FANUC America Corporation SYSTEM R-30*i*B and R-30*i*B Mate Controller Software Installation Manual

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>
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Patents

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

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VersaBell, ServoBell and SpeedDock Patents Pending.

Conventions

This manual includes information essential to the safety of personnel, equipment, software, and data.
This information is indicated by headings and boxes in the text.

> ⚠️ **Warning**
>
> **Information appearing under WARNING concerns the protection of personnel. It is boxed and in bold type to set it apart from other text.**

> ⚠️ **Caution**
>
> Information appearing under **CAUTION** concerns the protection of equipment, software, and data. It is boxed to set it apart from other text.

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

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Safety

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

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

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

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

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

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

CONSIDERING SAFETY FOR YOUR ROBOT INSTALLATION

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

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

Keeping People Safe

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

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

Using Safety Enhancing Devices

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

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

Setting Up a Safe Workcell

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

- Sponsor your personnel for training in approved FANUC America Corporation training course(s) related to your application. Never permit untrained personnel to operate the robots.
- Install a lockout device that uses an access code to prevent unauthorized persons from operating the robot.
- Use anti-tie-down logic to prevent the operator from bypassing safety measures.
- Arrange the workcell so the operator faces the workcell and can see what is going on inside the cell.

- Clearly identify the work envelope of each robot in the system with floor markings, signs, and special barriers. The work envelope is the area defined by the maximum motion range of the robot, including any tooling attached to the wrist flange that extend this range.

- Position all controllers outside the robot work envelope.

- Never rely on software or firmware based controllers as the primary safety element unless they comply with applicable current robot safety standards.

- Mount an adequate number of EMERGENCY STOP buttons or switches within easy reach of the operator and at critical points inside and around the outside of the workcell.

- Install flashing lights and/or audible warning devices that activate whenever the robot is operating, that is, whenever power is applied to the servo drive system. Audible warning devices shall exceed the ambient noise level at the end-use application.

- Wherever possible, install safety fences to protect against unauthorized entry by personnel into the work envelope.

- Install special guarding that prevents the operator from reaching into restricted areas of the work envelope.

- Use interlocks.

- Use presence or proximity sensing devices such as light curtains, mats, and capacitance and vision systems to enhance safety.

- Periodically check the safety joints or safety clutches that can be optionally installed between the robot wrist flange and tooling. If the tooling strikes an object, these devices dislodge, remove power from the system, and help to minimize damage to the tooling and robot.

- Make sure all external devices are properly filtered, grounded, shielded, and suppressed to prevent hazardous motion due to the effects of electro-magnetic interference (EMI), radio frequency interference (RFI), and electro-static discharge (ESD).

- Make provisions for power lockout/tagout at the controller.

- Eliminate *pinch points* . Pinch points are areas where personnel could get trapped between a moving robot and other equipment.

- Provide enough room inside the workcell to permit personnel to teach the robot and perform maintenance safely.

- Program the robot to load and unload material safely.

- If high voltage electrostatics are present, be sure to provide appropriate interlocks, warning, and beacons.

- If materials are being applied at dangerously high pressure, provide electrical interlocks for lockout of material flow and pressure.

Staying Safe While Teaching or Manually Operating the Robot

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

- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.

- Know whether or not you are using an intrinsically safe teach pendant if you are working in a hazardous environment.

- Before teaching, visually inspect the robot and *work envelope* to make sure that no potentially hazardous conditions exist. The work envelope is the area defined by the maximum motion range of the robot. These include tooling attached to the wrist flange that extends this range.

- The area near the robot must be clean and free of oil, water, or debris. Immediately report unsafe working conditions to the supervisor or safety department.

- FANUC America Corporation recommends that no one enter the work envelope of a robot that is on, except for robot teaching operations. However, if you must enter the work envelope, be sure all safeguards are in place, check the teach pendant DEADMAN switch for proper operation, and place the robot in teach mode. Take the teach pendant with you, turn it on, and be prepared to release the DEADMAN switch. Only the person with the teach pendant should be in the work envelope.

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

- Know the path that can be used to escape from a moving robot; make sure the escape path is never blocked.

- Isolate the robot from all remote control signals that can cause motion while data is being taught.

- Test any program being run for the first time in the following manner:

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

  — Using a low motion speed, single step the program for at least one full cycle.

  — Using a low motion speed, test run the program continuously for at least one full cycle.

  — Using the programmed speed, test run the program continuously for at least one full cycle.

- Make sure all personnel are outside the work envelope before running production.

Staying Safe During Automatic Operation

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

- Make sure all safety provisions are present and active.

- Know the entire workcell area. The workcell includes the robot and its work envelope, plus the area occupied by all external devices and other equipment with which the robot interacts.

- Understand the complete task the robot is programmed to perform before initiating automatic operation.

- Make sure all personnel are outside the work envelope before operating the robot.

- Never enter or allow others to enter the work envelope during automatic operation of the robot.

- Know the location and status of all switches, sensors, and control signals that could cause the robot to move.

- Know where the EMERGENCY STOP buttons are located on both the robot control and external control devices. Be prepared to press these buttons in an emergency.

- Never assume that a program is complete if the robot is not moving. The robot could be waiting for an input signal that will permit it to continue 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 an applicator bell cup can continue to spin at a very high speed even if the robot is idle. Use protective gloves or disable bearing air and turbine air before servicing these items.

- 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 personal 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 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.

OVERVIEW

Contents

1.1 OVERVIEW

This chapter describes the SYSTEM R-30*i*B and R-30*i*B Mate Software Installation Package. This manual includes information on

- **What you must do** to set up and install the components of this package in your system
- **What you have** in your Software Installation Package
- **What you need** to set up and install the components of this package

1.2 INSTALLATION TASKS

The first time you install your software, and whenever you update your controller with components in this package, you **must** perform the tasks shown in Figure 1–1 .

Figure 1–1. Installation Overview
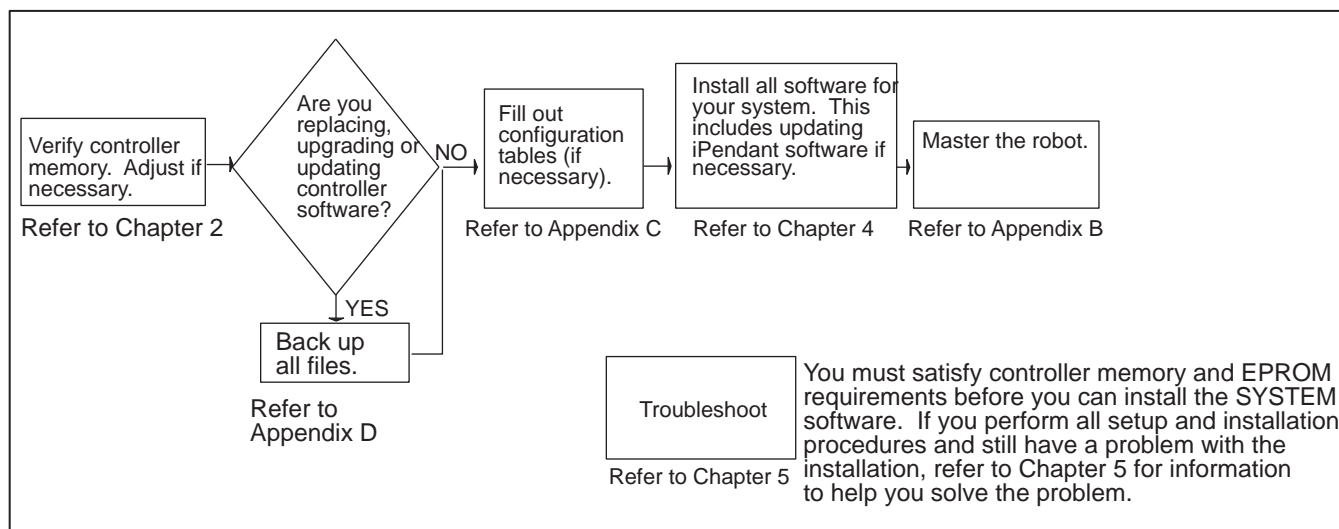
1.3 PACKAGE CONTENTS

The software utilizes a features-based design. A feature is a high-level building block which uses SOCKETS and SOFT PARTS in the application software structure. It is constructed from standard features and can be enhanced using optional features.

The software installation package consists of the FANUC America Corporation load media. Your software installation package contains the load media that can be used for your robot.

Note The software package delivered to you is delivered under the terms and conditions of the FANUC America Corporation Software License Agreement ("SLA"). A copy of the SLA was previously delivered to you. Your use of this software constitutes your consent to the applicability of the terms and conditions of the SLA to such use.

Note Customers should check the for the latest software and updates at either:

- the FANUC America Corporation cRc customer web site: http://crc.frc.com or
- by contacting cRc Support at: 1-800-iQ-ROBOT.

General software packages are frequently available for download or ordered on media.

Your load media contains the following:

- **Application Products**
- **Robot Library Products**
- **Options**
- **_i_Pendant Firmware**
- **Boot Monitor Firmware**

Your package can also contain **Updates** and **Customizations**.

An *application* is a group of standard software features that can be used specifically to perform application-specific functions. A *robot library* is used to define the mechanical unit used to perform the application. An *option* provides additional features that can be used to enhance the application. Your option disk set will contain all the options supported by your software. The *iPendant firmware* provides the latest firmware for the *i*Pendant if one is included with your system. An *update* contains changes that add new functionality and enhance the existing functionality of the application. A *customization* contains specific changes or enhancements related to your implementation of the robot and software.

Media Label

Figure 1–2 contains an example of a software media label.

Figure 1–2. Media Label Example
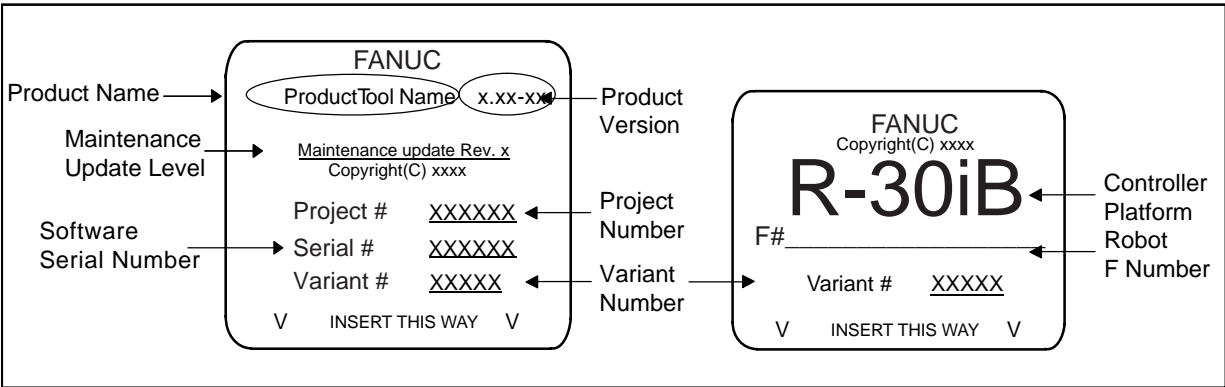
A media label contains the following information:

Product Name is the name of the product.

Product Version is the released version number of the software product.

Maintenance Update is the released update version of the software product.

Project Number identifies the FANUC America Corporation project number. This is determined and used by FANUC America Corporation.

Variant Number is a part number that identifies a unique configuration.

Software Serial Number identifies the serial number of the software. This is determined by FANUC America Corporation AmericaCorporation

Note Software part numbers and actual media information are included in the ssd.html file located on the load media. ssd.html files are technical reference documents. Some robots and features listed in these documents might be included for internal use only by FANUC America Corporation and are not necessarily available for commercial sale. See the corresponding Software Release Note for the list of robots and features that are offered for commercial sale. Software Release Notes are released as Engineering Bulletins and are available on the FANUC America Corporation Customer Resource Center (cRc) website (https://crc.frc.com). Contact FANUC America Corporation Spare Parts to get a cRc account. Refer to Table 1–1 for the location of the .html file.

Table 1–1. .html File Location by Tool

Tool Name	Load Media Location
ArcTool	\product\arctool\ssd.html
HandlingTool/PalletTool	\product\h552\ssd.html

Table 1–1. .html File Location by Tool (Cont'd)

Tool Name	Load Media Location
PaintTool	\product\paint\ssd.html
SpotTool+	\product\spotplus\ssd.html

1.4 INSTALLATION REQUIREMENTS

In order to install a new Application Software Package, you need

- A teach pendant
- Load media
- Controller hardware tools

1.4.1 Teach Pendant Styles

The teach pendant is a hand-held operator interface device that displays the software menus. It is connected to the controller via a cable that plugs into either the MAIN CPU board inside the controller or, if it is a disconnectable teach pendant, to the operator panel.

The teach pendant is the device you use to

- Move (jog) the robot
- Set up your application
- Create and edit programs
- Test programs
- Set up production
- Check status
- Perform manual functions
- Configure the application
- Access diagnostic tools (optional)
- Access Internet/intranet websites (optional)

The *i*Pendant is the standard teach pendant style. The *i*Pendant provides

- Teach pendant keys designed to make the FANUC America Corporation software easy to use
- An ON/OFF switch, DEADMAN switches, and an EMERGENCY STOP button

In addition to these features the *i*Pendant, shown in Figure 1–3 , provides:

- A color graphics interface

- Popup menus

- Multiple screens displayed simultaneously

- Internet/intranet access

- Integrated Help and Diagnostics

- User-customized help and web pages

- Customized displays

- An optional touch screen interface

- A USB port

- A 3D graphics processing engine to display the robot, tooling, parts and other cell components in 3D desktop quality graphics

Figure 1–3. iPendant

The monochrome teach pendant is available as an Intrinsically Safe teach pendant (ISTP). The ISTP, used in most hazardous paint environments, plugs into the intrinsically safe barrier (ISB) unit within the controller and consists of an additional eleven status indicators displayed on the teach pendant screen.

The monochrome Intrinsically Safe Teach Pendant (ISTP), shown in Figure 1–4 provides

• A 16 line x 40 character teach pendant screen

• Eleven status indicators

Figure 1–4.   Monochrome Intrinsically Safe Teach Pendant
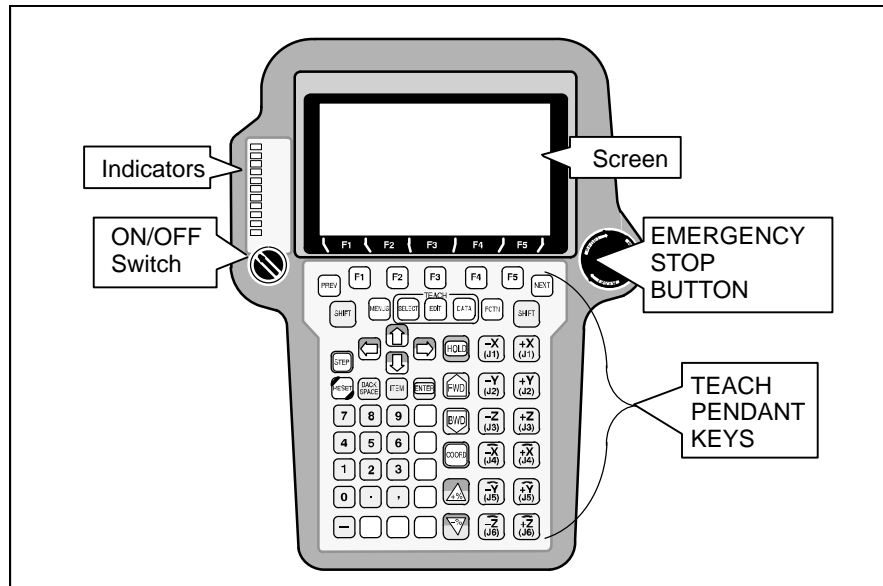
The monochrome ISTP provides

• Teach pendant keys designed to make the FANUC America Corporation software easy to use

• An ON/OFF switch, DEADMAN switches, and an EMERGENCY STOP button

1.4.2 Installation and Storage Devices

To perform a software installation, or store information you can use one of the following devices:

• Memory card interface (not available on the R-30*i*B Mate Controller)

• USB memory stick device

You can also use other external devices to store information:

Refer to Section 4.2 for more information.

SETTING UP CONTROLLER MEMORY

Contents

2.1 IDENTIFYING KINDS OF MEMORY

2.1.1 Overview

The following kinds of memory exist in the controller:

- Flash Read Only Memory (Flash ROM, F-ROM or FROM)
- Static Random Access Memory (S-RAM or SRAM)
- Dynamic Random Access Memory (D-RAM or DRAM)

To set up controller memory you must

- Check system memory allocation to be sure you have enough to load software (Section 2.2).
- Install the DRAM, SRAM and Flash ROM modules on the main CPU board inside the controller (Section 2.3).

Most of the system software executes from DRAM. When the controller is turned on, the system software is loaded from Flash ROM to DRAM and then is executed. Teach pendant programs are stored and executed from SRAM or a combination of DRAM and Flash ROM. When KAREL programs are used, they execute from DRAM, and are loaded from Flash ROM when the controller is turned on.

2.1.2 Flash ROM

Flash ROM (F-ROM or FROM disk) is not battery-backed but is *non-volatile* . Non-volatile means that all data in Flash ROM is saved even after you turn off and turn on the controller.

Flash ROM is file oriented and all of it is allocated to the flash file system. The flash file system contains both system and user files.

2.1.3 SRAM

SRAM is battery-backed and is non-volatile only while the batteries are working. (SRAM can also be called CMOS memory). If the batteries are faulty or removed, SRAM is lost. SRAM has two parts:

- The TPP memory pool, which contains the teach pendant programs.
- The permanent (PERM) memory pool, which contains system variables and KAREL variables.

⚠️ **Caution**

Data in SRAM can be lost if the battery is removed or loses its charge, or if new core software is loaded on the controller. The SRAM memory will last for 30 minutes without the battery when power is off. To prevent loss of data, back up or copy all files for permanent storage.

2.1.4 DRAM

DRAM is volatile, but it is loaded from Flash ROM when the controller is turned on. DRAM also has two parts: a SYSTEM memory pool, and a TEMP memory pool. The SYSTEM memory pool contains the software that executes all system software. Typically, the TEMP memory pool contains KAREL programs, software options, and the read/write scratch space for system software.

Note The size of SYSTEM and TEMP cannot be configured or changed.

The DRAM is located on the CPU card and cannot be replaced separately. There are multiple versions of the CPU card that contain varying amounts of DRAM. The CPU card must be replaced to change the amount of DRAM that is available.

2.2 CHECKING MEMORY

2.2.1 Controller Memory

Controller memory is the amount of Flash ROM, DRAM, and SRAM memory available in your system.

The amount of memory installed in your controller will be displayed when you turn the controller on, or you can use Procedure 2-1 to verify the amount of controller memory you have. You can also display the STATUS MEMORY screen to display the current memory status. Refer to Procedure 2-1 to display memory status.

Procedure 2-1 Checking Controller Memory

Conditions

- The controller is turned off.

Steps

  1. While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON.

When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up and you will see a screen similar to the following.

```
Base System Version V8.xxxx (FRNA)
Initializing file devices ... done.
******* BMON MENU *******
1.    Configuration Menu
2.    All software installation (MC:)
3.    INIT start
4.    Controller backup/restore
5.    Hardware diagnosis
6.    Maintenance
7.    All software installation (ETHERNET)
8.    All software installation (USB)
Select:
```

2. Select Hardware diagnosis and press ENTER. You will see a screen similar to the following.

```
****** Hardware Diagnoses Menu ******
    1. Show size of RAM/ROM modules
    2. Show list of S-BUS modules
    3. Dump memory
    4. Write memory
    5. Check SRAM memory
    6. Clear vision SRAM memory
    7. Check FROM memory
    8. Display MAC address
    9. Return to main menu
    Select :
```

3. Select Show size of RAM/ROM modules and press ENTER. You will see a screen similar to the following.

```
FROM: 32MB  DRAM:  32MB  SRAM:  2MB
```

4. To display the previous menu, press PREV.

> ⚠ **Caution**
>
> The minimum controller memory configuration required to install software is shown in Table 2–1 . If your controller has less than this requirement of F-ROM, DRAM, and SRAM, you must contact your FANUC America Corporation representative for information on increasing the amount of memory in your controller.

Table 2–1. Minimum Requirements

Memory Device	Minimum Amount of Memory Required (ArcTool, PaintTool and SpotTool+)	Minimum Amount of Memory Required (DispenseTool and HandlingTool)
Flash ROM	64.0 MB	64.0 MB
DRAM	64.0 MB	64.0 MB
SRAM	3 MB	2 MB

These values will depend on the option set. Certain options require 64MB of Flash and DRAM. For R744 TPDRAM requires the additional Flash and DRAM but the CMOS requirement is less. For multiple groups the amount of SRAM is typically more.

The following options require 64M of Flash ROM or DRAM:

- Any irVision option requires 64MB DRAM and 64MB Flash ROM.
- *J573: LVC Function* (Learning Vibration Control) requires 64MB DRAM.
- *R709: TP DRAM/FILE Storage* requires 64MB DRAM but reduces CMOS requirement.

2.2.2 Load Media Audit Report

The load media audit report is supplied with your FANUC America Corporation software and identifies details about the software on your load media. It lists the memory requirements for your

system, the features on your system that are installed automatically, and the features that have been authorized for you to install manually. It also lists group setup parameters that have been defined for your system. The media contains the file *AuditReport.htm*.

The load media audit report displays the *product name* which is the formal name used to identify the feature. It also displays the *part number* for the feature which is based on the *order number*. The order number is the substring of the part number that is unique. Any of these items can be used to identify the feature. Figure 2–1 shows an example audit report.

Figure 2–1. Load Media Audit Report

Version R-xxx Standard Distribution
1. Personality:RobotName, ApplicationTool

Application	*ApplicationTool*
Version	*VX.XX*
Controller ID	*FXXXXX*
Serial Number	*XXXXXX*
Description	*XXXXXX*
Memory Requirements	F-ROM: X MB
	D-RAM: X MB
	SRAM: X MB

1.11 Software Feature

INIT Start Features
(Automatically Loaded)

CTRL Start Options (Authorized for Manual
Loading)

Order
Number

```
H552 : HandlingTool (N.A.)
H521 : English Dictionary
H685 : A 520i
```

```
J631 : AccuPath
FIND : Auto Normal Utility
J618 : CE Mark
J535 : CRT/Keyboard Manager
CLIO : Cell I/O
J666 : Collision Skip
CNRE : Control Reliable
J619 : Coordinated Motion
J523 : Cycle Time Priority
CTOP : Cycle time Opt.
J646 : Duty Diagnosis
J664 : Error Recovery
J717 : Ethernet CBR
J518 : Extended Axis Control
J716 : FTP Interface
FABT : FabTool
IOSC : IO Strip Chart
J650 : KAREL Cmd. Language
KDBG : KAREL Diagnostic
K_DP : KAREL Edit/Trans?Comp
PLUS : M.H. Shell
MHGR : MH Gripper Option
MOST : Motion Stream
J601 : Multi Group Motion
TLBX : Progrma ToolBox
J624 : Remote TCP
J667 : Safety space
J644 : Small Circle Accuracy
J524 : TCP Speed Prediction
TPSH : TP Shim (FlexTool)
```

Product
Name

1.2 RobotLibrary SetupFiles
Warning

Verify that robot configuration settings are correct before jogging the robot (i.e. brake type on the
M-6*i* or ARC Mate 100*i* robots or cabinet type on all *i* cabinet robots).

View and edit configuration settings through the Teach Pendant at Controlled Start using the
Maintenance Menu in Manual Mode. Incorrect settings may damage the robot.

Group1 SetUp Parameters

```
! This file contains the information to set the robot DEFAULT settings
! it must be loaded to the controller as robotname.dt for this to work.
! if a ! is encountered the line is ignored, thus a question will be asked.
!
!MME>flange_type1 - 1. Standard Flange (default) 2. Insulated Flange

cabinet 0 - 0. Controller is attached 1. Remote controller
payload165 - 0 to 165 for the payload
tb_cart1 - cartesian 1. cycle priority 2. path priority
tb_jnt1 - joint 1. cycle priority 2. path priority
ENDOFL -- end of the file
```

2.3   INSTALLING FLASH ROM, SRAM AND DRAM CHIPS

2.3.1   Overview

A maximum of one FROM/SRAM module can be used in the controller. A maximum of one CPU card which contains the DRAM memory can be used in the controller. FROM/SRAM, and DRAM are installed on the MAIN board inside the controller.

You might want to increase SRAM to have more room in memory for teach pendant programs or KAREL.VR files, or you might want to increase Flash ROM whenever a software option will exceed the minimum recommended size in memory.

- Refer to Section 2.3.3 to replace DRAM.
- Refer to Section 2.3.4 to replace the FROM/SRAM module.

Refer to your controller-specific *Controller Maintenance Manual* for additional information.

2.3.2   Removing the MAIN CPU Board

The Main CPU Board must be removed before you can remove or replace any other memory module in the controller. Use Procedure 2-2 to remove the Main CPU Board for memory upgrades.

Procedure 2-2   Removing the Main CPU Board for Memory Upgrades

Conditions

- The controller is turned off.

> ⚠ **Warning**
>
> **Disconnect electrical power from the controller before you remove or replace components, or you could be injured seriously.**

> ⚠ **Caution**
>
> Use anti-static devices and observe anti-static safety precautions when handling any electronic material; otherwise, you could damage the equipment.

- You are wearing a wrist strap to prevent static discharge to the circuits.
- **You have backed up all your system, program, and application files. Refer to Appendix E .**

Note If you replace a memory chip, note that **if SRAM is replaced**, you must perform an INIT start. Refer to Section A.1.6

Note If you replace F-ROM, you must completely re-install all program and application software. Refer to Chapter 4 *SOFTWARE INSTALLATION* .

> ⚠️ **Caution**
>
> A restore from a controller backup will be unsuccessful if the memory configuration of the restored CPU is different from the backup CPU.

Steps

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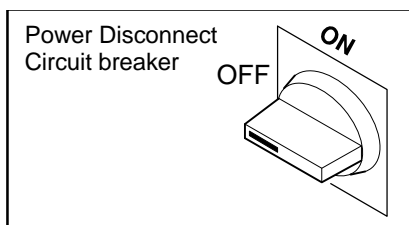
> ⚠️ **Warning**
>
> **Lethal voltage is present in the controller WHENEVER IT IS CONNECTED to a power source. Be extremely careful to avoid electrical shock. HIGH VOLTAGE IS PRESENT at the input side whenever the controller is connected to a power source. Turning the power disconnect circuit breaker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

2. Open the front door of the controller using a flat-tip screwdriver to turn the latch.
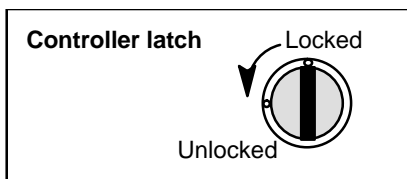
3. Locate the MAIN CPU board inside the controller. See Figure 2–2 through Figure 2–4 .

Figure 2–2. R-30*i*B A Cabinet Controller Internal View
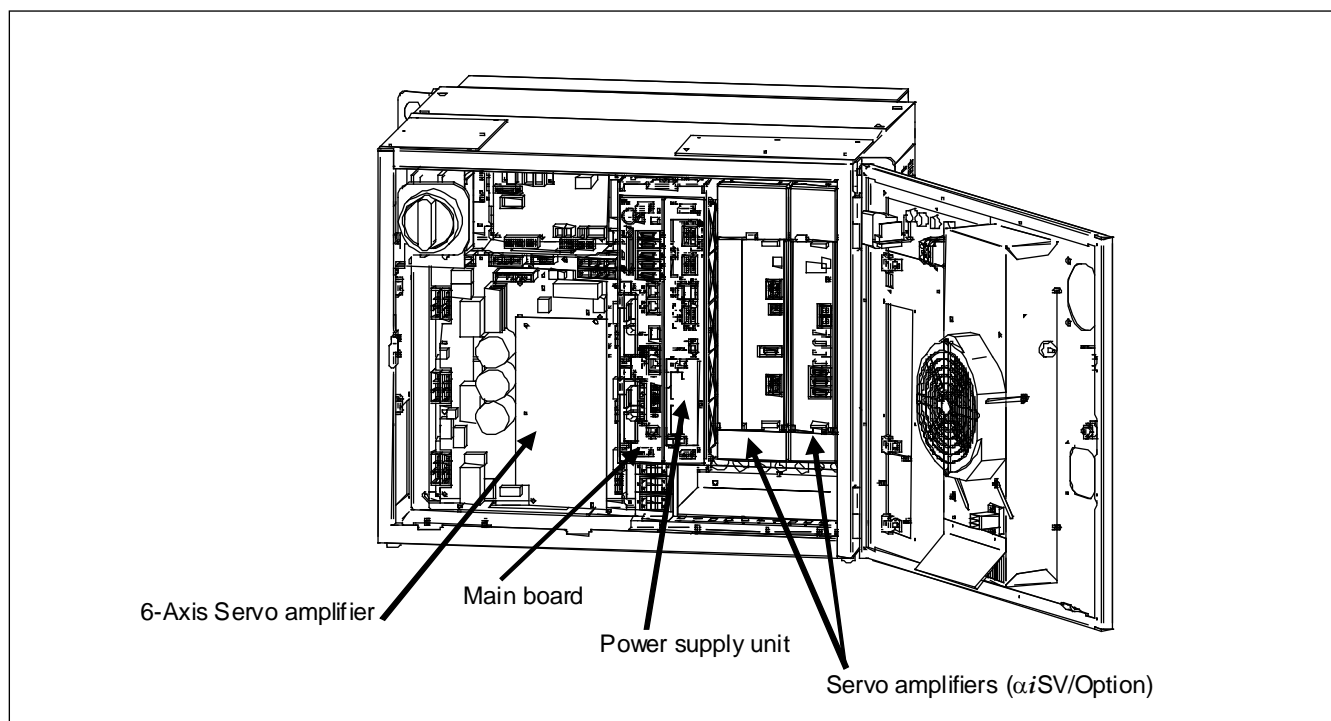
6-Axis Servo amplifier

Main board

Power supply unit

Servo amplifiers (αiSV/Option)

Figure 2–3. R-30*i*B B Cabinet Controller Internal View

6-Axis Servo amplifier

Back plane

Optional slot

Door Fan   Main board   Power supply unit   E-stop unit

Figure 2–4. R-30*i***B Mate Controller Internal View**

Main board　　Back plane unit　　Heat exchanger　　6-Axis Servo amplifier　E-stop unit
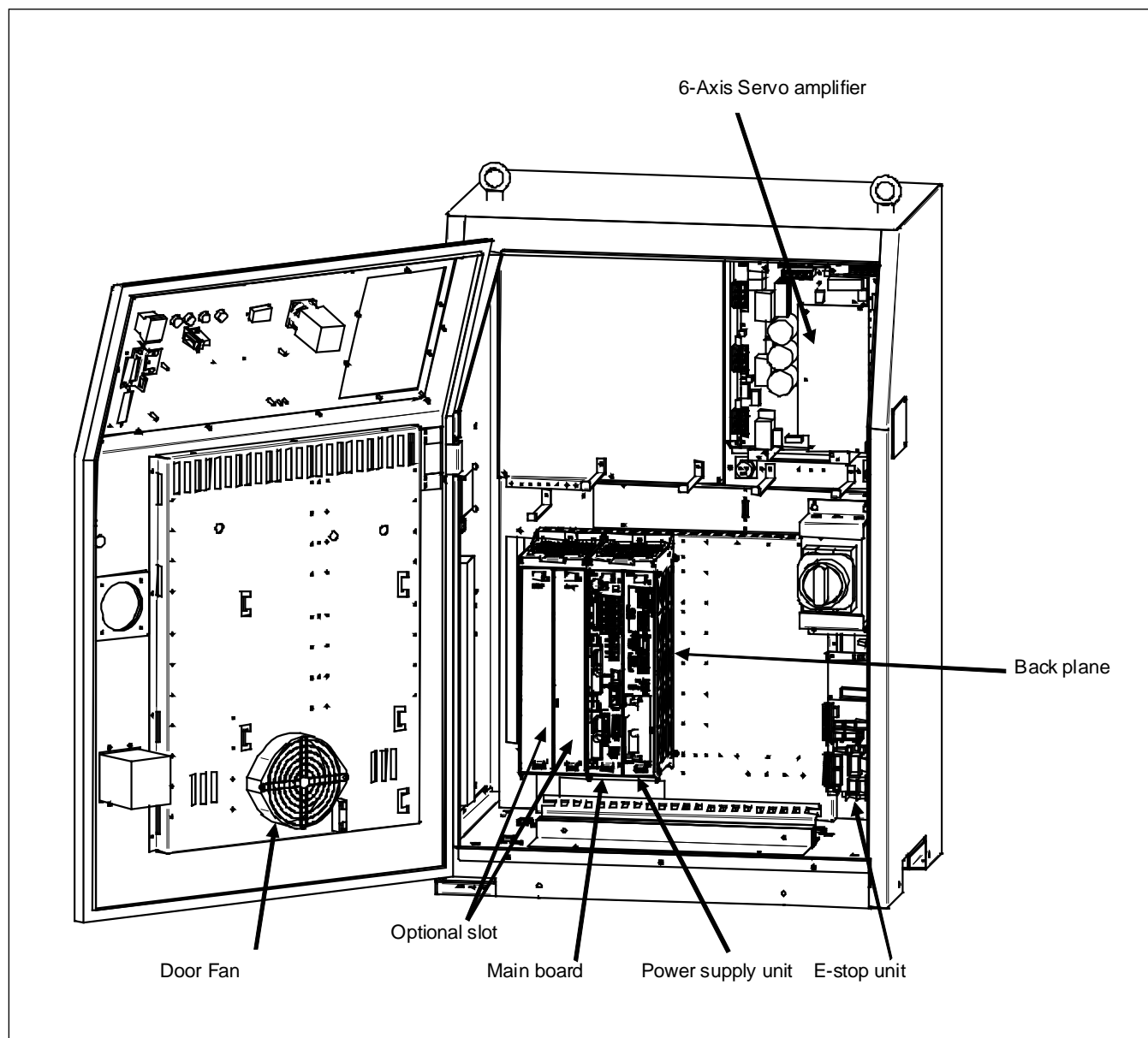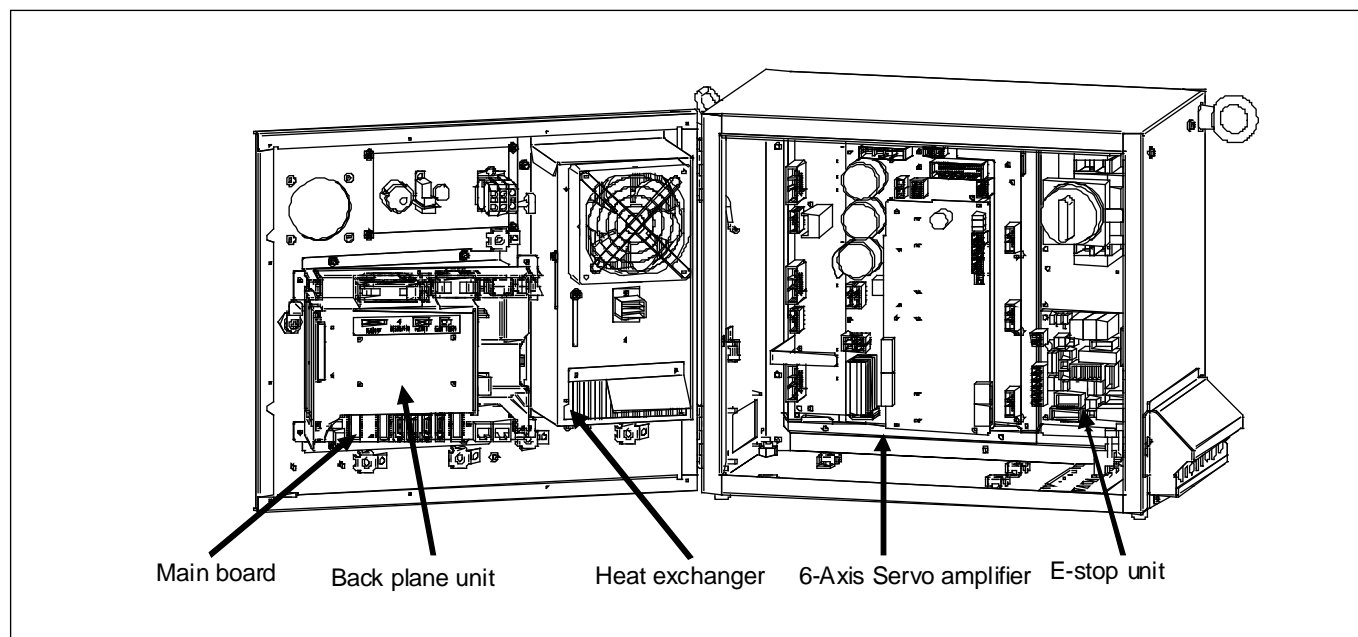
4. Disconnect the cables from the MAIN CPU board.

5. Press and hold both latches of the MAIN CPU board and remove the board from the backplane. See Figure 2–5 .

Figure 2–5.   Removing the MAIN CPU Board
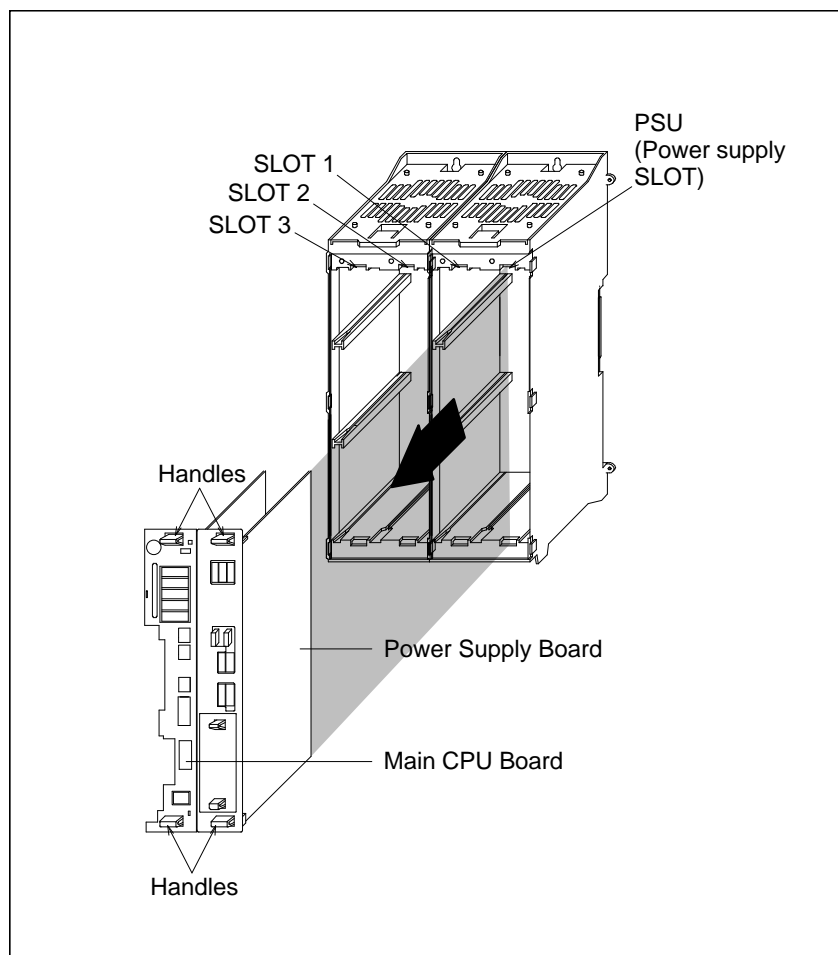
6. Identify the module on which to perform the memory upgrade. See Figure 2–6 and Figure 2–7 .

• FROM/SRAM Module

Figure 2–6.   R-30*i*B Main CPU PC Board Module Locations

Figure 2–7. R-30*i*B Mate Main Board

Axis control card   CPU card   FROM/SRAM module
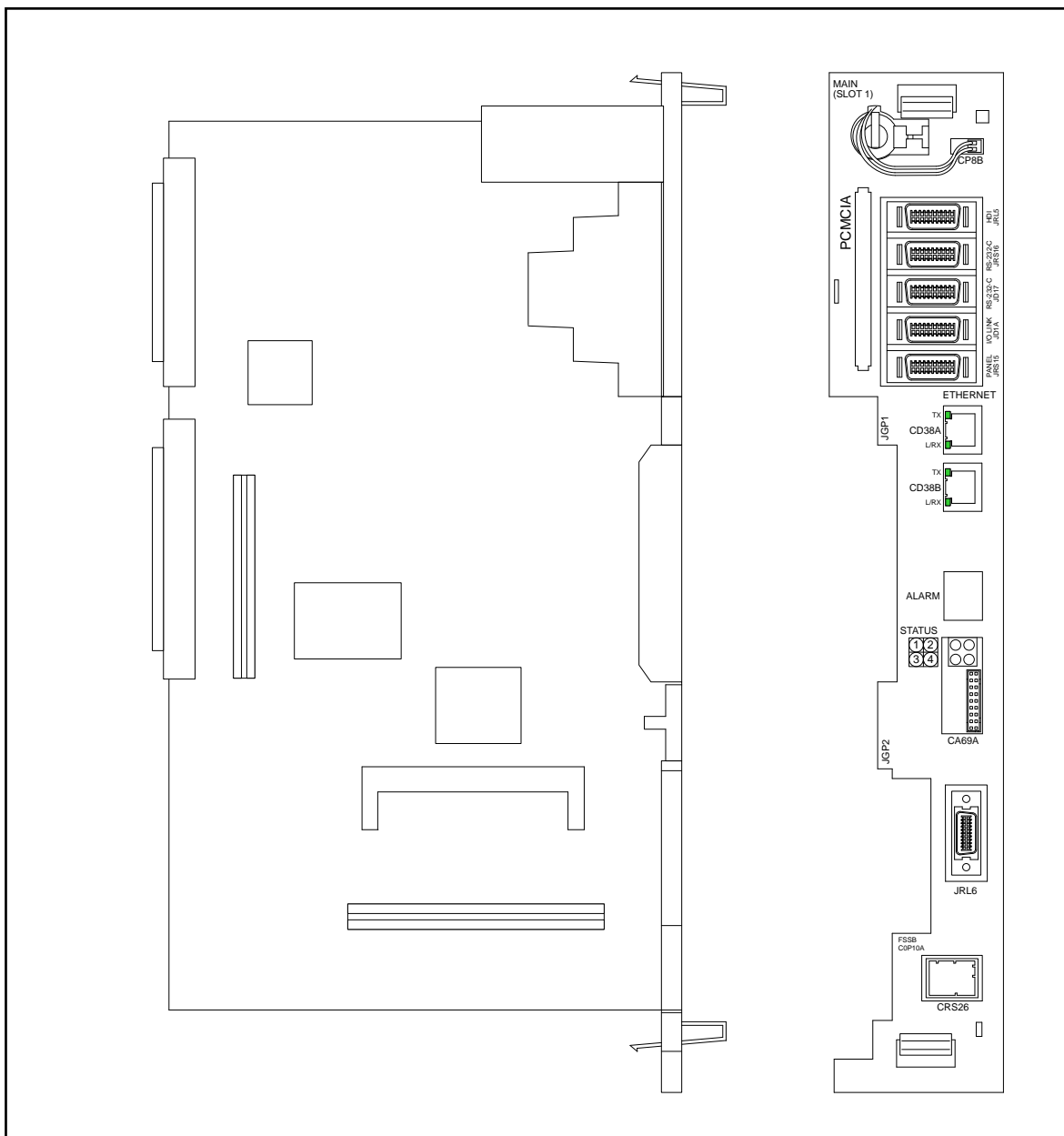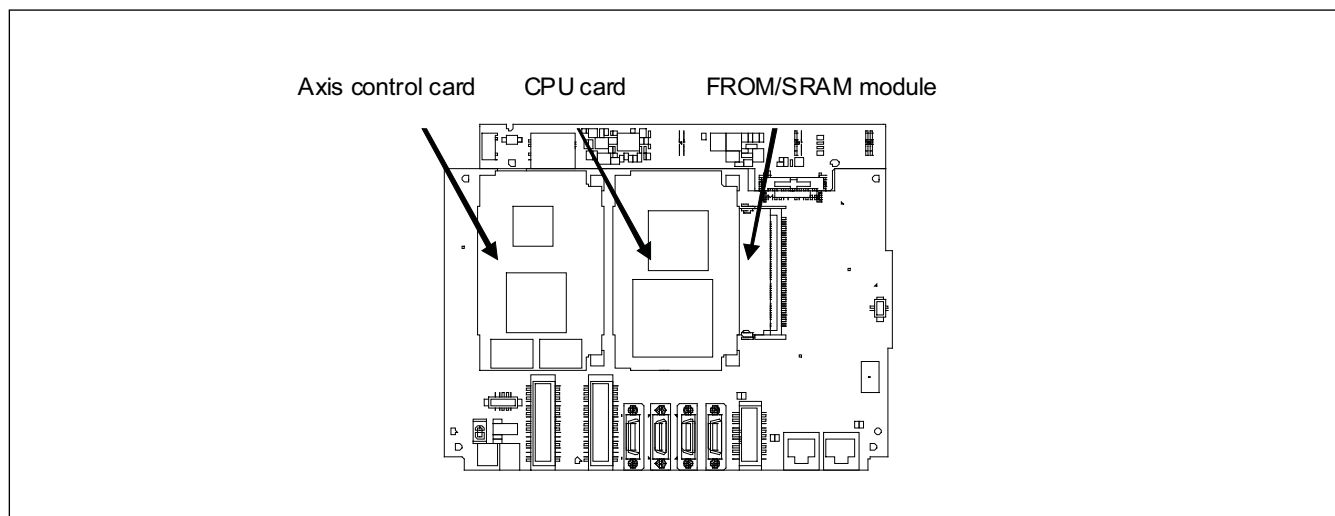
2.3.3   Replacing DRAM

You might want to increase DRAM whenever a software option will exceed the minimum recommended size in memory. Use Procedure 2-3 to replace DRAM.

Procedure 2-3   Replacing the DRAM (CPU Card)

Conditions

- You have removed the Main CPU board from the controller. (Procedure 2-2

Steps

1. Identify the location of the CPU card on the MAIN CPU. See Figure 2–6 .

2. Pull the claw of each of the four spacers used to secure the card PCB outward, then release each latch. See Figure 2–8 .

Figure 2–8.　Detaching a CPU Card
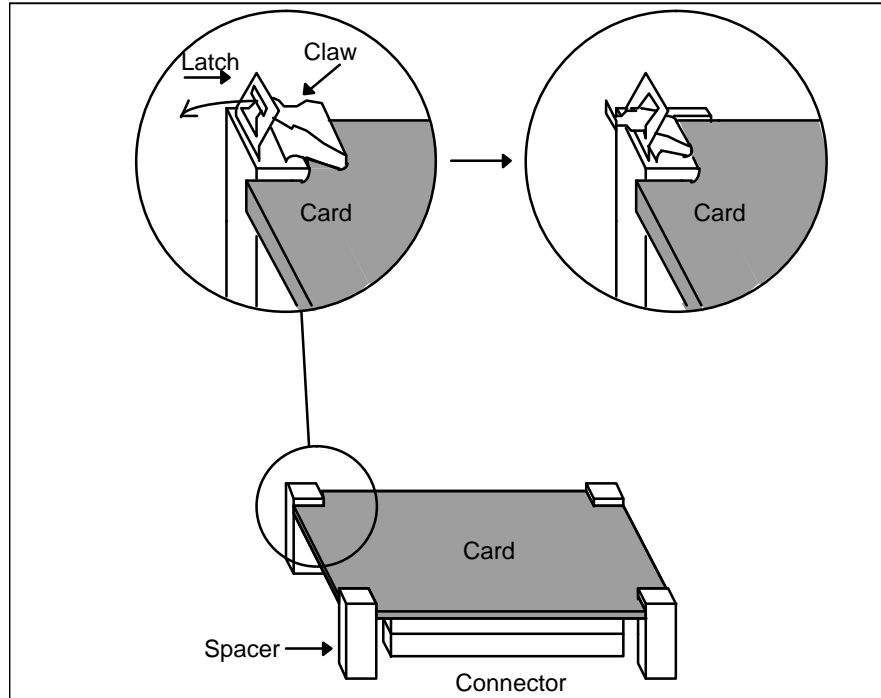
3. Extract the card upward. See Figure 2–9 .

Figure 2–9.　Removing a CPU Card
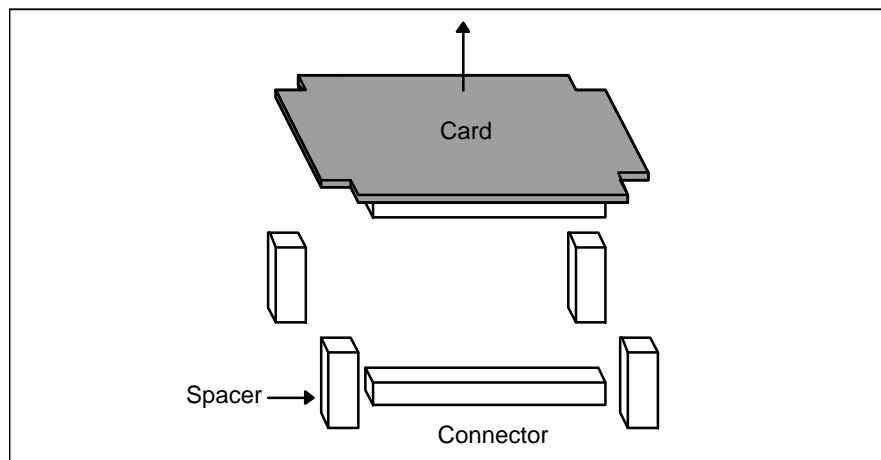
4. Replace the CPU card with a new card that contains the appropriate amount of memory:

　　a.　Check that the claw of each of the four spacers is latched outward, then insert the card into the connector. See Figure 2–10

b. Push the claw of each spacer downward to secure the card PCB.

Figure 2–10. Replacing a Card
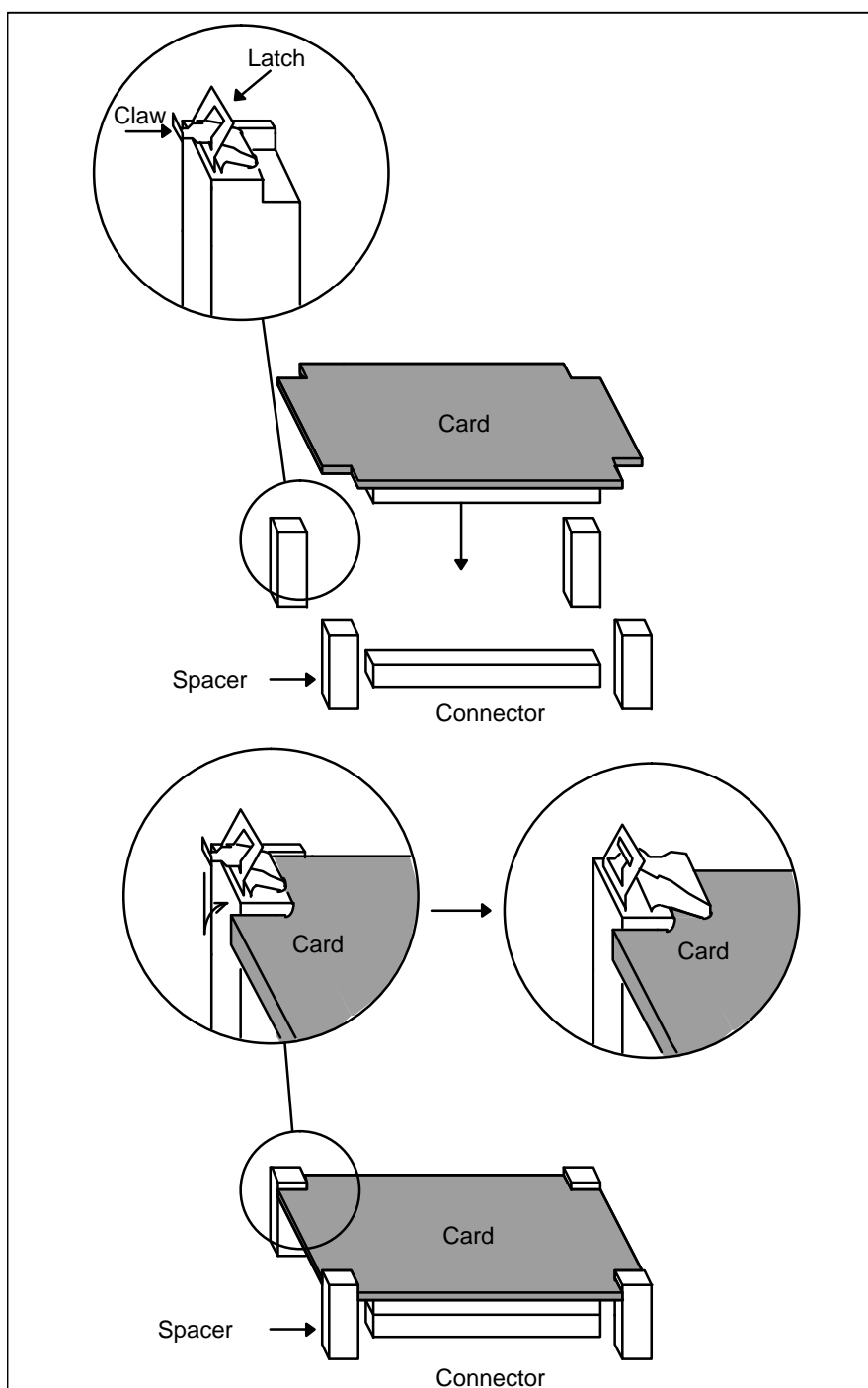
2.3.4 Replacing an FROM/SRAM Module

You might want to increase SRAM to have more room in memory for teach pendant programs or KAREL.VR files, or you might want to increase Flash ROM whenever a software option will exceed the minimum recommended size in memory. Use Procedure 2-4 to replace an FROM/SRAM module.

Procedure 2-4 Replacing an FROM/SRAM Module

Conditions

- You have removed the Main CPU board from the controller. (Procedure 2-2).

Steps

1. Identify the location of the FROM/SRAM card on the MAIN CPU board. See Figure 2–6 .

2. **To remove a module:**

   a. Open the claw of the socket outward. See Figure 2–11 (a).

   b. Extract the module slanted slightly upward. See Figure 2–11 (b).

3. **To install a module:**

   - Insert the module slanted slightly into the module socked with the B-SIDE facing upward. See Figure 2–11 (b).

   - Push the module downward until it locks into position. See Figure 2–11 (c).

Figure 2–11.   Installing the FROM/SRAM Module
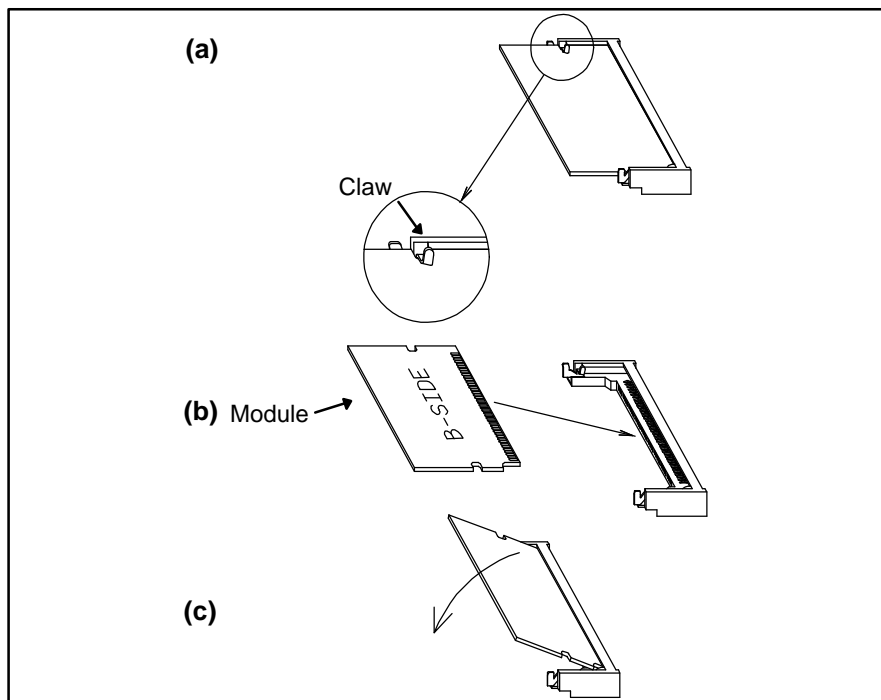
EPROM INSTALLATION AND BMON UPGRADES

Contents

3.1 OVERVIEW

The controller uses Erasable Programmable Read-Only Memory (EPROM) chips that contain special setup software. They are located on the monochrome teach pendant PCB. Your controller must contain the EPROM chip that is compatible with the version of system software you are installing.

Note Software version information is included in the ssd.html file on the load media that contains your software. Refer to Table 1–1 for the location of the .html file specific to your software.

3.2 INSTALLING TEACH PENDANT EPROM CHIPS

Note The following only pertains to the monochrome Teach Pendant.

The character based monochrome Teach Pendant is only used with the controller for special setups. As such, if an update is required, please contact the FANUC America Corporation Service Hotline at 1-800-iQ-robot, or you can also contact us at www.fanucamerica.com for further information and directions.

For information on upgrading the *i* Pendant firmware refer to Appendix A .

3.3 MANUALLY UPDATING BMON FLASH ROM SOFTWARE

The controller uses a Flash-ROM memory (F-ROM) chip that contains the system startup software. It is located on the CPU card and is not replaceable. However, it can be updated from the flash file system.

The version of the software on the BMON F-ROM must be compatible with the version of the system software you are using.

There is one procedure that can be used to update the BMON F-ROM:

- From the Configuration menu, the F-ROM chip can be updated from a BMON Image file (BOOTROM.LD0) on the flash file system. This procedure is typically used when a BMON update is required. Use Procedure 3-1 from flash file storage.

  Note If you are updating your software between major versions BMON will be updated automatically. If you are updating your software with a minor version you might have to update BMON manually. Refer to Section A.4 .

Procedure 3-1 Updating BMON F-ROM

Note Updating BMON F-ROM takes approximately 30 seconds.

Conditions

- The BMON F-ROM chip is not a valid version.

- The controller is capable of running and has valid loaded software.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Steps

1. **If the controller is turned on**, press FCTN and select CYCLE POWER.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select **Maintenance** and press ENTER. You will see a screen similar to the following.

```
------------ Maintenance Menu ------------
0. Top menu
1. Update boot software
2. Development
3. Upgrade iPendant software
6. Obtain network configuration
7. File system chkdsk
Select >
```

4. Select **Update Boot Software** and press ENTER. You will see a screen similar to the following.

```
Select > 4
Select function.
0. Cancel (top menu)
1. Write boot ROM directly
Select >
```

5. Select **Write boot ROM directly** and press ENTER. You will see a screen similar to the following.

```
Select > 1
Select source device.
0. Cancel (top menu)
1. Memory card (MC:)
2. System flash file (FRS:)
3. USB (UD1:)
Select >
```

6. Select **System flash file (FRS:)** and press ENTER.

You will see the message Writing Boot F-ROM. Please wait as the F-FROM will begin to update.

Do not cycle power or attempt any other operation until the pendant screen return to the **Select>** prompt..

7. Type 0 and press ENTER to display the top level Configuration Menu.

8. Select a start mode. Refer to Appendix A .

3.4 UPGRADE *i*PENDANT SOFTWARE

If an *i*Pendant is connected to the controller, the *i*Pendant firmware version will be checked automatically at the end of the Software Installation process. This is to determine if it is compatible with the controller software you are installing. If is it not compatible, you will be prompted to update the firmware. Failure to update the firmware could result in inconsistent operation. Refer Section A.4.3 for more information.

Chapter 4

SOFTWARE INSTALLATION

Contents

4.1 OVERVIEW

Installing software involves loading the software from load media into controller memory (Flash ROM, DRAM, and SRAM). You install software when you first install a new system or when you update an existing system. During this load, you will install

- Application software

- Robot libraries

- Software options

- Software updates (if distributed with the load media)

- Software customizations (if distributed with the load media)

You can also install at a Controlled start (CTRL STRT):

- Additional Software Options

- Software Customizations

- Additional Languages

Note Not all options can be loaded at Control start (CTRL STRT) due to issues of complexity. The set of options presented at Control start (CTRL STRT) can be loaded at Control start (CTRL STRT).

You can also install at a Cold start (COLD STRT):

- Additional Robot Libraries

- Additional Software options

Note Every option can be loaded at Cold start (COLD STRT). A sub set of options can also be loaded at Control start (CTRL STRT).

> ⚠️ **Caution**
>
> All options loaded at Cold start (COLD STRT) require an Auto Update as their last step to complete the installation.

4.1.1 Installation Procedure Overview

The installation procedure begins with the load media.

Note Typically, when you install the software, you will not have to answer any questions regarding your system setup. However, in some cases, your system setup might need to be modified. Refer to Section 4.4.

> ⚠ **Caution**
>
> Your load media includes all tool applications, software options, and robot libraries. However, FANUC America Corporation has authorized only those options that you have purchased. You will be unable to install any options that you have not purchased.
>
> **To install an option that has not been authorized** for this card, you must purchase the option and receive a Product Authorization Code (PAC) from FANUC America Corporation. Contact your FANUC America Corporation Spare Parts representative for more information.

> ⚠ **Caution**
>
> A 3-volt battery pack supplies SRAM memory with power when the controller power is off. Make sure the output voltage of the battery pack is **at least 2.5 volts**, otherwise the information stored in SRAM memory could be lost when controller power is off.

