as heat-resistant gloves, a face shield, or body suit if necessary.

Before replacing a component, please refer to “SAFETY PRECAUTION” chapter of this manual.

8.1 REPLACING THE PRINTED-CIRCUIT BOARDS

> ⚠ **CAUTION**
> When you replace printed-circuit boards, observe the following cautions:
> 1. Keep the controller power switched off.
> 2. When you remove a printed-circuit board, do not touch the semiconductor devices on the board with your hand or make them touch other components.
> 3. Make sure that the replacement printed-circuit board has been set up appropriately. (Setting plug etc.)
> 4. After replacing a printed-circuit board, make adjustments correctly if the board needs to be adjusted.
> 5. If the backplane board, power supply unit, or main board (including cards and modules) is replaced, it is likely that robot parameters and taught data are lost. Before you start to replace these components, save a backup copy of the robot parameters and taught data to an external memory device.
> 6. Before you disconnect a cable, note its location. If a cable is detached for replacement, reconnect it exactly as before.

8.1.1 Replacing the Backplane Board (Unit)

When replacing the backplane board, do so together with the plastic rack.

(1) Detach the cables from the power unit and boards on the backplane board.

> ⚠ **CAUTION**
> When you remove the main board, be sure that the battery is good (3.1-3.3VDC) and it is installed correctly. USE STATIC PROTECTION.

(2) Remove the power supply unit and boards from the backplane (rack).
(3) Detach the grounding cable from the backplane unit.
(4) Loosen the retaining screws in the upper section of the rack. Remove the retaining screws from the lower section of the rack.
(5) Slide the rack up and out.
(6) To replace the backplane and rack, reverse steps (1) - (5).

> ⚠ **CAUTION**
> There is a possibility of data loss when a backplane- mounted printed circuit board is replaced. Be sure to back up all program and setup data on an external device such as a memory card before proceeding.

8.1.2 Replacing the Power Unit and Printed-Circuit Boards on the Backplane

The backplane incorporates the power unit, main board, and option boards. There are two types of option boards: Full-size board and mini-size board. A full-size board occupies one slot. A mini-size board uses part of a full-size board.

> ⚠ **CAUTION**
> Before starting replacement, turn off the controller main power. The main board is equipped with battery-backed memory devices for holding robot parameters and taught data. When the main board is replaced, the data in the memory devices is lost.

(1) Detach the cable from the power supply unit or the printed-circuit board, whichever is to be replaced.
(2) Pinch the barbed handles on the upper and lower sections of the board to unlatch it, then pull it toward you.
(3) Place the replacement board on the rail in the appropriate slot of the rack, then push it in gently by the handles until it is latched.
(4) There are two rails in the main board SLOT (slot 1). When inserting the main board, align it to the right-side rail.
(5) There are two rails in slots 3 (slots for a full-size option board). When you insert a full-size option board, align it to the left-side rail.

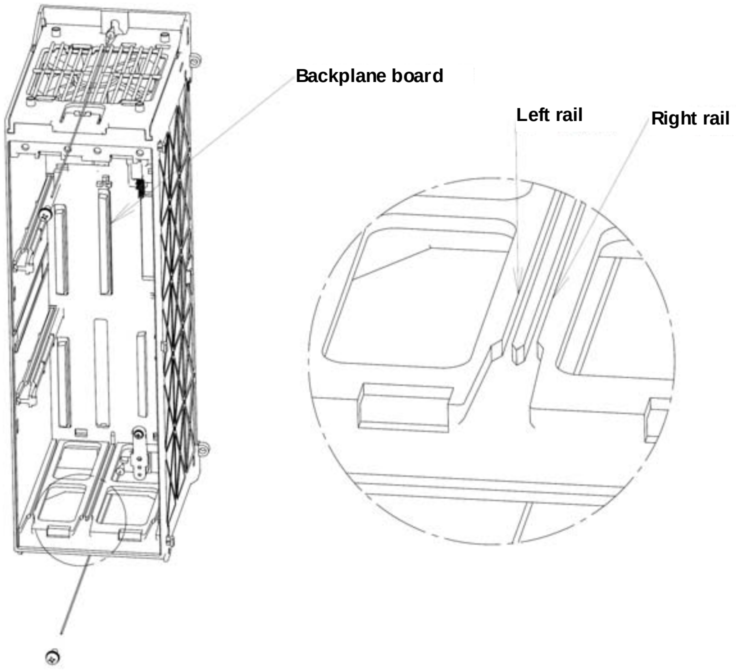


Fig.8.1.2 (a) Replacing the backplane board

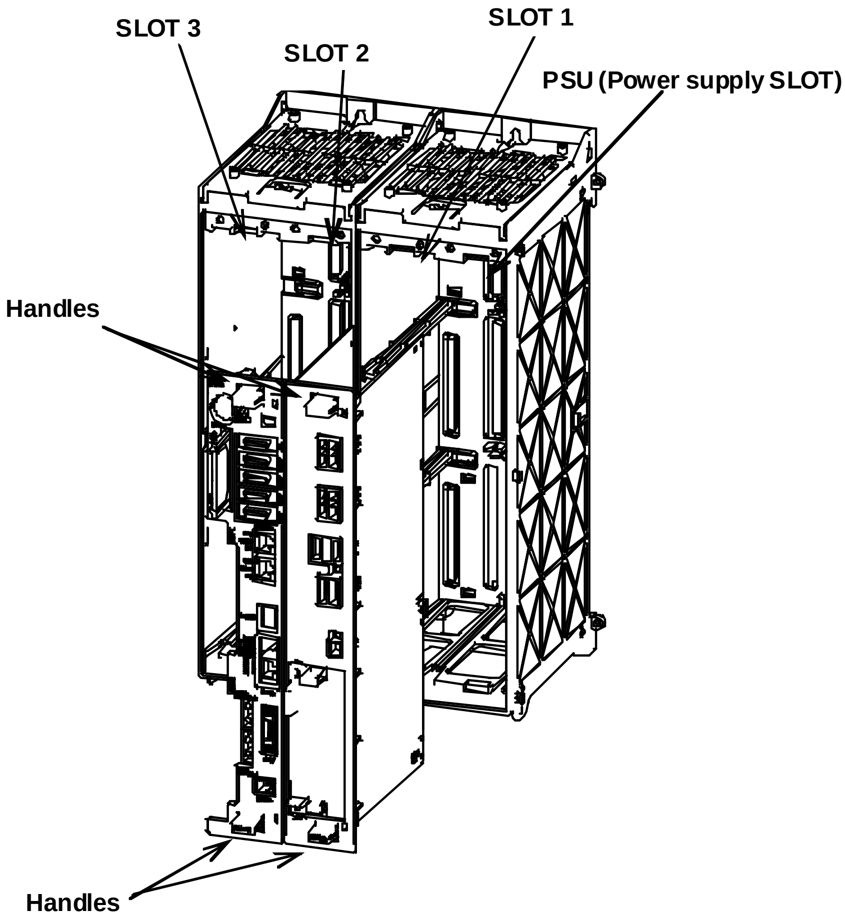


Fig.8.1.2 (b) Replacing the power unit and printed-circuit boards on the backplane

8.2 REPLACING CARDS AND MODULES ON THE MAIN BOARD

> ⚠ **CAUTION**
> Before you start to replace a card or module, make a backup copy of robot parameters and programs. If the FROM/SRAM module is replaced, SRAM memory contents are lost.

Demounting a Card

1. Pull up the spacer metal fitting. (Fig. 8.2 (a))
2. Insert a finger into the rear of the card and pull up the card slowly in the arrow direction. (Fig. 8.2 (b) (Note: At this time, hold the main board on the opposite side with the other hand whenever possible. A force of 7 to 8 kgf is required for extraction.)
3. When one side of the card board is raised slightly by pulling up, do not fully extract the card board, but push back the card softly.
4. When the card board is pushed back to be parallel with the main board, pinch two sides of the card board and pull up the card board. This completes the extraction of the card board.

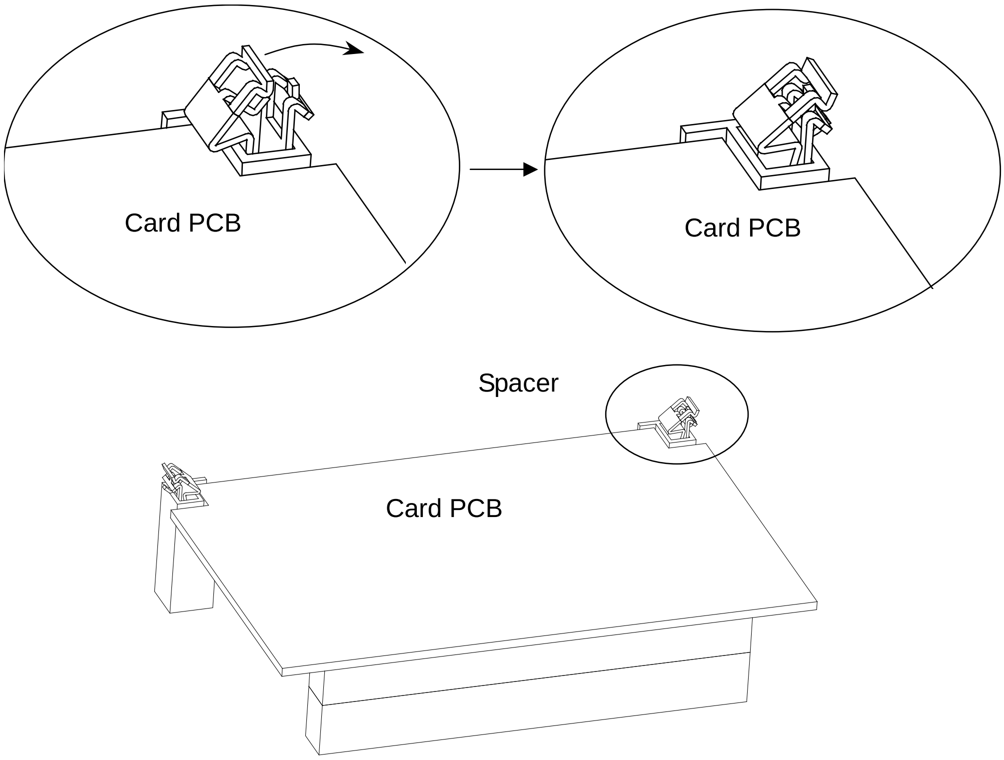


Fig.8.2 (a) Demounting a card

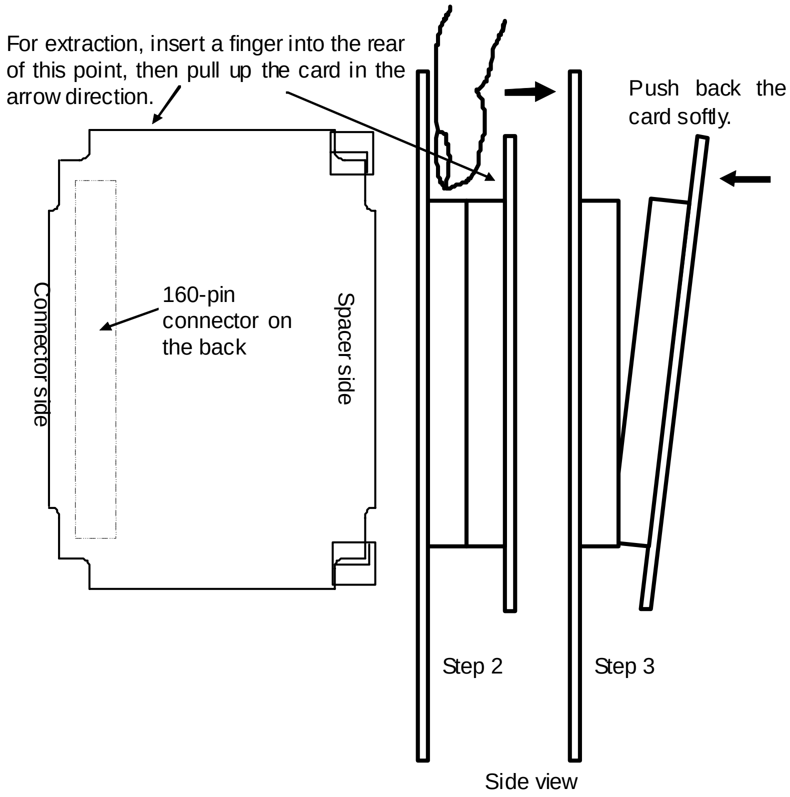


Fig.8.2 (b) Demounting a card

Mounting a Card

1. Check that the metal fittings of the spacers are raised. (Fig.8.2 (c))
2. To align the board insertion position, touch the spacer end faces of the board with the spacer. (Fig. 8.2 (d)) (At this time, the board is touching the spacers only.)
3. While aligning the board with the spacers, lower the connector side slowly until the connectors touch each other. (Fig.8.2 (d)) (do not press until aligned.)
4. The mating position can be determined more easily by moving the card back and forth until the alignment “nubs” and “holes” are aligned on the connectors. The board must be turned to view the board connectors on the side. (Fig.8.2 (d))
5. At this time, push on the back of the board over the connector. The force required for connector insertion is about 10 kgf. If the connector will not insert easily, re-check the alignment of the connector to prevent damaging the connector(s). If installing a standard CPU CARD, do not press on the heat sink installed on the CPU and LSI chip. Otherwise, the CPU or LSI chip can be damaged. (Fig.8.2 (e))
6. Push in the spacer metal fitting to lock the board in place. (Fig.8.2 (f))

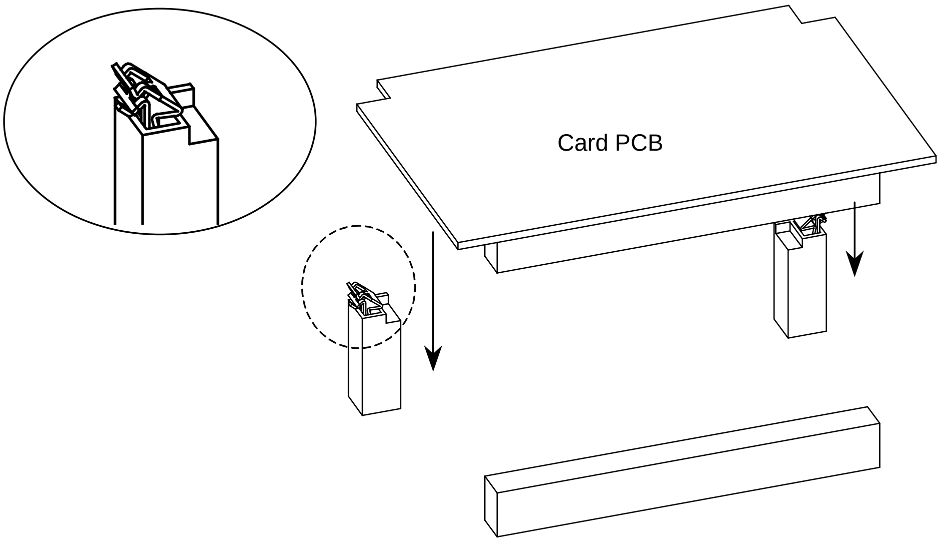


Fig.8.2 (c) Mounting a card

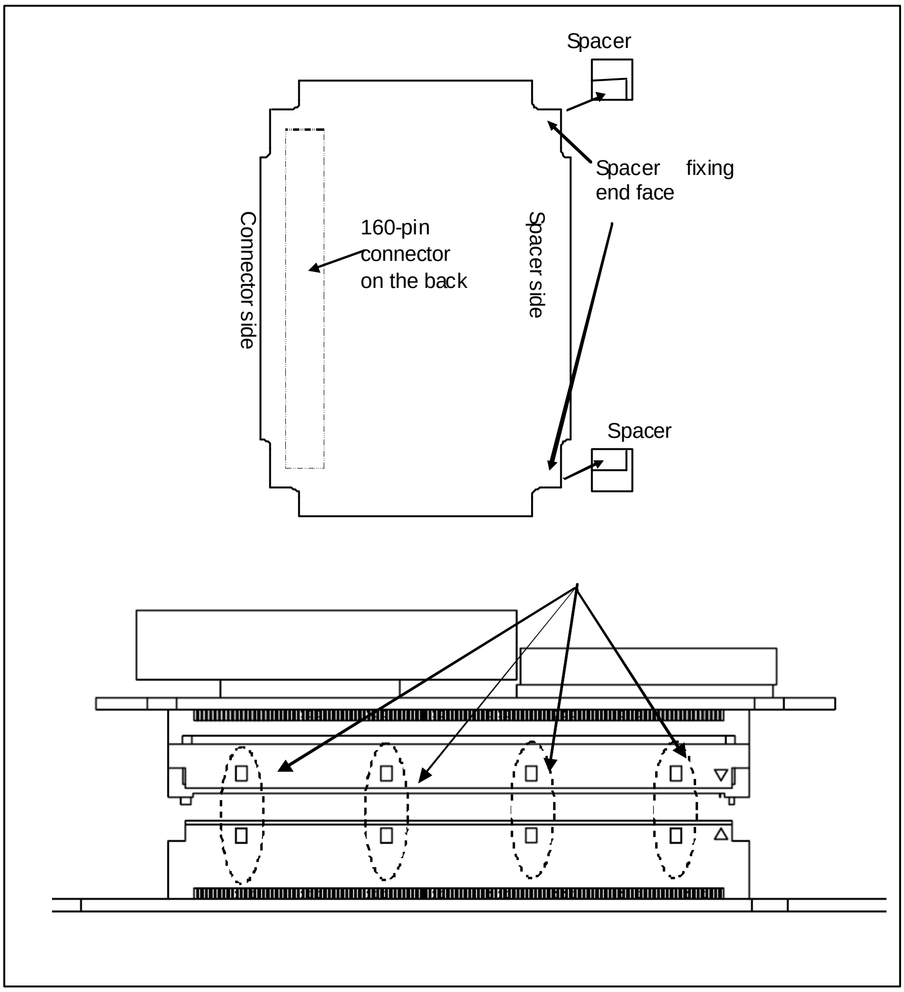


Fig.8.2 (d) Mounting a card

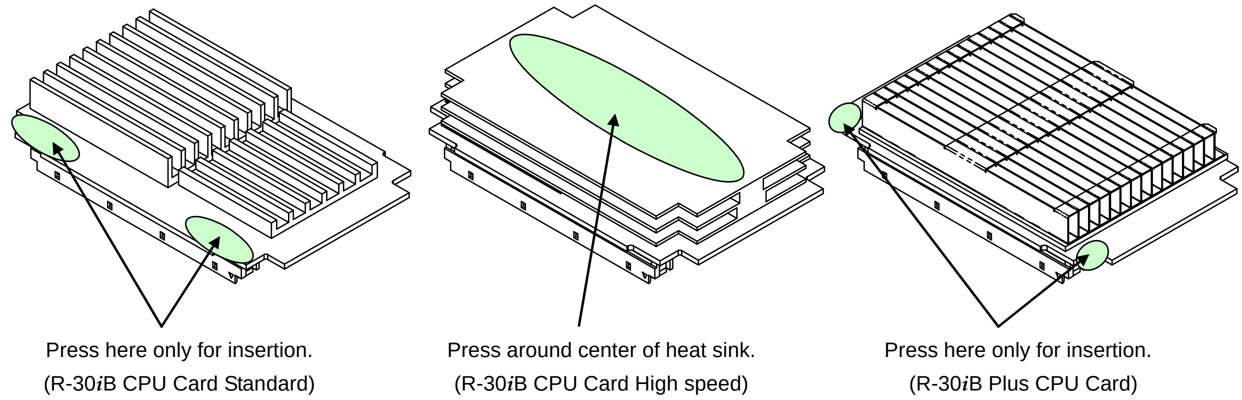


Fig.8.2 (e) Mounting a card

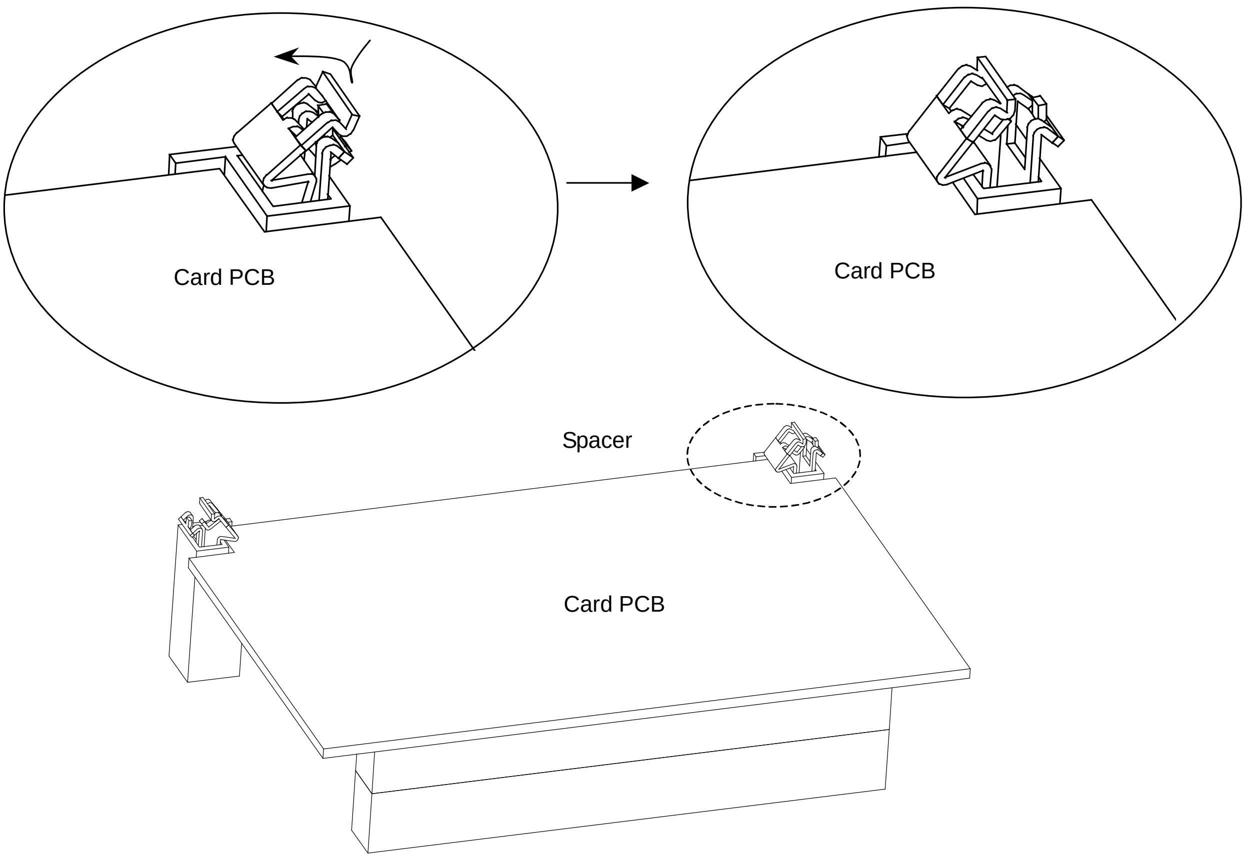


Fig.8.2 (f) Mounting a card

Demounting a module

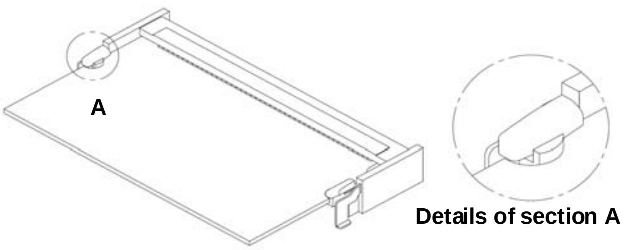
> ⚠ **CAUTION**
> When replacing the module, be careful not to touch the module edge connector. If you touch the edge connector inadvertently, wipe any dirt off of the contact with a clean cloth.

(1) Move the clip of the socket outward. (a)
(2) Extract the module by raising it at a 30 degree slant and pulling outward.

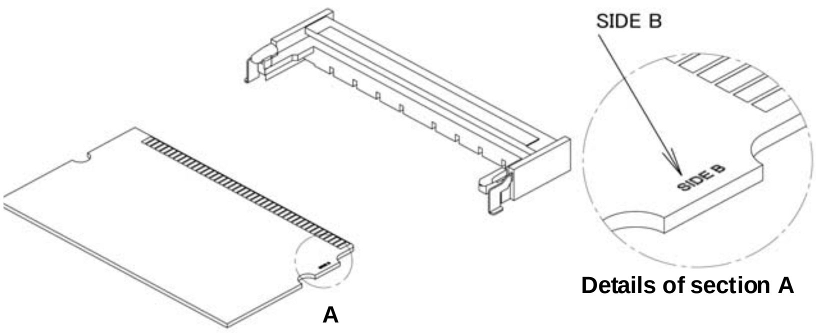
Mounting a module

(1) Insert the module at a 30 degree slant into the module socket, with side B facing upward. (b)
(2) Push the module inward and downward until it is locked. (c)

(a)



(b)



(c)

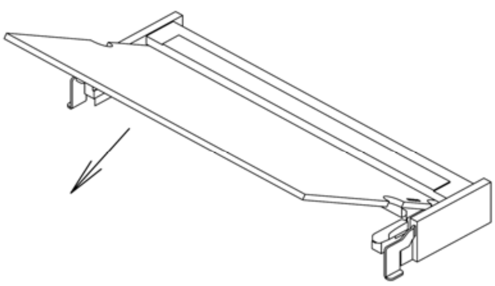
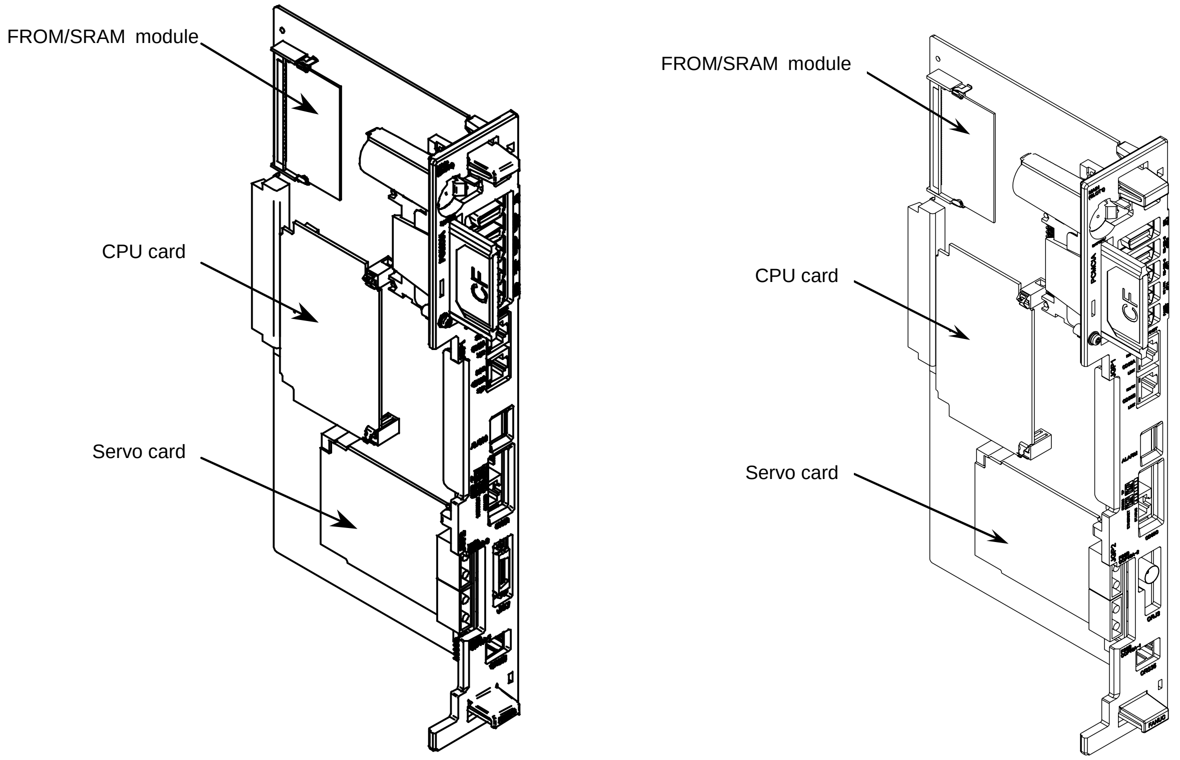


Fig.8.2 (g) Demounting/mounting a module

Figure 8.3 (h) shows the locations of the cards and modules.

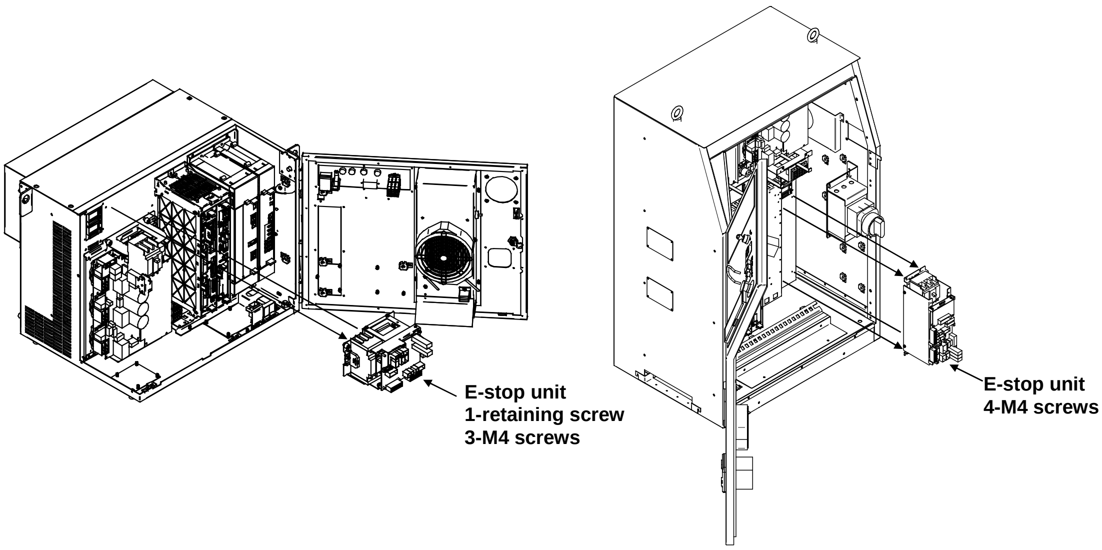


(R-30*i*B main board) **(R-30*i*B Plus main board)**

Fig.8.2 (h) Locations of cards and modules

8.3 REPLACING THE E-STOP UNIT

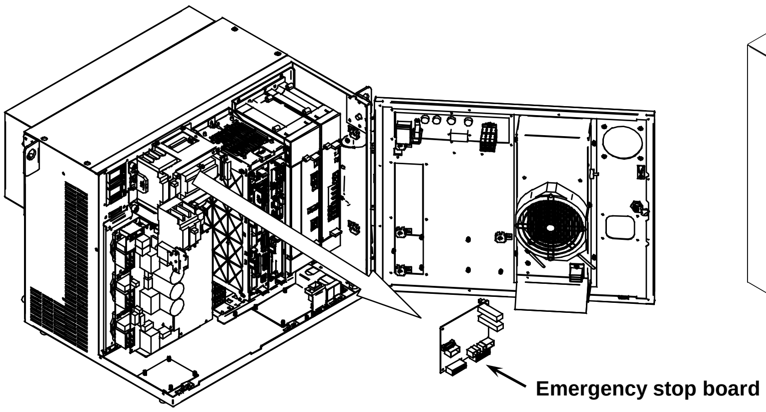
(1) Detach the cables from the E-stop unit.
(2) Loosen 1-retaining screw and 3-M5 screws, and replace the E-stop unit.(A-cabinet)
Remove 4-M4 screws, and replace the E-stop unit.(B-cabinet)
(3) Reconnect the cables.



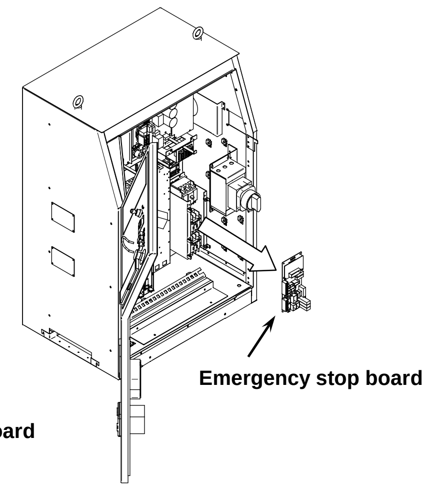
(A-cabinet) **(B-cabinet)**

8.4 REPLACING THE EMERGENCY STOP BOARD

(1) Detach the cables from the emergency stop board unit.
(2) Unlock the nylon latches (5 places) holding the board, and replace the board.
(3) Reconnect the cables.



(A-cabinet)



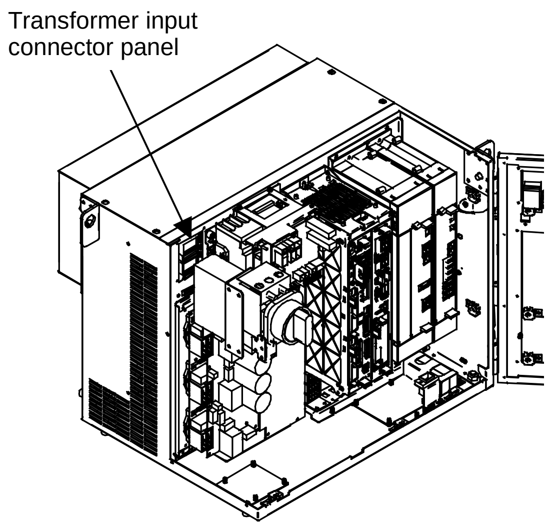
(B-cabinet)

8.5 REPLACING THE TRANSFORMER

> ⚠ **WARNING**
> The transformer is heavy. When replacing the transformer, be careful not to cause injury. (The transformer weighs 45 to 60 kg.)

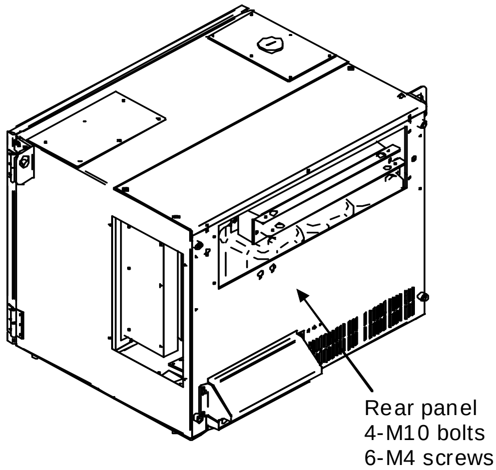
In case of A-cabinet

(1) Disconnect all cables from the transformer input connector panel.

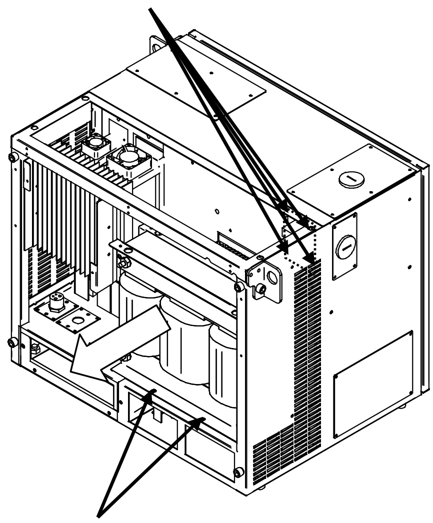


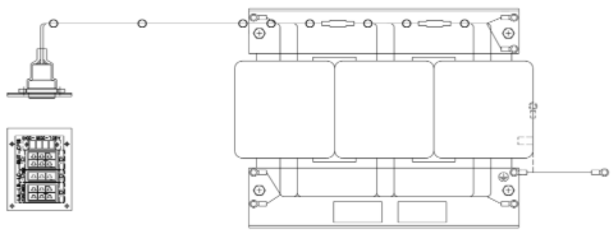
(2) Remove the rear fan unit.
(3) Remove the regenerative resister.

(4) Remove the rear panel.
Remove (6)-M4 screws and (4)-M10 bolts.



(5) Remove (4)-screws from the transformer input connector panel, and remove the (2)-M6 screws at the foot of the transformer. Then replace the transformer.

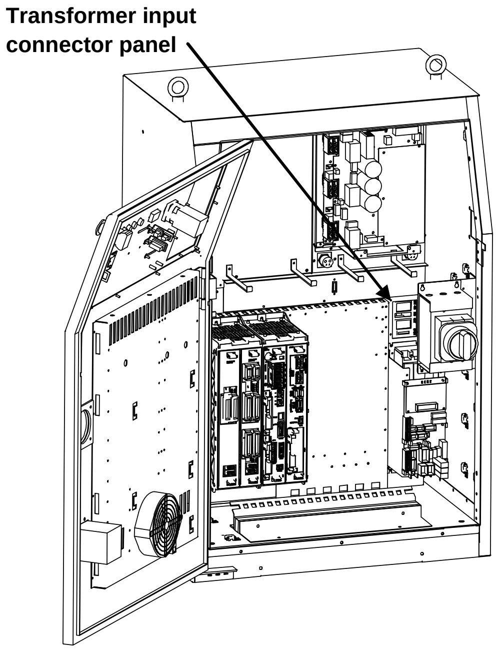




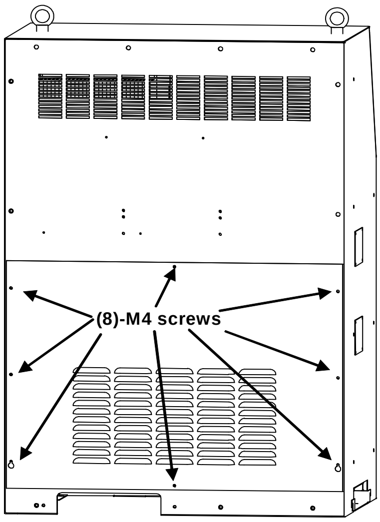
(6) Install a replacement transformer by reversing above steps.

In case of B-cabinet

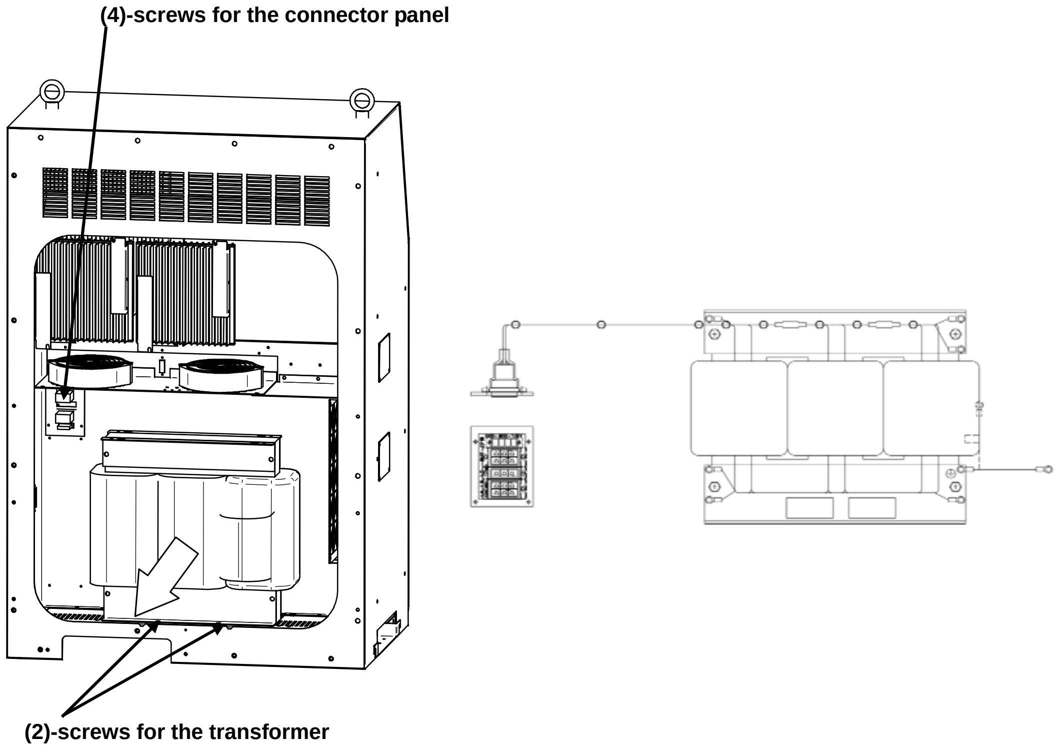
(1) Disconnect all cables from the transformer input connector panel.



(2) Remove the rear panel.
Remove (8)-M4 screws.



(3) Remove (4)-screws from the transformer input connector panel, and remove the (2)-M6 screws at the foot of the transformer. Then replace the transformer.



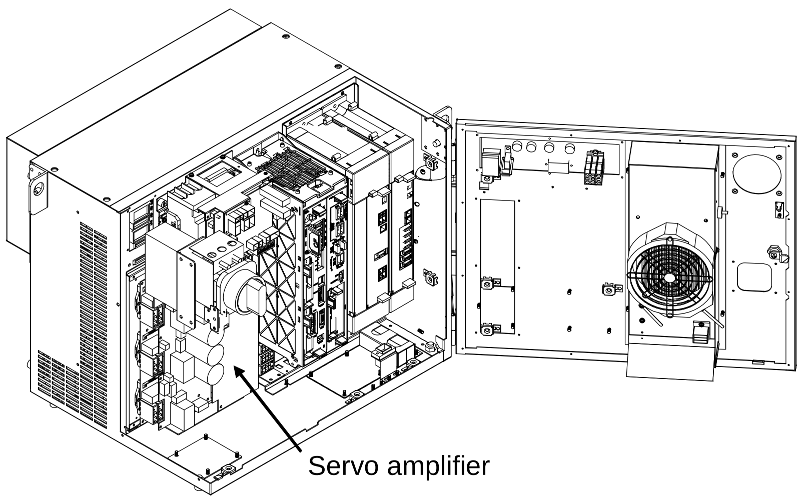
(4) Install a replacement transformer by reversing above steps.

8.6 REPLACING THE REGENERATIVE RESISTOR UNIT

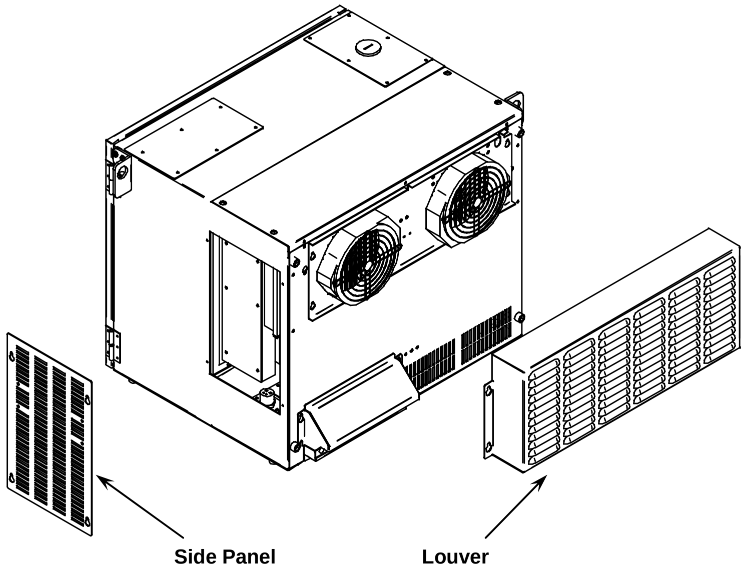
> ⚠ **WARNING**
> Before you start, turn off the controller main power. Be careful not to get burned, because the regenerative resistor unit is very hot immediately after operation.

In case of A-cabinet

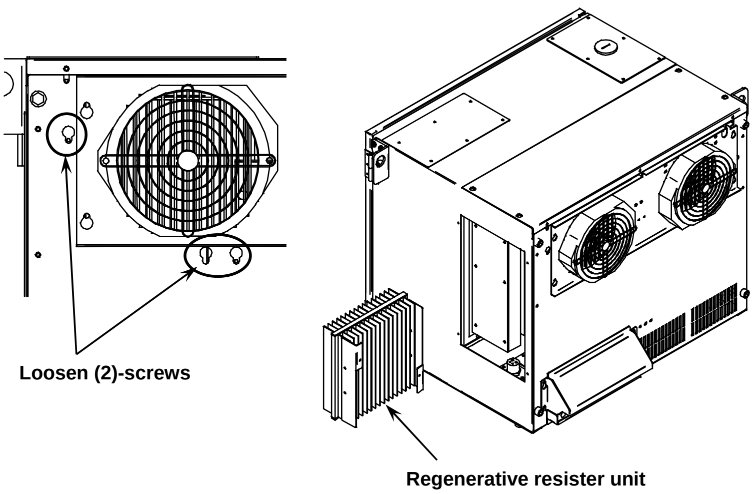
(1) Unplug CRR63A/B and CRR11A/B connectors from the servo amplifier. In case the cables of these connectors were fastened by cable ties, cut the cable ties to free the cables.



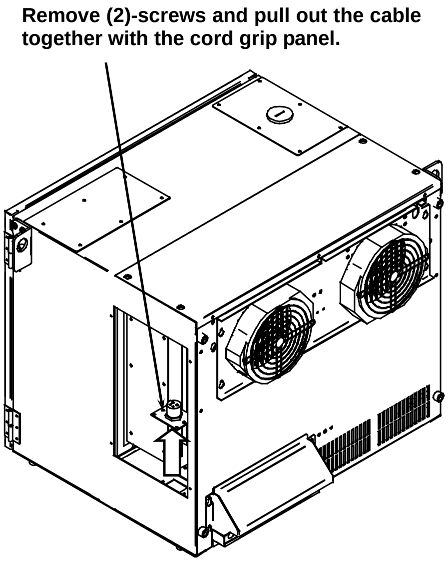
(2) Remove the side panel and the louver from the A-cabinet.



(3) Loosen two screws near the rear fan unit and lift up the regenerative resister unit so that it comes off from the rear panel of the cabinet.



(4) Remove four screws at the cord grip panel and pull out the cable together with the panel. Then the regenerative resister unit is separated from A-cabinet.



(5) Install a replacement unit by reversing above procedure.

In case of B-cabinet

(1) Remove the servo amplifier. (See Section 8.7)
(2) Remove the cord grip panel securing the cable of the regenerative resistor.
(3) If a cable is fastened with cable ties, cut them with a diagonal cutter to release the cable. Be careful not to damage the cable.
(4) Of the two nuts fastening the regenerative resistor, remove the upper nut, loosen the lower nut, and then remove the regenerative resistor.

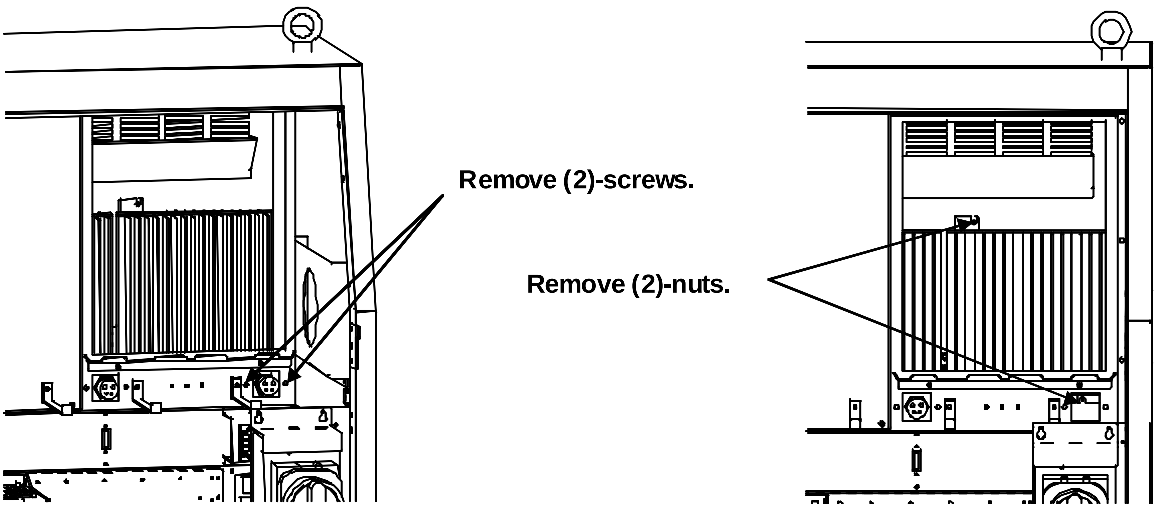


Fig. 8.6 Regenerative resister

(5) Install a replacement unit by reversing above procedure.

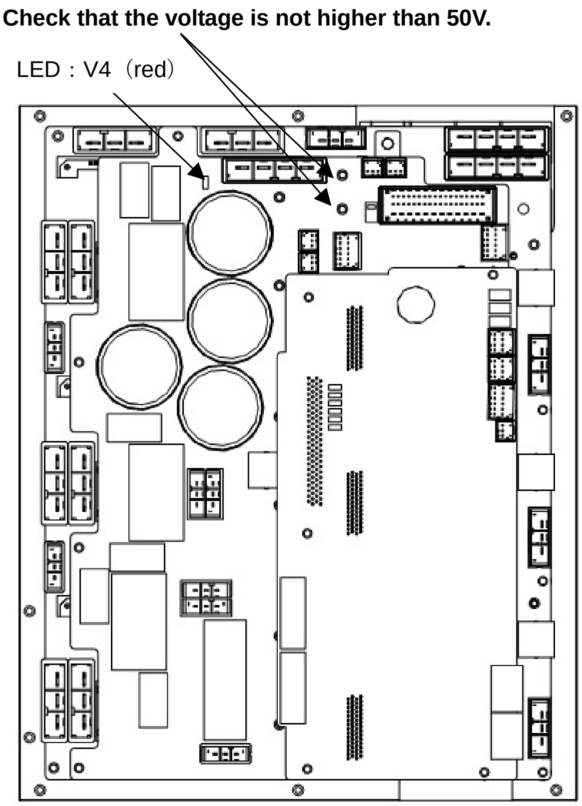
8.7 REPLACING SERVO AMPLIFIERS

> ⚠ **WARNING**
> Before touching the servo amplifier, for example, for maintenance purposes, check the voltage at the screw above the LED “V4” with a DC voltage tester to see if the remaining voltage is not higher than 50V.

> ⚠ **CAUTION**
> Because the servo amplifier is heated immediately after operation, leave the servo amplifier until it cools down thoroughly, before replacing it.

In case of A-cabinet

(1) Check the voltage at the screw above the LED "V4" with a DC voltage tester to see if the remaining voltage is not higher than 50V.



(2) Detach the cables from the servo amplifier. Pull out the detached cables away from the amplifier.
(3) Loosen 2-retaining screws at the upper side of the servo amplifier.
(4) Hold the handle at the upper side of the amplifier and pull to tilt it.
(5) Lift up the amplifier and pull out from the cabinet.
(6) Install a replacement amplifier by reversing above procedure.

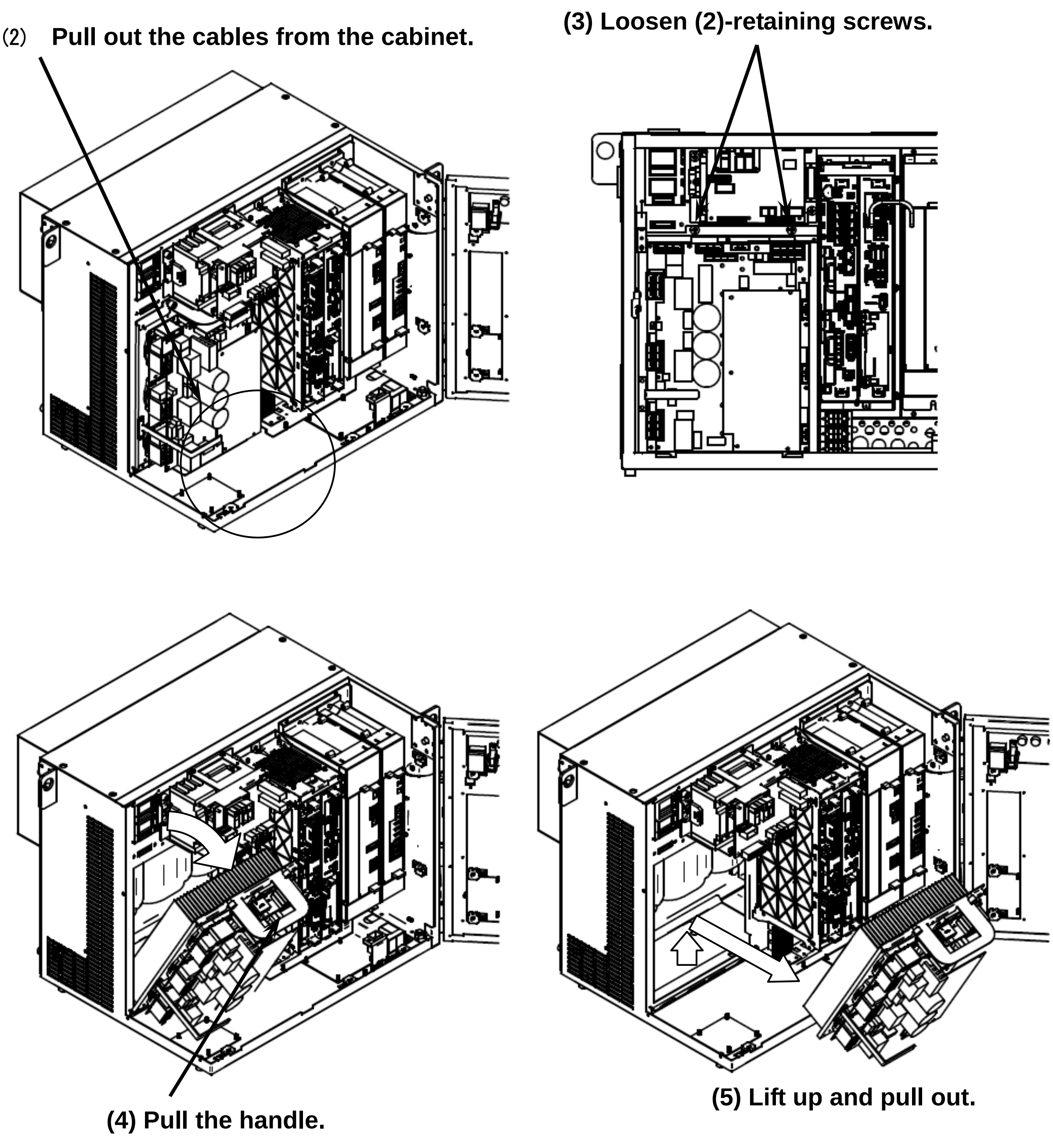
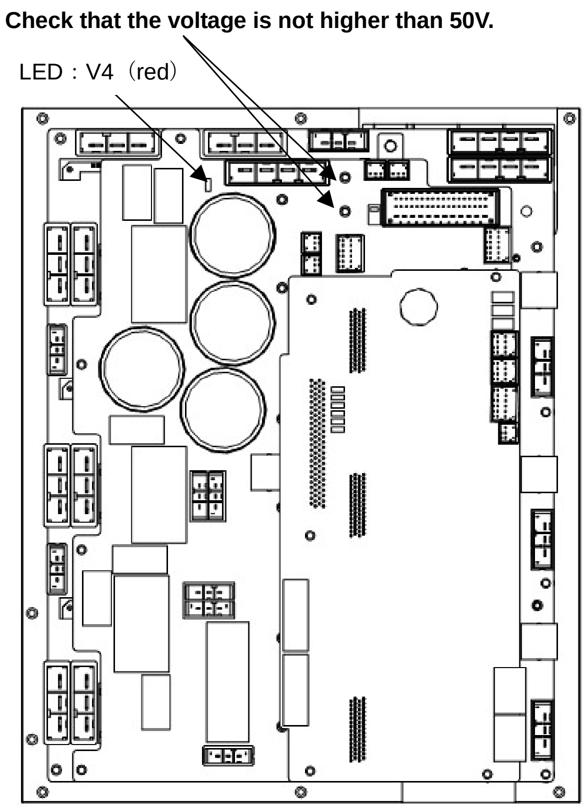


Fig.8.7(a) Replacing the servo amplifier (A-cabinet)

In case of an exchange of an amplifier is difficult by a procedure of figure 8.7(a).

(1) Check the voltage at the screw above the LED "V4" with a DC voltage tester to see if the remaining voltage is not higher than 50V.



(2) Detach the cables from the servo amplifier. Pull out the detached cables away from the amplifier.
(3) Loosen 2-retaining screws at the upper side of the servo amplifier.
(4) Hold the handle at the upper side of the amplifier and pull to tilt it.
(5) Lift up the amplifier and pull the side handle.
(6) Lift up the amplifier and pull out from bottom side.
(7) Install a replacement amplifier by reversing above procedure.

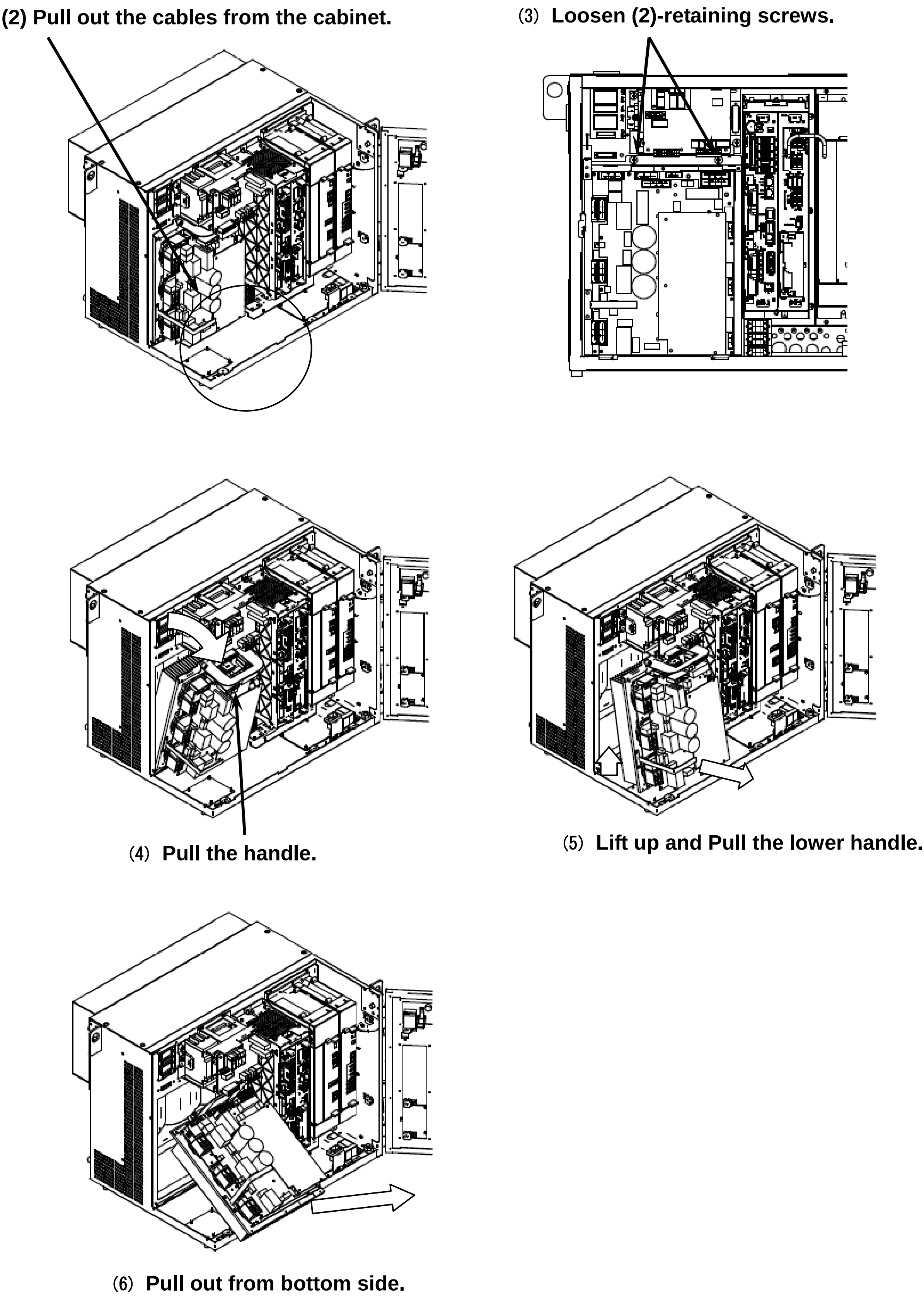
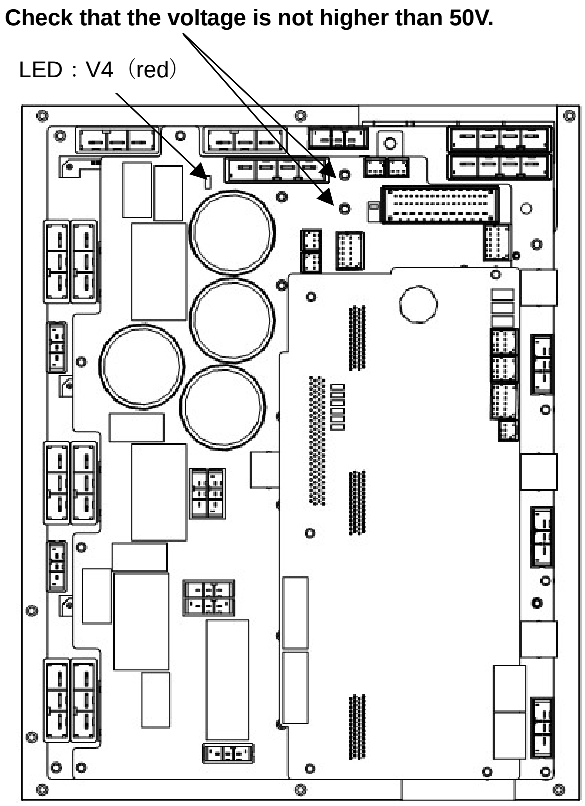


Fig.8.7(b) Replacing the servo amplifier (A-cabinet)

In case of B-cabinet

(1) Make sure that servo amplifier shipping screws (2cross-head) have been removed. Retain screws for shipping purposes.
(2) Check the voltage at the screw above the LED "V4" with a DC voltage tester to see if the remaining voltage is not higher than 50V.



(3) Remove the cover from servo amplifier.
(4) Detach the cables from the servo amplifier. Pull out the detached cables away from the amplifier.
(5) Loosen 2-retaining screws at the upper side of the servo amplifier.
(6) Hold the handle at the upper side of the amplifier and pull to tilt it.
(7) Lift up the amplifier and pull out from the cabinet.
(8) Install a replacement amplifier by reversing above procedure.

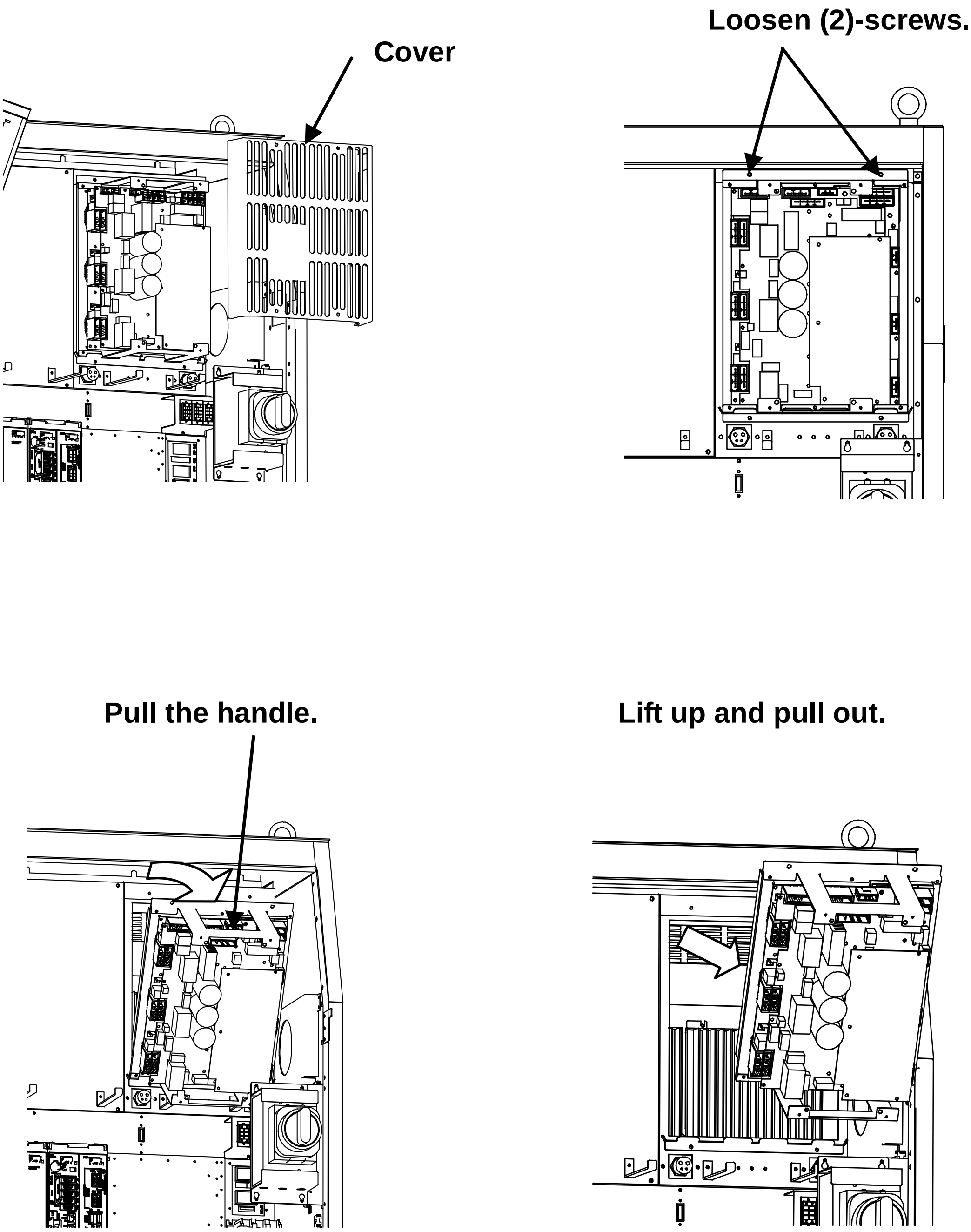
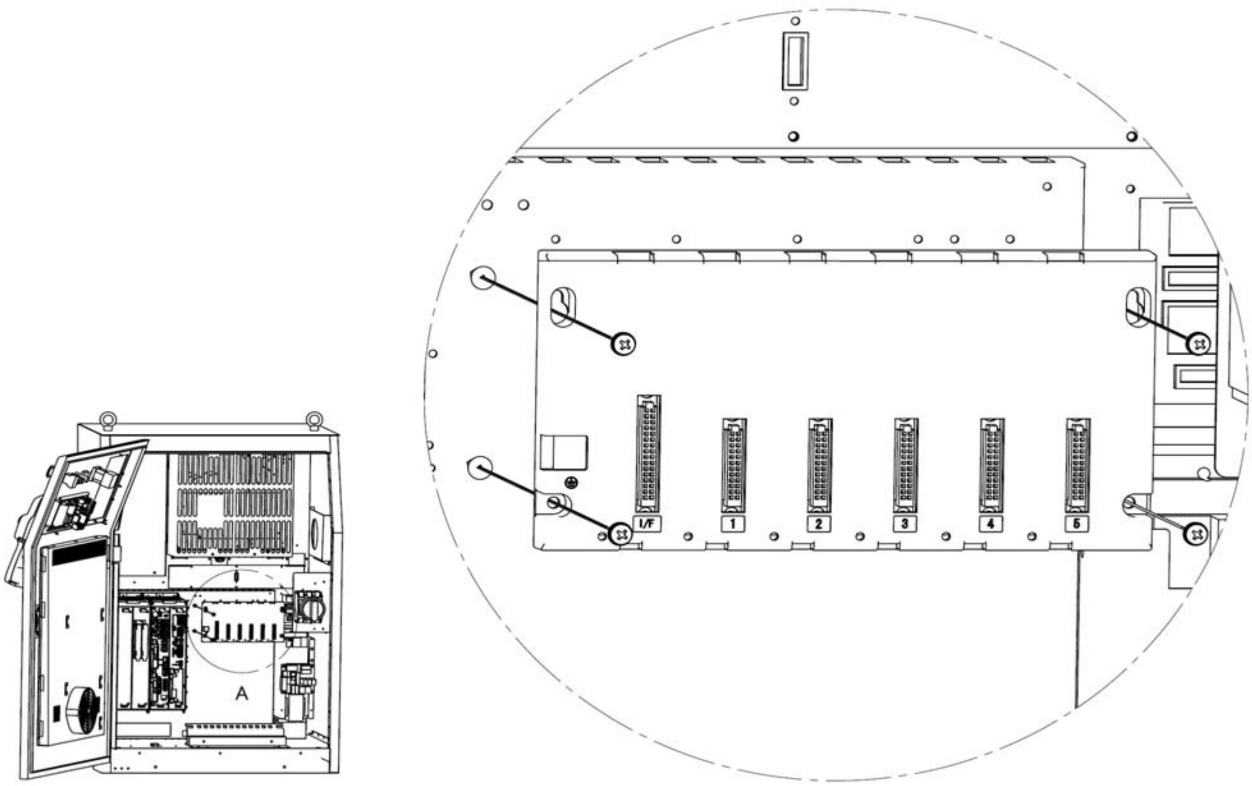


Fig.8.7(c) Replacing the servo amplifier (B-cabinet)

8.8 REPLACING I/O UNIT-MODEL A

8.8.1 Replacing the Base Unit of I/O Unit-MODEL A

First, remove the modules from the base unit of I/O Unit-MODEL A. The base unit is retained with 4 screws. Of these screws, loosen the upper 2 screws and remove the lower 2 screws, then replace the base unit.



Details of section A

Fig.8.8.1 Replacing the base unit of I/O unit model A

8.8.2 Replacing a Module

An interface module and input/output module can be easily installed in and removed from the base unit, as described below.

Installing a module

(1) Put the upper hook of the module into the upper hole of the base unit.
(2) Fit the connectors of the module and the base unit to each other.
(3) Push the module until the lower stopper of the module is caught in the lower hole of the base unit.

Removing a module

(1) Press the lever at the bottom of the module to release the stopper.
(2) Lift the module up.

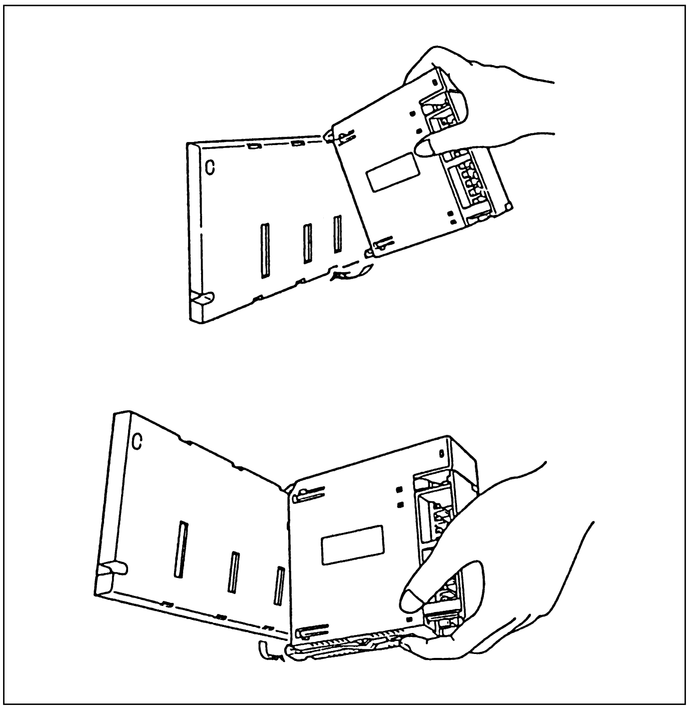


Fig.8.8.2 Replacing the module

8.9 REPLACING THE TEACH PENDANT

The specifications of the teach pendant vary with its use. When you replace the teach pendant, check its specifications carefully.

(1) Be sure that the power of the robot controller is off.
(2) Detach the cable from the teach pendant.
(3) Replace the teach pendant.

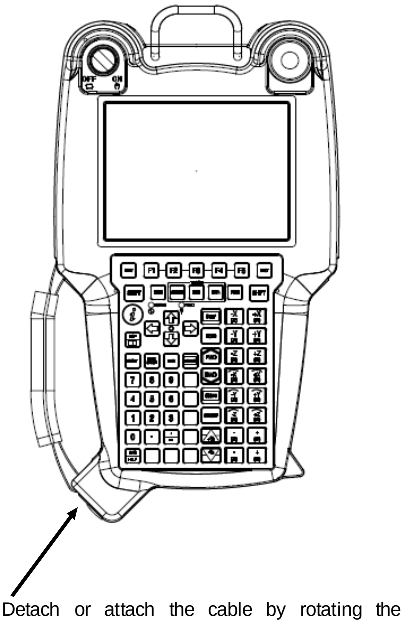


Fig.8.9 Replacing the teach pendant

8.10 REPLACING THE CONTROL SECTION FAN MOTOR

The control section fan motor can be replaced without using a tool. The fan motor is mounted on the fan unit rack.

(1) Be sure that the power of a robot controller is off.
(2) Put your finger in the dent in the upper section of the fan unit, and pull the fan unit until it is unlatched.
(3) Lift the fan unit slightly, and dismount it from the rack.
(4) Place a replacement fan on the upper section of the rack, and slide it gently until it is latched.

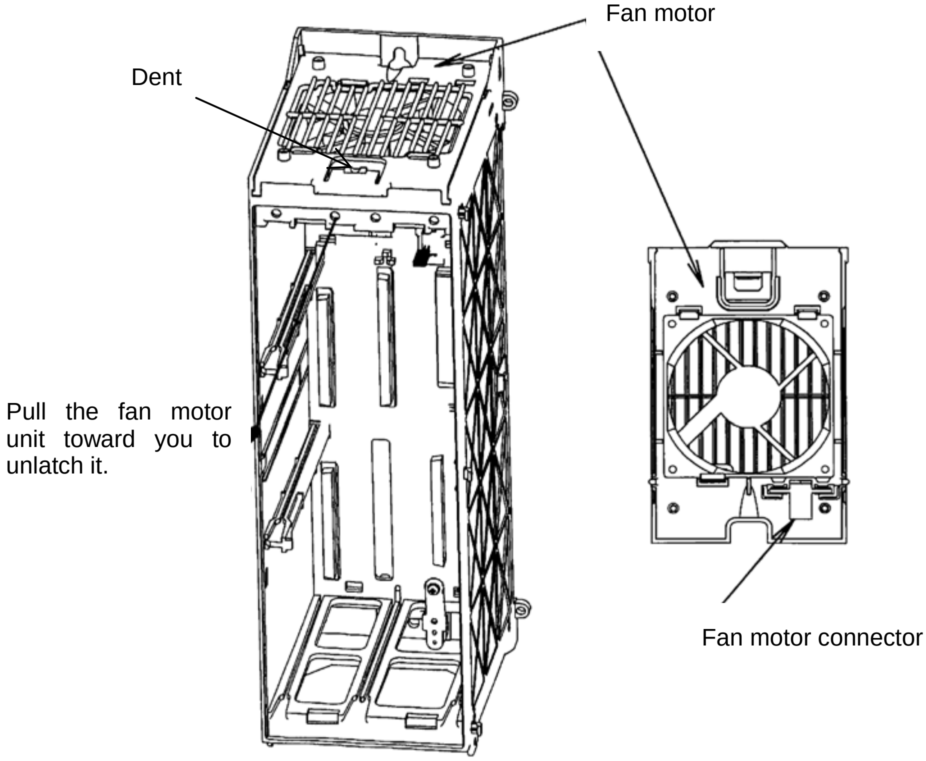


Fig.8.10 Replacing the control section fan motor

8.11 REPLACING THE AC FAN MOTOR

> ⚠ **WARNING**
> Do not touch the fan motor when it is rotating, or you could be injured.

8.11.1 Replacing the Heat Exchanger and Door Fan Unit (A-cabinet)

The heat exchanger of the A-cabinet is inside its door. To replace the heat exchanger, it is necessary to remove the door fan unit in advance.

Door fan unit

(1) Remove retaining screws (M4, 4 places).
(2) Disconnect the connector at the FAN.
(3) Mount the replacement fan unit by reversing above procedure. Be careful not to let the cable get caught in the fan.

Heat exchanger

(1) Dismount the door fan unit. (See the above procedure.)
(2) Open the A-cabinet door, and detach cables.
(3) Remove retaining nuts (M5, 4 places), and dismount the unit.
(4) Mount the replacement unit by reversing above procedure.

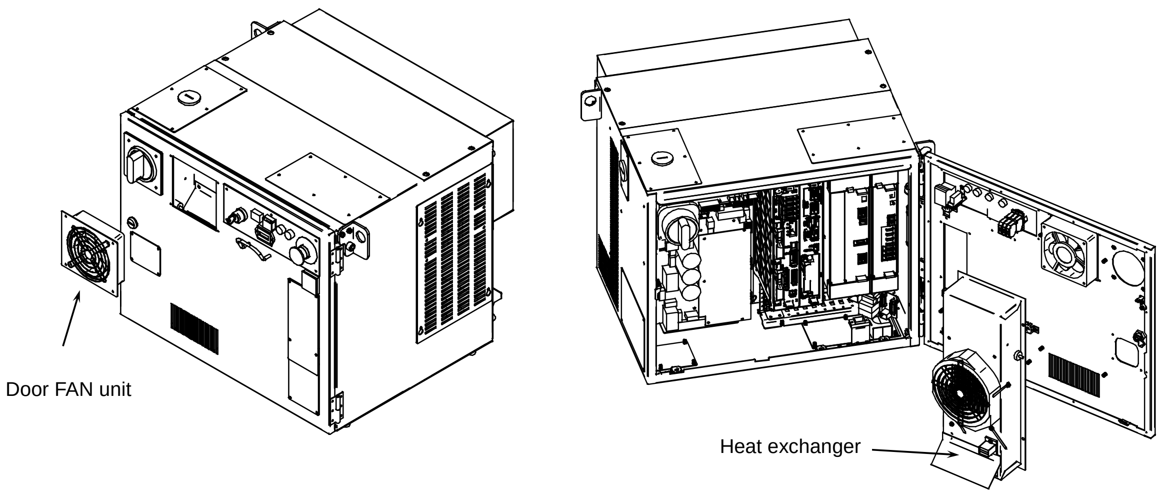


Fig.8.11.1 Replacing the heat exchanger and door fan unit (A-cabinet)

8.11.2 Replacing Rear Fan Unit (A-cabinet)

(1) Loosen the 4-screws(M4) of the louver, then remove it.
(2) Loosen 4-screws(M4) , and then detach the fan unit.
(3) Unplug the connector at the cabinet.
(4) Mount the replacement unit by reversing above procedure.

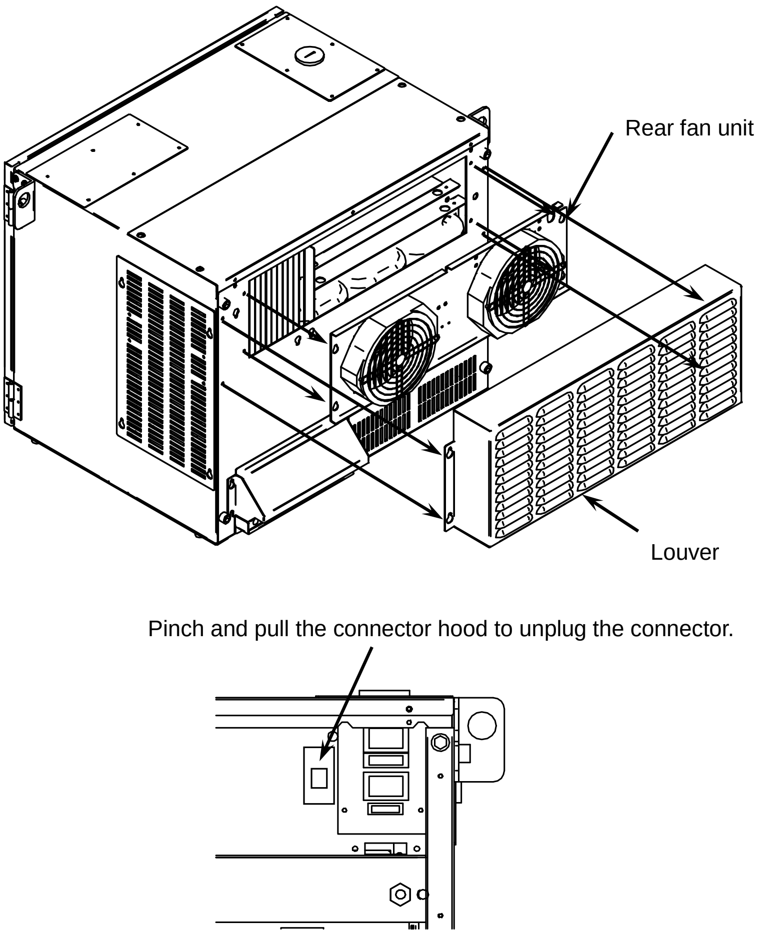
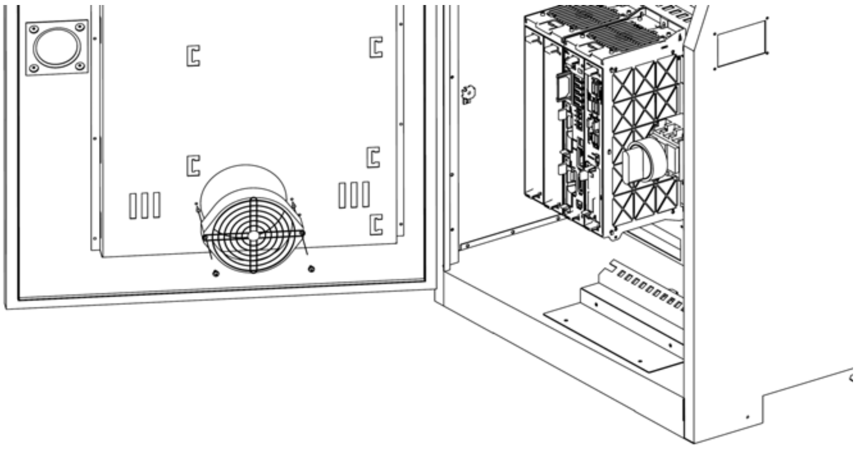


Fig.8.11.2 Replacing rear fan unit (A-cabinet)

8.11.3 Replacing External Fan Unit and Door Fan (B-cabinet)

Door fan

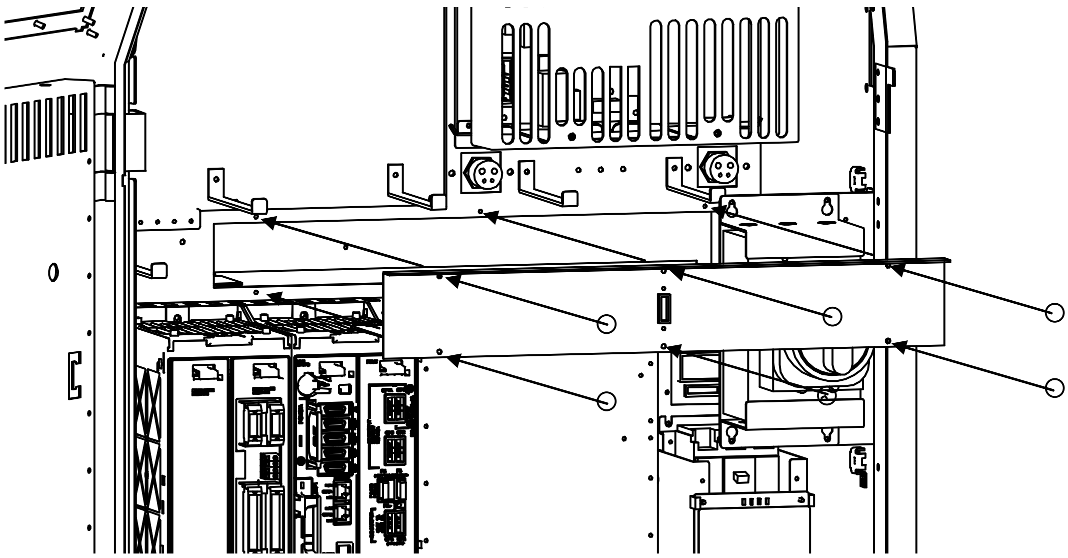
(1) Detach the cable from the fan unit.
(2) Remove the retaining screws from the fan unit, then dismount it.
(3) Install a new fan unit by reversing the dismounting procedure.



(Replacing the Door Fan Unit)

External fan unit

(1) Detach the cable connecting the fan unit.
(2) Remove the screws and pull out the fan unit toward you.
(3) Install a new fan unit by reversing the dismounting procedure.



(Replacing the External Fan Unit)

8.12 REPLACING THE BATTERY

8.12.1 Battery for Memory Backup (3 VDC)

The programs and system variables are stored in the SRAM located on the main board. The power to the SRAM memory is backed up by a lithium battery mounted on the front panel of the main board. The above data is not lost even when the main power of the controller is turned off. A new battery can maintain the contents of memory for about 4 years (Note).
When the voltage of the battery becomes low, the low-voltage battery alarm (system-035) is displayed on the teach pendant. When this alarm is displayed, replace the battery as soon as possible. In general, the battery can be replaced within one or two weeks, however, this depends on the system configuration.
If the battery voltage gets lower, it becomes impossible to back up the content of the SRAM. Cycling power to the controller in this state causes the system not to start, and the LED located on the main board displays "1" because the contents of memory have been lost. Clear the entire SRAM memory and reenter data after replacing the battery. Important data should be saved to a memory card or other external device beforehand for just such an emergency.

NOTE
In a newly introduced robot, the battery is factory-installed. Since some time passes between when the robot is built and when it is installed, battery replacement may, therefore, be needed within 4 years after the introduction of the robot.

Replacing the lithium battery

(1) Prepare a new lithium battery (ordering drawing number: A02B-0200-K102, A98L-0031-0012).
(2) Turn the robot controller on for about 30 seconds.

⚠ CAUTION
Complete the steps (3) to (5) within 30 minutes.
If the battery is left disconnected for a long time, the contents of memory will be lost.
To prevent possible data loss, it is recommended that the robot data such as programs and system variables be backed up before battery replacement.

(3) Turn the robot controller off.
(4) Remove the old battery from the top of the main board.
First unlatch the battery, remove it from the battery holder, and detach its connector.

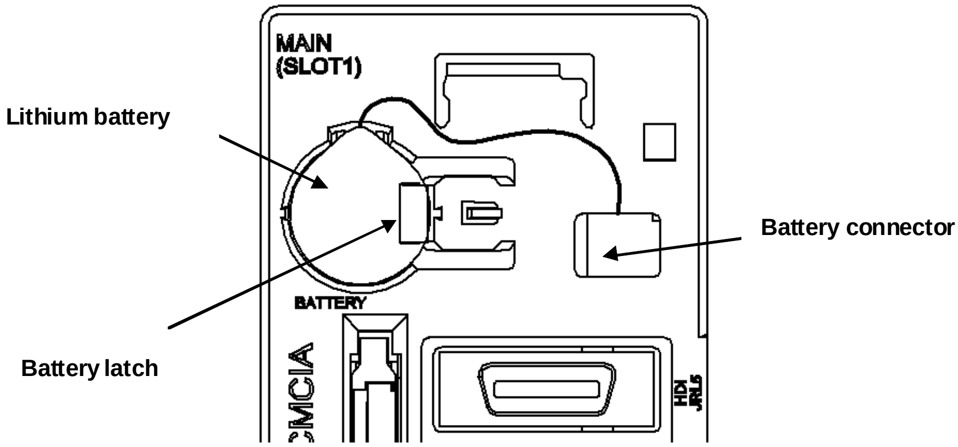


Fig.8.12.1 Replacing the lithium battery

(5) Remove the old battery, insert a new one into the battery holder, and attach the connector. Confirm that the battery is latched firmly.

> ⚠ **WARNING**
> Using other than the recommended battery may result in a battery explosion. Replace the battery only with the specified battery (A02B-0200-K102, A98L-0031-0012).

Dispose of the replaced battery as an industrial waste, according to the laws and other rules in the country where the controller is installed and those established by the municipality and other organizations that have jurisdiction over the area where the controller is installed.

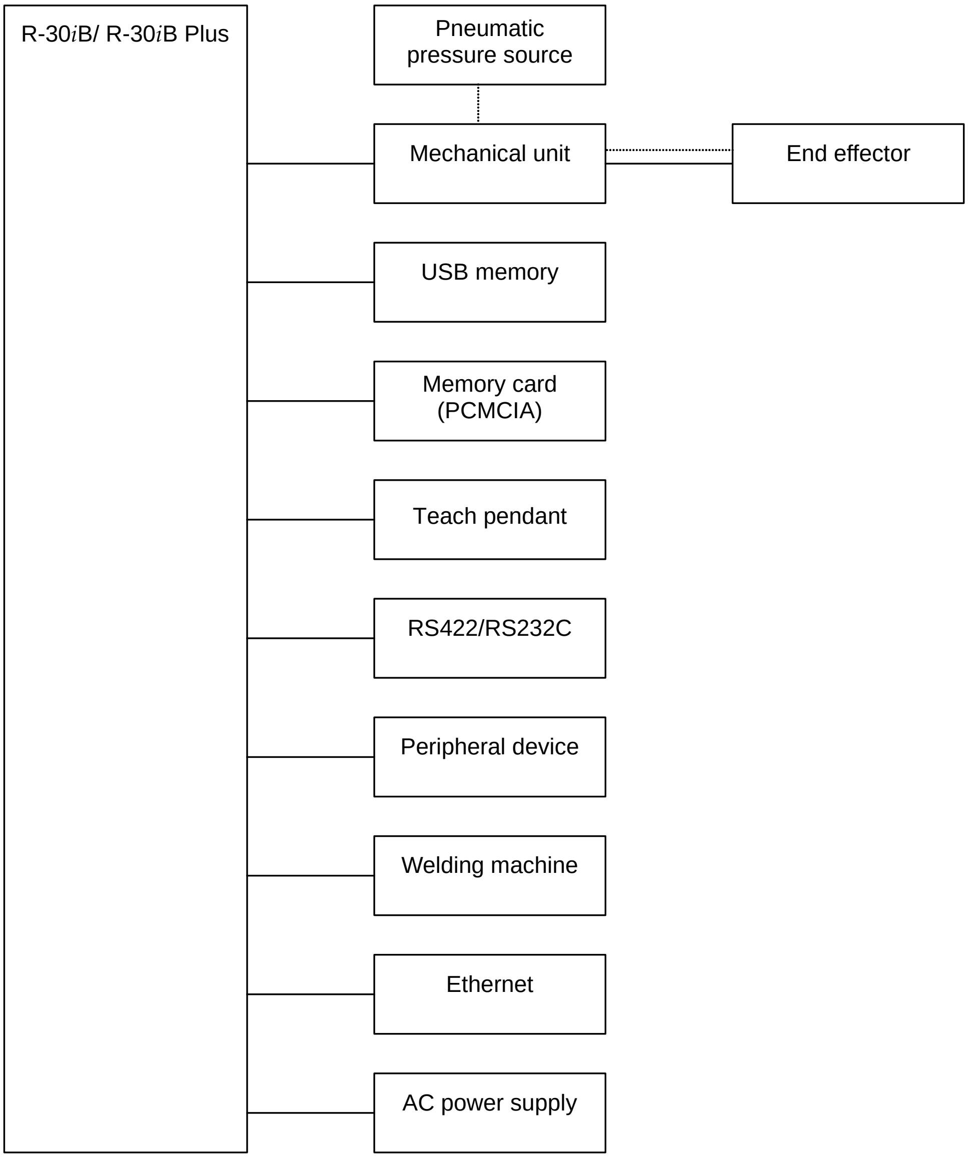
II. CONNECTIONS

1 OVERVIEW

This section describes the electrical interface connections in the R-30*i*B/R-30*i*B Plus. It also includes information about installation of the R-30*i*B/R-30*i*B Plus.

2 BLOCK DIAGRAM

Fig.2 is a block diagram of electrical interface connections with the R-30*i*B/R-30*i*B Plus.



NOTE

——— : Indicates electrical connection.
-------- : Indicates mechanical connection.

Fig.2 Block diagram of electrical interface connection

3 ELECTRICAL CONNECTIONS

3.1 CONNECTIONS BETWEEN THE CONTROLLER AND THE MECHANICAL UNIT AND OTHER GENERAL CONTROLLER CONNECTIONS

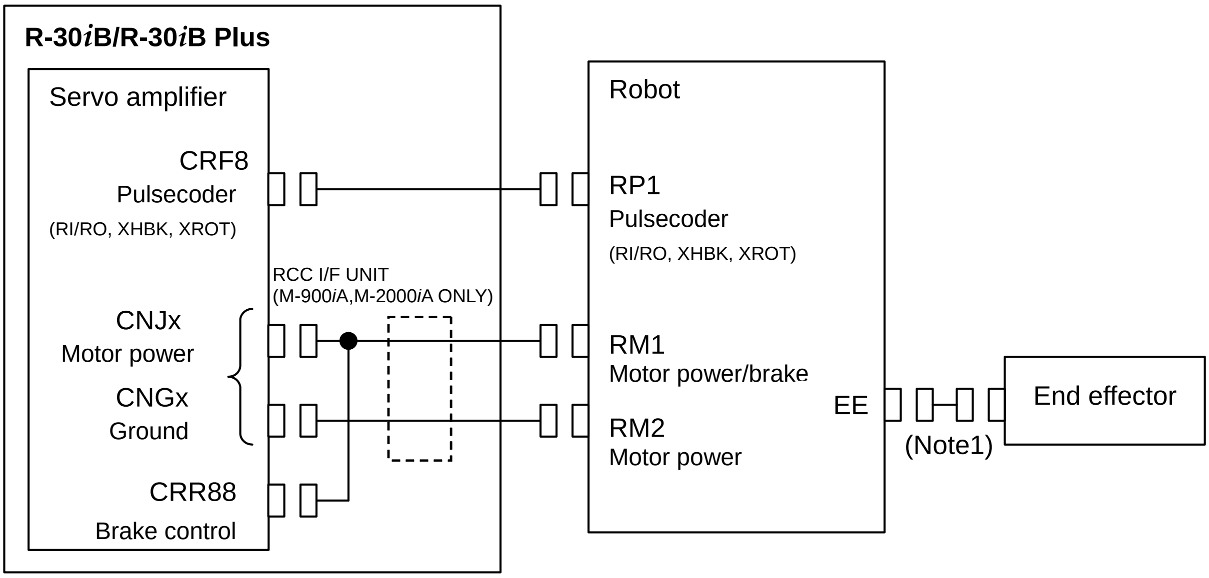
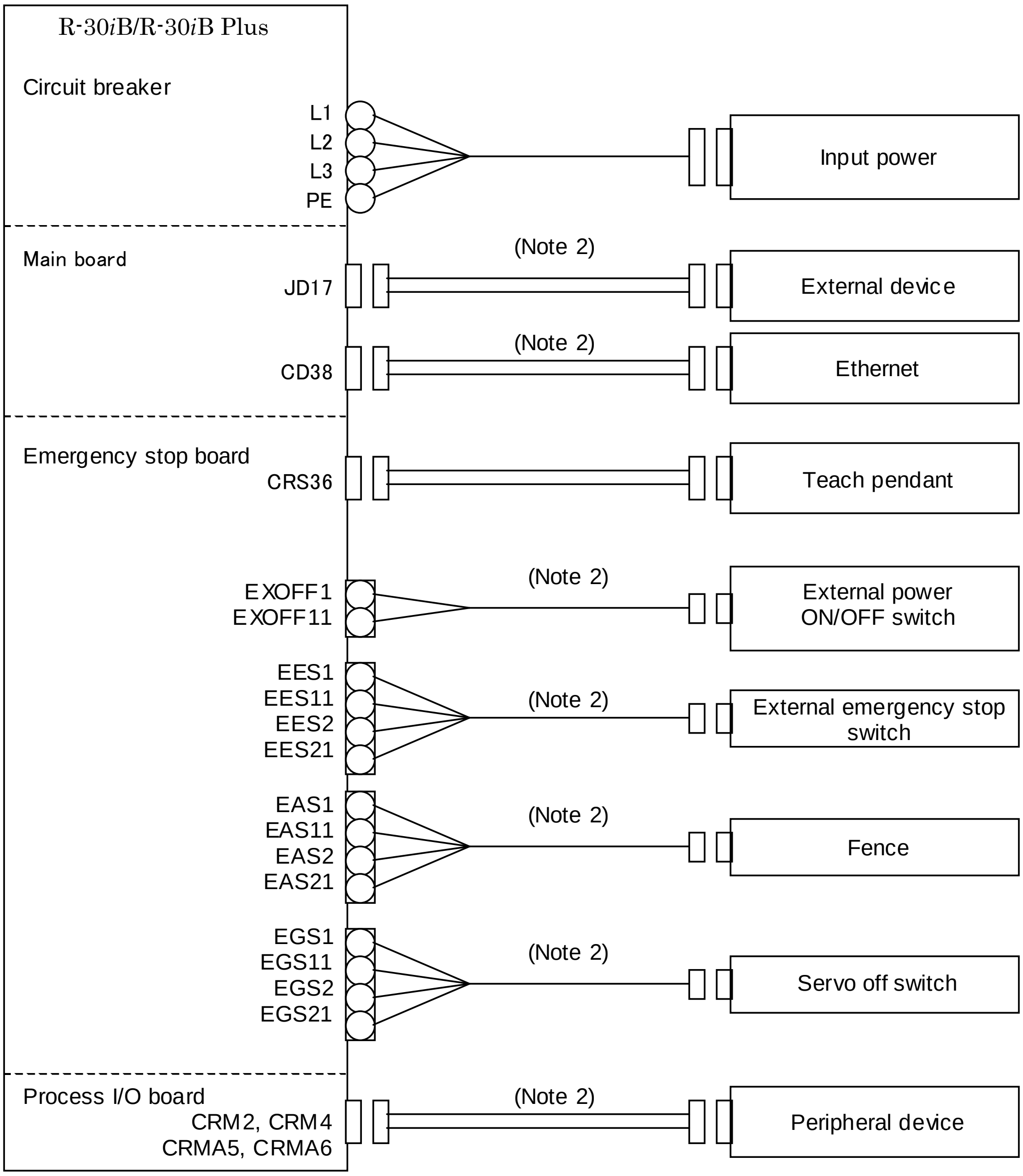


Fig.3.1 (a) Mechanical connection diagram

> **NOTE**
> 1 This cable is not included. It must be supplied by the customer.



> **NOTE**
> 1 For detail of the peripheral device connection, see the section of Peripheral device interface.
> 2 This cable is not included. It must be supplied by the customer.

Fig.3.1 (b) Unit-to-unit connection diagram

3.2 CONNECTION TO FANUC I/O LINK AND FANUC I/O LINK *i*

3.2.1 Connection of I/O Link by Using JD1A Connector

The connection of I/O link by using JD1A connector is shown below.

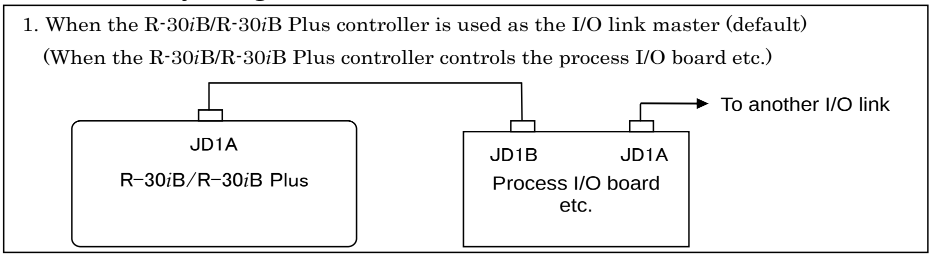


Fig.3.2.1 Connection of I/O link by using JD1A connector

3.2.1.1 Connection of the I/O Link cable by using JD1A connector

1. Connect the cable according to the system. Be sure to perform shielding.
2. Before connection turn off the power.

> **NOTE**
> For connection with the CNC with I/O links, turn on or off the power of the CNC and the robot controller at the following timing.
> a) Slave units and the master must be powered on or off at the same time.
> b) If the CNC or robot controller is powered off after startup of the system, an I/O link error occurs. To successfully make connection with I/O links again, power off all of the units and then power them on at the timing indicated in a).

When used as master interface
JD1A
interface

1	RXSLCA	11	0V
2	*RXSLCA	12	0V
3	TXSLCA	13	0V
4	*TXSLCA	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	+24E
10	+24E	20	+5V

3. When the R-30iB/R-30iB Plus controller is used as the I/O link master, use a twisted-pair cable in which wires RXSLCA(Pin No.1 of JD1A) and *RXSLCA(Pin No.2 of JD1A) are paired and wires TXSLCA(Pin No.3 of JD1A) and *TXSLCA(Pin No.4 of JD1A) are paired.
4. Shield the cable collectively and ground the shield on the CNC side.

3.2.1.2 Cable connection diagram of the I/O Link cable when using JD1A connector

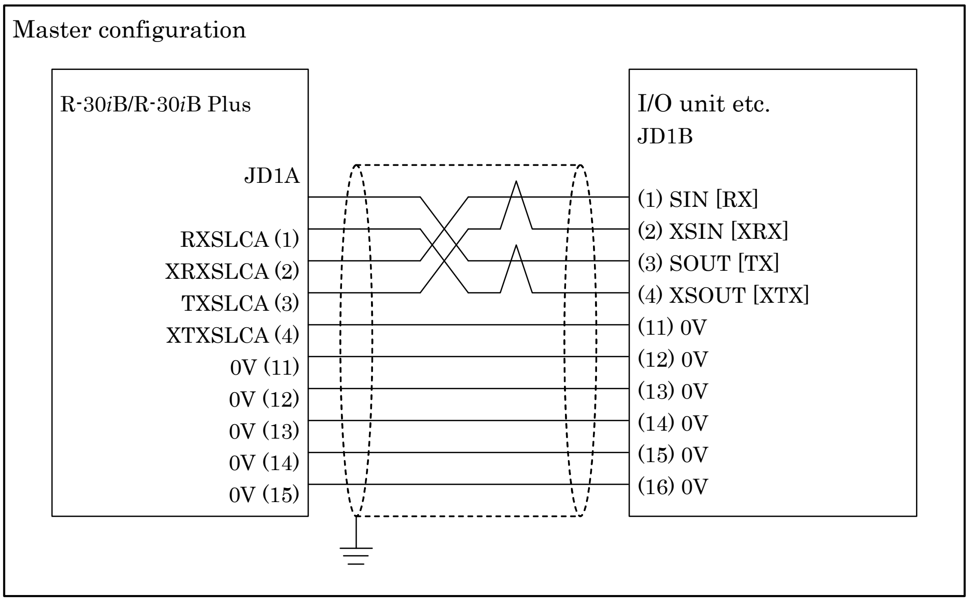


Fig.3.2.1.2 Cable connection diagram of the I/O Link cable when using JD1A connector

3.2.2 Connection of I/O Link and I/O Link *i* when Using JRL8 Connector

The connection of I/O link and I/O link *i* when using JRL8 connector is shown below.

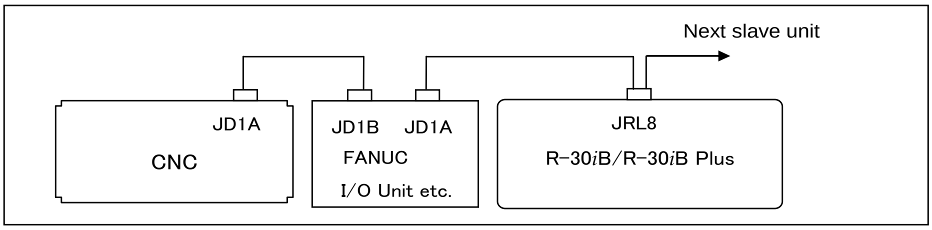


Fig.3.2.2 Connection of I/O link and I/O Link *i* by using JRL8 connector

3.2.2.1 Connection of the I/O Link cable when using JRL8 connector

1 Connect the cable according to the system. Be sure to perform shielding.
Shield the cable collectively and ground the shield on the CNC side.

2. Before connection turn off the power.

> **NOTE**
> For connection with the CNC with I/O Link and I/O link *i*, turn on or off the power of the CNC and the robot controller at the following timing.
> a) Slave units and the master must be powered on or off at the same time.
> b) If the CNC or robot controller is powered off after startup of the system, I/O Link and I/O link *i* error occurs. To successfully make connection with I/O Link and I/O link *i* again, power off all of the units and then power them on at the timing indicated in a).

JRL8

1	RXSLCB	11	*HDI1
2	0V	12	0V
3	*RXSLCB	13	*HDI2
4	0V	14	0V
5	TXSLCB	15	*HDI3
6	RXSLCC	16	0V
7	*TXSLCB	17	*HDI4
8	*RXSLCC	18	0V
9	TXSLCC	19	*HDI5
10	*TXSLCC	20	0V

JRL8 Interface

3. When the R-30*i*B/R-30*i*B Plus controller is connected to CNC or preceding I/O link ***i*** slave unit, use a twisted-pair cable in which wires RXSLCB (Pin No.1 of JRL8) and *RXSLCB (Pin No.3 of JRL8) are paired and wires TXSLCB (Pin No.5 of JRL8) and *TXSLCB (Pin No.7 of JRL8) are paired.

4. When the R-30*i*B/R-30*i*B Plus controller is connected to next I/O link *i* slave unit, use a twisted-pair cable in which wires RXSLCC (Pin No.6 of JRL8) and *RXSLCC (Pin No.8 of JRL8) are paired and wires TXSLCC (Pin No.9 of JRL8) and *TXSLCC (Pin No.10 of JRL8) are paired.

3.2.2.2 Cable connection diagram of the I/O Link cable by using JRL8 connector

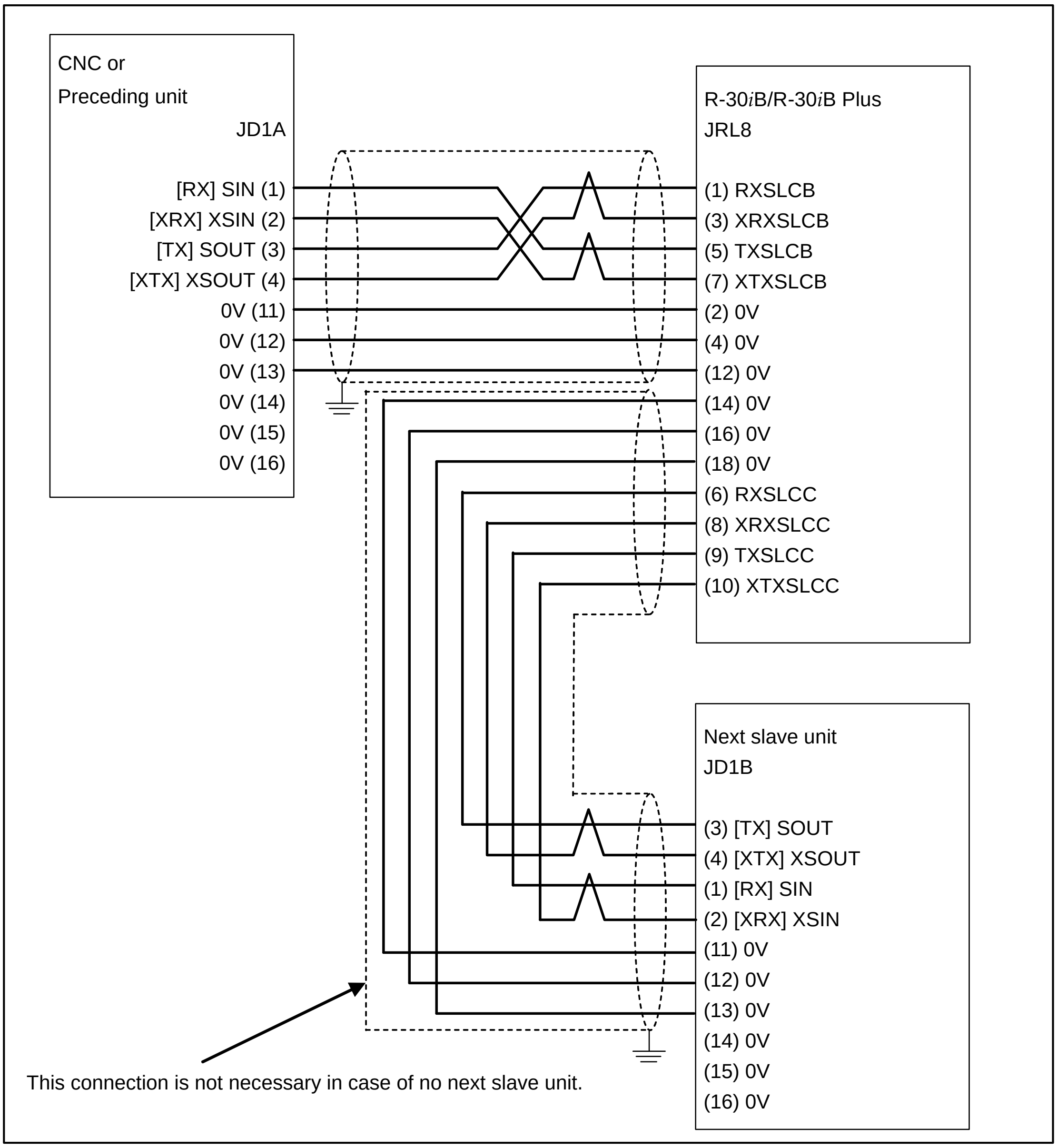


Fig.3.2.2.2 Cable connection diagram of the I/O Link cable by using JRL8 connector

3.3 EXTERNAL CABLE WIRING DIAGRAM

3.3.1 Robot Connection Cables

> ⚠ **CAUTION**
> Before operating the robot, uncoil the interconnection cables from their shipping position to prevent excessive heat, which may damage the cables.
> (Coiled part should be shorter than 10 meter.)

There are two types of the robot connection cable;

Non-flex type: usage is restricted to fixed laying

Flex type: possible to use in the cable track

Specification of cable

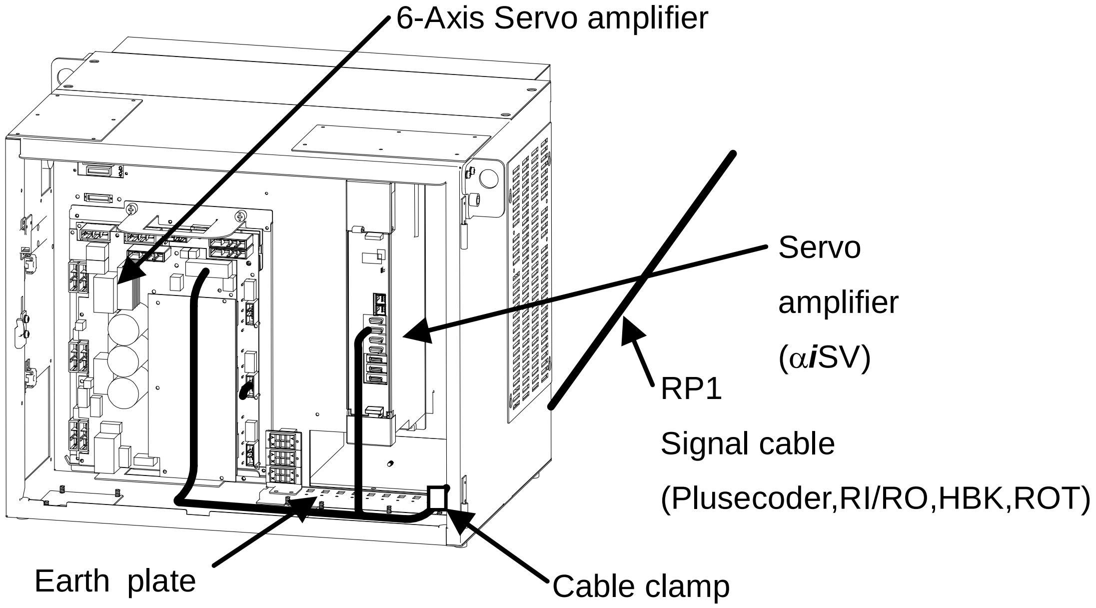
		Robot	Non-flex type			Flex type		
			Diameter (mm)	**Weight (kg/m)**	**Minimum bending radius (mm)**	**Diameter (mm)**	**Weight (kg/m)**	**Minimum bending radius (mm)**
RP1		All models	16.0	0.45	200	20.5	0.71	200
RM1		Group 1 Group 3 Group 4 Group 5 Group 11 Group 12	26.1	1.22	200	25.4	1.2	200
		Group 2 Group 6	20.0	0.7	200	18.4	0.7	200
RM2		Group 3 Group 4 Group 5	26.1	1.22	200	25.4	1.2	200
RMP	RP	Group7 Group8	16.0	0.45	200	20.5	0.71	200
	RM		20.0	0.7	200	18.4	0.7	200
RP7A		Group 12	8.5	0.09	200	9.1	0.12	200
RM7A			20.6	0.71	200	20	0.64	200
EARTH		All models	4.7	0.065	200	4.7	0.065	200

Group1	R-1000*i*A(Except /120F-7B), R-2000*i*B (Except /200T/220U/220US), R-2000*i*C(Except /210L/270F), M-420*i*A, M-421*i*A, M-710*i*C
Group2	F-200*i*B
Group3	R-2000*i*B/200T/220U/220US, R-2000*i*C/210L/270F, M-410*i*B, M-410*i*C
Group4	M-900*i*A/150P/260L/350
Group5	M-900*i*A/400L/600,M-900*i*B/400L/700
Group6	M-430*i*A/2PH/4FH
Group7	M-430*i*A/2P
Group8	ARC Mate 100*i*C, ARC Mate 120*i*C, M-10*i*A, M-20*i*A, M-20*i*B, CR-35*i*A
Group11	M-2*i*A, M-3*i*A
Group12	R-1000*i*A/120F-7B

Using condition of flex type cable

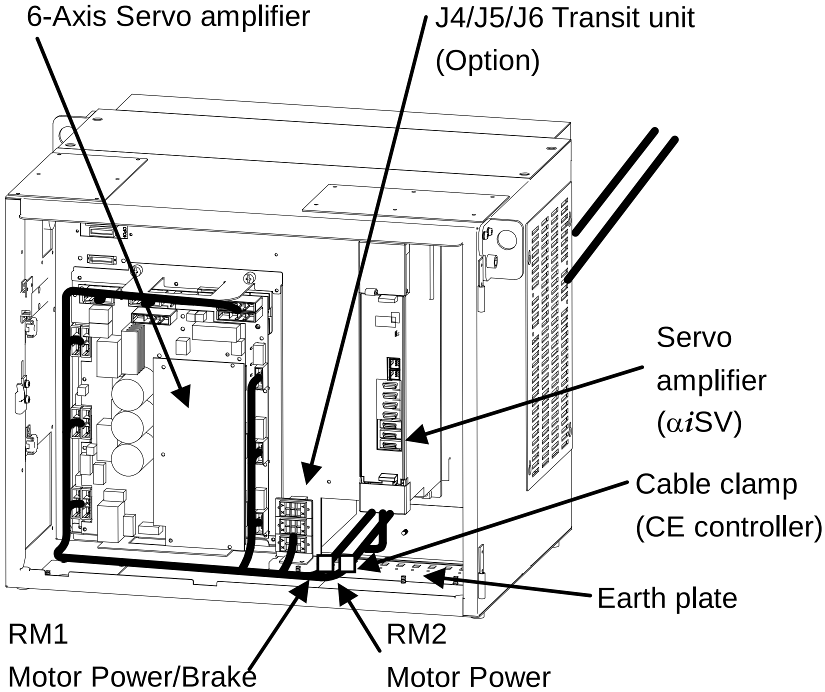
(1) When routing cables in movable places, use a cable bearer.
(2) The bending radius (R) of the cable track is more than 200mm.
(3) The cable should be fixed to the cable track by using the clamp. (e.g. foam rubber)
(4) The size of the hole to support a cable in the cable track should be more than 110% of the cable size and should have the gap more than 3mm.
(5) When cables are laid in the cable track, pay attention for the cable not to be twisted.

