FANUC Terminal Type I/O Module

CONNECTING MANUAL

MARMCTERM02081E REV. B

This publication contains proprietary information of FANUC Robotics America, Inc. furnished for customer use only. No other uses are authorized without the express written permission of FANUC Robotics America, Inc.

FANUC Robotics America, Inc. 3900 W. Hamlin Road Rochester Hills, Michigan 48309–3253 This manual can be used with controllers labeled R-30iA or R-J3iC. If you have a controller labeled R-J3iC, you should read R-30iA as R-J3iC throughout this manual.

Copyrights and Trademarks

This new publication contains proprietary information of FANUC Robotics America, Inc. furnished for customer use only. No other uses are authorized without the express written permission of FANUC Robotics America, Inc.

The descriptions and specifications contained in this manual were in effect at the time this manual was approved for printing. FANUC Robotics America, Inc, hereinafter referred to as FANUC Robotics, reserves the right to discontinue models at any time or to change specifications or design without notice and without incurring obligations.

FANUC Robotics manuals present descriptions, specifications, drawings, schematics, bills of material, parts, connections and/or procedures for installing, disassembling, connecting, operating and programming FANUC Robotics' products and/or systems. Such systems consist of robots, extended axes, robot controllers, application software, the KAREL® programming language, INSIGHT® vision equipment, and special tools.

FANUC Robotics recommends that only persons who have been trained in one or more approved FANUC Robotics Training Course(s) be permitted to install, operate, use, perform procedures on, repair, and/or maintain FANUC Robotics' products and/or systems and their respective components. Approved training necessitates that the courses selected be relevant to the type of system installed and application performed at the customer site.



A WARNING

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

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

FANUC Robotics America, Inc. Training Department 3900 W. Hamlin Road Rochester Hills, Michigan 48309-3253 www.fanucrobotics.com

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

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

Copyright ©2010 by FANUC Robotics America, Inc. All Rights Reserved

The information illustrated or contained herein is not to be reproduced, copied, downloaded, translated into another language, published in any physical or electronic format, including internet, or transmitted in whole or in part in any way without the prior written consent of FANUC Robotics America, Inc.

AccuStat®, ArcTool®, iRVision®, KAREL®, PaintTool®,PalletTool®, SOCKETS®, SpotTool®, SpotWorks®, and TorchMate® are Registered Trademarks of FANUC Robotics.

FANUC Robotics reserves all proprietary rights, including but not limited to trademark and trade name rights, in the following names:

AccuAirTM, AccuCalTM, AccuChopTM, AccuFlowTM, AccuPathTM, AccuSealTM, ARC MateTM, ARC Mate Sr.TM, ARC Mate System 1TM, ARC Mate System 2TM, ARC Mate System 3TM, ARC Mate System 4TM, ARC Mate System 5TM, ARCWorks ProTM, AssistToolTM, AutoNormalTM, AutoTCPTM, BellToolTM, BODYWorksTM, Cal MateTM, Cell FinderTM, Center FinderTM, Clean WallTM, DualARMTM, LR ToolTM, MIG EyeTM, MotionPartsTM, MultiARMTM, NoBotsTM, Paint StickTM, PaintProTM, PaintTool 100TM, PAINTWorksTM, PAINTWorks IITM, PAINTWorks IIITM, PalletMateTM, PalletMate PCTM, PalletTool PCTM, PayloadIDTM, RecipToolTM, RemovalToolTM, Robo ChopTM, Robo SprayTM, S-420iTM, S-430iTM, ShapeGenTM, SoftFloatTM, SOFT PARTSTM, SpotTool+TM, SR MateTM, SR ShotToolTM, SureWeldTM, SYSTEM R-J2 ControllerTM, SYSTEM R-J3 ControllerTM, SYSTEM R-J3*i*B ControllerTM, SYSTEM R-J3*i*C ControllerTM, SYSTEM R-30*i*A ControllerTM, TCP MateTM, TorchMateTM, TripleARMTM, TurboMoveTM, visLOCTM, visPRO-3DTM, visTRACTM, WebServerTM, WebTPTM, and YagToolTM.

©FANUC LTD 2010

- No part of this manual may be reproduced in any form.
- All specifications and designs are subject to change without notice.

Patents

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

FRA Patent List

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

FANUC LTD Patent List

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

Conventions

AWARNING

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

ACAUTION

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

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

Safety

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

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

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

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

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

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

CONSIDERING SAFETY FOR YOUR ROBOT INSTALLATION

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

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

Keeping People and Equipment Safe

The safety of people is always of primary importance in any situation. However, equipment must be kept safe, too. When prioritizing how to apply safety to your robotic system, consider the following:

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

Using Safety Enhancing Devices

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

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

Setting Up a Safe Workcell

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

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

motion range of the robot, including any tooling attached to the wrist flange that extend this range.

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

Staying Safe While Teaching or Manually Operating the Robot

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

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

- Know whether or not you are using an intrinsically safe teach pendant if you are working in a hazardous environment.
- Before teaching, visually inspect the robot and work envelope to make sure that no potentially hazardous conditions exist. The work envelope is the area defined by the maximum motion range of the robot. These include tooling attached to the wrist flange that extends this range.
- The area near the robot must be clean and free of oil, water, or debris. Immediately report unsafe working conditions to the supervisor or safety department.
- FANUC Robotics recommends that no one enter the work envelope of a robot that is on, except for robot teaching operations. However, if you must enter the work envelope, be sure all safeguards are in place, check the teach pendant DEADMAN switch for proper operation, and place the robot in teach mode. Take the teach pendant with you, turn it on, and be prepared to release the DEADMAN switch. Only the person with the teach pendant should be in the work envelope.

AWARNING

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:

AWARNING

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

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

Staying Safe During Automatic Operation

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

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

Staying Safe During Inspection

When inspecting the robot, be sure to

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

Staying Safe During Maintenance

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

- Never enter the work envelope while the robot or a program is in operation.
- Before entering the work envelope, visually inspect the workcell to make sure no potentially hazardous conditions exist.
- Never wear watches, rings, neckties, scarves, or loose clothing that could get caught in moving machinery.
- Consider all or any overlapping work envelopes of adjoining robots when standing in a work envelope.
- Test the teach pendant for proper operation before entering the work envelope.
- If it is necessary for you to enter the robot work envelope while power is turned on, you must be sure that you are in control of the robot. Be sure to take the teach pendant with you, press the DEADMAN switch, and turn the teach pendant on. Be prepared to release the DEADMAN switch to turn off servo power to the robot immediately.
- Whenever possible, perform maintenance with the power turned off. Before you open the controller front panel or enter the work envelope, turn off and lock out the 3-phase power source at the controller.
- Be aware that when you remove a servomotor or brake, the associated robot arm will fall if it is not supported or resting on a hard stop. Support the arm on a solid support before you release the brake.
- 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.

AWARNING

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.

AWARNING

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 software limits, limit switches, and mechanical hardstops to prevent undesired movement of the robot into the work area of machine tools and external devices.

KEEPING THE ROBOT SAFE

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

Operating Safety Precautions

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

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

Programming Safety Precautions

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

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

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

ADDITIONAL SAFETY CONSIDERATIONS FOR PAINT ROBOT INSTALLATIONS

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

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

Although paint booth hazards have been minimized, potential dangers still exist. Therefore, today's highly automated paint booth requires that process and maintenance personnel have full awareness of the system and its capabilities. They must understand

the interaction that occurs between the vehicle moving along the conveyor and the robot(s), hood/deck and door opening devices, and high-voltage electrostatic tools.



A CAUTION

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

Paint robots are operated in three modes:

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

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

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

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

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

Paint System Safety Features

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

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

The paint system includes the following safety features:

- Most paint booths have red warning beacons that illuminate when the robots are armed and ready to paint. Your booth might have other kinds of indicators. Learn what these are.
- Some paint booths have a blue beacon that, when illuminated, indicates that the electrostatic devices are enabled. Your booth might have other kinds of indicators. Learn what these are.
- EMERGENCY STOP buttons are located on the robot controller and teach pendant. Become familiar with the locations of all E-STOP buttons.

- An intrinsically safe teach pendant is used when teaching in hazardous paint atmospheres.
- A DEADMAN switch is located on each teach pendant. When this switch is held in, and the teach pendant is on, power is applied to the robot servo system. If the engaged DEADMAN switch is released or pressed harder during robot operation, power is removed from the servo system, all axis brakes are applied, and the robot comes to an EMERGENCY STOP. Safety interlocks within the system might also E–STOP other robots.

AWARNING

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. 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.



Observe all safety rules and guidelines to avoid injury.

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.

A 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.



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

FANUC TERMINAL TYPE I/O MODULE CONNECTING MANUAL

Table of contents

#2 #3 #4

#4

#2 #3 #4

| | 4.2 Connecting Input power source |
|------------------------------------|---|
| 1. Outline | 4.3 Power turn-on sequence |
| | 4.4 Power turn-off sequence |
| 2. Specification of module | 4.5 Signal assignment on terminal block |
| 2.1 Ordering specification | 4.5.1 Basic module, Extension module A or B |
| 2.2 Environmental conditions | 4.5.2 Extension module C |
| 2.3 Specification of I/O signals | 4.5.3 Extension module D |
| 2.3.1 Basic module, | 4.5.4 Extension module E |
| Extension module A and B | 4.6 Connection of DI / DO |
| 2.3.2 Extension module C | 4.6.1 Basic module, Extension module A or B |
| 2.3.3 Extension module D | 4.6.1.1 Connection of DI |
| 2.3.4 Extension module E | 4.6.1.2 Connection of DO |
| 2.4 Required current | 4.6.2 Extension module C |
| 2.5 Weight | 4.6.3 Extension module D |
| 2.6 Heat value | 4.6.4 Extension module E |
| 2.7 Suited wire | 4.7 Connection between modules |
| | 4.8 Connection of manual pulse generator |
| 3. Outer dimensions | 4.9 How to connect wire to the terminal |
| 3.1 Outer dimensions | 4.10 Detaching of the terminal |
| 3.2 Mounting and dismounting | |
| 3.2.1 Cautions for mounting module | 5. Setting |
| 3.2.2 Details of mounting holes | 5.1 DI/DO map on the I/O Link |
| 3.2.3 Using DIN rail for mounting | 5.2 Detection of DO Alarm |
| 3.3 Name of each part on module | 5.2.1 Basic module, Extension module A or B |
| 3.3.1 Basic module | 5.2.2 Extension module C |
| 3.3.2 Extension module A | 5.3 Setting of rotary switch (Distribution I/O |
| 3.3.3 Extension module B | Setting) |
| 3.3.4 Extension module C | 6. How to increase the number of common terminals |
| 3.3.5 Extension module D | |
| 3.3.6 Extension module E | 7. Others |
| | 7.1 DO signal reaction to a system alarm |
| 4. Connection | 7.2 Parallel DO (output signal) connection |
| 4.1 General connection diagram | |
| | |

| 03 | 07.05.10 | Akimoto | Out of frame #3 is added Y.Nomoto | TITLE TERMINAL TYPE I/O | | |
|------|----------|----------|--|-------------------------|-------|------|
| 05 | 09.09.09 | Kurokawa | Out of frame #5 is added,3,7,39 Y.Nomoto | CONNECTING MANUA | | JAL |
| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added Y.Nomoto | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 1/47 |

#4

#2 #3

#2 #3

#4

1. Outline

Specification of terminal type I/O module is based on connector panel I/O module.

The strong points of terminal type I/O module are below.

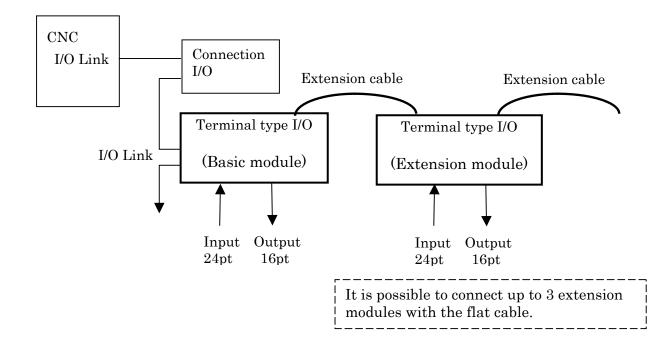
- Using ferrule terminal for connect input/output signal.
- LED which indicates On/Off state every input/output signal. (Extension module D and E has no LED.)
- 16 points of digital output and 24 points of digital input for one module.

Note) Extension module C has no DI.

Extension module D has only Analog Inputs.

Extension module E has only Analog Outputs.

- Photo coupler insulation is adopted for output circuit.
- It is possible to install in the DIN rail.
- Using extension modules, the maximum point input: 96 points and outputs: 64 points.
- The terminal block can be detached from module.
- There is Extension module with MPG (The manual pulse generator) interface.



