Motoman XRC Controller

DeviceNet (XFB01B) Instruction Manual

for UP/SKX-Series Robots

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SECTION 1
INTRODUCTION

1.1 About this Document

This manual provides instructions for DeviceNet (XFB01B) and contains the following sections:

SECTION 1 – INTRODUCTION

General information about this manual, a list of reference documents, and customer service information.

SECTION 2 – SAFETY

Provides information for the safe use and operation of Motoman products.

SECTION 3 – DEVICENET INSTRUCTIONS

Provides detailed instructions for DeviceNet (XFB01B).

1.2 Reference to Other Documentation

For additional information refer to the following:

- Concurrent I/O Parameters Manual (P/N 142102-1)
- Operator's Manual for General Purpose (P/N 142099-1)
- Operator's Manual for Handling (P/N 142100-1)
- Operator's Manual for Spot Welding (P/N 142101-1)
- Operator's Manual for Arc Welding (P/N 142098-1)
- Motoman UP6, XRC Manipulator Manual (P/N 142104-1)
- Motoman UP20, XRC Manipulator Manual (P/N 144342-1)
- Motoman UP50, XRC Manipulator Manual (P/N 144343-1)
- Motoman UP130, XRC Manipulator Manual (P/N 142107-1)

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (UP6, SK16X, etc.)
- Application Type (welding, handling, etc.)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)

NOTES

SECTION 2
SAFETY

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- DANGER
- WARNING
- CAUTION
- NOTE

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

DANGER!

Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

WARNING!

Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

CAUTION!

Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

NOTE: Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the MRC controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will **VOID YOUR WARRANTY!**
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. **YOUR WARRANTY WILL BE VOID** if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place.
- Check the E-STOP button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

YASNAC XRC OPTIONS INSTRUCTIONS

FOR JARCR-XFB01B BOARD

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN SETUP MANUAL
MOTOMAN-□□□ INSTRUCTIONS
YASNAC XRC INSTRUCTIONS
YASNAC XRC OPERATOR'S MANUAL
YASNAC XRC OPERATOR'S MANUAL for BEGINNERS

The YASNAC XRC operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.

MANDATORY

- This manual explains the JARCR-XFB01B board of the YASNAC XRC system and general operations. Read this manual carefully and be sure to understand its contents before handling the YASNAC XRC.
- General items related to safety are listed in Section 1: Safety of the Setup Manual. To ensure correct and safe operation, carefully read the Setup Manual before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the YASNAC XRC.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”,or ”PROHIBITED”.

 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.
 MANDATORY	Always be sure to follow explicitly the items listed under this heading.
 PROHIBITED	Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

PROHIBITED

- Do not use or keep the board in the following environmental conditions.
  - Where exposed to direct sunshine
  - Where vibration or impact occurs
  - Where high humidity exists
  - Where a strong magnetic field exists
  - Where much dust exists
  - Where a sudden change in the temperature occurs
  - Where corrosive gases occur
  - Where condensation occurs

  Improper usage of the board may damage the board.

WARNING

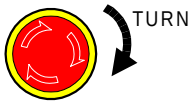
- Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the playback panel or programming pendant are pressed.
  When the servo power is turned off, the SERVO ON READY lamp on the playback panel and the SERVO ON LED on the programming pendant are turned off.

  Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Emergency Stop Button 

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

  Injury may result from unintentional or unexpected manipulator motion.

Release of Emergency Sto 

- Always set the Teach Lock before entering the robot work envelope to teach a job.

  Operator injury can occur if the Teach Lock is not set and the manipulator is started from the playback panel.

WARNING

- Observe the following precautions when performing teaching operations within the working envelope of the manipulator :
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

  Improper or unintended manipulator operation may result in injury.

- Confirm that no persons are present in the manipulator's work envelope and that you are in a safe location before:
  - Turning on the YASNAC XRC power
  - Moving the manipulator with the programming pendant
  - Running check operations
  - Performing automatic operations

  Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop button is located on the right side of both the YASNAC XRC playback panel and programming pendant.

- Before wiring, be sure to turn OFF the power supply and put up a warning sign, such as "DO NOT TURN ON THE POWER".

  Failure to observe this warning may result in an electric shock or an injury.

- Do not touch the inside of the panel for 5 minutes after the power is turned OFF.