> ⚠ **Caution**
>
> Loading software erases all controller Flash ROM, DRAM, and SRAM memory, as well as the RAM disk. Back up to **load media** all system variables, programs, and files stored on the controller before you load software. Refer to Appendix E for more information.

> ⚠ **Caution**
>
> Do not turn off the controller during software installation. If the controller is turned off, you will have to restart the entire software installation procedure from the beginning.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

To install software, you must perform the general steps shown in Figure 4–1 .

Figure 4–1. Installation Procedure Overview
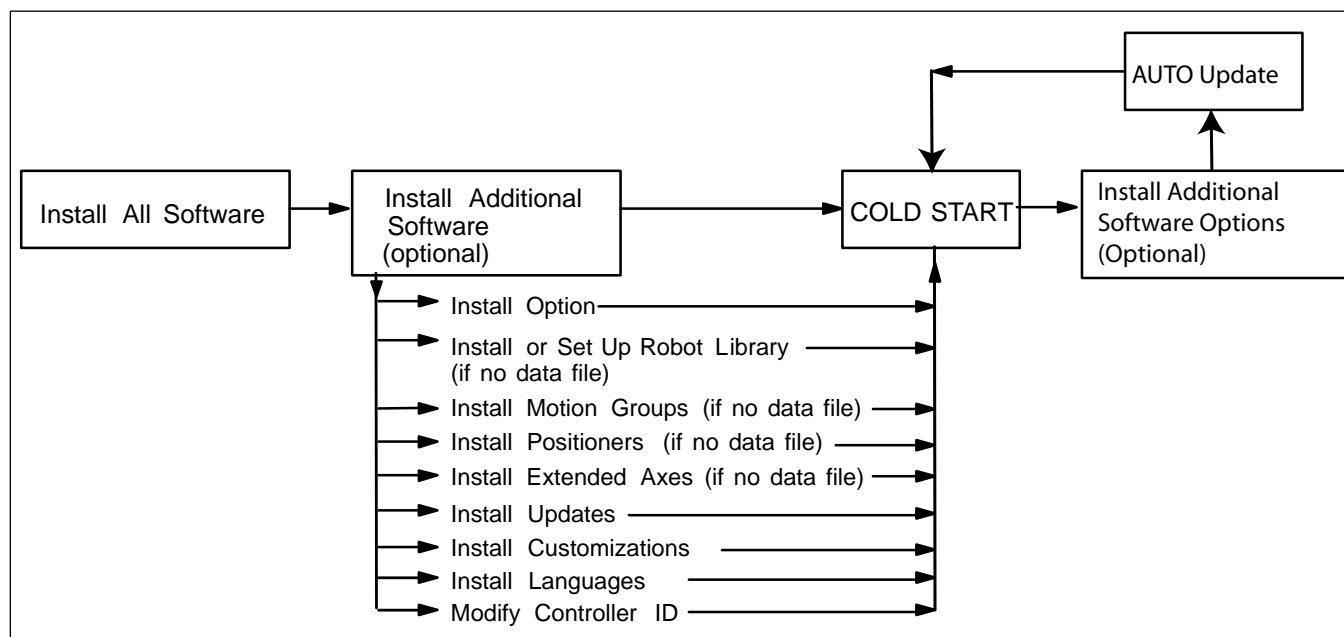
Refer to the ssd.html file on the load media that contains your software for information on the options available with the software. Refer to Table 1–1 for the location of the .html file specific to your software.

4.1.2 Robot Configuration

Each robot library supports several parameters that are specific to your application of the robot and software. Normally, these parameters are set when the software is ordered. You will be able to review and change these parameters at a Controlled start from the Maintenance Menu. Refer to Procedure 4-17.

4.1.3 Timetable

Your loading timetable will vary depending on the load media you are using. However, the larger the load media device you use will slow down the access performance of the device.

4.1.4 Troubleshooting

If at any time during the installation procedure you make a mistake , boldface items within the procedure provide a solution to the problem. Refer to Chapter 5 *TROUBLESHOOTING AND ERROR MESSAGES* for more information.

4.2 STORAGE DEVICES

4.2.1 Overview

The following kinds of storage devices can be used to store programs and files:

- Memory Card (MC:) (not available on the R-30*i*B Mate Controller)
- Flash File Storage disk (FR:)
- RAM Disk (RD:) (Not for SpotTool+)
- Ethernet Device (optional)
- Memory Device (MD:)
- Memory Device Binary (MDB:)
- Filtered Memory Device (FMD:)
- USB Memory Stick Device on the controller (UD1:)
- USB Memory Stick Device on the *i*Pendant (UT1:)

   Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

This section describes how to set up storage devices for use. Depending on the storage device, this can include

- Setting up a port on the controller
- Connecting the device to the controller
- Formatting a device

Memory Card (MC:)

The R-30*i*B Controller includes a memory card interface. Memory cards are available in various sizes. Compact Flash PC cards are also supported if used with a suitable compact adapter. The memory card

requires a memory card interface which is standard on Main CPU inside the controller. The controller also supports loading software from memory cards.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

⚠️ **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.

⚠️ **Warning**

The memory card interface is located on the Main CPU on the R-30*i*B controller cabinet. When the power disconnect circuit breaker is OFF, power is still present inside the controller. Turn off the power disconnect circuit breaker before you insert a memory card into the memory card interface; otherwise, you could injure personnel.

⚠️ **Caution**

Do not remove the memory card when the controller is reading or writing to it. Doing so could damage the card and lose all information stored on it.

The memory card can be formatted on the controller, and can be used as a load device to install software.

Note Data on all internal file devices such as FR:, RD:, and MD: should be backed up to external file device such as ATA Flash PC card.

Note The controller formats the card with a sector size of 512 bytes.

The memory card can be formatted and used as an MS-DOS file system. It can be read from and written to the controller and an IBM PC equipped with the proper hardware and software. If the memory card is used as an MS-DOS file system, it should be formatted on the controller.

The controller can read and write memory cards that are formatted with FAT or FAT32 type of formatting (File Access Tables). When a memory card is formatted on the Controller it can be formatted as FAT or FAT32 type.

The FAT32 format (32 Bit FAT) removes a few limitations that are included with FAT. One of these is the limitation that only 255 files can be created in the Root directory. Another is that FAT format type only supports memory cards up to 2 GB in size. This feature is included in the controller to increase the compatibility of the robot controller with other computer systems.

USB Memory Stick Device on the controller (UD1:), and USB Memory Stick Device on the *i*Pendant (UT1:)

The controller supports USB Flash memory sticks up to 2GB in size if it is formatted as FAT. FAT is much faster for access. USB Memory sticks with any security or encryption features are not supported. Memory sticks larger than 2GB can not be formatted FAT, they must be formatted FAT32.

Note USB Memory sticks cannot be formatted when plugged into the USB connector on the *i*Pendant (UT1:) They must be formatted on a PC or when plugged into the front panel USB connector on the controller.

Note USB Memory sticks with any security or encryption features are not supported.

Note Memory sticks larger than 2GB can not be formatted FAT, they must be formatted FAT32.

Note Generally the larger the size of the device such as a USB memory stick, the slower the access speed and device performance. A USB memory stick should be formatted FAT if possible. Larger memory sticks formatted as FAT32 will work, but will be slower for file operations and startup of the memory stick when it is first inserted.

Note In order to use the UT: device on the *i*Pendant, you must have the USB Port on *i*Pendant option (J957) installed.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

Note Since USB is a well established specification, FANUC America Corporation does not qualify specific USB Memory sticks for use with the robot. FANUC America Corporation uses USB Flash drives manufactured by SanDisk® (CRUZER Mini and Micro) to qualify the operation of the USB interface. Therefore, FANUC America Corporation recommends that you use SanDisk® USB Flash Drives, without security or encryption features. Other drives might work properly but are not specifically qualified by FANUC America Corporation.

The USB Memory Stick Device requires a USB interface which is standard on the controller.

The USB memory stick device can be formatted on the controller.

> ⚠ **Caution**
>
> Do not remove the memory stick when the controller is reading or writing to it. Doing so could damage the memory stick and lose all information stored on it.

Flash File Storage Disk (FR:)

Flash File Storage Disk is a portion of FROM memory that functions as a separate storage device. Flash file storage disk (FR:) does not require battery backup for information to be retained. You can store the following information on Flash file storage disk:

- Programs

- System variables

- Anything you can save as a file

Due to the nature of FROM, each time you copy or save a file to the FR: there will be a drop in available FR: memory, even if you are working with the same file.

RAM Disk (Not for SpotTool+)

RAM Disk is a portion of Static RAM (SRAM) or DRAM memory that functions as a separate storage device. Any file can be stored on the RAM Disk. RAM Disk files should be copied to an external device for permanent storage.

The location and size of the RAM disk (RD:) depends on the value of the system variable $FILE_MAXSEC. The default value of $FILE_MAXSEC depends on the options and tool packages that are installed.

The value in $FILE_MAXSEC represents the memory size allocated for RD: in 512 byte sectors. For example, a value of -128 means that 64K of memory is allocated in DRAM for RD:.

- If **$FILE_MAXSEC > 0** , then RAM disk is defined to be in the PERM pool of SRAM. Because RAM disk is a portion of SRAM, copy all RAM disk files to an external device for permanent storage to prevent losing information due to loss of battery power or system software loading.

  SRAM is battery-backed volatile memory. This means that all information in SRAM, including programs, requires battery backup for information to be retained when the controller is turned off and then on again. Teach pendant programs are automatically stored in the TPP pool of SRAM when you write a program.

> ⚠️ **Caution**
>
> Data in SRAM can be lost if the battery is removed or loses its charge, or if new system software is loaded on the controller. To prevent loss of data, back up or copy all files to permanent storage devices such as FR: or ATA Flash PC memory cards.

- If **$FILE_MAXSEC < 0** , then RAM disk is defined to be in DRAM.

DRAM is non-battery-backed volatile memory. This means that all information in DRAM disappears between power cycles. In effect, DRAM is a temporary device. Information stored in DRAM is lost when you turn off the controller.

> ⚠ **Caution**
>
> Data in DRAM will be lost if you turn off the controller or if the controller loses power. Do not store anything you want to save beyond the next controller power cycle in DRAM, otherwise, you will lose it.

Note Volatile means the memory is lost when power is disconnected. Non-volatile memory does not require battery power to retain.

You can store anything that is a file on the RAM Disk. The RAM disk is already formatted for you.

Information stored on RAM disk can be stored as compressed or uncompressed. By default, information is compressed. If you want information to remain uncompressed, you must use the **RDU:** device designation to indicate that information will be saved to that device in an uncompressed file format.

FTP Ethernet Device

FTP Ethernet devices are used to copy files from the controller to the network PC or workstation if the FTP option is installed. The client devices displayed are the client devices that have been defined and started. Refer to the *Internet Options Setup and Operations Manual* for more information.

Memory Device (MD:)

The memory device (MD:) treats the controller's program memory as if it were a file device. You can access all teach pendant programs, KAREL programs, and KAREL variables loaded in the controller.

The Memory Device is a group of devices (MD:, MDB:, and optionally FMD:) that provide the following :

- MD: provides access to ASCII and binary versions of user setup and programs

- MDB: provides access to binary versions of user setup and programs (similar to "backup - all of the above" on the teach pendant file menu)

- FMD: provides access to ASCII versions of user setup and programs filtered to include only user settable information (eg. internal timers or time system variables changed by the system are not included) making these files useful for detecting user changes.

Memory Device Binary (MDB:)

The memory device binary device (MDB:) allows you to copy the same files as provided by the Backup function on the File Menu. This allows you to back up the controller remotely such as from SMON, FTP, or KCL. For example, you could use the MDB: device to copy all teach pendant files (including invisible files) to the memory card (KCL>copy MDB:*.tp TO mc:).

Filtered Memory Device (FMD:)

The Filtered Memory Device option generates text versions of all backup files of user programs and variables that have been changed manually. Included are system and KAREL variables, position and data registers, teach pendant programs, and I/O configuration data.

When logging into the robot FTP server from a remote client you are defaulted into the MD: device. You can navigate to other robot file devices (FR:, RD:, MC:, MDB:, FMD:) using the change directory service in your remote FTP client. At a command line using the *cd* command where in this example fmd: is the device being used, this might look like :

```
D:\temp>ftp pderob029
Connected to pderob029.frc.com
220 FTP server ready.  [PaintTool Vx.xxP/01]
User <pderob029.frc.com:<none>>:
230 User logged in [NORM].
ftp>cd fmd:
250 CWD command successful.
ftp>
```

You can compare these files with previous versions to determine what users or operators have changed. Variables and programs that change without user input are filtered out, and will appear in filter exclusion files.

After the option is installed, it will run automatically whenever you perform an Ethernet backup of the controller from the FMD: device. After you install the Filtered Memory Device option, any of the following filter exclusion files could appear on the FR: device.

⚠️ **Caution**

Do not delete these files, or filter exclusion data will be lost.

- FR:SVAREEG.DT
- FR:KVAREEG.DT
- FR:POSREEG.DT
- FR:REGEEG.DT
- FR:TPLINEEG.DT

You can view program, variable, or filter exclusion files via KCL. For example:

```
KCL> DIR FMD:*.*.
```

Note Computer systems that perform periodic backups could be modified to use the FMD: device instead of the MD: device for some compare operations, for example. Contact FANUC America Corporation for more information.

FRA:

There is a special area for Automatic Backup in the controller F-ROM (FRA:). You do not need an external device to use Automatic Backup, but a memory card can also be used. Refer to your *application-specific Setup and Operations Manual* for more information.

4.2.2 Storage Device Hints

The following are hints regarding the storage devices that can be used for a remote backup:

MDB: This is the only true source device for the files to be backed up. It produces an up to the minute set of backup files for the controller. The files provided are the closest match to the operation of the File Menu "Backup, All of the Above" or the backup made by the Automatic Backup function.

MD: This provides the same files as MDB: but in addition it provides a text file (ASCII) equivalent to most of the files. Backups using this device will take significantly longer than ones from the MDB: device, but the text files can be useful.

FRA: This device does not contain any files until the Automatic Backup function puts them there. If the Automatic Backup function is set up to run on a regular basis, once a day for example, then this could be a good source for a Full Backup. The files provided would very closely match those provided by the MDB: device.

Typically, the best device to use to back up files using a standard PC FTP client is the MDB: device. Otherwise, if the Automatic Backup function is set up and runs properly, (at least daily) then FRA could be an option to provide the backup more quickly. However, if a site evaluates the need and usefulness of the text file equivalents provided on the "MD:" device, then this device could also be used.

4.2.3   Setting the Default Device

Setting the default device specifies which device to use when manipulating programs and files. You must set the default device before you can perform any program or file manipulations, including formatting a memory card. You can set the default device to

- Memory Card (MC:) (not available on the R-30*i*B Mate Controller)

- USB Memory Stick (UD1:)

- Flash File Storage disk (FR:) - built-in storage for controller system files.

- Client tag (C1: - C8:) - used if the FTP option is installed. The client devices displayed are the client devices that have been defined and started.

- Memory device (MD:) - treats the controller's program memory as if it were a file device.

- Console device (CONS:) - used for debug purposes only. This displays the conslog.ls and constail.ls powerup log files.

- RAM disk - RAM disk, specified by RD: (Not for SpotTool+)

- MF device (MF:) - a composite device that searches the RAM Disk (RD:) and flash file storage disk (FR:) devices, in that order, for a specified file.

After you set the default device, the device will remain the default until you change it.

Use Procedure 4-1 to set the default device.

Procedure 4-1   Setting the Default Device

> ⚠ **Caution**
>
> If a device such as a vision system are connected to the controller, always turn on the robot first, then turn on these devices; otherwise, equipment could be damaged.

Conditions

- **If you are setting the default device to memory card or USB memory stick,** the memory card or memory stick must be properly installed. Refer to Section 4.2.5 .

Steps

1. Press MENU.

2. Select FILE.

3. Press F1, [TYPE].

4. Select File. You will see a screen similar to the following.

```
FILE
MC:\*.*
   1    *         *    (all files)
   2    *         KL   (all KAREL source)
   3    *         CF   (all command files)
   4    *         TX   (all text files)
   5    *         LS   (all KAREL listings)
   6    *         DT   (all KAREL data files)
   7    *         PC   (all KAREL p-code)
   8    *         TP   (all TP programs)
   9    *         MN   (all MN programs)
  10    *         VR   (all variable files)
  11    *         SV   (all system files)
  12    *         IO   (I/O config data)
  13    *         DF   (all DEFAULT files)
  14    *         ML   (all part model files)
  15    *         BMP  (all bit-map images)
  16    *         PMC  (all PMC files)
  17    [you enter]
Press DIR to generate directory
```

5. Press F5, [UTIL].

6. Select Set Device.

7. Move the cursor to the device you want to select and press ENTER. You will see a screen similar to the following.

```
FILE MC:\*.*
```

The default device is now set. The default device name is displayed on the FILE screen, under the word "FILE."

4.2.4 Setting Up a Port

Setting up a port means initializing controller serial ports to use specific devices, such as the CRT/KB. Initializing ports involves setting up specific information for a port based on the kind of device that will connect to the port. This is done on the teach pendant PORT INIT screen.

The controller supports up to four serial ports. Several different kinds of devices can be connected to these ports.

Note P3: and P4: are not available on the R-30*i*B Mate Controller.

Figure 4–2 and Figure 4–3 show the ports on each controller.

Figure 4–2. R-30*i*B Controller Ports
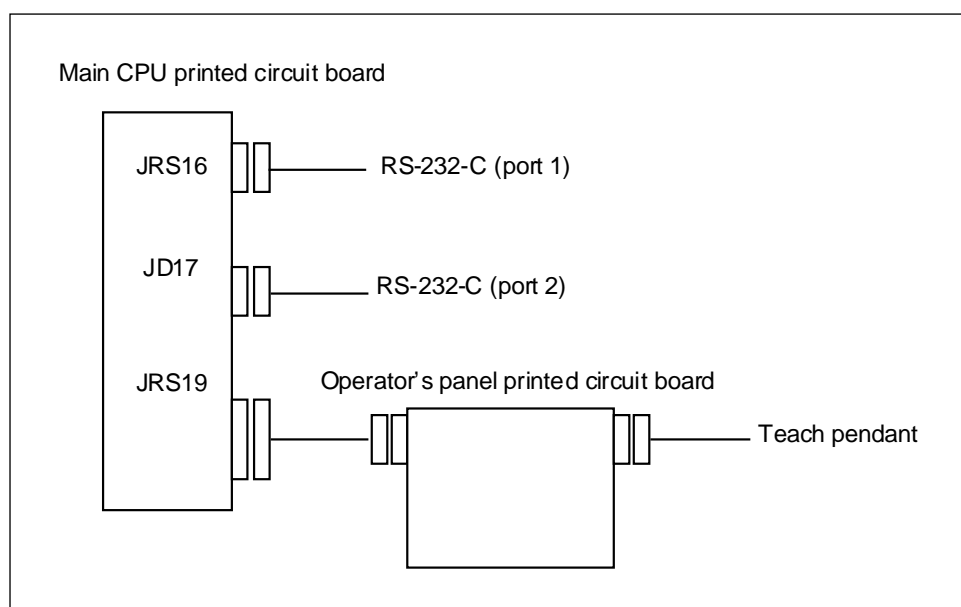
Figure 4–3. **R-30***i***B Mate Controller Ports**
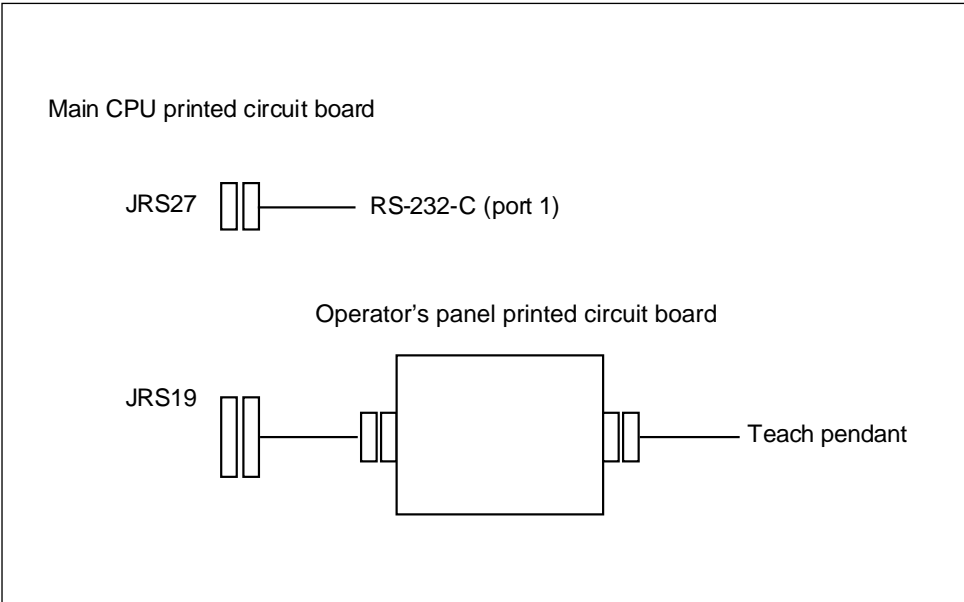
Ports

Up to four ports are available, P1-P4. Table 4–1 lists the ports. You can set up ports P2 through P4 if you have them, but you cannot set up the teach pendant port, P1.

Note P3: and P4: are not available on the R-30*i*B Mate Controller.

Table 4–1. **Ports P1 - P4**

Port	Item Name on Screen	Kind of Port	Use	Default Device
P2	JRS16 RS-232–C	RS-232-C	Any device	Maintenance Console
P3	JD17 RS-232–C on Main CPU card	RS-232-C		KCL
P4	JD17 on Main CPU card. This port is displayed on the teach pendant if $RS232_NPORT=4.	RS-422		No use

Devices

You can modify the default communications settings for each port except port 1, which is dedicated to the teach pendant (TP). Table 4–2 lists the default settings for each kind of device you can connect to a port.

Table 4–2. **Default Communications Settings for Devices**

Device	Speed (baud)	Parity Bit	Stop Bit	Timeout Value (sec)
Sensor*	4800	Odd	1 bit	0
Host Comm.*	4800	Odd	1 bit	0
KCL/CRT	9600	None	1 bit	0
Maintenance Console	9600	None	1 bit	0
Factory Terminal	9600	None	1 bit	0
TP Demo Device	9600	None	1 bit	0
No Use	9600	None	1 bit	0
Current Position (for use with the Current Position option)	9600	None	1 bit	0
PMC Programmer	9600	None	2 bit	0
Modem/PPP	Refer to the *Internet Options Setup and Operations Manual* for information on the supported modems.			
HMI Device	19200	Odd	1 bit	0

*You can adjust these settings; however, if you do, they might not function as intended because they are connected to an external device.

RS-232-C Interface

On the SETUP Port screen, you can choose the RS-232-C interface on one of the following ports:

Note P3: and P4: are not available on the R-30*i*B Mate Controller.

- Port 1 (P2:)
- Port 2 (P3:)
- Port 3 (P4:) (RS-422) available if $RS232_NPORT is set to 4.

The maximum cable length is approximately 50 feet (15 meters). Consult the RS-232-C Industry Standard for more information.

Connector Pin Configuration for P2:, and P3:

The connector pin configuration for P2: is normal Data Terminal Equipment (DTE). For the pin configuration on P3: for the RS-232-C interface on JD17 (on the operator panel board), refer to the *Controller Maintenance Manual*.

> ⚠️ **Warning**
>
> ***Pins 10 and 19 on JD17 are +24 volts. Be careful; otherwise, you could injure personnel or damage equipment.**

Use Procedure 4-2 to set up a port.

Procedure 4-2 Setting Up a Port

Conditions

- The default device is set.

Steps

1. Press MENU.

2. Select SETUP.

3. Press F1, [TYPE].

4. Select Port Init. You will see a screen similar to the following.

```
SETUP Port Init
     Connector       Port    Comment
1 JRS16 RS-232-C      P2:    [Maintenance Cons]
2 JD17  RS-232-C      P3:    [KCL/CRT         ]
3 JD17 RS-422         P4:    [                ]
```

5. Move the cursor to the port you want to set up and press F3, DETAIL. You will see a screen similar to the following.

```
SETUP Port Init
JRS16 RS-232-C         P2:
   1 Device              [Maintenance Cons]
   2 Speed(Baud rate)            [9600 ]
   3 Parity bit                  [None ]
   4 Stop bit                    [1bit  ]
   5 Time out value(sec)         [   0]
```

6. Select each item and press F4, [CHOICE], to select the appropriate value.

   Note To indicate that you are not using a port, set the port to *No Use* . Set the port to no use if you are performing a READ/WRITE from a KAREL program.

7. A device cannot be assigned to two ports. To move a device to another port, set the existing port to **No Use** and then assign the device to another port.

8. Perform a Cold start of the controller to implement the changes to the Port Init screen.

RS-422 Interface

The RS-422 interface is available on port 3 (P4:).

- The maximum cable length is approximately 50 meters.

- RS-422 provides more noise rejection than RS-232C

- The electrical signal of RS-422 is different from the RS-232-C signal. If you need to connect between a robot controller and personal computer, you will need a converter, because normally a personal computer does not support the RS-422 interface.

   If you are using ArcTool , RS-422 is useful because the data transfer function or sensor interface fails sometimes due to electrical noise.

Connector Pin Configuration for P4:

Refer to the *Controller Maintenance Manual* for the pin configuration of the P4: port JD17 connector, located on the MAIN CPU Card or the operator panel board if you are using the optional cable. Table 4–3 lists the Port Init screen items you can set up. Use Procedure 4-3 to set up a port to use the RS-422 Interface.

⚠	**Warning**
	*Pins 10 and 19 on JD17 are +24 volts. Be careful; otherwise, you could injure personnel or damage equipment.

Table 4–3. **SETUP Port Init Screen Items**

ITEM	DESCRIPTION
Connector	This column shows the type of connector/protocol.
Port	This column shows the physical port on the robot.
Comment	This column shows the comments on port settings.

Procedure 4-3 **Setting Up a Port to Use the RS-422 Interface**

Conditions

- The default device is set. (Procedure 4-1)
- The RS-422 cable is connected to the JD17 connector on the Panel Board.

Steps

1. Perform a Controlled start:

   a. **If the controller is turned on**, press FCTN, select CYCLE POWER, press ENTER, and select YES. **If the controller is turned off**, turn the power disconnect circuit breaker to ON.

   If you are using a Paint Robot, also press the ON button.

   b. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

   c. Select Controlled start and press ENTER.

2. Press MENU.

3. Select Variables.

4. Move the cursor to $RS232_NPORT.

5. Press ENTER.

6. Type 4 and press ENTER.

7.   Press FCTN and select START (COLD).

8.   Press MENU.

9.   Select Setup.

10.   Press F1, [TYPE].

11.   Select Port Init. You will see a screen similar to the following.

```
SETUP Port Init
      Connector        Port     Comment
1 JRS16 RS-232-C       P2:    [Maintenance Cons ]
2 JD17 RS-232-C        P3:    [KCL/CRT          ]
3 JD17 RS-422          P4:    [No Use           ]
```

12.   Move the cursor to JD17-422 and press F3, DETAIL. You will see a screen similar to the following.

```
SETUP Port Init
JD17 RS-422-C          P4:
   1 Device            [Maintenance Cons]
   2 Speed(Baud rate)            [9600 ]
   3 Parity bit                  [None ]
   4 Stop bit                    [1bit  ]
   5 Time out value(sec)         [  0]
```

13.   Select each item and set as desired.

4.2.5   Using a Memory Card or USB Memory Stick Interface

The memory card and USB memory stick interfaces are integral to the controller.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Use Procedure 4-4 to use the memory card interface or the USB memory stick device.

Procedure 4-4   Using the Memory Card or USB Memory Stick Interface

Conditions

- You are using a ATA Flash memory card that is based on one of the following standards:

    — JEIDA "IC Memory Card Guideline Version 4.0"

    — PCMCIA "PC Card Standard R. 2.0"

- You are using a memory stick that is compatible with a USB 1.1 interface. The USB Organization specifies standards for USB 1.1 and 2.0. Most memory stick devices conform to the USB 2.0 specification for operation and electrical standards. USB 2.0 devices as defined by the USB Specification be backward compatible with USB 1.1 devices.

    However, FANUC America Corporation does not support any security or encryption features on USB memory sticks. The controller supports most widely-available USB Flash memory sticks from 32MB up to 2GB in size.

    Note Generally the larger the size of the device such as a USB memory stick, the slower the access speed and device performance.

> ⚠ **Caution**
>
> Media devices, such as a memory card or USB memory stick, are fragile. Use care when inserting the media devices to avoid damage to the connector. Do not remove media when the controller is reading or writing to it. Doing so could damage the media and lose all information stored on it.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Steps

1. If you are using a memory card, turn the power disconnect circuit breaker to OFF.

> ⚠ **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.**

⚠️ **Warning**

When the power disconnect circuit breaker is OFF, power is still present inside the controller. Turn off the power disconnect circuit breaker before you insert a memory card into the memory card interface; otherwise, you could injure personnel.

    a. Identify the memory card interface. See Figure 4–4 .

Figure 4–4. **R-30*i*B Controller Memory Card Interface Location**
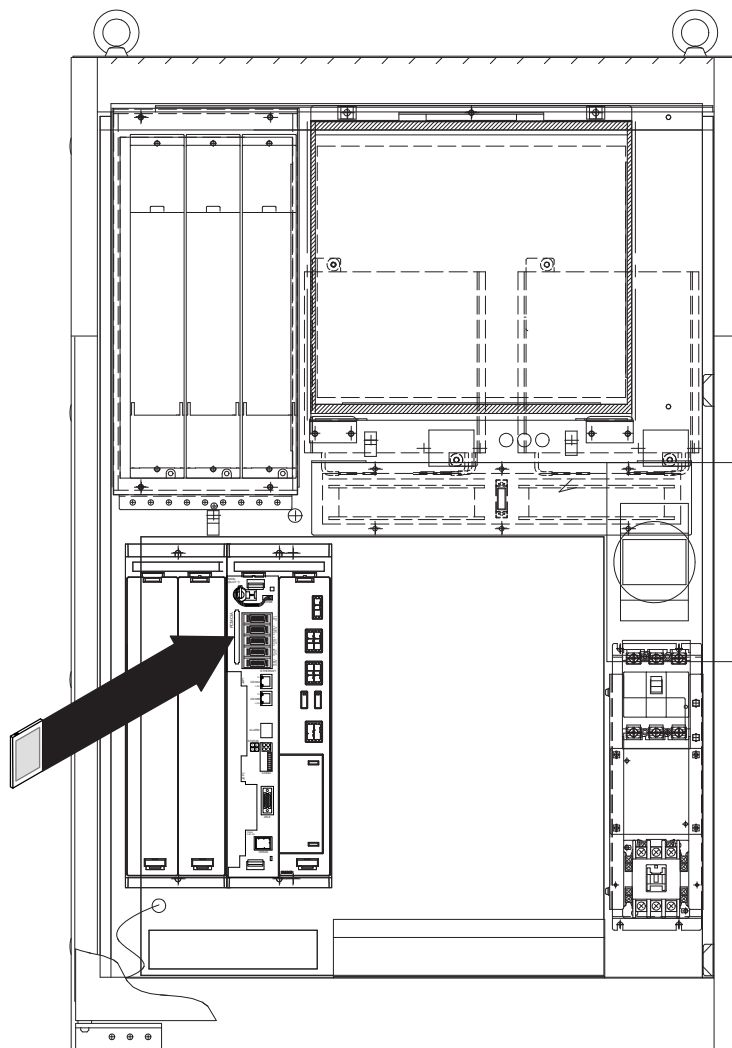
    b. Insert the memory card as shown in Figure 4–4 .

  2. If you are using a USB memory stick device,

    a. Identify the USB interface.

See Figure 4–5 and Figure 4–6 or Figure 4–7 .

Figure 4–5.   **R-30*i*B Controller USB Memory Stick Device Location**
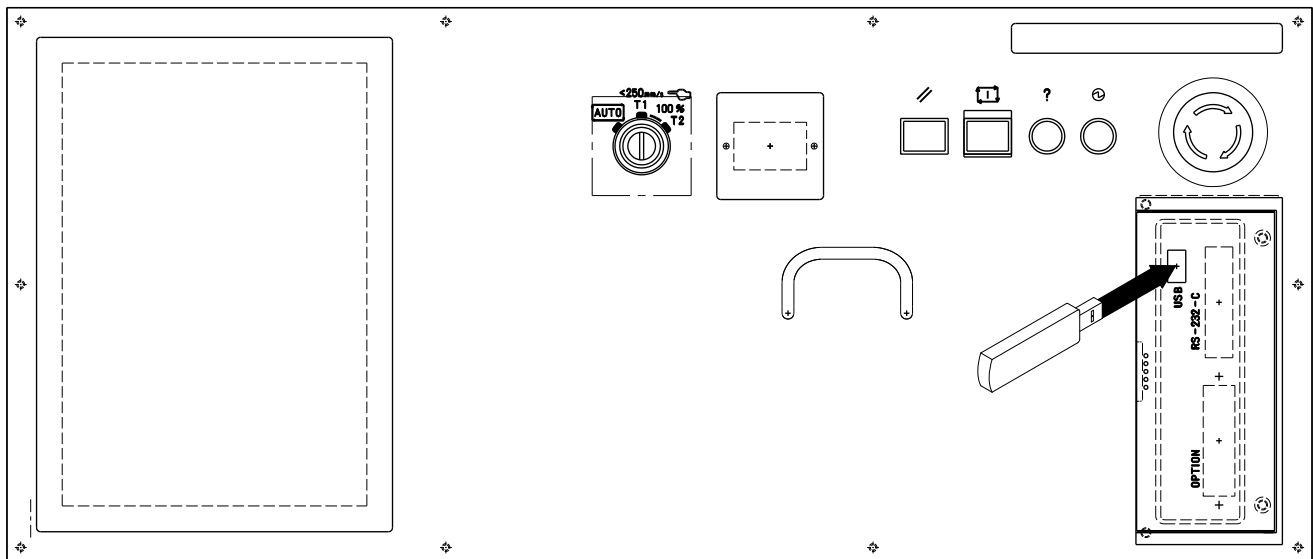
Figure 4–6. **R-30iB Mate Controller USB Location**

USB port (option)
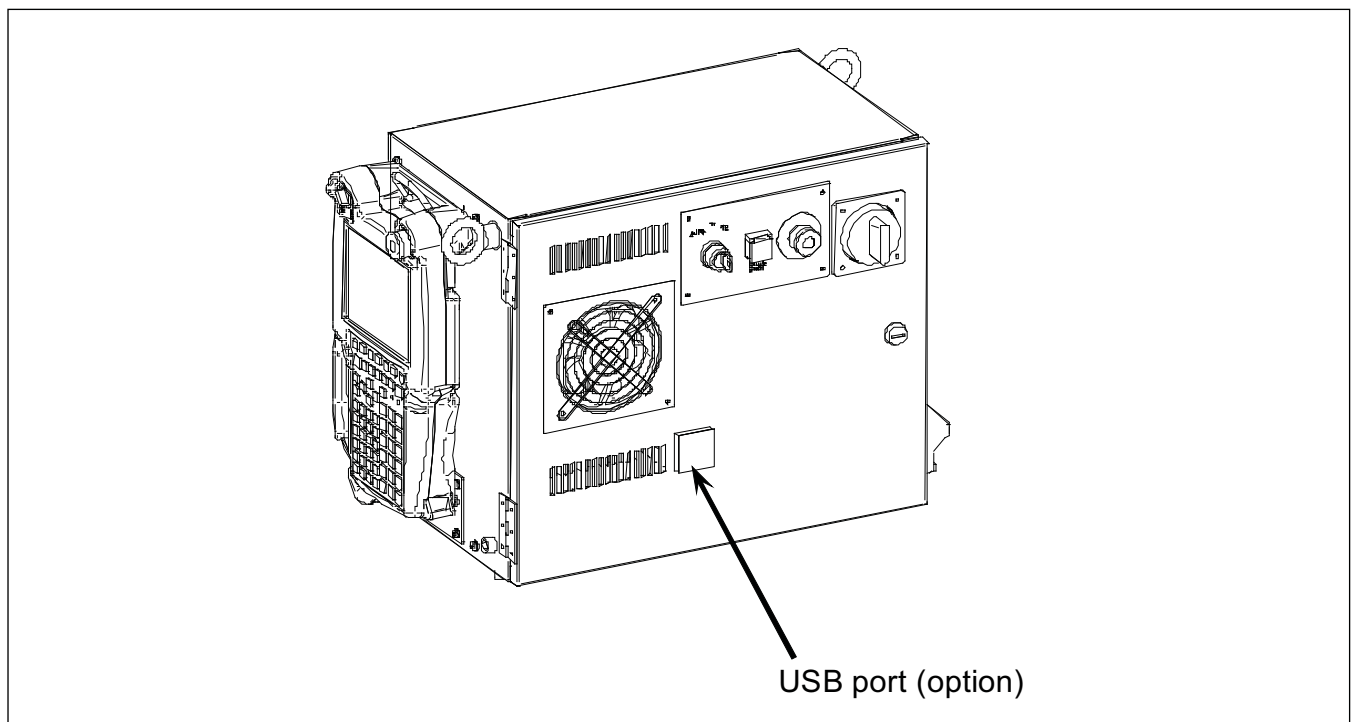
Figure 4–7. New *i*Pendant USB Port (UT1:) Interface Location
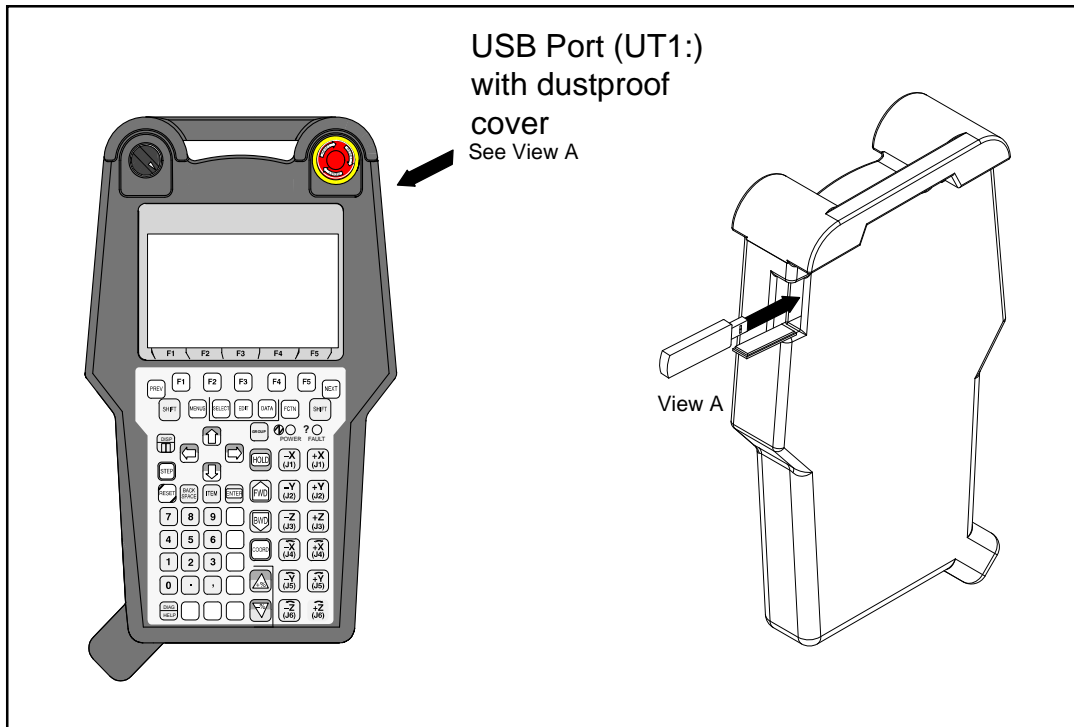
b. Insert the memory stick as shown in Figure 4–5 or in Figure 4–7 .

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

4.2.6 Formatting Devices

You must format the FLASH ATA memory card or USB memory stick only before you use them for the first time. Use Procedure 4-5 to format a memory card or memory stick.

Note USB Memory sticks cannot be formatted when plugged into the USB connector on the iPendant (UT1:) They must be formatted on a PC or when plugged into the front panel USB connector on the controller.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

The RAM disk is formatted automatically for you each time you change the disk size. If you want to format the RAM Disk from KCL, use Procedure 4-6 .

Note SpotTool+ does not use the RAM disk.

⚠️ **Caution**

Formatting deletes all the files on a memory card. Do not format a memory card or USB memory stick that contains files you want to keep.

Procedure 4-5 Formatting a Memory Card or USB Memory Stick from the File Menu

Conditions

- The default device is set to MC:. Refer to Procedure 4-1 .

- The FLASH ATA memory card is not write protected (if it has the write protect option).

- If you are formatting a memory card, the power disconnect circuit breaker is OFF and the memory card is inserted in the memory card interface properly. Refer to Procedure 4-4 .

⚠️ **Warning**

When the disconnect or circuit breaker handle is OFF, power is still present inside the controller. Disconnect electrical power from the controller before you remove or replace components, or you could be injured seriously.

- If you are formatting a USB memory stick, hold the card to be formatted with the label toward you and insert it into the interface. Refer to Procedure 4-4 .

Steps

1. Turn on the power disconnect circuit breaker to turn on the controller.

2. Press MENU.

3. Select FILE.

4. Press F5, [UTIL] and select Format (FAT) or Format FAT32 to format the card or memory stick.

   Note The device must be 2 Gbytes or smaller in size to be formatted as FAT.

   Select Format which is a FAT type of format if:

   - More than 255 files do not need to be stored in the root directory of the media.
   - It is necessary to write files to the media quickly.
   - Larger quantities of files can still be stored in sub-directories.
   - If the device is smaller than 64 Mbytes

Note The device must at least 64 Mbytes in size to be formatted as FAT32.

Select Format FAT32 which is a FAT32 type of format if:

- There is no limit to the number of files stored in the root directory of the media.

- If the device is larger than 2 Gbytes (2.0 GB).

If you are formatting a memory card, you will see a screen similar to the following.

```
File Format
MC:\*.*
               Formatting MC:
    *************  WARNING  *************
      ANY DATA ON THE DISK WILL BE LOST!
Insert the disk to be formatted into the
               interface
Format disk?
```

If you are formatting a USB memory stick, you will see a screen similar to the following.

```
File Format
UD1:\*.*
               Formatting UD1:
    *************  WARNING  *************
      ANY DATA ON THE DISK WILL BE LOST!
Insert the disk to be formatted into the
               interface
Format disk?
```

5. Format the card:

- **If you do not want to format the device,** press F5, NO.

- **To format the device,** press F4, YES. You will see a screen similar to the following.

```
1 Words
2 Upper Case
3 Lower Case
4 Options
                              --Insert--
Enter volume label:
```

6. Use the appropriate function keys and numeric keys to type a volume label, such as usb1 or mcard1, and press ENTER.

Formatting takes a few seconds. When the formatting is complete the teach pendant FILE menu will be displayed.

If your application includes KCL and you want to format the RAM disk , use Procedure 4-6 to format the RAM disk from KCL.

Procedure 4-6   **Formatting the RAM Disk from KCL**

Conditions

- The controller has a minimum of 2 MB of SRAM.
- The default device is set to RAM Disk. Refer to Procedure 4-1 .
- You have KAREL.
- You have enough memory in the Permanent Memory Pool.

Steps

1. Press MENU.

2. Select KCL>.

3. Type the following and press ENTER:

```
SET VAR $FILE_MAXSEC = n
```

where **n** is the size of the RAM disk divided by 512. For a 512 Kbyte RAM disk, **n** is 1000.

4. Press MENU.

5. Select KCL>.

6. Type the following and press ENTER:

```
FORMAT RD:
```

7. Type the following and press ENTER:

```
MOUNT RD:
```

8. Type the following and press ENTER:

```
SHOW DEVICE RD:
```

9. Type the following and press ENTER:

```
CD RD:
```

4.2.7 Subdirectories

Subdirectories can be used to organize programs or files on the controller. Subdirectories can be created on the FILE menu. Use Procedure 4-7 to create a subdirectory.

Procedure 4-7 Using Subdirectories

1. Press MENU.

2. Select FILE.

3. Press F5, [UTIL].

4. Select Make DIR. You will see a display similar to the following.

Figure 4–8. Making Subdirectories

```
FILE
  MC:\*.*                                    1/28
    1  *         *     (all files)
    2  *         KL    (all KAREL source)
    3  *         CF    (all command files)
    4  *         TX    (all text files)
    5  *         LS    (all KAREL listings)
    6  *         DT    (all KAREL data files)
    7  *         PC    (all KAREL p-code)
    8  *         TP    (all TP prog┌─────────────────┐
    9  *         MN    (all MN prog│ Alpha input   1 │
   10  *         VR    (all variabl│ Words           │
   11  *         SV    (all system │ Upper Case      │
  Directory name: █              │ Lower Case      │
                                   │ Options         │
                                   └─────────────────┘
```
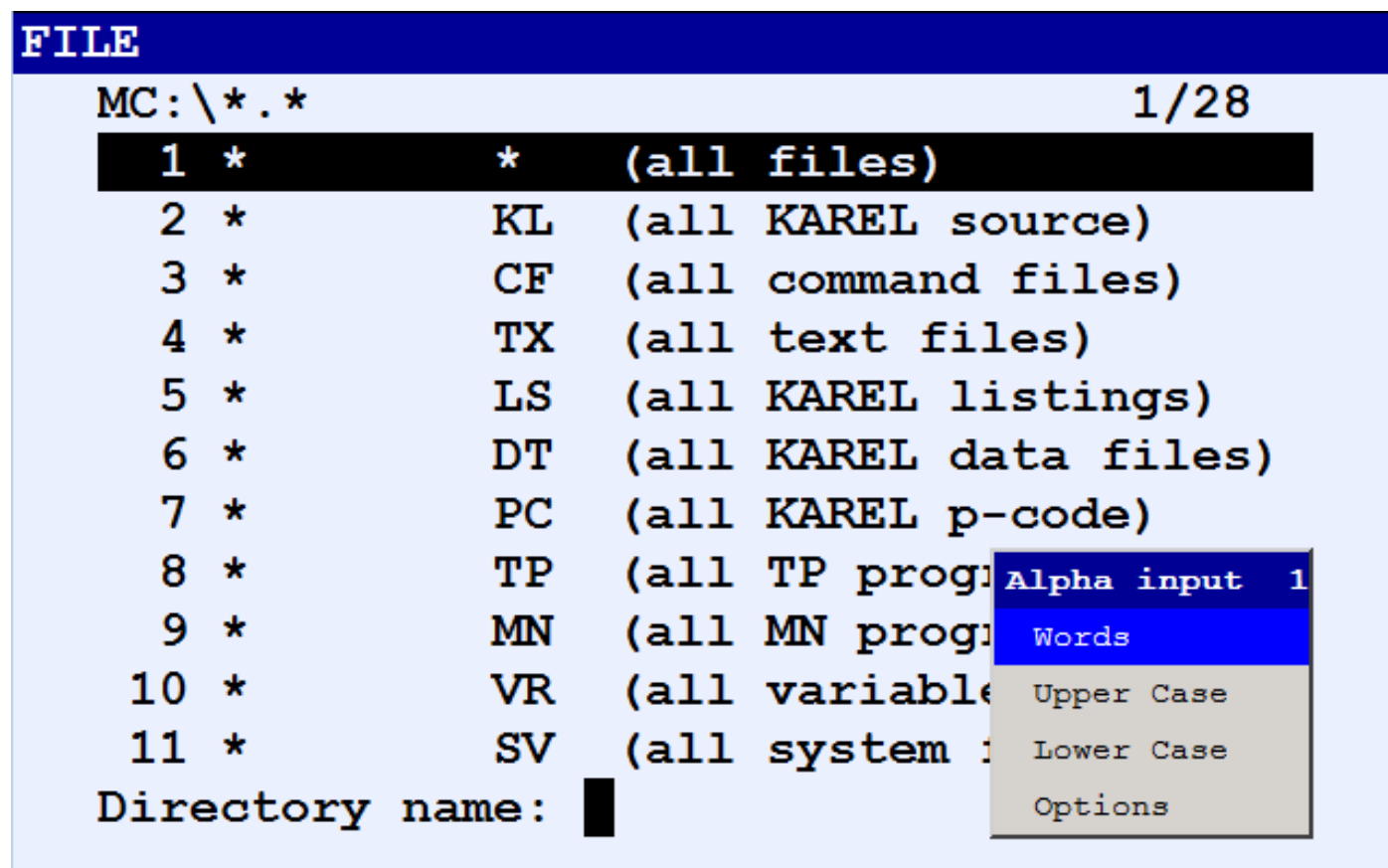
    5. Press F2, [DIR], and select *.*.

    6. Move cursor to a sub directory, and press ENTER.

Figure 4–9. Displaying Subdirectories

```
FILE
   MC:\MAINSUBTEST\*.*                      1/29
    1 ..      (Up one level)      <DIR>
    2 *         *      (all files)
    3 *        KL      (all KAREL source)
    4 *        CF      (all command files)
    5 *        TX      (all text files)
    6 *        LS      (all KAREL listings)
    7 *        DT      (all KAREL data files)
    8 *        PC      (all KAREL p-code)
    9 *        TP      (all TP programs)
   10 *        MN      (all MN programs)
   11 *        VR      (all variable files)
```

7. Move cursor to "(Up one level)" and press left arrow, right arrow or enter key to back out of the directory display.

Figure 4–10. Subdirectories

```
FILE
  MC:\*.*                              1/30
   1 MAINSUBTEST                   <DIR>
   2 TESTMAIN                      <DIR>
   3 *         *    (all files)
   4 *         KL   (all KAREL source)
   5 *         CF   (all command files)
   6 *         TX   (all text files)
   7 *         LS   (all KAREL listings)
   8 *         DT   (all KAREL data files)
   9 *         PC   (all KAREL p-code)
  10 *         TP   (all TP programs)
  11 *         MN   (all MN programs)
```

4.3 INSTALL ALL SOFTWARE

This section contains the information you need to install software. Use Procedure 4-8 to install all software.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

Procedure 4-8 Installing All Software

Conditions

- The controller is off.

- Enough system memory is available to install all application software. Refer to the ssd.html file on the load media that contains your software for information on the amount of memory available for your application and required by each option and robot library. Refer to Table 1–1 for the location of the .html file specific to your software.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the *application-specific Setup and Operations Manual for more information*.

- **If you are updating controller software** , you have backed up everything that you want to use on this controller. Refer to Appendix E for more information on backing up system, programs, and application files.

- You have the load media containing the software you want to load, and the media is inserted properly. Refer to Procedure 4-4 .

Note To perform a full load over Ethernet, refer to the *Internet Options Manual*.

Steps

1. While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON.

```
Power  Disconnect        ON
Circuit   breaker  OFF
```

When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up and you will see a screen similar to the following.

```
Base System Version V8.xxxx (FRNA)
Initializing file devices ... done.
******* BMON MENU *******
1.    Configuration Menu
2.    All software installation (MC:)
3.    INIT start
4.    Controller backup/restore
5.    Hardware diagnosis
6.    Maintenance
7.    All software installation (ETHERNET)
8.    All software installation (USB)
Select:
```

2. Select All software installation (MC:), and press ENTER. You will see a screen similar to the following.

```
***** HARDWARE CONFIGURATION *****
FROM: 32Mb  DRAM: 32Mb  SRAM 2MB
Fbus Modules
SLOT  ID    FC   OP0
D0    2     1    MAIN CPU8
F2    0     1    PC104 WIDE MINI
 PROCEED? [Y=1/N=else]:_
```

3. Verify that the memory structure and currently installed hardware is correct. **To continue installing software**, type 1 and press ENTER. You will see a screen similar to the following.

```
 HARDWARE CONFIGURATION *****
**** All software installation ****
CAUTION:    This operation ERASES ALL of
            FROM and SRAM.
Insert PC card with system software
Are you READY? [Y=1/N=else]:_
```

4. When you are ready to begin loading software, type 1 and press ENTER.

   Note All load media contain at least one *load personality*. A load personality is a predefined set of control files that determines which tool, options, and robot libraries are loaded from the load media during software installation. Each load personality has a unique description.

   The controller supports a *permanent load personality*. In this case the controller will match the personality currently on the controller exactly and load only the matching personality from the load media. The permanent load personality is always described as 0. Existing personality.

5. **If your load media contains multiple load personalities,** you will see a screen similar to the following.

   Note If only a permanent load personality exists on the controller and the load media the choice, 0. Current Personality, will be chosen automatically and the following screen will not be displayed.

```
Multiple Load Personalities Exist
0. Existing Personality
1. R-2000iX/165F, SpotTool+
2. M-710iC/50, HandlingTool
Select >
```

6. Select the load personality you want to install, and press ENTER.

Note Personalities are used to support multiple robots in an order such as those in a cell. The personality descriptions are chosen when the robot order is placed. The description should be unique so each robot can be uniquely identified.

Note If you see the following message, you must request new media from FANUC America Corporation,

```
"Checking Language"
Process is stopped by ABORT command!
```

7. If you are installing an R-2000iA robot, you will see a screen similar to the following.

```
1. Standard Flange
2. Insulated Flange
select flange type?
```

    a. Select the kind of flange for your robot. The standard flange is the default.

    b. Press ENTER.

        Note If you are installing extended axes OR multiple groups, you might be asked for setup information.

        Note If you are installing extended axes AND multiple groups, you might be prompted to enter multiple group data first, followed by extended axes data (Independent Axes or Positioner and extended axes, for example). Be careful to answer the Hardware Start number correctly. Automatic prompts for other options will follow Group axes data prompts. Other options which require setup can be performed from the Software Install/OPTION screen.

8. Perform a Cold start:

    a. Press FCTN.

b. Select START (COLD). When you have finished, you will see a screen similar to the following.

```
UTILITIES Hints                          ^
             ApplicationTool
    Vx.xxx/xx                  XXXX/XX


  Copyright xxxx, All Rights Reserved
            FANUC CORPORATION
       FANUC America Corporation
Licensed Software: Your use constitutes
your acceptance. This product protected
by several U.S. patents.
```

Note If you are updating your software **between major versions** , BMON will be updated automatically. If you are updating your software **with a minor version** , you might have to update BMON manually. Refer to Section A.4.2 . The *i*Pendant firmware does not get automatically updated for full loads over Ethernet. If you have an *i*Pendant, and you loaded a robot over Ethernet, you might see the following message just after you transition to Cold start: "*i*Pendant firmware should be upgraded, but necessary files are missing. Please contact FANUC America Corporation." This means that the firmware must be upgraded manually. Refer to Section A.4.3 to update *i*Pendant firmware.

4.4 INSTALL ADDITIONAL SOFTWARE AT CONTROLLED START

This section only covers installing addtional software at controlled start (CTRL CSTRT).

4.4.1 Overview

This section provides information on how to install additional software or change software currently loaded on your controller. This includes how to:

- Changing the Controller ID - Section 4.4.4

- Adding Options or Robot Libraries - Section 4.4.5

- Adding Customizations - Section 4.4.6

- Adding Additional Languages - Section 4.4.7

- Modifying a Robot Library - Section 4.4.8

Options come in three variants: Regular, Demonstration, and Free. Regular options need a product authorization code (PAC) in order to be loaded. Once loaded, regular options are permanently loaded. Demonstration options are similar to regular options in that a PAC was needed in order to be loaded. Demonstration options are different from regular options in that they operate for a time and then turn off. A product enable code (PEC) is needed to temporarily turn a demonstration option back on. A handful of regular options are available as a demonstration option for users to try out. A different PEC is used purchase a demonstration option and convert the option into a regular option. Unwanted demonstration options can also be forced to turn off. Free options are similar to regular options, but they do not need a PAC in order to load. Robot libraries are similar to free options in that a PAC is not needed in order to load. Unlike options, a multiple copies of a robot library can be loaded.

Note Because of complexity issues, some options may be installed at CTRL Start, but most options may be installed at COLD Start. Since V8.30P/11, all options can be installed at COLD Start. Robot Library Groups are added at COLD start, but may be modified at CTRL Start.

4.4.2 Control Starting a Controller

Procedure 4-9 Control Starting a Controller

Condition

- The controller is not in Controlled Start Mode.

Steps

1. If the controller is off but was in Controlled start mode, just cycle power.

2. Determine the Start method:

   - If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–11. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

4.4.3 Getting to the S/W Install Page

Procedure 4-10   Getting to the S/W Install Page

Conditions

- The controller is at Controlled start. Refer to Procedure 4-9 for more information.

Steps

1. You will see a screen similar to the following.

Figure 4–12. Default Control Start Page
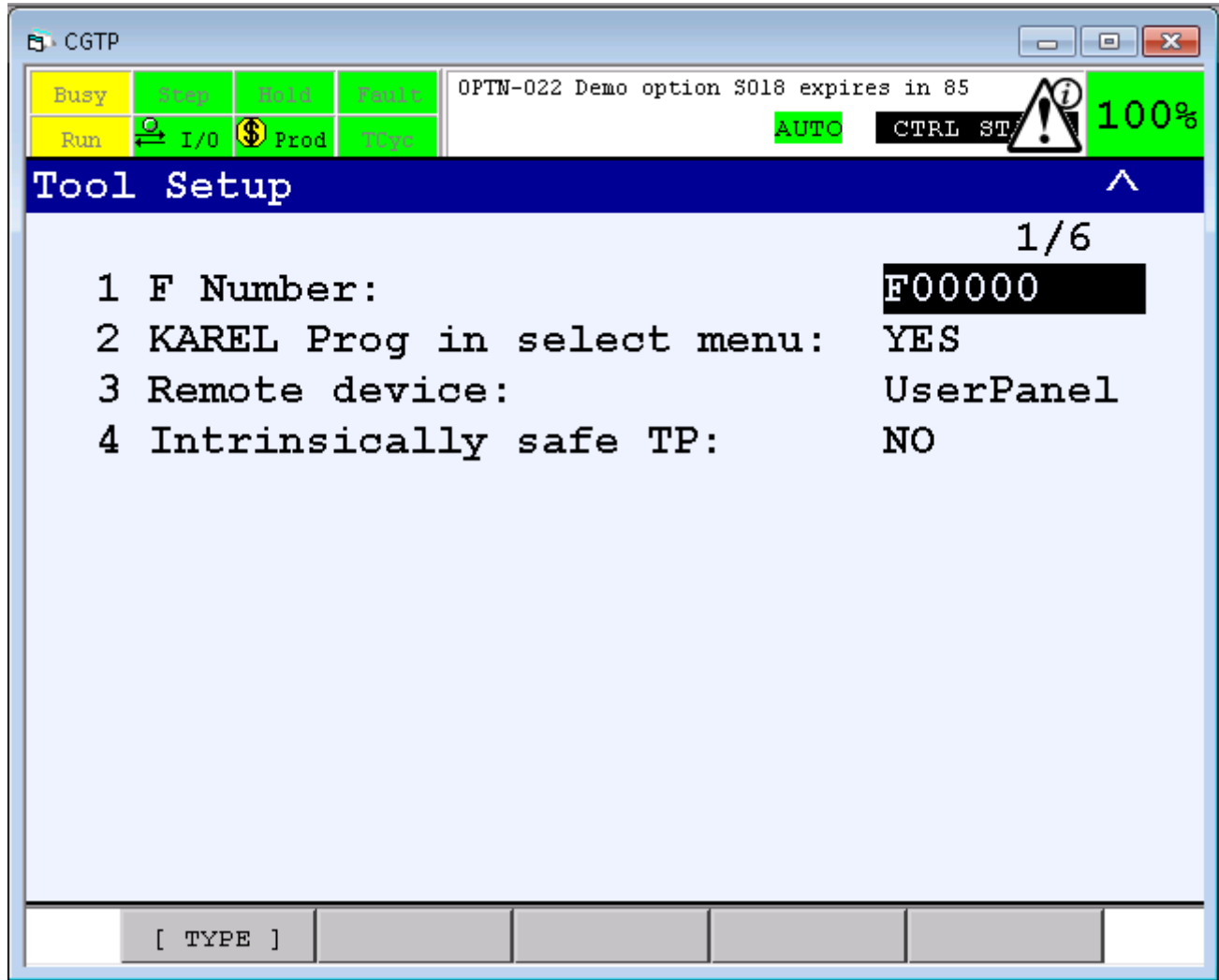
2. Press MENU, and then select S/W INSTALL. You will see a screen similar to the following.