Note)

There is a possibility that I/O Link slave module will not operate normally due to a failure of CNC or I/O Link slave module, or abnormally power supply voltage. To prevent accidents even in this case, design the machine to operate safely by making a redundant circuit outside the I/O Link slave module.

| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added TITLE TERMINAL TYPE I/O MOD CONNECTING MANU | | | |
|------|----------|----------|---|--------------------|-------|------|
| 03 | 07.05.10 | Akimoto | Out of frame #3 is added | CONNECTING | MAN | JAL |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 2/ |

#3

#2

#3

#4

2.Specification of module 2.1 Ordering specification

| Name Ordering specification Basic module A03B-0823-C001 DI 24pt / DO 16pt With I/O Link I/F Extension module A A03B-0823-C002 DI 24pt / DO 16pt With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Note) Connect extension module A next to basic module. Extension module C A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 Analog input Analog output Analog Output Analog Output module Spare fuse A03B-0823-K001 Spare fuse A03B-0823-K001 | 2.1 Ordering specific | | , |
|--|--------------------------|----------------|---|
| Basic module A03B-0823-C001 DI 24pt / DO 16pt With I/O Link I/F Extension module A A03B-0823-C002 DI 24pt / DO 16pt With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 A03B-0823-C006 Extension module E A03B-0823-C006 | Name | Ordering | Specification of module |
| With I/O Link I/F Extension module A A03B-0823-C002 DI 24pt / DO 16pt With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Extension module E A03B-0823-C006 | | specification | |
| Extension module A A03B-0823-C002 DI 24pt / DO 16pt With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 A03B-0823-C006 Extension module E A03B-0823-C006 | Basic module | A03B-0823-C001 | DI 24pt / DO 16pt |
| With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Note 1 Extension module E A03B-0823-C006 | | | With I/O Link I/F |
| With MPG I/F Note) Connect extension module A next to basic module. Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Note 1 Extension module E A03B-0823-C006 | Extension module A | A03B-0823-C002 | DI 24pt / DO 16pt |
| Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Extension module E A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 | | | |
| Extension module B A03B-0823-C003 DI 24pt / DO 16pt Without MPG I/F Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Extension module E A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 | | | Note) Connect extension module A next to basic |
| Extension module C A03B-0823-C004 Extension module D A03B-0823-C005 Extension module D A03B-0823-C005 Extension module E A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 | | | |
| Extension module C A03B-0823-C004 DO 16pt, Max 2A/pt 2A output module Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Extension module E A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 Analog Output Analog Output module | Extension module B | A03B-0823-C003 | DI 24pt / DO 16pt |
| Extension module D A03B-0823-C005 A03B-0823-C005 Analog input module Extension module E A03B-0823-C006 A03B-0823-C006 A03B-0823-C006 Analog Output Analog Output module | | | Without MPG I/F |
| Extension module D A03B-0823-C005 A03B-0823-C006 Extension module E A03B-0823-C006 Analog input module Analog Output Analog Output Analog Output module | Extension module C | A03B-0823-C004 | DO 16pt, Max 2A/pt |
| Extension module E A03B-0823-C006 Analog input module Note 1 Analog input module Note 1 4ch 12 bit analog Output Analog Output module | | | |
| Extension module E A03B-0823-C006 Analog input module Note 1 Analog input module Note 1 4ch 12 bit analog Output Analog Output module | Extension module D | A03B-0823-C005 | 4ch 12 bit analog input |
| Analog Output module | | | |
| | Extension module E | A03B-0823-C006 | 4ch 12 bit analog Output |
| Spare fuse A03R-0823-K001 24 (for Rasic module) | | | Analog Output module |
| ppare ruse A00D 0020 N001 2A (101 Dasic illoudie) | Spare fuse | A03B-0823-K001 | 2A (for Basic module) |
| Spare terminals set A03B-0823-K010 Terminal block for cable side (T1-T4) | Spare terminals set | A03B-0823-K010 | Terminal block for cable side (T1-T4) |
| (For Basic module or Note) Terminal block for cable side is attached | (For Basic module or | | Note) Terminal block for cable side is attached |
| Extension module A or B) with module. This set is for maintenance. | Extension module A or B) | | with module. This set is for maintenance. |
| Spare terminals set A03B-0823-K011 Terminal block for cable side (T1,T2) | Spare terminals set | A03B-0823-K011 | Terminal block for cable side (T1,T2) |
| (For extension module C) Note) Terminal block for cable side is attached | (For extension module C) | | Note) Terminal block for cable side is attached |
| with module. This set is for maintenance. | | | with module. This set is for maintenance. |
| Spare terminals set A03B-0823-K012 Terminal block for cable side (T1,T2) | Spare terminals set | A03B-0823-K012 | Terminal block for cable side (T1,T2) |
| (For extension module D) Note) Terminal block for cable side is attached | (For extension module D) | | Note) Terminal block for cable side is attached |
| with module. This set is for maintenance. | | | with module. This set is for maintenance. |
| Spare terminals set A03B-0823-K013 Terminal block for cable side (T1,T2) | Spare terminals set | A03B-0823-K013 | Terminal block for cable side (T1,T2) |
| (For extension module E) Note) Terminal block for cable side is attached | | | |
| with module. This set is for maintenance. | | | with module. This set is for maintenance. |
| Extension cable A A03B-0823-K100 Length of cable is 100mm. | Extension cable A | A03B-0823-K100 | Length of cable is 100mm. |
| It is necessary to use this cable for using | | | |
| extension module. | | | extension module. |

Note 1. It is possible to connect up to two Extension module D to one Basic module.

| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|----------|----------|--------------------------|--|-------|------|
| 03 | 07.05.10 | Akimoto | Out of frame #3 is added | CONNECTING | J WAN | UAL |
| 05 | 09.09.09 | Kurokawa | Out of frame #5 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 3/ |

#4 #2

#2 #3 #5

#2

#3

#4

2.2 Environmental conditions

The terminal type I/O module have been designed on the assumption that they are housed in closed cabinets. The environmental conditions when installing these cabinets shall conform to the following table.

| T4 | C if i | | |
|----------------------------|---|--|--|
| Item | Specification | | |
| Power supply for the | 24VDC±10% | | |
| control and input circuits | | | |
| Ambient temperature | In operation:0~55°C | | |
| | In storage or transportation:-20~60°C | | |
| Variations in temperature | Up to 1.1°C per minute | | |
| Humidity | General condition: 75% or lower (relative humidity) | | |
| | Short–period condition (up to one month): Up to 95% | | |
| Vibration | 0.5G or less (Operating), 1.0G or less (Non-operating) | | |
| | FANUC conducted an evaluation test under the following conditions: | | |
| | 10 to 58 Hz: 0.075 mm (amplitude) | | |
| | 58 to 500Hz: 1G | | |
| | Direction of vibration: Each of the X, Y, and Z directions | | |
| | Number of sweep cycles: 10 | | |
| | Conforming to IEC68-2-6 | | |
| Environment | Normal machine shop environment (The environment must be | | |
| | considered if the cabinets are in a location where the density of dust, | | |
| | coolant, organic solvent, and/or corrosive gas is relatively high.) | | |

| | | | | TITLE TERMINAL TYPE I/O CONNECTING I | | |
|------|------|--------|-------------|---|------|------|
| | | | | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | HEET | 4/ |

T

2.3 Specification of I/O signals

$2.3.1\ Basic$ module, Extension module A and B

| | Digital | input |
|------------------|---------|--------------------|
| Point | | 24 points |
| Common | | 8 points/common |
| | | (Common terminals |
| | | are 6 points.) |
| Ratings inp | ut | 24VDC±10% |
| voltage | | |
| Ratings inp | ut | 7.5 mA on average |
| current | | |
| Polarity | | Sink type |
| ON voltage | , | Min.20VDC, |
| current | | min.6mA |
| OFF voltage | e, | Max.5VDC, |
| current | | Min.1.5mA |
| Response Off->On | | 2ms or less (Note) |
| time | On->Off | 2ms or less (Note) |

| a | ina B | | |
|------------------------|----------------------------------|---------|--|
| Digita | | | al output |
| | Point | | 16 points |
| | Common | | 8 points/common (Common terminals are 8 points.) |
| Ratings output voltage | | tput | 12~24VDC (+20%,-15%) |
| | Ratings output current | | 0.2A/pt |
| | | | |
| Polarity | | | Source type |
| | Maximum voltage | | 0.63V |
| | drop when | ON | (load current $\times 1.25 \Omega$) |
| | Maximum leak current when OFF | | $40\mu\mathrm{A}$ |
| | Response | Off->On | 2ms or less (Note) |
| | time | On->Off | 2ms or less (Note) |
| | Insulation | method | Photo coupler insulation |
| | Output pro | tection | Overheating and over |
| | function | | current protection |

2.3.2 Extension module C

| 2.5.2 Extension mod | idic C | |
|------------------------------|----------------|--|
| Digi | | gital output |
| Point | | 16 points |
| Common | | 4 points/common |
| Ratings output vo | ltage | DC12~24V (+20%、-15%) |
| Ratings output cu | rrent | 2A/pt (4A/common) |
| Polarity | | Source type |
| Maximum voltage drop when ON | | $0.18V(load current \times 0.09 \Omega)$ |
| Maximum leak cu | rrent when OFF | 0.1mA |
| Response time | Off->On | 2ms or less (Note) |
| | On->Off | 2ms or less (Note) |
| Insulation method | | Photo coupler insulation |
| Output protection function | | Overheating and over current protection |
| | | Open load detection |

Note)

The actual response time is the sum of this value and the scanning time determined by the system.

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|----------|----------|--------------------------|--------------------------------|-------|------|--|
| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added | CONNECTING MANUAL | | | |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 5/ | |

#4

#2

#4

2.3.3 Extension module D

| Item | Specification | 1 | | Remarks |
|------------------------------|---|------------------------|--|---|
| Number of input | 4channels | | | |
| channels (Note) | | | | |
| Analog input | | | esistance $4.7 \mathrm{M}\Omega)$ resistance $250\Omega)$ | Voltage or Current input can be selected on channel-by-channel basis by jumper connections. |
| Digital output (Note) | 12 bits (bina | ry) | | Represented as 2's complement |
| Input / Output | | | | |
| correspondence | Analog | g Input | Digital Output | |
| | Voltage | Current | | |
| | input | input | | |
| | +10V | | +2000 | |
| | +5V | +20mA | +1000 | |
| | 0V | 0mA | 0 | |
| | -5V | -20mA | -1000 | |
| | | | -2000 | |
| Resolution | $5 \mathrm{mV} \ \mathrm{or} \ 20 \mu$ | A | | |
| Overall precision | Voltage inpu | $\mathrm{tt}:\pm0.5\%$ | | With respect to full scale |
| | Current inpu | ut: ±1.0% | | |
| Maximum input | $\pm 15 \mathrm{V} / \pm 3$ | 30mA | | |
| voltage / current | | | | |
| A-D Conversion time | Under 2ms | | | |
| Minimum digital | Ladder scan | period of Cl | NC connected | |
| reload time | | | | |
| Number of occupied | 3 bytes for D | Ι | | |
| input / output points (Note) | 2 bytes for D | Ю | | |

Note) This module has 4 channels of analog input and 1 set of 12 bits digital output.

So, the ladder program needs dynamic selection of a conversion channel from 4 input channels. There are channel switching DO points at occupied two-byte output points.

Ref: 5.1 DI/DO map on the I/O Link (As for address of Extension module D)

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|----------|---------|--------------------------|--|-------|------|--|
| 03 | 07.05.10 | Akimoto | Out of frame #3 is added | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 6/ | |

#5

2.3.4 Extension module E

| 2.5.4 Extension | 1110 01 01 10 12 | | | | | | | | |
|-----------------------|---|---------------------|----------------------------|-------------------|--|--|--|--|--|
| Item | Specification | | | | | | | | |
| Number of output | Achannels | | | | | | | | |
| channels (Note1) | | | | | | | | | |
| Analog output | DC -10 to +10V (e | external load resis | tance: 10KΩ or n | nore) | | | | | |
| (Note2) | DC 0 to +20mA (e | xternal load resist | tance: 400Ω or less | $_{\mathrm{ss}})$ | | | | | |
| Digital input | 12 bits (binary) | | | | | | | | |
| Input / output | | | | _ | | | | | |
| correspondence | Digital input | Analog | output | | | | | | |
| | | Voltage output | Current output | | | | | | |
| | +2000 | +10V | _ | | | | | | |
| | +1000 | +5V | +20mA | | | | | | |
| | 0 | 0V | 0mA | | | | | | |
| | -1000 | -5V | _ | | | | | | |
| | -2000 | -10V | _ | | | | | | |
| | | | | | | | | | |
| Resolution | $5 \mathrm{mV} \ \mathrm{or} \ 20 \mu \mathrm{A}$ | | | | | | | | |
| Overall precision | Voltage output: ± | 0.5% (For the full | scale) | | | | | | |
| | Current output: ± | 1.0% (For the full | scale) | | | | | | |
| D-A Conversion time | 1ms or less | | | | | | | | |
| Minimum digital | Ladder scan period of CNC connected | | | | | | | | |
| reload time (Note3) | | | | | | | | | |
| Number of occupied | 3 bytes for DI | | | | | | | | |
| input / output points | 2 bytes for DO | | | | | | | | |

- Note) 1 The ladder program needs selection of a conversion channel from 4 output channels. Ref: 5. 1 DI/DO map on the I/O Link (As for address of Extension module E)
 - 2 Which method to use, voltage output or current output, can be selected by connecting the corresponding output to the terminal block.
 - 3 The converting time is the one only inside the module. The actual response time is added a scan time that is determined by the system.
 - $4\ 3$ bytes for DI are not used although automatically occupied by mapping. Ref: $5.\ 1$

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|----------|----------|--------------------------|--------------------------------|------|--|--|
| 05 | 09.09.09 | Kurokawa | Out of frame #5 is added | CONNECTING MANUAL | | | |
| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added | DRAW. NO. A-86491E | CUST | | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | 7/ | | |