Cable Route
In case of A-cabinet
Signal cable



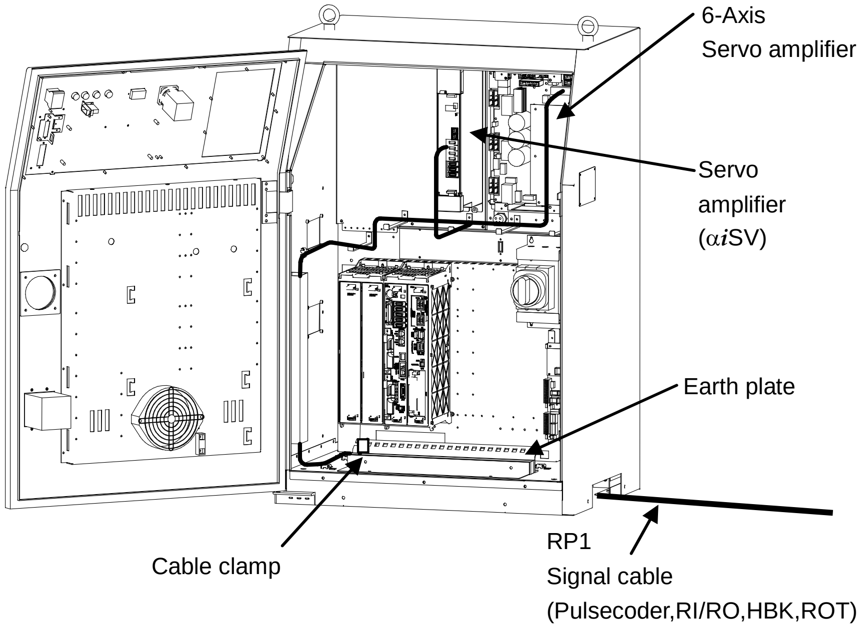
> ⚠ **CAUTION**
> Signal cable should be clamped to Earth plate by cable clamp.

Power/Brake cable



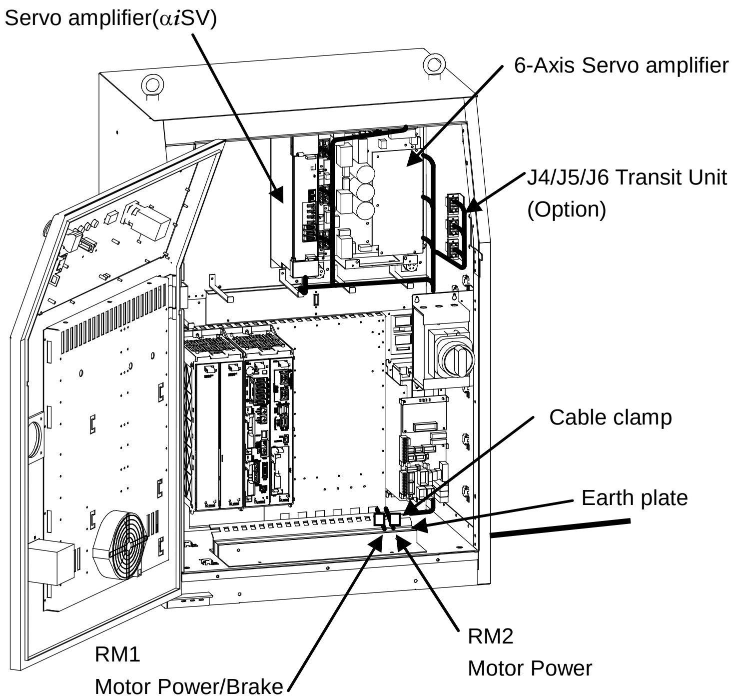
> ⚠ **CAUTION**
> Power/Brake cable should be clamped to Earth plate by cable clamp.

In case of B-cabinet
Signal cable



> ⚠ **CAUTION**
> Signal cable should be clamped to Earth plate by cable clamp.

Power/Brake cable



> ⚠ **CAUTION**
> Power/Brake cable should be clamped to Earth plate by cable clamp.

Robot Model
Group1: R-1000*i*A(except /120F-7B), R-2000*i*B(expect /200T/220U/220US), R-2000*i*C(expect /210L/270F), M-420*i*A,M-421*i*A,M-710*i*C
Group2:F-200*i*B
Group11:M-2*i*A, M-3*i*A
Detail of cable connection to servo amplifier

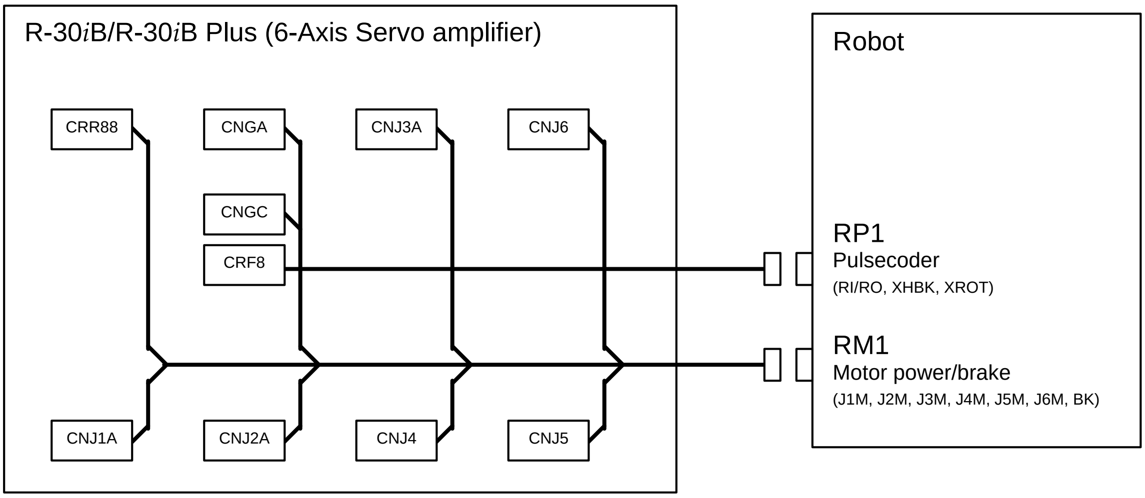


Fig.3.3.1 (a) Robot connection cable (Group1, Group2, Group11)

Robot Model
Group3:R-2000*i*B/200T/220U/220US, R-2000*i*C/210L/270F, M-410*i*B, M-410*i*C
Detail of cable connection to servo amplifier

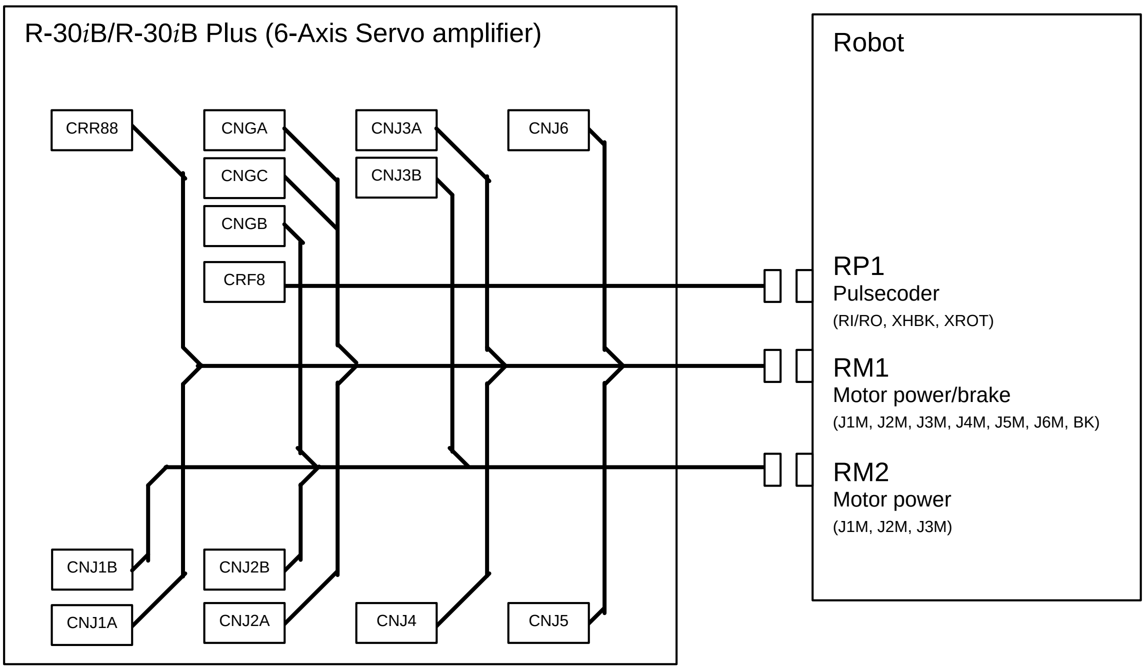


Fig.3.3.1 (b) Robot connection cable (Group3)

Robot Model
Group4:M-900*i*A/150P/260L/350
Detail of cable connection to servo amplifier

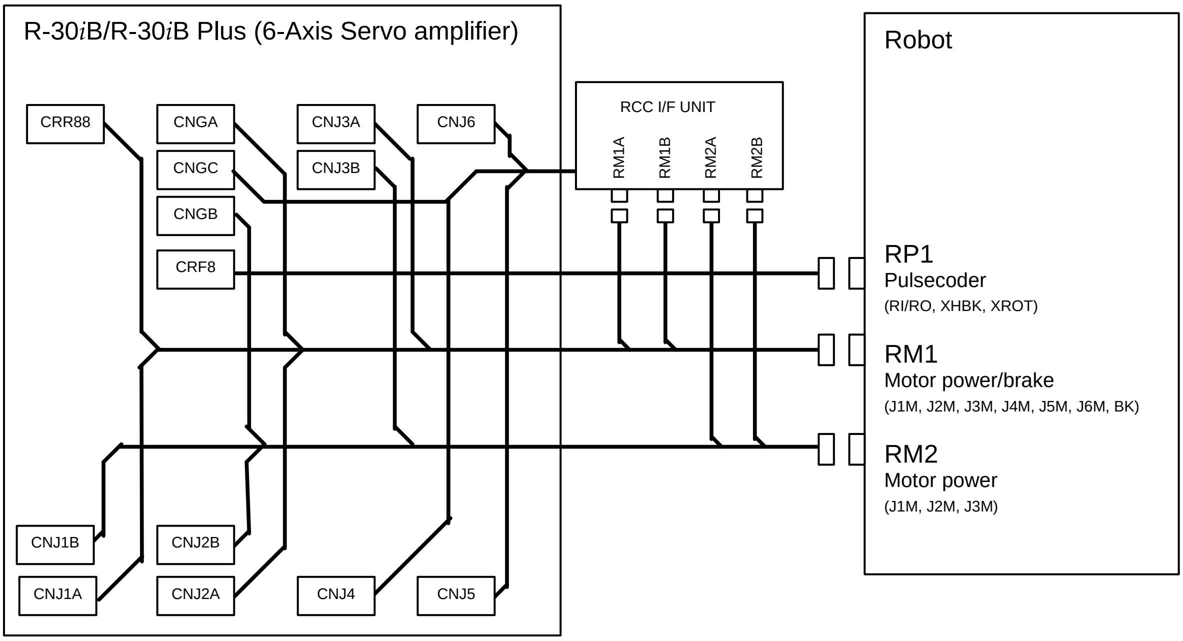


Fig.3.3.1 (c) Robot connection cable (Group4)

Robot Model
Group5:M-900*i*A/400L/600,M-900*i*B/400L/700
Detail of cable connection to servo amplifier

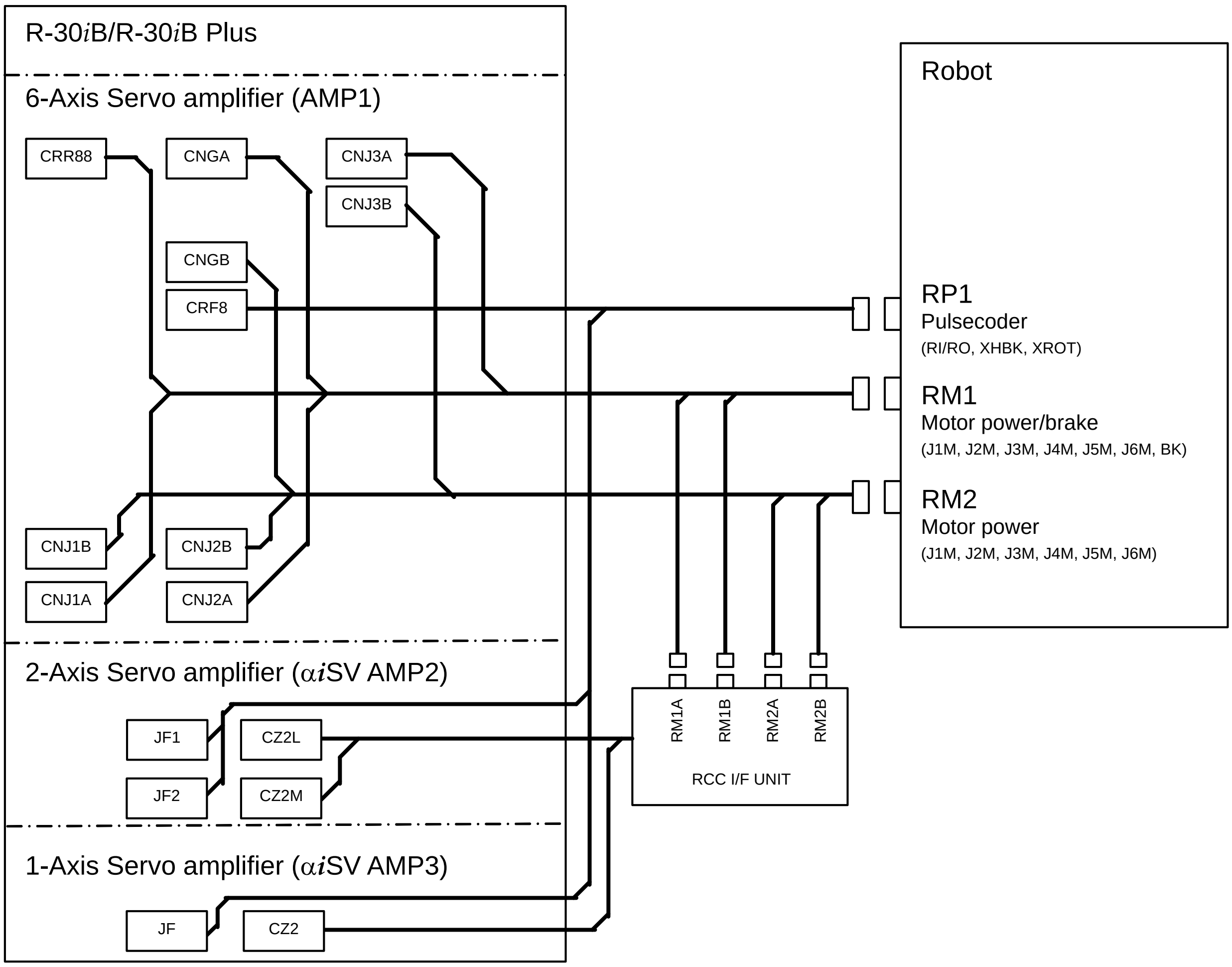


Fig.3.3.1 (d) Robot connection cable (Group5)

Robot Model
Group6:M-430*i*A/2PH/4FH
Detail of cable connection to servo amplifier

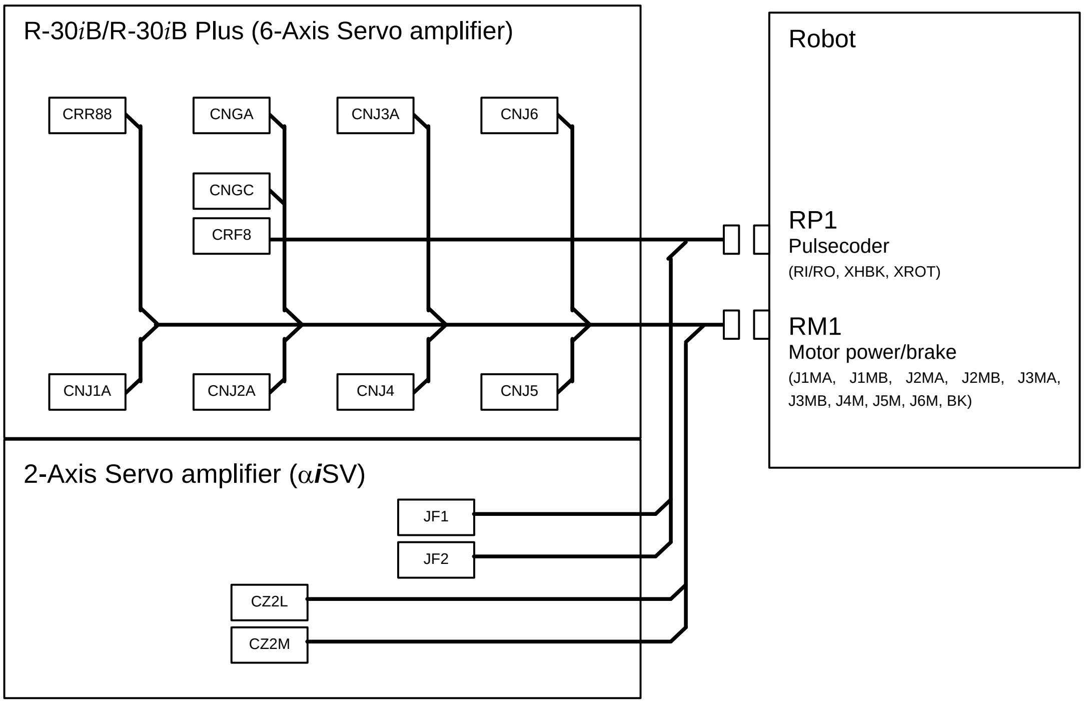


Fig.3.3.1 (e) Robot connection cable (Group6)

Robot Model
Group7:M-430*i*A/2P
Detail of cable connection to servo amplifier

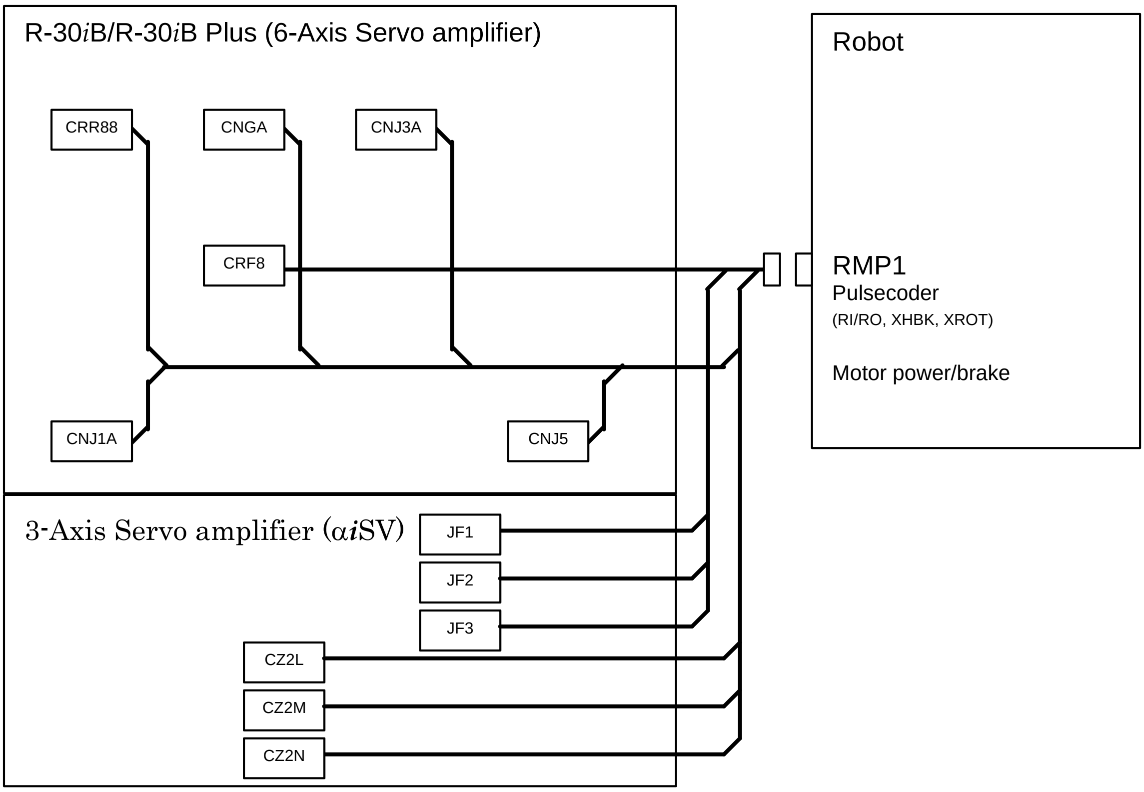


Fig.3.3.1 (f) Robot connection cable (Group7)

Robot Model
Group8:ARC Mate 100*i*C, ARC Mate 120*i*C, M-10*i*A, M-20*i*A, M-20*i*B,CR-35*i*A
Detail of cable connection to servo amplifier

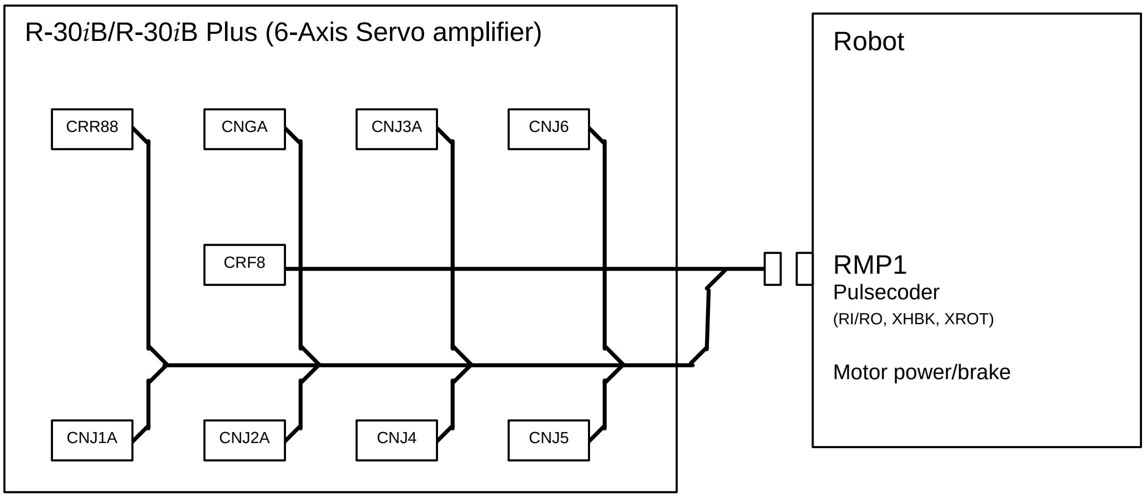


Fig.3.3.1 (g) Robot connection cable (Group8)

Robot Model
Group12:R-1000*i*A/120F-7B
Detail of cable connection to servo amplifier

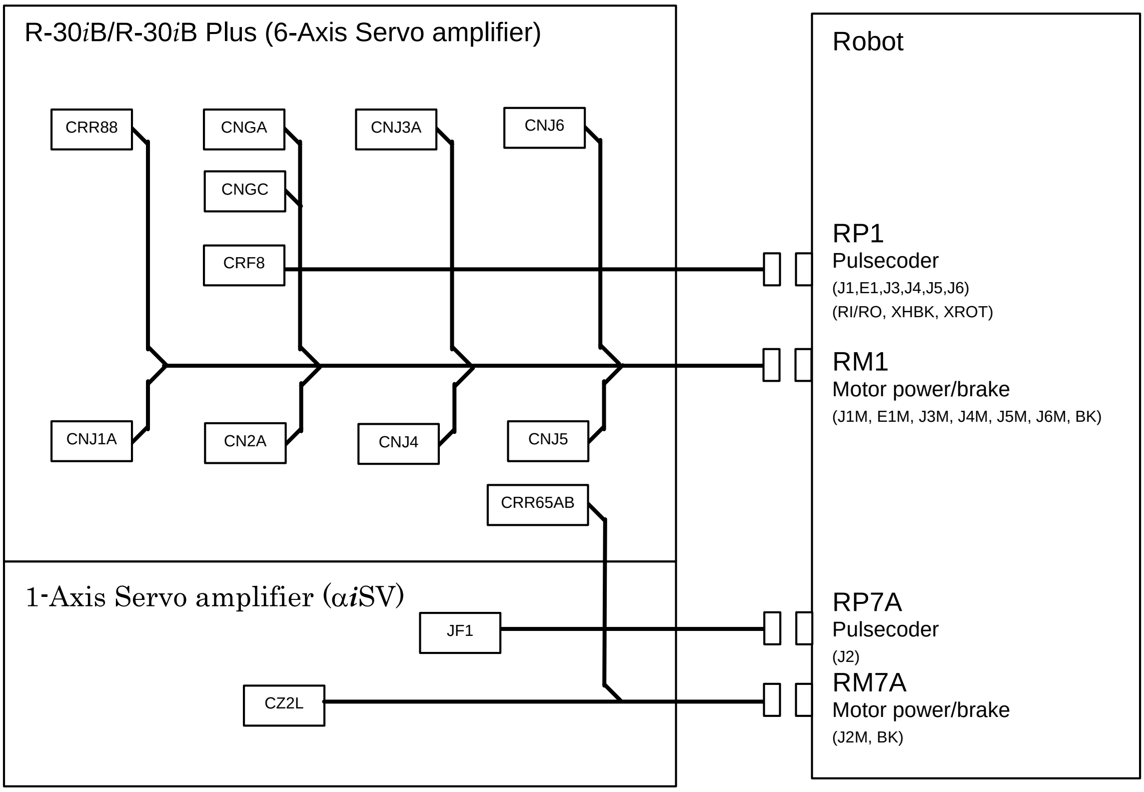
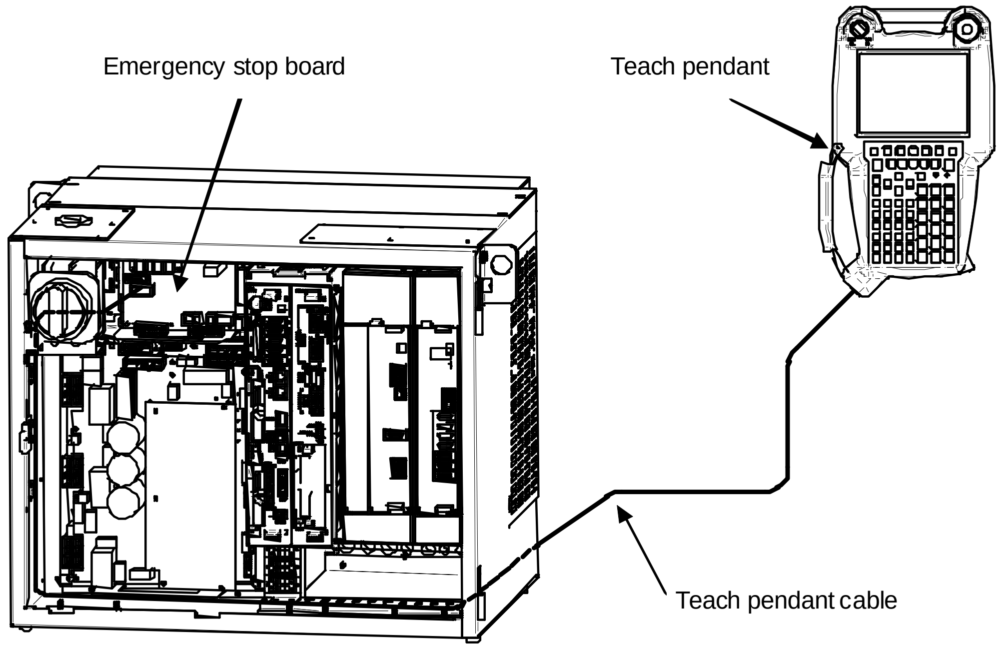
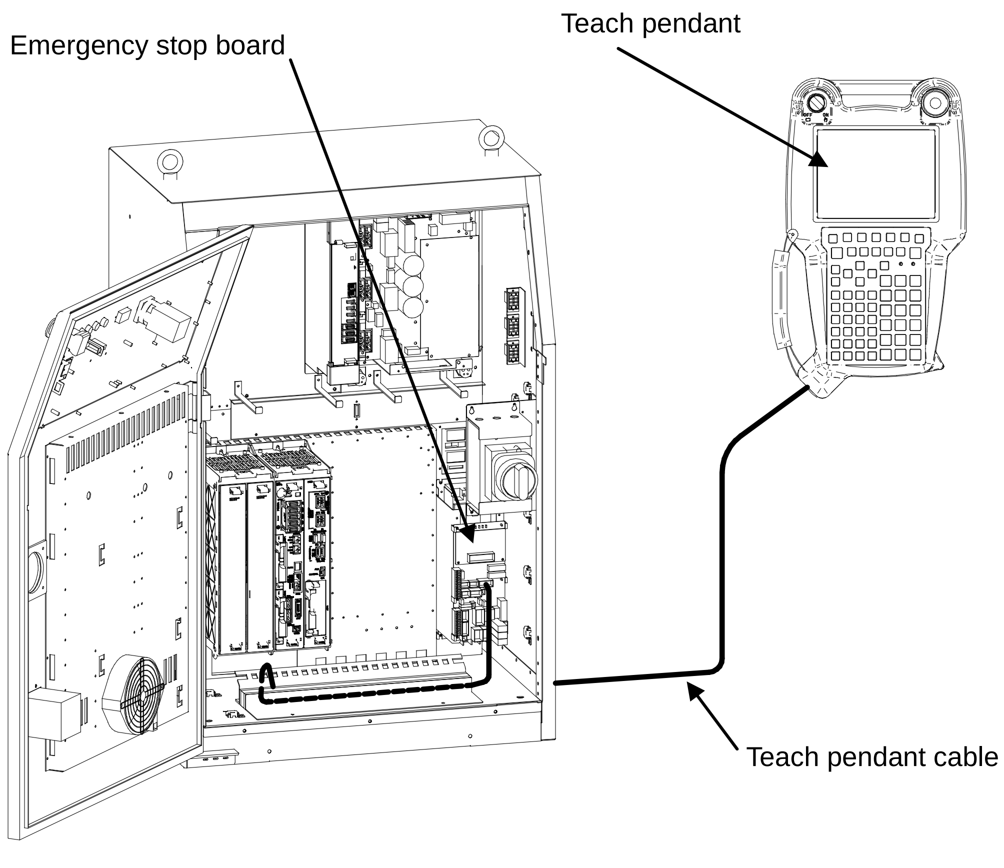


Fig.3.3.1 (h) Robot connection cable (Group12)

3.3.2 Teach Pendant Cable



(A-cabinet)



(B-cabinet)

Fig.3.3.2 Teach pendant cable

3.3.3 Connecting the Input Power

3.3.3.1 Connecting the input power cable

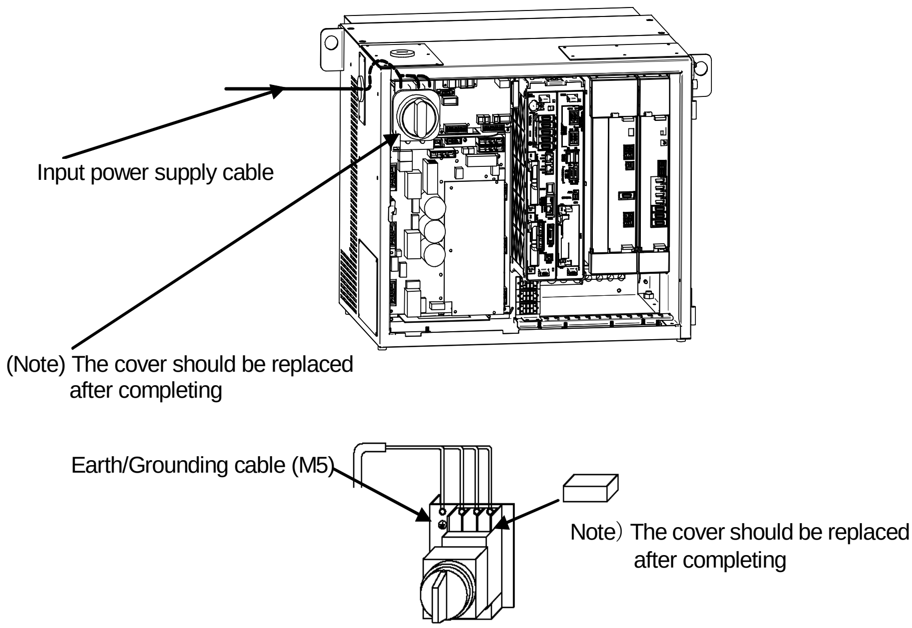
(1) Fig3.3.3.1 shows the method of connecting the input power supply cable.
(2) Use the input power cable according to the following Table 3.3.3.1. However, the input power cable according to the breaker or the fuse of the input power supply (power distribution panel) connected to the robot controller must be used.
(3) Provide a class-D or better ground.
There shall be no switches or disconnects in the grounding conductor.
The resistance to the ground must not exceed 100Ω.
Use a thick wire to withstand the maximum current used.

In case of NRTL controller
Grounding/Bonding to comply with NEC Article 250 or CEC Section 10 as appropriate.
Provide a grounding conductor of equivalent gauge as the supply conductors.

Table 3.3.3.1 Conductor size and terminal size of AC power supply

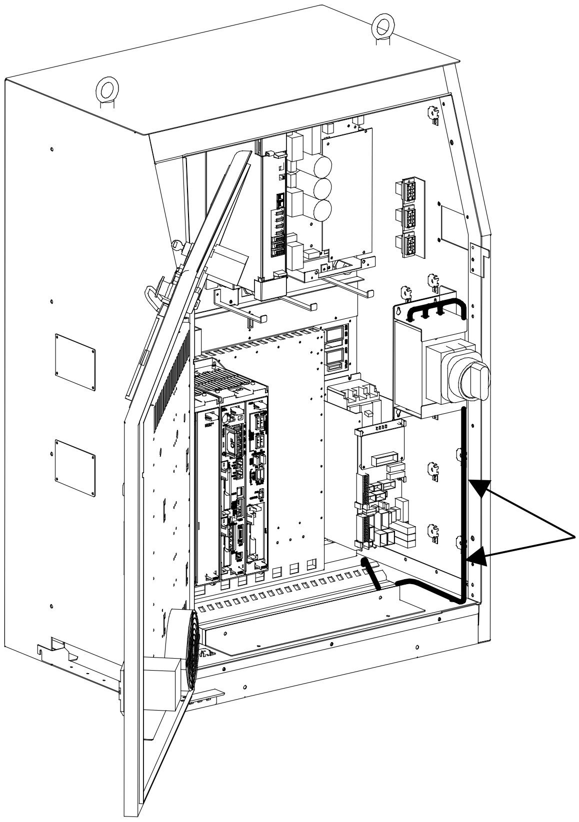
Input Voltage	Input power source capacity (Refer to CONNECTIONS 5.3)	Conductor size of AC Power supply cable	Terminal size of AC power supply cable	Conductor size of earth cable	Terminal size of earth cable
400V	All robot	AWG10 or more (Note 1)	M5	WARNING 2	M5
200V	15KVA or more	AWG8 or more (Note 1)	M8	WARNING 2	M5
200V	12KVA or less	AWG10 or more (Note 1)	M5	WARNING 2	M5

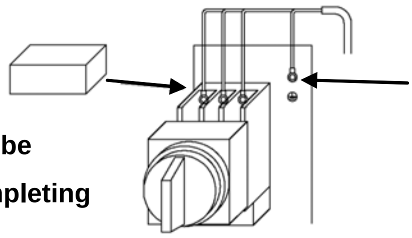
⚠ WARNING
1 The input power cable according to the breaker or the fuse of the input power supply (power distribution panel) connected to the robot controller must be used.
2 Use conductor of earth cable size is as well as the AC power supply cable size.
3 Disconnection of protective earth ground may impair the protection provided by the system.



(A-cabinet)

⚠ **WARNING**
The cover for primary terminal of main breaker should be replaced after completing.





(B-cabinet)

⚠ **WARNING**
The cover for primly terminal of main breaker should be replaced after completing.

Fig.3.3.3.1 Connecting the input power cable

3.3.3.2 Leakage breaker

(1) The motor is driven by the PWM inverter system using a power transistor bridge. A high-frequency leakage current flows through the stray capacitance between the ground and the motor coils, power cable, and amplifier. This might cause the leakage-current circuit breaker or leakage-protection relay installed in the path of the power supply to cut out.
Use the following leakage current circuit breaker for inverters to prevent incorrect operation.
(2) Leakage breaker using robot controller has sensitive electric current of 30mA.

Table 3.3.3.2 Example of leakage current circuit breaker for inverters

Manufacture	Type
Fuji Electric Co., Ltd.	EG A series or later SG A series or later
Hitachi, Ltd.	ES100C type or later ES225C type or later
Matsushita Electric Works, Ltd.	Leakage current circuit breaker, C type or later Leakage current circuit breaker, KC type or later

3.3.3.3 Check input voltage

Setting of transformer tap is necessary depending on the input voltage.
The tap is set to the specified voltage before shipment. However, check it referring to section 6.2 in MAINTENANCE before supplying power (before the breaker switch is turned on).

3.3.3.4 ON/OFF timing by the breaker

If the power supply is turned on, turned off, and then turned on again repeatedly in a short time, the controller may not start up. If the power is turned off before the controller is completely started up (it takes about 30 seconds), wait for at least 10 seconds before turning on the power again.

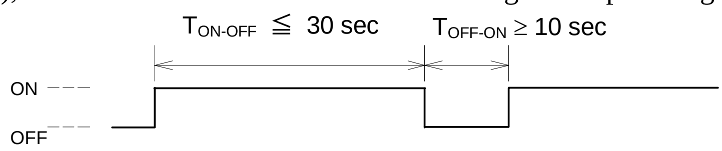
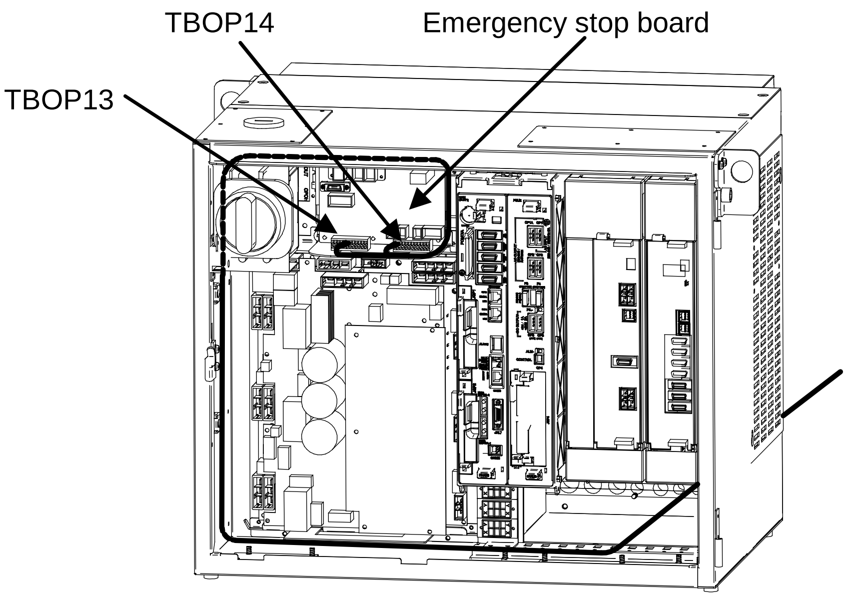
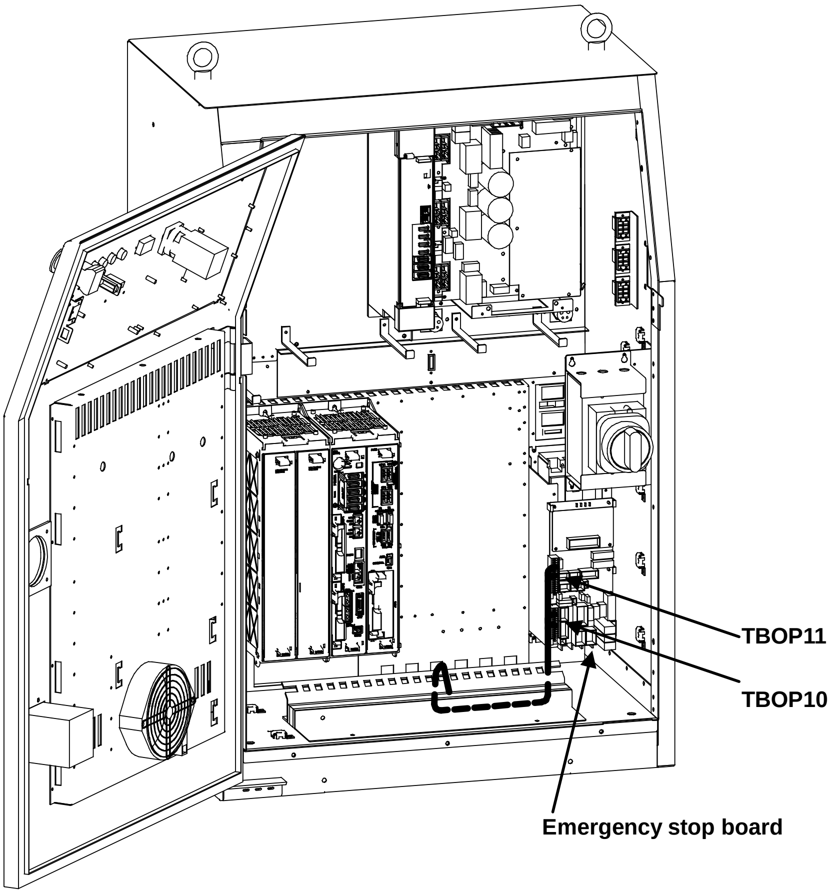


Fig.3.3.3.4 The power is turned off within 30 seconds after it has been turned on

3.3.4 Connecting the External Power Supply ON/OFF Switch

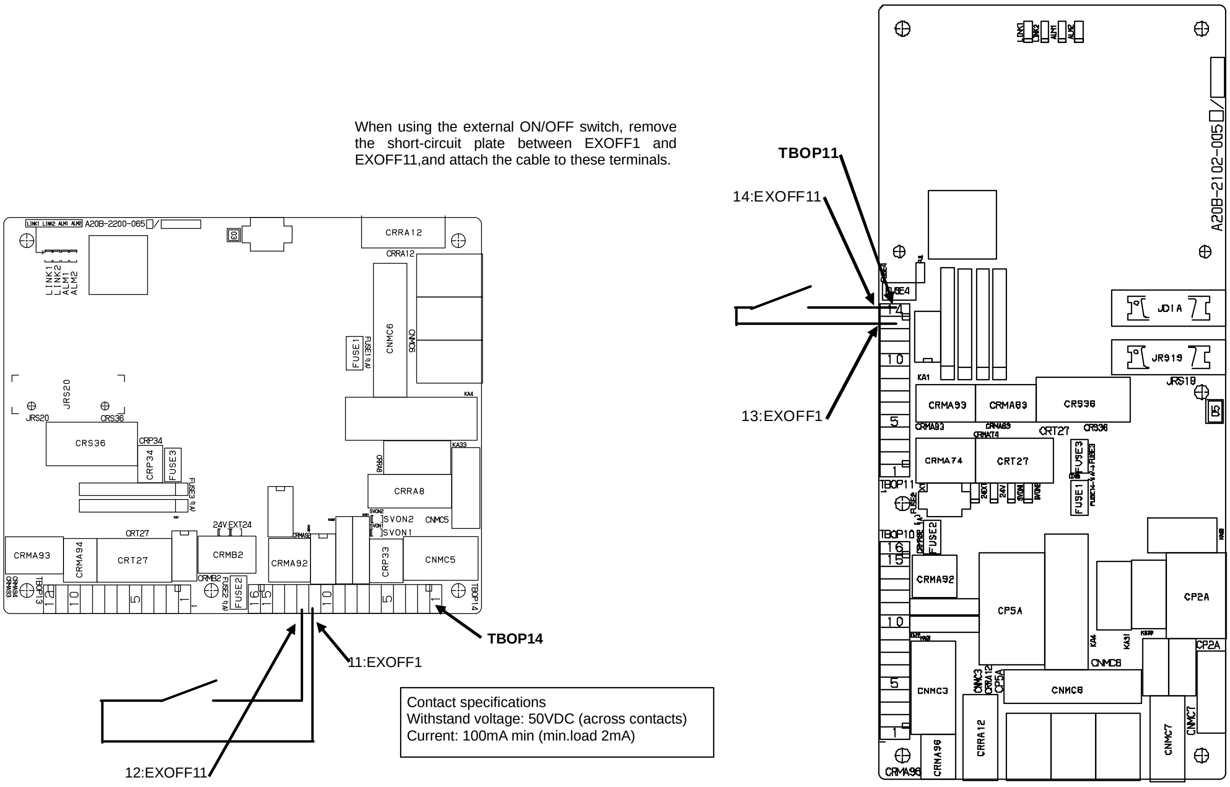


(A-cabinet)



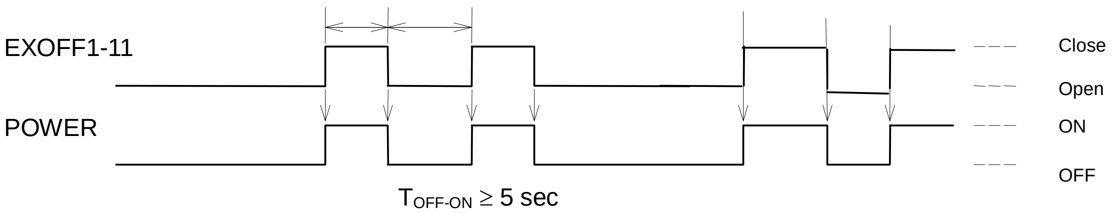
(B-cabinet)

Fig.3.3.4 (a) Connection of the external power supply ON/OFF switch



(A-cabinet) **(B-cabinet)**

Fig.3.3.4 (b) Emergency stop board



> **NOTE**
> 1 When the external power supply ON/OFF switch is set to ON (closed), the controller can be turned on and off by using the circuit breaker.
> 2 When the external power supply ON/OFF switch is set to OFF (open), the controller cannot be turned on and off by using the circuit breaker.

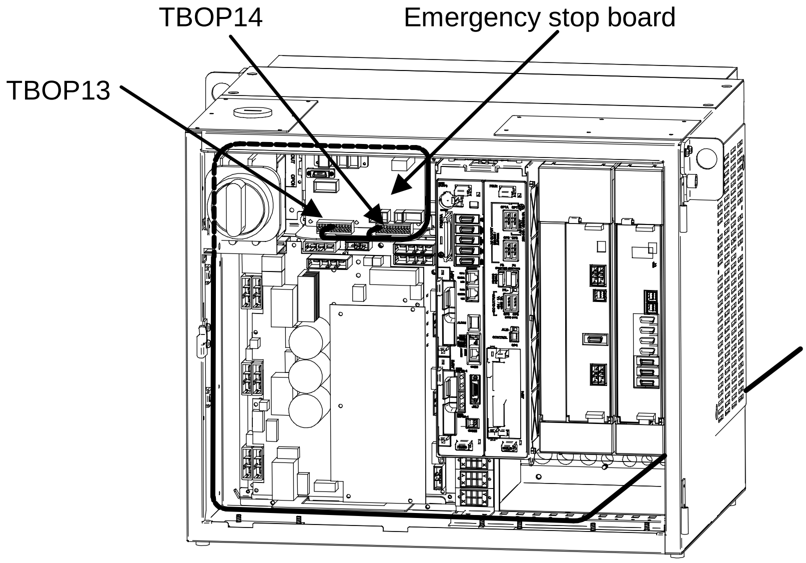
Fig.3.3.4 (c) Connection of the external power supply switch ON and OFF

3.3.5 Connecting the External Emergency Stop

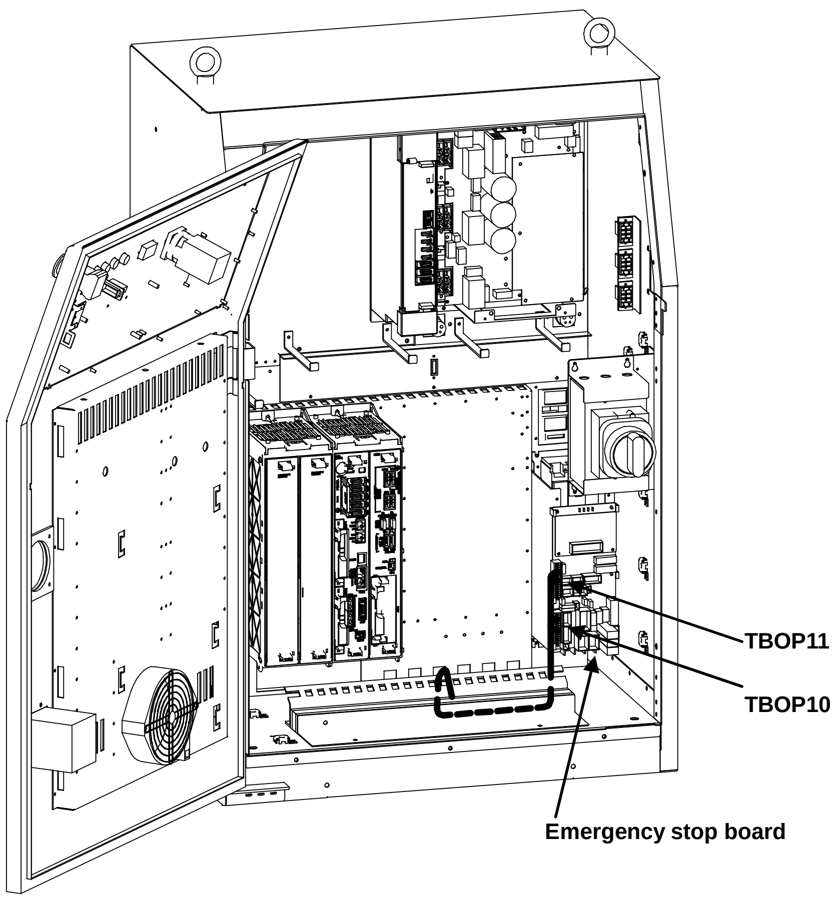
After connecting the safety signals like external emergency stop signal and/or safety fence signal, verify that,

・All safety signals stop the robot as intended.

・There is no mistake in connection of safety signals.



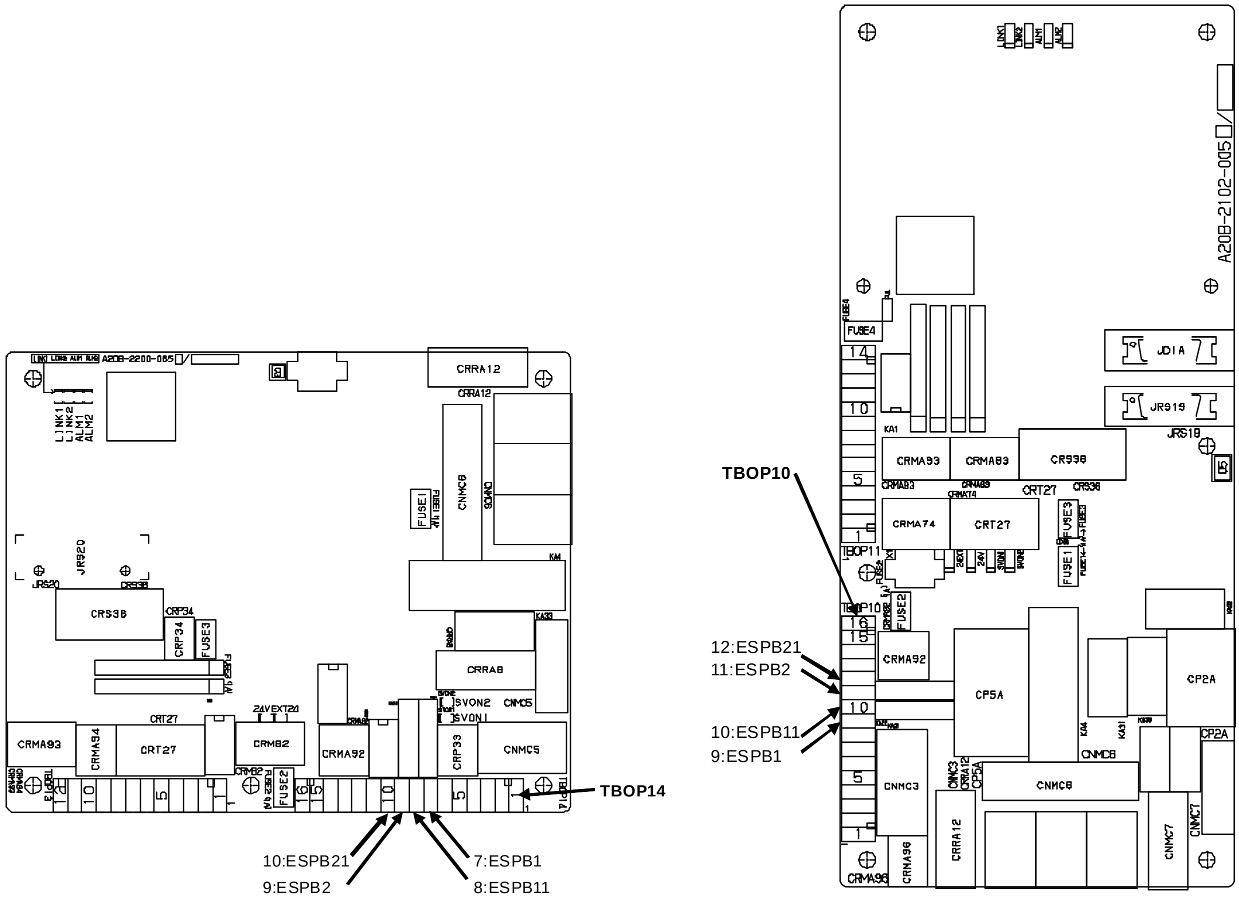
(A-cabinet)



(B-cabinet)

Fig.3.3.5 (a) Connecting the external emergency stop

External emergency stop output

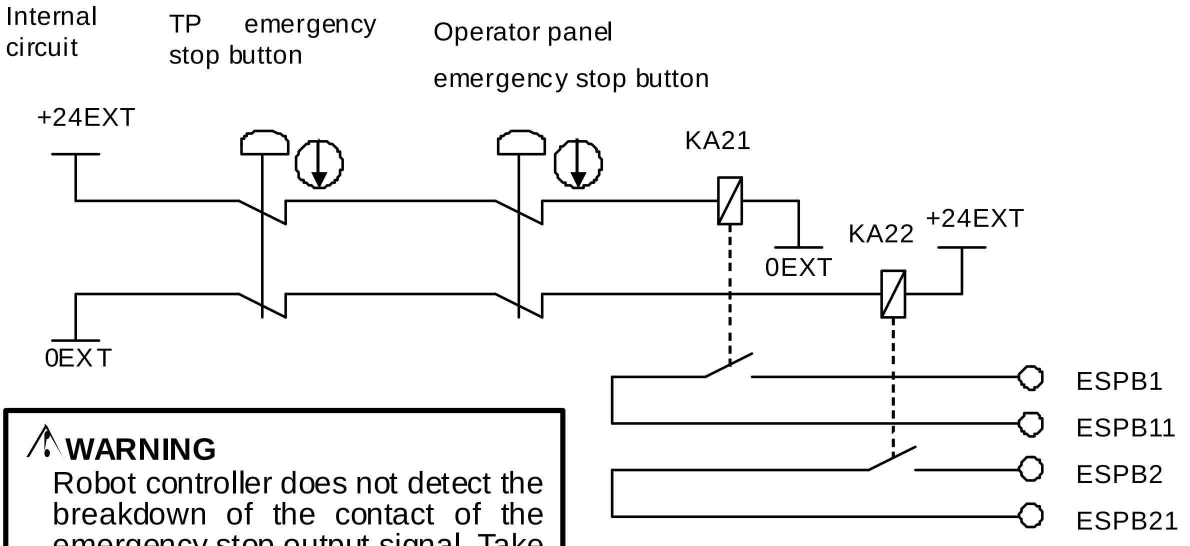


(A-cabinet) **(B-cabinet)**

Fig. 3.3.5 (b) Emergency stop board

For the circuit, see Fig. A (i) (j) (k) (l) in Appendix A, "TOTAL CONNECTION DIAGRAM".

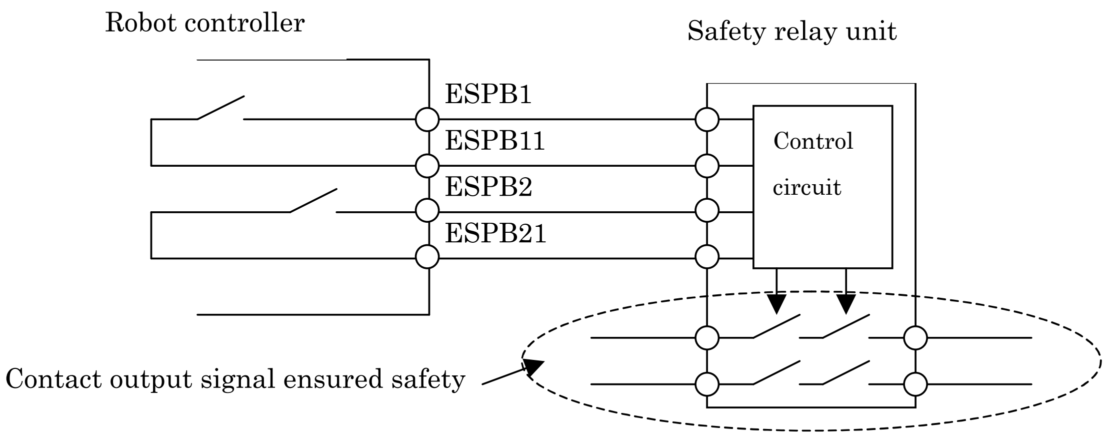
Signal	Description	Current, voltage	Min. load
ESPB1 —— ESPB11 ESPB2 —— ESPB21	The contact is open when one of the TP emergency stop button or the Operator panel emergency stop button is pressed. The contact is also open while the controller is powered off regardless of status of emergency stop buttons. By connecting external power supply to the emergency stop circuit, the contact works even while the robot controller is powered off. (See “External power connection” of this section) The contact is closed during normal operation.	Rated contact: 30 VDC, 5 A resistor load	(Reference value) DC5V 10mA



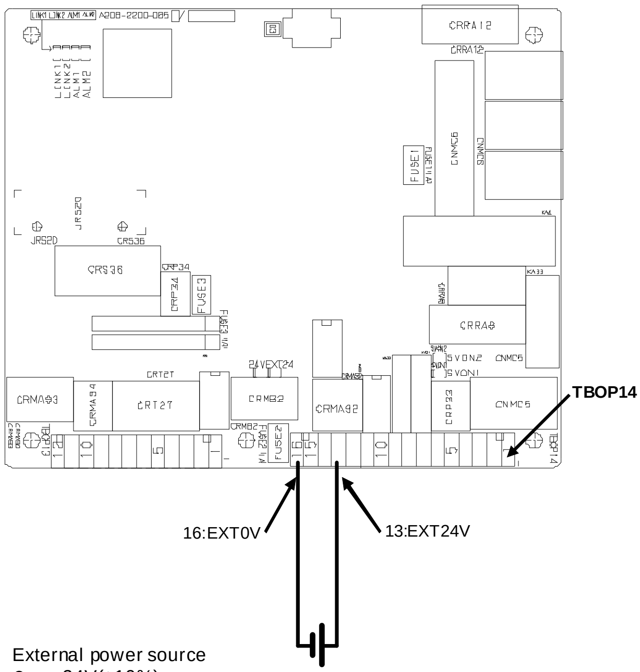
⚠ WARNING

Robot controller does not detect the breakdown of the contact of the emergency stop output signal. Take countermeasures such as inspecting the duplicated contacts, or using a safety relay circuit that can detect the breakdown.

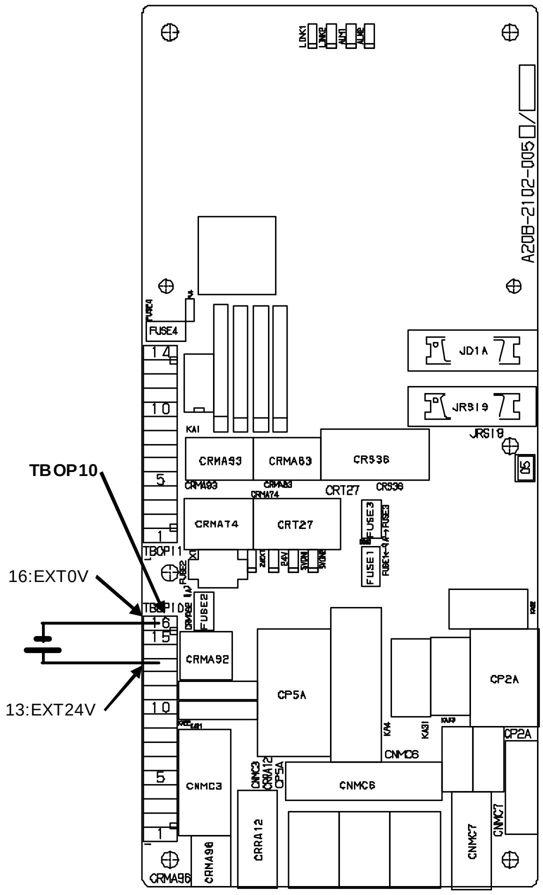
Example of the connection with the safety relay unit



External power connection



External power source
- +24V(±10%)
- More than 300mA
- EMC Compliant(CE mark controller)



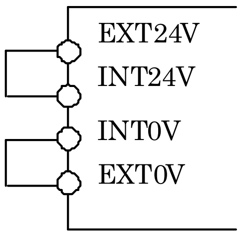
(A-cabinet) **(B-cabinet)**

Emergency stop board

The relays for the emergency stop input and output can be separated from the controller's power. Please connect the external +24V instead of the internal +24V,if the emergency stop output must not affect the controller's power.

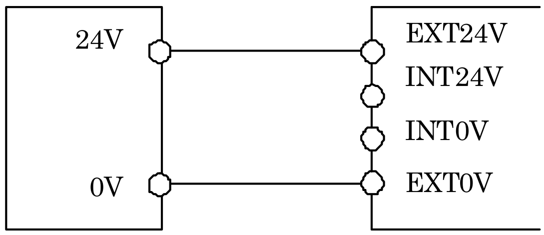
Example of the connection

In case of not using the external power source



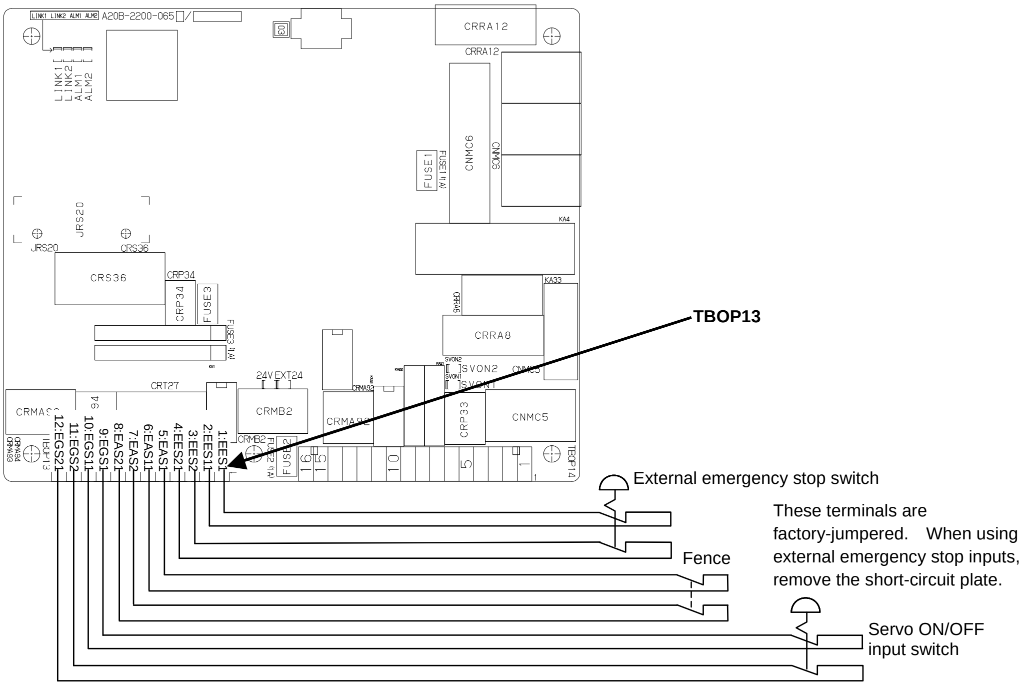
In case of using the external power source

External power source

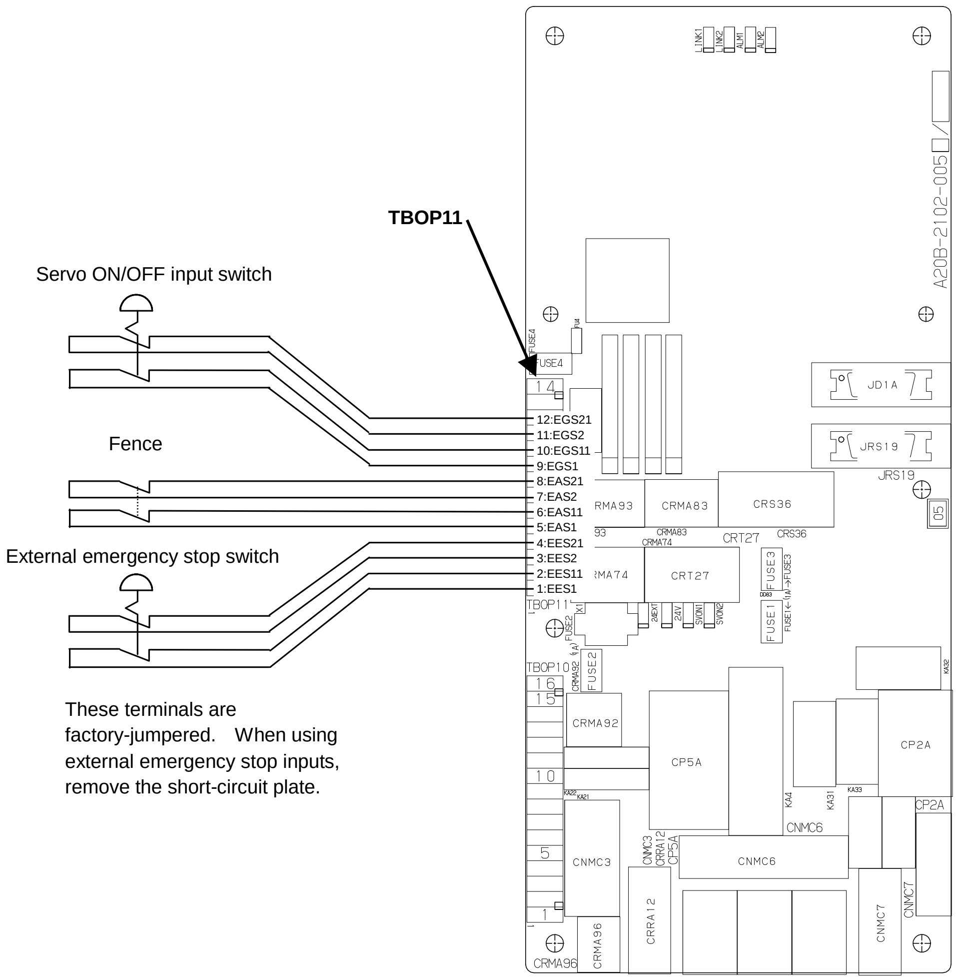


+24V(±10%)
more than 300mA

External emergency stop input



Emergency stop board (A-cabinet)

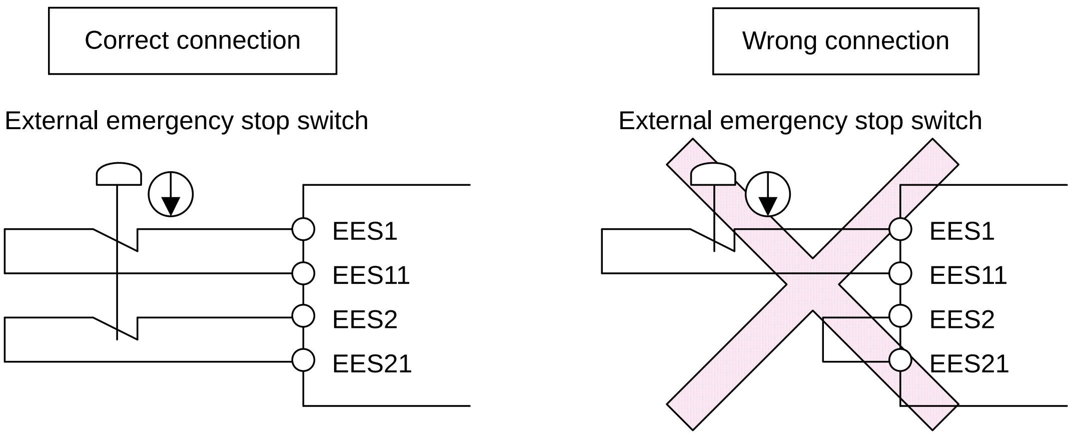


Emergency stop board (B-cabinet)

Signal	Description	Current, voltage
EES1 EES11 EES2 EES21	Connect the contacts of the external emergency stop switch to these terminals. When the contacts are open, the robot stops according to predetermined stop pattern. (Note 2) When using the contacts of a relay or contactor instead of the switch, connect a spark killer to the coil of the relay or contactor, to suppress noise. When these terminals are not used, jumper them.	Open and close of 24VDC 0.1A (Note 1)
EAS1 EAS11 EAS2 EAS21	These signals are used to stop the robot safely when the safety fence gate is opened during operation in the AUTO mode. When the contacts are open in the AUTO mode, the robot stops according to predetermined stop pattern. (Note 2) In the T1 or T2 mode and the DEADMAN switch is held correct position, the robot can be operated even when the safety fence gate is open. When using the contacts of a relay or contactor instead of the switch, connect a spark killer to the coil of the relay or contactor, to suppress noise. When these terminals are not used, jumper them.	Open and close of 24VDC 0.1A (Note 1)
EGS1 EGS11 EGS2 EGS21	Connect the contacts of the servo-off input switch to these terminals. . When the contacts are open, the robot stops according to predetermined stop pattern. (Note 2) When using the contacts of a relay or contactor instead of the switch, connect a spark killer to the coil of the relay or contactor, to suppress noise. When these terminals are not used, jumper them.	Open and close of 24VDC 0.1A (Note 1)

NOTE
1. Use a contact which minimum load is 5 mA less.
2. See Chapter 7 in SAFETY PRECAUTIONS.

Examples of connection of duplicate safety signals



Discrepancy in duplicate inputs results in an alarm.

Input timing of duplicate safety signals

Duplicate inputs are used for signals such as the external emergency stop signal, safety fence signal, and servo off signal so that a response is made even when a single failure occurs. The statuses of these duplicate input signals must always be changed at the same timing according to the timing specifications provided in this section. The robot controller always checks that the statuses of the duplicate inputs are the same, and if the controller finds a discrepancy, it issues an alarm. If the timing specifications are not satisfied, an alarm may be issued because of a signal discrepancy.

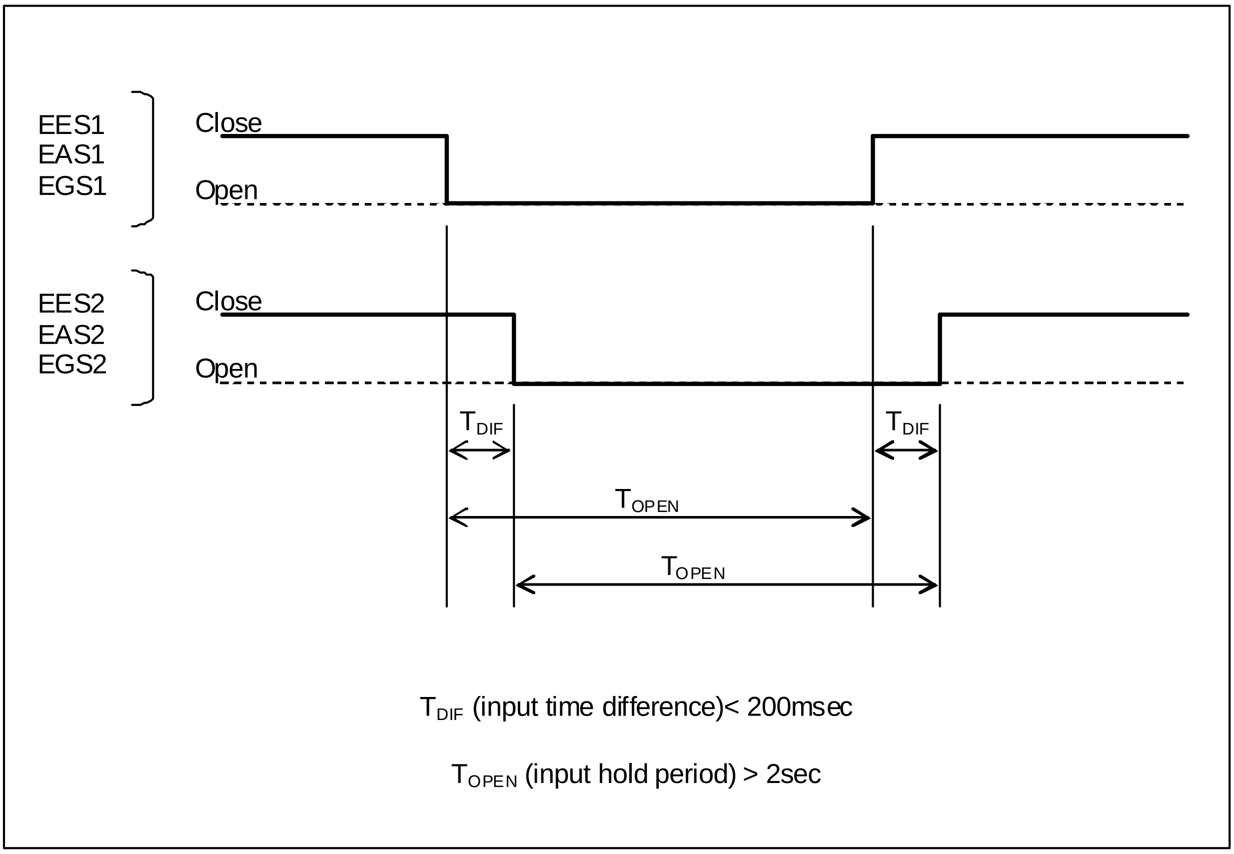


Fig.3.3.5(c) Input timing of duplicate safety signals

Connecting external on/off and external emergency stop signal input/output wires

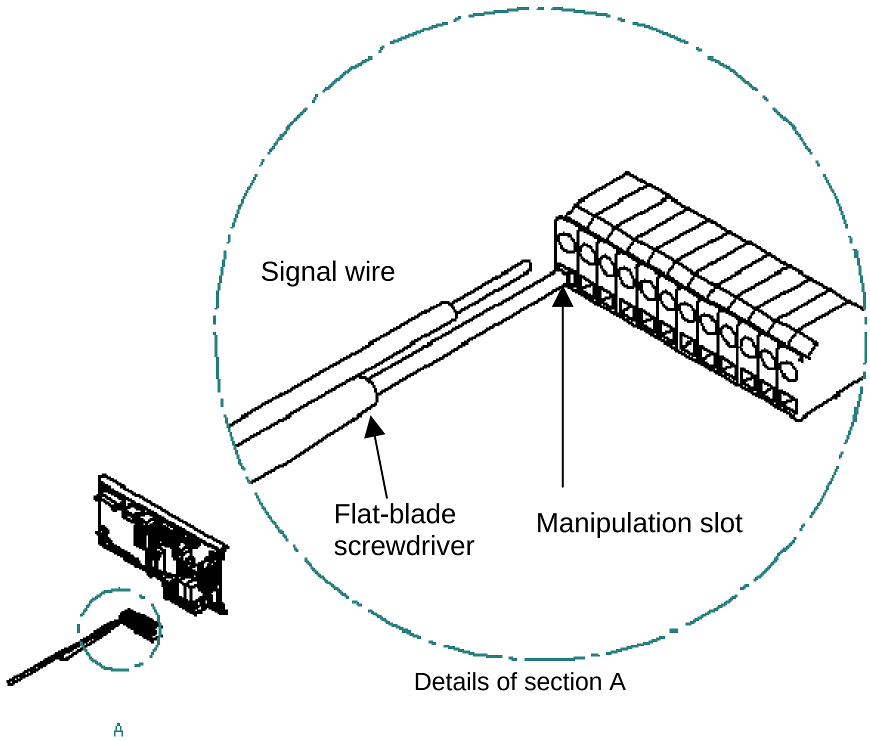
	FANUC's specification	Manufacturer's specification (WAGO)	Remark
16-pole terminal block (TBOP14:A-cabinet) (TBOP10:B-cabinet)	A63L-0002-0154#116	734-116	
14-pole terminal block (TBOP11:B-cabinet)	A63L-0002-0154#114	734-114	
12-pole terminal block (TBOP13:A-cabinet)	A63L-0002-0154#112	734-112	
Operation lever	A63L-0002-0154#230-M	734-230	2 pieces of 734-230 and operation manual are included in FANUC's specification

1. Detach the plug connector block from the emergency stop board.
2. Use the lever or insert the tip of a flat-blade screwdriver into the manipulation slot and push down its handle.

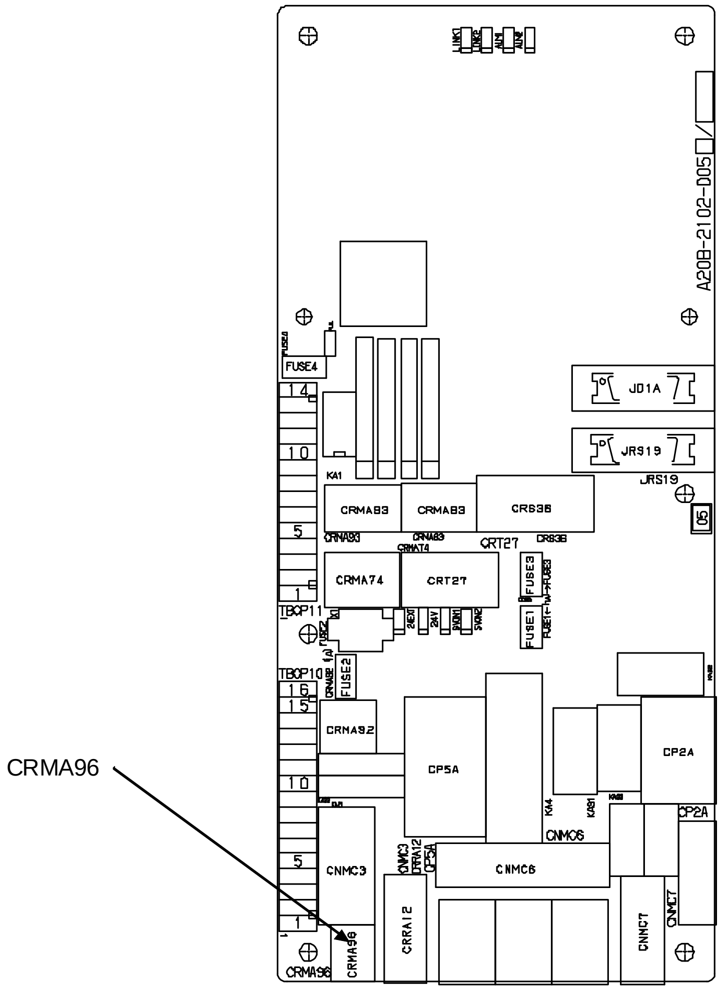
3. Insert the end of the signal wire into the wire slot.
4. Pull out the lever or screwdriver.
5. Attach the plug connector block to the emergency stop board.

> ⚠ **CAUTION**
> Do not insert a wire into the wire hole of a plug connector or pull it out with the plug connector block mounted on the emergency stop board; otherwise, the emergency stop board may be damaged.

FANUC recommends the lever (A05B-2600-K030) for connecting the signal wire to the plug connector block instead of Flat-blade screwdriver.



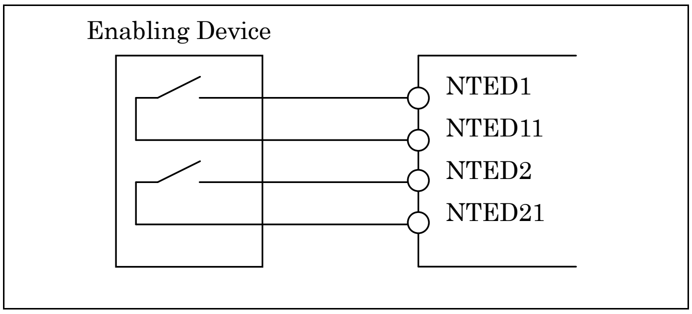
3.3.6 Connecting the Non-Teaching Enabling (NTED) Signal (CRMA96)(For B-cabinet)



Emergency stop board (B-cabinet)
Fig.3.3.6 Connecting the NTED Signal (B-cabinet)

NTED provides a way to connect an external enabling device to the robot. In the auto mode, robot moves without reference to the state of the switch connected with NTED signal. CRMA96 connector is provided in B-cabinet.
Refer to “APPENDIX A, Total connection Diagram Fig.A (i) (j) (k) (l)” about NTED circuit.
Input timing of NTED signal must comply with rules in the section “Input timing of duplicate safety signals”.

⚠ **CAUTION**
After connecting a NTED switch, be sure to check the operation of this switch, the emergency stop button on the operator’s panel, and the emergency stop button on the teach pendant.



CRMA96 connector

A1	NTED1	B1	NTED11
A2	NTED2	B2	NTED21
A3	(DM1)	B3	(DM2)

CRMA96 connector Specification

	TE Connectivity Specification	FANUC Specification
Rece-housing	1-1318119-3	A63L-0001-0812#R06DX
Rece-contact(AWG18-22)	1318107-1	A63L-0001-0812#CRM

3.3.7 Connecting the Auxiliary Axis Brake (CRR65 A/B)

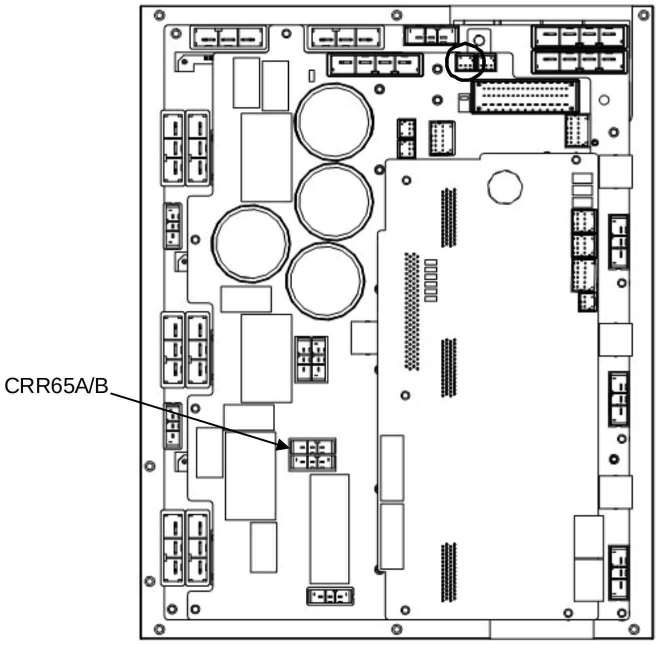


Fig.3.3.7 6-axis servo amplifier

CRR65 A/B

A1	BKA1	B1	BKA2
A2		B2	
A3	COMMON	B3	COMMON

Specification

	TE Connectivity Specification	FANUC Specification
Rece-housing	1-178128-3	A63L-0001-0460#032KSX
Rece-contact	175218-2	A63L-0001-0456#ASL

3.3.8 Connecting the Auxiliary Axis Over Travel (CRM68)

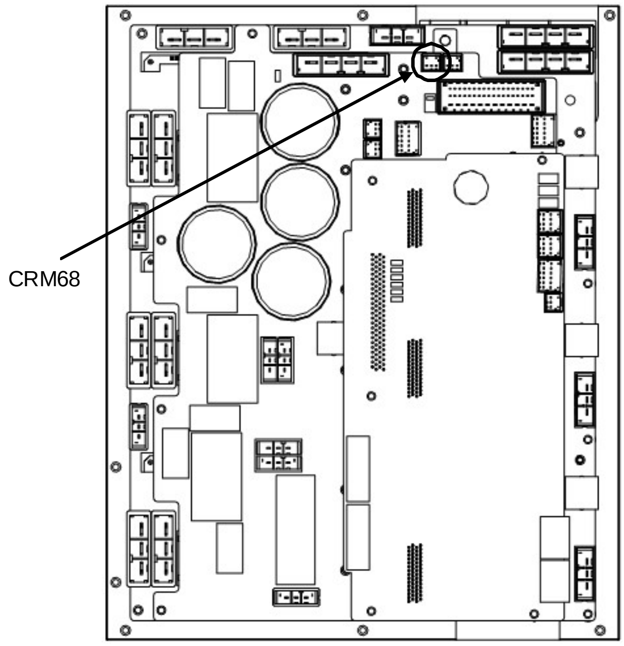


Fig.3.3.8 6-axis servo amplifier

CRM68

A1	AUXOT1
A2	AUXOT2
A3	

Specification

	TE Connectivity Specification	FANUC Specification
Rece-housing	1-1318120-3	A63L-0001-0812#R03SX
Rece-contact	1318107-1	A63L-0001-0812#CRM

4 PERIPHERAL DEVICE, ARC WELDING, AND EE INTERFACES

R-30*i*B/R-30*i*B Plus I/O peripheral device interfaces include printed circuit boards and a unit selected according to the applications. Table 4 lists details of the printed-circuit boards and units. Figure 4 shows the locations of these boards and units.

Table 4 Peripheral device interface types

No.	Name	Drawing number	Number of I/O points				Remarks
			DI	DO	D/A	A/D	
1	Process I/O board JA	A05B-2600-J001	96	96 (Source type)	0	0	Installed in back plane
2	Process I/O board JB	A05B-2600-J002	40	40 (Source type)	0	0	Installed in back plane
3	Process I/O board MA	A05B-2600-J020	20	16 (Source type)	0	0	Installed in A-cabinet
4	Process I/O board KA	A05B-2600-J010	40	40 (Source type)	3	2	Installed in A-cabinet top box
5	Process I/O board KB	A05B-2600-J011	40	40 (Source type)	2	0	Installed in A-cabinet top box
6	I/O Unit-MODEL A	A05B-2601-J130 (Base and interface unit)	Depending on selected I/O module.				A-cabinet (five slots)
		A05B-2603-J130 (Base and interface unit)					B-cabinet (five slots)

No.	Name	Drawing number	Number of I/O points				Remarks
			WI	WO	D/A	A/D	
7	Process I/O board MB	A05B-2600-J021	5	4 (Sink type)	2	0	Installed in A-cabinet

NOTE

1 General purpose I/O (DI/DO) is a number, which subtract an exclusive signal from the table value.
Example: Process I/O board JB
Table value Exclusive DI General purpose DI
DI;40 -18=22 points
Table value Exclusive DO General purpose DO
DO;40 -20=20 points

2 When there are slave units on the I/O Link and the power for control to these slave units is supplied from other than the robot controller, the power to the controller and the power to the slave units must be turned on and off at the following timings:
a) The power to the slave units must be turned on before or when the power to the controller, which is the master of the I/O Link, is turned on.
b) If the power to a slave unit is turned off after the system has started up, an I/O Link error occurs. To establish the I/O Link again, turn off the power to all units including the controller, then turn on the power to the units in the order described in a).

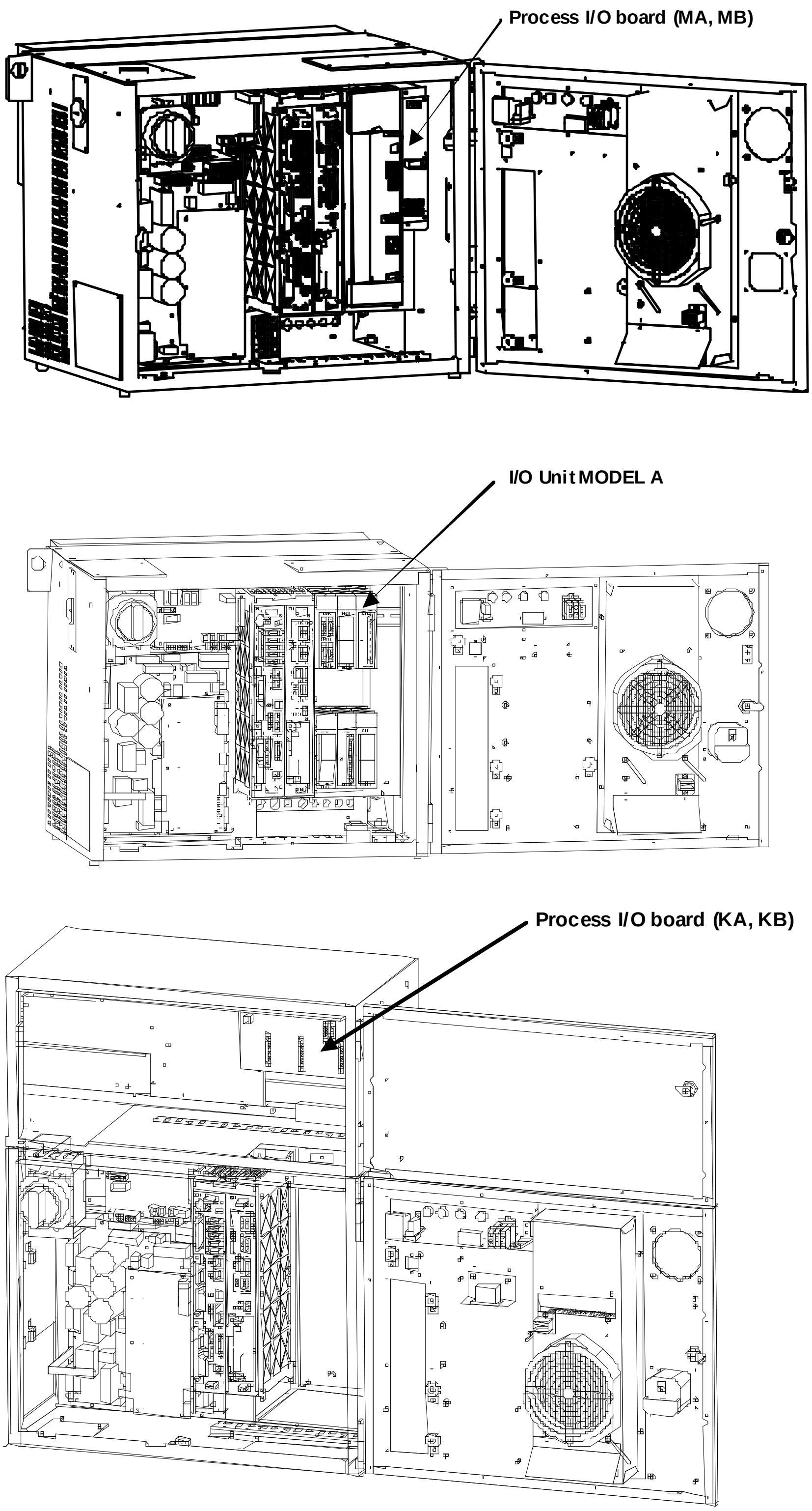


Fig.4(a) Locations of peripheral device interfaces (A-cabinet)

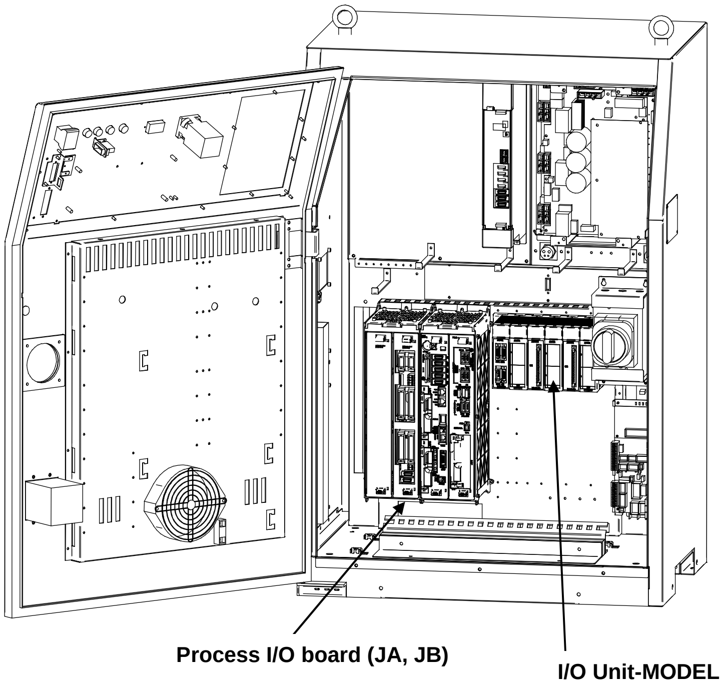


Fig.4(b) Locations of peripheral device interfaces (B-cabinet)

4.1 PERIPHERAL DEVICE INTERFACE BLOCK DIAGRAM

Following are a block diagram of the peripheral device interface and the specifications.

4.1.1 When Process I/O Board JA/JB is Used (B-cabinet)

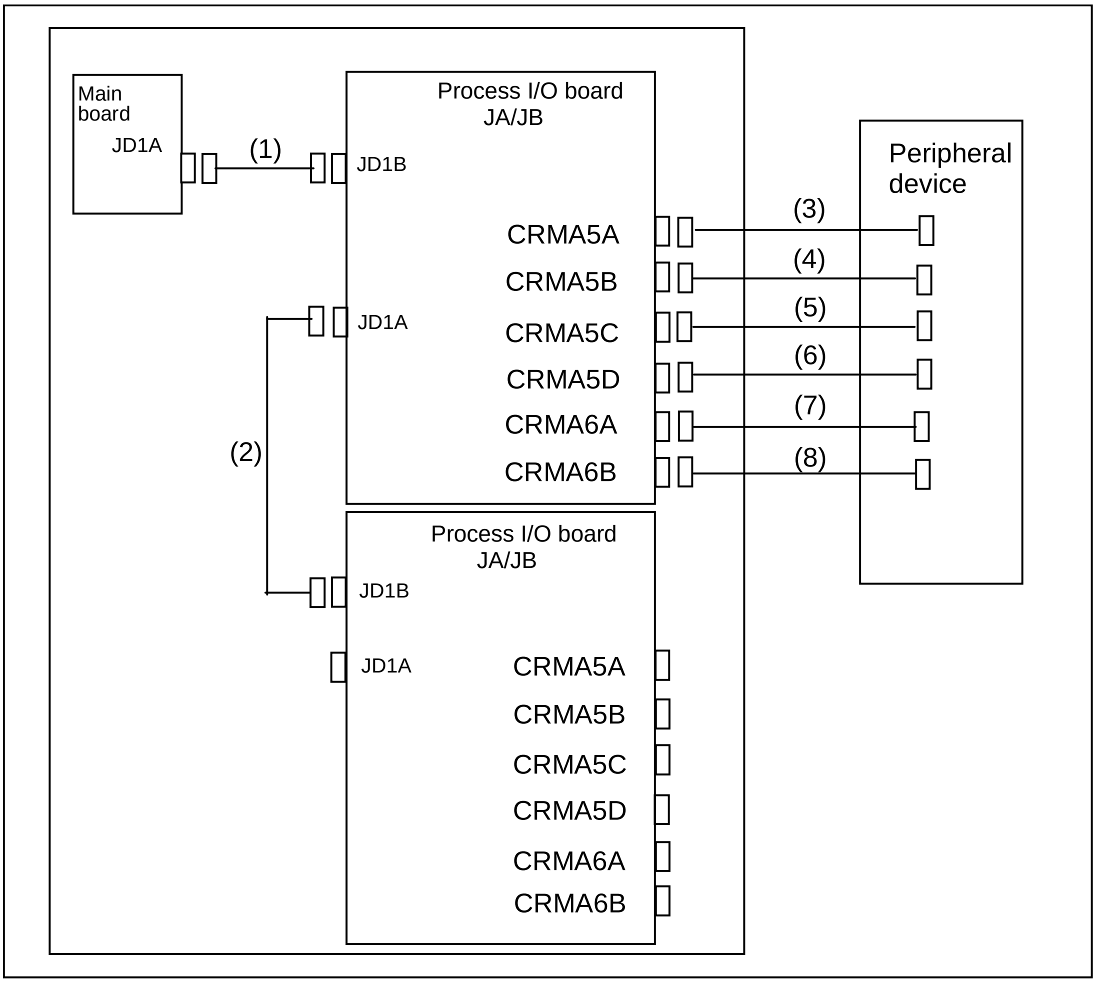


Fig.4.1.1 Block diagram of the process I/O board JA/JB

> **NOTE**
> The process I/O board JB does not have CRMA5C, CRMA5D, CRMA6A, and CRMA6B.

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	A05B-2603-J170	Between main board and process I/O
(2)	I/O Link cable	A05B-2603-J171	Between process I/O and process I/O
(3) (4) (5) (6)	Peripheral device connection cable (Process I/O JA, JB)	A05B-2603-J200	Connected length: 10m (one)
		A05B-2603-J201	Connected length: 20m (one)
		A05B-2603-J202	Connected length: 30m (one)
(7) (8)	Peripheral device connection cable (Process I/O JA)	A05B-2603-J203	Connected length: 10m (one)
		A05B-2603-J204	Connected length: 20m (one)
		A05B-2603-J205	Connected length: 30m (one)

4.1.2 When Process I/O Board MA is Used (A-cabinet)

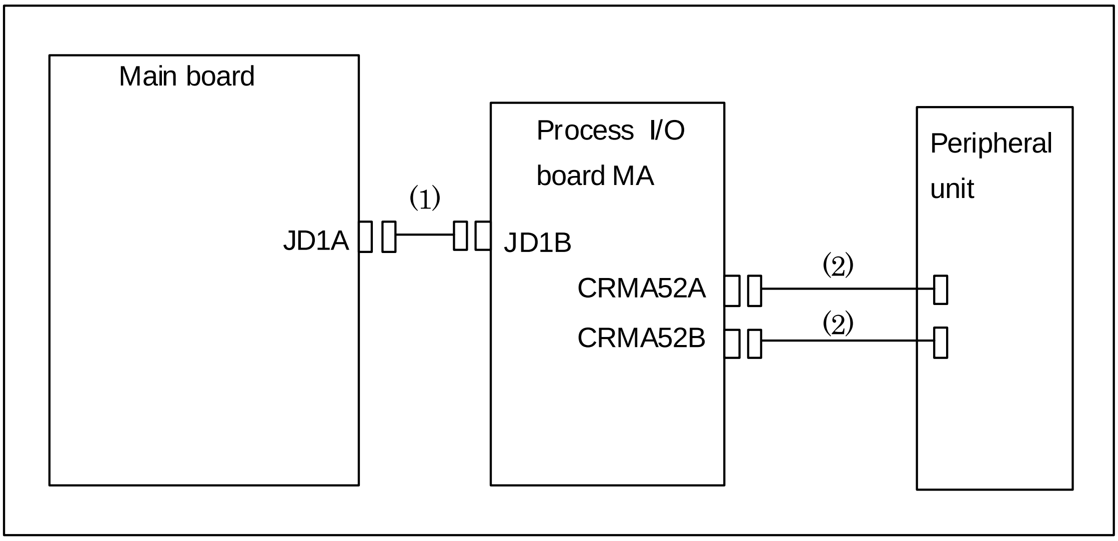


Fig.4.1.2 Block diagram of the process I/O MA

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	A05B-2601-J172	
(2)	Peripheral device cable	A05B-2601-J240	Connection length 10m (one): CRMA52
		A05B-2601-J241	Connection length 20m (one): CRMA52
		A05B-2601-J242	Connection length 30m (one): CRMA52

4.1.3 When Process I/O Board MB is Used (A-cabinet)

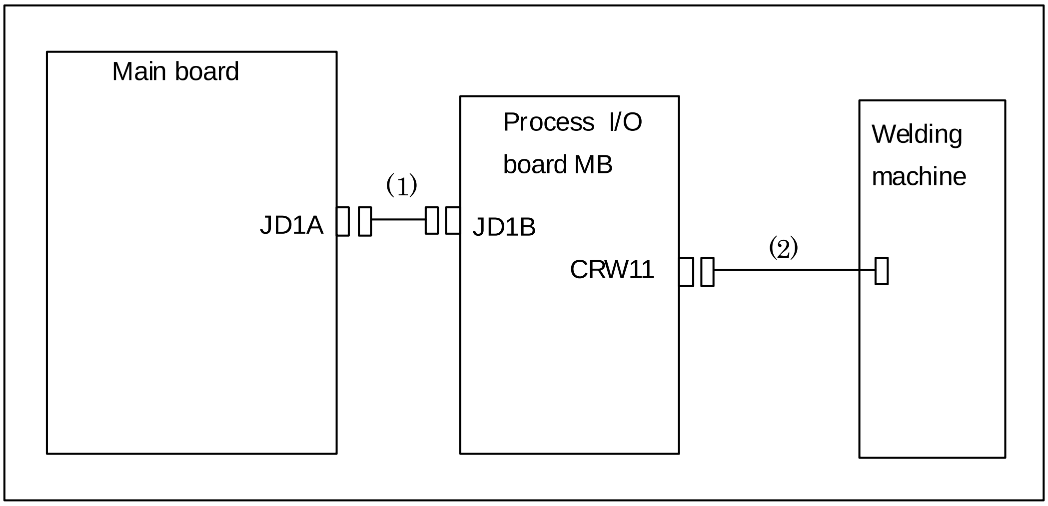


Fig.4.1.3 Block diagram of the process I/O MB

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	A05B-2601-J174	
(2)	Welding machine connection cable (FANUC interface/elbow type)	A05B-2601-J246	Connection length 3m (one): CRW11
		A05B-2601-J247	Connection length 7m (one): CRW11
		A05B-2601-J248	Connection length 14m (one): CRW11
	Welding machine connection cable (FANUC interface/straight type)	A05B-2601-J250	Connection length 3m (one): CRW11
		A05B-2601-J251	Connection length 7m (one): CRW11
		A05B-2601-J252	Connection length 14m (one): CRW11

4.1.4 When Process I/O Board KA/KB is Used (A-cabinet)

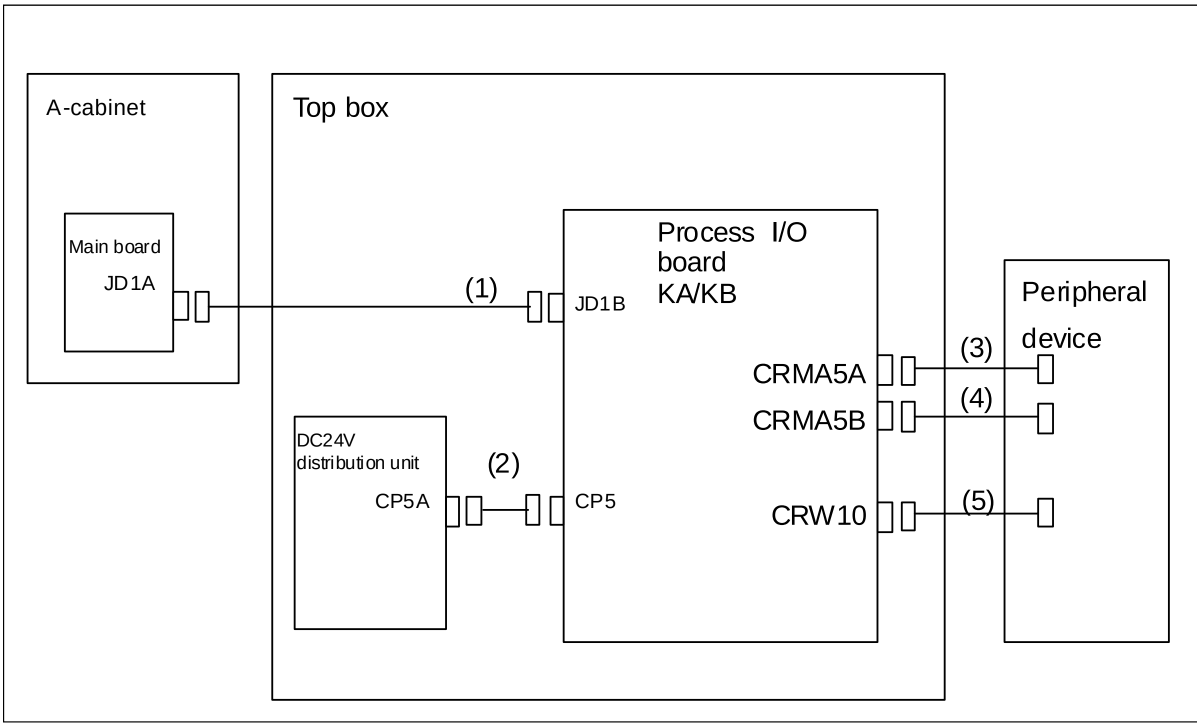


Fig.4.1.4 Block diagram of the process I/O board KA/KB

Integrated type

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	A05B-2601-H180	
(2)	Process I/O cable		
(3) (4)	Peripheral device connection cable	A05B-2601-J230	Connection length of 10 m (one)
		A05B-2601-J231	Connection length of 20 m (one)
		A05B-2601-J232	Connection length of 30 m (one)
(5)	Welding machine connection cable (For process I/O board KA, KB) (FANUC interface/elbow type)	A05B-2601-J235	Connection length of 3 m (one), CRW10
		A05B-2601-J236	Connection length of 7 m (one), CRW10
		A05B-2601-J237	Connection length of 14 m (one), CRW10

4.1.5 When I/O Unit-MODEL A is Used

4.1.5.1 In case of A-cabinet

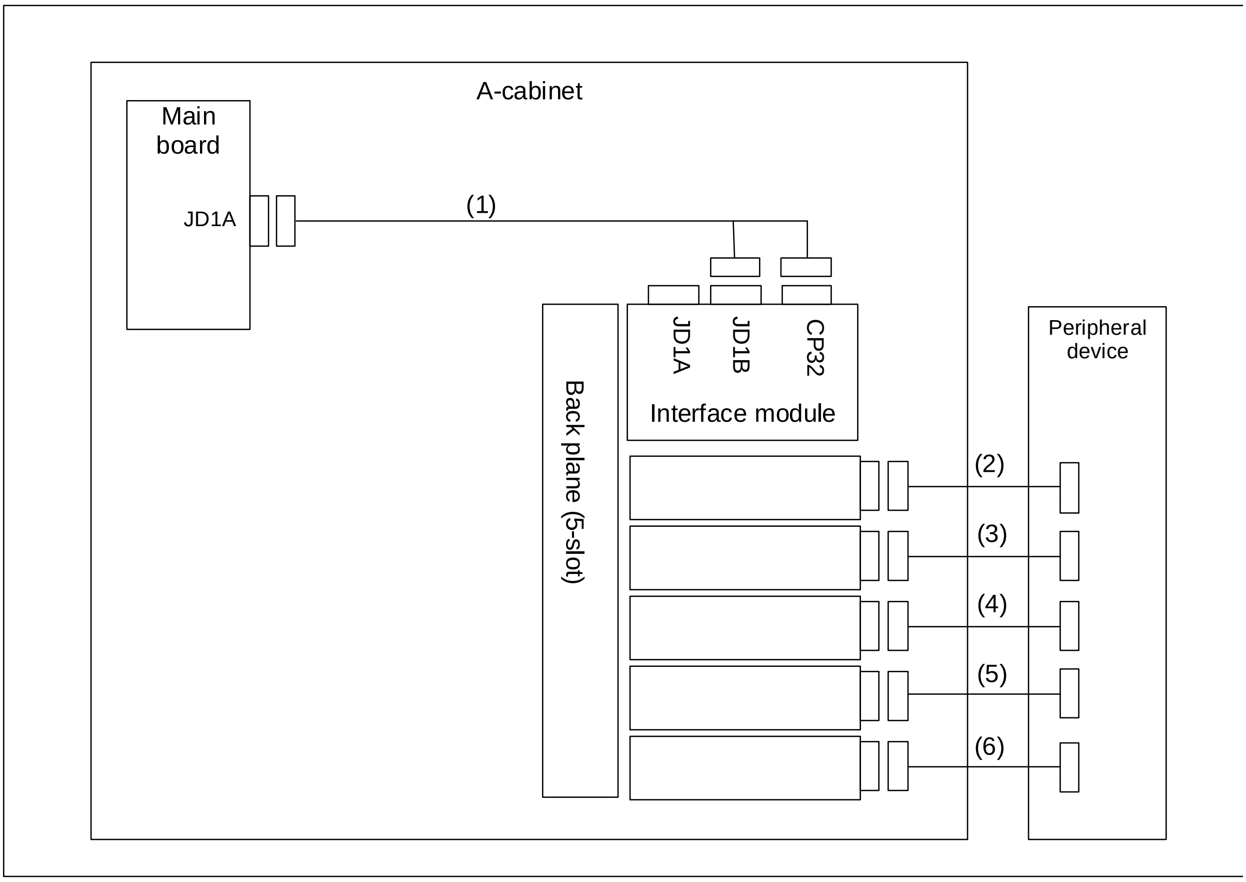


Fig.4.1.5.1 Block diagram of I/O Unit-MODEL A (In case of A-cabinet)

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	-	Included in (A05B-2601-J130)
(2)-(6)	Peripheral device cable	-	Must be supplied by the customer.

4.1.5.2 In case of B-cabinet

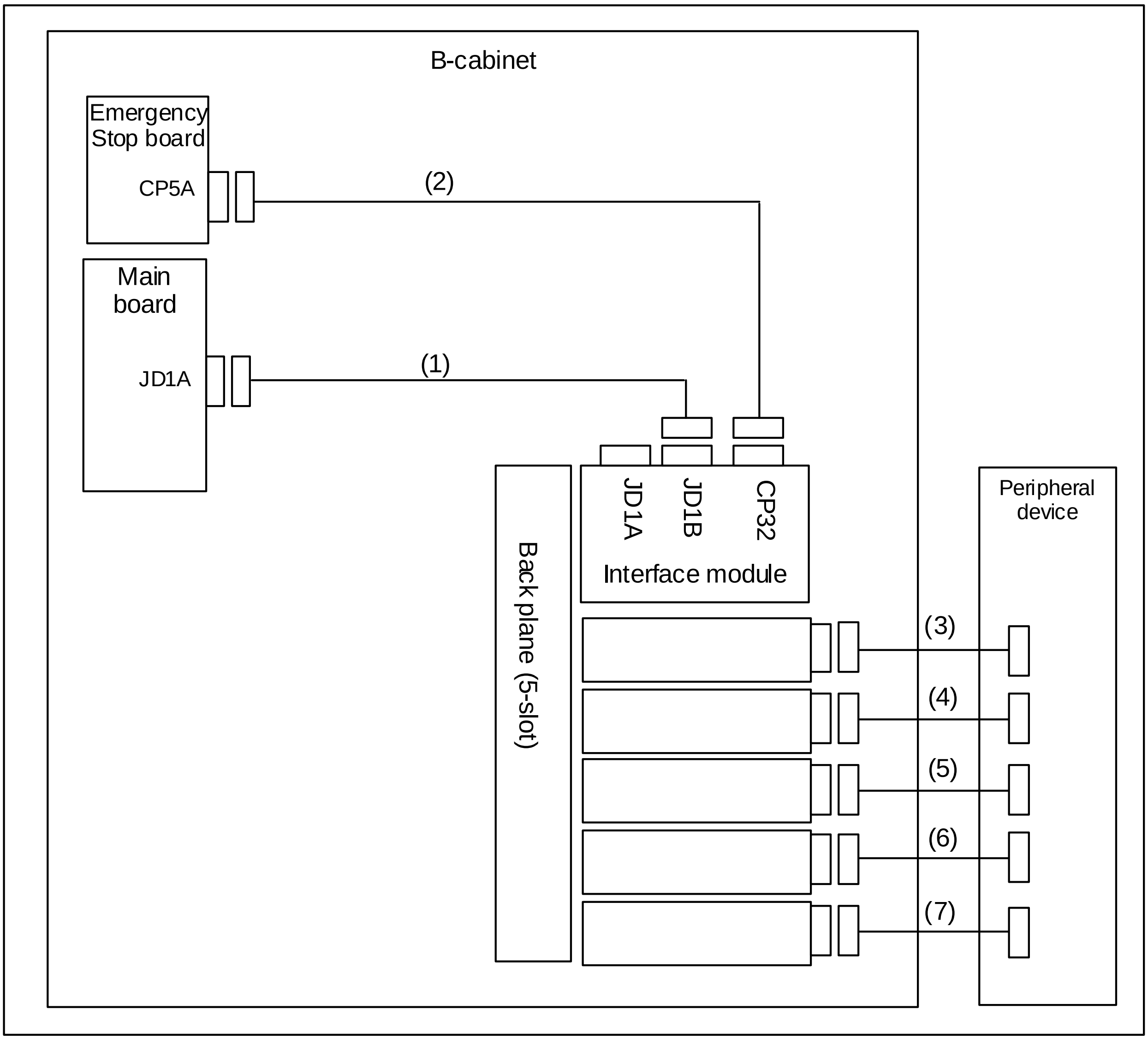


Fig.4.1.5.2 Block diagram of I/O Unit-MODEL A (In case of B-cabinet)

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	-	Included in (A05B-2603-J130)
(2)	Power supply cable	-	Included in (A05B-2603-J130)
(3)-(7)	Peripheral device cable	-	Must be supplied by the customer.

4.1.6 When Two or More Process I/O Board and I/O Unit-MODEL A are Used

4.1.6.1 In case of B-cabinet

When several units of the process I/O PCB, I/O Unit-A are used, connect them as shown below.

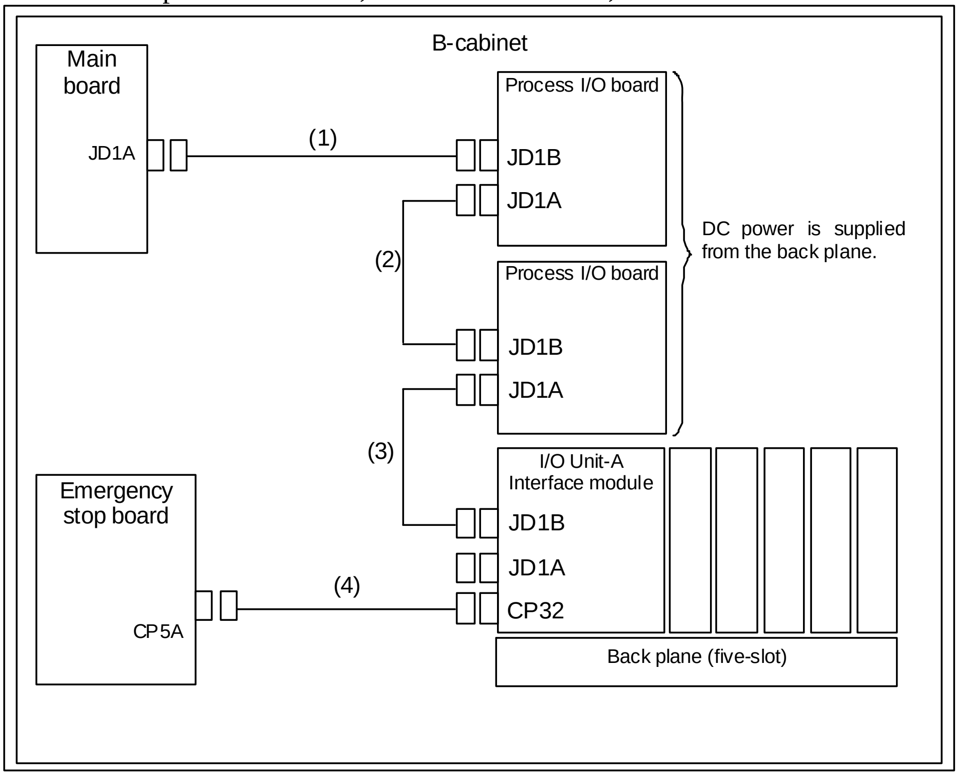


Fig.4.1.6.1 Block diagram of two or more process I/O printed circuit boards and I/O unit-MODEL A (In case of B-cabinet)

Number	Name	Drawing number	Remarks
(1)	I/O Link cable	A05B-2603-J170	Between main board and process I/O
(2)	I/O Link cable	A05B-2603-J171	Between process I/O and process I/O
(3)	I/O Link cable	-	Included in (A05B-2603-J130)
(4)	Power supply cable	-	Included in (A05B-2603-J130)

4.2 PROCESS I/O BOARD SIGNALS

There are 18 exclusive data inputs (DI) and 20 exclusive data outputs (DO) for a process I/O board.
These signals are allocated to the process I/O board connected first when two or more printed boards are combined. (General signals DI/DO are allocated to the second and the following process I/O boards.)
The common voltage of the DI signals input to pins 1 to 4 of connector CRMA5A is clamped +24 V (common) in each process I/O board.
Table 4.2(a)(b) shows signals of a process I/O board.