Figure 4–13. S/W Install Page (V8.30P/10 and Later)
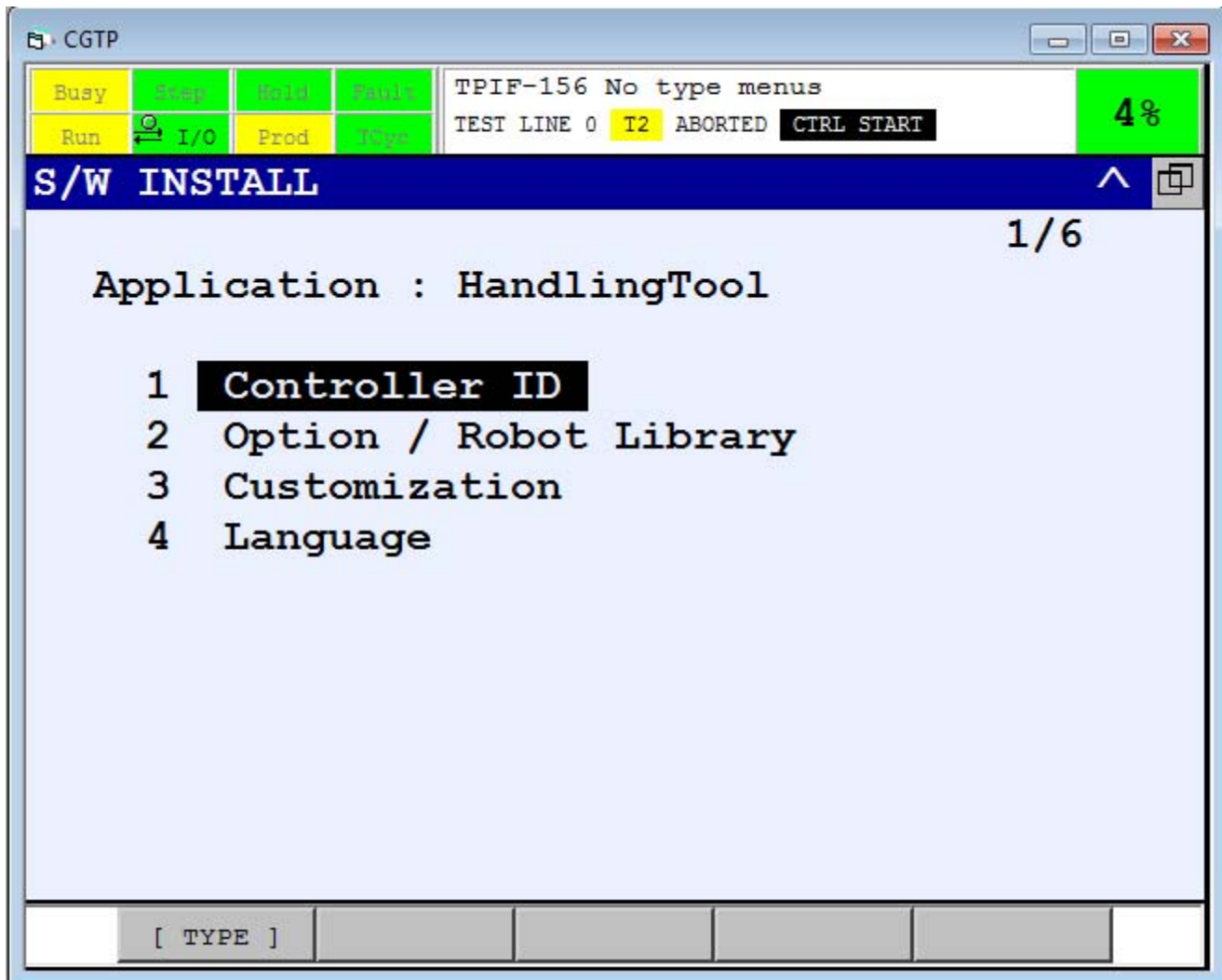
Older versions of software might display a screen similar to the following.

Figure 4–14. S/W INSTALL Screen (V8.30P/01 thru V8.30P/05)
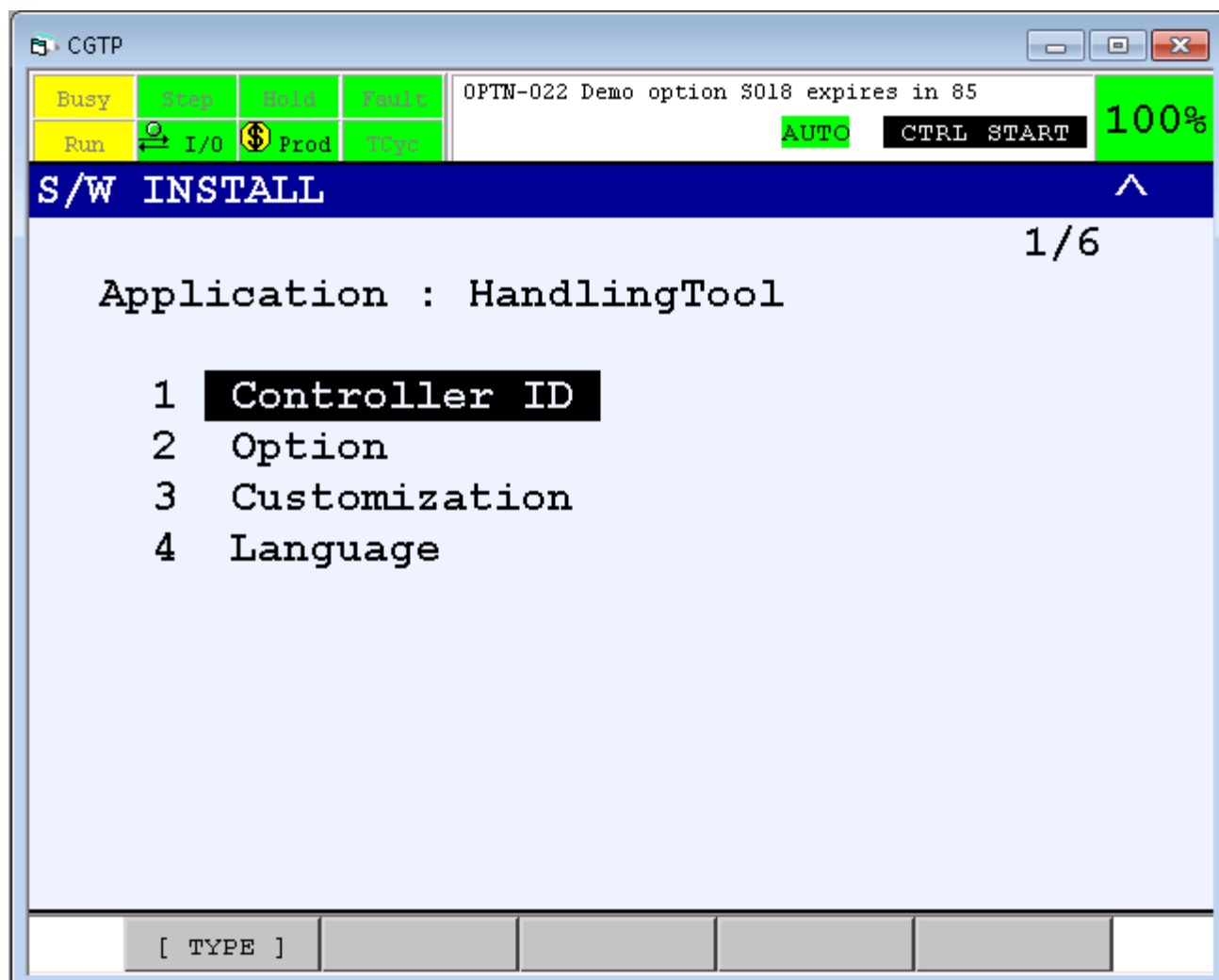
Figure 4–15. Software Install Menu (V8.30P/06 thru V8.30P/10)
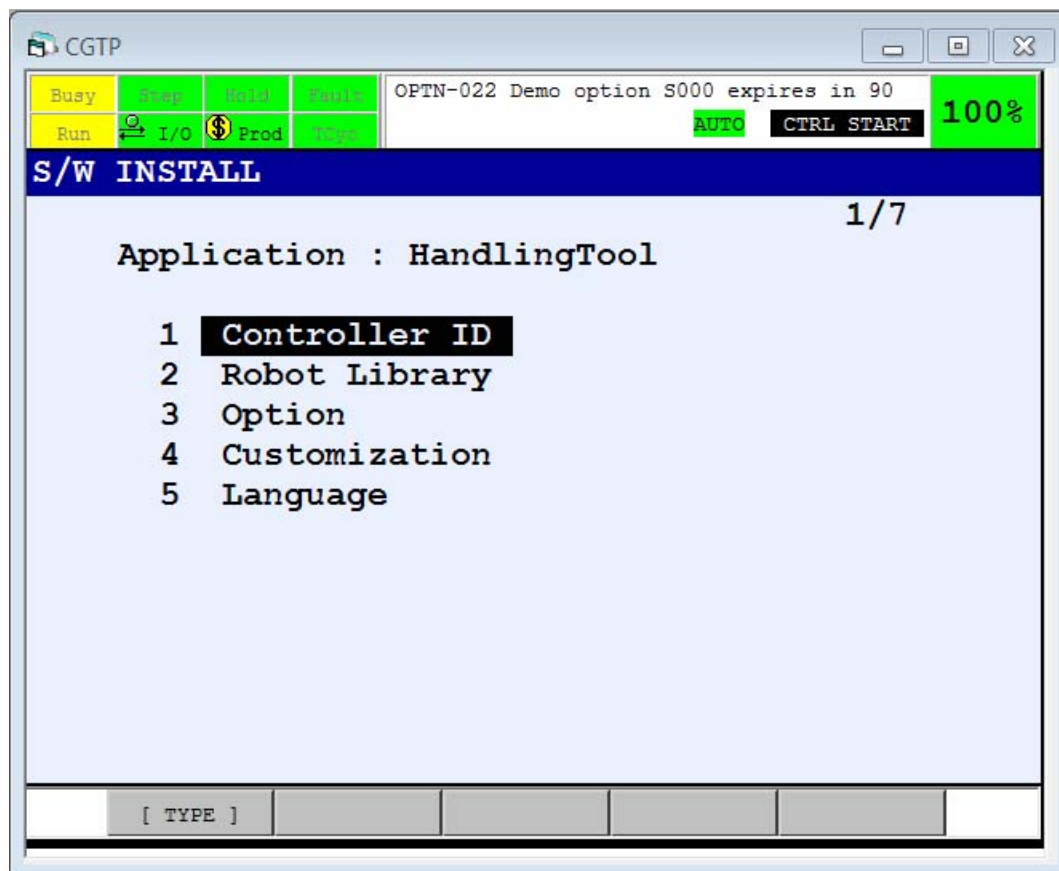
4.4.4 Changing The Controller ID

This section contains information on reserializing the controllers in a multiple controller environment so that they have the same licensing parameters. When controllers are purchased through different distribution networks, or traded between manufacturing plants, or purchased as used equipment, the licensing parameters will be different. If a controller is backed up to an image and then that image is restored on a different controller, the licensing parameters will be different. When the licensing parameters are mismatched on a controller, probably due to an image restore, an OPTN-027 ID Mismatch alarm will be posted on every COLD start.

Note Software is serialized to multiple parameters including the controller ID, software serial number, and load mask. When multiple robots are involved, a group of robots can be serialized to common parameters.

If you are installing software on multiple controllers, all the controllers can be serialized to a common parameter set. Typically, this is done when software is installed. However, if the controllers were

delivered from separate locations, you can reserialize them to match a common parameter set. UseProcedure 4-11 to reserialize a controller.

Procedure 4-11 Serializing a Controller ID

Conditions

- You have obtained a License Authorization Code (LAC) from FANUC America Corporation.

- The controller is at Controlled start. Refer to Procedure 4-9 for more information.

- The controller is at the S/W Install page. Refer to Procedure 4-10 for more information.

Steps

1. Select Controller ID and press ENTER. You will see a screen similar to the following.

Figure 4–16. RESERIALIZE Screen
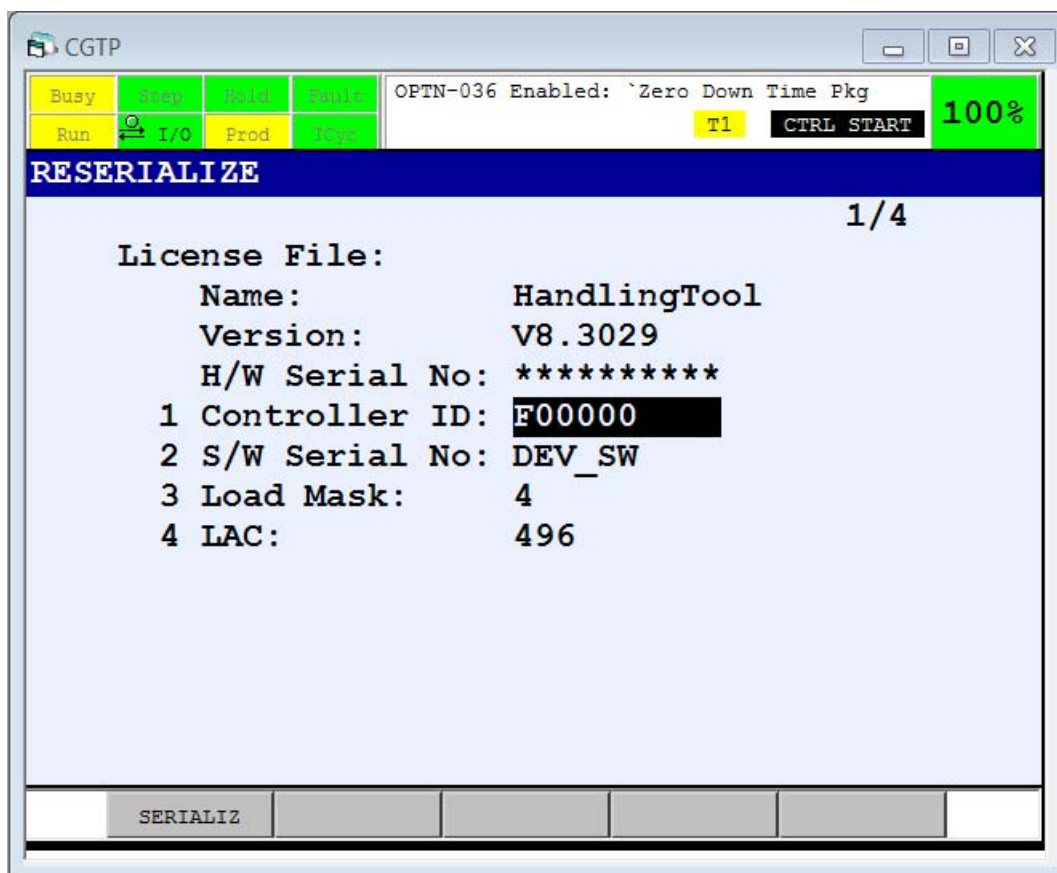
Note To return to the S/W Install screen without making any changes to the ID File settings, press PREV.

2. Change the Serial Number, Controller ID, Load Mask, and LAC to match the LAC Delivery Sheet. The LAC Delivery Sheet is provided by FANUC America Corporation whenever a controller is to be reserialized.

Note If the H/W Serial No and the Controller ID are different, an OPTN-027 ID Mismatch alarm will be posted every COLD start.

3. If all the displayed information is correct, press F1, SERIALIZ. If the LAC you typed was correct, your changes will be saved, and you will be returned to the Software Install Screen.

4.4.5 Adding Options and Robot Libraries at CTRL START

Some options may be added at CTRL Start. Prior to V8.30P/12, most (but not all) options could be added at COLD Start. Prior to V8.30P/06 and after V8.30P/09, experienced users may add robot libraries at CTRL Start. Since V8.30P/06, COLD start is the recommended place to add robot libraries.

Note For detailed information about options and robot libraries that are available with your software, including loading restrictions, refer to the ssd.html file on the load media that contains your software. Refer to Table 1–1 for the location of the .html file specific to your software. Refer to the *Internet Options Manual* for more information on loading options or robot libraries over Ethernet.

Note An *i*Pendant is required to add options at CTRL start. Option R558 — Internet Conn/Custo, provides a virtual *i*Pendant that can be used on a personal computer or tablet computer instead of a physical *i*Pendant. Refer to the *Internet Options Manual* for more information on using a virtual *i*Pendant.

Figure 4–17. Option Install Page at CTRL Start Using Virtual iPendant
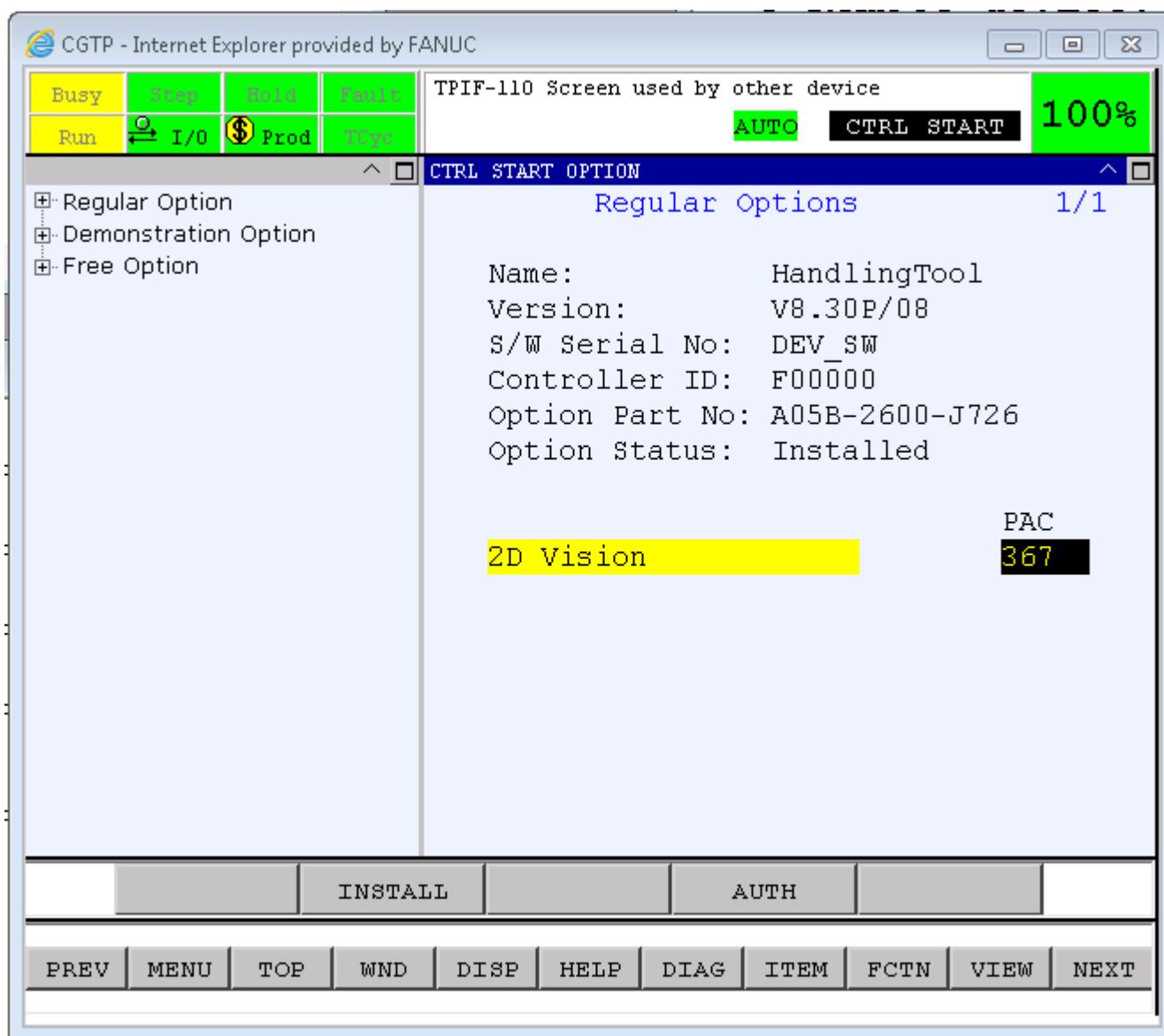
4.4.5.1 Adding Options at CTRL Start

Procedure 4-12 Authorizing and Installing Options

Conditions

- The controller is plugged in and is working properly.
- You are trying to do one of the following:

— Authorize an unauthorized option

— Install an authorized option

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Section 4.2.5 for more information.

- The controller is at Controlled start.

- The controller is at the S/W Install page.

Steps

1. Move the cursor to Option and press ENTER. You will see a screen similar to the following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

2. To choose the device, press F4, [CHOICE], and select the item from the list of available devices.

3. When you have finished, press F3, [DONE]. You will be left at the Option Screen.

   Note The following screen is an example. Your option screen will be different depending on the options that are available with your software. The four digits preceding the option name uniquely identify each option. Each option has an installation status of Authorized, Installed, Unauthorized, or blank. Options included by a demonstration option may have an installation status of Active.

Figure 4–18. **Option Screen**
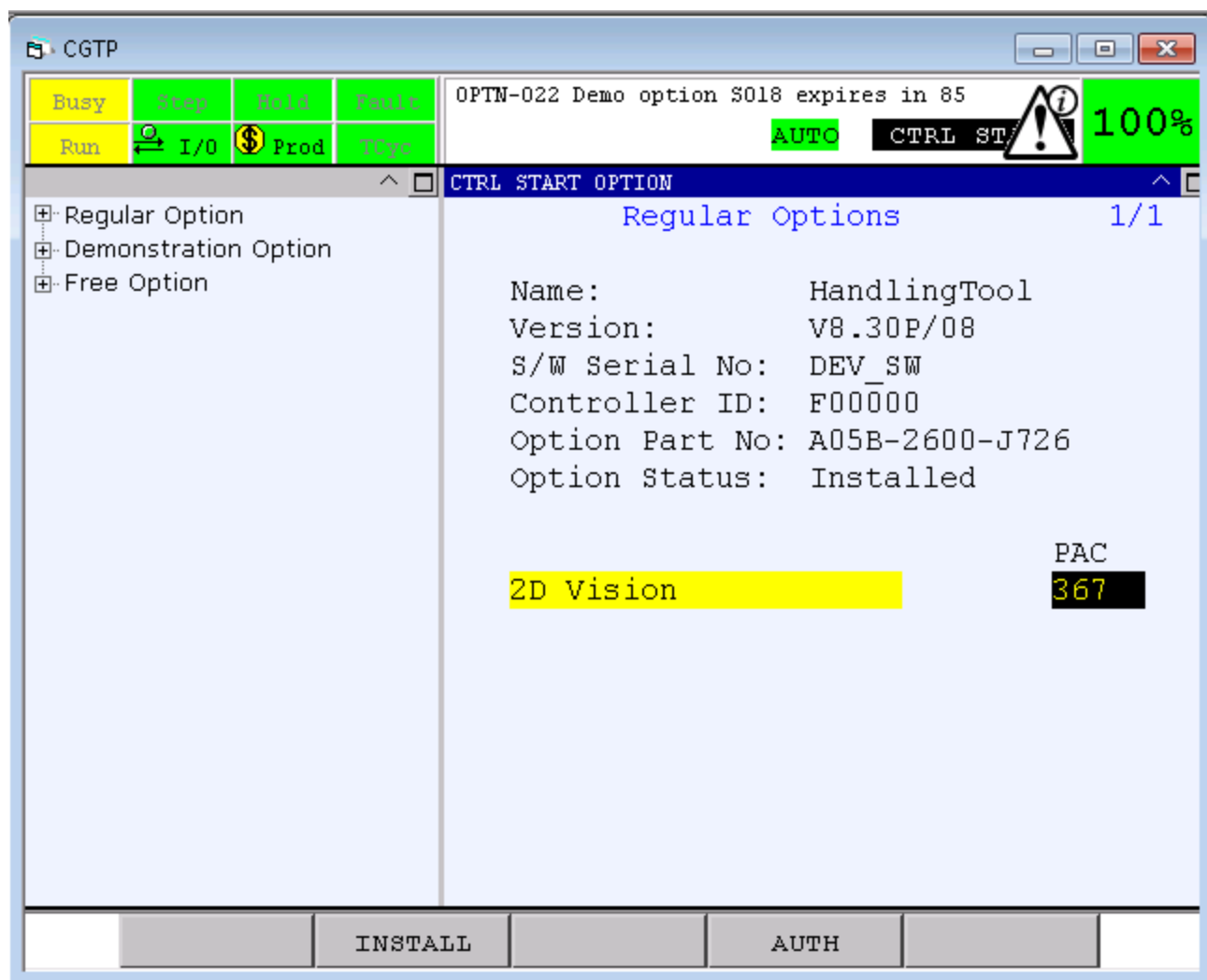
4. The CTRL START OPTION menu is split into two pane. The left pane shows available Regular, Demonstration, and Free Options. Nodes on the tree may be opened to show more information. Some Regular Options are also available as a Demonstration Option. Free Options are unique from Regular and Demonstration Options

Figure 4–19. Selecting An Option
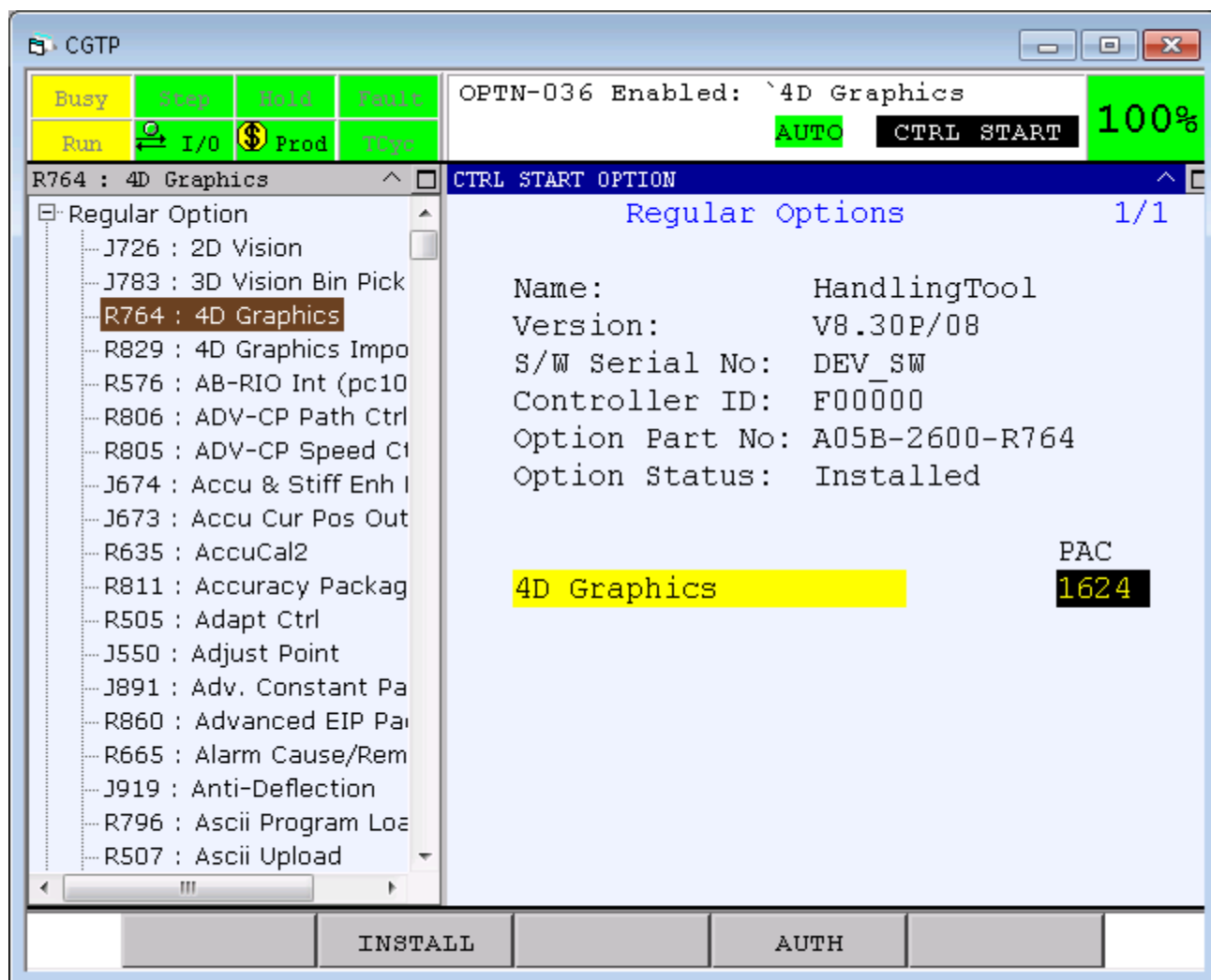
Selecting an option in the left pane will cause detailed information about that option to appear in the right pane. There are function keys to install, enable, and authorize the selected option.

The Option screen also shows parameters which you must share with FANUC America Corporation in order for FANUC America Corporation to generate a Product Authorization Code (PAC) to authorize the option. A PAC is an unsigned integer that uniquely authorizes this option on this controller.

5. Only Authorized options may be installed.

- **If the option status is Authorized**, it is not required for your application, but it has been preauthorized for you. In this case, it has not yet been installed and you can decide whether or not to install it.

- **If this option status is Installed**, it was purchased with the application software, and is a requirement for your application.

- **If this option status is Unauthorized or empty**, it has not yet been authorized for installation.

6. To authorize and install additional options that have been purchased separately from the application software, follow the instructions in Table 4–4 .

Table 4–4. Authorizing and Installing Options

Step Order	To do this	You must do this
1.	Obtain the PAC	Obtain the Product Authorization Codes (PAC) for each option you have purchased and want to install from FANUC.
2.	Authorize	1. Press F4, AUTH. 2. Type the PAC for the option and press ENTER. 3. PressF4, AUTH. The option status will be Authorized if you have entered a valid PAC. 4. Go to Step 3, Install, to install the option.
3.	Install	1. Press F2, INSTALL. The software will be installed. **NOTE** The requirements for the option will be evaluated. If requirements have not been met, INSTALL will fail.

Note If you are using PaintTool and have installed options after the initial software installation, you must display the PaintTool Setup screen and set up the PaintTool software. Then, select your Robot No., Applicator Type, Cell I/O Hardware, and Process I/O Hardware. After you have configured these items press F2, SETUP, to set up your PaintTool software properly.

7. Only expired demonstration options need to be enabled. Upon loading, demonstration options automatically enable.

8. For demonstration options only, pressing the ENABLE function key brings up the S/W Enable page. The enable screen is used to enable options.

Figure 4–20. Enable Screen (Pane 2 of 2 Pane Display)
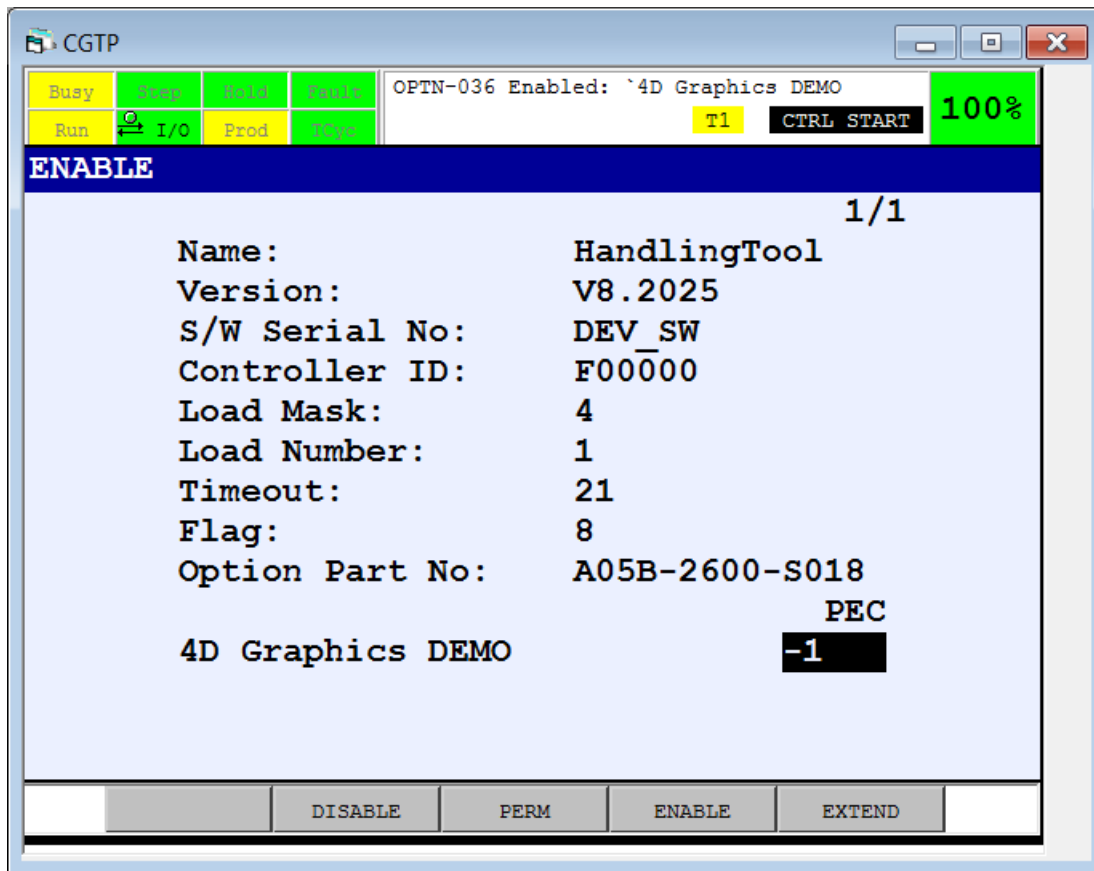
To enable demonstration options, follow the instructions in Table 4–13.

Table 4–5. **Enabling Demonstration Options**

Step Order	To do this	You must do this
1.	Obtain the PEC	Obtain from FANUC the Product Enable Code (PEC) for each demonstration option you enable or purchase.
2.	Enable	1. Press F3, ENABLE. a. If the option was just installed, the option is pre-enabled and will auto-enable and the S/W INSTALL menu will be displayed. b. If the option is not pre-enabled then the S/W ENABLE menu will be displayed. c. Press F2, DISABLE to disable the demonstration option. A new PEC will be required to enable the option. d. Type the PEC for the option and press ENTER. Press F3, PERM to purchase (and permanently enable) the demonstration option. e. Type the PEC for the option and press ENTER. Press F4, ENABLE to enable or re-enable the demonstration option. f. If the demonstration has expired, a one day extension can be granted with the EXTEND function key. Press F5, EXTEND to re-enable the demonstration option one more day.

4.4.5.2 Adding Robot Libraries at CTRL Start (V8.30P/05 and Earlier)

Procedure 4-13 Adding Robot Library Groups at CTRL Start

Conditions

- The controller is plugged in and is working properly.

- You are trying to add a robot library group.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Section 4.2.5 for more information.

- The controller is at Controlled start.

- The controller is at the S/W Install page.

Figure 4–21. S/W INSTALL Screen (V8.30P/01 thru V8.30P/05)
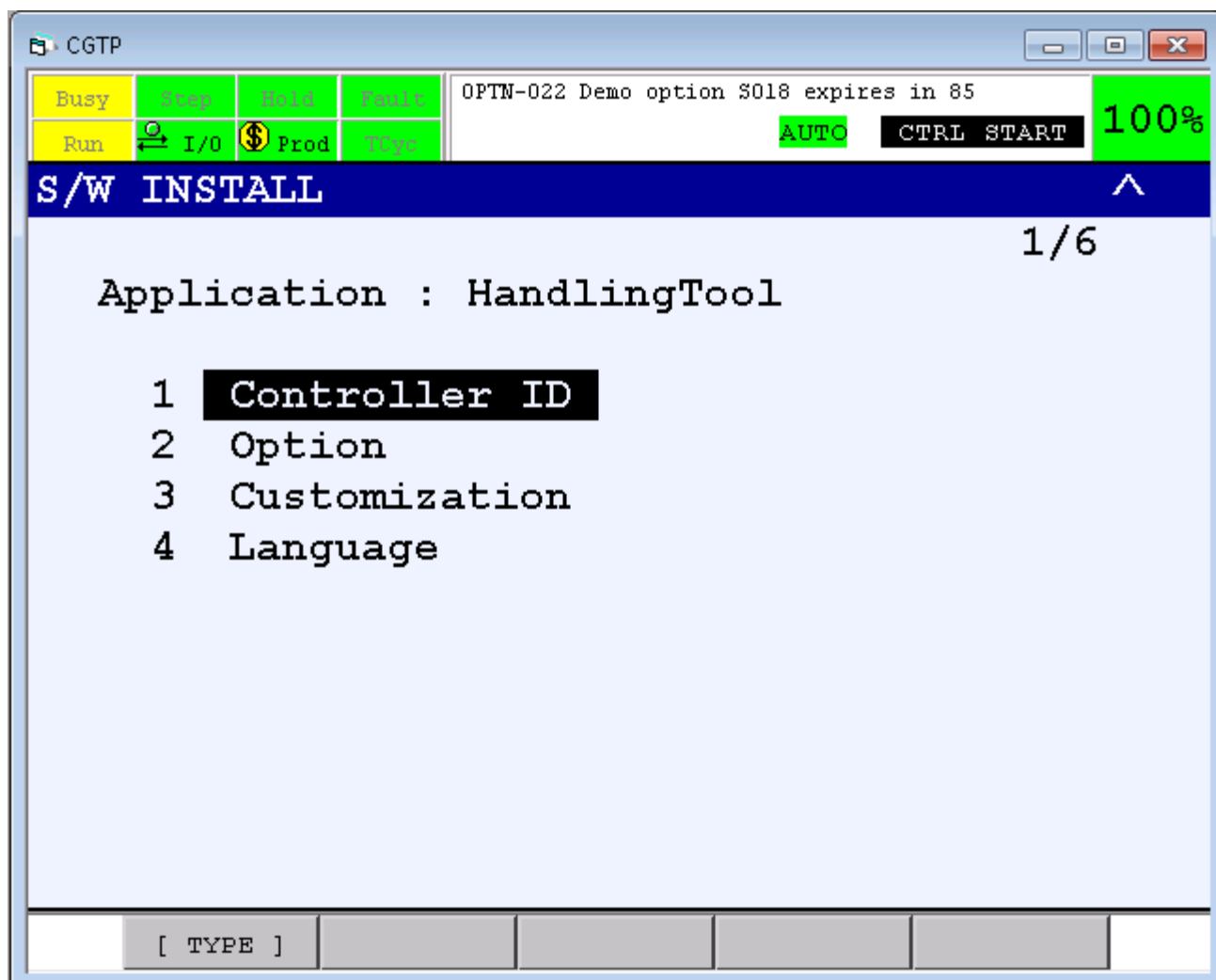
Steps

1. Move the cursor to Robot Library and press ENTER. You will see a screen similar to the
following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

2. To choose the device, press F4, [CHOICE], and select the item from the list of available devices.

3. When you have finished, press F3, [DONE]. You will be left at the Robot Library Screen.

Note The following screen is an example. Your robot library screen will be different depending on the robot libraries that are available with your software. The four digits preceding the robot library name uniquely identify each robot library.

Figure 4–22. Robot Library Screen
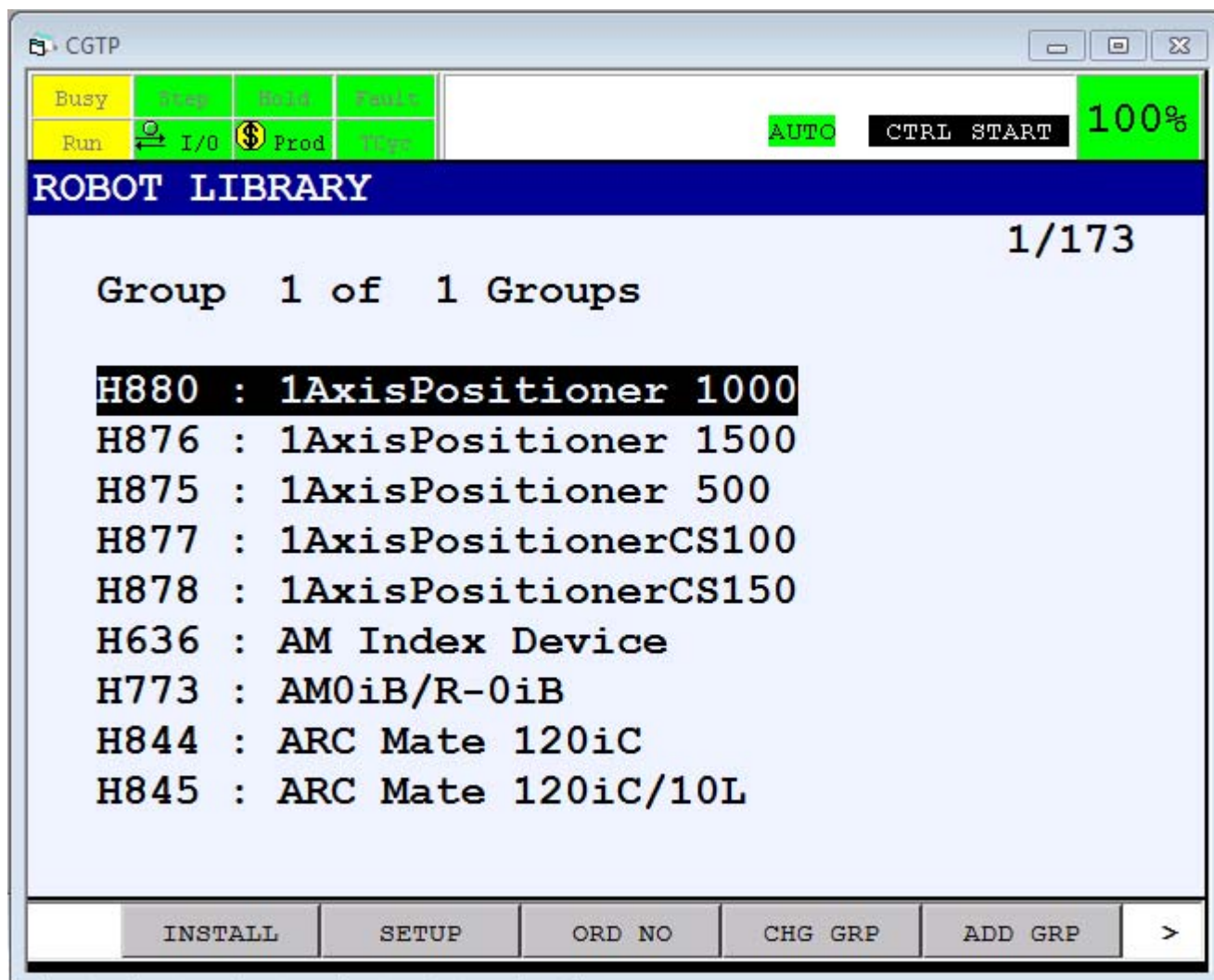
4. The top of the display will show how many groups are currently installed, in this case 1 (Group 1 of 1 Groups).

5. If you have not already set up the FSSB (FANUC Serial Servo Bus), you must set up the FSSB. Refer to Appendix H for additional detail on how to answer these questions. You will see a screen similar to the following.

```
**** GROUP 2 INDEPENDENT AXES SETUP ****
-  FSSB configuration setting - —
 1: FSSB line 1 (main axis card)
 2: FSSB line 2 (main axis card)
 3: FSSB line 3 (auxiliar axis board)
Select FSSB line >
Default value = 1
```

> ⚠ **Caution**
>
> Each robot library has a setup program associated with it. If the setup
> program has an assigned data file, the software will read all of the setup
> information from it. If there is no assigned data file, you must answer several
> questions regarding how your robot is to be set up (refer to Appendix D for
> a list of questions). If you answer the questions incorrectly, you can correct
> them by performing a MANUAL setup from the MAINTENANCE screen.
> Refer to Section 4.4.8.1 to modify the robot setup manually.

6. **To change the display from TITLE to ORDER NUMBER** , press F3, ORD NO. You will see
   a screen similar to the following.

```
ROBOT LIBRARY       CONTROLLED START MENUS
Group 1 of 1 Groups
H685:  A05B-2400-H685
H888:  A05B-2400-H888
```

7. **To change the display from ORDER NUMBER to TITLE** , press F3, TITLE. You will see
   a screen similar to the following.

```
ROBOT LIBRARY       CONTROLLED START MENUS
Group 1 of 1 Groups
H685:  A-520i
H888:  F-100 Robot Library
```

8. **To allocate a new robot library group**, press F5, ADD GRP.

⚠️ **Caution**

When you add a group, the teach pendant screen might go blank for approximately 60 to 90 seconds for each group in the system.

Note The robot library group will be uninitialized until a robot library is installed.

9. Select the robot you want to install from the list of robots and press F1, INSTALL.

⚠️ **Caution**

Each robot library has a setup program associated with it. If the setup program has an assigned data file, the software will read all of the setup information from it. If there is no assigned data file, you must answer several questions regarding how your robot is to be set up (refer to Appendix D for a list of questions). If you answer the questions incorrectly, you can correct them by performing a MANUAL setup from the MAINTENANCE screen. Refer to Section 4.4.8.1 to modify the robot setup manually.

Note During a transition to a Cold start, the robot will re-execute a Controlled start. This is required to allocate resources needed by the new robot group.

4.4.5.3 Adding Robot Libraries at CTRL Start (V8.30P/06 thru V8.30P/09)

Robot Libraries cannot be added at CTRL Start.

4.4.5.4 Adding Robot Libraries at CTRL Start (V8.30P/10 and Later)

Procedure 4-14 Installing a Robot Library

Conditions

- The controller is plugged in and is working properly.

- You are trying to add a robot library group.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Section 4.2.5 for more information.

- The controller is at Controlled start.

• The controller is at the S/W Install page.

Figure 4–23. S/W Install Page (V8.30P/10 and Later)
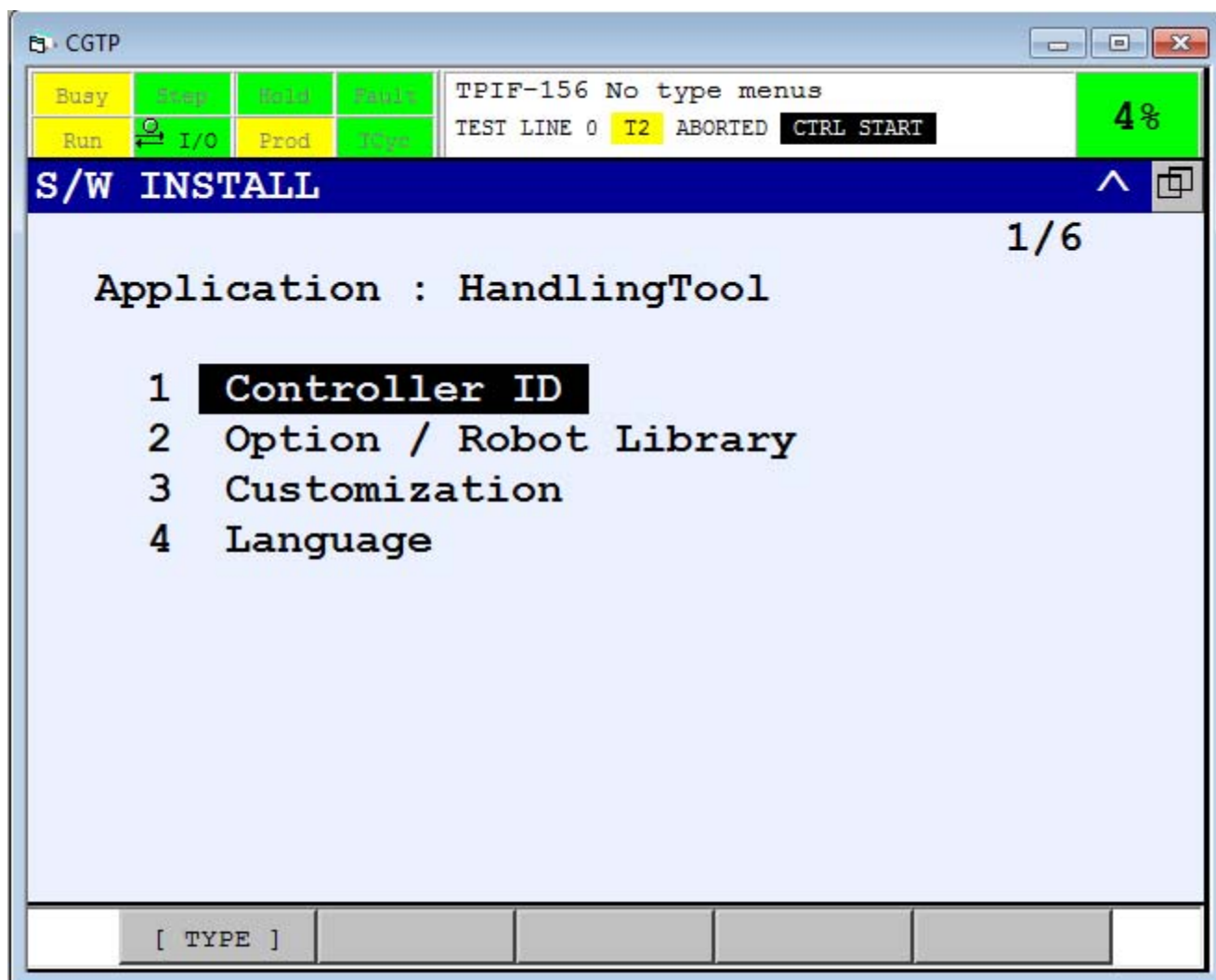
Steps

1. Move the cursor to Option / Robot Library and press ENTER. You will see a screen similar to the following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

2. To choose the device, press F4, [CHOICE], and select the item from the list of available devices.

3. When you have finished, press F3, [DONE]. You will be left at the Option/Library Screen.

   Note The following screen is an example. Your Option/Library screen will be different
   depending on the robot libraries that are available with your software. The four digits preceding
   the option or robot library name uniquely identify each option or robot library. For details on
   how to install an option, follow the instructions in

Figure 4–24. Robot Library Installation at CTRL start
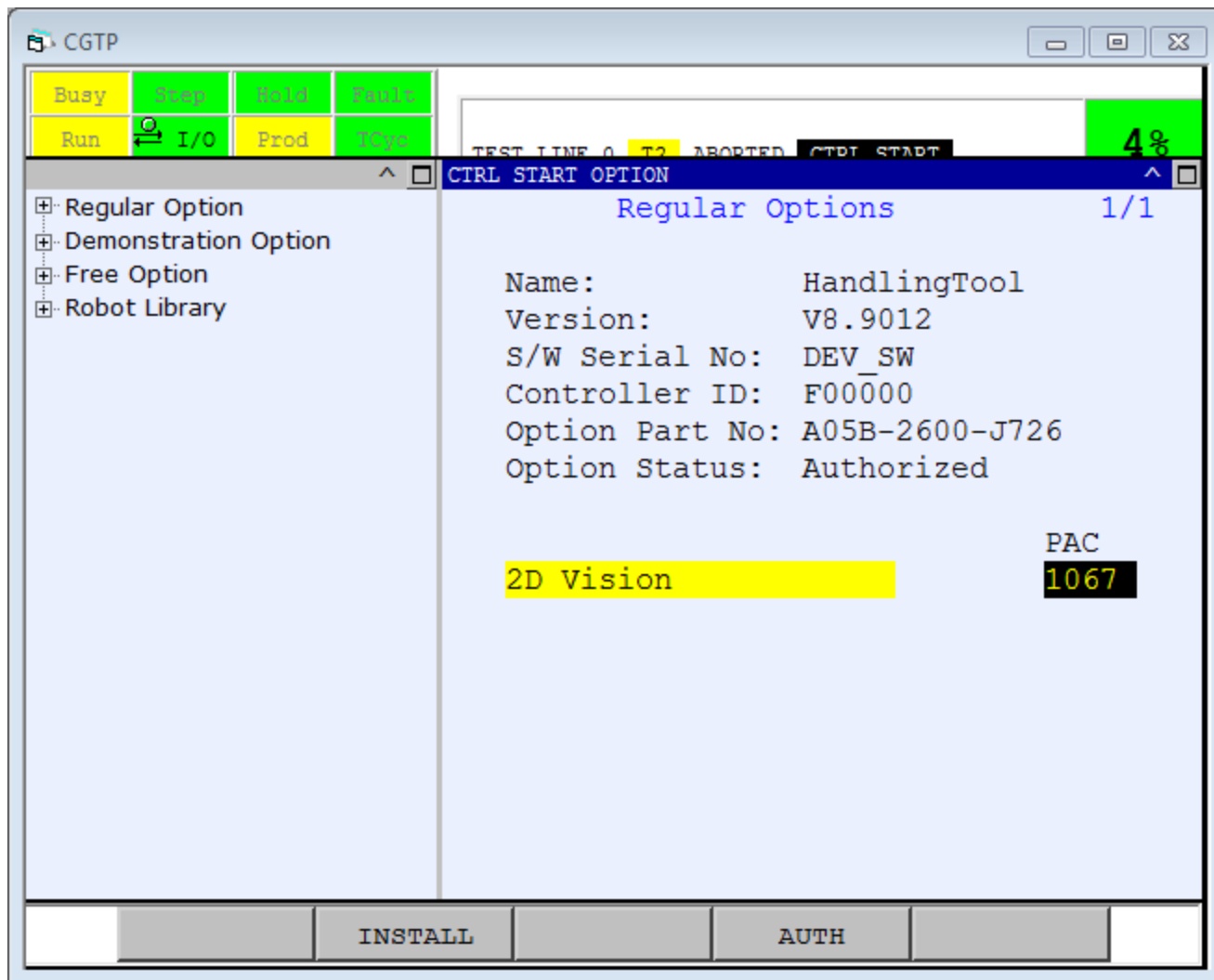
4. The CTRL START OPTION menu is split into two panes. The left pane shows available Regular
   Options, Demonstration Options, Free Options, and Robot Libraries. Nodes on the tree may be
   opened to show more information.

Figure 4–25. Sselecting a Robot Library
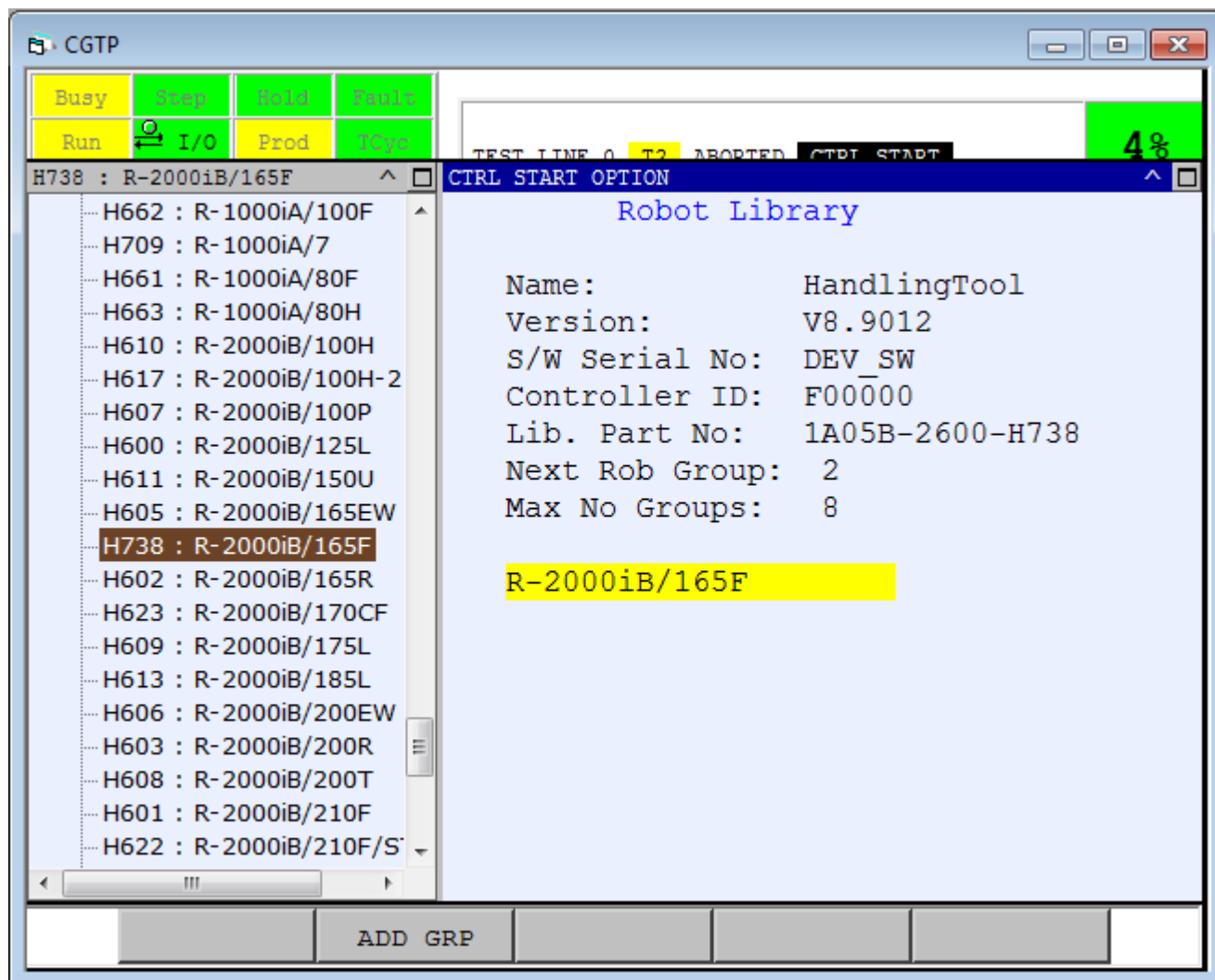
Selecting a robot library in the left pane will cause detailed information about that robot to appear in the right pane. There is a function keys to install the selected robot library.

4.4.6 Installing Customizations

Use Procedure 4-15 to install a software customization.

Procedure 4-15 Installing Customizations

Conditions

- Media with a customizations on it.

- If installing over Ethernet, a BOOTP/DHCP and TFTP server must be configured and running on the network.

- You have the software load media containing the software you want to load, and the media is inserted properly.

Steps

Note You can perform a customizations over Ethernet.

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2

   - If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–26. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. Press MENU. You will see a screen similar to the following.

Figure 4–27. Tool Setup Screen
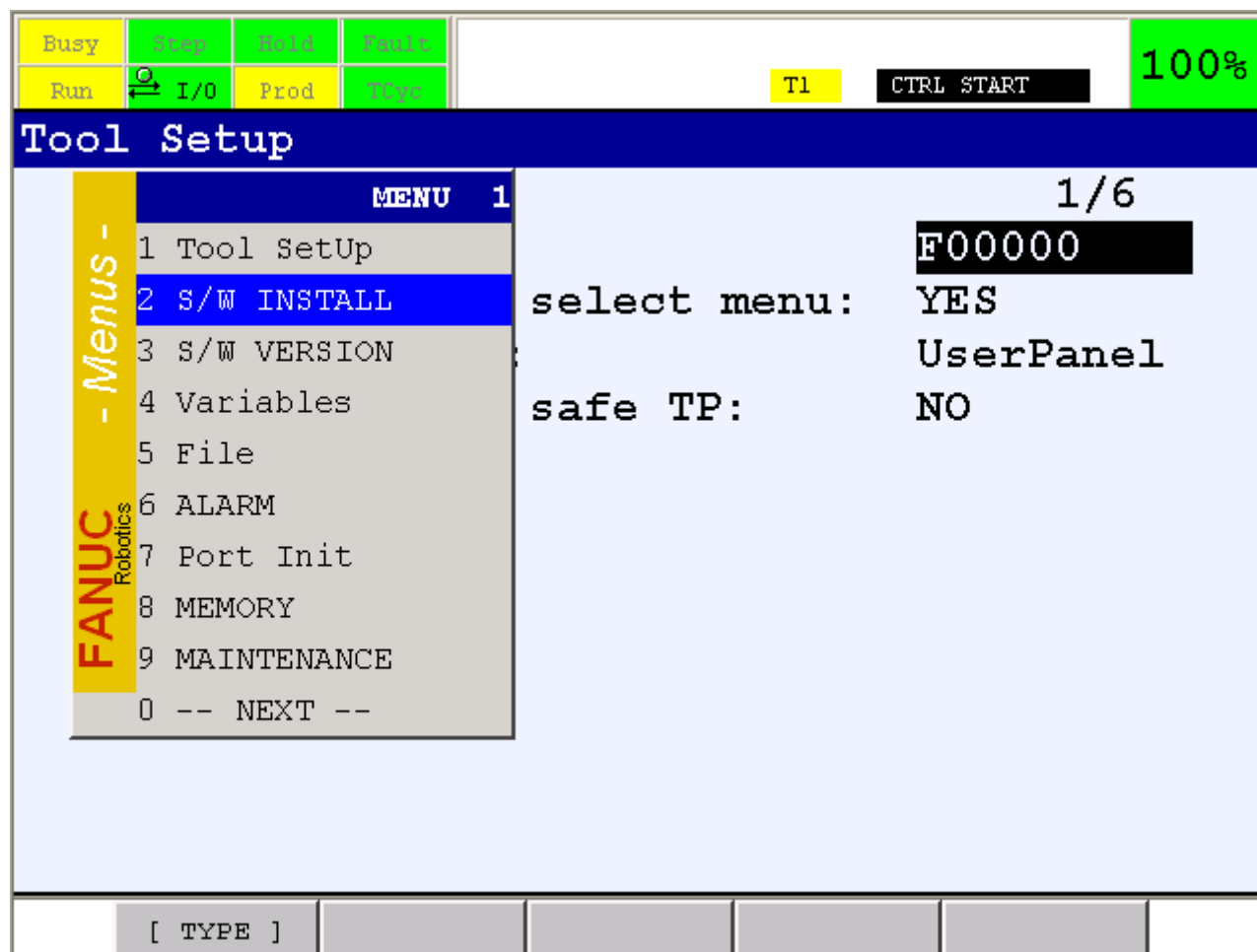
3. Select S/W INSTALL. You will see a screen similar to the following.

```
 S/W INSTALL        CONTROLLED START MENUS
Application: ProductName
1  Controller ID
2  Robot Library
3  Option
4  Customization
5  Language
```

4. **To install a customization**, move the cursor to Customization and press ENTER. You will see a screen similar to the following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

5. To choose the device, press F4, [CHOICE], and select the item from the list of available devices. If you are loading over Ethernet, choose " Ethernet (TFTP) from the list of available devices.

6. When you have finished, press F3, [DONE]. The files will be copied to the controller. When they are finished, the S/W Install screen will be displayed. You will see a screen similar to the following.

```
S/W INSTALL         CONTROLLED START MENUS
Application: ProductName
     1  Controller ID
     2  Robot Library
     3  Option
     4  Customization
     5  Language
```

4.4.7 Install A Language

The Install Language feature allows you to add a dictionaries to support a language that is not part of the standard product. For example at this time only English and Japanese (with Kanji) is available in the standard product. One of the following dictionaries can also be installed:

- Chinese
- English
- French

- German

- Japanese

- Spanish

- Taiwanese

- Other

Note Installing the language will load the dictionaries that are needed on the controller for the features and options that exist on the controller.