#2

2.4 Required current

| Name of module | Power supply input voltage | Required current | Remarks |
|-----------------------|----------------------------|------------------|------------------------|
| Basic module | 24VDC±10% | 0.2A+7.3mA×DI | DI: Number of DI |
| | | | points which states ON |
| Extension module A, B | Supply from Basic module | 0.1A+7.3mA×DI | DI: Number of DI |
| | | | points which states ON |
| Extension module C | Supply from Basic module | 0.1A | - |
| Extension module D | Supply from Basic module | 0.1A | - |
| Extension module E | Supply from Basic module | 0.16A | - |

2.5 Weight

| Name of module | Weight (g) |
|--------------------|------------|
| Basic module | 420 |
| Extension module A | 400 |
| Extension module B | 380 |
| Extension module C | 440 |
| Extension module D | 400 |
| Extension module E | 400 |

2.6 Heat value

The heat value of the module is the sum of 'Heat value per input of one point'× Simultaneous ON point, and 'Heat value per output of one point'× Simultaneous ON point and Basic heat value.

| Module name | Basic heat value (W) | Heat value per input | Heat value per output of |
|-----------------------|----------------------|----------------------|-----------------------------|
| | | of one point (W) | one point (W) |
| | | | IL: Load current of output |
| Basic module | 4.8 | 0.23 | $0.04 + 0.9 \times IL^{2}$ |
| Extension module A, B | 2.4 | 0.23 | $0.04 + 0.9 \times IL^{2}$ |
| Extension module C | 1.0 | _ | $0.04 + 0.09 \times IL^{2}$ |
| Extension module D | 2.4 | _ | _ |
| Extension module E | 3.8 | _ | _ |

Example:

[Basic module] Input: 16 points

Output: 12 points (8 points IL=0.1A, 4 points IL=0.2A)

[Extension module C] Output: 8 points (IL=0.1A)

 $P = 4.8 + 0.23 \times 16 + (0.04 + 0.9 \times 0.1^{2}) \times 8 + (0.04 + 0.9 \times 0.2^{2}) \times 4 + 1.0 + (0.04 + 0.09 \times 2^{2}) \times 8$

=13.4W

| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|----------|----------|--------------------------|--------------------------------|-------|------|--|
| 03 | 07.05.10 | Akimoto | Out of frame #3 is added | CONNECTING MANUAL | | | |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 8/ | |

#2

#2

2.7 Suited wire

Electrical wire size

Φ D3

Φ D2

Φ D2

Diameter of below table is made by Weidmuller Co.,Ltd.

Ferrule terminal specifications

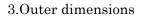
| Cross sectional area of electrical wire (mm ²) | JIS VSF KIV (mm²) | JIS IV (mm²) | UL1007 (AWG) | UL1015 (AWG) | Electrical wire sheath stripped length (mm) | Overall length L1 (mm) | Length of metallic part L2 (mm) | Inside diameter of conductor D1 (mm) | Inside diameter of sheath D2 (mm) | Outside diameter of sheath D3 (mm) |
|--|-------------------|--------------|--------------|--------------|--|---------------------------|---------------------------------|--------------------------------------|-----------------------------------|------------------------------------|
| 0.5 | - | - | 20 | - | 10 | 14 | 8 | 1 | 2.6 | 3.1 |
| | | | | | 12 | 16 | 10 | | | |
| 0.75 | 0.5 | - | 18 | 20 | 10 | 14 | 8 | 1.2 | 2.8 | 3.3 |
| | | | | | 12 | 16 | 10 | | | |
| 1.0 | 0.75 | 0.9 | - | 18 | 10 | 14 | 8 | 1.4 | 3 | 3.5 |
| | | | | | 12 | 16 | 10 | | | |

Suited wire which is connected to terminal type I/O module. Wire size: 0.127 to 1.5mm²(VDE) / AWG28 to AWG14(UL/CSA) Size conformable when a ferrule (rod terminal) is used: 0.5 to 1.5 mm² Peeling length: 6 mm

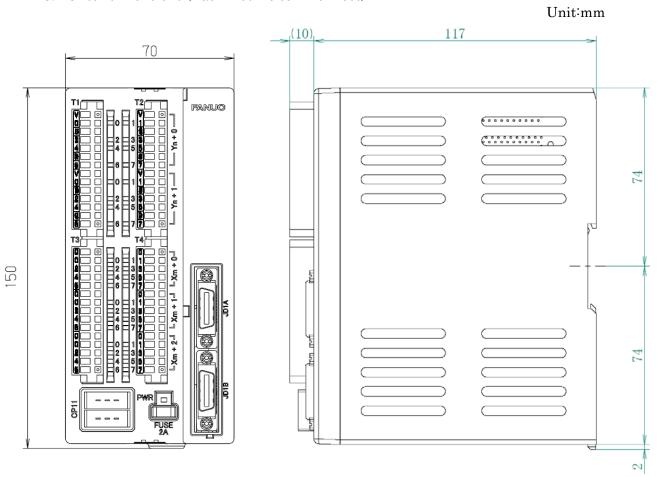
Note) Please use a ferrule from the long-term reliability viewpoint.

It is possible to connect wire into terminal block directly. However, we recommend a ferrule to be used from the long-term reliability viewpoint.

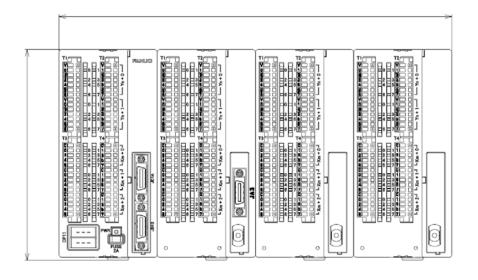
| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|----------|----------|--------------------------|---|-------|------|--|
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 9/ | |



3.1 Outer dimensions (Each module commonness)



At maximum composition (1 Basic module and 3 Extension modules)



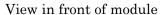
| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|------|--------|-------------|---|-------|------|--|
| | | | | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 10/ | |

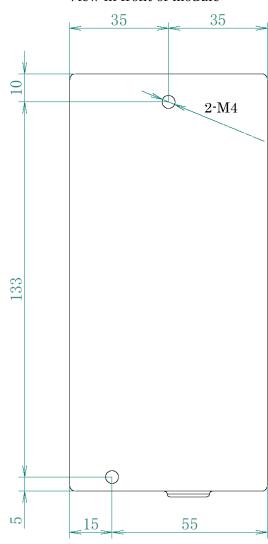
3.2 Mounting and dismounting

- 3.2.1 Cautions for mounting module
 - (1) Use the unit in a completely sealed cabinet.
 - (2) Mount the unit on a vertical surface, and allow a space of at least 100 mm above and below the unit for ventilation and module removal. Do not place any unit generating a large amount of heat under the detector interface unit.

3.2.2 Details of mounting holes

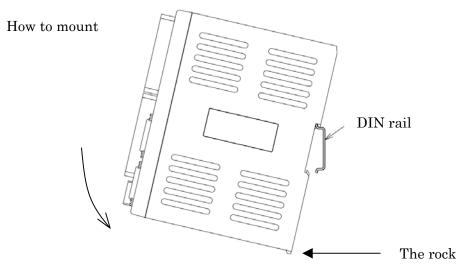
Unit:mm





| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|----------|----------|--------------------------|---|-------|------|
| 04 | 09.05.25 | Kurokawa | Out of frame #4 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 11/ |

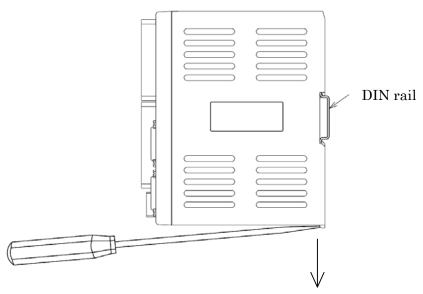
3.2.3 Using DIN rail for mounting



- 1.Place the hook of the unit on the top end of the DIN rail
- 2. Push in the unit firmly until it clicks.

Note) Please note that the lock doesn't remain falling.

How to remove

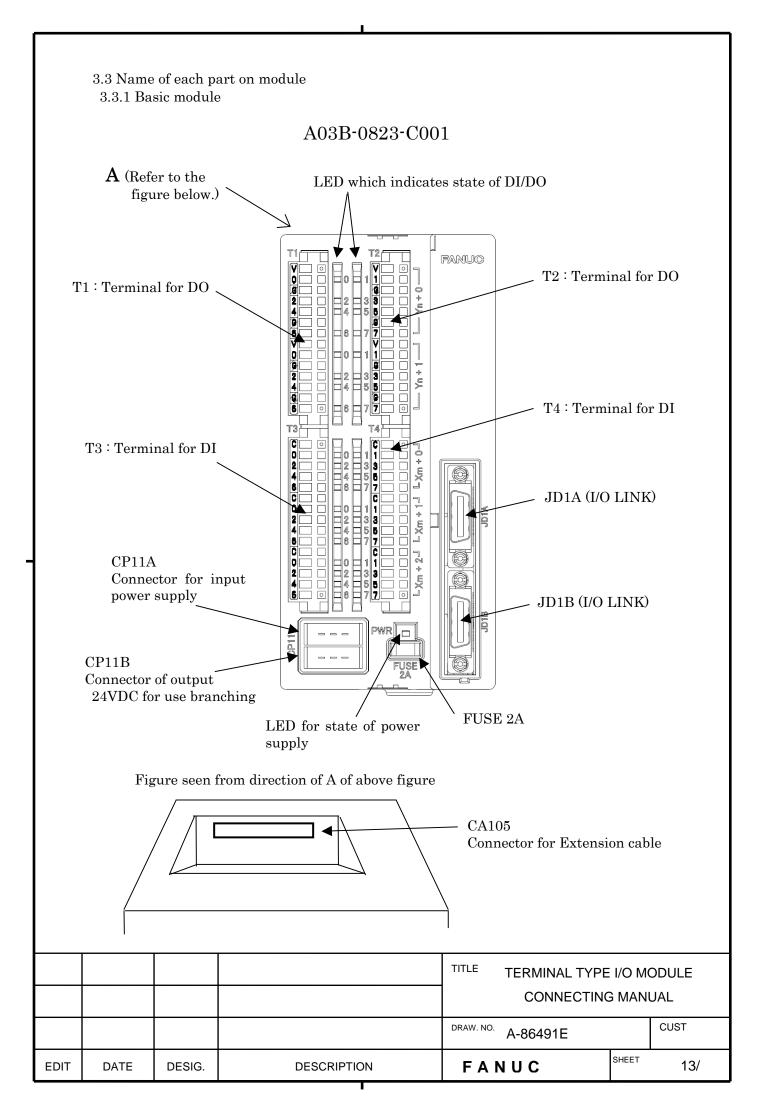


- 1. Pull down the look on the unit using a flat-blade screwdriver or similar object.
- 2. Remove the unit by pulling bottom toward you.

Note)

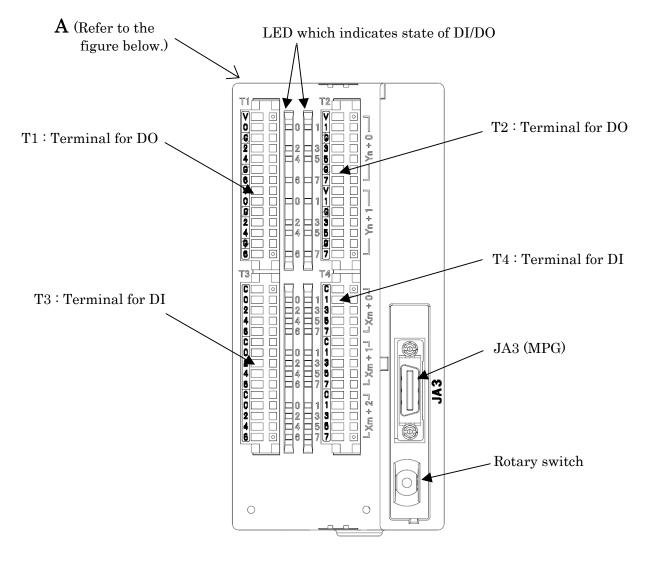
To prevent damage to the lock when removing the unit, be careful not to apply excessive force to the lock.

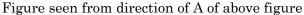
| | | | | TITLE TERMINAL TYPE I/O MODULE | | | | |
|------|------|--------|-------------|--------------------------------|-------|-----|--|--|
| | | | | CONNECTING MANUAL | | | | |
| | | | | DRAW. NO. A-86491E | CUST | | | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 12/ | | |

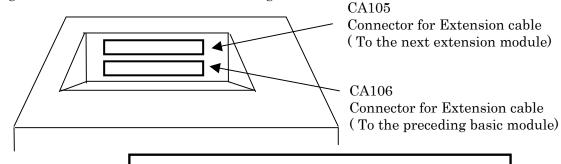


3.3.2 Extension module A

A03B-0823-C002





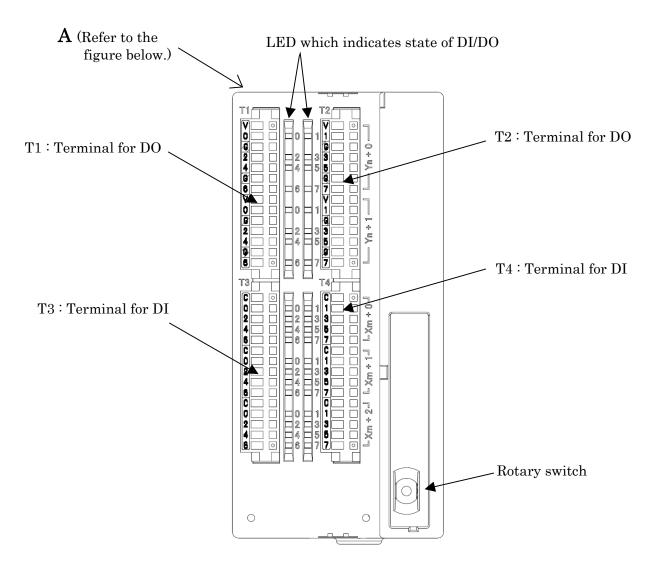


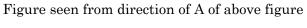
Note) Connect extension module A next to basic module.