  The remaining charged voltage in the capacitor may cause an electric shock or an injury.

- Be sure to close the door and install the protection cover while the power is turned ON.

  Failure to observe this warning may result in a fire or an electric shock.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  -Check for problems in manipulator movement.
  -Check for damage to insulation and sheathing of external wires.

- Always return the programming pendant to the hook on the XRC cabinet after use.

  The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of the Alarm Display in the setup manual before operating the manipulator.

- The wiring and mounting must be performed by authorized and qualified personnel.

  Failure to observe this caution may result in a fire or an electric shock.

- Make sure that there is no foreign matter such as metal chips on the board.

  In case of malfunction, etc. it may result in an injury or damage the board.

- Make sure that there is no damage or deflection of parts on the board.

  In case of malfunction, etc. it may result in an injury or damage the board.

- Correctly connect each cable and connector.

  Failure to observe this caution may result in a fire or damage the board.

- Set the switches, etc. correctly.

  Malfunction, caused by an incorrect setting, may result in an injury or damage the board.

- Never touch the mounting surfaces of the board parts directly with fingers.

  The generated static electricity may damage the IC.

- Never touch the soldered surfaces of the board directly with fingers.

  Protrusions on the soldered surface may result in an injury.

- Never give any shock to the board.

  The shock may damage the board.

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product.
The manipulator usually consists of the controller, the playback panel, the programming pendant, and supply cables.
The MOTOMAN manipulator is the YASKAWA industrial robot product.
In this manual, the equipment is designated as follows.

Equipment	Manual Designation
YASNAC XRC Controller	XRC
YASNAC XRC Playback Panel	Playback Panel
YASNAC XRC Programming Pendant	Programming Pendant

Descriptions of the programming pendant and playback panel keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page ke  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}
Playback Panel	Buttons	Playback panel buttons are enclosed in brackets. ex. [TEACH] on the playback panel

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed.

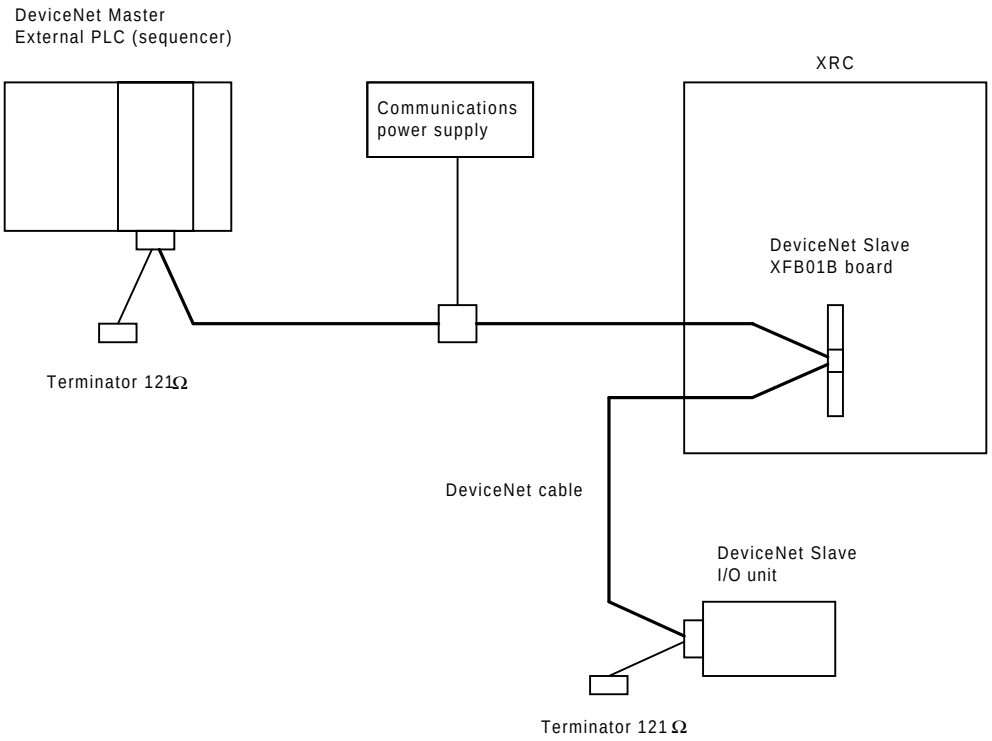
1 Outline

This manual gives the instructions for using the JARCR-XFB01B board (hereinafter called the XFB01B board) for the DeviceNet on the XRC. The application of this board allows the transmission of XRC's general-purpose I/O data with other devices connected to DeviceNet.