Note Only two or three languages can be installed on a controller at one time depending on how much FROM is still available. If the FROM becomes nearly full during the install of a language then that language will be automatically deleted.

If a user installs an option at Controlled Start, then the language needs to be reloaded unless the language was already part of the Product Media. You can reinstall a language to add or update additional dictionaries. This feature will check the software version to make sure the inserted media is the correct version.

Languages can be installed automatically during a full load, or manually after a full load is complete.

The controller will search for a for a file called lang.tx and a directory /lang/*langname*/. Where the *langname* is one of: Chines, French, German, Japane, KANJI, Spanis or Taiwan. This will be loaded as the Other language if the first five characters of the language name do not match the name of one of the following existing language options: Chinese, French, German, Japanese (KANA), Japanese (KANJI), and Spanish.

Use Procedure 4-16 to install a language after a full load is complete.

Procedure 4-16 Installing a Language Manually After a Full Load is Complete

Conditions

- Media with the language or customizations on it.

- If installing over Ethernet, a BOOTP/DHCP and TFTP server must be configured and running on the network.

- You have the software load media containing the software you want to load, and the media is inserted properly.

Steps

Note You can perform updates and customizations over Ethernet.

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2

- If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–28. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. Press MENU.

3. Select S/W INSTALL. You will see a screen similar to the following.

```
 S/W INSTALL          CONTROLLED START MENUS
Application: ProductName
1   Controller ID
2   Robot Library
3   Option
4   Customization
5   Language
```

4. **To install a language**, move the cursor to Language and press ENTER. You will see a screen similar to the following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

5. To choose the device, press F4, [CHOICE], and select the item from the list of available devices. If you are loading over Ethernet, choose " Ethernet (TFTP) from the list of available devices. You will see a screen similar to the following.

```
Language loading        CTRL START 100%
                                 1/10
Include text for these if available:
  Alarm Cause/Remedy :     No
  Online Help :            Yes
Optional Languages:        Status:
1 Chinese Dictionary
2 French Dictionary
3 German Dictionary        Installed
4 Japanese (KANA)Dict.
5 Spanish Dictionary
```

Note The language that is already installed is shown as **Installed**. It can be *re-installed*. The primary language can only be either English or one of the forms of Japanese.

6. **To install a language**, move the cursor to the language name and press F1, INSTALL.

Note There must be enough space on FROM to install the language dictionaries. If not, the message, "Not enough space on FROM, Undoing," will be displayed. If any dictionary files had been loaded, they will be deleted.

7. If a customization or maintenance update has been installed and you need **to reinstall a language**, move the cursor to the name of the language to be reinstalled, and press F2, REINSTALL.

8. **To delete an installed language**, move the cursor to the name of the installed language to be deleted, and press F3, DELETE. You will see a screen similar to the following.

```
Are you sure delete? Press 1 to continue, other to abort
```

To continue deleting the language, press 1. **If you do not want to delete the language** , press any other key.

Note The primary language cannot be deleted. If you attempt to delete the primary language, you will see the following message, "Can't remove the primary language." You can also not delete the only language that is installed on the controller. Otherwise, the following message will be displayed, "Can't remove the only language."

9. **To install Language-specific Help files** set Online Help to Yes and repeat steps 6 or 7 as appropriate.

Note Install Language-specific Help Files is not yet available.

10. **To install Language-specific Alarm Cause/Remedy** set Alarm Cause/Remedy to Yes and repeat steps 6 or 7 as appropriate.

Note Install Language-specific Alarm Cause/Remedy is not yet available.

4.4.8 Modifying a Robot Library

Refer to Table C–1 for valid FANUC motor and amp combinations and Table C–2 for supported Third-Party Motor and Amp Combinations.

4.4.8.1 Robot Library and Extended Axis Maintenance

Robot library maintenance allows you to modify the following information:

- Robot library setup

- Extended axis setup

Use Procedure 4-17 to perform robot library and option maintenance.

Table 4–6 lists the items shown on the Robot Maintenance screen. These items will vary depending on the robot libraries that are installed.

Table 4–6. Robot Maintenance Screen Items

ITEM	DESCRIPTION
Group	This item displays the group number of the installed robot library.
Robot Library/Option	This item displays the name of the installed robot library or option.
Ext. Axis	This item displays the number of extended axes if applicable.

Procedure 4-17 Performing Robot Library and Option Maintenance

Conditions

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Procedure 4-4 .

Steps

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2

- If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–29. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. Press MENU.

3. Select MAINTENANCE. You will see a screen similar to the following.

Note The following screen is an example. Your screen will be different depending on how your system is set up.

```
ROBOT MAINTENANCE     CONTROLLED START MENUS
Setup Robot System Variables
Group    Robot Library/Option    Ext Axes
  1      M-410iHS                    0
```

4. **To change the display from TITLE to ORDER NUMBER**, press F2, ORD NO. You will see a screen similar to the following.

```
ROBOT MAINTENANCE     CONTROLLED START MENUS
Setup Robot System Variables
Group    Robot Library/Option     Ext Axes
  1      A05B-2400-H863                0
```

5. **To change the display from ORDER NUMBER to TITLE**, press F2, ORD NO.

6. Move the cursor to the title or order number of the robot library you want to modify.

7. Decide whether you want to perform AUTO setup or MANUAL setup. Refer to Table 4–7 .

Table 4–7. **Auto and Manual Robot Library Setup**

ITEM	DESCRIPTION
AUTO	This item allows you to set up the robot library or option automatically using default values for each setup item.
MANUAL	This item allows you to set up the robot library or option manually by allowing you to answer each setup question individually. Manual setup records your answers as the new default values.

8. **To modify your setup**,

a. Move the cursor to the order number or title of the item you want to modify.

Note During automatic setup of some libraries, you will be asked to answer some robot setup questions. These questions and their settings vary depending on how your system is set up.

b. **To perform an automatic setup**, press F2, AUTO. The robot library questions will be answered automatically and will be displayed quickly on the screen.

c. **To perform a manual setup**, press F3, MANUAL. The questions, if they exist, will be displayed on the screen and you will have to answer them. The default value for each question will be displayed. You can either accept the default or change it.

- To set up a **robot library** manually, refer to Appendix D .

- To set up a **non-standard robot** manually, go to Procedure 4-18 .

- To set up a **process axis** manually, go to Procedure 4-20 .

4.4.8.2 Setting up Common, Non-Standard Robot Libraries Manually

Examples of non-standard robot library setups:

- Independent Axes

- Basic Positioners

- Index Devices

- General Positioner

Note The General Positioner is used for multi-axis positioners that have non-orthogonal axes. The Basic Positioner has the constraint that all axes are parallel or perpendicular to each other. For more information, refer to the *Coordinated Motion Setup and Operations Manual*.

Procedure 4-18 Modifying the Non–Standard Robot Library Setup Manually

Conditions

- A Non-Standard robot library has been installed on your controller. Refer to Procedure 4-25 .

- You have just finished Procedure 4-17 , have selected the group you want to set up, and have pressed F4, MANUAL.

Steps

1. If no axes have been installed for the group, you will be asked to define the FSSB connection and Hardware Start axis for the group. You will see a screen similar to the following. Refer to Appendix H for detailed examples on how to answer these setup questions.

```
******** Group 3 Initialization ********
********** Independent Axes ************
— FSSB configuration setting –
 1: FSSB line 1 (main axis card)
 2: FSSB line 2 (main axis card)
 3: FSSB line 3 (auxiliary axis board)
Select FSSB line >
```

2. Answer the remaining prompts according to the kind of multi-group device you have selected.

3. After answering the FSSB and hardware start questions, you will see a screen similar to the following.

```
******** Group 3 Initialization ********
********** Independent Axes ************
Total Axes Installed = 0
  1: Display/Modify Axis 1~4
  2: Add Axis
  3: Delete Axis
  4: Exit
  Select Item?
```

4. The total number of axes defined for this group will be displayed on this screen. From this menu, you can:

- 1: Display or modify an existing axes.

- 2: Add an additional axis.

- 3: Delete an existing axis

- 4: Exit back to the main menu.

5. For details on how to answer each question refer to Appendix H .

6. When all changes have been completed, select 4 to exit to the Maintenance Menu.

7. Press FUNC. to display the Functions Menu.

8. Select Cold start and press ENTER.

9. **When the Cold start is finished**, master and calibrate the axes. Refer to Appendix B .

4.4.8.3 Modifying an Extended Axis Setup Manually

Use Procedure 4-19 to modify the extended axis setup manually. If you have Local Stop hardware installed, you must also install the Local Stop software option. Refer to Section 4.6 .

Procedure 4-19 Modifying the Extended Axis Setup Manually

Conditions

- An extended axis has been installed on your controller. Refer to Procedure 4-25 .

- You have just finished Procedure 4-17 , have selected the extended axis you want to set up, and have pressed F4, MANUAL.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Procedure 4-4 .

Steps
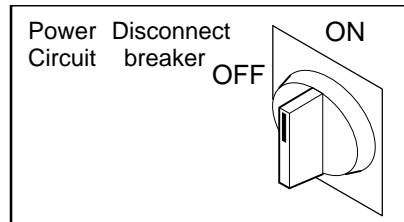
1. Answer each extended axis setup question according to your system setup. Refer to Table 4–8 .

Table 4–8. **Extended Axis Setup Configuration Information**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Select Group(optional for multiple groups only)	Extended axes to (1-> 3)	Select the group number to which the extended axis hardware is installed and press ENTER. For example, if you are adding a rail to a six-axis robot, the group number is 1. The hardware specific information will be added later.	
Select Hardware	Enter hardware start number for the extended axes	Type the starting number of the extended axis hardware and press ENTER.	

2. When you have finished answering the questions in Table 4–8 , you will see a screen similar to the following.

```
**** EXTENDED AXIS SETTING PROGRAM ****

                            E1 E2 E3
*** Group 1 Total Ext Axis = *  *  *
   1. Display/Modify Ext_axis 1~3
   2. Add Ext axes
   3. Delete Ext axes
   4. EXIT
Select?
```

Note Extended axes can be added out of order. For example, you can add extended axis 2 before you add extended axis 1, as long as the hardware follows the order shown above (the first extended axis on group 1 is axis 7; the second extended axis on group one is 8, and so forth).

3. **To add an extended axis**, type 2 and press ENTER. **To delete an extended axis**, type 3 and press ENTER. You will see a screen similar to the following.

Note If an "I" is displayed in place of an "*" under the extended axis name (E1, E2, E3) in the following screen, the axis is initialized.

```
**** EXTENDED AXIS SETTING PROGRAM ****

                         E1 E2 E3
*** Group 1 Total Ext Axis = I  *  *
   1. Display/Modify Ext_axis 1~3
   2. Add Ext axes
   3. Delete Ext axes
   4. EXIT
Select?2
Enter axis to add (1 ->3)
```

Note If you choose to install axis 2, and the hardware start number is 7, the extended axis 2 will be connected to hardware port number 8.

> ⚠ **Caution**
>
> If you add axes on a previously defined axis (for example, axis 1 of Group 2), you will corrupt your system software.

4. Type the extended axis number you are adding (1, 2, or 3) and press ENTER.

5. Answer the remaining questions to set up your extended axis. Refer to Table 4–9 .

Table 4–9. **Extended Axis Setup Configuration Information**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Extended Axis Type	1. Integrated Rail (Linear axis) 2. Integrated Arm (Rotary axis) 3. Auxiliary Linear axis 4. Auxiliary Rotary axis	For auxiliary linear or rotary axes, the extended axis is not added into the robot position. For integrated rail or integrated arm, the position on the rail (or arm) is added to the robot position.	
Integrated Rail or Integrated Arm only	Direction 1:X 2:Y 3:Z Direction (1~3)?	**For integrated rail** , the rail alignment is usually with respect to the World frame axes of the robot. **For integrated arm** , arm-specific information is required. Typically, the offset length is 0 except for cases where the first axis of the robot is replaced by an extension arm. The direction defines about which world axis the arm rotates.	

6. When you have finished answering the questions, you will see a screen similar to the following.

```
**** EXTENDED AXIS SETTING PROGRAM ****


                          E1 E2 E3
*** Group 1 Total Ext Axis = I  *  *
   1. Display/Modify Ext_axis 1->3
   2. Add Ext_axes
   3. Delete Ext_axes
4. Exit
Select?
```

7. **When you have finished** type 4, Exit, and press ENTER.

    Note In a multi-group system, press 0, Exit, to display the Robot Maintenance Menu and go to Step 9 .

8. Press the FCTN key to display the Robot Maintenance Menu.

9. Select START (COLD) and press ENTER.

10. **When the controller is turned on** , master and calibrate the robot or Positioner/Independent Axes. Refer to Appendix B .

4.4.8.4 Displaying, Modifying and Installing Process Axes

Typically, your software will automatically configure your process axes hardware when it is installed initially. However, if you want to reconfigure your process axes hardware, use Procedure 4-20 .

Note The process axes hardware setup is based on the following rules:

• The process axes are not tied to a group

• The process axes are installed after the standard robot axes, extended axes, and line tracking axes

• You can only set up one axis at a time

Table 4–10 lists the process axes default hardware setup **for the PaintTool Integral Pump Control option only**.

Table 4–10. Process Axes Default Hardware Setup

SETUP ITEM	DEFAULT SETTING
Motor Type	ACbM0.5
Motor Size	/4000
Current Limit for Amplifier	20A

Table 4–10. Process Axes Default Hardware Setup (Cont'd)

SETUP ITEM	DEFAULT SETTING
Amplifier Number	Automatically configured
Amplifier Type	A06B-6093 Beta Series (FSSB)
Gear Ratio	10
Maximum Joint Speed	250 rpm
Motor Direction	TRUE
Exponential Acceleration Time	24 ms
Load Ratio	0.0
Brake Number	0

Procedure 4-20 Modifying Process Axes at Controlled Start

Conditions

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to Procedure 4-4 .

Steps

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2

- If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–30. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. Press MENU.

3. Select MAINTENANCE. You will see a screen similar to the following.

Note The following screen is an example. Your screen will be different depending on how your system is set up.

```
ROBOT MAINTENANCE       CONTROLLED START MENUS
Setup Robot System Variables
Group    Robot Library/Option      Ext Axes
  1       S-430iW                      0
  0      Process Axis Control          0
```

4. Move the cursor to the title or order number of the robot library you want to modify. In this case, move to Process Axis Control.

5. Decide whether you want to perform AUTO setup or MANUAL setup. Refer to Table 4–11 .

Table 4–11. **Auto and Manual Process Axes Setup**

ITEM	DESCRIPTION
AUTO	This item allows you to set up the process axes automatically using default values for each setup item.
MANUAL	This item allows you to set up the process axes manually by allowing you to answer each setup question individually. Manual setup records your answers as the new default values.

    a. **To perform a manual setup**, press F4, MANUAL and proceed to Step 7 .

    b. **To perform an automatic setup**, press F2, AUTO. If setup has not been previously run and there is not an ISDTCFG.DT file on the controller, then you will see a screen similar to the following:

```
ERROR  data file is not opened
Process Axes initialization failed.
Abort AUTO Process Axes Setup.
Start MANUAL Process Axes Setup.
Press ENTER to continue.
```

In this case, press ENTER and you will see a screen similar to the following:

```
Enter the total number of ISDT
Axes to be installed (max 8):
```

Type in the total number of process axes that are connected to the controller, and then press ENTER. You will then see a prompt similar to the following:

```
Enter the FSSB number (from 1 to 3) On which ISDT axis 1 is installed:
```

Refer to section Section 4.5.6 of this manual for further instruction on how to determine the FSSB number on which the ISDT axis is installed. Type in the correct FSSB number and press ENTER, and you will see a prompt similar to the following:

```
Valid Hardware Axis numbers are
From 17 to 24
Enter the hardware axis number
For ISDT axis 1:
```

Type the hardware axis number for this process axis and press ENTER. Please take note of the range of valid values for this number that is provided as part of the prompt described above. This range will vary depending upon which FSSB has been selected.

After pressing ENTER you will see a prompt similar to the following:

```
Save ISDTCFG.DT?
Enter (1:Yes, 0:No)
```

Typing "1" and then ENTER after this prompt means that if you were to return to this setup again later, you would not have to answer these prompts again. Typing "0" and then ENTER after this prompt means that you will have to answer these questions again if you re-run the setup, regardless of whether you select AUTO or MANUAL.

After typing 1 or 0 and pressing ENTER, you will then see a prompt similar to the following:

```
Setup Process Axes using ISDT.DT? Enter (1:Yes, 0:Manual Setup)
```

c. **To set up process axes manually**, type 0, and press ENTER. When you have finished, go to Step 6 to set up the process axes manually.

d. To set up process axes automatically, type 1, and press ENTER. The process axes will be set up with the default setup information. You will see a screen similar to the following.

Note If the ISDT.DT file that is used to set up process axes does not exist on the controller, you will see the following error message. After you press ENTER, the setup program will then perform manual setup. Go to Step 6 .

```
ERROR  data file is not opened
Process Axes initialization failed.
Abort AUTO Process Axes Setup.
Start MANUAL Process Axes Setup.
Press ENTER to continue.
```

6. Begin manual setup of process axes. You will see a screen similar to the following.

```
**** PROCESS AXIS SETTING PROGRAM ****
                          P1 P2
*** Group 0 Total Proc Axis = *  *
   1. Display/Modify Proc axis 1~3
   2. Add Proc axes
   3. Delete Proc axes
   4. Exit
Select?
```

7.   To add a process axis, type 2. **To delete an process axis** , type 3.

Note If an "I" is displayed in place of an "*" under the process axis name in the following screen, the axis is initialized.

Note If you choose to install axis 2, and the hardware start number is 7, the process axis 2 will be connected to hardware port number 8.

8. Type the process axis number you are adding (1, 2, 3, or 4) and press ENTER.

When you have finished, you will see a screen similar to the following.

```
**** PROCESS AXIS SETTING PROGRAM ****
                          P1 P2
*** Group 0 Total Proc Axis = I  *
   1. Display/Modify Proc axis 1->3
   2. Add Proc_axes
   3. Delete Proc_axes
   4. Exit
Select?
```

9. Repeat Step 4 through Step 8 for each process axis you are adding.

10.   When you have finished type 4, Exit, and press ENTER. You will see a screen similar to the following.

```
Save ISDT.DT?
Enter (1:YES, 0:No)
```

⚠️ **Caution**

If you type 1, YES and press ENTER, the old values in ISDT.DT will be overwritten with the new values you have just defined. Make sure these new values are correct before you save this new configuration. Otherwise, you could lose valuable information.

11. **To save this data**, type 1 and press ENTER. **If you do not want to save this data**, type 0 and press ENTER.

12. **Perform a Cold start:**

   a. Press FCTN.

   b. Select START (COLD).

   c. **When the controller is turned on**, you should master and calibrate the robot. Refer to Appendix B .

4.5 INSTALL ADDITIONAL SOFTWARE AT COLD START

This section only covers installing additional software at cold start (COLD STRT).

4.5.1 Overview

This section provides information on how to install additional software options or robot library groups on your controller. An Auto Update is required to complete the installation for most options. A handful of options require the Full Load variant of Auto Update to complete the installation. A Full Load differs from an Auto Update in that not all user data is restored. Installing a robot library group also uses the Full Load variant of Auto Update.

Options come in three variants: Regular, Demonstration, and Free. Regular options need a product authorization code (PAC) in order to be loaded. Once loaded, regular options are permanently loaded. Demonstration options are similar to regular options in that a PAC was needed in order to be loaded. Demonstration options are different from regular options in that they operate for a time and then turn off. A product enable code (PEC) is needed to temporarily turn a demonstration option back on. A handful of regular options are available as a demonstration option for users to try out. A different PEC is used purchase a demonstration option and convert the option into a regular option. Unwanted demonstration options can also be forced to turn off. Free options are similar to regular options, but

they do not need a PAC in order to load. Robot libraries are similar to free options in that a PAC is not needed in order to load. Unlike options, a multiple copies of a robot library can be loaded.

Note For detailed information about options and robot libraries that are available with your software, including loading restrictions, refer to the ssd.html file on the load media that contains your software. Refer to Table 1–1 for the location of the .html file specific to your software. Refer to the *Internet Options Manual* for more information on loading options or robot libraries over Ethernet.

Note An *i*Pendant is required to add options at CTRL start. Option R558 — Internet Conn/Custo, provides a virtual *i*Pendant that can be used on a personal computer or tablet computer in stead of a physical *i*Pendant. Refer to the *Internet Options Manual* for more information on using a virtual *i*Pendant.

Figure 4–31. Option Install Page at CTRL Start Using Virtual iPendant
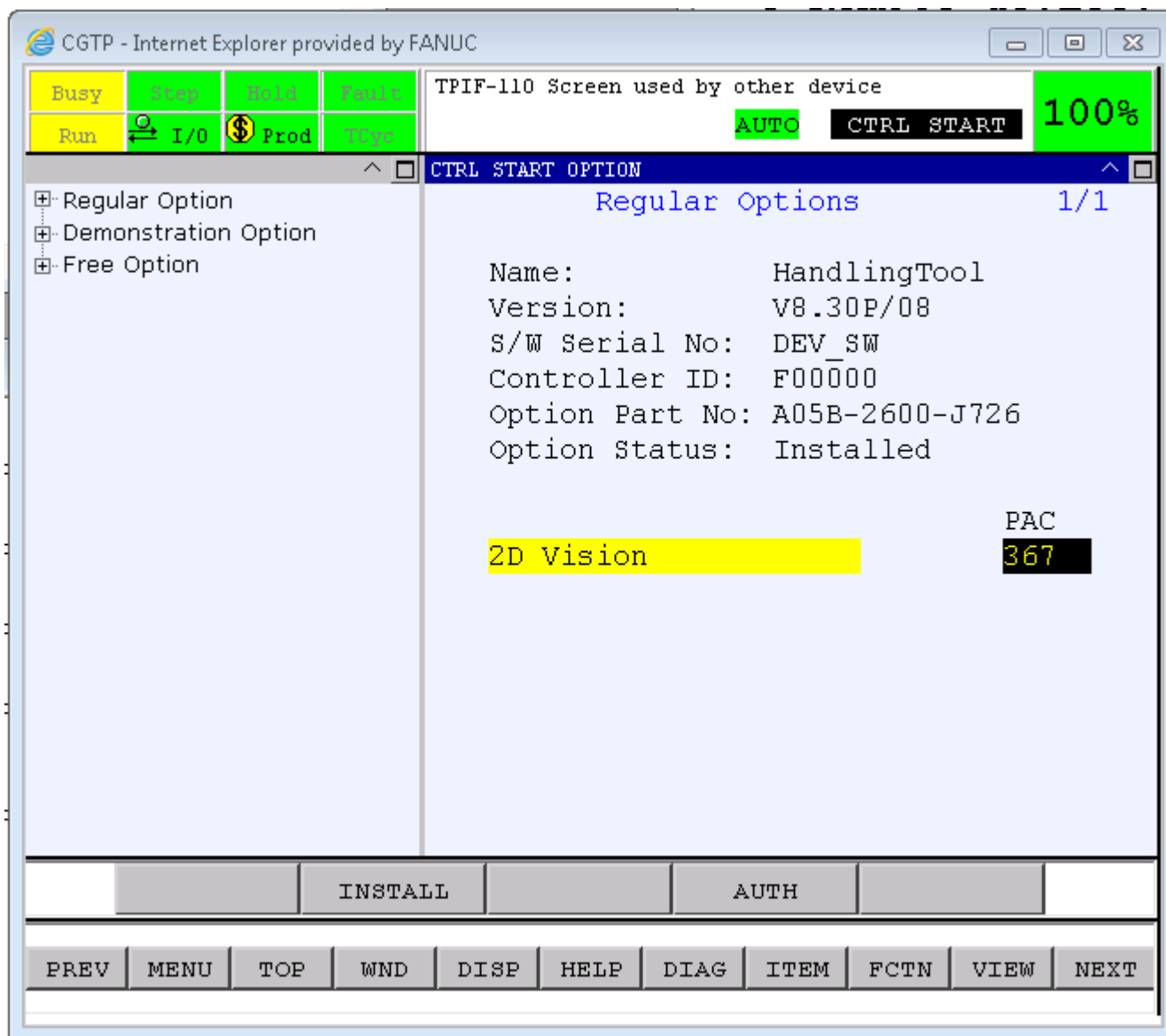
4.5.2 Cold Starting a Controller

Procedure 4-21 Cold Starting a Controller

    Condition

        • The controller is not in Cold Start Mode.

Steps

1. If the controller is turned on but in Controlled start mode, press FCTN and select START (COLD). After a few moments, you will see the Cold start screen for your application.

2. If the controller is off but was in Cold start mode, just cycle power.

3. Perform a Cold Start:

- If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–32. Power Disconnect Breaker
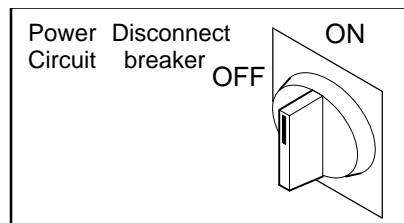
When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Cold start and press ENTER. After a few moments, you will see the Cold start screen for your application.

4.5.3 The COLD START OPTION Menu (Used for Options and Robot Libraries)

The COLD START OPTION menu can be used to install regular options, demonstration options, and free options. Starting with V8.30P/06, the COLD START OPTION menu can be used to install robot libraries.

<u>**Procedure 4-22**</u> **Getting to the Option Install Page at COLD Start**

Conditions

- The controller is plugged in and is working properly.

- You are trying to do one of the following:

  — Authorize an unauthorized option

  — Install an authorized option

  — Enable an installed demonstration option

  — Install a robot library group

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to the procedure *Using the Memory Card or USB Memory Stick Interface* in the *Software Installation Manual* for more information.

- The controller is at Cold start. Refer to Procedure 4-21 for more information.

Steps

1. You may see a screen similar to the following. If you do not, try to Press MENU key, select FILE, and then select S/W INSTALL. You will see a screen similar to the following.

```
Load Media
Please choose device to load options.
Press F3 (DONE) when done.
Current Load Media: USB (UD1:)
```

2. To choose the device, press F4, [CHOICE], and select the item from the list of available devices.

3. When you have finished, press F3, [DONE]. You will be left at the Cold Start Option Screen.

   Note The following screen is an example. Your option screen will be different depending on the options that are available with your software. The four digits preceding the option name uniquely identify each option. Each option has an installation status of Authorized, Installed, Unauthorized, or blank. Options included by a demonstration option may have an installation status of Active.

Figure 4–33. **COLD Start Option Screen**
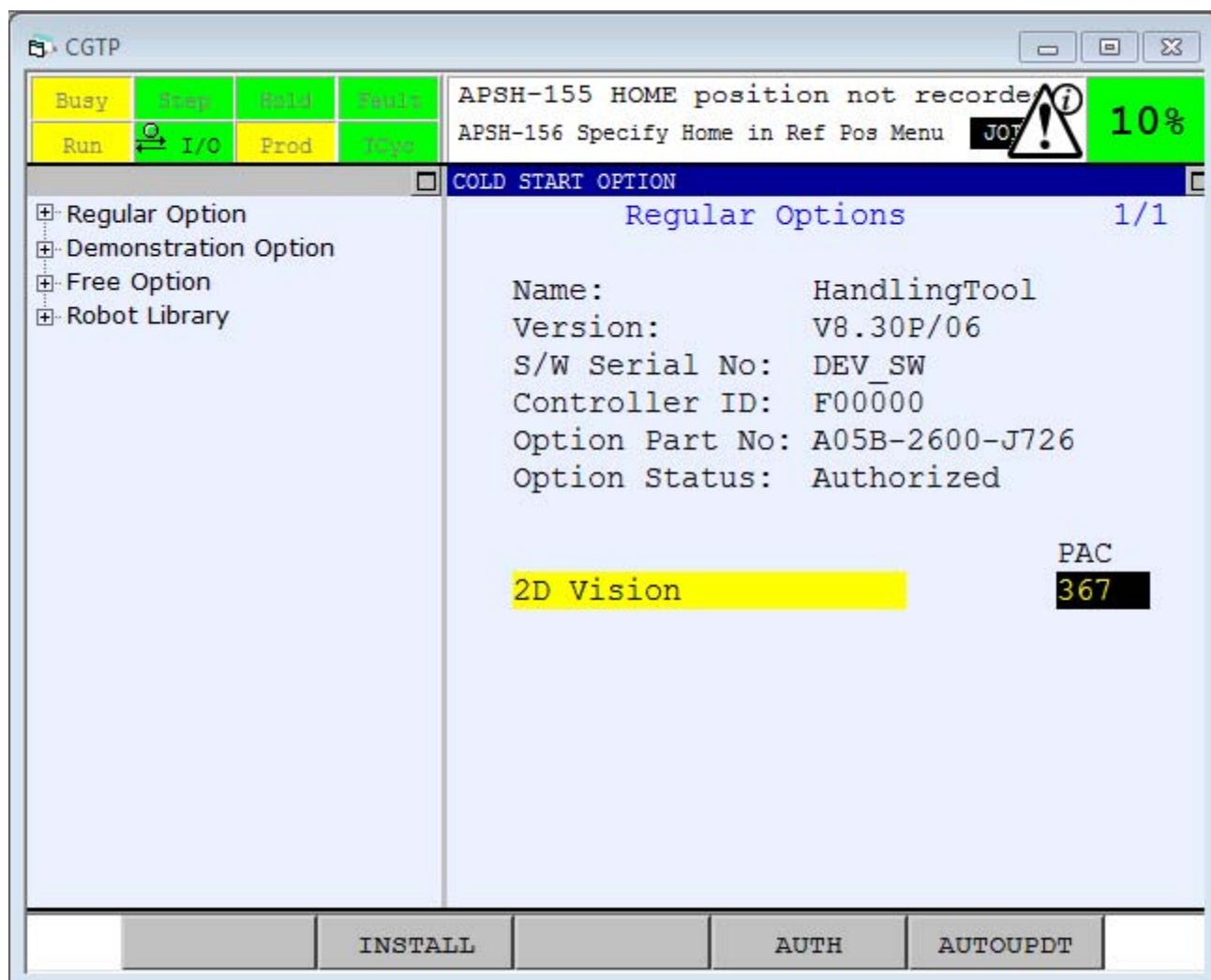
The COLD START OPTION menu is split into two pane. The left pane shows available Regular Option, Demonstration Option, Free Option, and Robot Library choices. Nodes on the tree may be opened to show more information. Some Regular Options are also available as a Demonstration Option. Free Options are unique from Regular and Demonstration Options. There is one Robot Library per motion group, and adding a Robot Library is almost identical to adding an option.

4.5.4 Adding an Option at COLD Start

Some options may be added at CTRL start. All options may be added at COLD start, but options added at COLD start require an Auto Update to complete the installation. A handful of options require a variant of Auto Update called Full Load, in which system variables are not restored. Check

the SSD (Software Structure Diagram) in order to determine if an option requires the Full Load variant of Auto Update.

Procedure 4-23 **Authorizing and Installing Options**

Conditions

- The controller is plugged in and is working properly.
- You are trying to do one of the following:
    — Authorize an unauthorized option
    — Install an authorized option
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.
- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to the procedure *Using the Memory Card or USB Memory Stick Interface* in the *Software Installation Manual* for more information.
- The controller is at Cold start. Refer to Procedure 4-21 for more information.
- The controller is at the Software Install page. Refer to Procedure 4-22 for more information.

Steps

1. Select the option that you wish to install.

Figure 4–34. **Selecting An Option at COLD Start**
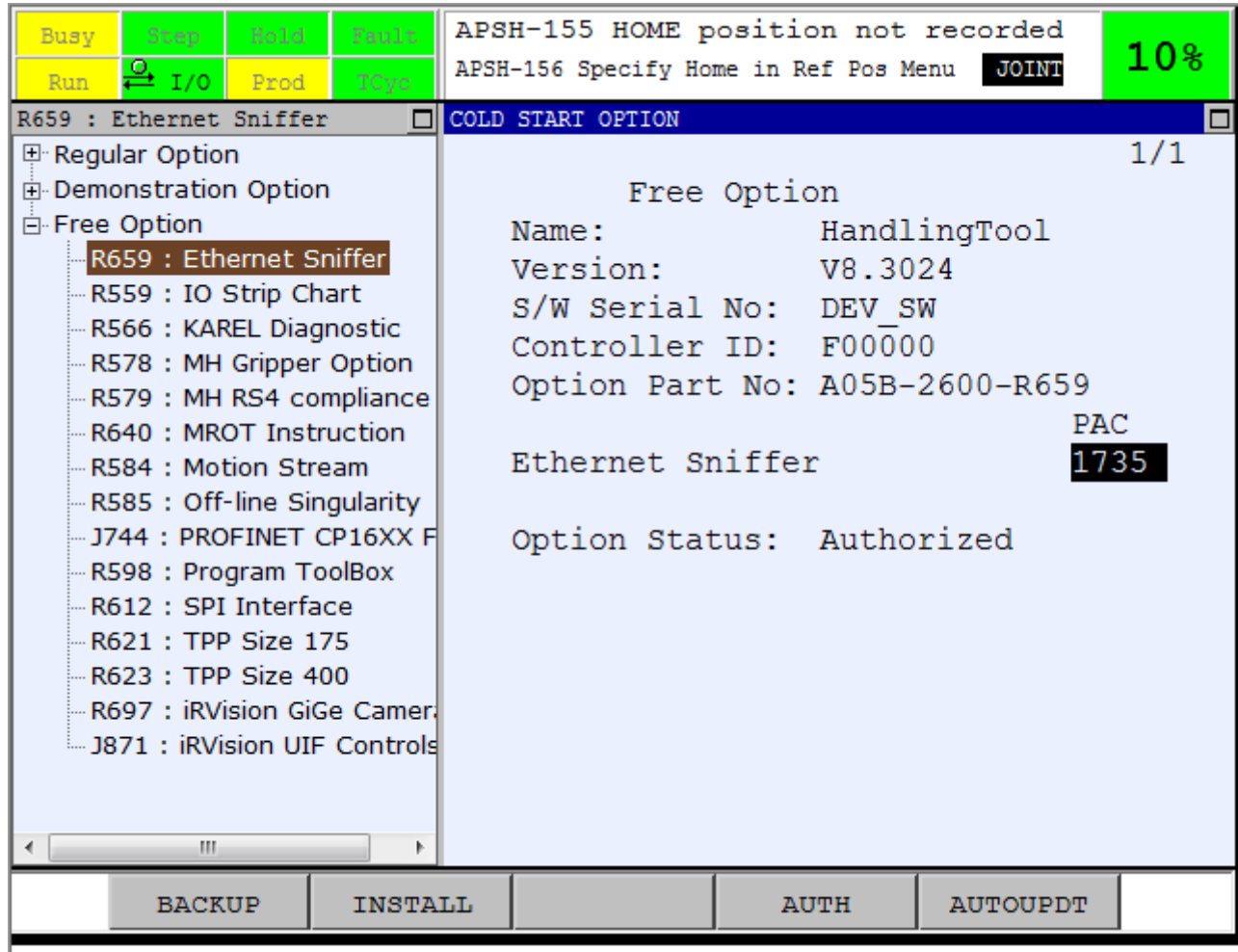
Selecting an option in the left pane will cause detailed information about that option to appear in the right pane. Regular Options have function keys to install, authorize, and auto update the selected option. Demonstration Options have an additional function key to enable the selected option. Free Options have function keys to install and auto update the selected option.

2. Only Authorized options may be installed.

- **If the option status is Authorized**, it is not required for your application, but it has been preauthorized for you. In this case, it has not yet been installed and you can decide whether or not to install it.

- **If this option status is Installed**, it was purchased with the application software, and is a requirement for your application.

- **If this option status is Unauthorized or empty**, it has not yet been authorized for installation.

3. The Option screen also shows parameters which you must share with FANUC America Corporation in order for FANUC America Corporation to generate a Product Authorization Code (PAC) to authorize the option. A PAC is an unsigned integer that uniquely authorizes this option on this controller.

4. To authorize and install additional options that have been purchased separately from the application software, follow the instructions in Table 4–4 .

Table 4–12. Authorizing and Installing Options

Step Order	To do this	You must do this
1.	Obtain the PAC	Obtain the Product Authorization Codes (PAC) for each option you have purchased and want to install from FANUC.
2.	Authorize	1. Press F4, AUTH. 2. Type the PAC for the option and press ENTER. 3. PressF4, AUTH. The option status will be Authorized if you have entered a valid PAC. 4. Go to Step 3, Install, to queue the option for deferred installation
3.	Install	1. Press F2, INSTALL. The software will be queued for deferred for installation during Auto Update. The option will be listed with a status of 'Pending' instead of 'Installed'. Once the Auto Update is completed these 'Pending' options will be listed as 'Installed'. **NOTE** Options requiring a Full LOAD will present a special acknowledgement screen. You must accept the term or the option will not be queued up for deferred installation. **NOTE** The requirements for the option will be evaluated. If requirements have not been met, INSTALL will fail.

5. To complete the deferred installation of all purchased options, an Auto Update is required. Press the F5 function key, AUTOUPDT (may also say FULL LD), to complete the installation. Refer to Section 4.7 for more information.

Note An Auto Update requires the load media to remain in the controller for the full duration (30-45 minutes).

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

4.5.5 Enabling a Demonstration Option at COLD Start

Only expired demonstration options need to be enabled. Upon loading, demonstration options automatically enable.

Procedure 4-24 Enabling Demonstration Options

Conditions

- The controller is plugged in and is working properly.

- You are trying enable an installed demonstration option.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the application-specific *Setup and Operations Manual* for more information.

- The controller is at Cold start. Refer to Procedure 4-21 for more information.

- The controller is at the Software Install page. Refer to Procedure 4-22 for more information.

Steps

1. Select the option that you wish to enable.

Figure 4–35. Selecting a Demonstration Option at COLD Start
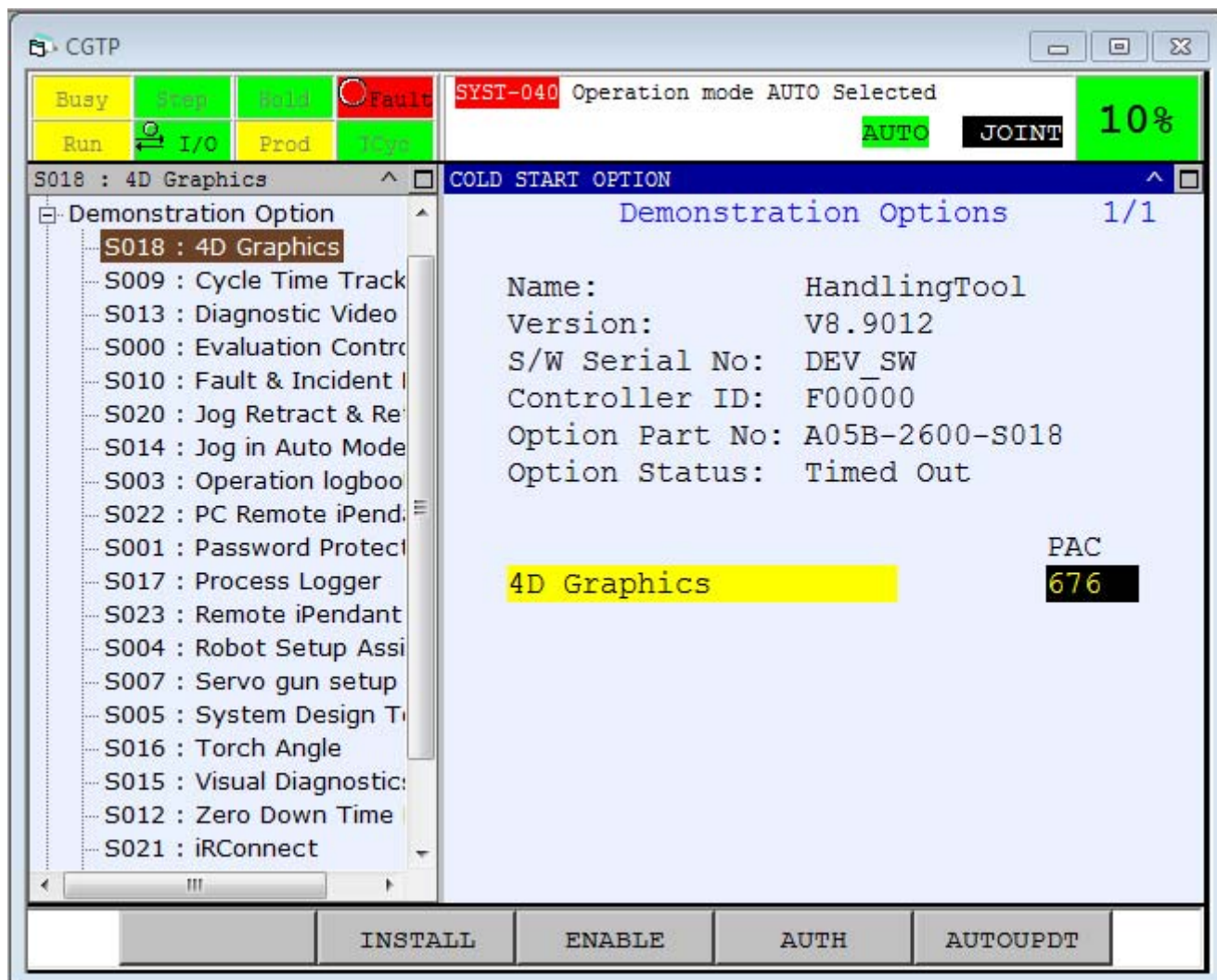
Selecting an option in the left pane will cause detailed information about that option to appear in the right pane. Demonstration Options have function keys to install, enable, authorize, and auto update the selected option.

2. Only expired demonstration options need to be enabled. Upon loading, demonstration options automatically enable.

3. Pressing the ENABLE function key brings up the S/W Enable page. The enable screen is used to enable options.

Figure 4–36. **Enable Screen (Pane 2 of 2 Pane Display)**
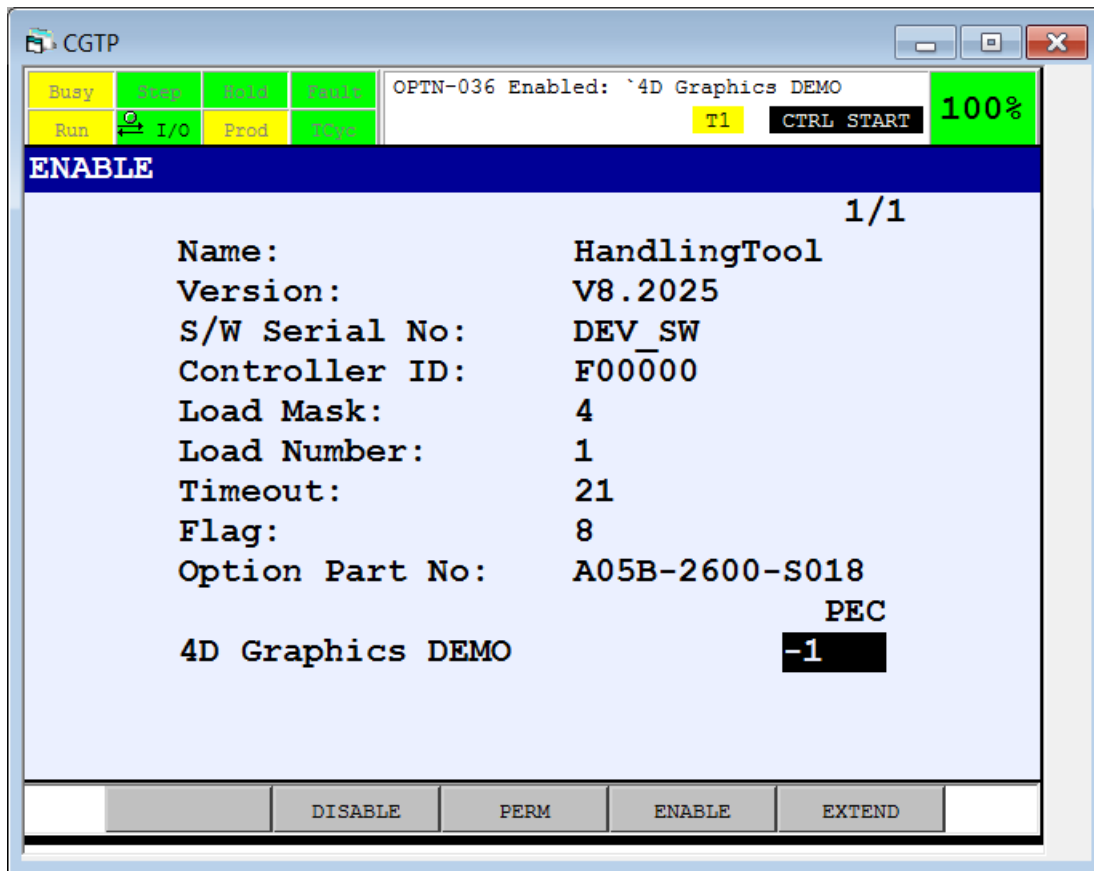
4. To enable demonstration options, follow the instruction in Table 4–13 .

Table 4–13. Enabling Demonstration Options

Step Order	To do this	You must do this
1.	Obtain the PEC	Obtain from FANUC the Product Enable Code (PEC) for each demonstration option you enable or purchase.
2.	Enable	1. Press F3, ENABLE. a. If the option was just installed, the option is pre-enabled and will auto-enable and the S/W INSTALL menu will be displayed. b. If the option is not pre-enabled then the S/W ENABLE menu will be displayed. c. Press F2, DISABLE to disable the demonstration option. A new PEC will be required to enable the option. d. Type the PEC for the option and press ENTER. Press F3, PERM to purchase (and permanently enable) the demonstration option. e. Type the PEC for the option and press ENTER. Press F4, ENABLE to enable or re-enable the demonstration option. f. If the demonstration has expired, a one day extension can be granted with the EXTEND function key. Press F5, EXTEND to re-enable the demonstration option one more day.

4.5.6 Adding a Robot Library Motion Group (V8.30P/06 or Later)

All robot libraries must be added at COLD start, and the Full Load variant of Auto Update is required to complete the installation.Use Procedure 4-25 to install a robot library options at Cold Start.

Procedure 4-25 Adding a Robot Library Group

Conditions

- The controller is plugged in and is working properly.

- You are trying to add a motion group (robot library).

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL. Refer to the *application-specific Setup and Operations Manual for more information*.

- You have the software load media containing the software you want to load, and the media is inserted properly. Refer to the procedure *Using the Memory Card or USB Memory Stick Interface* in the *Software Installation Manual* for more information.

- The controller is at Cold start. Refer to for more information.

- The controller is at the Software Install page. Refer to for more information.

Steps

1. Select the robot library that you wish to add.

Figure 4–37. Selecting a Robot Library at COLD Start
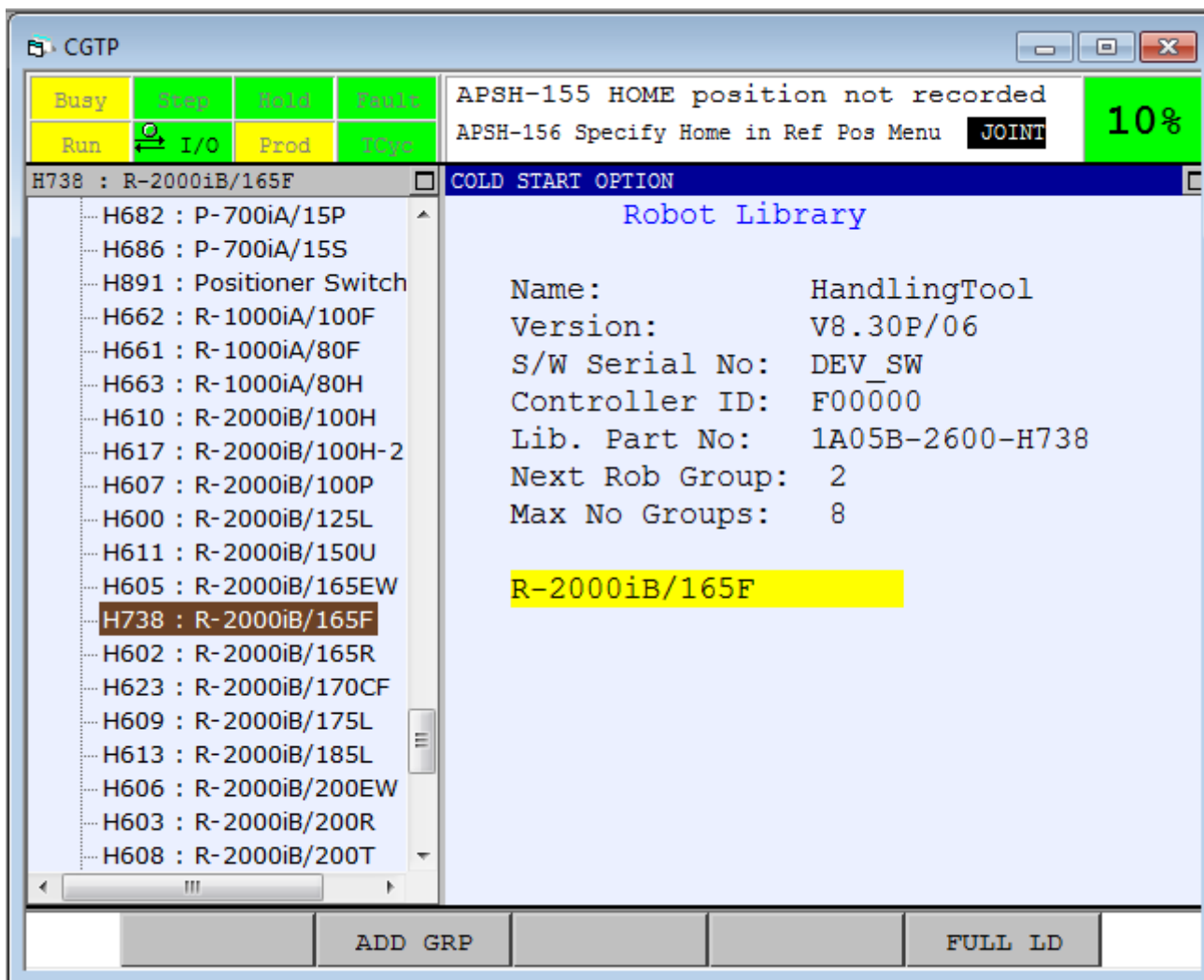
Selecting a robot library in the left pane will cause detailed information about that robot to appear in the right pane. The display will show you which group will be assigned to the new robot library. There are function keys to install and auto update the selected robot library.

2. Press the F2 function key, ADD GRP, to queue up the robot library for installation.

3. Additional robot library groups may be queued up for installation.

4. Press the F5 function key, FULL LD, to execute a modified Auto Update to complete the installation (not all system variables will be restored). Refer to Section 4.7 for more information on the Auto Update procedure.

   Note An Auto Update requires the load media to remain in the controller for the full duration (30-45 minutes).

5. You will be asked to set up the FSSB (FANUC Serial Servo Bus). Refer to Appendix H for additional detail on how to answer these questions. You will see a screen similar to the following.

```
**** GROUP 2 INDEPENDENT AXES SETUP ****
–  FSSB configuration setting – —
 1: FSSB line 1 (main axis card)
 2: FSSB line 2 (main axis card)
 3: FSSB line 3 (auxiliar axis board)
Select FSSB line >
Default value = 1
```

Each robot library has a setup program associated with it. If the setup program has an assigned data file, the software will read all of the setup information from it. If there is no assigned data file, you must answer several questions regarding how your robot is to be set up (refer to Appendix D for a list of questions). If you answer the questions incorrectly, you can correct them by performing a MANUAL setup from the MAINTENANCE screen. Refer to Section 4.4.8.1 to modify the robot setup manually.

4.6 LOCAL STOP AND PROGRAM LIMITS

4.6.1 Setting Up Local Stop Software

Local Stop Hardware is installed for each aux axis motion group. The Local Stop Hardware interfaces to the robot controller through I/O. The default I/O settings are based on the Local Stop Control Harness (EE-4707-011-001) provided with the local stop hardware. These settings must be modified to enable the Local Stop functionality for each motion group. You can also modify the I/O setting as required. FANUC recommends using the default I/O settings for each Local Stop Unit (LSU). Refer to the *Local Stop Function with STO Maintenance Manual*, and the application-specific *Setup and Operations Manual* for more information.

4.6.2 Program Limits Setup

Program limits setup allows you to modify individual software limits related to your program. Table 4–14 lists the items you can modify.

Use Procedure 4-26 to modify program limits.

Table 4–14.   Program Limits Setup Configuration Information

ITEM	DEFAULT	MIN.	MAX.	DESCRIPTION
User Tasks	3	1	30	This item indicates the maximum number of user programs that can be run simultaneously.
Numeric Registers	200	1	999* *The Max is 5000 if the (R830) Expanded Registers option is installed.	This item indicates the number of numeric registers available on the controller.
Position Registers	100	1	2000 (see Note below)	This item indicates the number of position registers available on the controller.
String Registers	25	1	99	This item indicates the number of string registers available on the controller.
Pallet Registers (if the TPP Palletizing option is installed)	32	1	127	This item indicates the maximum number of pallet registers in a program.
Macros	120	1	200	This item indicates the maximum number of macros available.
User Alarms	10	1	999	This item indicates the maximum number of user alarms that can be defined.
Tracking Queues (if DispenseTool or PaintTool is installed)	10	1	100	This item indicates the maximum number of tracking queues available in a program.

Table 4–14.   Program Limits Setup Configuration Information (Cont'd)

ITEM	DEFAULT	MIN.	MAX.	DESCRIPTION
Trace Length	200	1	999	This item indicates the length of the execution history list.
NUM. Dig. Ports	512	16	1024	This item indicates the maximum number of digital inputs and outputs available in your system.
Error Severity Table	20	20	999	This item indicates the maximum number of entries in the Error Severity Table.
Program Adjust Schedule	10	1	99	This item indicates the maximum number of Program Adjust Schedules.
Number DI —> DO Interconnect	32	1	64	This item allows you to configure the number of inputs connected to outputs in your system.
Extended Alarm Log Size	0	0	1000	This item allows you to display all alarms and events in one log and extends the log to a possible maximum of 1000. The log file, called MD:errext.ls can be displayed on the MD: device or on a web page. If it is set to 0, the extended alarm log is disabled. If the alarm log size is changed, all previously logged alarms will be erased.

Table 4–14. Program Limits Setup Configuration Information (Cont'd)

ITEM	DEFAULT	MIN.	MAX.	DESCRIPTION
UTOOLs available	10	1	29	This item allows you to set the number of Tool Frames available.
UFRAMEs available	9	1	61	This item allows you to set the number of User Frames available.

Note The maximum number of position registers is constrained by the number of motion groups configured as shown in Table 4–15.

Table 4–15. Maximum Number of Position Registers

Group(s)	Maximum Number of Position Registers
1	372
2	372
3	248
4	186
5	148
6	124
7	106
8	93

If option R830 - Expanded Registers is installed, the maximum number of position registers is increased to 2000. The default number of registers will be the maximum.

The following table shows the number of registers which can be configured for a multi-group system:

Table 4–16. Maximum Number of Position Registers with R830

Group(s)	Maximum Number of Position Registers
1	2000
2	1000
3	666
4	500
5	400

Table 4–16. **Maximum Number of Position Registers with R830 (Cont'd)**

Group(s)	Maximum Number of Position Registers
6	333
7	285
8	250

Procedure 4-26 **Modifying Program Limits**

Steps

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2

- If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure 4–38. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on

the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. Press MENU.

3. Select PROGRAM SETUP.

4. Set each item as desired. Refer to .

Note If you change the software limits, your system might require more SRAM memory. The system will check if the new software limits are valid with the memory configuration. If not, the error message, "No more available memory," will be displayed. The entered data that caused the problem will be reset back to the original value.

Note You must cycle controller power for the new settings to take effect.

5. Cycle controller power:

    a. Press FCTN.

    b. Select CYCLE POWER.

4.7 AUTOMATIC SOFTWARE UPDATE

4.7.1 Overview

Auto Update is used to install a revised version of the controller software. The revised version might include new functions or fixes for various issues. It can be used to update versions by a small or large amount. For example, it can be used to update from a V8.10P/05 to a later release of V8.10P or V8.20P software. Similarly, Auto Update can be used to upgrade V8.13P software to later versions of V8.13P software.

The Auto Update must be used on storage media that is at least 512 MB in size. This is because the Auto Update makes a Full Backup and an Image Backup of the controller to the storage media.

```
┌─────────────────────────────────────────────────────────────────────┐
│  ⚠   Caution                                                          │
│                                                                       │
│      Do not attempt a full load from Auto Update media.  Otherwise, the following │
│      warning message will be displayed:                               │
├─────────────────────────────────────────────────────────────────────┤
│ CAUTION: This media does not appear to                                │
│          be a proper full load media.                                 │
│                                                                       │
│          Continuing to load with this                                 │
│          media may result in a failure                                │
│          later in the process.                                        │
│     Quit ? [Y=1/N=else] :                                             │
├─────────────────────────────────────────────────────────────────────┤
│          If this message is ignored, (N=else), then other more serious alarms and failures │
│          will occur.                                                  │
└─────────────────────────────────────────────────────────────────────┘
```

Note Auto Update can be done from memory card or a USB stick plugged into the controller.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

Media that is only 512 MB can be used to update only 1 controllers before the backups that have been made must be cleared off to a Personal Computer or deleted. Follow the guidelines for this clean up that are provided in this chapter. Currently, the smallest available media size is 2MB which will also work and can contain many backups.

Because the Auto Update makes an Image Backup of the controller to media it is easy to recover from a failure. Use Procedure 4-28 .

The Automatic Software Update function executes these operations in the following order:

• All Backup

  This backup includes:

  — All of the files that are included in a **Backup, All of the Above**. These are the same as what are provided in an Automatic Backup.

  — All of the files on the device **FR:**. This includes any files in sub-directories on this device.

  — All of the files on the device **FRA:**. This includes any files in sub-directories on this device.

• Update Boot Monitor to the version on the Media

- Re-power

- Image backup

- All Software installation

- Controlled start

- Restore all backup

- Cold start

When the software update process is finished, the warning message, "SYST-176 Software was updated," is displayed. Also the Alarm History is cleared (blanked out) except for this message.

Note Auto Update does not update the *i*Pendant firmware. An update of the *i*Pendant firmware is rarely needed.

4.7.2 Auto Update Operations

The INSTAL function key provides the operations to begin an Auto Update. In addition, functions to support the Auto Update operations are also included.

Refer to Procedure 4-27 for complete instructions on how to start the Auto Update. Refer to Procedure 4-28 for complete instructions on how to get an image backup. Refer to Section 4.7.5 for complete instructions on how to make space on Auto Update Media.

Refer to Table 4–17 .

Table 4–17. Auto Update Operations Items

ITEM	DESCRIPTION
Start Auto Update	This function will start the complete Auto Update operation.
Display Backups	This function is used to display the Auto Update backups so that one can be selected for the other operations.
Get Image Backup	This function is used to quickly get the right Image Backup files to the top-level directory. This will allow the user to quickly select and copy a specific Image Backup made by Auto Update.
Clear Backup	This function is used to make room on the Auto Update media. This will allow you to select and clear out a specific Backup made by Auto Update. This deletes the content of the directory and all sub-directories and removes the directory itself.

Procedure 4-27   **Performing an Automatic Software Update**

     Conditions

- Obtain the media for the Automatic Update by doing one of the following:

   — Order the Auto Update media for the appropriate version from FANUC America Corporation.

   — Copy the Automatic Update software to the storage media. This software can be downloaded from the FANUC America Corporation Customer Resource Center. At certain times this software may also be obtained from the FANUC America Corporation FTP site.

- The Update operation takes from 15 to 30 minutes to complete. Be sure you have the time available to complete this operation.

- If you are updating software from V8.10 to V8.20, you must

   — Purchase V8.20 media from FANUC America Corporation.

   — Be sure your current software version is V8.10P/04 or later. If not, you will have to auto update your software version to the latest V8.10 first before you update to V8.20.

> ⚠️ **Caution**
>
> You cannot perform an auto update for PickTool in V8.20 or later. Contact your FANUC America Corporation Representative for more information.

---

1. Insert the Auto Update media to the target controller which needs the software update.

2. Make sure that all of the robot program and process operations have completed, and then enable the teach pendant.

3. Press MENU.

4. Select File. You will see a screen similar to the following.

```
FILE
MC:\*.*                      25/106
   20 CG7203_3 LD0    466981
   21 CG7203_4 LD0    686805
   22 CG7203_5 LD0    279932
   23 CG7203_6 LD0    123809
   24 CG7203_5 LD0    123862
   25 AUTOCOLD COM       618
   26 AUTOCTRL COM       133
   27 AUTOINIT COM       333
   28 PRODUCT  TX         71
   29 VERSION  TXT        10
   30 *        *    (all files)
```

5. Press NEXT, > and then press F4, INSTALL.

6. Select Start Auto Update. You will see a screen similar to the following.

```
FILE
MC:\*.*                      25/106
   20 CG7203_3 LD0    466981
   21 CG7203_4 LD0    686805
   22 CG7203_5 LD0    279932
   23 CG7203_6 LD0    123809
   24 CG7203_5 LD0    123862
   25 AUTOCOLD COM       618
   26 AUTOCTRL COM       133
   27 AUTOINIT COM       333
   28 PRODUCT  TX         71
   29 VERSION  TXT        10
   30 *        *     (all files)
Software will be Updated, OK?
```

Note The Update operation takes 15 to 30 minutes to complete.

