FANUC Robot series

R-30*i*A/R-30*i*A Mate/R-30*i*B CONTROLLER
PROFIBUS-DP (12M) Interface Function

OPERATOR'S MANUAL

MAROCPRDP04071E REV. B

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B-82644EN/02

If you have a controller labeled R-J3*i*C, you should read R-30*i*A as R-J3*i*C throughout this manual.

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WARNING

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FANUC Robotics 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:
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Patents

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

FANUC Robotics America Corporation Patent List

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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**

Before using the Robot, be sure to read the "FANUC Robot Safety Manual (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.

In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

Safety

FANUC Robotics 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 Robotics 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 Robotics 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 Robotics therefore, recommends that all personnel who intend to operate, program, repair, or otherwise use the robotics system be trained in an approved FANUC Robotics 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 Robotics 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 Robotics 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

Thank you for purchasing FANUC Robot.
This chapter describes the precautions which must be observed to ensure the safe use of the robot.
Before attempting to use the robot, be sure to read this chapter thoroughly.

Before using the functions related to robot operation, read the relevant operator's manual to become familiar with those functions.

If any description in this chapter differs from that in the other part of this manual, the description given in this chapter shall take precedence.

For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral devices installed in a work cell.
In addition, refer to the “FANUC Robot SAFETY HANDBOOK (B-80687EN)”.

1 WORKING PERSON

The personnel can be classified as follows.

Operator:
- Turns robot controller power ON/OFF
- Starts robot program from operator’s panel

Programmer or teaching operator:
- Operates the robot
- Teaches robot inside the safety fence

Maintenance engineer:
- Operates the robot
- Teaches robot inside the safety fence
- Maintenance (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 DEFINITION OF WARNING, CAUTION AND NOTE

To ensure the safety of user 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 attempting to use the oscillator.

⚠WARNING
Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

⚠CAUTION
Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE
Notes are used to indicate supplementary information other than Warnings and Cautions.

- Read this manual carefully, and store it in a sales place.

3 WORKING PERSON SAFETY

Working person 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 working person safety.

(1) Have the robot system working persons 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 working person 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 working person 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 (a) and Fig.3 (b).

(4) Provide the peripheral devices with appropriate grounding (Class A, Class B, Class C, and Class D).

(5) Try to install the peripheral devices outside the work area.
(6) Draw an outline on the floor, clearly indicating the range of the robot motion, 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 working person enters the work area.
(8) If necessary, install a safety lock so that no one except the working person 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 device independently, be sure to turn off the power of the robot
(10) Operators should be ungloved while manipulating the operator's 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.
(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 in the area of 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.)

(16) When connecting the peripheral devices 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 trestle, please consider security for installation and maintenance work in high place according to Fig.3 (c). Please consider footstep and safety bolt mounting position.

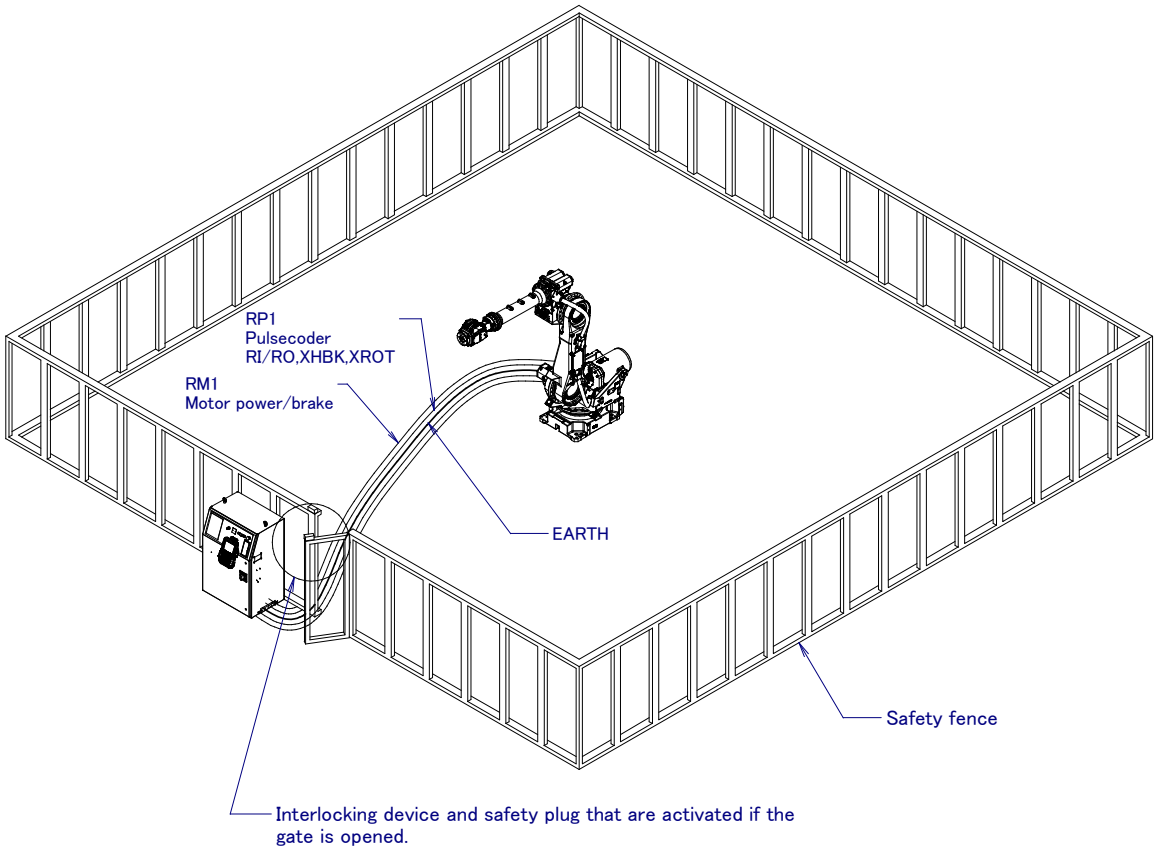


Fig. 3 (a) Safety fence and safety gate

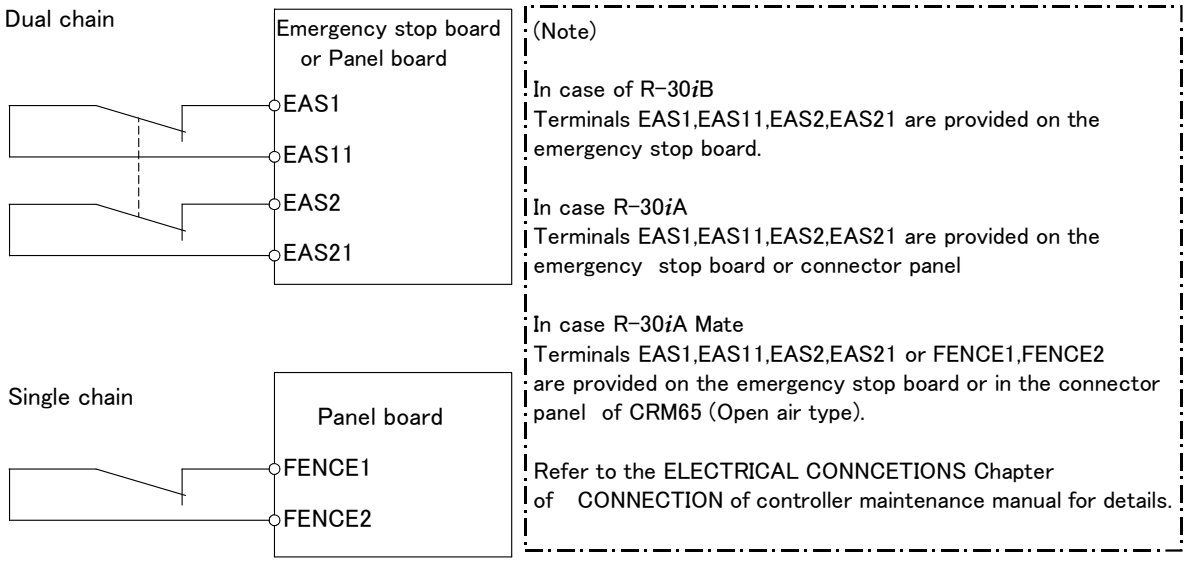


Fig. 3 (b) Limit switch circuit diagram of the safety fence

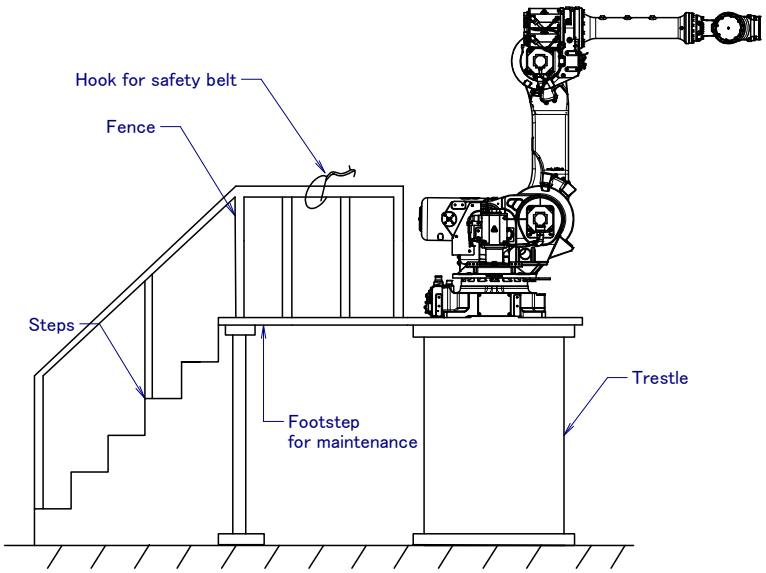


Fig.3 (c) Footstep for maintenance

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 an EMERGENCY STOP button within the operator's reach.

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. See the diagram below for connection.

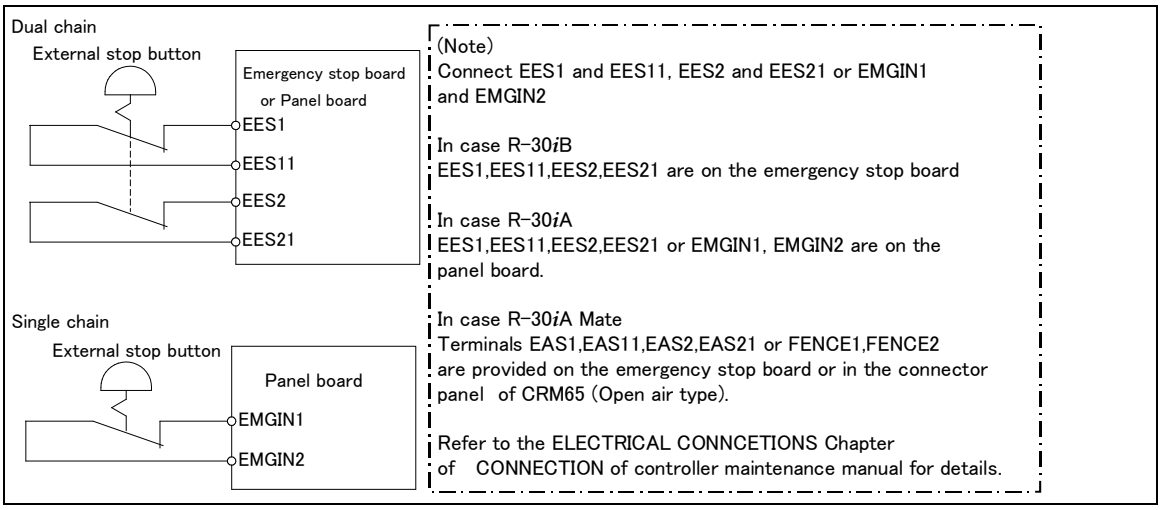


Fig.3.1 Connection diagram for external emergency stop button

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.

Our 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. (In case of R-30*i*A Mate Controller standard specification, there is no mode switch. The automatic operation mode and the teach mode is selected by teach pendant enable switch.)

Our teach pendant is provided with a DEADMAN switch as well as an emergency stop button. These button and switch function as follows:
(1) Emergency stop button: Causes an emergency stop (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*A/ R-30*i*A Mate 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.

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.

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

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 and the DEADMAN switch of the operator panel, the teach pendant enable switch and the remote condition on the software.

In case of R-30*i*B/R-30*i*A controller or CE or RIA specification of R-30*i*A Mate controller

Mode	Teach pendant enable 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.

In case of standard specification of R-30*i*A Mate controller

Teach pendant enable switch	Software remote condition	Teach pendant	Peripheral device
On	Ignored	Allowed to start	Not allowed
Off	Local	Not allowed	Not allowed
	Remote	Not allowed	Allowed to start

(6) (Only when R-30*i*B/R-30*i*A Controller or CE or RIA specification of R-30*i*A Mate controller is selected.) To start the system using the operator's panel, 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 work area.
(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 operation range while the power is on, press the emergency stop button on the operator panel, or the teach pendant before entering the range. The

maintenance personnel 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 maintenance worker must check the entire 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 entire 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 teaching, check that the robot and its peripheral devices are all in the normal operating condition.

(7) Do not operate the robot in the automatic mode while anybody is in the robot work area.

(8) When you maintain the robot alongside a wall or instrument, or when multiple workers are working nearby, make certain that their escape path is not obstructed.

(9) When a tool is mounted on the robot, or when any moving device other than the robot is installed, such as belt conveyor, pay careful attention to its motion.

(10) If necessary, have a worker who is familiar with the robot system stand beside the operator panel and observe the work being performed. If any danger arises, the worker should be ready to press the EMERGENCY STOP button at any time.

(11) When replacing a part, please contact FANUC service center. If a wrong procedure is followed, an accident may occur, causing damage to the robot and injury to the worker.

(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 work area and that the robot and the peripheral devices 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 worker needs to touch such a part in the heated state, the worker 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 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 operation should be given for the robot according to a predetermined method. (See TESTING section of "Controller operator's manual".) During the test operation, the maintenance staff 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, and operate the robot in an environment free of grease, water, and dust.

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

(3) Employ a limit switch or mechanical stopper to limit the robot motion so that the robot or cable does not strike against its peripheral devices or tools.

(4) Observe the following precautions about the mechanical unit cables. When theses attentions are not kept, unexpected troubles might occur.
- Use mechanical unit cable that have required user interface.
- Don't add user cable or hose to inside of mechanical unit.
- Please do not obstruct the movement of the mechanical unit cable 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.
- Please do not interfere with the other parts of mechanical unit when install equipments in the robot.

(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 execute 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.
- When alteration was necessary, safety switch is operated by opening safety fence and power-off stop is executed 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 operate routinely and power-off stop is executed for the robot.

(6) Robot stops urgently when collision detection alarm (SRVO-050) etc. occurs. The frequent urgent stop by alarm causes 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 by the robot), brake release unit can be used to move the robot axes without drive power.
Please refer to controller maintenance 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 emergency 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 3 Stop patterns.

Stop pattern	Mode	Emergency stop button	External Emergency stop	FENCE open	SVOFF input	Servo disconnect
A	AUTO	P-Stop	P-Stop	C-Stop	C-Stop	P-Stop
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop
B	AUTO	P-Stop	P-Stop	P-Stop	P-Stop	P-Stop
	T1	P-Stop	P-Stop	-	P-Stop	P-Stop
	T2	P-Stop	P-Stop	-	P-Stop	P-Stop
C	AUTO	C-Stop	C-Stop	C-Stop	C-Stop	C-Stop
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop

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

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

Option	R-30*i*B
Standard	A (*)
Controlled stop by E-Stop (A05B-2600-J570)	C (*)

(*) R-30*i*B does not have servo disconnect.

Option	R-30*i*A				R-30*i*A Mate		
	Standard (Single)	Standard (Dual)	RIA type	CE type	Standard	RIA type	CE type
Standard	B (*)	A	A	A	A (**)	A	A
Stop type set (Stop pattern C) (A05B-2500-J570)	N/A	N/A	C	C	N/A	C	C

(*) R-30*i*A standard (single) does not have servo disconnect.
(**) R-30*i*A Mate Standard does not have servo disconnect, and the stop type of SVOFF input is Power-Off stop.

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

"Controlled stop by E-Stop" option

When "Controlled stop by E-Stop" (A05B-2600-J570) option (In case of R-30*i*A/R-30*i*A Mate, it is Stop type set (Stop pattern C) (A05B-2500-J570)) is specified, 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 emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open. (R-30*i*A/R-30*i*B controller)
SRVO-194 Servo disconnect	Servo disconnect input (SD4-SD41, SD5-SD51) is open. (R-30*i*A controller)
SRVO-218 Ext.E-stop/Servo Disconnect	External emergency stop input (EES1-EES11, EES2-EES21) is open. (R-30*i*A Mate/R-30*i*B controller)
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.

Alarm	Condition
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.

In case of R-30*i*A or R-30*i*A Mate, this function is available only in CE or RIA type hardware.

When this option is loaded, this function cannot 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.

120919

TABLE OF CONTENTS

1 INTRODUCTION

Purpose of this Manual

This manual explains the PROFIBUS-DP (12M) interface functions used by the FANUC SYSTEM R-30*i*B/R-30*i*A/R-30*i*A Mate (referred as the R-30*i*B, R-30*i*A, R-30*i*A Mate or robot). The descriptions are based on the PROFIBUS standards stipulated in DIN 19245 Parts 1 and 3.

Related Manuals

Other manuals provided with this product describe system settings/operations other than those described in this manual. These manuals need not be referenced by readers of this manual. Users are, however, urged to observe the safety precautions described at the beginning of each of these manuals.

Manuals specific to individual tools	Each of these manuals describes the procedure for setting up and operating the software for the related tool, such as a spot welding tool or handling tool.

How to Use this Manual

The contents of each section of this manual are briefly described below.