Table 4.2(a) Process I/O board signals(DI signal)

Connector number	Signal name	Description	Remarks
DI signals			
CRMA5A- 1	XIMSTP	Immediate stop	Clamped at +24 V common
CRMA5A- 2	XHOLD	Temporary stop	Clamped at +24 V common
CRMA5A- 3	XSFSD	Safe speed	Clamped at +24 V common
CRMA5A- 4	CSTOPI	Cycle stop	Clamped at +24 V common
CRMA5A- 5	FAULT RESET	External reset	
CRMA5A- 6	START	Start	
CRMA5A- 7	HOME	Return to home position	
CRMA5A- 8	ENBL	Operation enabled	
CRMA5A- 9	RSR1	Robot service request	
	PNS1	Program number selection	Option
CRMA5A-10	RSR2	Robot service request	
	PNS2	Program number selection	Option
CRMA5A-11	RSR3	Robot service request	
	PNS3	Program number selection	Option
CRMA5A-12	RSR4	Robot service request	
	PNS4	Program number selection	Option
CRMA5A-13	RSR5	Robot service request	
	PNS5	Program number selection	Option
CRMA5A-14	RSR6	Robot service request	
	PNS6	Program number selection	Option
CRMA5A-15	RSR7	Robot service request	
	PNS7	Program number selection	Option
CRMA5A-16	RSR8	Robot service request	
	PNS8	Program number selection	Option
CRMA5A-29	PNSTROBE	PNS strobe	
CRMA5A-30	PROD START	Start of automatic operation	
CRMA5A-31	DI01	Peripheral device status	General signal
CRMA5A-32	DI02	Peripheral device status	General signal
CRMA5B- 1	DI03	Peripheral device status	General signal
CRMA5B- 2	DI04	Peripheral device status	General signal
CRMA5B- 3	DI05	Peripheral device status	General signal
CRMA5B- 4	DI06	Peripheral device status	General signal
CRMA5B- 5	DI07	Peripheral device status	General signal
CRMA5B- 6	DI08	Peripheral device status	General signal
CRMA5B- 7	DI09	Peripheral device status	General signal
CRMA5B- 8	DI10	Peripheral device status	General signal
CRMA5B- 9	DI11	Peripheral device status	General signal
CRMA5B-10	DI12	Peripheral device status	General signal
CRMA5B-11	DI13	Peripheral device status	General signal
CRMA5B-12	DI14	Peripheral device status	General signal
CRMA5B-13	DI15	Peripheral device status	General signal
CRMA5B-14	DI16	Peripheral device status	General signal
CRMA5B-15	DI17	Peripheral device status	General signal
CRMA5B-16	DI18	Peripheral device status	General signal
CRMA5B-29	DI19	Peripheral device status	General signal
CRMA5B-30	DI20	Peripheral device status	General signal
CRMA5B-31	DI21	Peripheral device status	General signal
CRMA5B-32	DI22	Peripheral device status	General signal

Table 4.2(b) Process I/O board signals(DO signal)

Connector number	Signal name	Description	Remarks
DO signals			
CRMA5A-33	CMDENBL	During automatic operation	
CRMA5A-34	SYSRDY	Preparation completed	
CRMA5A-35	PROGRUN	Program running	
CRMA5A-36	PAUSED	Program being interrupted	
CRMA5A-38	HELD	During temporary stop	
CRMA5A-39	FAULT	Alarm	
CRMA5A-40	ATPERCH	Home position	
CRMA5A-41	TPENBL	Teach pendant enabled	
CRMA5A-43	BATALM	Battery voltage drop	
CRMA5A-44	BUSY	During operation	
CRMA5A-45	ACK1	Robot service request acceptance	
	SNO1	Selected program number	Option
CRMA5A-46	ACK2	Robot service request acceptance	
	SNO2	Selected program number	Option
CRMA5A-19	ACK3	Robot service request acceptance	
	SNO3	Selected program number	Option
CRMA5A-20	ACK4	Robot service request acceptance	
	SNO4	Selected program number	Option
CRMA5A-21	ACK5	Robot service request acceptance	
	SNO5	Selected program number	Option
CRMA5A-22	ACK6	Robot service request acceptance	
	SNO6	Selected program number	Option
CRMA5A-24	ACK7	Robot service request acceptance	
	SNO7	Selected program number	Option
CRMA5A-25	ACK8	Robot service request acceptance	
	SNO8	Selected program number	Option
CRMA5A-26	SNACK	Response signal to PNS	
CRMA5A-27	RESERVED		
CRMA5B-33	DO01	Peripheral device control signal	General signal
CRMA5B-34	DO02	Peripheral device control signal	General signal
CRMA5B-35	DO03	Peripheral device control signal	General signal
CRMA5B-36	DO04	Peripheral device control signal	General signal
CRMA5B-38	DO05	Peripheral device control signal	General signal
CRMA5B-39	DO06	Peripheral device control signal	General signal
CRMA5B-40	DO07	Peripheral device control signal	General signal
CRMA5B-41	DO08	Peripheral device control signal	General signal
CRMA5B-43	DO09	Peripheral device control signal	General signal
CRMA5B-44	DO10	Peripheral device control signal	General signal
CRMA5B-45	DO11	Peripheral device control signal	General signal
CRMA5B-46	DO12	Peripheral device control signal	General signal
CRMA5B-19	DO13	Peripheral device control signal	General signal
CRMA5B-20	DO14	Peripheral device control signal	General signal
CRMA5B-21	DO15	Peripheral device control signal	General signal
CRMA5B-22	DO16	Peripheral device control signal	General signal
CRMA5B-24	DO17	Peripheral device control signal	General signal
CRMA5B-25	DO18	Peripheral device control signal	General signal
CRMA5B-26	DO19	Peripheral device control signal	General signal
CRMA5B-27	DO20	Peripheral device control signal	General signal

4.3 INTERFACE FOR PERIPHERAL DEVICES

4.3.1 Peripheral Device and Controller Connection (Source Type DO)

Controller

Process I/O board JA,JB, KA, KB

Peripheral device control interface A1
(Source type DO)

CRMA5A

01	*IMSTP			33	CMDENBL
02	*HOLD	19	ACK3/SNO3	34	SYSRDY
03	*SFSPD	20	ACK4/SNO4	35	PROGRUN
04	CSTOPI	21	ACK5/SNO5	36	PAUSED
05	FAULT RESET	22	ACK6/SNO6	37	DOSRC1
06	START	23	DOSRC1	38	HELD
07	HOME	24	ACK7/SNO7	39	FAULT
08	ENBL	25	ACK8/SNO8	40	ATPERCH
09	RSR1/PNS1	26	SNACK	41	TPENBL
10	RSR2/PNS2	27	RESERVED	42	DOSRC1
11	RSR3/PNS3	28	DOSRC1	43	BATALM
12	RSR4/PNS4	29	PNSTROBE	44	BUSY
13	RSR5/PNS5	30	PROD START	45	ACK1/SNO1
14	RSR6/PNS6	31	DI01	46	ACK2/SNO2
15	RSR7/PNS7	32	DI02	47	DOSRC1
16	RSR8/PNS8			48	
17	0V			49	+24E
18	0V			50	+24E

Peripheral device A1

Peripheral device control interface A2
(Source type DO)

CRMA5B

01	DI03			33	DO01
02	DI04	19	DO13	34	DO02
03	DI05	20	DO14	35	DO03
04	DI06	21	DO15	36	DO04
05	DI07	22	DO16	37	DOSRC1
06	DI08	23	DOSRC1	38	DO05
07	DI09	24	DO17	39	DO06
08	DI10	25	DO18	40	DO07
09	DI11	26	DO19	41	DO08
10	DI12	27	DO20	42	DOSRC1
11	DI13	28	DOSRC1	43	DO09
12	DI14	29	DI19	44	DO10
13	DI15	30	DI20	45	DO11
14	DI16	31	DI21	46	DO12
15	DI17	32	DI22	47	DOSRC1
16	DI18			48	
17	0V			49	+24E
18	0V			50	+24E

Peripheral device A2

Terminal block
TBSRC1

1	DOSRC1
2	0V

NOTE
1. The peripheral device connection cables are optional.
2. The DOSRC1 pins of the CRMA5A and CRMA5B are pins for supplying power to drivers. (None of these pins can be left open.)
3. When the level of the voltage applied to the load is insufficient for a cause such as a too long peripheral device connection cable, supply power from the TBSRC1 terminal block.

Controller

Process I/O board JA

Peripheral device control interface A3
(Source type DO)

CRMA5C

01	DI23			33	DO21
02	DI24	19	DO33	34	DO22
03	DI25	20	DO34	35	DO23
04	DI26	21	DO35	36	DO24
05	DI27	22	DO36	37	DOSRC2
06	DI28	23	DOSRC2	38	DO25
07	DI29	24	DO37	39	DO26
08	DI30	25	DO38	40	DO27
09	DI31	26	DO39	41	DO28
10	DI32	27	DO40	42	DOSRC2
11	DI33	28	DOSRC2	43	DO29
12	DI34	29	DI39	44	DO30
13	DI35	30	DI40	45	DO31
14	DI36	31	DI41	46	DO32
15	DI37	32	DI42	47	DOSRC2
16	DI38			48	
17	0V			49	+24E
18	0V			50	+24E

Peripheral device A3

Peripheral device control interface A4
(Source type DO)

CRMA5D

01	DI43			33	DO41
02	DI44	19	DO53	34	DO42
03	DI45	20	DO54	35	DO43
04	DI46	21	DO55	36	DO44
05	DI47	22	DO56	37	DOSRC2
06	DI48	23	DOSRC2	38	DO45
07	DI49	24	DO57	39	DO46
08	DI50	25	DO58	40	DO47
09	DI51	26	DO59	41	DO48
10	DI52	27	DO60	42	DOSRC2
11	DI53	28	DOSRC2	43	DO49
12	DI54	29	DI59	44	DO50
13	DI55	30	DI60	45	DO51
14	DI56	31	DI61	46	DO52
15	DI57	32	DI62	47	DOSRC2
16	DI58			48	
17	0V			49	+24E
18	0V			50	+24E

Peripheral device A4

Terminal block

TBSRC2

1	DOSRC2
2	0V

NOTE

1 The peripheral device connection cables are optional.
2 The DOSRC2 pins of the CRMA5C and CRMA5D are pins for supplying power to drivers. (None of these pins can be left open.)
3 When the level of the voltage applied to the load is insufficient for a cause such as a too long peripheral device connection cable, supply power from the TBSRC2 terminal block.

Controller

Process I/O board JA

Peripheral device control interface B1

(Source type DO)

CRMA6A

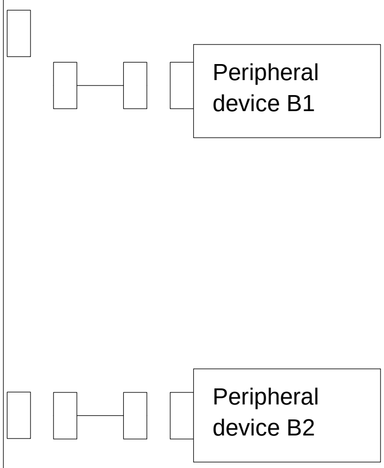
01	DI63	08	DO65	14	DO61
02	DI64	09	DO66	15	DO62
03	DI65	10	DO67	16	DO63
04	DI66	11	DO68	17	DO64
05	DI67	12	DOSRC3	18	DOSRC3
06	DI68	13	DI70	19	+24E
07	DI69			20	0V

Peripheral device control interface B2

(Source type DO)

CRMA6B

01	DI71	08	DO73	14	DO69
02	DI72	09	DO74	15	DO70
03	DI73	10	DO75	16	DO71
04	DI74	11	DO76	17	DO72
05	DI75	12	DOSRC3	18	DOSRC3
06	DI76	13	DI78	19	+24E
07	DI77			20	0V



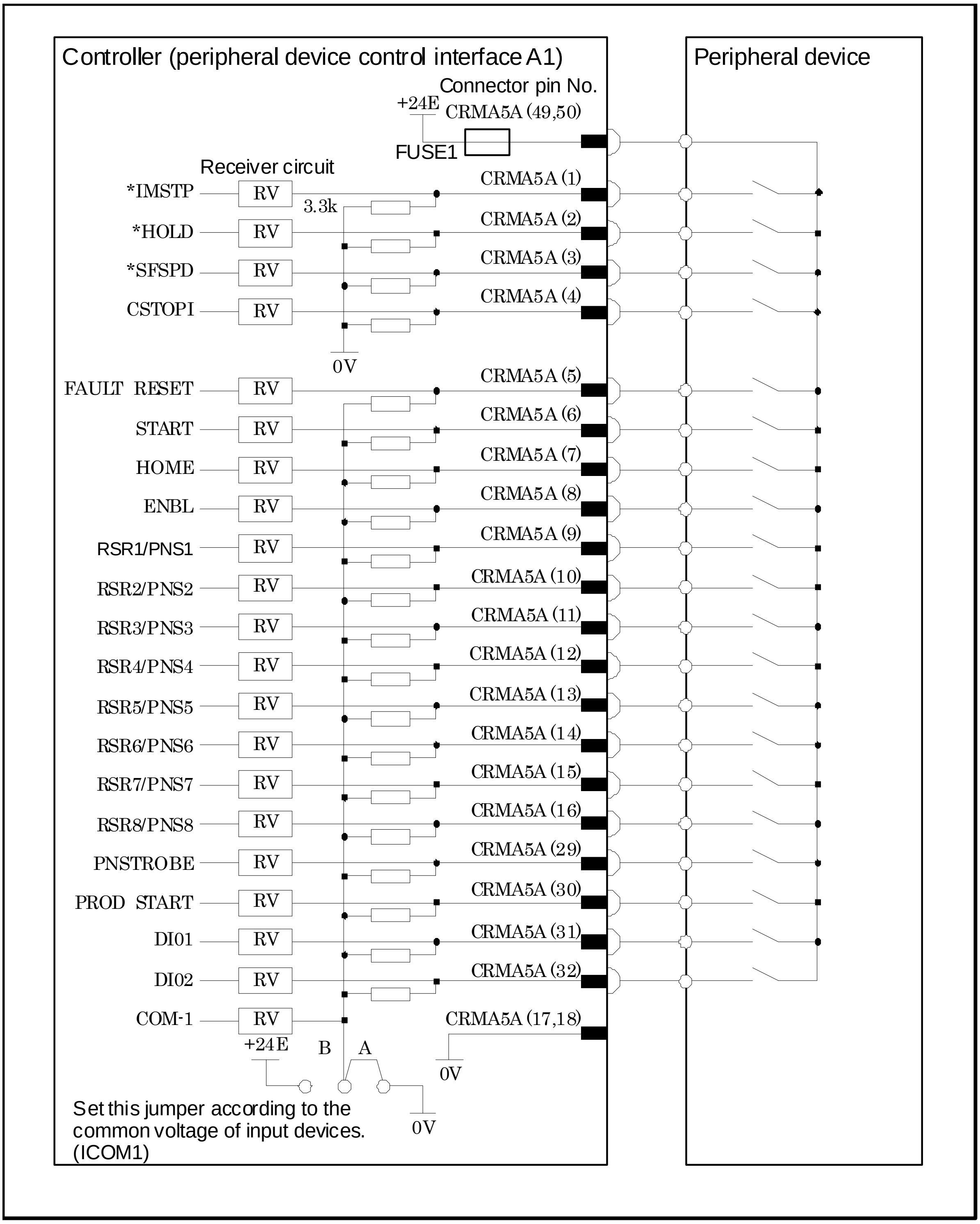
Terminal block

TBSRC3

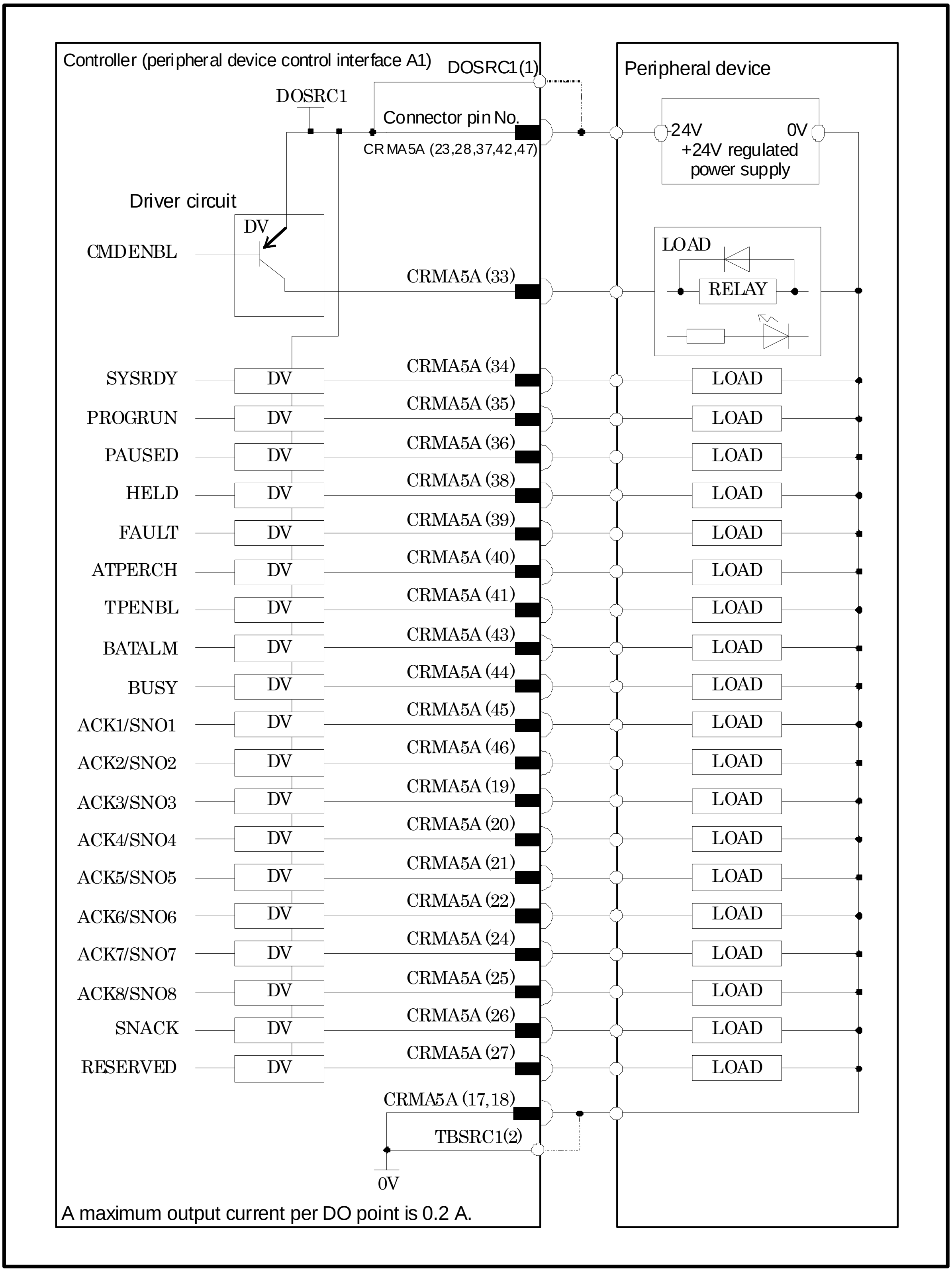
1	DOSRC3
2	0V

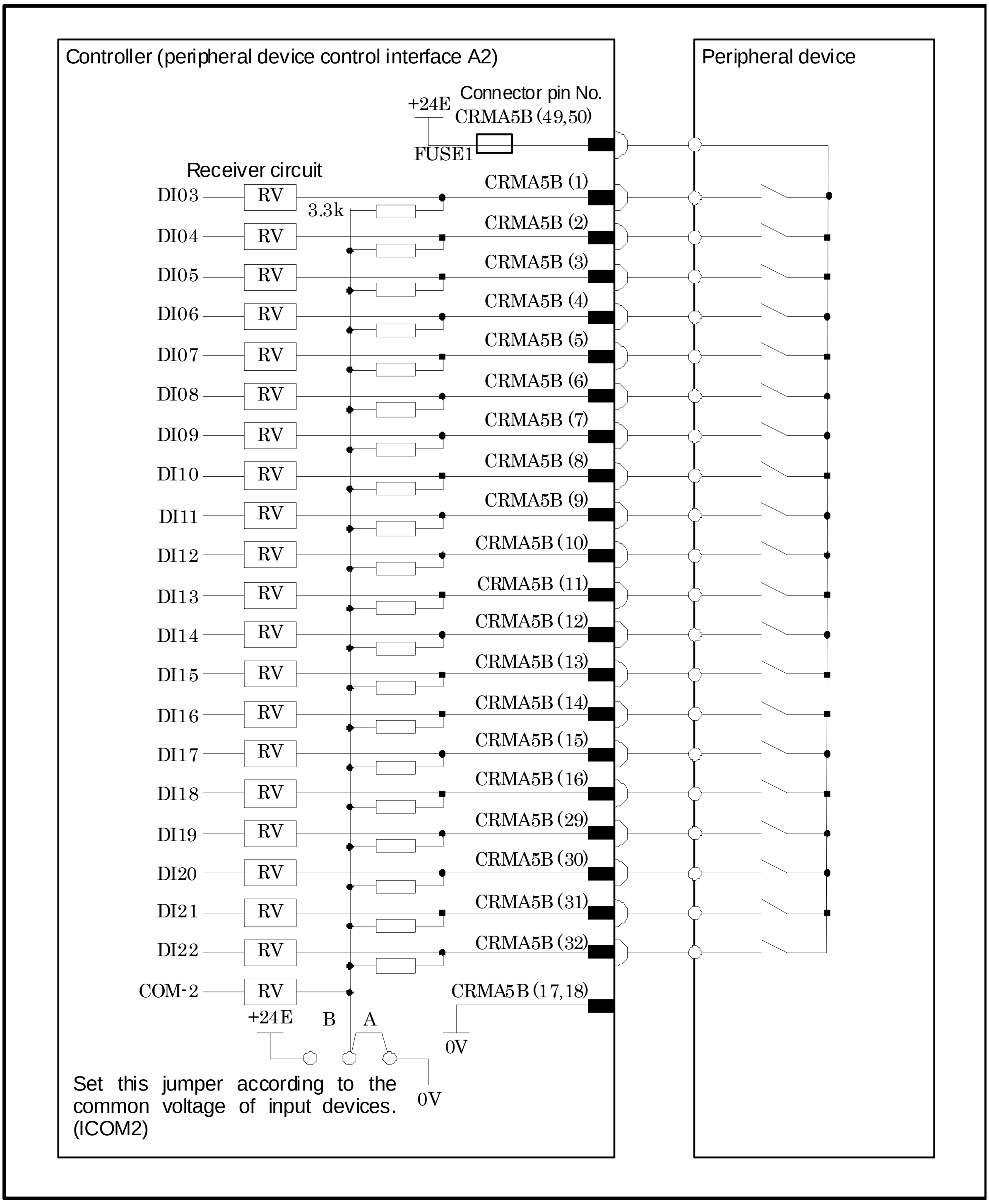
NOTE

1. The peripheral device connection cables are optional.
2. The DOSRC3 pins of the CRMA6A and CRMA6B are pins for supplying power to drivers. (None of these pins can be left open.)
3. When the level of the voltage applied to the load is insufficient for a cause such as a too long peripheral device connection cable, supply power from the TBSRC3 terminal block.

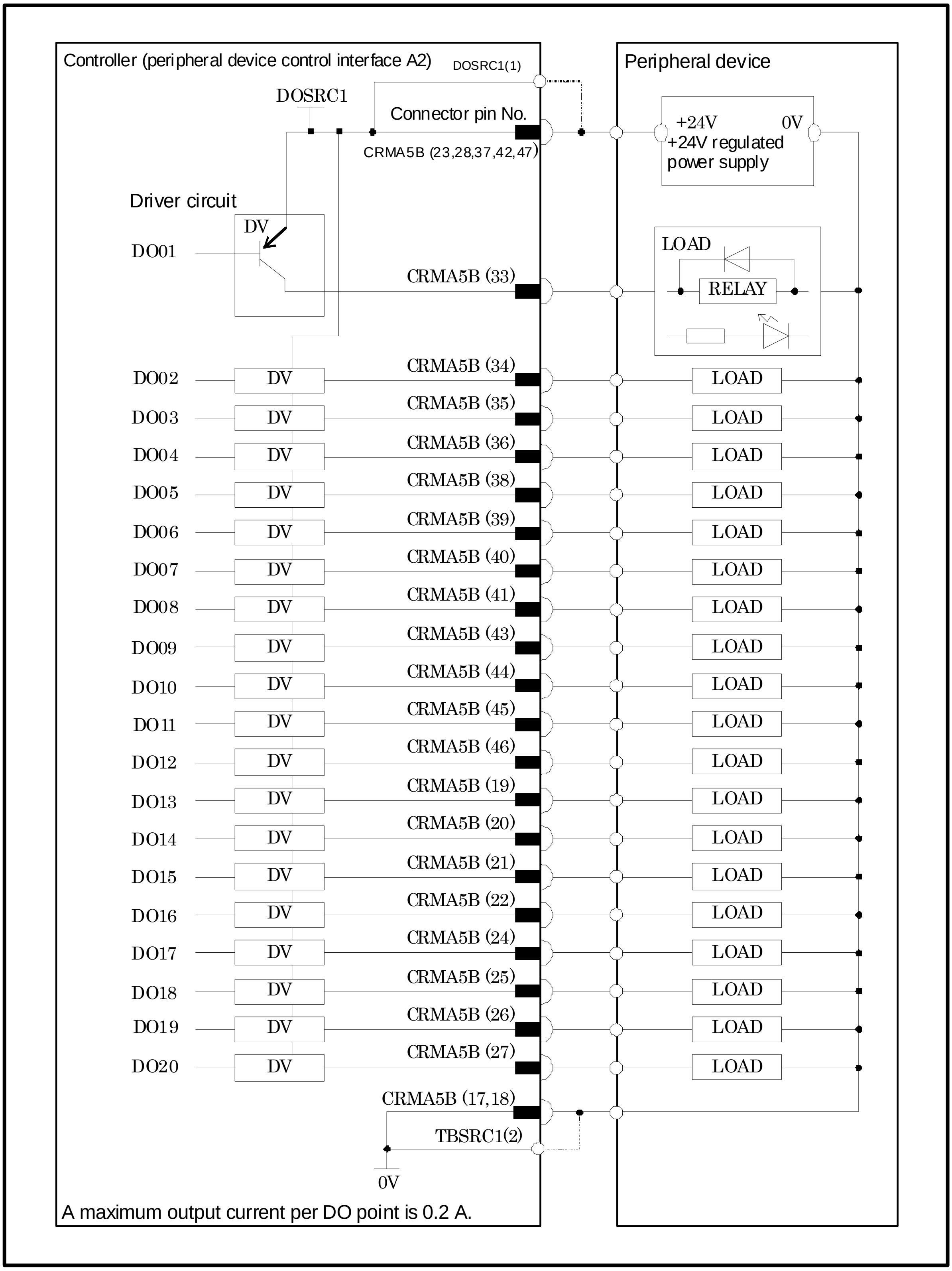


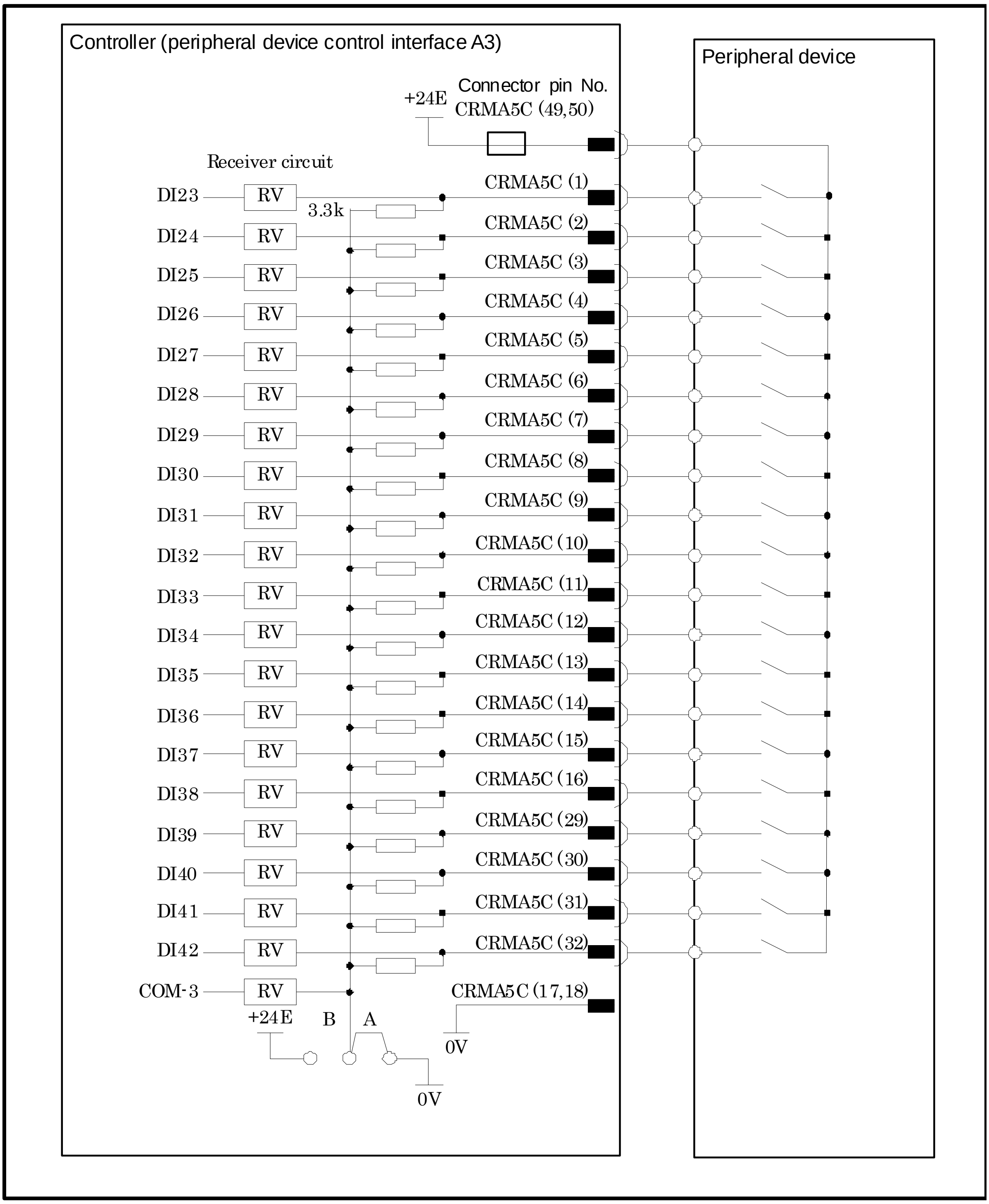
NOTE
In this diagram, common voltage of input devices is +24V.


Controller (peripheral device control interface A1)
DOSRC1(1)
DOSRC1
Connector pin No.
CRMA5A (23,28,37,42,47)
Peripheral device
24V
0V
+24V regulated power supply
Driver circuit
DV
CMDENBL
CRMA5A (33)
LOAD
RELAY
SYSRDY
PROGRUN
PAUSED
HELD
FAULT
ATPERCH
TPENBL
BATALM
BUSY
ACK1/SNO1
ACK2/SNO2
ACK3/SNO3
ACK4/SNO4
ACK5/SNO5
ACK6/SNO6
ACK7/SNO7
ACK8/SNO8
SNACK
RESERVED
CRMA5A (34)
CRMA5A (35)
CRMA5A (36)
CRMA5A (38)
CRMA5A (39)
CRMA5A (40)
CRMA5A (41)
CRMA5A (43)
CRMA5A (44)
CRMA5A (45)
CRMA5A (46)
CRMA5A (19)
CRMA5A (20)
CRMA5A (21)
CRMA5A (22)
CRMA5A (24)
CRMA5A (25)
CRMA5A (26)
CRMA5A (27)
CRMA5A (17,18)
TBSRC1(2)
0V
A maximum output current per DO point is 0.2 A.

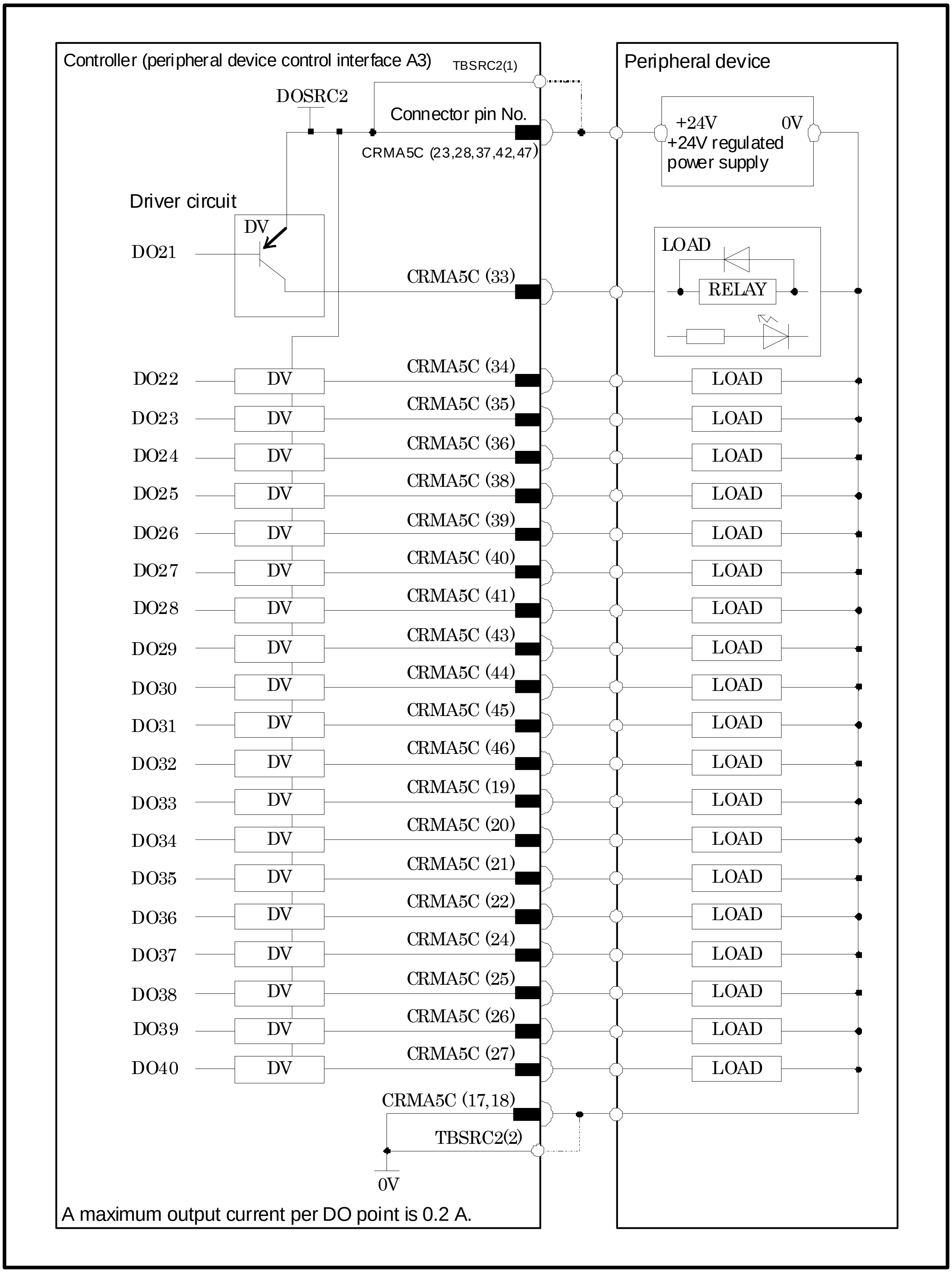


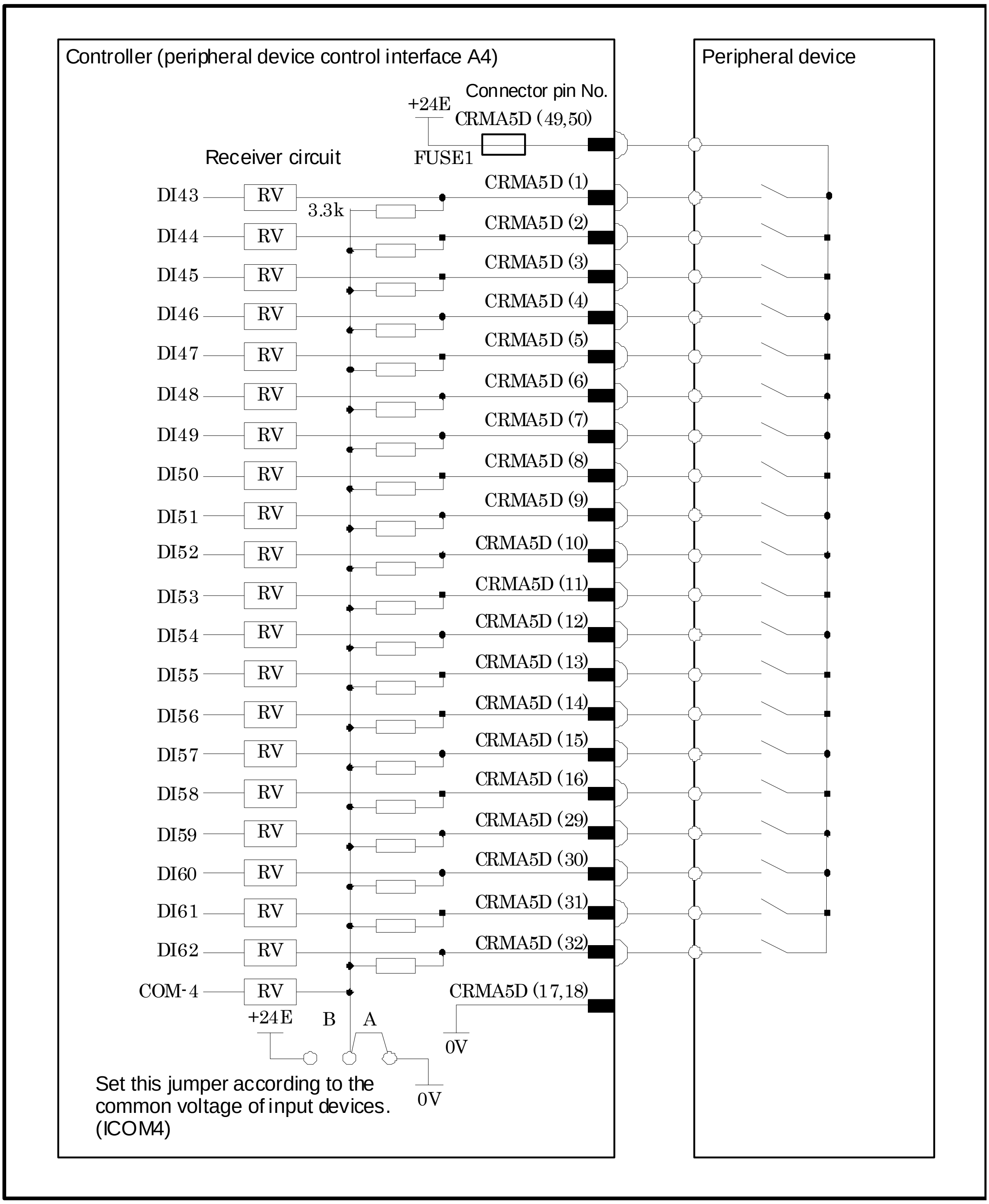
NOTE
In this diagram, common voltage of input devices is +24V.


Controller (peripheral device control interface A2)
DOSRC1(1)
DOSRC1
Connector pin No.
CRMA5B (23,28,37,42,47)
Peripheral device
+24V
0V
+24V regulated power supply
Driver circuit
DV
DO01
CRMA5B (33)
LOAD
RELAY
DO02 DV CRMA5B (34) LOAD
DO03 DV CRMA5B (35) LOAD
DO04 DV CRMA5B (36) LOAD
DO05 DV CRMA5B (38) LOAD
DO06 DV CRMA5B (39) LOAD
DO07 DV CRMA5B (40) LOAD
DO08 DV CRMA5B (41) LOAD
DO09 DV CRMA5B (43) LOAD
DO10 DV CRMA5B (44) LOAD
DO11 DV CRMA5B (45) LOAD
DO12 DV CRMA5B (46) LOAD
DO13 DV CRMA5B (19) LOAD
DO14 DV CRMA5B (20) LOAD
DO15 DV CRMA5B (21) LOAD
DO16 DV CRMA5B (22) LOAD
DO17 DV CRMA5B (24) LOAD
DO18 DV CRMA5B (25) LOAD
DO19 DV CRMA5B (26) LOAD
DO20 DV CRMA5B (27) LOAD
CRMA5B (17,18)
TBSRC1(2)
0V
A maximum output current per DO point is 0.2 A.

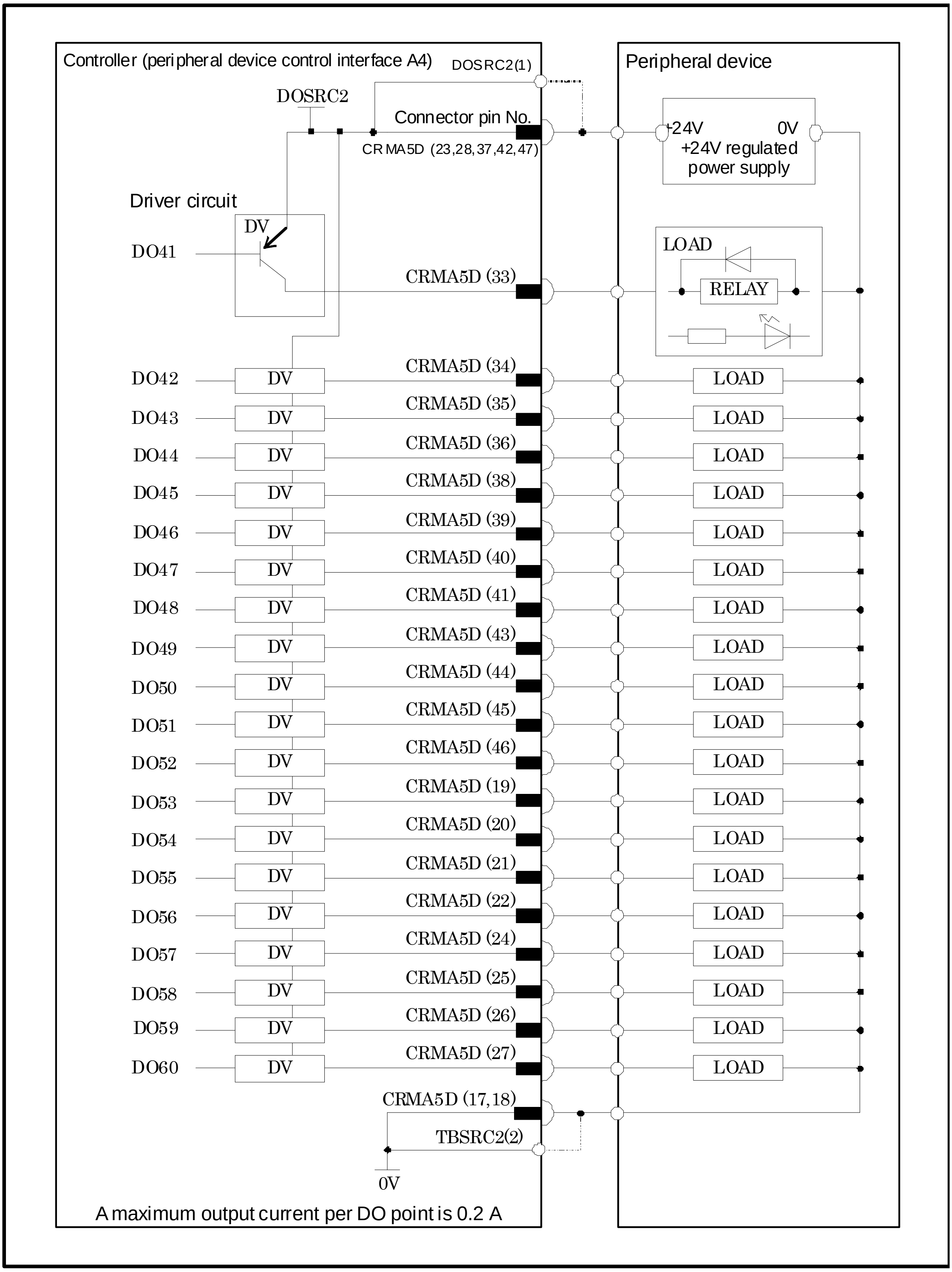


NOTE
In this diagram, common voltage of input devices is +24V.

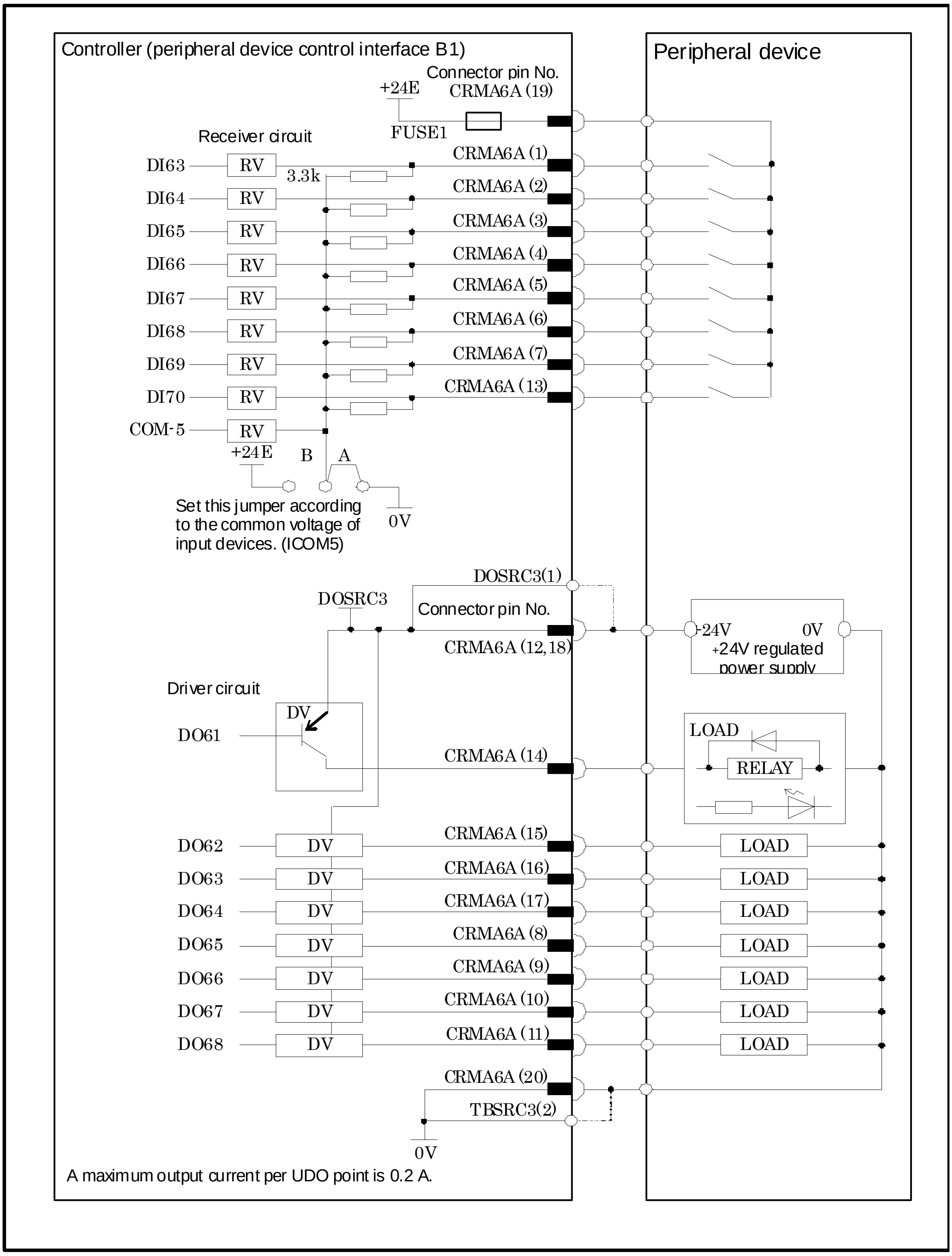

Controller (peripheral device control interface A3)
TBSRC2(1)
DOSRC2
Connector pin No.
CRMA5C (23,28,37,42,47)
Driver circuit
DV
DO21
CRMA5C (33)
DO22
DV
CRMA5C (34)
DO23
CRMA5C (35)
DO24
CRMA5C (36)
DO25
CRMA5C (38)
DO26
CRMA5C (39)
DO27
CRMA5C (40)
DO28
CRMA5C (41)
DO29
CRMA5C (43)
DO30
CRMA5C (44)
DO31
CRMA5C (45)
DO32
CRMA5C (46)
DO33
CRMA5C (19)
DO34
CRMA5C (20)
DO35
CRMA5C (21)
DO36
CRMA5C (22)
DO37
CRMA5C (24)
DO38
CRMA5C (25)
DO39
CRMA5C (26)
DO40
CRMA5C (27)
CRMA5C (17,18)
TBSRC2(2)
0V
A maximum output current per DO point is 0.2 A.
Peripheral device
+24V
0V
+24V regulated power supply
LOAD
RELAY



NOTE
In this diagram, common voltage of input devices is +24V.

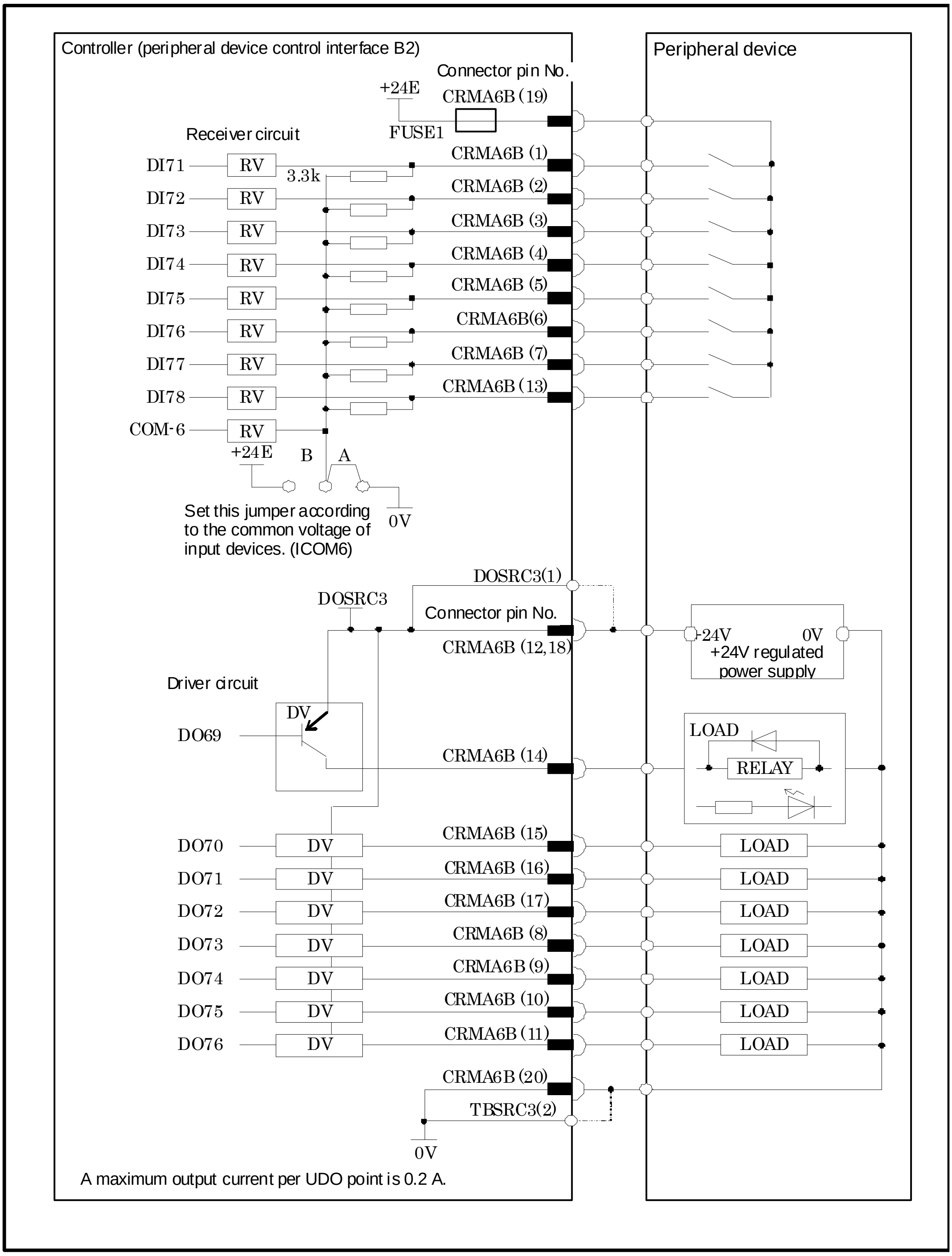


Controller (peripheral device control interface A4)
DOSRC2(1)
DOSRC2
Connector pin No.
CRMA5D (23,28,37,42,47)
Driver circuit
DV
DO41
CRMA5D (33)
DO42 DV CRMA5D (34)
DO43 DV CRMA5D (35)
DO44 DV CRMA5D (36)
DO45 DV CRMA5D (38)
DO46 DV CRMA5D (39)
DO47 DV CRMA5D (40)
DO48 DV CRMA5D (41)
DO49 DV CRMA5D (43)
DO50 DV CRMA5D (44)
DO51 DV CRMA5D (45)
DO52 DV CRMA5D (46)
DO53 DV CRMA5D (19)
DO54 DV CRMA5D (20)
DO55 DV CRMA5D (21)
DO56 DV CRMA5D (22)
DO57 DV CRMA5D (24)
DO58 DV CRMA5D (25)
DO59 DV CRMA5D (26)
DO60 DV CRMA5D (27)
CRMA5D (17,18)
TBSRC2(2)
0V
A maximum output current per DO point is 0.2 A
Peripheral device
+24V 0V
+24V regulated power supply
LOAD
RELAY
LOAD



NOTE

In this diagram, common voltage of input devices is +24V.



> **NOTE**
> In this diagram, common voltage of input devices is +24V.

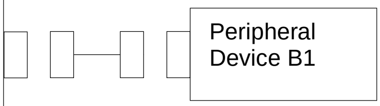
4.3.2 Connection between the Process I/O Board MA and Peripheral Devices

Controller

Peripheral device control interface B1 (source type DO)

CRMA52A

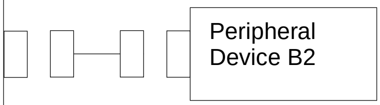
	A	B
01	24F	24F
02	DI01	DI02
03	DI03	DI04
04	DI05	DI06
05	DI07	DI08
06	DI09	DI10
07		
8	DO01	DO02
09	DO03	DO04
10	DO05	DO06
11	DO07	DO08
12		
13	0V	0V
14	0V	0V
15	DOSRC3	DOSRC3



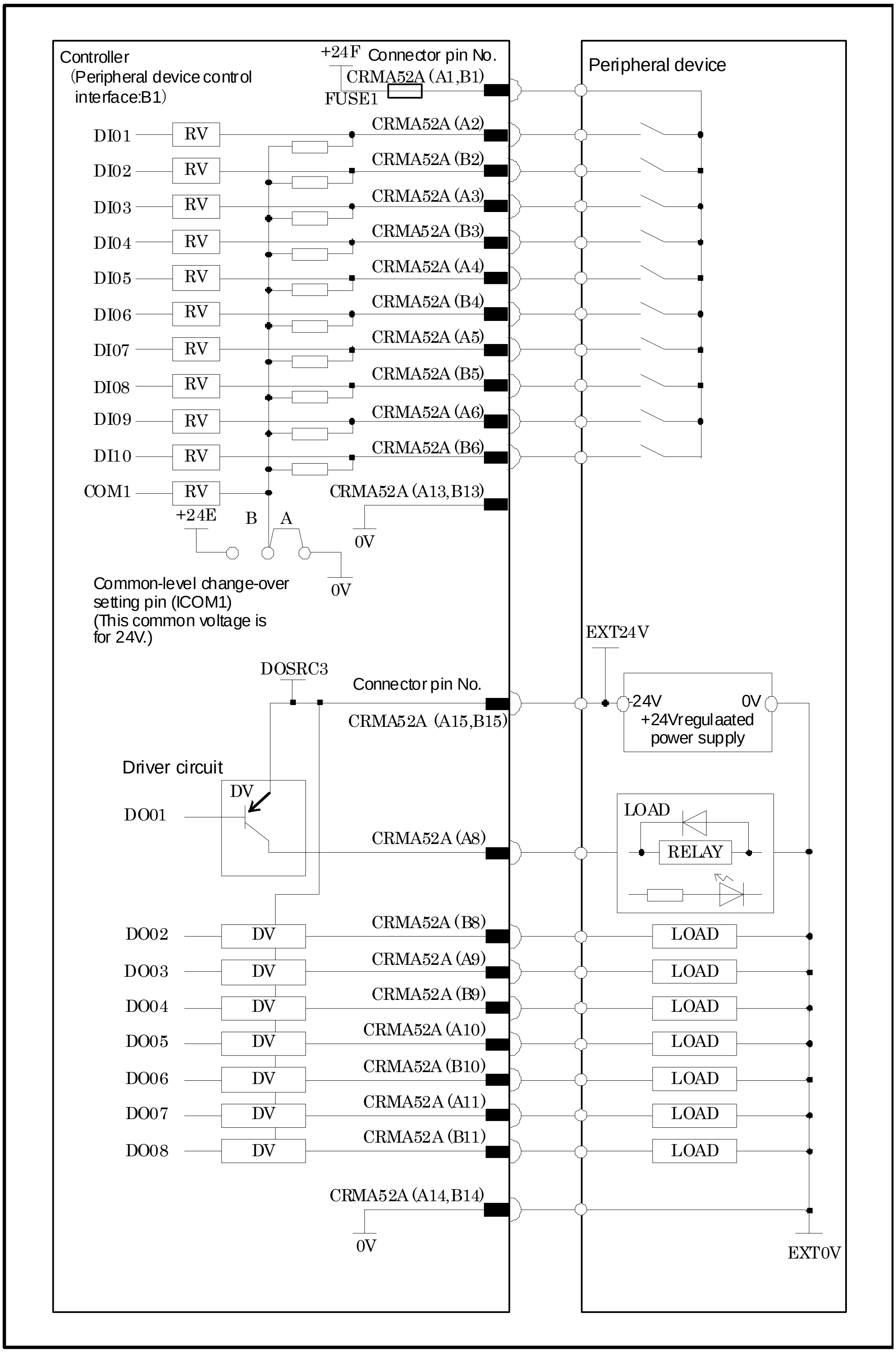
Peripheral device control interface B2 (source type DO)

CRMA52B

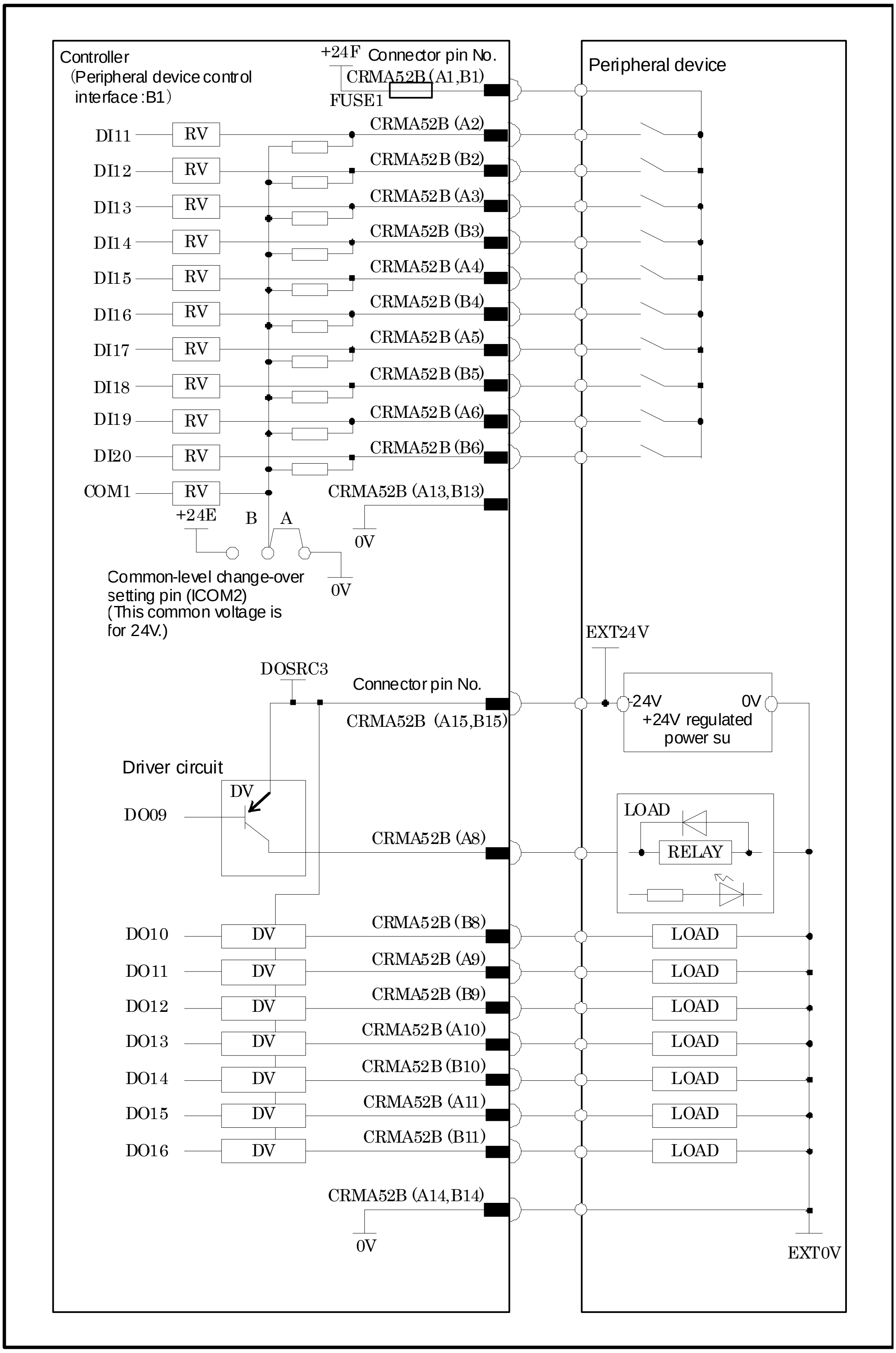
	A	B
01	24F	24F
02	DI11	DI12
03	DI13	DI14
04	DI15	DI16
05	DI17	DI18
06	DI19	DI20
07		
08	DO09	DO10
09	DO11	DO12
10	DO13	DO14
11	DO15	DO16
12		
13	0V	0V
14	0V	0V
15	DOSRC3	DOSRC3



NOTE
1 The peripheral device connection cable is optional.
2 The DOSRC3 pin of CRMA52A and CRMA52B supply power to the drivers (connect all pins).

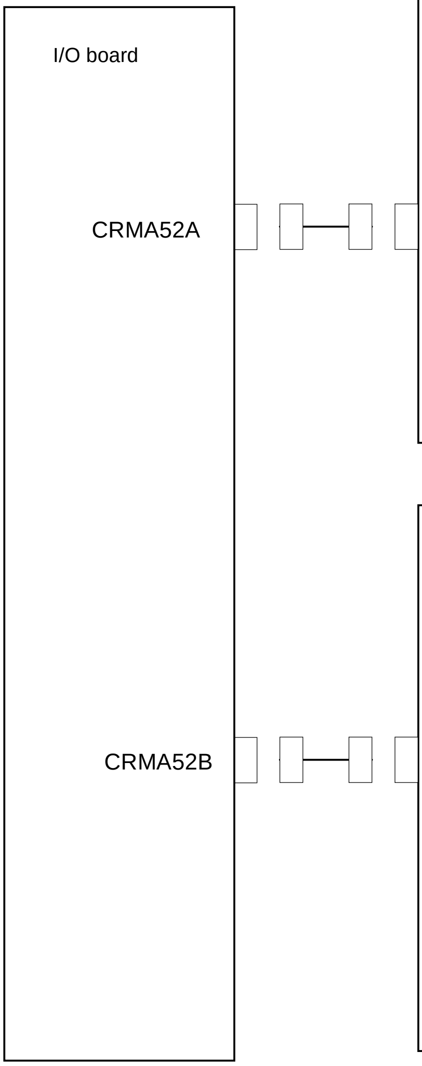


NOTE
In this diagram, common voltage of input device is 24V.



NOTE
In this diagram, common voltage of input device is +24V.

The following shows the connector interface of the optional peripheral device cables on the peripheral device side.



Peripheral device A3

01	DI01			33	DO01
02	DI02	19		34	DO02
03	DI03	20		35	DO03
04	DI04	21		36	DO04
05	DI05	22		37	DO05
06	DI06	23		38	DO06
07	DI07	24		39	DO07
08	DI08	25		40	DO08
09	DI09	26		41	
10	DI10	27		42	
11		28		43	
12		29	0V	44	
13		30	0V	45	
14		31	DOSRC3	46	
15		32	DOSRC3	47	
16				48	
17	0V			49	+24F
18	0V			50	+24F

Peripheral device A4

01	DI11			33	DO09
02	DI12	19		34	DO10
03	DI13	20		35	DO11
04	DI14	21		36	DO12
05	DI15	22		37	DO13
06	DI16	23		38	DO14
07	DI17	24		39	DO15
08	DI18	25		40	DO16
09	DI19	26		41	
10	DI20	27		42	
11		28		43	
12		29	0V	44	
13		30	0V	45	
14		31	DOSRC3	46	
15		32	DOSRC3	47	
16				48	
17	0V			49	+24F
18	0V			50	+24F

NOTE
Refer to the previous page about details of connection.

4.4 INTERFACE FOR WELDER

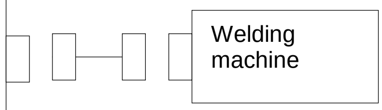
4.4.1 Connection between the Process I/O Board MB and Welding Machines

Controller

Welding machine interface

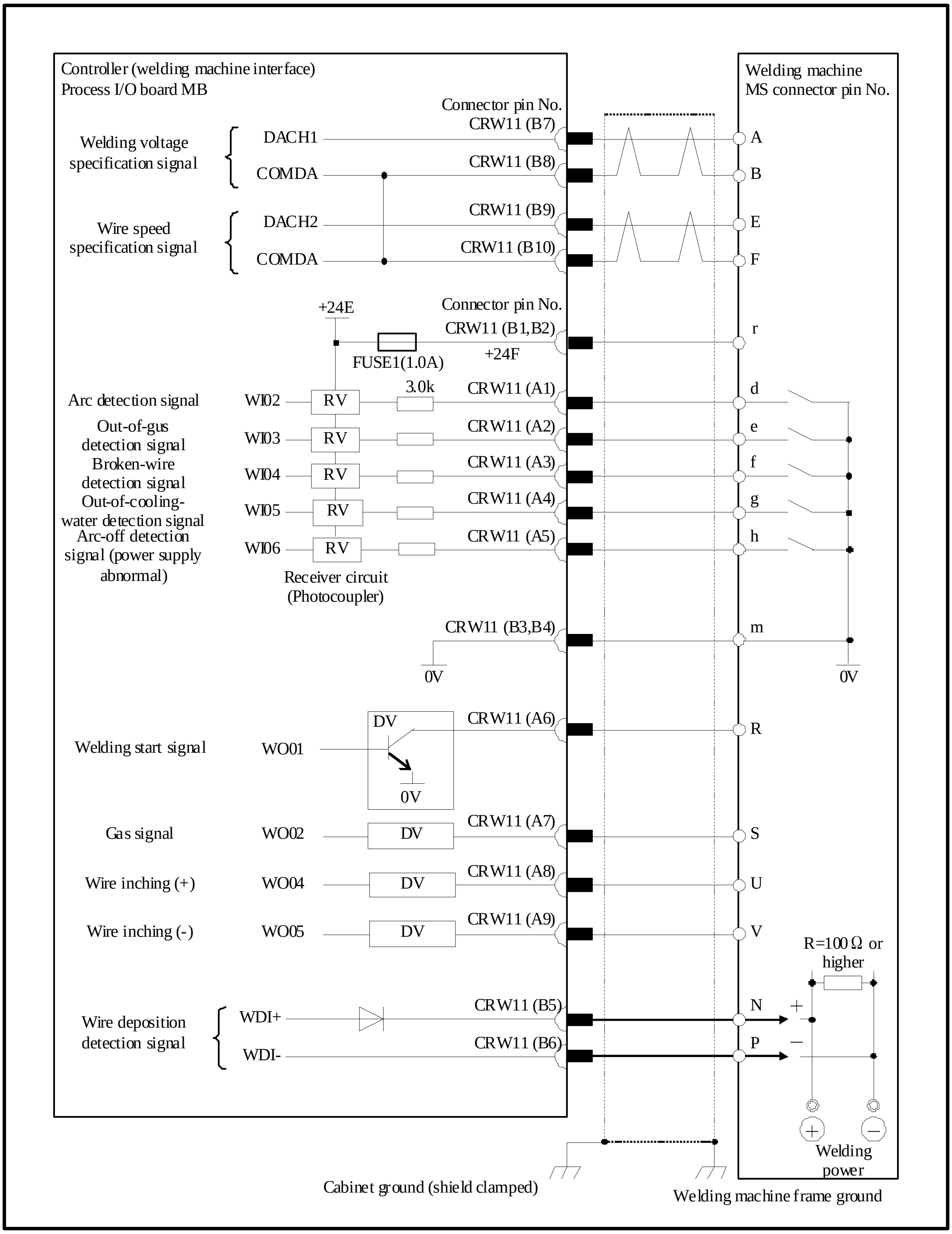
CRW11

	A	B
01	WI02	24F
02	WI03	24F
03	WI04	0V
04	WI05	0V
05	WI06	WDI+
06	WO01	WDI-
07	WO02	DACH1
08	WO04	COMDA
09	WO05	DACH2
10		COMDA



NOTE

1 The welding machine connection cable is optional.



Pin-to-pin connection between CRW11 connector and welding machine connector (FANUC interface)
(Analog output, welding wire deposition detection, WI/WO connection)

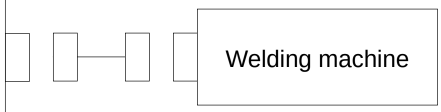
4.4.2 Connection between the Process I/O Board KA, KB and Welding Machines

Control unit

Welding machine interface

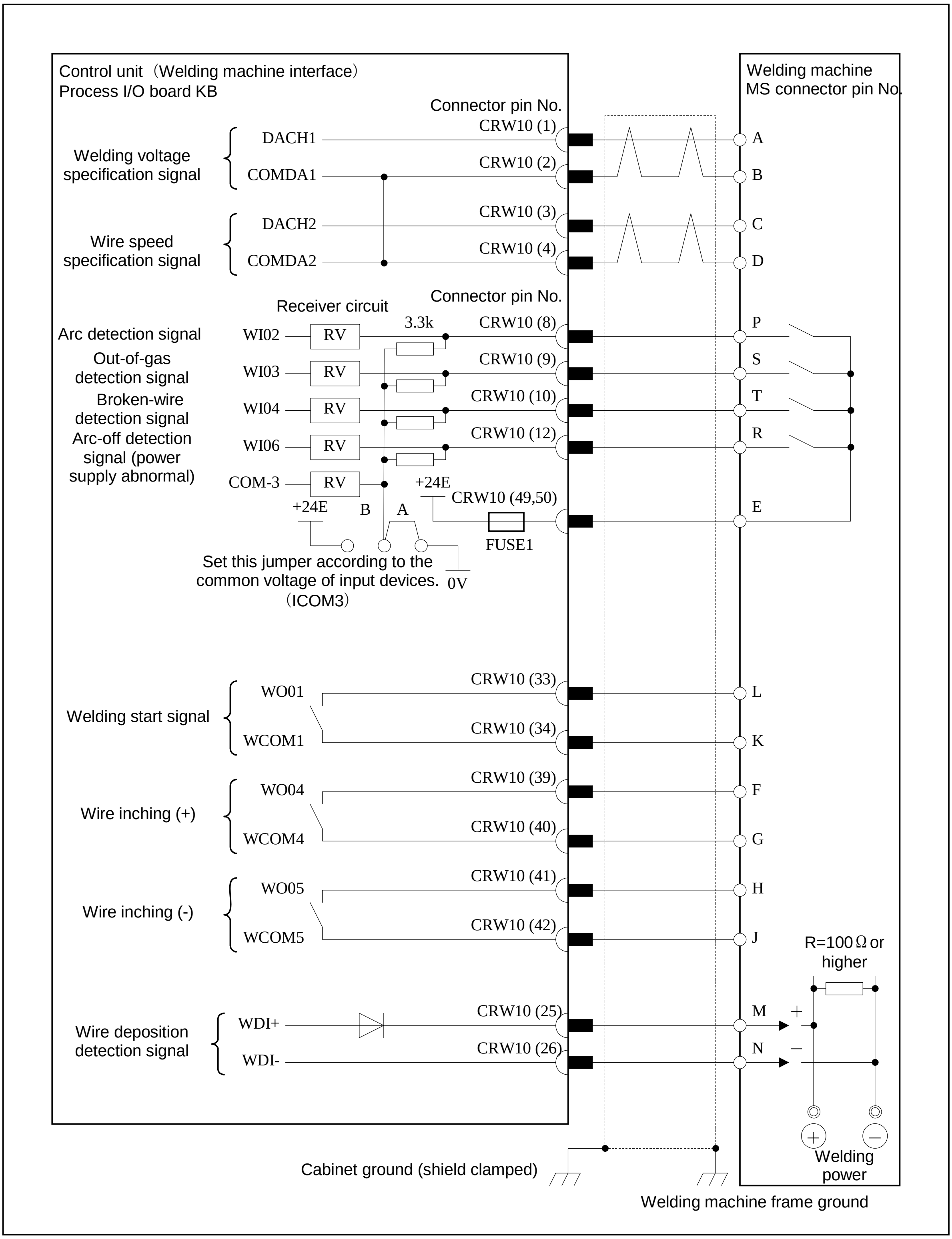
CRW10

01	DACH1			33	WO1
02	COMDA1	19	ADCH1	34	WCOM1
03	DACH2	20	COMAD1	35	WO2
04	COMDA2	21	ADCH2	36	WCOM12
05	DACH3	22	COMAD2	37	WO3
06	COMDA3	23		38	WCOM3
07	WI1	24		39	WO4
08	WI2	25	WDI+	40	WCOM4
09	WI3	26	WDI-	41	WO5
10	WI4	27		42	WCOM5
11	WI5	28		43	WO6
12	WI6	29		44	WCOM6
13	WI7	30		45	WO7
14	WI8	31		46	WCOM7
15	0V	32		47	WO8
16	0V			48	WCOM8
17	0V			49	+24E
18	0V			50	+24E



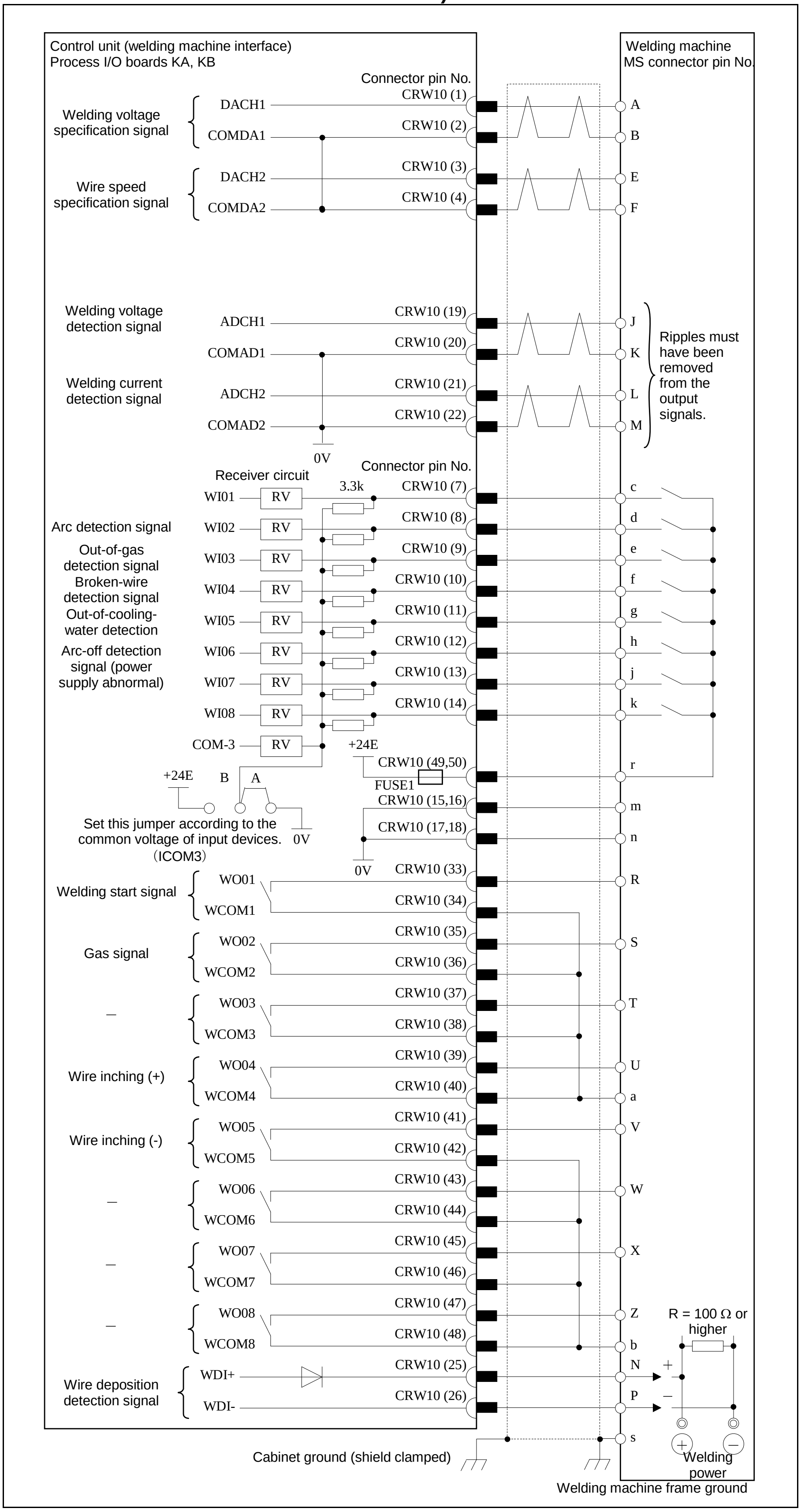
NOTE
The welding machine connection cables are options.

Pin-to-pin connection between CRW10 connector and welding machine connector (general interface)
(Analog output, welding wire deposition detection, WI/WO connection, for connections with +24 V common)



> **NOTE**
> In this diagram, common voltage of input devices is +24V.

Pin-to-pin connection between CRW10 connector and welding machine connector: FANUC interface (Analog input/output, welding wire deposition detection, WI/WO connection, for connections with +24 V common)



4.5 EE INTERFACE

4.5.1 Connection between the Mechanical Unit and End Effector

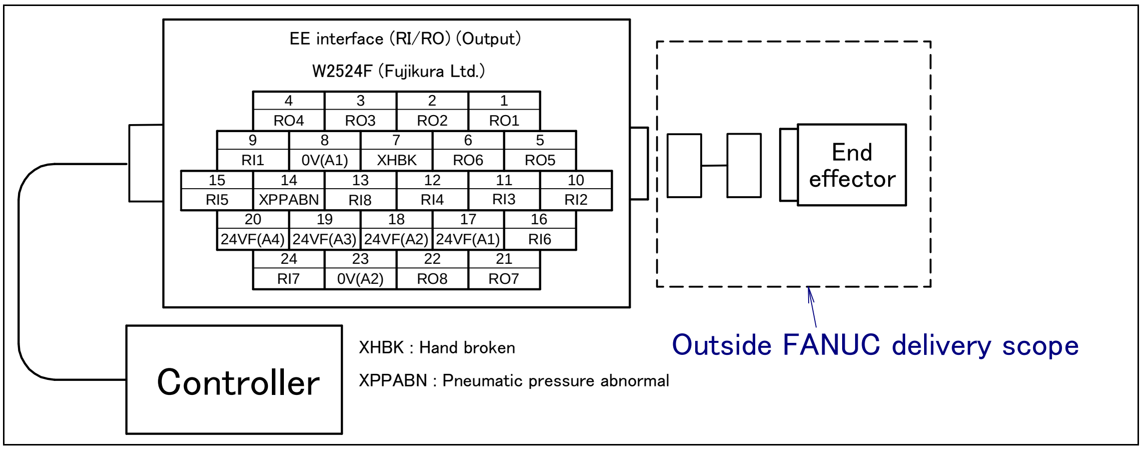
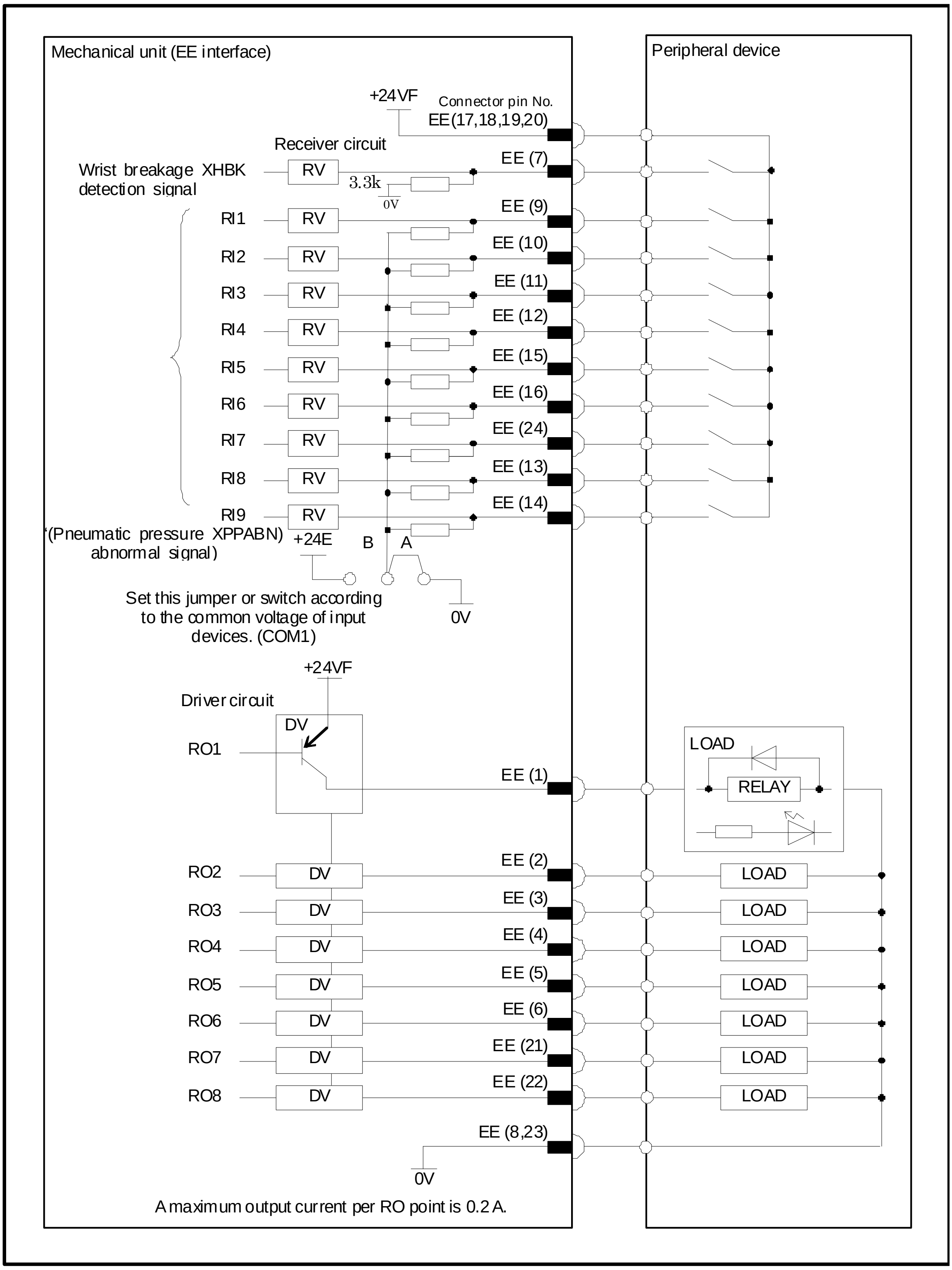


Fig.4.5.1 EE interface

> **NOTE**
> EE interface depends on the option of the robot. Refer to the robot-specific operator's manual.



NOTE

1. In this diagram, common voltage of input devices is +24V.
2. The common-level change-over setting pin or switch (COM1) is in the 6-axis servo amplifier.

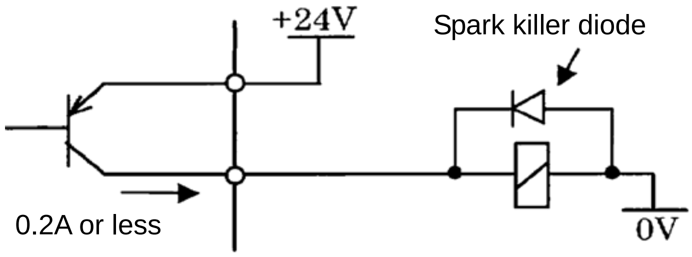
4.6 DIGITAL I/O SIGNAL SPECIFICATIONS

This section describes the specifications of the digital I/O signals interfaced with the peripheral device, end effector, and arc welder.

4.6.1 Peripheral Device Interface A

(1) Output signals in peripheral device interface A (Source type DO)

(a) Example of connection



(b) Electrical specifications

Maximum load current when driver is on:	200mA (including momentary level)
Saturation voltage when driver is on:	1.0V max.
Dielectric strength:	24V ±20% (including momentary level)
Leakage current when driver is off:	100μA

(c) The external power supply to output signals must satisfy the following:

Power supply voltage: +24V ±10%

Power supply current: For each printed circuit board of this type (Total sum of maximum load currents including momentary levels + 100mA or more)

Power-on timing:

At the same time when the controller is turned on or earlier

Power-off timing:

At the same time when the controller unit is turned off or later

(d) Spark killer diode

Rated peak reverse voltage: 100V or more

Rated effective forward current: 1A or more

(e) Driver for output signals

In the driver device, the current of each output signal is monitored, and when an overcurrent is detected, the relevant output is turned off. After an output has been turned off by overcurrent, the overcurrent state is released because the output is off, so the output on state is restored. Therefore, in the ground fault or overcurrent state, the output is turned on and off repeatedly. Such a condition is found also when a load with a high surge current is connected.

The driver device also includes an overheat detection circuit, which turns off all outputs of the device when the internal temperature of the device has increased as a result of a continued overcurrent state due to a ground fault of an output and so on. The outputs are held off, but their normal states can be restored by turning the power to the controller on and off after the internal temperature of the device has lowered.

(f) Note on use

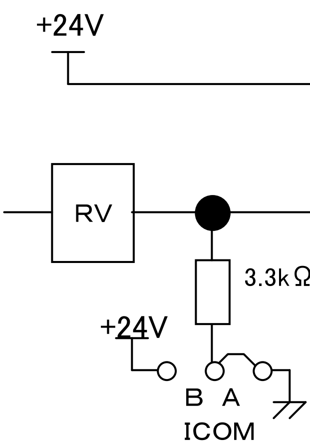
Do not use the +24V power supply of the robot.

When adding a relay, solenoid, or the like directly to the circuit, connect a diode for counter electromotive voltage protection in parallel to the load.

When using a load, such as a lamp, that generates surge current when it is turned on, install a protection resistor.

(g) Applicable signals
Output signals of process I/O board CRMA5 and CRMA6
CMDENBL, SYSRDY, PROGRUN, PAUSED, HELD, FAULT, ATPERCH, TPENBL, BATALM, BUSY,
ACK1 to ACK8, SNO1 to SNO8, SNACK, DO1 to DO76

(2) Input signals in peripheral device interface A
(a) Example of connection

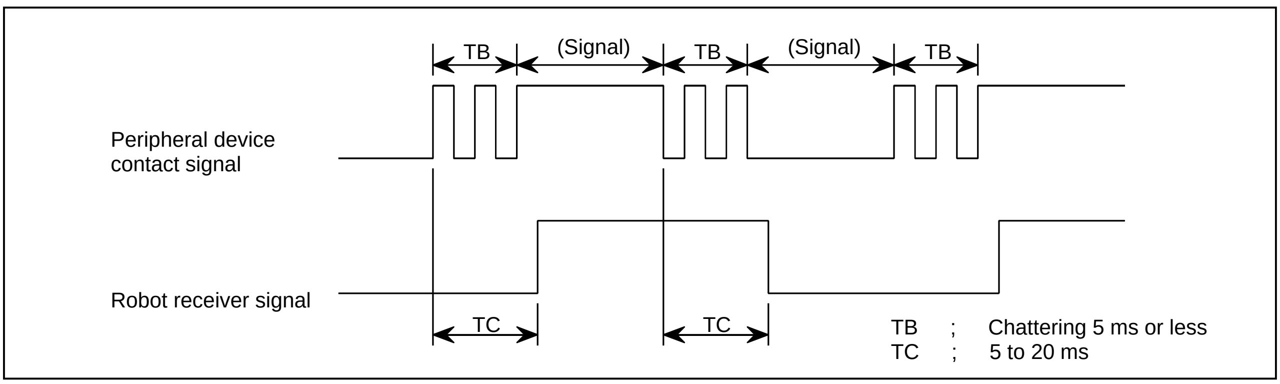


(b) Electrical specifications of the receiver

Type:	Grounded voltage receiver
Rated input voltage:	Contact close : +20V to +28V
	Contact open : 0V to +4V
Maximum applied input voltage:	+28VDC
Input impedance:	3.3kΩ (approx.)
Response time:	5ms to 20ms

(c) Specifications of the peripheral device contact

Voltage and Current:	DC24V, 0.1A
	(Use a contact which minimum load is 5mA or less.)
Input signal width:	200ms or more (on/off)
Chattering time:	5ms or less
Closed circuit resistance:	100Ω or less
Opened circuit resistance:	100kΩ or more

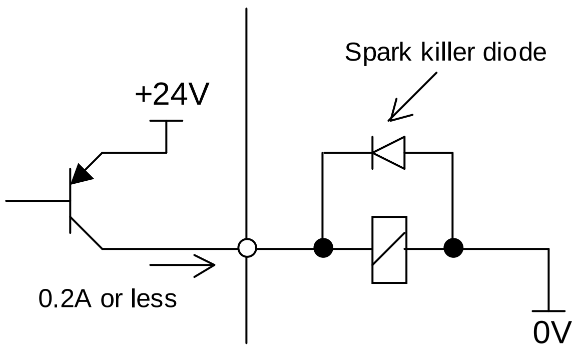


(d) Note on use
Apply the +24 V power at the robot to the receiver.
However, the above signal specifications must be satisfied at the robot receiver.

(e) Applicable signals
Input signals of process I/O board CRMA5 and CRMA6
XIMSTP, XHOLD, XSFSD, CSTOPI, FAULT RESET, START, HOME, ENBL, RSR1 to RSR8, PNSTROBE, PROD START, DI1 to DI78

4.6.2 EE Interface

(1) Output signals in EE interface
(a) Example of connection



(b) Electrical specifications

Maximum load current when driver is on:	200mA (including momentary level)
Saturation voltage when driver is on:	1.0V max.
Dielectric strength:	24V ±20% (including momentary level)
Leakage current when driver is off:	100μA

(c) Power supply to output signals
The +24V power supply on the robot side can be used if the total current level, including the current of the welding interface, is 0.7A or less.

(d) Driver for output signals
In the driver device, the current of each output signal is monitored, and when an overcurrent is detected, the relevant output is turned off. After an output has been turned off by overcurrent, the overcurrent state is released because the output is off, so the output on state is restored. Therefore, in the ground fault or overcurrent state, the output is turned on and off repeatedly. Such a condition is found also when a load with a high surge current is connected.
The driver device also includes an overheat detection circuit, which turns off all outputs of the device when the internal temperature of the device has increased as a result of a continued overcurrent state due to a ground fault of an output and so on. The outputs are held off, but their normal states can be restored by turning the power to the controller on and off after the internal temperature of the device has lowered.

(e) Note on use
When adding a relay, solenoid, or the like directly to the circuit, connect a diode for counter electromotive voltage protection in parallel to the load.
When using a load, such as a lamp, that generates surge current when it is turned on, install a protection resistor.

(f) Applicable signals
RO1 to RO8

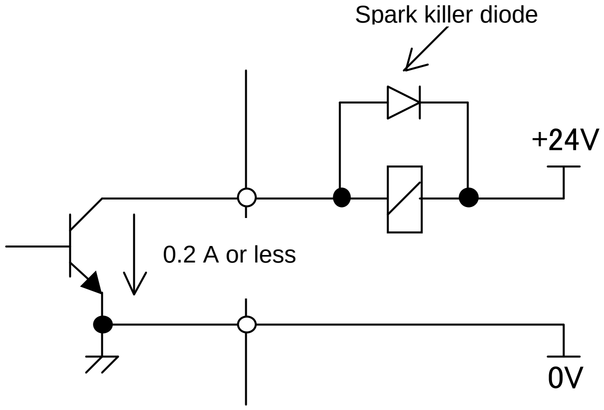
(2) Input signal in peripheral device interface
The input signals are the same as those of other I/O boards. (Refer to Subsection 4.5.1 in CONNECTIONS.)

(a) Applicable signals
RI1 to RI8, XHBK, XPPABN

4.6.3 I/O Signal Specifications for ARC-Welding Interface (A-cabinet/Process I/O Board MB)

(1) Specification for arc welding machine interface digital output signals

(a) Example of connection



(b) Electrical specifications

Rated voltage:	24VDC
Maximum applicable voltage:	30VDC
Maximum load current:	200mA (including momentary level)
Transistor type:	Open-collector NPN
Saturation voltage when the circuit is on:	Approximately 1.0V

(c) Spark killer diode

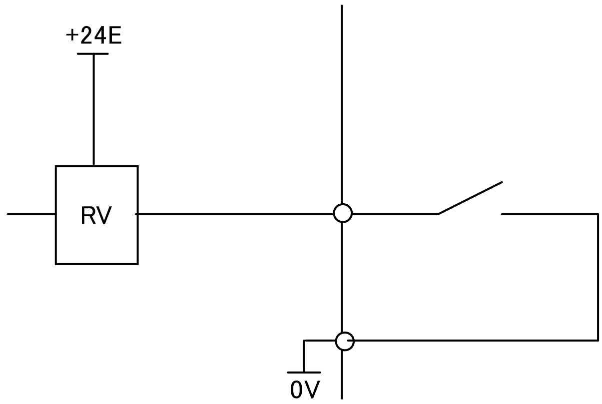
Rated peak-to-peak reverse withstand voltage:	100V or higher
Rated effective forward current:	1A or more

(d) Caution for use
The arc welding machine interface can use the +24V power supply of the robot unless the sum of its sink current and that of the EE interface exceeds 0.7A. When using a relay or solenoid directly as a load, connect the load and a back electromotive force voltage prevention diode in parallel.
When using a load, such as a lamp, that generates surge current when it is turned on, install a protection resistor.

(e) Applicable signals
Arc welding machine interface output signals
[WO1, 2,4,5]

(2) Specification for arc welding machine interface digital output signals

(a) Example of connection

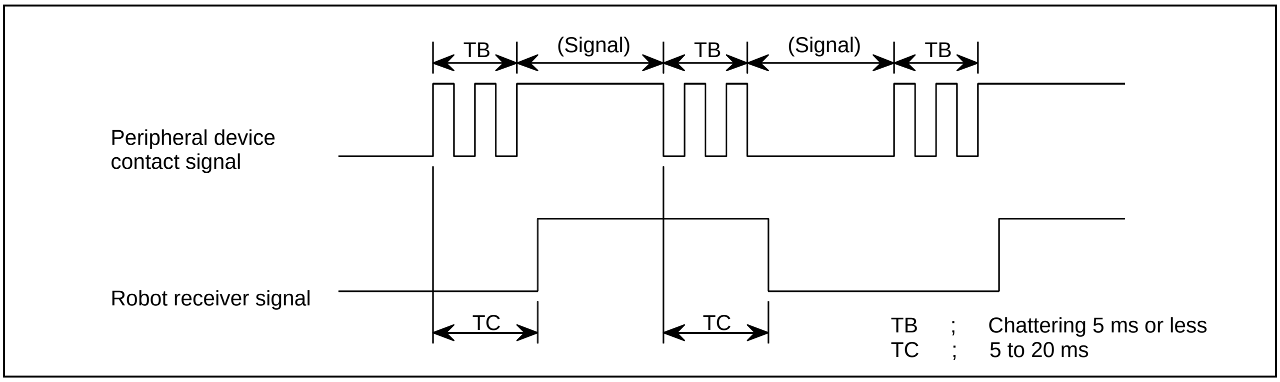


(b) Electrical specifications of the receiver

Type:	Grounded voltage receiver	
Rated input voltage:	Contact close	+20V to +28V
	Contact open	0V to +4V
Maximum applied input voltage:	+28VDC	
Input impedance:	3.0kΩ (approx.)	
Response time:	5ms to 20ms	

(c) Specifications of the peripheral device contact

Voltage and Current:	DC24V, 0.1A (Use a contact which minimum load is 5mA less.)
Input signal width:	200ms or more (on/off)
Chattering time:	5ms or less
Closed circuit resistance:	100Ω or less
Opened circuit resistance:	100kΩ or more

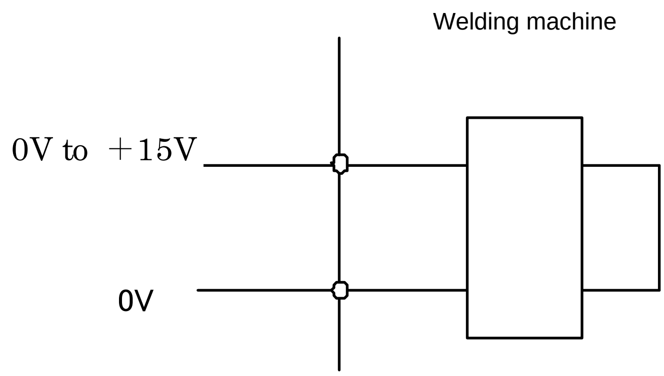


(d) Note on use
Apply the +24 V power at the robot to the receiver.
However, the above signal specifications must be satisfied at the robot receiver.

(e) Applicable signals
Arc welding machine interface input signals
[WI2 to 6]

(3) Specification for arc welding machine interface analog output signals (welding voltage and wire feed speed specification signals)

(a) Example of connection



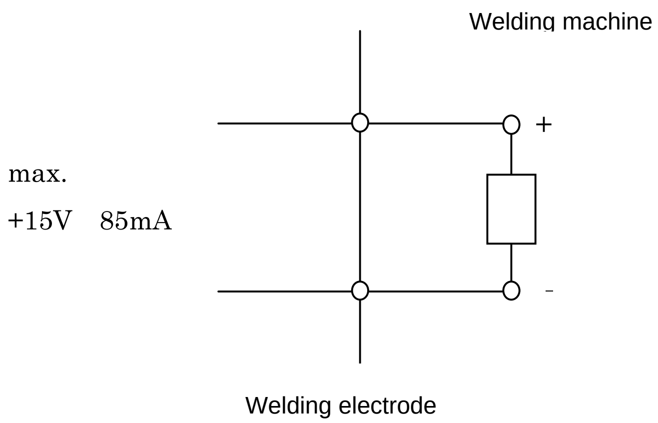
(b) Caution for use

Input impedance: 3.3kΩ or higher

Install a high-frequency filter.

(Wire deposit detection: WDI+ and WDI-)

(a) Example of connection



(Wire deposition detection: WDI+, WDI-)

(b) Caution for use

The resistance between the + and - terminals of the welding machine must be 100 Ω or higher.

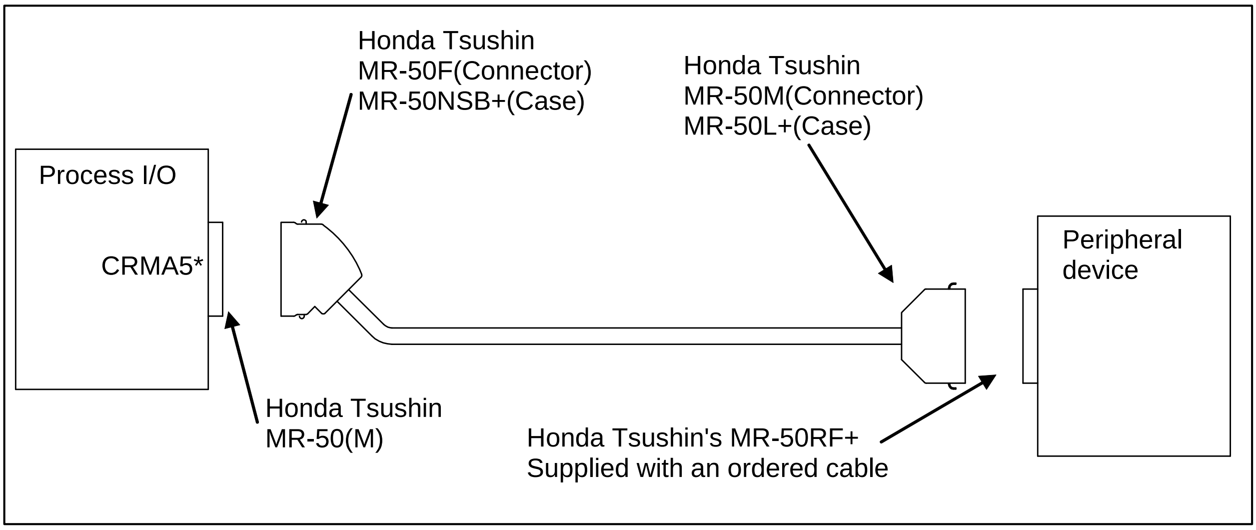
The TIG welding deposition detection circuit must be isolated from the welding circuit (high frequency).

This circuit can withstand up to 80 V.

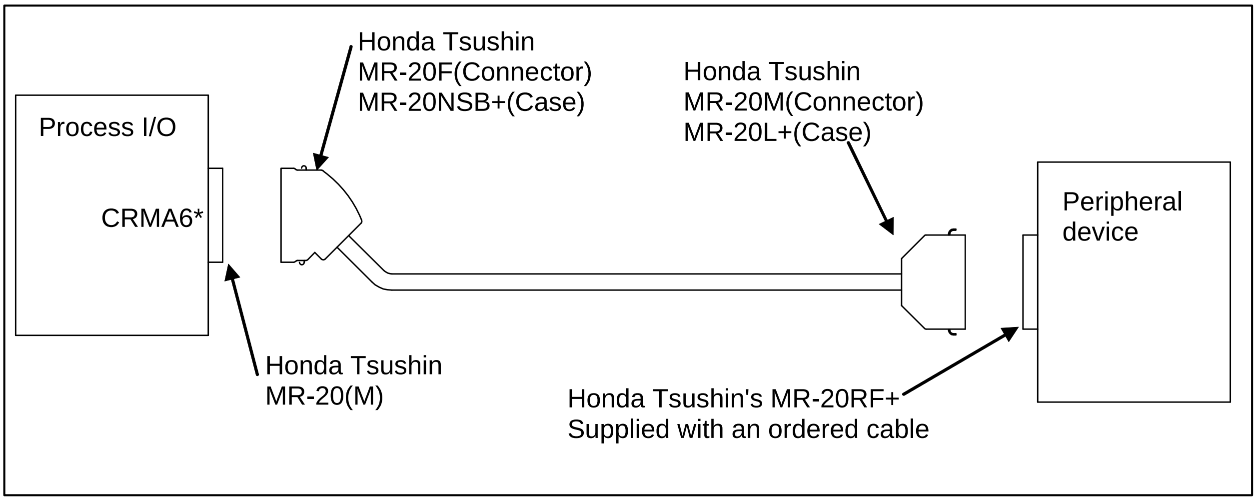
4.7 SPECIFICATIONS OF THE CABLES USED FOR PERIPHERAL DEVICES AND WELDERS

If the customer manufactures cables, make sure they conform to the FANUC standard cables described in this section.
(See the description in "Peripheral Device Interface" in this manual for the specifications of the FANUC standard cables.)

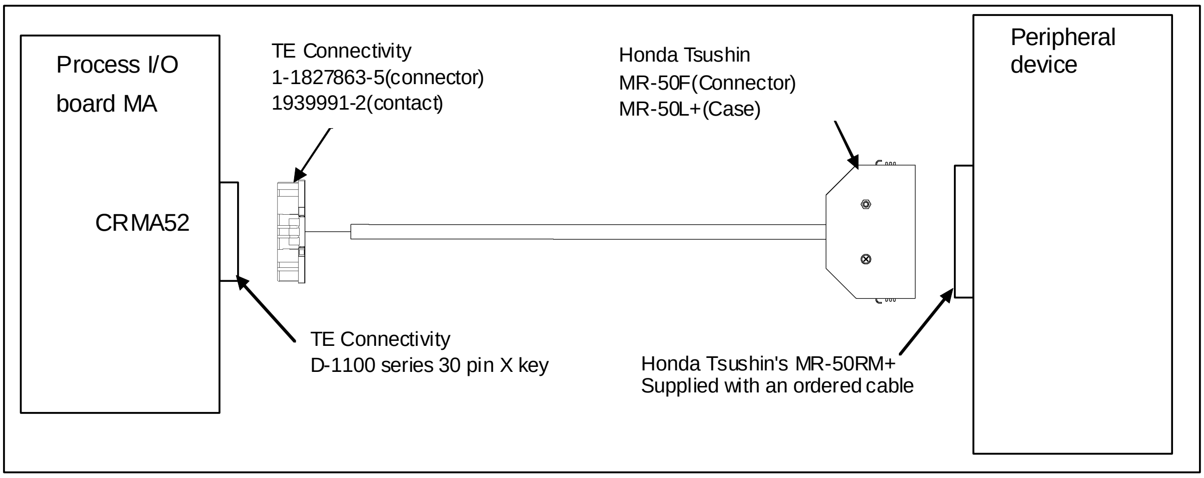
4.7.1 Peripheral Device Interface A Cable (CRMA5*: Honda Tsushin, 50 pins)



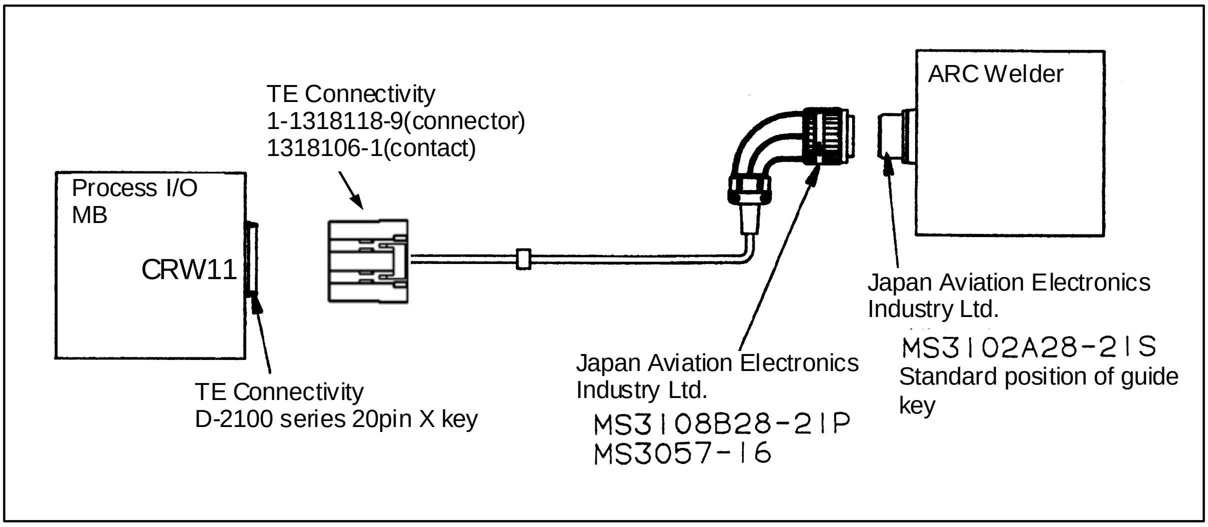
4.7.2 Peripheral Device Interface B Cable (CRMA6*: Honda Tsushin, 20 pins)



4.7.3 Peripheral Device Interface B1 and B2 Cables (CRMA52; TE Connectivity 30 pin)



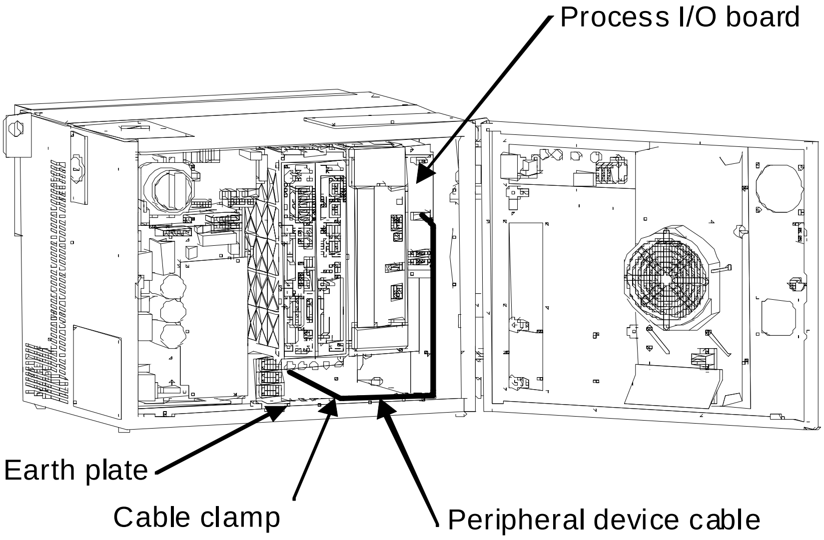
4.7.4 ARC Weld Connection Cables (CRW11; TE Connectivity 20 pin)



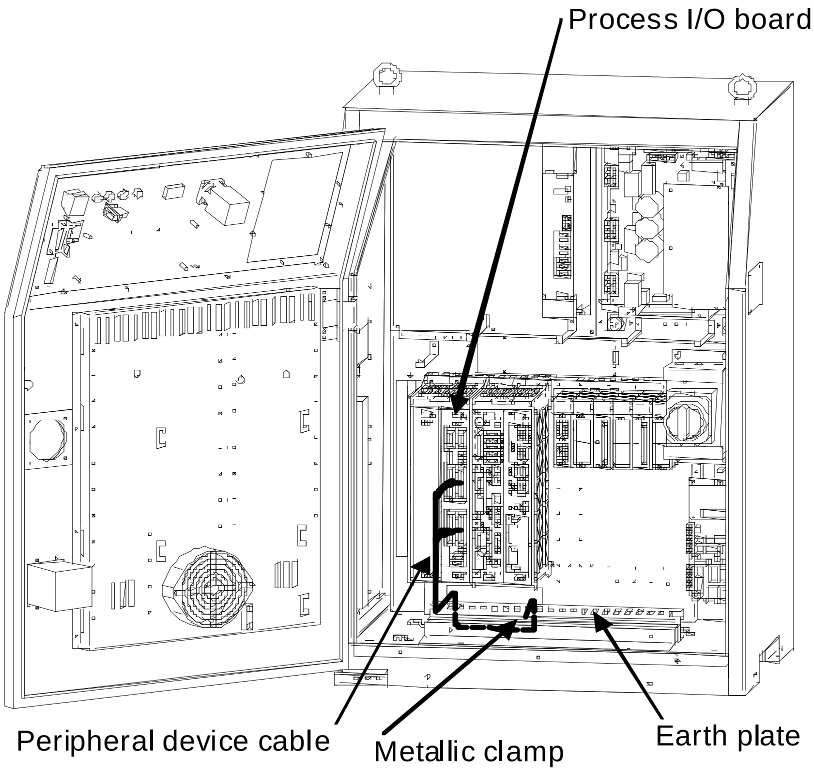
4.8 CABLE CONNECTION FOR THE PERIPHERAL DEVICES, END EFFECTORS, AND ARC WELDERS

4.8.1 Peripheral Device Connection Cable

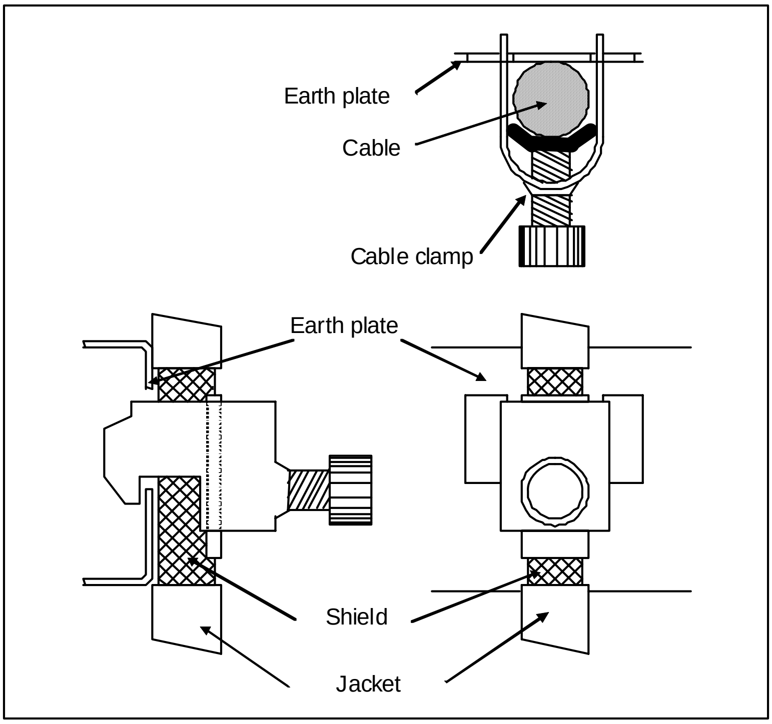
Fig.4.8.1 shows the connection of the peripheral device cable in the cabinet.