7. Press F4, [YES]. You will see a screen similar to the following.

```
FILE
MC:\*.*                   25/106
Backup Directory name:  \
```

8. Type the name of the target directory, up to seven characters, where the backups should be placed. You will see a screen similar to the following.

```
FILE
MC:\*.*                   25/106
Backup Directory name: \robot1
Bmon update, don't Cycle Power,
```

9. The Automatic software update will start. After 15 to 30 minutes the software update process will be finished. The controller will be at Cold Start and the warning message "SYST-176 Software was updated" is displayed.

This process completes an Image Backup and an Automatic backup (backup "All of the Above") to the media. These can be found in the subdirectory name provided in Step 7 , but under the subdirectory: /00/. For example mc:\00\robot1\

10. When the Auto Update operation has completed check to make sure that it was successful. If the operation was successful, then the top line of the teach pendant and the Alarm log should include the following message:

```
Sys-176 Software was updated
```

Note If the Automatic Software Update does not complete, refer to Procedure 4-28 .

4.7.3 Auto Update Recovery Procedures

If an Auto Update fails to complete or for some reason the operations of the controller are not satisfactory after the Auto Update then complete this procedure. Procedure 4-28 will restore the controller back to the original software and the original version. It will remove the Auto Update from the controller.

Procedure 4-28 Restoring the Auto Update Backup Image

Conditions

- Have the Auto Update media inserted into the controller. This must be the same media that was used to Update this specific controller.

- If the controller where the Auto Update failed can not start up, then Step 1 (to get the Image Backup to the root directory) will need to be completed on a different controller.

Note The following steps can be completed using a personal computer.

1. Copy the Image files from the specific sub-directory to the top level directory of the media.

    a. Press MENU.

    b. Select File.

    c. Press NEXT,>, and then press F4, INSTAL and select Display Backups.You will see a screen similar to the following.

```
 FILE
MC:\00\*.*                              1/31
  1 ..   (Up one level)              <DIR>
  2 BG2                              <DIR>
  3 BG3                              <DIR>
  4 *        *   (all files)
  5 *        KL  (all KAREL source)
  6 *        CF  (all command files)
  7 *        TX  (all text files)
  8 *        LS  (all KAREL listings)
  9 *        DT  (all KAREL data files)
 10 *        PC  (all KAREL p-code)
 11 *        TP  (all TP programs)
```

   d. Using the up and down arrow keys move the cursor to the appropriate directory.

   e. Press F4, [INSTAL], and select the Get Image Backup item.

   The following prompt might be displayed: "Remove existing IMG files?". If this is
   displayed then there were already some Image Backup files in the top level (root directory)
   of this media. If it is certain that these are not needed, press the YES. Otherwise, press NO
   and then copy these Image Files to another media or to a directory on this media.

   The function will get the Image Backup files to the root directory by doing a copy. This
   copy might take a couple of minutes. When the operation is completed then the display
   prompt line will indicate "Copied to MC:\SRAMnn.IMG".

2. Go to the Boot Monitor Menu and Restore the Image. Refer to Section E.3.3 .

   Note Step 3 is important. If you do not remove the media, the controller might immediately
   start the Auto Update again.

3. After the Image restore is complete, remove the media.

4. Either cycle power on the controller, or select the Cold Start menu item from the Main menu.

Procedure 4-29 Cleaning Up the Auto Update Media When an Auto Update Does Not Complete

Conditions

- The following error is displayed on the screen of the teach pendant when first starting an Auto
  Update

```
Last Auto software update is failed.
Please restore backup from MC:\00\TEMP and move the directory from MC:.
```

- One of these conditions has occurred:

  — An Auto Update was just attempted and failed, someone tried to just start the Auto Update again without restoring the Image backup that was made.

  — The media has been used for more than one controller and the Auto Update on the previous controller failed.

1. First complete Procedure 4-28 on the controller where the Auto Update failed.

2. Insert or connect the media to the robot controller.

Now this Auto Update media can continue to be used to Auto Update other controllers.

3. Clear the unused "TEMP" backup using the following steps.

  a. Press MENU and Select File.

  b. Press NEXT, > and then press F4, [INSTAL] function key and select the "Display Backups" item.

  c. Using the up and down arrow keys move the cursor to the "TEMP" directory.

  d. Press F4, [INSTAL] and select the "Clear Backup" item.

  A prompt will be displayed: "Clear selected backup?". If it is certain that this Backup made during an Auto Update should be deleted then press the "YES" function key, otherwise press "NO".

Note This should only be done after the controller Image from this directory has been restored to the right robot controller.

4.7.4 Advanced Auto Update Operations

An Auto Update operation can be controlled by an Auto Update Configuration file. This file will control only certain operations of the Auto Update. This configuration file exists only on the Auto Update load media (typically a memory card if available). It is a text file and is named: autocfg.dat. Comment lines can be included in this file by placing a "!" character at the start of a line. An example comment line is:

```
! Next what devices should be backed up:
```

This file controls the following operations:

1. It can select to enable or disable the Image Backup operation of Auto Update. By default the Image backups are made. If the Auto Update configuration data file does not exist then Image Backups are still made. If there are already good Image Backups of the controller, then

this operation can be disabled. This can save time during the Auto Update. It saves about two minutes.

To disable the Image Backup, change this line in the Auto Update Configuration file:

```
Img.Backup Yes
```

Change it to this:

```
Img.Backup No
```

This line must have the string "Img.Backup" followed by a space character followed by 'yes' or 'no'. The word "yes" or "no" can be any combination of upper or lower case (for example: Yes, yes, or YES).

An example of the Auto Update configuration file can be found at the end of this section.

2. It can save the backup (all and image) after the auto update. Set AterBackup to YES to back up files automatically after the Auto Update. Set AfterBackup to NO if you do not want to perform the backup after the Auto Update. See the following lines from autocfg.dat for an example:

```
! Next is whether saving the backup (all and image) after
! auto update or not. Select 'YES' or 'NO' after
! "AfterBackup" and one space. YES: save, NO: not save.
! When media does not have enough capacity, backup is not
! saved even if "AfterBackup YES".
AfterBackup NO
```

3. Auto Update will back up and restore the device FR: and other devices as controlled by the Auto Update Configuration File. By default only FR: is backed up. In addition, the backup of the FR: device can also be disabled.

The supported devices are: FR:, FRA:, FR1:, RD:.

Subdirectories of a device or any part of the MC: device can not be included. These are ignored.

To add devices to the backup and restore operations of Auto Update, remove the "!" character from the appropriate line. For example change this line:

```
!BackupDevice FRA:
```

To this:

```
BackupDevice FRA:
```

These lines must have the string "BackupDevice" followed by a space character followed by the device name. The device name must end in a ":".

Figure 4–39. Example AUTOCFG.DAT File

```
Img.Backup Yes     * must have one ' ' then 'yes' or 'no'
! Next what devices should be backed up:
! Each line needs the word "BackupDevice", then space then
! the device name with ":"
BackupDevice FR:
!BackupDevice FRA:
!BackupDevice RD:
!BackupDevice FR1:
```

4.7.5 Making Space on an Auto Update Media Using a PC

The media used for the Auto Update operations can get filled up and have no more space available. When this happens some of the backups must be moved off of the media or deleted. Follow either Procedure 4-30 or Procedure 4-31 to complete those operations.

Procedure 4-30 Making Space on an Auto Update Media using the Controller

1. Insert or connect the media to the robot controller.

2. Press MENU.

3. Select File.

4. Press NEXT, > and then press [INSTAL function key and select the "Display Backups" item. You will see a screen similar to the following.

```
 FILE
MC:\00\*.*                      1/31
  1 ..   (Up one level)            <DIR>
  2 BG2                            <DIR>
  3 BG3                            <DIR>
  4 *        *   (all files)
  5 *        KL  (all KAREL source)
  6 *        CF  (all command files)
  7 *        TX  (all text files)
  8 *        LS  (all KAREL listings)
  9 *        DT  (all KAREL data files)
 10 *        PC  (all KAREL p-code)
 11 *        TP  (all TP programs)
```

5. Using the up and down arrow keys move the cursor to the appropriate directory.

6. Press F4, INSTAL and select Clear Backup item.

A prompt will appear: "Clear selected backup?". If it is certain that this Backup made during an Auto Update should be deleted then press the "YES" function key, otherwise press "NO".

All of the contents of the selected directory will be deleted, this will be indicated by a series of messages, such as: "Deleted MC:\00\backup1\get_home.tp". This operation should only take about a minute.

Procedure 4-31   Making Space on an Auto Update Media Using a PC

Conditions

- These operations must be done on a personal computer.

1.   Insert or connect the media into the computer.

2.   Using Microsoft® Windows Explorer, browse to the device and then to the following directory: \00\ Each directory under this one is a backup for a separate robot controller. The names are those supplied by the operator at the start of each Automatic Update process.

3.   Decide if the backup will be moved off of the media and stored on the computer or just deleted. If it will be moved into the computer skip Step 4 and complete Step 5 . If it will be deleted, complete Step 4 .

4.   Delete one of the backups by deleting the directory and all of it contents:

   a.   Select one of the directories shown. The directory should be one that is for a controller that has been fully updated and is fully operational.

   b.   Press and hold SHIFT and then press Delete. This will permanently delete this backup and not keep it in the Recycle Bin .

   c.   Go to Step 6 .

5.   Move one of the backups to the computer by completing these steps:

   a.   Select one of the directories shown. The directory should be one that is for a controller that has been fully updated and is fully operational.

   b.   In the "Edit" drop down menu, select "Move to Folder …". Follow the prompt to browse and select a destination folder on the computer.

6.   Now space has been made for one more Automatic Update. If needed, repeat Step 4 **or** Step 5 to make space for more Updates.

4.7.6 Auto Update Troubleshooting

Table 4–18.   Auto Update Troubleshooting

Symptom	Solution
Auto Software Update failed	Some part of the Auto Update process has failed. In most cases this is caused by some file failing to be restored. If this message occurs at Controlled Start then display the Alarms Page and record the top 10 Alarms. Note that the Alarms page might be displayed automatically. If this message is displayed at Cold Start then restore the controller to its original state by restoring the Image Backup that was made at the start of the Auto Update. To do this follow Procedure 4-28 .
Auto Update media or files not found	The files needed to complete an Auto Update were not found on the media. Usually this is caused by not having a media inserted or not having an Auto Update media inserted. Insert the Auto Update media into the controller. Make sure the media is fully inserted. Make sure the media has not been modified.
Backup files are not correct	This message would occur near the start of the Auto Update. Some file was not properly backed up. A separate alarm in the Alarm Log provides the specific file name. Check the Alarms page for one of the following alarms, then follow the instructions for that alarm: "File-082 Backup file not found: %s" or "File-083 A Backup file is empty: %s".
Backup files are overwritten.	This occurs when a partial backup or incomplete backup has previously occurred with this media. Confirm that this message has been read by pressing the "YES" function key. No other operations are normally required and the Auto Update will continue.
Directory name is not entered.	When a directory name for the Backup was requested, no characters were entered. Confirm this message by pressing the "YES" function key and then start the Auto Update operations again.
Directory already exists. Cancel?	The directory with the name that was provided already exists. Because this direct already exists the Auto Update operation is being canceled. Confirm this message by pressing the "YES" function key and start the Auto Update operations again. Be sure to enter a different name. A directory of the existing directories can also be made by selecting the "00" subdirectory and then doing a directory of "*.*".

Table 4–18.   Auto Update Troubleshooting (Cont'd)

Symptom	Solution
Enable TP for Auto Update.	This indicates that the teach pendant must be enabled for this operation to begin. Turn the teach pendant "Enable" switch to "Enable" and start the operation again.
Fail to update BOOT F-ROM.	For some reason the operation to update the Boot Monitor F-ROM has failed. The top line of the teach pendant should show an alarm that indicates the reason. Low TEMP memory is the most common cause. Check the alarm message on the top line of the teach pendant or in the Alarm History page. Follow the remedy for that message.
Last Auto software update is failed. Please restore backup from MC:\00\TEMP and move the directory from MC:.	One of these conditions has occurred: • An Auto Update was just attempted and failed, someone tried to just start the Auto Update again without restoring the Image backup that was made. • The media has been used for more than one controller and the Auto Update on the previous controller failed. To correct this condition complete both of these procedures: Procedure 4-28 and Procedure 4-29 .
Not enough space on MC: **or** Check the rest of memory (MC:)	There was not enough free space found on the Memory Media to complete the Auto Update (Backup) operation. Perform one of the following: Find a backup on the media (in directory /00/) that is no longer needed and then clear it out. See the procedure "Making space on the Auto Update media" for details of this operation. If possible, obtain another Auto Update media that has not been used to update a lot of controllers.
Use this only in Single pane or pane 1	This operation must run from Pane #1 or in Single Pane mode. If Double or Triple pane mode is selected then either move the cursor to Pane #1, or select Single Pane. Select Single pane by pressing SHIFT and Display, and then select Single.

TROUBLESHOOTING AND ERROR MESSAGES

Contents

5.1 OVERVIEW

This chapter contains information on how to solve problems that occur during setup and installation of the Software and EPROM Package.

This troubleshooting information is specific to software installation. Refer to the application-specific*Setup and Operations Manual* for general system troubleshooting and error message information.

5.2 TROUBLESHOOTING USING SYMPTOMS
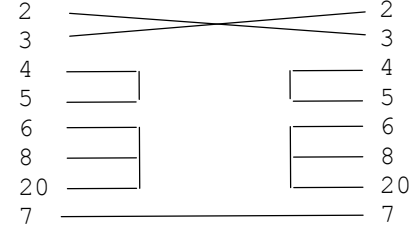
Refer to Table 5–1 to determine the cause of a problem and to solve it.

For information on a fuse blown or an intermittent fuse alarm, refer to the *Controller Maintenance Manual* .

Table 5–1. Troubleshooting Symptoms and Solutions

Symptom	Possible Cause	Solution
The controller will not turn on.	The controller power disconnect circuit breaker is turned OFF.	Turn ON the controller power disconnect circuit breaker.
	Internal hardware is not operating properly.	Check the *Mechanical Unit Connection and Maintenance Manual* for your specific robot model for specific troubleshooting procedures.
	The controller is not receiving the proper power, or the front panel cable is not plugged in.	Check the *Mechanical Unit Connection and Maintenance Manual* for your robot model for specific troubleshooting procedures.
	The EX-OP JRS7 cable is not connected to the CPU.	Check the cable connection to the MAIN CPU PCB.
The controller will turn on but the when you immediately press and hold the PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON, the second line on the pendant doesn't display "Boot system activating..." in reverse video.	Internal hardware is not operating properly.	Check the *Mechanical Unit Connection and Maintenance Manual* for your robot model for specific troubleshooting procedures.
The controller will turn on (Boot Monitor is running) but the software will not start running.	The MAIN CPU is not operating properly.	Replace defective memory boards as necessary and reload the software.

Table 5–1. **Troubleshooting Symptoms and Solutions (Cont'd)**

Symptom	Possible Cause	Solution
A file will not load.	The media is corrupted.	Check the media using suitable PC diagnostic tools on a PC with a hardware adapter. **If the media is completely bad,** you might see the message "No System Software Loaded." Contact FANUC America Corporation to receive new media. **If the media is partially bad,** nothing will happen. Contact FANUC America Corporation to receive new media.
		If the media is ok but file access problems still occur, try using a different or new media. Contact FANUC America Corporation to receive new media.
	A file was omitted from the media.	Contact FANUC America Corporation to receive new media.
The controller will not turn on.	**If a VT-220 terminal is being used** , the cable is configured incorrectly or is broken/intermittent.	
The controller clears F-ROM and aborts the load: "Process is stopped by ABORT command!"	The configuration is invalid.	Contact FANUC America Corporation to review your configuration and then receive new software media.
The controller clears F-ROM and stops the load: "% is missing"	Your media is unserialized.	Contact FANUC America Corporation to review your configuration and then receive new software media.
The controller clears F-ROM and stops the load: "% is corrupt"	Your media (license.dat file) has been corrupted.	Contact FANUC America Corporation to review your configuration and then receive new software media.
The controller clears F-ROM and stops the load: "% is not authorized"	Your media (keyfile.dat file) has been corrupted.	Contact FANUC America Corporation to review your configuration and then receive new software media.

5.3 TROUBLESHOOTING USING ERROR MESSAGES

Setup and installation error messages pertain to the *robot operating system* (*ROS*). The ROM-based portion of the software used during powerup, referred to as the *Bootstrap ROM or BootROM*, directs the controller hardware to load ROS. After the ROS has been loaded, it directs the remaining software installation.

There are three kinds of error messages:

- **Software Option Messages** are messages that indicate the success or failure of a particular step during installation of a software option. These messages are from ROS.
- **General BootROM Messages** are numbered messages that indicate the success or failure of a particular step during installation.
- **Boot /Save Messages** are status messages that indicate the success or failure of a step during system startup after installation has been performed. These messages appear alone or can be coupled with general BootROM messages.

  Note A percent sign followed by the letter *s* (%s) indicates that a string, representing a program name, file name, or variable name, actually appears in the error message when the error occurs.

For example:

```
Skipped: %^s
```

When this error occurs, the actual name of the file that was skipped will appear on the teach pendant error line instead of %s.

Table 5–2 lists the software option messages, their possible cause, and a typical solution.

Table 5–3 lists all the BootROM error messages, their possible cause, and a typical solution.

Table 5–2. Software Option Messages

Error Message	Possible Cause	Solution
1 Too many options installed	The maximum number of software options is installed.	None required.
2 Installed: %s	The software option or update installation has finished successfully.	None required.
3 Skipped: %s	The software option or update is already installed and was skipped.	None required.
6 Not Installed: %s	The software option or update was not installed. Look at previous errors for details.	None required.

Table 5–2.   Software Option Messages (Cont'd)

Error Message	Possible Cause	Solution
7 Unauthorized: %s	The software option or update was not authorized for the configuration.	Contact the FANUC America Corporation Spare Parts Department to purchase and authorize the option.
8 Requires: %s	To load this option or update, you must also have the specified option or update installed.	Install the specified option or update. If you do not have the specified option or update, contact the FANUC America Corporation Spare Parts Department to purchase and authorize the option.
9 Authorized: %s	You have performed a successful field authorization.	None required.
10 Force COLD Start	This is a notice for you to perform a Cold Start.	Perform a Cold Start.
11 Cycle Power	This is a notice for you to turn off the controller and then turn it on again.	Turn off the controller and then turn it on again.
12 ID/File is Missing/Corrupt	Your software was installed improperly or the F-ROM in your controller is damaged.	Reinstall the software from the beginning.
13 Invalid PAC	You have typed an invalid PAC code.	Retry typing the PAC code again. If you are still unsuccessful, contact the FANUC America Corporation Spare Parts Department.
14 Dependency nesting too deep	Software options can be nested to contain other software options. In this case, the option nesting tree is too deep.	Contact FANUC America Corporation.
15 Excludes: %	This option cannot be installed because an incompatible option is already installed.	Install all software without the incompatible option.
16 Key File is Missing/Corrupt	Your software was installed improperly or the F-ROM in your controller is damaged.	Reinstall the software from the beginning.
17 No UPDATES on this media	This load media does not contain any UPDATES.	Standard products do not contain updates. This is a normal message. For updates, contact FANUC America Corporation.
18 No CUSTOMIZATIONS on this media	This load media does not contain any CUSTOMIZATIONS.	This is normal for most applications. If you know there should be a customization loaded or expect that one should be loaded then contact FANUC America Corporation to receive the Customization.

Table 5–2. Software Option Messages (Cont'd)

Error Message	Possible Cause	Solution
19 Versions mismatched	This load media is not the same release level as your base software.	Contact FANUC America Corporation to receive a load media of the proper release level.
21 Check orderfil.dat fails: %	One or more lines in orderfil.dat have Order Numbers for options that can not work for this Application Tool	This message should only occur at the FANUC factory. Contact FANUC America Corporation to receive a correction. Possibly remove or correct the line with the Order Number that is shown.

Table 5–3. BootROM Error Messages

Error Message	Possible Cause	Solution
SRAM ECC error detected	This indicates a failure in DRAM.	Replace DRAM module. Refer to Section 2.3.3
XM & XM area ... ERROR xxxx	This indicates a failure in FROM.	Replace FROM module. Refer to Section 2.3.4
Initializing Flash File ... ERROR	This indicates a failure in FROM.	Replace FROM module Refer to Section 2.3.4
Error with Flash File System	This indicates a failure in FROM.	Replace FROM Module Refer to Section 2.3.4
Load Failure, status = xxxxx	This indicates a failure with the load media.	Try again. If the operation is still unsuccessful, replace the load media and all files.
Restoring SRAM image from FROM ... Error	This indicates a failure in SRAM or mismatched SRAM sizes during backup.	Try the operation again. Check the memory sizes. Refer to Section 2.2
** Not enough free space on *media.* Change the *media* and press ENTER.	The media is full during a backup.	Change the media and continue.
** ERROR: memory allocation failure	This indicates corrupted memory.	Turn off the controller and try the operation again. If the error still occurs, document the events that led to the error, and contact your FANUC America Corporation representative.
** ERROR: Can not create file	Can not write to media.	The media is write protected or is the wrong type. Replace the media.
** File write error at page xx	Can not write to media.	The media is write protected or is the wrong type. Replace the media.
** File write failure	Can not write to media.	The media is write protected or is the wrong type. Replace the media.

Table 5–3. BootROM Error Messages (Cont'd)

Error Message	Possible Cause	Solution
FROM write failure at page xx	This indicates a failure in FROM.	Replace the FROM module.
Warning: FROM read error at page xx	This indicates a failure in FROM during backup.	Try again. If not successful, replace the FROM module.

5.4 DISPLAYING MEMORY STATUS

5.4.1 Checking Memory

Table 5–4 lists and describes each memory status item. Use Procedure 5-1 to check system memory. You can also modify the allocation of SRAM memory for selected software products.

Table 5–4. Memory Status

MEMORY STATUS	DESCRIPTION
Pools	These items indicate the amount of memory for • **TPP** contains teach pendant programs. TPP memory is stored in permanent memory. Therefore, to determine the amount of memory available for teach pendant programs, you must subtract the total amount of TPP SRAM memory shown from the total amount of permanent memory shown. • **PERM** contains system variables and KAREL variables. • **SYSTEM** contains the operating system. • **SHADOW** contains variables designated to be in SHADOW memory. • **TEMP** contains temporary memory used for system operations, and KAREL programs. • **FR FROM** Flash ROM is file oriented and all of it is allocated to the Flash File system. The flash file system contains both system and user files.
Hardware	These items indicate the total amount of memory for • **FROM** Flash ROM • **DRAM** • **SRAM**

Procedure 5-1   Displaying Memory Status

Steps

1. Press MENU.

2. Select STATUS.

3. Press F1, [TYPE].

4. Select Memory. You will see a screen similar to the following.

```
STATUS Memory
          Total       Available
 Pools    ----------------------
   TPP      1000.0KB       986.4KB
   PERM     3002.0KB      1338.7KB
   TEMP   114416.4KB     71904.8KB
   FR      63481.0KB     32964.0KB
 Description:
 TPP:   Used by .TP, .MR, .JB, .PR
 PERM:  Used by .VR, RD:, Options
 TEMP:  Used by .PC, .VR, Options
```

5. To display the DETAIL screen press F2, DETAIL. You will see a screen similar to the following.

```
STATUS Memory
          Total        Free   Lrgst Free
Pools    ----------------------------
 TPP      1000.0KB      986.4KB      986.4KB
 PERM     3002.0KB     1338.7KB     1338.2KB
 SYSTEM  10190.6KB        2.4KB        2.4KB
 SHADOW   6296.4KB     5916.6KB       32.0KB
 TEMP   114416.4KB    71867.4KB    66582.1KB
 FR      63481.0KB    32964.0KB
Hardware ----------------------------
 FROM       64.0MB (T) DRAM      128.0MB
 SRAM        3.0MB (CMOS)
```

Note (T) indicates the FROM hardware manufacturer.

6. To display the first screen, press F2, BASIC.

Note Software options require TEMP and PERM memory.

5.4.2 Modifying Memory Allocations

You can modify the allocation of TPP and PERM SRAM memory in your system to reduce the amount of available TPP memory. This allows the DRAM to be used for KAREL variables or another purpose. Two software options are available to adjust memory size:

- R621: TPP Size 175

- R623: TPP Size 400

Default TPP Memory sizes are shown in Table 5–5 .

Table 5–5. Allowable TPP Memory Values

Amount of TPP Memory	1 MB of SRAM	2 MB of SRAM	3 MB of SRAM	Effect on TPP or KAREL programs
Default	500K (.5MB)	700K (.7MB)	1000K (1MB)	N/A

Appendix A

SYSTEM OPERATIONS

Contents

A.1 STARTUP METHODS

A.1.1 Overview

The BootROM Monitor provides the following startup methods:

- Hot start

- Cold start

- Cycle power

- Controlled start

- INIT start

<table>
<tr><td>⚠️</td><td>

Warning

DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.
</td></tr>
</table>

Table A–1 lists the controller startup methods.

Table A–1. Startup Methods

To perform this operation:	Perform Method 1	or, Perform Method 2
Hot Start (not available for PaintTool) (Only if $SEMIPOWERFL is TRUE)	Turn the power disconnect circuit breaker to ON. **Note** Do not turn off the power disconnect circuit breaker and then turn it on again without waiting at least 3 seconds. Otherwise, the controller might not start up again. If the controller does not start up, turn the power disconnect circuit breaker off, wait at least 5 seconds, and then turn it on again.	None
Cold start	Press FAULT RESET, and turn the power disconnect circuit breaker to ON. Press SHIFT and RESET and turn the power disconnect circuit breaker to ON. Turn the power disconnect circuit breaker to ON and press the ON button (PaintTool only).	Select Item 2 from the Configuration Menu. To perform a Cold start when the controller is on, enable the teach pendant, press FCTN, and then select CYCLE POWER. Press ENTER, and select YES.

Table A–1.   Startup Methods (Cont'd)

To perform this operation:	Perform Method 1	or, Perform Method 2
Controlled start	**Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.	Select item 3 from the Configuration Menu
Start the Boot Monitor (BMON) Menu When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up	Turn the power disconnect circuit breaker to ON, and press and hold F1 and F5 on the teach pendant. **Note** While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON. When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up	N/A
INIT start	Select item 3 from the Boot Monitor (BMON) Menu	N/A
Display the Configuration Menu	**Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.	Select Item 1 from the Boot Monitor (BMON) Menu
Cycle Controller Power	Enable the teach pendant, press FCTN, and then select CYCLE POWER	Press FAULT RESET and turn the power disconnect circuit breaker to OFF, wait 3 seconds, then turn it to ON again.

A.1.2 Hot Start

Hot start is a method for turning on power to the robot and controller without entering Boot Monitor (BMON) functions. *Semi hot start* is active when the system variable $SEMIPOWERFL is set to TRUE. You perform a Hot start by turning the power disconnect circuit breaker to OFF (and $SEMIPOWERFL is set to TRUE). At the completion of a Hot start, the screen that was displayed before power was turned off is displayed.

Use Procedure A-1 to perform a Hot start. Use Procedure A-2 to perform a Hot start from the Configuration Menu.

Procedure A-1 Performing a Hot Start

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠️ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.

- The $SEMIPOWERFL system variable is set to TRUE. Or, you can set the Use Hot START option on the System Configuration Screen to TRUE.

- The REMOTE/LOCAL setup item in the System Configuration Screen is set to LOCAL.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

Steps

1. **If the controller is turned on**, press FCTN, select CYCLE POWER, press ENTER, and select YES. **If the controller is turned off**, turn the power disconnect circuit breaker to ON.

2. You will see a screen similar to the following.

```
UTILITIES Hints                       ^
            ApplicationTool
    Vx.xxx/xx                  XXXX/XX


  Copyright xxxx, All Rights Reserved
            FANUC CORPORATION
       FANUC America Corporation
Licensed Software: Your use constitutes
your acceptance. This product protected
by several U.S. patents.
```

Note Do not turn off the power disconnect circuit breaker and then turn it on again without waiting at least 3 seconds. Otherwise, the controller might not start up again. If the controller does not start up, turn the power disconnect circuit breaker off, wait at least 5 seconds, and then turn it on again.

Procedure A-2   Performing a Hot Start from the Configuration Menu

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠️ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in, is working properly, and is turned on.
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.

Steps

1. **If the controller is turned on**, press FCTN, select CYCLE POWER, press ENTER, and select YES. **If the controller is turned off**, turn the power disconnect circuit breaker to ON.

    If you are using a Paint Robot, also press the ON button.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

    You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Hot start and press ENTER. After a few seconds, you will see a screen similar to the following.

```
UTILITIES Hints                     ^
              ApplicationTool
    Vx.xxx/xx                   XXXX/XX


   Copyright xxxx, All Rights Reserved
            FANUC CORPORATION
       FANUC America Corporation
Licensed Software: Your use constitutes
your acceptance. This product protected
by several U.S. patents.
```

A.1.3 Cold Start(START COLD)

A *Cold start (START COLD)* is the standard method for turning on power to the robot and controller. If your robot is set up to perform a Hot start, you can force a Cold start. A cold start does the following:

- Initializes changes to system variables

- Initializes changes to I/O setup

- Displays the UTILITIES Hints screen

    Note Any programs that were running before the power was turned off will be aborted after a Cold start.

Use Procedure A-3 to perform a Cold start. Use Procedure A-4 to perform a Cold start from the Configuration Menu.

Procedure A-3   Performing a Cold Start

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.

- The controller is off.

Steps

1. Visually inspect the robot, controller, workcell, and the surrounding area. During the inspection make sure all safeguards are in place and the work envelope is clear of personnel.

2. Turn the power disconnect circuit breaker to ON.

```
Power   Disconnect          ON
Circuit   breaker  OFF
```
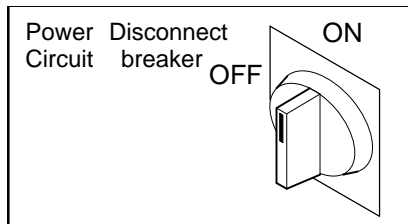
3. If you are using a Paint Robot, press the ON button.

4. **On the teach pendant screen,** you will see a screen similar to the following.

```
UTILITIES Hints                     ^
            ApplicationTool
   Vx.xxx/xx                XXXX/XX


  Copyright xxxx, All Rights Reserved
            FANUC CORPORATION
       FANUC America Corporation
Licensed Software: Your use constitutes
your acceptance. This product protected
by several U.S. patents.
```

Note Do not turn off the power disconnect circuit breaker and then turn it on again without waiting at least 3 seconds. Otherwise, the controller might not start up again. If the controller does not start up, turn the power disconnect circuit breaker off, wait at least 5 seconds, and then turn it on again.

Procedure A-4 Performing a Cold Start from the Configuration Menu

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠️ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

Steps

1. **If the controller is turned on**, press FCTN, select CYCLE POWER, press ENTER, and select YES. **If the controller is turned off**, turn the power disconnect circuit breaker to ON.

   If you are using a Paint Robot, also press the ON button.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Cold start and press ENTER. When the Cold start is complete, you will see a screen similar to the following.

```
UTILITIES Hints                         ^
             ApplicationTool
   Vx.xxx/xx                  XXXX/XX

  Copyright xxxx, All Rights Reserved
            FANUC CORPORATION
      FANUC America Corporation
Licensed Software: Your use constitutes
your acceptance. This product protected
by several U.S. patents.
```

Note Do not turn off the power disconnect circuit breaker and then turn it on again without waiting at least 3 seconds. Otherwise, the controller might not start up again. If the controller does not start up, turn the power disconnect circuit breaker off, wait at least 5 seconds, and then turn it on again.

A.1.4 Cycle Power

The CYCLE POWER option is available on the FCTN menu after a Cold or Hot start on non-Mate controllers. This item toggles the power relay via external I/O. The teach pendant must be enabled for this to work. If the teach pendant is enabled, a prompt box will be displayed asking if you are sure. This is not available on an external robot connection — only from the teach pendant.

Note If Hot Start is enabled (Use Hot Start on the System Configuration Screen is set to TRUE, or $SEMIPOWERFL is set to TRUE) CYCLE POWER will by default perform a Hot Start.

Note A one time start mode change can be made by selecting OPTIONS from the CYCLE POWER dialog and selecting a mode. Making a selection in this screen will also cycle power. On R-30*i*B Mate controllers, one time start mode options are available on the FCTN menu by selecting START MODE. After making a selection, power must be manually switched off and back on.

Use Procedure A-5 to cycle controller power from the FCTN menu. Use Procedure A-6 to cycle controller power and change the start mode one time from the FCTN menu.

Procedure A-5   Cycling Controller Power

Note For R-30*i*B Mate controllers, power must be manually switched off and then on.

Conditions

- The teach pendant is enabled.
- You are not using an external robot connection. This is only available on the teach pendant.
- The controller is currently in a Cold or Hot start state.

1. Press FCTN.
2. Select CYCLE POWER.
3. Press ENTER. You will see a screen similar to the following.

```
                        CYCLE POWER

          This will cycle power. Are you sure?


              NO          YES          OPTIONS
```
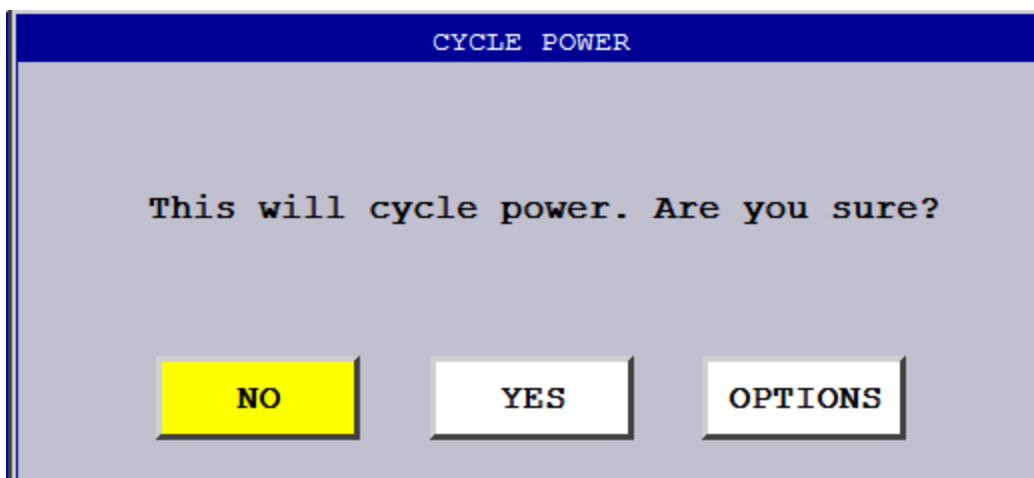
4. Use the teach pendant arrow keys to select YES, and press ENTER.

Procedure A-6 Changing Start Mode with Cycle Power

Note This is a more convenient way to change the start mode than using the configuration menu, but serves the same purpose.

Conditions

- The teach pendant is enabled.

- You are not using an external robot connection. This is only available on the teach pendant.

- The controller is currently in a Cold or Hot start state.

1. Press FCTN.

2. Select CYCLE POWER and press ENTER.

      Note On R-30*i*B Mate controllers select START MODE and press ENTER. You will not need to select OPTIONS in the next step.

3. Select OPTIONS and press ENTER. You will see a screen similar to the following:

START MODE

Select a start mode for the next startup.
This will cycle power.

CANCEL   COLD   CTRL
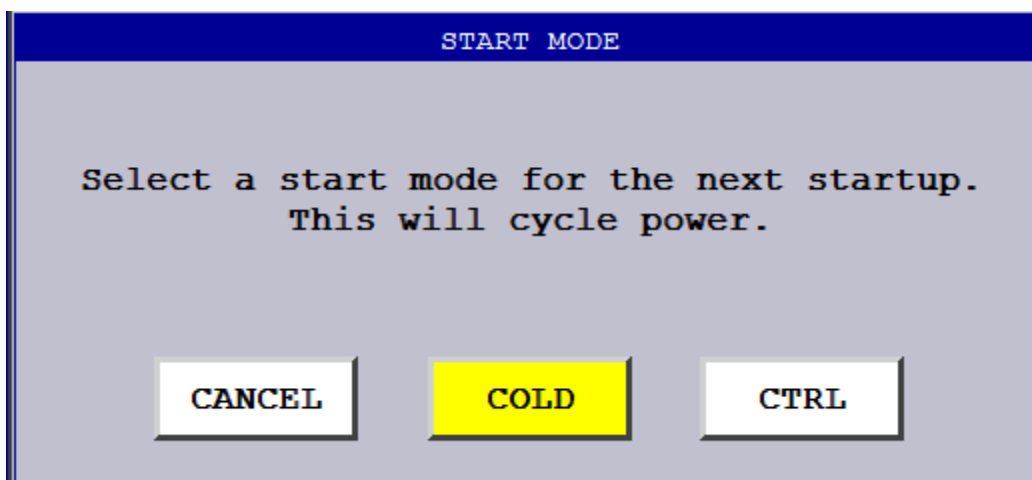
The following screen will be seen on systems with hot start enabled ($SEMIPOWERFL = TRUE):

START MODE

Select a start mode for the next startup.
This will cycle power.

CANCEL   HOT   COLD   CTRL
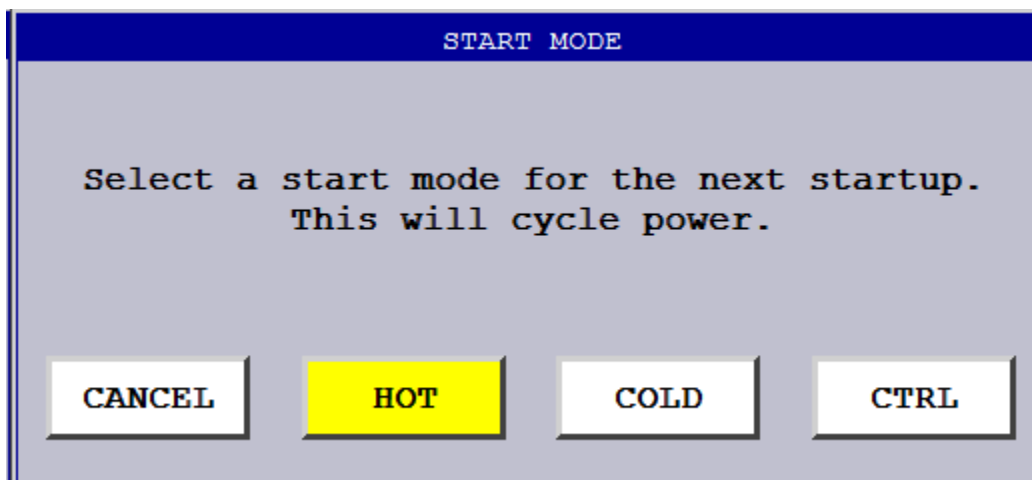
Note The controller's default start mode (hot or cold) will be the default selected option on the start mode screen.

4. Use the teach pendant arrow keys to make a selection and press ENTER. This will cycle power.

Note On R-30*i*B Mate controllers a message will be posted requesting the power to be manually switched off and on.

A.1.5   Controlled Start

A *Controlled start (START CTRL)* turns on power to the robot and controller and allows you to do the following:

- Set robot motion parameters

- Execute initial software setup

- Install options and updates

- Load or set system variables

The following tables describe the Controlled start menu items. Use Procedure A-7 to perform a Controlled start.

Caution

The items that appear on the Controlled start screen control how the robot and controller operate. Do not set these items unless you are certain of their effect; otherwise, you could disrupt the normal operation of the robot and controller.

Note If you change any of the items described in the Controlled Start tables, you will need to perform a Cold start for the changes to take effect.

Table A–2. Controlled Start Options for All Software Applications

ITEM	AVAILABLE FUNCTIONS	DESCRIPTION
Controlled Start Menu	You access items using the MENU and FCTN function keys.	This item displays the Controlled start Menu. Press FCTN and select START (COLD) when you are finished using the Controlled start Menu.

Table A–2.   **Controlled Start Options for All Software Applications (Cont'd)**

ITEM	AVAILABLE FUNCTIONS	DESCRIPTION
MENU key	S/W Install	This item allows you to install software.
	S/W Version	This item allows you to display information about the current software version.
	Variables	This item allows you to set up robot system variables.
	File	This item allows you to display the FILE menu.
	Alarm	This item allows you to display the ALARM HIST screen.
	Port Init	This item allows you to display the SETUP PORT INIT screen.
	Memory	This item allows you to display the STATUS Memory screen.
	Maintenance	This item allows you to set up robot system variables.
	Program Setup	This item allows you to modify individual software limits related to your program.
	Setup Passwords	This item allows you to set up the password option.
	Host Communications	This item allows you to set up host communication information. Refer to the *Internet Options Setup and Operations Manual* for more information.
	Appl-select	This item allows you to select an application from the Appl selection screen.
	Handling Config	This item allows you to display the Handling Signals screen.
FCTN key	START (COLD)	This item performs a Cold start.
	RESTORE/BACKUP	This item performs a controller backup.
	PRINT SCREEN	This item prints the current screen to a file called TPSCRN.LS on the default device.
	UNSIM ALL I/O	This item unsimulates all I/O settings.

Table A–3. Controlled Start Options for PaintTool

ITEM	AVAILABLE FUNCTIONS	DESCRIPTION
MENU key	TOOL SETUP	This item performs PaintTool setup and initialization. You have the following options: **F Number** - This item indicates the robot's F number. **Version** - This item indicates the version number of PaintTool. **Project** - This item is the project number. **Engineer** - This item is used to display the name of the software installation engineer. By default, this item is set to FANUC. **Date** - This item is used to display the date of software installation or update. **Controller Number** - This item is the number of the robot. Zone Number - This item is used to assign robots to different zones (for example, Base, Clear, or Prime). **Applicator Type** - This item is the type of applicator. It can be set to GUN, VersaBell, Bell(607), or ServoBell. By default, this item is set to GUN. **I/O Configuration** - This item is the type of I/O being used. It will display "Standard" or "Enhanced' depending on the I/O type loaded. **Cell I/O Hardware** - This item allows you to define what type of I/O is used for Cell I/O. Options include: **Memory:** Results in Cell I/O being memory-mapped. Used for development only or if your I/O hardware is not yet present. **Model A I/O**, **CC-Link** , **ControlNet** , **DeviceNet** , **EthernetIP** , **EGD I/O**, **FANUC I/O Link**, **FIP I/O** , **Interbus** , **Profibus** , **Process I/O Hardware** - This item allows you to define what type of I/O is to be used for Process I/O. **Memory:** Results in Process I/O being memory-mapped. Used for development only, or if your I/O hardware is not yet present. **Model A (R1-5):** Model A I/O setup on rack 1 (5-slot configuration); **Model A (R2-5):** Model A I/O setup on rack 2 (5-slot configuration); **Model A (R1-10):** Model A I/O setup on rack 1 (10-slot configuration);DeviceNet; Profibus **No. of System Colors** - This item is used to set up the maximum allowable number of system colors that can be created. The maximum value that can be used depends on available SRAM memory. By default, this item is set to 35. **No. of Color Valves** - This item is used to set up the maximum allowable number of color valves that can be created. The maximum value that can be used depends on available SRAM memory. By default, this item is set to 31. If you are using SpeedDock in a ServoBell system, only three possible configurations are allowed: 12, 24, or 36 color valves. **Enab Applic in Test Run** This item is used to allow applicator to be enabled during Test Run in Teach Mode. **Manual Functions in Teach** This item is used to allow PaintTool manual functions (flow test, color change cycle) in teach mode from the Teach Pendant. **Intrinsic Teach Pendant** This item is used to select between a non-intrinsic and intrinsic teach pendant

<u>Table A−3.</u> **Controlled Start Options for PaintTool (Cont'd)**

ITEM	AVAILABLE FUNCTIONS	DESCRIPTION
MENU key (cont'd)	TOOL SETUP (cont'd)	**Use Preset per job/style** This selection determines if presets are used based on style. Otherwise, presets by color will be used. **No. of presets/color** Determines number of presets to allocate per color when preset per job/style is set to no. **No. of jobs/styles** Determines number of styles to support when allocating presets per job/style. **No. of controllers** Determines number of controllers in zone and is used for job naming, ROS IP configuration among other functions. **No. RIPE Members** Used in conjunction with No. of controllers to setup ROS IP configuration. **Standard Operator Panel, Table Top Controller, and PDEROB ID** These items are for internal use only for FANUC America Corporation and should only be set to "YES" by employees of FANUC America Corporation.

<u>Table A−4.</u> **Handling Config Menu Options**

Item	Description
Number of MH Tools	Use this item to configure the number of tools you need for your system. The maximum number of tools is 29. At cold start, you will then have the specified number of tools available in the MH Valves menu under Setup.
Number of Valves Per Tool	Use this item to configure the number of valves you have in your tool. The maximum number of valves is 29. At cold start, you will then have the specified number of valves available in the **MH Valves** menu under Setup. You can then configure any valve to be a vacuum or clamp style tool and set up the required I/O for each.
Number of Clamps	Use this item to configure the number of clamps you need for your tool. The maximum number of clamps is 64. At Cold start, you will then have the specified number of clamps available in the MH Valves menu under Setup to assign to a valve.
Number of Part Present Inputs	Use this item to configure the number of Part Present Inputs you need for your tool. the maximum number of Part Present Inputs is 29. At cold start, you will then have the specified number of Part Present Inputs available in the MH Valves menu under Setup to assign to a valve.
Number of Vacuum Inputs	Use this item to configure the number of Vacuum Inputs you need for your tool. the maximum number of Vacuum Inputs is 29. At cold start, you will then have the specified number of Vacuum Inputs available in the MH Valves menu under Setup to assign to a valve.
Use Active Tool for Arguments	Use this item to change the behavior of the tool macros when no parameters are passed to them. When this is set to YES, the number of valves set in the tool SETUP are used to operate that number of valves for that tool. When set to NO, they act like the original specification.

Procedure A-7   Performing a Controlled Start

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.

Steps

Note Refer to Procedure A-6 to perform a controlled start from the CYCLE POWER menu.

wea

1. **If the controller is turned on**, press FCTN, select CYCLE POWER, press ENTER, and select YES. **If the controller is turned off**, turn the power disconnect circuit breaker to ON.

   If you are using a Paint Robot, also press the ON button.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Controlled start and press ENTER.

4. **When you are finished** with the Controlled start:

   a. **If you want to set configuration items**, refer to Table A–2 for more information on setting these items. When you are finished, press FCTN, select CYCLE POWER, press ENTER, and select YES.

b. **If you want to operate the robot**, perform a Cold start. Press FCTN select CYCLE POWER, press ENTER, and select YES.

c. **If you want to load system variable files**, press MENU, select FILE, and load .SV or .VR files.

d. **If you have installed an update**,

- Perform a Cold start.

- When the Cold start has completed, press FCTN, select CYCLE POWER, press ENTER, and select YES for the changes to take effect.

A.1.6 INIT Start

An initialized (INIT) start occurs automatically as the first phase of software installation.

Note This step must be completed before you perform a Controlled start.

> ⚠ **Caution**
>
> **Do not use INIT start** to start the controller. An INIT start erases all information stored in the saved memory pools.

A.2 HARDWARE DIAGNOSIS

Hardware diagnosis allows you to display memory pool sizes, dump memory, and write memory.

Table A–5 lists the hardware diagnostic functions. Use Procedure A-8 to perform hardware diagnosis functions.

Table A–5. Hardware Diagnostic Functions

FUNCTION	DESCRIPTION
Show size of RAM/ROM Modules	This function lists the sizes of the FROM, DRAM, and SRAM modules currently in the controller.
Show list of F-BUS Modules	This function displays a list of F-BUS modules currently in the controller. This shows a list of both standard and optional hardware in the controller.
Dump Memory	This function dumps a list of controller memory information and displays it on the teach pendant screen.
Write Memory	This function allows you to change the contents of controller memory

Table A–5. **Hardware Diagnostic Functions (Cont'd)**

FUNCTION	DESCRIPTION
Check SRAM Memory	This function allows you to display the controller ECC (error correcting C-MOS) status.
Display MAC Address	This function displays the MAC addresses for the various Ethernet ports.

Procedure A-8   Performing Hardware Diagnosis Functions

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠️ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.

- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.

- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.

Steps

1. **If the controller is turned on,** turn the power disconnect circuit breaker to OFF.

2. While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON.

When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up and you will see a screen similar to the following.

```
Base System Version V8.xxxx (FRNA)
Initializing file devices ... done.
******* BMON MENU *******
1.     Configuration Menu
2.     All software installation (MC:)
3.     INIT start
4.     Controller backup/restore
5.     Hardware diagnosis
6.     Maintenance
7.     All software installation (ETHERNET)
8.     All software installation (USB)
Select:
```

3. Select Hardware diagnosis. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
Base System Version V7.xxxx (FRNA)
Select: 5
  ****** Hardware Diagnosis Menu ******
1. Show size of RAM/ROM Modules
2. Show list of F-BUS Modules
3. Dump Memory
4. Write Memory
5. Check SRAM Memory
8. Display MAC address
9. Return to Main Menu
Select : _
```

4. To display the size of RAM/ROM modules, select Show size of RAM/ROM Modules. You
will see a screen similar to the following.

```
FROM: 64Mb    DRAM: 64Mb    SRAM: 3Mb
FROM CONTROLLER: TDK-rb04.00a
MODEL:
TDK GBDriver CF2.0 Rev 1.20
Press ENTER key
```

5. **To display a list of S-BUS modules**, select Show list of S-BUS Modules. You will see a screen similar to the following.

```
 S-Bus modules:
ASIC ID   Rev Bus Slot Name
   0 04    8     LIME
   1 03    4     ETCC
   2 01    4     IFSB
   5 0A    2     PHIS
   6 04    8     LIME
 Press ENTER key
 SS-Bus modules:
 ASIC ID   REV  Name
    1 05    5     NBH
Press ENTER key _
```

6. **To dump controller memory to the screen**,

   a. Select Dump Memory. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
Base System Version V7.xxxx (FRNA)
Next = [ENTER], Quit=[.][ENTER]
Input Address (HEX):
```

> ⚠ **Caution**
>
> The input address you type in Step 6b must be a valid address. If not, the Boot Monitor will be corrupted and you will have to repeat Step 1 through Step 3 of this procedure.

   b. Type the input address and press ENTER. If you do not know the input address, contact your FANUC America Corporation representative. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
Base System Version V7.xxxx (FRNA)
Next = [ENTER], QUIT=[.][ENTER]
Input Address [HEX]:
400200  <-- User Input

00400200  7C  00  04  AC  4C00  01  2C
00400208  7C  00  04  AC  4C00  01  2C
00400210  7C  00  04  AC  4C00  01  2C
00400218  7C  00  04  AC  4C00  01  2C
00400220  7C  00  04  AC  4C00  01  2C
00400228  7C  00  04  AC  4C00  01  2C
00400230  7C  00  04  AC  4C00  01  2C
00400238  7C  00  04  AC  4C00  01  2C
Next = [ENTER], QUIT=[.][ENTER]
Input Address [HEX
```

Note If the controller hangs up or halts during a Dump Memory, this can indicate problems with

- The entered address
- Memory hardware

If this occurs, contact a FANUC America Corporation Service Representative.

7. **To display the next screen**, press ENTER.

8. **To quit** and display the Hardware Diagnosis screen, press . (period) and then ENTER.

⚠ **Caution**

Do not use the write memory function unless it is absolutely necessary. The write memory function can write data in the controller and could corrupt the controller software if it is not done correctly. Contact your FANUC America Corporation representative for more information.

To write memory,

a. Select Write Memory. You will see a screen similar to the following.

```
****** Hardware Diagnosis Menu ******
Data size [BYTE=0/WORD=1/LONG=2] : 0
Input Address(HEX) : 02000000
Current value is 81
input new value :
```

> **Note** To quit without making any changes, press ENTER.

      b.   Type the new value and press ENTER. You will see a screen similar to the following.

```
****** Hardware Diagnosis Menu ******
Data size [BYTE=0/WORD=1/LONG=2] : 0
Input Address(HEX) : 02000000
Current value is 81
Input new value :
old value is 81
new value is 20
Press ENTER key
```

  9. **To Check the SRAM Memory**,

⚠ **Caution**

Performing this step will require a full load or an image restore of your controller. Be sure you have performed an image backup, or backed up your entire controller, before you continue.

      a.   Select Check SRAM Memory. You will see a screen similar to the following.

```
****** Hardware Diagnosis Menu ******
  005010120000:01 -> 0000:00
  005033201234:56 -> 1235:56
  00510024789A:BC -> 789:BD
Total correction: 3
Press ENTER key
```

b. Press ENTER to display the Hardware Diagnosis menu.

Note The information displayed on the screen means that errors exist at address 00501012, 00503320, and 00510024. The message xxx:yy means that the SRAM data value is xxxx and the ECC code value is yy.

For example, 1234:56 means that the data is 1234 and the ECC check bits are 56. The message 0000:01 -> 0000:00 means that the error bit exists at the least significant bit of ECC and this bit is corrected to 0. If there are several errors on SRAM, only the first ten locations will be displayed.

10. To Display MAC address,

Select **Display MAC address**. When it is finished, you will see a screen similar to the following. The example below shows 0 = All.

```
MAC ADDRESS Number? [0-4](0:All): 0
MAC address[1] 00:E0:E4:0F:D5:0B
MAC address[1] 00:E0:E4:0F:D5:0C
MAC address[1] 00:E0:E4:0F:D5:0D
MAC address[1] 00:E0:E4:0F:D5:0E
Press ENTER key
```

A.3 CONTROLLER BACKUP AND RESTORE

A.3.1 Overview

Refer to Table A–6 for description of each restore controller function.

Table A–6. Backup and Restore Controller Items

ITEM	DESCRIPTION
Emergency Backup	This item is not yet available.
Backup Controller as Images	This item allows you to back up the controller as memory images.
Restore Controller Images	This item allows you to restore a controller from memory images performed using the Backup Controller as Images function.
Bootstrap to Cfg Menu	Refer to the *Internet Options Setup and Operations Manual* for more information.

A.3.2 Backing Up a Controller as Images

This feature allows you to back up a controller with minimal system interaction. It will make a memory image of the F-ROM and S-RAM memory controller modules.

Procedure A-9   Backing up a Controller as Images

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠️ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.
- You have storage media (such as USB Memory Stick or memory card) that has enough free space.

   Note You should use storage media (such as USB Memory Stick or memory card) with enough free space to hold the full controller image files. For example, a 32MB F-ROM and 2MB S-RAM configuration will require a card with more than 34MB of free space and has been formatted using the controller.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Steps

1. **If the controller is turned on,** turn the power disconnect circuit breaker to OFF.

2. While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON.

When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up and you will see a screen similar to the following.

```
Base System Version V8.xxxx (FRNA)
Initializing file devices ... done.
******* BMON MENU *******
1.    Configuration Menu
2.    All software installation (MC:)
3.    INIT start
4.    Controller backup/restore
5.    Hardware diagnosis
6.    Maintenance
7.    All software installation (ETHERNET)
8.    All software installation (USB)
Select:
```

3. Insert storage media (such as USB Memory Stick or memory card) with enough free space to hold the full controller image files. For example, a 32MB F-ROM and 2MB S-RAM configuration will require a card with 34MB of free space.

4. Select Controller backup/restore and press ENTER. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
**** BACKUP/RESTORE MENU ****
0.    Return To Main Menu
1.    Emergency Backup
2.    Backup Controller As Images
3.    Restore Controller Images
4.    Bootstrap To Cfg Menu
Select:
```

5. Select Backup controller as Images and press ENTER. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
** Device Selection **
1. Memory card(MC:)
2. Ethernet(TFTP:)
3. USB(UD1:)
4. USB(UT1:)
```

6.   Select Memory card (MC:) or USB (UD1:) and press ENTER. You will see a screen similar to the following.

```
Current Directory:
MC:\
1. OK (Current Directory)
2. TESTDIR
3. OTHERDIR
Select[0.NEXT, -1PREV]:
```

This allows you to select a sub-directory to use. You enter at the root of the device. Form there the available sub-directories are displayed.

To select a sub-directory, enter the number.

7.   Type 1 and press ENTER. The memory files will be written to the selected storage media. You should see messages similar to the following.

```
Writing UD1:\FROM00.IMG (1/64)
Writing UD1:\FROM01.IMG (2/64)
Writing UD1:\FROM02.IMG (3/64)
 . . .
Writing UD1:\SRAM0x.IMG (64/64)
```

Note If BMON crashes or hangs during "Writing UD1:\SRAM0x.img...," this could be an indication of problems with the SRAM memory. If this occurs, contact a FANUC America Corporation Service Representative.

Note If the storage media does not have enough free space for the next image file, you will need to insert new storage media. If this occurs, you will see the following message:

```
**Not enough free space on UD1:
  CHANGE card and Press ENTER>
```

8. When all the image files have been written to the memory card, you will see a message similar to the following.

```
DONE!!
Press ENTER to return>
```

9. Press ENTER to display the main BMON menu.

> ⚠ **Caution**
>
> Be sure to label the storage media properly so that you can restore it to the correct configuration. Otherwise, if you restore an incorrect configuration you will lose valuable data and possibly corrupt the controller.

A.3.3 Restoring Controller Images

This feature allows you to restore the F-ROM and S-RAM controller memory from an image backup. It can only be restored to a controller with the same memory configuration.

Procedure A-10 Restoring Controller Images

Conditions

- All personnel and unnecessary equipment are out of the workcell.

> ⚠ **Warning**
>
> **DO NOT turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.**

- The controller is plugged in and is working properly.
- The teach pendant ON/OFF switch is OFF and the DEADMAN switch is released.
- The REMOTE/LOCAL setup item in the System Configuration Menu is set to LOCAL.
- You have a media that has the controller images backed up in .

> ⚠ **Caution**
>
> A restore from a controller backup will be unsuccessful if the memory configuration of the restored CPU is different from the backup CPU.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Steps

1. **If the controller is turned on,** turn off the power disconnect circuit breaker.

2. While you press and hold the F1 and F5 keys on the teach pendant, turn the power disconnect circuit breaker to ON.

```
Power  Disconnect        ON
Circuit    breaker OFF
```

When you see Boot system activating... in reverse video on the *i*Pendant you can release the F1 and F5 keys. The *i*Pendant will continue to boot up and you will see a screen similar to the following.

```
Base System Version V8.xxxx (FRNA)
Initializing file devices ... done.
******* BMON MENU *******
1.    Configuration Menu
2.    All software installation (MC:)
3.    INIT start
4.    Controller backup/restore
5.    Hardware diagnosis
6.    Maintenance
7.    All software installation (ETHERNET)
8.    All software installation (USB)
Select:
```

3. Insert your storage media (such as a memory card or USB memory stick) with the controller images backed up into the controller.

4. Select Controller backup/restore and press ENTER. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
**** BACKUP/RESTORE MENU ****
0.    Return To Main Menu
1.    Emergency Backup
2.    Backup Controller As Images
3.    Restore Controller Images
4.    Bootstrap To Cfg Menu
Select:
```

5. Select Restore Controller Images and press ENTER. You will see a screen similar to the following.

```
***BOOT MONITOR for CONTROLLER***
** Device Selection **
1. Memory card(MC:)
2. Ethernet TFTP:)
3. USB(UD1:)
4. USB(UT1:)
```

6. Select Memory card (MC:) or USB (UD1:) and press ENTER. You will see a screen similar to the following.

```
Current Directory:
MC:\
1. OK (Current Directory)
2. TESTDIR
3. OTHERDIR
Select[0.NEXT, -1.PREV]:
```

This allows you to select a sub-directory to use. You enter at the root of the device. Form there the available sub-directories are displayed.

To select a sub-directory, enter the number.

7. Place media with the controller images backed up in Procedure A-9

8. Type 1 and press ENTER. The memory files will be restored from the selected device. You should see the following messages:

```
Reading UD1:\FROM00.IMG (1/64)
Reading UD1:\FROM01.IMG (2/64)
Reading UD1:\FROM02.IMG (3/64)
```

```
       . . .
   Reading UD1:\SRAM0x.IMG (64/64)
```

9. Press ENTER to display the main BMON menu.

10. Turn the controller off and then on again to accept the new image information.

A.4 MAINTENANCE OPERATIONS

A.4.1 Overview

Maintenance operations include the following operations:

- Update boot software
- Development
- Ethernet based loading (Refer to the *Internet Options Setup and Operations Manual* for more information)
- Upgrade *i*Pendant software

Note Making Boot Load Media is for FANUC America Corporation internal use only.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

A.4.2 Updating Boot Software from the Configuration Menu

The BootROM Monitor (BMON) software version must be compatible with the version of loaded system software. Use Procedure A-11 to update Boot Software from the Configuration Menu if your version of Boot software is incorrect. The controller system software checks the BMON version at every Controlled start to Cold start and will automatically update the BMON version if necessary.

> ⚠ **Caution**
>
> If your version of Boot software is incompatible with the current version of system software, your controller could become corrupted. You should only update the version of Boot software in your controller if you have been instructed to do so by a FANUC America Corporation representative or if you are doing it as part of a software update.

⚠️ **Caution**

Do not turn off controller power while the BMON code is being updated. Otherwise, you controller could become corrupted.

Note Refer to the SSD.html file on the load media for information on the BMON version that is compatible with your software.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Procedure A-11   Manually Updating BMON FROM

Note Updating BMON F-ROM takes approximately 30 seconds.

Conditions

- The BMON F-ROM chip is not a valid version.

- The controller is capable of running and has valid loaded software.

Steps

1. **If the controller is turned on**, turn off the power disconnect circuit breaker.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Maintenance and press ENTER. You will see a screen similar to the following.

```
---------- Maintenance Menu -----------
0. Top menu
1. Update boot software
2. Development
3. Upgrade iPendant software
4. ....
Select >
```

4. Select Update boot software and press ENTER. You will see a screen similar to the following.

```
Select > 4
Select function.
0. Cancel (top menu)
1. Write boot ROM directly
Select >
```

> ⚠️ **Caution**
>
> Do not turn off controller power while the BMON code is being updated. Otherwise, you controller could become corrupted.