SECTION	Description
Chapter 2, SYSTEM OVERVIEW	Briefly describes the functions of the robot PROFIBUS-DP (12M) interface.
Chapter 3, PROFIBUS-DP BOARD	Describes the PROFIBUS board required to enable the robot to communicate using the PROFIBUS-DP interface.
Chapter 4, SETUP PRIOR TO STARTING COMMUNICATION	Describes how the robot master/slave function must be set up before communication can be started.
Chapter 5, DIAGNOSTIC DATA OUTPUT BY A SLAVE COMMUNICATING WITH THE robot MASTER	Describes how to determine the causes of problems that may occur during communication between the robot master and slave.
Chapter 6, communication with dp master (class 2)	Describes the communication with DP Master(Class 2).
Chapter 7, Error codes and recovery	Describes the alarm codes related to the PROFIBUS-DP functions, their causes, and the corresponding countermeasures.
Appendix A, GSD File for R-30*i*B/ R-30*i*A/ R-30*i*A Mate PROFIBUS-DP Slave	Use this file on the configurator (DP Slave Class2) to setup robot PROFIBUS-DP.
Appendix B, GSD File for R-30*i*B/ R-30*i*A/ R-30*i*A Mate PROFIBUS-DP Master	Use this file on the configurator (DP Master Class2) to setup robot PROFIBUS-DP.
Appendix C, MENU Map for R-30*i*B/ R-30*i*A/ R-30*i*A Mate PROFIBUS-DP Interface Function	When you look for the PROFIBUS-DP screen you want to display, use this MENU MAP.

2 SYSTEM OVERVIEW

This section briefly describes the functions of the robot PROFIBUS-DP (12M) interface.

2.1 FUNCTION OVERVIEW

The PROFIBUS-DP (12M) interface function is implemented on a two PROFIBUS-DP interface board. The PROFIBUS Master Interface board is used for the DP master (class 1) function (referred to as the master function) and The PROFIBUS Slave Interface board is used for the DP slave function (referred to as the slave function). These functions can be connected to separate networks.

On one of the networks to which it is connected, the Robot operates as a master to exchange I/O data with peripheral equipment (such as welding equipment). On the other network, the Robot operates as a slave to exchange I/O data with a unit such as a PLC, used to integrate cells. This function is supported only for the Robot.

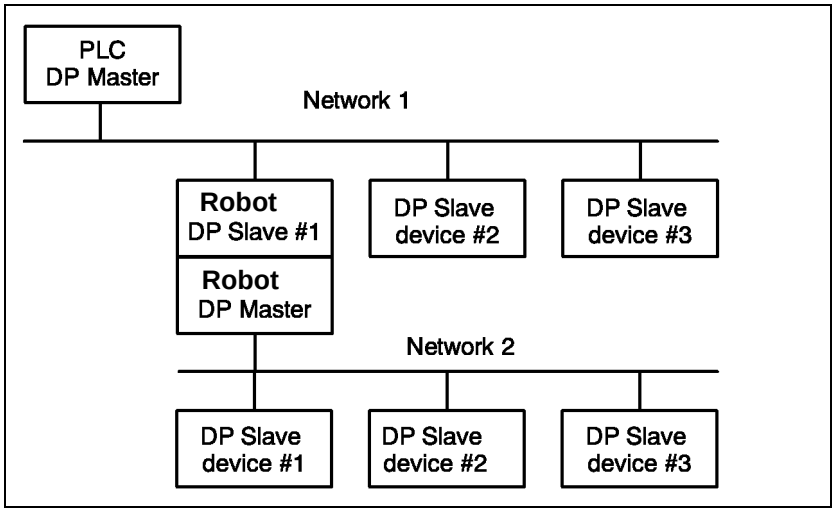


Fig. 2.1 Example system configuration

Networks 1 and 2 are independent of each other.

2.2 SPECIFICATION OVERVIEW

Table 2.2 Specification overview

Item	Specification
Robot Master function	
Baud rate	max. 12 Mbauds
Supported types	DP master
Number of inputs	1024
Number of outputs	1024
Number of analog inputs	16 channels per one device (max. 48 channels). Some analog devices can not be assigned to 1 slave.
Number of analog outputs	16 channels per one device (max. 48 channels) Some analog devices can not be assigned to 1 slave.
Supported signal types	Digital, UOP, group, analog, and arc welding signals
Number of slave nodes that can be connected	32

Item	Specification
Robot Slave function	
Baud rate	max. 12 Mbauds
Supported types	DP slave
Number of inputs	1024 NOTE The total of inputs and outputs for the Robot slave must NOT be more than 1952.
Number of outputs	1024 NOTE The total of inputs and outputs for the Robot slave must NOT be more than 1952.
Supported signal types	Digital, UOP and group signals

NOTE
1 Analog and arc welding signals can be transmitted only with the master function.
2 The total of inputs for the Robot master and the Robot slave must NOT be more than 1024. The total of outputs for the Robot master and the Robot slave must NOT be more than 1024.

2.3 FEATURES

The Robot PROFIBUS-DP interface has the following features.

- The DP master and slave functions operate independently of each other.
- The PROFIBUS-DP interface can be used together with other I/O devices such as process I/O boards and the FANUC I/O Unit Model B.
- A dedicated signal (UOP) can be allocated to I/O data exchanged via the PROFIBUS-DP interface. The default setting allocates the signal to I/O data transmitted with the slave function.
- The signals and states listed below can be output to the PROFIBUS-DP by reflecting them in DOs using the I/O Interconnect function. The TP screen can be used to specify the DO to which a particular signal or state is to be output. Refer to the "R-30*i*B CONTROLLER OPERATOR'S MANUAL (Basic Operation)" or (R-30*i*A or R-30*i*A Mate) CONTROLLER OPERATOR'S MANUAL for each tool.
  - CE marking 3-mode switch
  - SOP START/RESET
  - Cause of emergency stop, in the following cases:
    TP emergency stop
    SOP emergency stop
    UOP immediately stop software signal (*IMSTP)
    Open deadman or fence switch (FENCE1 and FENCE2)
    External emergency stop (EMGIN1 and EMGIN2)

NOTE
A DO that indicates the cause of an emergency stop is turned off once the cause has been eliminated, even if the system remains in an alarm state.

- The PROFIBUS-DP interface can be used with arc welding and sealing equipments. Refer to the manual provided with the relevant tool for details.

2.4 COMMUNICATION DATA FLOW

The contents of this section relate to the example system configuration illustrated in Fig 2.1

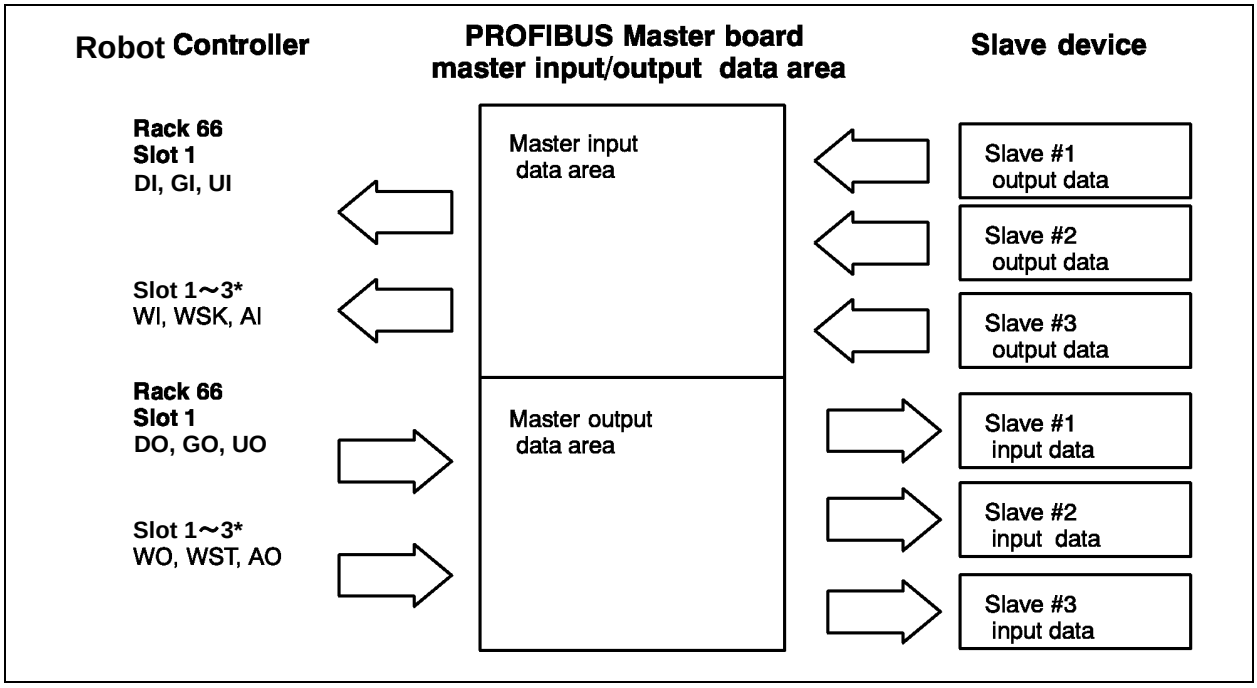


Fig. 2.4 (a) Robot master function data flow

*See Section 4.3.2

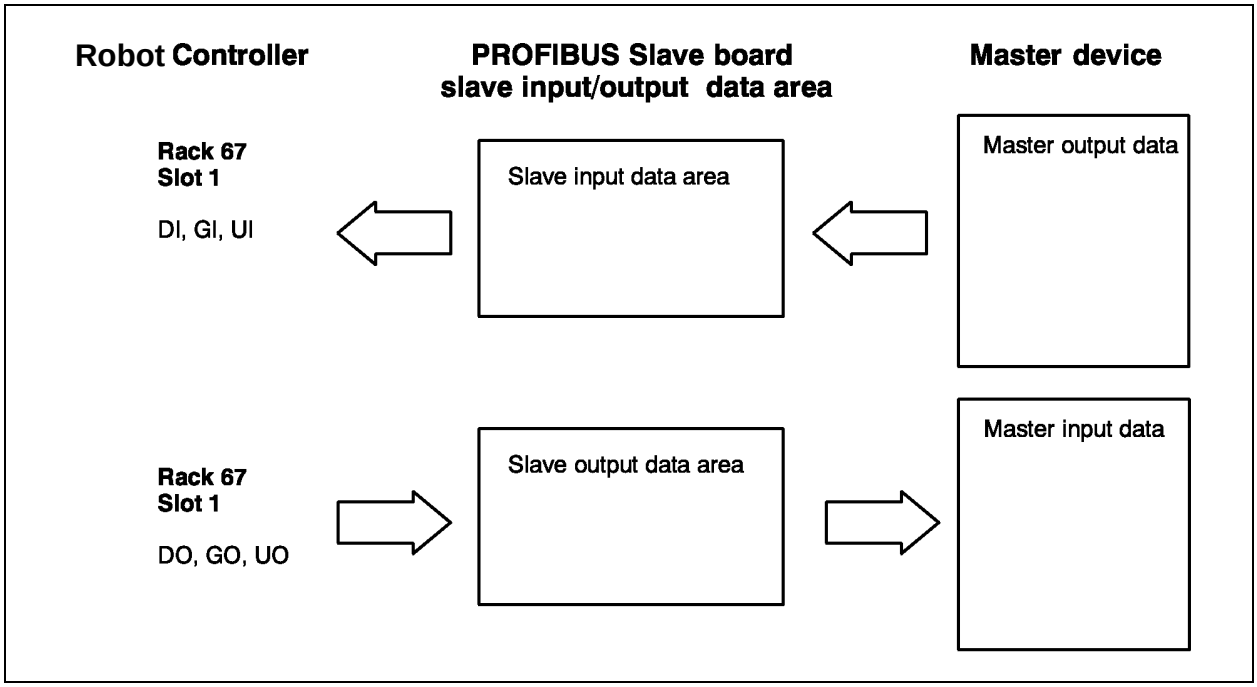


Fig. 2.4 (b) Robot DP slave function data flow

2.5 ORDER NUMBER

Table 2.5 (a) PROFIBUS DP interface (software)

Name	Order number
PROFIBUS DP (12M) Interface (Master&Slave function)	(R-30*i*B) A05B-2600-J713 (R-30*i*A/R-30*i*A Mate) A05B-2500-J713
PROFIBUS DP (12M) Slave (Only Slave function)	(R-30*i*B) A05B-2600-J751 (R-30*i*A/R-30*i*A Mate) A05B-2500-J751
PROFIBUS DP (12M) Master (Only Master function)	(R-30*i*B) A05B-2600-J752 (R-30*i*A/R-30*i*A Mate) A05B-2500-J752

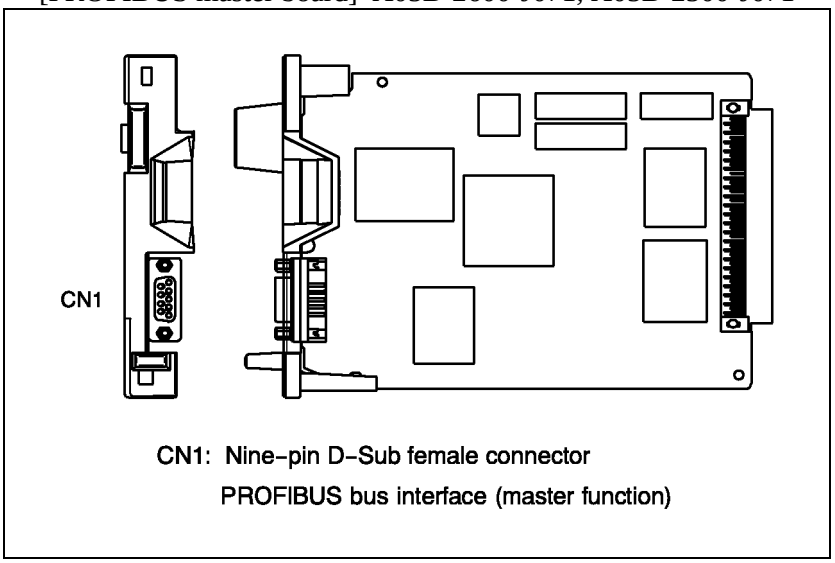
Table 2.5 (b) PROFIBUS DP interface (hardware)

Name	Order number
PROFIBUS board (Slave)	(R-30*i*B) A05B-2600-J070 (R-30*i*A) A05B-2500-J070 (R-30*i*A Mate) A05B-2550-J001
PROFIBUS board (Master)	(R-30*i*B) A05B-2600-J071 (R-30*i*A) A05B-2500-J071 (R-30*i*A Mate) A05B-2550-J002

3 PROFIBUS-DP BOARD

This section describes the PROFIBUS board required to enable PROFIBUS-DP communication.

[PROFIBUS master board] A05B-2600-J071, A05B-2500-J071



[PROFIBUS slave board] A05B-2600-J070, A05B-2500-J070

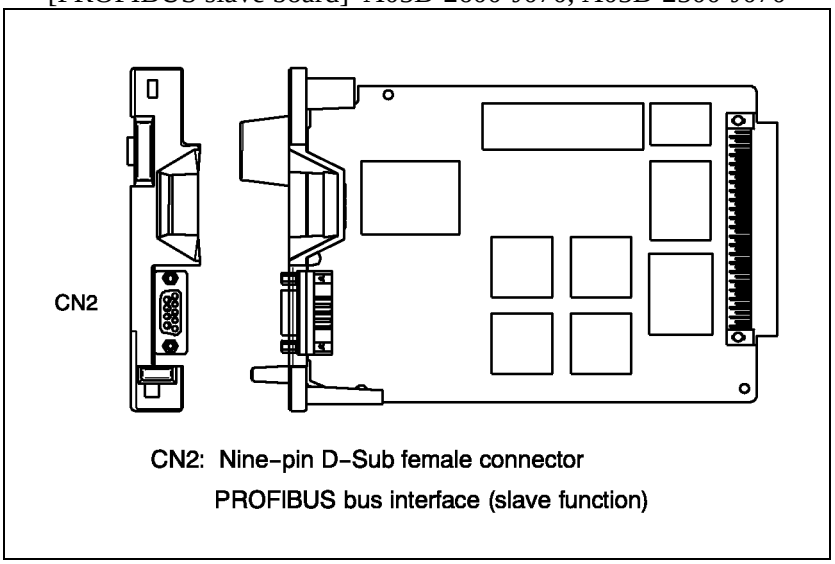


Fig. 3 PROFIBUS BOARD

3.1 PROFIBUS-DP BOARD COMPONENT NAMES

- Master function connector
- Master function status indication LEDs
- Slave function connector
- Slave function status indication LEDs

3.2 PROFIBUS-DP BOARD CONNECTORS

Table 3.2 PROFIBUS-DP Board Connectors

CONNECTOR	DESCRIPTION
CN1	Connector for cable used to connect the Robot master function
CN2	Connector for cable used to connect the Robot slave function

3.3 MASTER FUNCTION LEDS

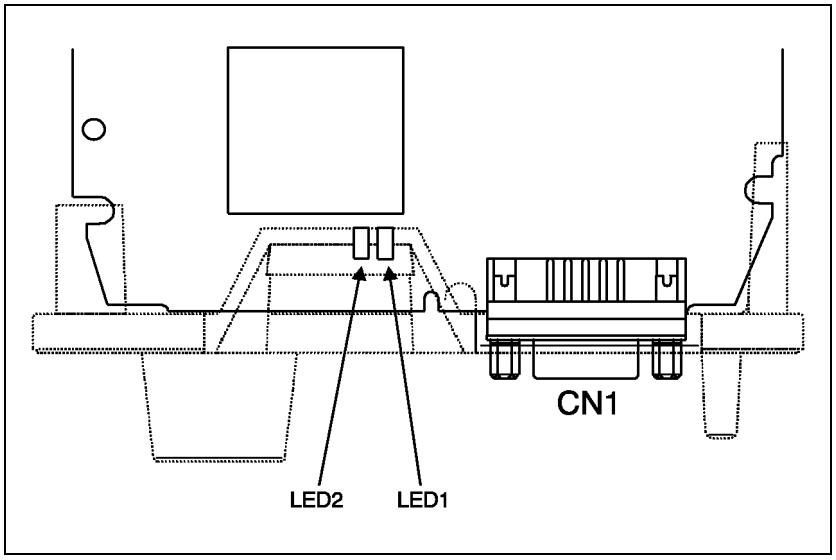


Fig. 3.3 Master LEDs

NOTE
The face plate is indicated by a broken line.