(A-cabinet)



(B-cabinet)



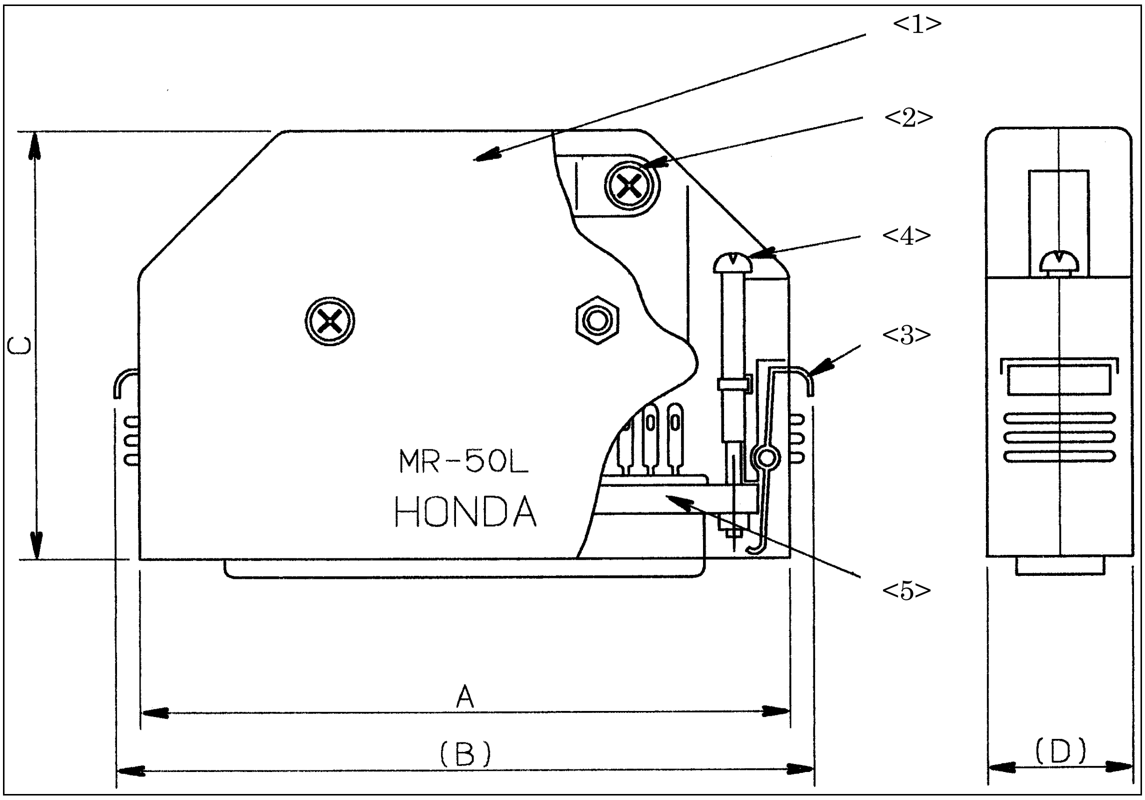
NOTE

For protection against the noise, cut part of the jacket of the connection cable to expose the shield, and fasten this part to the earth plate with the cable clamp.

Fig.4.8.1 Peripheral Device Cable Connection

4.8.2 Peripheral Device Cable Connector

(1) Fig.4.8.2 shows the connector for peripheral device cables A and B.

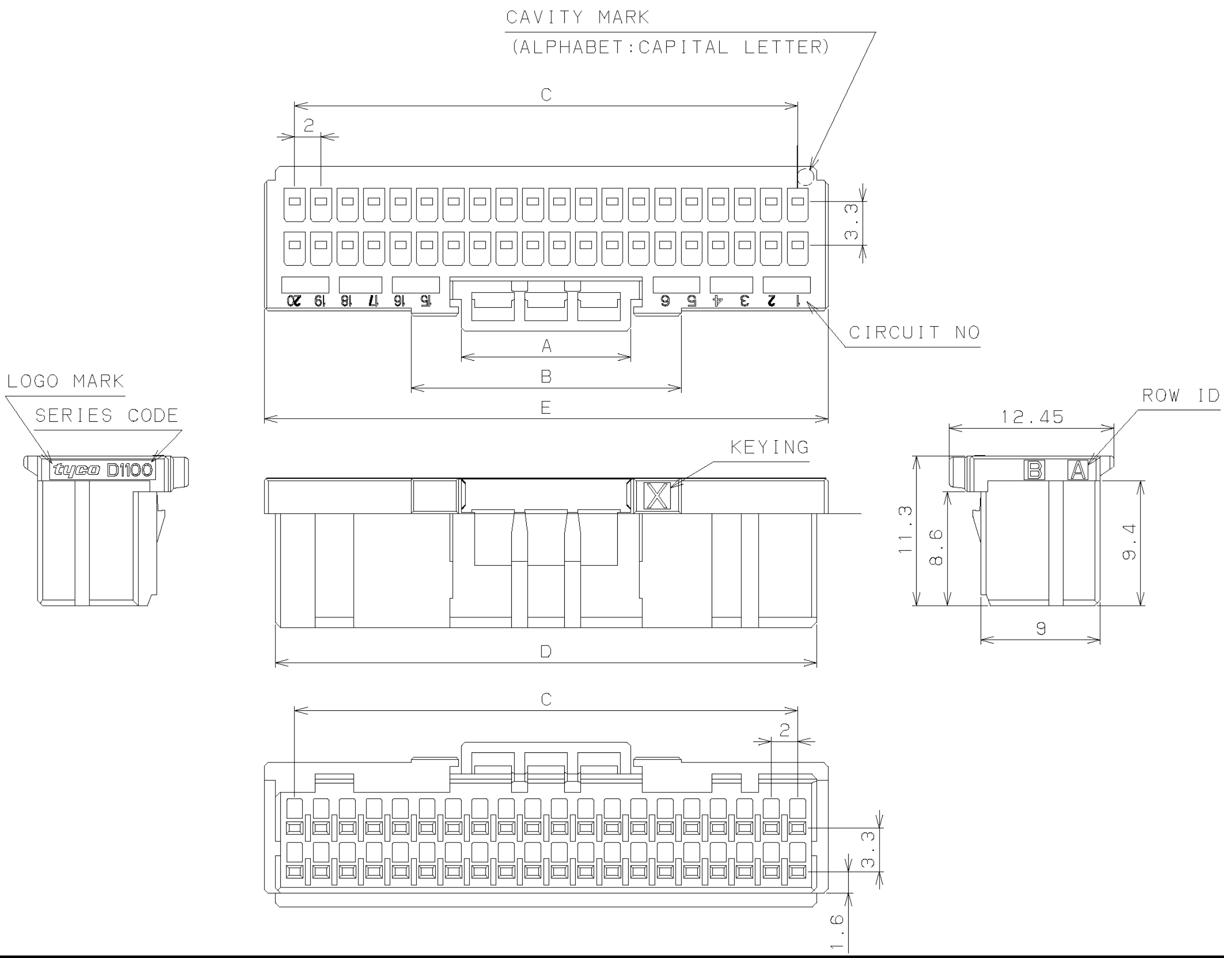


Connector specifications	Applicable interface	Dimensions				Remark
		A	(B)	C	(D)	
MR-50F(Connector) MR-50L+(Case)	CRMA5	67.9	73.5	44.8	18	Honda Tsushin Kogyo, 50 pins Female, Solder type
MR-20F(Connector) MR-20L+(Case)	CRMA6	39.3	44.9	39.8	17	Honda Tsushin Kogyo, 20 pins Female, Solder type

Symbol	Name
<1>	Connector cover
<2>	Cable clamp screw
<3>	Connector clamp spring
<4>	Connector clamp screw
<5>	Connector

Fig.4.8.2 (a) Peripheral device cable connector

(1) Fig.4.8.2 shows the connector for peripheral device cables A1 and A2.



Connector specifications	Applicable interface	Dimensions					Remark
		A	B	C	D	E	
1-1827863-5 (Rece-housing)	CRMA52	12.8	20.4	28.0	30.9	32.6	TE Connectivity D-1000 series 30pin (X-key)
1939991-2 (Rece-contact)	CRMA52						TE Connectivity

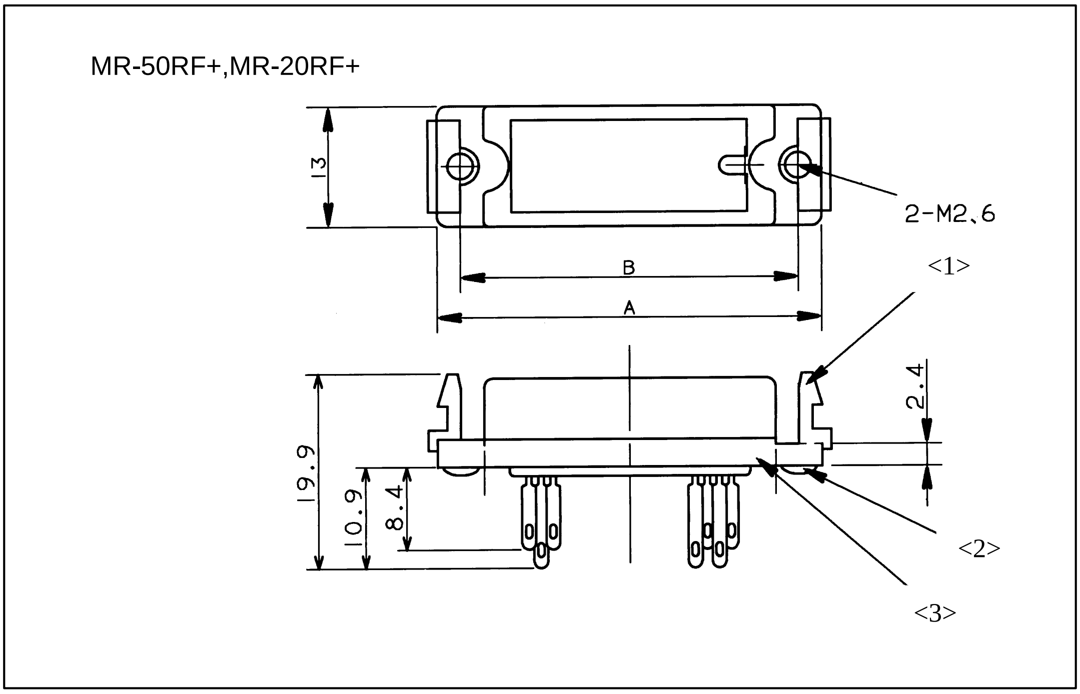
Maintenance tool

Hand tool (for crimping contact) 2119141-1:A05B-2550-K064

Extraction tool 1891526-1:A05B-2550-K061

Fig.4.8.2 (b) Peripheral device cable connector

(2) Peripheral device connector



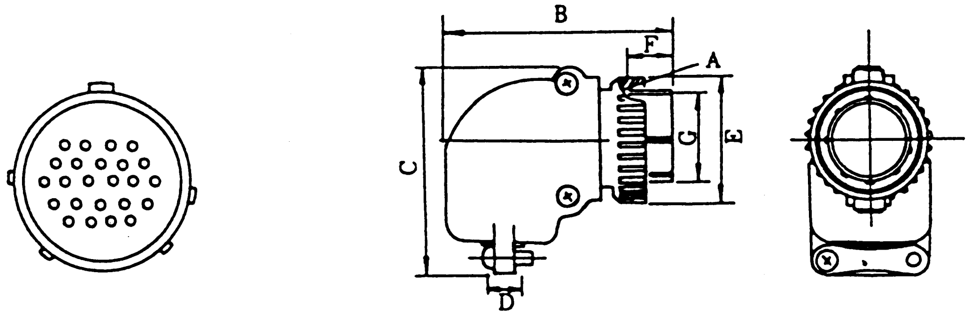
Connector specifications	Applicable	Dimensions		Remark
		A	B	
MR-50RF+	Peripheral device	61.4	56.4	Honda Tsushin Kogyo, 50 pins Female, Solder type
MR-20RF+	Peripheral device	39.3	44.9	Honda Tsushin Kogyo, 20 pins Female, Solder type

Symbol	Name
<1>	Connector clamp screw
<2>	Screw M2.6 x 8
<3>	Connector

Fig.4.8.2 (c) Peripheral device connector

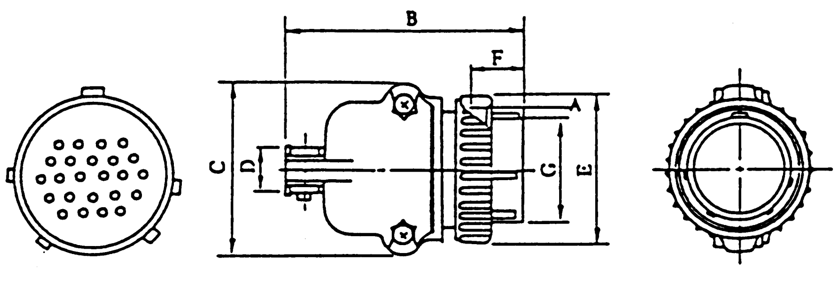
4.8.3 End Effector Cable Connector (EE interface)

(1) Connector external view (Example: For R-2000*i*B, M-710*i*C)



A: M30 x 1
B: 63.0
C: 54.5
D: 9.6 to 15.0 (Inside diameter)
E: ϕ33
F: 11.2
G: 24.7
Manufactured by Fujikura JMLP2524M

Fig.4.8.3 (a) Connector (Elbow Type)



A: M30 x 1
B: 54.1
C: 37.5
D: 9.6 to 15.0 (Inside diameter)
E: ϕ33
F: 11.2
G: 24.7
Manufactured by Fujikura JMLP2524M

Fig.4.8.3 (b) Connector (Straight Type)

NOTE
EE interface depends on the option of the robot. Refer to the robot-specific operator's manual of each robot.

4.8.4 Recommended Cables

(1) Peripheral device connection cable
Connect a peripheral device using a completely shielded, heavily protected cable conforming to the specifications in Table 4.8.4 (a).
Allow an extra 50 cm for routing the cable in the controller.
The maximum cable length is 30 m.

Table 4.8.4 (a) Recommended Cable (for Peripheral Device Connection)

Number of wires	Wire specifications (FANUC specifications)	Conductor		Sheath thicknes s (mm)	Effective outside diameter (mm)	Electrical characteristics	
		Diameter (mm)	Configuration			Conductor resistance (Ω/km)	Allowable current (A)
50	A66L-0001-0042	ϕ1.05	7/0.18 AWG24	1.5	ϕ12.5	106	1.6A
20	A66L-0001-0041	ϕ1.05	7/0.18 AWG24	1.5	ϕ10.5	106	1.6A

(2) End effector connection cable
Connect an end effector using a heavily protected cable with a movable wire conforming to the specifications in Table 4.8.4 (b).
The cable length is determined so that the cable will not interfere with the end effector and the wrist can move through its full stroke.

Table 4.8.4 (b) Recommended Cable (for End Effector Connection)

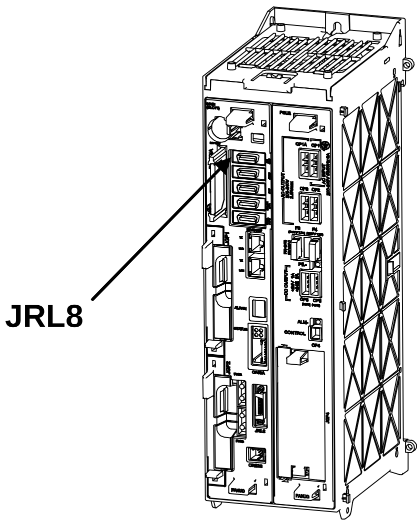
Number of wires	Wire specifications (FANUC specifications)	Conductor		Sheath thicknes s (mm)	Effective outside diameter (mm)	Electrical characteristics	
		Diameter (mm)	Configuration			Conductor resistance (Ω/km)	Allowable current (A)
6	A66L-0001-0143	ϕ1.1	40/0.08 AWG24	1.0	ϕ5.3	91	3.7
20	A66L-0001-0144	ϕ1.1	40/0.08 AWG24	1.0	ϕ8.6	91	2.3
24	A66L-0001-0459	ϕ0.58	40/0.08 AWG24	1.0	ϕ8.3	93	2.3

NOTE
For protection against the noise, cut part of the jacket of the connection cable to expose the shield, and fasten this part to the earth plate with the cable clamp.

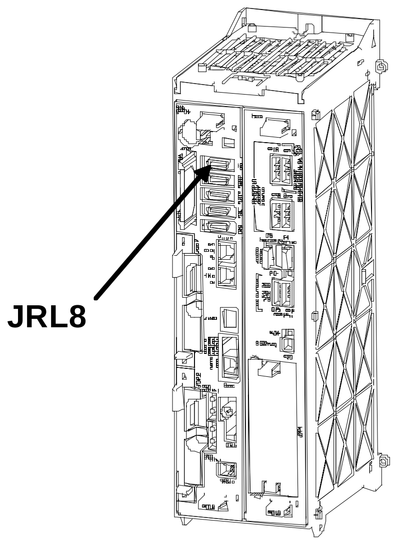
4.9 CONNECTION OF HDI

4.9.1 Connecting HDI

The HDI signals are used in combination with special application software. The HDI signals cannot be used as general-purpose DIs.



(R-30*i*B)



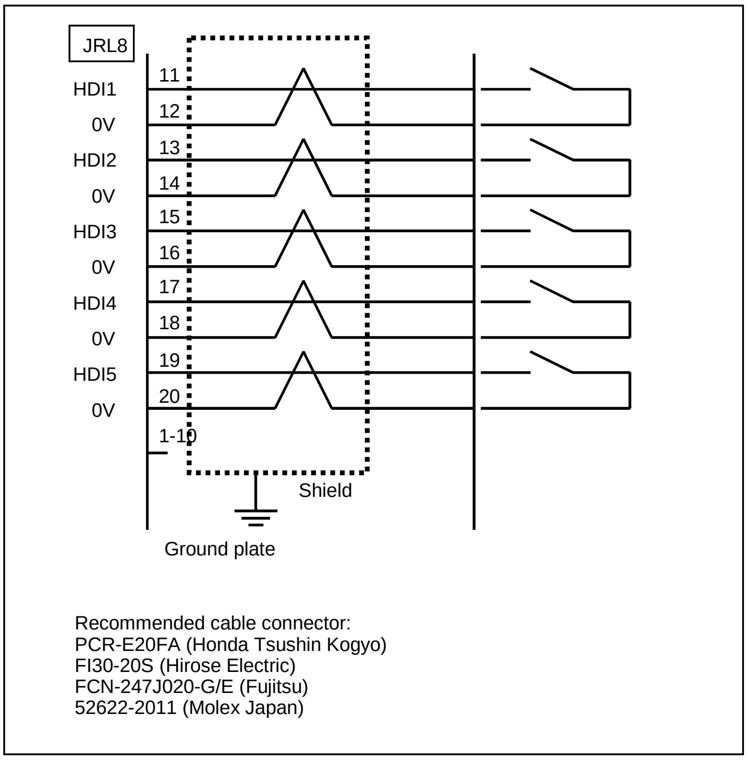
(R-30*i*B Plus)

R-30*i*B/R-30*i*B Plus

Main board
JRL8

1	Reserved	11	HDI1
2	Reserved	12	0V
3	Reserved	13	HDI2
4	Reserved	14	0V
5	Reserved	15	HDI3
6	Reserved	16	0V
7	Reserved	17	HDI4
8	Reserved	18	0V
9	Reserved	19	HDI5
10	Reserved	20	0V

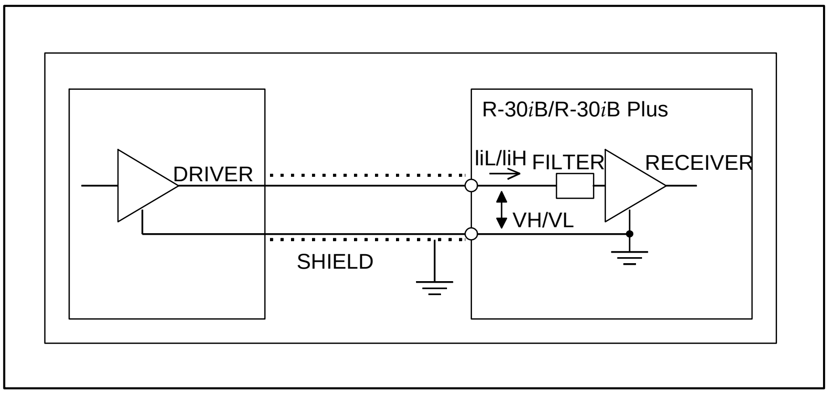
Cable connections



NOTE
1. Pair each signal with 0V.
2. For protection against the noise, cut part of the jacket of the connection cable to expose the shield, and fasten this part to the earth plate with the cable clamp.

4.9.2 Input Signal Rules for the High-speed Skip (HDI)

Circuit configuration



Absolute maximum rating
Input voltage range Vin: -3.6 to +10 V
Input characteristics

Unit	Symbol	Specification	Unit	Remark
High level input voltage	VH	3.6 to 11.6	V	
Low level input voltage	VL	0 to 1.0	V	

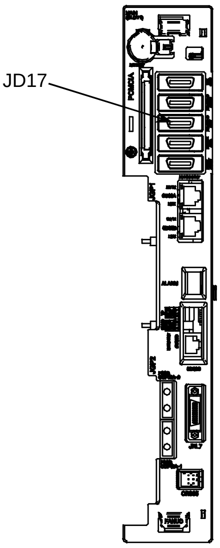
Unit	Symbol	Specification	Unit	Remark
High level input current	IiH	2 max	mA	Vin=5 V
		11 max	mA	Vin = 10 V
Low level input current	IiL	-8.0 max	mA	Vin = 0 V
Input signal pulse duration		20 min	μs	
Input signal delay or variations		20 max	μs	

NOTE
1. The plus (+) sign of IiH/IiL represents the direction of flow into the receiver. The minus (-) sign of IiH/IiL represents the direction of flow out of the receiver.
2. The high-speed skip signal is assumed to be 1 when the input voltage is at the low level and 0 when it is at the high level.

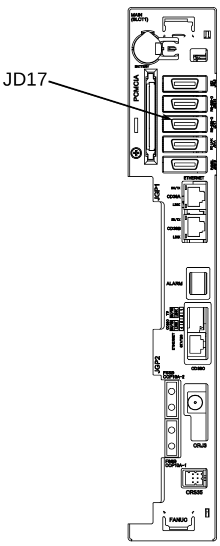
4.10 CONNECTING THE COMMUNICATION UNIT

4.10.1 RS232C Interface

4.10.1.1 Interface



(R-30*i*B main board)



(R-30*i*B Plus main board)

JD17

1	RD	11	SD
2	SG	12	SG
3	DR	13	ER
4	SG	14	SG
5	CS	15	RS
6	SG	16	SG
7		17	
8		18	
9		19	+24V
10	+24V	20	

Honda Tsushin Kogyo
CONNECTOR: PCR-E20FS
COVER: PCR-V20LA, or compatible connector

NOTE
1. +24 V can be used as the power supply for FANUC RS232C equipment.
2. Do not connect anything to those pins for which signal names are not indicated.

4.10.1.2 RS232C interface signals

Generally signals as follows are used in RS232C interface.

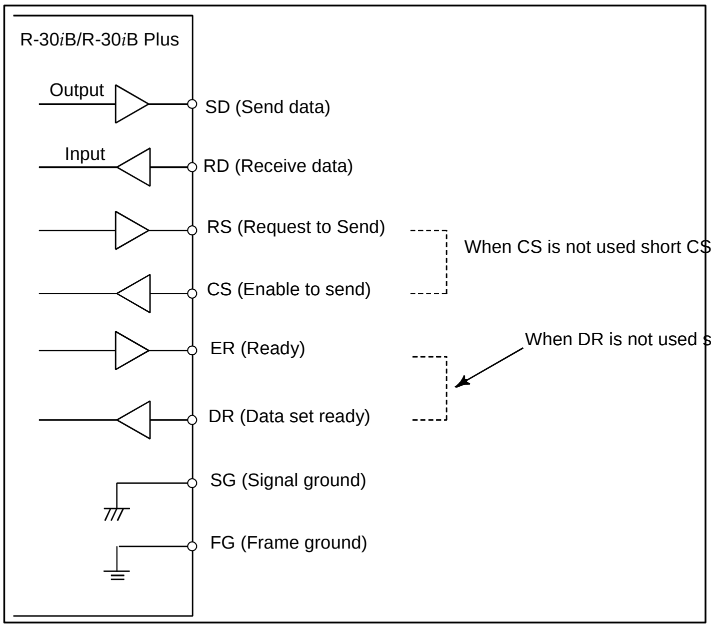
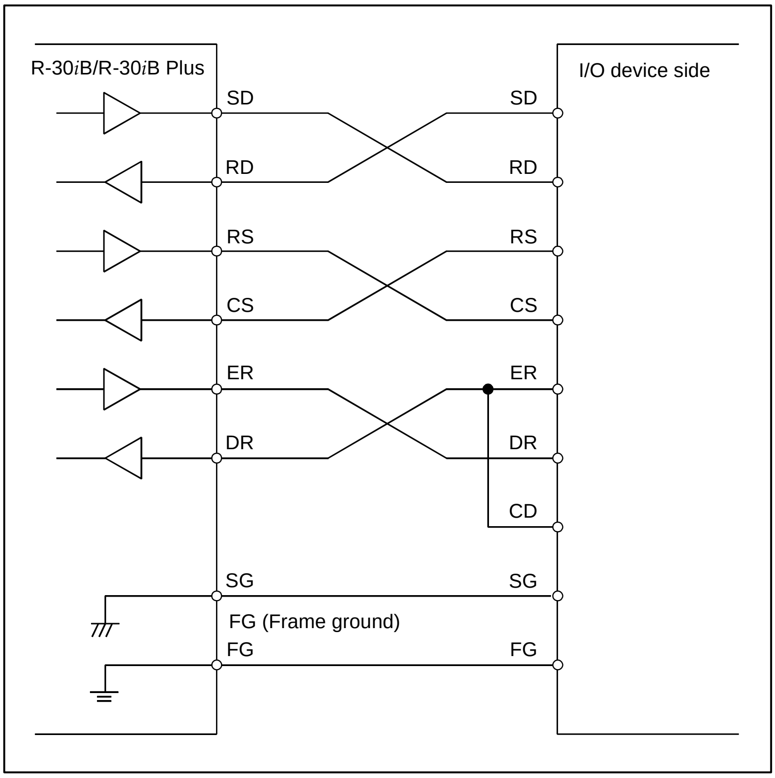


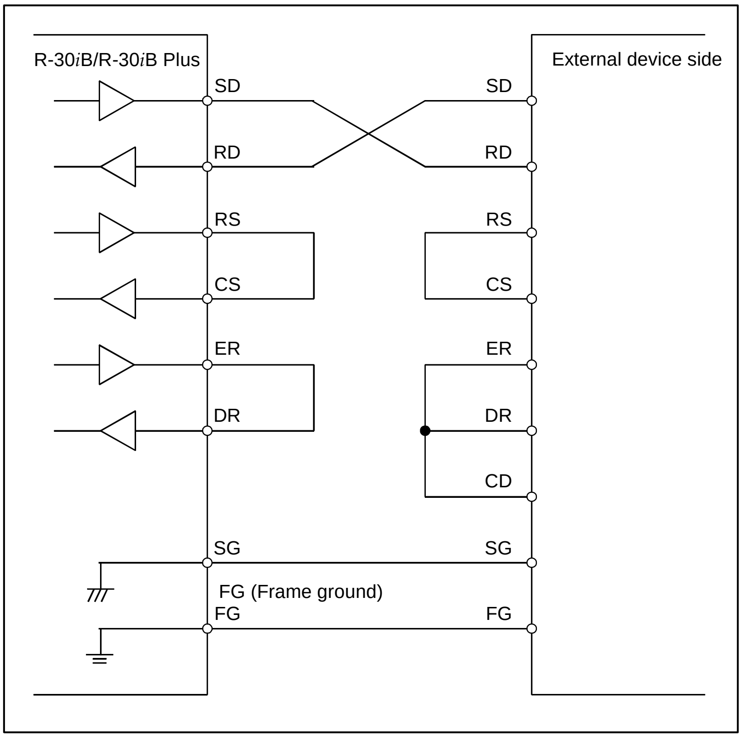
Fig.4.10.1.2 RS232C interface

4.10.1.3 Connection between RS232C interface and I/O device

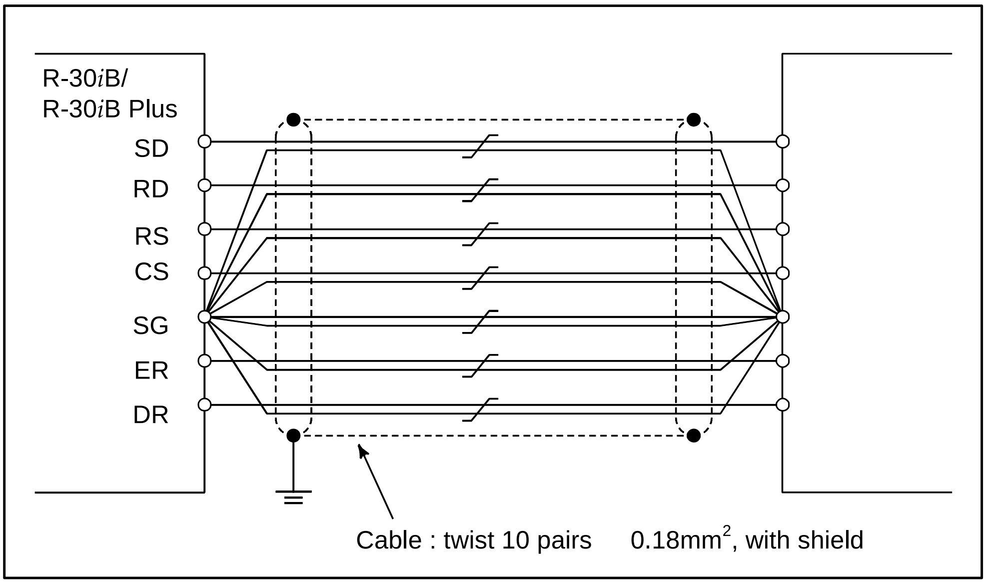
The figure below shows a connection with the handshaking of the ER/DR, RS/CS signals.



- The figure below shows a connection without the handshaking of the RS/CS, ER/DR signals.



Cable connection



> **NOTE**
> 1 Pair each signal with SG.
> 2 For protection against the noise, cut part of the jacket of the connection cableto expose the shield, and fasten this part to the earth plate with the cable clamp.

4.10.2 Ethernet Interface

This section describes information relating to the physical Ethernet connection.

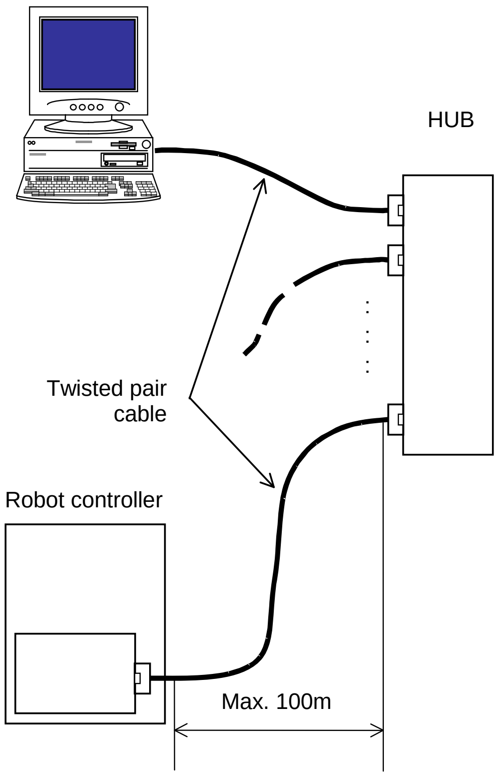
> ⚠ **CAUTION**
> 1 Before connecting or disconnecting the Ethernet cable, make sure that the power to the robot controller is turned off.
> 2 Please inquire of each manufacturer (of hub, transceiver, cable etc.) about the construction of the network or the condition in which the equipment is being used. When configuring your network, you must take other sources of electrical noise into consideration to prevent your network from being influenced by electrical noise. Make sure that network wiring is sufficiently separated from power lines and other sources of electrical noise such as motors, and ground each of the devices as necessary. In addition, high and insufficient ground impedance may cause interference during communications. After installing the robot, conduct a communications test before you actually start operating the robot.
> We cannot ensure operation that is influenced by network trouble caused by a device other than the robot controller.

4.10.2.1 Connection to Ethernet

The robot controller is provided with a 100BASE-TX and 1000BASE-T (Only R-30*i*B Plus) interface.
Prepare a hub for connecting the controller to the Ethernet trunk. The following shows an example of a general connection.

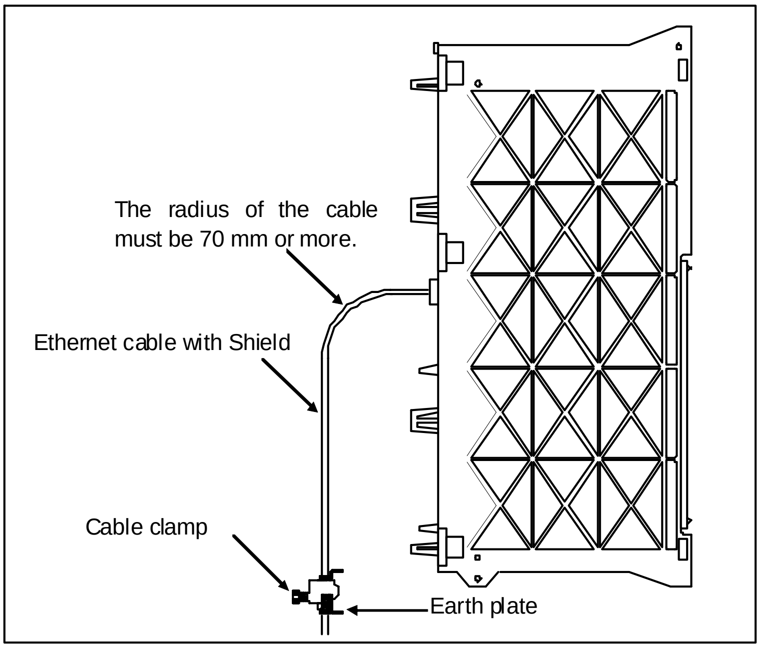
To connect the control unit to the CD38C (for R-30iB Plus) Ethernet interface in a half duplex communication mode, use a hub which satisfies the following conditions:
- Supports 100BASE-TX/1000BASE-T.
- Has an auto-negotiation function.
- Supports store-and-forward switching.
- Supports flow controll.

Some devices (hub, transceiver, etc.) that are needed for building a network do not come in dust-proof construction. Using such devices in an atmosphere where they are subjected to dust or oil mist will interfere with communications or damage the robot controller. Be sure to install such devices in a dust-proof cabinet.



4.10.2.2 Leading out the Ethernet Cable

For this type of controller, the cable is drawn out only from the front of the controller. See the outline drawing of each type of board for the location of the connector.



The Ethernet cable must be fastened by a cable clamp to prevent tension being applied to the modular connector (RJ-45) that connects the cable to the controller even if the Ethernet cable is pulled directly. This clamp is also used to ground the cable shield.

4.10.2.3 100BASE-TX Connector (CD38A, CD38B) / 1000BASE-T Connector (CD38C) Pin Assignments

CD38A,CD38B(R-30*i*B, R-30*i*B Plus)

Pin No.	Signal name	Description
1	TX+	Send +
2	TX-	Send -
3	RX+	Receive +
4		Not used
5		Not used
6	RX-	Receive -
7		Not used
8		Not used

CD38C(1000BASE-T, R-30*i*B Plus only)

Pin No.	Signal name	Description
1	MDI0+	Bi-directional Data 0+
2	MDI0-	Bi-directional Data 0-
3	MDI1+	Bi-directional Data 1+
4	MDI2+	Bi-directional Data 2+
5	MDI2-	Bi-directional Data 2-
6	MDI1-	Bi-directional Data 1-
7	MDI3+	Bi-directional Data 3+
8	MDI3-	Bi-directional Data 3-

4.10.2.4 Twisted-pair Cable Specification

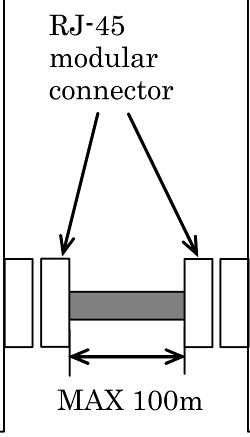
Cable Connection

The cable used for connection between the 100BASE-TX/1000BASE-T interface, CD38, of the controller and the hub is connected as follows:

R-30*i*B/R-30*i*B Plus

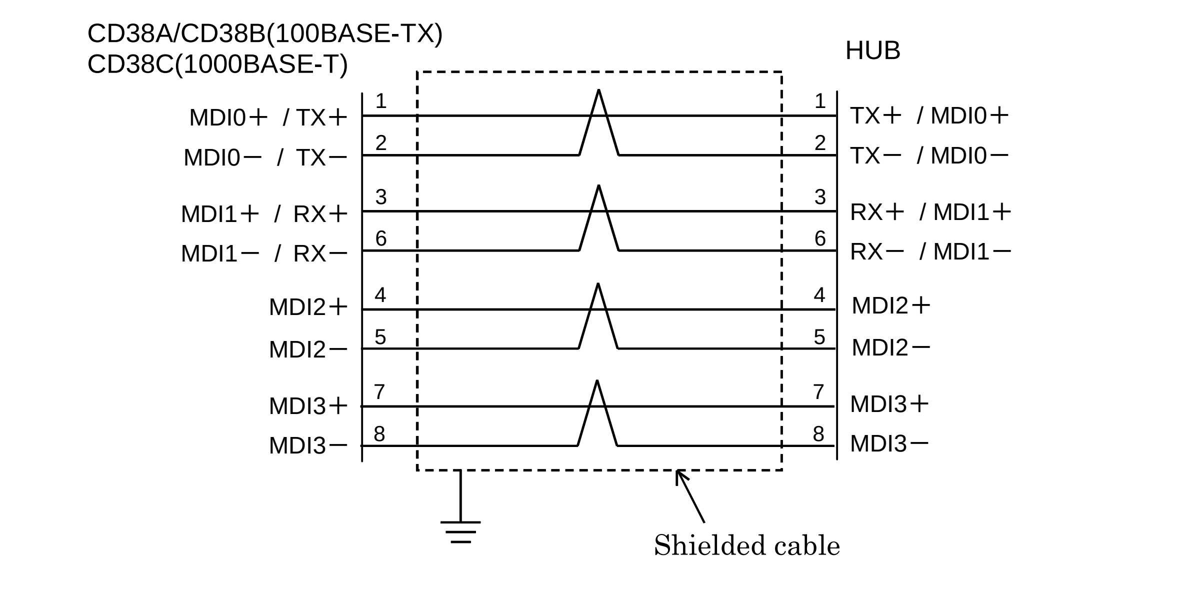
CD38A/CD38B(R-30*i*B/ R-30*i*B Plus)
CD38C(R-30*i*B Plus)

Pin No.	100BASE-TX (CD38A/CD38B)	1000BASE-T (CD38C)
1	TX+	MDI0+
2	TX-	MDI0-
3	RX+	MDI1+
4		MDI2+
5		MDI2-
6	RX-	MDI1-
7		MDI3+
8		MDI3-

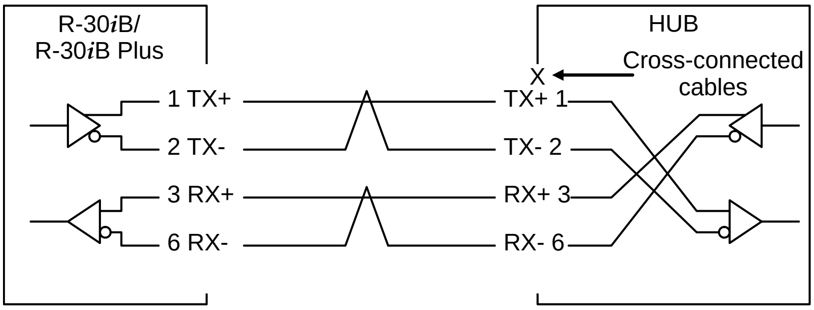


HUB

Pin No.	100BASE-TX	1000BASE-T
1	TX+	MDI0+
2	TX-	MDI0-
3	RX+	MDI1+
4		MDI2+
5		MDI2-
6	RX-	MDI1-
7		MDI3+
8		MDI3-



- Keep the total cable length within 100 m. (The maximum cable length of the movable cable recommended by FANUC is 40m.) Do not extend the cable more than is necessary.
- The figure above shows the cable connection when cables are crossed in the hub.
  "X" is usually indicated at the port of the hub to signify that cables are crossed in the hub.



(1) Cable Materials

> ⚠ **CAUTION**
> Unshielded cable (UTP cable) is commercially available as 100BASE-TX/ 1000BASE-T twisted-pair cable: You should, however, use shielded Category 5(100BASE-TX) / 5e(1000BASE-T) twisted-pair cable (STP cable) to improve the resistance to electrical noise in an FA environment.

Recommended Cables (100BASE-TX)

Manufacturer	Specification	Remarks
FURUKAWA ELECTRIC CO., LTD.	DTS5087C-4P	Twisted-pair cable
NISSEI ELECTRIC CO., LTD.	F-4PFWMF	Single-conductor cable

Inquiries

Manufacturer		Contact address
FURUKAWA ELECTRIC CO., LTD. Sales Headquarters		2-6-1 Marunouchi, Chiyoda-ku. Tokyo 100-8322 TEL: 03-3286-3126 FAX: 03-3286-3979
NISSEI ELECTRIC CO., LTD. Machida Branch		3F MU Bldg., 1-9-1 Minami-narise, Machida City, Tokyo 194-0045 TEL: 0427-29-2531 FAX: 0427-29-3375
	Overseas Sales Office	IWATANI International Corporation Tokyo Head Office 21-8 Nishi-shinbashi 3-chome, Minato-ku, TOKYO, 105-8458, JAPAN TEL: 03-5405-5810 FAX: 03-5405-5666 Telex: 2524256 IWATYO J
	Remarks	A finished cable with connectors at both ends can be offered.

NOTE
The recommended cables cannot be connected to moving parts.

Recommended cable (for movable parts, dedicated to FANUC)

Manufacturer	Specification	Remarks
Oki Electric Cable Co., Ltd.	AWG26 4P TPMC-C5E (S-HFR) K	CAT5e (1Gbps capable, For 1000BASE-T)
Oki Electric Cable Co., Ltd.	AWG26 4P TPMC-C5-F (SB)	CAT3, CAT5 (100Mbps capable, For 100BASE-TX)
Shinko Electric Industrial Co., Ltd.	FNC-118	CAT3, CAT5 (100Mbps capable, For 100BASE-TX)

Specification

1. Manufacture: Oki Electric Cable Co., Ltd.
   Manufacture’s model number: AWG26 4P TPMC-C5E(S-HFR) K

- Electrical characteristic:
  Complying with EIA/TIA 568B.2 Category 5e.
- Structure:
  Common-shield braided cable with drain wire. The conductors of the cable are AWG26 annealed-copper strand wire, with a sheath 0.6 mm thick and an outer diameter of 6.8 mm.
- Fire resistance:
  UL1581 VW-1
- Oil resistance:
  As per Fanuc’s internal standard (Equivalent to conventional oil-resistant electrical cable)
- Flexing resistance:
  Sliding: 3 millions or more sliding cycles with a bending radius of 50 mm.
  bending: 300 thousands or more bending cycles with a bending radius of 20 mm
  Twisting: 5 millions or more sliding cycles. (+/- 180degrees)
- UL style No. :
  AWM20276（80℃/30V/VW-1）

2. Manufacture: Oki Electric Cable Co., Ltd.
   Manufacture’s model number: AWG26 4P TPMC-C5-F (SB)
   Manufacture: SHINKO ELECTRIC INDUSTRIES CO., LTD.
   Manufacture’s model number: FNC-118

- Electric characteristics:

Conforms to EIA/TIA 568A Category 3 and Category 5.
From the viewpoint of attenuation performance, ensure that the length to the hub is 50 m or less.

- Structure:
  Group shielded (braided shield). A drain wire is available.
  The conductor is an AWG26 annealed copper twisted wire, with a sheath thickness of 0.8 mm and an outer diameter of 6.7 mm ±0.3 mm.
- Fire retardancy:
  UL1581 VW-1
- Oil resistance:
  Conforms to the FANUC internal standards (equivalent to the conventional oil-resistant electric cables).
- Flexing resistance:
  1,000,000 times or more with a bending radius of 50 mm (U-shaped flex test)
- UL style No. :
  AWM 20276 (80°C/30V/VW-1)

NOTE
Be sure to use the connector TM21CP-88P (03) manufactured by HIROSE ELECTRIC CO., LTD. for this cable.

Inquiries

Manufacturer	Contact address
Oki Electric Cable Co., Ltd.	Nagano Sales Office TEL:0266-27-1597
Shinko Electric Industrial Co., Ltd.	Tokyo Sales Office TEL:03-3492-0073

Cable assembly
Oki Electric Cable Co., Ltd. can also supply the cable assembly mentioned above.
Contact Oki Electric directly to determine the specifications (length, factory test, packing, and so forth) for purchase.

(2) Connector Specification

Use an 8-pin modular connector (RJ-45) with the twisted-pair cable for the Ethernet connection. The following connectors or equivalents must be used.

Non-Flex	Specification	Manufacturer	Remarks
Solid wire	5-569530-3	TE Connectivity	
Solid wire	MS8-RSZT-EMC	SK KOHKI CO., LTD.	Special tools required
Twisted-pair cable	5-569552-3	TE Connectivity	
Twisted-pair cable	TM11AP-88P	HIROSE ELECTRIC CO., LTD.	Special tools required

Flex	Specification	Manufacturer	Remarks
AWG26 4P TPMC-C5-F (SB) AWG26 4P TPMC-C5E (S-HFR) K, or FNC-118	TM21CP-88P (03)	HIROSE ELECTRIC CO., LTD.	Note

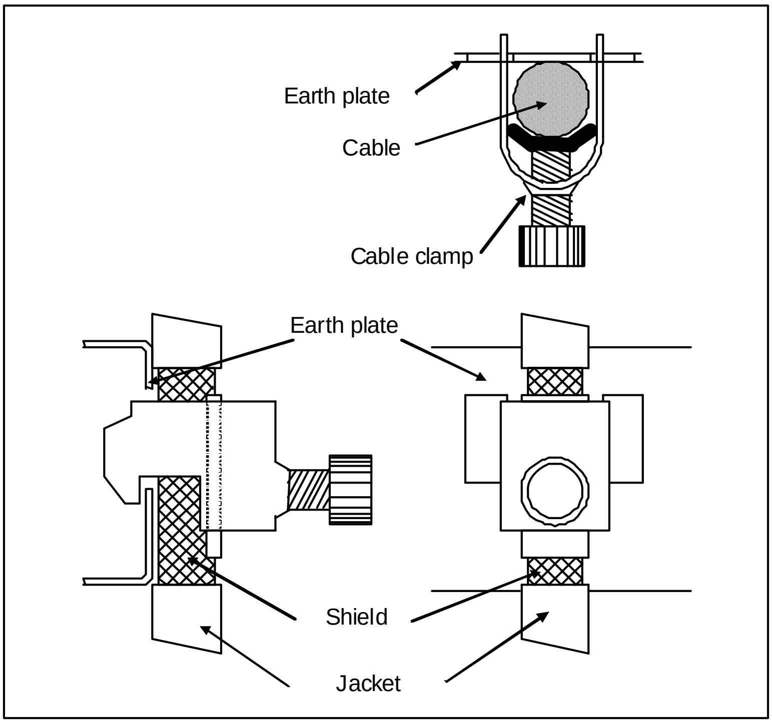
NOTE

Information about TM21CP-88P (03):
Connector (standard product of the manufacturer)
Drawing number: A63L-0001-0823#P
Manufacturer: HIROSE ELECTRIC CO., LTD.
Manufacturer type number: TM21CP-88P (03)
Conforms to EIA/TIA 568B.2 Category 5e.
For assembly with a cable, contact HIROSE ELECTRIC CO., LTD. directly.
(From HIROSE ELECTRIC CO., LTD., "TM21CP-88P (03) Connection Procedure Manual (Technical Specification No. ATAD-E2367)" is available as a technical document.)

4.10.2.5 Electrical Noise Countermeasures

Clamping and Shielding Cables

Clamp an Ethernet twisted pair cable according to the method described below, as with cables that need to be shielded. Clamping cables provides support and shielding and is extremely important to the safe operation of the system. Never overlook cable clamping.
Peel off part of the jacket as shown in the figure to expose the outer coating of the shield, and press this outer coating against the earth plate with the cable clamp.
The machine manufacturer must prepare the ground plate and install it as follows:



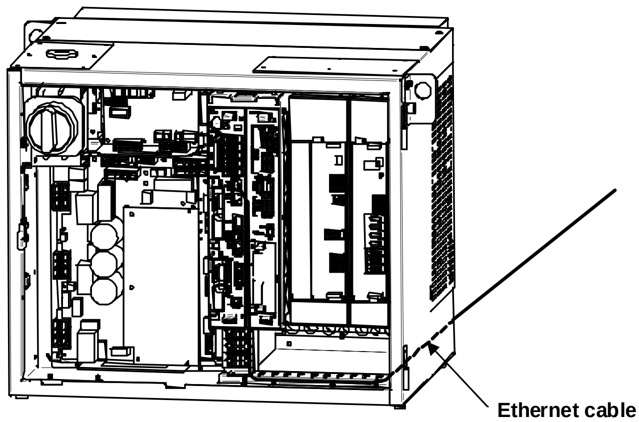
NOTE

To ensure the safe operation of the system, clamp and shield the cables.

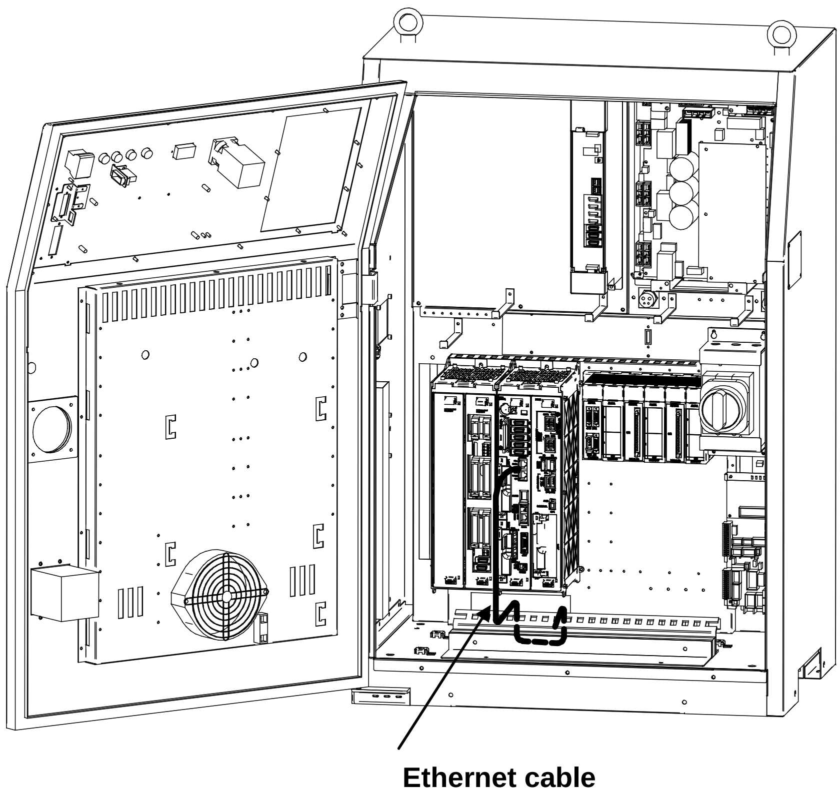
NOTE

1 To secure fast response, FL-net communication is not provided with a retransmission process at intervals of several seconds, unlike normal Ethernet communication. It is, therefore, necessary to provide more noise resistance than that provided by general Ethernet wiring work.
2 After the laying of cables, conduct satisfactory communication tests not only before system operation but after system operation from the viewpoint of noise prevention measures.

Cable route



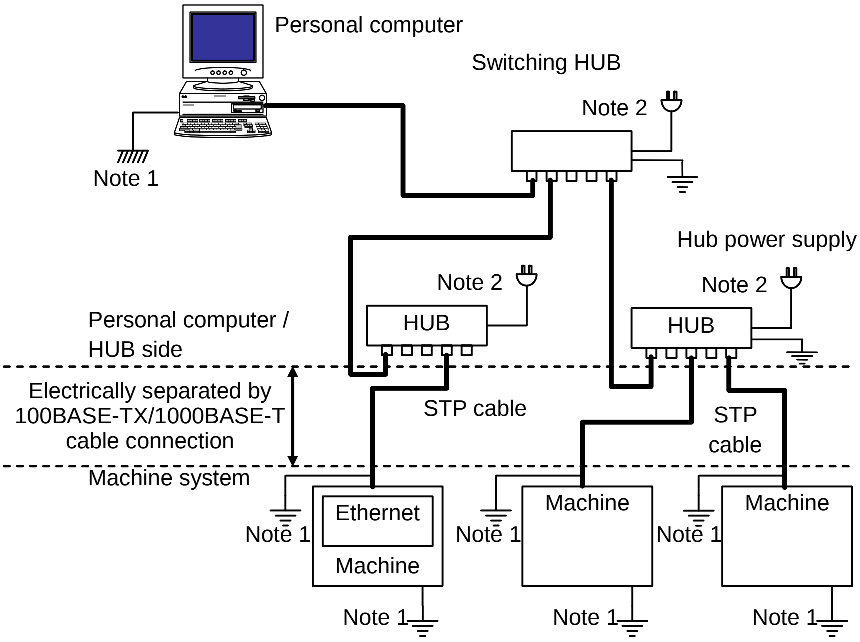
(A-cabinet)



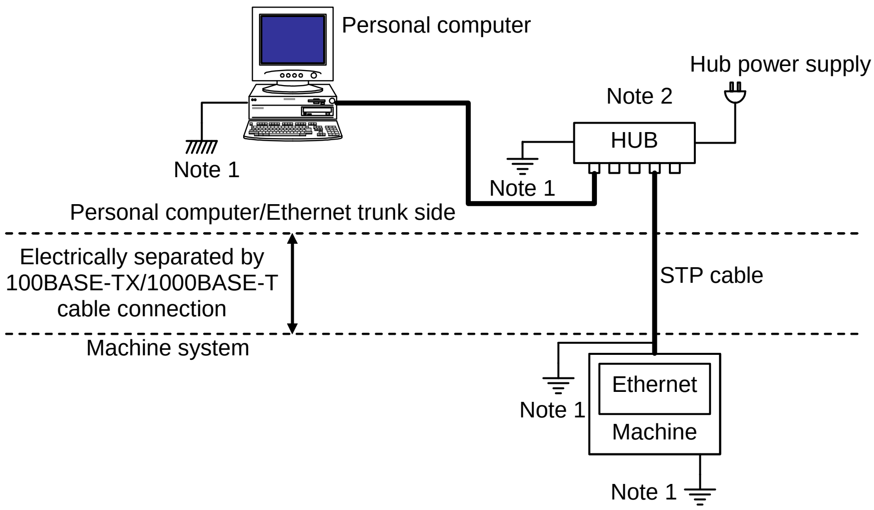
(B-cabinet)

Grounding the Network

Even if the grounding condition on the machine side is satisfied, the communication line can pick up noise from the machine, depending on the machine installation condition and environment, thus resulting in a communication error. To protect against such noise, the machine should be separated and insulated from the Ethernet trunk cable and personal computer. Examples of connection are given below.



Large-Scale Network



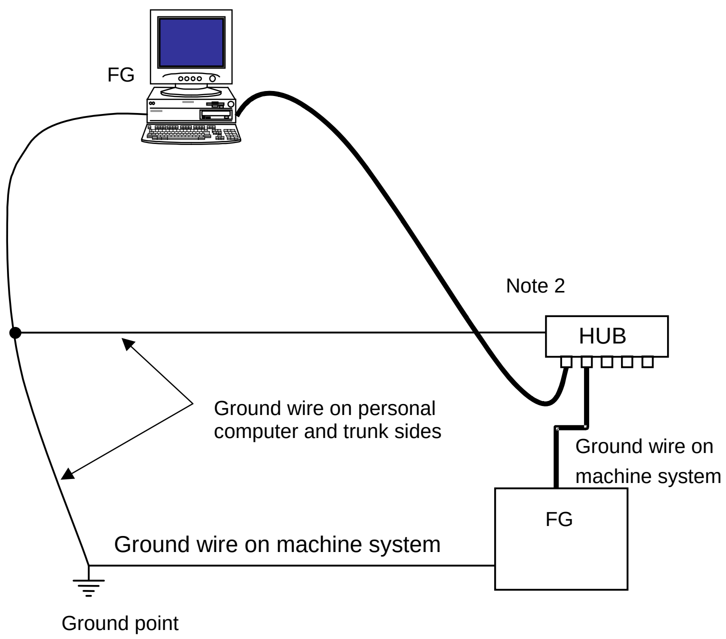
Small-Scale Network

NOTE

1 The ground between PC/HUB side and machine system side must be separated. If it is impossible to separate the ground because there is only one grounding point, connect the ground cable for each system to the grounding point independently. (See figure below.)
The resistance for grounding must be less than 100-ohm (Class D). The thickness of the ground cable is the same as the thickness of AC power cable or more. At least thickness of 5.5mm^2 is necessary.

2 Note that the number of allowable hub-to-hub connections depends on the type of hub.

3 There is possibility that noise makes the obstacle of communication even if the ground is separated using the 100BASE-TX/1000BASE-T. In the case of using the FAST Ethernet/FAST Data Server under the worst environment, please separate between the PC/Trunk line side and machine system side completely using the 100BASE-FX/1000BASE-SX/LX (Optical fiber media).



Wiring on a single ground point

4.10.2.6 Check Items at Installation

The following table lists check items at installation.

Check item		Description	Check
Ethernet cable			
	Type	Use cables which satisfies all the following conditions:	
		1) With shielding	
		2) Twisted-pair cable	
		3) Category 5	
	Length	The cable length shall be within 100 m (50 m (100BASE-TX) or 40m (1000BASE-T) for a movable cable recommended by FANUC).	
	Connection	For a twisted-pair cable of 100BASE-TX, the following pins shall be paired:	
		1) Pin No. 1 (TX+) – pin No. 2 (TX-)	
		2) Pin No. 3 (RX+) – pin No. 6 (RX-)	
		For a twisted-pair cable of 1000BASE-T, the following pins shall be paired:	
		1) Pin No. 1 (MDI0+) – pin No. 2 (MDI0+)	
		2) Pin No. 3 (MDI1+) – pin No. 6 (MDI1+)	
		3) Pin No. 4 (MDI2+) – pin No. 5 (MDI2+)	
		4) Pin No. 7 (MDI3+) – pin No. 8 (MDI3+)	
	Separation	The Ethernet cables shall be bound separately from the following cables or covered with an electromagnetic shield(Note) :	
		1) Group A: AC power lines, power lines for motors, and others	
		2) Group B: Current DC (24 VDC) and others	
	Shielding	For a shielded cable, the part of which outer coating is peeled off and exposed shall be fixed to the ground plate with a clamp fixture.	
	Clamping	The ground plate shall be located as nearest to the CNC as possible (to make the cable between the ground plate and CNC hard to be affected by noise).	
	Connectors	Any cable connector shall not be pulled (to prevent poor contact of the connector).	
	Wiring	No cable shall be laid under a heavy object.	
	Bending radius	The bending radius shall be at least four times as long as the diameter of the cable.	
	For movable part	For a movable part, a cable for a movable part shall be used.	
HUB			
	Use conditions	The "cautions on use" of the hub shall be observed (A terminating resistor shall be mounted properly if required).	
	Grounding	The hub shall be grounded.	
	Cabinet	The hub shall be installed in an enclosed cabinet.	
	Vibration	The hub shall be installed so that it is not affected by vibration.	
	Bending radius	The bending radius shall be at least four times as long as the diameter of the cable.	

NOTE

Covering a group with an electromagnetic shield means that shielding is provided between groups with grounded steel plates.

4.11 CONNECTING THE SENSOR CONNECTION CABLE

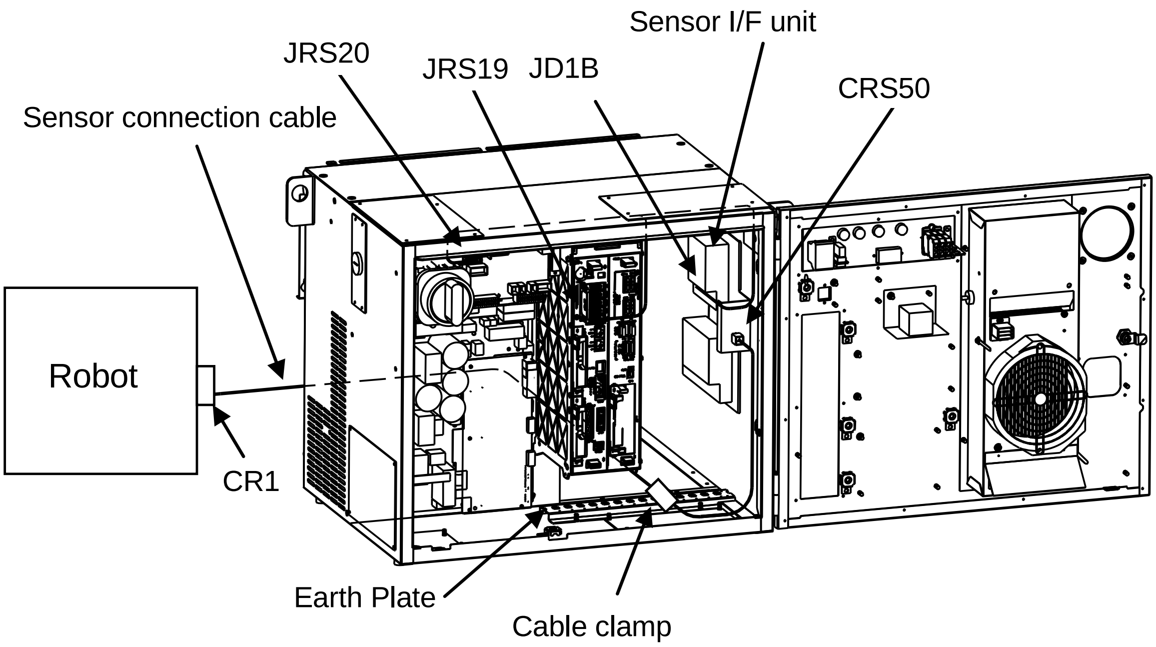


Fig. 4.11 Connecting the sensor connection cable

> ⚠ **CAUTION**
> Sensor connection cable should be clamped to Earth plate by cable clamp.

Table4.11 Specification of cable

Diameter (mm)	Weight (kg/m)	Minimum bending radius (mm)
8.5	0.115	200

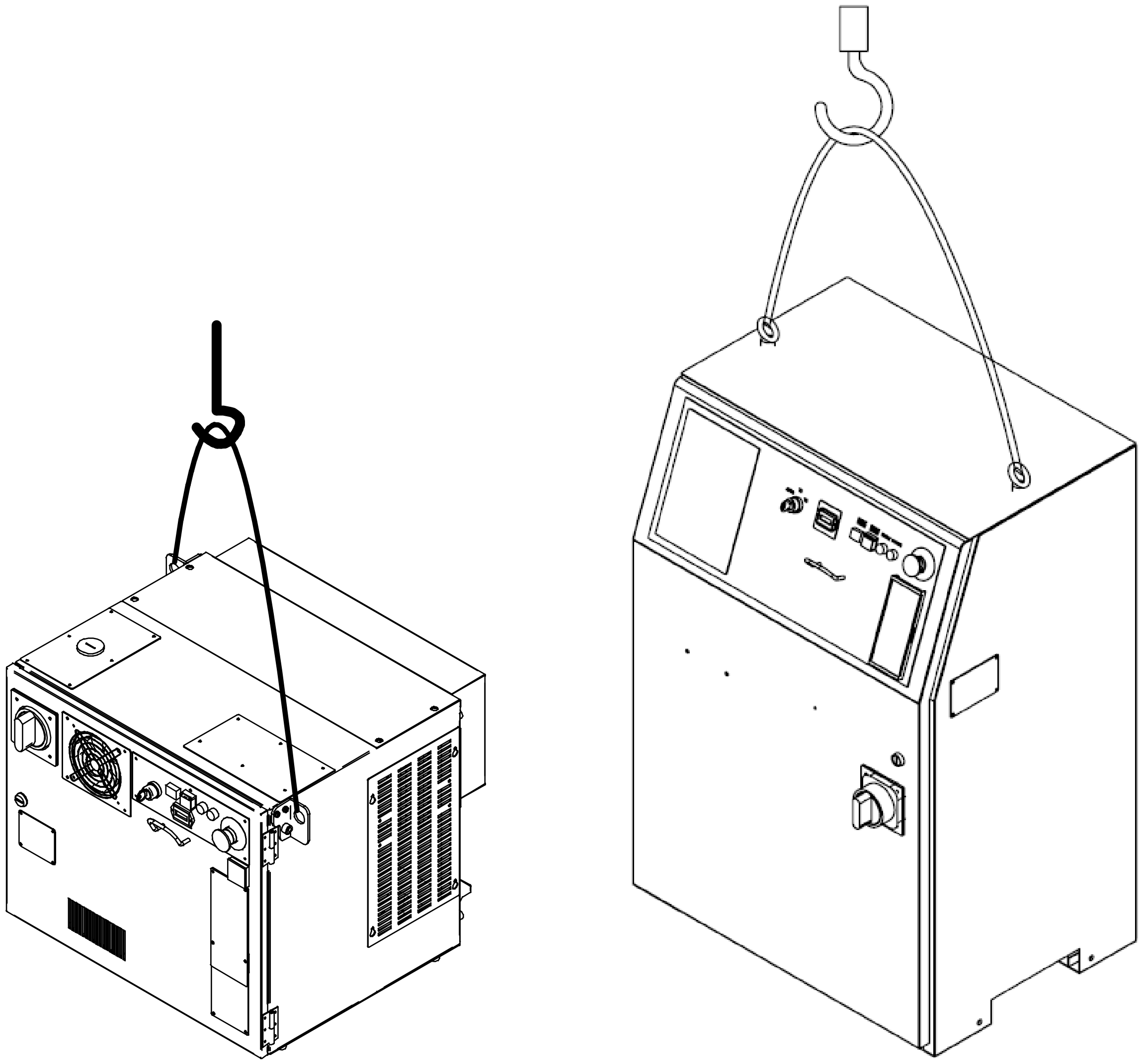
5 TRANSPORTATION AND INSTALLATION

This chapter describes the transportation and installation for the controller.

5.1 TRANSPORTATION

The controller is transported by a crane. Attach a sling to eyebolts at the top of the controller.

Crane capacity: Minimum 300kg
Sling capacity: Minimum 300kg



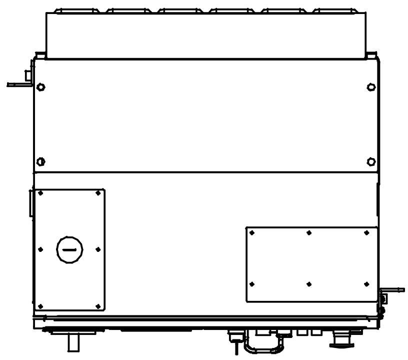
(A-cabinet) (B-cabinet)

Fig.5.1 Transportation

5.2 INSTALLATION

5.2.1 Installation Method

Following is the installation method for cabinet.
When installing the controller, allow the space for maintenance shown in the following figure.



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

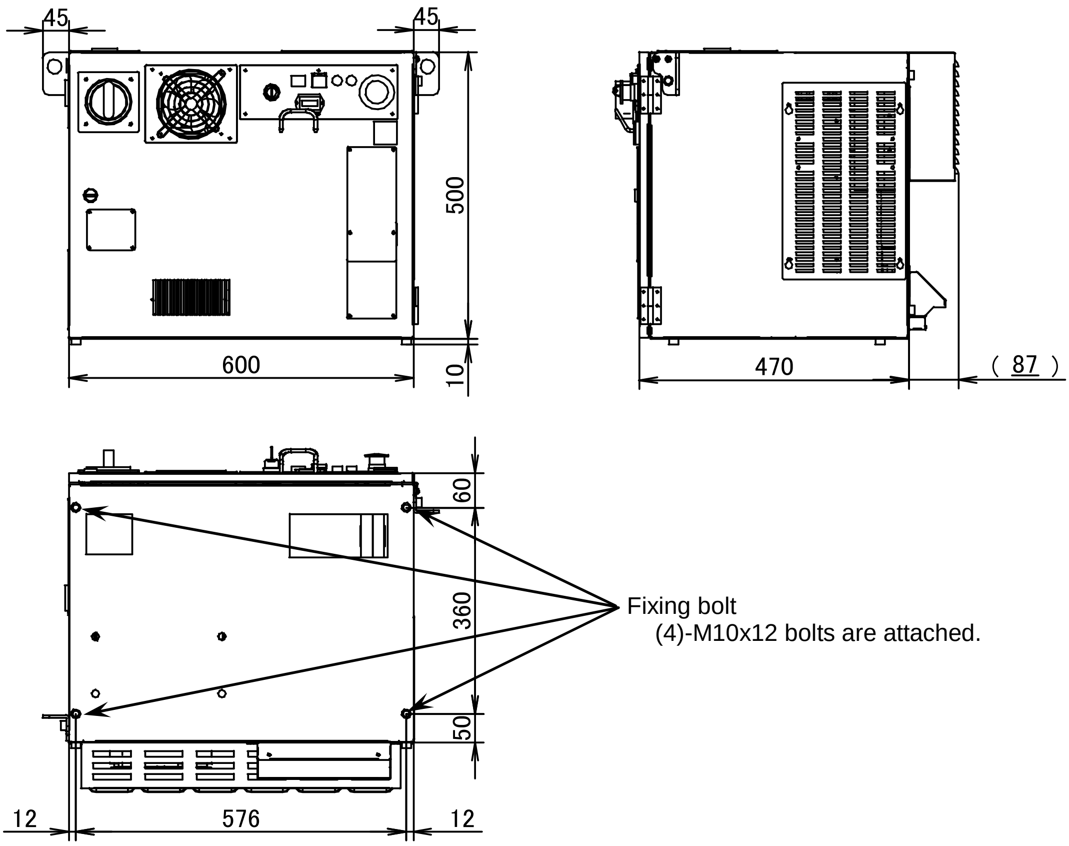
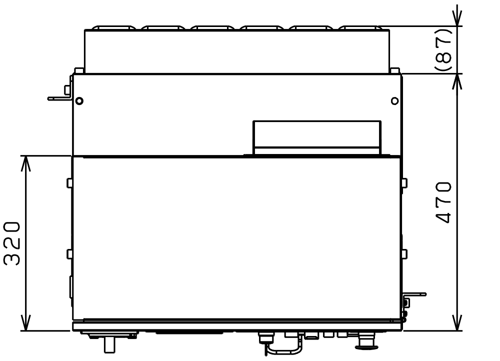
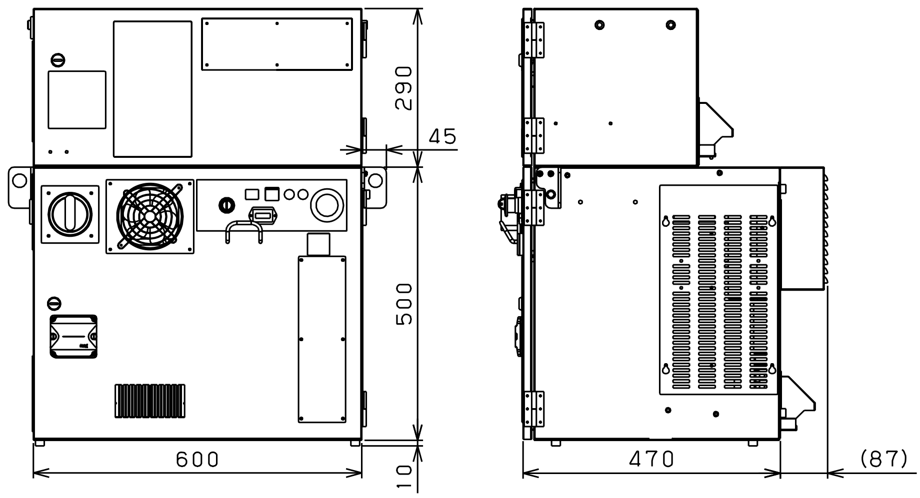


Fig.5.2.1(a1) External dimensions (A-cabinet)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black



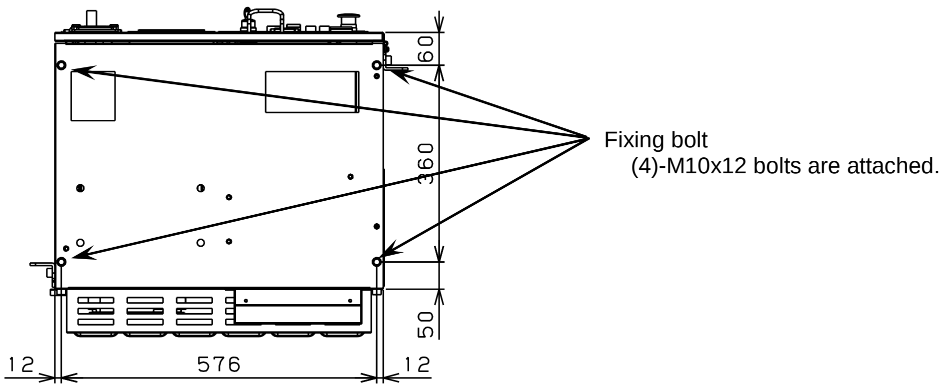
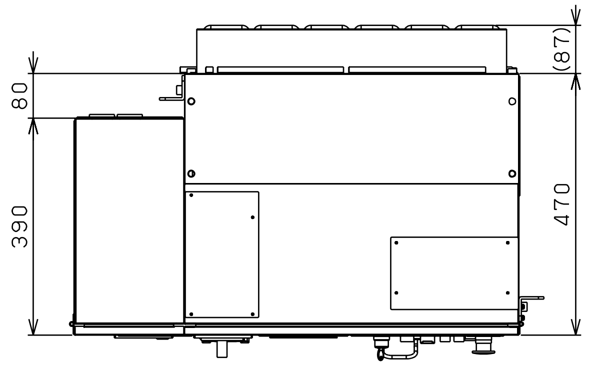
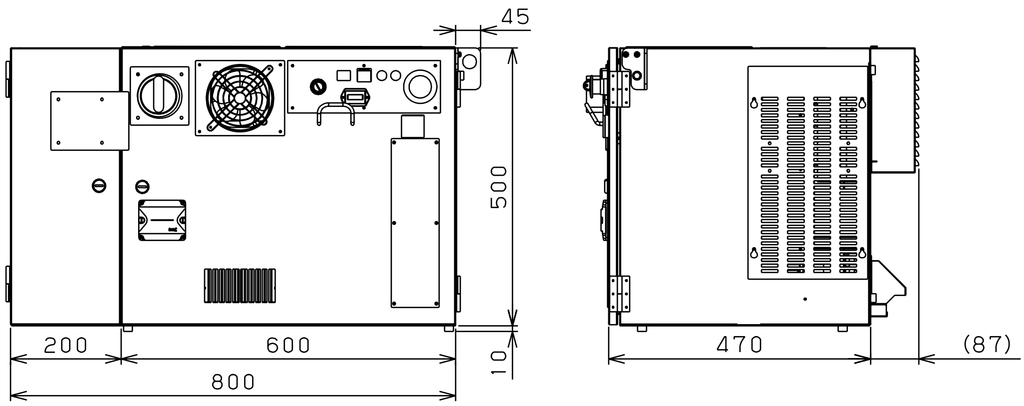


Fig.5.2.1(a2) External dimensions (A-cabinet with Top box)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black



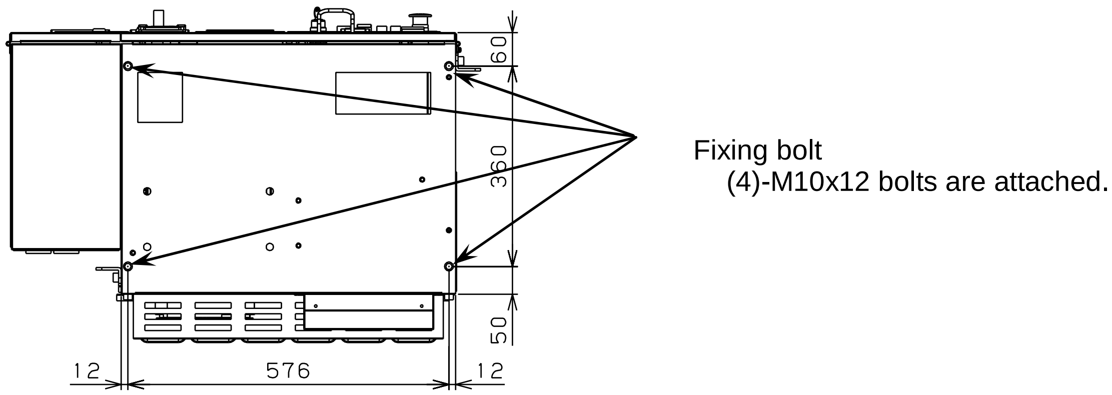
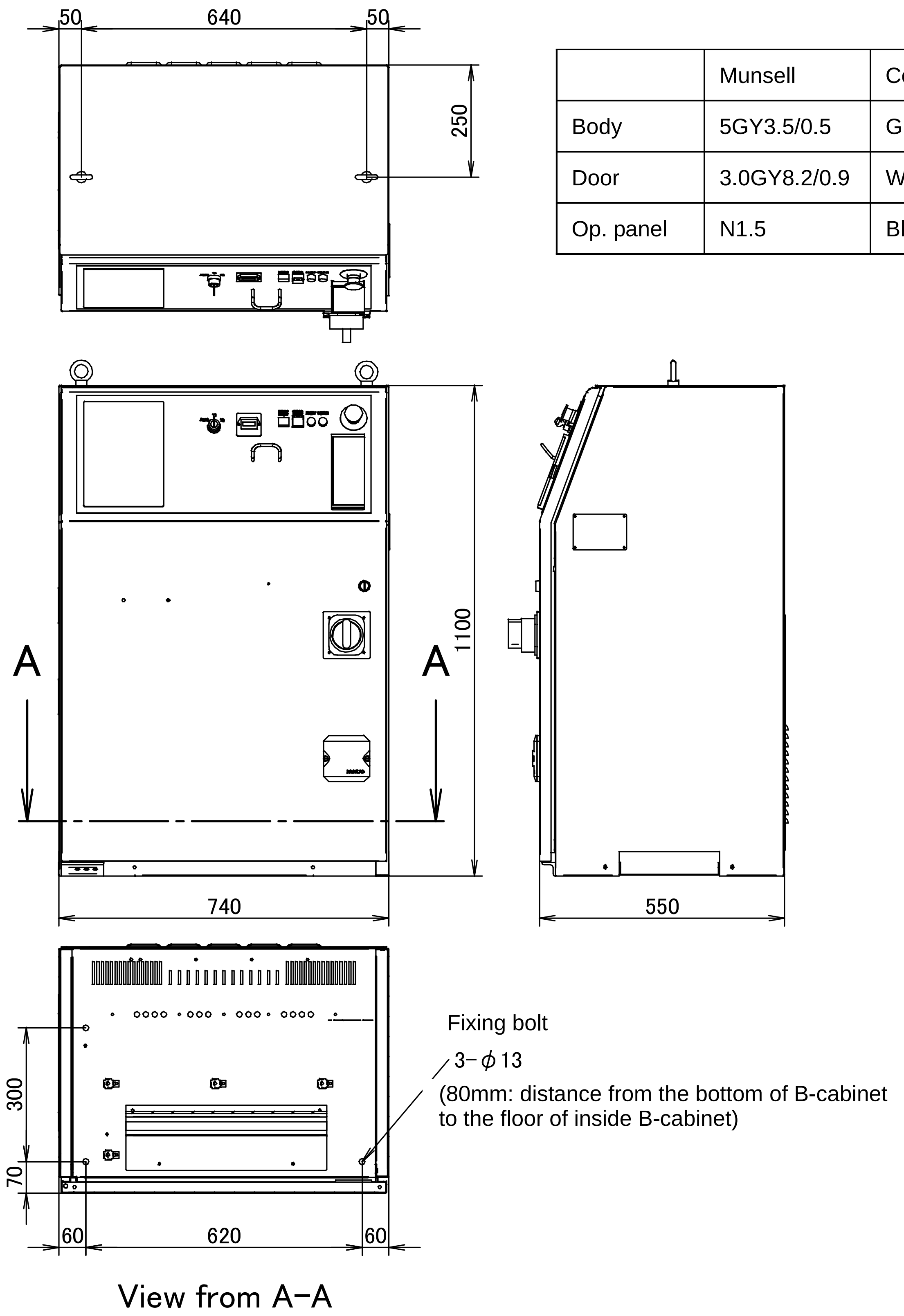


Fig.5.2.1(a3) External dimensions (A-cabinet with Side box)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

Fig.5.2.1(b) External dimensions (B-cabinet)

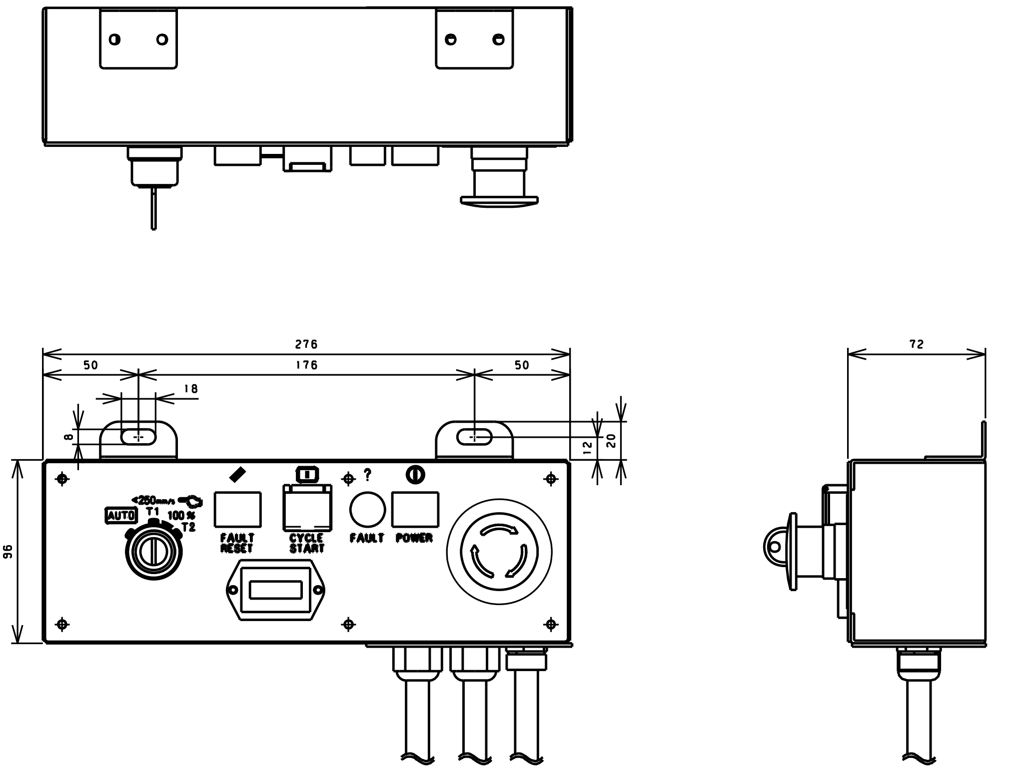
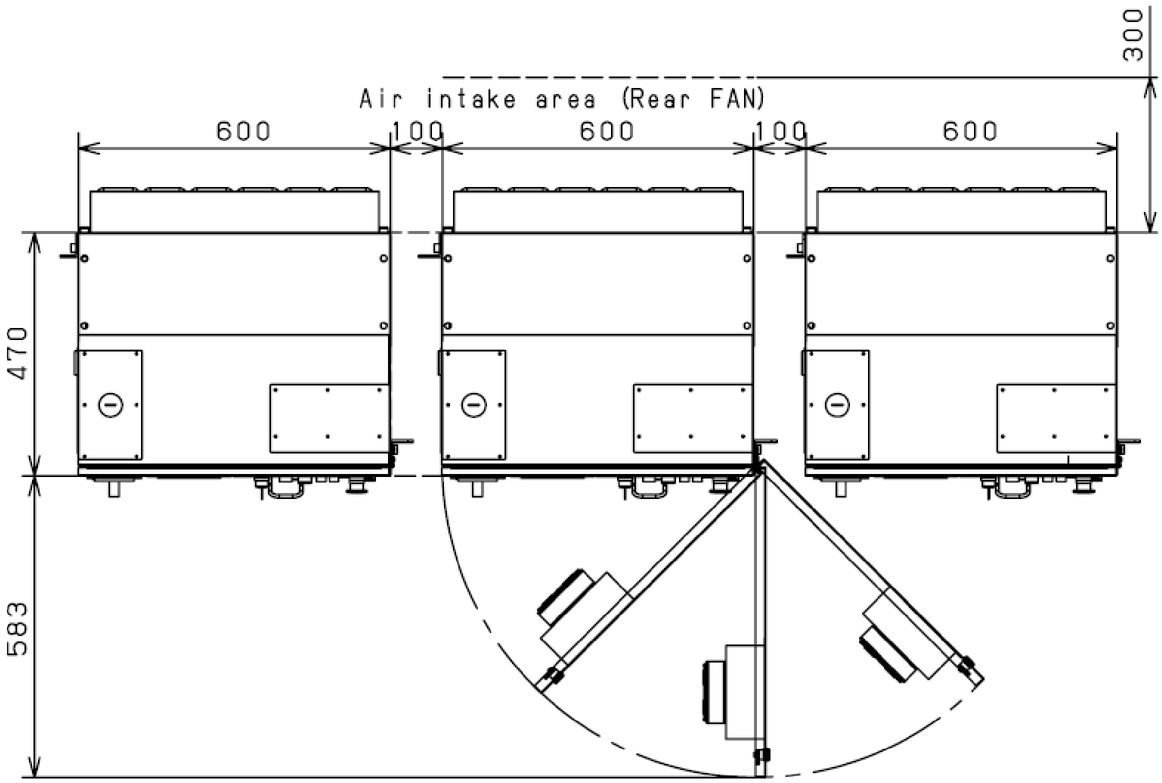


Fig.5.2.1(c) External dimensions (Switch box)



> **NOTE**
> Keep this area for maintenance and the radiation of heat.

Fig.5.2.1 (d) Installation dimensions (A-cabinet)

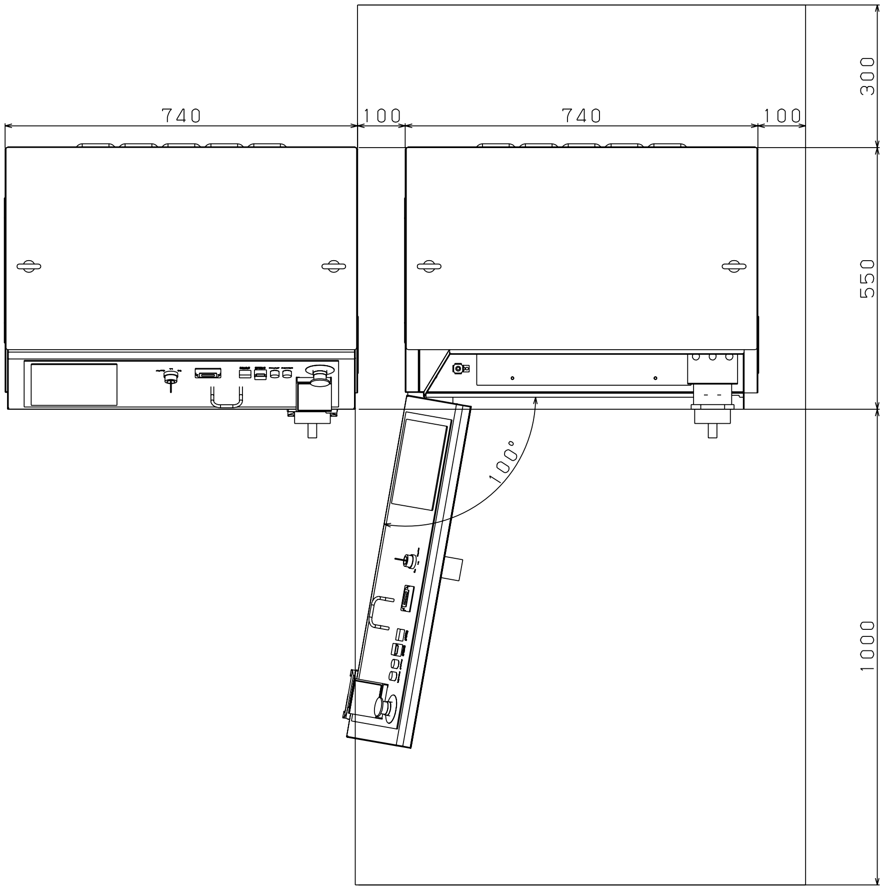


Fig.5.2.1 (e) Installation dimensions (B-cabinet)

> **NOTE**
> Keep this area for maintenance and the radiation of heat.

5.2.2 Assemble at Installation

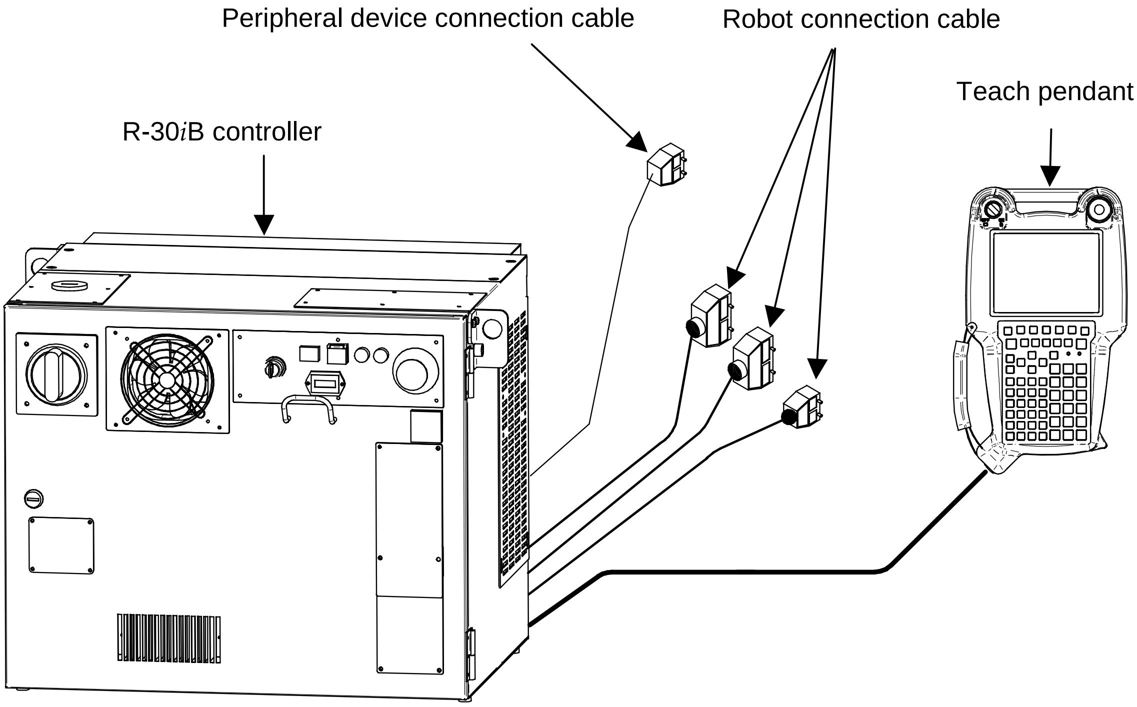


Fig.5.2.2 (a) Assemble at installation (A-cabinet)

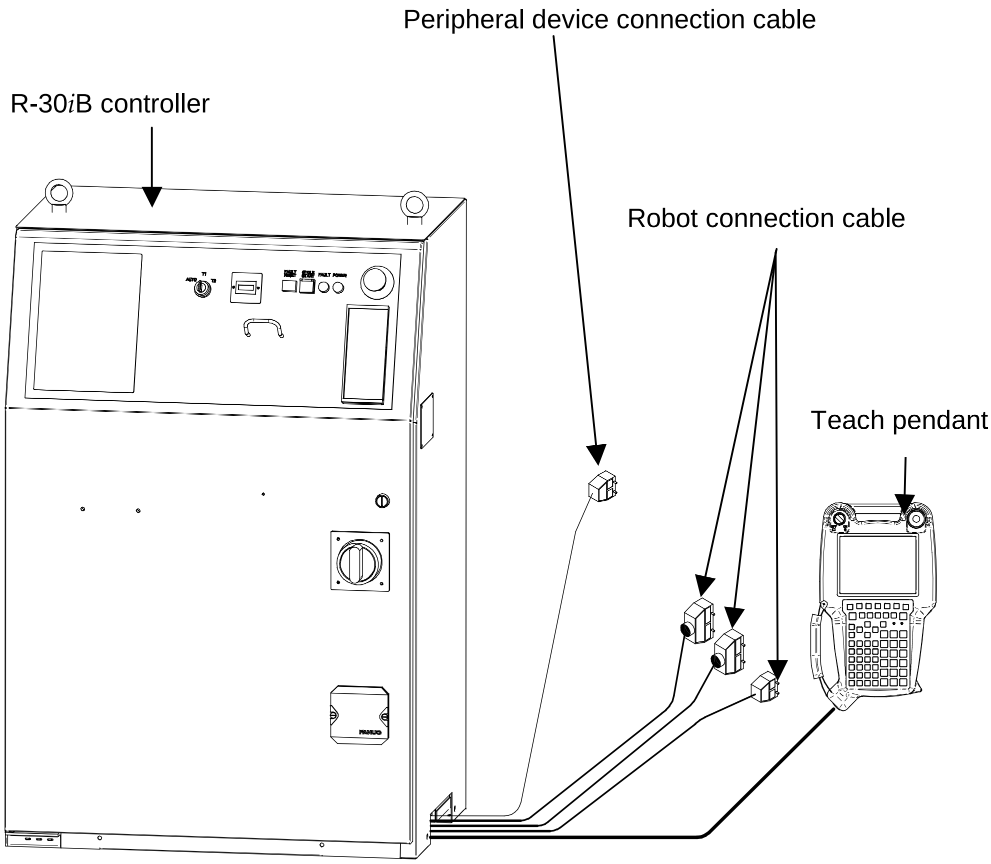


Fig.5.2.2 (b) Assemble at installation (B-cabinet)

5.3 INSTALLATION CONDITION

Item	Model	Specification/condition
Rated Voltage	All models	Trans. Type E:380-415, 440-500, 500-575VAC(*1) Trans. Type D:200-230, 380-400VAC 50/60Hz 3phases (*1) In case of NRTL controller with UL/CSA breaker (600V Rating), 500-575VAC tap can be used.
Tolerant fluctuation	All models	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power source capacity	M-900*i*A/400L/600,M-900*i*B/400L/700	18kVA
	M-900*i*A/200P, M-2000*i*A	30kVA(One cabinet is15kVA)
	R-1000*i*A/120F-7B, R-2000*i*B/200T/220U/220US, R-2000*i*C/210L/270F, M-410*i*B, M-900*i*A/260L/350/150P, M-410*i*C,M-900*i*B/280L/360	15kVA
	R-2000*i*B (except /200T/220U/220US), R-2000*i*C (except /210L/270F),R-1000*i*A (except /120F-7B), M-420*i*A,M-421*i*A, M-710*i*C,M-2*i*A,M-3*i*A	12kVA
	F-200*i*B	5kVA
	M-430*i*A/2PH/4FH/2P	3.5kVA
	ARC Mate 120*i*C,M-20*i*A, M-20*i*B, CR-35*i*A	3kVA
	ARC Mate 100*i*C,M-10*i*A	2kVA
Average power consumption	M-900*i*A/400L/600/150P, M-900*i*B/700/400L	5kW
	M-900*i*A/200P	10kW
	M-2000*i*A	8kW
	R-1000iA/120F-7B, R-2000*i*B/200T/220U/220US, R-2000*i*C/210L/270F ,M-410*i*B, M-900*i*A/260L/350,M-410*i*C, M-900*i*B/280/360	3kW
	R-2000*i*B (except /200T,220U,220US), R-2000*i*C(except /210L/270F),R-1000*i*A (except /120F-7B), M-420*i*A,M-421*i*A, M-710*i*C,M-2*i*A,M-3*i*A	2.5kW
	ARC Mate100*i*C,ARC Mate 120*i*C M-10*i*A,M-20*i*A,M-20*i*B M-430*i*A/2PH/4FH/2P,F-200*i*B, CR-35*i*A	1kW
Permissible ambient temperature	All models	Operating 0°C to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	All models	Normal: 75%RH or less, no condensation Short period(less than 1 month): 95%RH or less, no condensation
Atmosphere	All models	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, and/of salt).

Item	Model		Specification/condition
Installation category	All models		Installation categoryⅢ, Pollution degree 3, IEC60664-1 and IEC61010-1
Vibration acceleration	All models		4.9m/s^2 (0.5G) or less. When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	All models		Operating:Up to 1,000m above sea level Non-operating:Up to 12,000m above sea level
Ionized and non-ionized radiation	All models		A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller (In case of 2 cabinet configuration, this means mass of each cabinet)	A-cabinet	All models (Except below models)	120kg
		R-1000*i*A/120F-7B, R-2000*i*B/200T/ 220U/220US, R-2000*i*C/210L/270F, M-900*i*A,M-900*i*B, M-410*i*B,M-410*i*C	140kg
	B-cabinet	All models (Except below models)	180kg
		R-1000*i*A/120F-7B, R-2000*i*B/200T, 220U,220US, R-2000*i*C/210L/270F, M-900*i*A,M-900*i*B, M-410*i*B,M-410*i*C	200kg
Degree of protection	A-cabinet		IP54
	B-cabinet		
	Teach pendant		

NOTE

The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.
If the acceleration/deceleration override (ACC) greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.
In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.

NOTE

In case of CE controller

R-30*i*B/R-30*i*B Plus controller is a group 1, class A product according to IEC55011.

This means that this product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection / analysis purpose and that it is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

There may be potential difficulties in ensuring electromagnetic compatibility in environments other than industrial, due to conducted as well as radiated disturbances.

This product must not be used in residual areas.

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

5.4 ADJUSTMENT AND CHECKS AT INSTALLATION

Adjust the robot according to the following procedure at installation.

No.	Description
1	Visually check the inside and outside of the controller.
2	Check the screw terminals for proper connection.
3	Check that the connectors and printed circuit boards are firmly connected.
4	Check transformer tap setting. (See Section 6.2 in MAINTENANCE)
5	The breaker off and connect the input power cable.
6	Check the input power voltage and transformer outputs.
7	Press the EMERGENCY STOP button on the operator panel and turn on the controller.
8	Check the interface signals between controller and robot mechanical unit.
9	Check the parameters. If necessary, set them.
10	Release the EMERGENCY STOP button on the operator panel. Turn on the controller.
11	Check the movement along each axis in manual jog mode.
12	Check the interface signals of end effector.
13	Check the peripheral device control interface signals.

5.5 RESETTING OVERTRAVEL AND EMERGENCY STOP AT INSTALLATION

An overtravel and emergency stop occur when the robot is operated for the first time after it is installed and the mechanical and controllers are wired. This section describes how to reset the overtravel and emergency stop.

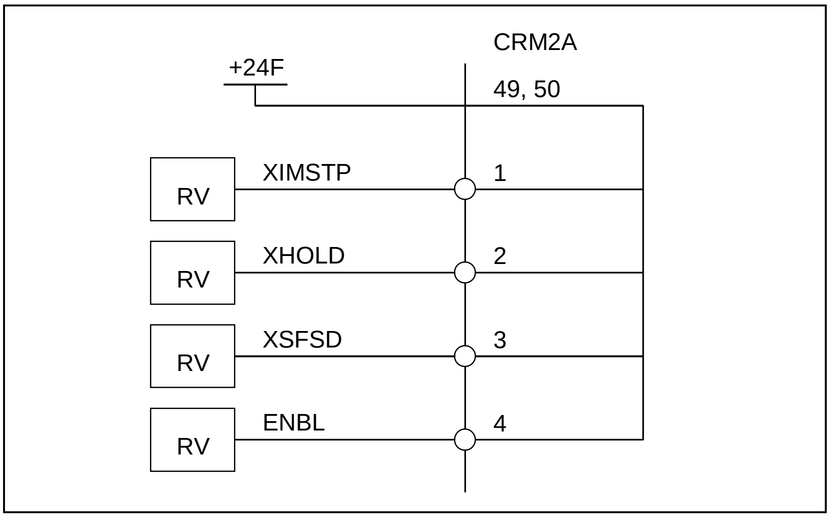
Remove the red plate fastening the swiveling axis beforehand.

The J2 and J3 axes are pressed against the hard stops at shipment. Therefore, an overtravel alarm occurs when the power is turned on after installation.

The robot can also be in an emergency stop state if the peripheral device control interface is not connected.

5.5.1 Peripheral Device Interface Processing

Take the following actions if signals XIMSTP, XHOLD, XSFSD, and ENBL are not used.



5.5.2 Resetting Overtravel

1) Select [OT release] on the overtravel release screen to release each robot axis from the overtravel state.
2) Hold down the shift key, and press the alarm release button to reset the alarm condition.
3) Still hold down the shift key, and jog to bring all axes into the movable range.

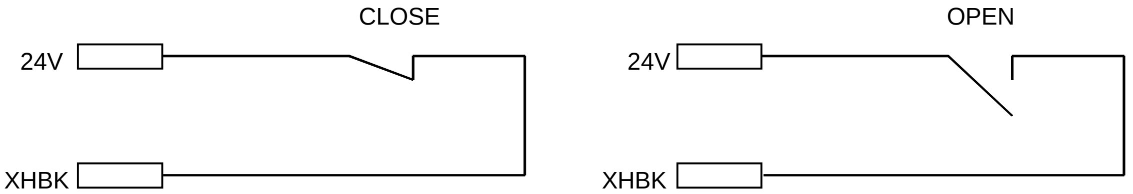
5.5.3 How to Disable/Enable HBK

1) Press [MENU] key on the teach pendant.
2) Select [NEXT].
3) Select [SYSTEM].
4) Press "F1" (TYPE) on the teach pendant.
5) Select "Config" to disable/enable HBK.

Status	Hand Broken enable/disable setting	HBK (*1)	HBK detection	Robot operation	Message
1	Enable	CLOSE	Yes	Possible	None
2	Enable	OPEN	Yes	Impossible	SRVO-006
3	Disable	CLOSE	No (*2)	Impossible	SRVO-302
4	Disable	OPEN	No	Possible	At cold start, SRVO-300

NOTE

1 Robot EE connector



2 The moment the HBK circuit is closed, alarm "Servo 302" occurs. HBK setting needs to be valid manually. When the HBK setting is valid and the HBK circuit is opened, causing alarm "Servo 006".

3 If the power is turned off and on again under the condition stated in *2, status 4 is entered, so the alarm condition is removed.

5.5.4 How to Disable/Enable Pneumatic Pressure Alarm (PPABN)

1) Press [MENU] key on the teach pendant.
2) Select [NEXT].
3) Select [SYSTEM].
4) Press "F1" (TYPE) on the teach pendant.
5) Select "Config" to disable/enable PPABN.