5. Select Write boot ROM directly and press ENTER. You will see a screen similar to the following.

```
Select > 1
Select source device.
0. Cancel (top menu)
1. Memory card (MC:)
2. System flash file (FRS:)
2. USB (UD1:)
Select >
```

6.

Note In this step, carefully wait until the process is complete! Do not power the controller off until it is finished.

If the Boot ROM load module is installed in the controller select System flash file, and press ENTER. **If the Boot ROM load module is on media** select the media (memory card, MC:, or USB, UD1:, and press ENTER. Carefully wait until the process is complete! Do not power the controller off until this process is complete. The screen will indicate: "Reading BOOTROM.LD0". Then it will indicate: Writing Boot FROM, please wait". Finally the "Maintenance Menu" will be displayed. The FROM is now updated. Be sure to wait until all of these occur before proceeding.

7. Type 0 and press ENTER to display the top level Configuration Menu.

8. Select a start mode. Refer to Section A.1 .

A.4.3 Updating *i*Pendant Firmware

The *i*Pendant Firmware version must be compatible with the version of loaded controller software. The correct version of the *i*Pendant firmware is distributed on the same load media as the controller software.

If an *i*Pendant is attached to the system, the *i*Pendant firmware version will be checked automatically at the end of the controller software loading process when the controller transitions from Controlled Start to Cold Start. You will be given the opportunity to update the firmware at that point or you can wait until a later time. Refer to Section A.4.3.1 for additional details on the Automatic process or Section A.4.3.2 for details on Manually updating the *i*Pendant Firmware.

> ⚠ **Caution**
>
> If your version of *i*Pendant firmware is incompatible with the current version of system software, your *i*Pendant operation might become erratic.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

A.4.3.1 Automatic Update of *i*Pendant Firmware

If an *i*Pendant is attached to the system, the *i*Pendant firmware version will be checked automatically when the controller transitions from Controlled Start to Cold Start at the end of the software installation process. The following procedure details the steps in this process.

Note The automatic update of the *i*Pendant firmware takes approximately 10 minutes.

Procedure A-12 Automatic *i*Pendant Firmware Update

Conditions

• Controller is at Controlled start.

- An *i*Pendant is attached to the system.

- The system has determined that the *i*Pendant firmware version is incompatible with the current controller software version.

> ⚠ **Warning**
>
> **DO NOT TURN OFF THE CONTROLLER DURING THIS PROCESS. Turning off the controller during the update process could cause the *i*Pendant to become inoperable, requiring you to return it to FANUC America Corporation for service.**

Steps

1. When you select FCTN >COLD to Cold Start the controller, the controller verifies that updated firmware files exist on either the MC: or FRS: device. If the files do not exist, a screen similar to the following is displayed:

```
-------------------------------------
A check of iPendant firmware found:
   System   version: xxxxx
   iPendant version: xxxxx
iPendant firmware should be upgraded,
but necessary files are missing
please contact FANUC America Corporation.
```

   Where xxxxx is the version numbers of the controller software and the *i*Pendant firmware that were found.

   You will need to obtain the necessary files or media and manually update the *i*Pendant firmware following the procedure in Section A.4.3.2

   Select F4, CONTINUE to continue with the Cold Start process.

2. If the appropriate files are found, a screen similar to the following will be displayed:

```
---------- iPendant Firmware ----------
   System   version: x.xxxx
   iPendant version: x.xxxx
iPendant firmware should be upgraded.
If you wish to upgrade, please power
off and on the robot controller.
  0. Continue without upgrade
Select >
--------------------------------------
```

3. To continue with the upgrade, power the controller off and then back on. To cancel the upgrade and continue with the Cold Start process, type 0, then ENTER. If you select CANCEL then you will need to manually update the *i*Pendant firmware following the procedure in Section A.4.3.2 .

4. If you are going to upgrade the firmware then a screen similar to the following will be displayed when you power the controller back on.

```
---------- iPendant Firmware ----------
   System   version: x.xxxx
   iPendant version: x.xxxx
iPendant firmware should be upgraded.
Do you wish to upgrade?
  0. Cancel
  1. Upgrade firmware
Select >
--------------------------------------
```

Selecting CANCEL will continue the Cold Start process without upgrading the *i*Pendant firmware. You will need to manually update the *i*Pendant firmware following the procedure in Section A.4.3.2

5. Type 1, and press ENTER to upgrade the firmware. A screen similar to the following will be displayed.

```
 ---------- iPendant Firmware ----------
 DO NOT POWER OFF
  Warning Ipendant firware updating
  takes a long time.
DO NOT POWER OFF
OK=[1], Cancel=[Other] >
--------------------------------------
```

6. Type 1, and press ENTER to continue with the firmware upgrade. The *i*Pendant firmware update process will begin.

During the upgrade process you will see a RED status line in the lower left corner of the *i*Pendant screen, indicating the status of the update process.

7. After the update is complete the following screen will be displayed.

```
---------- iPendant Firmware ----------
iPendant firmware has been upgraded.
Please power off and on the robot
controller to make it effective.
  0. Continue with older firmware
     until next powerup.
Select >
---------------------------------------
```

If you type 0 and then press ENTER, the controller will continue through the Cold start process. The *i*Pendant will continue to operate with the older firmware until the next time the controller is turned off then on again.

8. To activate the new firmware, turn the controller off then on. When the *i*Pendant first turns on you will see the updated firmware version displayed at the bottom of the screen.

A.4.3.2 Manually Updating the *i*Pendant Firmware

The following sections detail the procedures to update and/or backup the *i*Pendant firmware manually. The available options include:

- Updating *i*Pendant Application Firmware - for *i*Pendant with $\odot$ and 8x2 jog keys

- Updating Whole *i*Pendant Firmware - for *i*Pendant without $\odot$ and 6x2 jog keys

- Creating an *i*Pendant Firmware Backup - for *i*Pendant without $\odot$ and 6x2 jog keys

Note An additional option, "Create bootable memory card," is for FANUC America Corporation internal use only.

The manual updating of the *i*Pendant firmware can be done either from a memory card, over the Ethernet, or USB stick. The procedures outlined here are for updating from a Memory Card. Updating from Ethernet is similar, however it requires that the robot and network are properly configured for

software loading. Refer to the *Internet Options Manual* for more information on how to set up the server and controller.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

A.4.3.2.1   Updating *i*Pendant Application Firmware

> ⚠ **Caution**
>
> This option is only available for *i*Pendants with the ⓘ and 8x2 jog keys. The *i*Pendants will have V8.xx or greater firmware already installed. In addition, the controller software version must be at least V8.xx. Any earlier version of the *i*Pendant requires a complete firmware update with V7.xx media card. If you select this option by mistake, you will get the message "Function can not work on this hardware". Press ENTER to return to the Configuration Menu.

Note Updating the *i*Pendant Application firmware takes approximately 3 minutes.

Procedure A-13   Update Application Code

Conditions

- The firmware currently installed on the *i*Pendant is at least version V8.xx.
- The controller is capable of running, and has valid loaded software.
- The*i*Pendant is connected and capable of running.
- The load media containing the controller system software and *i*Pendant firmware is properly inserted in the appropriate storage device (memory card or USB device) on the controller.

Steps

1. **If the controller is turned on**, turn the power disconnect circuit breaker to OFF.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Maintenance and press ENTER. You will see a screen similar to the following. There may be other items listed.

```
---------- Maintenance Menu -----------
0. Top menu
1. Update boot software
2. Development
3. Update iPendant software
Select >
```

4. Select Update iPendant software. You will see a screen similar to the following.

```
---------- iPendant Menu -----------
0. Cancel
1. Update application code
2. Update whole firmware
3. Firmware backup
4. Create bootable memory card
Select >
```

5. Select Update application code and press ENTER. You will see a screen similar to the following:

```
Select source device.
0. Cancel
1. Memory Card (MC:)
2. System flash file (FRS:)
3. Ethernet (TFTP:)
4. USB (UD1:)
Select >
```

6. Select Memory Card. You will see a screen similar to the following.

```
Select > 1
You need much time to update.
You should not power off the controller
during updating.
OK=[1], Cancel=[Other]>
```

7. Select OK. The *i*Pendant Application firmware update process will begin. During the process you will see the message "Updating Firmware. Please do not power off." ... are displayed on the screen as the updating proceeds.

> ⚠ **Warning**
>
> **DO NOT TURN OFF THE CONTROLLER DURING THIS PROCESS. Turning off the controller during the update process could cause the *i*Pendant to become inoperable, requiring you to return it to FANUC America Corporation for service.**

8. When the update is complete, you will see "Firmware update complete. Please shut down and recycle the power." Turn off the power disconnect circuit breaker.

9. Turn on the power disconnect circuit breaker again to activate the new application firmware.

A.4.3.2.2 Updating Whole *i*Pendant Firmware

Updating the Whole firmware requires a special USB stick. This is not typically required.

To update the whole firmware insert the special USB media in the UT1 USB slot on the pendant. Power up the controller while holding F3. Follow the on screen instructions.

> ⚠ **Caution**
>
> This option is only available for *i*Pendants without the ⓘ and 6x2 jog keys. The *i*Pendants will have V7.xx or lesser firmware already installed. In addition, the media card must be at V7.7x. You cannot use V8.xx media card. If you select this option by mistake, you will get the message "Function can not work on this hardware". Press ENTER to return to the Configuration Menu.

Note Updating the whole *i*Pendant firmware takes approximately 10 minutes.

Procedure A-14   Update Whole Firmware

Conditions

- You are using a teach pendant without an i and 6x2 jog keys for Paint.

- The firmware currently installed on the *i*Pendant is version V7.7x or lesser.

- The controller is capable of running and has valid loaded software.

- The *i*Pendant is connected and capable of running.

- The media containing the controller system software is properly inserted in the appropriate storage device (memory card or USB device) on the controller.

Steps

1. **If the controller is turned on**, turn the power disconnect circuit breaker to OFF.

2. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

   You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

3. Select Maintenance and press ENTER. You will see a screen similar to the following. There may be other items listed.

```
---------- Maintenance Menu -----------
0. Top menu
1. Update boot software
2. Development
3. Update iPendant software
Select >
```

4. Select Update iPendant software. You will see a screen similar to the following.

```
---------- iPendant Menu -----------
0. Cancel (top menu)
1. Update application code
2. Update whole firmware
3. Firmware backup
4. Create bootable memory card
Select >
```

5. Select Update whole firmware and press ENTER. You will see a screen similar to the following.

```
Select source device.
0. Cancel
1. Memory Card (MC:)
2. System flash file (FRS:)
3. Ethernet (TFTP:)
4. USB (UD1:)
```

6. Select Memory Card. You will see a screen similar to the following.

```
Select > 1
You need much time to update.
You should not power off the controller
during updating.
OK=[1], Cancel=[Other]>
```

7. Select OK. The *i*Pendant firmware update process will begin. During the process you will see messages displayed in the lower left corner of the screen as the updating proceeds.

> ⚠ **Warning**
>
> **DO NOT TURN OFF THE CONTROLLER DURING THIS PROCESS. Turning off the controller during the update process could cause the *i*Pendant to become inoperable, requiring you to return it to FANUC America Corporation for service.**

8. After the update is complete the following screen will be displayed.

```
---------- iPendant Firmware ----------
iPendant firmware has been upgraded.
Please power off and on the robot
controller to make it effective.
  0. Continue with older firmware
     until next powerup.
Select >
---------------------------------------
```

If you type 0 and then press ENTER, the controller will continue through the Cold start process. The *i*Pendant will continue to operate with the older firmware until the next time you turn off the controller then turn it on again.

9. To activate the new firmware, turn the controller off then on. When the *i*Pendant first turns on you will see the updated firmware version displayed at the bottom of the screen.

A.4.3.2.3 Creating an *i*Pendant Firmware Backup

Backing up the *i*Pendant Firmware is not normally necessary since the firmware is included on the Controller software load media. However if required, the firmware from an operational *i*Pendant can be backed up to media and can be loaded to an *i*Pendant using the procedure outlined in Procedure A-14 .

Note Backing up the *i*Pendant firmware takes approximately 15 minutes.

Procedure A-15   Firmware Backup

Conditions

- You are using a teach pendant without an i and 6x2 jog keys for Paint.
- The controller is capable of running and has valid loaded software.
- The *i*Pendant is connected and capable of running.
- Storage media is available with at least 5MB of free space.
- You want to back up the *i*Pendant firmware to be used later in case a reload is necessary.

Steps

1. If the controller is turned on , turn the power disconnect circuit breaker to OFF.

2. Plug the blank storage media into the slot in the controller.

3. Immediately press and hold, PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should

display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

4. Select Maintenance and press ENTER. You will see a screen similar to the following.

```
---------- Maintenance Menu -----------
0. Top menu
1. Update boot software
2. Development
3. Ethernet based loading
4. Upgrade iPendant software
Select >
```

5. Select Upgrade iPendant software. You will see a screen similar to the following.

```
---------- iPendant Menu -----------
0. Cancel (top menu)
1. Update application code
2. Update whole firmware
3. Firmware backup
4. Create bootable memory card
Select >
```

6. Select Firmware backup and press ENTER. You will see a screen similar to the following.

```
Select >3
You need much time to save the contents
of iPendant firmware.
OK=[1], Cancel=[Other]>
```

7. Type 1, and press ENTER. The *i*Pendant firmware backup process will begin. This process takes about 45 minutes. During the process you will see messages displayed in the lower left corner of the screen as the backup proceeds. When the backup is complete, you will be returned to the top level Configuration Menu.

8. Select a start mode. Refer to .

A.5 DIAGNOSTIC TOOLS

A.5.1 Development Tools

Development Tools are special functions used by a FANUC America Corporation engineer to examine the details of the running system. They are used to control the timing to help diagnose problems. Some of these functions include:

> ⚠ **Caution**
>
> Do not use any of these development functions unless explicitly instructed to do so by a FANUC America Corporation representative. Otherwise, you could corrupt your system.

- The Step by step startup is used to control the start sequence in order to examine the system at various stages.

- The Target monitor is used to communicate to an external PC to examine the internal details of the system or a particular function.

- The Memory protect function is used to disable some of the memory management functions of the hardware and operating system.

- The Set Port 1 for Maintenance Consol function resets the maintenance console back to Port P2:.

- The Delete All DT Files function is used to delete certain system level .DT (data) files from the controller for diagnostic and repair purposes.

A.5.2 Diagnostic Log

If you need additional information to help you solve a specific problem, and you are instructed to do so by a FANUC America Corporation software support representative, at Cold start press FCTN and select Diagnostic Log.

Appendix B

MASTERING

Contents

B.1 OVERVIEW

When you *master* a robot you define the physical location of the robot by synchronizing the mechanical information with the robot's positional information. A robot must be mastered to operate properly. Robots are usually mastered before they leave FANUC America Corporation. However, it is possible that a robot might lose its mastering data and need to be remastered.

The robot axes are controlled by a closed loop servo system. The controller outputs a command signal to drive each motor. A feedback device mounted on the motor, called a *serial pulse coder,* sends a signal back to the controller. During robot operation, the controller constantly analyzes the feedback signal, and modifies the command signal to maintain proper location and velocity of the end effector at all times.

For the robot to move accurately to recorded positions, the controller has to "know" the position of each axis. It does this by comparing the serial pulse coder reading during operation with a reading taken at a known mechanical reference point on the robot. Mastering records the serial pulse coder reading at a known mechanical reference point. This mastering data is stored with other user data in the controller backup battery (and maintained when the controller is shut down).

When the controller is shut down under normal conditions, each serial pulse coder's present reading is maintained in the pulse coder by backup batteries *on the robot* . (These batteries might be located in the controller on P-series robots.) When the controller is turned on, the controller requests the stored reading from the serial pulse coder. When the controller receives the pulse coder reading, the servo system can operate normally. This process is called *calibration* . Calibration occurs automatically each time the controller is turned on.

When pulse coder backup battery power is interrupted while the controller is powered down, calibration fails at power up and the only robot motion possible is joint mode jogging. To restore proper operation, the robot must be mastered and calibrated.

> ⚠️ **Warning**
>
> **When calibration has failed, the axis software travel limits will be ignored, allowing the robot to be jogged farther than normal. Be careful when jogging the robot in an uncalibrated condition or you could injure personnel or damage equipment.**

Note The following procedures might be password-protected on your robot. If passwords have been set, you will need access at the Install level to perform mastering. Obtain the Install level password and log in at the Install level or you will be unable to perform the following procedures.

Before mastering the robot, you must clear any faults that prevent servo power from being restored or that prevent mastering completion.

Use Procedure B-1 to clear common faults related to mastering and to prepare the robot for mastering. For more detailed information on fault recovery, refer to the *Controller Maintenance Manual.*

If you are using a FANUC America Corporation A-series robot you should use a mastering fixture to master your robot. Fixture mastering is performed on **FANUC America Corporation P-series robots** by aligning mastering pins and surfaces on the robot. Refer to the *Mechanical Unit Service Manual* specific to your robot model for procedures on how to set up and use a mastering fixture.

If you are using a FANUC America Corporation M-series or S-series robot you can either master to a fixture or you can master to zero degrees. Refer to the *Mechanical Unit Service Manual* specific to your robot model for more information about either of these methods.

If you are using a FANUC America Corporation P-series robot , and you have zero degree witness marks scored onto your robot, then you can master the robot to zero degrees. Refer to the *Mechanical Unit Service Manual* specific to your robot model for procedures on how to master your robot.

Quick mastering is a convenient way to master a robot **after** you have recorded a reference position. You cannot quick master a robot unless the reference position was taught before mastering was lost.

> ⚠️ **Caution**
>
> Record the quick master reference position after the robot is installed to preserve the factory mastering settings for future remastering.

Refer to Table B–1 for information on each kind of mastering procedure.

Table B–1. SYSTEM Master/Cal Items

ITEM	DESCRIPTION
SET QUICK MASTER REF	This item allows you to set master reference positions. You can save the master reference positions to the default device in case the robot has lost mastery due to an electrical or software problem.
FIXTURE POSITION MASTER	This item allows you to master the robot to a fixture. When you master to a fixture, you use a mastering fixture to align the robot axes and then record their serial pulse coder readings. You can master any robot to a fixture.
SINGLE AXIS MASTER	This item allows you to master a single axis of the robot. You can master a single axis of any robot provided that there is a reference mark at a known position on that axis. When a single axis of a robot is mastered, mastering data for the other axes remains unchanged.
QUICK MASTER	This item allows you to quick master the robot. Quick mastering allows you to minimize the time required to remaster the robot using a reference position you established when the robot was properly mastered. You cannot quick master the robot unless you have previously recorded this quick master reference position. Record the quick master reference position when the robot is properly mastered. The best time to record the quick master reference position is when the robot is still factory-mastered. Refer to the Mastering appendix in the application-specific *Setup and Operations manual* .

Table B–1. SYSTEM Master/Cal Items (Cont'd)

ZERO POSITION MASTER	This item allows you to master the robot to zero degrees. When you master to zero degrees, you position all axes at their zero degree witness marks and record their serial pulse coder readings. You can master any M-series or S-series robot to zero degrees. If you are using a P-series robot, and you have witness marks scored onto your robot, you can master the robot to zero degrees.
CALIBRATE	This item allows you to calibrate the robot.
Message Field	This item is a status area at the bottom of the screen that lets you know when the robot has been successfully mastered or calibrated.

When the Gravity Compensation is enabled, the procedure of mastering is different. For detailed information, refer to the "Gravity Compensation" section in software options chapter. When you start mastering, you will see the following screen:

```
Gravity Compensation is
enabled.
Confirm you have set payload
data correctly.
Execute mastering?
 [No]      Yes
```

If you select "Yes", mastering will be executed. If you select "No", mastering will not be executed and the screen will go back to the previous screen.

B.2 RESETTING ALARMS AND PREPARING FOR MASTERING

When you turn on the robot after pulse coder backup battery power has been interrupted you will see a SRVO-062 BZAL alarm. You might also see a SRVO-038 Pulse Mismatch alarm. Before mastering the robot you must reset these alarms and rotate the motor of each axis that lost battery power to prepare the robot for mastering. Use Procedure B-1 to reset these alarms and prepare the robot for mastering.

Procedure B-1 Preparing the Robot for Mastering

Conditions

- You see a SRVO-062 BZAL or SRVO-038 Servo mismatch alarm.

- You are not mastering a P-200 robot.

Steps

1. If necessary, replace the robot batteries with four new 1.5 volt alkaline batteries, size D. Observe the direction arrows in the battery box for proper orientation of the batteries.

2. Press MENU.

3. Select SYSTEM.

4. Press F1, [TYPE].

5. If Master/Cal is not listed on the [TYPE] menu, do the following; otherwise, continue to Step 6

   a. Move the cursor to VARIABLE and press ENTER.

   b. Move the cursor to $MASTER_ENB.

   c. Press the numeric key "1" and then press ENTER on the teach pendant.

   d. Press F1, [TYPE].

6. Select Master/Cal. You will see a screen similar to the following.

⚠️ **Warning**

For the M-6i (ARC Mate 100i), M-16i (ARC Mate 120i), and M-16iL (ARC Mate 120iL) robots, setting TORQUE to OFF using the F4, TORQUE function key on the SYSTEM Master/Cal screen releases the robot brakes. When the brakes are released, the robot arm will drop suddenly unless it is supported. DO NOT use this function key unless instructed to do so, otherwise, you could injure personnel or damage equipment.

```
SYSTEM Master/Cal
TORQUE = ON
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

7. Press F3, RES_PCA. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Reset pulse coder alarm? [NO]
```

   8. Press F4, YES. You will see a screen similar to the following.

```
SYSTEM Master/Cal
TORQUE = ON
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Pulse coder
alarm reset!
```

   Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not be available by pressing F1, [TYPE]. To display the Master/Cal screen again, perform Step 1 through Step 6 .

   9. Turn off the controller.

  10. Wait a few seconds, then turn the power disconnect circuit breaker on to turn the controller on again.

  11. If the SRVO-062 BZAL alarm is still present; there is a battery, cable or pulsecoder problem. Refer to the *Controller Maintenance Manual* for further information.

  12. If a SRVO-038 Pulse Mismatch alarm is present at this time, repeat Step 1 through Step 8 to reset it. It is not necessary to restart the robot after resetting to clear this alarm.

  13. If a SRVO-075 Pulse Not Established alarm is present at this time, press the RESET key to clear it.

  14. Rotate each axis that lost battery power by at least one motor revolution in either direction. Failure to do so will result in the SRVO-075 Pulse Not Established alarm recurring and mastering will not be possible.

       a. For each rotary axis, jog at least twenty degrees.

      b.   For each linear axis, jog at least thirty millimeters.

  15. Perform any of the mastering procedures from the MASTER/CAL menu.

B.3 SAVING AND RESTORING MASTERING DATA

You can save the master reference positions to the default device in case the robot has lost mastery due to an electrical or software problem. Use Procedure B-2 to save and restore master reference position data.

Procedure B-2 Saving and Restoring Master Reference Position Data

Conditions

- The robot is mastered. Refer to Section B.4 through Section B.7 to choose a mastering method and master your robot.

- The default device is set.

- The robot is on and is working properly.

Steps

  1. Press MENU.

  2. Select SYSTEM.

  3. Press F1, [TYPE].

  4. Select Master/Cal.

     If Master/Cal is not listed on the [TYPE] menu, do the following; otherwise, continue to Step 5

      a.   Select VARIABLE from the [TYPE] menu.

      b.   Move the cursor to $MASTER_ENB.

      c.   Press the numeric key "1" and then press ENTER on the teach pendant.

      d.   Press F1, [TYPE].

      e.   Select Master/Cal. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1   FIXTURE POSITION MASTER
2   ZERO POSITION MASTER
3   QUICK MASTER
4   SINGLE AXIS MASTER
5   SET QUICK MASTER REF
6   CALIBRATE
Press `Enter' or number key to select.
```

> **Note** F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

5. Press FCTN.

6. Select SAVE. The file SYSMAST.SV is copied to the default device.

7. To restore the saved file, press F2, LOAD.

B.4 MASTERING TO A FIXTURE (FIXTURE POSITION MASTER)

When you master to a fixture, you use a mastering fixture to align the robot axes and then record their serial pulse coder readings. You can master any robot to a fixture.

Use Procedure B-3 to master to a fixture.

Procedure B-3   Mastering to a Fixture

Conditions

- You have the appropriate mastering fixture for your robot.
- You are not mastering a P-series robot.
- You have cleared any servo faults that prevent you from jogging the robot.
- You have jogged each axis that has lost mastering at least one motor turn. See Procedure B-1

Steps

1. If automatic brake control is enabled, disable it as follows; otherwise continue to Step 2

   a.   Press MENU.

   b.   Select SYSTEM.

   c.   Press F1, [TYPE].

   d.   Select VARIABLE.

   e.   Move the cursor to $PARAM_GROUP and press ENTER twice.

   f.   Move the cursor to $SV_OFF_ALL and press F5, FALSE.

   g.   Move the cursor to $SV_OFF_ENB and press ENTER.

   h.   Move the cursor to each line where the value is TRUE, and press F5, FALSE.

   i.   Turn off the controller.

   j.   Turn on the controller.

2. Install the mastering fixture on the robot and jog the robot into the mastering position. Refer to the *Mechanical Service Manual* or *Mechanical Connection and Maintenance Manual* specific to your robot model for the procedures for set up and use of a mastering fixture.

3. Press MENU.

4. Select SYSTEM.

5. Press F1, [TYPE].

6. If Master/Cal is not listed on the [TYPE] menu, do the following; otherwise, continue to Step 7

    a. Move the cursor to VARIABLE and press ENTER.

    b. Move the cursor to $MASTER_ENB.

    c. Press the numeric key "1" and then press ENTER on the teach pendant.

    d. Press F1, [TYPE].

7. Select Master/Cal. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

8. Move the cursor to FIXTURE POSITION MASTER and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Master at master position ? [NO]
```

9. Press F4, YES. Mastering will be performed automatically. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Mastered!  Mastering Data:
<0> <11808249> <38767856>
<9873638> <122000309> <2000319>
```

10. Move the cursor to CALIBRATE and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Calibrate ? [NO]
```

11. Press F4, YES. You will see a screen similar to the following

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Calibrated!  Cur Jnt Ang(deg):
<0.000> <29.226> <-100.625>
<0.000> <-79.375> <0.000>
```

Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not appear on the SYSTEM F1, [TYPE] submenu. To see the Master/Cal screen again perform Step 1 through Step 7

12. Move the wrist clear of the mastering fixture and remove the mastering fixture from the robot. Refer to the *Mechanical Service Manual* or *Mechanical Connection and Maintenance Manual* specific to your robot model for the procedures for use of a mastering fixture.

13. If you have disabled automatic brake control in Step 1 , enable it as follows:

   a. Press MENU.

   b. Select SYSTEM.

   c. Press F1, [TYPE]

   d. Select VARIABLE.

   e. Move the cursor to $PARAM_GROUP and press ENTER twice.

   f. Move the cursor to $SV_OFF_ALL and press F4, TRUE.

   g. Move the cursor to $SV_OFF_ENB and press ENTER.

   h. Move the cursor to each line where you previously changed the value, and press F4, TRUE.

14. Turn off the controller.

15. Wait a few seconds, then press the ON/OFF button on the operator panel to turn the controller on again.

16. If you are using Dual Check Safety and the alarm "SYST-212 Need to apply to DCS param" occurs, the value of the setting parameters and the value of the DCS parameters are different. To reset this alarm, you must perform the "Apply to DCS parameter" procedure. Refer to the Dual Check Safety Operator's Manual for more information.

B.5   SINGLE AXIS MASTERING

You can master a single axis of any robot provided that there is a reference mark at a known position on that axis. When a single axis of a robot is mastered, mastering data for the other axes remains unchanged.

Use Procedure B-4 to master a single axis.

Procedure B-4   Mastering a Single Axis

Conditions

- You have cleared any servo faults that prevent you from jogging the robot.

- You have jogged each axis that has lost mastering at least one motor turn. See Procedure B-1

Steps

1. Jog the unmastered axis of the robot to the single axis mastering position.

- **For M-series or S-series robots only:** Using the joint coordinate system, jog the unmastered axis of the robot to the zero degree witness mark. If you are single axis mastering the J3-axis, the J2-axis must first be lined up at its zero degree mark. Otherwise the positions of the other axes are unimportant. Refer to the *Mechanical Service Manual* or *Mechanical Connection and Maintenance Manual* specific to your robot model for the location of the zero degree witness marks.

- **For P-series robots only:** Using the joint coordinate system, jog the unmastered axis of the robot to the standard mastering location and align the mark, pin or surface using a straight edge if necessary. If you are single axis mastering the J3-axis, the J2-axis must first be lined up at its standard mastering location. Otherwise the positions of the other axes are unimportant.

2. Press MENU.

3. Select SYSTEM.

4. Press F1, [TYPE].

5. **If Master/Cal is not listed on the [TYPE] menu,** do the following; otherwise, continue to Step 6

    a. Select VARIABLE.

    b. Move the cursor to $MASTER_ENB.

    c. Press the numeric key "1" and then press ENTER on the teach pendant.

    d. Press F1, [TYPE].

6. Select Master/Cal. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

7. Move the cursor to SINGLE AXIS MASTER and press ENTER. You will see a screen similar to the following.

```
SINGLE AXIS MASTER
ACTUAL  POS      (MSTR POS)   (SEL)     [ST]
J1   0.000   (     0.000)    (0)      [2]
J2   3.514   (    35.000)    (0)      [0]
J3  -7.164   ( -100.000)     (0)      [2]
J4 -35.366   (     0.000)    (0)      [2]
J5  -1.275   (   -80.000)    (0)      [2]
J6   4.571   (     0.000)    (0)      [2]
E1   0.000   (     0.000)    (0)      [0]
E2   0.000   (     0.000)    (0)      [0]
E3   0.000   (     0.000)    (0)      [0]
```

Note A "0" in the [ST] column indicates that the axis is unmastered.

8. Move the cursor to the (MSTR POS) column and move it up or down to the unmastered axis. (Any unmastered axis will have the number 0 in the [ST] column).

9. Enter the position where single axis mastering is to be performed in the (MSTR POS) column for the unmastered axis.

    a. For robots where single axis mastering is performed at the zero degree position, press the numeric key "0" and press ENTER.

    b. For robots where single axis mastering is performed at the fixture position, enter the fixture position and press ENTER.

    Note Some P-series robots are single axis mastered at the fixture position. All other robots are single axis mastered at the zero degree position.

10. Continuously press and hold the DEADMAN switch and turn the teach pendant ON/OFF switch to ON.

11. Move the cursor to the SEL column and move it up or down to the unmastered axis.

12. Press the numeric key "1" and press ENTER.

13. Press F5, EXEC. Mastering will be performed automatically. You will see a screen similar to the following.

```
SINGLE AXIS MASTER
ACTUAL POS    (MSTR POS)  (SEL)   [ST]
J1    0.000  (   0.000)   (0)     [2]
J2    3.514  (   0.000)   (0)     [2]
J3   -7.164  (-100.000)   (0)     [2]
J4  -35.366  (   0.000)   (0)     [2]
J5   -1.275  ( -80.000)   (0)     [2]
J6    4.571  (   0.000)   (0)     [2]
E1    0.000  (   0.000)   (0)     [0]
E2    0.000  (   0.000)   (0)     [0]
E3    0.000  (   0.000)   (0)     [0]
```

Note The J2 axis is now mastered and a 2 is displayed in the [ST] column.

14. Press PREV.

15. Move the cursor to CALIBRATE and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Calibrate ? [NO]
```

16. Press F4, YES. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Calibrated!  Cur Jnt Ang(deg):
<0.000> <0.000> <-7.164>
<-35.366> <-1.275> <4.571>
```

Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not be available by pressing 1, [TYPE]. To display the Master/Cal screen again perform Step 1 through Step 6

17. If you are using Dual Check Safety and the alarm "SYST-212 Need to apply to DCS param" occurs, the value of the setting parameters and the value of the DCS parameters are different. To reset this alarm, you must perform the "Apply to DCS parameter" procedure. Refer to the Dual Check Safety Operator's Manual for more information.

B.6 QUICK MASTERING

Quick mastering allows you to minimize the time required to remaster the robot using a reference position you established when the robot was properly mastered. You cannot quick master the robot unless you have previously recorded this quick master reference position.

Record the quick master reference position when the robot is properly mastered. The best time to record the quick master reference position is when the robot is still factory-mastered.

If calibration fails because pulse coder backup battery power has been interrupted, you can use this reference position to master the robot in a minimum amount of time. When the zero position marks do not line up because of mechanical disassembly or repair, you must master to a fixture or perform zero degree mastering.

You can define a quick master reference position and perform quick mastering on any robot model.

Use Procedure B-5 to record the quick master reference position. Use Procedure B-6 to quick master the robot.

> ⚠ **Caution**
>
> Record the quick master reference position after the robot is installed to preserve the factory mastering settings for future remastering.

Procedure B-5   Recording the Quick Master Reference Position

Conditions

- The robot is properly mastered.

Steps

1. Align each axis of the robot with the reference mark you have chosen as a quick master reference position.

    Note It is convenient to use the zero degree marks for the quick master reference position Refer to the *Mechanical Unit Service Manual* or *Mechanical Connection and Maintenance Manual*

specific to your robot model for the location of the zero degree marks. But if you prefer, you can use any robot position as long as you scribe witness marks on each axis at the reference point.

2. Press MENU.

3. Select SYSTEM.

4. Press F1, [TYPE].

5. If Master/Cal is not listed on the [TYPE] menu, do the following; otherwise, continue to

    a.   Select VARIABLE.

    b.   Move the cursor to $MASTER_ENB.

    c.   Press the numeric key "1" and then press ENTER on the teach pendant.

    d.   Press F1, [TYPE].

6. Select Master/Cal. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

7. Move the cursor to SET QUICK MASTER REF and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Set quick master reference ? [NO]
```

8. Press F4, YES. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Quick Master Reference Set!
```

Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not be available by pressing F1, [TYPE]. To display the Master/Cal screen again, perform Step 1 through Step 6

Procedure B-6   Quick Mastering the Robot

Conditions

- Calibration has failed because backup battery power has been interrupted.

  Note If the zero degree marks do not line up because of mechanical disassembly or repair, you cannot perform this procedure. In this case, master to a fixture or master to zero degrees to restore robot mastering.

- The quick master reference position was recorded before calibration failed.

- You have cleared any servo faults that prevent you from jogging the robot.

- You have jogged each axis that has lost mastering at least one motor turn. See Procedure B-1

Steps

1. Jog the robot to the quick master reference position that has previously been recorded.

2. Press MENU.

3. Select SYSTEM.

4. Press F1, [TYPE].

5. If Master/Cal is not listed on the [TYPE] menu, do the following; otherwise, continue to Step 6

   a. Select VARIABLE.

   b. Move the cursor to $MASTER_ENB.

   c. Press the numeric key "1" and then press ENTER on the teach pendant.

   d. Press F1, [TYPE].

6. Move the cursor to Master/Cal and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

7. Move the cursor to QUICK MASTER and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Quick master ? [NO]
```

8. Press F4, YES. Mastering will be performed automatically. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Mastered!  Mastering Data:
<0> <11808249> <38767856>
<9873638> <122000309> <2000319>
```

9.   Move the cursor to CALIBRATE and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Calibrate ? [NO]
```

10.   Press F4, YES. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Calibrated!  Cur Jnt Ang(deg):
<0.003> <-0.0012> <-0.050>
<0.009> <0.015> <-0.002>
```

Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not be available by pressing F1, [TYPE]. To display the Master/Cal screen again, perform Step 1 through Step 6

11. If you are using Dual Check Safety and the alarm "SYST-212 Need to apply to DCS param" occurs, the value of the setting parameters and the value of the DCS parameters are different. To reset this alarm, you must perform the "Apply to DCS parameter" procedure. Refer to the Dual Check Safety Operator's Manual for more information.

B.7 ZERO DEGREE MASTERING

When you master to zero degrees, you position all axes at their zero degree witness marks and record their serial pulse coder readings. You can master any M-series or S-series robot to zero degrees.

If you are using a P-series robot, and you have witness marks scored onto your robot, you can master the robot to zero degrees.

Use Procedure B-7 to master to zero degrees.

Procedure B-7   Mastering to Zero Degrees

Conditions

- You have cleared any servo faults that prevent you from jogging the robot.

- You have jogged each axis that has lost mastering at least one motor turn. Refer to Procedure B-1

Steps

1. Using the joint coordinate system, jog each axis of the robot to the zero degree witness mark. Refer to the *Mechanical Service Manual* or *Mechanical Connection and Maintenance Manual* specific to your robot model for the location of the witness marks.

2. Press MENU.

3. Select SYSTEM.

4. Press F1, [TYPE].

5. **If Master/Cal is not listed on the [TYPE] menu,** do the following; otherwise, continue to Step 6

    a. Select VARIABLE.

    b. Move the cursor to $MASTER_ENB.

    c. Press the numeric key "1" and then press ENTER on the teach pendant.

    d. Press F1, [TYPE].

6. Select Master/Cal. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
```

Note F4, TORQUE does not appear on the Master/Cal screen for all robot models. When F4, TORQUE appears on the Master/Cal screen, it allows the robot brakes to be released.

7. Move the cursor to ZERO POSITION MASTER and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Master at zero position ? [NO]
```

8. Press F4, YES. Mastering will be performed automatically. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Mastered!  Mastering Data:
<0> <11808249> <38767856>
<9873638> <122000309> <2000319>
```

9. Move the cursor to CALIBRATE and press ENTER. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Press 'ENTER' or number key to select.
Calibrate ? [NO]
```

10. Press F4, YES. You will see a screen similar to the following.

```
SYSTEM Master/Cal
1 FIXTURE POSITION MASTER
2 ZERO POSITION MASTER
3 QUICK MASTER
4 SINGLE AXIS MASTER
5 SET QUICK MASTER REF
6 CALIBRATE
Robot Calibrated!  Cur Jnt Ang(deg):
<0.000> <0.000> <0.000>
<0.000> <0.000> <0.000>
```

Note If you exit the Master/Cal screen by pressing F5, DONE, the Master/Cal screen will be hidden. Master/Cal will not be available by pressing F1, [TYPE]. To display the Master/Cal screen again perform Step 1 through Step 6

11. If you are using Dual Check Safety and the alarm "SYST-212 Need to apply to DCS param" occurs, the value of the setting parameters and the value of the DCS parameters are different. To reset this alarm, you must perform the "Apply to DCS parameter" procedure. Refer to the Dual Check Safety Operator's Manual for more information.

SUPPORTED MOTOR AND AMP COMBINATIONS

Contents

Table C−1. Supported Motor and Amp Combinations

Motor Name	Direct Entry Motor Selection	Standard and Enhanced Motor Selection		
	Motor ID (DEC)	Size	RPM	Current
α*i*S2/5000 20A	15562	60	12	10
α*i*S2/5000 40A	15557	60	12	5
α*i*S2/6000 20A	15578	60	13	10
α*i*S4/5000 20A	15818	61	12	10
α*i*S4/5000 40A	15813	61	12	5
α*i*S8/4000 40A	16053	62	11	5
α*i*S8/4000 80A	16055	62	11	7
α*i*S8/6000 80A	16087	62	13	7
α*i*S12/4000 80A	16311	63	11	7
α*i*S22/4000 160A	16572	64	11	12
α*i*S22/4000 80A	16567	64	11	7
α*i*S30/3000 80A	16679	65	2	7
α*i*S30/4000 160A	16828	65	11	12
α*i*S40/4000 160A	17084	66	11	12
β*i*S0.2/5000 4A	20674	80	12	2
β*i*S0.3/5000 4A	20930	81	12	2
β*i*S0.4/5000 20A	21194	82	12	10
β*i*S0.5/6000 20A	21466	83	13	10
β*i*S1/6000 20A	21722	84	13	10
β*i*S2/4000 20A	21946	85	11	10
β*i*S2/4000 40A	21941	85	11	5
β*i*S4/4000 20A	22202	86	11	10
β*i*S4/4000 40A	22197	86	11	5
β*i*S8/3000 20A	22314	87	2	10
β*i*S8/3000 40A	22309	87	2	5
β*i*S12/2000 20A	22554	88	1	10

Table C–1. Supported Motor and Amp Combinations (Cont'd)

Motor Name	Direct Entry Motor Selection	Standard and Enhanced Motor Selection		
	Motor ID (DEC)	Size	RPM	Current
β*i*S12/2000 40A	22549	88	1	5
β*i*S12/3000 40A	22565	88	2	5
β*i*S22/2000 40A	22805	89	1	5
α*i*F1/5000 20A	25802	100	12	10
α*i*F1/5000 40A	25797	100	12	5
α*i*F2/5000 20A	26058	101	12	10
α*i*F2/5000 40A	26053	101	12	5
α*i*F4/4000 40A	26293	102	11	5
α*i*F4/4000 80A	26295	102	11	7
α*i*F8/3000 40A	26405	103	2	5
α*i*F8/3000 80A	26407	103	2	7
α*i*F12/3000 80A	26663	104	2	7
α*i*F22/3000 80A	26919	105	2	7
α*i*F30/3000 160A	27180	106	2	12
α*i*F40/3000 160A	27436	107	2	12

Table C–2. Supported Third-Party Motor and Amp Combinations

Motor Name	Direct Entry Motor Selection	Standard and Enhanced Motor Selection		
	Motor ID (DEC)	Size	RPM	Current
NIMAK 40A	40485	158	2	5
BAUTZ/3300 80A	40743	159	2	7
ARO/3000(6Pole) 80A	40999	160	2	7
ARO/3000 40A	41253	161	2	5
ARO/3000(4Pole) 80A	41255	161	2	7
ARO 3G 40A	43301	169	2	5
ARO 3G 80A	43303	169	2	7
Tolmtc HT12/4000 40A	41653	162	11	5
Tolmtc HT23/4000 40A	41909	163	11	5
EXLAR GSX40/3000i 40A	42069	164	5	5
EXLAR GSX30 20A	43098	168	5	10
Tolmtc SW44/4000 40A	42421	165	11	5
Tolmtc SW44/4000 80A	42423	165	11	7
TolmtcGSWA101 40A	42677	166	11	5

Table C–2. Supported Third-Party Motor and Amp Combinations (Cont'd)

Motor Name	Direct Entry Motor Selection	Standard and Enhanced Motor Selection		
	Motor ID (DEC)	Size	RPM	Current
TolmtcGSWA101 80A	42679	166	11	7
TolmtcGSWA102/3 40A	42933	167	11	5
TolmtcGSWA102/3 80A	42935	167	11	7
TolmtcGSWA301/2 20A	43706	170	11	10
TolmtcGSWA301/2 40A	43701	170	11	5
TS4817N4930E239 80A	38583	150	11	7
TS4817N4930E235 40A	38837	151	11	5
TS4817N4930E235 80A	38839	151	11	7
DENYOU KRM-32198 40A	39717	155	2	5
DENYOU KRM-32198 80A	39719	155	2	7

um=micrometers

Figure C–1. Servo Amplifier Module

Module	Amplifier		1	2	4		8	12	22	30	40		50		100	200	300	500
Motor — α_{is}				α2/5000is	α4/5000is		α8/4000is	α12/4000is	α22/4000is	α30/4000is	α40/4000is		α50/3000is	α50/3000is FAN	α100/2500is	α200/2500is	α300/2000is	α500/2000is
Amplifier — α_i			α1/5000i	α2/5000i		α4/4000i	α8/3000i	α8/3000i	α8/3000i	α30/3000i	α40/3000i	α40/3000i FAN						
SVM1	SVM1-20i		o	o	o													
	SVM1-40i					o	o											
	SVM1-80i						o	o	o									
	SVM1-160i									o	o	o						
	SVM1-360i												o	o	o	o		
	SVM1-360i X2																o	o
SVM2	SVM2-20/20i	L																
		M	o	o	o													
	SVM2-20/40i	L	o	o	o													
		M				o	o											
	SVM2-40/40i	L				o	o											
		M				o	o											
	SVM2-40/80i	L				o	o											
		M					o	o	o									
	SVM2-80/80i	L					o	o	o									
		M					o	o	o									
	SVM2-80/160i	L					o	o	o									
		M								o	o	o						
	SVM2-160/160i	L								o	o	o						
		M								o	o	o						
SVM3	SVM3-20/20/20i	L	o	o	o													
		M	o	o	o													
		N	o	o	o													
	SVM3-20/20/40i	L	o	o	o													
		M	o	o	o													
		N				o	o											

A06B-6117-HXXX

Peak Current Values

Figure C–2. R-30*i***B A-Cabinet Aux Axis Amplifier**

Aux Axis Amp

6-Axis Servo amplifier

Main board

Power supply unit

Servo amplifiers (α*i*SV/Option)

Figure C–3. **R-30*i*B B-Cabinet Aux Axis Amplifier**

Aux Axis amplifier

6-Axis Servo amplifier

Optional slot

Main board   Power supply unit   E-stop unit
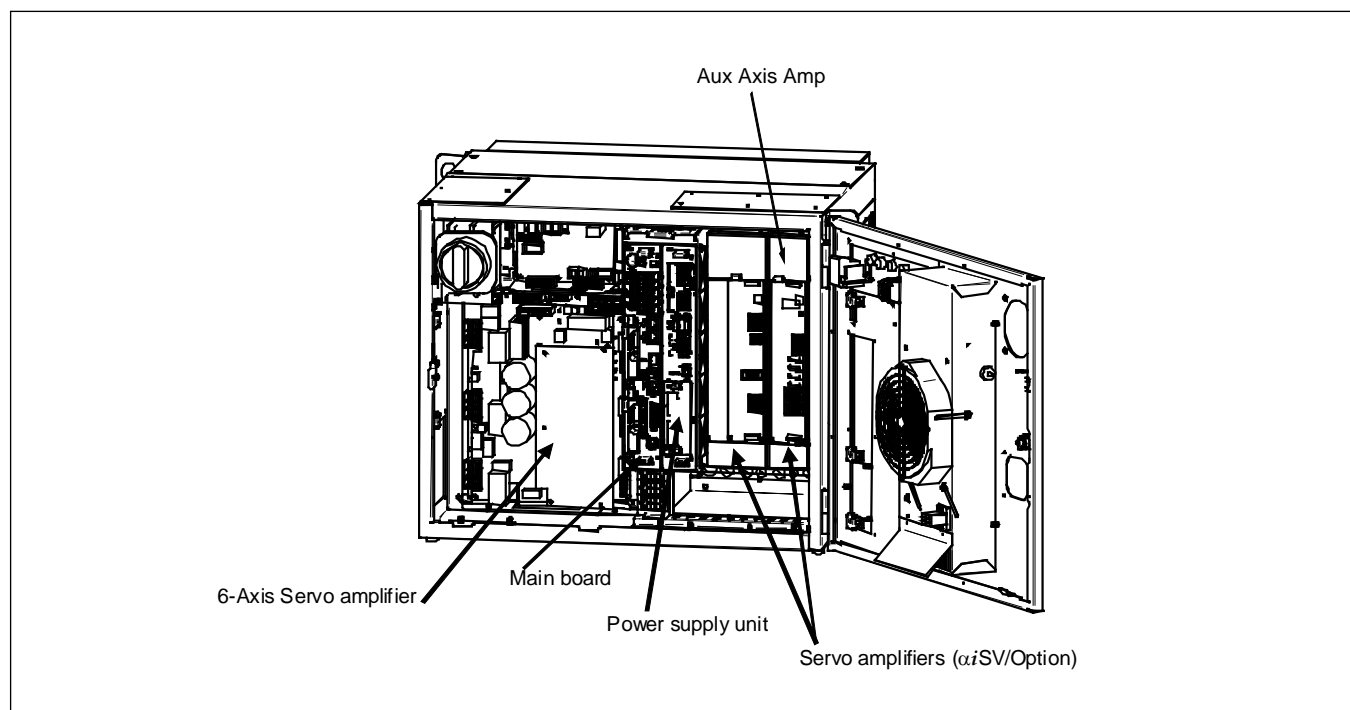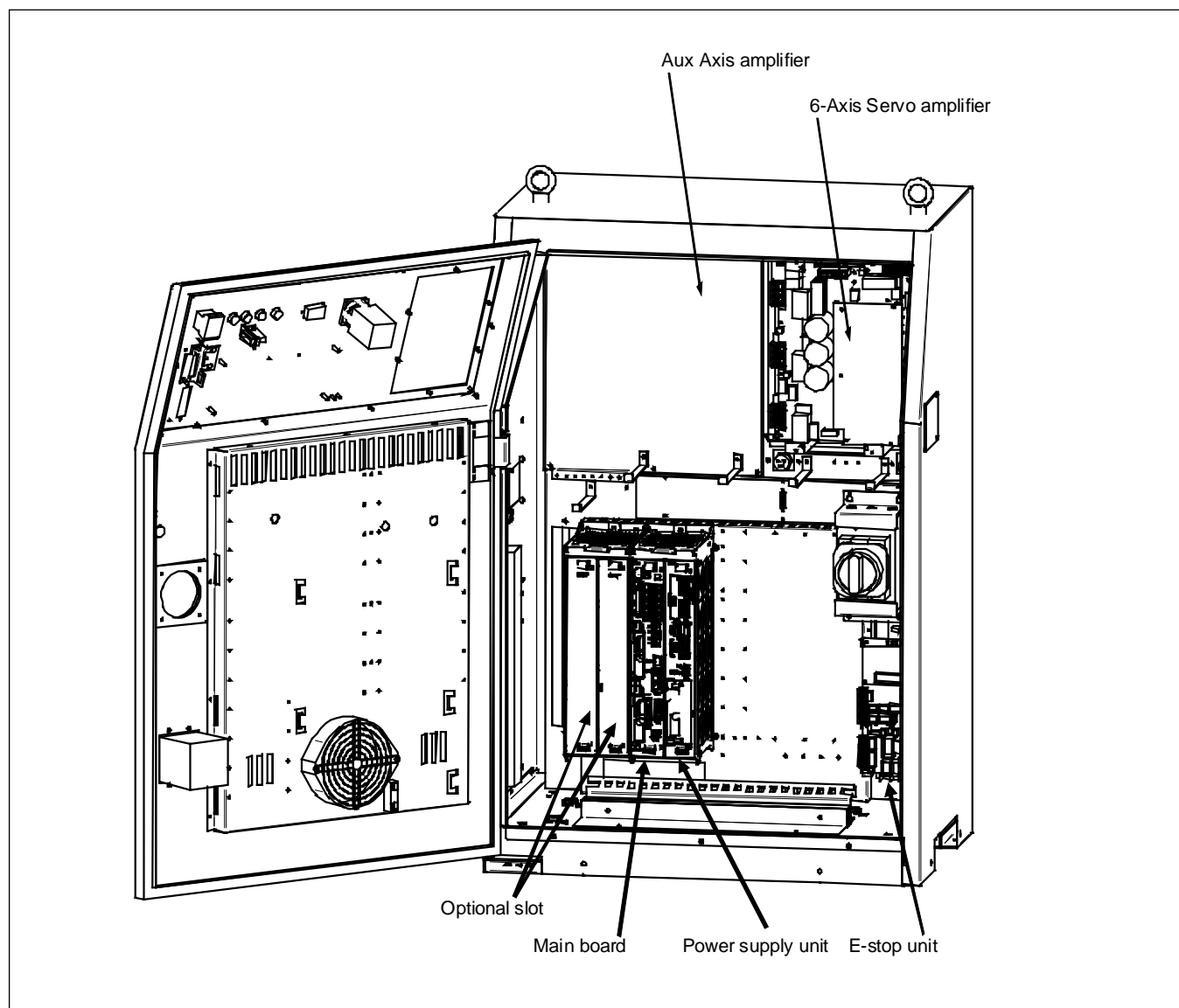
Figure C–4. R-30iB Mate Side Cabinet for Aux Axis

Aux Axis Amplifier

Side Cabinet   R-30iB Mate Controller
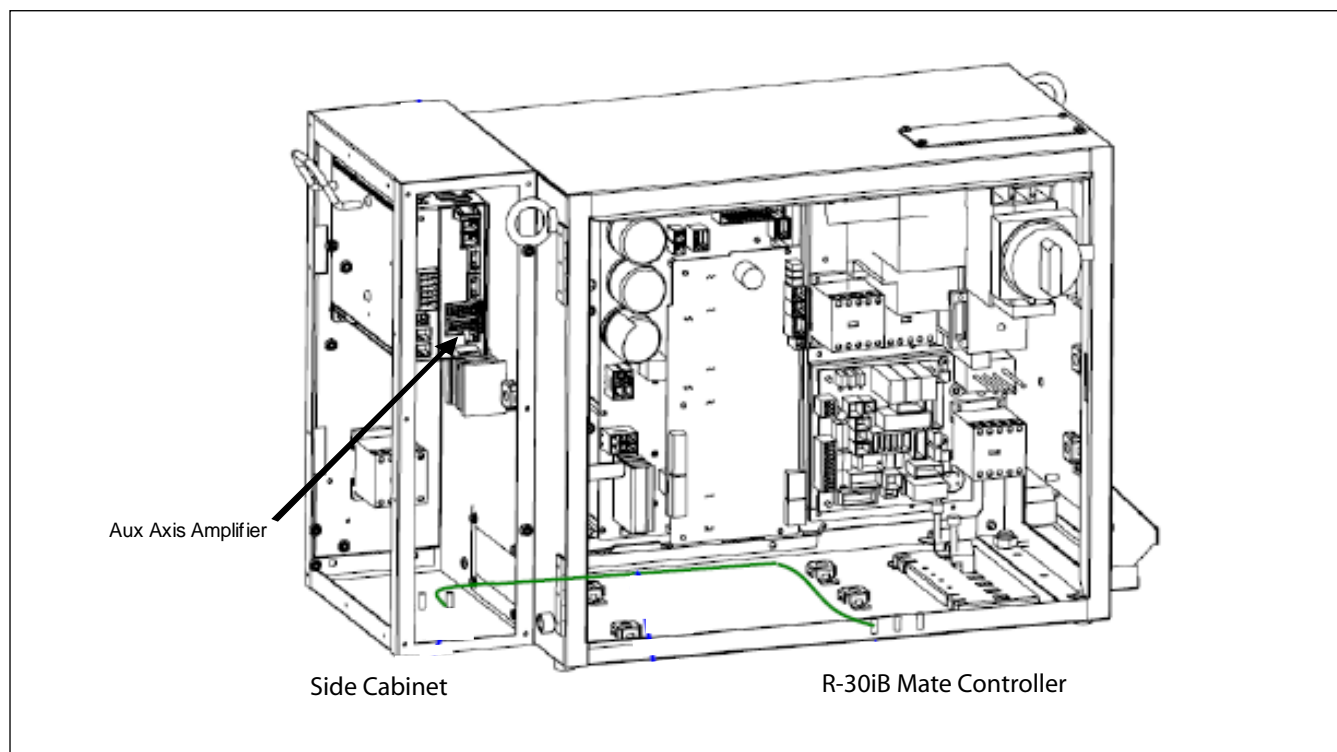
Figure C–5. Brake Number Selection

1	A	B	C
1	XPRQ1	PRQ1	5V
2	XPRQ2	PRQ2	5V
3	XPRQ3	PRQ3	5V
4	XPRQ4	PRQ4	5V
5	XPRQ5	PRQ5	5V
6	XPRQ6	PRQ6	5V
7	S+	S-	0V
8	RDI1	RDI2	0V
9	RDI3	RDI4	0V
10	RDI5	RDI6	0V
11	RDI7	RDI8	0V
12	RDI9	RDO1	0V
13	RDO2	RDO3	
14	RDO4	RDO5	
15	RDO6	RDO7	
16	RDO8	XHBK	
17	24VF	XROT	
18	24VFIN	0V	

COP10B

1	FSSB1
2	FSSB2

COP10A

1	FSSB1
2	FSSB2

CRM96
D4200D (X)

A1	+24V	B1	+24v
A2	0V	B2	0V
A3	XSVEMG	B3	MON1
A4	MON2	B4	MON3
A5	XPCHON	B5	XMCCON
A6		B6	XTON
A7	BRKDLY	B7	KM2ON
A8	XBRKON	B8	XOTHBK

CRM97
D2100D (Y)

	A1	XBRKRLS2	B1	+24VF
BRK2	A2	XBRKRLS3	B2	0V
BRK3	A3	XBRKRLS4	B3	XFUSEALM
BRK4	A4	GUNCHG	B4	XSVEMG
	A5	KM3ON	B5	OTHBK
	A6		B6	

CNJ1A
D5200(X)

1	2	3
J1U1	J1V1	J1W1

CNJ2A
D5200(X)

1	2	3
J2U1	J2V1	J2W1

CNJ3A
D5200(X)

1	2	3
J3U1	J3V1	J3W1

CNJ4
D4200(X)

1	2	3
J4U	J4V	J4W

CNJ5
D4200(X)

1	2	3
J5U	J5V	J5W

CNJ8
D4200(X)

1	2	3
J6U	J6V	J6W

CNGA
D5200(Y)

1	2	3
J1G1	J2G1	J3G1

CNGB
D5200(Y)

1	2	3
J1G2	J2G2	J3G2

CNGC
D4200(Y)

1	2	3
J4G	J5G	J6G

CRR45A
D4200 (X)

1	DCRA1
2	DCRA2

CRR45B
D4200 (X)

1	DCRB1
2	DCRB2

CRR63
D2100 (X)

1	DCTHA1
2	DCTHA2

CRR63B
D2100 (X)

1	DCTHB1
2	DCTHB2
3	DCEXSTB

CRS23
D2100 (Y)

A1	S2+
A2	S2-
A3	0V

CRM68
D2100 (X)

A1	AUXOT1
A2	AUXOT2
A3	

CRM68
D2100 (X)

1	AUXOT1
2	AUXOT2
3	

CRR38A
D5200 (X)

1	PE
2	AC1
3	AC2
4	AC3

CRR38B
D5200 (X)

1	PE
2	AC1
3	AC2
4	AC3

CRR88
D3200M (YY)

A1	BK1_2	B1	COMMON
A2	BK3	B2	COMMON
A3	BK4_5_6	B3	COMMON

→ BRK1

CRR65A/CRR65B
D3200M (XX)

A1	BKA1	B1	BKA2
A2		B2	
A3	COMMON	B3	COMMON

A4:
Servo Amplifier
Connector Table

CONFIGURATION TABLES

Contents

Note This appendix lists the configuration items available at the time of release. If you upgrade to a newer software version, you might have an item that is not listed in this appendix. If this occurs, use the blank regions at the bottom of Table D–1 to write down the items. Contact your FANUC America Corporation technical representative for configuration information for your robot model.

Note After you set up the robot, the configuration screen for your product will be displayed. Refer to Section 4.3 .

> ⚠ **Caution**
>
> Be sure to set the Payload correctly for your robot. If you do not, your system will not operate properly.

- **If you choose the right robot but specify robot configuration information incorrectly,** you must repeat Procedure 4-17 .

Table D–1. Possible Robot Configuration Items

CONFIGURATION ITEM	WRITE YOUR SETTING AND DESCRIPTION HERE
Robot Type	
Mount Type	
Mount Angle	
Washdown Type	
Payload	
Solution Type	
Cabinet Location	
Aux Cabinet	
Axis 1 Limit	
Axis 2 Limit	
Axis 1 Rail Length	
Axis 1 Carriage Type	
Frame Type	
Cartesian Motion Option **Note** Select Path Priority if you have loaded or plan to load Continuous Turn or Soft Float.	

Table D–1. Possible Robot Configuration Items (Cont'd)

CONFIGURATION ITEM	WRITE YOUR SETTING AND DESCRIPTION HERE
Joint Motion Option **Note** This item will be displayed only if you select Path Priority for Cartesian Motion Option.	
Flange Type	
Brake Type	
Group 2 Brake Setting(s)	
Group 3 Brake Setting(s)	
Option Brake Enable	
Hardware Start Axis	
Cable	
Arm Configuration	
Arm Number	
Arm Length	
Paint Rail Settings	
Hand Orientation	
Wrist Orientation	
Wrist Limits	

Table D–2. **Independent Axes Setup Configuration Information**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Motor Selection Method	1. Standard Method 2. Enhanced Method 3. Direct Entry Method	4. The standard method has not changed from the default motor selection method from previous versions. 5. The enhanced method will list only valid motor based on the answer to the motor size question. 6. The direct entry method will allow direct input of the motor ID from the motor table. Table C–2	
Motor Size Type	Refer to Table C–1 and Table C–2 for valid. motor and amp combinations.	Standard and Enhanced method. The motor size can be found on the motor name plate on your robot. NOTE If the motor combination you specify is not supported, the message, "Motor type not found," will be displayed. The system will ask for the motor information again. Refer to the FANUC AC Servo Motor Digital Series Descriptions Manual or the FANUC AC Servo Motor Beta Series Descriptions Manual for more information.	
Motor RPM	Refer to and for valid motor and amp combinations	Standard method only.	

Table D–2. **Independent Axes Setup Configuration Information (Cont'd)**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Current Limit for Amplifier	Refer to Table C–1and Table C–2 for valid motor and amp combinations.	Standard Method Only **Note** If the motor combination you specified is not supported, the message, "Motor type not found," will be displayed. The system will ask for the motor information again. All robots have 6 channel amplifiers. Optional extended axes used on these robot models are numbered starting with amplifier #2. Refer to Figure C–1 for information on selecting a servo amplifier module. Refer to the FANUC AC Servo Motor Digital Series Descriptions Manual or the FANUC AC Servo Motor Beta Series Descriptions Manual for more information.	
Motor Selection	Choices generated based on answer to Motor Type Question	Enhanced Method Only This list will only display valid motor selections.	
Motor ID	Refer to Motor ID column of Table C–1 and Table C–2 for valid motor and amp combinations.	Direct Entry Method Only.	
Axis Type	7. Linear Axis 8. Rotary Axis		

Table D–2. Independent Axes Setup Configuration Information (Cont'd)

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Gear Ratio	Enter Gear Ratio	**The gear ratio for linear axes** is the number of millimeters traveled for one rotation of the motor. For example, if a 50mm pinion on the motor is directly coupled to the rack, and the radius of the pinion is 25mm, the gear ratio is 2(pi)(25) = 157.08. If the axis has a gear box between the motor and pinion, divide the number by the gear ratio. For example, if the motor is connected to a 5:1 gear box and a 50mm pinion, the gear ratio is (2)(pi)(25)/5 = 31.416. **The gear ratio for rotary axes** is in motor turns per single rotation of the rotary axes. The ratio is ng2:ng1, where ng is the number of teeth on a gear. ng1 is attached to the motor and ng2 is attached to the axis. For example, if gear 1 has 25 teeth and gear 2 has 50 teeth, the ratio would be 2:1.	
Max Joint Speed Setting	For example: Suggested Speed = 200.040(deg/s) (Calculated with Max Motor Speed) (1:Change, 2:No Change)?	The maximum joint velocity is automatically calculated, based on the gear ratio and the maximum RPM of the motor chosen. This value can be used or it can be lowered. **Note CAUTION** Do not increase the value of the maximum joint velocity, otherwise the maximum motor RPM will be exceeded, possibly damaging equipment and causing unexpected results.	

Table D–2. Independent Axes Setup Configuration Information (Cont'd)

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Motor Direction	Motion Sign : (1: TRUE, 2: FALSE)	The direction determines which way the motor turns when the positive jog key is pressed, and should be consistent with axis alignment. TRUE indicates that the motor will turn counterclockwise when looking at the motor shaft from the front. **Note** If the rotation is incorrect, you can modify it by setting up the Independent Axes again. Perform a Controlled start (refer to Appendix A) and then set up the Independent Axes again by repeating Procedure 4-17 starting at Step 2	
Upper Limit	Enter the upper software limit.	Set the upper software limit of the axis to a value smaller than the hard stop.	
Lower Limit	Enter the lower software limit.	Set the lower software limit of the axis to a value smaller than the hard stop. This is usually 0 or a negative number.	
Master Position	Enter the master position.		
ACC/DEC Time 1 and 2	Default Value of acc_time1 = 360(ms) (1:Change, 2:No Change)? Default Value of acc_time2 = 168(ms) (1:Change, 2:No Change)?	The sum of acc_time_1 and acc_time_2 is the time, in milliseconds, it will take for the axis to reach full joint speed.	
MIN_ACCEL Time	Default Value of min_acctime = 256(ms) (1:Change, 2:No Change)?	The min_acctime value is used for acceleration/deceleration if the distance between the two points is short enough that the axis cannot reach full speed.	

Table D–2. **Independent Axes Setup Configuration Information (Cont'd)**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Load Ratio	Enter Load ratio (0:None 1~5:Valid)	The load ratio adjusts the gain of the axis based on the load inertia and the motor inertia. A value of 0 continues the program without adjusting the gain. Equation for calculating load ratio: $$Load\,Ratio = \frac{I_l + I_m}{I_m}$$ $$I_l = Load\,Inertia\,(Kg * cm * s^2)$$ $$I_m = Motor\,Inertia\,(Kg * cm * s^2)$$ Refer to the *FANUC AC Servo Motor Digital Series Descriptions Manual* or the *FANUC AC Servo Motor Beta Series Descriptions Manual* for more information.	
Select Amp Number	Enter amplifier number	Multiple channel amps should be considered as one amp number.	
Select Amp Type	1. A06B-6105 series 6 axes amplifier 2. A06B-6114 series Alpha i amp or A06B-6096 Alpha amp. or A06B-6093 series Beta amp.	Select 1 for 6 channel amplifiers. Select 2 for all other amplifiers.	
Brake Setting	Enter brake number.	**CAUTION** Make sure that the brake number is assigned and is connected correctly, otherwise, improper operation will result. If robot has brakes, they should be connected in the controller. Refer to Appendix C for proper brake assignments. Each brake requires 0.6A or 0.8A, depending on the specification, and each brake output is fused at 2.0 A.	

Table D–2. **Independent Axes Setup Configuration Information (Cont'd)**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Servo Timeout	Servo Off is Disable (1: Enable 2: Disable)?	If enabled, SERVO OFF allows the brakes to hold the axis and drop servo power after the specified time.	
Servo Timeout Value	Servo Off Time (0.0~30.0)	Displayed if Servo Timeout is Enabled. If enabled, SERVO OFF allows the brakes to hold the axis and drop servo power after the specified time.	

Table D–3. Index Device Configuration Information

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Number of index Positions	Type the number of index positions	The maximum number of index positions for any index axis is 8. For 3 or more index positions the index device can be used as a dial positioner. This means that the index axis has continuous turn capability i.e. to rotate in one direction indefinitely. **NOTE** Continuous turn must be set up before using the index device as a dial positioner. A system macro will be created at loading time for each index position of an index axis. For example, 3 index positions are defined for index axis 1. The following macro programs will be created: INDEX1_1, INDEX1_2 and INDEX1_3. If index axis 2 has 2 index positions, INDEX2_1 and INDEX2_2 will be created. Running a system macro from a TP program is the only way to move an index axis to one of pre-defined index positions for that axis. You will not be able to create a TP program that includes an index device group. Only 4 entries (entries 90~93) are available for index devices in the system's macro table. If the total number of macro programs created for the index devices is greater than 4 (see above example), only the first 4 systems macros will appear in the macro table. For macros 5 and so forth: — You can use the CALL or RUN instructions to run a macro program. — You can manually add macro programs to the macro table if empty entries are available.	
For each index position [i]			
angle (deg) [i]	Type the joint angle for the index position [i].	Set the angle for index position[i] to a value within the range defined by the upper and lower limits.	
digital output [i]	Type the digital output number (1~512).	The digital output number specifies which digital output to be turned on when the index axis is at the designated position. **NOTE** The specified digital output number should correspond to a valid connection to I/O hardware.	
joint speed % [i]	1 - 100%		

Table D–4.   **Positioner Setup Configuration Information**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Direction Setting Only if used with a Positioner	1: +X 2: -X 3: +Y 4: -Y 5: +Z 6: -Z	Select the direction of linear or rotary motion relative to the frame you want to establish for the positioner device; this is not necessarily aligned with the robot WORLD frame. For example, the first axis of the positioner could be defined as +z, but could be aligned with the robot x-axis. Refer to the *Coordinated Motion Setup and Operations Manual* for more information.	

Table D–4. **Positioner Setup Configuration Information (Cont'd)**

You Must Answer These Questions	You Have These Choices	Comments	Write Your Answer Here
Offset Setting Only if kinematics is used with a Positioner.	Enter Offset X (mm)? Enter Offset Y (mm)? Enter Offset Z (mm)?	**NOTE** Axis 1 has a value of 0 for the x, y, and z offsets. Each of axes 2, 3, and so forth will have non-zero offset values.	
D-H Parameter Setting Only if known kinematics is used with a General Positioner.	Enter A[i] (mm)? Enter ALPHA[i] (deg)? For rotary axis: Enter D[i] (mm)? For linear axis: Enter THETA[i] (deg)? where i is the index of axis.	The default value is displayed. Refer to the *Coordinated Motion Setup and Operations Manual* for more information.	

Appendix E

BACKING UP AND RESTORING FILES

Contents

E.1 OVERVIEW

> ⚠ **Caution**
>
> **If you are updating controller software** you should first back up all program, system and application files you want saved to disks in case these files are lost during the update. **If these files are lost during the update** , you can load these files back into the controller from the disks.

Note FTP can be used to transfer controller memory files over an Ethernet network. The Trivial File Transfer Protocol (TFTP) can be used to load controller memory files onto the controller via an Ethernet network. Refer to the *Internet Options Setup and Operations Manual* for more information.

Note You can perform a backup to the UT1: device but you can not use UT1: to perform a full load or an Auto Update.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

E.2 BACKING UP FILES

You can *back up* program, system, application, error log, and diagnostic files to valid media using the FILE screen. When you back up a file you save it from controller memory to storage media so that you have a second copy of the file.

Note To back up all memory on the controller, use the Image Backup function. Refer to Section E.3 .

Program Files

When you back up program files, all teach pendant program files currently loaded onto controller memory (listed on the SELECT menu) and default motion instruction files (DF_xxxx.DF)will be saved to the default device: RAM disk, memory card, or USB memory stick.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

System Files

System files are binary files that store values for system variables, servo parameter data, and mastering data. They contain information specific to the controller, robot, and software. When you backup system files, all system variable, servo parameter, and mastering data currently on controller memory is saved to the default device.

There are several system files (file type .SV). Refer to the application-specific *Setup and Operations Manual* for information on the system files used in your application. When you back up system files, all system files are copied to the default device.

Application Files

Application files are all program variable files and other application files. Refer to the application-specific *Setup and Operations Manual* for information on the application files used in your application.

Application Teach Pendant Program Files

Application teach pendant program files are teach pendant program files with file type .TP, .DF, or .MN. The names of the application teach pendant files are stored in the system variable $FILE_AP2BCK.

Error Log Files

Error log files are ASCII files that give a snapshot of the errors in the system. They can be backed up to the default device, but cannot be restored or loaded into the controller. Two kinds of error log files are backed up: ERRALL.LS and ERRACT.LS. In addition, depending on the options installed on your controller, there are other error log files that can be backed up. Refer Table E–1 to for descriptions of these files.

Table E–1. Error Log Files

File	Description	Menu
ERRALL.LS	Contains a snapshot of the history of errors in the system	ALARM, [TYPE], Alarm Log, Hist menu
ERRACT.LS	Contains a snapshot of the active errors in the system	ALARM, [TYPE], Alarm Log, Active menu

The information in an error log file follows a specific format, which is shown as follows. The first line is the error log *header* , and subsequent lines are *error entries*.