Table 3.3 Master LEDs

LED	DESCRIPTION
LED1	Turned on if the CPU of this board starts. Usually ON.
LED2	Turned on when the Robot master contains the token. Usually ON.

3.4 SLAVE FUNCTION LEDS

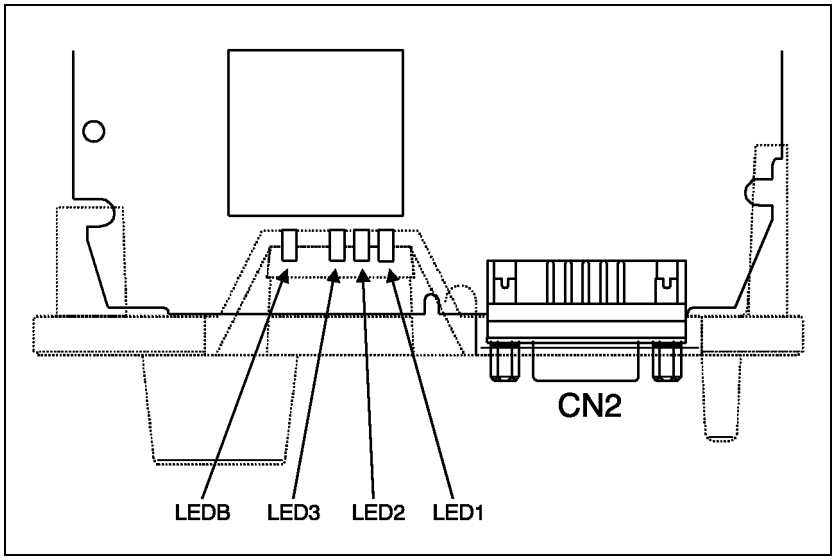


Fig. 3.4 Slave LEDs

NOTE
The face plate is indicated by a broken line.

Table 3.4 Slave LEDs

LED	DESCRIPTION
LED1	Turned on if the CPU of this board starts. Usually ON.
LED2	Turned on when the Robot slave is performing DI/DO transfer according to valid parameter and configuration data (see Section 4.1.2) received from the DP master.
LED3	Turned off the following cases: - The Robot slave has received no parameter or configuration data from DP master since the Robot was switched on. Probable causes are an incorrectly connected cable or the DP master not being switched on. - The Robot slave has received the invalid parameter or configuration data. - The Robot slave cannot communicate with the DP master. Probable causes are a detached communication cable or that the DP master has been switched off.
LEDB	Turned on if the parity error occurs on this board. Usually OFF.

3.5 PROFIBUS-DP BOARD INSTALLATION

The PROFIBUS Master and Slave board can be installed in any unoccupied option slot in the Robot controller.

⚠ WARNING
Before attempting to attach or detach a unit or board, completely disconnect the power to the controller. Failure to do so presents a serious risk of injury.

Procedure 3-1 Installing PROFIBUS-DP Board

Step

1 Switch off the power to the controller.
2 Disconnect electrical power from the controller. Turn the circuit breaker to the OFF position.

⚠ WARNING

Even when the disconnect switch and circuit breaker are set to their OFF positions, hazardous voltages are present inside the controller. To completely disconnect the controller, remove the plug of the controller's power cord from the wall outlet.

3 Using a standard (flat-blade) screwdriver, release the controller's front door by moving the latch to the UNLOCKED position. See Fig. 3.5 (a)

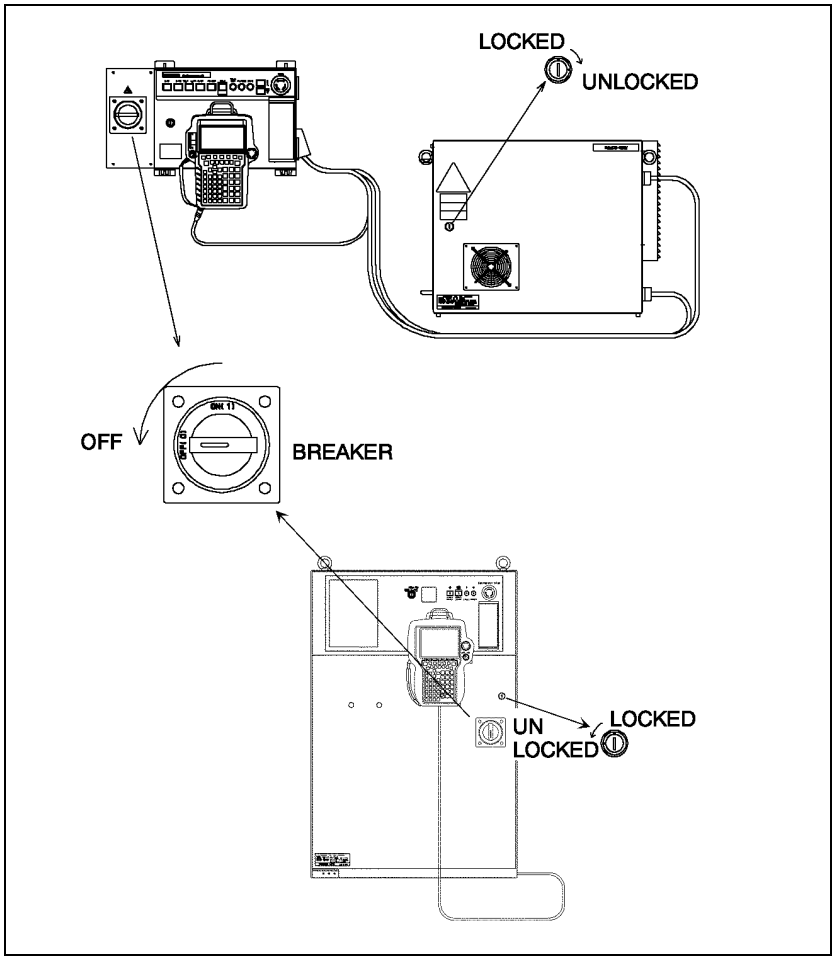


Fig. 3.5 (a) Circuit breaker and latch of robot controller

4 Insert the PROFIBUS-DP interface board into any unoccupied option slot. Do not insert it into a slot intended for a power supply unit.

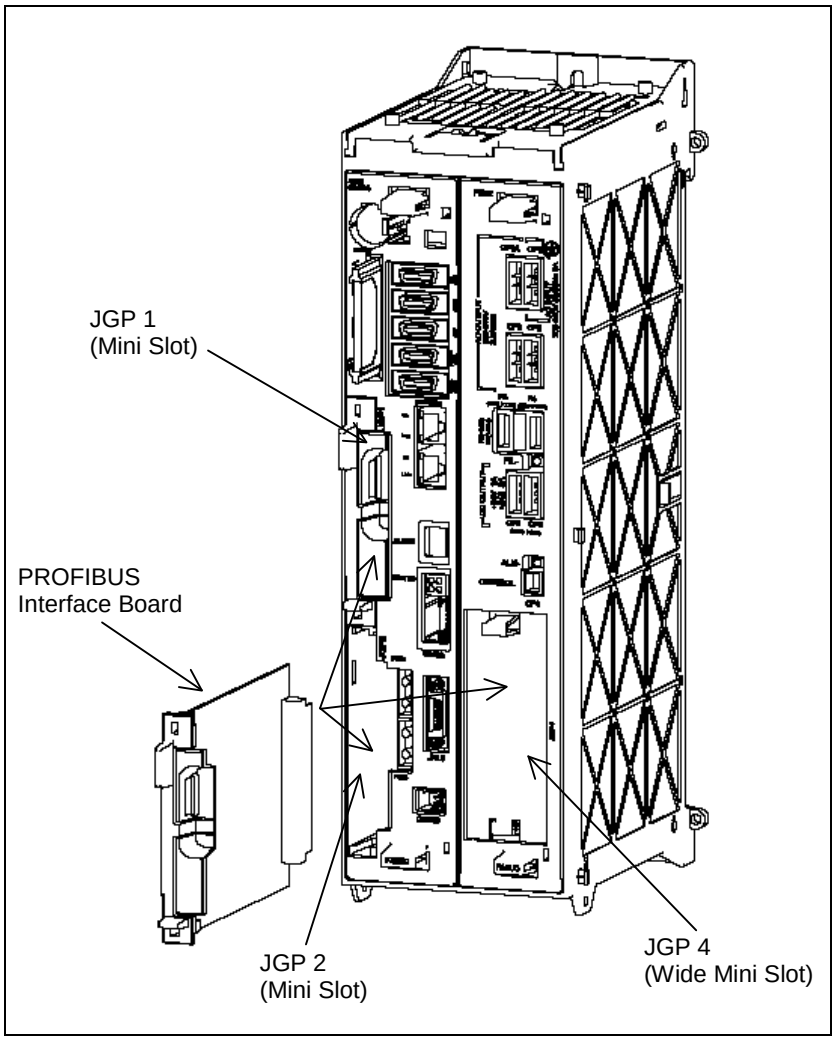


Fig. 3.5 (b) Installing the robot PROFIBUS-DP interface board

NOTE
Partially strip the insulation of the PROFIBUS cable to expose the shielding, and secure the cable with a metal clamp at the point where the shielding is exposed. Refer to the relevant Connection/Maintenance Manual for details.

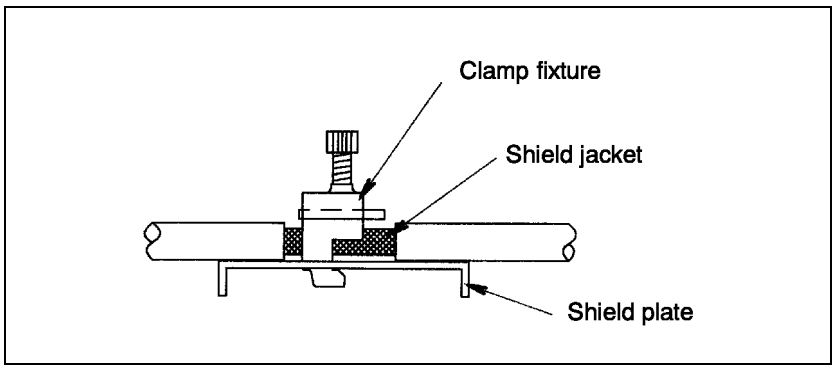


Fig. 3.5 (c) Cable clamp

5 Close the controller door. Set the circuit breaker handle or disconnect switch to the ON position.

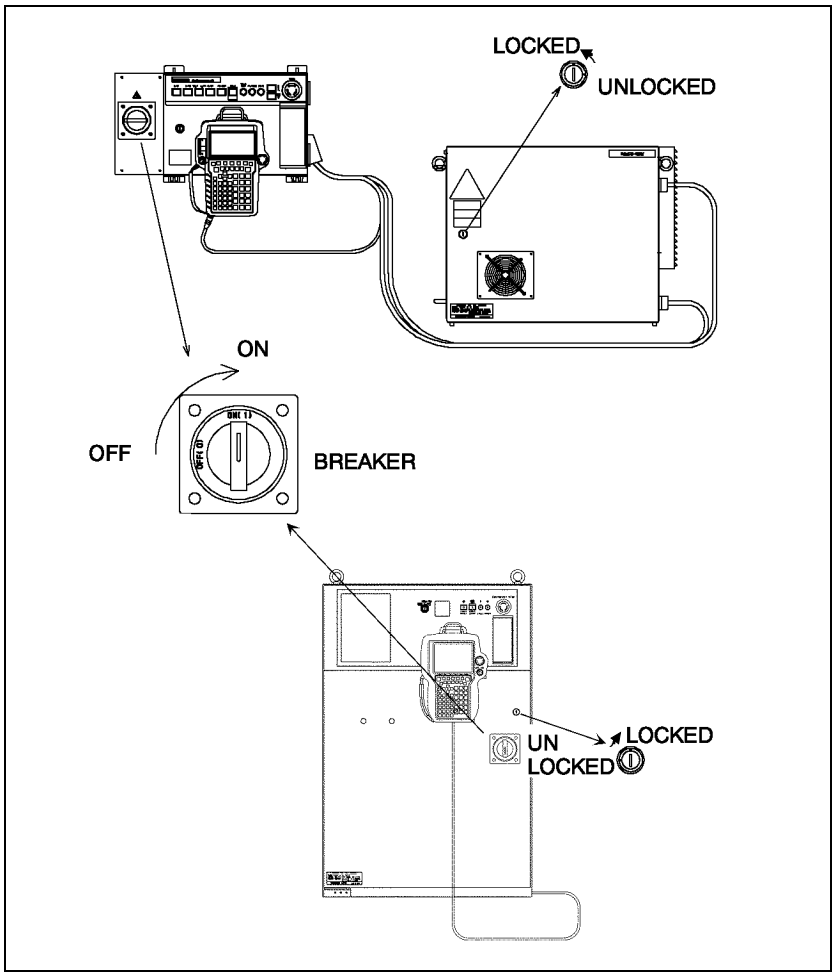


Fig. 3.5 (d) Circuit breaker and latch of robot controller

4 SETUP PRIOR TO STARTING COMMUNICATION

This chapter describes the master/slave function settings that must be made before communication can be started.

4.1 DP SLAVE/MASTER SETUP

This section describes how to set the number of master/slave input/output bytes and so on.

4.1.1 Number of Master/Slave Input/Output Bytes

Setting the number of master/slave input/output bytes. The number of master/slave input/output bytes is default settings as listed in Table 4.1.1

Number of input bytes to the master	Number of signals that can be input to the master
Number of output bytes from the master	Number of signals that can be output from the master
Number of input bytes to the slave	Number of signals that can be input to the slave
Number of output bytes from the slave	Number of signals that can be output from the slave

Table 4.1.1 Number of master/slave input/output bytes

Signal types	Default settings
Number of input bytes to the slave	8
Number of output bytes from the slave	10
Number of input bytes to the master	24
Number of output bytes from the master	22

The number of input/output bytes can be changed by using Procedure 4-1 or Procedure 4-2.

For the new settings to become effective, it is necessary to clear all the I/O assignment data and switch the robot controller power off then on again.

Limit on the number of master/slave input/output bytes

Maximum number of input bytes
128 >= (number of input bytes to the slave + number of input bytes to the master)

Maximum number of output bytes
128 >= (number of output bytes from the slave + number of output bytes from the master)

Maximum number of slave input/output bytes
244 >= (number of input bytes to the slave + number of output bytes from the slave)

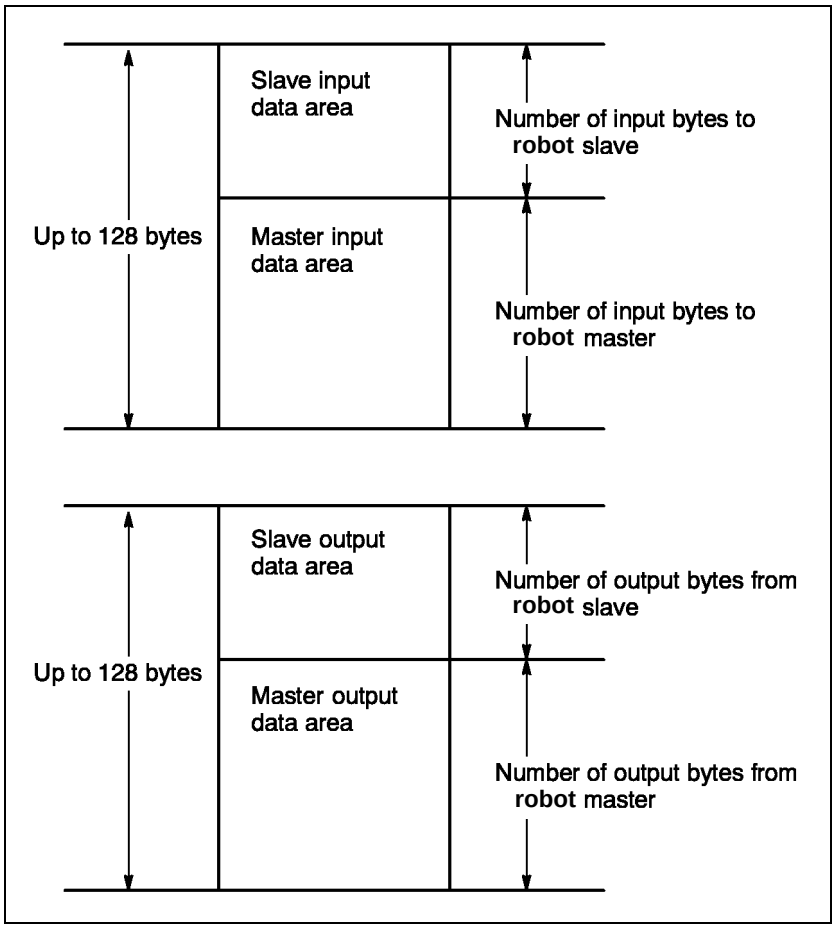


Fig. 4.1.1 Limits on the number of master/slave input/output bytes

4.1.2 Setting The Slave Function

Setting the DP master that will communicate with the robot slave.