APPENDIX

A SPECIFICATION LIST

Name	Ordering Specification	FANUC Specification	Note
Main board	A05B-2600-H001	A16B-3200-0730 A16B-3200-0780	Standard
	A05B-2600-H002	A16B-3200-0731 A16B-3200-0781	Option (Force sensor)
	A05B-2600-H003	A16B-3200-0732 A16B-3200-0782	Option (Force sensor) (High speed com. CPU)
	A05B-2600-H004	A16B-3200-0800	Standard For I/O Link *i* slave
	A05B-2600-H005	A16B-3200-0801	Option (Force sensor) For I/O Link *i* slave
	A05B-2600-H006	A16B-3200-0802	Option (Force sensor, High speed) For I/O Link *i* slave
	A05B-2670-H001 (R-30*i*B Plus)	A16B-3200-0810	Standard For I/O Link *i* slave
	A05B-2670-H002 (R-30*i*B Plus)	A16B-3200-0811	Option (Force sensor) For I/O Link *i* slave
	A05B-2670-H003 (R-30*i*B Plus)	A16B-3200-0812	Option (Force sensor, High speed) For I/O Link *i* slave
CPU card	A05B-2600-H020	A20B-3300-0686 A17B-3301-0106	Standard / SDRAM 32Mbyte
	A05B-2600-H021	A20B-3300-0687 A17B-3301-0107	Standard / SDRAM 64Mbyte
	A05B-2600-H022	A20B-3300-0688 A17B-3301-0108	Standard / SDRAM 128Mbyte
	A05B-2600-H023	A20B-3300-0683 A17B-3301-0103	High speed / SDRAM 32Mbyte
	A05B-2600-H024	A20B-3300-0684 A17B-3301-0104	High speed / SDRAM 64Mbyte
	A05B-2600-H025	A20B-3300-0685 A17B-3301-0105	High speed / SDRAM 128Mbyte
	A05B-2600-H026	A17B-3301-0109	Standard / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2600-H027	A17B-3301-0110	Standard / SDRAM 64Mbyte For I/O Link *i* slave
	A05B-2600-H028	A17B-3301-0111	Standard / SDRAM 128Mbyte For I/O Link *i* slave
	A05B-2600-H029	A17B-3301-0112	High speed / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2600-H030	A17B-3301-0113	High speed / SDRAM 64Mbyte For I/O Link *i* slave
	A05B-2600-H031	A17B-3301-0114	High speed / SDRAM 32Mbyte For I/O Link *i* slave
	A05B-2670-H020 (R-30*i*B Plus)	A17B-3301-0250	Standard /DRAM 1GB For I/O Link *i* slave

Name	Ordering Specification	FANUC Specification	Note
Axis control card	A05B-2600-H040	A20B-3300-0664	6-axis
		A20B-3300-0774	
	A05B-2600-H041	A20B-3300-0663	12-axis
		A20B-3300-0773	
	A05B-2600-H042	A20B-3300-0662	18-axis
		A20B-3300-0772	
	A05B-2600-H043	A20B-3300-0661	24-axis
		A20B-3300-0771	
	A05B-2600-H044	A20B-3300-0660	36-axis
		A20B-3300-0770	
	A05B-2670-H040 (R-30*i*B Plus)	A20B-3300-0819	6-axis
	A05B-2670-H041 (R-30*i*B Plus)	A20B-3300-0818	12-axis
	A05B-2670-H042 (R-30*i*B Plus)	A20B-3300-0817	18-axis
	A05B-2670-H043 (R-30*i*B Plus)	A20B-3300-0816	24-axis
	A05B-2670-H044 (R-30*i*B Plus)	A20B-3300-0815	36-axis
FROM/SRAM module	A05B-2600-H060	A20B-3900-0283 A20B-3900-0297	FROM 32M/ SRAM 1M
	A05B-2600-H061	A20B-3900-0284 A20B-3900-0298	FROM 32M/ SRAM 2M
	A05B-2600-H062	A20B-3900-0285 A20B-3900-0299	FROM 32M/ SRAM 3M
	A05B-2600-H063	A20B-3900-0286	FROM 64M/ SRAM 1M
	A05B-2600-H064	A20B-3900-0287	FROM 64M/ SRAM 2M
	A05B-2600-H065	A20B-3900-0288	FROM 64M/ SRAM 3M
	A05B-2600-H066	A20B-3900-0280	FROM 128M/ SRAM 1M
	A05B-2600-H067	A20B-3900-0281	FROM 128M/ SRAM 2M
	A05B-2600-H068	A20B-3900-0282	FROM 128M/ SRAM 3M
	A05B-2600-H069 (R-30*i*B Plus)	A20B-3900-0293	FROM 256M/SRAM 1M
	A05B-2600-H070 (R-30*i*B Plus)	A20B-3900-0295	FROM 256M/SRAM 2M
	A05B-2600-H071 (R-30*i*B Plus)	A20B-3900-0296	FROM 256M/SRAM 3M
Battery	A02B-0200-K102	A98L-0031-0012	For memory backup
Backplane	A05B-2600-H080	A20B-2004-0980	2 slot
	A05B-2600-H081	A20B-2004-0990	4 slot
Power supply unit	A05B-2600-H100	A16B-2203-0910	
Fixing plate for CF card	A05B-2500-J300		With adapter for CF card
Emergency stop board		A20B-2200-0650	For A-cabinet
		A20B-2102-0050	For B-cabinet
16-pole terminal block		A63L-0002-0154#116	(TBOP14:A-cabinet) (TBOP10:B-cabinet) Manufacturer’s specification (WAGO):734-116
14-pole terminal block		A63L-0002-0154#114	(TBOP11:B-cabinet) Manufacturer’s specification (WAGO):734-114

Name	Ordering Specification	FANUC Specification	Note
12-pole terminal block		A63L-0002-0154#112	(TBOP13:A-cabinet) Manufacturer’s specification (WAGO):734-112
Jumper pin		A63L-0002-0154#402F	Manufacturer’s specification (WAGO):734-402F
Operation lever		A63L-0002-0154#230-M	2 pieces of 734-230 and operation manual are included in FANUC's specification Manufacturer’s specification (WAGO):734-230
CRMA96 connector Rece-housing		A63L-0001-0812#R06DX	NTED, B-cabinet Manufacturer’s specification (TE connectivity): 1-1318119-3
CRMA96 connector Rece-contact (AWG18-22)		A63L-0001-0812#CRM	NTED, B-cabinet Manufacturer’s specification (TE connectivity): 1318107-1
Process I/O board JA	A05B-2600-J001	A16B-2204-0010	DI/DO=96/96(Source type)
Process I/O board JB	A05B-2600-J002	A16B-2204-0011	DI/DO=40/40(Source type)
I/O Link cable (Process I/O JA, JB)	A05B-2603-J170		Between main board and process I/O
	A05B-2603-J171		Between process I/O and process I/O
Peripheral device connection cable (Process I/O JA, JB)	A05B-2603-J200		Connected length: 10m (one)
	A05B-2603-J201		Connected length: 20m (one)
	A05B-2603-J202		Connected length: 30m (one)
Peripheral device connection cable (Process I/O JA)	A05B-2603-J203		Connected length: 10m (one)
	A05B-2603-J204		Connected length: 20m (one)
	A05B-2603-J205		Connected length: 30m (one)
Process I/O board MA	A05B-2600-J020	A20B-2004-0380	DI/DO=20/16(Source type)
	A05B-2600-J022	A20B-2004-0381	
Process I/O board MB	A05B-2600-J021	A20B-2101-0730	WI/WO=5/4(Sink type), D/A=2
	A05B-2600-J023	A20B-2101-0731	
I/O Link cable (Process I/O MA)	A05B-2601-J172		Between main board and process I/O
Peripheral device cable (Process I/O MA)	A05B-2601-J240		Connection length 10m (one): CRMA52
	A05B-2601-J241		Connection length 20m (one): CRMA52
	A05B-2601-J242		Connection length 30m (one): CRMA52
I/O Link cable (Process I/O MB)	A05B-2601-J174		Between main board and process I/O
Welding machine connection cable (FANUC I/F/elbow type) (Process I/O MB)	A05B-2601-J246		Connection length 3m (one): CRW11
	A05B-2601-J247		Connection length 7m (one): CRW11
	A05B-2601-J248		Connection length 14m (one): CRW11
Welding machine connection cable (FANUC I/F/straight type)	A05B-2601-J250		Connection length 3m (one): CRW11
	A05B-2601-J251		Connection length 7m (one): CRW11
	A05B-2601-J252		Connection length 14m (one): CRW11
Process I/O board KA	A05B-2600-J010	A20B-2101-0560	DI/DO=40/40(Source type), D/A=3, A/D=2

Name	Ordering Specification	FANUC Specification	Note
Process I/O board KB	A05B-2600-J011	A20B-2101-0561	DI/DO=40/40(Source type), D/A=2
I/O Link cable Process I/O power supply cable	A05B-2601-J180		Between main board and process I/O
Peripheral device cable (Process I/O KA,KB)	A05B-2601-J230		Connected length: 10m (one)
	A05B-2601-J231		Connected length: 20m (one)
	A05B-2601-J232		Connected length: 30m (one)
Welding machine connection cable (FANUC I/F/elbow type) (Process I/O KB)	A05B-2601-J235		Connection length 3m (one): CRW10
	A05B-2601-J236		Connection length 7m (one): CRW10
	A05B-2601-J237		Connection length 14m (one): CRW10
I/O Unit-MODEL A (Base and interface unit)	A05B-2601-J130		A-cabinet (five slots) A03B-0819-C003: Base unit A03B-0819-C011: Interface unit
	A05B-2603-J130		B-cabinet (five slots) A03B-0819-C002: Base unit A03B-0819-C011: Interface unit
6-axis servo amplifier	A05B-2601-H050	A06B-6400-H101	A-cabinet
	A05B-2603-H050		B-cabinet
	A05B-2601-H051	A06B-6400-H102	A-cabinet
	A05B-2603-H051		B-cabinet
	A05B-2601-H052	A06B-6400-H002	A-cabinet
	A05B-2603-H052		B-cabinet
	A05B-2601-H053	A06B-6400-H003	A-cabinet
	A05B-2603-H053		B-cabinet
6-axis servo amplifier	A05B-2601-H054	A06B-6400-H004	A-cabinet
	A05B-2603-H054		B-cabinet
	A05B-2601-H055	A06B-6400-H005	A-cabinet
	A05B-2603-H055		B-cabinet
Servo amplifier	A05B-2605-J040 #H105	A06B-6240-H105	
	A05B-2605-J040 #H106	A06B-6240-H106	
	A05B-2605-J040 #H201	A06B-6240-H201	
	A05B-2605-J040 #H209	A06B-6240-H209	
	A05B-2605-J040 #H301	A06B-6240-H301	
CRR65A/B connector Rece-housing		A63L-0001-0460#032KSX	Auxiliary Axis Brake Manufacturer's specification (TE connectivity): 1-178128-3
CRR65A/B connector Rece-contact (AWG16-20)		A63L-0001-0456#ASL	Auxiliary Axis Brake Manufacturer's specification (TE connectivity): 175218-2
CRM68 connector Rece-housing		A63L-0001-0812#R03SX	Auxiliary Axis Over Travel Manufacturer's specification (TE connectivity): 1-1318120-3
CRM68 connector Rece-contact (AWG18-22)		A63L-0001-0812#CRM	Auxiliary Axis Over Travel Manufacturer's specification (TE connectivity): 1318107-1

Name	Ordering Specification	FANUC Specification	Note
Discharge resistor	A05B-2601-C100		A-cabinet
	A05B-2601-C102		A-cabinet
	A05B-2603-C100		B-cabinet
Regenerative resistor	A05B-2601-C101		A-cabinet
	A05B-2603-C101		B-cabinet
αiPS	A06B-6200-H015		Power supply regeneration
	A06B-6200-H037		
Transformer	A05B-2601-H350 A05B-2603-H350	A80L-0024-0028	A/B-cabinet, 3kVA, TYPE E
	A05B-2601-H354 A05B-2603-H354	A80L-0024-0029	A/B- cabinet, 3kVA, TYPE D
	A05B-2601-H351	A80L-0026-0040#A	A- cabinet, 7.5kVA, TYPE E
	A05B-2601-H355	A80L-0026-0041#A	A- cabinet, 7.5kVA, TYPE D
	A05B-2601-H352	A80L-0028-0024#A	A- cabinet,10.5kVA, TYPE E
	A05B-2601-H356	A80L-0028-0027#A	A- cabinet,10.5kVA,TYPE D
	A05B-2603-H351	A80L-0026-0040	B- cabinet, 7.5kVA, TYPE E
	A05B-2603-H355	A80L-0026-0041	B- cabinet, 7.5kVA, TYPE D
	A05B-2603-H352	A80L-0028-0024	B- cabinet,10.5kVA, TYPE E
	A05B-2603-H356	A80L-0028-0027	B- cabinet,10.5kVA,TYPE D
	A05B-2603-H353	A80L-0028-0025	B- cabinet,13.0kVA, TYPE E
	A05B-2603-H357	A80L-0028-0028	B- cabinet,13.0kVA,TYPE D
Brake release unit connection cable		A660-2005-T559	R-2000*i*B,R-2000*i*C, R-1000*i*A,M-2*i*A,M-3*i*A M-710*i*C,M-410*i*B,M-420*i*A,M-421*i*A, M-410*i*C M-900*i*A, M-900*i*B,M-2000*i*A
		A660-2005-T871	F-200*i*B
		A660-2006-T881	M-10*i*A,M-20*i*A, ARC Mate 100*i*C,ARC Mate 120*i*C CR-35*i*A
		A660-2006-T888	M-430*i*A/2PH,4FH
		A660-2006-T887	M-430*i*A/2P
		A660-2005-T711	Aux. Axis
		A660-2006-T803	M-410*i*B, M-410*i*C
Sensor I/F unit	A05B-2600-C320		CR-35*i*A

B TOTAL CONNECTION DIAGRAM

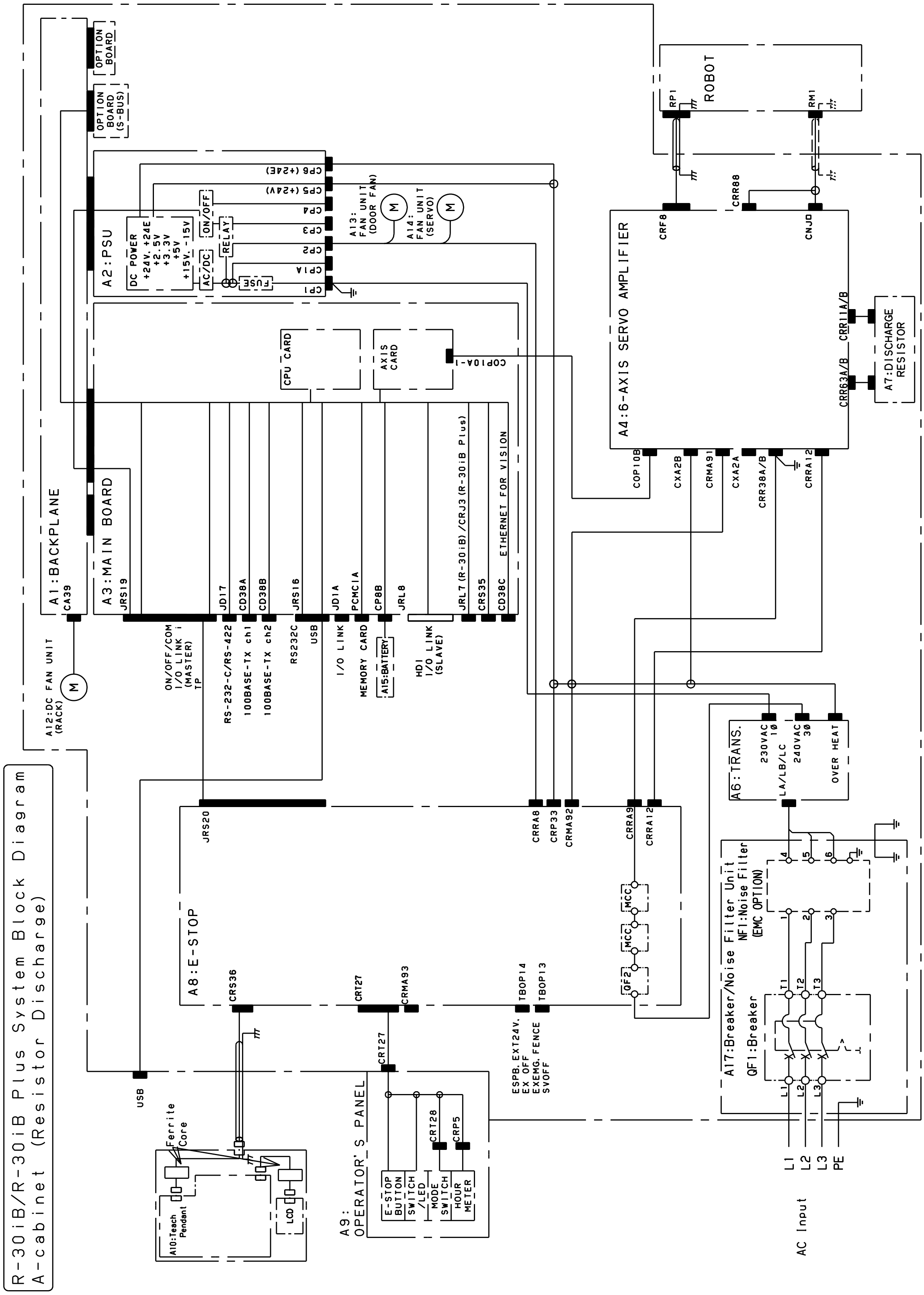


Fig.B (a) System block diagram (A-cabinet / Resistor discharge)

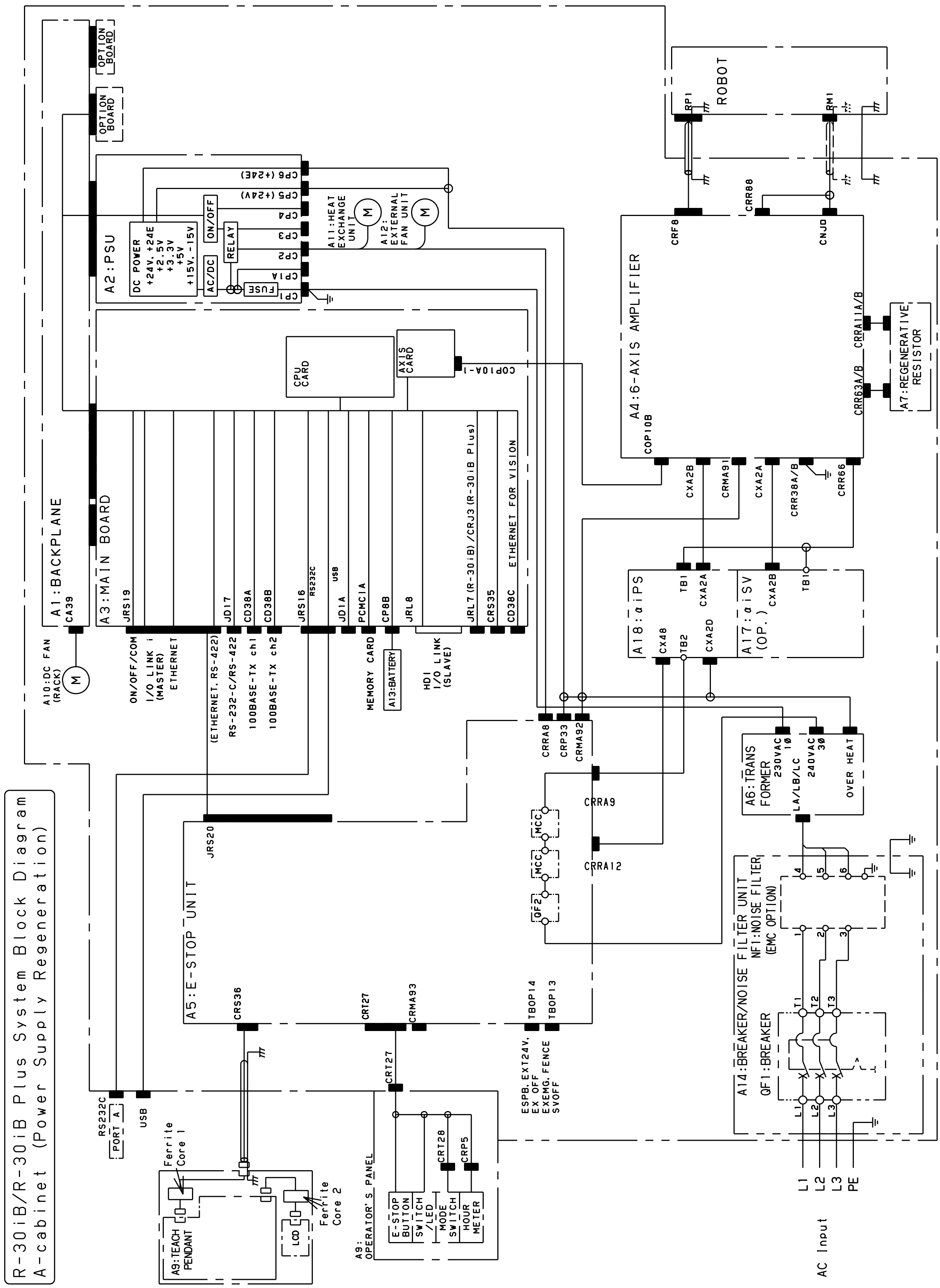


Fig.B (b) System block diagram (A-cabinet / Power supply regeneration)

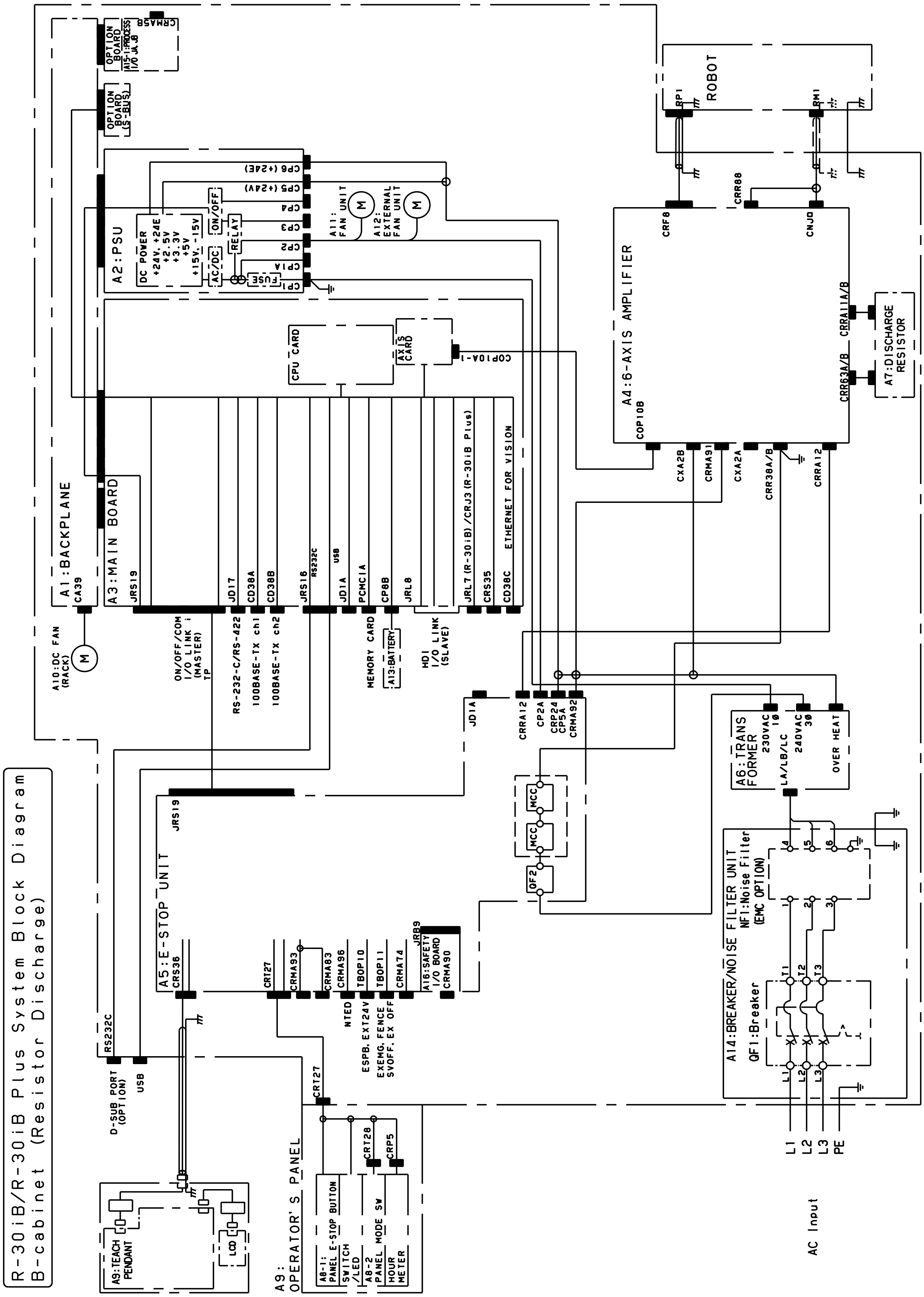


Fig.B (c) System block diagram (B-cabinet / Resistor discharge)

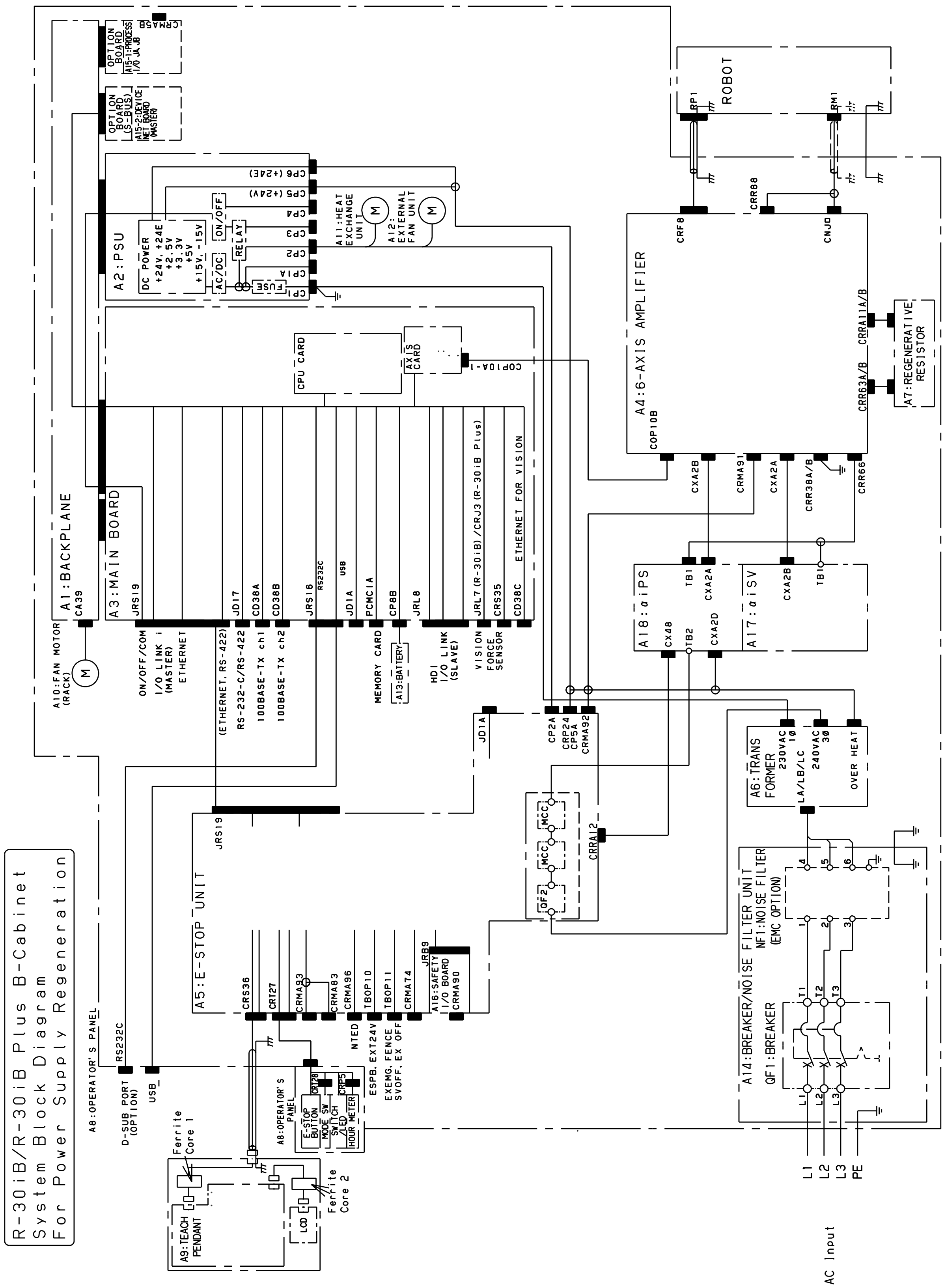
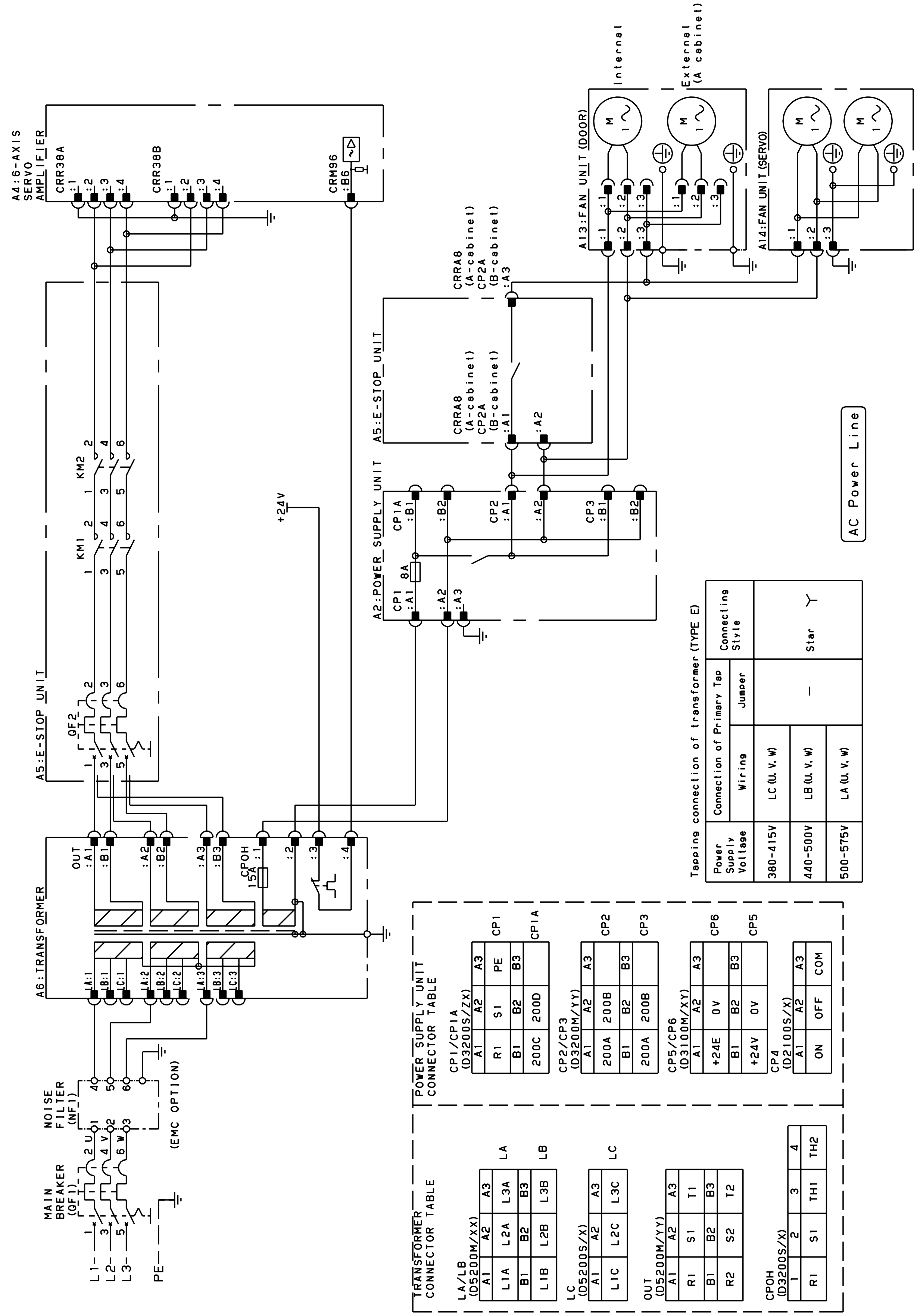


Fig.B (d) System block diagram (B-cabinet / Power supply regeneration)



Tapping connection of transformer (TYPE E)

Power Supply Voltage	Connection of Primary Tap: Wiring	Connection of Primary Tap: Jumper	Connecting Style
380-415V	LC (U, V, W)	—	Star
440-500V	LB (U, V, W)		
500-575V	LA (U, V, W)		

POWER SUPPLY UNIT CONNECTOR TABLE

CP1/CP1A (D3200S/ZX)

A1	A2	A3	
R1	S1	PE	CP1
B1	B2	B3	
200C	200D		CP1A

CP2/CP3 (D3200M/YY)

A1	A2	A3	
200A	200B		CP2
B1	B2	B3	
200A	200B		CP3

CP5/CP6 (D3100M/XY)

A1	A2	A3	
+24E	0V		CP6
B1	B2	B3	
+24V	0V		CP5

CP4 (D2100S/X)

A1	A2	A3
ON	OFF	COM

TRANSFORMER CONNECTOR TABLE

LA/LB (D5200M/XX)

A1	A2	A3	
L1A	L2A	L3A	LA
B1	B2	B3	
L1B	L2B	L3B	LB

LC (D5200S/X)

A1	A2	A3	
L1C	L2C	L3C	LC

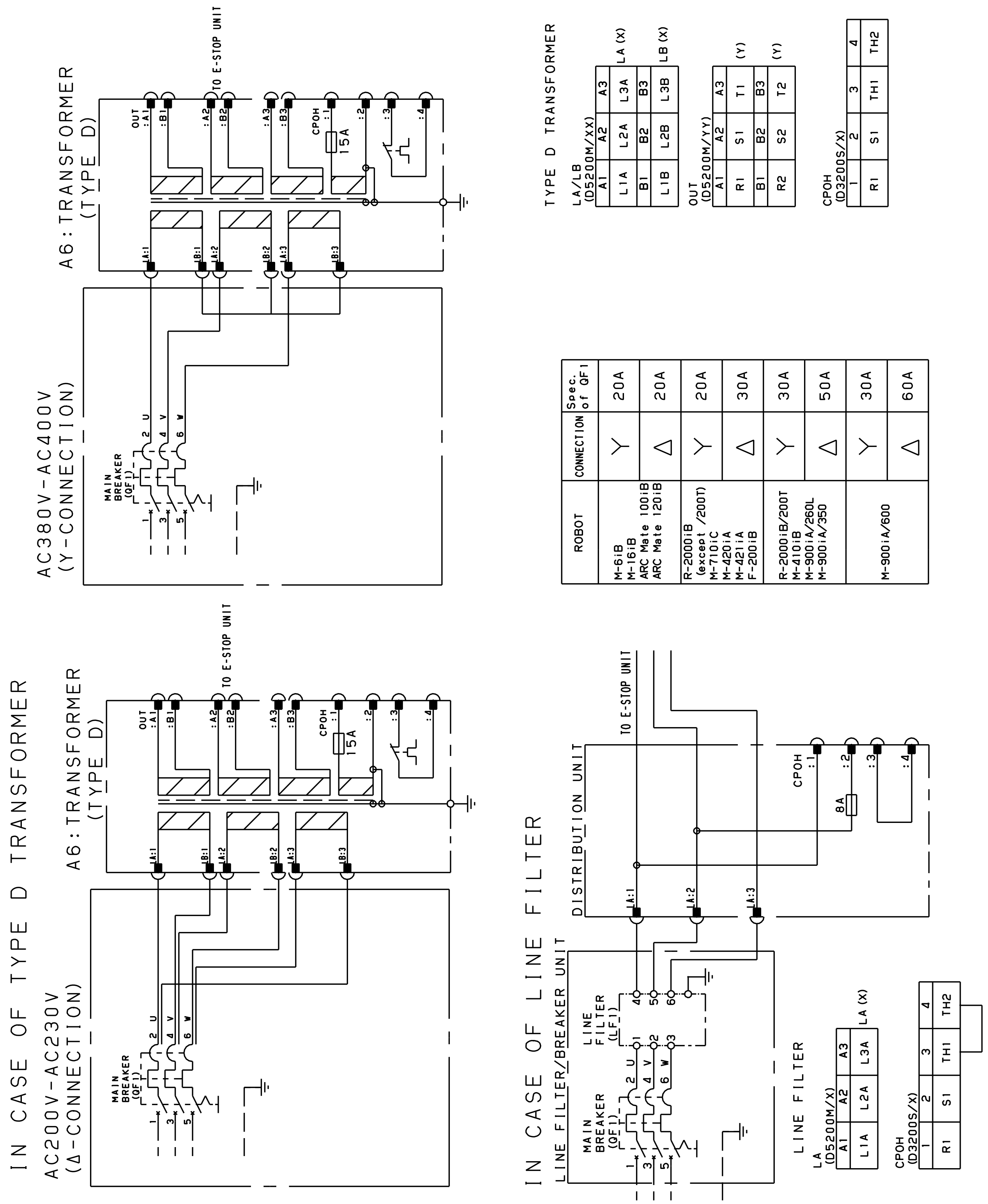
OUT (D5200M/YY)

A1	A2	A3
R1	S1	T1
B1	B2	B3
R2	S2	T2

CPOH (D3200S/X)

1	2	3	4
R1	S1	TH1	TH2

Fig.B (e) AC power line connection diagram (in case of TYPE E transformer)



ROBOT	CONNECTION	Spec. of QF1
M-6iB M-16iB ARC Mate 100iB ARC Mate 120iB	Y	20A
	Δ	20A
R-2000iB (except /200T) M-710iC M-420iA M-421iA F-200iB	Y	20A
	Δ	30A
R-2000iB/200T M-410iB M-900iA/260L M-900iA/350	Y	30A
	Δ	50A
M-900iA/600	Y	30A
	Δ	60A

Fig.B (f) AC power line connection diagram (in case of TYPE D transformer or line filter)

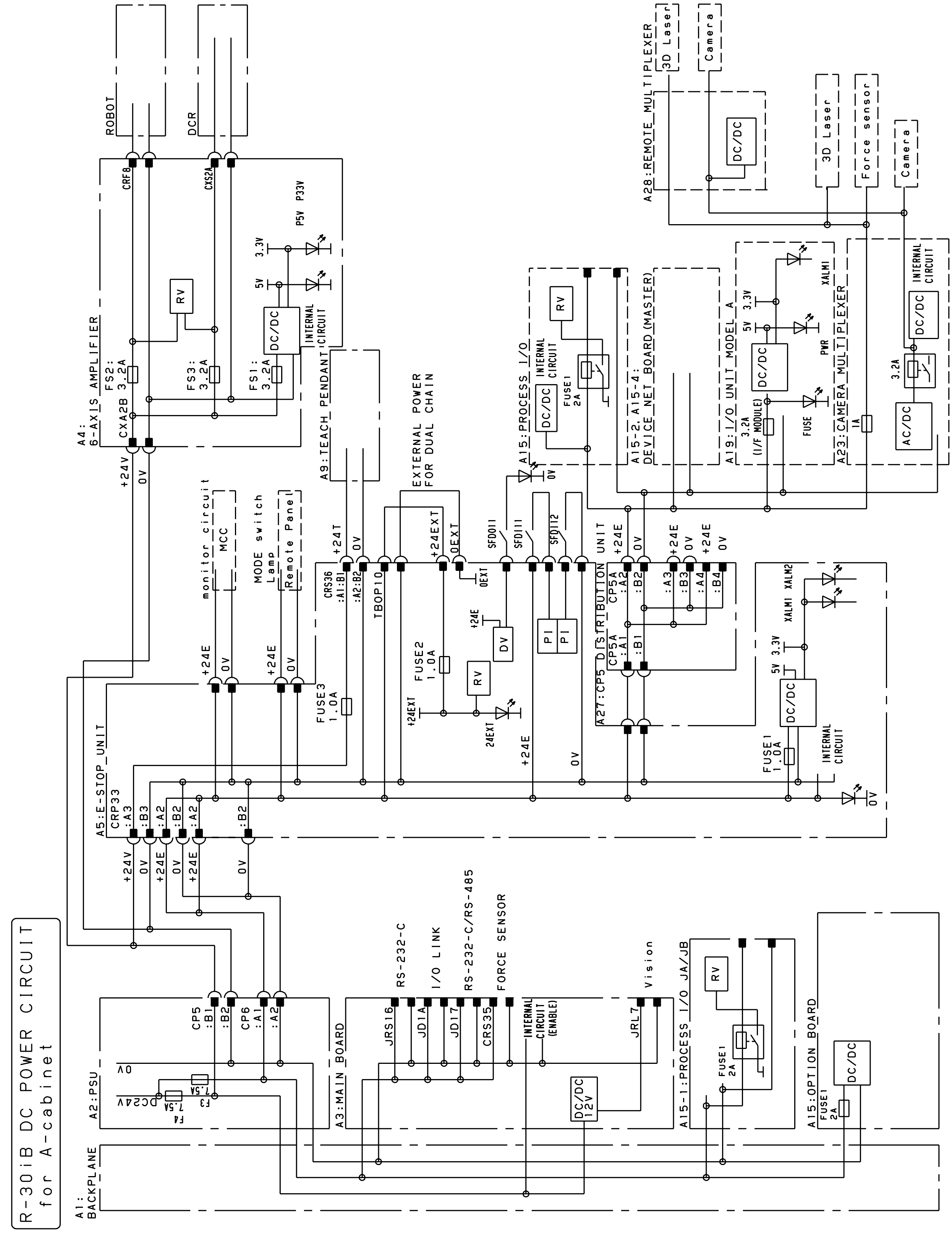


Fig.B (g) DC power line connection diagram (R-30iB A-cabinet)

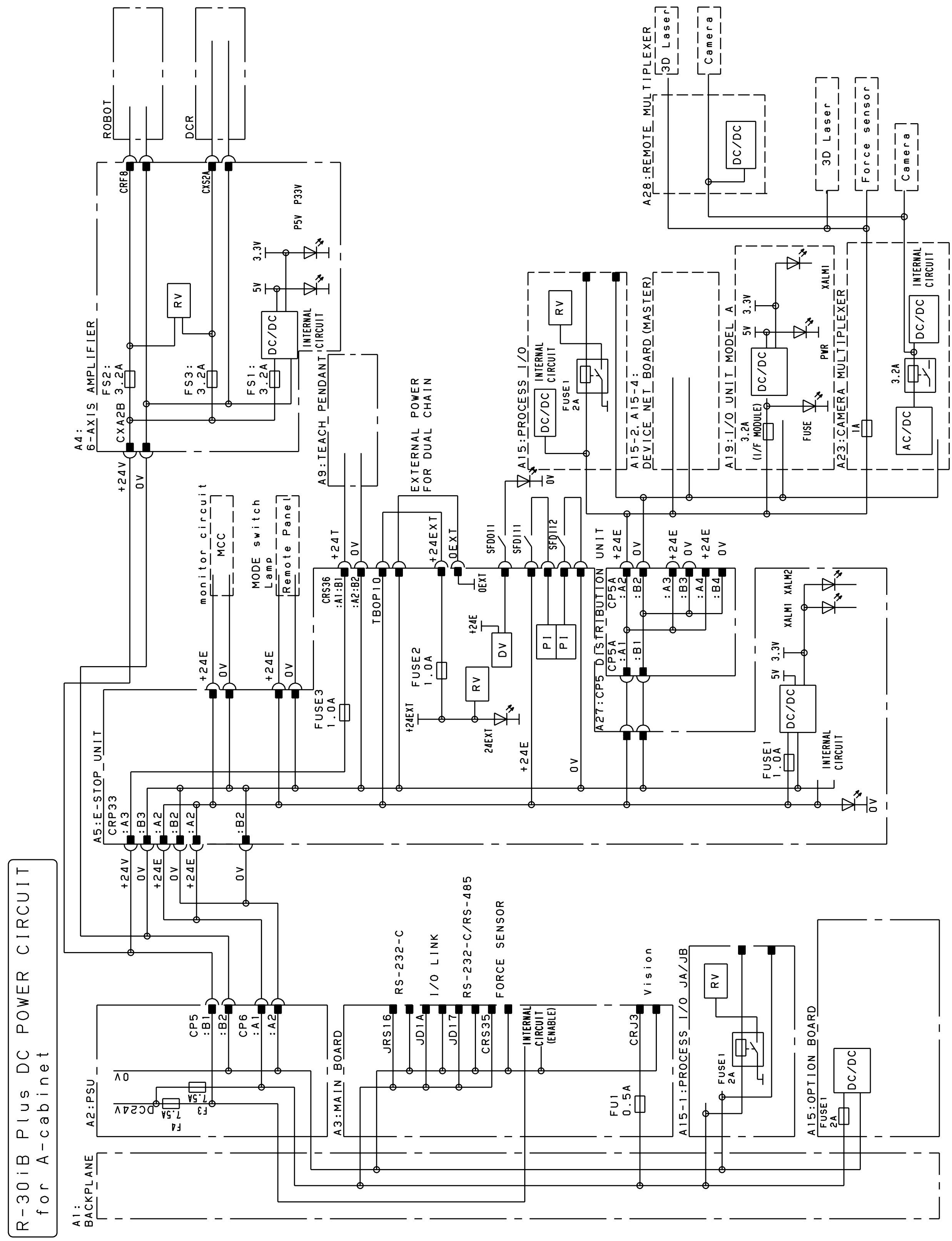


Fig.B (h) DC power line connection diagram (R-30iB Plus A-cabinet)

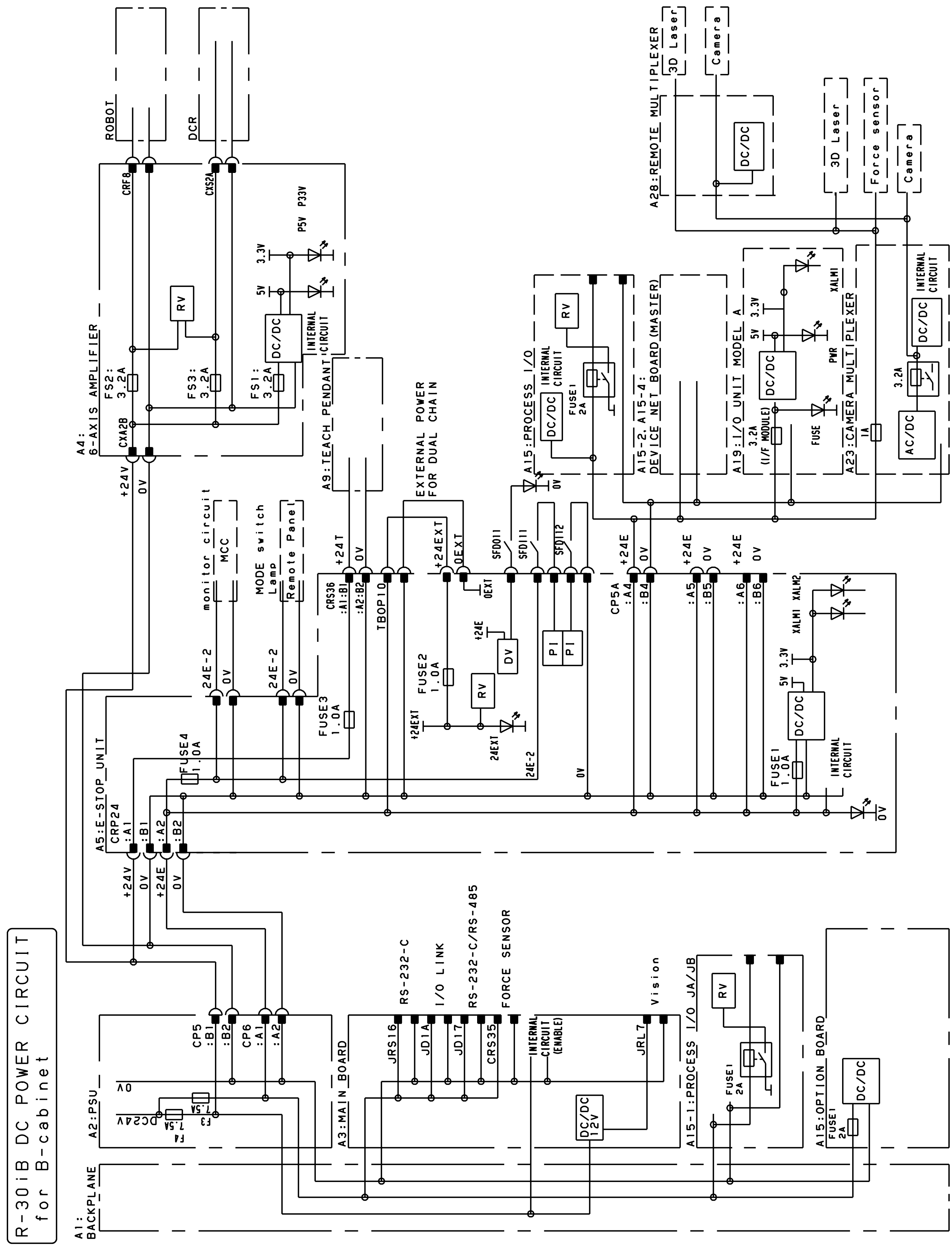


Fig.B (i) DC power line connection diagram (R-30iB B-cabinet)

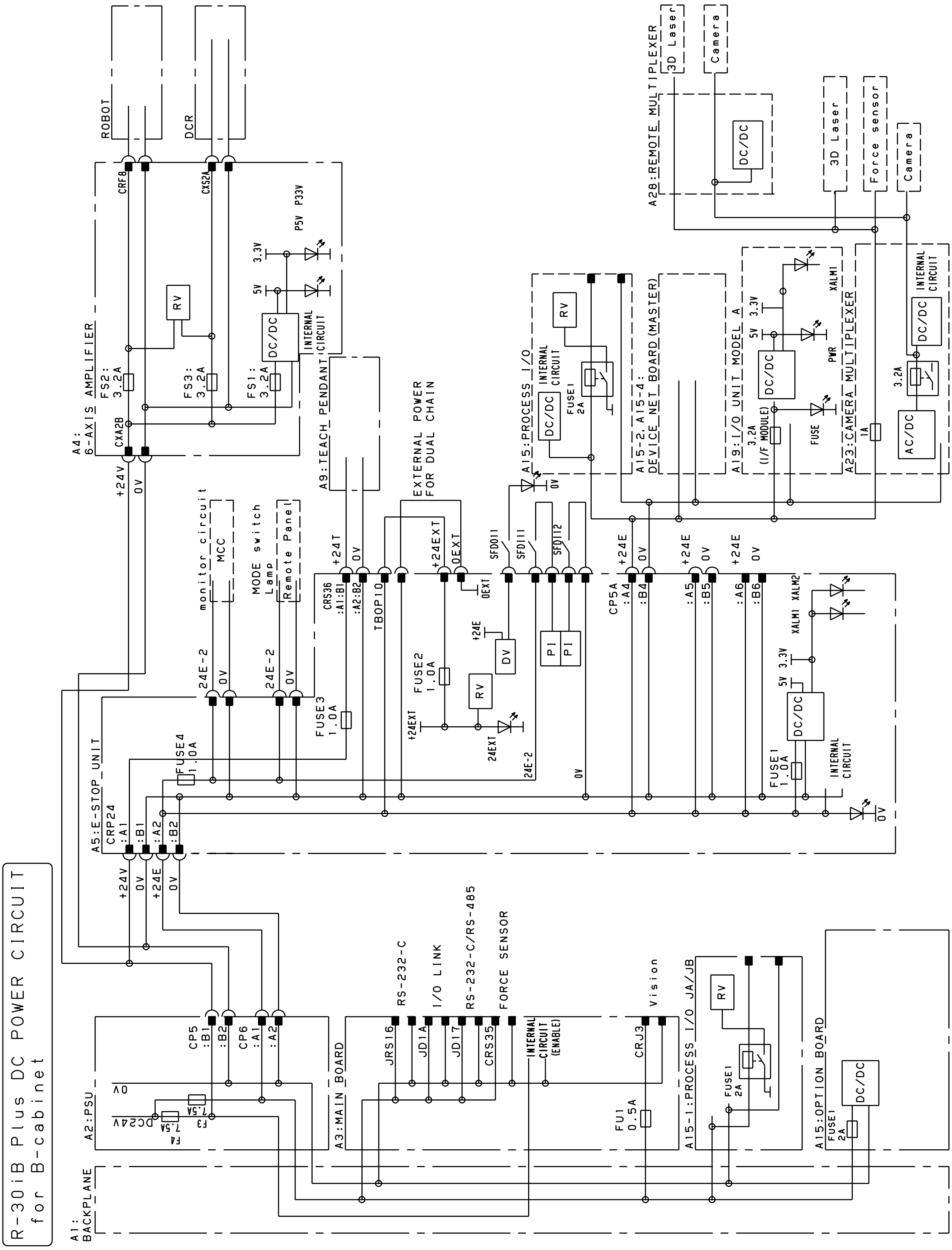


Fig.B (j) DC power line connection diagram (R-30iB Plus B-cabinet)

E-STOP CIRCUIT FOR A-CABINET
RESISTOR DISCHARGE

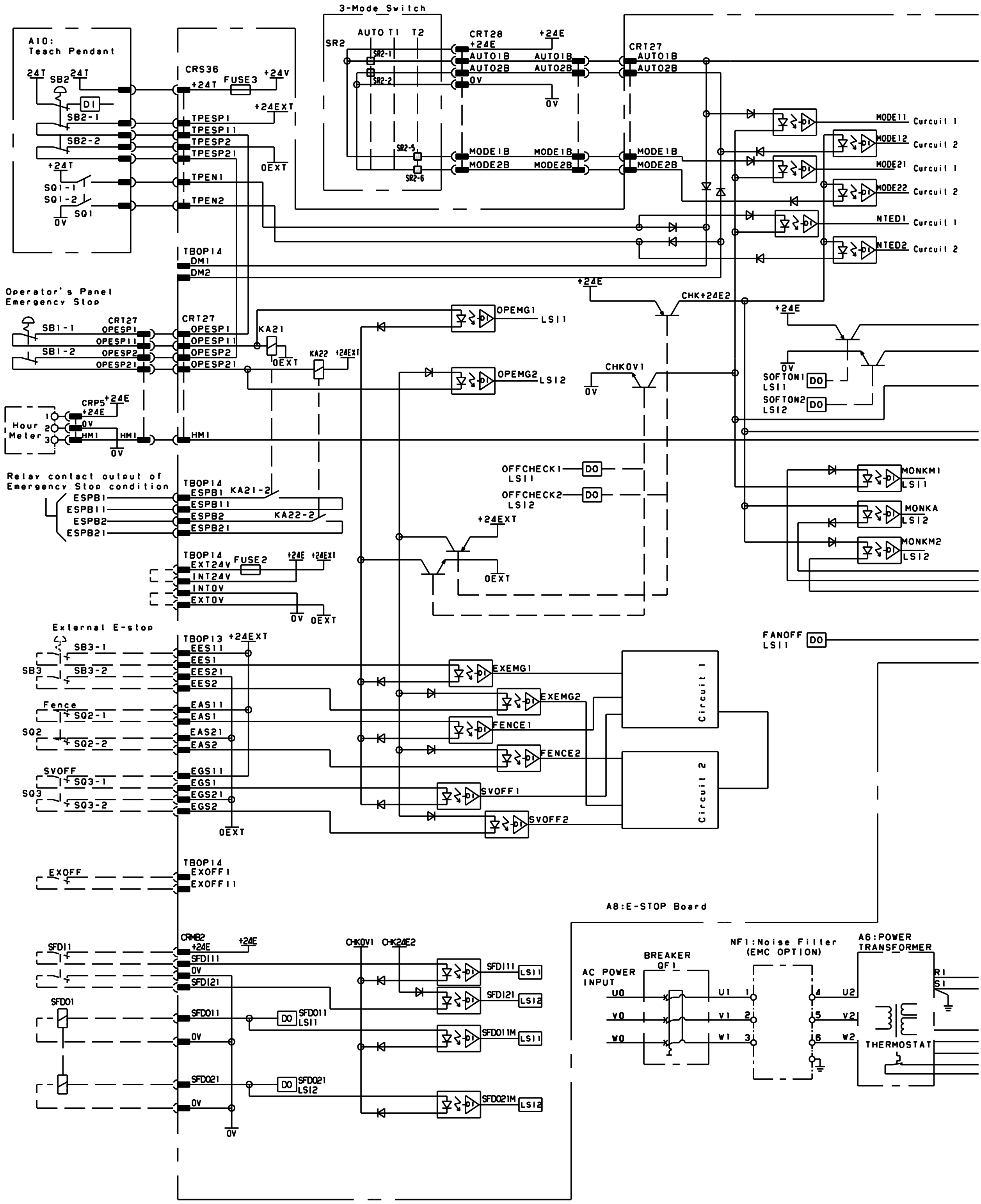
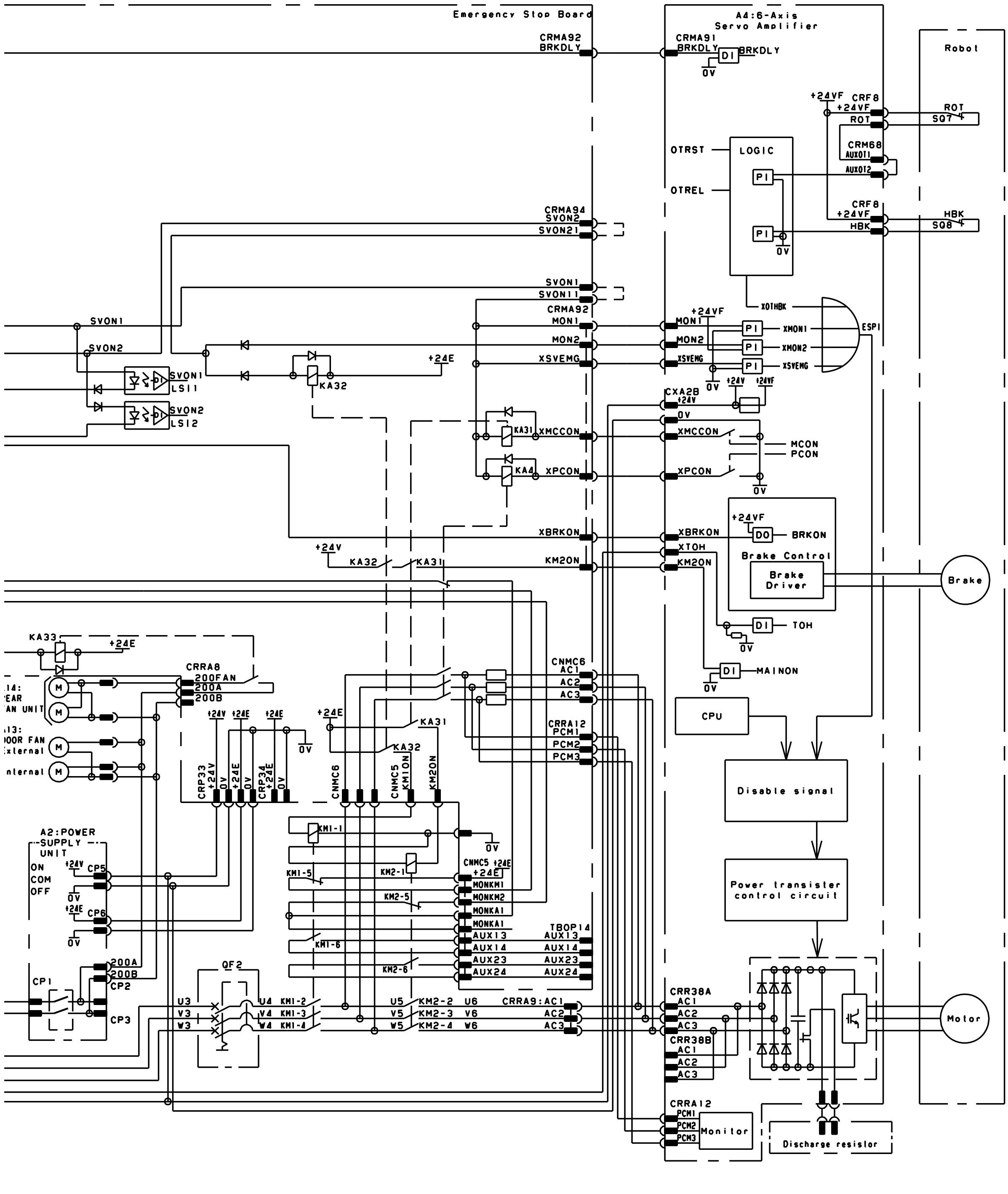


Fig.B (k) Emergency stop circuit connection diagram (A-cabinet/Resistor discharge)


Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
CRMA92
BRKDLY
CRMA91
CRMA94
SVON2
SVON21
SVON1
SVON11
MON1
MON2
XSVEMG
XMCCON
XPCON
XBRKON
KM2ON
LOGIC
OTRST
OTREL
ESP1
MCON
PCON
Brake Control
Brake Driver
Brake
CPU
Disable signal
Power transister control circuit
Motor
Monitor
Discharge resistor
A2:POWER SUPPLY UNIT
CRRA8
CNMC6
CNMC5
TBOP14
CRP33
CRP34
QF2
CRR38A
CRR38B
CRRA12
CRRA9

E-STOP CIRCUIT FOR A-CABINET
POWER SUPPLY REGENERATION

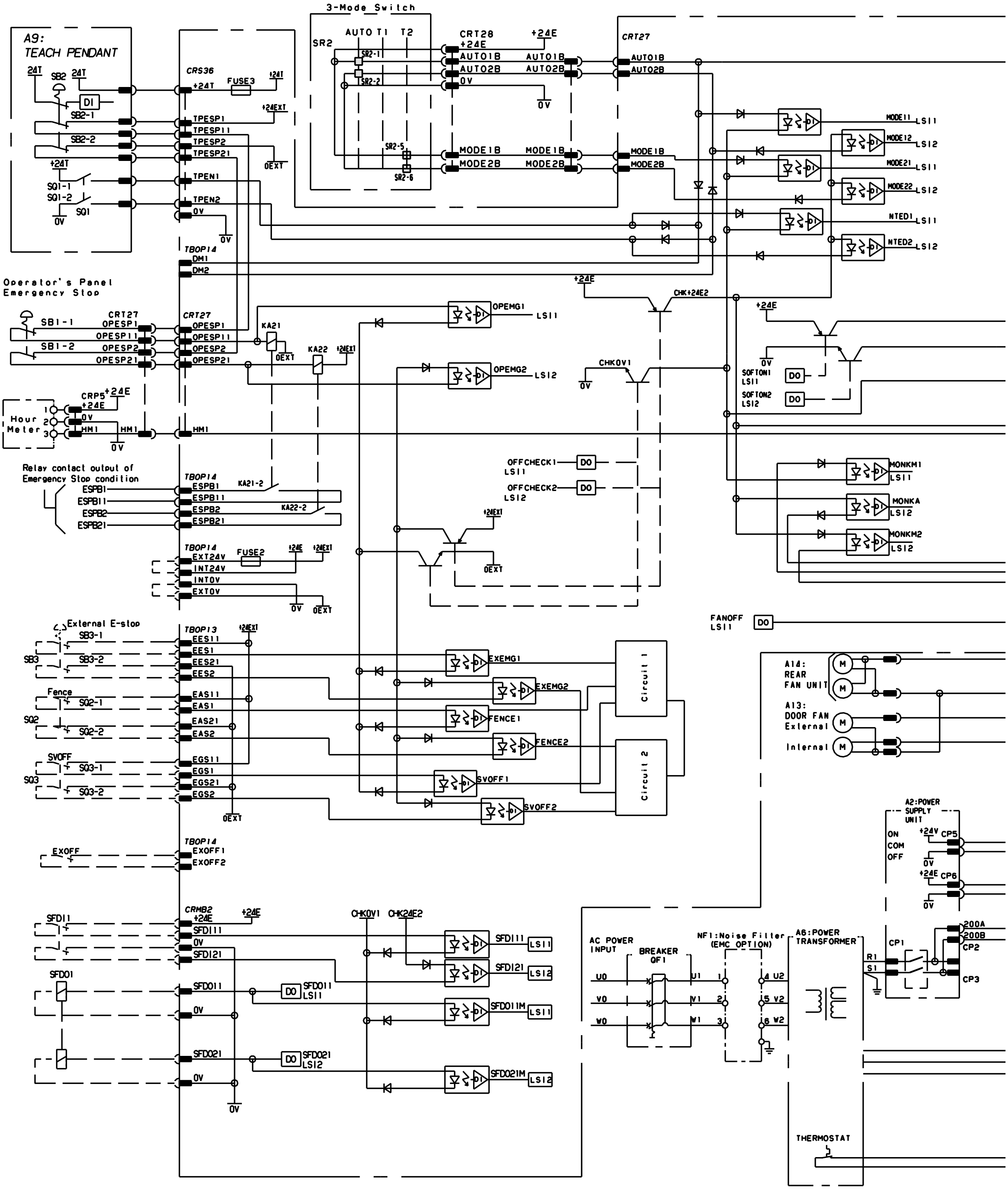
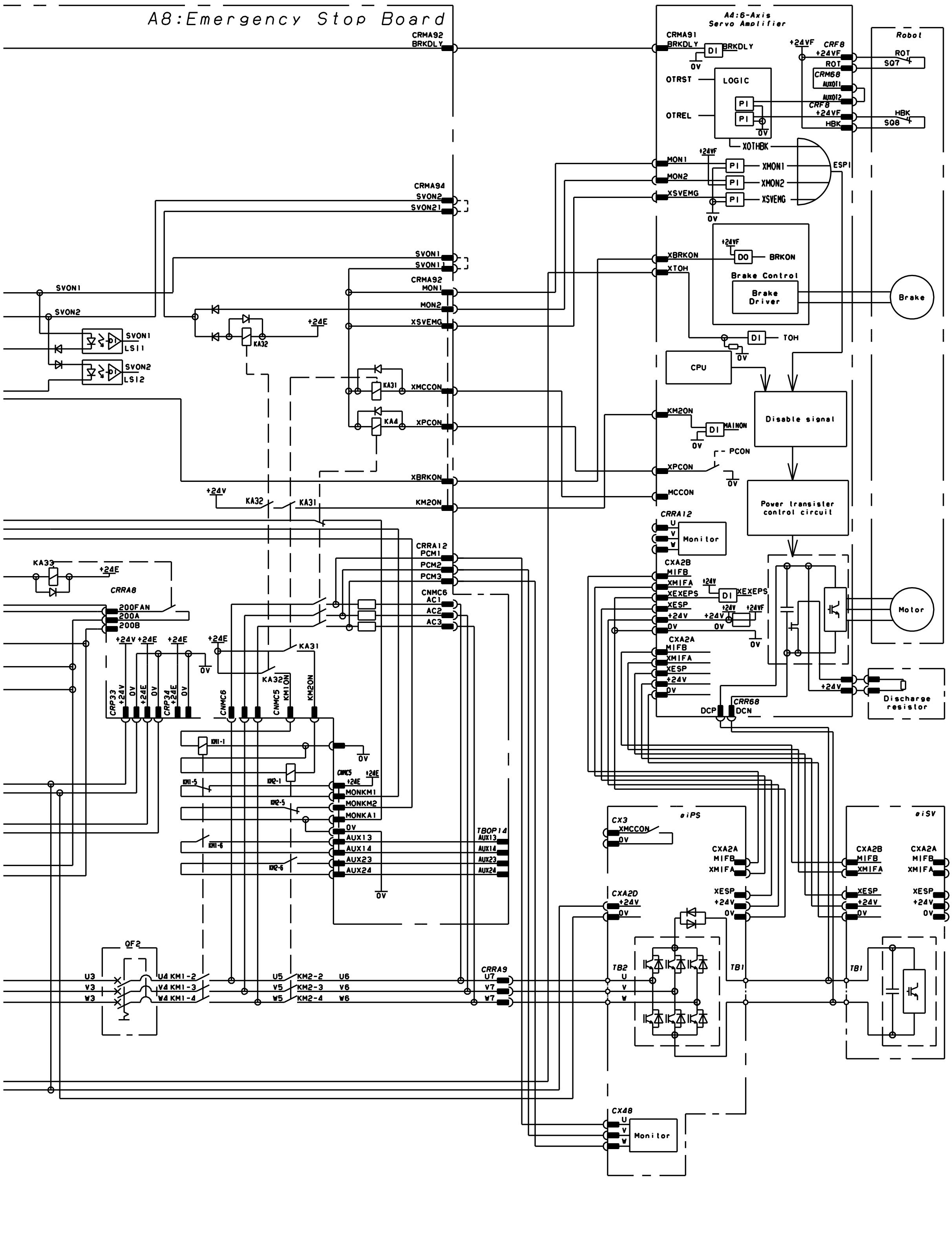


Fig.B (l) Emergency stop circuit connection diagram (A-cabinet/Power supply regeneration)


A8:Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
LOGIC
Brake Control
Brake Driver
Brake
CPU
Disable signal
Power transister control circuit
Motor
Monitor
Discharge resistor
αiPS
αiSV
QF2

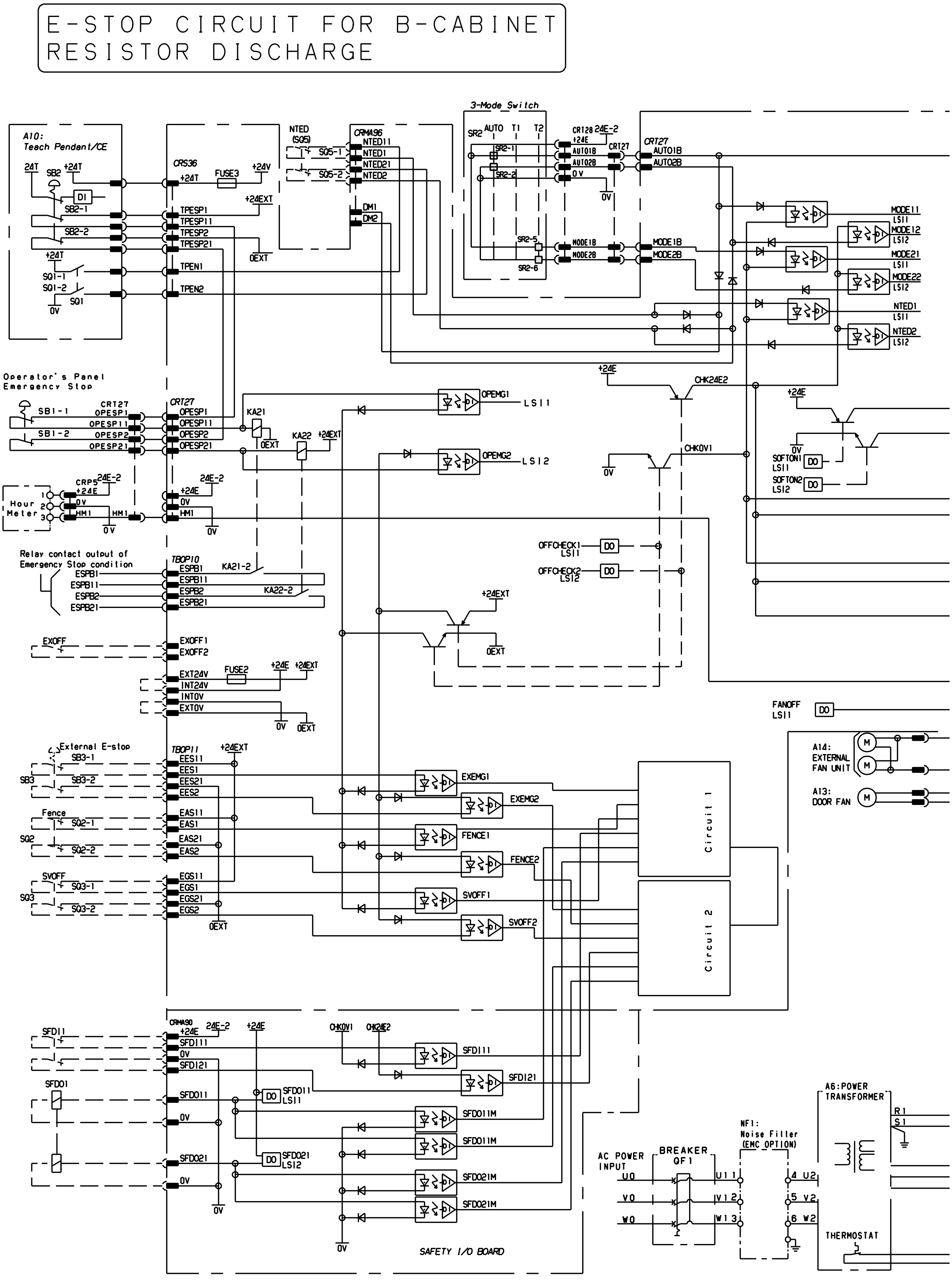
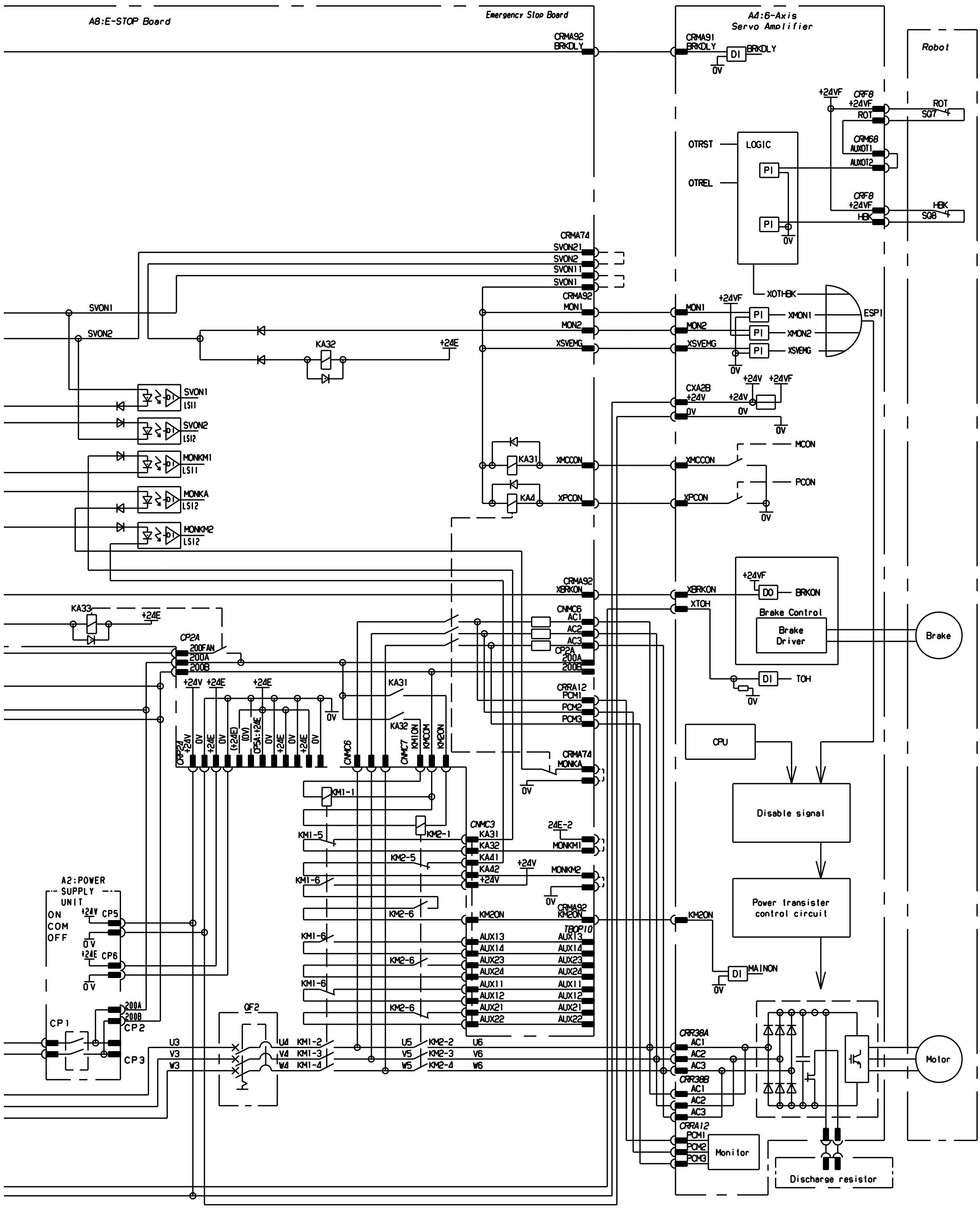


Fig.B (m) Emergency stop circuit connection diagram (B-cabinet/Resistor discharge)



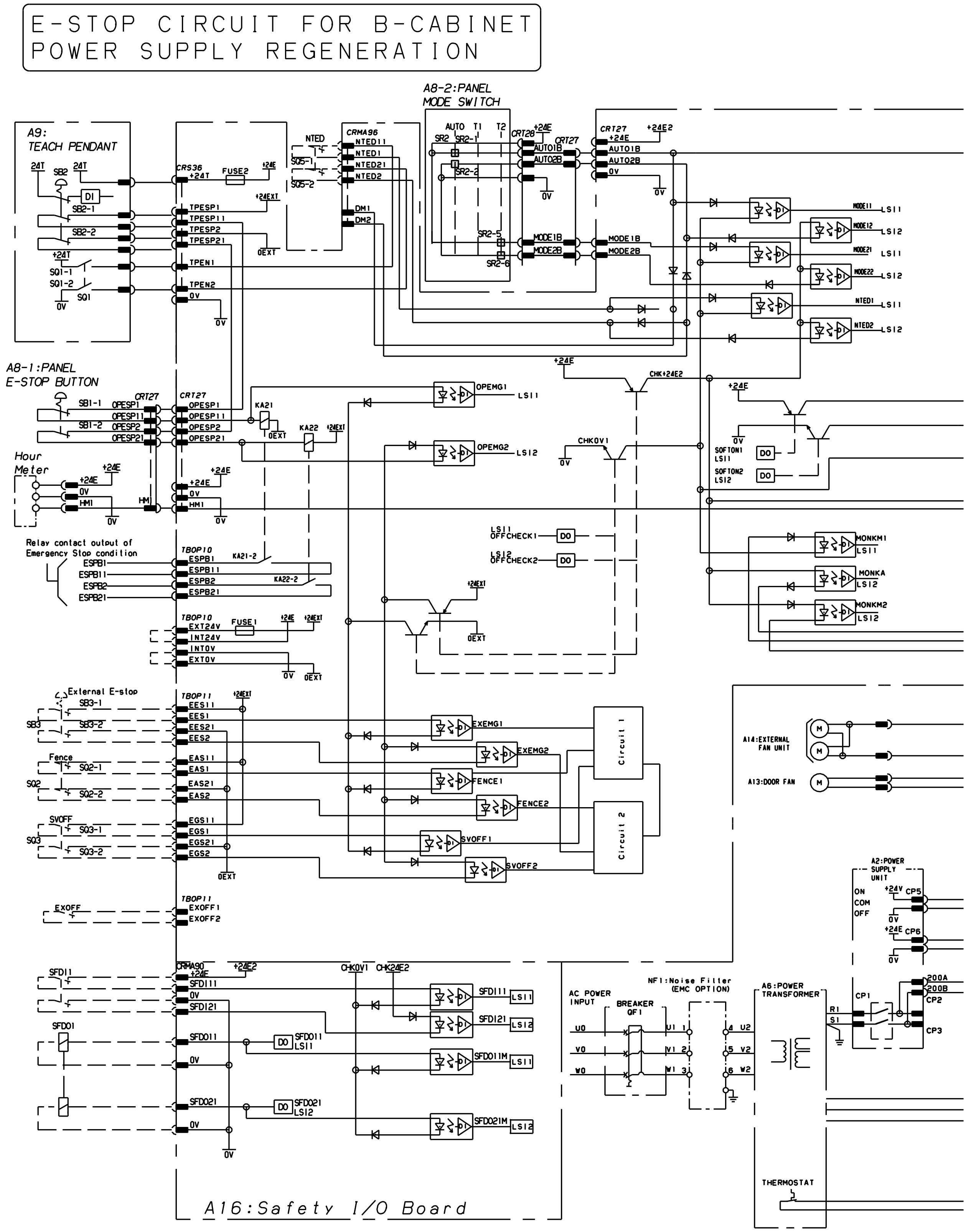
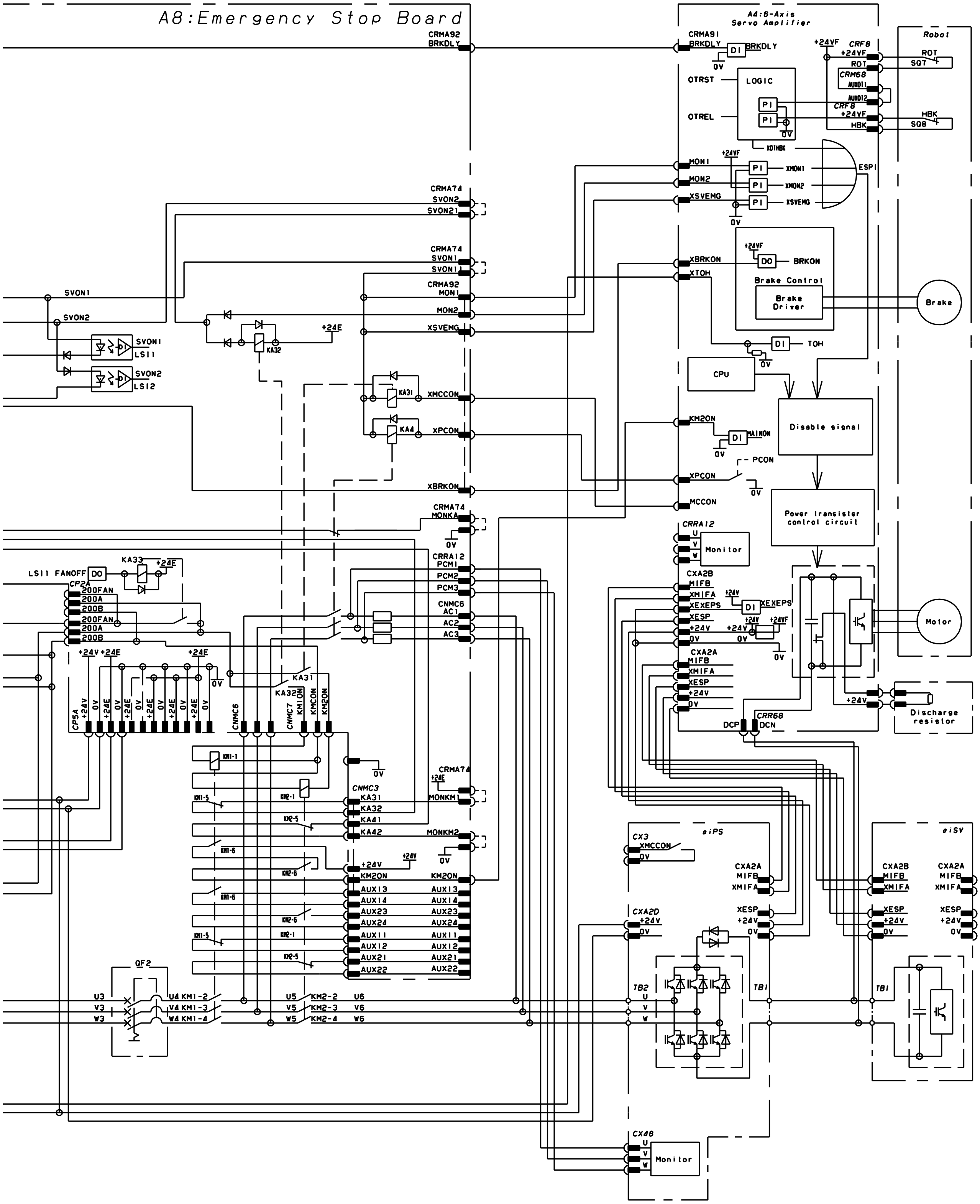


Fig.B (n) Emergency stop circuit connection diagram (B-cabinet/Power supply regeneration)


A8:Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
Brake Control
Brake Driver
Brake
CPU
Disable signal
Power transister control circuit
Motor
Monitor
Discharge resistor
αiPS
αiSV
QF2

Emergency Stop Board
Connector Table
For A-cabinet

JRS20
PCR20

1	RXTP	11	RXP_TP
2	XRXTP	12	RXN_TP
3	TXTP	13	TXP_TP
4	XTXTP	14	TXN_TP
5	ON	15	COM
6	OFF	16	0V
7	RXSILD1	17	RXSILD2
8	XRXSILD1	18	XRXSILD2
9	TXSILD1	19	TXSILD2
10	XTXSILD1	20	XTXSILD2

CRMB2
D1200D (Y)

A1	+24E	B1	0V
A2	+24E	B2	0V
A3	SFDI11	B3	SFDI21
A4	SFDI12	B4	SFDI22
A5	SFDO11	B5	SFDO21
A6	SFDO12	B6	SFDO22

E-STOP UNIT

CRRA9
D5200S (X)

1	AC1
2	AC2
3	AC3

CRMA93
D1200D (X)

A1	+24E	B1	0V
A2	OPDI1	B2	OPDO1
A3	OPDI2	B3	OPDO2
A4	OPDI3	B4	OPDO3
A5	OPDI4	B5	OPDO4
A6	OFF1	B6	OFF11

CRMA94
D2100D (Y)

A1	SVON1	B1	SVON11
A2	SVON2	B2	SVON21
A3	OPDI5	B3	FANOFF

CRP33
D2100D (X)

A1	+24E	B1	0V
A2	+24E	B2	0V
A3	+24V	B3	0V

CRP34
D1200D (X)

A1	+24E	B1	0V
A2	+24E	B2	0V

TBOP13
TERMINAL

1	EES1
2	EES11
3	EES2
4	EES21
5	EAS1
6	EAS11
7	EAS2
8	EAS21
9	EGS1
10	EGS11
11	EGS2
12	EGS21

TBOP14
TERMINAL

1	AUX13
2	AUX14
3	AUX23
4	AUX24
5	DM1
6	DM2
7	ESPB1
8	ESPB11
9	ESPB2
10	ESPB21
11	EXOFF1
12	EXOFF11
13	EXT24V
14	INT24V
15	INT0V
16	EXT0V

CRT27
D2100D (Y)

A1	+24E	B1	0V
A2	+24E	B2	HM1
A3	AUTO1B	B3	AUTO2B
A4	MODE1B	B4	MODE2B
A5	OPESP1	B5	OPESP11
A6	OPESP2	B6	OPESP21
A7	PDO1 (BUSY)	B7	PDI1 (FAULT RESET)
A8	PDO2 (FAULT)	B8	PDI2 (CYCLE START)

CRMA92
D2100D (X)

A1	MON2	B1	XBRKON
A2	XSVEMG	B2	BRKDLY
A3	XMCCON	B3	MON1
A4	XPCON	B4	KM2ON

CRS36
D2100D (Y)

A1	+24T	B1	TPESP21
A2	+24T	B2	TPESP2
A3	TPEN2	B3	TPESP11
A4	TPEN1	B4	TPESP1
A5	TPDSC	B5	0V
A6	0V	B6	0V
A7	XTXTP	B7	TXN_TP
A8	TXTP	B8	TXP_TP
A9	XRXTP	B9	RXN_TP
A10	RXTP	B10	RXP_TP

CRRA8
D3200S (X)

1	200A
2	200B
3	200FAN

CNMC6
D3200S (Y)

1	200R
2	200S
3	200T
4	AC1
5	AC2
6	AC3

CRRA12
D3200S (Z)

1	PCM1
2	PCM2
3	PCM3

CNMC5
D2100D (X)

A1	AUX24	B1	AUX24
A2	AUX23	B2	AUX23
A3	AUX14	B3	AUX14
A4	AUX13	B4	AUX13
A5	+24E	B5	MONKM1
A6	0V	B6	MONKM2
A7	MCC1ON	B7	MCC2ON
A8	0V	B8	MONKA

Fig.B (o) Emergency stop board connector table (A-cabinet)

Emergency Stop Board
Connector Table
For B-cabinet

JD1A PCR20

1	RXSILD2	11	0V
2	XRXSILD2	12	0V
3	TXSILD2	13	0V
4	XTXSILD2	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	
10		20	+5V

JRS19 PCR20

1	RXTP	11	RXP_TP
2	XRXTP	12	RXN_TP
3	TXTP	13	TXP_TP
4	XTXTP	14	TXN_TP
5	ON	15	COM
6	OFF	16	0V
7	RXSILD1	17	
8	XRXSILD1	18	
9	TXSILD1	19	
10	XTXSILD1	20	

CRP24/CP5A D3500D

A1	+24E	B1	0V	CP5A
A2	+24E	B2	0V	CP5A
A3	+24E	B3	0V	CP5A
A4		B4		
A5	+24E	B5	0V	CRP24
A6	+24V	B6	0V	CRP24

CRMA96 D2100D (X)

A1	NTED1	B1	NTED11
A2	NTED2	B2	NTED21
A3	DM1	B3	DM2

CRMA74 D2100D (Y)

A1	MONKA1	B1	BRKDLY
A2	SVON11	B2	SVON1
A3	SVON21	B3	SVON2
A4	24E-2	B4	MONKM1
A5	0V	B5	MONKM2
A6	FANOFF	B6	MONKA

CRMA93 D1200D (X)

A1	+24E	B1	0V
A2	OPDI1	B2	OPDO1
A3	OPDI2	B3	OPDO2
A4	OPDI3	B4	OPDO3
A5	OPDI4	B5	OPDO4
A6	OFF1	B6	OFF11

CRMA83 D1200D (Y)

A1	+24E	B1	0V
A2	OPDI5	B2	OPDI10
A3	OPDI6	B3	OPDI11
A4	OPDI7	B4	OPDI12
A5	OPDI8	B5	OPDI13
A6	OPDI9	B6	

CNMC3 D2100D (X)

A1	KA31	B1	KA32
A2	KA41	B2	KA42
A3	0V	B3	0V
A4	+24V	B4	KM2ON
A5	AUX11	B5	AUX12
A6	AUX21	B6	AUX22
A7	AUX24	B7	AUX24
A8	AUX23	B8	AUX23
A9	AUX14	B9	AUX14
A10	AUX13	B10	AUX13

TBOP11 TERMINAL

1	EES1
2	EES11
3	EES2
4	EES21
5	EAS1
6	EAS11
7	EAS2
8	EAS21
9	EGS1
10	EGS11
11	EGS2
12	EGS21
13	EXOFF1
14	EXOFF11

TBOP10 TERMINAL

1	AUX13
2	AUX14
3	AUX23
4	AUX24
5	AUX11
6	AUX12
7	AUX21
8	AUX22
9	ESPB1
10	ESPB11
11	ESPB2
12	ESPB21
13	EXT24V
14	INT24V
15	INT0V
16	EXT0V

CRT27 D2100D (Y)

A1	24E-2	B1	0V
A2	24E-2	B2	HM1
A3	AUTO1B	B3	AUTO2B
A4	MODE1B	B4	MODE2B
A5	OPESP1	B5	OPESP11
A6	OPESP2	B6	OPESP21
A7	PDO1 (BUSY)	B7	PDI1 (FAULT RESET)
A8	PDO2 (FAULT)	B8	PDI2 (CYCLE START)

CRMA92 D2100D (X)

A1	MON2	B1	XBRKON
A2	XSVEMG	B2	BRKDLY
A3	XMCCON	B3	MON1
A4	XPCON	B4	KM2ON

CONNECTOR ON THE SAFETY I/O BOARD CRMA90 D1000D (X)

A1	+24E	B1	0V
A2	SFDI11	B2	SFDI21
A3	SFDI12	B3	SFDI22
A4	SFDI13	B4	SFDI23
A5	SFDI14	B5	SFDI24
A6	SFDI15	B6	SFDI25
A7	SFDI16	B7	SFDI26
A8	SFDI17	B8	SFDI27
A9	SFDI18	B9	SFDI28
A10		B10	
A11	SFDO11	B11	SFDO21
A12	SFDO12	B12	SFDO22
A13	SFDO13	B13	SFDO23
A14	SFDO14	B14	SFDO24
A15	SFDO15	B15	SFDO25
A16	SFDO16	B16	SFDO26
A17	SFDO17	B17	SFDO27
A18	SFDO18	B18	SFDO28
A19	0V	B19	0V
A20	0V	B20	0V

CP2A D3200M (YY)

A1	200A	B1	200A
A2	200B	B2	200B
A3	200FAN	B3	200FAN

CNMC6 D3200S (Y)

1	200R
2	200S
3	200T
4	AC1
5	AC2
6	AC3

CNMC7 D3200S (X)

1	COIL1
2	COIL2
3	COILC

CRRA12 D3200S (Z)

1	PCM1
2	PCM2
3	PCM3

CRS36 D2100D (Y)

A1	+24T	B1	TPESP21
A2	+24T	B2	TPESP2
A3	TPEN2	B3	TPESP11
A4	TPEN1	B4	TPESP1
A5	TPDSC	B5	0V
A6	0V	B6	0V
A7	XTXTP	B7	TXN_TP
A8	TXTP	B8	TXP_TP
A9	XRXTP	B9	RXN_TP
A10	RXTP	B10	RXP_TP

Fig.B (p) Emergency stop board connector table (B-cabinet)

JD1A
I/O Link
(Main Board - I/O Device)

1	RXSLCA	11	0V
2	XRXSLCA	12	0V
3	TXSLCA	13	0V
4	XTXSLCA	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	+24E
10	+24E	20	+5V

JRS19
ON-OFF/TP/IO LINK i
(Main Board - E-STOP Board)

1	RXTP	11	RXP_TP
2	XRXTP	12	RXN_TP
3	TXTP	13	TXP_TP
4	XTXTP	14	TXN_TP
5	ON	15	COM
6	OFF	16	0V
7	RXSILC1	17	
8	XRXSILC1	18	
9	TXSILC1	19	
10	XTXSILC1	20	

BAT1
Battery Interface
(Main Board - Battery)

1	VBAT
2	0V

CRS35
FORCE SENSOR

	3	2	1
A	CAMD04	XSDATA	SDATA
B	CAMD05S	0V	+24E

CD38A
Ethernet 100Base-TX
(Main Board - Network)

1	TPTXA+
2	TPTXA-
3	TPRXA+
4	NCA1
5	NCA1
6	TPRXA-
7	NCA2
8	NCA2

CD38B
Ethernet 100Base-TX
(Main Board - Network)

1	TPTXB+
2	TPTXB-
3	TPRXB+
4	NCB1
5	NCB1
6	TPRXB-
7	NCB2
8	NCB2

CD38C
Ethernet 100Base-TX
(Main Board - Network)

1	TPTXC+
2	TPTXC-
3	TPRXC+
4	NCC1
5	NCC1
6	TPRXC-
7	NCC2
8	NCC2

JD17
RS-232-C & LVC
(Main Board - Serial Device/LVC)

1	RXDB	11	TXDB
2	0V	12	0V
3	DSRB	13	DTRB
4	0V	14	0V
5	CTSB	15	RTSB
6	0V	16	0V
7	RXLVC	17	TXLVC
8	XRXLVC	18	XTXLVC
9	+5V	19	+24E
10	+24E	20	+5V

JRS16
RS232-C/USB
(Main Board - Panel)

1	RXDA	11	TXDA
2	0V	12	0V
3	DSRA	13	DTRA
4	0V	14	0V
5	CTSA	15	RTSA
6	0V	16	0V
7	USB_5V	17	USB_P
8	USB_0V	18	USB_M
9		19	+24E
10	+24E	20	

JRL8
HDI I/O Link
(Main Board - I/O Device)

1	RXSLCB	11	XHDI0
2	0V	12	0V
3	XRXSLCB	13	XHDI1
4	0V	14	0V
5	TXSLCB	15	XHDI2
6	RXSLCC	16	0V
7	XTXSLCB	17	XHDI3
8	XRXSLCC	18	0V
9	TXSLCC	19	XHDI4
10	XTXSLCC	20	0V

JRL7
Sensor interface
(Video Interface)

1	XVD	11	CAMD02
2	0V	12	0V
3	XHD	13	CAMD03
4	0V	14	0V
5	XTRIG	15	CAMDI1
6	0V	16	CAMDI2
7	VIDEOIN	17	CAMDI0
8	0V	18	CAMD00
9		19	P12V
10	0V	20	CAMD01

R-30iB Main Board
Connector Table

Fig.B (q) Main board connector table (R-30*i*B)

R-30iB Plus Main Board Connector Table

JD1A
I/O Link
(Main Board - I/O Device)

1	RXSLCA	11	0V
2	XRXSLCA	12	0V
3	TXSLCA	13	0V
4	XTXSLCA	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	+24E
10	+24E	20	+5V

JRS19
ON-OFF/TP/IO LINK i
(Main Board - E-STOP Board)

1	RXTP	11	RXP_TP
2	XRXTP	12	RXN_TP
3	TXTP	13	TXP_TP
4	XTXTP	14	TXN_TP
5	ON	15	COM
6	OFF	16	0V
7	RXSILC1	17	
8	XRXSILC1	18	
9	TXSILC1	19	
10	XTXSILC1	20	

BAT1
Battery Interface
(Main Board - Battery)

1	VBAT
2	0V

CRS35
FORCE SENSOR

	3	2	1
A	CAMD04	XSDATA	SDATA
B	CAMD05S	0V	+24E

JD17
RS-232-C & LVC
(Main Board - Serial Device/LVC)

1	RXDB	11	TXDB
2	0V	12	0V
3	DSRB	13	DTRB
4	0V	14	0V
5	CTSB	15	RTSB
6	0V	16	0V
7	RXLVC	17	TXLVC
8	XRXLVC	18	XTXLVC
9	+5V	19	+24E
10	+24E	20	+5V

JRS16
RS232-C/USB
(Main Board - Panel)

1	RXDA	11	TXDA
2	0V	12	0V
3	DSRA	13	DTRA
4	0V	14	0V
5	CTSA	15	RTSA
6	0V	16	0V
7	USB_5V	17	USB_P
8	USB_0V	18	USB_M
9		19	+24E
10	+24E	20	

CD38A
Ethernet 100Base-TX
(Main Board - Network)

1	TPTXA+
2	TPTXA-
3	TPRXA+
4	NCA1
5	NCA1
6	TPRXA-
7	NCA2
8	NCA2

CD38B
Ethernet 100Base-TX
(Main Board - Network)

1	TPTXB+
2	TPTXB-
3	TPRXB+
4	NCB1
5	NCB1
6	TPRXB-
7	NCB2
8	NCB2

CD38C
Ethernet
100Base-TX/1000Base-T
(Main Board - Network)

1	TDPA
2	TDMA
3	TDPB
4	TDPC
5	TDMC
6	TDMB
7	TDPD
8	TDMD
9	FG
10	FG

JRL8
HDI I/O Link
(Main Board - I/O Device)

1	RXSLCB	11	XHDI0
2	0V	12	0V
3	XRXSLCB	13	XHDI1
4	0V	14	0V
5	TXSLCB	15	XHDI2
6	RXSLCC	16	0V
7	XTXSLCB	17	XHDI3
8	XRXSLCC	18	0V
9	TXSLCC	19	XHDI4
10	XTXSLCC	20	0V

CRJ3
Sensor interface
(Video Interface)

1	CAMERA

Fig.B (r) Main board connector table (R-30*i*B Plus)

Emergency Stop Board diagram

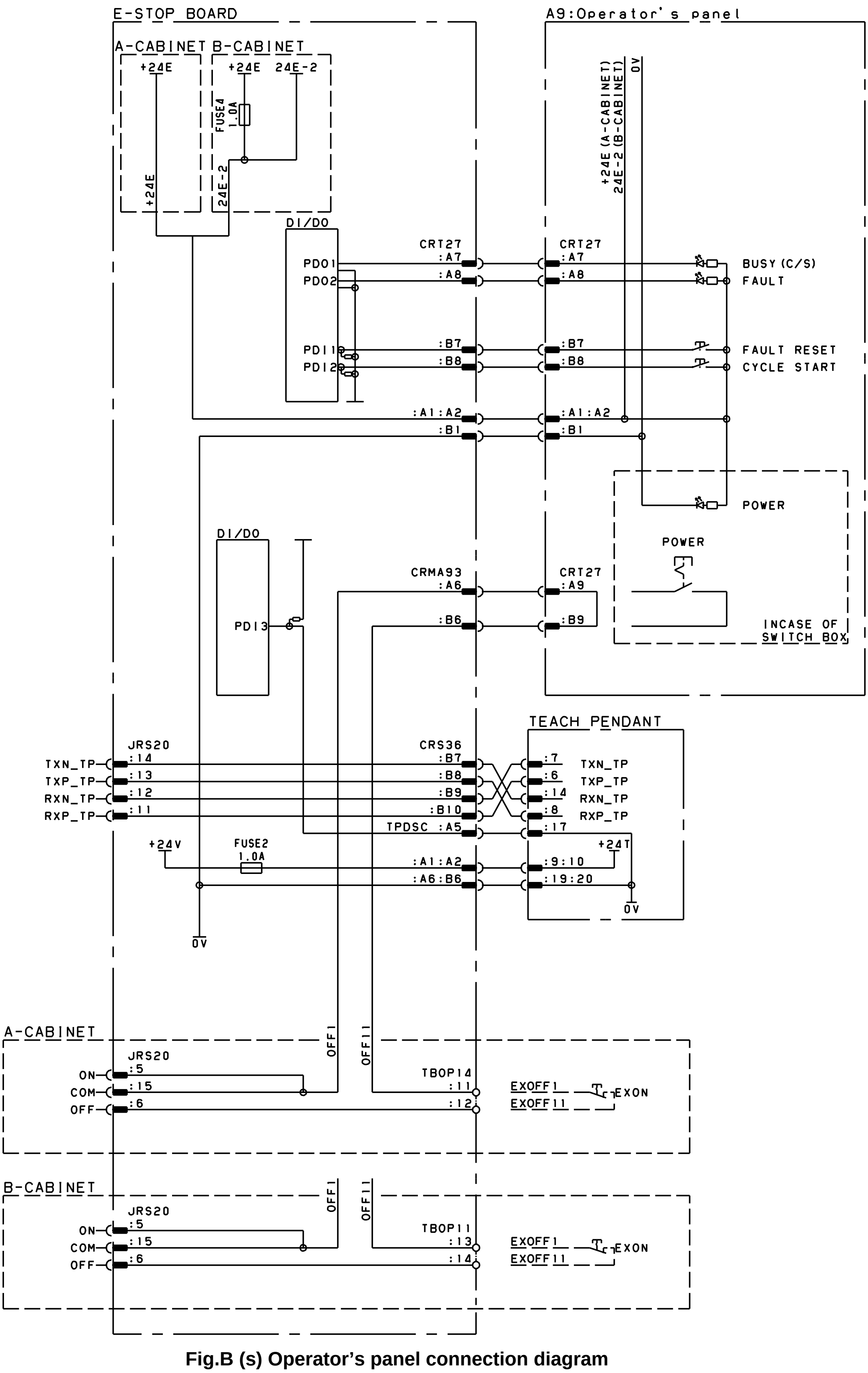


Fig.B (s) Operator's panel connection diagram

Operator's panel Connector Table (A-CABINET)

CRT27
D2100D (X)

A1	+24E	B1	0V
A2	+24E	B2	HM1
A3	AUTO1B	B3	AUTO2B
A4	MODE1B	B4	MODE2B
A5	OPESP1	B5	OPESP11
A6	OPESP2	B6	OPESP21
A7	PDO1 (BUSY)	B7	PDI1 (FAULT RESET)
A8	PDO2 (FAULT)	B8	PDI2 (CYCLE START)
A9	OFF1	B9	OFF11
A10		B10	

CRT28
D2100D (X)

A1	+24E	B1	0V
A2	AUTO1B	B2	AUTO2B
A3	MODE1B	B3	MODE2B

CRP5
D2100S (X)

1	+24E
2	0V
3	HM1

Operator's panel Connector Table (B-CABINET)

CRT27
D2100D (X)

A1	24E-2	B1	0V
A2	24E-2	B2	HM1
A3	AUTO1B	B3	AUTO2B
A4	MODE1B	B4	MODE2B
A5	OPESP1	B5	OPESP11
A6	OPESP2	B6	OPESP21
A7	PDO1 (BUSY)	B7	PDI1 (FAULT RESET)
A8	PDO2 (FAULT)	B8	PDI2 (CYCLE START)
A9	OFF1	B9	OFF11
A10		B10	

CRT28
D2100D (X)

A1	24E-2	B1	0V
A2	AUTO1B	B2	AUTO2B
A3	MODE1B	B3	MODE2B

CRP5
D2100S (X)

1	24E-2
2	0V
3	HM1

Teach pendant Connector Table

CONNECTOR ON THE TEACH PENDANT

		4		3		2		1			
10	+24T	9	+24T	8	RXP_TP	7	TXN_TP	6	TXP_TP	5	DRAIN
16	TPESP21	15	TPESP2	14	RXN_TP	13	TPESP11	12	TPESP1	11	TPEN1
		20	0V	19	0V	18	TPEN2	17	TPDSC		

Fig.B (t) Operator's panel/Teach pendant connector table

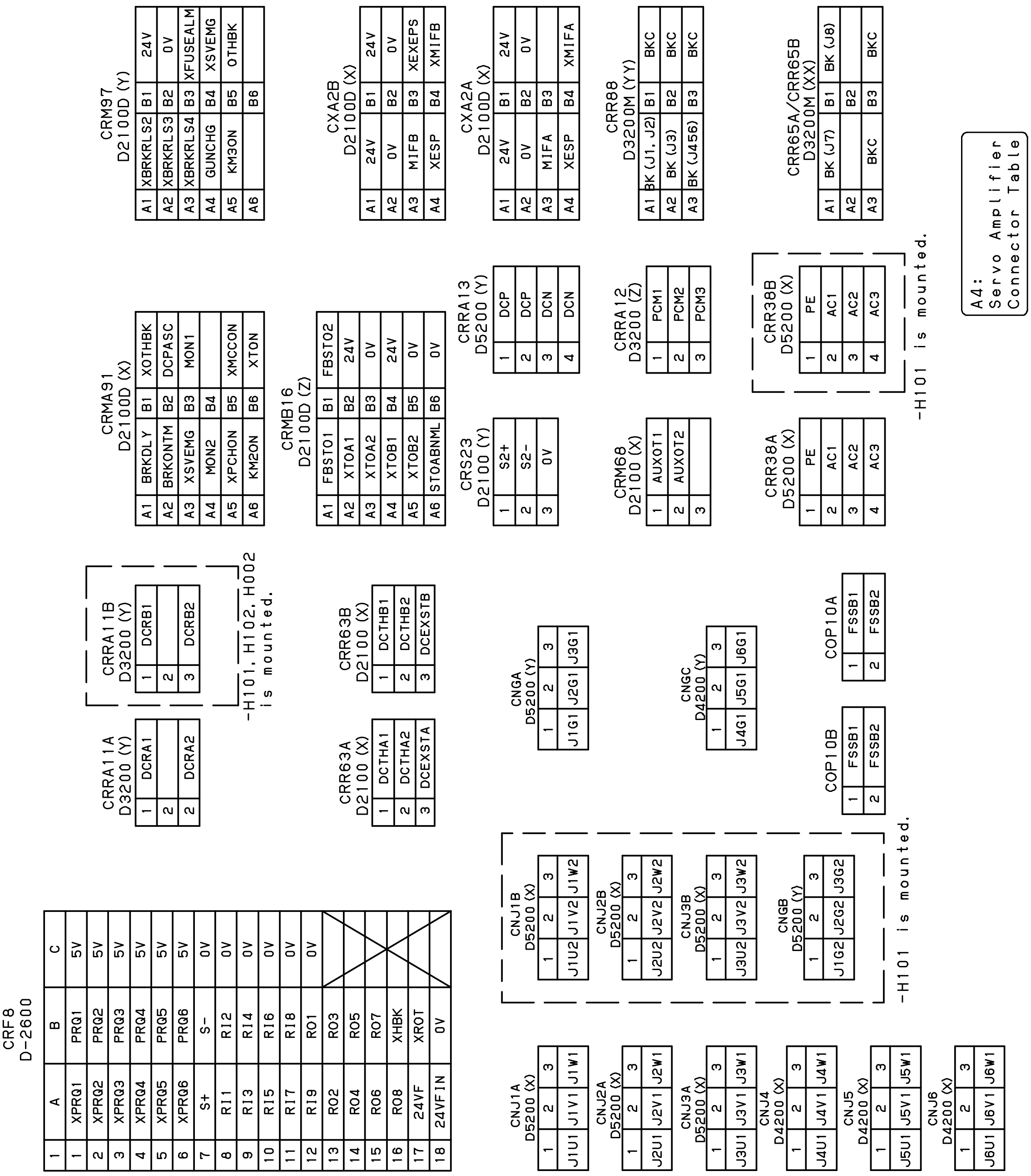


Fig.B (u) Servo amplifier connector table

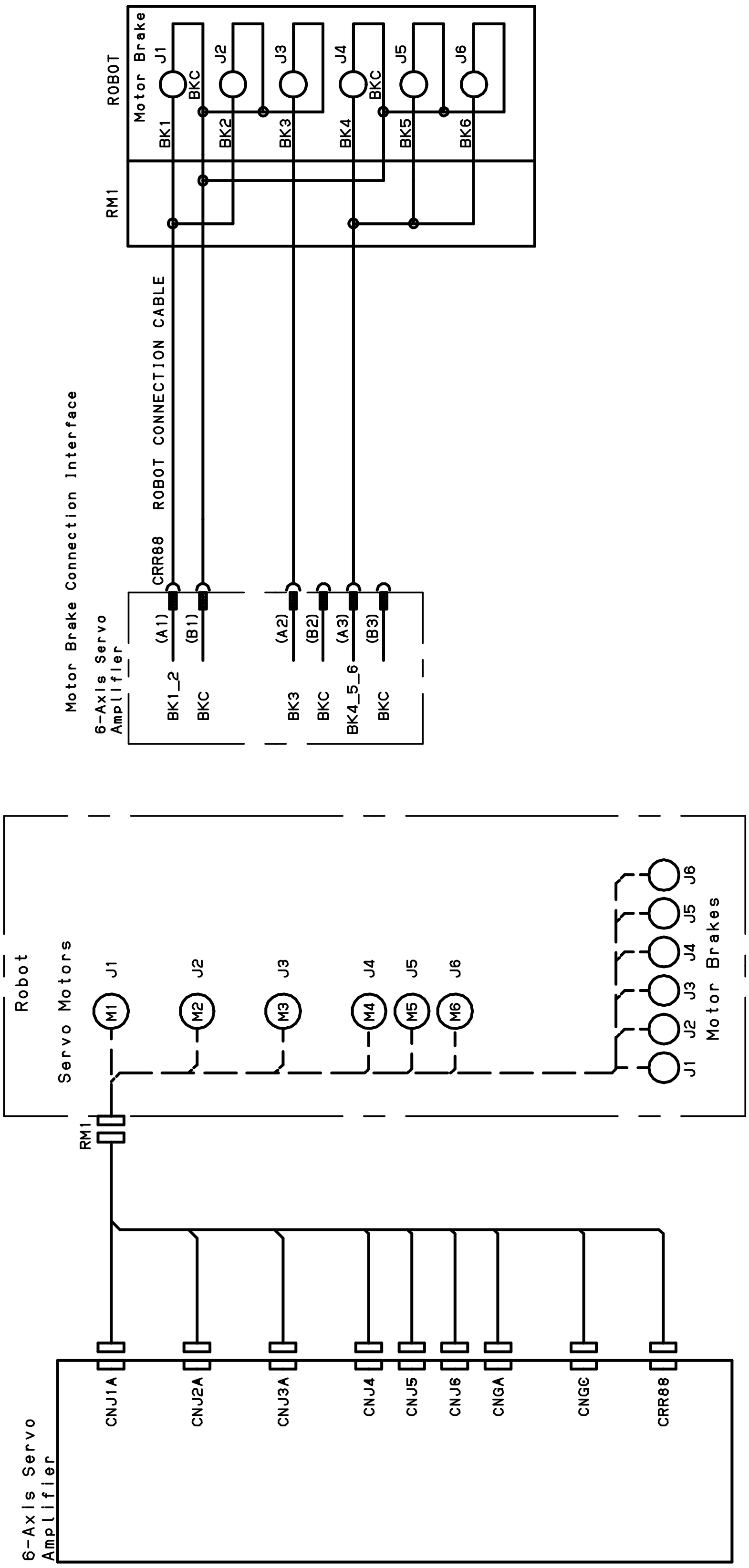


Fig.B (v) Motor power connection (Group1, Group11)

Group1: R-2000*i*B(except /200T/220U/220US), R-2000*i*C(except /210L/270F), R-1000*i*A(except /120iF-7B), M-710*i*C,M-420*i*A,M-421*i*A

Group11: M-2*i*A,M-3*i*A

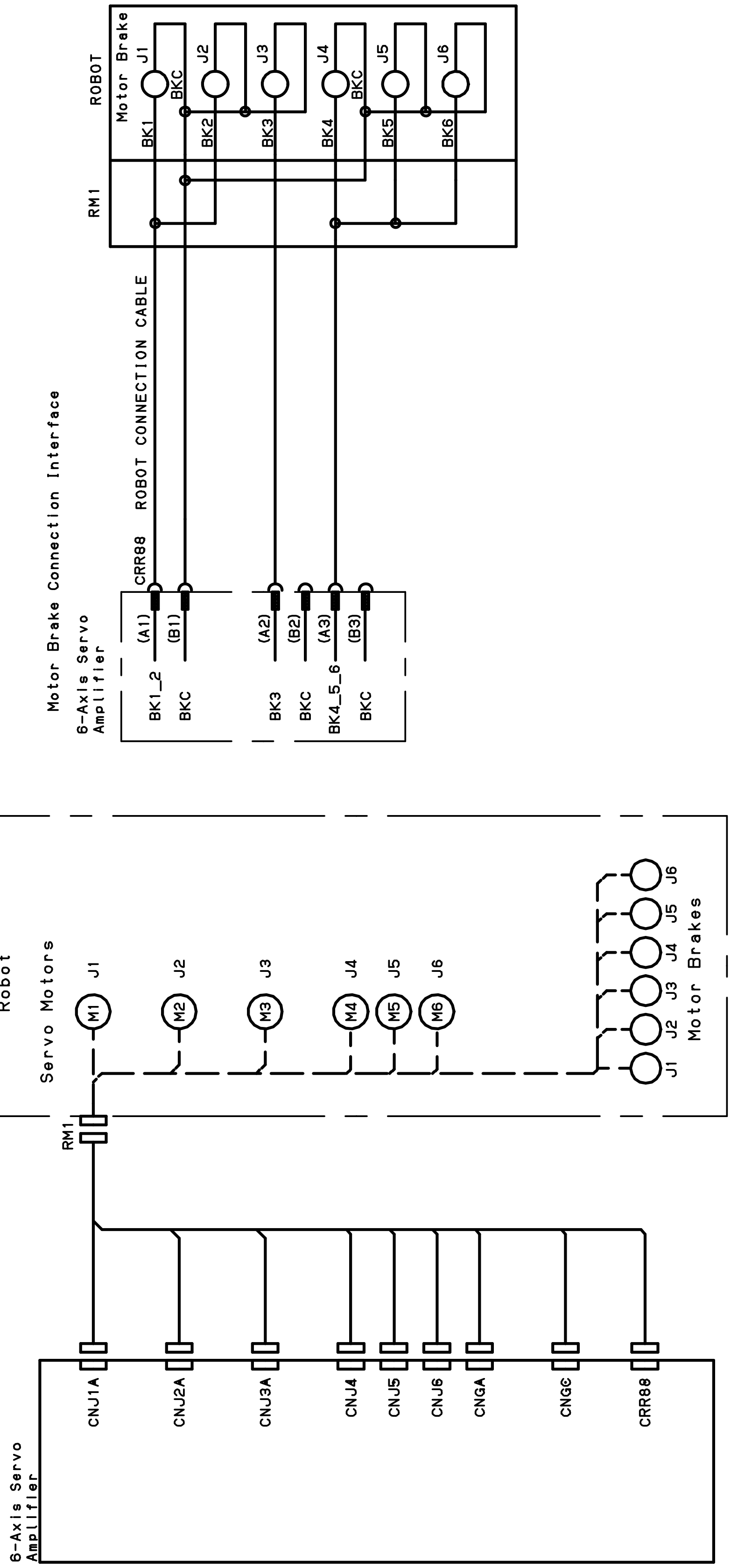


Fig.B (w) Motor power connection (Group2)
F-200*i*B

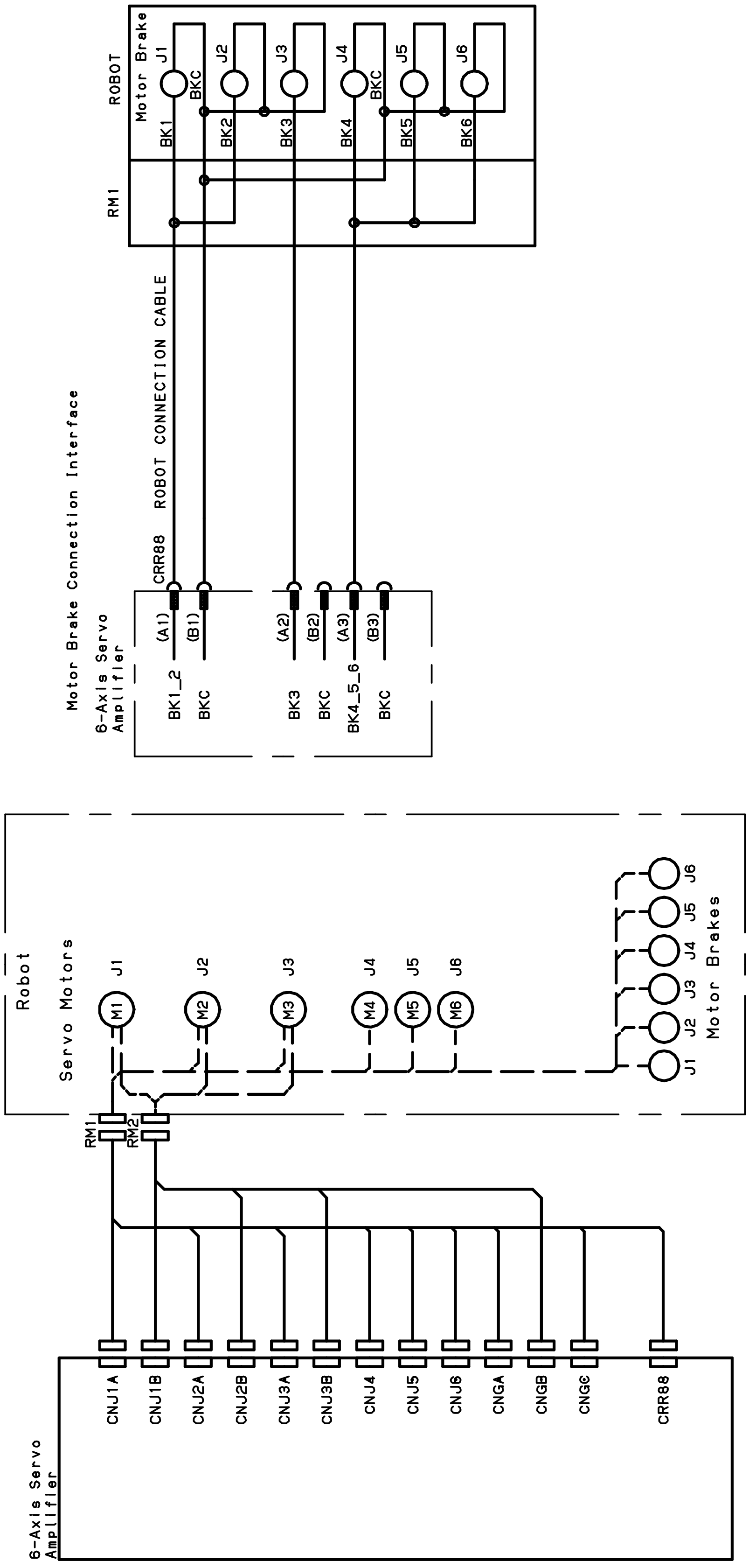
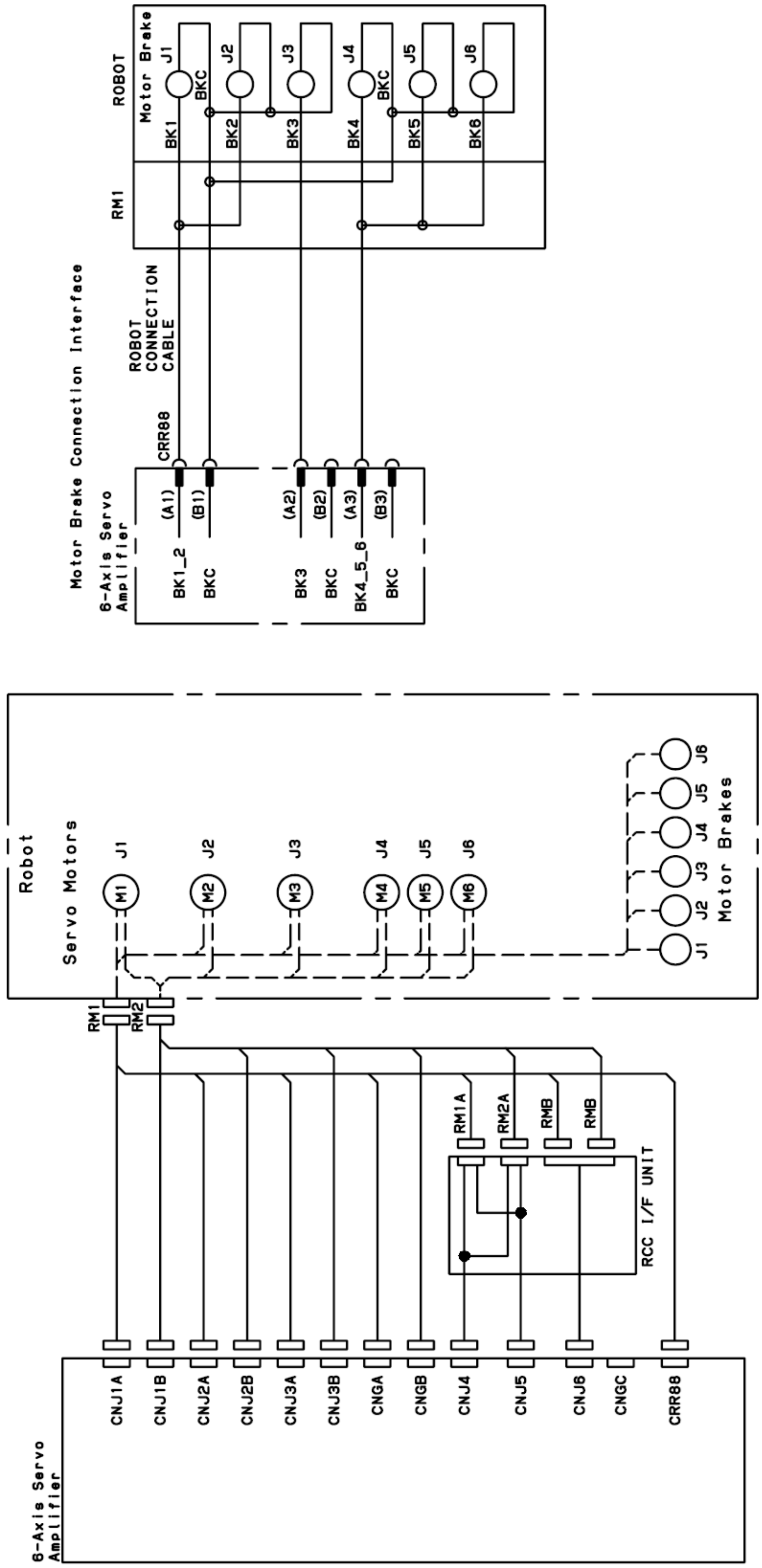


Fig.B (x) Motor power connection (Group3)
R-2000*i*B/200T/220U/220US, R-2000*i*C/210L/270F,M-410*i*B,M-410*i*C



RM1A

	A	B
1	J4U	J5U
2	J4V	J5V
3	J4W	J5W

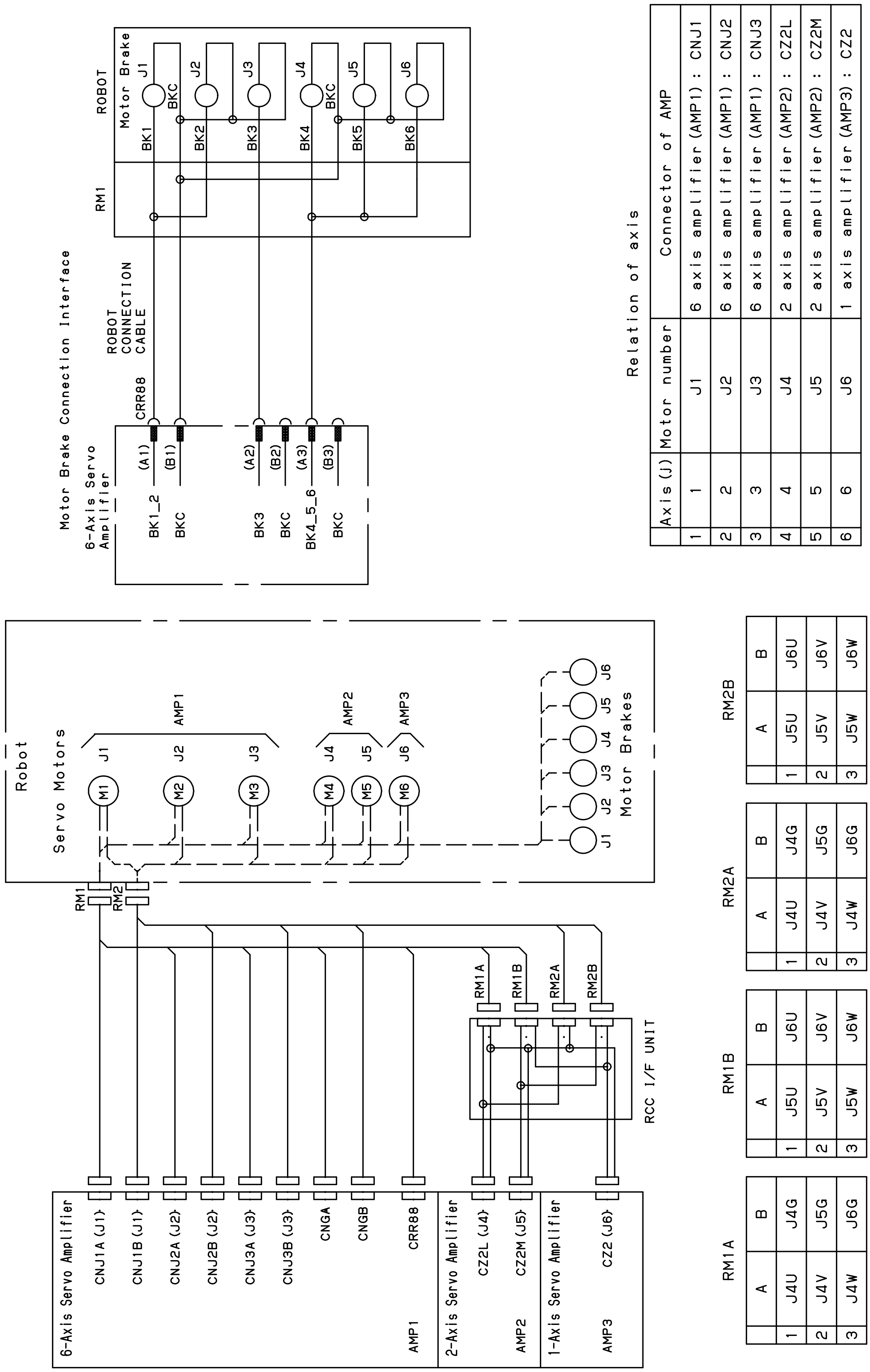
RM2A

	A	B
1	J4U	J5U
2	J4V	J5V
3	J4W	J5W

RMB

	A	B
1	J6U	J6U
2	J6V	J6V
3	J6W	J6W

Fig.B (y) Motor power connection (Group4)
M-900*i*A/150P,260L,350



Relation of axis

	Axis (J)	Motor number	Connector of AMP
1	1	J1	6 axis amplifier (AMP1) : CNJ1
2	2	J2	6 axis amplifier (AMP1) : CNJ2
3	3	J3	6 axis amplifier (AMP1) : CNJ3
4	4	J4	2 axis amplifier (AMP2) : CZ2L
5	5	J5	2 axis amplifier (AMP2) : CZ2M
6	6	J6	1 axis amplifier (AMP3) : CZ2