1.1 System Configuration

1.1.1 XFB01B Board in Slave Mode

The following diagram shows an example of the system configuration when the XFB01 board is used in slave mode.



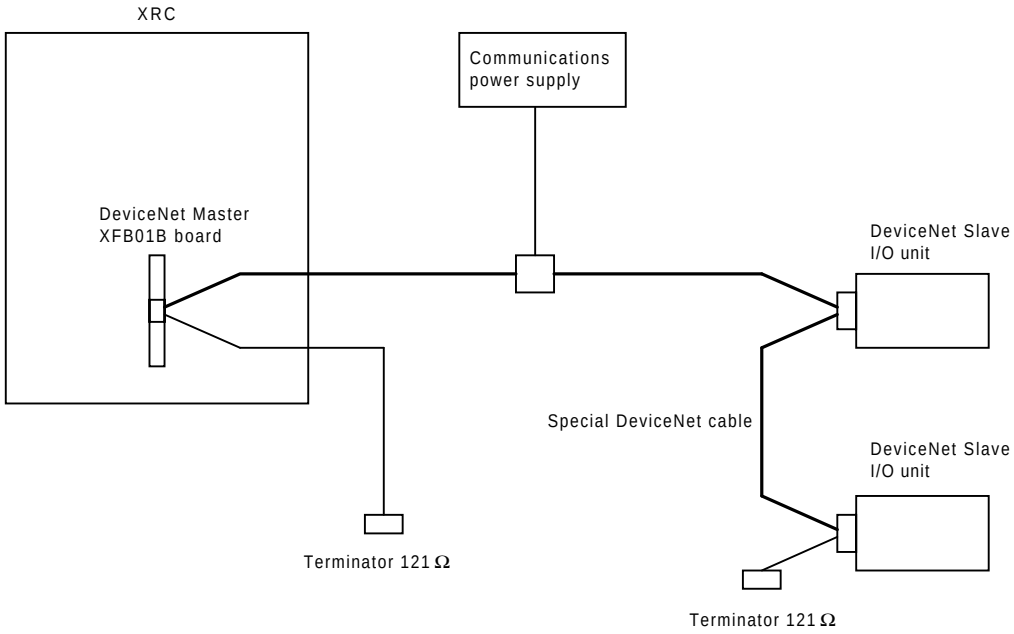
System Configuration Example with XFB01B board as Slave

NOTE

- A cable for DeviceNet and terminators that are to be connected externally are not included with the XFB01B board.
- When the XFB01B board is connected at the end of a network, connect a terminator externally. Correctly connect the terminators, or communication may not be performed correctly.

1.1.2 XFB01B Board in Master Mode

The following diagram shows an example of the system configuration when the XFB01B board is used in master mode.