Robot Slave Address

Use Procedure 4-1 to set the robot slave address. Robot Slave Address is default settings to 3. For the new robot slave address to become effective, it is necessary to switch the robot controller power off then on again.

For the configuration data for using the robot slave, usually set the value specifying the input/output type with the first data, and input/output byte number with the following data. The value specifying the input/output type is set in hexadecimal as follows:

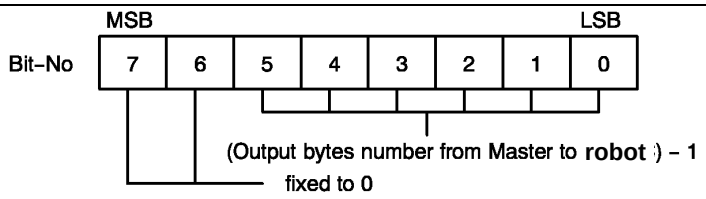
(a) For using both input/output
(input/output byte number > 0) : 0xC0

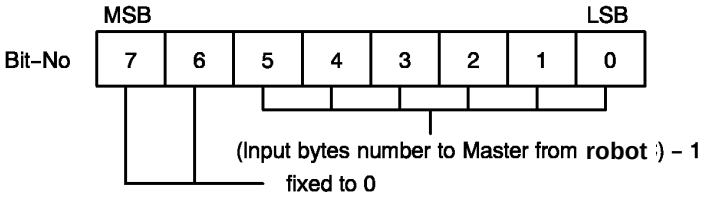
(b) For using only output
(input byte number = 0, output byte number > 0) : 0x80

(c) For using only input
(input byte number > 0, output byte number = 0) : 0x40

For example, for (a) For using both input/output, the format is as listed below.

Table 4.1.2 (a) The configuration data for the robot slave

<table>
<tr><td>Byte 1</td><td>0xC0</td></tr>
<tr><td>Byte 2</td><td> 

If the outputs bytes number from Master to robot is 8, for example, byte 2 must be set to 0x07.</td></tr>
<tr><td>Byte 3</td><td> 

If the input bytes number to Master from robot is 10, for example, byte 3 must be set to 0x09.</td></tr>
</table>

Because the maximum values of input byte number -1 and output byte number -1 are 3F, the above format can be used when the input or output byte number is up to 64 bytes.

When the input and output byte numbers are 65 bytes or more, the above format is repeated as follows:

Data length: 6
Byte1: 0xC0
Byte2: Bit7 = 0, Bit6 = 0, Bit(5-0) = output byte number -1
Byte3: Bit7 = 0, Bit6 = 0, Bit(5-0) = input byte number -1
Byte4: 0xC0
Byte5: Bit7 = 0, Bit6 = 0, Bit(5-0) = output byte number -1
Byte6: Bit7 = 0, Bit6 = 0, Bit(5-0) = input byte number -1

For using only output or input, the following format is used:
(b) For using only output
Data length: Multiple of 2
Byte n: 0x80
Byte n+1: Bit7 = 0, Bit6 = 0, Bit(5-0) = output byte number -1
... repeated.
(c) For using only input
Data length: Multiple of 2
Byte n: 0x40
Byte n+1: Bit7 = 0, Bit6 = 0, Bit(5-0) = input byte number -1
... repeated.

Table 4.1.2 (b) Example of CONFIG DATA

OUT (byte)	IN (byte)	CONFIG DATA BYTES	CONFIG DATA					
			1	2	3	4	5	6
0	10	2	64(0x40)	9(0x09)				
0	128	4	64(0x40)	63(0x3F)	64(0x40)	63(0x3F)		
1	32	3	192(0xC0)	0(0x00)	31(0x1F)			
8	0	2	128(0x80)	7(0x7)				
8	10	3	192(0xC0)	7(0x7)	9(0x9)			
32	1	3	192(0xC0)	31(0x1F)	0(0x00)			
64	128	5	192(0xC0)	63(0x3F)	63(0x3F)	64(0x40)	63(0x3F)	
116	128	6	192(0xC0)	63(0x3F)	63(0x3F)	192(0xC0)	51(0x33)	63(0x3F)

OUT (byte)	IN (byte)	CONFIG DATA BYTES	CONFIG DATA					
			1	2	3	4	5	6
128	0	4	128(0x80)	63(0x3F)	128(0x80)	63(0x3F)		
128	116	6	192(0xC0)	63(0x3F)	63(0x3F)	192(0xC0)	63(0x3F)	51(0x33)
128	64	5	192(0xC0)	63(0x3F)	63(0x3F)	128(0x80)	63(0x3F)	

Parameter Data

Set the parameter data for the robot slave as follows:
Set Station_status as listed below.

Table 4.1.2 (c) The Station_status of parameter data for the robot slave

Bit 7	Lock_Req = 1
Bit 6	UnLock_Req = 0
Bit 5	Sync_Req = 0
Bit 4	Freeze_Req = 0
Bit 3	WD_on = 1

Set WD_Fact_1 and WD_Fact_2 to 50 ms or more.
Set Ident_Number to 0x0A2D (hexadecimal).
Do not set User_Prm_Data.

For details, please refer to Appendix A The Robot GSD file.

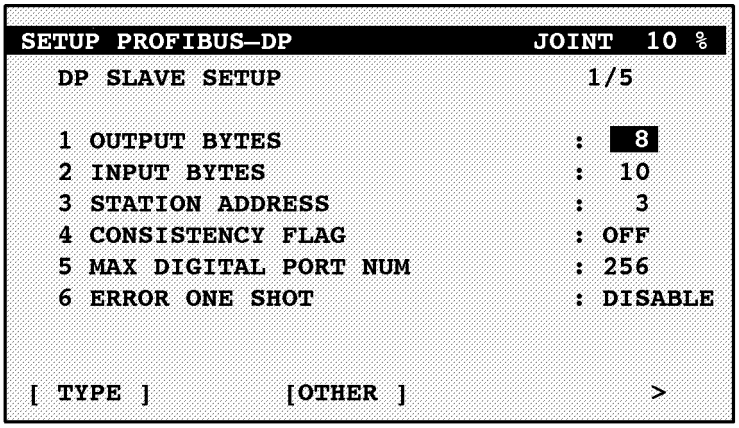
Table 4.1.2 (d) DP SLAVE SETUP Screen

ITEM	Description
OUTPUT BYTES	Output byte number from DP Master to robot
INPUT BYTES	Input byte number to DP Master from robot
STATION ADDRESS	Robot Slave station address
CONSISTENCY FLAG	This function is not supported. This item must be set to OFF.
MAX DIGITAL PORT NUM	The maximum point which can be displayed on digital I/O screen.
ERROR ONE SHOT	When this function is enabled, even if the alarm related to the Profibus communication occurs, you can reset this alarm then the alarm doesn't occur again. When this function is enabled, "PROF-017 Slave disconnected" doesn't happen fundamentally. This function is useful when you want to check the robot program before establishing the Profibus communication. **NOTE** You must set it to disabled during the production.

Procedure 4-1 Displaying DP SLAVE SETUP Screen

Step

1 Press MENUS.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP SLAVE SETUP Screen is not displayed, press F3, [OTHER], and select SLAVE. If F3, [OTHER], is not displayed, press F2, LIST or NEXT,> or PREV.
You can see the following screen.



4.1.3 Setting The Master Function

Use Procedure 4-2 to set the robot master function.

Table 4.1.3 (a) DP MASTER SETUP Screen

ITEM	Description
OUTPUT BYTES	Output byte number to DP Slave from robot
INPUT BYTES	Input byte number from DP Slave to robot
SLAVE PARAMETER INIT	The following procedure initializes the slave parameter sets. **⚠ CAUTION** Initialization sets all slave parameters to standard values, canceling all user-set data. If previously set data must be preserved, make a note of it before performing initialization. 1 Set this item to ON 2 Turn off the controller, then turn it on again.This procedure initializes the slave parameter set specified for a slave communicating with the robot. The slave parameter set for station NO.3,4,5,6 are set as listed in Table 4.1.3 (b). The other slave parameter sets are set using the same initialization data.
MAX DIGITAL PORT NUM	The maximum point which can be displayed on digital I/O screen.

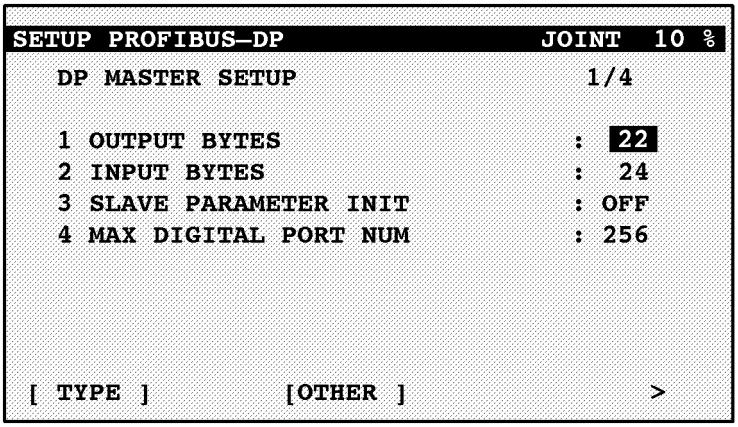
Table 4.1.3 (b) Initialization data of slave parameter

STATION NO.	DEVICE
The slave parameter set for station NO.3	24 DIs/8 DOs 0.2 ms for Siemens ET 200B
The slave parameter set for station NO.4	Robot slave
The slave parameter set for station NO.5	Robot slave
The slave parameter set for station NO.6	Siemens ET 200M (The installed module in ET 200M are SM321, SM322, SM331 and SM332.)

Procedure 4-2 Displaying DP MASTER SETUP Screen

Step

1 Press MENUS.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP MASTER SETUP Screen is not displayed, press F3, [OTHER], and select MASTER. If F3, [OTHER], is not displayed, press F2, LIST or PREV or NEXT,>. You can see the following screen.



6 To change the setting, set the cursor to the item to be set, and enter a value by using the numeric keys or function keys.
7 To clear the I/O assignment,
  a Press NEXT,>.
  b Press F1,CLR_ASG, then the following message is displayed.
    "Clear all assignments ?"
  c Press F4,YES to clear all I/O assignment.
8 To save all the PROFIBUS-DP setup data to a file,
  a Press FCTN.
  b Select SAVE. This will save all the PROFIBUS-DP setup data to the file, PROFIBUS.SV file, on the selected device.

4.2 DP MASTER PARAMETER

This section describes how to set the master parameters that must be set before the robot master function can be used, as well as the slave parameter to be set for a slave that communicates with the robot master.

4.2.1 DP Master Bus Parameter

The master parameter data consists of data such as bus parameter data. Use Procedure 4-3 to set the master parameters.

For details, refer to PROFIBUS STANDARD DIN 19245 Part 1 and Draft Standard PROFIBUS-DP DIN 19245 Part 3.

These parameters may have to be modified if communication between the robot master and slave proves impossible. Whenever communication is possible with the default settings, those settings should be left as it. If new data is specified, it does not become effective until the power is switched off then on again.

You need not change if there is no necessity because the optimum data has already been set.

And when the Baudrate is changed, the optimum data is automatically set as for other data.

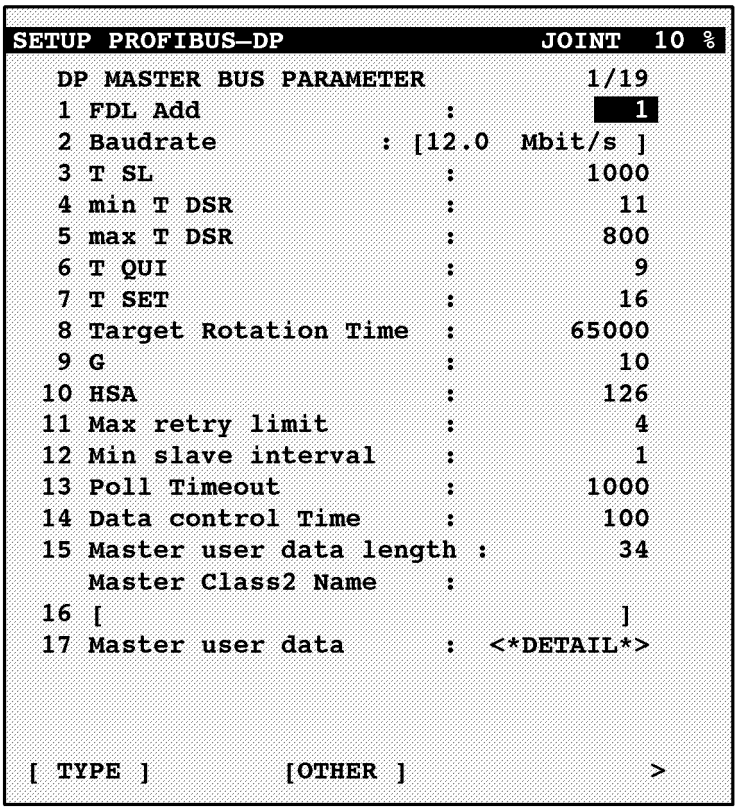
Table 4.2.1 DP MASTER BUS PARAMETER Screen

ITEM	Description
FDL Add	Fieldbus Data Link Address of this station (Robot Master) The legal range of values are 0 to 125.
Baudrate	Baudrate
T SL	Slot Time
min T DSR	Minimum Station Delay Time
max T DSR	Maximum Station Delay Time
T QUI	Transmitter fall/Repeater switch Time
T SET	Setup Time
Target Rotation Time	Target Rotation Time
G	Gap Update Time
HSA	Highest Station Address
Max retry limit	Maximum Number of retries
Min slave interval	Minimum slave interval for between two slave poll cycles
Poll Timeout	Poll Timeout for the master-master communication
Data control Time	Data control time for sending own operation mode
Master user data length	The byte length of master user data
Master Class2 Name	master who created this parameter sets
Master user data	This field contains specific data from the manufacturer which necessary for the bus parameter set.

Procedure 4-3 Displaying DP MASTER BUS PARAMETER Screen

Step

1 Press MENUS.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP MASTER BUS PARAMETER Screen is not displayed, press F3, [OTHER], and select BUS PARAM. If F3, [OTHER], is not displayed, press F2,LIST or NEXT,> or PREV.
You can see the following screen.

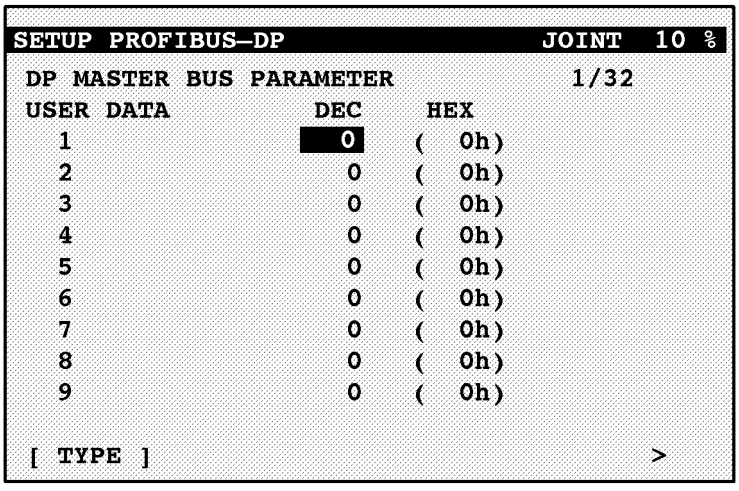


6 To change the setting, set the cursor to the item to be set, and enter a value by using the numeric keys or function keys.

7 To change the baudrate:
   a Move the cursor to Baudrate item.
   b Enter the appropriate baudrate using F4, [CHOICE].

8 To change Master Class 2 Name:
   a Move the cursor to the Master Class 2 Name item and press the ENTER key.
   b Select a method of naming this item.
   c Press the appropriate function keys to enter this item.
   d When you finished, press ENTER.

9 To change Master user data:
   a Move the cursor to Master user data item.
   b Press ENTER. The following is the screen for setting this item. Press PREV on this screen returns to the screen shown above. Each data must be set using a decimal number. The setting data which is represented by hexadecimal number is displayed on the right position.



10 To clear the I/O assignment,
   a Press NEXT,>.
   b Press F1,CLR_ASG, then the following message is displayed.
   "Clear all assignments ?"
   c Press F4,YES to clear all I/O assignment.
11 To save all the PROFIBUS-DP setup data to a file,
   a Press FCTN.
   b Select SAVE. This will save all the PROFIBUS-DP setup data to the file, PROFIBUS.SV file, on the selected device.

4.2.2 DP Master Slave Parameter

Setting the slave parameters for a slave that communicates with the robot master. Use Procedure 4-4 to set the Slave parameter sets.

Setting the slave parameter

The user only has to set device-specific parameter data, an ID, configuration data, user parameter data, and the robot master-specific data (described later). If a slave parameter is set incorrectly due to user error, initialization should be performed to re-set that slave parameter (See Section 4.1).

Each item must be set using a decimal number. For details, refer to PROFIBUS STANDARD DIN 19245 Part 1 and Draft Standard PROFIBUS-DP DIN 19245 Part 3.