RM2B

	A	B
1	J5U	J6U
2	J5V	J6V
3	J5W	J6W

RM2A

	A	B
1	J4U	J4G
2	J4V	J5G
3	J4W	J6G

RM1B

	A	B
1	J5U	J6U
2	J5V	J6V
3	J5W	J6W

RM1A

	A	B
1	J4U	J4G
2	J4V	J5G
3	J4W	J6G

Fig.B (z) Motor power connection (Group5)
M-900*i*A/400L,600,M-900*i*B/400L,700

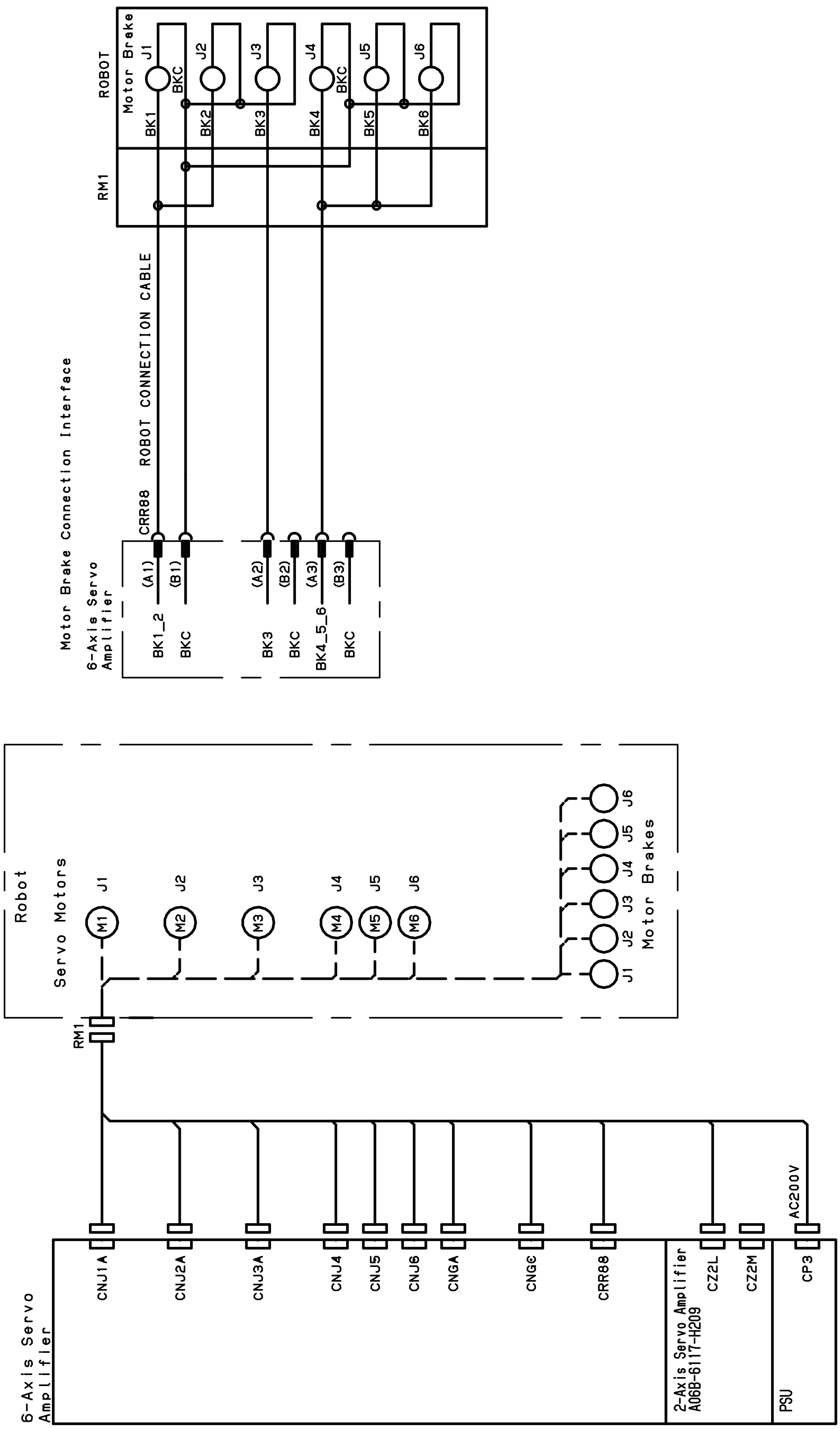


Fig.B (aa) Motor Power Connection (group6-1)
M-430*i*A/4FH

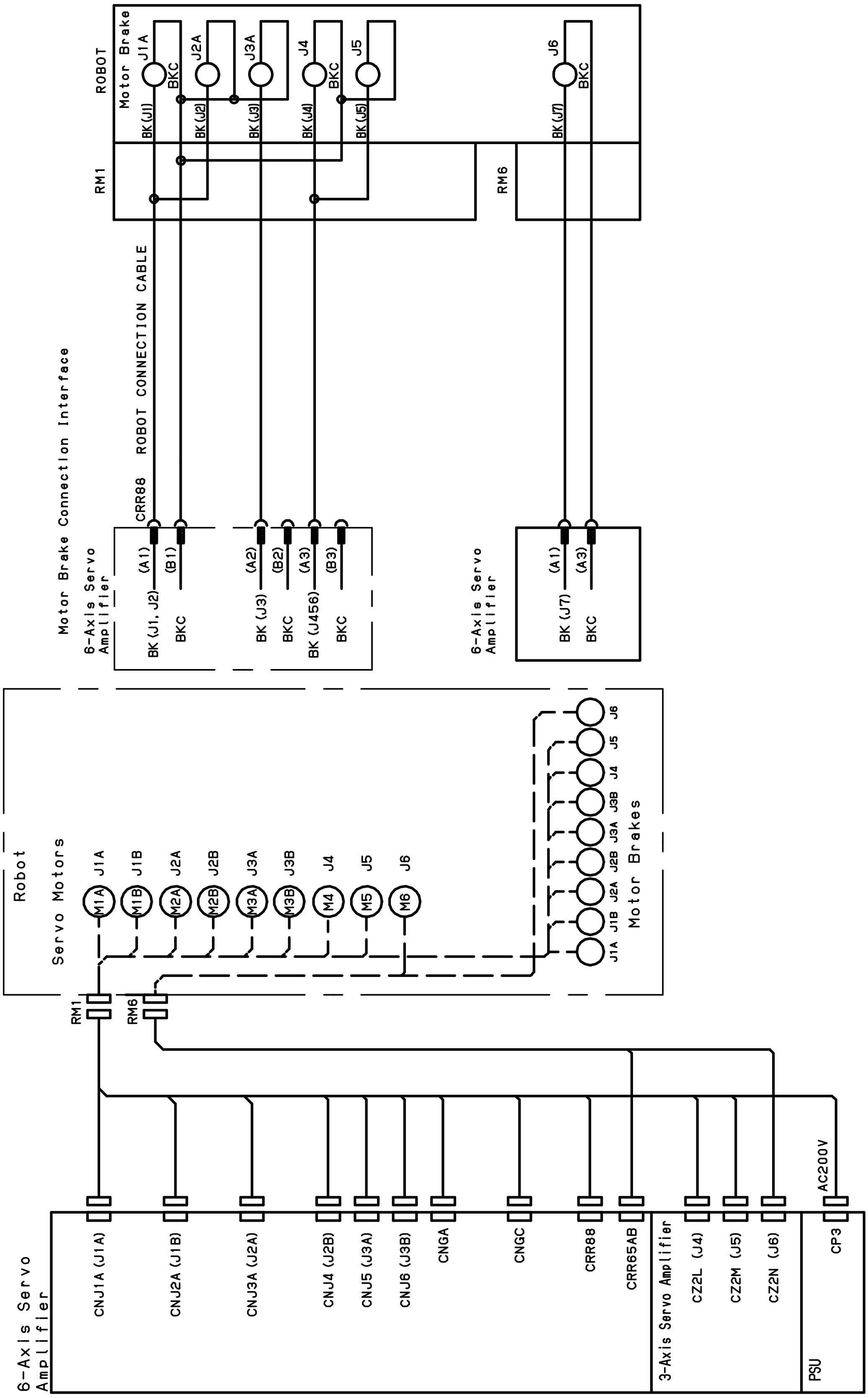


Fig.B (ab) Motor Power Connection (group6-2)
M-430*i*A/2PH

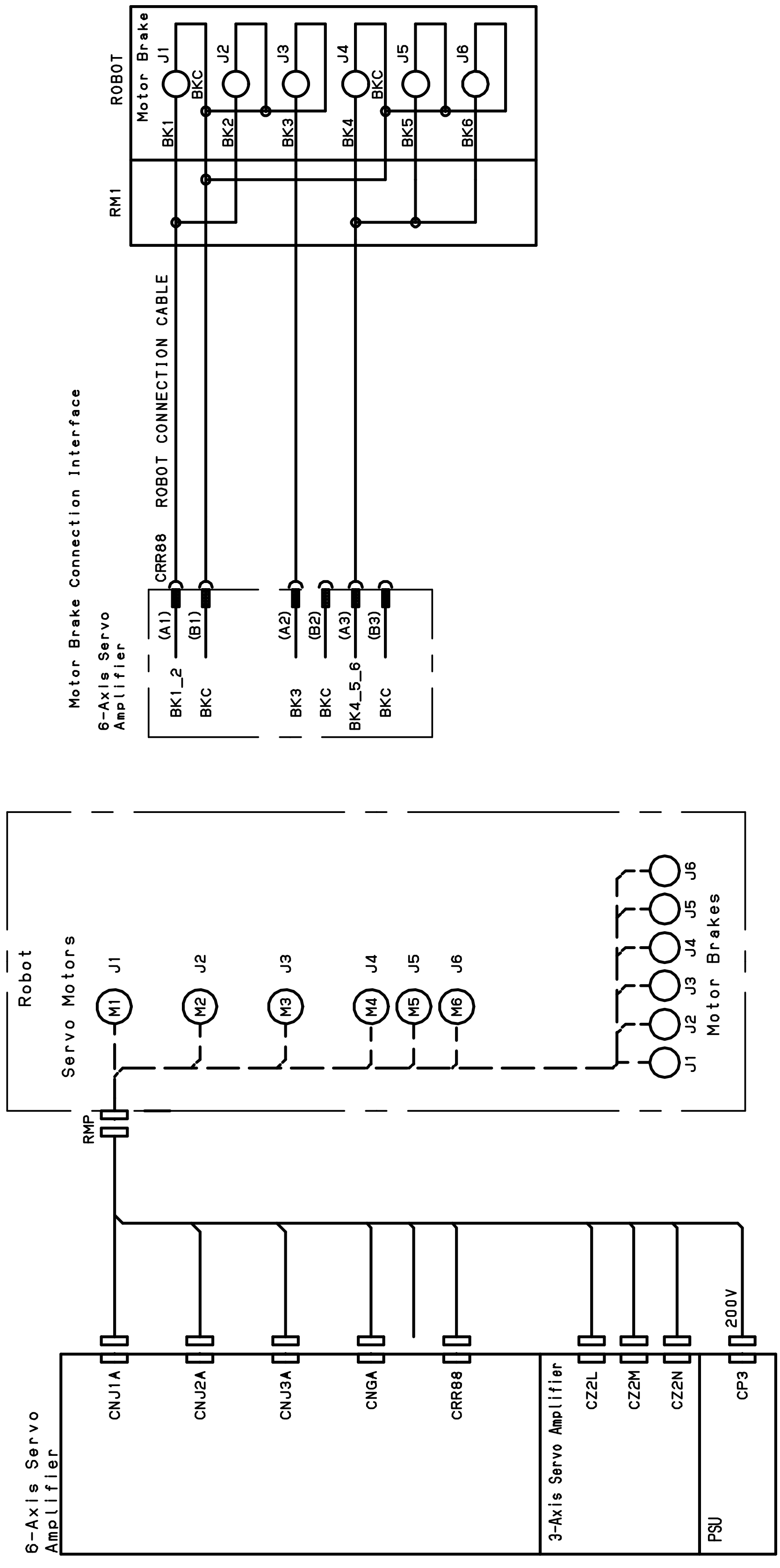


Fig.B (ac) Motor Power Connection (Group 7)
M-430*i*A/2P

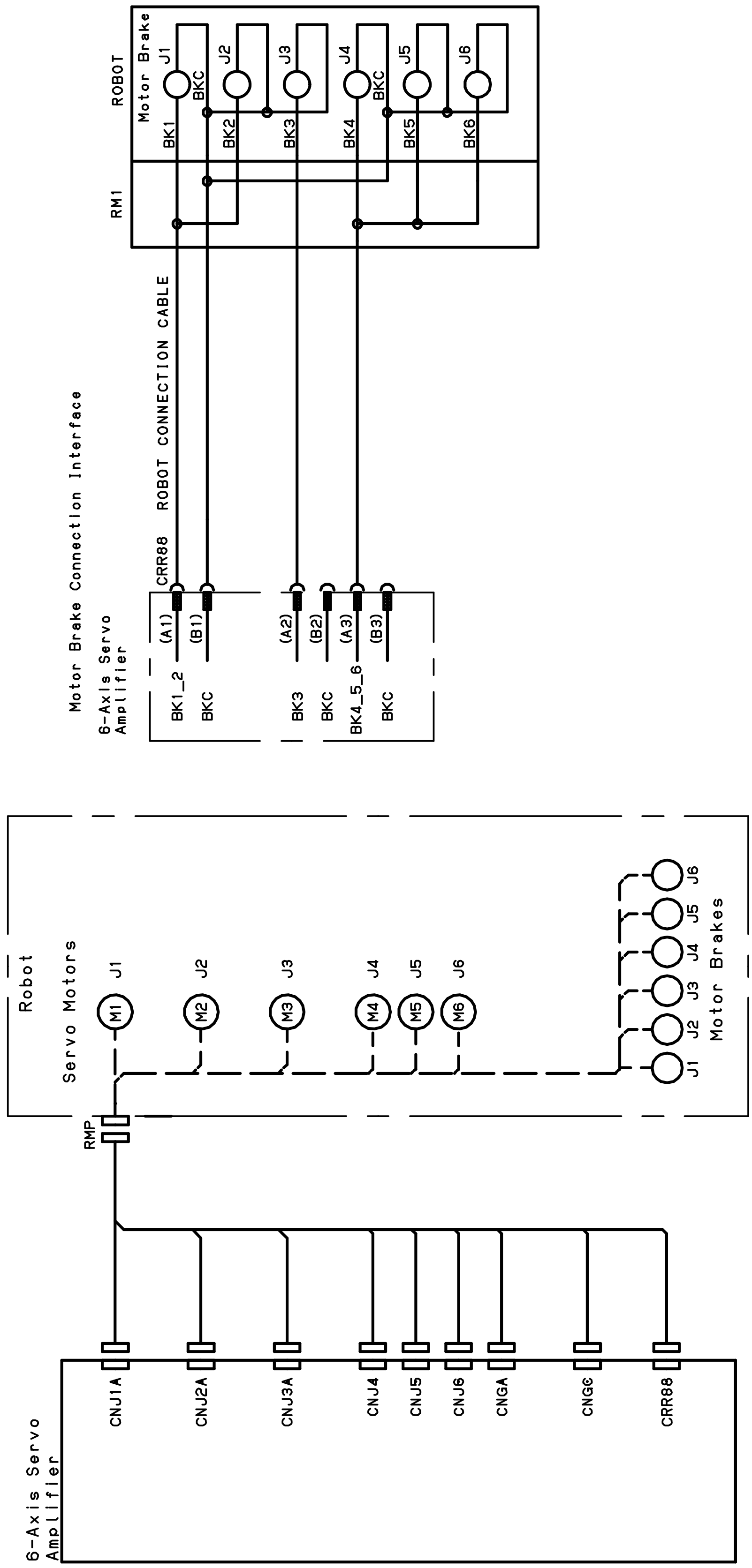


Fig.B (ad) Motor Power Connection (Group 8)
ARC Mate 100*i*C,ARC Mate 120*i*C,M-10*i*A,M-20*i*A,M-20*i*B,CR-35*i*A

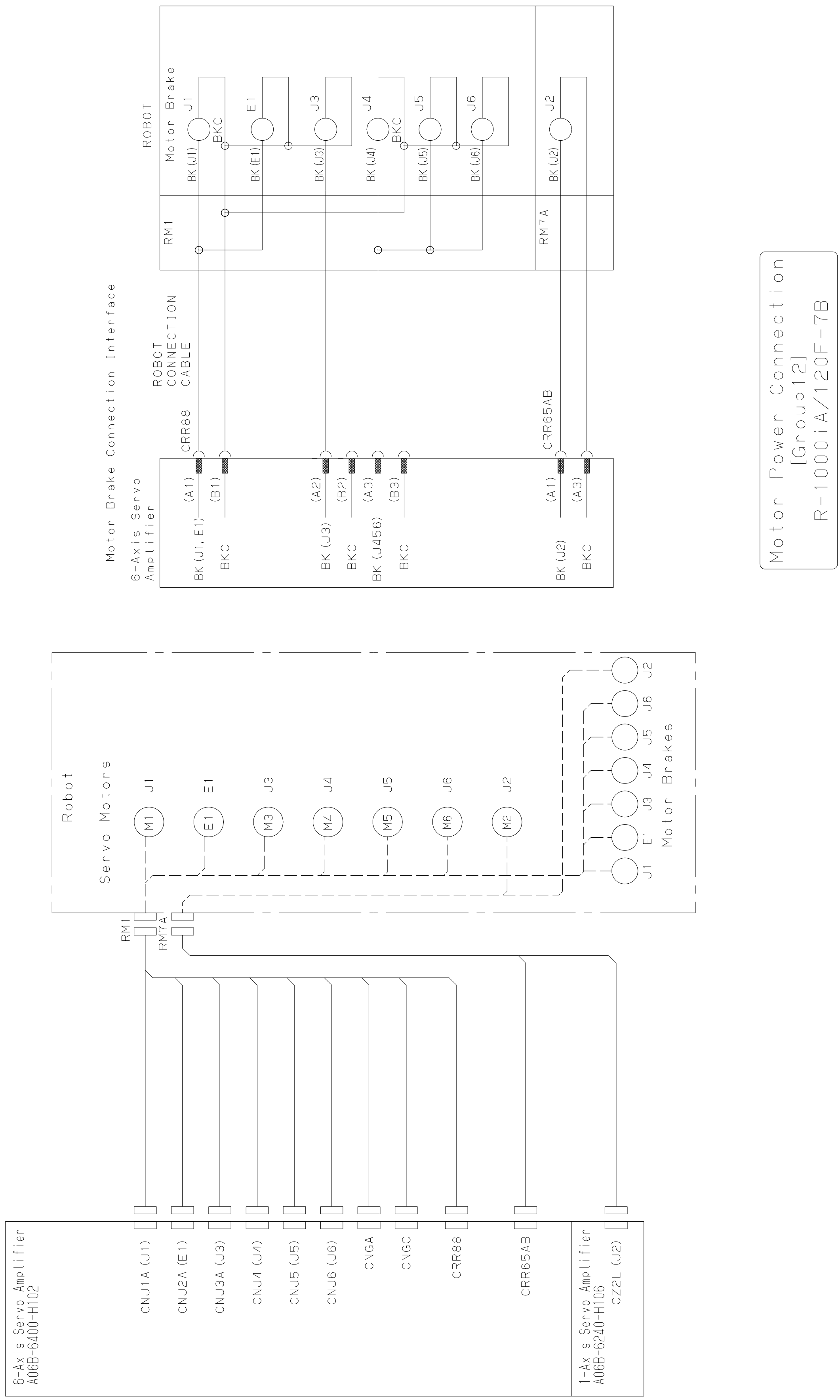


Fig.B (ae) Motor Power Connection (Group 12)
R-1000iA/120F-7B

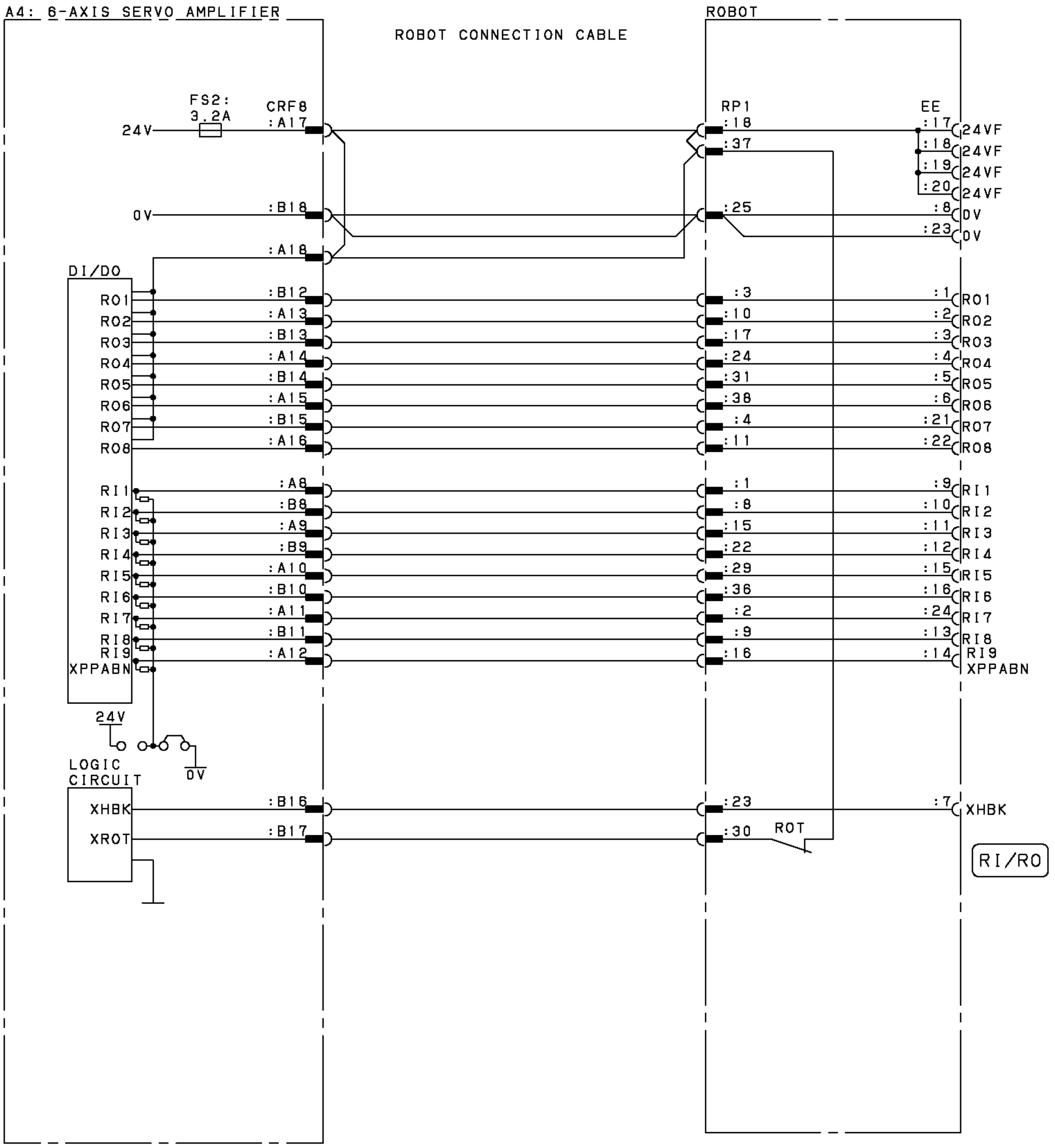


Fig.B (af) RI/RO connection diagram (Group1 to 5 and 12)

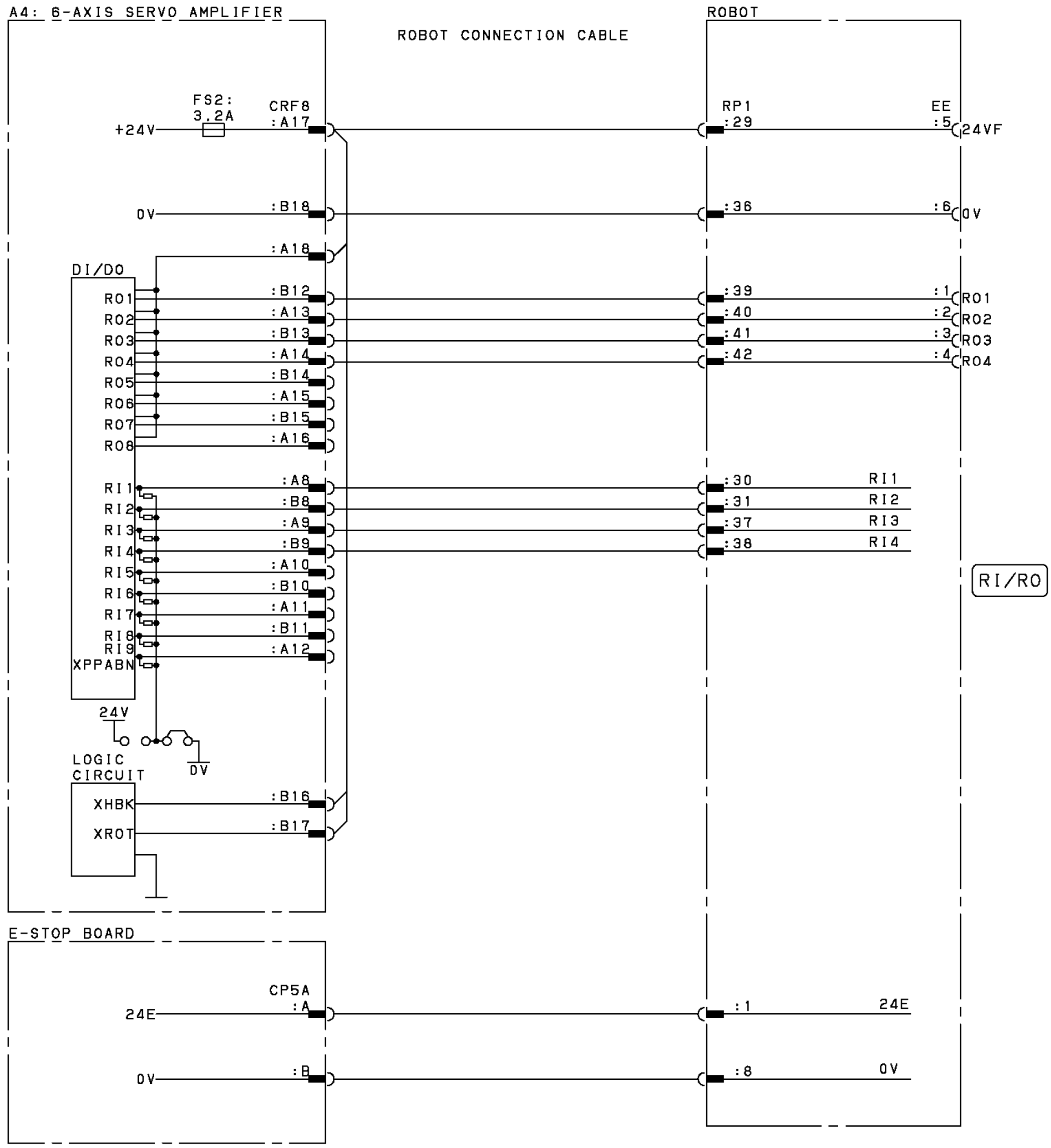


Fig.B (ag) **RI/RO Connection Diagram (Group6; M-430*i*A/2PH,4FH)**

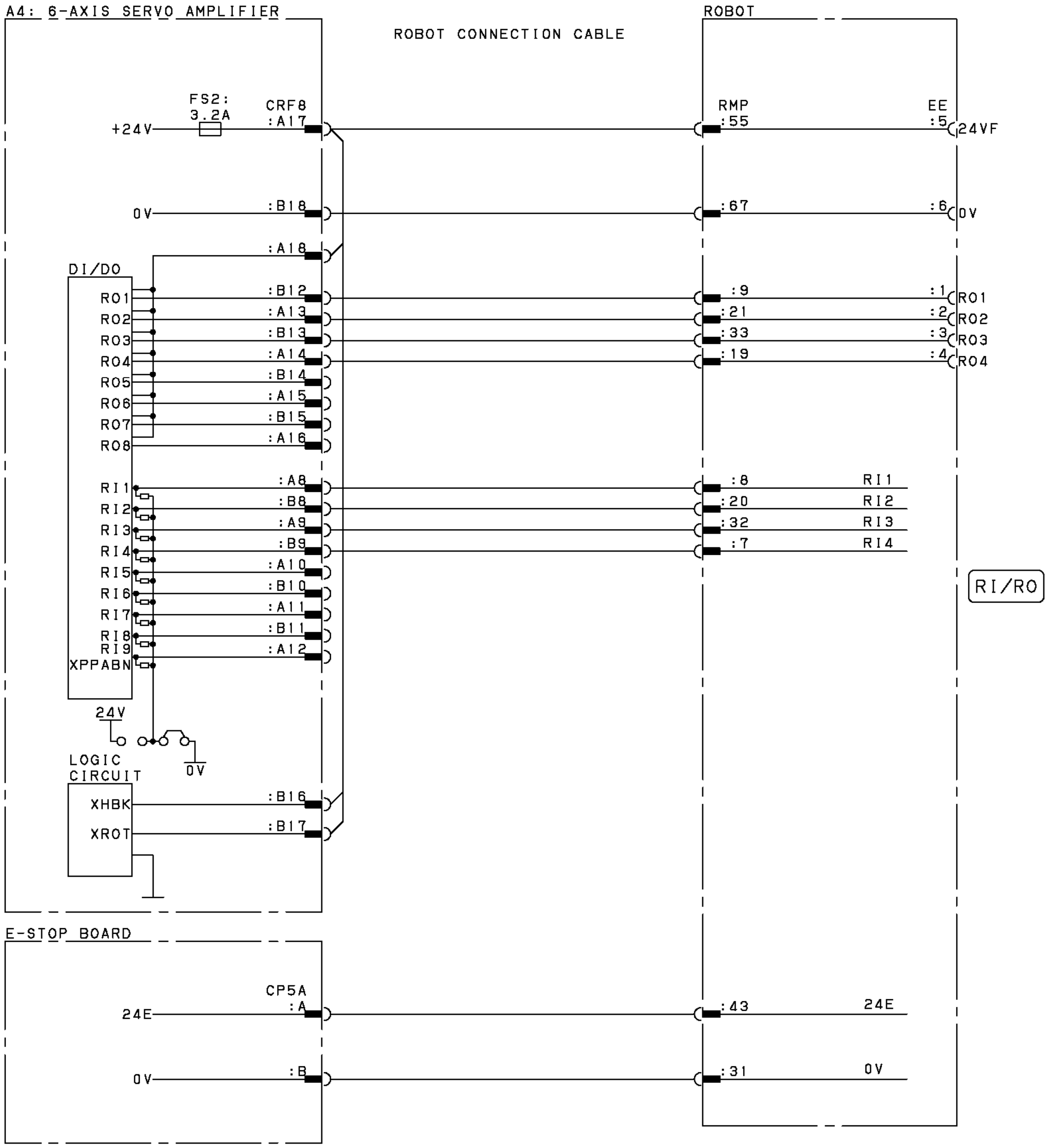


Fig.B (ah) RI/RO Connection Diagram (Group7; M-430*i*A/2P)

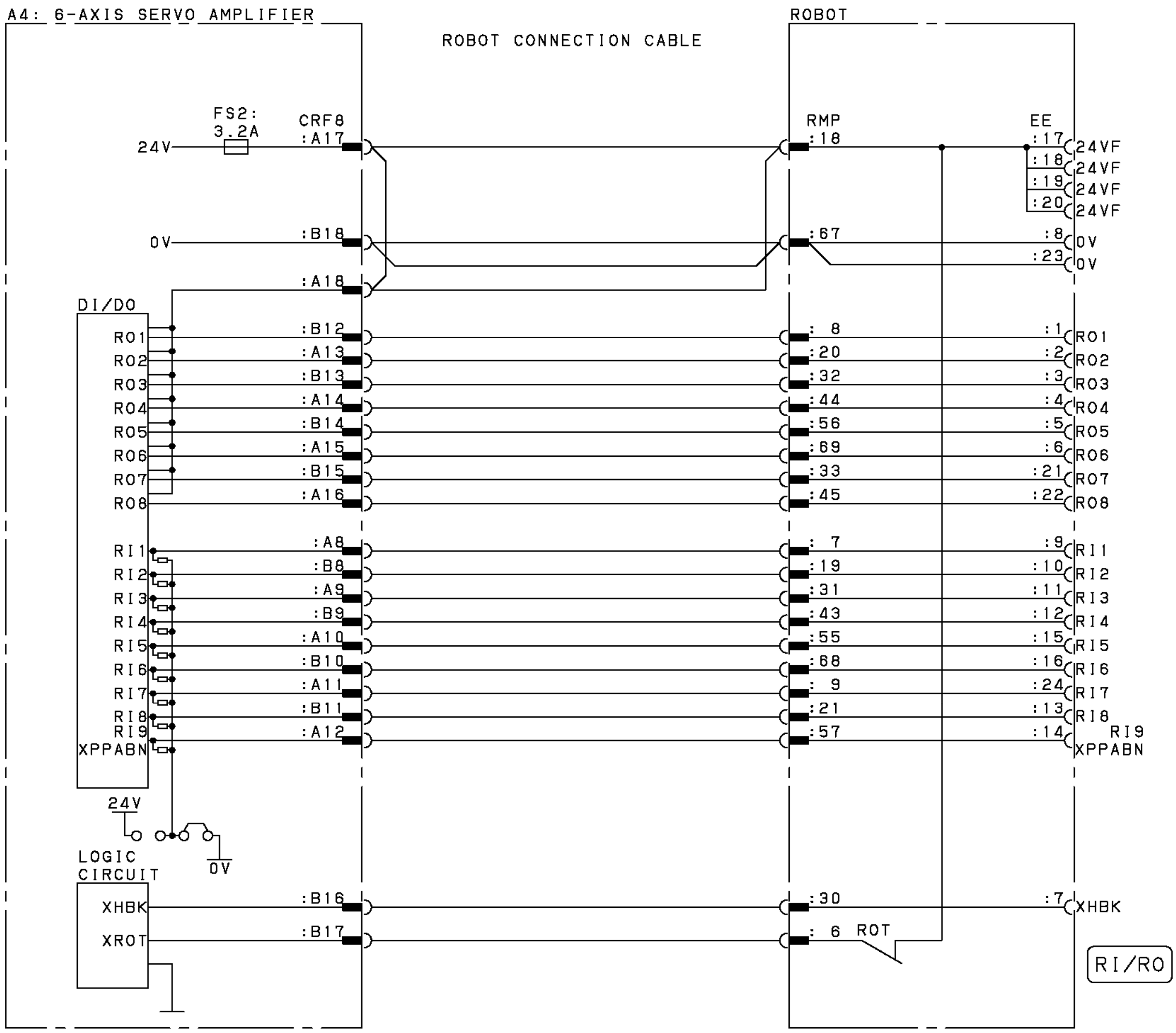


Fig.B (ai) RI/RO Connection Diagram (Group8; ARC Mate 100*i*C, ARC Mate 120*i*C)

There are many type EE connector of mechanical unit.
The detail is shown on the mechanical unit manual.

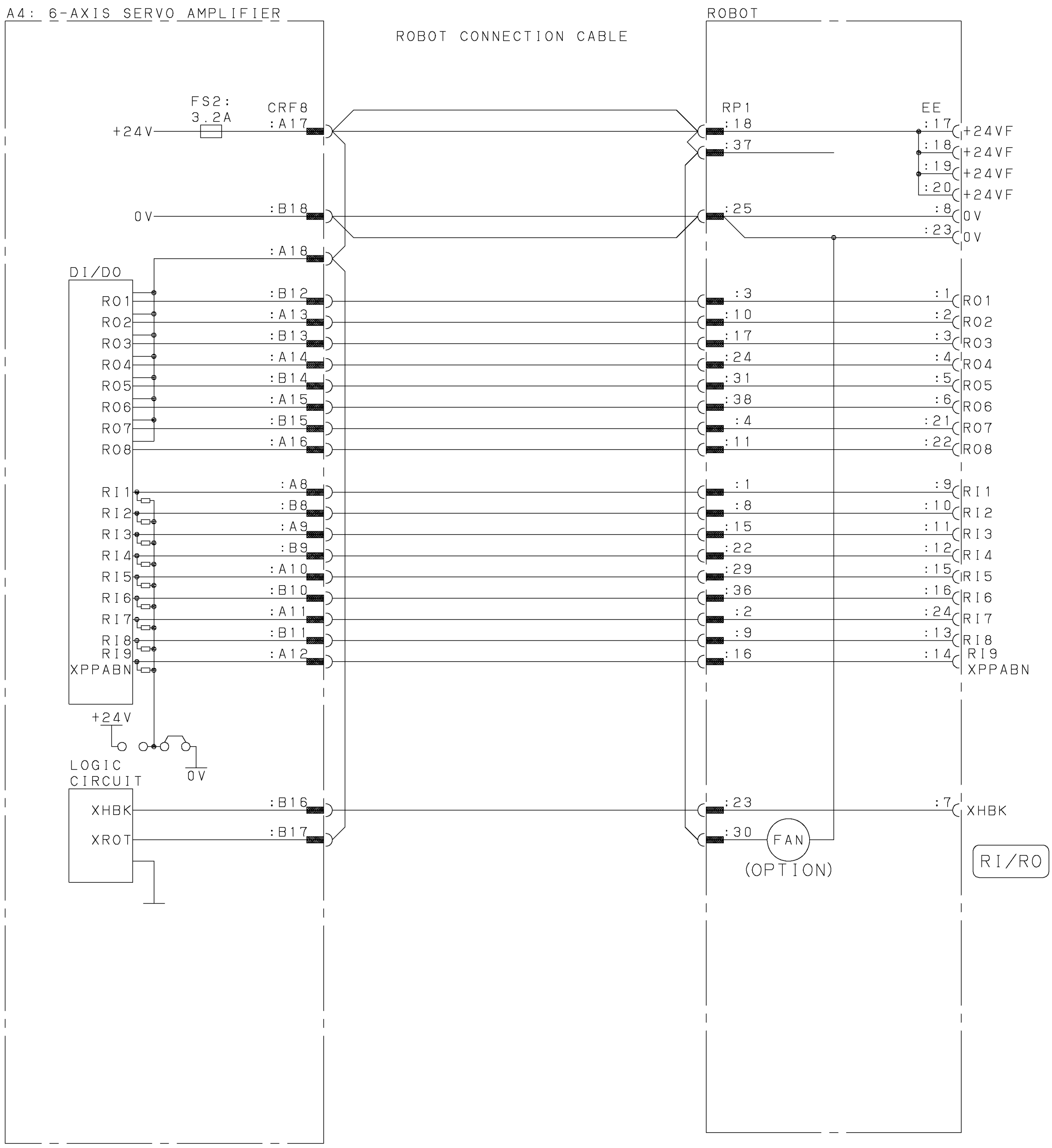


Fig.B (aj) RI/RO Connection Diagram (Group11; M-2*i*A,M-3*i*A)

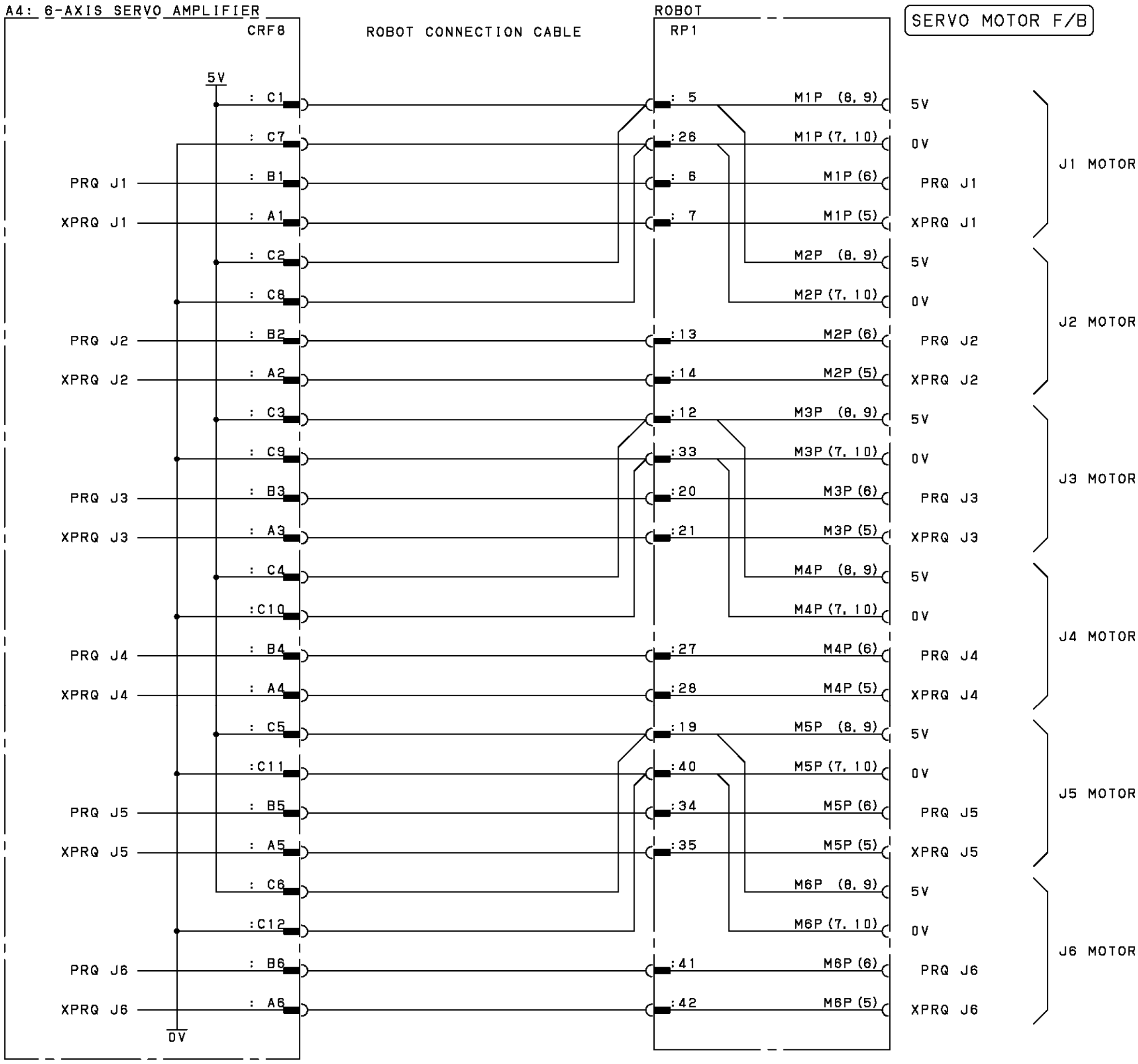


Fig.B (ak) Pulsecoder signal connection diagram (Group1 to 4, 11)

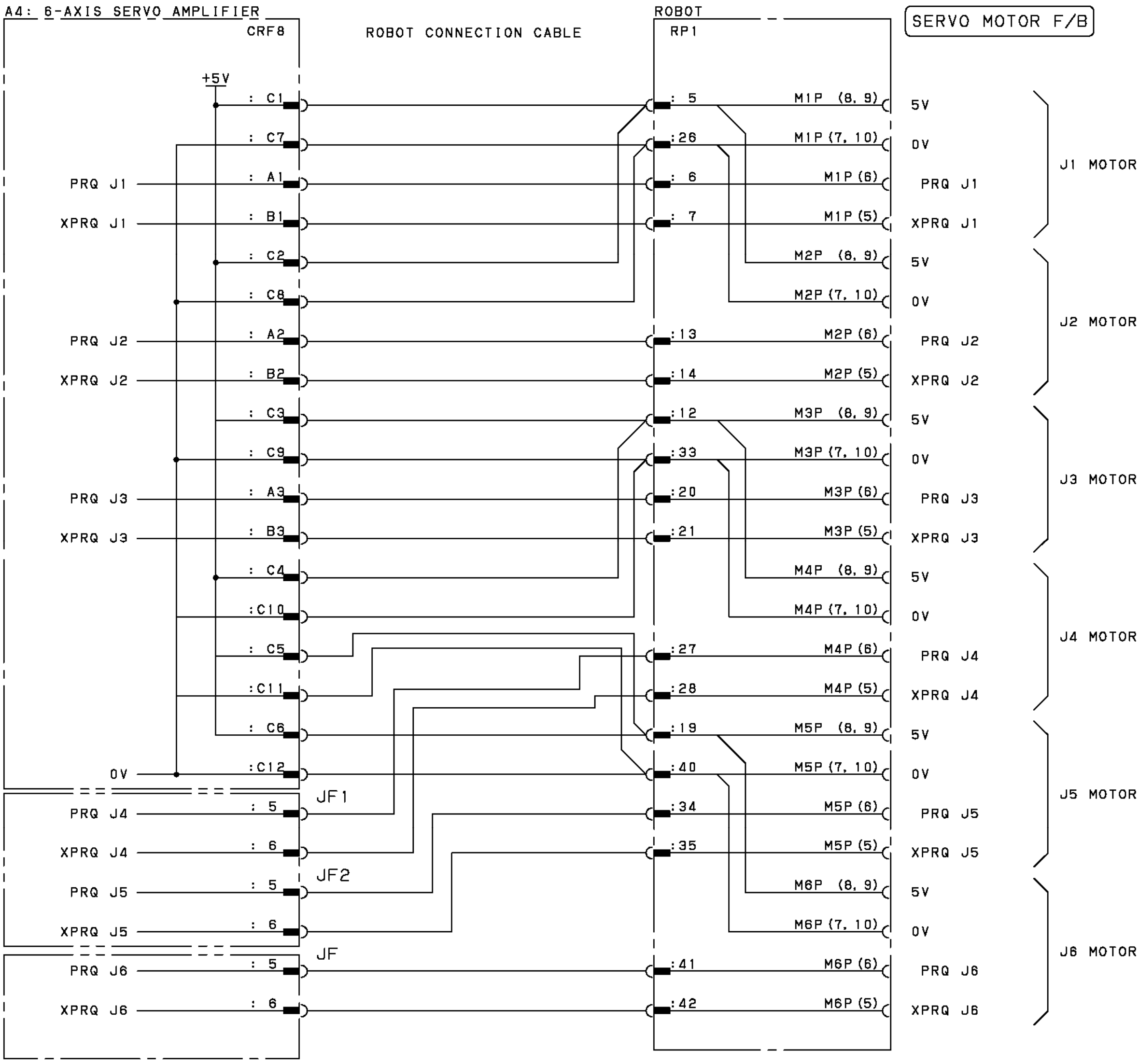


Fig.B (al) Pulsecoder Signal Connection Diagram (Group5; M-900*i*A/400L,600,M-900*i*B/400L,700)

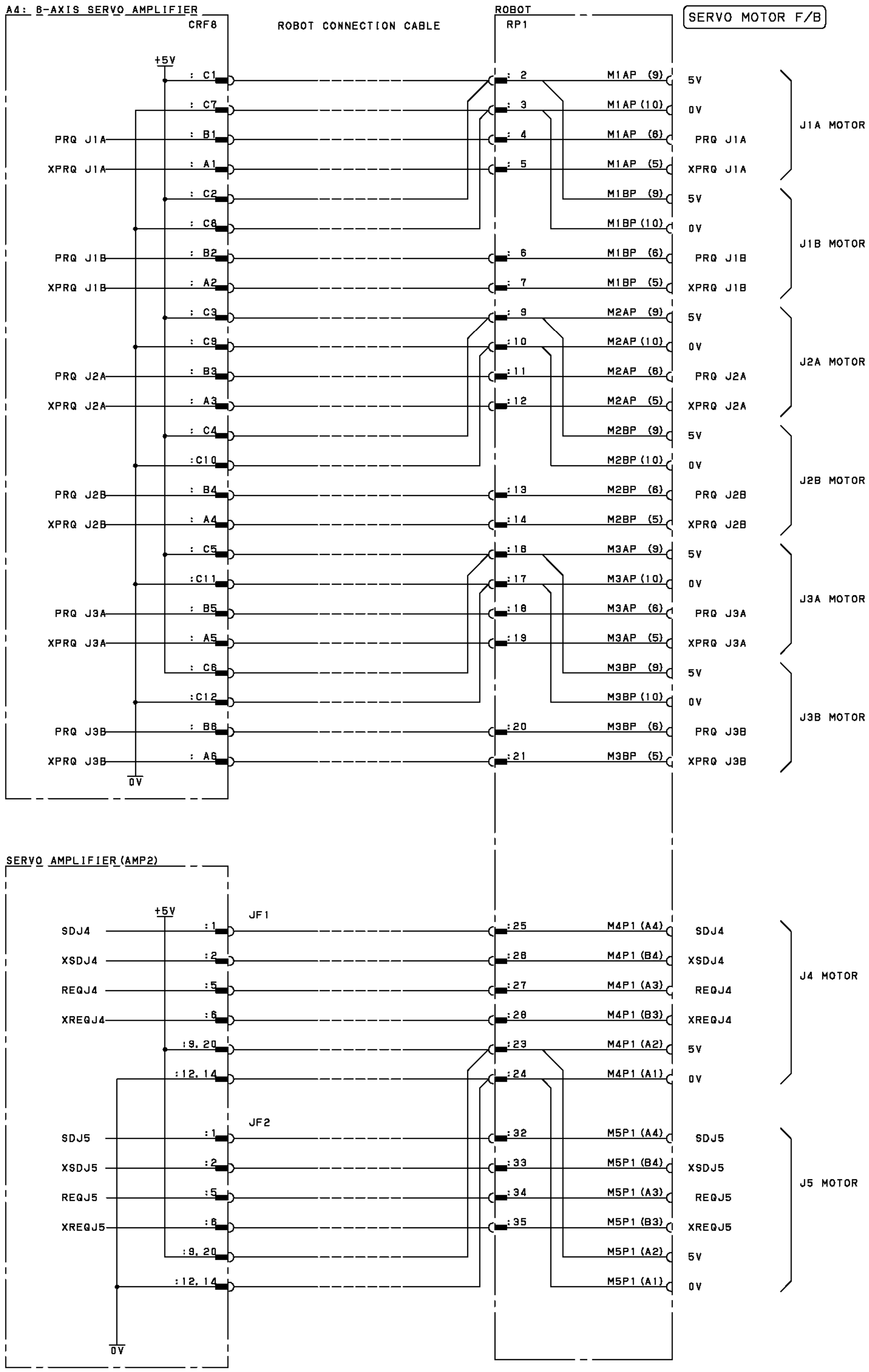


Fig.B (am) Pulsecoder Signal Connection Diagram (group6; excluding M-430*i*A/2PH)

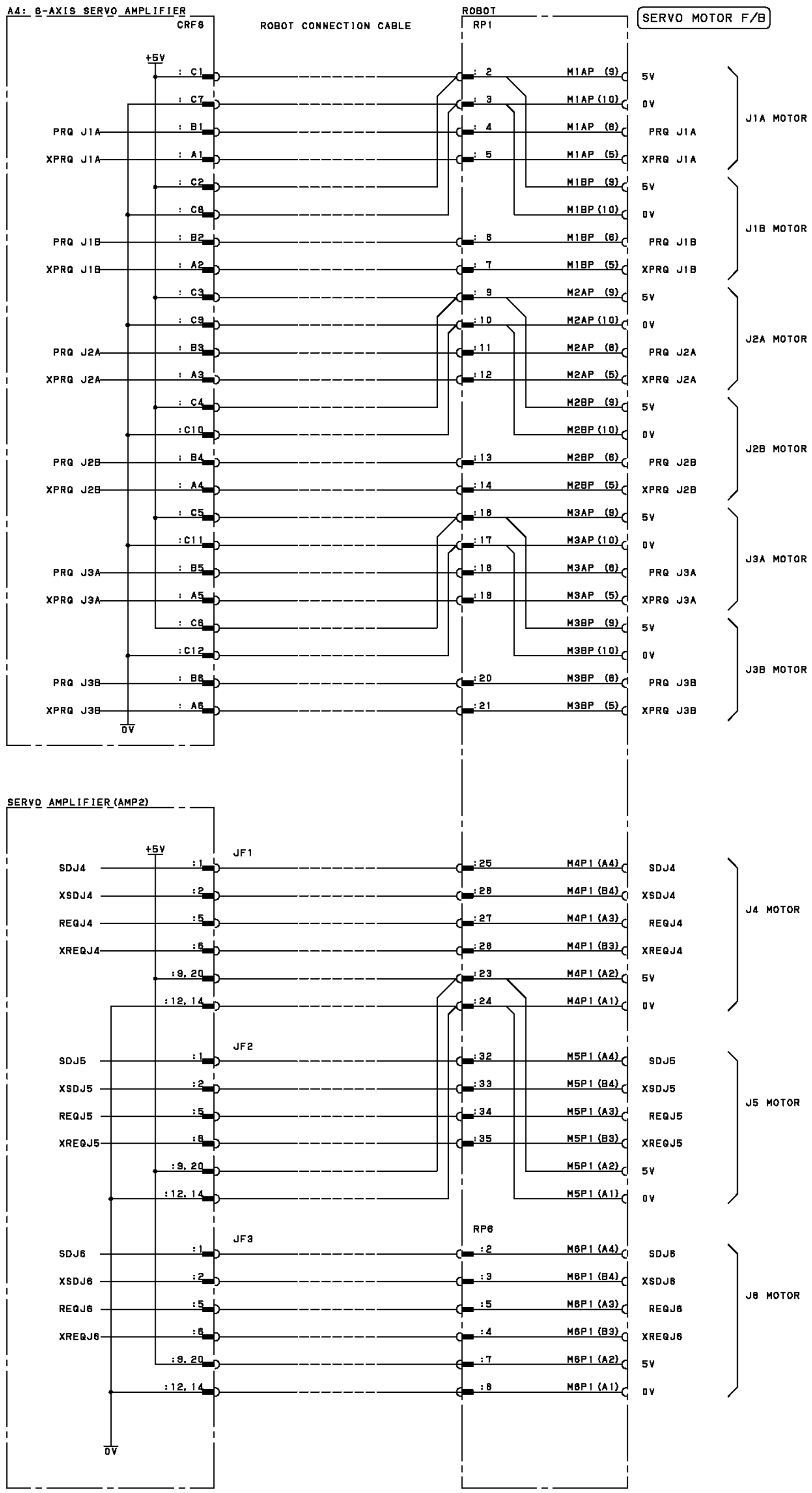


Fig.B (an) Pulsecoder Signal Connection Diagram (group6; M-430*i*A/2PH)

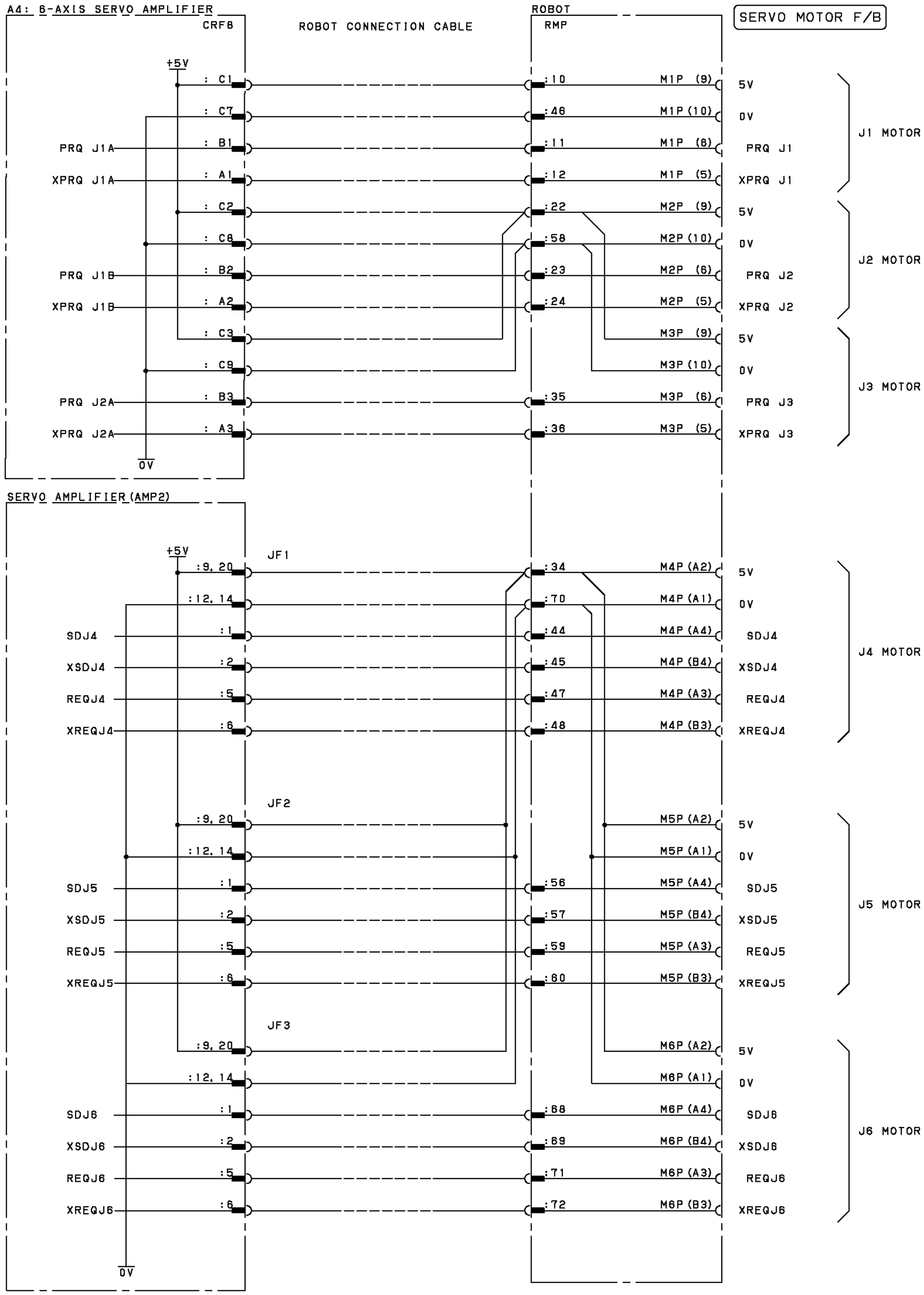


Fig.B (ao) Pulsecoder Signal Connection Diagram (Group7; M-430*i*A/2P)

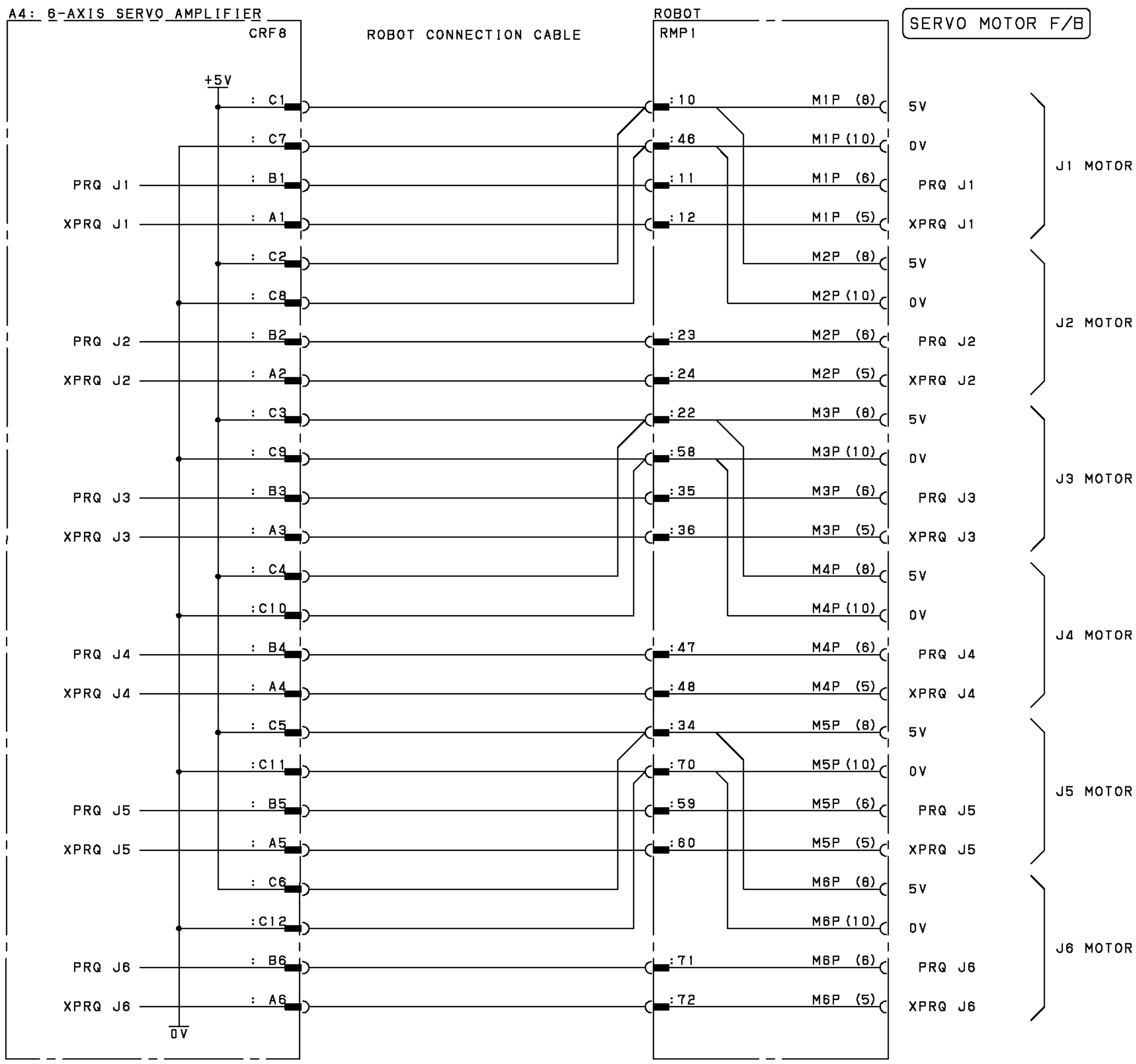


Fig.B (ap) Pulsecoder Signal Connection Diagram (Group8; ARC Mate 100*i*C, ARC Mate 120*i*C)

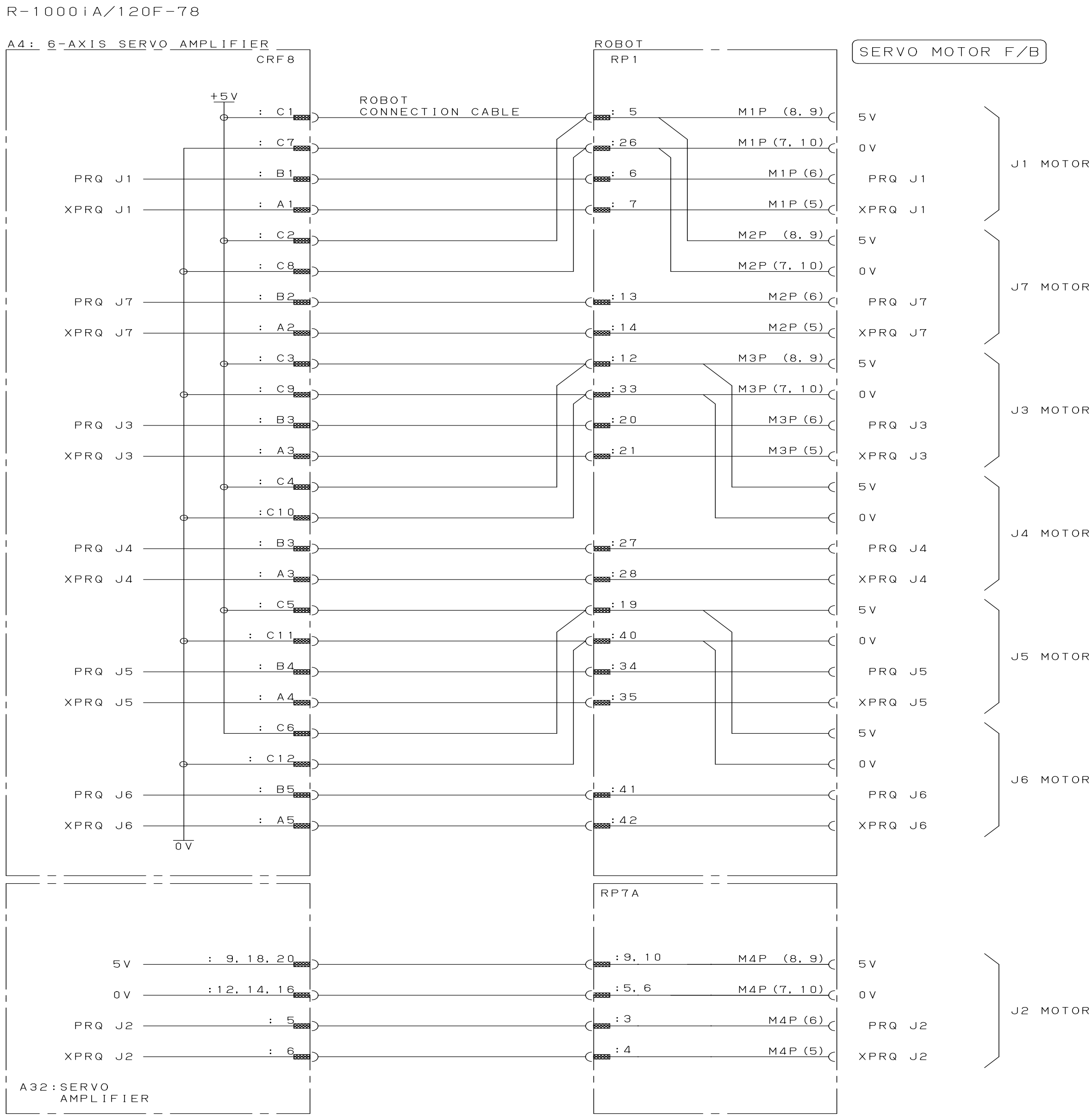


Fig.B (aq) Pulsecoder Signal Connection Diagram (Group12; R-1000iA/120F-7B)

Group1

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9	23	XHBK	30	XROT	37	24VF-3
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF-1 24VF-2	25	0V-1 0V-2	32	S2+	39	S2-
5	5V-1 5V-2	12	5V-3 5V-4	19	5V-5 5V-6	26	0V-3 0V-4	33	0V-5 0V-6	40	0V-7 0V-8
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2V1	26	J2W1	36	J1G1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18	J3V1	28	J3W1	38	J2G1
6	J3U1	19	J3V1	29	J3W1	39	J3G1
7	J3U1	20	J4V	30	J4W	40	J3G1
8	J4U	21	J5V	31	J5W	41	J4G
9	J5U	22	J6V	32	J6W	42	J5G
10	J6U	23	BK2	33	BK3	43	J6G
11	BK1					44	BK4
12	BKC					45	BK5
13	BKC					46	BK6

Mechanical Unit Interface Group1
R-2000*i*B (except/200T,220U,220US),R-2000*i*C,
R-1000*i*A(except /120F-7B),M-710*i*C,M-420*i*A,M421*i*A

Group2

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9	23	XHBK	30	XROT	37	24VF-3
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF-1 24VF-2	25	0V-1 0V-2	32	S2+	39	S2-
5	5V-1 5V-2	12	5V-3 5V-4	19	5V-5 5V-6	26	0V-3 0V-4	33	0V-5 0V-6	40	0V-7 0V-8
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1	BRK1P	8	BKC	15	J1U1	22	J1V1	29	J1W1	36	J1G1
2	BRK2P	9	BKC	16	J2U1	23	J2V1	30	J2W1	37	J2G1
3	BRK3P	10	BKC	17	J3U1	24	J3V1	31	J3W1	38	J3G1
4	BRK4P	11	BKC	18	J4U	25	J4V	32	J4W	39	J4G
5	BRK5P	12	BKC	19	J5U	26	J5V	33	J5W	40	J5G
6	BRK6P	13	BKC	20	J6U	27	J6V	34	J6W	41	J6G
7		14		21	J2U1	28	J2V1	35	J2W1	42	J2G1

Mechanical Unit Interface Group2
F-200*i*B

Fig.B (ar) Mechanical unit interface (Group1, Group2)

Group3

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9	23	XHBK	30	XROT	37	24VF-3
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF-1 24VF-2	25	0V-1 0V-2	32	S2+	39	S2-
5	5V-1 5V-2	12	5V-3 5V-4	19	5V-5 5V-6	26	0V-3 0V-4	33	0V-5 0V-6	40	0V-7 0V-8
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2V1	26	J2W1	36	J1G1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18	J3V1	28	J3W1	38	J2G1
6	J3U1	19	J3V1	29	J3W1	39	J3G1
7	J3U1	20	J4V	30	J4W	40	J3G1
8	J4U	21	J5V	31	J5W	41	J4G
9	J5U	22	J6V	32	J6W	42	J5G
10	J6U	23	BK2	33	BK3	43	J6G
11	BK1					44	BK4
12	BKC					45	BK5
13	BKC					46	BK6

RM2
(MOTOR Power)

1		14	J1V2	24	J1W2	34	
2	J1U2	15	J1V2	25	J1W2	35	J1G2
3	J1U2	16	J2V2	26	J2W2	36	J1G2
4	J2U2	17	J2V2	27	J2W2	37	J2G2
5	J2U2	18	J3V2	28	J3W2	38	J2G2
6	J3U2	19	J3V2	29	J3W2	39	J3G2
7	J3U2	20		30		40	J3G2
8		21		31		41	
9		22		32		42	
10		23		33		43	
11						44	
12						45	
13						46	

Mechanical Unit Interface
Group3
R-2000iB/200T, 220U, 220US, M-410iB

Group4

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9	23	XHBK	30	XROT	37	24VF-3
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF-1 24VF-2	25	0V-1 0V-2	32	S2+	39	S2-
5	5V-1 5V-2	12	5V-3 5V-4	19	5V-5 5V-6	26	0V-3 0V-4	33	0V-5 0V-6	40	0V-7 0V-8
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2V1	26	J2W1	36	J1G1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18	J3V1	28	J3W1	38	J2G1
6	J3U1	19	J3V1	29	J3W1	39	J3G1
7	J3U1	20	J4V1	30	J4W1	40	J3G1
8	J4U1	21	J5V1	31	J5W1	41	J4G1
9	J5U1	22	J6V1	32	J6W1	42	J5G1
10	J6U1	23	BK2	33	BK3	43	J6G1
11	BK1					44	BK4
12	BKC					45	BK5
13	BKC					46	BK6

RM2
(MOTOR Power)

1		14	J1V2	24	J1W2	34	
2	J1U2	15	J1V2	25	J1W2	35	J1G2
3	J1U2	16	J2V2	26	J2W2	36	J1G2
4	J2U2	17	J2V2	27	J2W2	37	J2G2
5	J2U2	18	J3V2	28	J3W2	38	J2G2
6	J3U2	19	J3V2	29	J3W2	39	J3G2
7	J3U2	20	J4V2	30	J4W2	40	J3G2
8	J4U2	21	J5V2	31	J5W2	41	J4G2
9	J5U2	22	J6V2	32	J6W2	42	J5G2
10	J6U2	23		33		43	J6G2
11						44	
12						45	
13						46	

Mechanical Unit Interface
Group4
M-900iA/260L, 350, 150P

Fig.B (as) Mechanical unit interface (Group3, Group4)

Group5

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9 (XPPABN)	23	XHBK	30	XROT	37	24VF (OT)
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF	25	0V	32		39	
5	5V (J1, J2)	12	5V (J3, J4)	19	5V (J5, J6)	26	0V (J1, J2)	33	0V (J3, J4)	40	0V (J5, J6)
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2V1	26	J2W1	36	J1G1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18	J3V1	28	J3W1	38	J2G1
6	J3U1	19	J3V1	29	J3W1	39	J3G1
7	J3U1	20	J4V1	30	J4W1	40	J3G1
8	J4U1	21	J5V1	31	J5W1	41	J4G1
9	J5U1	22	J6V1	32	J6W1	42	J5G1
10	J6U1	23	BK (J2)	33	BK (J3)	43	J6G1
11	BK (J1)					44	BK (J4)
12	BKC					45	BK (J5)
13	BKC					46	BK (J6)

RM2
(MOTOR Power)

1		14	J1V2	24	J1W2	34	
2	J1U2	15	J1V2	25	J1W2	35	J1G2
3	J1U2	16	J2V2	26	J2W2	36	J1G2
4	J2U2	17	J2V2	27	J2W4	37	J2G2
5	J2U2	18	J3V2	28	J3W3	38	J2G2
6	J3U2	19	J3V2	29	J3W4	39	J3G2
7	J3U2	20	J4V2	30	J4W2	40	J3G2
8	J4U2	21	J5V2	31	J5W2	41	J4G2
9	J5U2	22	J6V2	32	J6W2	42	J5G2
10	J6U2	23		33		43	J6G2
11						44	
12						45	
13						46	

Mechanical Unit Interface
Group5
M-900iA/400L, 600, M-900iB/700

Group6

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	24E (BLOWER)	8	0V (BLOWER)	15		22		29	24VF	36	0V
2	5V (J1A, J1B)	9	5V (J2A, J2B)	16	5V (J3A, J3B)	23	5V (J4, J5)	30	RI1	37	RI3
3	0V (J1A, J1B)	10	0V (J2A, J2B)	17	0V (J3A, J3B)	24	0V (J4, J5)	31	RI2	38	RI4
4	PRQJ1A	11	PRQJ2A	18	PRQJ3A	25	SDJ4	32	SDJ5	39	RO1
5	XPRQJ1A	12	XPRQJ2A	19	XPRQJ3A	26	XSDJ4	33	XSDJ5	40	RO2
6	PRQJ1B	13	PRQJ2B	20	PRQJ3B	27	REQJ4	34	REQJ5	41	RO3
7	XPRQJ1B	14	XPRQJ2B	21	XPRQJ3B	28	XREQJ4	35	XREQJ5	42	RO4

RM1
(MOTOR Power & Brake)

1	BK (J1A)	8	J1AU1	15	J1AV1	22	J1AW1	29	J1AG1	36	J5U1
2	BK (J2A)	9	J1BU1	16	J1BV1	23	J1BW1	30	J1BG1	37	J5V1
3	BK (J3A)	10	J2AU1	17	J2AV1	24	J2AW1	31	J2AG1	38	J5W1
4	BK (J4)	11	J2BU1	18	J2BV1	25	J2BW1	32	J2BG1	39	J5G1
5	BK (J5)	12	J3AU1	19	J3AV1	26	J3AW1	33	J3AG1	40	
6	BKC	13	J3BU1	20	J3BV1	27	J3BW1	34	J3BG1	41	AC200A
7	BKC	14	J4U1	21	J4V1	28	J4W1	35	J4G1	42	AC200B

In case of M-430iA/2PH, this connectors are added.

RP6
(Pulsecoder Feedback Signal)

3	XSDJ6	2	SDJ6	8	
		1		7	5V (J6)
4	XREQJ6	5	REQJ6	6	0V (J6)

RM6
(MOTOR Power & Brake)

C1		C2		C3		C4		C5	
B1	BK (J6)	B2	BKC	B3		B4		B5	
A1	J6U1	A2	J6V1	A3	J6W1	A4	J6G1	A5	

Mechanical Unit Interface
Group6
M-430iA/2PH, 4FH

Fig.B (at) Mechanical Unit Interface (Group5, Group6)

Group7

RMP
(Pulsecoder Feedback Signal & RI/RO)
(MOTOR Power & Brake)

1	BK (J1)	13	BK (J2)	25	BK (J3)	37	BK (J4)	49	BK (J5)	61	BK (J6)
2	BKC	14	BKC	26	AC200A	38	AC200B	50		62	
3	J1U1	15	J2U1	27	J3U1	39	J4U1	51	J5U1	63	J6U1
4	J1V1	16	J2V1	28	J3V1	40	J4V1	52	J5V1	64	J6V1
5	J1W1	17	J2W1	29	J3W1	41	J4W1	53	J5W1	65	J6W1
6	J1G1	18	J2G1	30	J3G1	42	J4G1	54	J5G1	66	J6G1
7	RI4	19	RO4	31	0V (BLOWER)	43	24E (BLOWER)	55	24VF	67	0V
8	RI1	20	RI2	32	RI3	44	SDJ4	56	SDJ5	68	SDJ6
9	RO1	21	RO2	33	RO3	45	XSDJ4	57	XSDJ5	69	XSDJ6
10	5V (J1)	22	5V (J23)	34	5V (J456)	46	0V (J1)	58	0V (J23)	70	0V (J456)
11	PRQJ1	23	PRQJ2	35	PRQJ3	47	REQJ4	59	REQJ5	71	REQJ6
12	XPRQJ1	24	XPRQJ2	36	XPRQJ3	48	XREQJ4	60	XREQJ5	72	XREQJ6

Mechanical Unit Interface
Group7
M-430iA/2P

Group8

RMP
(Pulsecoder Feedback Signal & RI/RO)
(MOTOR Power & Brake)

1	BK (J1)	13	BK (J2)	25	BK (J3)	37	BK (J4)	49	BK (J5)	61	BK (J6)
2	J1U1	14	J2U1	26	J3U1	38		50		62	BKC
3	J1V1	15	J2V1	27	J3V1	39	J4U1	51	J5U1	63	J6U1
4	J1W1	16	J2W1	28	J3W1	40	J4V1	52	J5V1	64	J6V1
5	J1G1	17	J2G1	29	J3G1	41	J4W1	53	J5W1	65	J6W1
6	XROT	18	24VF	30	XHBK	42	J4G1	54	J5G1	66	J6G1
7	RI1	19	RI2	31	RI3	43	RI4	55	RI5	67	0V
8	RO1	20	RO2	32	RO3	44	RO4	56	RO5	68	RI6
9	RI7	21	RI8	33	RO7	45	RO8	57	RI9 (XPPABN)	69	RO6
10	5V (J1, J2)	22	5V (J3, J4)	34	5V (J5, J6)	46	0V (J1, J2)	58	0V (J3, J4)	70	0V (J5, J6)
11	PRQJ1	23	PRQJ2	35	PRQJ3	47	PRQJ4	59	PRQJ5	71	PRQJ6
12	XPRQJ1	24	XPRQJ2	36	XPRQJ3	48	XPRQJ4	60	XPRQJ5	72	XPRQJ6

Mechanical Unit Interface
Group8
ARC Mate 100iC, M-10iA
ARC Mate 120iC, M-20iA

Fig.B (au) Mechanical Unit Interface (Group7, Group8)

Group 11

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9	23	XHBK	30	24VF (FAN)	37	24VF-3
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF-1 24VF-2	25	0V-1 0V-2	32	S2+	39	S2-
5	5V-1 5V-2	12	5V-3 5V-4	19	5V-5 5V-6	26	0V-3 0V-4	33	0V-5 0V-6	40	0V-7 0V-8
6	PRQJ1	13	PRQJ2	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ2	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RM1
(MOTOR Power & Brake)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2V1	26	J2W1	36	J1G1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18	J3V1	28	J3W1	38	J2G1
6	J3U1	19	J3V1	29	J3W1	39	J3G1
7	J3U1	20	J4V1	30	J4W1	40	J3G1
8	J4U1	21	J5V1	31	J5W1	41	J4G1
9	J5U1	22	J6V1	32	J6W1	42	J5G1
10	J6U1	23	BK1_2 (J2)	33	BK3	43	J6G1
11	BK1_2 (J1)					44	BK4_5_6 (J4)
12	BKC (J1, J2, J3)					45	BK4_5_6 (J5)
13	BKC (J4, J5, J6)					46	BK4_5_6 (J6)

Mechanical Unit Interface
M-2iA, M-3iA

Fig.B (av) Mechanical Unit Interface (Group11)

Group12

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9 (XPPABN)	23	XHBK	30	XROT	37	24VF (OT)
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF	25	0V	32		39	
5	5V (J1, J7)	12	5V (J3, J4)	19	5V (J5, J6)	26	0V (J1, J7)	33	0V (J3, J4)	40	0V (J5, J6)
6	PRQJ1	13	PRQJ7	20	PRQJ3	27	PRQJ4	34	PRQJ5	41	PRQJ6
7	XPRQJ1	14	XPRQJ7	21	XPRQJ3	28	XPRQJ4	35	XPRQJ5	42	XPRQJ6

RP7A
(Pulsecoder Feedback Signal)

1		5	0V (J2)	9	5V (J2)	13		17		21	
2		6	0V (J2)	10	5V (J2)	14		18		22	
3	PRQJ2	7		11		15		19		23	
4	XPRQJ2	8		12		16		20		24	

RM1
(MOTOR Power & Brake power)

1	
2	J1U1
3	J1U1
4	J7U1
5	J7U1
6	J3U1
7	J3U1
8	J4U1
9	J5U1
10	J6U1
11	BK (J1)
12	BKC
13	BKC

14	J1V1	24	J1W1
15	J1V1	25	J1W1
16	J7V1	26	J7W1
17	J7V1	27	J7W1
18	J3V1	28	J3W1
19	J3V1	29	J3W1
20	J4V1	30	J4W1
21	J5V1	31	J5W1
22	J6V1	32	J6W1
23	BK (J7)	33	BK (J3)

34	
35	J1G1
36	J1G1
37	J7G1
38	J7G1
39	J3G1
40	J3G1
41	J4G1
42	J5G1
43	J6G1
44	BK (J4)
45	BK (J5)
46	BK (J6)

RM7A
(MOTOR Power & Brake power)

A1	J2U1	A2	J2V1	A3	J2W1
B1	J2G1	B2	BK (J2)	B3	BKC

Mechanical Interface
Group12
R-1000iA/120F-7B

Fig.B (aw) Mechanical Unit Interface (Group12)

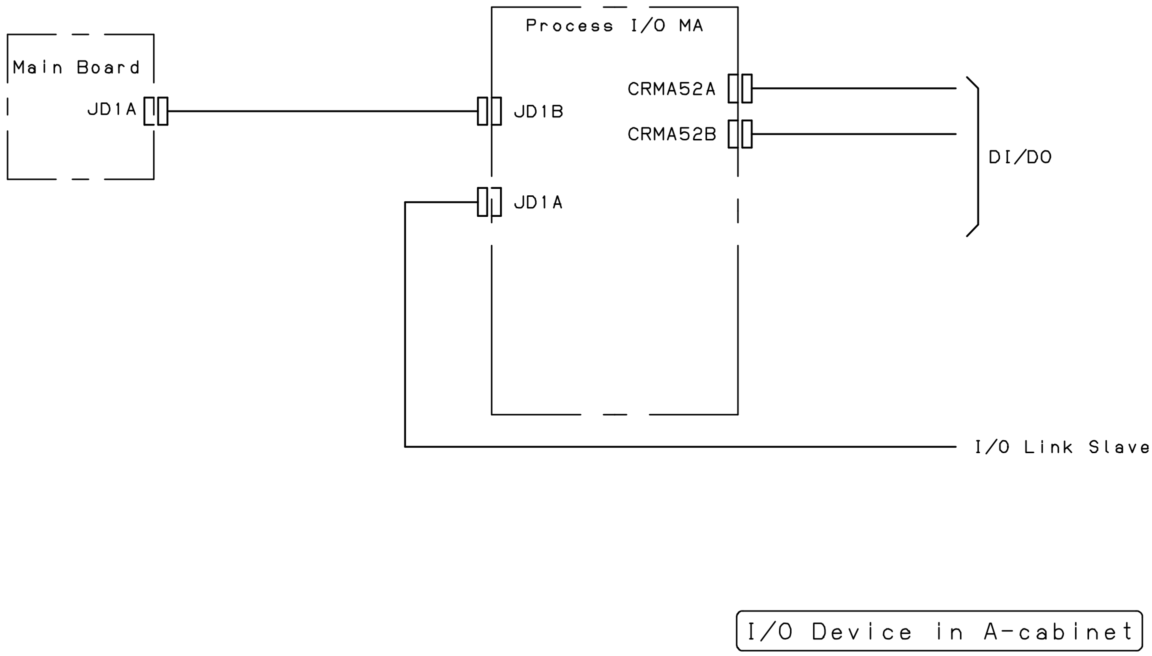


Fig.B (ax) I/O device connection diagram (A-cabinet)

JD1A, B
(RS-422/SLC)

1	RX	11	0V
2	XRX	12	0V
3	TX	13	0V
4	XTX	14	0V
5		15	0V
6		16	0V
7		17	
8		18	
9		19	
10		20	

CRMA5A
(DI/DO)

01	XIMSTP			33	CMDENBL
02	XHOLD	19	ACK3/SNO3	34	SYSRDY
03	XSFSPD	20	ACK4/SNO4	35	PROGRUN
04	CSTOP1	21	ACK5/SNO5	36	PAUSED
05	FAULT RESET	22	ACK6/SNO6	37	DOSRC1
06	START	23	DOSRC1	38	HELD
07	HOME	24	ACK7/SNO7	39	FAULT
08	ENBL	25	ACK8/SNO8	40	ATPERCH
09	RSR1/PNS1	26	SNACK	41	TPENBL
10	RSR2/PNS2	27	RESERVED	42	DOSRC1
11	RSR3/PNS3	28	DOSRC1	43	BATALM
12	RSR4/PNS4	29	PNSTROBE	44	BUSY
13	RSR5/PNS5	30	PROD START	45	ACK1/SNO1
14	RSR6/PNS6	31	DI01	46	ACK2/SNO2
15	RSR7/PNS7	32	DI02	47	DOSRC1
16	RSR8/PNS8			48	
17	0V			49	24V
18	0V			50	24V

CRMA5B
(DI/DO)

01	DI03			33	DO01
02	DI04	19	DO13	34	DO02
03	DI05	20	DO14	35	DO03
04	DI06	21	DO15	36	DO04
05	DI07	22	DO16	37	DOSRC1
06	DI08	23	DOSRC1	38	DO05
07	DI09	24	DO17	39	DO06
08	DI10	25	DO18	40	DO07
09	DI11	26	DO19	41	DO08
10	DI12	27	DO20	42	DOSRC1
11	DI13	28	DOSRC1	43	DO09
12	DI14	29	DI19	44	DO10
13	DI15	30	DI20	45	DO11
14	DI16	31	DI21	46	DO12
15	DI17	32	DI22	47	DOSRC1
16	DI18			48	
17	0V			49	24V
18	0V			50	24V

CRMA6A
(DI/DO)

01	DI63			14	DO61
02	DI64	08	DO65	15	DO62
03	DI65	09	DO66	16	DO63
04	DI66	10	DO67	17	DO64
05	DI67	11	DO68	18	DOSRC3
06	DI68	12	DOSRC3	19	24V
07	DI69	13	DI70	20	0V

CRMA6B
(DI/DO)

01	DI71			14	DO69
02	DI72	08	DO73	15	DO70
03	DI73	09	DO74	16	DO71
04	DI74	10	DO75	17	DO72
05	DI75	11	DO76	18	DOSRC3
06	DI76	12	DOSRC3	19	24V
07	DI77	13	DI78	20	0V

CRMA5C
(DI/DO)

01	DI23			33	DO21
02	DI24	19	DO33	34	DO22
03	DI25	20	DO34	35	DO23
04	DI26	21	DO35	36	DO24
05	DI27	22	DO36	37	DOSRC2
06	DI28	23	DOSRC2	38	DO25
07	DI29	24	DO37	39	DI26
08	DI30	25	DO38	40	DO27
09	DI31	26	DO39	41	DO28
10	DI32	27	DO40	42	DOSRC2
11	DI33	28	DOSRC2	43	DO29
12	DI34	29	DI39	44	DO30
13	DI35	30	DI40	45	DO31
14	DI36	31	DI41	46	DO32
15	DI37	32	DI42	47	DOSRC2
16	DI38			48	
17	0V			49	24V
18	0V			50	24V

CRMA5D
(DI/DO)

01	DI43			33	DO41
02	DI44	19	DO53	34	DO42
03	DI45	20	DO54	35	DO43
04	DI46	21	DO55	36	DO44
05	DI47	22	DO56	37	DOSRC2
06	DI48	23	DOSRC2	38	DO45
07	DI49	24	DO57	39	DO46
08	DI50	25	DO58	40	DO07
09	DI51	26	DO59	41	DO48
10	DI52	27	DO60	42	DOSRC2
11	DI53	28	DOSRC2	43	DO49
12	DI54	29	DI59	44	DO50
13	DI55	30	DI60	45	DO51
14	DI56	31	DI61	46	DO52
15	DI57	32	DI62	47	DOSRC2
16	DI58			48	
17	0V			49	24V
18	0V			50	24V

I/O Device

Fig.B (ay) Process I/O board connector table (JA, JB)

C SPECIFICATIONS OF PERIPHERAL DEVICE INTERFACE

C.1 SIGNAL

The following table lists the I/O signals used for the peripheral device interface in the R-30*i*B/R-30*i*B Plus controller.

Input signals (Refer to C.3.1)

Signal	Description
*IMSTP	Instantaneous stop signal
*HOLD	Hold signal
*SFSPD	Safety speed signal
CSTOPI	Cycle stop signal
FAULT_RESET	Alarm release signal
START	Cycle start signal
HOME	Robot service request/program number select signal (*1)
ENBL	Enabling signal
RSR1/PNS1	Robot service request/program number select signal (*1)
RSR2/PNS2	Robot service request/program number select signal (*1)
RSR3/PNS3	Robot service request/program number select signal (*1)
RSR4/PNS4	Robot service request/program number select signal (*1)
RSR5/PNS5	Robot service request/program number select signal (*1)
RSR6/PNS6	Robot service request/program number select signal (*1)
RSR7/PNS7	Robot service request/program number select signal (*1)
RSR8/PNS8	Robot service request/program number select signal (*1)
PNSTROBE	PNS strobe signal
PROD_START	Automatic operation start signal
DI01	General-purpose input signal
DI02	General-purpose input signal
DI03	General-purpose input signal
DI04	General-purpose input signal
DI05	General-purpose input signal
DI06	General-purpose input signal
DI07	General-purpose input signal
DI08	General-purpose input signal
DI09	General-purpose input signal
DI10	General-purpose input signal
DI11	General-purpose input signal
DI12	General-purpose input signal
DI13	General-purpose input signal
DI14	General-purpose input signal
DI15	General-purpose input signal
DI16	General-purpose input signal
DI17	General-purpose input signal
DI18	General-purpose input signal
DI19	General-purpose input signal
DI20	General-purpose input signal
DI21	General-purpose input signal
DI22	General-purpose input signal

NOTE

*1: RSR: Robot Service Request (RSR5 to RSR8 are optional)
PNS: Program Number Select Input (optional)
Whether RSR is used or PNS is used can be preset.

Output signals (Refer to C.3.2)

Signal	Description
CMDENBL	Command acceptance enabled signal
SYSRDY	System ready signal
PROGRUN	Program run signal
PAUSED	Program paused signal
HELD	Held signal
FAULT	Alarm signal
ATPERCH	Reference point signal
TPENBL	Teach pendant enabled signal
BATALM	Battery alarm signal
BUSY	Operating signal
ACK1/SNO1	RSR acknowledge/Selected program number signal
ACK2/SNO2	RSR acknowledge/Selected program number signal
ACK3/SNO3	RSR acknowledge/Selected program number signal
ACK4/SNO4	RSR acknowledge/Selected program number signal
ACK5/SNO5	RSR acknowledge/Selected program number signal
ACK6/SNO6	RSR acknowledge/Selected program number signal
ACK7/SNO7	RSR acknowledge/Selected program number signal
ACK8/SNO8	RSR acknowledge/Selected program number signal
SNACK	PNS acknowledge signal
______	Not used (for future expansion)
DO01	General-purpose output signal
DO02	General-purpose output signal
DO03	General-purpose output signal
DO04	General-purpose output signal
DO05	General-purpose output signal
DO06	General-purpose output signal
DO07	General-purpose output signal
DO08	General-purpose output signal
DO09	General-purpose output signal
DO10	General-purpose output signal
DO11	General-purpose output signal
DO12	General-purpose output signal
DO13	General-purpose output signal
DO14	General-purpose output signal
DO15	General-purpose output signal
DO16	General-purpose output signal
DO17	General-purpose output signal
DO18	General-purpose output signal
DO19	General-purpose output signal
DO20	General-purpose output signal

C.2 SETTING COMMON VOLTAGE

All process I/O boards have a jumper to set the common voltage of input signals to 0 V or 24 V. The system automatically adjusts the polarity by software according to the status of this pin. Therefore, you can operate the system without being concerned about the setting of the common voltage.

To ensure safety, the common reference voltage of the following four signals, is remains at +24V.

*IMSTP
*HOLD
*SFSPD
CSTOPI

C.3 I/O SIGNALS

C.3.1 Input Signals

This section describes the specifications of each input signal.

(1) Instantaneous stop signal (input) *IMSTP
Effective: At any time
Function: Use the normally closed switch because it is a reverse signal. The system turns off power to the servo unit when the *IMSTP is open (turned off). Do not use *IMSTP as safety relevant signal. For safety purpose, use the external emergency stop signal.

(2) Alarm release signal (input) FAULT RESET
Effective: In the alarm status
Function: The FAULT RESET signal releases the alarm status. If the servo unit has been turned off, it also turns on the unit. At the same time, the alarm display on the teach pendant (the top line) is cleared.
Description: This signal releases only the alarm status. It does not re-start execution of the program. The robot will keep running if the signal is triggered "ON" during operation.

(3) Hold signal (input) *HOLD
Effective: At any time
Function: Use the normally-closed switch because it is a reverse signal. The *HOLD signal has the same function as the hold button on the teach pendant. It halts the current program and stops the operation of the robot. While this signal is being input, the held signal (output) HELD is turned on and the robot cannot be operated.

(4) Start signal (input) START
Effective: When the command acceptance enabled signal (output) CMDENBL is turned on. See the description of CMDENBL in Section C.3.2 (1) for details.
Function: This input signal starts the selected program at the falling edge when the signal is turned off after being turned on. Its function differs according to the setting of parameter $SHELL_CFG. $CONT_ONLY.
- If parameter $SHELL_CFG.$CONT_ONLY is set to DISABLED, the START signal starts the program which has been selected from the teach pendant. By default, the program starts from the current cursor position.
- If parameter $SHELL_CFG.$CONT_ONLY is set to ENABLED, the START signal only resumes the execution of the temporarily held program. To execute an inactivated program from the start, input the PROD_START signal.

(5) Cycle stop signal (input) CSTOPI
Effective: At any time
Function:
- If parameter $SHELL_CFG.$USE_ABORT is set to DISABLED, the CSTOPI signal releases the program from the wait status caused by an RSR. It does not stop the execution of the current program and allows it to continue processing (by default).
- If parameter $SHELL_CFG.$USE_ABORT is set to ENABLED, the CSTOPI signal immediately cancels the execution of the current program. The program returns to the status in which it was before execution, and the information for the subprogram to return to the main program is lost. At the same time, this signal also releases the program from the wait status caused by RSR.

(6) Enabling signal (input) ENBL
Effective: At any time
Function: If the ENBL signal is turned off, the operation of the robot or the activation of a program is inhibited, and the execution of the current program is suspended.

(7) Safety speed signal (input) *SFSPD
Effective: At any time
Function:
- Use the normally-closed switch because it is a reverse signal. Usually this switch should be connected to safety fence. It must be set normally on.
- Since the *SFSPD signal is counted as a remote condition, such input signals as RSR and START to the peripheral device interface cannot take effect unless this signal is turned on.
- If this signal is turned from on to off during robot operation, the execution of the current program is suspended. At the same time, the overriding value is switched to a preset value (parameter $SCR. $FENCEOVER.)
- As long as this signal is off, the overriding value cannot be increased beyond the preset value ($SCR.$SFJOGOVLIM: For jog, $SCR. $SFRUNOVLIM : For test execution.)

(8) Robot service request signal (input) RSR1/RSR2/RSR3/RSR4
Effective: When the command acceptance enabled signal (output) CMDENBL is turned on. See the description of CMDENBL in Section C.3.2 (1) for details.
Function:
- The user can choose between RSR and PNS (optional), although they cannot be used simultaneously.
- Four input signals, RSR1 to RSR4, are used.
- If a signal is input to an RSR input, a specified program is started. The program number can be set by a menu.
- If another program has already started processing, the newly activated program enters the wait status. As soon as the current program terminates, the waiting program starts processing.
- By using an RSR instruction, each RSR in a program can be enabled or disabled.
- A menu is provided to register the program number of a specified program when each RSR is input. (Refer to the application manual for details of the menu).

```
+---------------------------------------+
|                                       |
|///////////////////////////////////////|
|                              1/8      |
|  1 Job selection:             RSR     | RSR or PNS
|  2 RSR1 program number:          12   | 0..9999
|  3 RSR2 program number:          23   | 0..9999
|  4 RSR3 program number:           5   | 0..9999
|  5 RSR4 program number:          64   | 0..9999
|  6 Base number:                 100   | 0..9999
|  7 Acknowledge:             Enabled   | Enabled or disabled
|  8 Acknowledge pulse width: 250 msec  | 0..9999msec
=                                       =
|                                       |
|[ TYPE ]                               |
+---------------------------------------+
```

- When an RSR is input, the program whose program name consists of the specified program number plus a base value is started. For example, if a signal is input to RSR2 when program number 23 is registered in RSR2, the program to be started is the one with the program name calculated from the expression RSR + (RSR2 program number + base number), i.e., RSR0123.
  The base number is stored in parameter $SHELL_CFG.$JOB_BASE, and can be changed in a program with a parameter instruction. (For example, $SHELL_ CFG. $JOB_BASE =100). In this way, the combination of programs which can be started by RSRs can be changed.
- Whether the system should output an acknowledge signal to an RSR can be selected from the menu. If so specified, a pulse is output from the signal corresponding to the RSR, one of signals ACK1 to ACK4, when the input of the RSR is accepted. From the same menu, the width of the pulse can also be specified.
  It is possible to accept other RSRs while outputting an acknowledge signal.
- Input of a CSTOPIT signal can clear the program queue waiting for execution after acceptance of RSRs.

(9) PNS/PNSTROBE (input)

Signal name: PNS: Program number select

PNSTROBE: Strobe input for PNS

Effective: When the command acceptance enabled signal (output) CMDENBL is turned on. See the description of CMDENBL in Section C.3.2 (1) for details.

Function:

- The PNS/PNSTROBE signal selects whether the RSR function is used or the PNS function (optional) is used. If the PNS function is enabled, the RSR function cannot be used.
- The eight signals PNS1 to PNS8 are used to specify a program at the instant the strobe signal PNSTROBE rises.
- A menu is provided to specify the information about PNS.

```
+-----------------------------------------+
|                                         |
|/////////////////////////////////////////|
|                                  1/3    |
|  1 Job selection:                 PNS   | RSR or PNS
|  2 Base number:                   100   | 0..9999
|  3 Acknowledge pulse width:   250 msec  | 0..9999msec
|                                         |
|                                         |
|                                         |
|                                         |
=                                         =
|                                         |
|[ TYPE ]                                 |
+-----------------------------------------+
```

If a number other than zero is entered to PNS input, a program is selected whose program number is the entered value plus the base number. For example, if the PNS value is 23, the program to be started has the program name calculated from the expression
PNS + (entered PNS value + base number), i.e., PNS0123.
If zero is entered to PNS input, it is cleared as if no selection has been made.

- A PNS signal, which can only select a program, cannot execute the selected program. The execution of the selected program can only be started after input of automatic operation start signal PROD_START.
- For safety, the selected program cannot be changed from the teach pendant unless PNSTROBE is turned off.
- If a program is selected by PNS, the program number is output to selected program number signal (output) SNO, and a pulse is output to program selection acknowledge signal SNACK. Using these signals, peripheral devices can confirm the correct program has been selected. For the timing of these signals, see the sections describing SNO and SNACK.
- The following operations are effective for the program selected by PNS. You can:
- Start up a program by input of automatic operation start signal PROD_START
- Restart the program that has been suspended.
  Inputting the START signal restarts the program selected by PNS when $SHELL_CFG.$CONT_ ONLY is set to ENABLED.
- Input of CSTOPI cancels execution of the pro-grams selected by PNS when $SHELL_CFG.$USE_ ABORT is set to ENABLED.

(10) Automatic operation start signal (input) PROD_START
Effective: When the command acceptance enabled signal (output) CMDENBL is turned on. See the description of CMDENBL in Section C.3.2 (1) for details.
Function: This input signal executes the selected program at the falling edge when the signal is turned off after being turned on.

C.3.2 Output Signals

This section describes the specifications of output signals for the peripheral device interface.

(1) Command acceptance enabled signal (output) CMDENBL
Turned on: When the remote conditions are satisfied and the system is not in the alarm status.
Turned off: When the remote conditions are not satisfied or the system is in the alarm status. The remote conditions are satisfied when all of the following are satisfied.

- The teach pendant is in the DISABLED status.
- The remote/local setting is set to REMOTE.
- Parameter $RMT_MASTER is set to 0 (external interface).

- Signal *SFSPD is set to on, or in the normal status.

(2) System ready signal (output) SYSRDY
Turned on: When power is applied to the motor of the robot.
Turned off: When power is not applied to the motor of the robot.

(3) Program run signal (output) PROGRUN
Turned on: When the program is being executed.
Turned off: When the program is not being executed.

(4) Held signal (output) HELD
This signal is used to check the status of the hold input.
Turned on: When the hold button on the teach pendant (or input) is being pressed down (or turned on).
Turned off: When the hold button on the teach pendant (or input) is not being pressed down (or is turned off).

(5) Program paused signal (output) PAUSED
This signal is used together with output signal PROGRUN to determine whether a program can be restarted while it is being held.
Turned on: When a program is held and has not been restarted yet. While this signal is on, the program can be restarted and retains information such as that to return from a subprogram to the main program.
Turned off: When a program is being executed or is ready to start. If signal PROGRUN is on, the program is being executed. If signal PROGRUN is off, the program has not been executed and can be started from this status.

(6) Alarm status signal (output) FAULT
Turned on: When the system is in the alarm status (or an alarm which can stop a program execution is detected.) The indicator lamp does not go on in warning.
Turned off: When the alarm status is released by an alarm release operation.

(7) Reference point signal (output) ATPERCH
Turned on: When the robot is in the reference position specified in the parameter. (The reference point No.1 in reference point setup screen.)
Turned off: When the robot is not in the reference position specified in the parameter. (The reference point No.1 in reference point setup screen.) Up to three reference positions can be specified, but this signal is output when the robot is in the first reference position. For the other two reference positions, general-purpose signals can be assigned to output as such. (They can be set from the setup screen.)

(8) Teach pendant enabled signal (output) TPENBL
Turned on: When the teach pendant is enabled.
Turned off: When the teach pendant is disabled.

(9) Battery alarm signal (output) BATALM
Turned on: When the voltage of the battery for the CMOS memory backup drops below the reference.
Turned off: When the voltage of the battery for the CMOS memory backup is at the normal level.

(10) Operating signal (output) BUSY
Turned on: When a program is being executed or is being processed from operation panels such as the teach pendant. (This has the same function as that of the BUSY lamp on the teach pendant.)

Turned off: When a program is not being executed nor is being processed from operation panels such as the teach pendant.

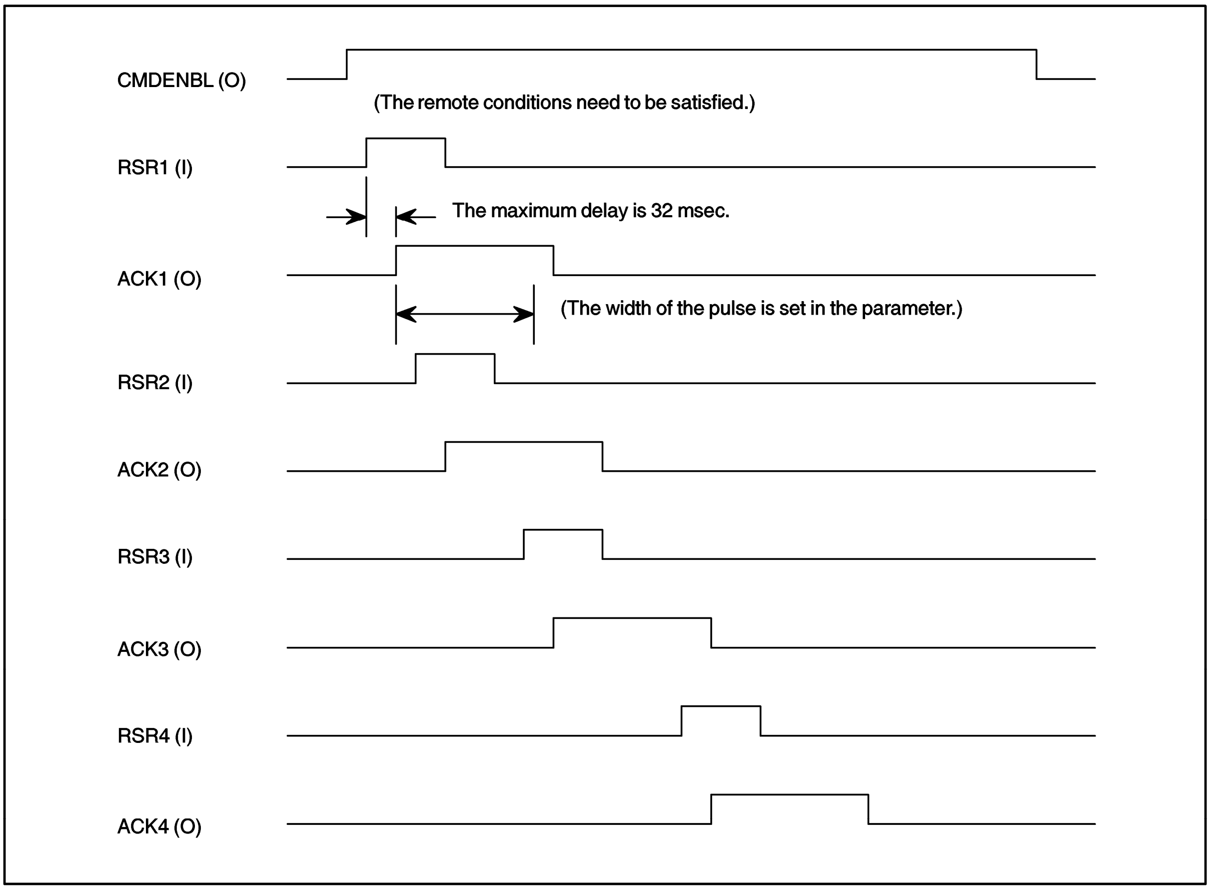
(11) RSR acknowledge signals (output) ACK1/ACK2/ACK3/ACK4

These signals are used together with the RSR function. They can be specified to be enabled or disabled from the RSR setup menu.

Turned on: When one of the signals from RSR1 to RSR4 is input and accepted. A pulse whose width is specified from the menu is output to acknowledge the signal.

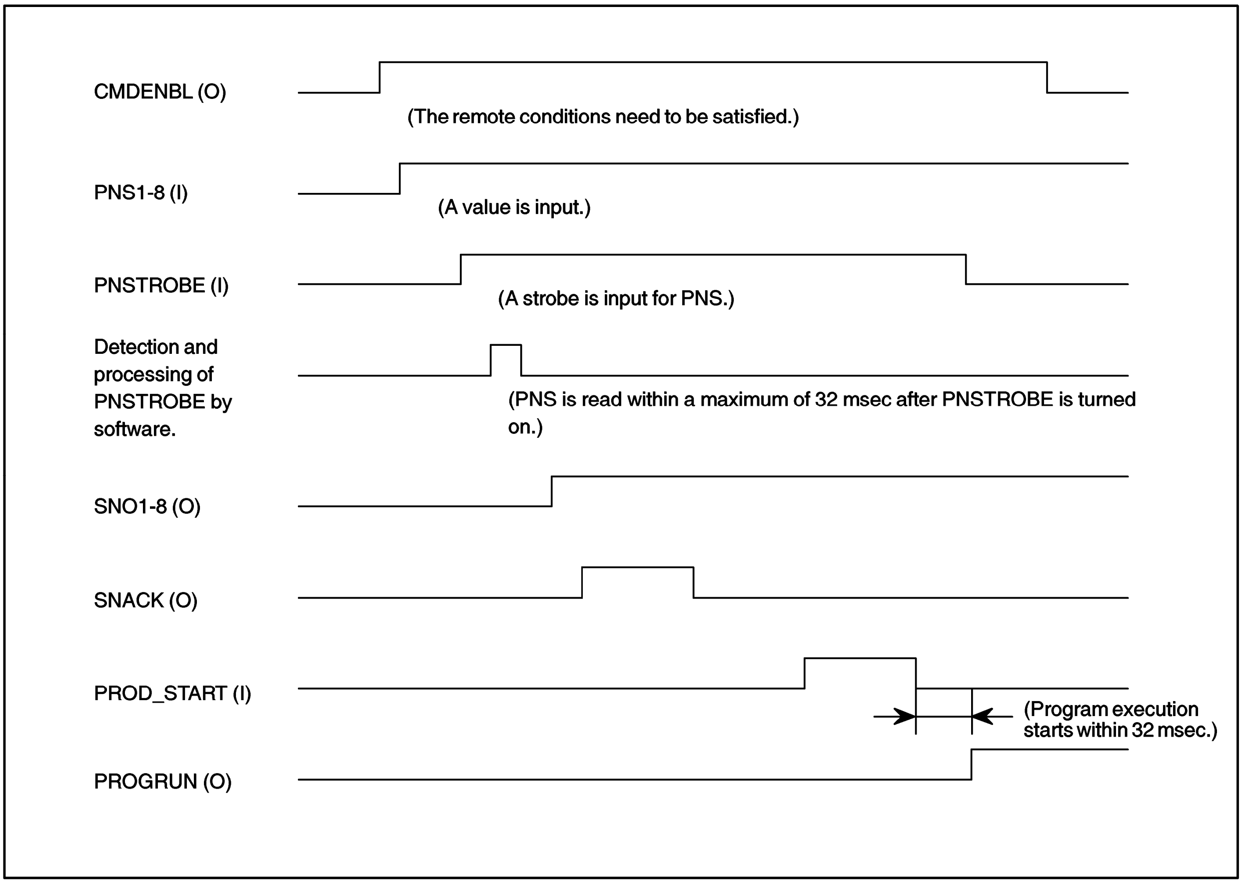
Turned off: Normally. Since these signals are always output as pulses, they are normally in the off status.

The following chart shows the timing of the RSR input and ACK output.



* Other RSR signals can be accepted even when the ACK signal is being output.

(12) PNS acknowledge signal (output) SNO/SNACK
These signals are used together with the PNS function.
Turned on: Whenever the PNS function is enabled. The selected program number is displayed in binary code (SN01 to SN08) on the teach pendant. If the number cannot be represented as an eight-bit number, it becomes zero. After selecting a program by PNS, a pulse is output from signal SNACK as a part of the PNS operation. The width of the pulse can be specified from the menu. See the timing chart below.



C.4 SPECIFICATIONS OF DIGITAL INPUT/OUTPUT

C.4.1 Overview

This section describes the external specifications of digital and analog input/output in the R-30*i*B/R-30*i*B Plus controller.

C.4.2 Input/Output Hardware Usable in the R-30*i*B/R-30*i*B Plus Controller

The R-30*i*B/R-30*i*B Plus controller can use up to 512 digital input and output points or an equivalent number of analog input and output points. One analog input/output point uses the resources equivalent to those used by 16 digital I/O points.
The R-30*i*B/R-30*i*B Plus can use a total of up to 512 I/O points.

The R-30*i*B/R-30*i*B Plus controller can use the following I/O hardware.
- Process I/O printed board
- I/O unit model A

The process I/O board and the I/O unit model A can be used together.

C.4.3 Software Specifications

(1) RI/RO
These are signals sent to the connector at the wrist of the robot.
They cannot be assigned (redefined) and are fixed.
The standard format is eight inputs and eight outputs. The number of points that can be used for the connector at the wrist depends on the individual robot.

(2) DI/DO
The signal No. that is determined at hardware can be changed by software operation.

(3) Analog I/O
An analog I/O signal can access the analog I/O port (optional) on the process I/O board or the I/O port on the analog I/O module (used together with the I/O unit model A).
It reads and writes the digital value converted from the analog value of the I/O voltage. It means that the value does not always represent the real I/O voltage.

(4) Group I/O
Group I/O is a function, which can input or output multiple DI/DO signals as binary codes. Any number of continuous signals of up to 16 bits can be set for its use. It can be set in the menu DETAILS on the group I/O screen.

D OPTICAL FIBER CABLE

The R-30*i*B/R-30*i*B Plus uses fiber optic cables for communication between the main board and servo amplifiers. Observe the following cautions when handling these fiber optic cables. Handle fiber optic cables with utmost care, especially when installing the unit.

(1) Protection during storage
When the electrical/optical conversion module (mounted on the printed) circuit board and the fiber optic cable are not in use, their mating surfaces must be protected with the lid and caps with which they are supplied. If left uncovered, the mating surfaces are likely to become dirty, possibly resulting in a poor cable connection.

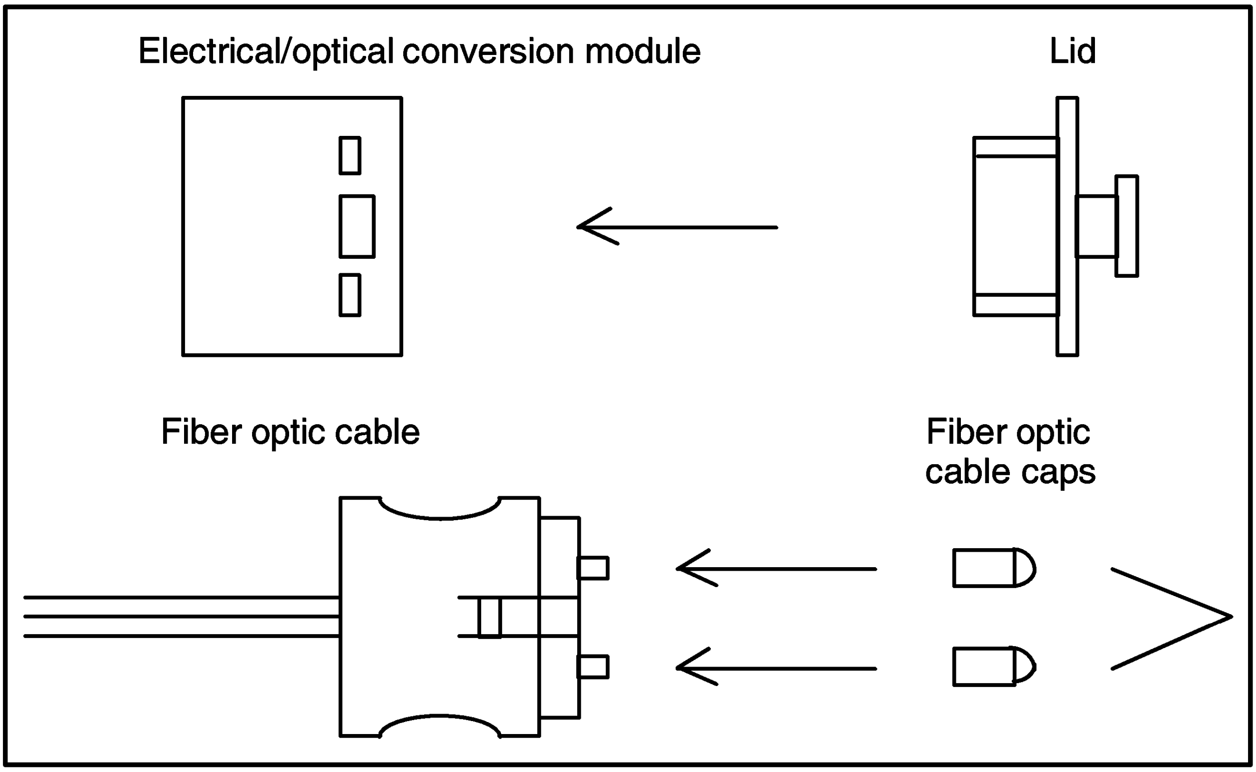


Fig.D (a) Protection of electrical/optical conversion module and fiber optic cable (when not in use)

(2) Fiber optic cable
External type

Fiber optic cord diameter:	ϕ 2.2 mm x2 cords
Diameter of cable with reinforced cover:	ϕ 7.6 mm
Tensile strength:	
Cable with reinforced cover:	75 kg
Fiber optic cord:	7 kg per cord
Between fiber optic cord and connector:	2 kg
Minimum bending radius of fiber optic cord:	25 mm
Minimum bending radius of cable with reinforced cover:	50 mm
Bending resistance (cable with reinforced cover):	10 million bending cycles at room temperature (when the bending radius is 100 mm)
Flame resistance:	Equivalent to UL VW-1
Operating temperature:	-20 to 70ºC

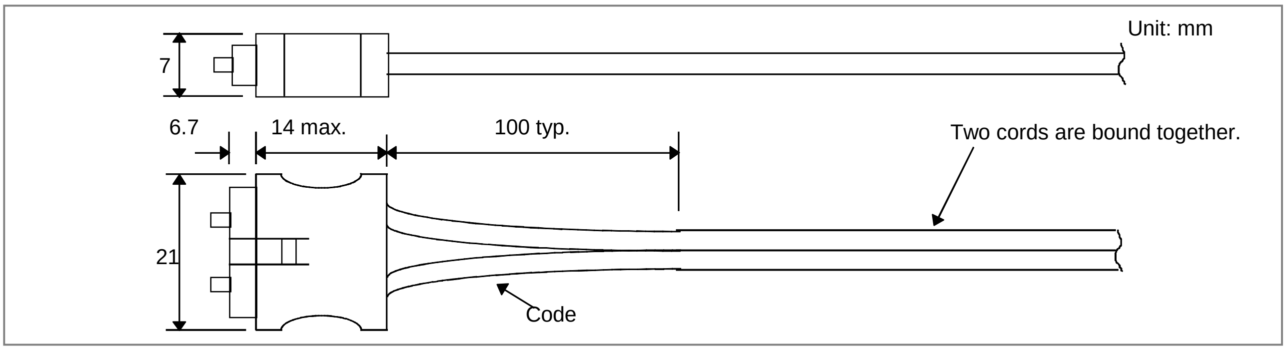


Fig.D (b) External dimensions of external optical cable Unit: mm

Internal type

Fiber optic cord diameter:	ϕ 2.2 mm×2 cords
Tensile strength:	
Fiber optic cord:	7 kg per cord
Between fiber optic cord and connector:	2 kg
Minimum bending radius of fiber optic cord:	25 mm
Flame resistance:	Equivalent to UL VW-1
Operating temperature:	-20 to 70ºC

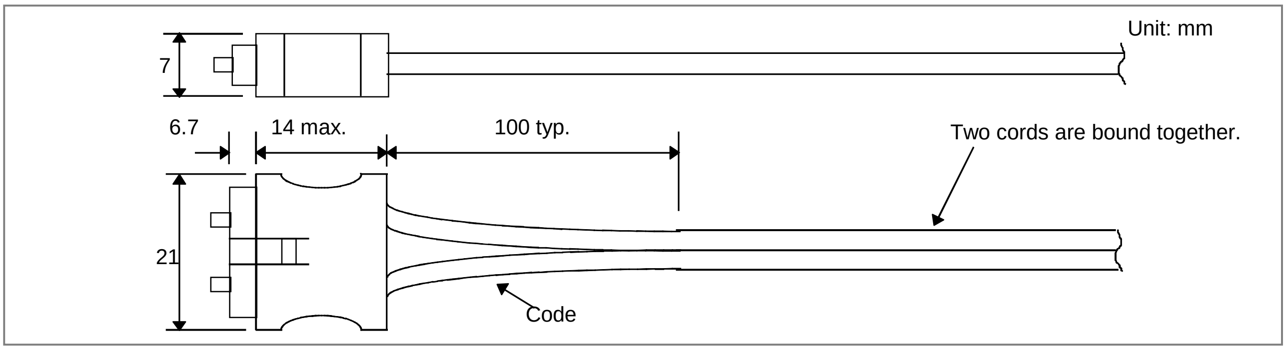


Fig.D (c) External dimensions of internal optical cable Unit: mm

- After it is connected, the optical connector is automatically locked by the lock levers on its top. To remove the connector, release the lock levers and pull the connector. (Do not pull on the fiber optic cord itself.)
- Although optical connectors cannot be connected in other than the correct orientation, always take note of the connector's orientation before making the connection.
- Take care to keep both parts of the optical connector (cable side and PCB side) clean. If they become dirty, wipe them with tissue paper or absorbent cotton to remove dirt. The tissue paper or absorbent cotton may be moistened with ethyl alcohol. Do not use any organic solvent other than ethyl alcohol.
- Fix the reinforcing cover by using a cable clamp, as shown in Fig.D(d), to prevent the weight of the fiber optic cable from being applied directly to the connecting part of the optical connector.
- Although the reinforcing cover of the external optical cable has sufficient mechanical strength, be careful not to drop heavy objects on the cable.