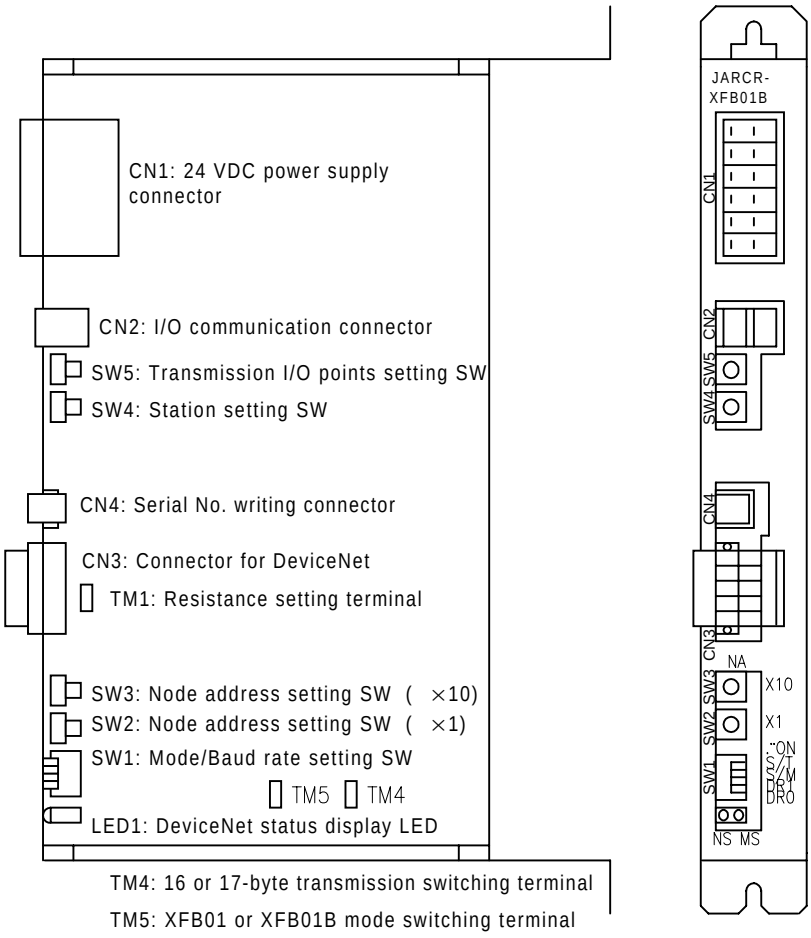
System Configuration Example with XFB01B Board as Master

NOTE When the XFB01B board is used in master mode, the total input points and the total output points of the connected slave devices must both be 112 (14 bytes) or less. For a system configuration whose slaves have more than 112 total input points and total output points, the XFB01B board is not applicable. Use another device such as a PLC applicable for DeviceNet as the master station.

SUPPLE-MENT DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association, Inc.).

2 Hardware Specifications

2.1 Board External View



2.2 Board Specifications

Items	Specifications
Interface to the external device	DeviceNet
Board mounting position	Optional board mounting space in the XRC
Error indicator	LED display
Number of transmission I/O points	Maximum number of I/O points Input: 112 points Output: 112 points Note: The number of input points and the number of output points can not be set individually.

2.3 Communication Specifications

Items	Specifications			
Connecting form	Multi-drop, T-branch (1:N communication)			
Transmission speed	Selectable among 500/250/125 kbps			
Transmission media	Dedicated 5 cables (2 cables for signals, 2 cables for power supply, 1 drain wire) Use a DeviceNet cable such as DCA1-5C10 (made by OMRON).			
Communication distance	Transmission speed 500 kbps 250 kbps 125 kbps	Network max. distance 100m and less 250m and less 500m and less	Branch line length 6m and less 6m and less 6m and less	Total length of branch lines 39m and less 78m and less 156m and less
Power supply voltage for communication	24 VDC (supplied through the connector CN3 for connecting DeviceNet)			
Maximam current consumption for communications	0.05 A			

2.4 Connector

CN3 (Connector for DeviceNet)

Terminal No.	Signal Name	Explanation
1 (black)	V-	0_{24}V power supply line connecting terminal
2 (blue)	CAN_L	DeviceNet signal line connecting terminal
3 (bared)	Drain	Drain wire connecting terminal (shield)
4 (white)	CAN_H	DeviceNet signal line connecting terminal
5 (red)	V+	+24V power supply line connecting terminal

The color mentioned in ( ) indicates the color of the DeviceNet cable to be connected when using a DeviceNet cable.

3 Setting the Functions

3.1 Function Setting Switches

The switches to set the functions of the XFB01B board are explained. Make the proper settings following the instructions. For details of setting, refer to Section 3.2.

SW1: Sets the DeviceNet operation mode and transmission baud rate, and the XFB01B board transmission mode, slave or master.

SW1-1 (S/T)

Always set to OFF (normal operation mode).

SW1-2 (S/M)

Sets the transmission mode, slave or master, for the XFB01B board.

SW1-3 and 1-4 (DR0 and DR1)

Sets the baud rate.

The transmission baud rate can be selected among the following three rates.

- 125 kbps
- 250 kbps
- 500 kbps

Note: When TM5 is set for XFB01B mode (short-circuited between 1 and 2), SW1-1 and SW1-2 are invalid.

SW2 and SW3: Sets the local node address of DeviceNet.

The node address setting range is 0 to 63.

SW4: Sets the station number for the XFB01B board on the XRC.