Table 4.2.2 DP MASTER SLAVE PARAMETER Screen

ITEM	Description
SLAVE ENABLE/DISABLE (ENB/DIS)	This data specifies whether this slave parameter set is effective. When the slave parameter set is effective, switching the robot controller power off then on again causes communication with the slave to start, using the slave parameter settings. If the slave parameter set is ineffective, switching the robot controller power off then on again causes communication with the slave to be disabled. - ENABLE : This slave parameter set is effective. - DISABLE: This slave parameter set is not effective.
STATION ADDRESS (Address)	This data is set to the station address of the slave that communicates with the robot Master using this slave parameter set. When you set the slave parameters, specifying n as the number of slave parameter set causes a value of n+2 to be set. For the slave parameters for slave address 6, for example, use the slave parameter set 4, where the number is 4, obtained by subtracting 2 from 6. This item can be set to any value between 3 and 34. Communication is disabled if a value that falls outside this range is specified.
Comment	Comment for this slave parameter.
INPUT OFFSET ADDRESS	This data is the offset in bytes from the beginning of the master input data area (DI data area). The number of input data area (DI data area) bytes is set to the value obtained by INPUT BYTES on DP MASTER SETUP Screen (See Section 4.1).
OUTPUT OFFSET ADDRESS	This data is the offset in bytes from the beginning of the master output data area (DO data area). The number of output data area (DO data area) bytes is set to the value obtained by OUTPUT BYTES on DP MASTER SETUP Screen (See Section 4.1).
INPUT BYTES	This data is the number of data bytes input from this slave.
OUTPUT BYTES	This data is the number of data bytes output to this slave.
SLAVE FLAG	This data contains slave specific flags. • ACTIVE : The Active flag of slave flag • NEW PRM : The NEW_Prm flag of slave flag
SLAVE TYPE	This data contains a manufacturer specific type. - 0:DP-Slave

ITEM	Description
STATION STATUS	This data contains the Station_status of parameter data. This data contains the following bits. • LOCK REQ : If LOCK_REQ=ON and UNLOCK_REQ=OFF, this slave is locked for other masters. • UNLOCK REQ : If UNLOCK_REQ=ON and LOCK_REQ=OFF, this slave is unlocked for other masters. • SYNC REQ : If ON, this slave accepts the sync control command. • FREEZE REQ : If ON, this slave accepts the freeze control command. • WD REQ : If ON, the watchdog control activated at this slave.
WD FACT1,2	The watchdog time=10ms * WD_FACT1 *WD_FACT2
MIN TSDR	This data is the minimum waiting time for a DP-Slave until it is allowed to send the response frame to the DP-Master.
IDENT NUMBER	The ident number of this slave.
GROUP IDENT	This data determines which group(s) shall be addressed. Each bit represents a group. • GROUP 1 to 8 - ON : addressed - OFF : Not addressed
USER PRM DATA BYTES	The byte length of user parameter data.
USER PRM DATA	The user parameter data.
CONFIG DATA BYTES	The byte length of configuration data.
CONFIG DATA	The configuration data.
DPRAM INPUT OFFSET	To set this data by using the following format. (STATION ADDRESS - 3) * 32
DPRAM OUTPUT OFFSET	To set this data by using the following format. (STATION ADDRESS - 3) * 32 + 1024
SLAVE USER DATA BYTES	The byte length of slave user data.
SLAVE USER DATA	The slave user data.

Robot master-specific data that must be set are as follows.

- SLAVE ENABLE/DISABLE (ENB/DIS)
- INPUT OFFSET ADDRESS
- OUTPUT OFFSET ADDRESS
- INPUT BYTES
- OUTPUT BYTES

Note that the data of INPUT BYTES and OUTPUT BYTES must match the configuration data set in CONFIG DATA for this slave parameter set.

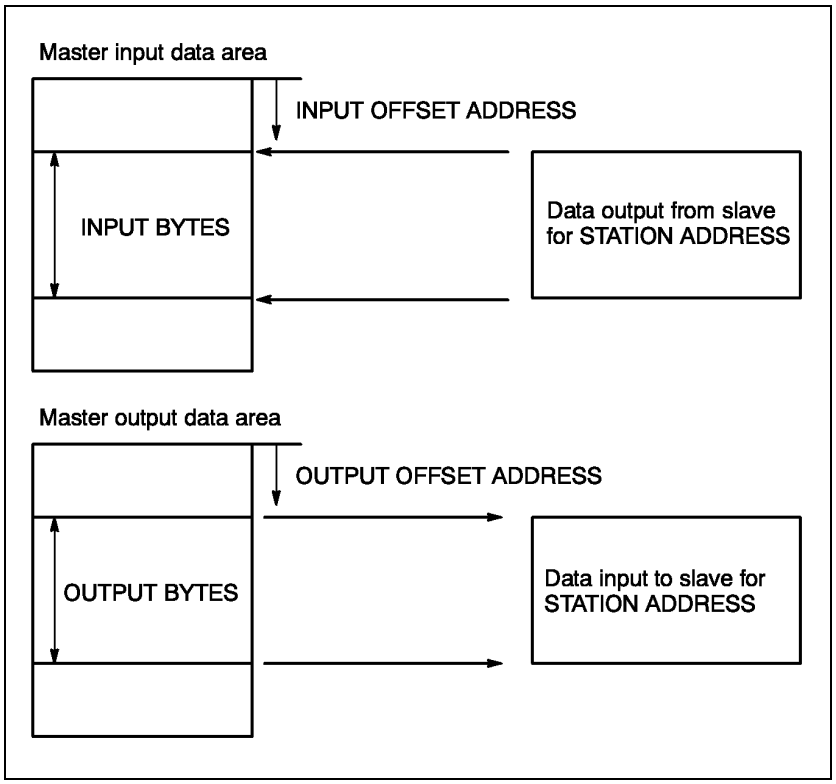


Fig. 4.2.2 Master Input/Output Data Area

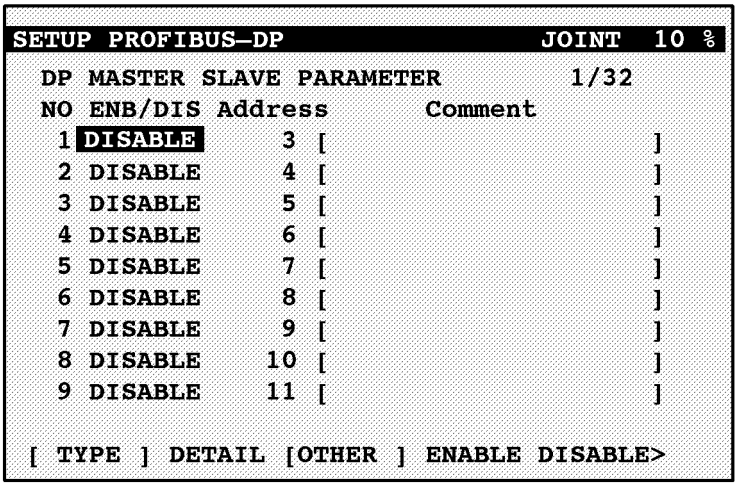
> **⚠ CAUTION**
> Be careful not to exceed the limits of the master data area. Otherwise, an error will be detected when the power is switched on, and the data input from the slave will not be reflected in the master input data area. Further more, no data will be output from the robot master to that slave.

> **⚠ CAUTION**
> Be careful to prevent the data area for one slave from overlapping that of another slave. Otherwise, the robot master will not be able to read data from, or output data to, the slave correctly.

Procedure 4-4 Displaying DP MASTER SLAVE PARAMETER Screen

Step

1 Press MENUS.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP MASTER SLAVE PARAMETER Screen is not displayed, press F3, [OTHER], and select SLAVE PARAM. If F3, [OTHER], is not displayed, press F2, LIST or NEXT,> or PREV. You can see the following screen.



6 To change the setting, set the cursor to the item to be set, and enter a value by using the numeric keys or function keys.

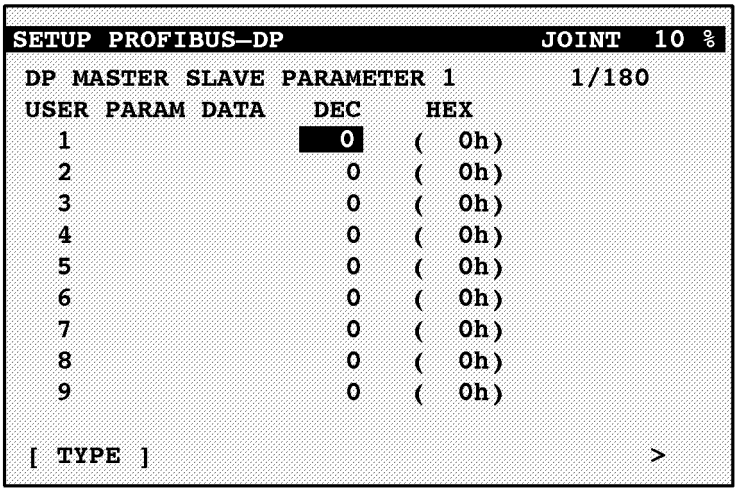
7 Move the cursor to the slave parameter you want to set up and Press F2, DETAIL. You will see the following screen. When you finished setting up the slave parameter, press F2, LIST or PREV.

```
SETUP PROFIBUS—DP                    JOINT  10 %
 DP MASTER SLAVE PARAMETER 1          1/38
   1 SLAVE ENABLE/DISABLE    :      DISABLE
   2 STATION ADDRESS         :            3
     COMMENT                 :
   3 [                     ]
   4 INPUT OFFSET ADDRESS    :            0
   5 OUTPUT OFFSET ADDRESS   :            0
   6 INPUT BYTES             :            3
   7 OUTPUT BYTES            :            1
   8 SLAVE FLAG          :   192 (  C0h)
   9  ACTIVE                 :           ON
  10  NEW PRM                :           ON
  11 SLAVE TYPE              :            0
  12 STATION STATUS      :   184 (  B8h)
  13  LOCK REQ               :           ON
  14  UNLOCK REQ             :          OFF
  15  SYNC REQ               :           ON
  16  FREEZE REQ             :           ON
  17  WD REQ                 :           ON
  18 WD FACT1                :           10
  19 WD FACT2                :           10
  20 MIN TSDR                :           55
  21 IDENT NUMBER        :    14 (   Eh)
  22 GROUP IDENT         :     0 (   0h)
  23  GROUP 1                :          OFF
  24  GROUP 2                :          OFF
  25  GROUP 3                :          OFF
  26  GROUP 4                :          OFF
  27  GROUP 5                :          OFF
  28  GROUP 6                :          OFF
  29  GROUP 7                :          OFF
  30  GROUP 8                :          OFF
  31 USER PRM DATA BYTES     :            5
  32 USER PRM DATA           : <*DETAIL*>
  33 CONFIG DATA BYTES       :            2
  34 CONFIG DATA             : <*DETAIL*>
  35 DPRAM INPUT OFFSET  :     0 (   0h)
  36 DPRAM OUTPUT OFFSET :  1024 ( 400h)
  37 SLAVE USER DATA BYTES   :            0
  38 SLAVE USER DATA         : <*DETAIL*>

 [ TYPE ]  LIST           ENABLE DISABLE>
```

8 To change Comment:
   a Move the cursor to Comment item and press the ENTER key.
   b Select a method of naming this item.
   c Press the appropriate function keys to enter this item.
   d When you finished, press ENTER.

9 To change USER PRM DATA or CONFIG DATA or SLAVE USER DATA:
   a Move the cursor to item.
   b Press ENTER. You will see a following screen for setting each data. See the following screen for an example. Press PREV on this screen returns to the screen shown above. Each data must be set using a decimal number. The setting data which is represented by hexadecimal number is displayed on the right position.



10 To clear the I/O assignment,
   a Press NEXT,>.
   b Press F1,CLR_ASG, then the following message is displayed.
   "Clear all assignments ?"
   c Press F4,YES to clear all I/O assignment.
11 To display the next or before slave parameter:
   a Press NEXT,>.
   b Press F2,PREV, then the slave parameter of previous number is displayed.
   c Press F3,NEXT, then the slave parameter of next number is displayed.
12 To save all the PROFIBUS-DP setup data to a file,
   a Press FCTN.
   b Select SAVE. This will save all the PROFIBUS-DP setup data to the file, PROFIBUS.SV file, on the selected device.

4.3 DP MASTER I/O CONFIGURATION

4.3.1 DP Master Digital I/O Configuration

This screen displays all digital I/O assignment data for the inputs and outputs from/to a slave that communicates with Robot Master. The following data can be set on DP MASTER SLAVE PARAMETER Screen, too. See Section 4.2.2.

Table 4.3.1 DP MASTER DIGITAL I/O CONFIG Screen

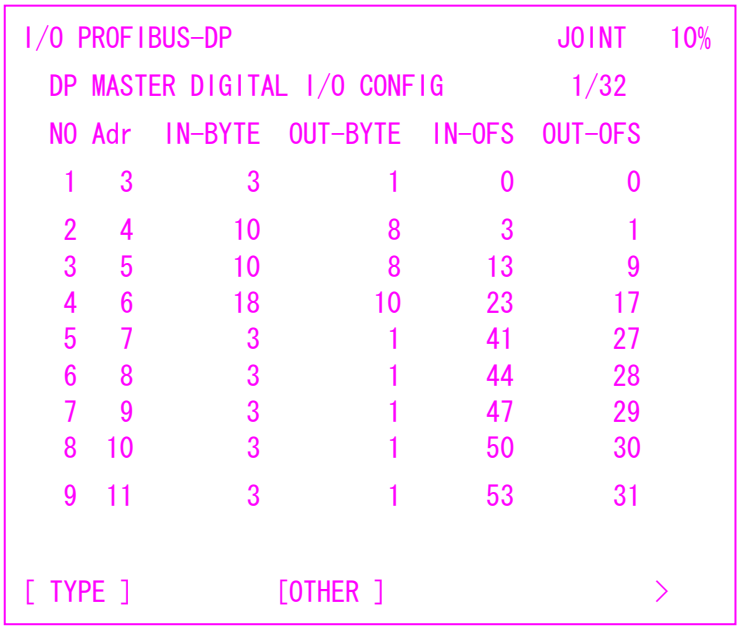
ITEM	Description
Adr	The slave station address.
IN-BYTE	This data is the number of data bytes input from the slave.
OUT-BYTE	This data is the number of data bytes output to the slave.
IN-OFS	This data is the offset in bytes from the beginning of the master input data area (DI data area). The number of input data area (DI data area) bytes is set to the value obtained by INPUT BYTES on DP MASTER SETUP Screen (See Section 4.1).
OUT-OFS	This data is the offset in bytes from the beginning of the master output data area (DO data area). The number of output data area (DO data area) bytes is set to the value obtained by OUTPUT BYTES on DP MASTER SETUP Screen (See Section 4.1).

Procedure 4-5 Displaying DP MASTER DIGITAL I/O CONFIG Screen

Step

1 Press MENUS.

2 Select I/O.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP MASTER DIGITAL I/O CONFIG Screen is not displayed, press F3, [OTHER], and select DIGITAL I/O. If F3, [OTHER], is not displayed, press NEXT,>. You can see the following screen.



6 To change the setting, set the cursor to the item to be set, and enter a value by using the numeric keys.
7 To clear the I/O assignment,
  a Press NEXT,>.
  b Press F1, CLR_ASG, then the following message is displayed.
    "Clear all assignments ?"
  c Press F4, YES to clear all I/O assignment.
8 To save all the PROFIBUS-DP setup data to a file,
  a Press FCTN.
  b Select SAVE. This will save all the PROFIBUS-DP setup data to the file, PROFIBUS.SV file, on the selected device.

4.3.2 DP Master Analog I/O Configuration

- Analog and arc welding signals can be transmitted only with the master function.
- Analog and arc welding signals use a different area to that used by digital signals (refer to Fig. 4.3.2 (a), 4.3.2 (b)).
- Up to three slave devices can be connected to handle analog and arc welding signals.
- Eight arc welding input (WI) signals and eight welding output (WO) signals can be transmitted.
- In the standard configuration, two analog input (AI) channels and two analog output (AO) channels are used for transmission. A maximum of 16 AI and 16 AO channels can be used.
- A welding stick detection (WST) command and welding stick detection (WSK) signal can be transmitted as arc welding signals.
- The analog and arc welding signals must be allocated to one slave.

To enable the exchange of analog and arc welding signals between the robot master and slave, the following data must be set.

Table 4.3.2 (a) DP MASTER ANALOG I/O CONFIG screen (1)

ITEM	Description
NUMBER OF DEVICE	This data specifies how many slave devices (referred to as analog devices) are involved in the transmission of a set of arc welding input/output signals, the arc welding stick detection signal, and arc welding or sealing analog signals (together referred to as analog input/output data) via the PROFIBUS-DP interface. In other words, it specifies the number of arc welding or sealing equipments that can be connected to the robot over a PROFIBUS-DP network. A maximum of three equipments can be connected. After changing this data, clear the I/O assignment data, and switch the power off then on again.
ARC WELD SIGNAL	This data specifies whether arc welding input/output and arc welding stick detection signals are to be output. If DISABLE (default), the arc welding signals are not transmitted. Instead, only analog data is transmitted. If ENABLE, the arc welding signals are transmitted. After changing this data, clear the I/O assignment data, and switch the power off then on again. If DISABLE, the configuration of the analog data will be as listed in Table 4.3.2 (b)

Table 4.3.2 (b) Data configuration when only analog inputs are enabled

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
AD15-1	AD14-1	AD13-1	AD12-1	AD11-1	AD10-1	AD09-1	AD08-1
AD07-1	AD06-1	AD05-1	AD04-1	AD03-1	AD02-1	AD01-1	AD00-1
AD15-2	AD14-2	AD13-2	AD12-2	AD11-2	AD10-2	AD09-2	AD08-2
AD07-2	AD06-2	AD05-2	AD04-2	AD03-2	AD02-2	AD01-2	AD00-2

AD00-1 to AD15-1 are data input via analog input data channel 1.
AD00-2 to AD15-2 are data input via analog input data channel 2.
AD08 to AD15 are the high-order byte, while AD00 to AD07 are the low-order byte.

Table 4.3.2 (c) Data configuration when only analog outputs are enabled

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
DA15-1	DA14-1	DA13-1	DA12-1	DA11-1	DA10-1	DA09-1	DA08-1
DA07-1	DA06-1	DA05-1	DA04-1	DA03-1	DA02-1	DA01-1	DA00-1
DA15-2	DA14-2	DA13-2	DA12-2	DA11-2	DA10-2	DA09-2	DA08-2
DA07-2	DA06-2	DA05-2	DA04-2	DA03-2	DA02-2	DA01-2	DA00-2

DA00-1 to DA15-1 are data output via analog output data channel 1.
DA00-2 to DA15-2 are data output via analog output data channel 2.
DA08 to DA15 constitute the high-order byte, while DA00 to DA07 constitute the low-order byte.