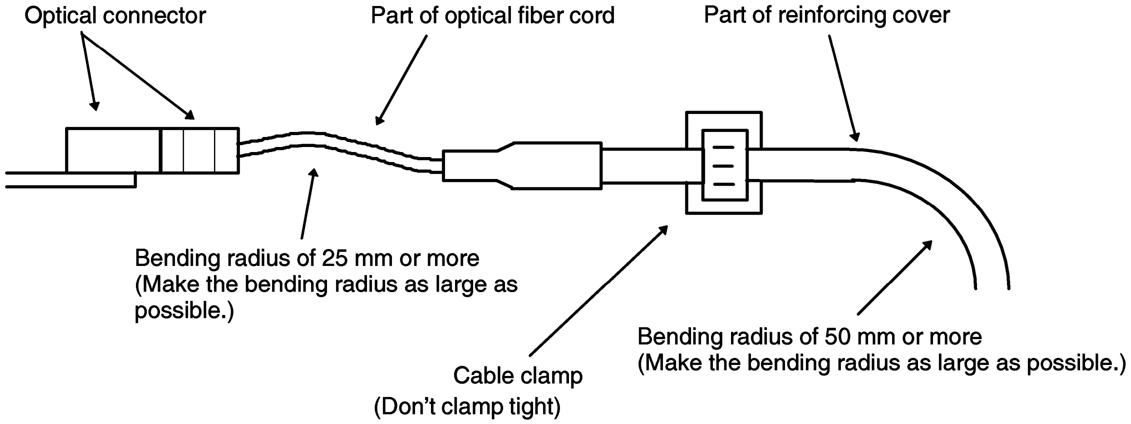


Fig.D (d) Fixing the cable with a clamp

- Any superfluous portion of the cable might be wound into loops. Should this prove necessary, make sure the diameter of each loop is at least 150 mm (for an external cable). Winding the cable into smaller loops can produce sharp curves that exceed the specified bend radius limit. Such bending can result in transmission loss, ultimately leading to a communication failure.
- When using a (cable tie) as a cable clamp, follow the instructions given below. Also, take care not to apply a bending force to one particular part of the cable when fixing it with a clamp. Failing to clamp the cable correctly might cut or damage it.

External cable:

Do not clamp the uncovered portion of the cable with a cable tie. When clamping the cable by the reinforcing cover, the clamping force is not an important factor to consider. However, ensure that the clamping force is as small as possible to ensure that the reinforcing cover is not deformed by the clamping.

If possible, the clamping force should be 5kg (111bs) or less.

Internal cable:

Lightly clamp the optical cable with a cable tie so that the cable shield is not deformed. Desirable clamping force is 1 to 2 kg (make sure that no force is applied to the cable).

Optical fiber cable for FSSB

Type	Specification	Max. length
Outside of cabinet	A66L-6001-0026#L˜	50m (Slave to Slave:40m)
Inside of cabinet	A66L-6001-0023#L˜	10m

E BRAKE RELEASE UNIT

E.1 SAFETY PRECAUTIONS

⚠ **WARNING**

- Support the robot arm by mechanical means to prevent it from falling down or rising up when the brake is released. Before using the brake release unit, read the Operator's manual of the robot on which you are trying to release the brake for more information.
- Confirm that the robot is fixed tightly to the floor to prevent it from falling down and to prevent unexpected movement of the robot.
- Confirm that an electrical outlet with an earth ground is used to supply power to the brake release unit and make sure that the earth ground of the brake release unit is securely connected to the earth ground of the power supply. There is danger of getting an electric shock if the earth ground is not connected.

E.2 CONFIRMATIONS BEFORE OPERATION

Confirm the followings before operation.

(1) Confirm the exterior of the brake release unit and the power cable. Do not use it if the unit and the cable are damaged.
(2) Confirm that the power supply of the robot controller is disconnected.
(3) There are two types of brake release units according to the input voltage as shown in Table E.2 (a). Confirm the input voltage of the unit to refer to the input voltage label put to the unit (Fig.E.4).
(4) Confirm that the voltage of power supply is correct before connecting the power supply to the brake release unit. It is possible to damage the brake or the brake release unit when the incorrect power supply is connected to the unit.

Table E.2 (a) Specification of Brake release unit

Brake release unit	Remarks
Brake release unit (AC 100V)	Input voltage AC100-115V, single phase
Brake release unit (AC 200V)	Input voltage AC200-240V, single phase

(5) The brake release unit connection cable is different in each robot. Confirm the cable specification corresponding to the robot referring to Table E.2 (b).

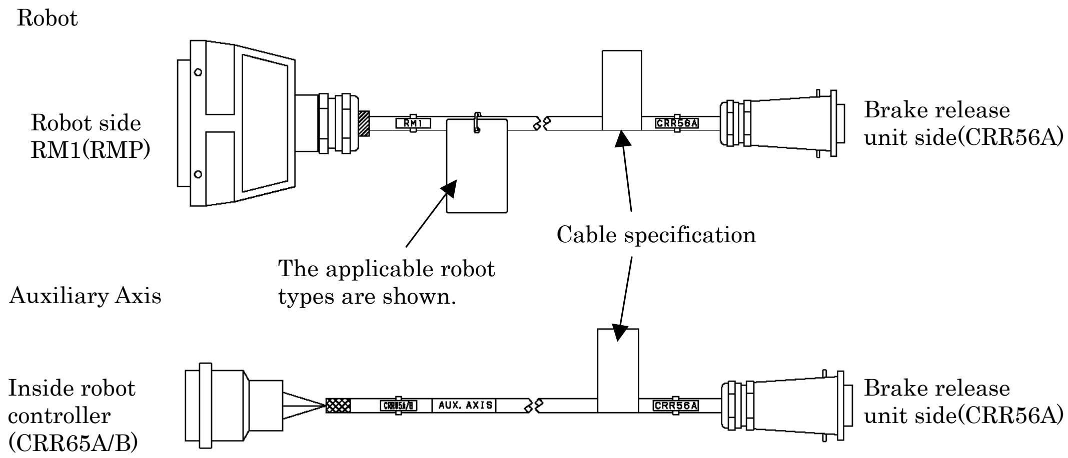


Fig.E.2 Brake release unit connection cable

Table E.2 (b) Specification of brake release unit connection cable

Controller	Applicable robot types	Specification of cable
R-30*i*B/R-30*i*B Plus Stand alone type	R-2000*i*B, R-2000*i*C, R-1000*i*A,M-2*i*A,M-3*i*A M-710*i*C,M-410*i*B,M-420*i*A,M-421*i*A,M-410*i*C, M-900*i*A, M-900*i*B,M-2000*i*A	A660-2005-T559
	F-200*i*B	A660-2005-T871
	M-10*i*A,M-20*i*A,M-20*i*B,CR-35*i*A, ARC Mate 100*i*C,ARC Mate 120*i*C	A660-2006-T881
	M-430*i*A/2PH,4FH	A660-2006-T888
	M-430*i*A/2P	A660-2006-T887
	Aux. Axis	A660-2005-T711
R-30*i*B/R-30*i*B Plus Integrated type	M-410*i*B,M-410*i*C	A660-2006-T803

E.3 OPERATION

E.3.1 In Case of Operating to the Robot

Operate the brake release unit according to the following procedures.

(1) Support the robot arm by mechanical means to prevent it from falling down or rising up when brake is released. Refer to the Operator’s manual for each robot for more information.
(2) Connect the Brake Release Unit connection cable to Brake Release Unit.
(3) Disconnect the RM1 connector from Robot, and connect the Brake Release Unit connection cable to the Robot. Keep the connection of Robot connection cable except RM1 cable.
(4) Connect the power cable of Brake release unit to power supply.
(5) Press and hold the deadman switch in the middle position.
(6) Press the brake switch ‘1’..’6’ according to the axis whose brake you are trying to release, then the brake will be released. (Refer to Table E.3.1) Two axes or more cannot be released at the same time.

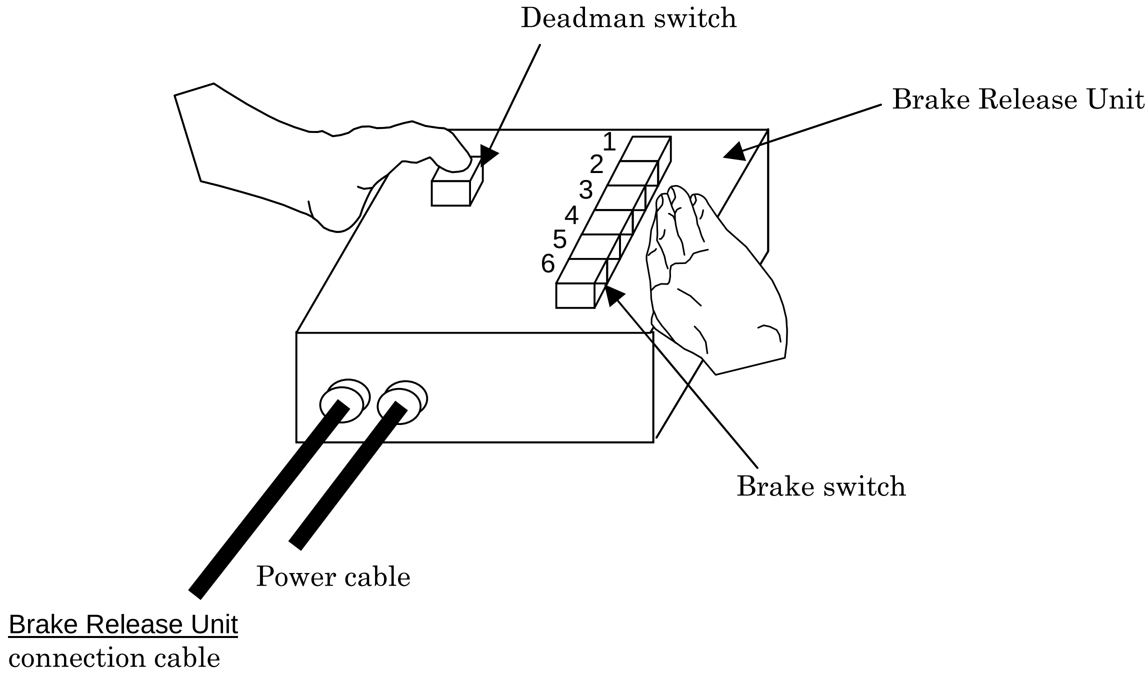


Fig.E.3.1 (a) Brake release unit

Table E.3.1 The relation between brake switch and robot axis

Robot Type	Brake Unit Button					
	1	2	3	4	5	6
Robot with R-30*i*B/R-30*i*B Plus (in case of 6 axis robot)	J1	J2	J3	J4	J5	J6
M-410*i*B (Integrated robot)	J1 to J4	-	-	-	-	-
In case of the auxiliary Axis	J1	-	-	-	-	-

- Refer to Fig.E.3.1 (c) for M-410*i*B (Integrated robot).
- Refer to Fig.E.3.2 for the auxiliary axis.

Except M-410*i*B (Integrated robot)

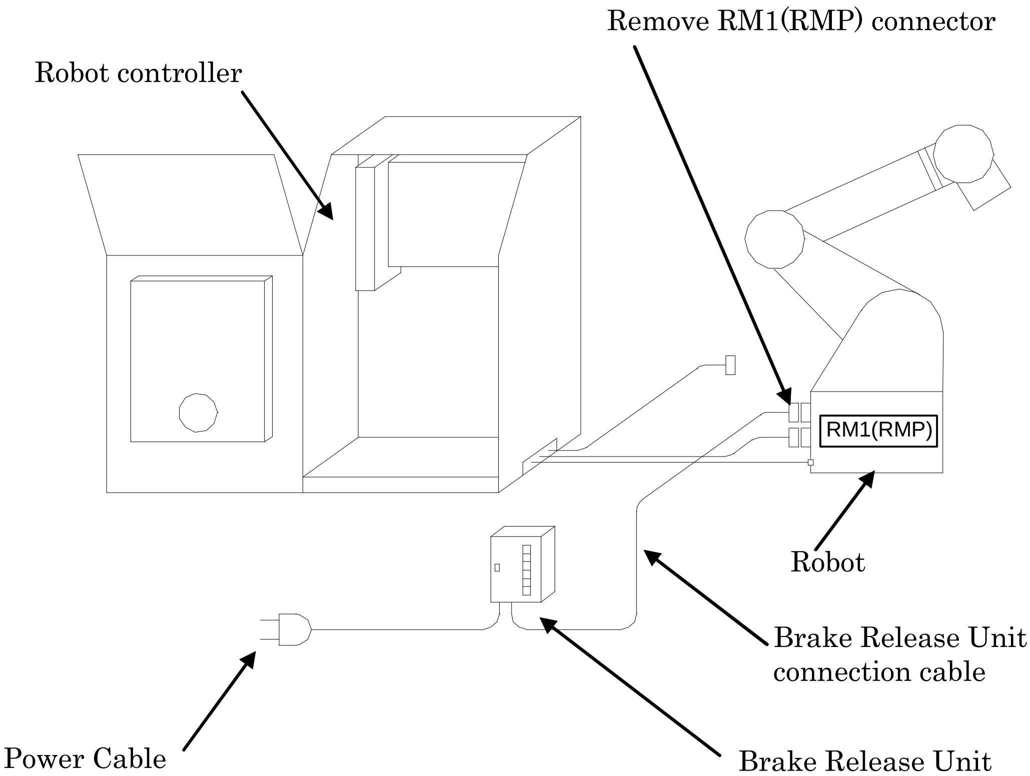


Fig.E.3.1 (b) How to connect brake release unit (In case of except M-410*i*B)

In case of M-410*i*B (Integrated robot)

Connect the Brake release unit cable to the servo motor brake connector. Only J1 switch is available.

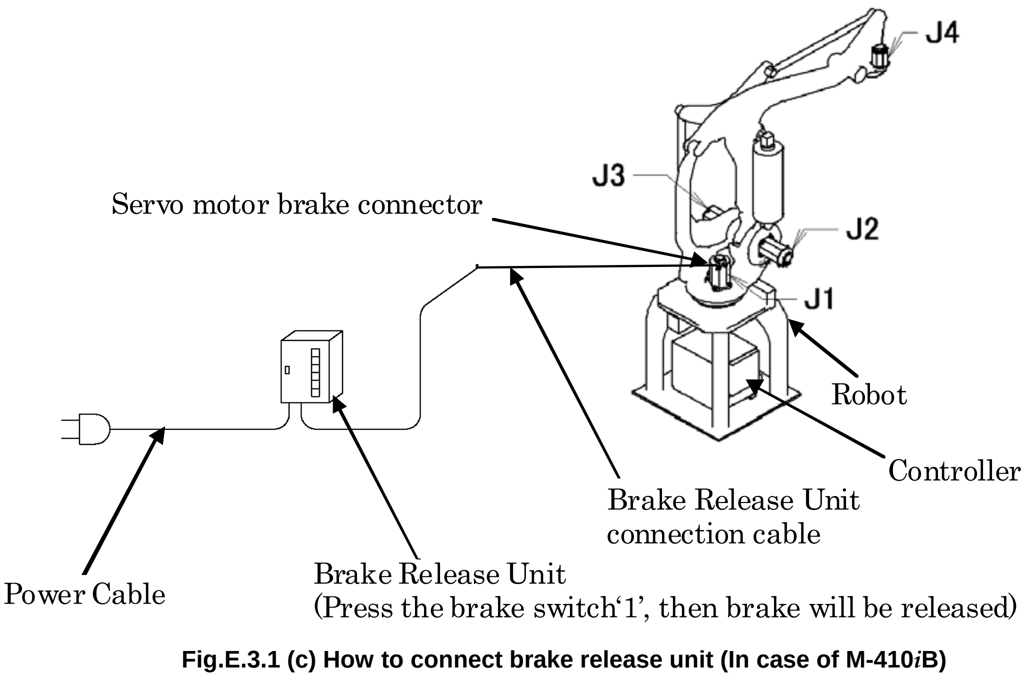


Fig.E.3.1 (c) How to connect brake release unit (In case of M-410*i*B)

E.3.2 Releasing the Brake of an Auxiliary Axis

Operate the brake release unit according to the following procedures.

(1) Support the auxiliary Axis by mechanical means to prevent it from falling down or rising up when the brake is released.
(2) Connect the Brake Release Unit connection cable to Brake Release Unit.
(3) Disconnect the aux. axis brake connector (CRR65A/B), and connect the CRR65A/B connector to the Brake Release Unit connection cable. Keep the connection of all cables of aux. axis motor (power, Pulsecoder, brake).
(4) Connect the power cable of Brake release unit to power supply.
(5) Press and hold the deadman switch in the middle position.
(6) Press the brake switch'1', then brake will be released.

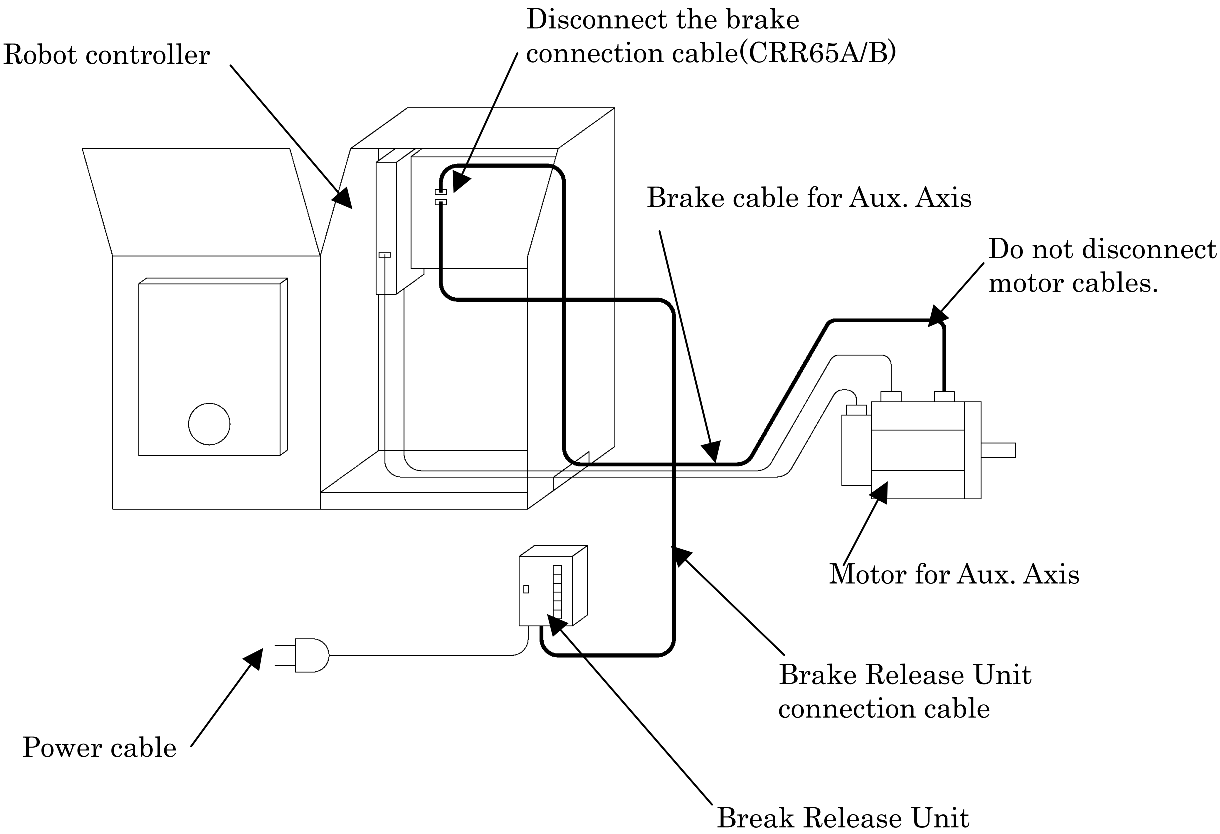
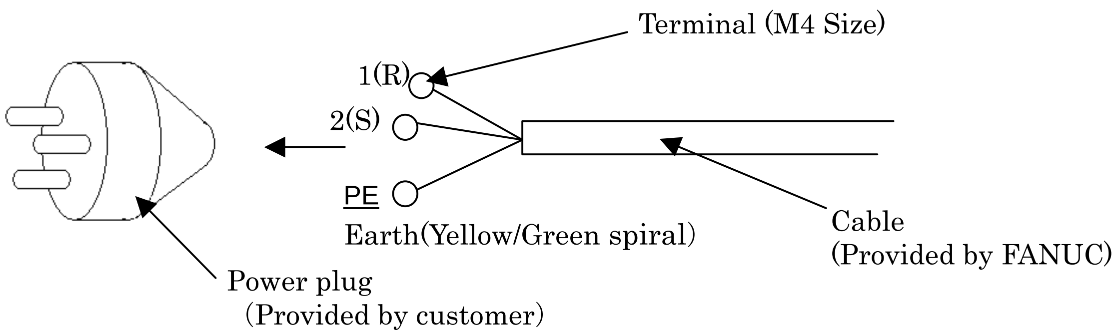


Fig.E.3.2 How to connect brake release unit (In case of operating to the Aux. Axis)

E.4 HOW TO CONNECT THE PLUG TO THE POWER CABLE (IN CASE OF NO POWER PLUG)

Connect the plug to the power cable as follows. This plug is provided by customer.



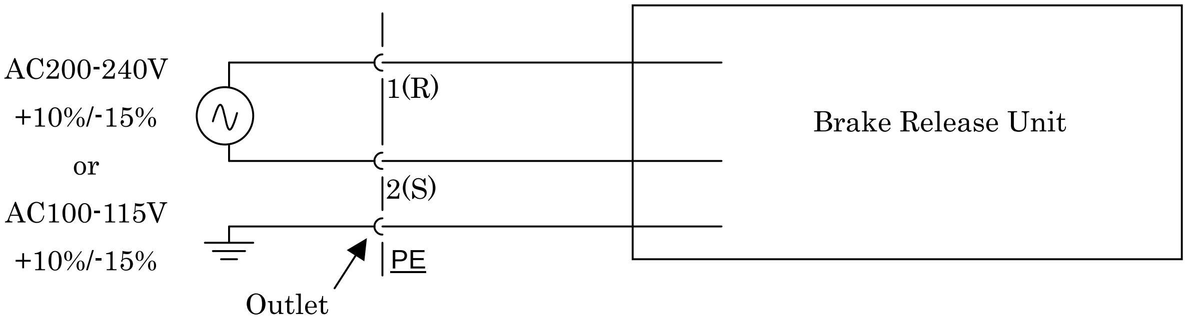


Fig.E.4 How to connect the plug to the power cable

⚠ **WARNING**

- Only a specialist having the relevant expertise knowledge is permitted to connect the plug to the power cable.
- In the EU area, only plug complying with the relevant European product standard can be used.
- Do not install the plugs without protective earth ground pin.

E.5 DIMENSION

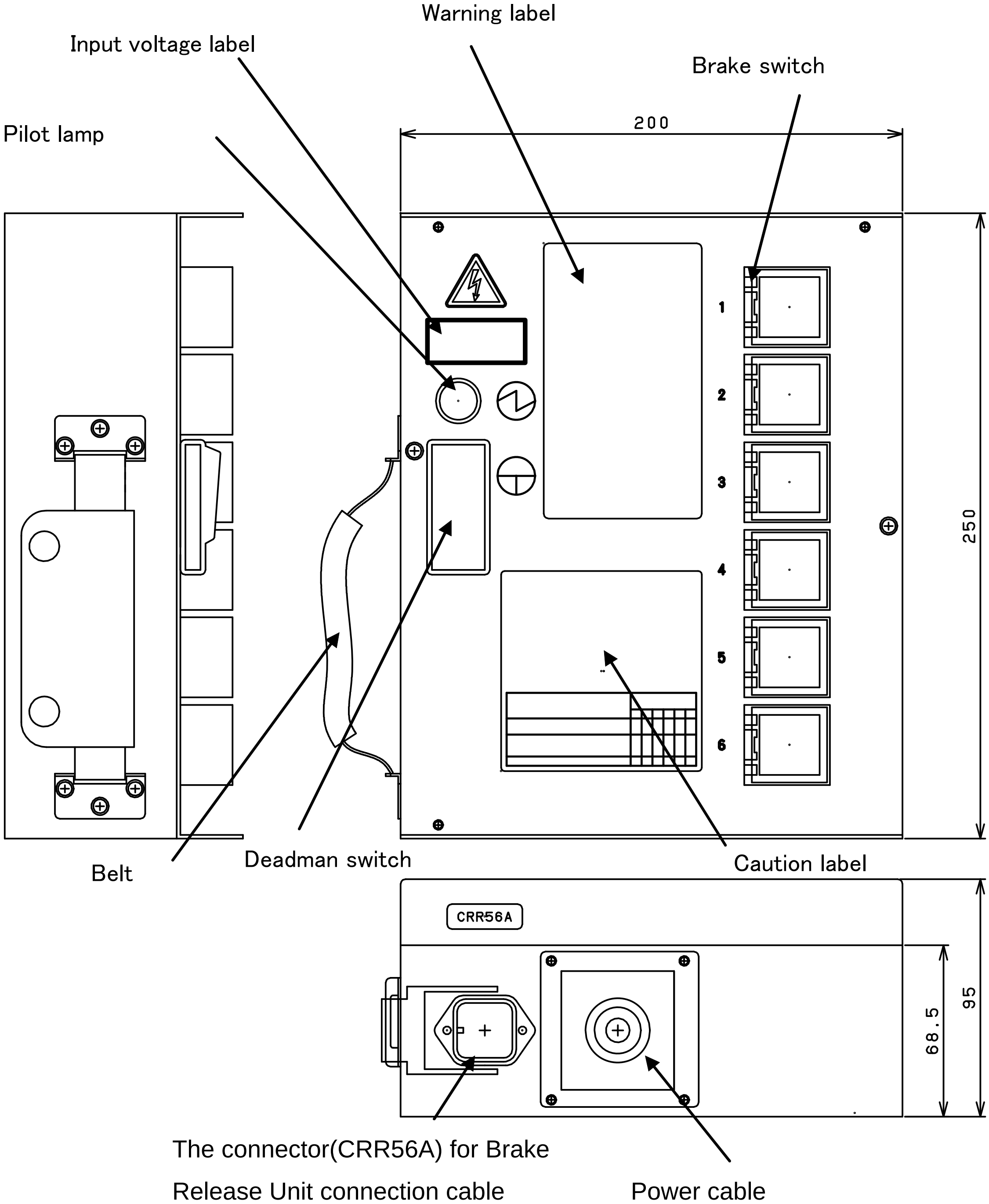


Fig.E.5 (a) Dimension of brake release unit (Front view)

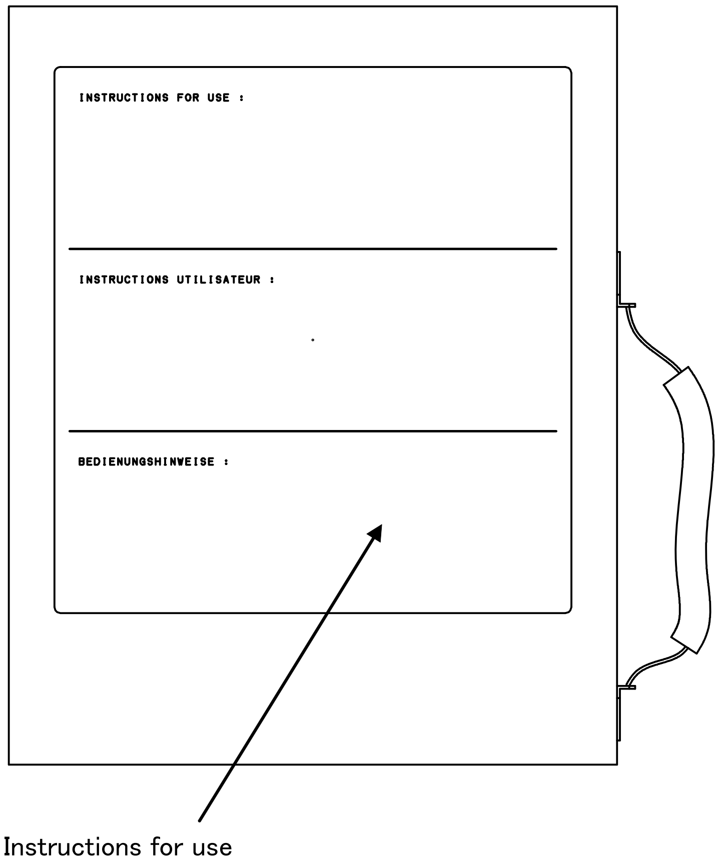


Fig.E.5 (b) Dimension of brake release unit (Rear view)

E.6 FUSE

The fuses are mounted inside this unit. Please check the fuse when the pilot lamp doesn't light even if deadman switch is pressed. When the fuse is blown, exchange the fuse after finding the root cause of failure, and taking the appropriate countermeasures.

Manufacturer: Daito Communication Co.
Specification: P420H
Rating: 2A

> ⚠ **WARNING**
> When the fuse is replaced, the power cable of brake release unit must be disconnected.

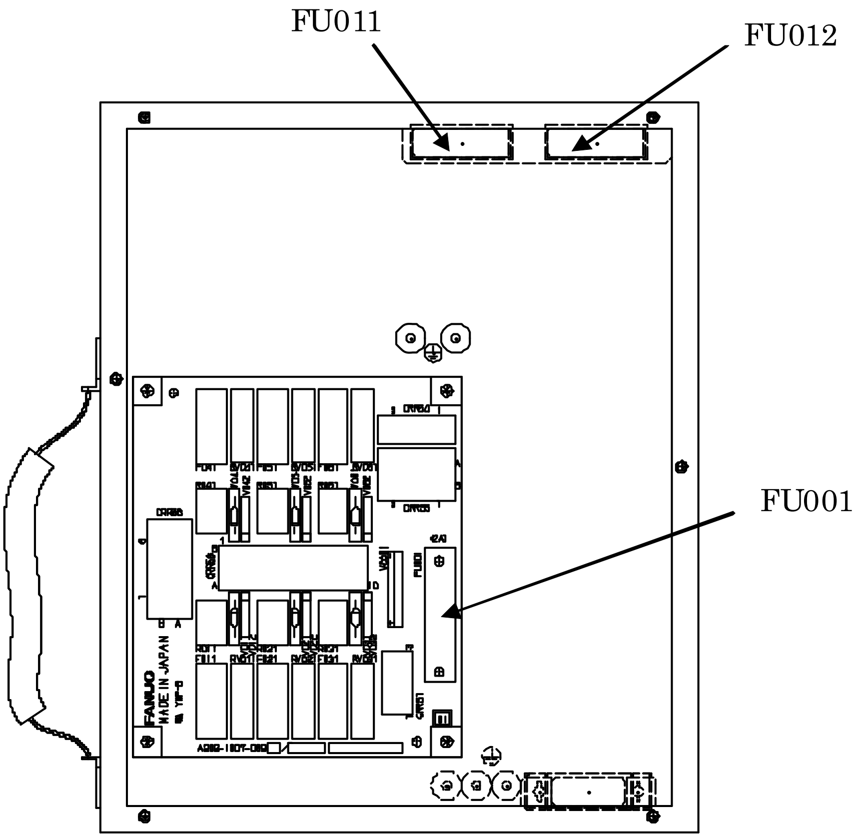


Fig.E.6 The location of fuses

E.7 SPECIFICATIONS

Input power supply

AC100-115V, 50/60Hz±1Hz, single phase, +10%/-15%, 1A
AC200-240V, 50/60Hz±1Hz, single phase, +10%/-15%, 1A

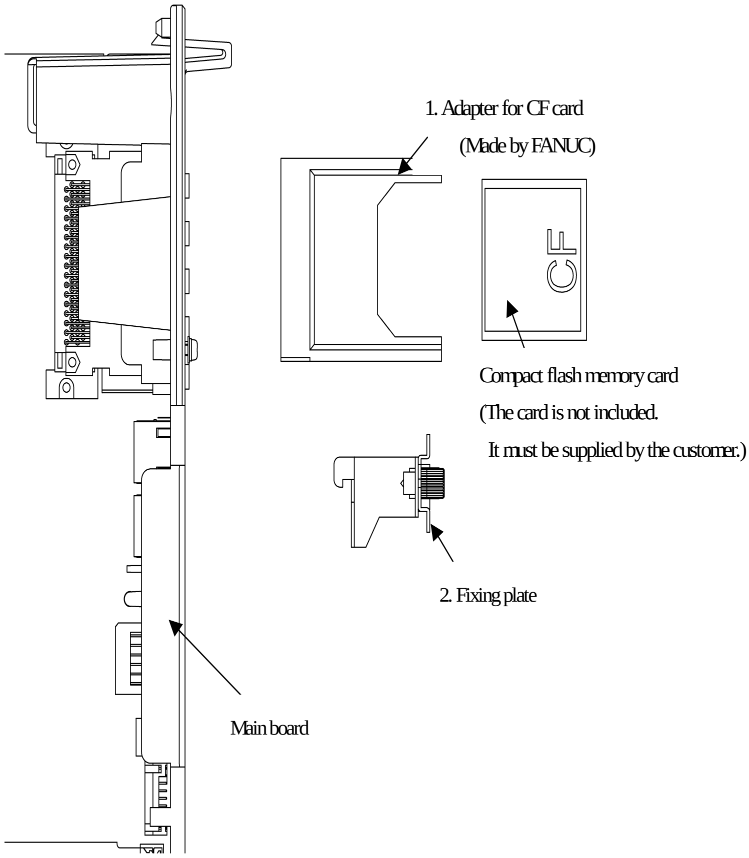
Weight

Brake Release Unit (AC 100V): 2.3 kg
Brake Release Unit (AC 200V): 3.5 kg

F HOW TO SECURE THE COMPACT FLASH MEMORY CARD TO THE MAIN BOARD

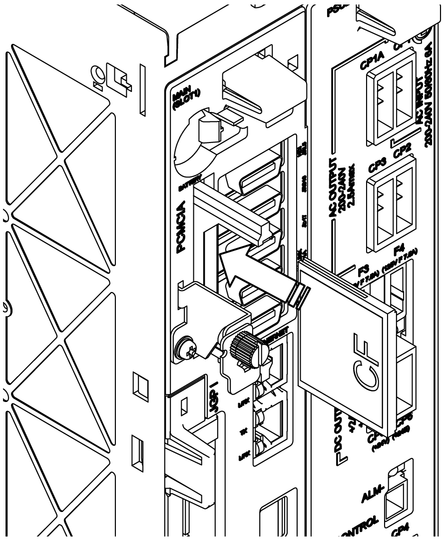
An optional bracket (fixing plate) can be used along with an adapter to semi-permanently secure the compact flash memory card (CF card) to the main board. The CF card can then be used whenever it is necessary to perform a back-up.

Parts
- Fixing plate (Ordering number A05B-2500-J300)
- Adapter for CF card (made by FANUC) (Ordering number A02B-0303-K150)

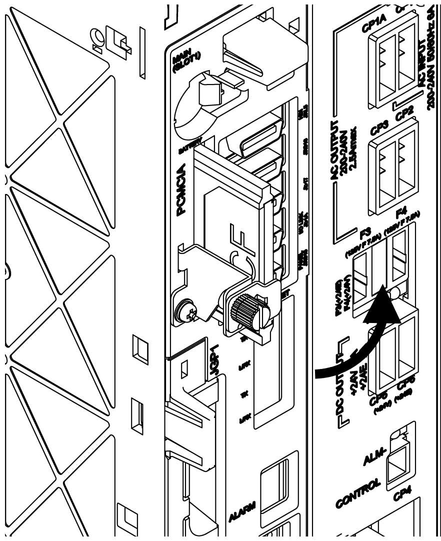


- Installation of the CF card

1. Insert the CF card into the Adapter.

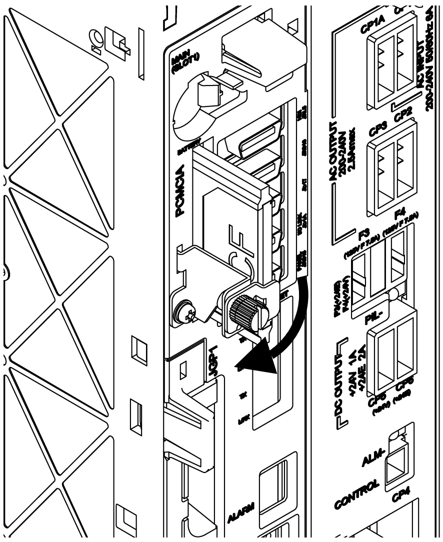


2. Lock the latch, and drive the screw.

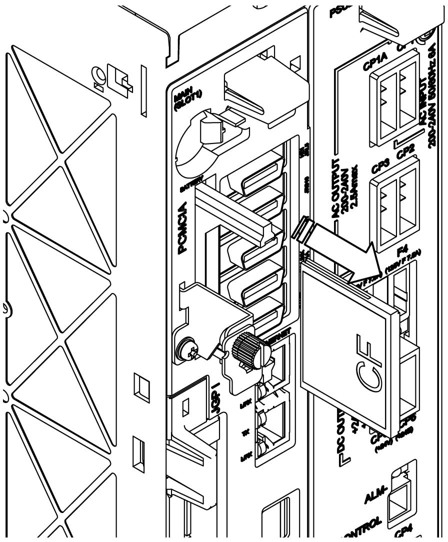


- Removal of the CF card

1. Loosen the screw, and unlock the latch.



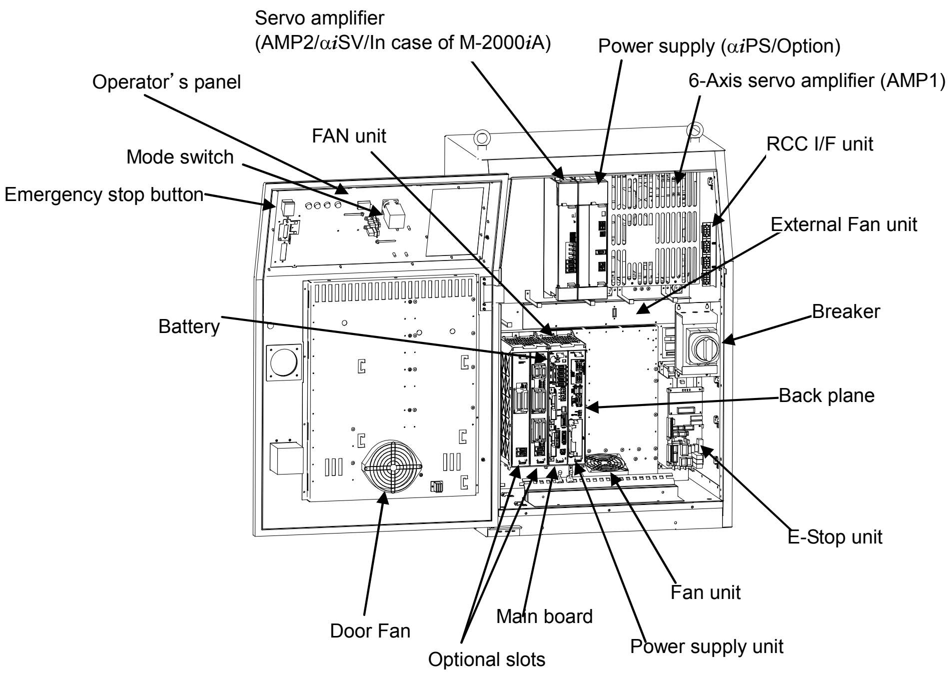
2. Pull the CF card out of the Adapter.



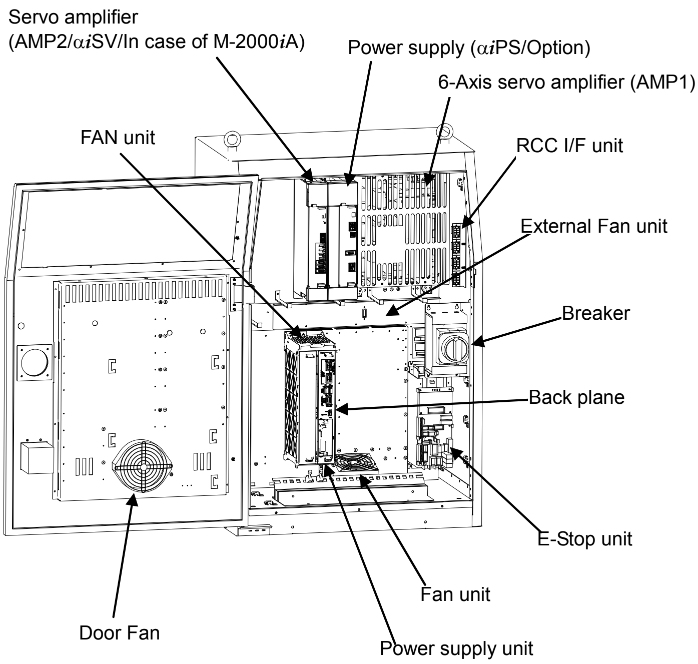
G THE CONTROLLER FOR M-900*i*A/200P, M-2000*i*A

Additional document of the controller specifically for the M-900*i*A/200P, M-2000*i*A.

G.1 CONFIGURATION



(Controller 1)



(Controller 2)

Fig.G.1(a) M-900*i*A/200P, M-2000*i*A CONTROLLER (B-cabinet)

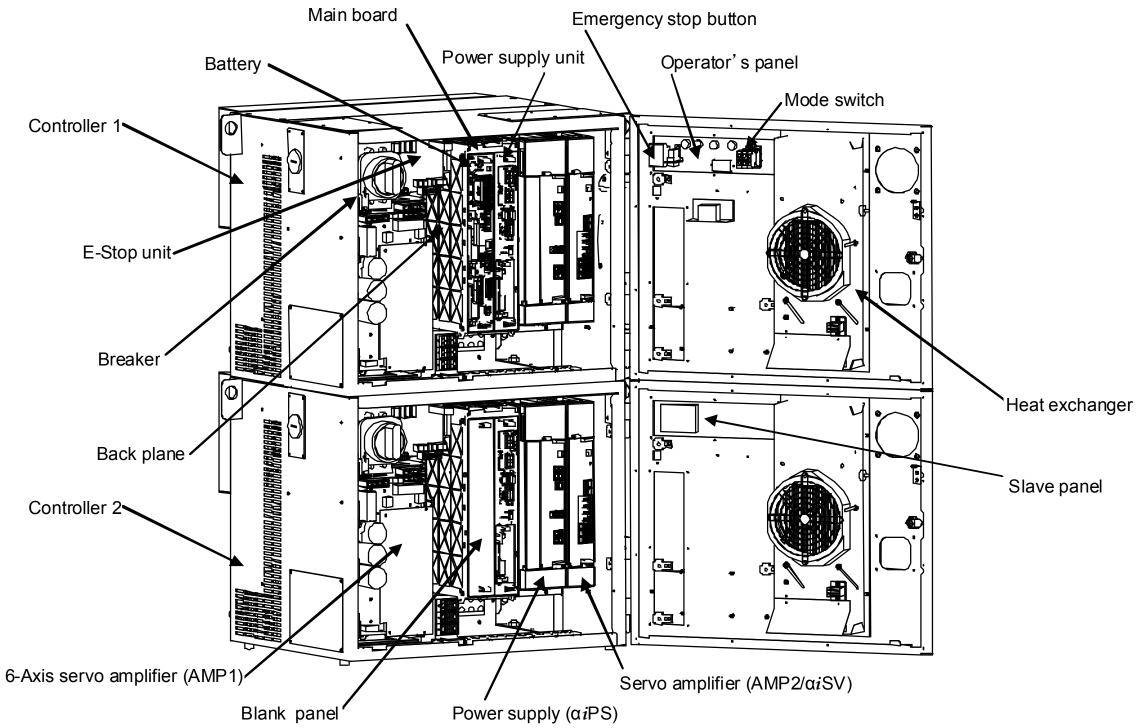


Fig.G.1(b) M-2000*i*A, CONTROLLER (A-cabinet)

G.2 TROUBLESHOOTING USING THE ALARM CODE

G.2.1 Troubleshooting Using the Alarm Code

SRVO-101 Robot overtravel (Group:i)

(Explanation) The robot has moved beyond a hardware limit switch on the axes.
(Action) Take the same actions as SRVO-005.

> **NOTE**
> It is factory-placed in the overtravel state for packing purposes.
> If the Overtravel signal is not in use, it may have been disabled by short-circuiting in the mechanical unit.

SRVO-102 Hand broken (Group:i)

(Explanation) The safety joint (if in use) might have been broken. Alternatively, the HBK signal on the robot connection cable might be a ground fault or a cable disconnection.
(Action) Take the same actions as SRVO-006.

> **NOTE**
> If the Hand broken signal is not in use, it can be disabled by software setting. Refer to Subsection 5.5.3 How to Disable/Enable HBK in Part III, "CONNECTIONS" of "Maintenance Manual" to disable the Hand broken signal.

SRVO-103 Pneumatic pressure abnormal (Group:i)

(Explanation) An abnormal air pressure was detected. The input signal is located on the EE interface of the robot. Refer to the manual of your robot.
(Action) Take the same actions as SRVO-009.

SRVO-106 Door open or E-stop (Robot:i)

(Explanation) The cabinet door is open.
- When the door switch is mounted.

(Action) Take the same actions as SRVO-105

SRVO-244 Chain 1 (+24V) abnormal (Robot:i)
SRVO-245 Chain 2 (0V) abnormal (Robot:i)

(Explanation) A mismatch occurred between duplicate safety signals.
SRVO-244 is issued if such a mismatch that a contact connected on the chain 1 side (between EES1 and EES11, between EAS1 and EAS11, between EGS1 and EGS11, and so forth) is closed, and a contact on the chain 2 side (between EES2 and EES21, between EAS2 and EAS21, 7between EGS2 and EGS21, and so forth) is open occurs.
SRVO-245 is issued if such a mismatch that a contact on the chain 1 side is open, and a contact on the chain 2 sides is closed occurs.
If a chain error is detected, correct the cause of the alarm then reset the alarm according to the method described later.
(Action) Take the same actions as SRVO-230, 231.

> ⚠ **WARNING**
> If this alarm is issued, do not reset the chain error alarm until the failure is identified and repaired. If robot use is continued with one of the duplicate circuits being faulty, safety may not be guaranteed when the other circuit fails.

⚠ **CAUTION**

1. The state of this alarm is preserved by software. After correcting the cause of the alarm, reset the chain error alarm according to the chain error reset procedure described later.
2. Until a chain error is reset, no ordinary reset operation must be performed. If an ordinary reset operation is performed before chain error resetting, the message "SRVO-237 Chain error cannot be reset" is displayed on the teach pendant.

SRVO-301 Hand broken/HBK dsbl (Group:i)
SRVO-303 Set HBK to ENABLE (Group:i)

(Explanation) Although HBK was disabled, the HBK signal was input.
(Action) Take the same actions as SRVO-300, 302.

G.2.2 Alarms Detected by Servo Amplifier

The following alarms are detected by servo amplifier.
If the alarms in the following table are caused, find the controller, which the alarm is caused according to the table of relationship of axis. (F2.3)
And find the cause and take an appropriate measure according to the troubleshooting in MAINTENANCE PART Chapter 3.

Table G.2.2 Alarms detected by servo amplifier

Alarm
SRVO - 018 Brake abnormal (Group:i Axis:j)
SRVO - 043 DCAL alarm (Group:i Axis:j)
SRVO - 044 DCHVAL alarm (Group:i Axis:j)
SRVO - 047 LVAL alarm (Group:i Axis:j)
SRVO - 049 OHAL1 alarm (Group:i Axis:j)
SRVO - 136 DCLVAL alarm (Group:i Axis:j)

G.2.3 Relationship of Axis

The following table is shown the relation ship of each axes (Axis (j) displayed in the teach pendant, motor number, Controller, Connector of Amplifier) for M-900*i*A/200P, M-2000*i*A
If the alarm is occurred, find the motor number, the connector of Amplifier and the controller (which the alarm is caused) according to the relationship of the axis and the alarm displayed in the teach pendant (Axis (j)), and find the cause of alarm according to the trouble shooing.

ALARM displayed in the teach pendant.

SRVO - *** ALARM (Group:i Axis:j)

Table G.2.3 (a) Relation of axis (In case of M-900*i*A/200P)

	Axis (j)	Motor number	Controller	Connector of AMP
M-900*i*A/200P Without Aux. Axis AMP	1	J1A	CONTROLLER 2	6 axis amplifier (AMP1): CNJ1
	2	J2	CONTROLLER 2	6 axis amplifier (AMP1): CNJ2
	3	J3	CONTROLLER 1	6 axis amplifier (AMP1): CNJ2
	4	J4	CONTROLLER 2	6 axis amplifier (AMP1): CNJ4
	5	J5	CONTROLLER 2	6 axis amplifier (AMP1): CNJ5
	6	J6	CONTROLLER 1	6 axis amplifier (AMP1): CNJ3
	7	J1B	CONTROLLER 1	6 axis amplifier (AMP1): CNJ1
M-900*i*A/200P In case of 1 Aux. Axis amplifier	1	J1A	CONTROLLER 2	6 axis amplifier (AMP1): CNJ1
	2	J2	CONTROLLER 2	6 axis amplifier (AMP1): CNJ2
	3	J3	CONTROLLER 1	6 axis amplifier (AMP1): CNJ2
	4	J4	CONTROLLER 2	6 axis amplifier (AMP1): CNJ4
	5	J5	CONTROLLER 2	6 axis amplifier (AMP1): CNJ5
	6	J6	CONTROLLER 1	6 axis amplifier (AMP1): CNJ3
	7	J7 (Aux. axis)	CONTROLLER 1	6 axis amplifier (AMP1): CNJ4
	8	J1B	CONTROLLER 1	6 axis amplifier (AMP1): CNJ1

Table G.2.3 (b) Relation of axis (In case of M-2000*i*A)

	Axis (j)	Motor number	Controller	Connector of AMP
M-2000*i*A No Aux. Axis AMP	1	J1	CONTROLLER 1	6 axis amplifier (AMP1): CNJ1
	2	J2A	CONTROLLER 1	6 axis amplifier (AMP1): CNJ2
	3	J3A	CONTROLLER 1	6 axis amplifier (AMP1): CNJ3
	4	J4	CONTROLLER 1	Aux. axis amplifier (AMP2): CNJ1
	5	J5	CONTROLLER 2	6 axis amplifier (AMP1): CNJ1
	6	J6	CONTROLLER 2	Aux. axis amplifier (AMP2): CNJ1
	7	J2B	CONTROLLER 2	6 axis amplifier (AMP1): CNJ2
	8	J3B	CONTROLLER 2	6 axis amplifier (AMP1): CNJ3

Note) J1A and J1B show the tandem axis.

G.3 INSTALLING THE CONNECTION CABLE BETWEEN CABINETS

The connection cable between cabinets (emergency stop cable, optical cable, and earth cable) is disconnected from the controller 1 at shipment.
Install the connection cable between cabinets as shown in the following Fig. G.3 .

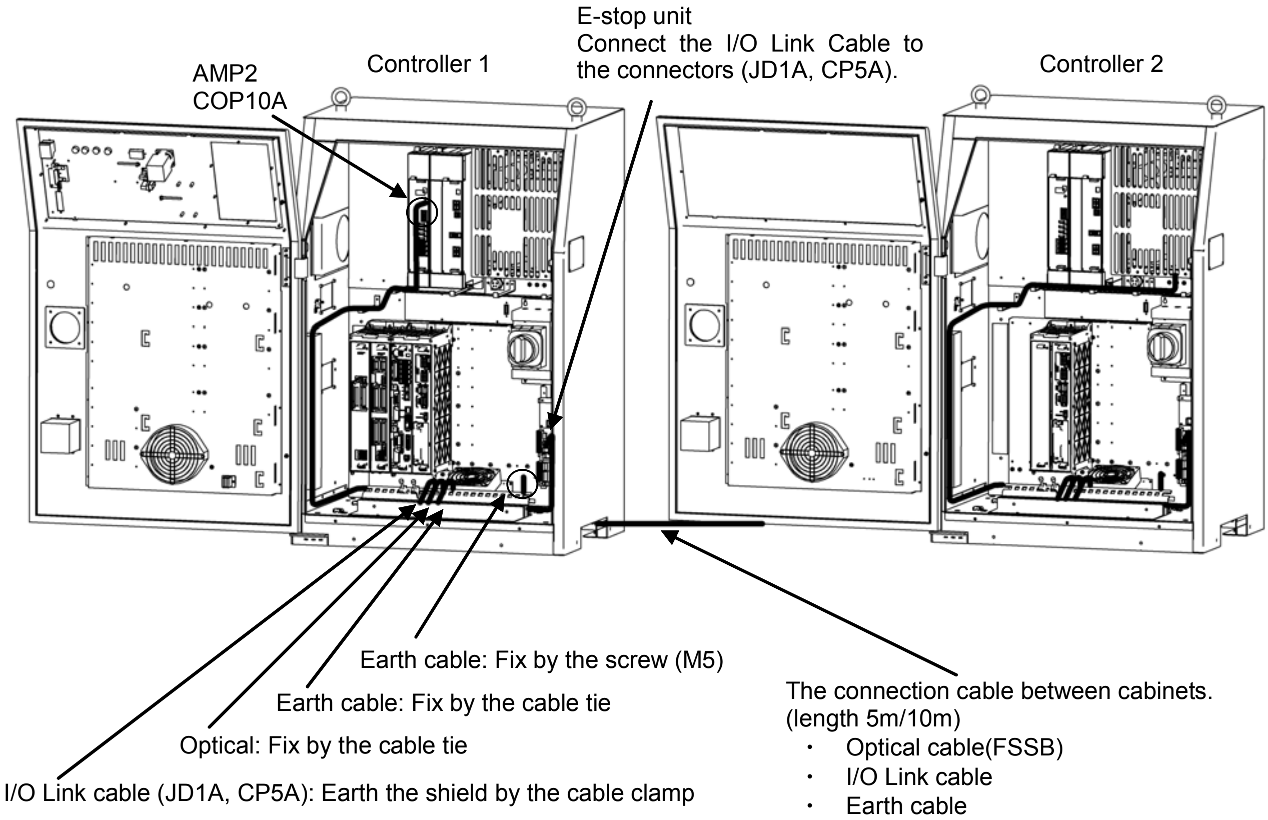


Fig.G.3 Installing the connection cable between cabinets

G.4 ROBOT CONNECTION CABLE

Following is the installation method of robot connection cable for M-900*i*A/200P, M-2000*i*A at installing. Cable route shown in CONNECTION PART Section 3.2.1.

There are two types of the robot connection cable;
Non-flex type: usage is restricted to fixed laying
Flex type: possible to use in the cable track

Table G.4 Specification of cable

	Robot	Non-flex type			Flex type		
		Diameter (mm)	Weight (kg/m)	Minimum bending radius (mm)	Diameter (mm)	Weight (kg/m)	Minimum bending radius (mm)
RP1,2	Group9 (M-900*i*A/200P)	16.0	0.45	200	-	-	-
RM1,2,3,4		26.1	1.22	200	-	-	-
RP1, 2	Group10 (M-2000*i*A)	16.0	0.45	200	20.5	0.71	200
RM1,2,3,4		26.1	1.22	200	25.4	1.2	200
EARTH	All models	4.7	0.065	200	4.7	0.065	200

⚠ **CAUTION**

Before operating the robot, uncoil the interconnection cables from their shipping position to prevent excessive heat, which may damage the cables.
(Coiled part should be shorter than 10 meter.)

- Detail of cable connection to servo amplifier

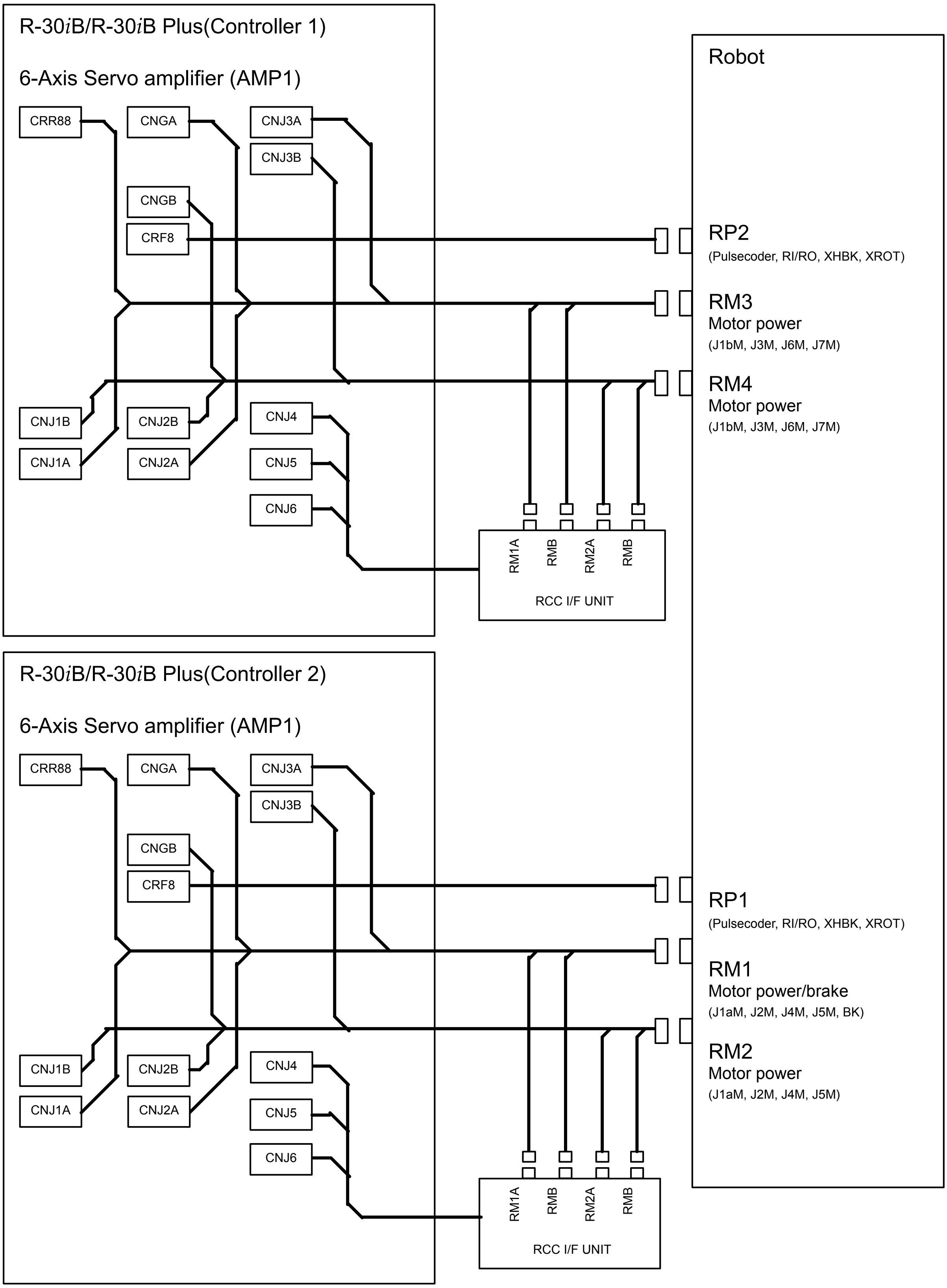


Fig.G.4 (a) Robot connection cable(Group9: M-900*i*A/200P)

- Detail of cable connection to servo amplifier

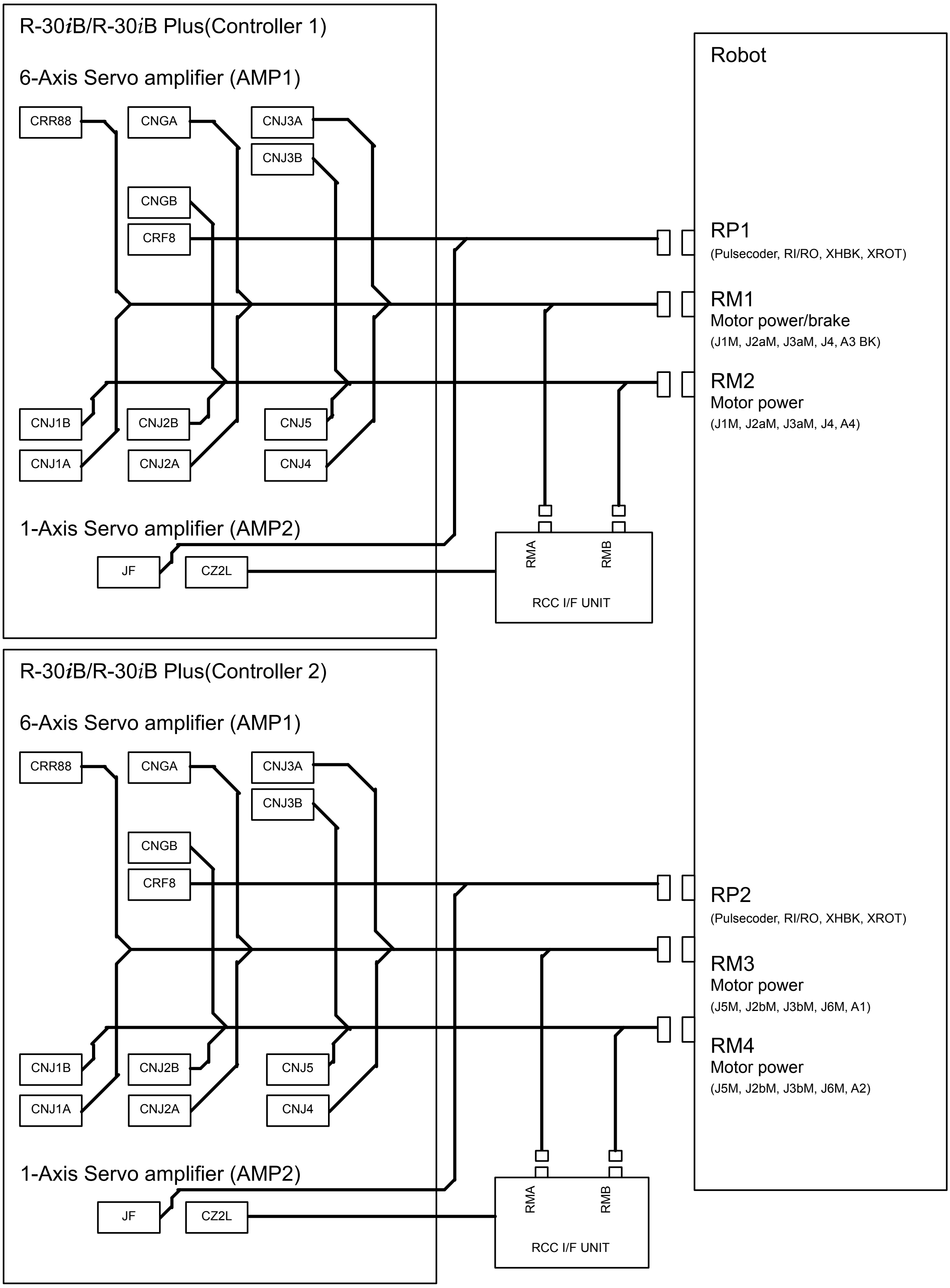


Fig.G.4(b) Robot connection cable (Group10: M-2000*i*A)

G.5 CONNECTING THE INPUT POWER CABLE

M-900*i*A/200P, M-2000*i*A is composed of two cabinets, and need to connect the power supply with each main breaker as shown in figure G.5.
Refer to CONNECTION PART Chapter 3.2 for the method of connecting the power supply with each main breaker.

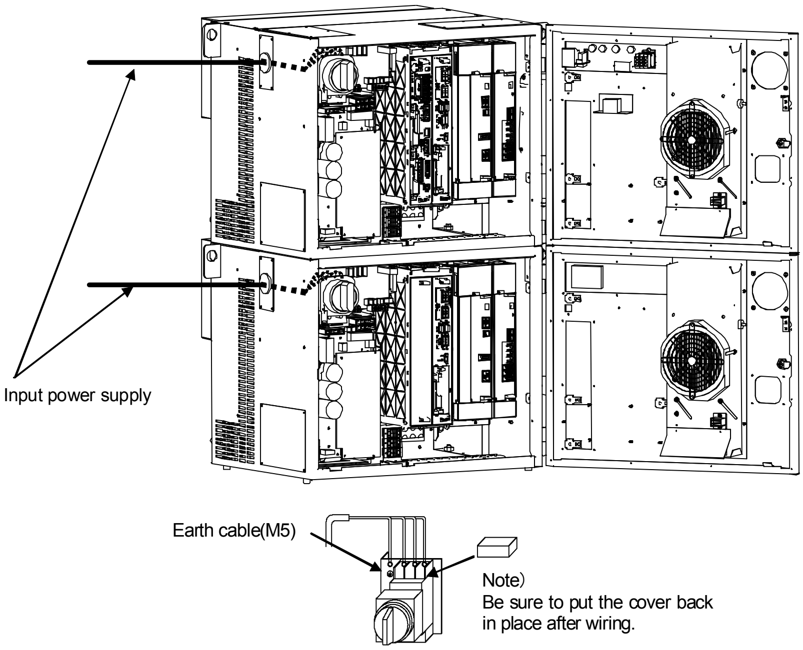


Fig.G.5(a) In case of A-cabinet

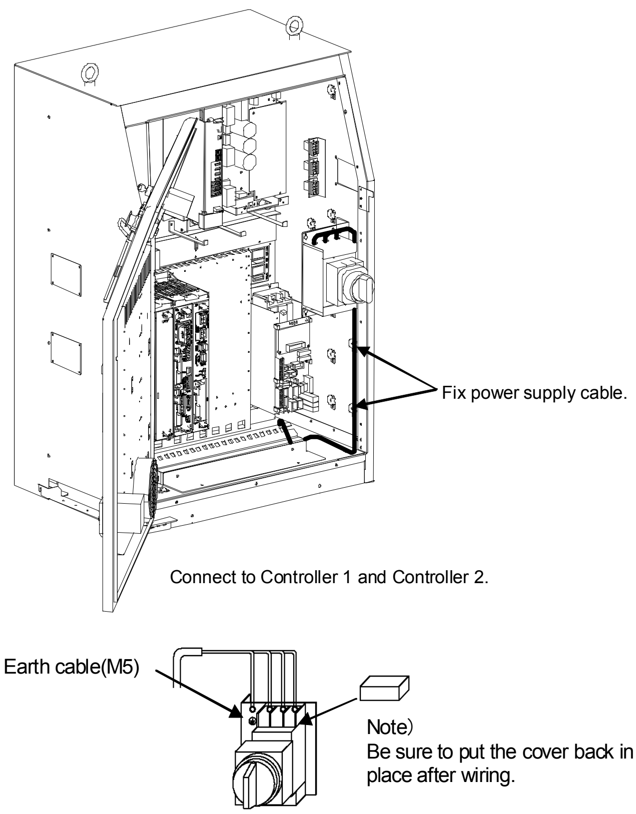


Fig.G.5(b) In case of B-cabinet

G.6 CONFIRMATIONS OF ON/OFF BY THE BREAKER FOR M-900*i*A/200P, M-2000*i*A

(1) In case of turn on, turn on the MAIN MACHINE DISCONNECT-2 (Breaker of Controller 2) first, and then turn on the MAIN MACHINE DISCONNECT-1 (Breaker of Controller 1). Or turn on both controllers at the same time.
(2) In case of turn off, turn off the MAIN MACHINE DISCONNECT-1 (Breaker of Controller 1) first, and then turn off the MAIN MACHINE DISCONNECT-2 (Breaker of Controller 2). Or turn off both controllers at the same time.

> ⚠ **WARNING**
> Turn off both MAIN MACHINE DISCONNECT-1 and MAIN MACHINE DISCONNECT-2 before servicing.

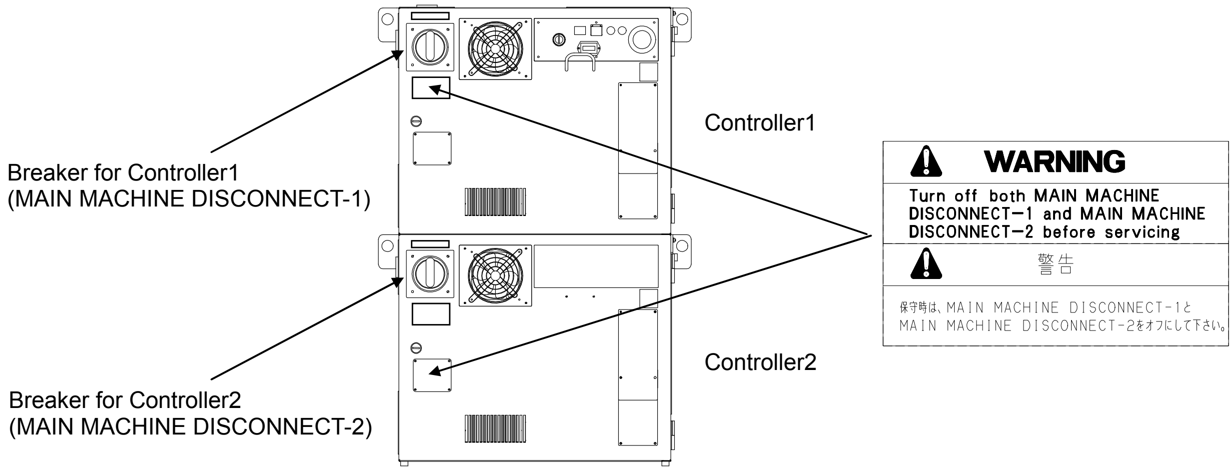


Fig.G.6(a) In case of A-cabinet

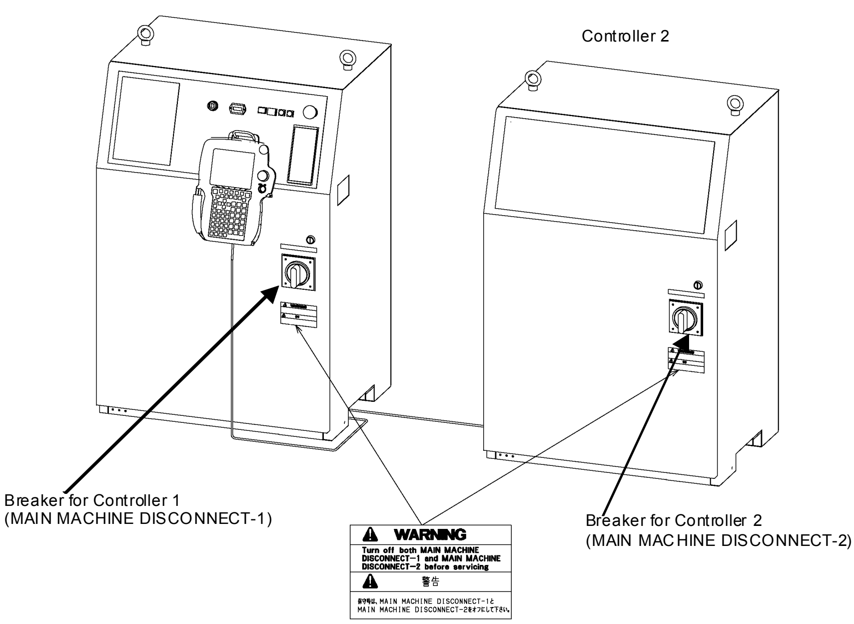


Fig.G.6(b) In case of B-cabinet

G.7 TOTAL CONNECTION DIAGRAM

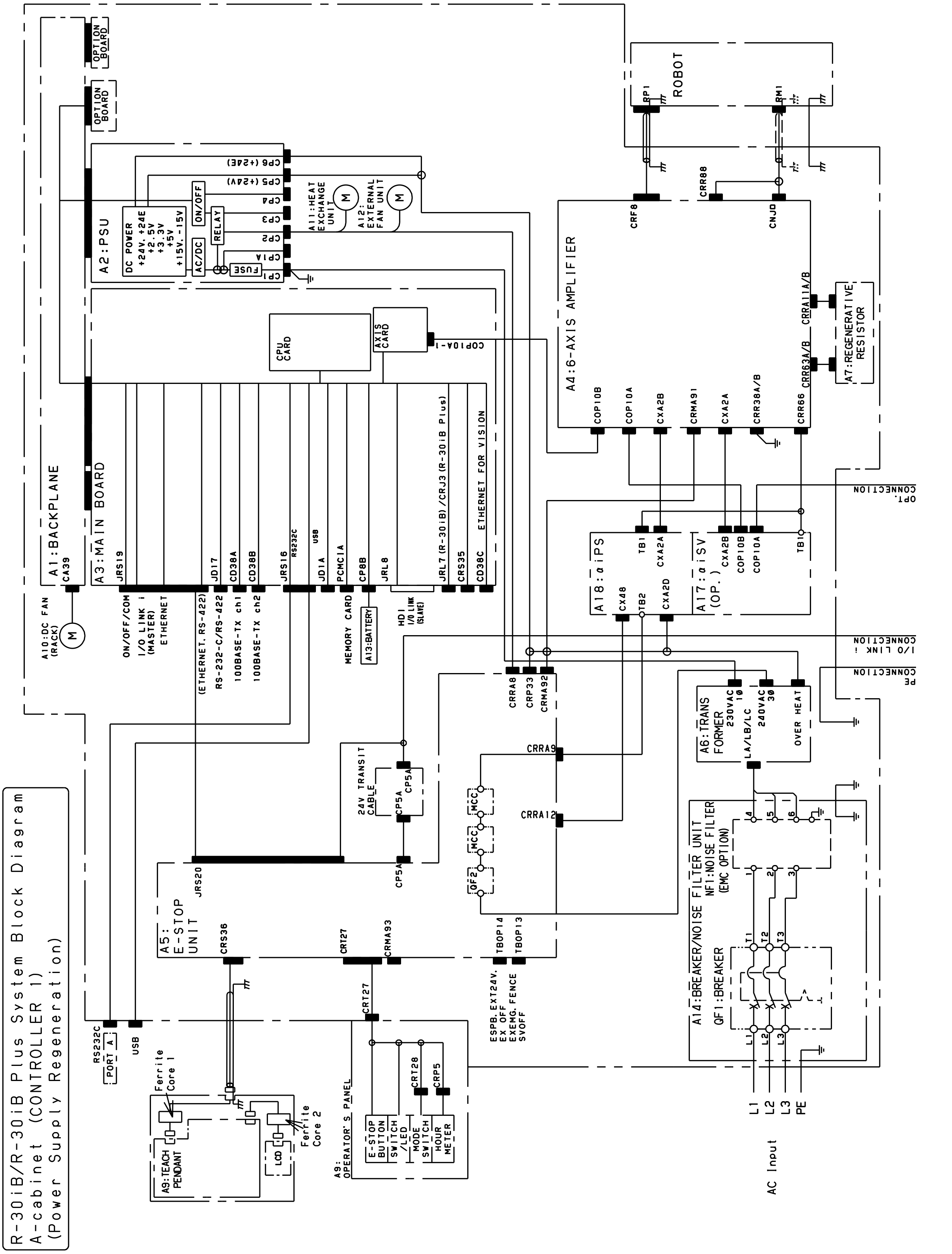


Fig.G.7(a) System block diagram (A-cabinet/Power supply regeneration/Controller 1)

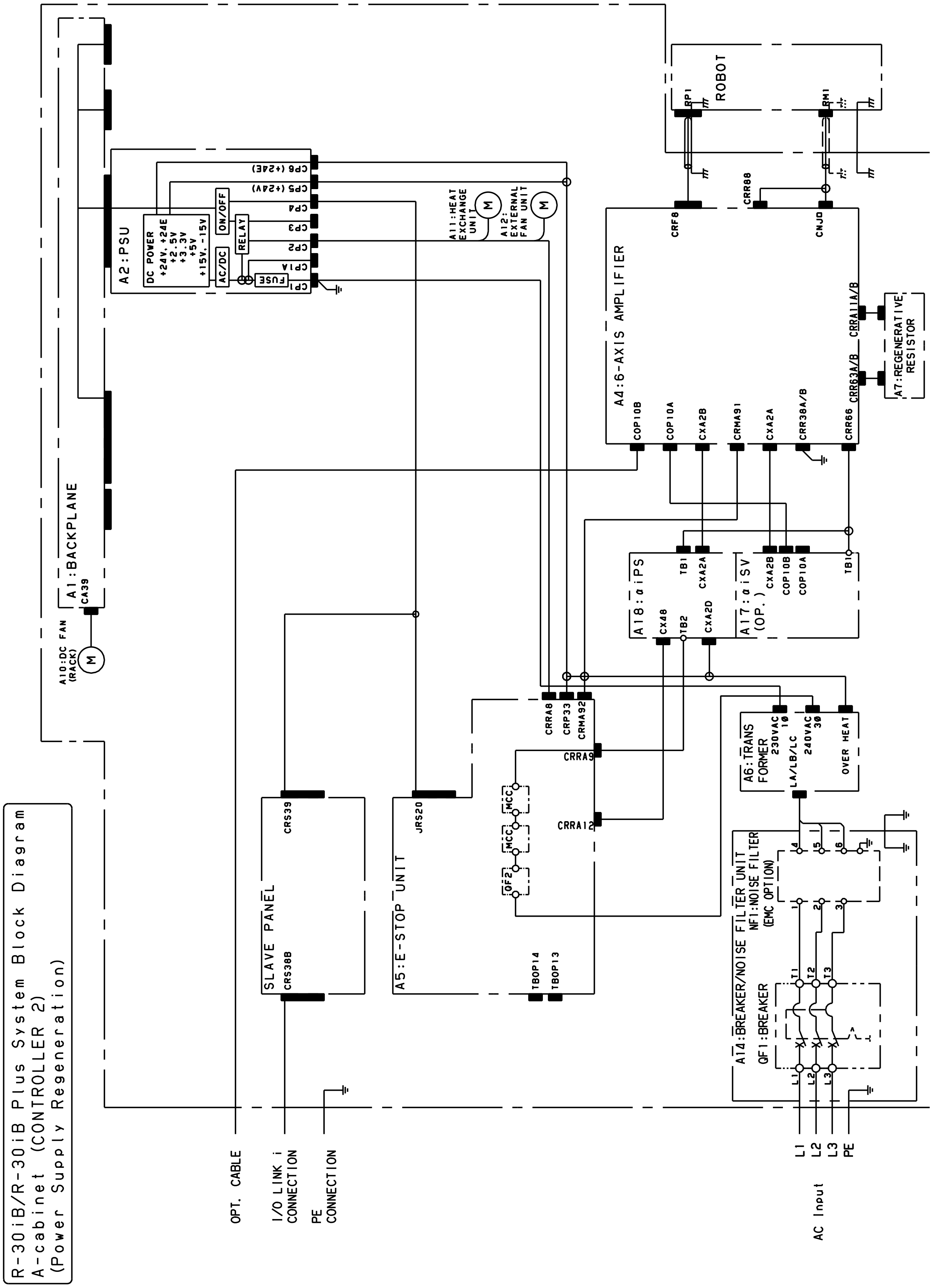


Fig.G.7(b) System block diagram (A-cabinet/Power supply regeneration/Controller 2)

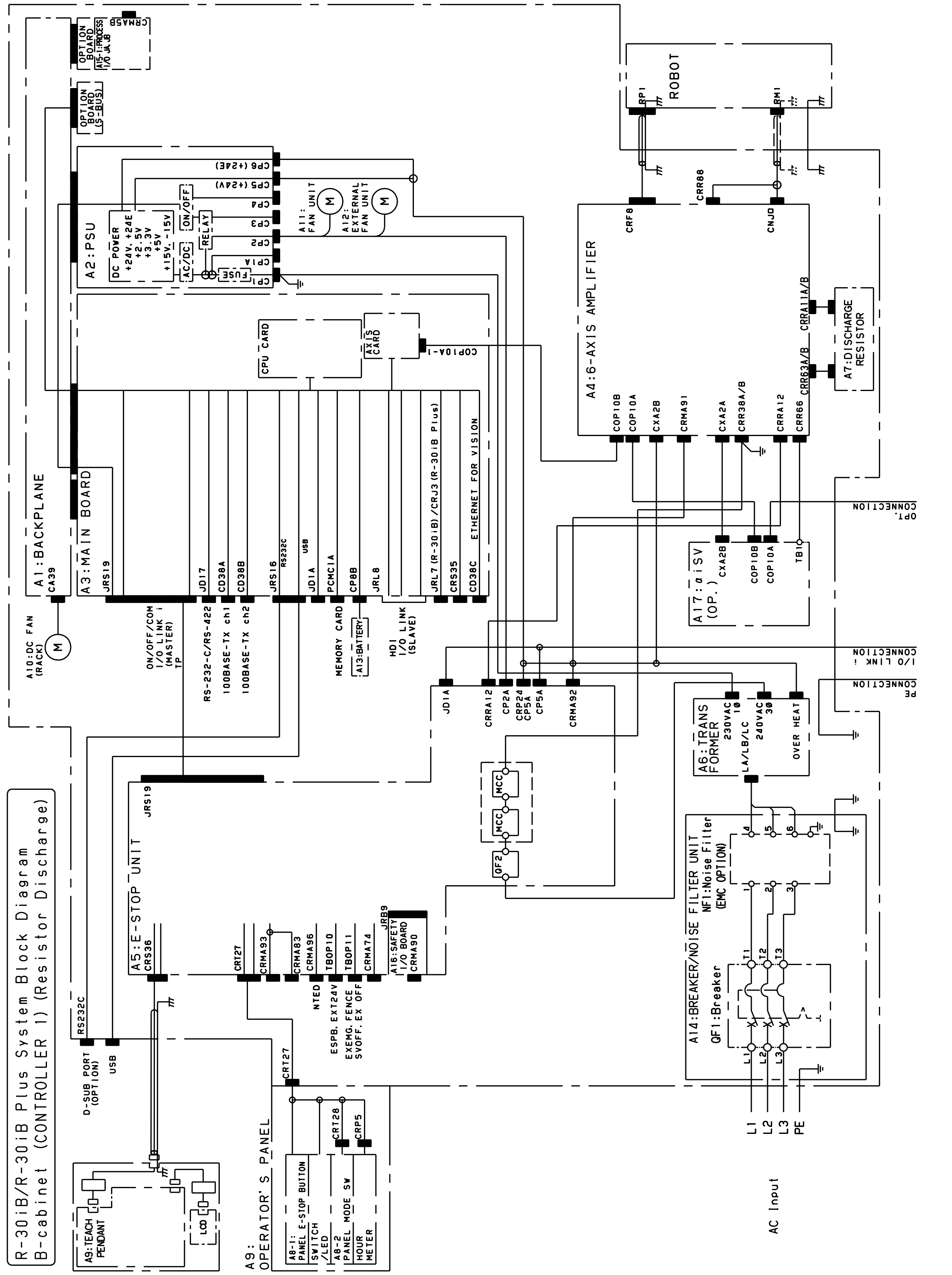


Fig.G.7(c) System block diagram (B-cabinet/Resistor discharge/Controller 1)

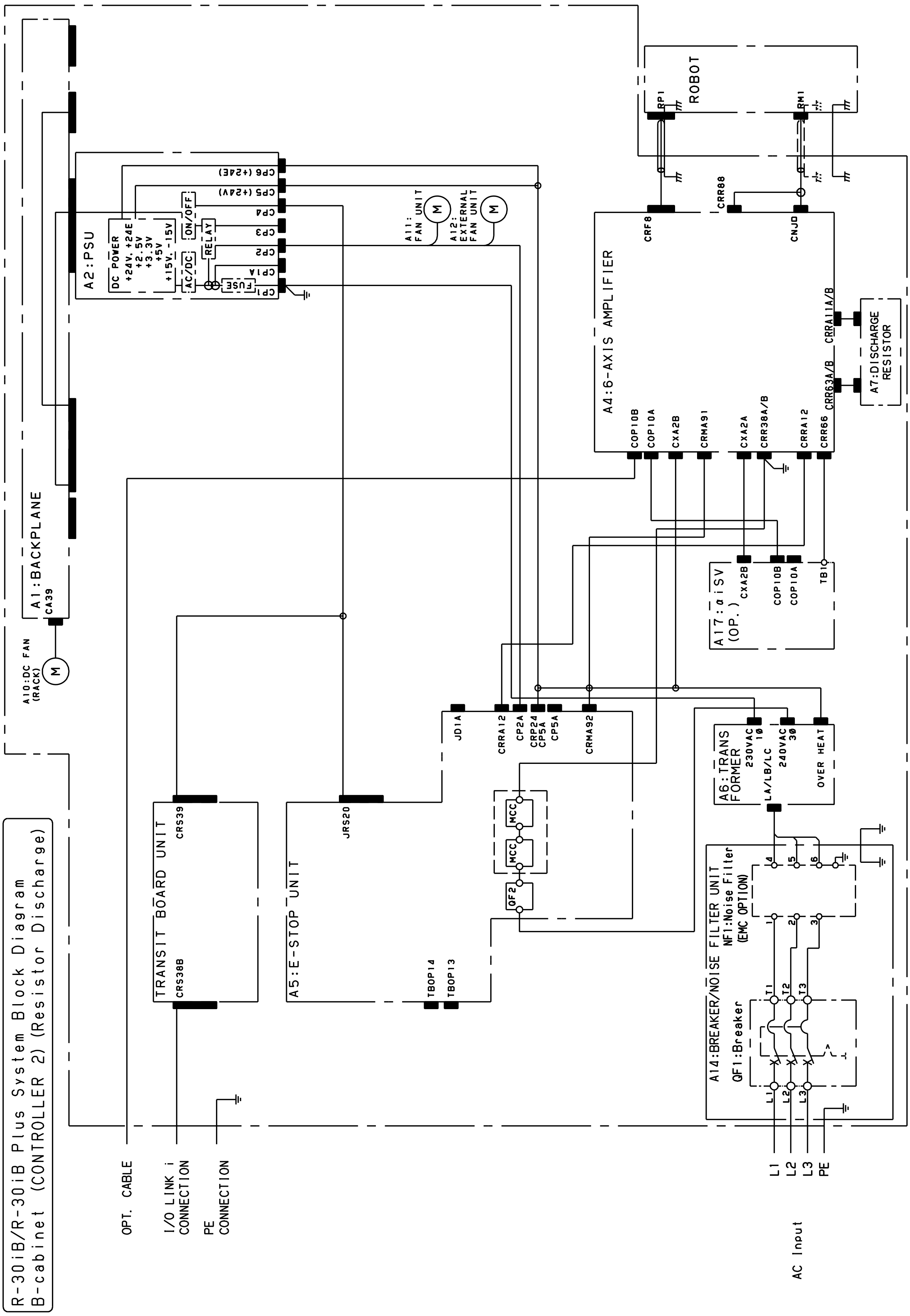


Fig.G.7(d) System block diagram (B-cabinet/ Resistor discharge/Controller 2)

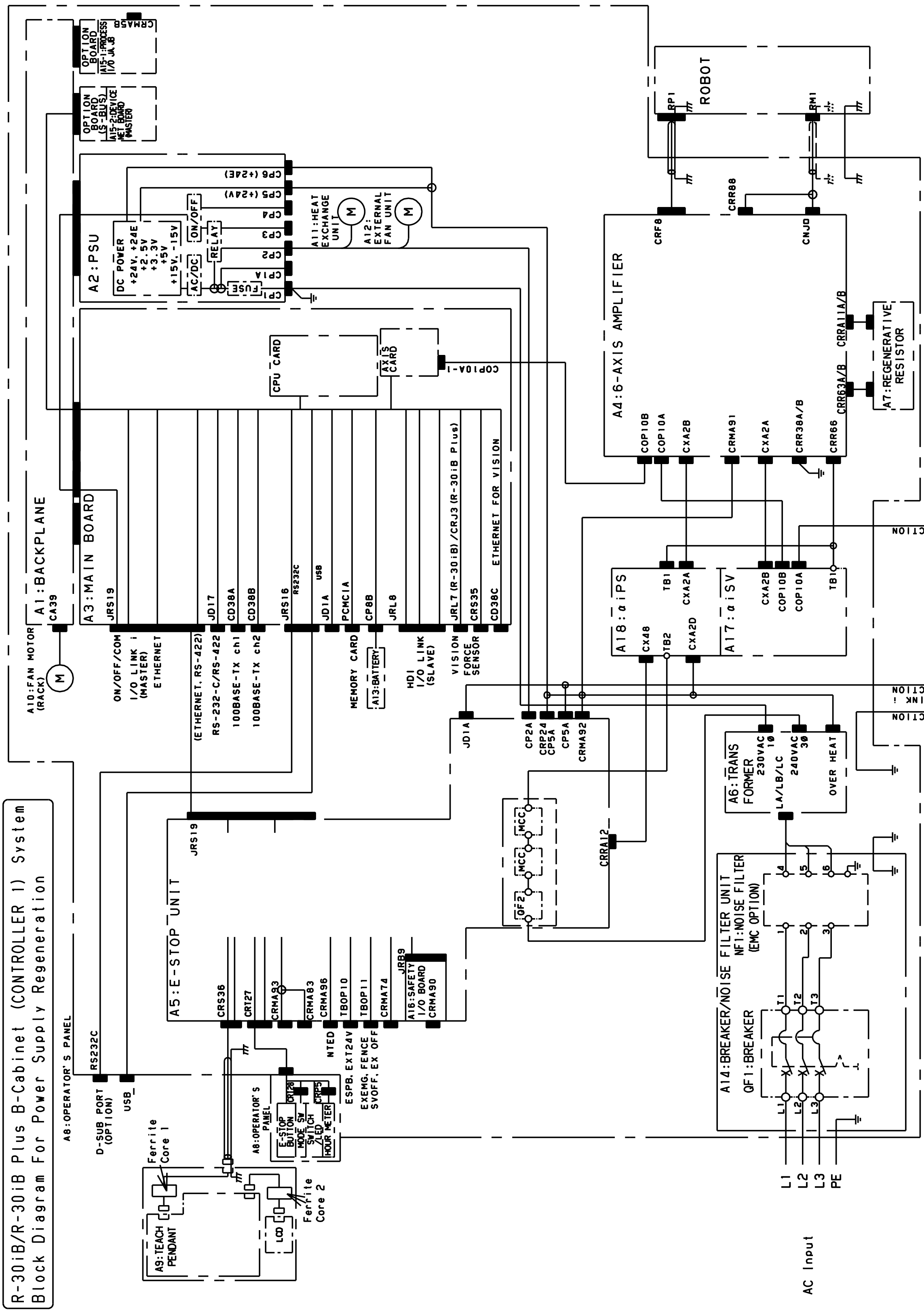


Fig.G.7(e) System block diagram (B-cabinet/Power supply regeneration/Controller 1)

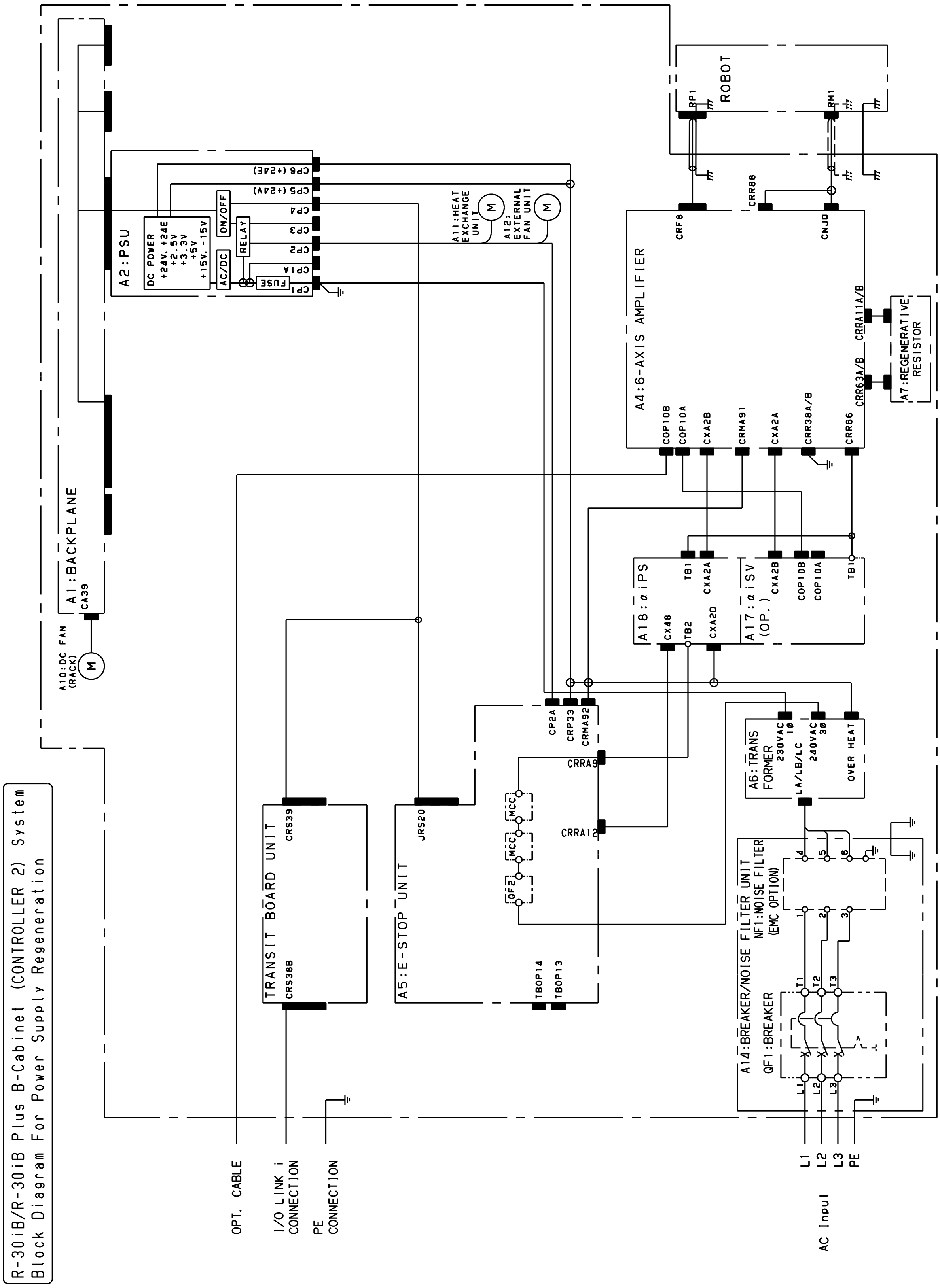


Fig.G.7(f) System block diagram (B-cabinet/Power supply regeneration/Controller 2)

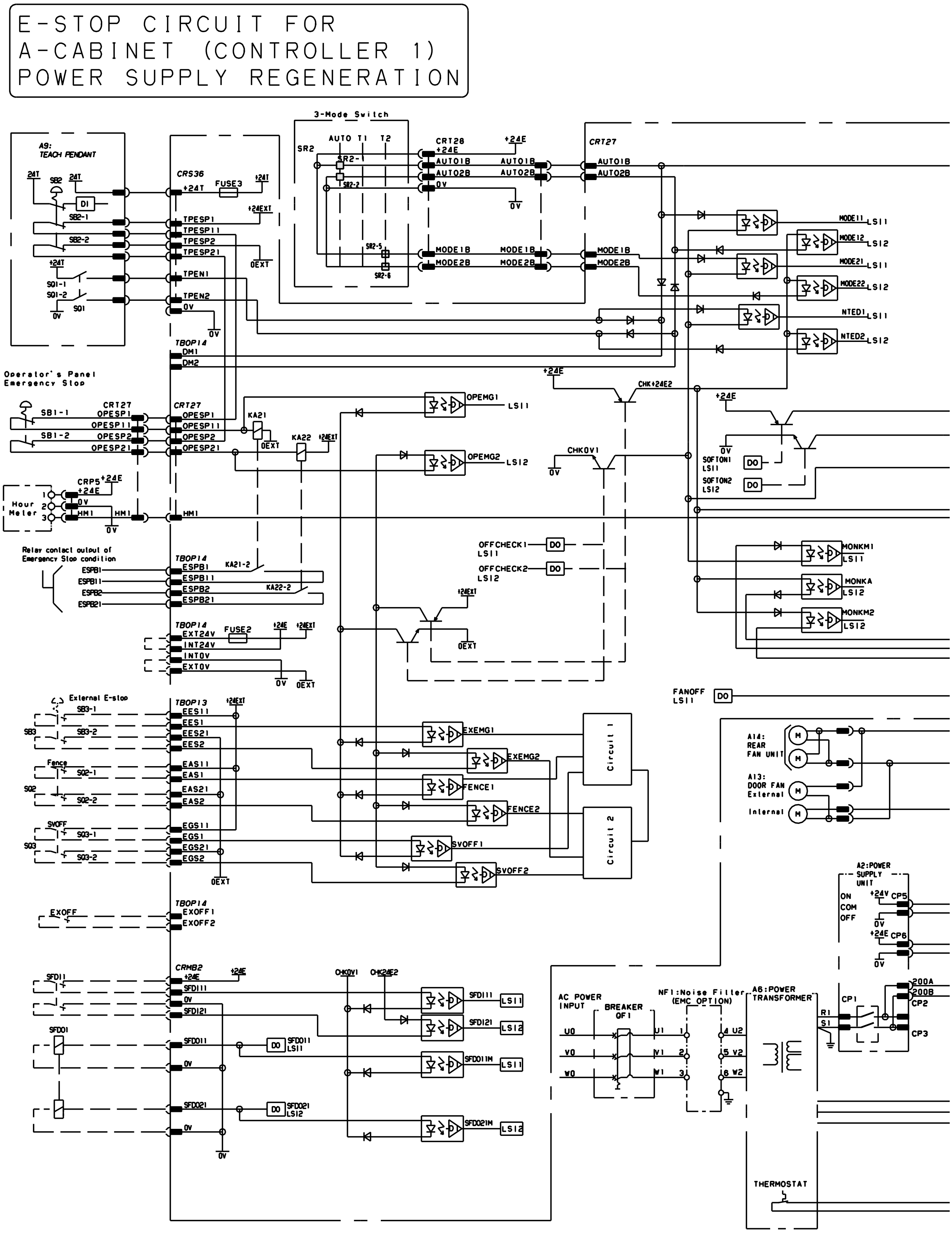
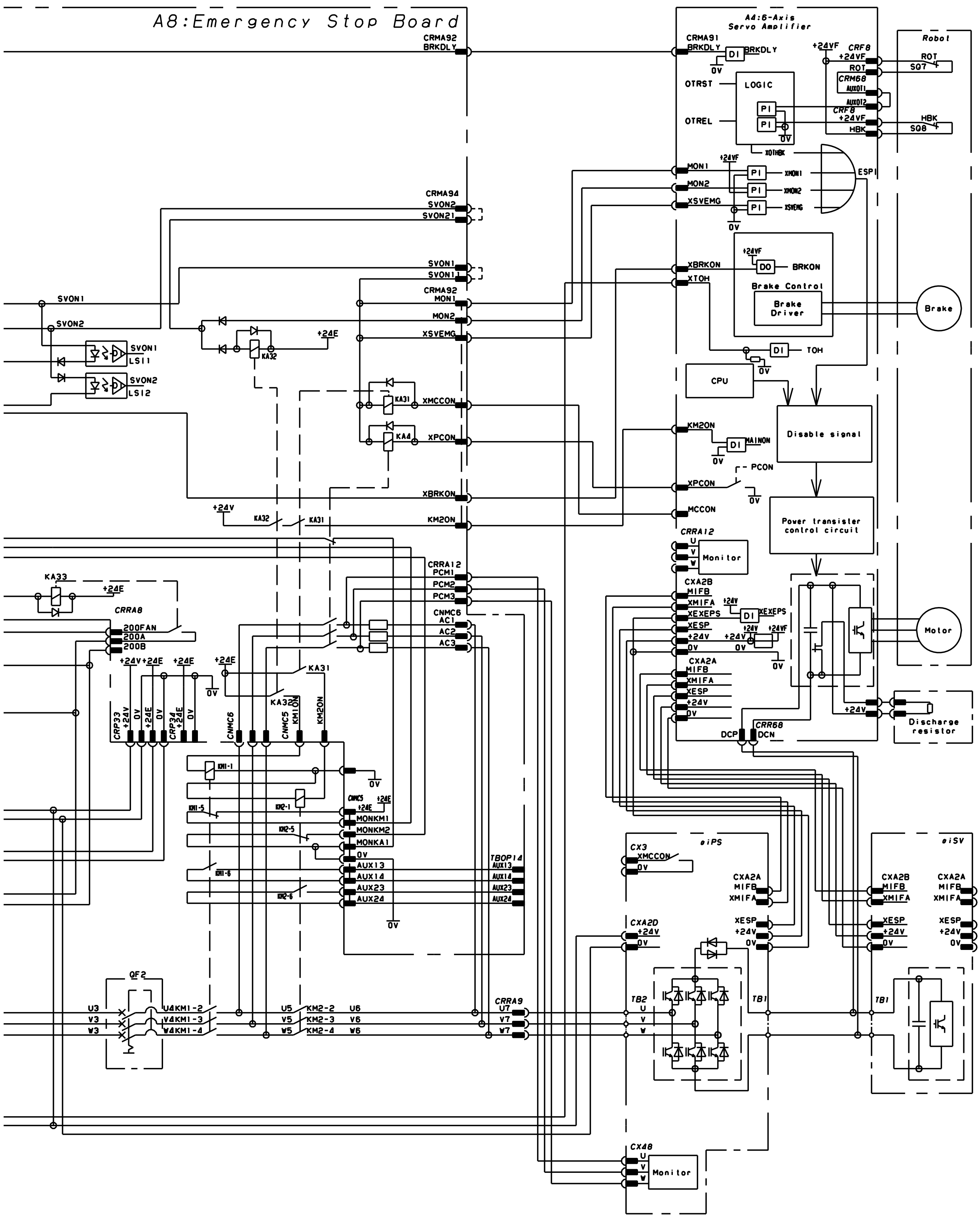


Fig.G.7(g) Emergency circuit connection diagram (A-cabinet/Power supply regeneration/Controller 1)


A8:Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
CRMA92
BRKDLY
CRMA91
LOGIC
OTRST
OTREL
CRF8
ROT
HBK
CRM68
MON1
MON2
XSVEMG
ESP1
CRMA94
SVON2
SVON21
SVON1
SVON11
XBRKON
XTOH
BRKON
Brake Control
Brake Driver
Brake
TOH
CPU
Disable signal
KM2ON
MAINON
XPCON
PCON
MCCON
XMCCON
Power transister control circuit
CRRA12
Monitor
CXA2B
MIFB
XMIFA
XEXEPS
XESP
CXA2A
Motor
Discharge resistor
CRR68
DCP
DCN
KA31
KA32
KA33
KA4
LS11
LS12
CRRA8
200FAN
200A
200B
CRP33
CRP34
CNMC6
CNMC5
KM1ON
PCM1
PCM2
PCM3
AC1
AC2
AC3
MONKM1
MONKM2
MONKA1
AUX13
AUX14
AUX23
AUX24
TBOP14
QF2
CRRA9
U7
V7
W7
CX3
eiPS
CXA2D
TB2
TB1
CX48
eiSV

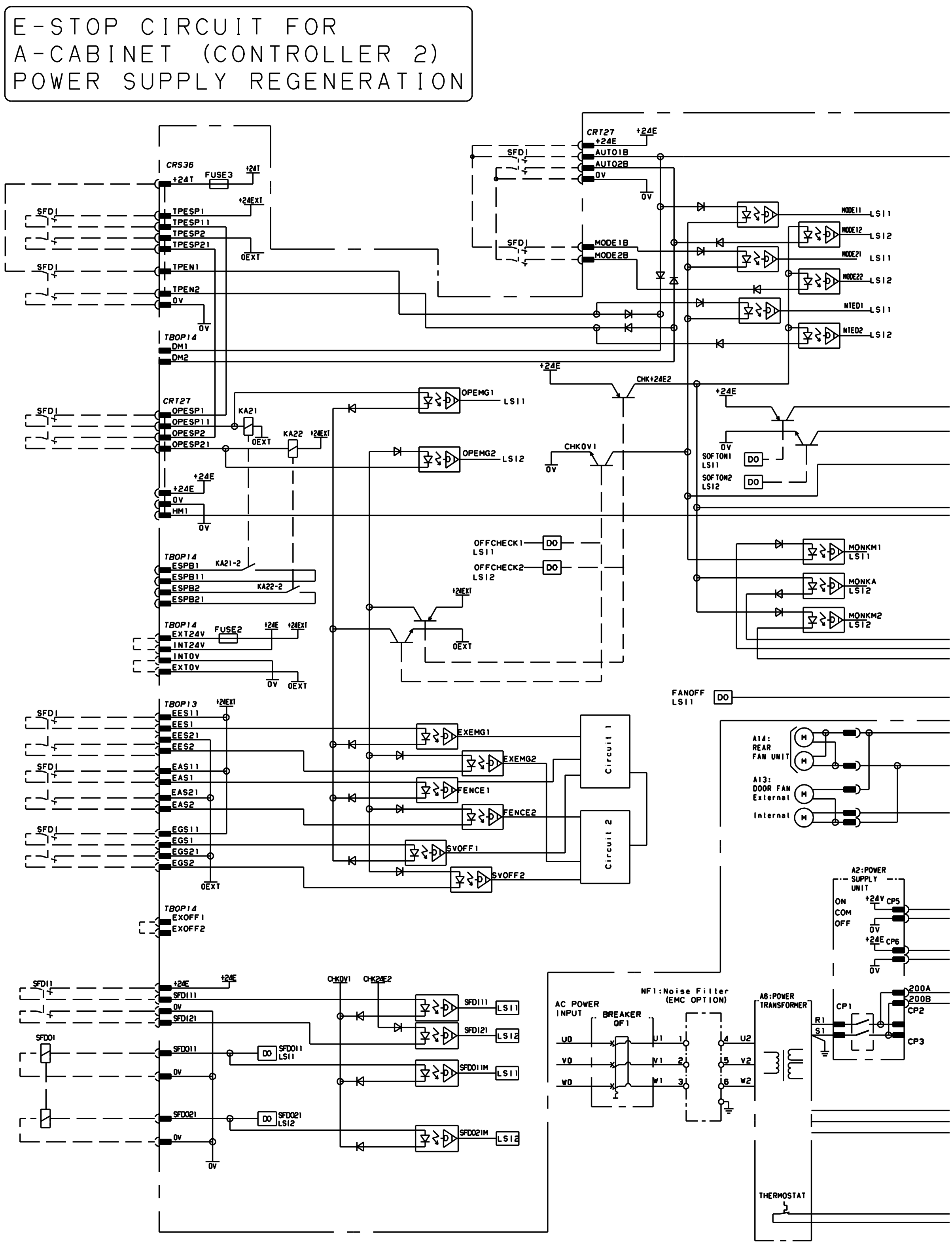
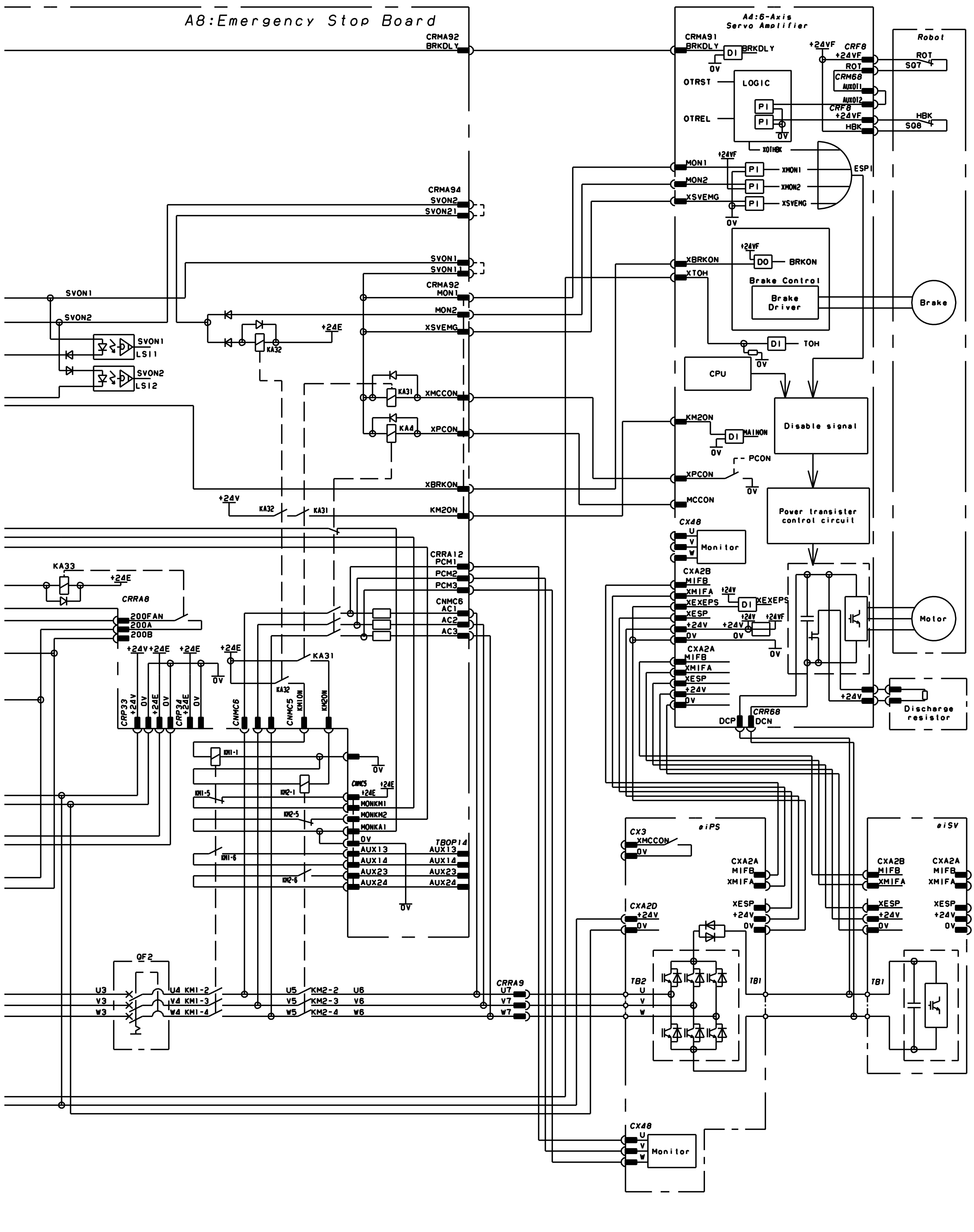


Fig.G.7(h) Emergency circuit connection diagram (A-cabinet/Power supply regeneration/Controller 2)