The setting range of station number is 1 (ST#01) to E (ST#14).
F (ST#15) is used by the XIU01 unit. Do not set for the others.

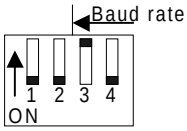
SW5: Sets the number of transmission I/O points.

(Set value of SW5) × 8 is the actual number of I/O points. The SW5 setting range is “1” (8 points) to “E” (112 points).

<Example>
When the SW2 is set to “E”, the number of I/O points are as follows.

- Input: 112 points
- Output: 112 points

3.2 Setting Switches

Switches	Setting Method
SW1 Mode and baud rate setting	 Sets the baud rate and mode of DeviceNet. ☐ shows the default setting. SW1-1: Operation mode (S/T) ☐ OFF:Normal Always set to OFF (normal operation mode). SW1-2: Slave/Master mode switching ☐ OFF: Slave ON: Master SW1-3: Baud rate setting (DR1) OFF: ☐ ON: 1 SW1-4: Baud rate setting (DR0) ☐ OFF: 0 1 SW1-3 SW1-4 Baud Rate 0 0 : 125kbps 0 1 : 250kbps 1 0 : 500kbps 1 1 : Cannot be set. Set the same value as for the other devices in the DeviceNet. Otherwise, DeviceNet communication cannot be established. When TM5 is connected for XFB01 mode (short-circuited between 1 and 2), SW1-1 and SW1-2 are invalid, enters the normal operation mode, and automatically set to “Slave.”

Switches	Setting Method
SW2 (× 1 setting) SW3 (× 10 setting) Node address setting	 Sets the local node address of DeviceNet. The following shows the relation between the setting of the switch and the actual number of I/O points. Turn the arrow to the number corresponding to the desired node address. (Use a precision flat-tipped screwdriver.) <Example> SW3 SW2 Node address 0 0 : 0 0 1 : 1 0 2 : 2 0 4 : 4 0 8 : 8 1 6 : 16 3 2 : 32 6 3 : 63 When the node address is set to a value exceeding 64, DeviceNet communication cannot be established. Select a node address in the range from 0 to 63 that does not overlap with that of another device.
SW4 Station setting	 Sets the station number. The following shows the relation between the switch setting and the station number. Turn the arrow to the number corresponding to the desired station. (Use a precision flat-tipped screwdriver.) 0 : Cannot be set. 8 : ST#08 1 : ST#01 9 : ST#09 2 : ST#02 A : ST#10 3 : ST#03 B : ST#11 4 : ST#04 C : ST#12 5 : ST#05 D : ST#13 6 : ST#06 E : ST#14 7 : ST#07 F : Cannot be set. The number after ST# is the station number displayed on the programming pendant of the XRC when setting I/O modules.

Switches	Setting Method
SW5 Number of transmission I/O points setting	 Sets the number of I/O points to be transferred. The following shows the relation between the switch setting and the number of I/O points. Turn the arrow to the number corresponding to the desired number of I/O points. (Use a precision flat-tipped screwdriver.) 0 : Cannot be set. 8 : 64 [72] 1 : 8 [16] 9 : 72 [80] 2 : 16 [24] A : 80 [88] 3 : 24 [32] B : 88 [96] 4 : 32 [40] C : 96 [104] 5 : 40 [48] D : 104 [112] 6 : 48 [56] E : 112 [120] 7 : 56 [64] F : Cannot be set. The value in [ ] indicates the number of I/O points reserved for the XFB01B board inside the XRC. (This includes the area for board status).

Since F in the SW4 station setting is typically used already, do not use the F setting. Be sure not to set more than one board to the same ST#.

3.3 Function Setting Terminals

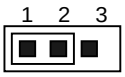
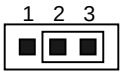
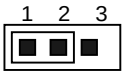
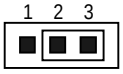
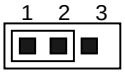
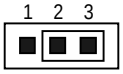
The terminals used to set functions of the XFB01B board are explained with descriptions of each function. Following the instructions, be sure to correctly set the terminals. Normally, the default settings are valid.

TM1: This terminal is reserved for the manufacturer to use a resistance (121 Ω) for maintenance purposes.
Always set to “without resistance.”