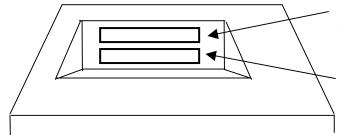
| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|------|--------|-------------|--|-------|------|
| | | | | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 14/ |

3.3.3 Extension module B

A03B-0823-C003







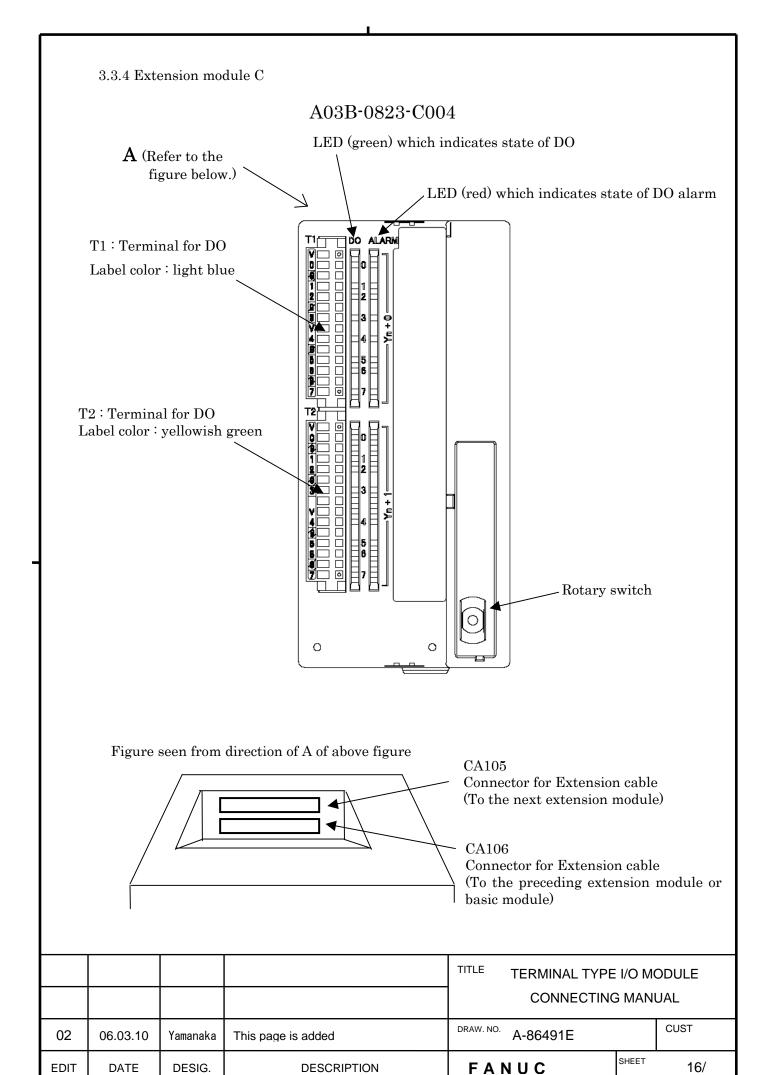
CA105

Connector for Extension cable (To the next extension module)

CA106

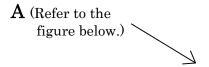
Connector for Extension cable (To the preceding extension module or basic module)

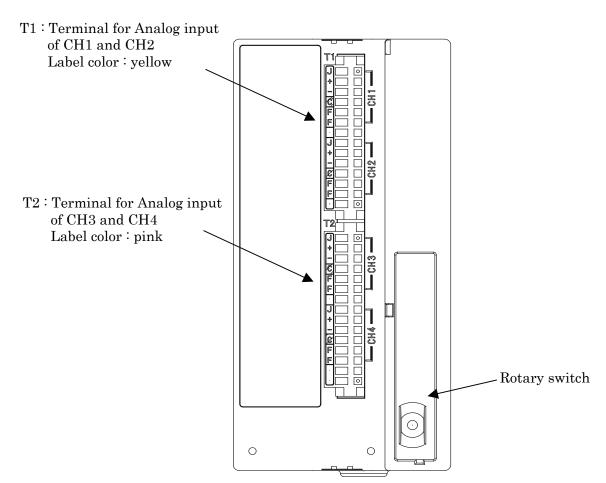
| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|------|--------|-------------|--------------------------------|----------|-------|------|
| | | | | CONNECTING MANUAL | | | |
| | | | | DRAW. NO. | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 15/ |

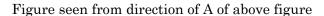


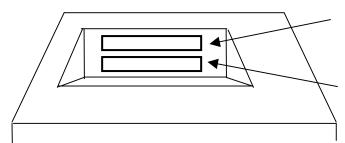


A03B-0823-C005









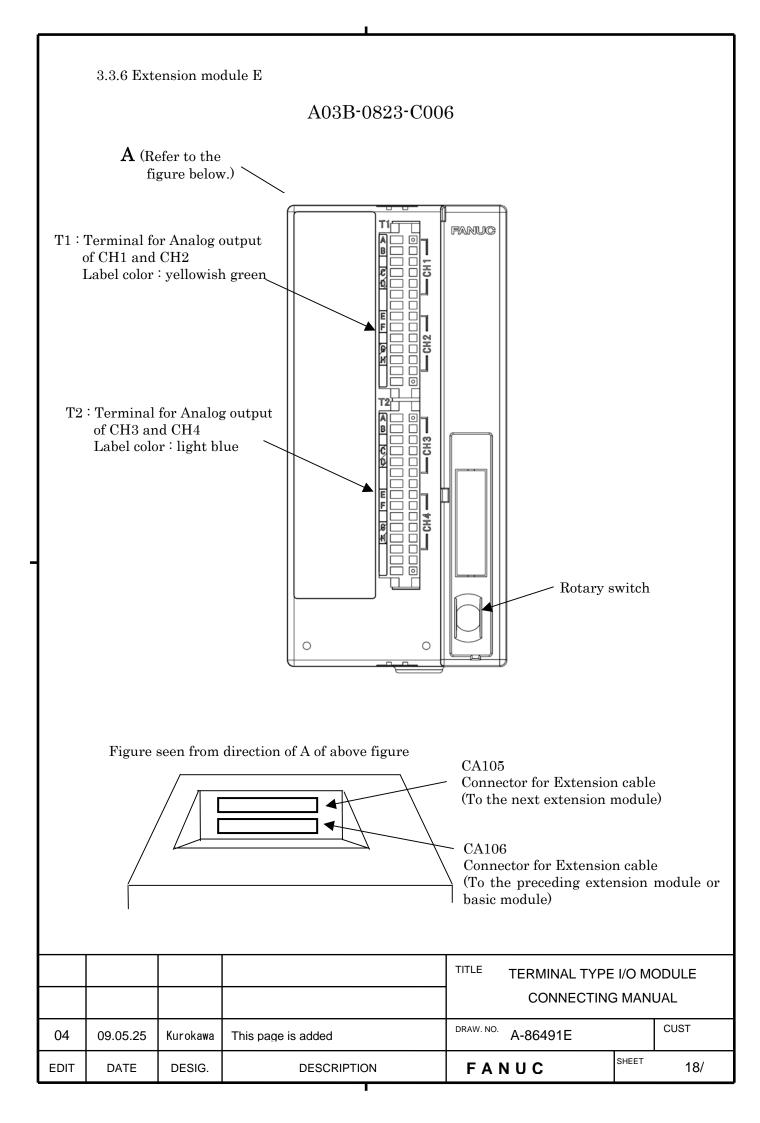
CA105

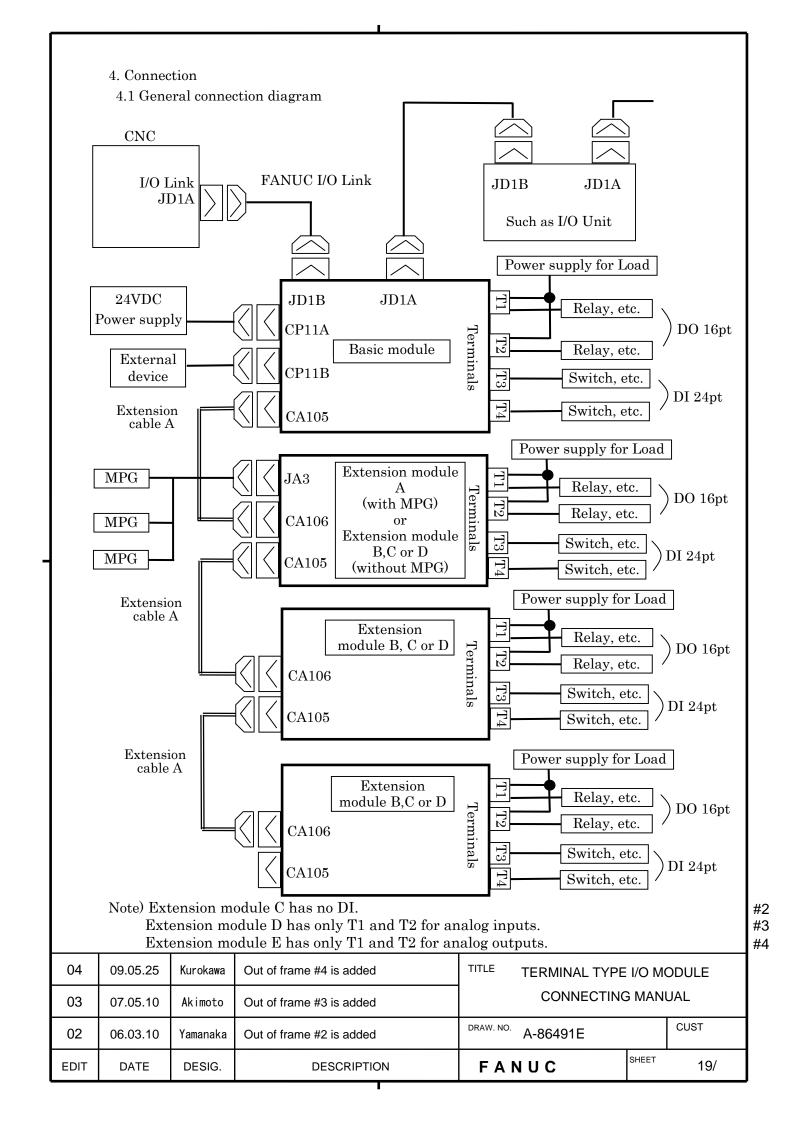
Connector for Extension cable (To the next extension module)

CA106

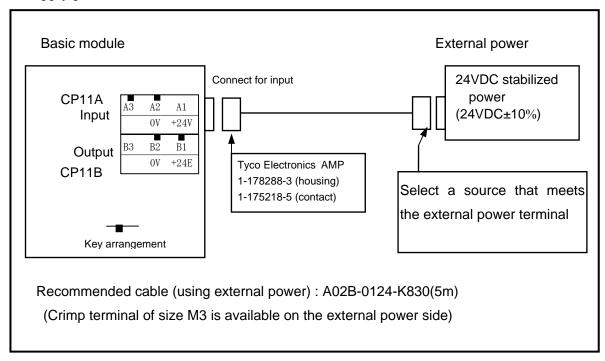
Connector for Extension cable (To the preceding extension module or basic module)

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|----------|---------|--------------------|--|-------|------|
| 03 | 07.05.10 | Akimoto | This page is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 17/ |

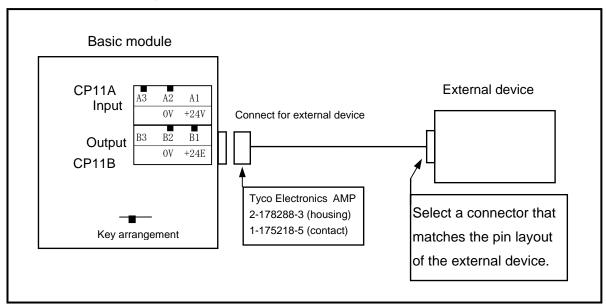




4.2 Connecting Input power source Supply power to this unit from CNC or external resource.



The 24V DC input to CP11A(A1,A2) can be output from CP11B(B1,B2) for use branching. The connection of CP11B(B1,B2) is as shown below. In this case, the external 24V DC power supply should have a rating which is equal to the sum of the current consumed by the control unit and the current used via CP11B(B1,B2).