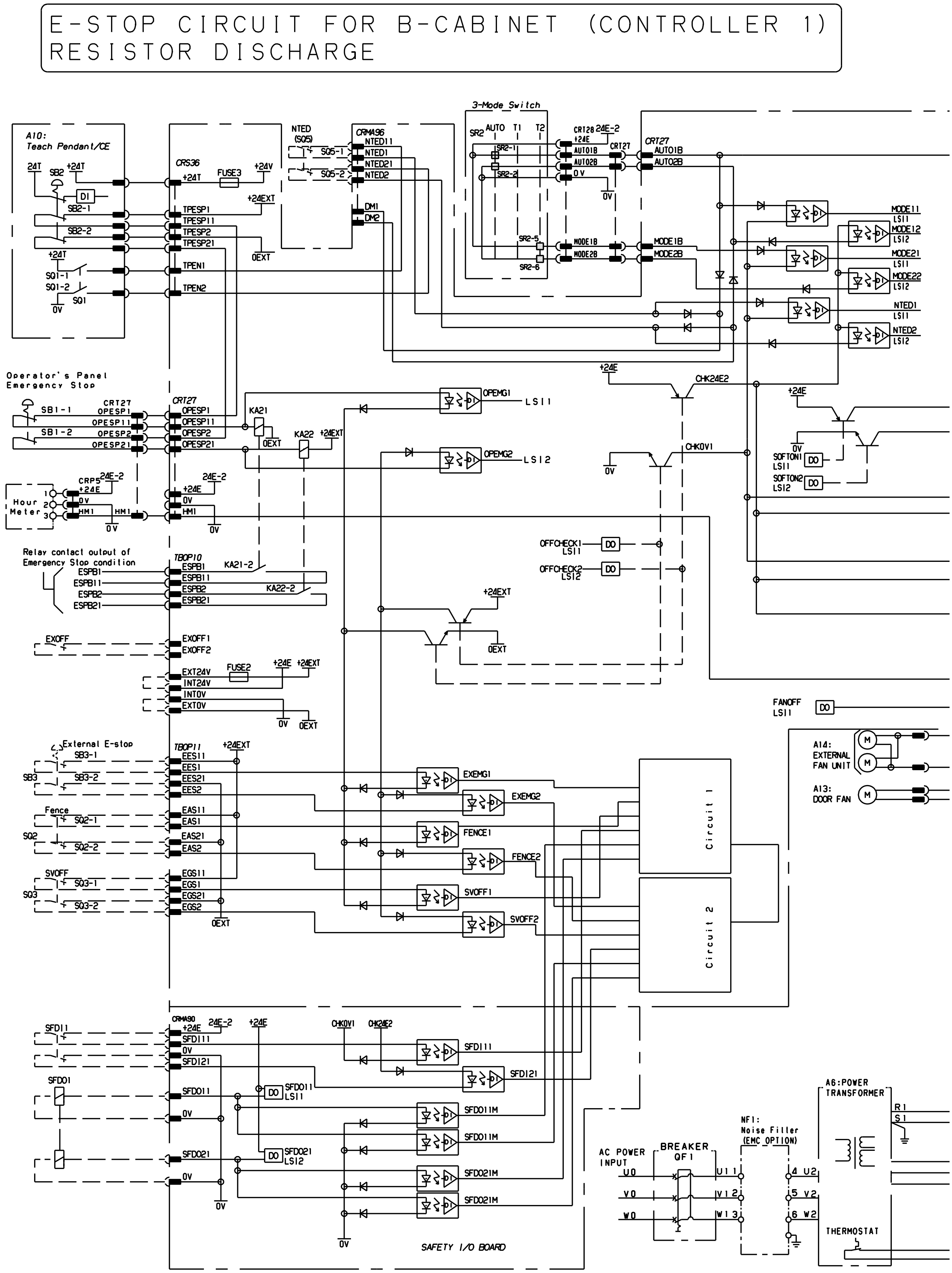
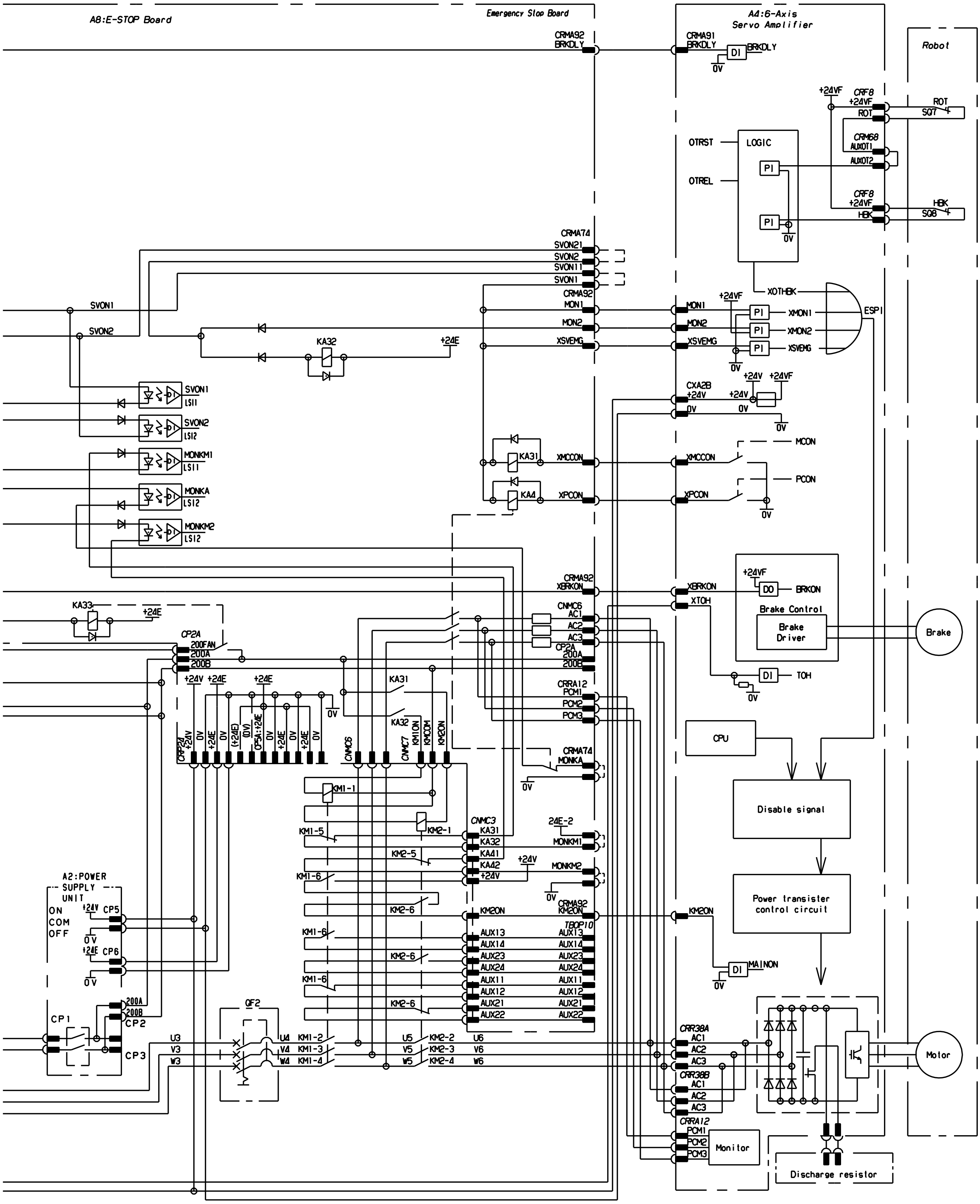


Fig.G.7(i) Emergency circuit connection diagram (B-cabinet/Resistor discharge/Controller 1)


A8:E-STOP Board
Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
A2:POWER SUPPLY UNIT
LOGIC
ESP1
Brake Control
Brake Driver
Brake
CPU
Disable signal
Power transistor control circuit
Motor
Monitor
Discharge resistor

E-STOP CIRCUIT FOR B-CABINET (CONTROLLER 2)
RESISTOR DISCHARGE

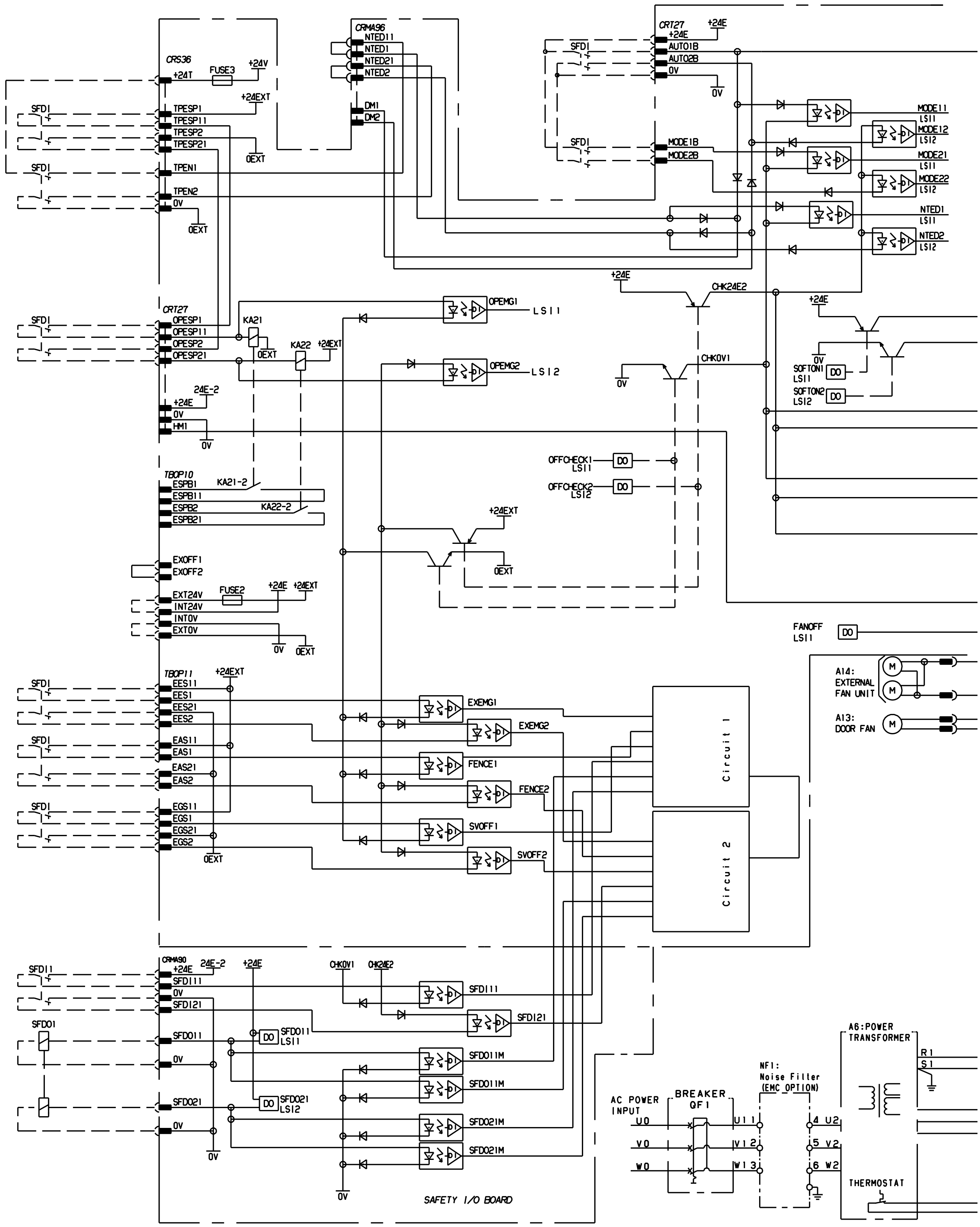
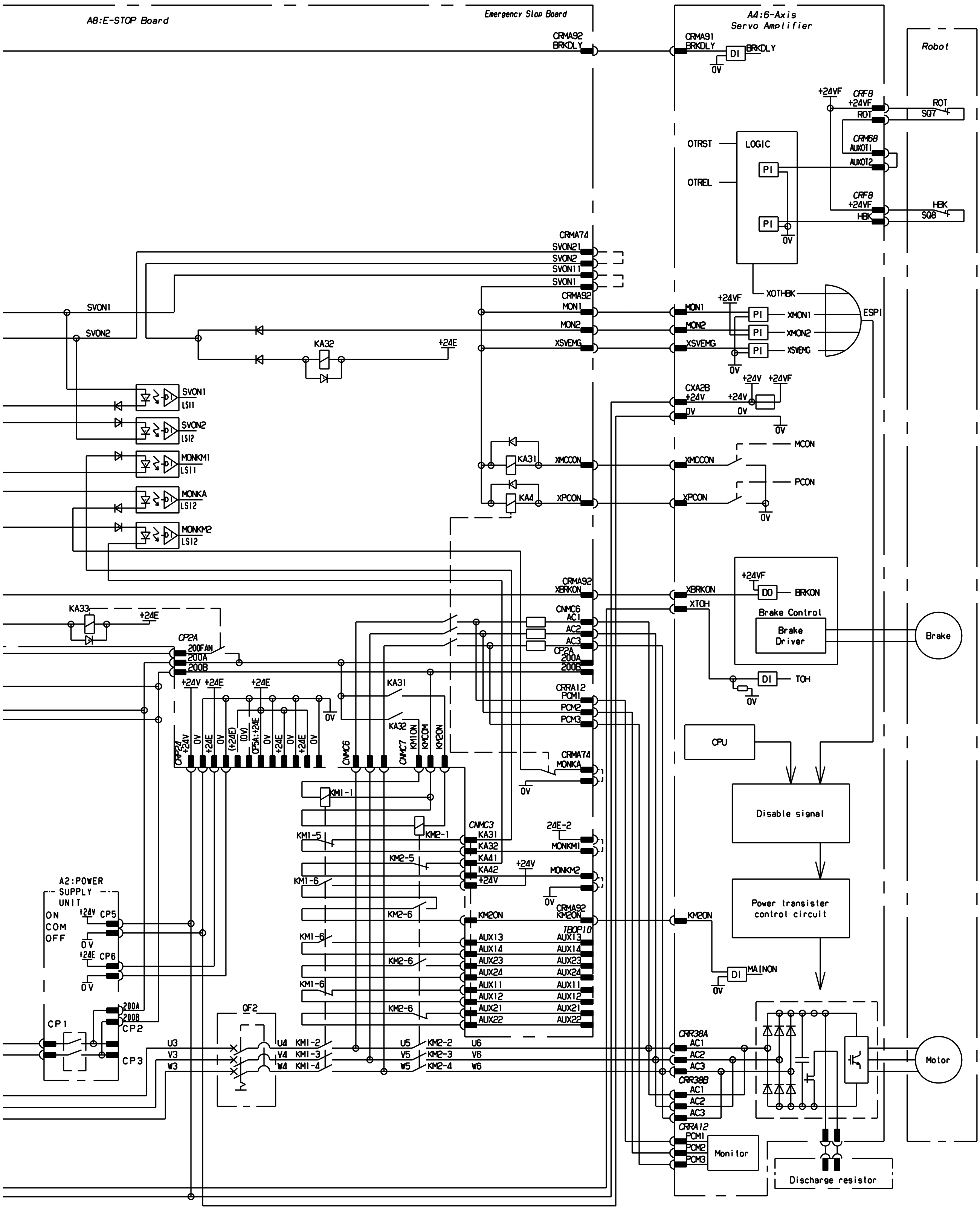


Fig.G.7(j) Emergency circuit connection diagram (B-cabinet/ Resistor discharge/Controller 2)


A8:E-STOP Board
Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
LOGIC
ESP1
Brake Control
Brake Driver
Brake
CPU
Disable signal
Power transister control circuit
Motor
Monitor
Discharge resistor
A2:POWER SUPPLY UNIT
ON
COM
OFF
QF2

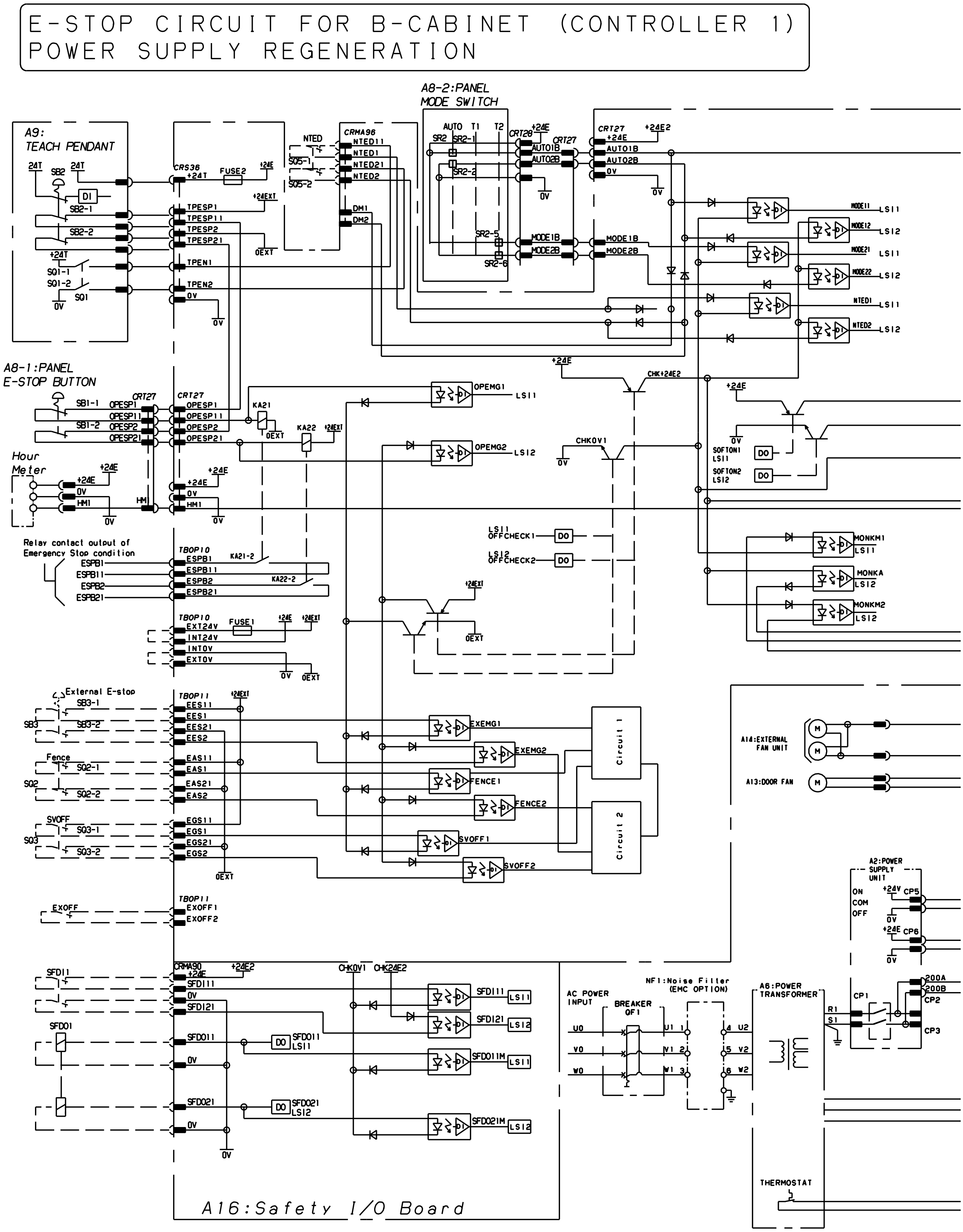
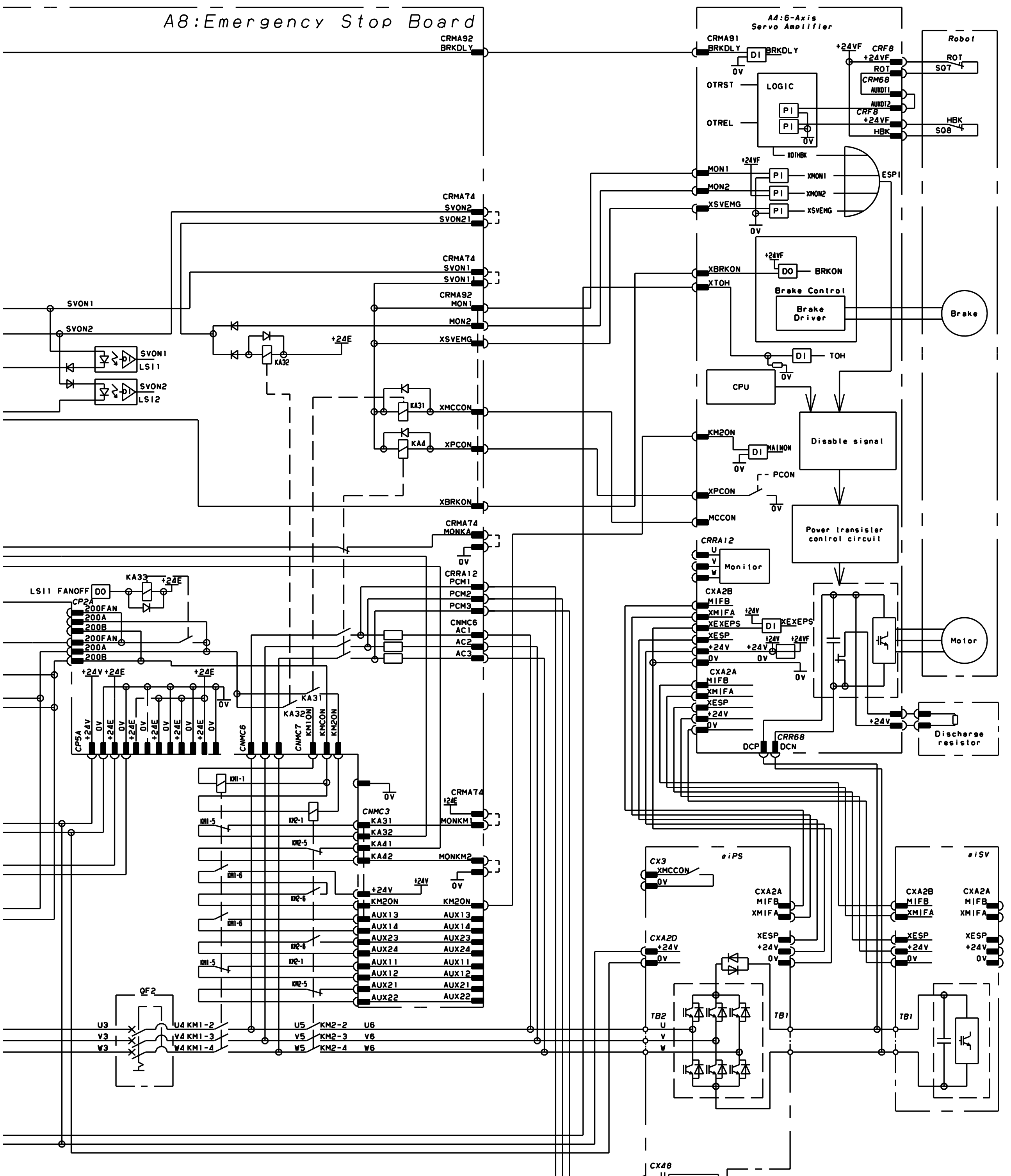


Fig.G.7(k) Emergency circuit connection diagram (B-cabinet/Power supply regeneration/Controller 1)


A8:Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
Brake Control
Brake Driver
Disable signal
Power transistor control circuit
Monitor
Motor
Brake
Discharge resistor
αiPS
αiSV

E-STOP CIRCUIT FOR B-CABINET (CONTROLLER 2)
POWER SUPPLY REGENERATION

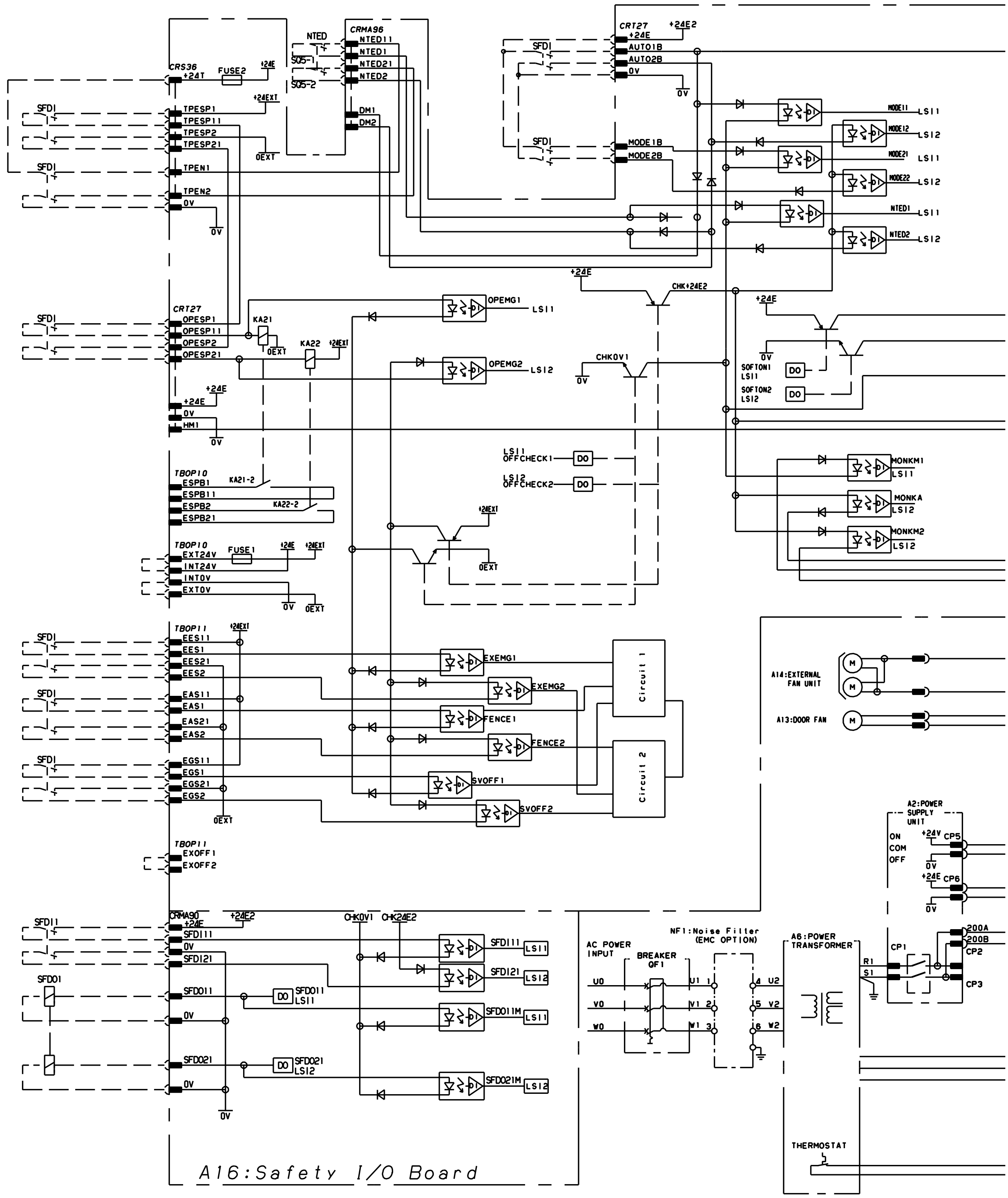
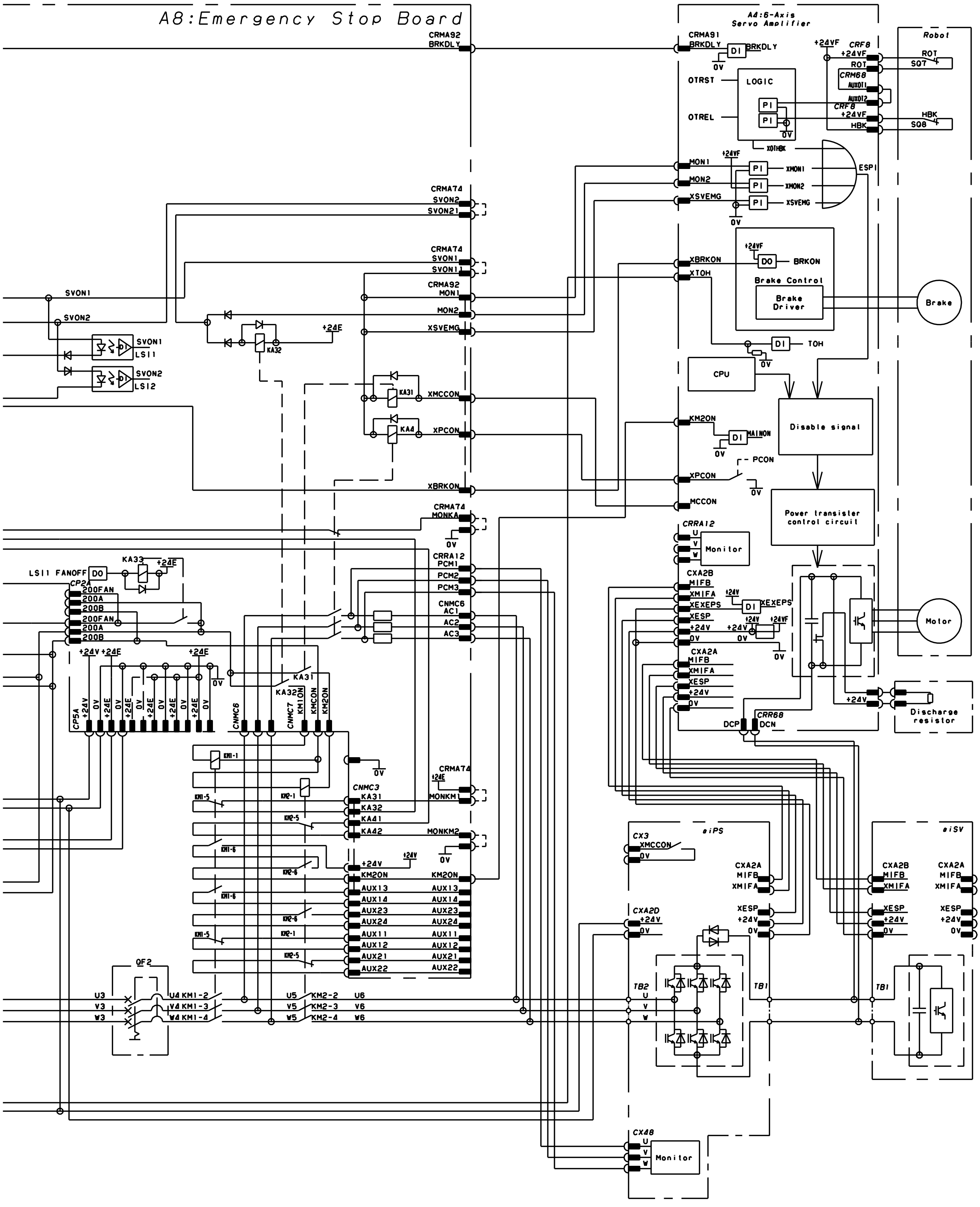
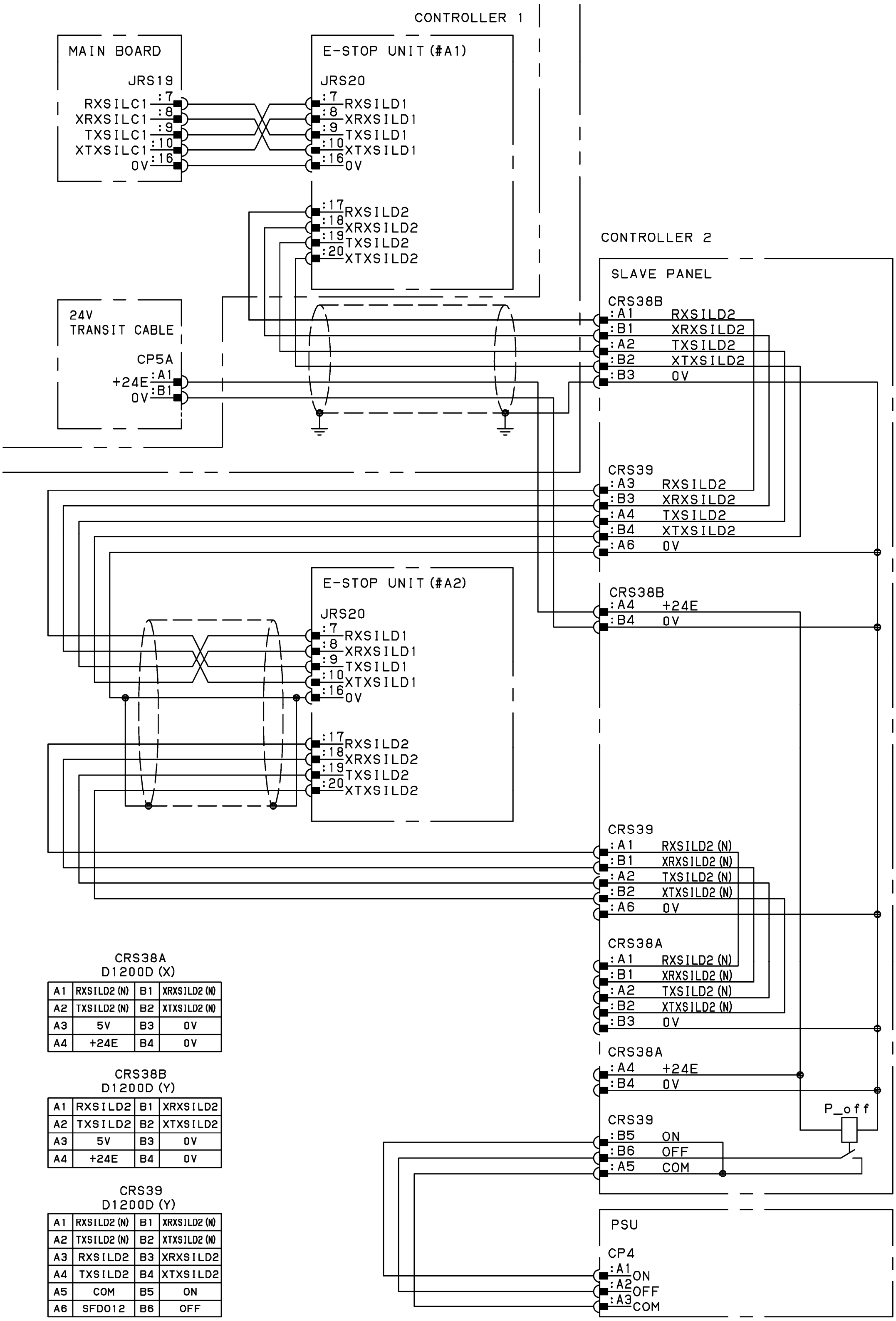


Fig.G.7(l) Emergency circuit connection diagram (B-cabinet/Power supply regeneration/Controller 2)


A8:Emergency Stop Board
A4:6-Axis Servo Amplifier
Robot
CRMA92
BRKDLY
CRMA91
DI
0V
+24VF
CRF8
RO1
SO7
CRM68
OTRST
LOGIC
PI
OTREL
HBK
SO8
MON1
MON2
XSVEMG
XMON1
XMON2
ESP1
CRMA74
SVON2
SVON21
SVON1
SVON11
XBRKON
XTOH
DO
BRKON
Brake Control
Brake Driver
Brake
TOH
CPU
Disable signal
KM2ON
MAINON
XPCON
PCON
MCCON
Power transister control circuit
CRRA12
Monitor
CXA2B
MIFB
XMIFA
XEXEPS
XESP
+24V
CXA2A
Motor
Discharge resistor
CRR68
DCP
DCN
LSI1
LSI2
KA32
KA31
KA4
+24E
XMCCON
XPCON
XBRKON
MONKA
PCM1
PCM2
PCM3
CNMC6
AC1
AC2
AC3
KA33
LSI1 FANOFF
CP2A
200FAN
200A
200B
CP5A
CNMC6
CNMC7
KM1ON
KMCON
KM2ON
CNMC3
KA41
KA42
MONKM1
MONKM2
AUX13
AUX14
AUX23
AUX24
AUX11
AUX12
AUX21
AUX22
QF2
U3
V3
W3
U4 KM1-2
V4 KM1-3
W4 KM1-4
U5
V5
W5
KM2-2
KM2-3
KM2-4
U6
V6
W6
CX3
XMCCON
αiPS
αiSV
CXA2D
TB2
TB1
CX48

CONNECTION BETWEEN CONTROLLER 1 AND 2 (A-CABINET)



CRS38A
D1200D (X)

A1	RXSILD2 (N)	B1	XRXSILD2 (N)
A2	TXSILD2 (N)	B2	XTXSILD2 (N)
A3	5V	B3	0V
A4	+24E	B4	0V

CRS38B
D1200D (Y)

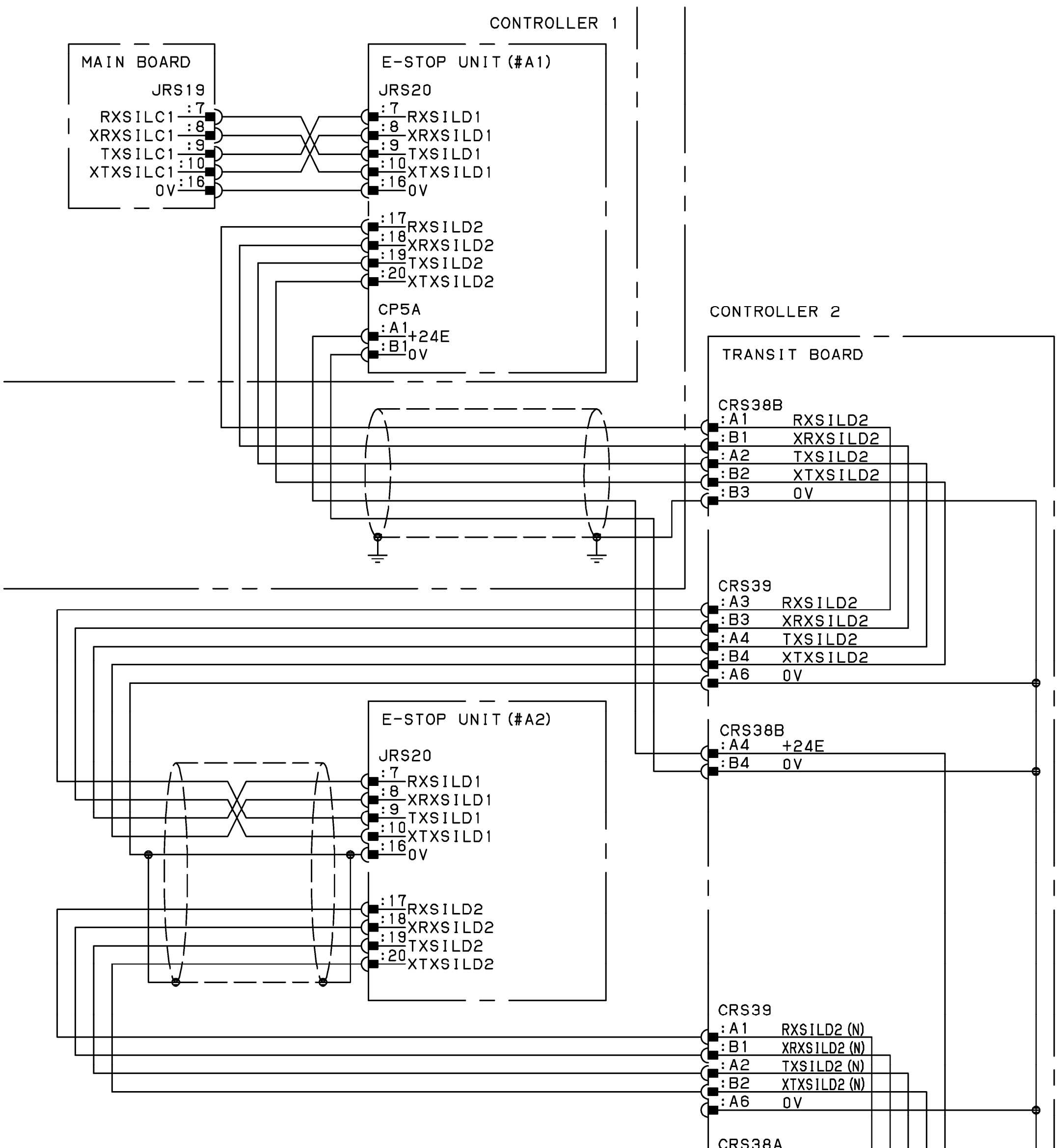
A1	RXSILD2	B1	XRXSILD2
A2	TXSILD2	B2	XTXSILD2
A3	5V	B3	0V
A4	+24E	B4	0V

CRS39
D1200D (Y)

A1	RXSILD2 (N)	B1	XRXSILD2 (N)
A2	TXSILD2 (N)	B2	XTXSILD2 (N)
A3	RXSILD2	B3	XRXSILD2
A4	TXSILD2	B4	XTXSILD2
A5	COM	B5	ON
A6	SFD012	B6	OFF

Fig.G.7(m) Connection between controller 1 and 2 (A-cabinet)

CONNECTION BETWEEN CONTROLLER 1 AND 2 (B-CABINET)



CRS38A
D1200D (X)

A1	RXSILD2 (N)	B1	XRXSILD2 (N)
A2	TXSILD2 (N)	B2	XTXSILD2 (N)
A3	5V	B3	0V
A4	+24E	B4	0V

CRS38B
D1200D (Y)

A1	RXSILD2	B1	XRXSILD2
A2	TXSILD2	B2	XTXSILD2
A3	5V	B3	0V
A4	+24E	B4	0V

CRS39
D1200D (Y)

A1	RXSILD2 (N)	B1	XRXSILD2 (N)
A2	TXSILD2 (N)	B2	XTXSILD2 (N)
A3	RXSILD2	B3	XRXSILD2
A4	TXSILD2	B4	XTXSILD2
A5	COM	B5	ON
A6	SFDO12	B6	OFF

Fig.G.7(n) Connection between controller 1 and 2 (B-cabinet)

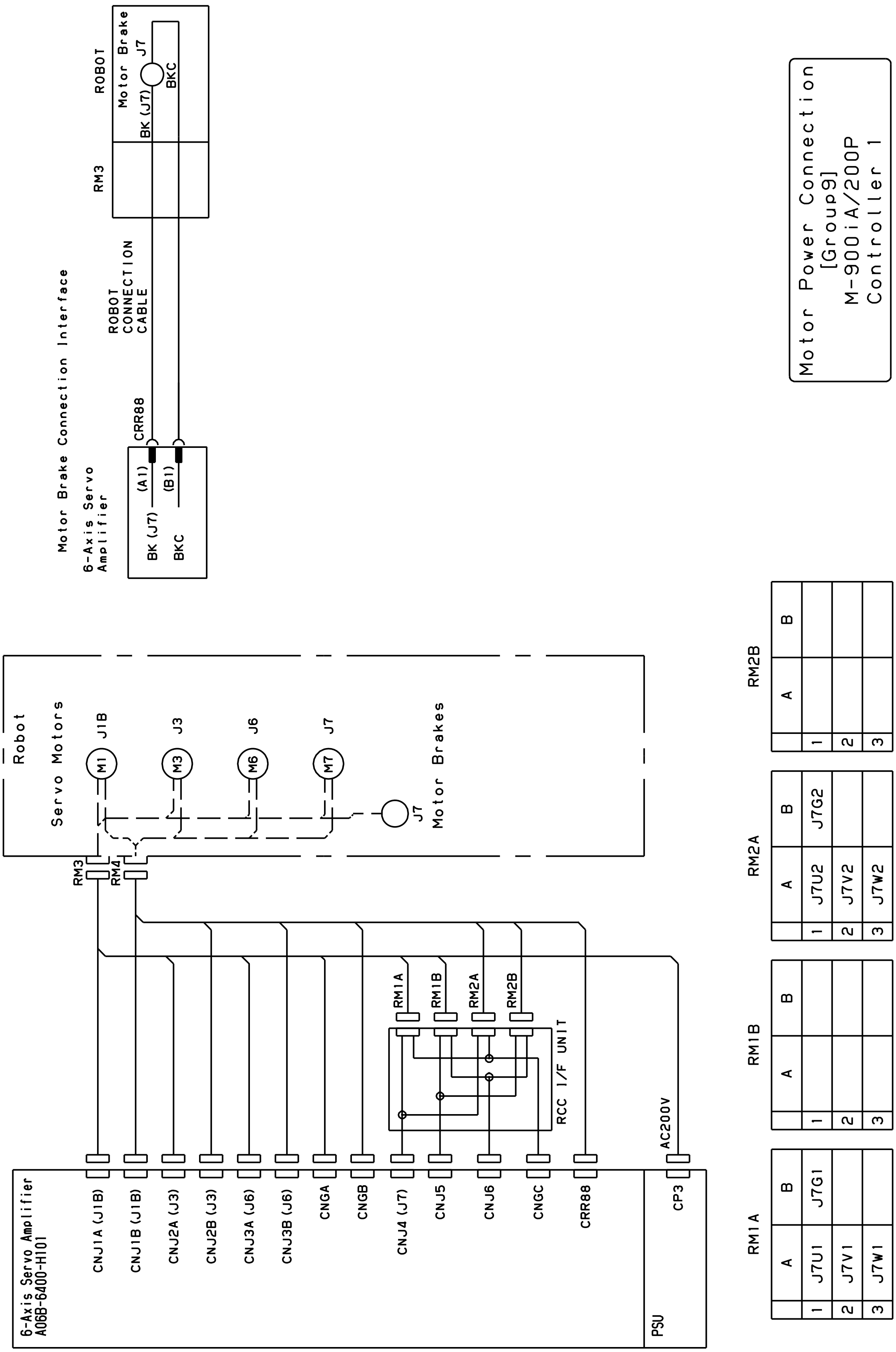
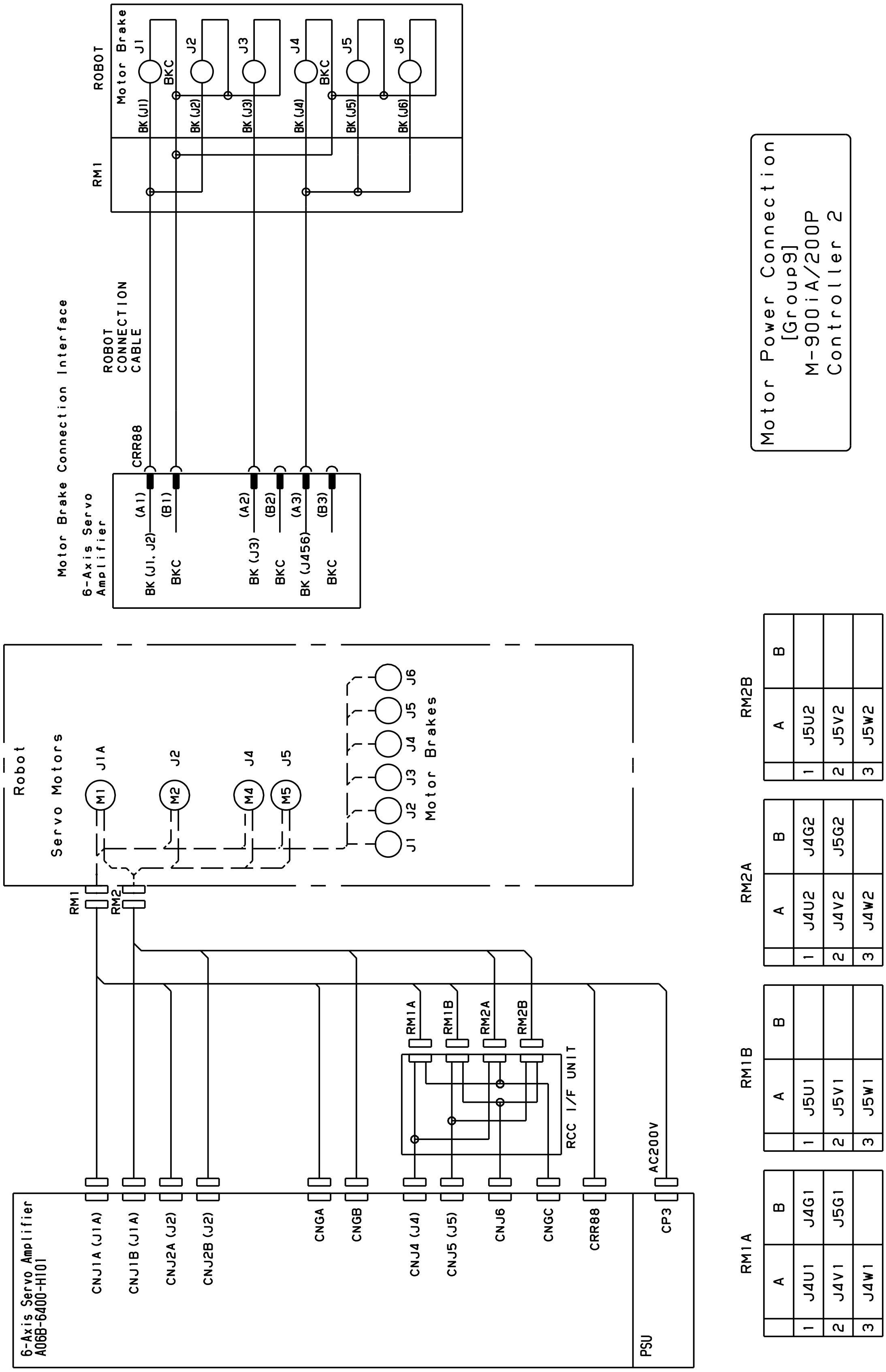


Fig.G.7(o) Motor power connection (Group 9:M-900*i*A/200P, Controller 1)



RM1A

	A	B
1	J4U1	J4G1
2	J4V1	J5G1
3	J4W1	

RM1B

	A	B
1	J5U1	
2	J5V1	
3	J5W1	

RM2A

	A	B
1	J4U2	J4G2
2	J4V2	J5G2
3	J4W2	

RM2B

	A	B
1	J5U2	
2	J5V2	
3	J5W2	

Fig.G.7(p) Motor power connection (Group 9:M-900*i*A/200P, Controller 2)

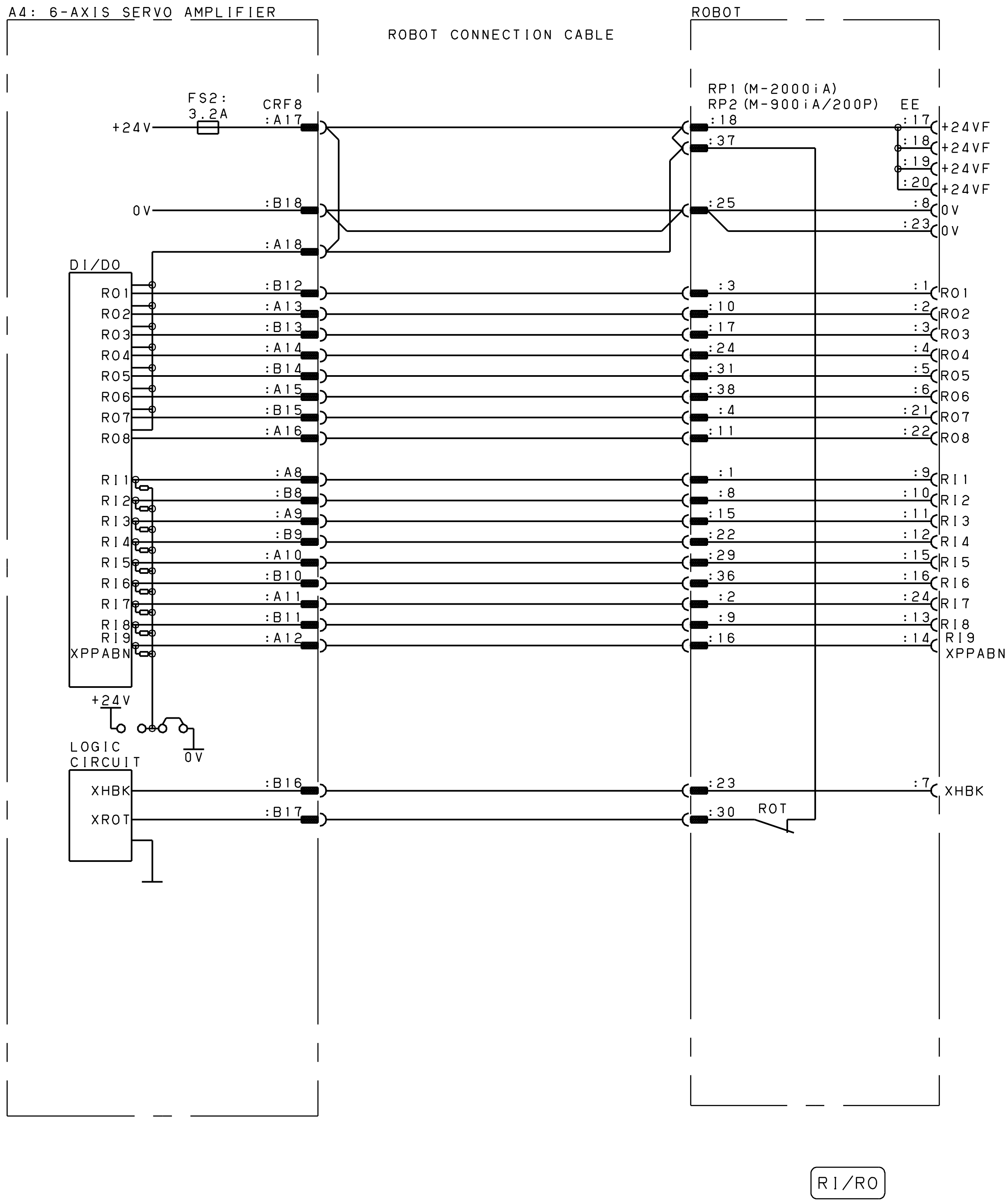
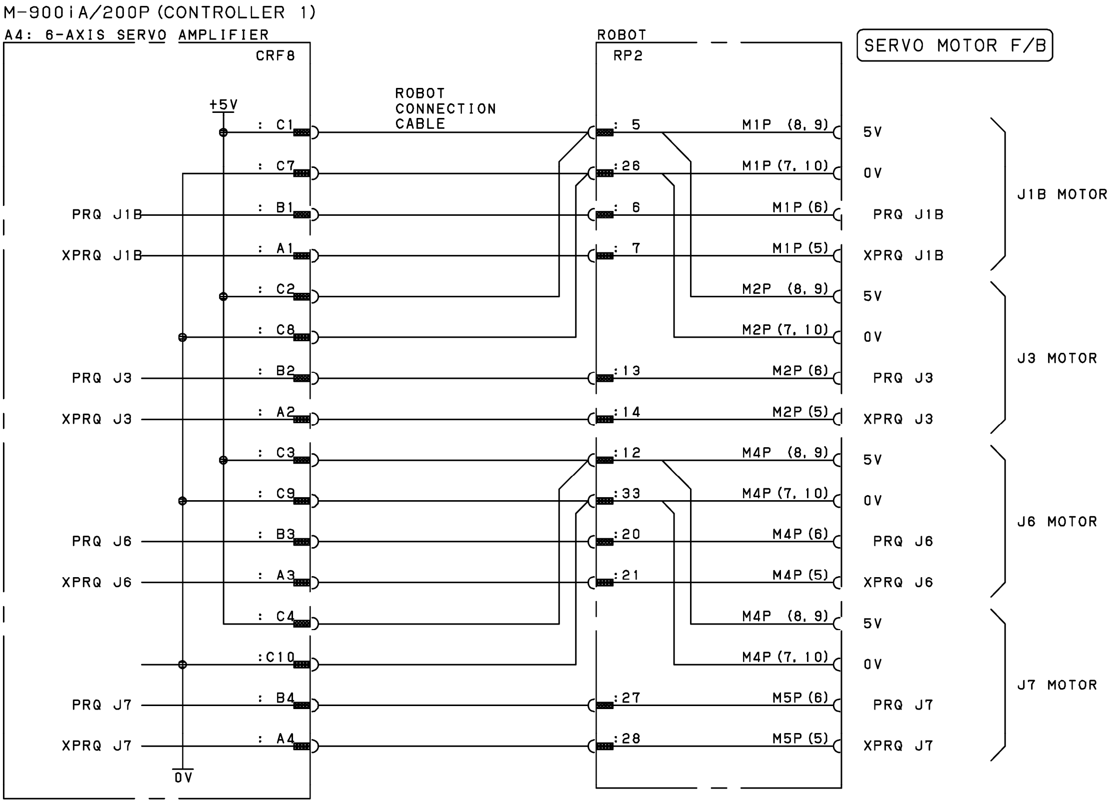


Fig.G.7(q) RI/RO connection diagram (Group 9:M-900*i*A/200P)



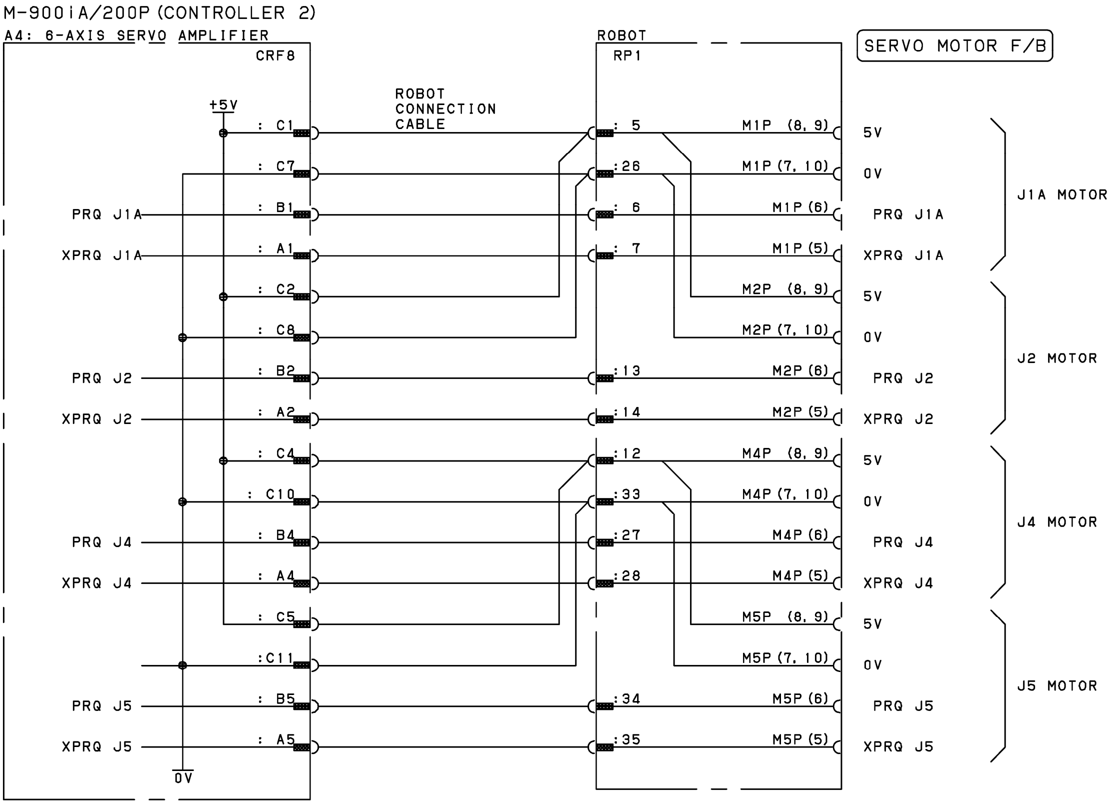


Fig.G.7(r) Pulsecoder signal connection diagram (Group 9:M-900*i*A/200P)

Group9 (CONTROLLER 1)

RP2
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9 (XPPABN)	23	XHBK	30	XROT	37	24VF (OT)
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF	25	0V	32		39	
5	5V (J1B, J3)	12	5V (J6, J7)	19		26	0V (J1B, J3)	33	0V (J6, J7)	40	
6	PRQJ1B	13	PRQJ3	20	PRQJ6	27	PRQJ7	34		41	
7	XPRQJ1B	14	XPRQJ3	21	XPRQJ6	28	XPRQJ7	35		42	

RM3
(MOTOR Power & Brake power)

1	AC200A (2)	14	J1BV1	24	J1BW1	34	AC200B (2)
2	J1BU1	15	J1BV1	25	J1BW1	35	J1BG1
3	J1BU1	16	J3V1	26	J3W1	36	J1BG1
4	J3U1	17	J3V1	27	J3W1	37	J3G1
5	J3U1	18	J6V1	28	J6W1	38	J3G1
6	J6U1	19	J6V1	29	J6W1	39	J6G1
7	J6U1	20	J7V1	30	J7W1	40	J6G1
8	J7U1	21		31		41	J7G1
9		22		32		42	
10		23		33		43	
11	BK (J7)					44	
12	BKC (2)					45	
13	BKC (2)					46	

RM4
(MOTOR Power & Brake power)

1		14	J1BV2	24	J1BW2	34	
2	J1BU2	15	J1BV2	25	J1BW2	35	J1BG2
3	J1BU2	16	J3V2	26	J3W2	36	J1BG2
4	J3U2	17	J3V2	27	J3W2	37	J3G2
5	J3U2	18	J6V2	28	J6W2	38	J3G2
6	J6U2	19	J6V2	29	J6W2	39	J6G2
7	J6U2	20	J7V2	30	J7W2	40	J6G2
8	J7U2	21		31		41	J7G2
9		22		32		42	
10		23		33		43	
11						44	
12						45	
13						46	

Group9 (CONTROLLER 2)

RP1
(Pulsecoder Feedback Signal & RI/RO)

1		8		15		22		29		36	
2		9		16		23	XHBK	30	XROT	37	24VF (OT)
3		10		17		24		31		38	
4		11		18		25		32		39	
5	5V (J1A, J2)	12	5V (J4, J5)	19		26	0V (J1A, J2)	33	0V (J4, J5)	40	
6	PRQJ1A	13	PRQJ2	20		27	PRQJ4	34	PRQJ5	41	
7	XPRQJ1A	14	XPRQJ2	21		28	XPRQJ4	35	XPRQJ5	42	

RM1
(MOTOR Power & Brake power)

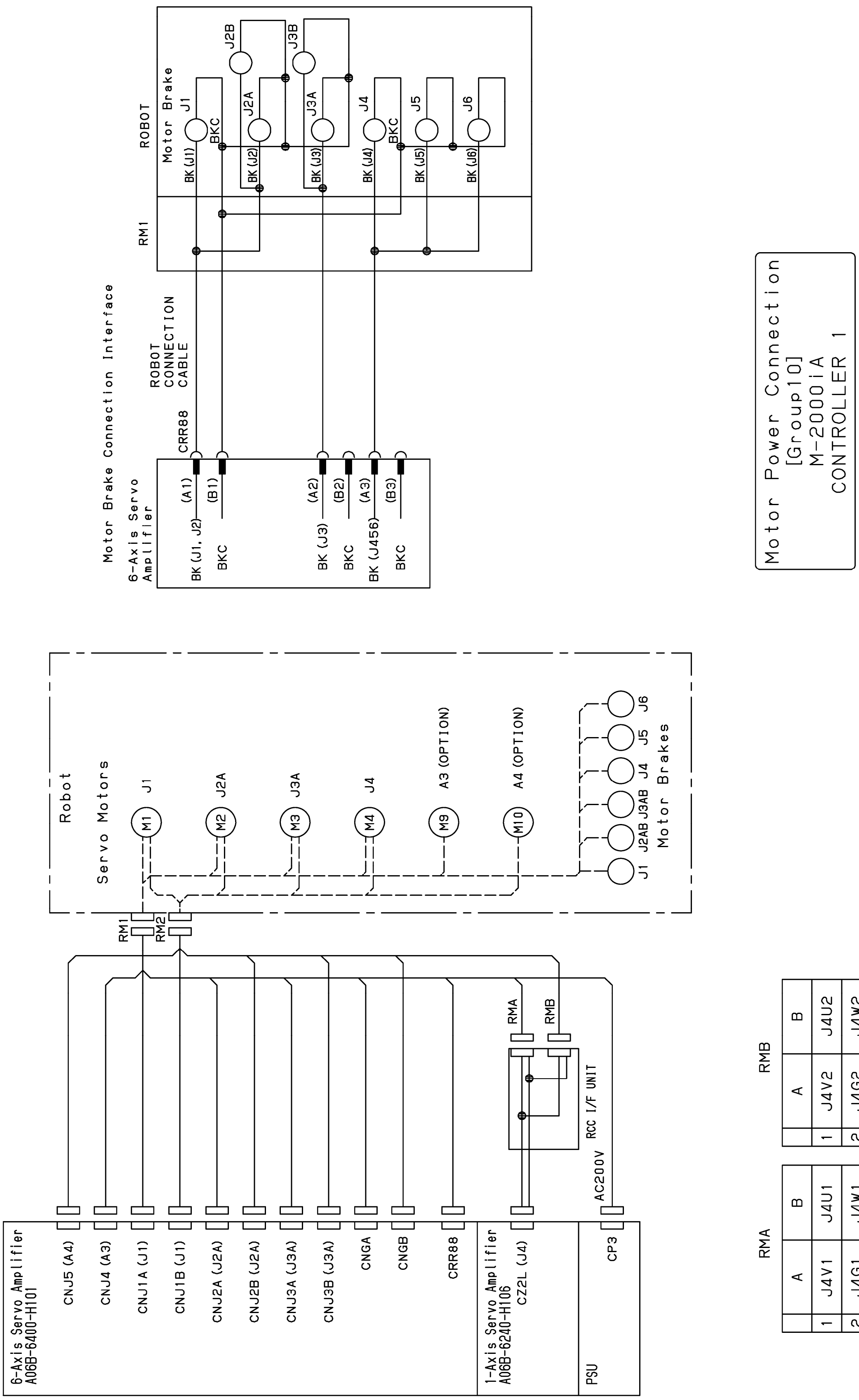
1	AC200A (1)	14	J1AV1	24	J1AW1	34	AC200B (1)
2	J1AU1	15	J1AV1	25	J1AW1	35	J1AG1
3	J1AU1	16	J2V1	26	J2W1	36	J1AG1
4	J2U1	17	J2V1	27	J2W1	37	J2G1
5	J2U1	18		28		38	J2G1
6		19		29		39	
7		20	J4V1	30	J4W1	40	
8	J4U1	21	J5V1	31	J5W1	41	J4G1
9	J5U1	22		32		42	J5G1
10		23	BK (J2)	33	BK (J3)	43	
11	BK (J1)					44	BK (J4)
12	BKC (1)					45	BK (J5)
13	BKC (1)					46	BK (J6)

RM2
(MOTOR Power & Brake power)

1		14	J1AV2	24	J1AW2	34	
2	J1AU2	15	J1AV2	25	J1AW2	35	J1AG2
3	J1AU2	16	J2V2	26	J2W2	36	J1AG2
4	J2U2	17	J2V2	27	J2W2	37	J2G2
5	J2U2	18		28		38	J2G2
6		19		29		39	
7		20	J4V2	30	J4W2	40	
8	J4U2	21	J5V2	31	J5W2	41	J4G2
9	J5U2	22		32		42	J5G2
10		23		33		43	
11						44	
12						45	
13						46	

Mechanical Interface
Group9
M-900iA/200P

Fig.G.7(s) Mechanical unit interface (Group 9:M-900*i*A/200P)



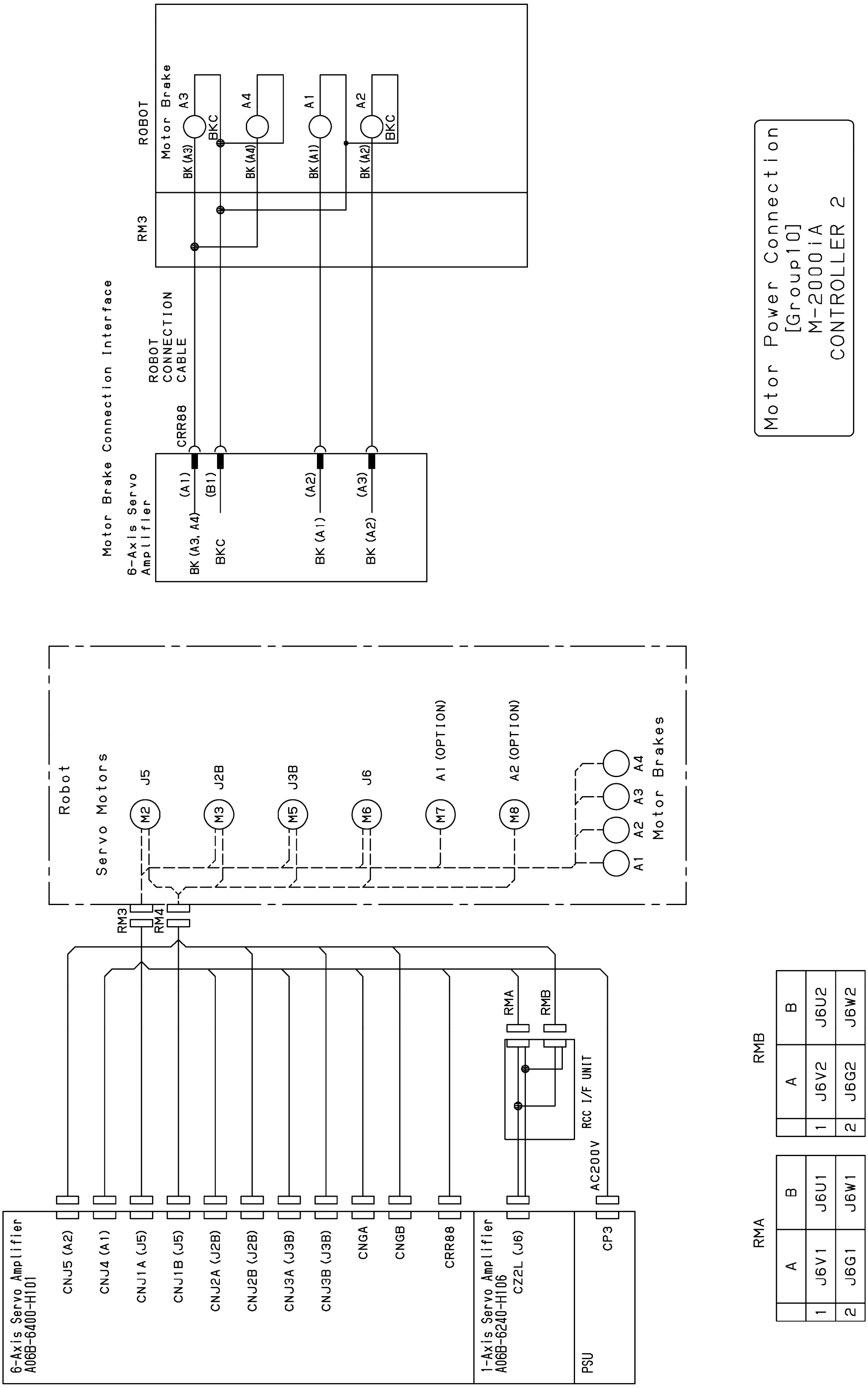
RMB

	A	B
1	J4V2	J4U2
2	J4G2	J4W2

RMA

	A	B
1	J4V1	J4U1
2	J4G1	J4W1

Fig.G.7(t) Motor power connection (Group 10:M-2000*i*A, Controller 1)



RMA

	A	B
1	J6V1	J6U1
2	J6G1	J6W1

RMB

	A	B
1	J6V2	J6U2
2	J6G2	J6W2

Fig.G.7(u) Motor power connection (Group 10:M-2000*i*A, Controller 2)

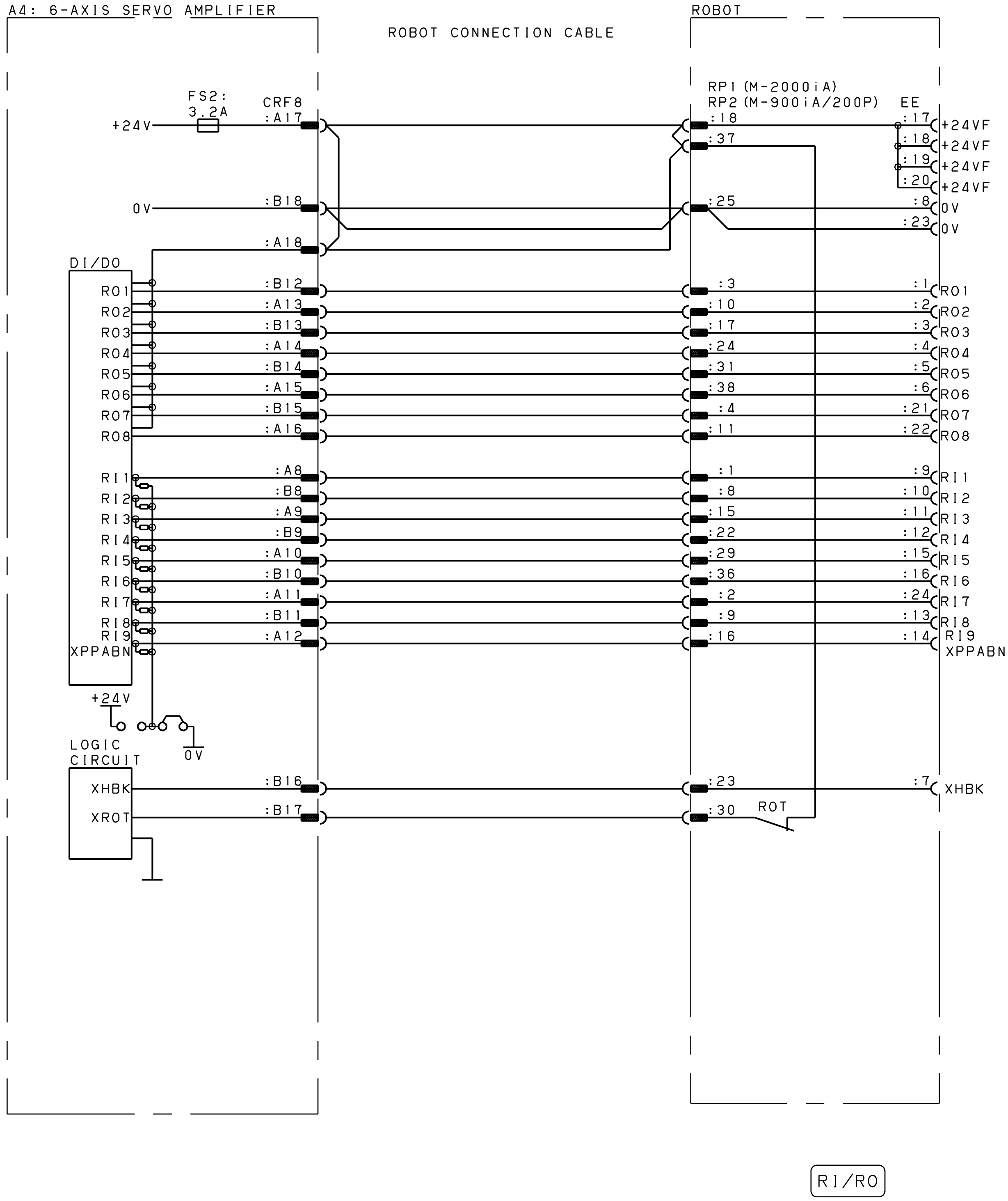


Fig.G.7(v) RI/RO connection diagram (Group 10:M-2000*i*A)

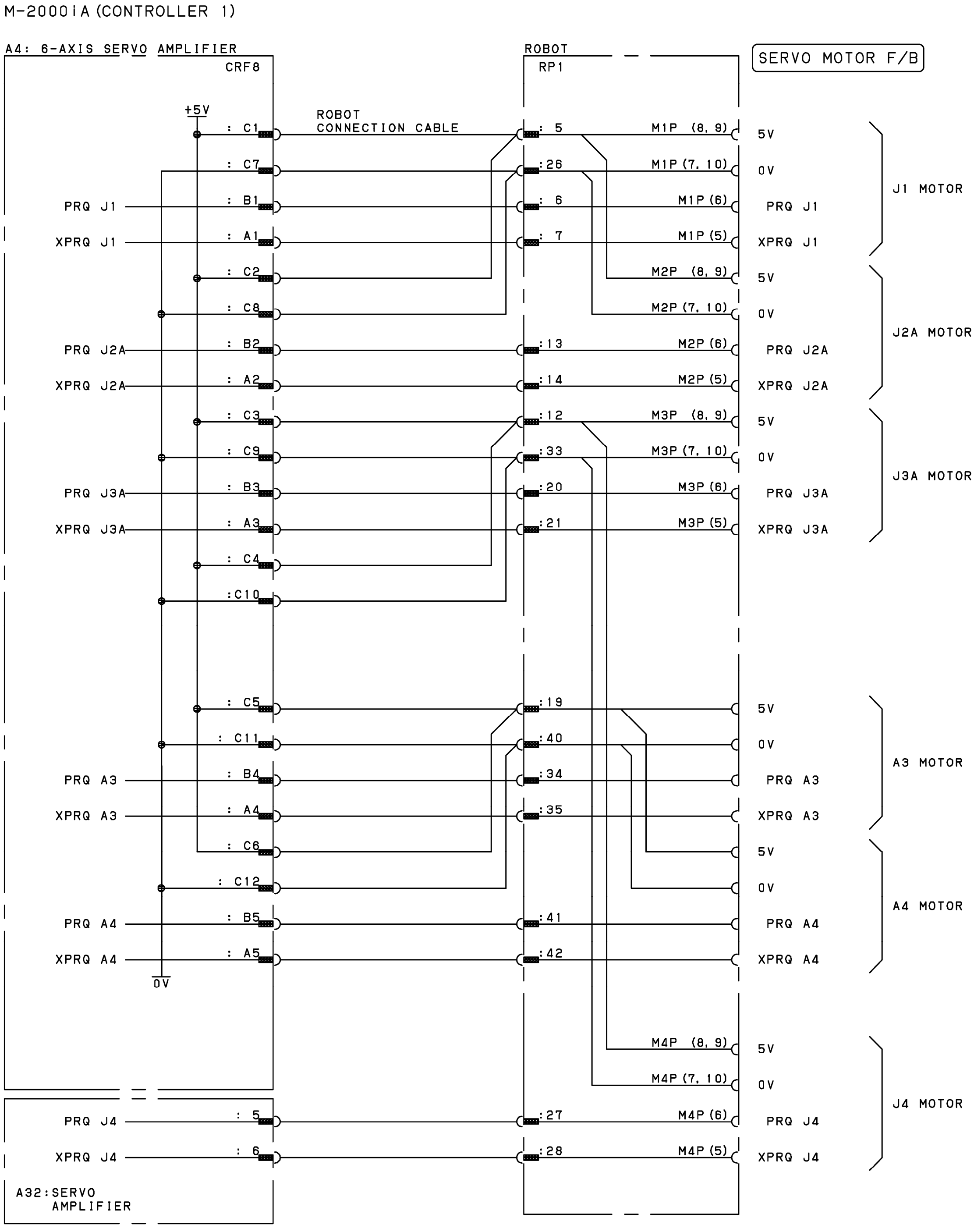


Fig.G.7(w) Pulsecoder signal connection diagram (Group 10:M-2000*i*A, Controller 1)

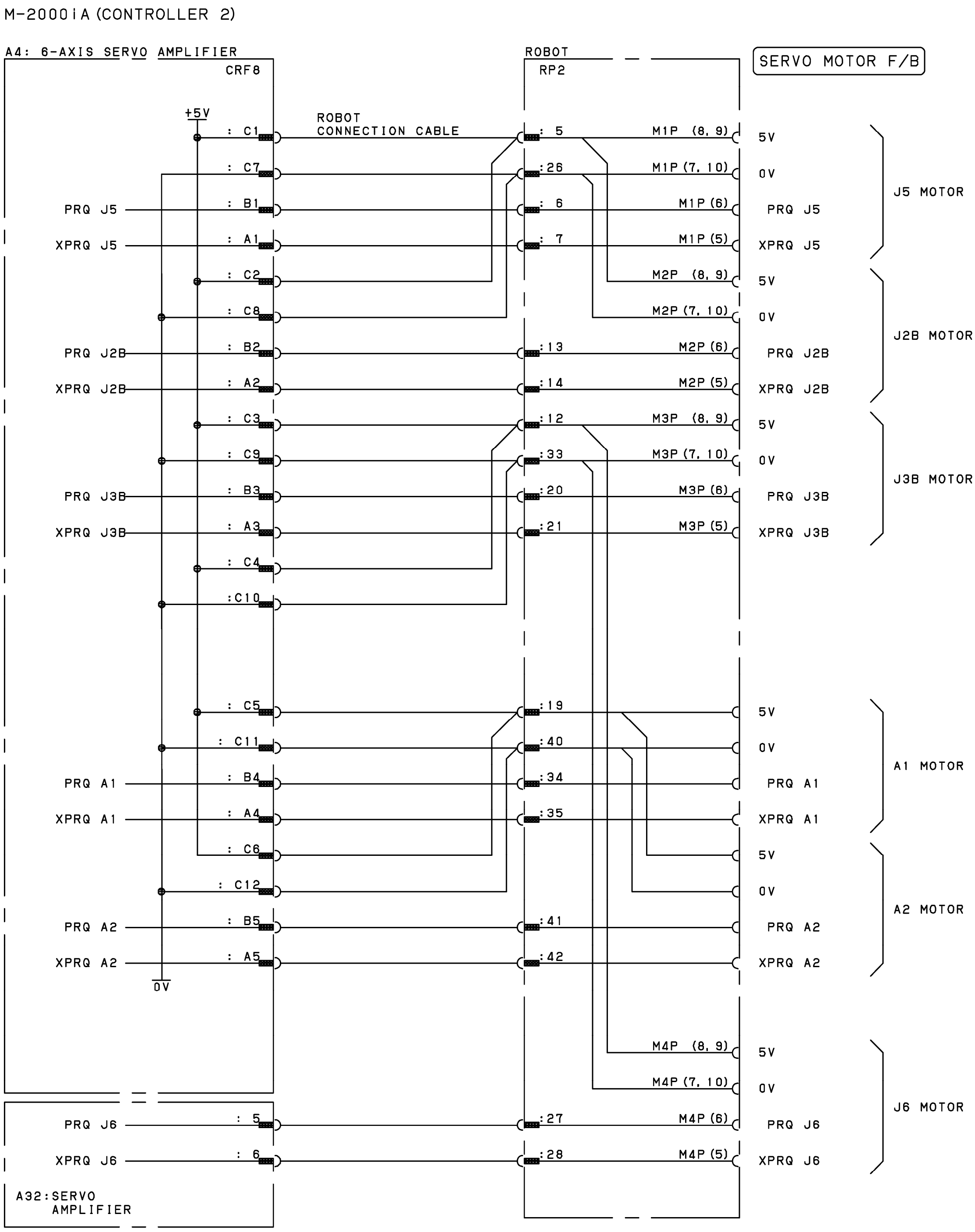


Fig.G.7(x) Pulsecoder signal connection diagram (Group 10:M-2000*i*A, Controller 2)

Group10 (Controller 1)

RP1
(Pulsecoder Feedback Signal & RI/RO)

1	RI1	8	RI2	15	RI3	22	RI4	29	RI5	36	RI6
2	RI7	9	RI8	16	RI9 (XPPABN)	23	XHBK	30	XROT	37	24VF (OT)
3	RO1	10	RO2	17	RO3	24	RO4	31	RO5	38	RO6
4	RO7	11	RO8	18	24VF	25	0V	32		39	
5	5V (J1, J2A)	12	5V (J3A, J4)	19	5V (A3, A4)	26	0V (J1, J2A)	33	0V (J3A, J4)	40	0V (A3, A4)
6	PRQJ1	13	PRQJ2A	20	PRQJ3A	27	PRQJ4A	34	PRQA3	41	PRQA4
7	XPRQJ1	14	XPRQJ2A	21	XPRQJ3A	28	XPRQJ4A	35	XPRQA3	42	XPRQA4

RM1
(MOTOR Power & Brake power)

1		14	J1V1	24	J1W1	34	
2	J1U1	15	J1V1	25	J1W1	35	J1G1
3	J1U1	16	J2AV1	26	J2AW1	36	J1G1
4	J2AU1	17	J2AV1	27	J2AW1	37	J2AG1
5	J2AU1	18	J3AV1	28	J3AW1	38	J2AG1
6	J3AU1	19	J3AV1	29	J3AW1	39	J3AG1
7	J3AU1	20	J4V1	30	J4W1	40	J3AG1
8	J4U1	21	J4V1	31	J4W1	41	J4G1
9	J4U1	22	A3V	32	A3W	42	J4G1
10	A3U	23	BK (J2AB)	33	BK (J3AB)	43	A3G
11	BK (J1)					44	BK (J4)
12	BKC					45	BK (J5)
13	BKC					46	BK (J6)

RM2
(MOTOR Power & Brake power)

1		14	J1V2	24	J1W2	34	
2	J1U2	15	J1V2	25	J1W2	35	J1G2
3	J1U2	16	J2AV2	26	J2AW2	36	J1G2
4	J2AU2	17	J2AV2	27	J2AW2	37	J2AG2
5	J2AU2	18	J3AV2	28	J3AW2	38	J2AG2
6	J3AU2	19	J3AV2	29	J3AW2	39	J3AG2
7	J3AU2	20	J4V2	30	J4W2	40	J3AG2
8	J4U2	21	J4V2	31	J4W2	41	J4G2
9	J4U2	22	A4V	32	A4W	42	J4G2
10	A4U	23		33		43	A4G
11						44	
12						45	
13						46	

Group10 (Controller 2)

RP2
(Pulsecoder Feedback Signal & RI/RO)

1		8		15		22		29		36	
2		9		16		23	XHBK	30	XROT	37	24VF (OT)
3		10		17		24		31		38	
4		11		18		25		32		39	
5	5V (J2B, J5)	12	5V (J3B, J6)	19	5V (A1, A2)	26	0V (J2B, J5)	33	0V (J3B, J6)	40	0V (A1, A2)
6	PRQJ5	13	PRQJ2B	20	PRQJ3B	27	PRQJ6	34	PRQA1	41	PRQA2
7	XPRQJ5	14	XPRQJ2B	21	XPRQJ3B	28	XPRQJ6	35	XPRQA1	42	XPRQA2

RM3
(MOTOR Power & Brake power)

1		14	J5V1	24	J5W1	34	
2	J5U1	15	J5V1	25	J5W1	35	J5G1
3	J5U1	16	J2BV1	26	J2BW1	36	J5G1
4	J2BU1	17	J2BV1	27	J2BW1	37	J2BG1
5	J2BU1	18	J3BV1	28	J3BW1	38	J2BG1
6	J3BU1	19	J3BV1	29	J3BW1	39	J3BG1
7	J3BU1	20	J6V1	30	J6W1	40	J3BG1
8	J6U1	21	J6V1	31	J6W1	41	J6G1
9	J6U1	22	A1V	32	A1W	42	J6G1
10	A1U	23	BK (A4)	33	BK (A1)	43	A1G
11	BK (A3)					44	BK (A2)
12	BKC					45	
13	BKC					46	

RM4
(MOTOR Power & Brake power)

1		14	J5V2	24	J5W2	34	
2	J5U2	15	J5V2	25	J5W2	35	J5G2
3	J5U2	16	J2BV2	26	J2bW2	36	J5G2
4	J2BU2	17	J2BV2	27	J2BW2	37	J2BG2
5	J2BU2	18	J3BV2	28	J3BW2	38	J2BG2
6	J3BU2	19	J3BV2	29	J3BW2	39	J3BG2
7	J3BU2	20	J6V2	30	J6W2	40	J3BG2
8	J6U2	21	J6V2	31	J6W2	41	J6G2
9	J6U2	22	A2V	32	A2W	42	J6G2
10	A2U	23		33		43	A2G
11						44	
12						45	
13						46	

Mechanical Interface
Group10
M-2000iA

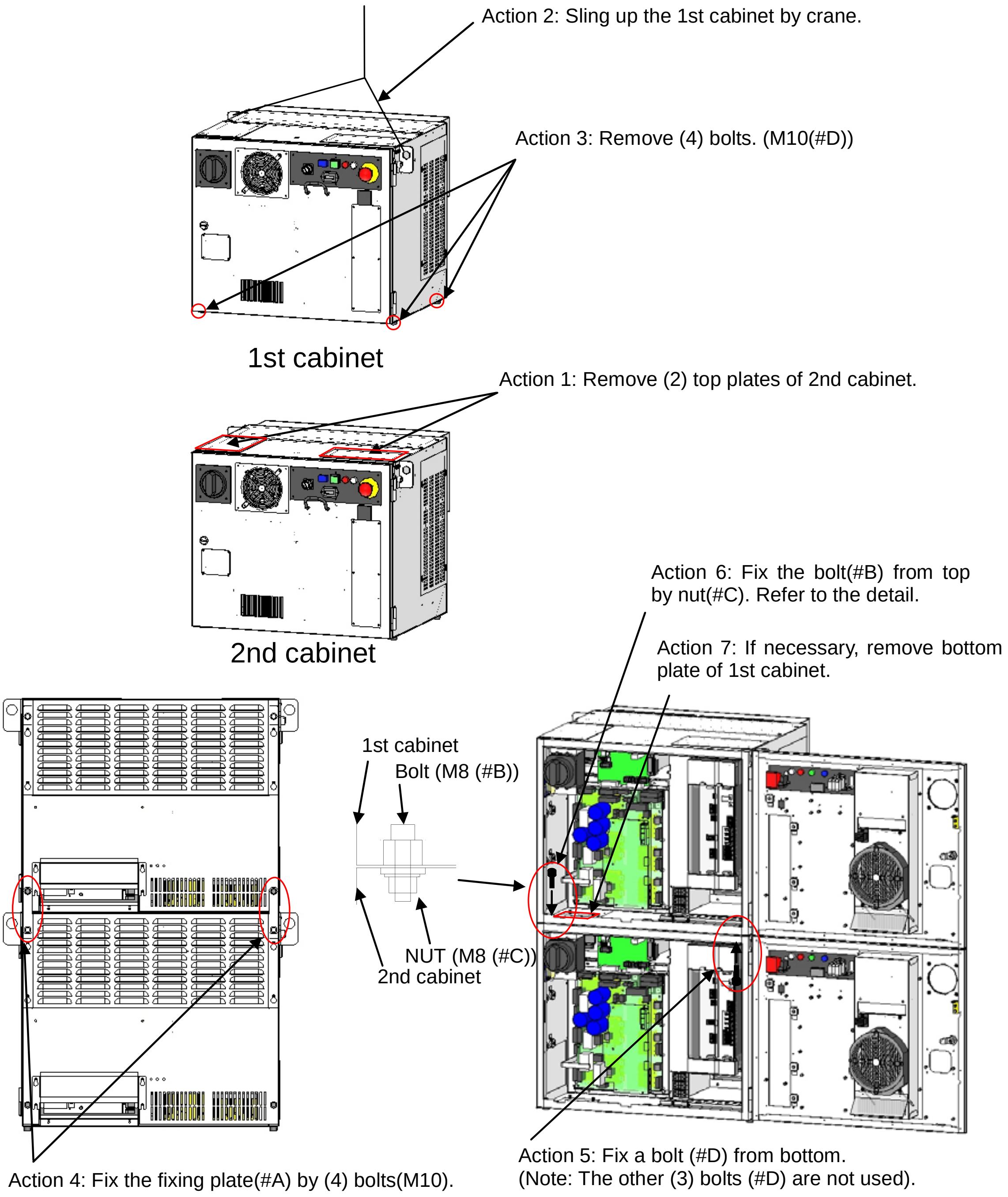
Fig.G.7(y) Mechanical unit interface (Group 10:M-2000*i*A)

H INSTRUCTION FOR STACKING A-CABINETS

This appendix shows instructions for stacking A-cabinets.

The A-cabinet fixing plate kit (A05B-2601-J342) includes following parts.

- Fixing plate (#A)
- Bolt (M8 (#B))
- NUT (M8 (#C))



I TEACH PENDANT DISCONNECT FUNCTION (OPTION)

This appendix shows instructions for the teach pendant disconnect function (Option).

I.1 CONFIGURATION

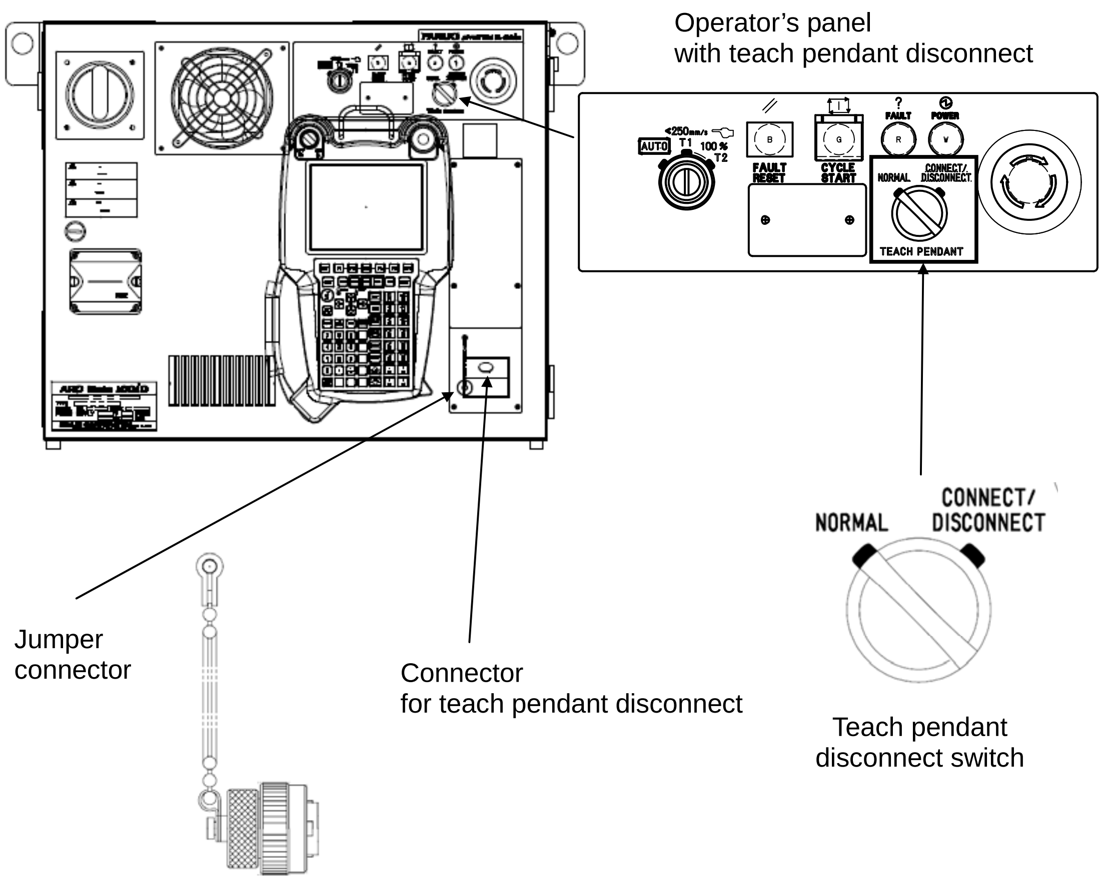


Fig. I.1 Teach pendant disconnect function

I.2 PROCEDURE OF TEACH PENDANT DISCONNECT

I.2.1 Teach Pendant Disconnect

(1) Set AUTO mode.
(2) Turn the disconnect switch to "Connect/Disconnect" position. (Robot stops because Operator's panel E-stop Alarm occurs and Power LED of the teach pendant is OFF.)
(3) Disconnect the teach pendant cable.
(4) Connect the jumper connector.
(5) Turn the disconnect switch to "Normal" position.
(6) Administrator should store the teach pendant and the teach pendant cable in the storage in order to avoid incorrect operation.

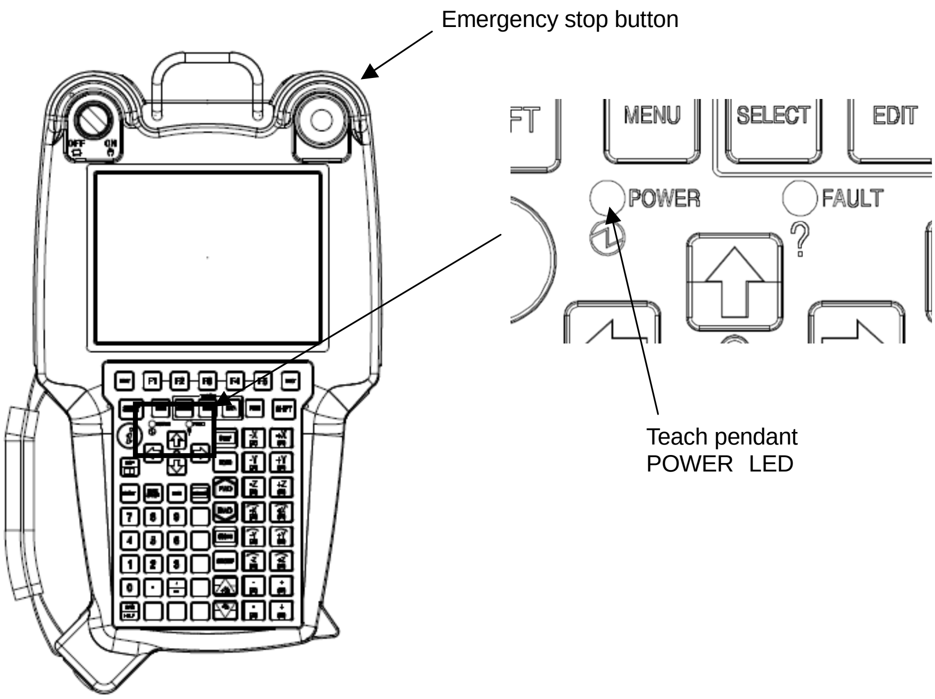
I.2.2 Teach Pendant Connect

(1) Set AUTO mode.
(2) Turn the disconnect switch to “Connect/Disconnect” position. (Robot stops because Operator’s panel E-stop Alarm occurs.)
(3) Disconnect the jumper connector.
(4) Connect the teach pendant cable with the teach pendant.
(5) Turn the disconnect switch to “Normal” position.

⚠WARNING

When the LED (POWER) on the teach pendant turned on, this teach pendant is connected to the robot controller and emergency stop button of the teach pendant is active.

When the LED (POWER) on the teach pendant turned off, This teach pendant is not connected to robot controller and emergency stop button of the teach pendant is not inactive.

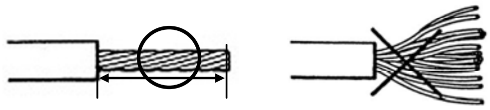


J INSTRUCTION FOR TERMINAL BLOCK

This appendix shows instructions for working with the external on/off and external emergency stop signal input/output terminal block.

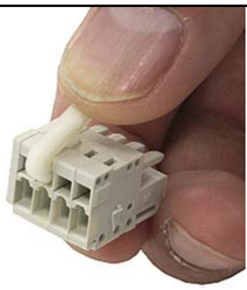
Stripping of Wire

Available wire size AWG 28 -14 (0.08 - 1.5mm^2)



- Please check a strip length carefully.
- Please readjust a loose end.

Handling of the lever

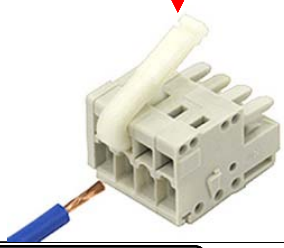


- Hold the connector, and push down the lever by finger.
- Don't handle the lever after fit the connector into PCB, otherwise PCB will be damaged by handling stress.

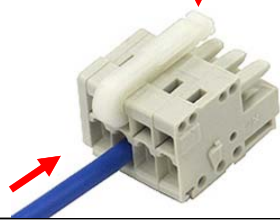
Operating Lever
Item No. **734-230**

Wiring

1. Push down the lever.

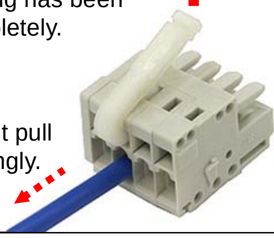


2.Insert a wire into the wire hole with holding the lever.

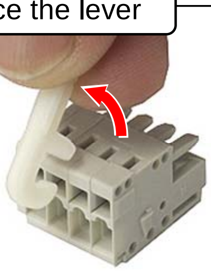


3.Release an operating tool. Pull a wire slightly to check if connecting has been done completely.

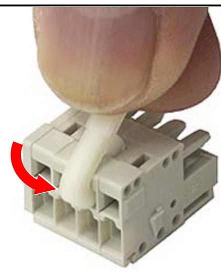
★Don't pull strongly.



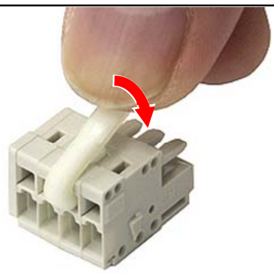
Replace the lever



1.Pull of the lever.



2.Hook the lever to the rectangle hole.

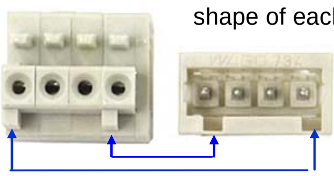


3.Push down the lever until click in.

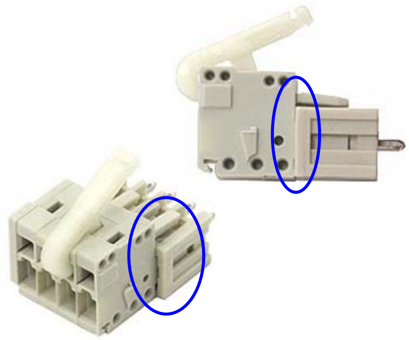
Fit to header

1.Push in the connector to the header.

★Be careful to fit the shape of each other.

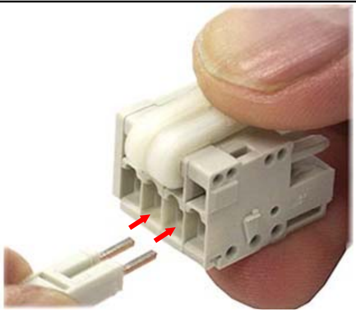


2.Please check if the latch is hooked to header.



Installation of Jumper

1. Attach two levers to the connector.

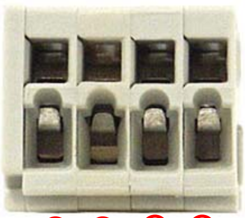


2.Hold down levers at the same time, then put the jumper into the connector.

★ Please confirm that the jumper is fully inserted.

Availability of wires

Without jumpers



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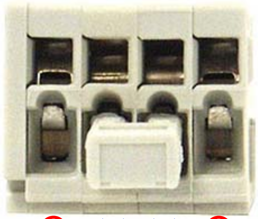
Max wire size 1.0mm^2 (AWG18) (with Ferrule)

With jumpers

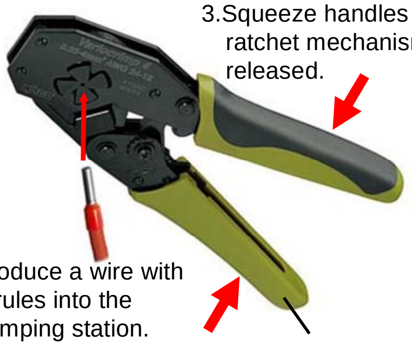


○ × × ○

The wire cannot connect, when attached the jumper.

Installation of Ferrules

1.Put a wire through the hole of ferrules.

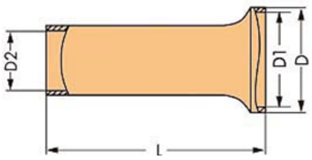


2.Introduce a wire with ferrules into the cramping station.

3.Squeeze handles until ratchet mechanism is released.

4.Please check if the wire crimped correctly.

Specifications of Ferrules



WAGO Item No.	Sleeve for mm^2 (AWG)	Color	Stripped length(mm)	L (mm)	L1	D	D1	D2
216-301	0.25 (24)	Yellow	9.5	12.5	8.0	2.5	2.0	0.8
216-302	0.34 (24)	Turquoise	9.5	12.5	8.0	2.5	2.0	0.8
216-201	0.5 (22)	White	9.5	13.5	8.0	3.0	2.5	1.1
216-202	0.75 (20)	Gray	10.0	14.0	8.0	3.3	2.8	1.3
216-203	1.0 (18)	Red	10.0	14.5	8.0	3.6	3.0	1.5

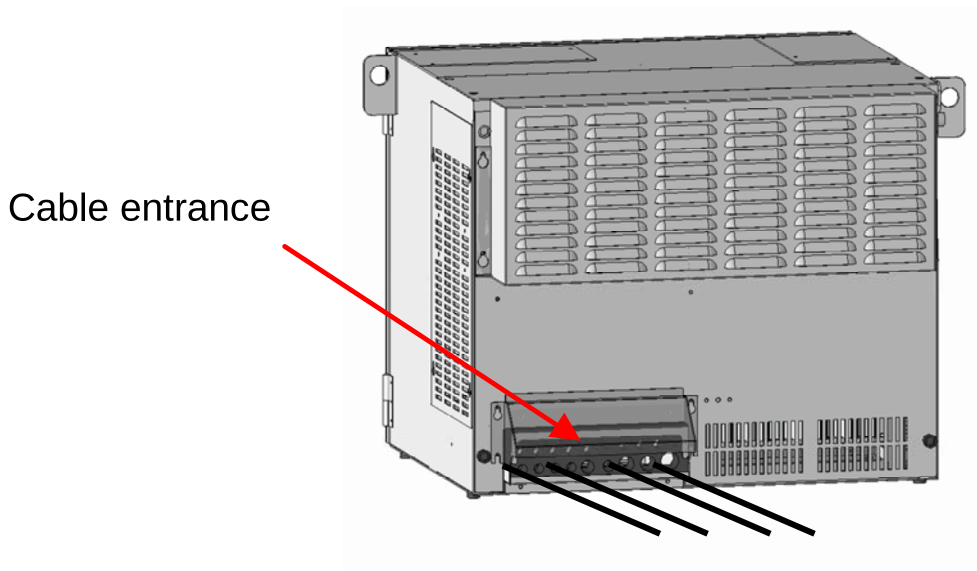
Pack-unit 100

★ **CAUTION!** Please make sure to use WAGO 206-204 to crimp the ferrules.

K SEALING OF THE CABLE ENTRANCE OF THE CABINET

K.1 CABLE ENTRANCE FOR A-CABINET

The external cables are connected through the cable entrance located on the rear surface of controller. The cable entrance consists of a hood, frame and Cable Seal Block with multiple circular shaped holes for cable sealing. There are different types of Cable Seal Block; the type used is determined by the controller and robot configuration. When all customer supplied cables are connected through the cable entrance, it may be necessary to increase the cable diameter of some cables to maintain an adequate seal at the cable entrance. It is also necessary to confirm Cable Seal Block has enough holes for all system and option cables. The number of available sealing holes for customer supplied cables varies depending on robot type and options. Reference the following illustrations.



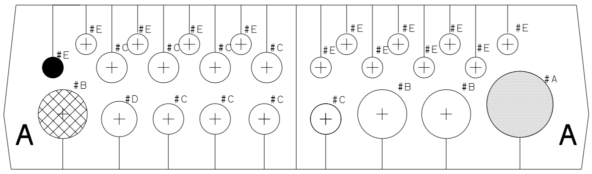
⚠ **CAUTION**

If the cable diameter is not suitable for the hole size of Cable Seal Block, controller problems may occur because of insufficient environmental sealing of controller.
Without proper cable entrance sealing, airborne contaminates, both non-conductive and conductive may enter the interior of the controller. Foreign particulate entering the controller can have an impact on controller operation and reliability.
When customer supplied cables are connected through the cable seal entrance, the diameter of these cables should be adjusted to a suitable cable diameter to ensure proper controller cabinet sealing. Reference the following illustrations.

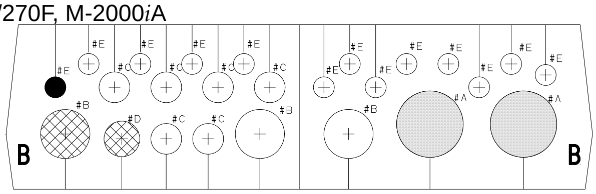
K.2 HOLES OF CABLE SEAL BLOCK FOR CABLE

The cutout of Cable Seal Block at the cable Entrance is shown as follows（Rear side view）.

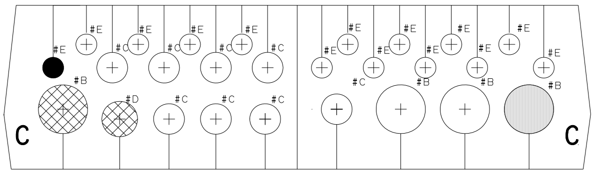
Type A(A230-0653-X028#A) : R-2000*i*B(except 200T/220U/220US) , R-2000*i*C(except 210L/270F), R-1000*i*A(excpet 120*i*F/7B), M-710*i*C, M-420*i*A

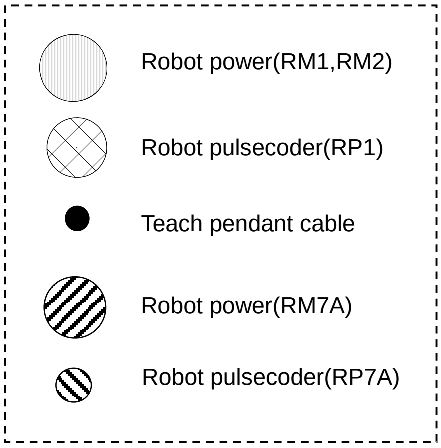


Type B(A230-0653-X028#B) : M-900*i*A/260L/350, M-410*i*B(Separated), M-410*i*C(Separated), R-2000*i*B/200T/220U/220US, R-2000*i*C/ 210L/270F, M-2000*i*A

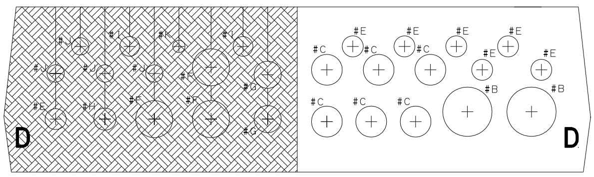


Type C(A230-0653-X028#C) : ARC Mate series, M-430*i*A, F-200*i*B, M-10*i*A, M-20*i*A, M-20*i*B, CR-35*i*A

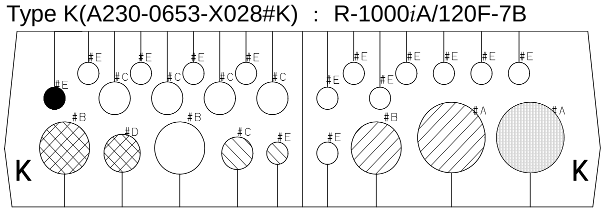




Type D(A230-0653-X028#D) : M-410*i*C(Integrated)



Type K(A230-0653-X028#K) : R-1000*i*A/120F-7B



Hole type	Diameter	Type A		Type B		Type C		Type D		Type K		Application（Include options）
		Qty	For Options	Qty	For Options	Qty	For Options	Qty	For Options	Qty	For Options	
#A	ϕ27mm	1	0	2	0	0	0	0	0	2	0	Robot power (RM1,RM2,RM7A)
#B	ϕ20mm	3	2	3	2	4	2	2	2	3	1	Robot Pulsecoder Thick/Flex(RP1) Robot power(RM1,RM7A)
#C	ϕ12.5mm	8	8	6	6	8	8	6	6	5	4	Robot Pulsecoder(RP7A) Aux axis power, I/O Line tracking, Switch box DeviceNet Thick cable
#D	ϕ14.5mm	1	0	1	0	1	0	0	0	1	0	Robot Pulsecoder(RP1)
#E	ϕ8.5mm	13	12	13	12	14	13	7	6	14	12	Aux brake/Pulsecoder Robot Pulsecoder (RP7A) Camera, Ethernet DeviceNet Thin cable Teach pendant cable

K.3 SUITABLE CABLE DIAMETER

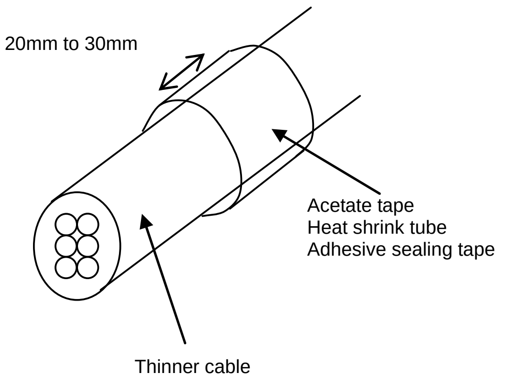
The suitable cable diameter for option cables are shown on the following table.

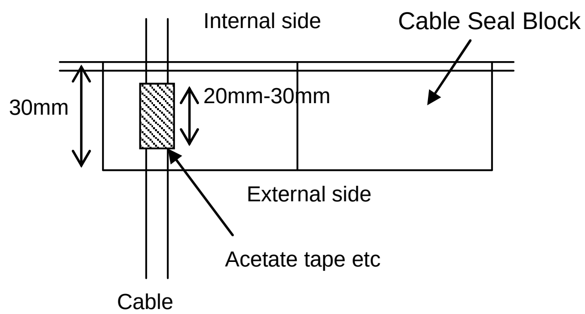
Hole type	Nominal	Tolerance	Suitable diameter	Q'ty Type A	Q'ty Type B	Q'ty Type C	Q'ty Type D	Q'ty Type K
#B	ϕ20mm	±1mm	ϕ19mm-21mm	2	2	2	2	1
#C	ϕ12.5mm	±1mm	ϕ11.5mm-13.5mm	8	6	8	6	4
#E	ϕ8.5mm	±1mm	ϕ7.5mm-9.5mm	12	12	13	6	12

NOTE
The holes for options(#B,#C,#E) are used for all options(Aux. axis, I/O, Network, Sensor). So confirm that the available holes are enough for all option cables.

K.4 ADJUST THE CABLE DIAMETER

To maintain proper sealing of controller enclosure, it may be necessary to adjust some cable diameters to work with an available cable port diameter. If the diameter of any cable is smaller than an available sealing port in the Cable Seal Block, increase the cable diameter to an appropriate diameter by applying acetate tape, adhesive sealing tape or heat shrink tubing over the cable jacket. If a foam type sealing tape is used, adjust the diameter to the compression state of foam for a particular cable diameter. The finished diameter of all cables should maintain an interference fit with Cable Seal Block. All unused cable ports must be plugged to ensure controller is sealed against contaminants. Sealing frame and hood must also be properly installed.



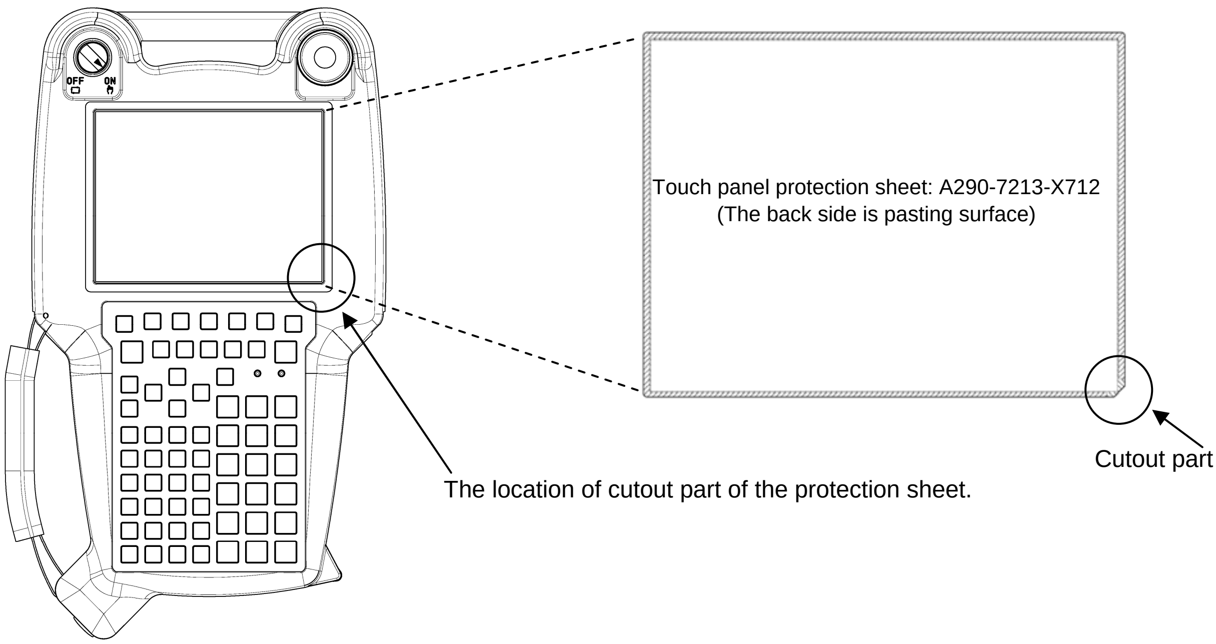


L REPLACING THE PROTECTION SHEET

This appendix shows instructions for replacing the protection sheet of the *i*Pendant with touch panel.

Replacement procedure

1. Remove the old protection sheet.
2. Peel clear sheets pasted on both sides of the new protect sheet.
3. Paste the new protection sheet so that the cutout part is placed on the lower right portion.



INDEX

REVISION RECORD

Edition	Date	Contents
09	Feb.,2017	• Addition of R-1000*i*A/120F-7B. • Addition of R-30*i*B Plus. • Correction of errors.
08	Feb.,2016	• Addition of R-2000*i*C/210L/270F, M-20*i*B/25, M-710*i*C/20M, M-410*i*C/500, F-100*i*A. • Addition of figure of process I/O board JA, JB, KA, KB, MA, MB. • Correction of errors.
07	Jul.,2015	• Addition of M-2000*i*A/1700L/2300, ARC Mate 100*i*C/8L, M-10*i*A/8L • Addition of specification of FROM/SRAM module. • Addition of sensor I/F unit for CR35*i*A.
06	Apr., 2015	• Addition of R-2000*i*C/125L,/165R,/210R, M-10*i*A/7L,/12S, M-20*i*A/12L,/20MT,/35MT, ARC Mate 100*i*C/7L,/12S, ARC Mate 120*i*C/12L, M-900*i*B/280L, CR35*i*A • Correction of errors.
05	Dec., 2013	Addition of R-2000*i*C, M-410*i*C. Correction of errors.
04	Dec.,2012	Addition of M-2*i*A. Correction of errors.
03	Aug.,2012	Addition of M-900*i*A/200P. Correction of errors.
02	May.,2012	Addition of M-2000*i*A.
01	Mar.,2012	

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