```
Header:
S1:\ERR_ALL.LS Robot Name PALROB   Time: 17:21:26
08/28/xx
```

The **header** consists of the error log file name, robot host name, the name of the currently selected program or file, and the current system time and date.

```
Error Entry:
255" 10-SEP-xx 10:35 "   SRVO-154 HVAL(CNV-DC)
alarm
(G:1 A:4)" "   SERVO"  act  "
```

Each **error entry** consists of the following:

- Sequence number - internal system number that identifies a particular error in the error log

- Date and time

- Error facility name

- Error code number

- Error code message

- Cause code message, if applicable

- Severity text

- Active/inactive status of the alarm, for ERRALL.LS only - indicates whether the alarm is currently active. "act" indicates that the alarm is currently active. No text indicates that the alarm is not active.

Diagnostic Files

Diagnostic files are ASCII files that provide you with a snapshot of the special diagnostic files on the memory device. Diagnostic files are the files with extension .DG. The names of the diagnostic files are stored in the system variable $FILE_DGBCK. The first three elements of this system variable are, by default, set to:

- config.dg

- status.dg

- system.dg

Remaining elements are, by default, uninitialized and you can set these elements to specific diagnostic file names to be backed up. In addition, depending on the options installed on your controller, there are other diagnostic files that can be backed up. Refer to Table E–2 for descriptions of the diagnostic files that can be backed up from the File Backup menu.

Table E–2. Diagnostic Files

File	Description	Menu
CONFIG.DG	Contains a summary of general configuration information.	None
STATUS.DG	Contains a summary of general status information.	None
SYSTEM.DG	Contains a summary of the system status information like I/O status, Ethernet status, and so forth.	None

Backdate.dt

This file is created and saved on the default device when System files Backup, Application Backup, and All of above Backup is performed. This file contains information about the date and time of the file backup and information about the software version and software options loaded on the controller.

Use Procedure E-1 to back up files.

Procedure E-1   Backing Up System Files, TP Programs, Application Files, Error Log Files, and All Files

> **⚠ Caution**
>
> Before you connect an external device to the controller, turn on the controller, then connect and turn on the device; otherwise, equipment could be damaged.

Conditions

- **If you are backing up files to a memory card or USB memory stick,** the memory card or memory stick is installed properly. Refer to

   Note The memory card interface is not available on the R-30*i*B Mate Controller.

   Procedure 4-4 .

- The default device is set correctly. Refer to Section 4.2.3 .

Steps

1. Press MENU.

2. Select FILE.

3. Press F1, [TYPE].

4. Select File.

5. Press F4, [BACKUP].

6. **To back up only system files,** select System files. You will see a screen similar to the following.

```
Save MC:\DIOCFGSV.IO?
```

   The first system file name in the system variable $FILE_SYSBCK will be displayed.

7. Back up the specified files:

   - **To back up this system file only**, press F4, YES.

   - **If you do not want to back up this system file**, press F5, NO. The next system file name in controller memory will be displayed.

   - **To back up all system files**, press F3, ALL. If the file already exists, then you will have the option to overwrite, skip, or cancel.

   - **To exit**, press F2, EXIT.

8. **To back up only teach pendant program files,** select TP Programs.

The first program name in controller memory (the SELECT menu) will be displayed.

- **To back up this program only**, press F4, YES.

- **If you do not want to back up this program**, press F5, NO. The next program name in controller memory will be displayed.

- **To back up all teach pendant programs,** press F3, ALL. If the file already exists, then you will have the option to overwrite, skip, or cancel.

- **To exit,** press F2, EXIT.

9. **To back up only application files other than Teach Pendant program files, select Application.**

The first application file name in the $FILE_APPBCK system variable will be displayed.

- **To back up this application file only**, press F4, YES.

- **If you do not want to back up this application file**, press F5, NO. The next application file name in controller memory will be displayed.

- **To back up all application files**, press F3, ALL. If the file already exists, then you will have the option to overwrite, skip or cancel.

- **To exit**, press F2, EXIT.

10. **To back up only application teach pendant program files (.TP, .DF, .MN),** select Applic.-TP.

The first application teach pendant program name in the $FILE_AP2BCK system variable will be displayed.

- **To back up this program only**, press F4, YES.

- **If you do not want to back up this program**, press F5, NO. The next program name in controller memory will be displayed.

- **To back up all application teach pendant programs,** press F3, ALL. If the file already exists, then you will have the option to overwrite, skip or cancel.

- **If you are using the CRT/KB to back up the teach pendant program and the program is being edited by another device,** then you will have the option to continue, skip, or cancel. Press F3, to continue and the system will try to back up the program again; press F4, Skip, to select the next file to be backed up; and press F5, Cancel to abort the rest of the backup.

- **To exit,** press F2, EXIT.

11. **To back up only error log files,** select Error log.

The first error log file name in the system variable $FILE_ERRBCK will be displayed.

- **To back up this error log file only**, press F4, YES.

- **If you do not want to back up this error log file,** press F5, NO. The next error log file name from the system variable $FILE_ERRBCK will be displayed.

- **To back up all error log files (from $FILE_ERRBCK),** press F3, ALL. If the file already exists, then you will have the option to overwrite, skip, or cancel.

- **To exit,** press F2, EXIT.

12. **To back up only Diagnostic files,** select Diagnostic. The first diagnostic file name in the system variable $FILE_DGBCK will be displayed

  - **To back up this Diagnostic file only,** press F4, YES.

  - **If you do not want to back up this Diagnostic file,** press F5, NO. The next error log file name from the system variable $FILE_DGBCK will be displayed.

  - **To back up all Diagnostic files (from $FILE_DGBCK)**, press F3, ALL. If the file already exists, then you will have the option to overwrite, skip or cancel.

  - **To exit**, press F2, EXIT.

13. **To back up all types of files,** select All of above. You will see the following message displayed at the bottom of the screen.

```
Delete MC: backup all files?
```

Note All files on the storage media are deleted before this type of backup. If the destination device is networked, files will not be deleted. The file number and total number of files are displayed during backup.

```
Backing up SYSVARS.SV  (8/21)
```

- **If you do not want to delete the files on the default device but you do want to back up the files** , press F5, NO. If you have SpotTool+ for example, you will be asked the following question:

```
No delete but backup all files to MC:?
```

If you do not want to delete the files but still back up the files, press F5, YES. The files will be backed up which will write over any files with the same name that already exists on the device.

If you do not want to delete the files on the default device or back up the files, press F5, NO. The files will not be backed up.

- **If you want to delete the files on the default device and back up the specified files** press F4, YES. All files in the $FILE_SYSBCK, $FILE_APPBCK, and $FILE_ERRBCK system variables will be backed up. All .TP and .DF files will also be backed up.

Note If an error occurs while the files are being saved, you will be prompted with a message and asked if you want to proceed. With certain errors, the only option will be to Cancel. Follow the prompt and alarm messages to correct the condition.

When the backup is complete, the FILE menu will be displayed and you can display a directory of the default device by pressing DIR. In addition, a date and time file called BACKDATE.DT will be created on the default device. This file contains the date and time the backup of all files was performed.

Note For information on backing up controller files, refer to the *Internet Options Setup and Operations Manual*.

Note If you are using the CRT/KB to back up a teach pendant program, and the teach pendant program is being edited by another device (such as the teach pendant), then you will have the option to continue, skip, or cancel as follows:

— F3, Continue, will retry backing up the teach pendant program.

— F4, Skip, will select the next file to be backed up.

— F5, Cancel will abort the rest of the backup.

14. **To restore backup files,** you must load them. Refer to .

E.3 IMAGE BACKUP

E.3.1 Overview

The Image Backup feature allows you to make an image of the F-ROM and S-RAM controller memory modules. The image is stored in a number of files (*.img) on a selected destination device.

Image Backup is available from the FILE menu when the system is in Cold start or Controlled start mode. After Image Backup is selected from the menu, the actual backup occurs the next time the controller is powered up.

The image created can later be used to restore the controller memory. The restore is also done during power up. If F1 and F2 are pressed while the controller is powering up, a menu is displayed that allows you to restore a previously saved image.

The following details must be considered when you use Image Backup:

- When TFTP: is selected, files are stored in the root directory of the device. The relationship between the Mac address and the directory should be configured on the server side.

- The FILE menu might not be automatically displayed after the image backup if another function forces a different menu on powerup.

- The automatic software update function precedes this function. Automatic software update may start software installation automatically at next startup even if the start up was caused by the image backup function. Software installation will occur and image backup will not be performed.

- If the F1 and F5 keys are pressed when the controller is turned on, image backup does not begin and the BOOT MONITOR menu is displayed. Image backup can be started by cycling power (FCTN:CYCLE POWER).

- If the F1 and F2 keys are pressed when the controller is turned on, the image backup does not begin and the restore menu (Section E.3.3) is displayed instead. Image backup can be started by cycling power (FCTN:CYCLE POWER).

- If an image from one controller is restored on another controller, the controller will post OPTN-027 alarms on cold start. The ReSerialization screen is where parameters are entered to eliminate OPTN-027 alarms. Contact your FANUC America Corporation technical representative for details.

> ⚠ **Caution**
>
> Do not turn off power while the image backup is occurring. Otherwise, the backup might not be performed correctly and you could lose data.

E.3.2 Performing an Image Backup

Procedure E-2 Performing an Image Backup

Conditions

- The controller is powered up in Controlled start or Cold start mode.

- A memory card is installed, a USB memory stick is installed, or TFTP is set up.

  Note The memory card interface is not available on the R-30*i*B Mate Controller.

1. Press MENU.
2. Select FILE.
3. If using MC: or UD1: select the device and sub-directory. If using TFTP: you will be prompted later on.
4. Press F4, [BACKUP].

```
FILE                            JOINT  10 %
MC:\*.*                                 1/25
  1
  2 *          KL   (a------------------
  3 *          CF   (a|1 System files  |
  4 *          TX   (a|2 TP program    |
  5 *          LS   (a|3 Application   |
  6 *          DT   (a|4 Applic.-TP    |
  7 *          PC   (a|5 Error log     |
  8 *          TP   (a|6 Diagnostic    |
  9 *          MN   (a|7 All of above  |
 10 *          VR   (a|8 Image backup  |
Press DIR to generate ----------+     +-
```

5. If the teach pendant is disabled when Image backup is selected, the following prompt is displayed.

```
Enable TP for image backup.
```

If not, the destination device selection menu is displayed as shown below.

```
                         JOINT 10%
 1 Current Directory
 2 Ethernet (TFTP: )

MC:\*.*                                 1/25
  1
  2 *          KL   (a------------------
  3 *          CF   (a|1 System files  |
  4 *          TX   (a|2 TP program    |
  5 *          LS   (a|3 Application   |
  6 *          DT   (a|4 Applic.-TP    |
```

6. Image backup files will be stored in the current directory of the selected device. If the device is MC: or UD1: and it already includes image files (*.IMG), the following confirmation message is displayed:

```
Remove existing IMG files?
                      Yes    No
```

If the destination is TFTP:, this confirmation is always displayed.

Note If destination is TFTP:, *.IMG files are always overwritten.

7. If you select No, the image backup will be aborted. Otherwise, you must cycle power on the controller:

- If the system is in Cold start mode, power can be automatically cycled. The following prompt will be displayed:

```
Cycle power?
                         OK     Cancel
```

- If the system is in Controlled start mode, power must be manually cycled. The following prompt will be displayed.

```
Cycle power is needed. OK?
                         OK     Cancel
```

8. Press OK. If the system was in Cold start mode, the controller will be automatically turned off and then on again. If the system is in Controlled start mode, the following message is displayed:

```
 Please cycle power
```

a.   Press FCTN.

b.   Select CYCLE POWER.

9. On power up, the image backup starts automatically. A screen similar to the following is displayed:

```
WRITING MC:\FROM00.IMG
WRITING MC:\FROM01.IMG
......
WRITING MC:\SRAM02.IMG
DONE!
```

> ⚠️ **Caution**
>
> If the destination device is MC:, do not remove the memory card during the image backup.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

Note If the destination device is TFTP, preparation for TFTP image backup must be completed before cycling power. Make sure communication between the robot controller and server is established during image backup.

10. After image backup is completed, or if an error occurs, the controller completes its usual startup sequence. When the startup is complete, one of the following screens is displayed:

```
FILE                         JOINT  10 %
MC:\
  *.*                              1/25
Image backup completed successfully.
                         OK
```

```
FILE                         JOINT  10 %
MC:\
  *.*                              1/25
Image backup failed.
                  OK
```

11. When OK is pressed, the file screen is automatically displayed.

12. If the backup fails, the alarm SYST-223 "Image backup failed(0x%x)" is posted in the alarm log. (0x%x) shows the cause of the failure.

E.3.3 Restoring an Image Backup

Note Stored within the image is the hardware serial number of the controller that was used to produce the image. If this image is restored on a different controller, an OPTN-027 alarm (ID Mismatch) will be posted on every COLD start. To stop OPTN-027 alarms from being posted, the ID of the image must be changed to match the new ID of the controller. Contact FANUC America Corporation for full details.

Procedure E-3   Restoring an Image Backup

Conditions

- The controller is powered up in Controlled start or Cold start mode.

- A memory card is installed, or TFTP is set up. Refer to Procedure 4-4 for more information.

    Note The memory card interface is not available on the R-30*i*B Mate Controller.

1. Press F1 and F2 while turning on the power disconnect circuit breaker. The following screen is displayed.

```
******* BMON MENU ******
1. Configuration menu
2. All software installation(MC:)
3. INIT start
4. Controller backup/restore
5. Hardware diagnosis
6. Maintenance
7. All software installation(Ethernet)
8. All software installation(UD1:)
```

2. Select Controller backup/restore and press ENTER. You will see a screen similar to the following.

```
******* BACKUP/RESTORE MENU ******
0. Return to MAIN menu
1. Emergency Backup
2. Backup controller as Images
3. Restore Controller Images
4. Bootstrap to CFG MENU
```

3. Select Restore Controller Images and press ENTER. You will see a screen similar to the following.

```
** RESTORE Controller Images ****
1. Memory card(MC:)
2. Ethernet(TFTP:)
3. USB(UD1:)
4. USB(UT1:)
```

4. Select Memory card (MC:) or USB (UD1:) and press ENTER. You will see a screen similar to the following.

```
***** RESTORE Controller Images *****
 Current module size:
    FROM: 32Mb
    SRAM: 3Mb
 CAUTION: You SHOULD have image files
   from the same size of FROM/SRAM.
   If you don't, this operation causes
   fatal damage to this controller.
   Are you ready ? [Y=1/N=else] :
```

> ⚠️ **Caution**
>
> The following operation erases all of SRAM and FROM. Be sure you are
> prepared to erase all of SRAM and FROM before you execute in Step 5 .

> ⚠️ **Caution**
>
> Do not turn off the controller until the Image Restore is complete. Turning
> off controller power during the startup sequence might cause another
> image backup to occur when the power is turned on again.
>
> Do not perform an image restore if the FROM/SRAM module is NOT on
> the main board.

5. **If you want to continue**, press 1 and then press ENTER.

    To cancel, press 0 and then press ENTER.

    Restoring will take several minutes (approximately 3–6 minutes). You will see messages
    displayed on the screen stating that SRAM and FROM are being cleared and that files are being
    loaded. You will see a screen similar to the following.

```
Reading MC:\FROM25.IMG  ... Done
Reading MC:\FROM26.IMG  ... Done
Reading MC:\FROM27.IMG  ... Done
Reading MC:\FROM28.IMG  ... Done
Reading MC:\FROM29.IMG  ... Done
Reading MC:\FROM30.IMG  ... Done
Reading MC:\FROM31.IMG  ... Done
Reading MC:\SRAM00.IMG  ... Done
Reading MC:\SRAM01.IMG  ... Done
 -- Restore complete --
Press ENTER to return >
```

6.　When all of the files have been loaded, the controller will display the Main BMON menu.

7.　Select Configuration Menu, and then select Cold Start to perform a Cold start of the controller.

E.4   AUTOMATIC BACKUP

E.4.1   Overview

An Automatic Backup can be set to run at a predetermined time. Refer to .

E.4.2   Automatic Backup

E.4.2.1   Overview

The Automatic Backup function performs the function of **All backup** in the FILE menu automatically at the following times:

- The specified time (Up to 5 settings).
- When the specified DI is turned on.
- At controller startup. (An interval can be specified.)

There is a special area for Automatic Backup in the controller F-ROM (FRA:). You do not need an external device to use Automatic Backup, but a memory card can also be used.

Note The memory card interface is not available on the R-30*i*B Mate Controller.

The Automatic Backup function can manage many backup versions on one device. Even if you back up the wrong programs or settings, you can load the previously backed up version. The number of versions to keep can be set from 1 up to 99. (The default is 2.)

If a memory card is used as the backup device, it must be initialized for Automatic Backup. If the Memory Card is not initialized for Automatic Backup, the Automatic Backup function will not write to the Memory Card. There is no concern about accidentally writing to the wrong memory card. USB is not supported for Automatic Backup.

If the controller power is down during Automatic Backup, backup is performed at the next startup. If you cancel the backup, or if an error occurs in backup, the latest version of backup is recovered automatically. The backup device never has incomplete backup files.

Table E–3. Automatic Backup Setup Items

ITEM	DESCRIPTION
Automatic Backup	This item indicates whether Automatic Backup is enabled or disabled.
Device	This item indicates what device will be used to store the backups. If it is set to Backup (FRA:), an area in F-ROM will be used. If it is set to Mem Card (MC:), backups will be saved to a memory card. **Note** The memory card interface is not available on the R-30*i*B Mate Controller.
Sub directory	This item indicates the sub-directory (or path) that will be used on the device. It is a one to eight character name that you choose. **Note** If you are using the Memory Card for backups, it is strongly recommended that a sub-directory is set and used. There is a potential for getting a "Directory Full" alarm if a sub-directory is not used.
Status	This item indicates the current status of the device to be used for Automatic Backup. This will be either Ready for Automatic Backup or Device is not Ready.
Backup time n	This item indicates the times at which the Automatic Backup is to be performed. Up to five settings can be specified. To clear a setting, press F4, CLEAR.
Backup at DI rising	This item allows the Automatic Backup to be performed when the specified digital input is turned on. If the setting is 0, this item is disabled.
Backup at Powerup	This item, when enabled, starts the Automatic Backup when the controller is turned on.
Interval	This item indicates the interval at which backup at powerup will be performed.
Backup in progress	This digital output turns on when the backup is being performed. f the setting is 0, this item is disabled.
Error occurs at backup	This digital output turns on when an error occurs during Automatic Backup. If this setting is 0, this item is disabled.
Maximum number of versions	This item indicates the maximum number of Automatic Backup versions that are stored.
Loadable version	This item indicates the date of the currently selected backup version on the device.

Use Section E.4.2.2 to set up Automatic Backup optional devices and intervals.

E.4.2.2 Setting Up Automatic Backup

Procedure E-4 Setting up Automatic Backup

1. Press MENU.

2. Select FILE.

3. Press F1, [TYPE].

4. Select Auto Backup. You will see a screen similar to the following.

```
AUTO BACKUP JOINT 100%                   1/ 13
 1 Automatic Backup:           ENABLE
 2 Device:              Backup (FRA:)
 3   Sub directory            [        ]
     Status: Ready for auto backup
Backup Schedule-----------------------
 4 Backup time 1:                 12:00
 5 Backup time 2:                 23:30
 6 Backup time 3:                 **:**
 7 Backup time 4:                 **:**
 8 Backup time 5:                 **:**
 9 Backup at DI rising:     DI[    0]
10 Backup at Power up:        DISABLE
11   Interval:             7 Day
Status Output--------------------------
12 Backup in progress:      DO[    0]
13 Error occurs at backup:   DO[    0]
Version Management--------------------
14 Maximum number of versions:       1
15 Loadable version:    xx/xx/xx 12:00
```

   Note To use a memory card for Automatic Backup, the memory card must be initialized for Automatic Backup. This is to prevent writing to other memory cards. The status of the device is displayed in the Status: line on the teach pendant screen.

5. Initialize the device by doing the following:

   a. If the device is a memory card, it must be formatted. Format the device in the FILE menu. Refer to Section 4.2.6 .

   b. Press F2, INITDEV. The message, "Initialize the device for auto backup?" is displayed.

   c. Press F4, YES. The message, Enter number of versions to keep:" is displayed.

   d. Type the number of incremental backup versions to be stored.

      Note INITDEV deletes all files in the device and creates special files and directories. INITDEV does not format the device. Use the FILE menu to format the device.

6. Set each item as desired. Refer to Table E–3 .

E.4.2.3 Performing an Automatic Backup

When the specified condition is satisfied, Automatic Backup will be performed. When this occurs, you will see a screen similar to the following.

```
AUTO BACKUP             JOINT 100% 1/9
  Automatic Backup in progress
            Please wait
            Device:  FRA:
To stop backup, press [PREV] key
Saving MC:SYSVARS.SV (3/48)
```

When Automatic Backup is complete, the previously displayed menu will be displayed again.

To cancel the Automatic Backup, press the PREV key. Automatic Backup is cancelled and the previous menu is displayed. No other key besides PREV will be accepted during the Automatic Backup. Even if you are using the teach pendant when Automatic Backup is performed, this menu is displayed and no other key besides PREV will be accepted. Wait for Automatic Backup to complete.

Automatic Backup can work even if a program is running. If the status DO for in progress is set, the specified DO is turned on while this menu is displayed.

If an error occurs, you will see a screen similar to the following.

```
AUTO BACKUP             JOINT 100% 1/9
  Error occurred at Automatic Backup!
Check device (FRA:)
To stop backup, press [PREV] key.
```

When this screen is displayed, the system is not in an Alarm Status and program execution is not stopped. Press F5, RETRY, to perform the backup again. Press PREV to cancel the backup and exit this menu. If the status DO for error occurring is set, the specified DO is turned on while this menu is displayed.

E.4.2.4 Version Management

The Automatic Backup function can keep many backups on one device. The number of versions to keep is set when the device is initialized. You can change the number of versions to keep by setting the item "Maximum number of versions." During backup, if the number of versions exceeds the specified number, the oldest version is deleted automatically.

If the device is FRA:, and the free area of F-ROM is not enough, the oldest version is deleted automatically even if the version number is smaller than the specified number. If the device is MC:, and the free area is not enough to backup, an error occurs at backup. If an error occurs because the device is full, reduce the setting of "Maximum number of versions". The old versions are deleted by this operation and you can continue to back up.

Note The versions that are deleted by decreasing the number of versions are not recovered even if you increase the number of versions later.

Backups are stored in individual sub directories. When Automatic Backup is performed, backup files are saved to the root directory, then these files are copied to the appropriate sub-directory. The FILE menu can access the files only in the root directory, so the latest version of backup can be loaded using the FILE menu. You can also load the older versions. (Refer to Section E.4.2.5 .)

When "all backup" is performed in the FILE menu to the device that is initialized for Automatic Backup, the files are copied to the appropriate sub directory the same as Automatic Backup.

If Automatic Backup is cancelled, the files of the current backup are deleted and the latest version of backup is copied to the root directory automatically.

E.4.2.5 Restoring the Automatic Backup

Backup files saved by Automatic Backup can be loaded using the FILE menu. Usually the latest version of backup is in the root directory and that version can be loaded. You can load the previous version by the following operation.

Procedure E-5 Restoring the Automatic Backup

1. Press F4, [CHOICE] on the "Loadable version" item. See the following screen for an example. The menu that contains the backup time of all versions on the device is displayed.

```
1 99/06/1612:00        5 99/06/1412:00
2 99/06/1523:30        6 99/06/1323:30
3 99/06/1512:00        7 99/06/1312:00
4 99/06/1423:30        8 --Next Page--
AUTO BACKUP
Version Management--------------------
13 Maximum number of versions:1
14 Loadable version: xx/06/1612:00
```

2. Select the version to load, then the item "Loadable version" shows the time of the selected version. At this time, the files of the selected version of backup are copied to the root directory.

3. You can load the files of the selected version using the FILE menu.

E.5 TROUBLESHOOTING FILE BACKUP OR AUTOMATIC BACKUP ERRORS

The file system on the robot controller only allows a total of 255 files to be saved in the root directory of any file device like a memory card or USB memory stick. The actual number of user files that can be saved is slightly less since the file system actually stores a few files in the root directory. This can inhibit an Automatic backup or File Backup from completing successfully if the number of files in the backup set is very large. This usually will result in errors when doing the Automatic Backup or file backup. Typically you will see the following message displayed on the teach pendant during the Automatic Backup or File backup operations, when this problem occurs:

```
Cannot backup file MC:\filename.xx
```

(where filename.xx is a valid file on the controller), or

```
Cannot backup file UD1:\filename.xx
```

SKIP and CANCEL function keys will also be displayed on the teach pendant, but will not resolve the problem.

If you have a PC available when this occurs, format the media as FAT32 format type, then try the operation again. FAT32 allows more than 255 files in the root directory of a device. You can also format the media as FAT32 using the controller. Refer to Section 4.2.6 .

If you do not have a PC available when this error occurs, perform Procedure E-6 .

Procedure E-6 **Resolving Backup or Automatic Backup Errors without using a PC**

Condition

- You are performing a FILE backup or Automatic Backup procedure but more than 255 files exist on the backup set.

  Note Be sure that the errors are not occurring because the media to which you are performing the backup is full. If the device is full, delete files from it or obtain a larger device before trying the backup operation again.

- **If you are backing up files to a memory card or USB memory stick,** the memory card or memory stick is installed properly. Refer to Procedure 4-4 .

  Note The memory card interface is not available on the R-30*i*B Mate Controller.

- The default device is set correctly. Refer to Section 4.2.3 .

1. Create a sub-directory on the memory device with an appropriate name (such as BACKUP). This can be done from the FILE Menu, on the teach pendant as follows:

   a. Press MENU.

   b. Select FILE.

   c. Press [UTIL].

   d. Choose Set Device.

   e. Select either Memory Card (MC:) or USB Memory Stick (UD1:).

      Note The memory card interface is not available on the R-30*i*B Mate Controller.

   f. Create a sub-directory, called BACKUP for example, by pressing [UTIL] again and then by choosing Make Dir from the menu.

   g. Type the directory name.

2. **If you are using Automatic Backup,** set the system variable $AUTOBACKUP.$DEVICE to MC:\BACKUP\ or UD1:\BACKUP from the system variable screen by doing the following:

   a. Press MENU.

   b. Select SYSTEM.

   c. Select Variables.

   d. Move the cursor to $AUTOBACKUP.

   e. Press DETAIL.

   f. Enter MC:\BACKUP\ if you are using an memory card or UD1:\BACKUP\ if you are using a USB Memory Stick.

      Note The memory card interface is not available on the R-30*i*B Mate Controller.

g. Press MENU.

h. Select FILE.

i. Press F1, [TYPE].

j. Select Auto Backup.

k. Select [INIT_DEV]. The memory card or USB Memory stick is now prepared for Automatic Backup of more than 255 files.

   Note The memory card interface is not available on the R-30*i*B Mate Controller.

3. **If you are using Backup, All of the Above,** and if you have just completed Step 1 then the directory that you created will already be selected and you can skip this step. If not, then perform the following operations to select the directory:

   a. Press MENU.

   b. Select FILE.

   c. Press [DIR].

   d. Select Directories or *.*.

   e. Move the cursor to the desired directory and then press ENTER.

4. Complete the backup by selecting [BACKUP] on the FILE screen.

5. Select All of the above from the menu. The backup of all of the files should complete successfully.

E.6 LOADING OR RESTORING FILES FROM EXTERNAL STORAGE TO CONTROLLER MEMORY

Loading or restoring files allows you to load a file and all of its relevant data from disk into controller memory. You can load files into controller memory from one of the following file devices:

- Flash File Storage disk

- RAM disk

- Memory card/ATA Flash File storage and SRAM memory cards

- USB Memory Stick Device

   Note The memory card interface is not available on the R-30*i*B Mate Controller.

Loading Files

Typically, you **load** a file when

- You want to modify a program (teach pendant program file, .TP) that is not currently in controller memory.

- You want to execute a file (teach pendant program file, .TP, or KAREL p-code file, .PC).

- You want to load variable information the system needs to function (system variable file, .SV).

- You want to load variable information required for a KAREL program (.VR file).

- You want to load saved I/O configuration (.IO file).

- You want to load saved default motion instructions (.DF file).

Loadable Files

Loadable files are those files that can be loaded into controller memory. They are

- Teach pendant program files (.TP)

- KAREL p-code files (.PC)

- System variable files (.SV)

- Mnemonic files (.MN)

- Variable files (.VR)

- I/O configuration files (.IO)

- Default motion instruction files (.DF)

  Note Some system files can be loaded only at Controlled start. Refer to Appendix A for more information.

Only these types of files can be loaded into controller memory. You can load a single file or a group of files. Use Procedure E-7 to load files using the FILE menu.

Restoring Files

You **restore** files from a disk when you have previously backed up the files using BACKUP on the FILE screen (Procedure E-8). You can restore the following groups of files if you have previously backed them up using BACKUP:

- System files

- Teach pendant programs

- Application files

Use Procedure E-8 to restore BACKUP files using the FILE menu. This procedure will restore all files on the default device that were backed up using the BACKUP command. Refer to Section E.2 for more information on backing up files.

> ⚠ **Caution**
>
> When you load or restore the file FRAMEVAR.VR, SYSVARS.SV, SYSFRAME.SV or SYSMAST.SV, make sure the motion configuration (items such as the number of motion groups and extended axes) of your system is the same as the motion configuration of the system on which the FRAMEVAR.VR, SYSVARS.SV, or SYSMAST.SV files were created. Otherwise, you might not be able to load or restore this file on an improperly configured system.

Note Variable files from an R-J3, R-J3*i*B, or R-30*i*A controller cannot be restored on an R-30*i*B or R-30*i*B Mate controller.

Procedure E-7 Loading Files Using the FILE Menu

> ⚠ **Caution**
>
> Before you connect an external device to the controller, turn on the controller, then connect and turn on the device; otherwise, you could damage the equipment.

Conditions

- The default device is set correctly. Refer to Section 4.2.3 .

- **If you are restoring files from memory card or USB memory stick**, the memory card or memory stick is installed in the appropriate interface.

    Note The memory card interface is not available on the R-30*i*B Mate Controller.

Steps

1. Press MENU.

2. Select FILE.

3. Press F1, [TYPE].

4. Select File.

5. **To load a single file:**

    a. Generate a directory of the disk that contains the file you want to load.

    b. Move the cursor to the name of the file you want to load and press F3, LOAD. You will see a screen similar to the following.

```
Load MC:\PROG1.TP?
```

> ⚠ **Caution**
>
> When you load or restore the file FRAMEVAR.VR, SYSVARS.SV, SYSFRAME.SV, or SYSMAST.SV, make sure the motion configuration (items such as the number of motion groups and extended axes) of your system is the same as the motion configuration of the system on which the FRAMEVAR.VR, SYSVARS.SV, or SYSMAST.SV files were created. Otherwise, you might not be able to load or restore this file on an improperly configured system.

Note Variable files from an R-J3, R-J3*i*B, or R-30*i*A controller cannot be restored on an R-30*i*B or R-30*i*B Mate controller.

6. Load the file(s):

- **To load the file(s) you selected,** press F4, YES.

- **If you do not want to load the file(s) you selected,** press F5, NO.

7. If the program already exists:

8. To overwrite , press F3, OVERWRITE.

- **To skip** the file, press F4, SKIP.

- **To cancel** , press F5, CANCEL.

Procedure E-8 Restoring BACKUP Files Using the FILE Menu at a Controlled Start

> ⚠ **Caution**
>
> Before you connect an external device to the controller, turn on the controller, then connect and turn on the device; otherwise, you could damage the equipment.

Conditions

- **If you are restoring files from memory card or USB memory stick,** the memory card or memory stick is installed in the appropriate interface.

  Note The memory card interface is not available on the R-30*i*B Mate Controller.

- The device from which you want to restore files is set as the default device. Refer to Section 4.2.3 .

Steps

1. Perform a Controlled start.

   a. **If the controller is turned on** , turn it off.

b. **Immediately press and hold,** PREV and NEXT keys on the teach pendant, and turn the power disconnect circuit breaker to ON. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- CONFIGURATION MENU ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

2. Type 3 and press ENTER.

If you have **ArcTool** , you will see a screen similar to the following.

```
ARCTOOL SETUP                CONTROLLED START MENUS
1   F number                  F00000
    Equipment:                1
2   Manufacturer:             General Purpose
3   Model:                    MIG (Volts, WFS)
Press FCTN then START (COLD) when done
```

If you have **DispenseTool** , you will see a screen similar to the following.

```
SEAL CONFIG              CONTROLLED START MENUS
DispenseTool Application Configuration
   EQ: 1
1   F number                  F00000
2   Number of equipment:      1
3   Number of guns:           1
4   Equipment type: ISD DOUBLE ACT METER
5   Atomizing air:            DISABLE
6   Remote start:             DISABLE
7   Automatic purge:          DISABLE
8   Bubble detected:          DISABLE
9   Linear 2P Calibration:    DISABLE
10  Channel 2 analog output:  DISABLE
Press FCTN then START (COLD) when done
```

If you have **HandlingTool** , you will see a screen similar to the following.

```
Tool Setup              CONTROLLED START MENUS
1   F Number:                   F00000
2   KAREL Prog in Select Menu: YES
3   Remote Device:             UserPanel
4   Password Oper. full menus: NO
5   Intrinsically Safe TP:     NO
Press FCTN then START (COLD) when done
```

If you have **PaintTool** , you will see a screen similar to the following.

```
PaintTool Setup            CONTROLLED START MENUS
1  F Number:                  F00000
2  Version :V5.xx>Project:
3  Engineer:FANUC Date:       xx/xx/xx
4  Robot Number:              1
5  Zone Number:               Zone #1
6  Applicator Type:           Gun
   I/O Configuration:         Standard
7  Cell I/O Hardware:         Memory
8  Process I/O Hardware:      Memory
9  No. of System Colors:      35
10 No. of Color Valves:       31
Press FCTN then START (COLD) when done
```

If you have **SpotTool**+ , you will see a screen similar to the following.

```
SPOT CONFIG             CONTROLLED START MENUS
1 F Number:                   F00000
2 Load Spottool Macros:       DISABLED
3 Number of equipments:       1
  Weld interface:             DIGITAL
4 Number of weld controllers: 1
5 Current equipment:          1
6   Number of guns:           1
7   Studwelder:               DISABLED
8      Enable Backup gun:     DISABLED
9   Tool changer gun:         DISABLED
Press FCTN then START (COLD) when done
```

   3.   Press MENU.

   4.   Select File.

   5.   Press F5, [UTIL].

   6.   Select Set Device.

7. Move the cursor to the device you want to select and press ENTER.

```
FILE
MC:\*.*
```

8. Press F4, [RESTOR]. **If F4, [BACKUP] is displayed** , press FCTN and then select RESTORE/BACKUP to display F4, [RESTOR].

9. To restore system files, select System files. You will see a screen similar to the following.

```
Restore from media (OVRWRT)?
```

> ⚠️ **Caution**
>
> In the next step, backed up files will be loaded and will overwrite existing files of the same name. Be sure you want to overwrite existing files before you restore them; otherwise, you could lose important data.

> ⚠️ **Caution**
>
> When you load or restore the file FRAMEVAR.VR, SYSVARS.SV, SYSFRAME.SV or SYSMAST.SV, make sure the motion configuration (items such as the number of motion groups and extended axes) of your system is the same as the motion configuration of the system on which the FRAMEVAR.VR, SYSVARS.SV, or SYSMAST.SV files were created. Otherwise, you might not be able to load or restore this file on an improperly configured system.

Note Variable files from an R-J3, R-J3*i*B, or R-30*i*A controller cannot be restored on an R-30*i*B or R-30*i*B Mate controller.

    a. Restore the files:

- **To continue the restore** , press F4, YES.
- **To cancel the restore** , press F5, NO.

       Note To **cancel** the restore at any time, press the PREV key.

       The system will load all of the files that are listed in the $FILE_SYSBCK system variable. You will not have to convert any variable files that have been restored. Any necessary conversion will be performed automatically.

b. **If an error occurs during the restore** , the restore will pause.

- • To **skip** the current file and continue restoring the remaining files, press F4, SKIP.

- • To **cancel** the restore from this file on, press F5, CANCEL.

c. **When the restore has completed,** you will see a message reporting the number of files restored. See the following screen for an example.

```
Total 9/9 files restored
```

10. To restore .TP, .DF, and .MN files, select TP programs. You will see a screen similar to the following.

```
Restore from media (OVRWRT)?
```

> ⚠ **Caution**
>
> In the next step, backed up files will be loaded and will overwrite existing files of the same name. Be sure you want to overwrite existing files before you restore them; otherwise, you could lose important data.

a. Restore the files:

- • **To continue the restore** , press F4, YES.
- • **To cancel the restore** , press F5, NO.

b. **If an error occurs during the restore** , the restore will pause.

- • To **skip** the current file and continue restoring the remaining files, press F4, SKIP.
- • To **cancel** the restore from this file on, press F5, CANCEL.

c. **When the restore has completed,** you will see a message reporting the number of files restored. See the following screen for an example.

```
Total 8/9 files restored
```

- • The label on the F4 function key will become [BACKUP].

11. **To restore non-program application files,** select Application files. You will see a screen similar to the following.

```
Restore from media (OVRWRT)?
```

> ⚠️ **Caution**
>
> In the next step, backed up files will be loaded and will overwrite existing files of the same name. Be sure you want to overwrite existing files before you restore them; otherwise, you could lose important data.

   a. Restore the files:

- **To continue the restore** , press F4, YES.

- **To cancel the restore** , press F5, NO.

   Note To **cancel** the restore at any time, press the PREV key.

   The system will load all of the files that are listed in the $FILE_APPBCK system variable. You will not have to convert any variable files that have been restored. Any necessary conversion will be performed automatically.

   b. **If an error occurs during the restore** , the restore will pause.

- To **skip** the current file and continue restoring the remaining files, press F4, SKIP.

- To **cancel** the restore from this file on, press F5, CANCEL.

   c. **When the restore has completed,** you will see a message reporting the number of files restored. See the following screen for an example.

```
Total 3/3 files restored
```

12. **To restore application teach pendant programs (.TP, .DF, .MN) files,** select Applic.-TP. You will see a screen similar to the following.

```
Restore from media (OVRWRT)?
```

> ⚠ **Caution**
>
> In the next step, backed up files will be loaded and will overwrite existing files of the same name. Be sure you want to overwrite existing files before you restore them; otherwise, you could lose important data.

a.   Restore the application teach pendant files:

- **To continue the restore** , press F4, YES.

- **To cancel the restore** , press F5, NO.

b.   **If an error occurs during the restore** , the restore will pause.

- To **skip** the current file and continue restoring the remaining files, press F4, SKIP.

- To **cancel** the restore from this file on, press F5, CANCEL.

c.   **When the restore has completed,** you will see a message reporting the number of files restored. See the following screen for an example.

```
Total 1/2 files restored
```

- The label on the F4 function key will become [BACKUP].

13.   To restore all files, select All of above. You will see a screen similar to the following.

```
Restore from media (OVRWRT)?
```

> ⚠ **Caution**
>
> In the next step, backed up files will be loaded and will overwrite existing files of the same name. Be sure you want to overwrite existing files before you restore them; otherwise, you could lose important data.

a.   Restore the files:

- **To continue the restore**, press F4, YES.

- **To cancel the restore**, press F5, NO.

   Note To **cancel** the restore at any time, press the PREV key.

The system will load all of the files that are listed in the $FILE_SYSBCK, $FILE_APPBCK, and $FILE_AP2BCK system variables, and all .TP, .DF, and .MN files. You will not have to convert any variable files that have been restored. Any necessary conversion will be performed automatically. During the restore, you will see a screen similar to the following.

```
Loading SYSVARS.SV     (4/21)
```

    b. **If an error occurs during the restore** , the restore will pause.

- To **skip** the current file and continue restoring the remaining files, press F4, SKIP.

- To **cancel** the restore from this file on, press F5, CANCEL.

    c. **When the restore has completed,** you will see a message reporting the number of files restored. See the following screen for an example.

```
Total 20/21 files restored
```

- The label on the F4 function key will become [BACKUP].

- The controller will be in a Controlled start.

14. To operate the robot, cycle controller power:

    a. Press FCTN.

    b. Select CYCLE POWER.

    c. Press ENTER. You will see a screen similar to the following.

```
Are you sure?
```

    d. Press OK.

Appendix F

DISPLAYING VERSION INFORMATION

Contents

When the installation process is complete, you might want to check the software version listed on the controller to be sure it is correct. Use Procedure F-1 to display the application software version. You can also use this to determine which options are installed on the controller.

The STATUS Version ID screen displays information specific to your controller. Use this information when you call the FANUC America Corporation Hotline if a problem occurs with your controller. You cannot change the information displayed on this screen.

Table F–1. STATUS Version ID SOFTWARE Screen Items

ITEM	DESCRIPTION
application- Tool	This item lists the Application Tool software that is loaded. The "ID:" column for this item shows the most important version number for Robot Controllers located in Asia.
S/W Serial No.	This item is a unique number that identifies the software installed on your controller. This is similar to a Customer Order Number.
Controller ID	This item is a unique number that identifies your controller.
Robot Model	This item is the model name of the robot you are using. The "ID:" column for this item shows the Version Number of the Robot Library.
Servo Code	This item is the version number of the robot servo software.
Cart. Mot. Parameter	This item is the version number of the Cartesian motion parameters.
Joint Mot. Parameter	This item is the version number of the joint motion parameters.
Software Edition No.	This item is the version number of the software. This item shows the most important version number for Robot Controllers located in North America.
Customization Ver.	This item is the version number of the customization, if applicable. It will show "None" if there is no Customization installed or the if Customization does not set this Version.
Root Version	This item is the version number of the Root software.
Boot MONITOR	This item is the version number of the BMON Flash ROM software.
Teach Pendant	This item is the version number of the teach pendant EPROM.
Browser Plugins	This item is the version number of the browser plugins.
TP Core Firmware	This item is the version number of the software item loaded.

Table F–2. STATUS Version ID CONFIG Screen Items

ITEM	DESCRIPTION
FEATURE	This item is the name of the installed feature or option.

Table F–2.   STATUS Version ID CONFIG Screen Items (Cont'd)

ITEM	DESCRIPTION
ORD. NO (order number)	This item uniquely identifies the feature or option.
application-Tool	This item is the software application tool that is installed.
All other items	These items list the features and options that are installed on your controller.

Table F–3.   STATUS Version ID MOTOR Screen Items

ITEM	DESCRIPTION
GROUP	This item is the number of the motion group associated with the displayed robot axis.
AXIS	This item is the number of the displayed robot axis.
MOTOR ID AND INFO	These items are the motor name (ID) and information that uniquely identify and describe the motor used for the displayed robot axis.

Table F–4.   STATUS Version ID SERVO Screen Items

ITEM	DESCRIPTION
GROUP	This item is the number of the motion group associated with the displayed robot axis.
AXIS	This item is the number of the displayed robot axis.
SERVO PARAM ID	This item is the name that identifies the group of servo parameters associated with the displayed robot axis.

Table F–5. STATUS Version ID UPDATES Screen Item

ITEM	DESCRIPTION
UPDATES	This item indicates the software that has been updated on the controller.

Table F–6. STATUS Version ID ORDER FILE Screen Item

ITEM	DESCRIPTION
ORDER FI	This item lists the software order file.

Use Procedure F-1 to display version identification status.

<u>**Procedure F-1**</u> **Displaying the Version Identification Status**

Steps

1. Press STATUS.

2. Press F1, [TYPE].

3. Select Version ID.

4. Press the key that corresponds to the version ID status screen you want to display:

- **To display software version information**, press F2, SOFTWARE. You will see a screen similar to the following.

```
STATUS Version ID
    SOFTWARE:               ID:    1/15
  1  application—Tool       xxxx/xx
  2  S/W Serial No.         xxxxx
  3  Controller ID          F00000
  4  Robot Model, application—Tool
  5  Robot Model            Vx.xxxx
  6  Servo Code             12345678
  7  Cart. Mot. Parameter   V3.00
  8  Joint Mot. Parameter   V3.00
  9  Software Edition No.   Vx.xxxx
 10  Customization Ver.     None
 11  Root Version           Vx.xxxx
 12  Boot MONITOR           Vx.xxxx
 13  Teach Pendant          xxxx/xxx
 14  Browser Plugins        Vx.xxxx
 15  TP Core Firmware       Vx.xxxx
```

- **To display a list of the software features and options that are loaded**, press F3, CONFIG.

```
STATUS Version ID
     SOFTWARE:                ORD NO:  1/128
1:
application
-Tool (TM)   XXXX
2:  English Dictionary     XXXX
3:  Kernel Software        XXXX
4:  Analog I/O             XXXX
5:  Arc EQ Program Select  XXXX
6:  Arc Softpart           XXXX
7:  Background Edition      XXXX
8:  Basic Software         XXXX
9:  Controller Backup      XXXX
10: Cycle Time Priority    XXXX
```

Note The information displayed here could be different at your site.

- **To display motor types for each axis**, press F4, MOTOR. You will see a screen similar to the following.

```
STATUS Version ID
   GR: AX: MOTOR ID AND INFO:      1/16
1   1  1  ACA22/2000 80A     H1  DSP1-L
2   1  2  ACAM30/3000HV 80A  H2  DSP1-M
3   1  3  ACA22/2000 80A     H3  DSP2-L
4   1  4  ACAM9/3000 40A     H4  DSP2-M
5   1  5  ACAM6/3000 40A     H5  DSP3-L
6   1  6  ACAM6/3000 40A     H6  DSP3-M
7  **  **   ***************************
8  **  **   ***************************
9  **  **   ***************************
10 **  **    ***************************
```

- **To display the servo parameters for each axis**, press F5, SERVO. You will see a screen similar to the following.

```
STATUS Version ID
    GROUP: AXIS:  SERVO PARAM ID:  1/16
1    1       1     P01.01
2    1       2     P01.01
3    1       3     P01.01
4    1       4     P01.01
5    1       5     P01.01
6    1       6     P01.01
7   **      **     ********
8   **      **     ********
9   **      **     ********
10  **      **     ********
```

- **To display software Updates**, press >, NEXT, and press F2, UPDATES. You will see a screen similar to the following.

```
Generated by SWILIB for F00000
U001! UPDT! CVIS — IRvision Confi
U002! UPDT! IRCAL
U003! UPDT! IIC: 4D Graphics
U006! UPDT! USB builtin call to F
Press PREV to exit.
```

- **To display the ORDER FILE**, press >, NEXT, and press F3, ORDER FI. You will see a screen similar to the following.

```
!  Generated by PCMCIA 8.1045.202 for F00
!    Min. F-ROM : 16 MB
!    Min. D-RAM : 32 MB
!    Min. S-RAM :  : 2.0 MB (with 800 KB
! on xxxxxx.frna.com
1A05B-2400-H590 ! SpotTool+
1A05B-2400-H590 ! SpotTool+
1A05B-2400-H521 ! English Dictionary
1A05B-2400-R764 ! 4D Graphics
1A05B-2400-R796 ! ASCII Program Loader
1A05B-2400-R650 ! FRA Params
1A05B-2400-R641 ! PC Interface
Continue displaying?
```

ENABLE/DISABLE APPLICATIONS (SPOTTOOL+ ONLY)

Contents

Use Procedure G-1 to enable or disable an application on your controller.

Procedure G-1   Enabling and Disabling Applications on a Controller

Steps

1. Perform a Controlled start. If the controller is already in Controlled Start mode, go to Step 2 .

   - If the controller is turned off, **immediately press and hold,** PREV and NEXT keys on the teach pendant.

Figure G–1. Power Disconnect Breaker

When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

- If the controller is turned on but in Cold start mode, press FCTN and select CYCLE POWER. While the controller is starting up, **immediately press and hold,** PREV and NEXT keys on the teach pendant. When power is cycled, the second line on the pendant should display "Boot system activating..." in reverse video. You can then release the PREV and NEXT keys.

You will see a screen similar to the following.

```
---------- Configuration Menu ----------
1 Hot start
2 Cold start
3 Controlled start
4 Maintenance
Select >
```

Select Controlled start and press ENTER. After a few moments, you will see the Controlled start screen for your application.

2. After a few moments, you will see the Controlled start screen for your application.

3. Press MENU.

4. Select Appl-select. You will see a screen similar to the following.

```
Appl selection CONTROLLED START MENUS
1 Spot Weld                      TRUE
2 Handling                       FALSE
3 Dispense                       FALSE
```

5. Move the cursor to the name of the application you want to enable.

6. **To enable an application** , press F4, TRUE. **To disable an application** , press F5, FALSE.

Note After you have enabled an application, you can use the enabled process in a teach pendant program. Refer to the application-specific *Setup and Operations Manual* for more information.

Appendix H

FSSB AND HARDWARE SETUP EXAMPLES

Contents

Use Procedure H-1 to answer FSSB Configuration questions.

Procedure H-1   FSSB and Hardware Setup

Condition

You are setting up an FSSB Configuration.

1. **FSSB Line Setting**
   Type the number of the FSSB line to which the additional axis is connected, and press ENTER. See Figure H–1 . There are four FSSB lines (1,2,3, and 5). Usually, the first FSSB line is used unless the system has many auxiliary axes or multiple robots.

Figure H–1.   FSSB Line Definition
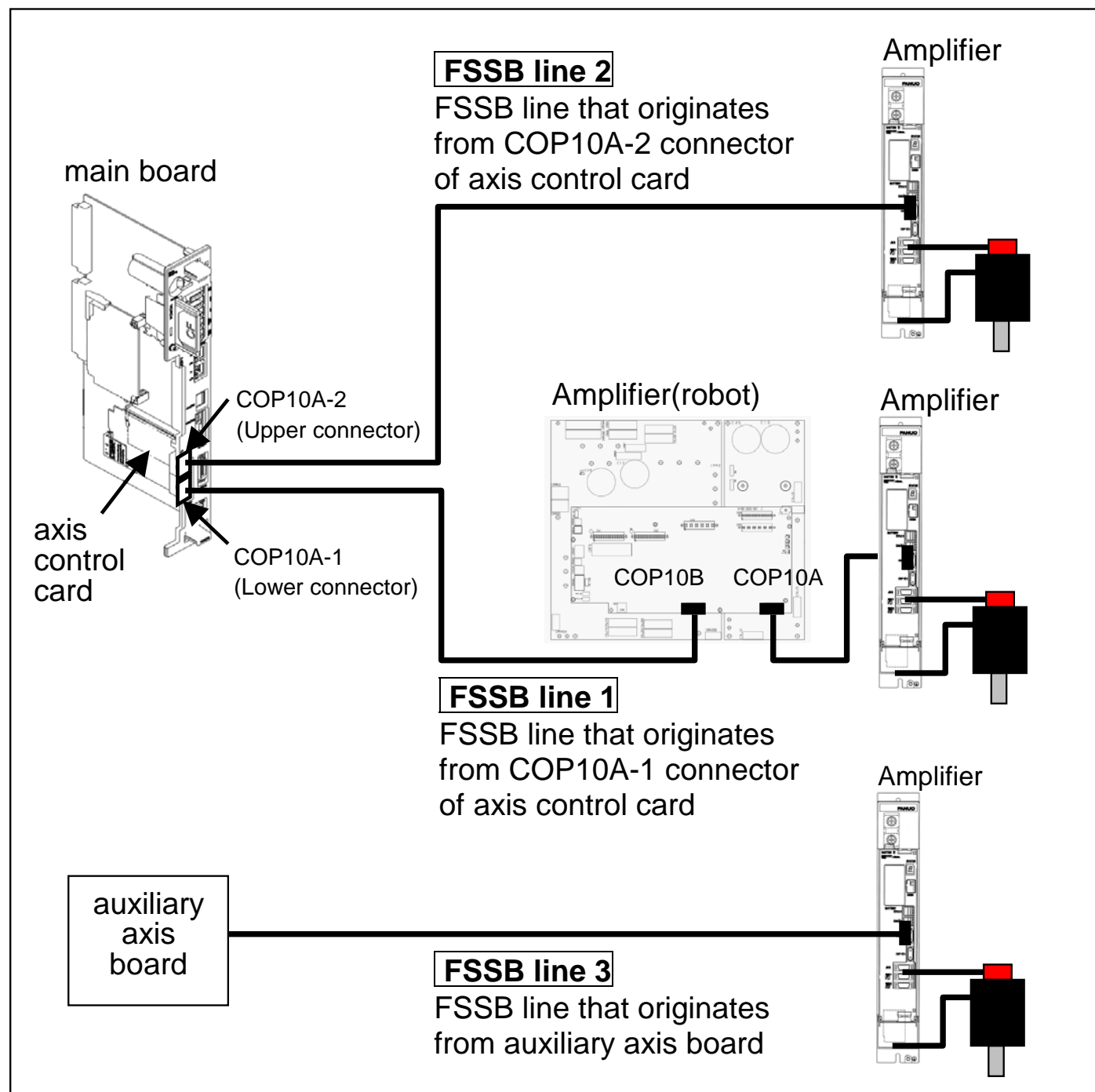
2. **If FSSB 2 is selected**, you will see a screen similar to the following.