Data configuration is listed below for the case of the configuration of the ARC WELD SIGNAL is changed to ENABLE.

Table 4.3.2 (d) Data configuration for arc welding input signals and analog inputs

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
WI08	WI07	WI06	WI05	WI04	WI03	WI02	WI01
WSK							
AD15-1	AD14-1	AD13-1	AD12-1	AD11-1	AD10-1	AD09-1	AD08-1
AD07-1	AD06-1	AD05-1	AD04-1	AD03-1	AD02-1	AD01-1	AD00-1
AD15-2	AD14-2	AD13-2	AD12-2	AD11-2	AD10-2	AD09-2	AD08-2
AD07-2	AD06-2	AD05-2	AD04-2	AD03-2	AD02-2	AD01-2	AD00-2

WI01 to WI08 are arc welding input signals. WSK is the welding stick detection signal.

Table 4.3.2 (e) Data configuration for arc welding output signals and analog outputs

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
WO08	WO07	WO06	WO05	WO04	WO03	WO02	WO01
WST							
DA15-1	DA14-1	DA13-1	DA12-1	DA11-1	DA10-1	DA09-1	DA08-1
DA07-1	DA06-1	DA05-1	DA04-1	DA03-1	DA02-1	DA01-1	DA00-1
DA15-2	DA14-2	DA13-2	DA12-2	DA11-2	DA10-2	DA09-2	DA08-2
DA07-2	DA06-2	DA05-2	DA04-2	DA03-2	DA02-2	DA01-2	DA00-2

WO01 to WO08 are arc welding output signals. WST is the welding stick detection signal.

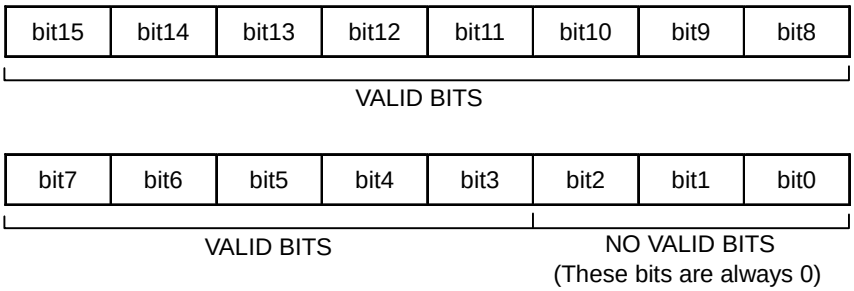
DEVICE 1 to 3 correspond to analog device numbers.
The data of DEVICE 1 specifies data for analog device 1.
The data of DEVICE 2 specifies data for analog device 2.
The data of DEVICE 3 specifies data for analog device 3.

The analog device number corresponds with the slot number to be used in specifying ports on the device in the I/O CONFIG Screens.

The term analog input indicates an analog input to the robot master, that is, data output from an analog slave device to the robot master.

The term analog output indicates an analog output from the robot master, that is, data output from the robot master to an analog device.

Table 4.3.2 (f) DP MASTER ANALOG I/O CONFIG Screen(2)

ITEM	Description
AI SLAVE ADDRESS	This data specifies the slave address for an analog input device.*
AO SLAVE ADDRESS	This data specifies the slave address for an analog output device.*
NUMBER OF AI	This data specifies the number of analog input channels.**
NUMBER OF AO	This data specifies the number of analog output channels.**
AI START BIT	An analog input consists of one word per channel. This data specifies the first bit in the word data to become effective.
AO START BIT	An analog output consists of one word per channel. This data specifies the first bit in the word data to become effective.
AI VALID/NOVALID BITS	This data specifies the number of valid/no valid bits on a analog input word data. The no valid bits start from bit0. The valid bits start after the no valid bits. If 13, 3, the valid bits are 13 and the no valid bits are 3. This setting indicates as follows. 
AO VALID/NOVALID BITS	This data specifies the number of valid/no valid bits on a analog output word data. The representation of this data is the same as AI VALID / NOVALID BITS.
AI OFFSET ADDRESS	This data specifies the first effective analog input data byte in an area dedicated to data received from a unit having the slave address specified in AI SLAVE ADDRESS.
AO OFFSET ADDRESS	This data specifies the first effective analog output data byte in an area dedicated to data received from a unit having the slave address specified in AO SLAVE ADDRESS.

*For an analog device having both analog input and output functions, both of the above data must be set to the same value. For an input-only analog device, set AO SLAVE ADDRESS to 0. For an output-only analog device, set AI SLAVE ADDRESS to 0.

**Analog data is represented as a two's complement. Both of the above data of default settings are two channels. They can, however, be set up to 16 channels. An attempt to specify more than 16 channels will result in only 16 channels being specified. After changing these data, clear the I/O assignment data, and switch the power off then on again.

NOTE
word = 2 bytes.

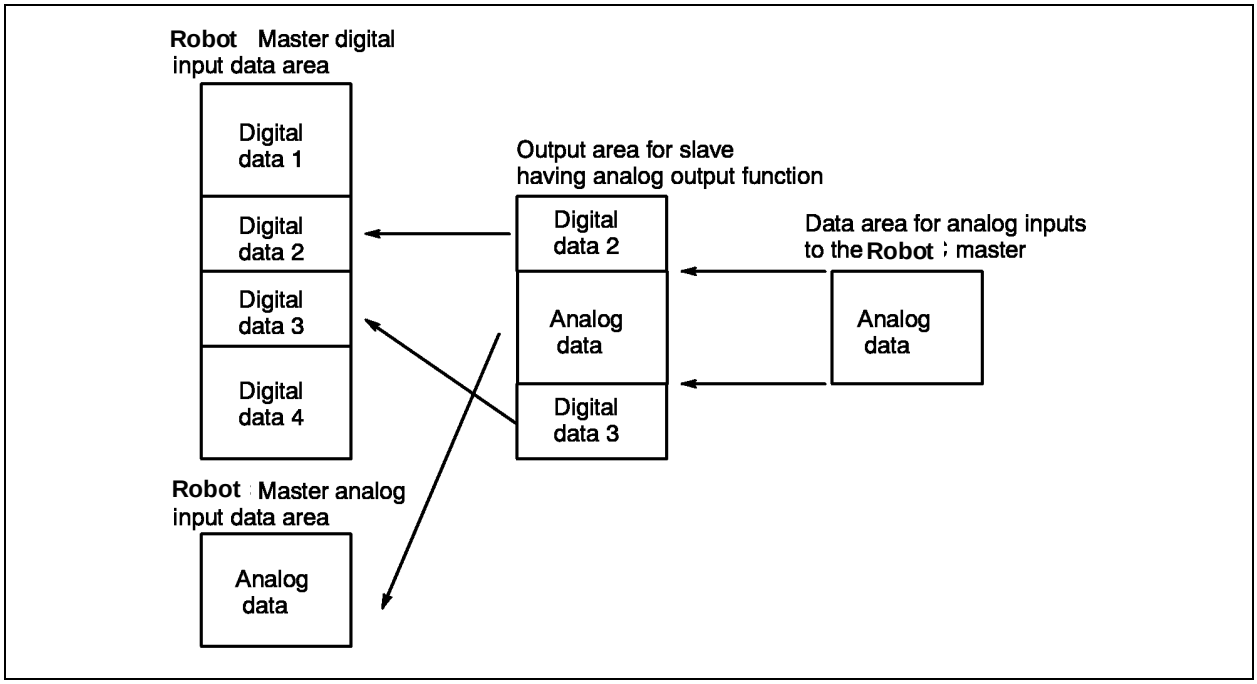


Fig. 4.3.2 (a) Analog Input Data Flow

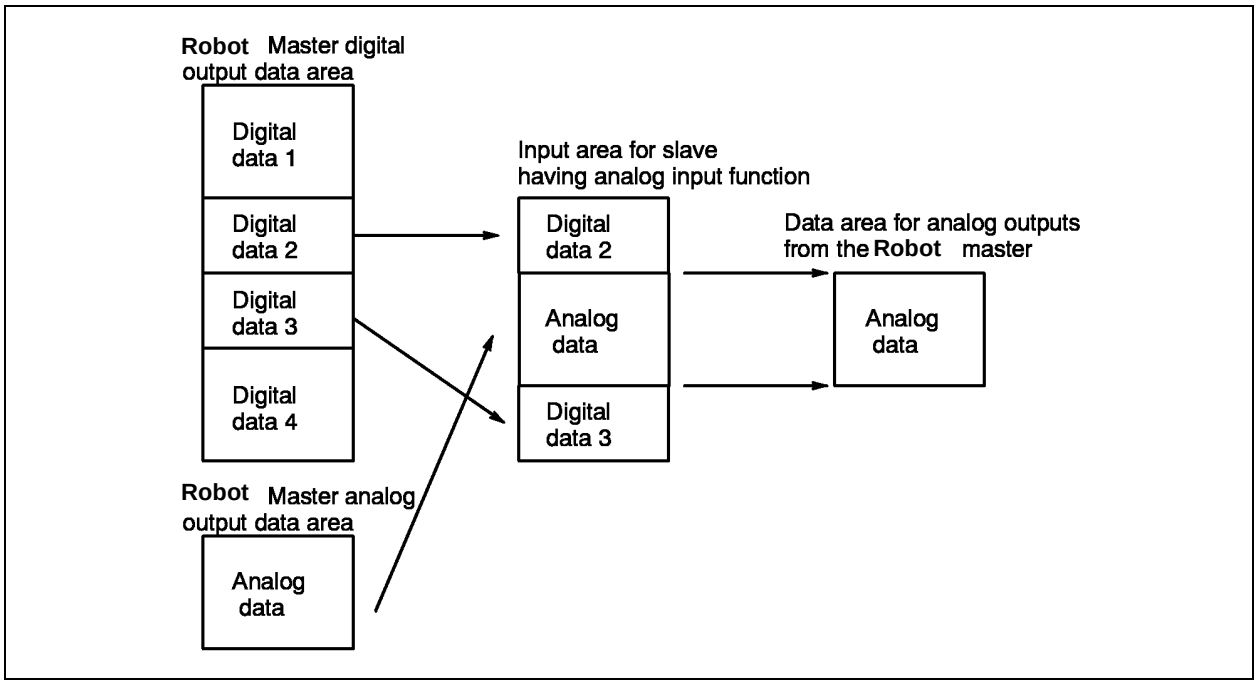


Fig. 4.3.2 (b) Analog Output Data Flow

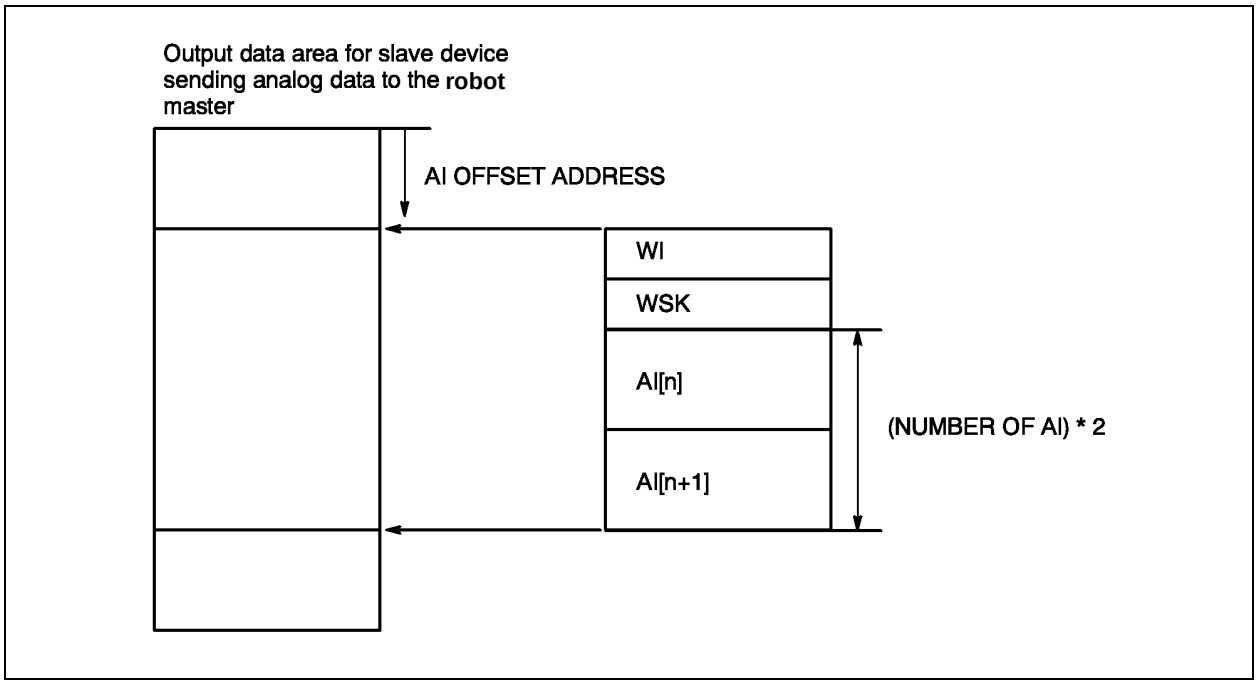


Fig. 4.3.2 (c) Robot analog input data position in analog slave area

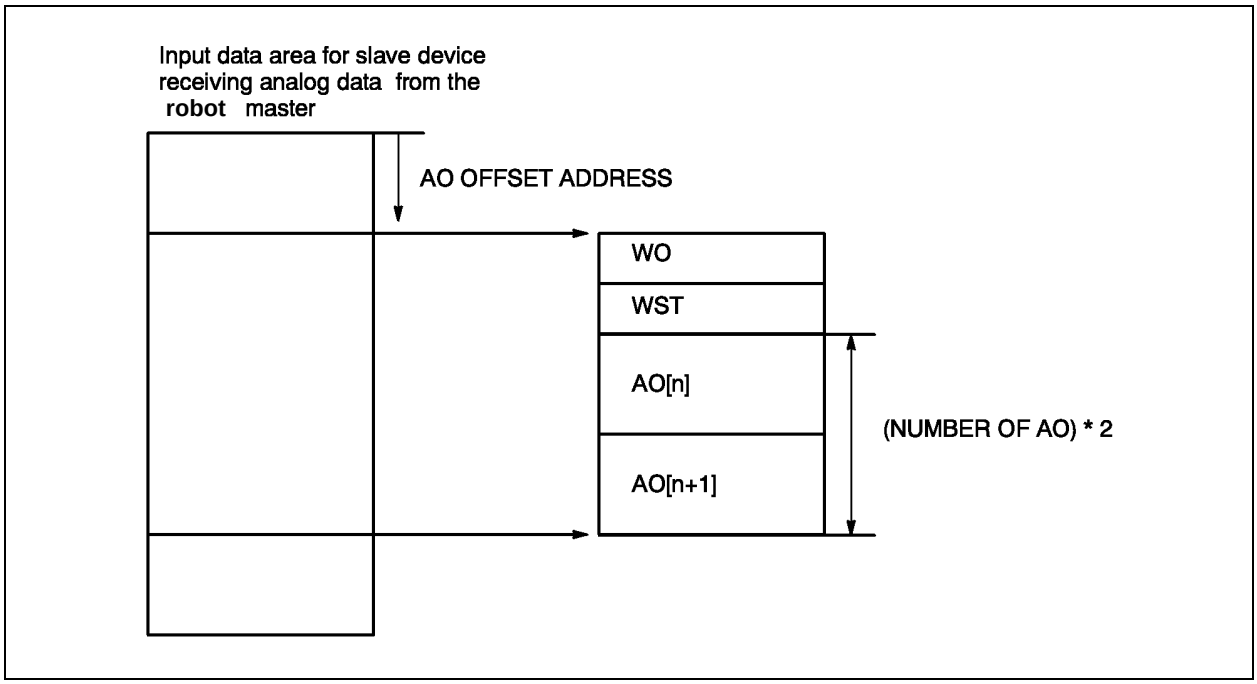


Fig. 4.3.2 (d) Robot analog output data position in analog slave area

NOTE
"n" is determined by configuring Analog I/O on Analog I/O Screen.

Procedure 4-6 Displaying DP MASTER ANALOG I/O CONFIG Screen

Step

1 Press MENUS.
2 Select I/O.
3 Press F1, [TYPE].
4 Select PROFIBUS.
5 If DP MASTER ANALOG I/O CONFIG Screen is not displayed, press F3, [OTHER], and select ANALOG I/O. If F3, [OTHER], is not displayed, press NEXT,>. You can see the following screen.

```
I/O PROFIBUS-DP                          JOINT  10 %
   DP MASTER ANALOG I/O CONFIG             1/32
   1 NUMBER OF DEVICE              :        0
   2 ARC WELD SIGNAL               : DISABLE
     DEVICE 1
   3  AI SLAVE ADDRESS             :        0
   4  AO SLAVE ADDRESS             :        0
   5  AI OFFSET ADDRESS            :        0
   6  AO OFFSET ADDRESS            :        0
   7  NUMBER OF AI                 :        2
   8  NUMBER OF AO                 :        2
   9  AI START BIT                 :        3
  10  AO START BIT                 :        3
  11  AI VALID/NOVALID BITS        :  13,   0
  12  AO VALID/NOVALID BITS        :  13,   0
     DEVICE 2
  13  AI SLAVE ADDRESS             :        0
  14  AO SLAVE ADDRESS             :        0
  15  AI OFFSET ADDRESS            :        0
  16  AO OFFSET ADDRESS            :        0
  17  NUMBER OF AI                 :        2
  18  NUMBER OF AO                 :        2
  19  AI START BIT                 :        3
  20  AO START BIT                 :        3
  21  AI VALID/NOVALID BITS        :  13,   0
  22  AO VALID/NOVALID BITS        :  13,   0
     DEVICE 3
  23  AI SLAVE ADDRESS             :        0
  24  AO SLAVE ADDRESS             :        0
  25  AI OFFSET ADDRESS            :        0
  26  AO OFFSET ADDRESS            :        0
  27  NUMBER OF AI                 :        2
  28  NUMBER OF AO                 :        2
  29  AI START BIT                 :        3
  30  AO START BIT                 :        3
  31  AI VALID/NOVALID BITS        :  13,   0
  32  AO VALID/NOVALID BITS        :  13,   0

 [ TYPE ]        [OTHER ]                   >
```

6 To change the setting, set the cursor to the item to be set, and enter a value by using the numeric keys or function keys.