Maximum current which is supplied from CP11B is 2A.

| | | | | TITLE TERMINAL TYPE I/O MODULE | | |
|------|----------|----------|--------------------------|--------------------------------|-------|------|
| | | | | CONNECTING MANUAL | | |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 20/ |

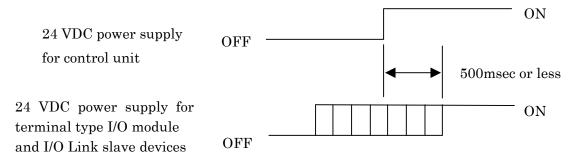
#2

4.3 Power turn-on sequence

Turn on the power to this unit in the following order or **simultaneously**.

- 1. Power supplies (200 VAC) for the entire machine (including the servo amplifier)
- 2. Power supplies (24 VDC) for terminal type I/O module and the FANUC I/O Link slave devices (such as the I/O Unit-MODEL A)
- 3. Power supplies (24 VDC) for the control unit (CNC)

"Simultaneously" here means that 1 and 2 above must be turned on within 500ms at the most of turning 3 on.

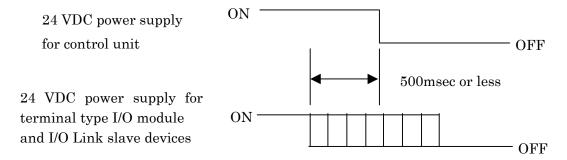


4.4 Power turn-off sequence

Turn off the power to this unit in the following order or **simultaneously**.

- 1. Power supplies (24 VDC) for the control unit (CNC)
- 2. Power supplies (24 VDC) for terminal type I/O module and the FANUC I/O Link slave devices (such as the I/O Unit-MODEL A) the servo amplifier.
- 3. Power supplies (200 VAC) for the entire machine

"Simultaneously" here means 2 and 3 may be turned off within 500ms before 1 is turned off. If 2 and 3 are turned off earlier, alarm information remains in the CNC.



| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|------|--------|-------------|--------------------------------|-----|-------|-----|
| | | | | CONNECTING MANUAL | | | |
| | | | | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FAN | U C | SHEET | 21/ |

- 4.5 Signal assignment on terminal block (Each module commonness)
 - 4.5.1 Basic module, Extension module A or B

Signal assignment for output

| <u>T1</u> | (Label color : light blue) | | T2 | (Label color | : yel <u>lowis</u> h green) |
|-----------|----------------------------|---|----|--------------|-----------------------------|
| 1 | DOCOM0 | V | 1 | DOCOM0 | V |
| 2 | Yn+0.0 | 0 | 2 | Yn+0.1 | 1 |
| 3 | 0V-0 | G | 3 | 0V-0 | G |
| 4 | Yn+0.2 | 2 | 4 | Yn+0.3 | 3 |
| 5 | Yn+0.4 | 4 | 5 | Yn+0.5 | 5 |
| 6 | 0V-0 | G | 6 | 0V-0 | G |
| 7 | Yn+0.6 | 6 | 7 | Yn+0.7 | 7 |
| 8 | DOCOM1 | V | 8 | DOCOM1 | V |
| 9 | Yn+1.0 | 0 | 9 | Yn+1.1 | 1 |
| 10 | 0V-1 | G | 10 | 0V-1 | G |
| 11 | Yn+1.2 | 2 | 11 | Yn+1.3 | 3 |
| 12 | Yn+1.4 | 4 | 12 | Yn+1.5 | 5 |
| 13 | 0V-1 | G | 13 | 0V-1 | G |
| 14 | Yn+1.6 | 6 | 14 | Yn+1.7 | _ 7 |

Indication on label -

#2

#2

#2

#2

Signal assignment for Input

| Т3 | (Label co | olor : <u>yell</u> ow) | T4 | (La | bel <u>color</u> : pink) | | |
|---------------------|-----------|------------------------|----|--------|--------------------------|--|--|
| 1 | DICOM | С | 1 | DICOM | С | | |
| 2 | Xm+0.0 | 0 | 2 | Xm+0.1 | 1 | | |
| 3 | Xm+0.2 | 2 | 3 | Xm+0.3 | 3 | | |
| 4 | Xm+0.4 | 4 | 4 | Xm+0.5 | 5 | | |
| 5 | Xm+0.6 | 6 | 5 | Xm+0.7 | 7 | | |
| 6 | DICOM | С | 6 | DICOM | С | | |
| 7 | Xm+1.0 | 0 | 7 | Xm+1.1 | 1 | | |
| 8 | Xm+1.2 | 2 | 8 | Xm+1.3 | 3 | | |
| 9 | Xm+1.4 | 4 | 9 | Xm+1.5 | 5 | | |
| 10 | Xm+1.6 | 6 | 10 | Xm+1.7 | 7 | | |
| 11 | DICOM | С | 11 | DICOM | С | | |
| 12 | Xm+2.0 | 0 | 12 | Xm+2.1 | 1 | | |
| 13 | Xm+2.2 | 2 | 13 | Xm+2.3 | 3 | | |
| 14 | Xm+2.4 | 4 | 14 | Xm+2.5 | 5 | | |
| 15 | Xm+2.6 | 6 | 15 | Xm+2.7 | 7 | | |
| Indication on label | | | | | | | |

Specification of terminal block

| Spec | meation of terminal block | |
|----------|-----------------------------|--|
| Name of | Specification of cable side | Remarks |
| terminal | | |
| T1 | Weidmuller BLZF3.5/14F | Terminal blocks (T1 and T2) have colored label each other. |
| T2 | | Each terminal blocks (T1 and T2) have protection parts |
| | | (type:BL/SL3.50KO) against incorrect insertion. |
| Т3 | Weidmuller BLZF3.5/15F | Terminal blocks (T3 and T4) have colored label each other. |
| T4 | | Each terminal blocks (T3 and T4) have protection parts |
| | | (type:BL/SL3.50KO) against incorrect insertion. |

| | | | | TITLE TERMINAL TYPE I/O MODULE | | ODULE | |
|------|----------|----------|----------------------------|--------------------------------|-----|-------|-----|
| | | | | CONNECTING MANUAL | | UAL | |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is changed | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FAI | NUC | SHEET | 22/ |

4.5.2 Extension module C

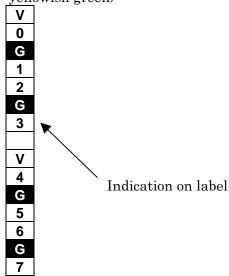
Signal assignment for output

| T1 | (Label color: light blue | ` |
|------|---------------------------|-----------|
| .1.1 | II ahal calar light bluc | 1 |
| 11 | (Label Color · Hgiit bluc | <i>51</i> |
| | | |

| 11 | (Lat | er color · fight blue/ | |
|----|--------|------------------------|-----|
| 1 | DOCOM0 | V | |
| 2 | Yn+0.0 | 0 | |
| 3 | 0V-0 | G | |
| 4 | Yn+0.1 | 1 | |
| 5 | Yn+0.2 | 2 | |
| 6 | 0V-0 | G | |
| 7 | Yn+0.3 | 3 | |
| 8 | DOCOM1 | V | |
| 9 | Yn+0.4 | 4 | |
| 10 | 0V-1 | G Indication on lab | oel |
| 11 | Yn+0.5 | 5 | |
| 12 | Yn+0.6 | 6 | |
| 13 | 0V-1 | G | |
| 14 | Yn+0.7 | 7 | |

T2 (Label color : yellowish green)

| 14 | (Label) | . 10101 | |
|----|---------|---------|---|
| 1 | DOCOM2 | | |
| 2 | Yn+1.0 | | |
| 3 | 0V-2 | | |
| 4 | Yn+1.1 | | |
| 5 | Yn+1.2 | | |
| 6 | 0V-2 | | |
| 7 | Yn+1.3 | | |
| 8 | | | |
| 9 | DOCOM3 | | |
| 10 | Yn+1.4 | | |
| 11 | 0V-3 | | |
| 12 | Yn+1.5 | | |
| 13 | Yn+1.6 | | |
| 14 | 0V-3 | | |
| 15 | Yn+1.7 | | L |
| | | | |



Specification of terminal block

| Name of terminal | Specification of cable side |
|------------------|-----------------------------|
| T1 | Weidmuller BLZF3.5/14F |
| T2 | Weidmuller BLZF3.5/15F |

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | DDULE |
|------|----------|----------|--------------------|--------------------------------|----------|-------|-------|
| | | | | CONNECTING MANUAL | | JAL | |
| 02 | 06.03.10 | Yamanaka | This page is added | DRAW. NO. | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 23/ |

4.5.3 Extension module D

Signal assignment for Analog input

| _T1 | (Lab | el color : y | rellow) |
|-----|------|--------------|---------------------|
| 1 | JMP0 | J | |
| 2 | INP0 | + | |
| 3 | INM0 | _ | |
| 4 | COM0 | C | |
| 5 | FG0I | F | |
| 6 | FG0O | F | |
| 7 | | | |
| 8 | JMP1 | J | |
| 9 | INP1 | + | |
| 10 | INM1 | _ | Indication on label |
| 11 | COM1 | C | |
| 12 | FG1I | F | |
| 13 | FG10 | F | |
| 14 | | | |

| T2 | (Lal | oel color : p | oink) | |
|----|------|---------------|-------|---------------------|
| 1 | JMP2 | J | | |
| 2 | INP2 | + | | |
| 3 | INM2 | _ | | |
| 4 | COM2 | C | | |
| 5 | FG2I | F | | |
| 6 | FG2O | F | | |
| 7 | | | ▶ | |
| 8 | JMP3 | J | | |
| 9 | INP3 | + | | |
| 10 | INM3 | _ | \ | Indication on label |
| 11 | COM3 | C | | mulcation on laber |
| 12 | FG3I | F | | |
| 13 | FG3O | F | | |
| 14 | | | | |
| 15 | | | | |

Specification of terminal block

| Name of terminal | Specification of cable side |
|------------------|-----------------------------|
| T1 | Weidmuller BLZF3.5/14F |
| T2 | Weidmuller BLZF3.5/15F |

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|----------|---------|--------------------|--|-------|------|
| 03 | 07.05.10 | Akimoto | This page is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 24/ |

4.5.4 Extension module E

Signal assignment for Analog Output

(Label color: yellowish green) VP1 A VN1 2 В 3 IP1 4 IN1 5 6 7 VP2 8 VN2 9 10 Indication on label IP2 G 11 IN2 12 13 14

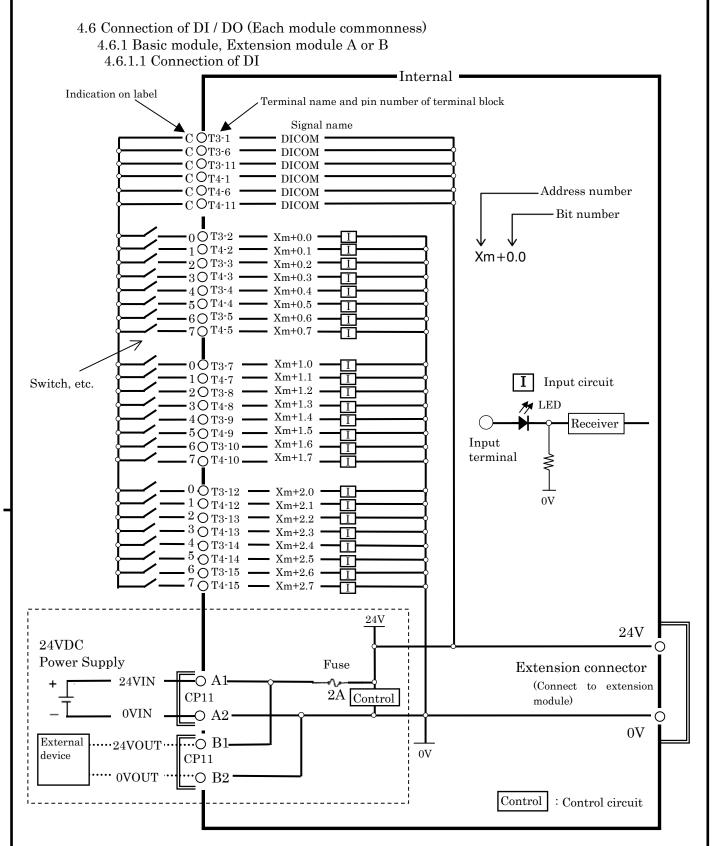
(Label color: light blue) T2VP3 VN3 В 3 IP3 4 IN3 D 5 6 8 VP4 VN4 9 10 IP4 11 Indication on label IN4 12 13 14 15

Specification of terminal block

| Name of terminal | Specification of cable side |
|------------------|-----------------------------|
| T1 | Weidmuller BLZF3.5/14F |
| T2 | Weidmuller BLZF3.5/15F |

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|----------|----------|--------------------|--|-----|-------|-----|
| 04 | 09.05.25 | Kurokawa | This page is added | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 25/ |

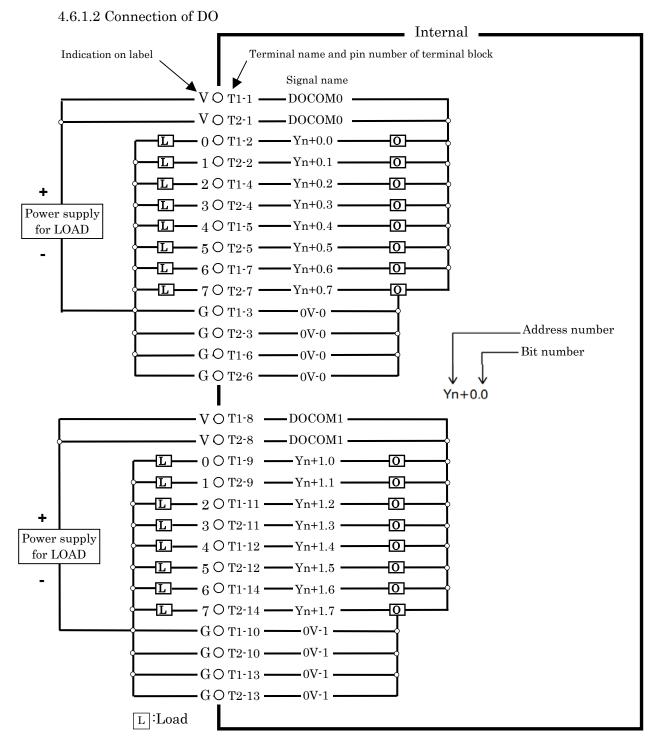




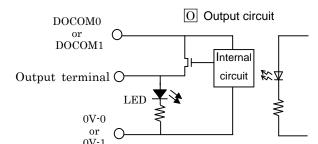
The circuit in the dotted line the above-mentioned is mounted only on a basic module. 24V of DICOM is supplied from a basic module or preceding extension module by way of extension cable.