```
Total number of axes on FSSB 1 >
```

Type the number of total axes of FSSB line 1, and press ENTER. This number includes the robot axes.

3. You will see a screen similar to the following.

```
**** GROUP 2 INDEPENDENT AXES SETUP ****
- — Hardware start axis setting — —
Enter hardware start axis
(Valid range: 1-32)
```

4. Hardware Start Setting:
Type the number of the hardware start axis within a valid range. The valid range of hardware start axis number differs according to the FSSB line to which the auxiliary axis is connected. Refer to Table H–1 .

Table H–1. **Hardware Start Axis Number**

FSSB line	Location of FSSB	Maximum number of axes	Valid Hardware Start Axis
1	Main servo card	32 (*5)	1 — 32(*1)
2	Main servo card	32 (*5)	5 — 36(*2)
3	Auxiliary axis board 1	24	37 — 60 (*3)
5	Auxiliary axis board 2	24	61 — 84 (*4)

(*1) It is possible to use the number less than 7 when the robot does not have six axes.

(*2) The lower limit of hardware start axis for 2nd FSSB line differs according to the total axis number that is connected to the 1st FSSB line. In case that hardware start axis number on the 2nd FSSB line = (Total axis number on the 1st FSSB line) + 1

(*3) The lower limit of hardware start axis for the 3rd FSSB line is 37 irrespective of the number of axes on 1st and 2nd FSSB line.

(*4) The lower limit of hardware start axis for the 5th FSSB line is 61 irrespective of the number of axes on 1st, 2nd , and 3rd FSSB line.

(*5) FSSB 1 and 2 can each support up to 32 axes but the total support by both is limited to 36 axes.

Example 1

Figure H–2.   FSSB Example 1
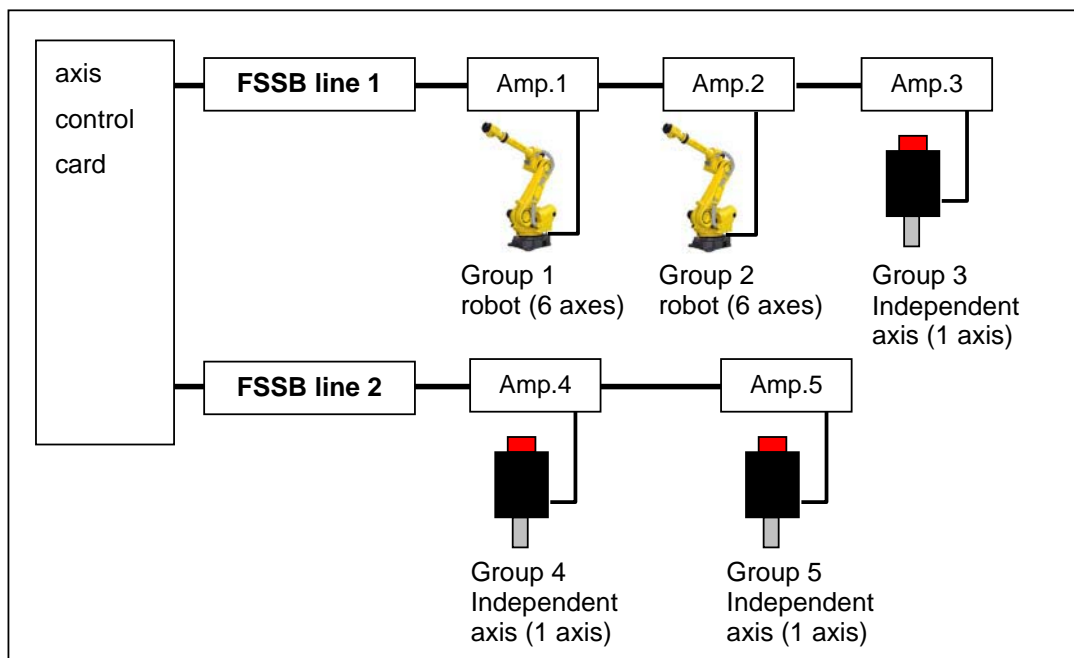
If your system configuration is similar to Figure H–2 , set up the FSSB as follows:

Table H–2.   FSSB Setup for Example 1

Motion Group	FSSB Line	Number of axes in group	Total Number of Axes on FSSB Line 1	Hardware Start Axis
1	1	6	No need to set up	1
2	1	6	No need to set up	7
3	1	1	No need to set up	13
4	2	1	13	14
5	2	1	13	15

Example 2

Figure H–3. FSSB Example 2
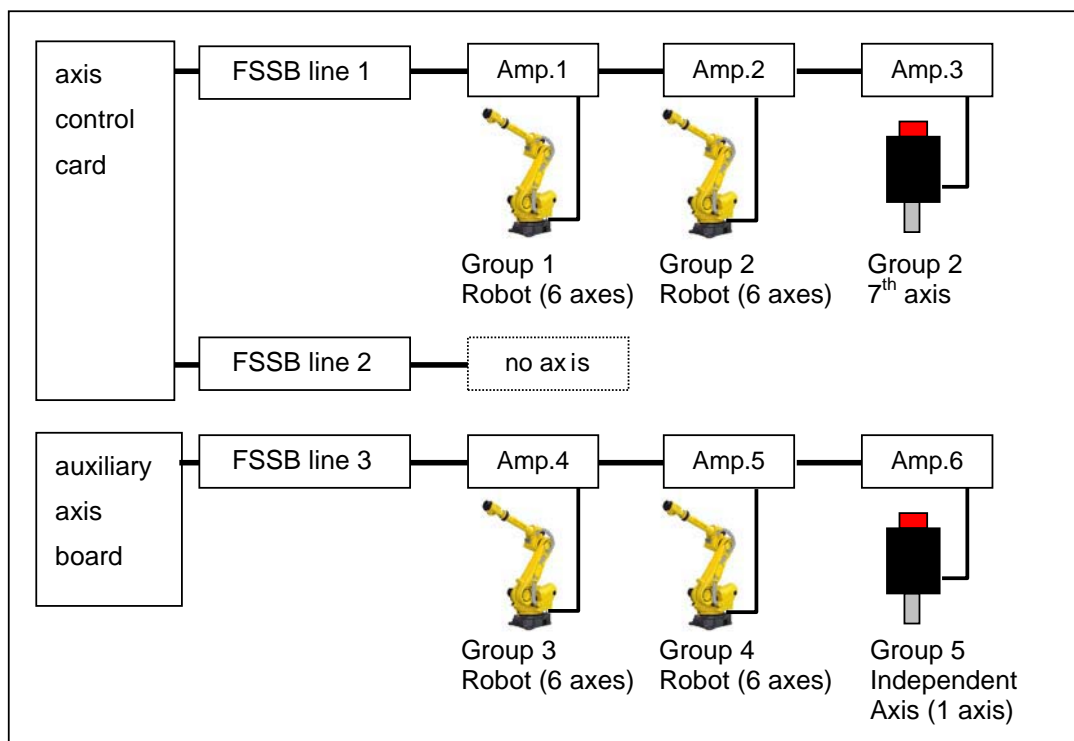
When the system configuration is similar to Figure H–3 , set this system up as shown in Table H–3 .

Table H–3. FSSB Setup for Example 2

Motion Group	FSSB Line	Number of axes in group	Total Number of Axes on FSSB Line 1	Hardware Start Axis
1	1	6	No need to set up	1
2	1	6	No need to set up	7
3	1	1	No need to set up	13
4	3	6	No need to set up	37
5	3	6	No need to set up	43
6	3	1	No need to set up	49

(*) The number of hardware axis starts from 37 for the 3rd FSSB line irrespective of the number of axes on the 1st and 2nd FSSB lines. T .

Example 3

- The amp numbers start with FSSB1 (amps 1 to X) then sequentially to FSSB2 and then FSSB3.

- The lower limit of the Hardware Start number for FSSB2 is dependent on the number of axis on FSSB1.

- FSSB3 always has a Hardware Start number lower limit of 37 irrespective of the number of axes on FSSB1 or FSSB2.

- FSSB5 always has a Hardware Start number lower limit of 61 irrespective of the number of axes on FSSB1, FSSB2, or FSSB3.

- For Dual, Triple and Quad ARM systems with an auxiliary axis in a separate group, that auxiliary axis group must be added to the $ROBOT_ISOLC[GRP] System Variable. Binary values (Grp 1=1, Grp 2=2, Grp 3=4, Grp 4=8, Grp 5=16, Grp 6=32, Grp 7=64, Grp 8=128). Example: If aux. axis groups 3 and 4 are powered from robot 2 (group 2) then set $ROBOT_ISOLC[2]=14 (2+4+8). (Note: Set all unused $ROBOT_ISOLC[ ] variables to zero.) Now when group 2 is isolated/activated (Multi ARM key switch) then groups 3 and 4 will also be isolated/activated.

Figure H–4. System Hardware Example –DualARM

System Hardware Example – DualARM

Example 1A

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	1	N/A	7	5

Example 1B

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	2	6	7 [(1)]	5

(1) Hardware start for FSSB 2 must be greater than the total on FSSB 1.

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	3	N/A	37	5
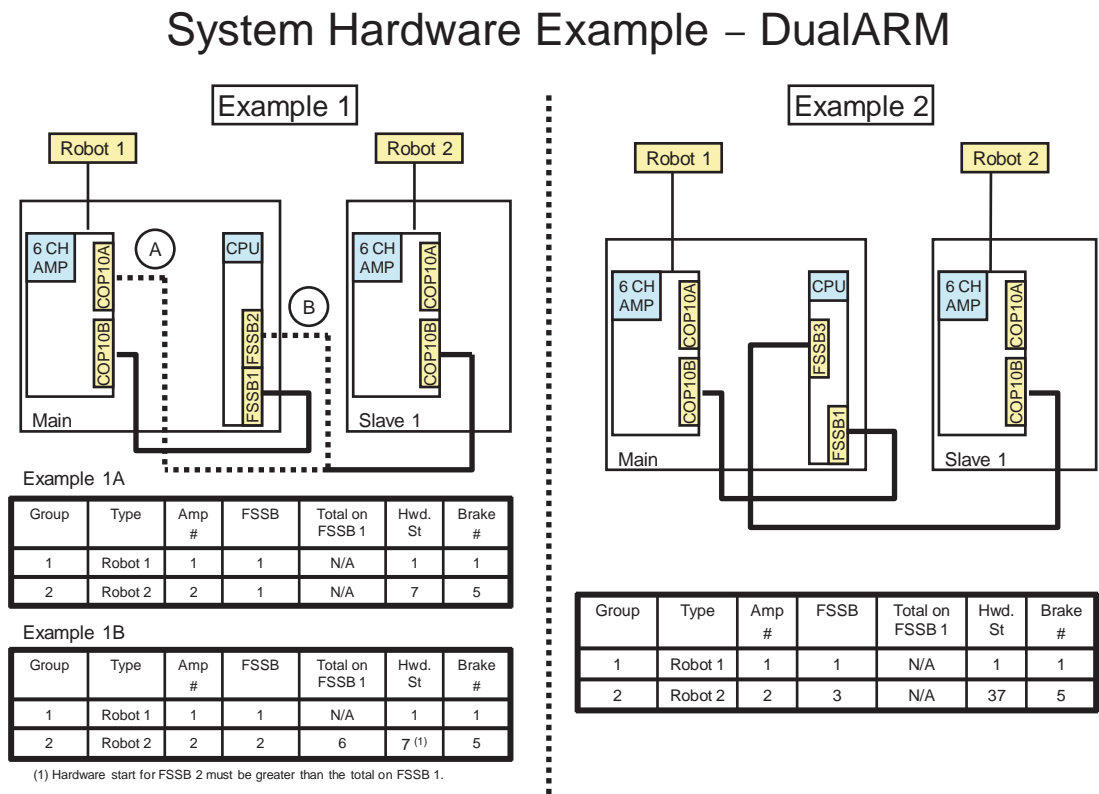
Figure H–5. System Hardware Example –DualARM & Single Aux.

System Hardware Example – DualARM & Single Aux.

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	3	2	7	8 [1]	5
Integrated Aux. – G1 Or G3	Aux. 1	2	1	N/A	7	1 [2]

If setup as a separate GROUP

$ROBOT_ISOLC[1]=5 $ROBOT_ISOLC[2]=2
$ROBOT_ISOLC[3 to 5]=0

(1) Hardware start for FSSB 2 must be greater than the total on FSSB 1.
(2) Brake number will change if Local Stop or a Brake Unit is added to the system.

Figure H–6. System Hardware Example –DualARM & ServoTorch

System Hardware Example –DualARM & ServoTorch

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	1	N/A	7	5
N/A	P. Axis 1	3	1	N/A	13	N/A
N/A	P. Axis 2	4	1	N/A	14	N/a

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St	Brake #
1	Robot 1	1	1	N/A	1	1
N/A	P. Axis 1	2	1	N/A	7	N/A
2	Robot 2	3	3	N/A	37	5
N/A	P. Axis 2	4	3	N/A	43	N/a

Figure H–7. System Hardware Example –DualARM & Ferris Wheel

System Hardware Example – DualARM & Ferris Wheel

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	4	3	N/A	37	5
3	Aux. 1	2	1	N/A	7	1 [1]
4	Aux. 2	3	1	N/A	8	1 [1]
5	Aux. 3	5	3	N/A	43	5 [1]

$ROBOT_ISOLC[1]=13 $ROBOT_ISOLC[2]=18
$ROBOT_ISOLC[3 to 5]=0

(1) Brake number will change if Local Stop or a Brake Unit is added to the system

Figure H–8. System Hardware Example –DualARM & Ferris Wheel

System Hardware Example – DualARM & Ferris Wheel

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	3	2	7	8 [1]	5
3	Aux. 1	4	2	7	14	5 [2]
4	Aux. 2	5	2	7	15	5 [2]
5	Aux. 3	2	1	N/A	7	1 [2]

$ROBOT_ISOLC[1]=17 $ROBOT_ISOLC[2]=14
$ROBOT_ISOLC[3 to 5]=0

(1) Hardware start for FSSB 2 must be greater than the total on FSSB 1.
(2) Brake number will change if Local Stop or a Brake Unit is added to the system.
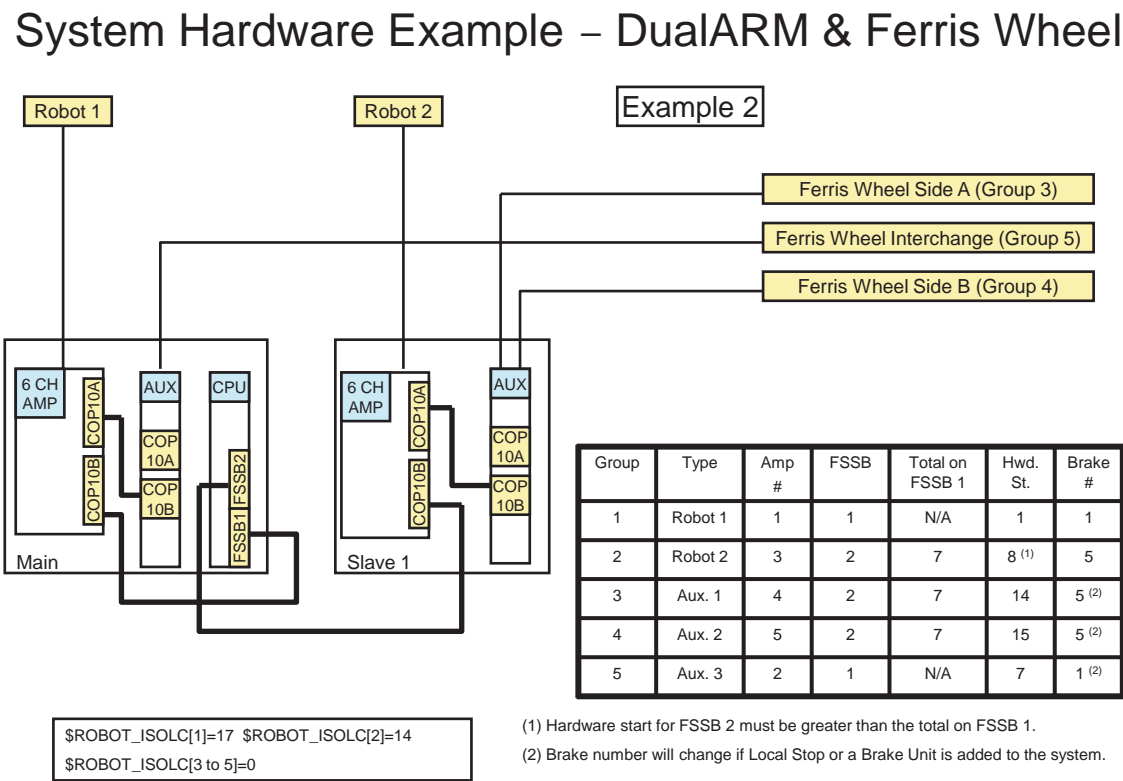
Figure H–9. System Hardware Example –TripleARM

System Hardware Example –TripleARM

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	2	6	7 (1)	5
3	Robot	3	2	6	13	9

(1) Hardware start for FSSB 2 must be greater than the total on FSSB 1.
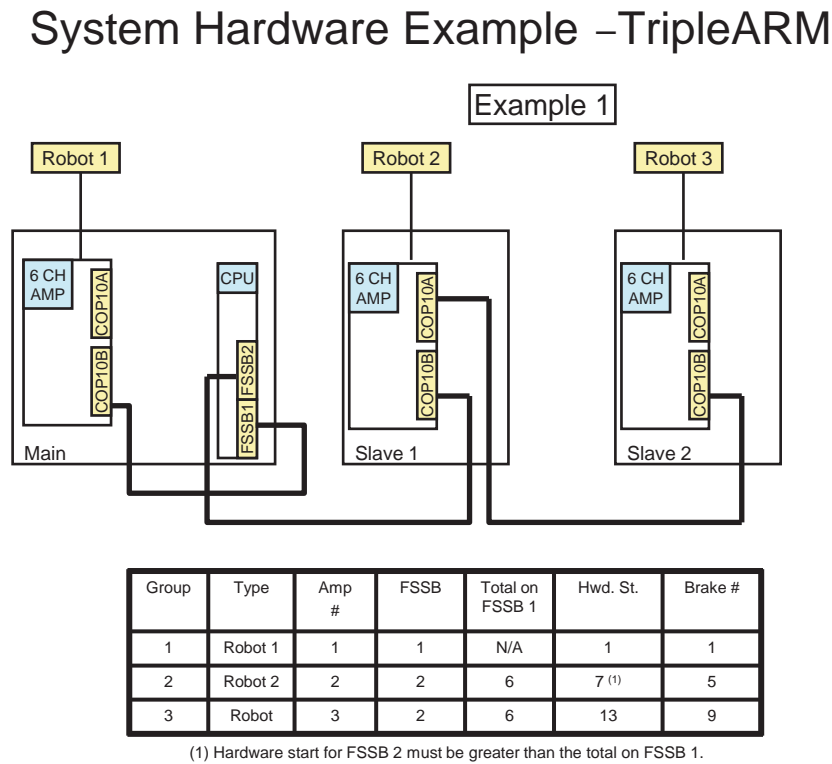
Figure H–10. System Hardware Example –TripleARM

System Hardware Example –TripleARM

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	3	N/A	37	5
3	Robot 3	3	3	N/A	43	9
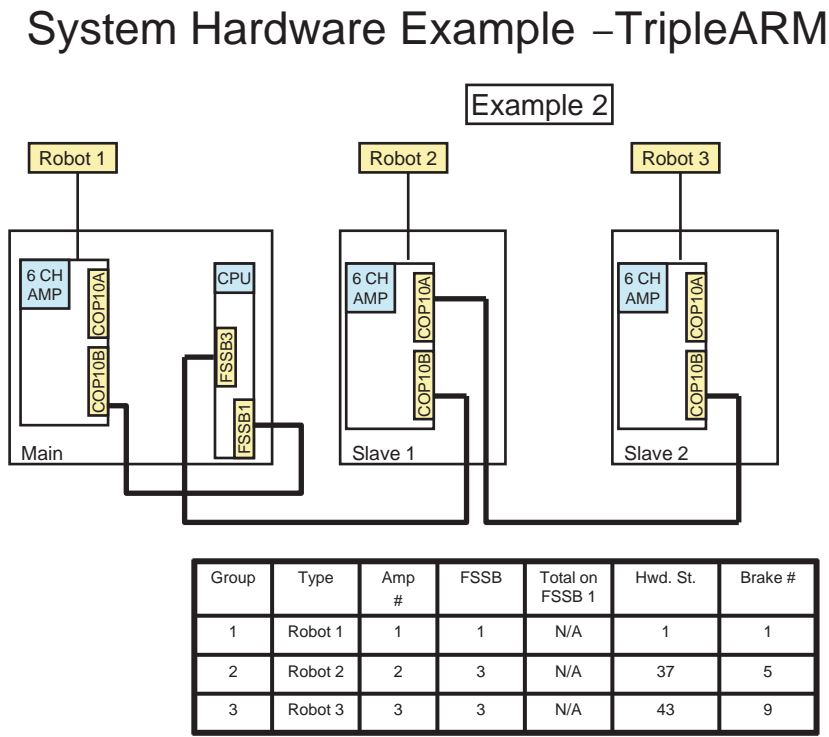
Figure H–11. System Hardware Example –TripleARM & Ferris Wheel

System Hardware Example –TripleARM & Ferris Wheel

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	4	3	N/A	37	5
3	Robot 3	5	3	N/A	43	9
4	Aux. 1	2	1	N/A	7	1*
5	Aux. 2	3	1	N/A	8	1*
6	Aux. 3	6	3	N/A	49	9*

$ROBOT_ISOLC[1]=25 $ROBOT_ISOLC[2]=2 $ROBOT_ISOLC[3]=36
$ROBOT_ISOLC[4 & 5]=0

* Brake number will change if Local Stop or a Brake Unit is added to the system

Figure　H–12. **System Hardware Example –QuadARM**

System Hardware Example – QuadARM

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	1	N/A	7	5
3	Robot 3	3	3	N/A	37	9
4	Robot 4	4	3	N/A	43	13

Figure H–13. **System Hardware Example –QuadARM & Ferris Wheel**

System Hardware Example – QuadARM & Ferris Wheel

$ROBOT_ISOLC[1]=1 $ROBOT_ISOLC[2]=2
$ROBOT_ISOLC[3]=52 $ROBOT_ISOLC[4]=72

$ROBOT_ISOLC[5]=0

* Brake number will change if Local Stop or a Brake Unit is added to the system

Group	Type	Amp #	FSSB	Total on FSSB 1	Hwd. St.	Brake #
1	Robot 1	1	1	N/A	1	1
2	Robot 2	2	1	N/A	7	5
3	Robot 3	3	3	N/A	37	9
4	Robot 4	6	3	N/A	45	13
5	Aux. 1	4	3	N/A	43	9*
6	Aux. 2	5	3	N/A	44	9*
7	Aux. 3	7	3	N/A	51	13 *

Figure H–14. System Hardware - Brake Control

System Hardware Brake Control

CRR65 – AUX AXIS
BRAKE

100VAC DIRECT
CONNECTION FOR TWO
MOTOR BRAKE CABLES

FIRST BRAKE NUMBER,
SAME AS THE ROBOT

CRM97 - BRAKE CONTROL
LOGIC SIGNAL FOR THE
SECOND, THIRD AND
FOURTH BRAKE (24VDC)

REQUIRES ADDITIONAL
HARDWARE TO USE (LOCAL
STOP OR BRAKE UNIT)

6 CHANNEL AMPLIFIER

Group	ROBOT	ROBOT BRAKE #	CRR65 BRAKE #	CRM97 BRAKE #
1	Robot 1	1	1	2, 3, 4
2	Robot 2	5	5	6, 7, 8
3	Robot 3	9	9	10, 11, 12
4	Robot 4	13	13	14, 15, 16

Glossary

A

abort

      Abnormal termination of a computer program caused by hardware or software malfunction or operator cancellation.

absolute pulse code system

      A positional information system for servomotors that relies on battery-backed RAM to store encoder pulse counts when the robot is turned off. This system is calibrated when it is turned on.

A/D value

      An analog to digital-value. Converts a multilevel analog electrical system pattern into a digital bit.

AI

      Analog input.

AO

      Analog output.

alarm

      The difference in value between actual response and desired response in the performance of a controlled machine, system or process. Alarm=Error.

algorithm

      A fixed step-by-step procedure for accomplishing a given result.

alphanumeric

      Data that are both alphabetical and numeric.

AMPS

Amperage amount.

analog

The representation of numerical quantities by measurable quantities such as length, voltage or resistance. Also refers to analog type I/O blocks and distinguishes them from discrete I/O blocks. Numerical data that can vary continuously, for example, voltage levels that can vary within the range of -10 to +10 volts.

AND

An operation that places two contacts or groups of contacts in series. All contacts in series control the resulting status and also mathematical operator.

ANSI

American National Standard Institute, the U.S. government organization with responsibility for the development and announcement of technical data standards.

APC

See absolute pulse code system.

APC motor

See servomotor.

application program

The set of instructions that defines the specific intended tasks of robots and robot systems to make them reprogrammable and multifunctional. You can initiate and change these programs.

arm

A robot component consisting of an interconnecting set of links and powered joints that move and support the wrist socket and end effector.

articulated arm

A robot arm constructed to simulate the human arm, consisting of a series of rotary motions and joints, each powered by a motor.

ASCII

Abbreviation for American Standard Code for Information Interchange. An 8-level code (7 bits plus 1 parity bit) commonly used for the exchange of data.

automatic mode

The robot state in which automatic operation can be initiated.

automatic operation

The time during which robots are performing programmed tasks through unattended program execution.

axis

1. A straight line about which a robot joint rotates or moves. 2. One of the reference lines or a coordinate system. 3. A single joint on the robot arm.

B

backplane

A group of connectors mounted at the back of a controller rack to which printed circuit boards are mated.

BAR

A unit of pressure equal to 100,000 pascals.

barrier

A means of physically separating persons from the restricted work envelope; any physical boundary to a hazard or electrical device/component.

battery low alarm

A programmable value (in engineering units) against which the analog input signal automatically is compared on Genius I/O blocks. A fault is indicated if the input value is equal to or less than the low alarm value.

baud

A unit of transmission speed equal to the number of code elements (bits) per second.

big-endian

The adjectives big-endian and little-endian refer to which bytes are most significant in multi-byte data types and describe the order in which a sequence of bytes is stored in a computer's memory. In a big-endian system, the most significant value in the sequence is stored at the lowest storage address (i.e., first). In a little-endian system, the least significant value in the sequence is stored first.

binary

A numbering system that uses only 0 and 1.

bit

Contraction of binary digit. 1. The smallest unit of information in the binary numbering system, represented by a 0 or 1. 2. The smallest division of a programmable controller word.

bps

Bits per second.

buffer

A storage area in the computer where data is held temporarily until the computer can process it.

bus

A channel along which data can be sent.

bus controller

A Genius bus interface board for a programmable controller.

bus scan

One complete communications cycle on the serial bus.

Bus Switching Module

A device that switches a block cluster to one bus or the other of a dual bus.

byte

A sequence of binary digits that can be used to store a value from 0 to 255 and usually operated upon as a unit. Consists of eight bits used to store two numeric or one alpha character.

C

calibration

The process whereby the joint angle of each axis is calculated from a known reference point.

Cartesian coordinate system

A coordinate system whose axes (x, y, and z) are three intersecting perpendicular straight lines. The origin is the intersection of the axes.

Cartesian coordinates

A set of three numbers that defines the location of a point within a rectilinear coordinate system and consisting of three perpendicular axes (x, y, z).

cathode ray tube

A device, like a television set, for displaying information.

central processing unit

The main computer component that is made up of a control section and an arithmetic-logic section. The other basic units of a computer system are input/output units and primary storage.

channel

The device along which data flow between the input/output units of a computer and primary storage.

character

One of a set of elements that can be arranged in ordered groups to express information. Each character has two forms: 1. a man-intelligible form, the graphic, including the decimal digits 0-9, the letters A-Z, punctuation marks, and other formatting and control symbols; 2. a computer intelligible form, the code, consisting of a group of binary digits (bits).

circular

A MOTYPE option in which the robot tool center point moves in an arc defined by three points. These points can be positions or path nodes.

clear

To replace information in a storage unit by zero (or blank, in some machines).

closed loop

A control system that uses feedback. An open loop control system does not use feedback.

C-MOS RAM

Complementary metal-oxide semiconductor random-access memory. A read/write memory in which the basic memory cell is a pair of MOS (metal-oxide semiconductor) transistors. It is an implementation of S-RAM that has very low power consumption, but might be less dense than other S-RAM implementations.

coaxial cable

A transmission line in which one conductor is centered inside and insulated from an outer metal tube that serves as the second conductor. Also known as coax, coaxial line, coaxial transmission line, concentric cable, concentric line, concentric transmission line.

component

An inclusive term used to identify a raw material, ingredient, part or subassembly that goes into a higher level of assembly, compound or other item.

computer

A device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes.

configuration

The joint positions of a robot and turn number of wrist that describe the robot at a specified position. Configuration is designated by a STRING value and is included in positional data.

continuous path

A trajectory control system that enables the robot arm to move at a constant tip velocity through a series of predefined locations. A rounding effect of the path is required as the tip tries to pass through these locations.

continuous process control

The use of transducers (sensors) to monitor a process and make automatic changes in operations through the design of appropriate feedback control loops. While such devices historically have been mechanical or electromechanical, microcomputers and centralized control is now used, as well.

continuous production

A production system in which the productive equipment is organized and sequenced according to the steps involved to produce the product. Denotes that material flow is continuous during the production process. The routing of the jobs is fixed and set-ups are seldom changed.

controlled stop

A controlled stop controls robot deceleration until it stops. When a safety stop input such as a safety fence signal is opened, the robot decelerates in a controlled manner and then stops. After the robot stops, the Motor Control Contactor opens and drive power is removed.

controller

A hardware unit that contains the power supply, operator controls, control circuitry, and memory that directs the operation and motion of the robot and communications with external devices. See control unit.

controller memory

A medium in which data are retained. Primary storage refers to the internal area where the data and program instructions are stored for active use, as opposed to auxiliary or external storage (magnetic tape, disk, diskette, and so forth.)

control, open-loop

An operation where the computer applies control directly to the process without manual intervention.

control unit

The portion of a computer that directs the automatic operation of the computer, interprets computer instructions, and initiates the proper signals to the other computer circuits to execute instructions.

coordinate system

See Cartesian coordinate system.

CPU

See central processing unit.

CRT

See cathode ray tube.

cps (viscosity)

Centipoises per second.

CRT/KB

Cathode ray tube/keyboard. An optional interface device for the robot system. The CRT/KB is used for some robot operations and for entering programs. It can be a remote device that attaches to the robot via a cable.

cycle

1. A sequence of operations that is repeated regularly. The time it takes for one such sequence to occur. 2. The interval of time during which a system or process, such as seasonal demand or a manufacturing operation, periodically returns to similar initial conditions. 3. The interval of time during which an event or set of events is completed. In production control, a cycle is the length of time between the release of a manufacturing order and shipment to the customer or inventory.

cycle time

1. In industrial engineering, the time between completion of two discrete units of production. 2. In materials management, the length of time from when material enters a production facility until it exits. See throughput.

cursor

An indicator on a teach pendant or CRT display screen at which command entry or editing occurs. The indicator can be a highlighted field or an arrow (> or ^).

cylindrical

Type of work envelope that has two linear major axes and one rotational major axis. Robotic device that has a predominantly cylindrical work envelope due to its design. Typically has fewer than 6 joints and typically has only 1 linear axis.

D

D/A converter

A digital-to-analog converter. A device that transforms digital data into analog data.

D/A value

A digital-to-analog value. Converts a digital bit pattern into a multilevel analog electrical system.

daisy chain

A means of connecting devices (readers, printers, etc.) to a central processor by party-line input/output buses that join these devices by male and female connectors. The last female connector is shorted by a suitable line termination.

daisy chain configuration

A communications link formed by daisy chain connection of twisted pair wire.

data

A collection of facts, numeric and alphabetical characters, or any representation of information that is suitable for communication and processing.

data base

A data file philosophy designed to establish the independence of computer program from data files. Redundancy is minimized and data elements can be added to, or deleted from, the file designs without changing the existing computer programs.

DC

Abbreviation for direct current.

DEADMAN switch

A control switch on the teach pendant that is used to enable servo power. Pressing the DEADMAN switch while the teach pendant is on activates servo power and releases the robot brakes; releasing the switch deactivates servo power and applies the robot brakes.

debugging

The process of detecting, locating and removing mistakes from a computer program, or manufacturing control system. See diagnostic routine.

deceleration tolerance

The specification of the percentage of deceleration that must be completed before a motion is considered finished and another motion can begin.

default

The value, display, function or program automatically selected if you have not specified a choice.

deviation

Usually, the absolute difference between a number and the mean of a set of numbers, or between a forecast value and the actual data.

device

Any type of control hardware, such as an emergency-stop button, selector switch, control pendant, relay, solenoid valve, or sensor.

diagnostic routine

A test program used to detect and identify hardware/software malfunctions in the controller and its associated I/O equipment. See debugging.

diagnostics

Information that permits the identification and evaluation of robot and peripheral device conditions.

digital

A description of any data that is expressed in numerical format. Also, having the states On and Off only.

digital control

The use of a digital computer to perform processing and control tasks in a manner that is more accurate and less expensive than an analog control system.

digital signal

A single point control signal sent to or from the controller. The signal represents one of two states: ON (TRUE, 1. or OFF (FALSE, 0).

directory

A listing of the files stored on a device.

discrete

Consisting of individual, distinct entities such as bits, characters, circuits, or circuit components. Also refers to ON/OFF type I/O blocks.

disk

A secondary memory device in which information is stored on a magnetically sensitive, rotating disk.

disk memory

A non-programmable, bulk-storage, random-access memory consisting of a magnetized coating on one or both sides of a rotating thin circular plate.

drive power

      The energy source or sources for the robot servomotors that produce motion.

DRAM

      Dynamic Random Access Memory. A read/write memory in which the basic memory cell is a capacitor. DRAM (or D-RAM) tends to have a higher density than SRAM (or S-RAM). Due to the support circuitry required, and power consumption needs, it is generally impractical to use. A battery can be used to retain the content upon loss of power.

E

edit

      1. A software mode that allows creation or alteration of a program. 2. To modify the form or format of data, for example, to insert or delete characters.

emergency stop

      The operation of a circuit using hardware-based components that overrides all other robot controls, removes drive power from the actuators, and causes all moving parts of to stop. The operator panel and teach pendant are each equipped with EMERGENCY STOP buttons.

enabling device

      A manually operated device that, when continuously activated, permits motion. Releasing the device stops the motion of the robot and associated equipment that might present a hazard.

encoder

      1. A device within the robot that sends the controller information about where the robot is. 2. A transducer used to convert position data into electrical signals. The robot system uses an incremental optical encoder to provide position feedback for each joint. Velocity data is computed from the encoder signals and used as an additional feedback signal to assure servo stability.

end effector

      An accessory device or tool specifically designed for attachment to the robot wrist or tool mounting plate to enable the robot to perform its intended tasks. Examples include gripper, spot weld gun, arc weld gun, spray paint gun, etc.

end-of-arm tooling

      Any of a number of tools, such as welding guns, torches, bells, paint spraying devices, attached to the faceplate of the robot wrist. Also called end effector or EOAT.

engineering units

      Units of measure as applied to a process variable, for example, psi, Degrees F., etc.

envelope, maximum

      The volume of space encompassing the maximum designed movements of all robot parts including the end effector, workpiece, and attachments.

EOAT

    See end of arm tooling, tool.

EPROM

    Erasable Programmable Read Only Memory. Semiconductor memory that can be erased and reprogrammed. A non-volatile storage memory.

error

    The difference in value between actual response and desired response in the performance of a controlled machine, system or process. Alarm=Error.

error message

    A numbered message, displayed on the CRT/KB and teach pendant, that indicates a system problem or warns of a potential problem.

Ethernet

    A Local Area Network (LAN) bus-oriented, hardware technology that is used to connect computers, printers, terminal concentrators (servers), and many other devices together. It consists of a master cable and connection devices at each machine on the cable that allow the various devices to "talk" to each other. Software that can access the Ethernet and cooperate with machines connected to the cable is necessary. Ethernets come in varieties such as baseband and broadband and can run on different media, such as coax, twisted pair and fiber. Ethernet is a trademark of Xerox Corporation.

execute

    To perform a specific operation, such as one that would be accomplished through processing one statement or command, a series of statements or commands, or a complete program or command procedure.

extended axis

    An optional, servo-controlled axis that provides extended reach capability for a robot, including in-booth rail, single- or double-link arm, also used to control motion of positioning devices.

F

faceplate

    The tool mounting plate of the robot.

feedback

    1. The signal or data fed back to a commanding unit from a controlled machine or process to denote its response to the command signal. The signal representing the difference between actual response and desired response that is used by the commanding unit to improve performance of the controlled machine or process. 2. The flow of information back into the control system so that actual performance can be compared with planned performance, for instance in a servo system.

field

A specified area of a record used for a particular category of data. 2. A group of related items that occupy the same space on a CRT/KB screen or teach pendant LCD screen. Field name is the name of the field; field items are the members of the group.

field devices

User-supplied devices that provide information to the PLC (inputs: push buttons, limit switches, relay contacts, an so forth) or perform PLC tasks (outputs: motor starters, solenoids, indicator lights, and so forth.)

file

1. An organized collection of records that can be stored or retrieved by name. 2. The storage device on which these records are kept, such as bubble memory or disk.

filter

A device to suppress interference that would appear as noise.

Flash File Storage

A portion of FROM memory that functions as a separate storage device. Any file can be stored on the FROM disk.

Flash ROM

Flash Read Only Memory. Flash ROM is not battery-backed memory but it is non-volatile. All data in Flash ROM is saved even after you turn off and turn on the robot.

flow chart

A systems analysis tool to graphically show a procedure in which symbols are used to represent operations, data, flow, and equipment. See block diagram, process chart.

flow control

A specific production control system that is based primarily on setting production rates and feeding work into production to meet the planned rates, then following it through production to make sure that it is moving. This concept is most successful in repetitive production.

format

To set up or prepare a memory card or floppy disk (not supported with version 7.20 and later) so it can be used to store data in a specific system.

FR

See Flash ROM.

F-ROM

See Flash ROM.

FROM disk

See Flash ROM.

G

general override stat

A percentage value that governs the maximum robot jog speed and program run speed.

Genius I/O bus

The serial bus that provides communications between blocks, controllers, and other devices in the system especially with respect to GE FANUC Genius I/O.

gripper

The "hand" of a robot that picks up, holds and releases the part or object being handled. Sometimes referred to as a manipulator. See EOAT, tool.

group signal

An input/output signal that has a variable number of digital signals, recognized and taken as a group.

gun

See applicator.

H

Hand Model.

Used in Interference Checking, the Hand Model is the set of virtual model elements (spheres and cylinders) that are used to represent the location and shape of the end of arm tooling with respect to the robot's faceplate.

hardware

1. In data processing, the mechanical, magnetic, electrical and electronic devices of which a computer, controller, robot, or panel is built. 2. In manufacturing, relatively standard items such as nuts, bolts, washers, clips, and so forth.

hard-wire

To connect electric components with solid metallic wires.

hard-wired

1. Having a fixed wired program or control system built in by the manufacturer and not subject to change by programming. 2. Interconnection of electrical and electronic devices directly through physical wiring.

hazardous motion

Unintended or unexpected robot motion that can cause injury.

hexadecimal

A numbering system having 16 as the base and represented by the digits 0 through 9, and A through F.

hold

A smoothly decelerated stopping of all robot movement and a pause of program execution. Power is maintained on the robot and program execution generally can be resumed from a hold.

HTML.

Hypertext Markup Language. A markup language that is used to create hypertext and hypermedia documents incorporating text, graphics, sound, video, and hyperlinks.

http.

Hypertext transfer protocol. The protocol used to transfer HTML files between web servers.

I

impedance

A measure of the total opposition to current flow in an electrical circuit.

incremental encoder system

A positional information system for servomotors that requires calibrating the robot by moving it to a known reference position (indicated by limit switches) each time the robot is turned on or calibration is lost due to an error condition.

index

An integer used to specify the location of information within a table or program.

index register

A memory device containing an index.

industrial robot

A reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions in order to perform a variety of tasks.

industrial robot system

A system that includes industrial robots, end effectors, any equipment devices and sensors required for the robot to perform its tasks, as well as communication interfaces for interlocking, sequencing, or monitoring the robot.

information

The meaning derived from data that have been arranged and displayed in a way that they relate to that which is already known. See data.

initialize

1. Setting all variable areas of a computer program or routine to their desired initial status, generally done the first time the code is executed during each run. 2. A program or hardware circuit that returns a program a system, or hardware device to an original state. See startup, initial.

input

> The data supplied from an external device to a computer for processing. The device used to accomplish this transfer of data.

input device

> A device such as a terminal keyboard that, through mechanical or electrical action, converts data from the form in which it has been received into electronic signals that can be interpreted by the CPU or programmable controller. Examples are limit switches, push buttons, pressure switches, digital encoders, and analog devices.

input processing time

> The time required for input data to reach the microprocessor.

input/output

> Information or signals transferred between devices, discreet electrical signals for external control.

input/output control

> A technique for controlling capacity where the actual output from a work center is compared with the planned output developed by CRP. The input is also monitored to see if it corresponds with plans so that work centers will not be expected to generate output when jobs are not available to work on.

integrated circuit

> A solid-state micro-circuit contained entirely within a chip of semiconductor material, generally silicon. Also called chip.

interactive

> Refers to applications where you communicate with a computer program via a terminal by entering data and receiving responses from the computer.

interface

> 1. A concept that involves the specifications of the inter-connection between two equipments having different functions. 2. To connects a PLC with the application device, communications channel, and peripherals through various modules and cables. 3. The method or equipment used to communicate between devices.

interference zone

> An area that falls within the work envelope of a robot, in which there is the potential for the robot motion to coincide with the motion of another robot or machine, and for a collision to occur.

interlock

> An arrangement whereby the operation of one control or mechanism brings about, or prevents, the operations of another.

interrupt

> A break in the normal flow of a system or program that occurs in a way that the flow can be resumed from that point at a later time. Interrupts are initiated by two types of signals: 1. signals originating within the computer system to synchronize the operation of the computer system with the outside

world; 2. signals originating exterior to the computer system to synchronize the operation of the computer system with the outside world.

I/O

Abbreviation for input/output or input/output control.

I/O block

A microprocessor-based, configurable, rugged solid state device to which field I/O devices are attached.

I/O electrical isolation

A method of separating field wiring from logic level circuitry. This is typically done through optical isolation devices.

I/O module

A printed circuit assembly that is the interface between user devices and the Series Six PLC.

I/O scan

A method by which the CPU monitors all inputs and controls all outputs within a prescribed time. A period during which each device on the bus is given a turn to send information and listen to all of the broadcast data on the bus.

ISO

The International Standards Organization that establishes the ISO interface standards.

isolation

1. The ability of a logic circuit having more than one inputs to ensure that each input signal is not affected by any of the others. 2. A method of separating field wiring circuitry from logic level circuitry, typically done optically.

item

1. A category displayed on the teach pendant on a menu. 2. A set of adjacent digits, bits, or characters that is treated as a unit and conveys a single unit of information. 3. Any unique manufactured or purchased part or assembly: end product, assembly, subassembly, component, or raw material.

J

jog coordinate systems

Coordinate systems that help you to move the robot more effectively for a specific application. These systems include JOINT, WORLD, TOOL, and USER.

JOG FRAME

A jog coordinate system you define to make the robot jog the best way possible for a specific application. This can be different from world coordinate frame.

jogging

Pressing special keys on the teach pendant to move the robot.

jog speed

Is a percentage of the maximum speed at which you can jog the robot.

joint

1. A single axis of rotation. There are up to six joints in a robot arm (P-155 swing arm has 8). 2. A jog coordinate system in which one axis is moved at a time.

JOINT

A motion type in which the robot moves the appropriate combination of axes independently to reach a point most efficiently. (Point to point, non-linear motion).

joint interpolated motion

A method of coordinating the movement of the joints so all joints arrive at the desired location at the same time. This method of servo control produces a predictable path regardless of speed and results in the fastest cycle time for a particular move. Also called joint motion.

K

K

Abbreviation for kilo, or exactly 1024 in computer jargon. Related to 1024 words of memory.

KAREL

The programming language developed for robots by the FANUC America Corporation.

L

label

An ordered set of characters used to symbolically identify an instruction, a program, a quantity, or a data area.

LCD

See liquid crystal display.

lead time

The span of time needed to perform an activity. In the production and inventory control context, this activity is normally the procurement of materials and/or products either from an outside supplier or from one's own manufacturing facility. Components of lead time can include order preparation time, queue time, move or transportation time, receiving and inspection time.

LED

See Light Emitting Diode.

LED display

An alphanumeric display that consists of an array of LEDs.

Light Emitting Diode

A solid-state device that lights to indicate a signal on electronic equipment.

limiting device

A device that restricts the work envelope by stopping or causing to stop all robot motion and that is independent of the control program and the application programs.

limit switch

A switch that is actuated by some part or motion of a machine or equipment to alter the electrical circuit associated with it. It can be used for position detection.

linear

A motion type in which the appropriate combination of axes move in order to move the robot TCP in a straight line while maintaining tool center point orientation.

liquid crystal display

A digital display on the teach pendant that consists of two sheets of glass separated by a sealed-in, normally transparent, liquid crystal material. Abbreviated LCD.

little-endian

The adjectives big-endian and little-endian refer to which bytes are most significant in multi-byte data types and describe the order in which a sequence of bytes is stored in a computer's memory. In a big-endian system, the most significant value in the sequence is stored at the lowest storage address (i.e., first). In a little-endian system, the least significant value in the sequence is stored first.

load

1. The weight (force) applied to the end of the robot arm. 2. A device intentionally placed in a circuit or connected to a machine or apparatus to absorb power and convert it into the desired useful form. 3. To copy programs or data into memory storage.

location

1. A storage position in memory uniquely specified by an address. 2. The coordinates of an object used in describing its x, y, and z position in a Cartesian coordinate system.

lockout/tagout

The placement of a lock and/or tag on the energy isolating device (power disconnecting device) in the off or open position. This indicates that the energy isolating device or the equipment being controlled will not be operated until the lock/tag is removed.

log

A record of values and/or action for a given function.

logic

A fixed set of responses (outputs) to various external conditions (inputs). Also referred to as the program.

loop

The repeated execution of a series of instructions for a fixed number of times, or until interrupted by the operator.

M

mA

> See milliampere.

machine language

> A language written in a series of bits that are understandable by, and therefore instruct, a computer. This is a "first level" computer language, as compared to a "second level" assembly language, or a "third level" compiler language.

machine lock

> A test run option that allows the operator to run a program without having the robot move.

macro

> A source language instruction from which many machine-language instructions can be generated.

magnetic disk

> A metal or plastic floppy disk (not supported on version 7.10 and later) that looks like a phonograph record whose surface can store data in the form of magnetized spots.

magnetic disk storage

> A storage device or system consisting of magnetically coated metal disks.

magnetic tape

> Plastic tape, like that used in tape recorder, on which data is stored in the form of magnetized spots.

maintenance

> Keeping the robots and system in their proper operating condition.

MC

> See memory card.

mechanical unit

> The robot arm, including auxiliary axis, and hood/deck and door openers.

medium

> plural **media** . The physical substance upon which data is recorded, such as a memory card (or floppy disk which is not supported on version 7.10 and later).

memory

> A device or media used to store information in a form that can be retrieved and is understood by the computer or controller hardware. Memory on the controller includes C-MOS RAM, Flash ROM and D-RAM.

memory card

> A C-MOS RAM memory card or a flash disk-based PC card.

menu

A list of options displayed on the teach pendant screen.

message

A group of words, variable in length, transporting an item of information.

microprocessor

A single integrated circuit that contains the arithmetic, logic, register, control and memory elements of a computer.

microsecond

One millionth (0.000001) of a second

milliampere

One one-thousandth of an ampere. Abbreviated mA.

millisecond

One thousandth of a second. Abbreviated msec.

module

A distinct and identifiable unit of computer program for such purposes as compiling, loading, and linkage editing. It is eventually combined with other units to form a complete program.

motion type

A feature that allows you to select how you want the robot to move from one point to the next. MOTYPES include joint, linear, and circular.

mode

1. One of several alternative conditions or methods of operation of a device. 2. The most common or frequent value in a group of values.

N

network

1. The interconnection of a number of devices by data communication facilities. "Local networking" is the communications network internal to a robot."Global networking" is the ability to provide communications connections outside of the robot's internal system. 2. Connection of geographically separated computers and/or terminals over communications lines. The control of transmission is managed by a standard protocol.

non-volatile memory

Memory capable of retaining its stored information when power is turned off.

O

Obstacle Model.

Used in Interference Checking, the Obstacle Model is the set of virtual model elements (spheres, cylinders, and planes) that are used to represent the shape and the location of a given obstacle in space.

off-line

Equipment or devices that are not directly connected to a communications line.

off-line operations

Data processing operations that are handled outside of the regular computer program. For example, the computer might generate a report off-line while the computer was doing another job.

off-line programming

The development of programs on a computer system that is independent of the "on-board" control of the robot. The resulting programs can be copied into the robot controller memory.

offset

The count value output from a A/D converter resulting from a zero input analog voltage. Used to correct subsequent non-zero measurements also incremental position or frame adjustment value.

on-line

A term to describe equipment or devices that are connected to the communications line.

on-line processing

A data processing approach where transactions are entered into the computer directly, as they occur.

operating system

Lowest level system monitor program.

operating work envelope

The portion of the restricted work envelope that is actually used by the robot while it is performing its programmed motion. This includes the maximum the end-effector, the workpiece, and the robot itself.

operator

A person designated to start, monitor, and stop the intended productive operation of a robot or robot system.

operator box

A control panel that is separate from the robot and is designed as part of the robot system. It consists of the buttons, switches, and indicator lights needed to operate the system.

operator panel

A control panel designed as part of the robot system and consisting of the buttons, switches, and indicator lights needed to operate the system.

optional features

Additional capabilities available at a cost above the base price.

OR

An operation that places two contacts or groups of contacts in parallel. Any of the contacts can control the resultant status, also a mathematical operation.

orientation

The attitude of an object in space. Commonly described by three angles: rotation about x (w), rotation about y (p), and rotation about z (r).

origin

The point in a Cartesian coordinate system where axes intersect; the reference point that defines the location of a frame.

OT

See overtravel.

output

Information that is transferred from the CPU for control of external devices or processes.

output device

A device, such as starter motors, solenoids, that receive data from the programmable controller.

output module

An I/O module that converts logic levels within the CPU to a usable output signal for controlling a machine or process .

outputs

Signals, typically on or off, that controls external devices based upon commands from the CPU.

override

See general override.

overtravel

A condition that occurs when the motion of a robot axis exceeds its prescribed limits.

overwrite

To replace the contents of one file with the contents of another file when copying.

P

parity

The anticipated state, odd or even, of a set of binary digits.

parity bit

A binary digit added to an array of bits to make the sum of all bits always odd or always even.

parity check

A check that tests whether the number of ones (or zeros) in an array of binary digits is odd or even.

parity error

A condition that occurs when a computed parity check does not agree with the parity bit.

part

A material item that is used as a component and is not an assembly or subassembly.

pascal

A unit of pressure in the meter-kilogram-second system equivalent to one newton per square meter.

path

1. A variable type available in the KAREL system that consists of a list of positions. Each node includes positional information and associated data. 2. The trajectory followed by the TCP in a move.

PCB

See printed circuit board.

PC Interface

The PC Interface option provides the RPC functions and PC send macros required by applications created using PC Developer's Kit.

pendant

See teach pendant.

PLC

See programmable logic controller or cell controller.

PMC

The programmable machine controller (PMC) functions provide a ladder logic programming environment to create PMC functions. This provides the capability to use the robot I/O system to run PLC programs in the background of normal robot operations. This function can be used to control bulk supply systems, fixed automation that is part of the robot workcell, or other devices that would normally require basic PLC controls.

printed circuit board

A flat board whose front contains slots for integrated circuit chips and connections for a variety of electronic components, and whose back is printed with electrically conductive pathways between the components.

production mode

See automatic mode.

program

1. A plan for the solution of a problem. A complete program includes plans for the transcription of data, coding for the computer, and plans for the absorption of the results into the system. 2. A sequence of instructions to be executed by the computer or controller to control a robot/robot system. 3. To furnish a computer with a code of instructions. 4. To teach a robot system a specific set of movements and instructions to do a task.

programmable controller

See programmable logic controller or cell controller.

programmable logic controller

A solid-state industrial control device that receives inputs from user-supplied control devices, such as switches and sensors, implements them in a precise pattern determined by ladder diagram-based programs stored in the user memory, and provides outputs for control of processes or user-supplied devices such as relays and motor starters.

Program ToolBox

The Program ToolBox software provides programming utilities such as mirror image and flip wrist editing capabilities.

protocol

A set of hardware and software interfaces in a terminal or computer that allows it to transmit over a communications network, and that collectively forms a communications language.

psi

Pounds per square inch.

Q

queue.

1. Waiting lines resulting from temporary delays in providing service. 2. The amount of time a job waits at a work center before set-up or work is performed on the job. See also job queue.

R

RAM

See Random Access Memory.

random access

A term that describes files that do not have to be searched sequentially to find a particular record but can be addressed directly.

Random Access Memory

1. Volatile, solid-state memory used for storage of programs and locations; battery backup is required. 2. The working memory of the controller. Programs and variable data must be loaded into RAM before the program can execute or the data can be accessed by the program.

range

1. A characterization of a variable or function. All the values that a function can possess. 2. In statistics, the spread in a series of observations. 3. A programmable voltage or current spectrum of values to which input or output analog signals can be limited.

RI

Robot input.

RO

Robot output.

read

To copy, usually from one form of storage to another, particularly from external or secondary storage to internal storage. To sense the meaning of arrangements of hardware. To sense the presence of information on a recording medium.

Read Only Memory

A digital memory containing a fixed pattern of bits that you cannot alter.

record

To store the current set or sets of information on a storage device.

recovery

The restoration of normal processing after a hardware or software malfunction through detailed procedures for file backup, file restoration, and transaction logging.

register

1. A special section of primary storage in a computer where data is held while it is being worked on.
2. A memory device capable of containing one or more computer bits or words.

remote/local

A device connection to a given computer, with remote devices being attached over communications lines and local devices attached directly to a computer channel; in a network, the computer can be a remote device to the CPU controlling the network.

repair

To restore robots and robot systems to operating condition after damage, malfunction, or wear.

repeatability

The closeness of agreement among the number of consecutive movements made by the robot arm to a specific point.

reset

To return a register or storage location to zero or to a specified initial condition.

restricted work envelope

That portion of the work envelope to which a robot is restricted by limiting devices that establish limits that will not be exceeded in the event of any reasonably foreseeable failure of the robot or its controls. The maximum distance the robot can travel after the limited device is actuated defines the restricted work envelope of the robot.

RIA

Robotic Industries Association Subcommittee of the American National Standards Institute, Inc.

robot

> A reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices, through variable programmed motions for the performance of a variety of tasks.

Robot Model.

> Used in Interference Checking, the Robot Model is the set of virtual model elements (sphere and cylinders) that are used to represent the location and shape of the robot arm with respect to the robot's base. Generally, the structure of a six axes robot can be accurately modeled as a series of cylinders and spheres. Each model element represents a link or part of the robot arm.

ROM

> See Read Only Memory.

routine

> 1. A list of coded instructions in a program. 2. A series of computer instructions that performs a specific task and can be executed as often as needed during program execution.

S

saving data.

> Storing program data in Flash ROM, to a floppy disk (not supported on version 7.10 and later), or memory card.

scfm

> Standard cubic feet per minute.

scratch start

> Allows you to enable and disable the automatic recovery function.

sensor

> A device that responds to physical stimuli, such as heat, light, sound pressure, magnetism, or motion, and transmits the resulting signal or data for providing a measurement, operating a control or both. Also a device that is used to measure or adjust differences in voltage in order to control sophisticated machinery dynamically.

serial communication

> A method of data transfer within a PLC whereby the bits are handled sequentially rather than simultaneously as in parallel transmission.

serial interface

> A method of data transmission that permits transmitting a single bit at a time through a single line. Used where high speed input is not necessary.

Server Side Include (SSI)

> A method of calling or "including" code into a web page.

servomotor

An electric motor that is controlled to produce precision motion. Also called a "smart" motor.

SI

System input.

signal

The event, phenomenon, or electrical quantity that conveys information from one point to another.

significant bit

A bit that contributes to the precision of a number. These are counted starting with the bit that contributes the most value, of "most significant bit", and ending with the bit that contributes the least value, or "least significant bit".

singulating

Separating parts into a single layer.

slip sheet

A sheet of material placed between certain layers of a unit load. Also known as tier sheet.

SO

System output.

specific gravity

The ratio of a mass of solid or liquid to the mass of an equal volume of water at 45C. You must know the specific gravity of the dispensing material to perform volume signal calibration. The specific gravity of a dispensing material is listed on the MSDS for that material.

SRAM

A read/write memory in which the basic memory cell is a transistor. SRAM (or S-RAM) tends to have a lower density than DRAM. A battery can be used to retain the content upon loss of power.

slpm

Standard liters per minute.

Standard Operator Panel (SOP).

A panel that is made up of buttons, keyswitches, and connector ports.

state

The on or off condition of current to and from and input or output device.

statement

See instruction.

storage device

Any device that can accept, retain, and read back one or more times. The available storage devices are SRAM, Flash ROM (FROM or F-ROM), floppy disks (not available on version 7.10 and later), memory cards, or a USB memory stick.

system variable

An element that stores data used by the controller to indicate such things as robot specifications, application requirements, and the current status of the system.

T

Tare

The difference between the gross weight of an object and its contents, and the object itself. The weight of an object without its contents.

TCP

See tool center point.

teaching

Generating and storing a series of positional data points effected by moving the robot arm through a path of intended motions.

teach mode

1. The mode of operation in which a robot is instructed in its motions, usually by guiding it through these motions using a teach pendant. 2. The generation and storage of positional data. Positional data can be taught using the teach pendant to move the robot through a series of positions and recording those positions for use by an application program.

teach pendant

1. A hand-held device used to instruct a robot, specifying the character and types of motions it is to undertake. Also known as teach box, teach gun. 2. A portable device, consisting of an LCD display and a keypad, that serves as a user interface to the KAREL system and attaches to the operator box or operator panel via a cable. The teach pendant is used for robot operations such as jogging the robot, teaching and recording positions, and testing and debugging programs.

telemetry

The method of transmission of measurements made by an instrument or a sensor to a remote location.

termination type

Feature that controls the blending of robot motion between segments.

tool

A term used loosely to define something mounted on the end of the robot arm, for example, a hand, gripper, or an arc welding torch.

tool center point

1. The location on the end-effector or tool of a robot hand whose position and orientation define the coordinates of the controlled object. 2. Reference point for position control, that is, the point on the tool that is used to teach positions. Abbreviated TCP.

TOOL Frame

The Cartesian coordinate system that has the position of the TCP as its origin to stet. The z-axis of the tool frame indicates the approach vector for the tool.

TP.

See teach pendant.

transducer

A device for converting energy from one form to another.

U

UOP

See user operator panel.

URL

Universal Resource Locator. A standard addressing scheme used to locate or reference files on web servers.

USB memory stick

The controller USB memory stick interface supports a USB 1.1 interface. The USB Organization specifies standards for USB 1.1 and 2.0. Most memory stick devices conform to the USB 2.0 specification for operation and electrical standards. USB 2.0 devices as defined by the USB Specification must be backward compatible with USB 1.1 devices. However, FANUC America Corporation does not support any security or encryption features on USB memory sticks. The controller supports most widely-available USB Flash memory sticks from 32MB up to 1GB in size.

USER Frame

The Cartesian coordinate system that you can define for a specific application. The default value of the User Frame is the World Frame. All positional data is recorded relative to User Frame.

User Operator Panel

User-supplied control device used in place of or in parallel with the operator panel or operator box supplied with the controller. Abbreviated UOP .

V

variable

A quantity that can assume any of a given set of values.

variance

The difference between the expected (or planned) and the actual, also statistics definitions.

vision system

A device that collects data and forms an image that can be interpreted by a robot computer to determine the position or to "see" an object.

volatile memory

Memory that will lose the information stored in it if power is removed from the memory circuit device.

W

web server

An application that allows you to access files on the robot using a standard web browser.

warning device

An audible or visible device used to alert personnel to potential safety hazards.

work envelope

The volume of space that encloses the maximum designed reach of the robot manipulator including the end effector, the workpiece, and the robot itself. The work envelope can be reduced or restricted by limiting devices. The maximum distance the robot can travel after the limit device is actuated is considered the basis for defining the restricted work envelope.

write

To deliver data to a medium such as storage.

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