7 To clear the I/O assignment,
   a Press NEXT,>.
   b Press F1,CLR_ASG, then the following message is displayed.
   "Clear all assignments ?"
   c Press F4,YES to clear all I/O assignment.

8 To save all the PROFIBUS-DP setup data to a file,
   a Press FCTN.
   b Select SAVE. This will save all the PROFIBUS-DP setup data to the file, PROFIBUS.SV file, on the selected device.

5 DIAGNOSTIC DATA OUTPUT BY A SLAVE COMMUNICATING WITH THE ROBOT MASTER

This section describes how to determine the cause of problems that may occur during communication between the robot master and slave.

5.1 DP MASTER DIAGNOSTIC DATA

All diagnostic data received from a slave communicating with the robot master after the robot controller power on is displayed on DP MASTER DIAGNOSTIC DATA screen. The latest diagnostic data is always on the top of list. The data on this screen are the status information and you can not change them.

Table 5.1 DP MASTER DIAGNOSTIC DATA screen

ITEM	Description
VALID (DIAGNOSTIC DATA VALID)	This data indicates whether the diagnostic data is valid or invalid. - TRUE: This diagnostic data is valid. - FALSE: This diagnostic data is invalid.
Address (SLAVE STATION ADDRESS)	Slave station address that has output each diagnostic data.
Station Status 1	The first data of diagnostic data. The detail of this data is as follows. • Master Lock This slave has been parameterized from another master • Prm Fault The received parameter data from the robot Master are different from those which the DP-Slave has determined. • Invalid Slave Response The received frame from a slave is not plausible response. • Not Supported A function which this slave does not support is requested. • Ext Diag A diagnostic entry exists in the slave specific diagnostic area(Ext_diag_Data). • Cfg Fault The received configuration data from the robot Master are different from those which the DP-Slave has determined. • Station Not Ready The DP-Slave is not yet ready for data transfer. • Station Non Existent The DP-Slave can not be reached over the line.

ITEM	Description
Station Status 2	The second data of diagnostic data. The detail of this data is as follows. • Deactivated The DP-Slave has been marked inactive. • Sync Mode The DP-Slave has received the Sync control command. • Freeze Mode The DP-Slave has received the Freeze control command. • WD on The watchdog control of DP-Slave has been activated. • Stat Diag The DP-Slave is not able to provide valid user data. • Prm Req The DP-Slave should be reparameterized and reconfigured.
Station Status 3	The third data of diagnostic data. The detail of this data is as follows. • Ext Diag Overflow These exists more diagnostic information than specified in Ext_Diag_Data.
Master Address	The address of DP Master is entered which has parameterized this slave.
Ident Number	The manufacturer identifier is given for this slave.
Ext Diag Data BYTES	The byte length of Ext_Diag_Data.
Ext Diag Data 1 - 26	In this area the DP-Slave can enter its specific diagnostic.

NOTE
For details, refer to PROFIBUS STANDARD DIN 19245 Part 1 and Draft Standard DIN 19245 Part 3.

Procedure 5-1 Displaying the DP MASTER DIAGNOSTIC DATA

Step

1 Press MENUS.
2 Select STATUS.
3 Press F1, [TYPE].
4 Select PROFIBUS. The DP Master diagnostic data will be displayed. See the following screen for an example.

```
STATUS PROFIBUS-DP                    JOINT  10 %
 DP MASTER DIAGNOSTIC DATA             1/64
 NO  VALID   Address   Station Status 1
  1   TRUE        4          00000000
  2   TRUE        4          00000010
  3   TRUE        4          00000001
  4  FALSE        0          00000000
  5  FALSE        0          00000000
  6  FALSE        0          00000000
  7  FALSE        0          00000000
  8  FALSE        0          00000000
  9  FALSE        0          00000000

[ TYPE ] DETAIL
```

NOTE
The most recent received diagnostic data from a slave is number 1.

5 To display more information about a diagnostic data, press F2,DETAIL. The detailed diagnostic data screen displays information specific to the diagnostic data you selected. When you finished viewing

the detailed diagnostic data, press F2,LIST or PREV.

```
STATUS PROFIBUS-DP                    JOINT  10 %
DP MASTER DIAGNOSTIC DATA 1             1/49
  1 DIAGNOSTIC DATA VALID  :          TRUE
  2 SLAVE STATION ADDRESS  :             4
  3 Station Status 1       :      00000000
  4  Master Lock           :           OFF
  5  Prm Fault             :           OFF
  6  Invalid Slave Response:           OFF
  7  Not Supported         :           OFF
  8  Ext Diag              :           OFF
  9  Cfg Fault             :           OFF
 10  Station Not Ready     :           OFF
 11  Station Non Existent  :           OFF
 12 Station Status 2       :      00001100
 13  Deactivated           :           OFF
 14  Sync Mode             :           OFF
 15  Freeze Mode           :           OFF
 16  WD on                 :           ON
 17  Stat Diag             :           OFF
 18  Prm Req               :           OFF
 19 Station Status 3       :      00000000
 20  Ext Diag Overflow     :           OFF
 21 Master Address         :             1
 22 Ident Number           :           9Fh
 23 Ext Diag Data BYTES    :             0
 24 Ext Diag Data  1       :            0h
 25 Ext Diag Data  2       :            0h
 26 Ext Diag Data  3       :            0h
 27 Ext Diag Data  4       :            0h
 28 Ext Diag Data  5       :            0h
 29 Ext Diag Data  6       :            0h
 30 Ext Diag Data  7       :            0h
 31 Ext Diag Data  8       :            0h
 32 Ext Diag Data  9       :            0h
 33 Ext Diag Data 10       :            0h
 34 Ext Diag Data 11       :            0h
 35 Ext Diag Data 12       :            0h
 36 Ext Diag Data 13       :            0h
 37 Ext Diag Data 14       :            0h
 38 Ext Diag Data 15       :            0h
 39 Ext Diag Data 16       :            0h
 40 Ext Diag Data 17       :            0h
 41 Ext Diag Data 18       :            0h
 42 Ext Diag Data 19       :            0h
 43 Ext Diag Data 20       :            0h
 44 Ext Diag Data 21       :            0h
 45 Ext Diag Data 22       :            0h
 46 Ext Diag Data 23       :            0h
 47 Ext Diag Data 24       :            0h
 48 Ext Diag Data 25       :            0h
 49 Ext Diag Data 26       :            0h

[ TYPE ]  LIST            NEW     OLD
```

6 To display the diagnostic data newer or older than the displayed data:
   a Press F4, NEW, then the diagnostic newer than the displayed data is displayed.
   b Press F5, OLD, then the diagnostic older than the displayed data is displayed.

6 COMMUNICATION WITH DP MASTER (CLASS 2)

This section describes the communication with DP Master (Class 2).
The robot DP Master Function supports the full functionality of services for Master-Master Communication in the Draft Standard PROFIBUS-DP DIN 19245 Part 3.

Supported services

The following service are supported by the robot DP Master Function

- Get_Master_Diag
- Upload
- Download
- Start_Seq
- End_Seq
- Act_para_brct
- Act_Param

7 ERROR CODES AND RECOVERY

PROF Error Codes (ID = 92)

PROF-000 STOP.G System error (n)

Cause: System error occurs

Remedy: Contact service. Please inform the digit value displayed in parenthesis. This data is needed to track the problem.

PROF-001 WARN PROFIBUS PCB not installed

Cause: PROFIBUS PCB is not mounted into the option slot on the backplane in the robot controller.

Remedy: Mount PROFIBUS PCB into the option slot on the backplane in the robot controller.

PROF-002 STOP.G PROFIBUS PCB abnormal (n)

Cause: When (n) is 1 or 3, system error occurs in the firmware for DP Slave on Profibus PCB.

Remedy: Contact service. Please inform the digit value displayed in parenthesis. This data is necessary to track the problem.

PROF-003 STOP.G Slave Config data error

Cause: The configuration data which is expected by robot/DP Slave does not match the configuration data for robot/DP Slave which is set by DP Master. While this alarm is active, BUS FAULT LED of slave side on Profibus PCB is turned on.

Remedy: Change the robot Slave setup data (See Section 4.1.2) to match the above 2 configuration data or change the configuration data for robot/DP Slave which is set by DP Master. When the correct data is set, BUS FAULT LED is turned off and RUN LED is turned on.

PROF-004 STOP.G Slave Param data error

Cause: The parameter data which is expected by robot/DP Slave does not match the parameter data for robot DP Slave which is set by DP Master. While this alarm is active, BUS FAULT LED of slave side on Profibus PCB is turned on.

Remedy: Change the parameter data (See Section 4.1.2) for robot DP Slave on DP Master. When the correct data is set, BUS FAULT LED is turned off and RUN LED is turned on.

PROF-005 STOP.G Master Slave Param error (n)

Cause: The robot DP MASTER SLAVE PARAMETER setting for slave which is specified by (n) is wrong. The reason for this alarm is explained by the conditional expression. Following abbreviations for setting data name are used to explain the reason.

NUMBER_IN	INPUT BYTES on DP MASTER SLAVE PARAMETER Screen
NUMBER_OUT	OUTPUT BYTES on DP MASTER SLAVE PARAMETER Screen
IN_OFFSET	INPUT OFFSET ADDRESS on DP MASTER SLAVE PARAMETER Screen
OUT_OFFSET	OUTPUT OFFSET ADDRESS on DP MASTER SLAVE PARAMETER Screen

Following terminologies are used to explain the reason.

DI byte number	INPUT BYTES on DP MASTER SETUP Screen
DO byte number	OUTPUT BYTES on DP MASTER SETUP Screen

Total byte number of analog output data and weld output signal data is calculated as follows.

In conditional expression, AO byte number means this data.
If ARC WELD SIGNAL on DP MASTER ANALOG I/O CONFIG Screen is DISABLE, analog output byte number is NUMBER OF AO on DP MASTER ANALOG I/O CONFIG Screen * 2.
If ARC WELD SIGNAL is ENABLE, analog output byte number is NUMBER OF AO * 2 + 2

AO_OFFSET	AO OFFSET ADDRESS on DP MASTER ANALOG I/O CONFIG Screen. The data of NUMBER OF AO and AO OFFSET ADDRESS should be used in the same DEVICE number in AO SLAVE ADDRESS which stores address number (n).

Total byte number of analog input data and weld input signal data is calculated as follows.

In conditional expression, AI byte number means this data.
If ARC WELD SIGNAL on DP MASTER ANALOG I/O CONFIG Screen is DISABLE, analog input byte number is NUMBER OF AI on DP MASTER ANALOG I/O CONFIG Screen * 2.
If ARC WELD SIGNAL is ENABLE, analog input byte number is NUMBER OF AI * 2 + 2

AI_OFFSET	ADDRESS on DP MASTER ANALOG I/O CONFIG Screen. The data of NUMBER OF AI and AI OFFSET ADDRESS should be used in the same DEVICE number in AI SLAVE ADDRESS which stores address number (n).

When one of the following conditions is satisfied, this alarm occurs.

a) DI byte number < NUMBER_IN + IN_OFFSET
b) DO byte number < NUMBER_OUT + OUT_OFFSET
c) NUMBER_IN < AI_OFFSET + AI byte number
d) DI byte number < NUMBER_IN - AI byte number + IN_OFFSET
e) NUMBER_OUT < AO_OFFSET + AO byte number
f) DO byte number < NUMBER_OUT - AO byte number + OUT_OFFSET

Remedy: Change the robot DP MASTER setup data not to satisfy the above conditional expressions.

PROF-006 STOP.G Another Master Lock (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave, DP Slave, with address shown by (n) is already parameterized by the other DP Master. "n" in (n) means the address of slave. Please refer to Diag.Master_lock of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please modify the setting so that DP Slave with the address shown by (n), connected with robot DP Master is not parameterized by the other DP Slave.

PROF-007 STOP.G Parameter Fault (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave, the parameter part of slave parameter set on DP MASTER SLAVE PARAMETER screen, to which robot connects with DP Slave with address shown by (n), is incorrect. Please refer to the description about Diag.Prm_Fault of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please modify the parameter part of slave parameter set. Please refer to the manual of DP Slave or consult the manufacturer.

PROF-008 STOP.G Invalid Slave Response (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave, it received the invalid response from DP Slave with address shown by (n). Please refer to the description of Diag.Invalid_Slave_Response of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please confirm the status of the corresponding DP Slave. Please refer to the manual of DP Slave or consult the manufacturer.

PROF-010 STOP.G Config Fault (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave, the configuration part of slave parameter set on DP MASTER SLAVE PARAMETER to connect with DP Slave with address shown by (n) is incorrect. Please refer to the description about Diag.Cfg_Fault of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please modify configuration part of slave parameter set. Please refer to the manual of DP Slave or consult the manufacturer.

PROF-011 STOP.G Slave not ready (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave, DP Slave with address shown by (n) is not yet ready for data transfer. Please refer to the description about Diag.Station_Not_Ready of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please adjust the corresponding DP Slave to ready for data transfer before receiving the request for data transfer from DP Master to the DP Slave.

PROF-012 STOP.G Slave not existent (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP. DP Slave with address shown by (n) has not connected with network or is not powered on. Please refer to the description about Diag.Station_Non_Existent of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please connect the corresponding DP Slave with network or turn it on.

PROF-013 STOP.G CMI error (code = n)

Cause: There is a contradiction between the robot controller software and the DP Master software on the PROFIBUS board. The detail is shown by the sub error code n as follows.

Code No.	Description
7	Unrecoverable error occurred in the PROFIBUS board DP Master software.
8	The initialize data in the common memory interface are invalid.
10	There is no response from the DP Master software on the PROFIBUS board. 1. PROFIBUS board is broken.
11	Controller type and version of the DP Master software are not compatible.
12	The layer is not correct when the robot controller software issues a service request to the DP Master software on the PROFIBUS board.
13	The service ID is not correct, when the robot controller software issues a service request to the DP Master software on the PROFIBUS board.
14	The service primitive is not correct, when the robot controller software issues a service request to the DP Master software on the PROFIBUS board.
15	Lack of the data block memory in the common memory interface on the PROFIBUS board.
16	Communication reference is invalid.
19	Routine call for the common memory interface is invalid.
20	Error occurred in the common memory interface.
21	There is no available memory space on the PROFIBUS board.
22	The service request was issued before receiving the response of the previous service request.

Code No.	Description
23	The DP Master software process on the PROFIBUS board overran.
24	Unsupported service request was issued from robot controller software to the DP Master software on the PROFIBUS board.
25	The service request which was issued from robot controller software was not executed by DP Master software on the PROFIBUS board.

Remedy: Contact service except the following 2 sub error codes. Please inform the digit value displayed in parenthesis. This data is needed to track the problem.

Code No.	Description
10	Exchange the PROFIBUS board.
23	Turn off and on the robot controller. Record error and contact service when this error occurs frequently.

PROF-014 STOP.G DP error (code = n)

Cause: DDLM-Function Call error occurred on the PROFIBUS board DP Master software. The sub error code n means the following status value. Please refer to the section 8.2 Description Format of DDLM-Function Calls in the document "Draft Standard PROFIBUS-DP DIN 19245 Part3" for details.

Code No.	Status value	Description
1	UE	Remote-DDLM/FDL interface error
2	RR	Resources of the remote-FDL Entity not sufficient or not available
3	RS	Service or remote-address at remote-LSAP or remote-LSAP not activated; - remote-station is no DP-Station - remote-station is not yet ready for these functions - remote-station is associated with an other Requestor - optional service not available
4	RA	Access of remote-SAP blocked
17	NA	Negative ack, no reaction from remote station
18	DS	Local-FDL/PHY Entity is not possible
19	NO	Service in this state not possible
20	LR	Local resource not available
21	IV	Invalid parameters in request
22	TO	Function-Timeout expired
193	FE	Format-Error in a Request-frame
194	NI	Function not implemented
195	AD	Access denied
196	EA	Area too large (Up-/Download)
197	LE	Data-block-length too large (Up-/Download)
198	RE	Format-Error in a Response-frame
199	IP	Invalid Parameter
200	SC	Sequence Conflict
201	SE	Sequence Error
202	NE	Area non-existent
203	DI	Data Incomplete
204	NC	Master parameter set not compatible

Remedy: Please refer to the section 8.2 Description Format of DDLM-Function Calls in the document "Draft Standard PROFIBUS-DP DIN 19245 Part3".

NOTE
The followings are cause & remedy of PROF-014 DP error(code = 199).

Cause: The total number of Input and/or Output Bytes for Profibus Master and Slave Interface too large.

Remedy: Please set the Maximum Digital Port Number correctly in the screen SETUP/PROFIBUS/MASTER.
Please set the system variables to maximum allowed value:
$PRIMAVAR.$MAX_OUT_LEN = 32 => 128
$PRIMAVAR.$MAX_IN_OUT_LEN = 32 => 128

PROF-015 STOP.G DP sub error (code = n)

Cause: DDLM-Function Call error occurred in the DP Master software on the PROFIBUS board. This alarm message is supplement of "PROF-014 DP error". The detail is shown by the sub error code n as follows.