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | |
|------|----------|----------|--------------------------|--|-------|------|
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 26/ |



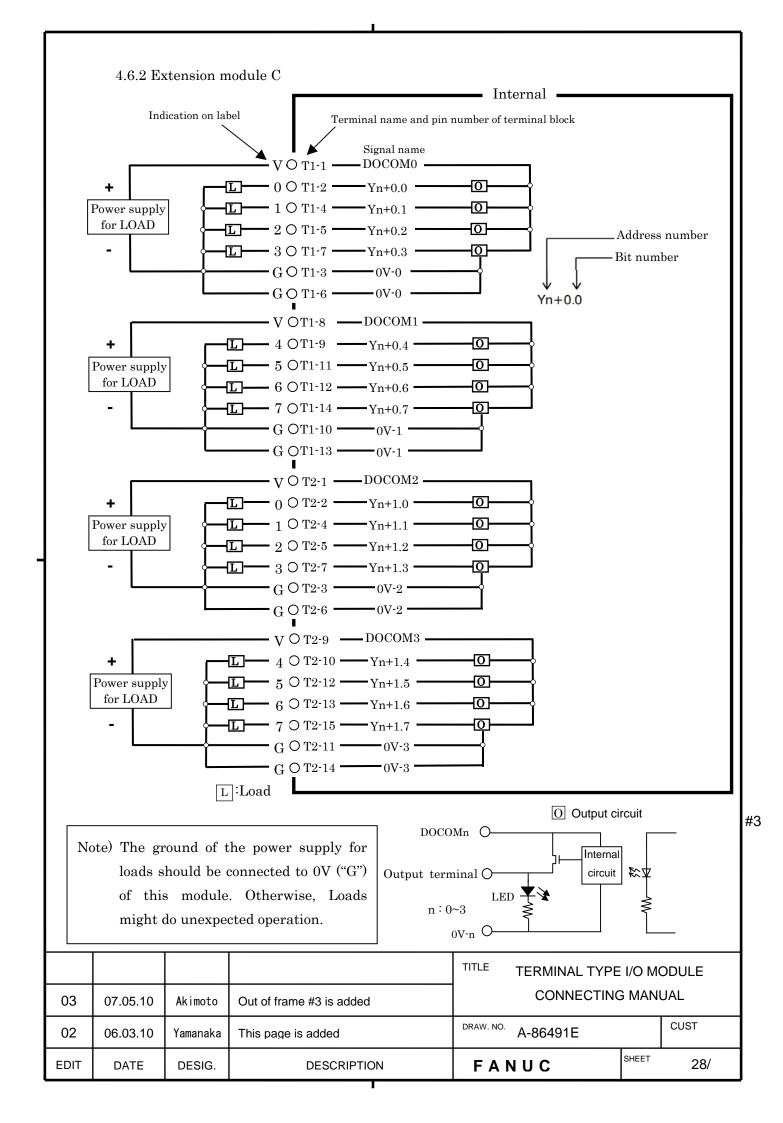


Note) The ground of the power supply for loads should be connected to 0V ("G") of this module. Otherwise, loads might do unexpected operation.



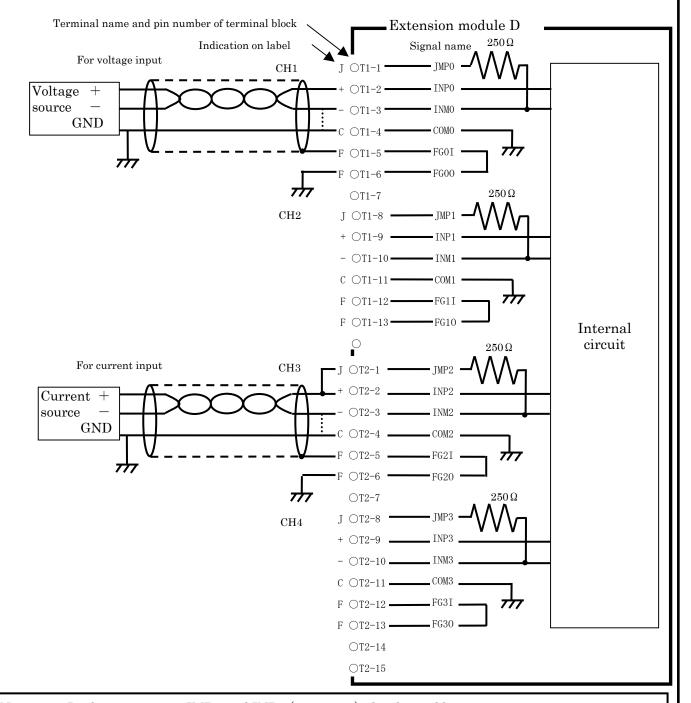
| | | | | TITLE TERMINAL TYPE I/O MODULE | | |
|------|----------|----------|--------------------------|--------------------------------|-------|------|
| 03 | 07.05.10 | Akimoto | Out of frame #3 is added | CONNECTING MANUAL | | |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 27/ |

#3



4.6.3 Extension module D

This connection example is a case that CH1 is current input, CH3 is current input, and CH2 and CH4 is unused.



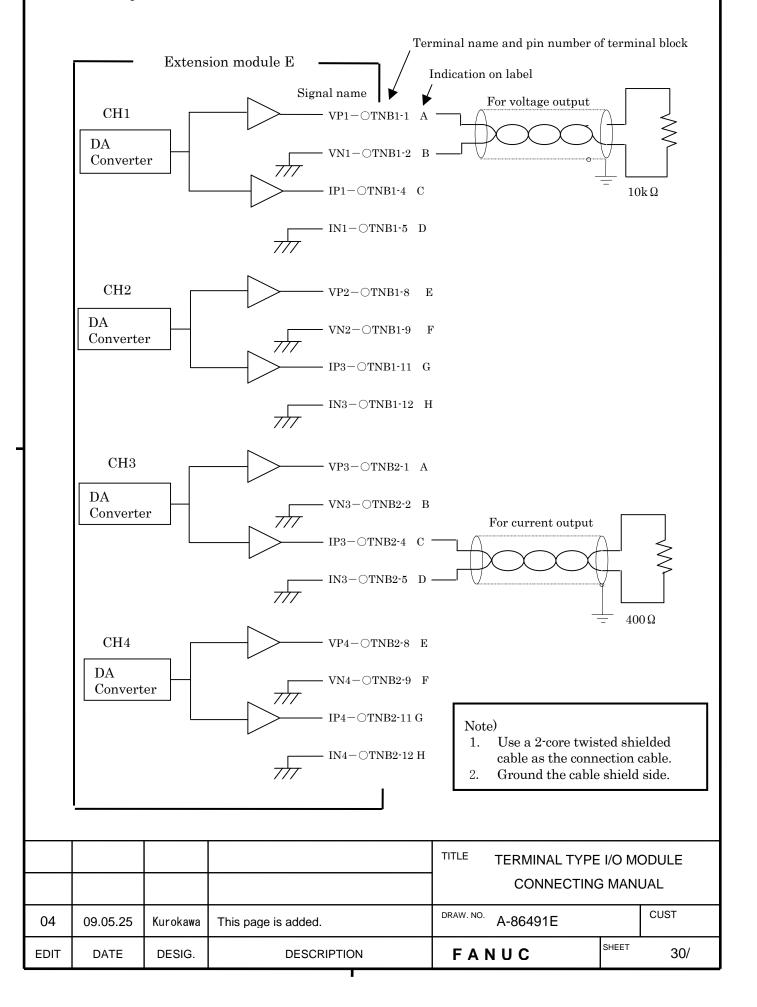
Note

- 1 In short-circuiting JMPn and INPn (n=0,1,2,3), the channel becomes current input.
- 2 For the connection cable, use a shielded twisted pair.
- 3 In diagram above, the shield of each channel is connected to FGnI for shield processing. However, the shield of a channel may be directly connected to frame ground by a cable clamp, instead of using FGnI and FGnO.
- 4 In diagram above, when a GND pin is in the source of voltage or current, connect the pin to COMn. Otherwise, connect COMn to INMn on the analog input module side. COMn of all the channels is connected to a common analog ground inside this module.

| | | | | TITLE TERMINAL TYPE I/O MODULE | | |
|------|----------|---------|---------------------|--------------------------------|------|--|
| | | | | CONNECTING MANUAL | | |
| 03 | 07.05.10 | Akimoto | This page is added. | DRAW. NO. A-86491E | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | 29/ | |

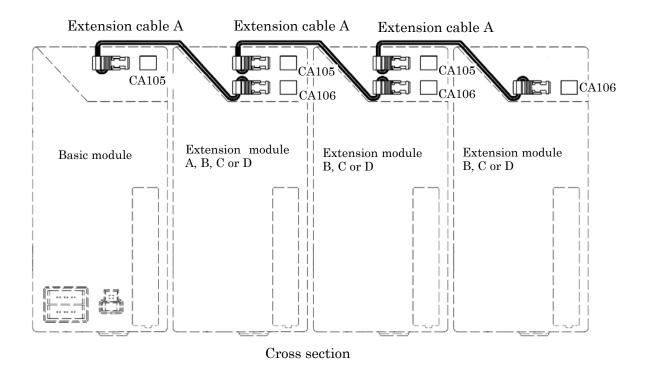
4.6.4 Extension module E

This connection example is a case that CH1 is voltage output, CH3 is current output, and CH2 and CH4 is unused.



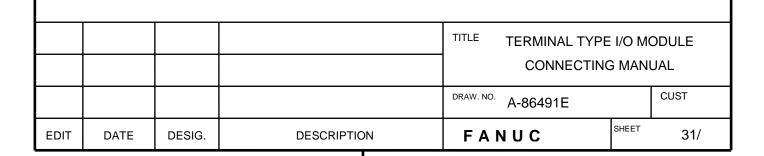
4.7 Connection between modules

A way to connect between each modules are same way. The flat cable is connected with the connector (CA105, CA106) that mounted in each modules as shown in the figure below. In that case, please connect all of the 52 pins carefully in the direction of the connector.



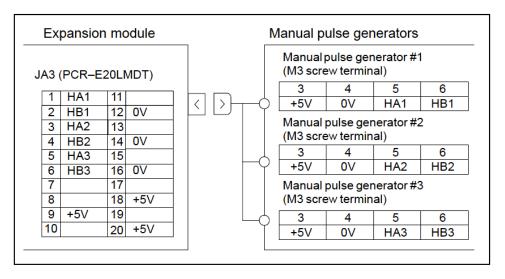
Method of removing connected cable

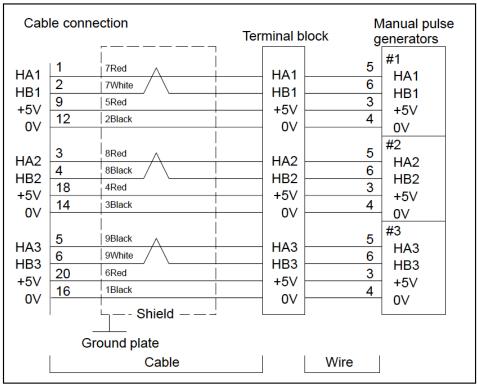
Please release the lock pushing the latch of the connector on the cable side in the direction of the arrow as shown in below when you remove connected cable from the module.



4.8 Connection of manual pulse generator

An example in which three manual pulse generators are connected to Extension module A is shown below. The manual pulse generator can be connected only for the *i* series CNC.





Recommended wire material: A66L-0001-0286 (#20 AWG × 6 + #24 AWG × 3 pairs) Recommended connector: A02B-0120-K303 (including the following connector and case)

(Connector: FI40–2015S (Hirose Electric Co., Ltd.))

(Case: FI40–20–CV5 (Hirose Electric Co., Ltd.))

Recommended cables:A02B–0120–K841 (7 m) (for connecting three manual pulse generators)
A02B–0120–K848 (7 m) (for connecting two manual pulse generators)
A02B–0120–K847 (7 m) (for connecting one manual pulse generator)

(These cables do not include the wire shown in the above figure.)

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|------|--------|-------------|--------------------------------|----------|-------|------|
| | | | | CONNECTING MANUAL | | | JAL |
| | | | | DRAW. NO | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 32/ |

Note)

The number of connectable manual pulse generators depends on the type and option configuration.

Cable Length for Manual Pulse Generator

Like a pulse coder, the manual pulse generator operates on 5 VDC. The supply voltage drop due to the cable resistance must be held below 0.2 V (when those of the 0-volt and 5-volt wires are combined), as expressed in the following expression:

$$0.2 \ge \frac{0.1 \times R \times 2L}{m}$$

Where

0.1 = manual pulse generator supply current (0.1 A)

R = resistance per unit cable length (Ω/m)

m = number of 0-volt and 5-volt wires

L = cable length (m).

Therefore, the cable length can be determined using the following expression.

$$L \leq \frac{m}{R}$$

In the case of the A66L–0001–0286 cable, for example, when three pairs of signal wires and six power supply wires (20/0.18, 0.0394 Ω /m) are used (three power supply wires connected to 5 V and the other three to 0 V), the cable length is:

$$L \le \frac{3}{0.0394} = 76.75[m]$$

However, the maximum pulse transmission distance for the manual pulse generator is 50 m. Taking this into consideration, the cable length may be extended to:

38.37 m (when two generators are used), or

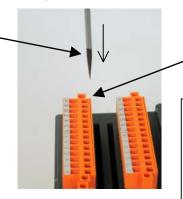
25.58 m (when three generators are used).

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|------|--------|-------------|--------------------------------|-------|------|--|
| | | | | CONNECTING MANUAL | | | |
| | | | | DRAW. NO. A-86491E CUST | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 33/ | |

4.9 How to connect wire to the terminal

(1) Insert a screwdriver whose up-to-date width is about 2.5mm into the clamp of the terminal block, and open the fixing bracket.

Flat-bladed screwdriver -



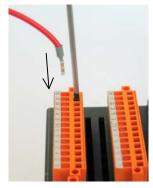
The clamp

Use recommendation flat—bladed screwdriver

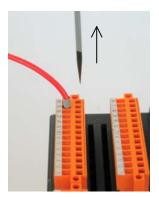
Weidmuller:

Product number SDI 0.4X2.5X80

(2) Insert the cable with ferrule into the terminal block.



(3) Pull the driver from the clamp and the wiring completion.



Note)

Do not pry the driver inside of the clamp. The terminal block might be damaged.

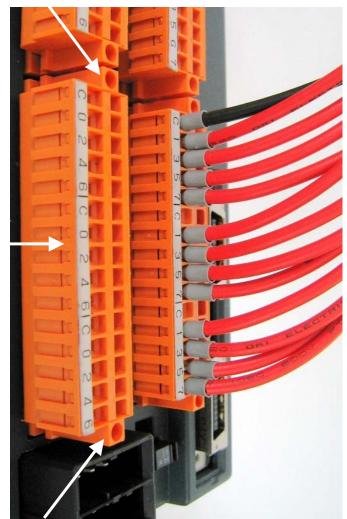
| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|------|--------|-------------|---|-------|-------|------|
| | | | | DRAW. NO. A-86491E CUST | | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FAN | 1 U C | SHEET | 34/ |

4.10 Detaching of the terminal

Terminal block

The terminal block can be detached from the module by loosening the installation screw at both ends of the terminal block.

The installation screw



The installation screw

The torque of the installation screw: 0.4Nm (max).

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | | |
|------|------|--------|-------------|--------------------------------|-----|-------|------|--|
| | | | | CONNECTING MANUAL | | | | |
| | | | | DRAW. NO. A-86491E | | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FAI | NUC | SHEET | 35/ | |

#2

5 Setting

5.1 DI/DO map on the I/O Link

| DI space r | Пар | | space map | | | |
|----------------------|---------------------|-------------|-----------|--|--|--|
| Xm | D:- | Yn | Basic | | | |
| Xm+1 | Basic module | Yn+1 | module | | | |
| Xm+2 | module | Yn+2 | Extension | | | |
| Xm+3 | F | Yn+3 | module 1 | | | |
| Xm+4 | Extension module 1 | Yn+4 | Extension | | | |
| Xm+5 | Yn+ | Yn+5 | module 2 | | | |
| Xm+6 | Extension | Yn+6 | Extension | | | |
| Xm+7 | | Yn+7 | module 3 | | | |
| Xm+8 | module 2 | | | | | |
| Xm+9 | | | | | | |
| Xm+10 | Extension module 3 | | | | | |
| Xm+11 | module 5 | | | | | |
| Xm+12 (for 1st MPG) | | | | | | |
| Xm+13 (for 2nd MPG) | Extension module 1 | | | | | |
| Xm+14 (for 3rd MPG) | module i | | | | | |
| Xm+15 | This area is | not used in | | | | |
| (DO alarm detection) | Extension module C. | | | | | |

Basically, terminal type I/O module is allocated a group of DI addresses (16 bytes) and a group of DO addresses (8 bytes). Up to three hardware Extension modules can be added or removed as required. The reason for this address allocation is explained below.

The MPG interface (MPG counter) occupies a DI space from Xm+12 through Xm+14. These addresses are fixed regardless of whether Extension module 2 or 3 is used, and Xm+12 through Xm+14 must be allocated as a DI work area to enable the use of the MPG. Therefore, when using an MPG for the *i* series CNC, allocate DI addresses in units of 16 bytes. Do not use the DI space from Xm+12 through Xm+14 for Ladder; the CNC processes the MPG counter value directly. DI address Xm+15 is used for detecting overcurrent and overheating alarms that occur in the IC used in the DO driver. [For details, see the section describing the detection of DO (output signal) alarms.] This address is fixed regardless of whether Extension module 2 or 3 is used, and it must be allocated as a work area before it can be used. When using this area, therefore, allocate DI addresses in units of 16 bytes.

·As for address of Extension module C

Extension module C is output module. In this module, DO alarm detection is assigned in DI area and occupy 2 bytes every module. Refer to section 5.2.2 about relation between address of DO and DO alarm detection.

| | | | | TITLE TERMINAL TYPE I/O MODULE CONNECTING MANUAL | | | |
|------|----------|----------|--------------------------|--|-------|------|--|
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. A-8649 | 1E | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 36/ | |

·As for address of Extension module D

(Digital output)

This module has 4 input channels and 1 set of the 12 bits digital output within the three—byte occupied input points. The output format is indicated below. The address of a digital output begins from a top even number address among 3 bytes (please refer to the following page).

Address in the

| Extension module D | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Xm (even address) | D07 | D06 | D05 | D04 | D03 | D02 | D01 | D00 | |
| Xm+1(odd address) | 0 | 0 | СНВ | CHA | D11 | D10 | D09 | D08 | |

D00 to D11 represent 12 bits digital output data. D00 and D11 correspond to weightings of 2^0 and 2^{11} , respectively. D11 is a sign bit expressed as a 2's complement.

CHA and CHB represent analog input channels. So, when these two bytes are read with ladder program, D11 to D00 are the A-D converted data of the channel indicated by the CHA and CHB.

(Channel selection)

With this extension module D, which of the 4 channels is to be output to the digital output have to be determined with ladder program. The DO points used for this selection are CHA and CHB (two-byte occupied output points). These are mapped as indicated below.

Address in the

| Extension module D | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------------------|---|---|---|---|---|---|-----|-----|
| Yn | X | X | X | X | X | X | X | X |
| Yn+1 | X | X | X | X | X | X | СНВ | CHA |

By writing the values indicated below to CHA and CHB, the corresponding channel is selected, and the A–D converted data of the channel and the data of the selected channel can be read as DI data. The character X indicated above represents an unused bit, so that either 1 or 0 may be written in place of X.

| СНВ | СНА | Channel selected |
|-----|-----|------------------|
| 0 | 0 | Channel 1 |
| 0 | 1 | Channel 2 |
| 1 | 0 | Channel 3 |
| 1 | 1 | Channel 4 |

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | | |
|------|----------|---------|---------------------|--------------------------------|-------|-----|--|--|
| | | | | CONNECTING MANUAL | | | | |
| 03 | 07.05.10 | Akimoto | This page is added. | DRAW. NO. A-86491E | CUST | | | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 37/ | | |

(Address)

The start address of X (DI) of the basic modules including the extension module D has always to be allocated at an even–numbered address. With this allocation, the digital output addresses of the extension module D are as described below, depending on where the extension module D is allocated.

When the extension module D is allocated in the space for extension module 1 (Xm represents the allocation start address of the basic modules.)

| Address in the module | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----------------------|-------------|-----------|-----|-----|-----|-----|-----|-----|
| Xm+3 (odd address) | | Undefined | | | | | | |
| Xm+4 (even address) | D 07 | D06 | D05 | D04 | D03 | D02 | D01 | D00 |
| Xm+5 (odd address) | 0 | 0 | СНВ | СНА | D11 | D10 | D09 | D08 |

When the extension module D is allocated in the space for extension module 2 (Xm represents the allocation start address of the basic modules.)

| Address in the module | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----------------------|-------------|-----|-----|-----|-----|-----|-----|-----|
| Xm+6 (odd address) | D 07 | D06 | D05 | D04 | D03 | D02 | D01 | D00 |
| Xm+7 (even address) | 0 | 0 | СНВ | CHA | D11 | D10 | D09 | D08 |
| Xm+8 (odd address) | Undefined | | | | | | | |

When the extension module D is allocated in the space for extension module 3 (Xm represents the allocation start address of the basic modules.)

| Address in the module | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----------------------|-----|-----------|-----|-----|-----|-----|-----|-----|
| Xm+9 (odd address) | | Undefined | | | | | | |
| Xm+10 (even address) | D07 | D06 | D05 | D04 | D03 | D02 | D01 | D00 |
| Xm+11 (odd address) | 0 | 0 | СНВ | CHA | D11 | D10 | D09 | D08 |

Note) When two-byte digital output addresses are to be referenced with a ladder program, a read have always to be performed word-by-word (16 bits).

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | | |
|------|----------|---------|---------------------|--------------------------------|-------|------|--|--|
| | | | | CONNECTING MANUAL | | | | |
| 03 | 07.05.10 | Akimoto | This page is added. | DRAW. NO. A-86491E | | CUST | | |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 38/ | | |

#5

·As for address of Extension module E

This module is analog output of four channels. By writing 12-bit digital data in the address of D00-D11, desired voltage and current are outputted to a corresponding analog output. D11 is a sign bit expressed as a 2's complement.

The start address of Y (DO) of the basic modules including the extension module E has always to be allocated at an even–numbered address.

Address in the

| xtension module E | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------------|-------------|-----|-------------|-----|-------------|-----|-----|-----|
| Yn (even address) | D 07 | D06 | D 05 | D04 | D 03 | D02 | D01 | D00 |
| Yn+1(odd address) | СНВ | СНА | 0 | 0 | D11 | D10 | D09 | D08 |

(Channel selection)

This module needs to choose by a ladder program which channel of the four channels is outputted. The DO points used for this selection are CHA and CHB (two-byte occupied output points). These are mapped as indicated above.

By writing the values indicated below to CHA and CHB, the corresponding channel is selected.

| СНВ | СНА | Channel selected |
|-----|-----|------------------|
| 0 | 0 | Channel 1 |
| 0 | 1 | Channel 2 |
| 1 | 0 | Channel 3 |
| 1 | 1 | Channel 4 |

- Note) 1 To write a value that is to be converted from digital to analog into a PMC program, be sure to write it in words (16bits).
 - 2 The output of each channel is held until data is written in the same channel.
 - 3 Some channels cannot be chosen within one scan of a ladder.

 The change of a channel needs the interval of one or more scans of a ladder.

| | | | | TITLE TERMINAL TYPE | I/O MC | DDULE |
|------|----------|----------|--------------------------|---------------------|--------|-------|
| 05 | 09.09.09 | Kurokawa | Out of frame #5 is added | CONNECTING | MANU | JAL |
| 04 | 09.05.25 | Kurokawa | This page is added. | DRAW. NO. A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 39/ |

5.2 Detection of DO alarm

5.2.1 Basic module, Extension module A or B

The DO driver of the Basic and Extension module A/B is capable of detecting an overcurrent and measuring its own temperature. If an accident, such as the connecting of the cable to ground, causes an abnormal increase in the load current or in the driver temperature, a protection circuit, which is provided for each DO driver (1 byte), is activated and keeps the DO signal for the relevant 1 byte in the OFF state until the cause of the problem is eliminated. Even if this occurs, the CNC and I/O module continue operating. The DI address (Xm+15) identifies the DO driver which has detected the alarm. The following table shows the correspondence between the DI address (Xm+15) bits and the DO addresses. Bit value "1" indicates that the corresponding DO driver has detected an alarm. The contents of the Xm+15 area can be checked by using the DGN screen of the CNC or by performing alarm processing for the area in advance by using Ladder. This helps alarm detection and recovery.

| Alarm detection address and bit | DO address | Location |
|---------------------------------|------------|----------------------|
| Xm+15.0 | Yn+0 | Basic module |
| Xm+15.1 | Yn+1 | Basic module |
| Xm+15.2 | Yn+2 | Extension module 1 |
| Xm+15.3 | Yn+3 | Extension module 1 |
| Xm+15.4 | Yn+4 | Extension module 2 |
| Xm+15.5 | Yn+5 | Extension module 2 |
| Xm+15.6 | Yn+6 | Extension module 3 |
| Xm+15.7 | Yn+7 | Extension module 3 |

5.2.2 Extension module C

The DO driver of the Extension module C is not only capable of detecting an over-current and measuring its own temperature like as else module, but also have over-voltage protection and open load detection every bit of DO.