Code No.	Description
1	Data alignment problem occurred.
2	Too many DP Slaves are connected.
3	Slave address is incorrect.
4	Specified address assign mode is not supported.
5	Too short diagnostic data.
6	Parameter data length in the slave parameter set is invalid.
7	Configuration data length in the slave parameter set is invalid.
8	Diagnostic data length is invalid.
9	Bus parameter length is invalid.
10	Slave parameter length is invalid.
11	I/O data length is invalid.
12	Memory area for the DP Master software on the PROFIBUS board is insufficient.
13	Operation mode of the DP Master software on the PROFIBUS board is not correct.
14	DP Slave denied the access.
15	The area code of the service request from robot controller to DP Master software on the PROFIBUS board is invalid.
16	The service request from robot controller to the DP Master software on the PROFIBUS board is not supported.
17	The parameter part in the slave parameter set for the DP Master software on the PROFIBUS board is invalid.
18	The configuration data part in the slave parameter set for the DP Master software on the PROFIBUS board is invalid.
19	The address assignment table in the slave parameter set for the DP Master software on the PROFIBUS board is invalid.
20	The slave user data part in the slave parameter set for the DP Master software on the PROFIBUS board is invalid.
21	The slave parameter set for DP Master software on the PROFIBUS board is invalid.
22	Cannot access the specified area.
23	The baud rate value in the bus parameter set for DP Master software on the PROFIBUS board is invalid.
24	The BP flag value in the bus parameter set for DP Master software on the PROFIBUS board is invalid.
25	FDL state is invalid when robot controller issues a service request to the DP Master software on the PROFIBUS board.
26	Specified activation is invalid when robot controller issues a service request to the DP Master software on the PROFIBUS board.
27	Master station address in the bus parameter set is invalid.
28	DPRAM initialization error occurred in DP Master software on the PROFIBUS board.
29	Specified data length is not correct when robot controller issues a service request to the DP Master software on the PROFIBUS board.
31	Specified identifier is invalid when robot controller issues a service request to the DP Master software on the PROFIBUS board.

Remedy: Contact service except the following 12 sub error codes. Please inform the digit value displayed in parenthesis. This data is needed to track the problem.

Code No.	Description
2	The number of the DP Slaves must be equal to or less than 32.
3	Set a correct slave address.
13	Issue a correct service request in the correct operation mode. If any slave parameter is downloaded into robot controller, the operation mode can be changed to CLEAR or OPERATE. If no slave parameter is downloaded into robot controller, the operation mode stays in the STOP. Pay attention to the above description when DP Master class2 issues service requests.
14	Confirm the status of the DP Slave device.
17	The parameter part in the slave parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the parameter part from the DP Master class2 is correct, when they are downloaded from DP Master class2. 2 Confirm the values in the following items on DP MASTER SLAVE PARAMETER Screen are correct. STATION STATUS • LOCK REQ • UNLOCK REQ • SYNC REQ • FREEZE REQ • WD REQ WD FACT1 WD FACT2 MIN TSDR IDENT NUMBER GROUP IDENT • GROUP 1 • GROUP 2 • GROUP 3 • GROUP 4 • GROUP 5 • GROUP 6 • GROUP 7 • GROUP 8 USER PRM DATA BYTES USER PRM DATA
18	The configuration data part in the slave parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the configuration data part from the DP Master class2 is correct, when they are downloaded from DP Master class2. 2 Confirm the values in the following items on DP MASTER SLAVE PARAMETER Screen are correct. CONFIG DATA BYTES CONFIG DATA
19	The address assignment table in the slave parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the address assignment table from the DP Master class2 is correct, when they are downloaded from DP Master class2. 2 Confirm the values in the following items on DP MASTER SLAVE PARAMETER Screen are correct. INPUT BYTES OUTPUT BYTES DPRAM INPUT OFFSET DPRAM OUTPUT OFFSET

Code No.	Description
20	The slave user data part in the slave parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the slave user data part from the DP Master class2 is correct, when they are downloaded from DP Master class2. 2 Confirm the values in the following items on DP MASTER SLAVE PARAMETER Screen are correct. SLAVE USER DATA BYTES SLAVE USER DATA
21	The slave parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the slave parameter set from the DP Master class2 is correct, when they are downloaded from DP Master class2. 2 Confirm the values in the following items on DP MASTER SLAVE PARAMETER Screen are correct. SLAVE FLAG • ACTIVE • NEW PRM SLAVE TYPE
23	The baud rate value in the bus parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the baud rate value in the bus parameter set from the DP Master class2 is correct, when it is downloaded from DP Master class2. 2 Confirm the value of Baudrate on DP MASTER BUS PARAMETER screen is correct.
24	The BP flag value in the bus parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the BP flag value in the bus parameter set from the DP Master class2 is correct, when it is downloaded from DP Master class2. 2 Confirm the BP Flag value on DP MASTER BUS PARAMETER Screen is correct.
27	The master station address of this robot in the bus parameter set is downloaded from DP Master class2 or robot DP Master class1. 1 Confirm the master station address in the bus parameter set from the DP Master class2 is correct, when it is downloaded from DP Master class2. 2 Confirm the FDL Add value on DP MASTER BUS PARAMETER Screen is correct.

NOTE
The followings are cause & remedy of PROF-015 DP sub error(code = 19).

Cause: The total number of Input and/or Output Bytes for Profibus Master and Slave Interface too large.

Remedy: Please set the Maximum Digital Port Number correctly in the screen SETUP/PROFIBUS/MASTER.
Please set the system variables to maximum allowed value:

$PRIMAVAR.$MAX_OUT_LEN = 32 => 128
$PRIMAVAR.$MAX_IN_OUT_LEN = 32 => 128

PROF-016 STOP.G Slave communication stop

Cause: 1. Some error occurred in the DP Slave software on the PROFIBUS board.
2. The version of the DP Slave software on the PROFIBUS board is old.

Remedy: 1. Record error and contact service.
2. Replace the DP Slave software on the PROFIBUS board to the new one.

PROF-017 STOP.G Slave disconnected

Cause:

1. The cable of the DP Slave on the PROFIBUS board in robot controller is disconnected.
2. The communication to the DP Master is disconnected.

3. The configuration data which is expected by robot/DP Slave does not match the configuration data for robot/DP Slave which is set by DP Master.
4. The parameter data which is expected by robot/DP Slave does not match the parameter data for robot DP Slave which is set by DP Master.

Remedy:

1. Reconnect the cable or replace the broken wire.
2. Confirm that the DP Master station is alive so that it can communicate with the DP Slave.
3. Change the robot Slave setup data to match the configuration data or change the configuration data for robot/DP Slave on DP Master.
4. Change the parameter data for robot/DP Slave on DP Master.

Please note robot PROFIBUS Slave posts neither "PROF-003 STOP.G Slave Config data error" nor "PROF-004 STOP.G Slave Param data error".

PROF-018 STOP.G Exist specific diag (n)

Cause: In case that robot is DP Master, Robot checks the status of its DP Slave; a status message exists in the slave specific diagnostic area in the received diagnostic data. This diagnostic data is sent from DP Slave with address shown by (n). Please refer to the description about Diag.Ext_Diag of Station_status_1 in 8.3.1 of Draft Standard PROFIBUS-DP DIN 19245 Part3 in detail.

Remedy: Please refer to the manual of DP Slave or consult the manufacturer to investigate the specific diagnostic data.

APPENDIX

A GSD FILE FOR R-30*i*B/R-30*i*A/R-30*i*A Mate PROFIBUS-DP SLAVE

```
;=====================================================
; DP-Slave : FANUC Robot
; Date : 26.MAY.2009
;=====================================================
;
#Profibus_DP
GSD_Revision        = 2
Vendor_Name         = "FANUC"
Model_Name          = "FANUC ROBOT-2"
Revision            = "2.0"
Ident_Number        = 0x0A2D
Protocol_Ident      = 0
Station_Type        = 0
FMS_supp            = 0
Hardware_Release    = "Release 2.0"
Software_Release    = "Release B.1"
9.6_supp            = 1
19.2_supp           = 1
45.45_supp          = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
12M_supp            = 1
MaxTsdr_9.6         = 15
MaxTsdr_19.2        = 15
MaxTsdr_45.45       = 15
MaxTsdr_93.75       = 15
MaxTsdr_187.5       = 15
MaxTsdr_500         = 15
MaxTsdr_1.5M        = 25
MaxTsdr_3M          = 50
MaxTsdr_6M          = 100
MaxTsdr_12M         = 200
Redundancy          = 0
Repeater_Ctrl_Sig   = 2
24V_Pins            = 0
;
; Slave specific parameters
;
Freeze_Mode_supp    = 0
Sync_Mode_supp      = 0
Auto_Baud_supp      = 1
Set_Slave_Add_supp  = 0
User_Prm_Data_Len   = 0
Min_Slave_Intervall = 1
Modular_Station     = 1
Max_Module          = 1
Max_Input_Len       = 128
Max_Output_Len      = 128
```

```
Max_Data_Len        = 244
Max_Diag_Data_Len   = 6
Slave_Family        = 8
;
Module = "8 Byte Out, 10 Byte In" 0xC0,0x07,0x09
EndModule
Module = "32 Byte Out, 32 Byte In" 0xC0,0x1F,0x1F
EndModule
Module = "28 Byte Out, 28 Byte In" 0xC0,0x1B,0x1B
EndModule
Module = "24 Byte Out, 24 Byte In" 0xC0,0x17,0x17
EndModule
Module = "20 Byte Out, 20 Byte In" 0xC0,0x13,0x13
EndModule
Module = "16 Byte Out, 16 Byte In" 0xC0,0x0F,0x0F
EndModule
Module = "12 Byte Out, 12 Byte In" 0xC0,0x0B,0x0B
EndModule
Module = " 8 Byte Out,  8 Byte In" 0xC0,0x07,0x07
EndModule
Module = " 4 Byte Out,  4 Byte In" 0xC0,0x03,0x03
EndModule
Module = " 2 Byte Out,  2 Byte In" 0xC0,0x01,0x01
EndModule
Module = "32 Byte Out,  1 Byte In" 0xC0,0x1F,0x00
EndModule
Module = " 1 Byte Out, 32 Byte In" 0xC0,0x00,0x1F
EndModule
Module = "38 Byte Out, 38 Byte In" 0xC0,0x25,0x25
EndModule
Module = "64 Byte Out, 64 Byte In" 0xC0,0x3F,0x3F
EndModule
Module = "128 Byte Out, 116 Byte In" 0xC0,0x3F,0x3F,0xC0,0x3F,0x33
EndModule
Module = "116 Byte Out, 128 Byte In" 0xC0,0x3F,0x3F,0xC0,0x33,0x3F
EndModule
;
```

B GSD FILE FOR R-30*i*B/R-30*i*A/R-30*i*A Mate PROFIBUS-DP MASTER

```
;=====================================================
;
; DP-Master(class1) : FANUC Robot-2
; Date : 13.SEP.2006;
;=====================================================
;
#Profibus_DP
GSD_Revision        = 2
Vendor_Name         = "FANUC"
Model_Name          = "FANUC ROBOT-2"
Revision            = "2.0"
Ident_Number        = 0x00A2
Protocol_Ident      = 0
Station_Type        = 1
FMS_supp            = 0
Hardware_Release    = "Release 2.0"
Software_Release    = "Release 7.0"
9.6_supp            = 1
19.2_supp           = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
12M_supp            = 1
MaxTsdr_9.6         = 60
MaxTsdr_19.2        = 60
MaxTsdr_93.75       = 60
MaxTsdr_187.5       = 60
MaxTsdr_500         = 100
MaxTsdr_1.5M        = 150
MaxTsdr_3M          = 250
MaxTsdr_6M          = 450
MaxTsdr_12M         = 800
Redundancy          = 0
Repeater_Ctrl_Sig   = 2
24V_Pins            = 0
;
; Master specific parameters
;
Download_supp       = 1
Upload_supp         = 1
Act_Para_Brct_supp  = 1
Act_Param_supp      = 1
Max_MPS_Length      = 65532
Max_Lsdu_MS         = 244
Max_Lsdu_MM         = 244
Min_Poll_Timeout    = 100
;
Trdy_9.6            = 10
Trdy_19.2           = 10
```

```
Trdy_93.75          = 10
Trdy_187.5          = 10
Trdy_500            = 10
Trdy_1.5M           = 10
Trdy_3M             = 10
Trdy_6M             = 10
Trdy_12M            = 10
;
Tqui_9.6            = 0
Tqui_19.2           = 0
Tqui_93.75          = 0
Tqui_187.5          = 0
Tqui_500            = 0
Tqui_1.5M           = 0
Tqui_3M             = 3
Tqui_6M             = 6
Tqui_12M            = 9
;
Tset_9.6            = 1
Tset_19.2           = 1
Tset_93.75          = 1
Tset_187.5          = 1
Tset_500            = 1
Tset_1.5M           = 1
Tset_3M             = 4
Tset_6M             = 8
Tset_12M            = 16
;
LAS_Len             = 32
;
Tsdi_9.6            = 70
Tsdi_19.2           = 70
Tsdi_93.75          = 70
Tsdi_187.5          = 70
Tsdi_500            = 150
Tsdi_1.5M           = 200
Tsdi_3M             = 250
Tsdi_6M             = 450
Tsdi_12M            = 800
;
Max_Slaves_supp     = 32
;
```

C MENU MAP FOR PROFIBUS-DP INTERFACE FUNCTION

There are the following screens for robot PROFIBUS-DP Interface Function.

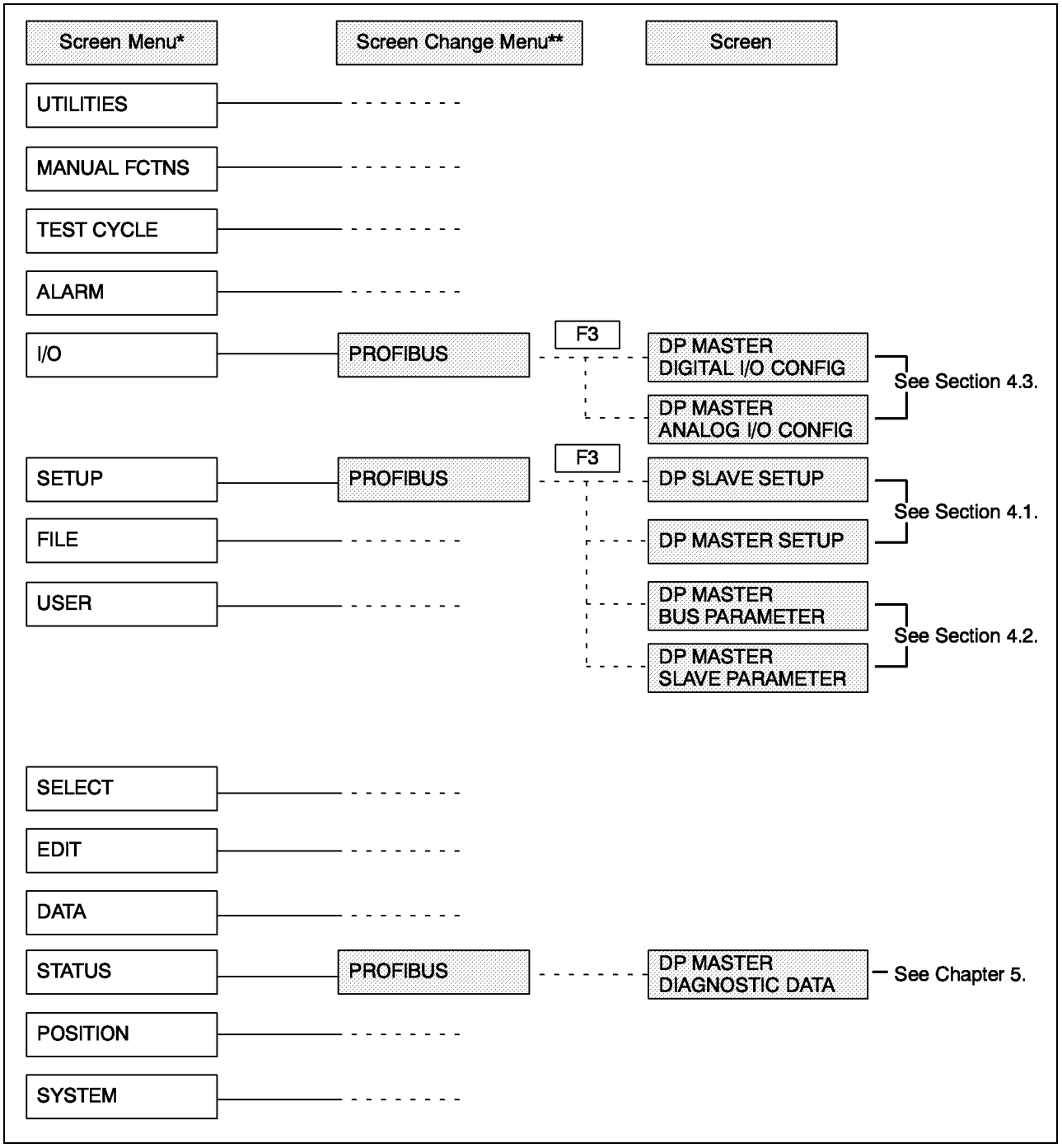


Fig. C Screens for PROFIBUS-DP interface function

* To display the screen menu, press the MENUS key on teach pendant. And then select the item with arrow key and press ENTER key.
** To display the screen change menu, press the F1, [TYPE].

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REVISION RECORD

Edition	Date	Contents
02	Sep., 2012	• Supported for R-30*i*A Mate and R-30*i*B controller and fix some literal.
01	Mar., 2007	

B-82644EN/02