When these protections work, LED "ALARM" turn on of module. Even if this occurs, the CNC and I/O module continue operating. The DI address identifies the DO driver which has detected the alarm. The next table shows the correspondence between the DI address bits and the DO addresses.

| | | | | TITLE | TERMINAL TYPE | : I/O M(| ODULE |
|------|----------|----------|--------------------------|-----------|---------------|----------|-------|
| | | | | | CONNECTING | MANI | JAL |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FΑ | NUC | SHEET | 40/ |

 \cdot Address of DO alarm when three Extension module C are assigned in Extension module 1,2 and 3.

("0" means nothing DO alarm. "1" means that DO alarm happen.) *=Don't care

| Addres | | bit | | | | | | | | |
|--------|------|------|-----------------|------|------|------|------|------|-------------|--|
| s | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Module | |
| Xm+3 | Yn+2 | Yn+2 | Yn+2 | Yn+2 | Yn+2 | Yn+2 | Yn+2 | Yn+2 | DO alarm of | |
| | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | Extension | |
| Xm+4 | Yn+3 | Yn+3 | Yn+3 | Yn+3 | Yn+3 | Yn+3 | Yn+3 | Yn+3 | module 1 | |
| | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | | |
| Xm+5 | * | * | * | * | * | * | * | * | | |
| Xm+6 | Yn+4 | Yn+4 | Yn+4 | Yn+4 | Yn+4 | Yn+4 | Yn+4 | Yn+4 | DO alarm of | |
| | Bit7 | Bit6 | $\mathrm{Bit}5$ | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | Extension | |
| Xm+7 | Yn+5 | Yn+5 | Yn+5 | Yn+5 | Yn+5 | Yn+5 | Yn+5 | Yn+5 | module 2 | |
| | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | | |
| Xm+8 | * | * | * | * | * | * | * | * | | |
| Xm+9 | Yn+6 | Yn+6 | Yn+6 | Yn+6 | Yn+6 | Yn+6 | Yn+6 | Yn+6 | DO alarm of | |
| | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | Extension | |
| Xm+10 | Yn+7 | Yn+7 | Yn+7 | Yn+7 | Yn+7 | Yn+7 | Yn+7 | Yn+7 | module 3 | |
| | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | | |
| Xm+11 | * | * | * | * | * | * | * | * | | |

[·]Viewpoint of above table.

DO alarm which data is assigned in address bit5 of Yn+3 is set in address bit5 of Xm+4.

Note)

DO alarm information is set above address area, not Xm+15.

The address Xm+5, Xm+8 and Xm+11 are not used in extension module C.

If extension module A or B is assigned in extension 1 or 2, area of address does not shift.

Bit value "1" indicates that the corresponding DO driver has detected an alarm. The contents of DI area can be checked by using the DGN screen of the CNC or by performing alarm processing for the area in advance by using Ladder. This helps alarm detection and recovery.

When alarm detection works, shutdown DO and power supply of system, and reduce the source of alarm.

| | | | | TITLE | TERMINAL TYPE | I/O MO | ODULE |
|------|----------|----------|--------------------|-----------|---------------|--------|-------|
| | | | | | CONNECTING | 3 MANI | JAL |
| 02 | 06.03.10 | Yamanaka | This page is added | DRAW. NO. | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FΑ | NUC | SHEET | 41/ |

When protections work, state of DO and DO alarm are below.

| State | Output of | State of DO | DO LED Alarm LED | | Alarm information |
|--------------|-----------|-------------|------------------|----------|-------------------|
| | PMC | driver | (Green) | (Red) | assigned in DI |
| Normal | 0 | OFF | Turn off | Turn off | 0 |
| | 1 | ON | Turn on | Turn off | 0 |
| Over-current | 0 | OFF | Turn off | Turn off | 0 |
| Protection | 1 | OFF | Turn off | Turn on | 1 |
| Over-voltage | 0 | OFF | Turn off | Turn on | 1 |
| protection | 1 | OFF | Turn off | Turn off | 0 |
| Open load | 0 | OFF | Turn off | Turn off | 0 |
| detection | 1 | ON | Turn on | Turn on | 1 |

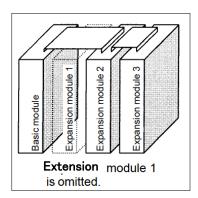
Note) When over-current protection or over-voltage protection is activated, a protection circuit, which is provided for each DO driver (1 bit) keeps the DO signal for the relevant 1 bit in the OFF state until the cause of the problem is eliminated. After problem is removed, DO driver turns ON whether system is re-started or not.

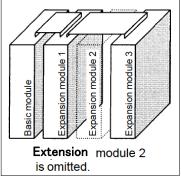
Note) Open load detection works to monitor the value of load current when DO turn on. If the value of load current is less than 100mA, open load detection works. So connecting a little load (like LED), this function work and DO alarm happen, however DO does not shutdown. If wire is connected again, open load detection is removed whether system is re-started or not.

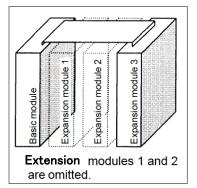
| | | | | TITLE TERMINA | AL TYPE I/O M | ODULE |
|------|----------|----------|--------------------|-------------------|---------------|-------|
| | | | | CONN | IECTING MAN | IUAL |
| 02 | 06.03.10 | Yamanaka | This page is added | DRAW. NO. A-86491 | E | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FANUC | SHEET | 42/ |

T

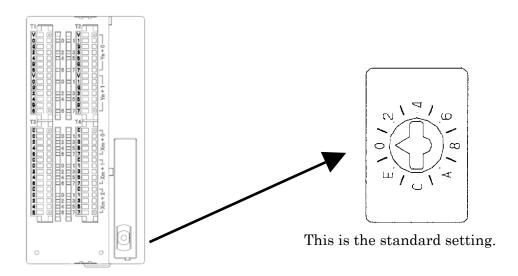
5.3 Setting of rotary switch (Distribution I/O Setting) By changing the setting (rotary switch) for the Extension modules, connections can be made by omitting some Extension modules as shown below.







Method of setting (control and method of setting the control) As shown below, the control (rotary switch) is located on an Extension module. To change the setting, turn the switch with a flat—bladed screwdriver with a tip width of about 2.5 mm.

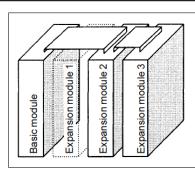


The function of the rotary switch is as follows:

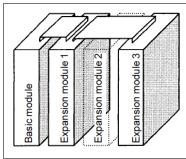
| | | | | TITLE | | | |
|------|------|--------|-------------|----------|---------------|----------|-------|
| | | | | '''' | TERMINAL TYPE | : I/O M(| ODULE |
| | | | | | CONNECTING | 3 MANI | JAL |
| | | | | DRAW. NO | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 43/ |

| Setting position | Actual indication | Meaning of setting | | |
|---------------------|---|--|--|--|
| 0 | 0 | This is the standard setting. The rotary switch is factory–set to this position. This setting is used when no expansion module is omitted. | | |
| 1 | _ | Set the rotary switch on an expansion module to this position when the preceding expansion module is omitted. | | |
| 2 | 2 | Set the rotary switch on an expansion module to this position when the preceding two expansion modules are omitted. | | |
| 3 | _ | This setting is prohibited. | | |
| 4 to F | 4, -, 6, -, 8, -, A, -, C, -, E, -, | 4, 8, or C has the same effect as 0. 5, 9, or D has the same effect as 1. 6, A, or E has the same effect as 2. 7, B, or F has the same effect as 3. (This setting, however, is prohibited.) | | |

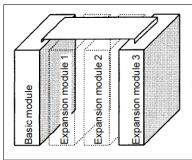
Examples of setting



(When expansion module 1 is omitted) On expansion module 2, set the rotary switch to setting position 1. On expansion module 3, keep the rotary switch set to setting position 0.



(When expansion module 2 is omitted) On expansion module 3, set the rotary switch to setting position 1. On expansion module 1, keep the rotary switch set to setting position 0.



(When expansion modules 1 and 2 are omitted)

On expansion module 3, set the rotary switch to setting position 2.

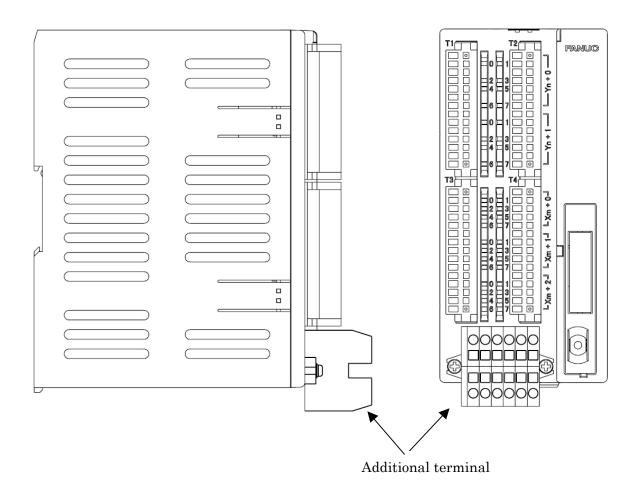
Note)

Extension module A is always mounted at the location of Extension module 1, so that its factory setting need not be changed.

| | | | | TITLE | TERMINAL TYPE | I/O MO | ODULE |
|------|------|--------|-------------|----------|---------------|--------|-------|
| | | | | | CONNECTING | S MANI | JAL |
| | | | | DRAW. NO | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 44/ |

6. How to increase the number of common terminals

Mounting terminal stand on the market on the top cover of extension module, it is possible to increase the number of common terminals.



Example of terminal on the market

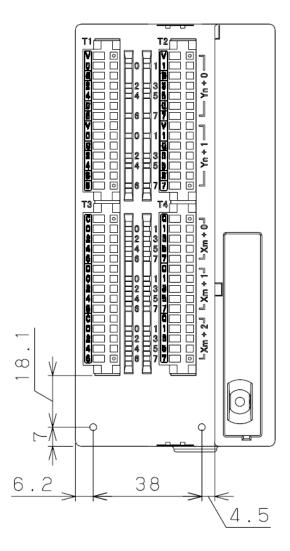
| Maker name | Type case | Number of maximum poles |
|------------|----------------|-------------------------|
| WAGO | 869 series | 12 |
| Weidmuller | ZDUB2.5 series | 10 |
| OSADA | TWM10B series | 14 |

Please inquire of each maker about details of the terminal.

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | DDULE |
|------|------|--------|-------------|--------------------------------|-----|-------|-------|
| | | | | CONNECTING MANUAL | | | JAL |
| | | | | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 45/ |

Installation size of additional terminal

 $Unit\\\vdots\\mm$



Use the M3 tap screw of 10mm or less in length for the fixation of the additional terminal.

| | | | | TITLE TERMINAL TYPE I/O MODULE | | | |
|------|------|--------|-------------|--------------------------------|-----|-------|-----|
| | | | | CONNECTING MANUAL | | | JAL |
| | | | | DRAW. NO. A-86491E | | CUST | |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 46/ |

#2

7. Others

7.1 DO signal reaction to a system alarm

There is a possibility that the I/O module will not operate normally due to a failure of CNC or I/O Link slave module, or abnormally power supply voltage. To prevent accidents even in this case, design the machine to operate safely by making a redundant circuit outside the I/O module.

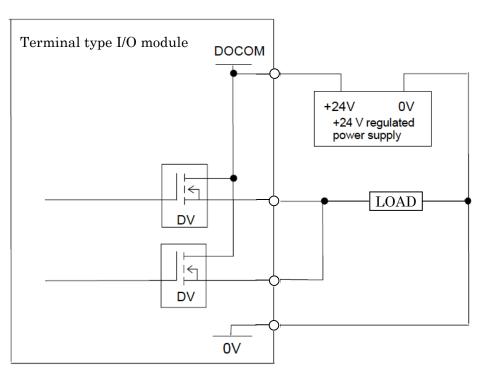
The circuit of this I/O module is designed so that all DO signals are turned off if a system alarm is occurred in the CNC which controls the I/O module, or if a power of the CNC or the I/O module is turned off. However, depending on the abnormal condition because of occurrence of failure, it cannot be guaranteed that all DO signals of the I/O module will certainly be turned off. Therefore, manage signals related to safety by making a redundant circuit outside this I/O module.

7.2 Parallel DO (output signal) connection

(Basic module, Extension module A or B)

A DO load current of twice the level can be obtained by connecting DO points in parallel and exercising ON/OFF control at the same time in the sequence. Namely, the maximum load current per DO point is 200mA. By connecting two DO points in parallel and turning on the two DO points at the same time, 400mA can be obtained. In this case, however, the leakage current is doubled up to $40\mu\text{A}$ when the DO points are turned off.

Please assign the bit turned on and off at the same time in the same address. (For example, bit0 and bit1 in address Yn+2.)



| | | | | TITLE TERMINAL TYPE I/O MODULE | | | ODULE |
|------|----------|----------|----------------------------|--------------------------------|----------|-------|-------|
| 04 | 09.05.25 | Kurokawa | Out of frame #4 is changed | CONNECTING MANUAL | | | JAL |
| 02 | 06.03.10 | Yamanaka | Out of frame #2 is added | DRAW. NO. | A-86491E | | CUST |
| EDIT | DATE | DESIG. | DESCRIPTION | FA | NUC | SHEET | 47/47 |