TM4: Sets the transmission mode to16-byte or 17-byte.
Usually set to “16-byte transmission.”
Only when the XRC system in which the XFB01B board is mounted is for 17-byte transmission, set to “17-byte transmission.”

TM5: Sets the board to XFB01 or XFB01B.
Usually set to “XFB01B mode.”
Only when the XFB01B board is used instead of the XFB01 board, set to “XFB01 mode.”

3.4 Setting Terminals

Terminals	Setting Method
TM1 Reserved for the manufacturer	 Short-circuit between 1 and 2: With resistance  Short-circuit between 2 and 3: Without resistance (default setting) Always set to “Without resistance.” Never set to “With resistance,” because this is used only for maintenance. When a terminator is required, install juuction tap or a terminator externally, and do not use this resistance.
TM4 Transmission mode setting	 Short-circuit between 1 and 2: 17-byte transmission  Short-circuit between 2 and 3: 16-byte transmission (default setting) Set according to the transmission mode of the XRC system where the XFB01B board is mounted. Usually, set to “16-byte transmission.” When TM5 is set to “XFB01 mode,” TM4 is invalid and “16-byte transmission” is automatically set.
TM5 Board setting	 Short-circuit between 1 and 2: XFB01 mode  Short-circuit between 2 and 3: XFB01B mode (default setting) Usually set to “XFB01B mode.” In XFB01B mode, either slave or master can be selected. Only when the XFB01B board is used instead of the XFB01 board, set to “XFB01 mode.”

3.5 Comparison with JARCR-XFB01 Board

The following table compares switches(SWs) and terminals(TMs) between the DeviceNet XFB01 board for the XRC and the XFB01B board.

Setting	JARCR-XFB01B	JARCR-XFB01
Transmission baud rate	SW1	SW1
Slave/Master switching	SW1	None
Operation mode	SW1	None
Node address	SW2 and SW3	SW2 and SW3
Station	SW4	SW4
Number of transmission I/O points	SW5	SW5
Resistance	TM1	TM1
Reset	None	TM2
Watchdog	None	TM3
Transmission mode (16-byte or 17-byte)	TM4	None
Board setting (XFB01 or XFB01B)	TM5	None

4 Mounting the XFB01B Board

WARNING

- Before wiring, be sure to turn OFF the power supply and put up a warning sign, such as “DO NOT TURN ON THE POWER”.

  Failure to observe this warning may result in an electric shock or an injury.

- Do not touch the inside of the panel for 5 minutes after the power is turned OFF.

  The remaining charged voltage in the capacitor may cause an electric shock or an injury.

- Be sure to close the door and install the protection cover while the power is turned ON.

  Failure to observe this warning may result in a fire or an electric shock.

CAUTION

- The wiring and mounting must be performed by authorized and qualified personnel.

  Failure to observe this caution may result in a fire or an electric shock.

- Make sure that there is no foreign matter such as metal chips on the board.

  In case of malfunction, etc. it may result in an injury or damage the board.

- Make sure that there is no damage or deflection of parts on the board.

  In case of malfunction, etc. it may result in an injury or damage the board.

- Correctly connect each cable and connector.

  Failure to observe this caution may result in a fire or damage the board.

- Set the switches, etc. correctly.

  Malfunction, caused by an incorrect setting, may result in an injury or damage the board.

- Never touch the mounting surfaces of the board parts directly with fingers.

  The generated static electricity may damage the IC.

- Never touch the soldered surfaces of the board directly with fingers.

  Protrusions on the soldered surface may result in an injury.

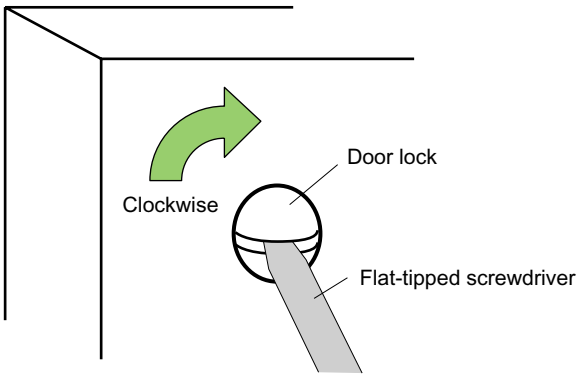
- Never give any shock to the board.

  The shock may damage the board.

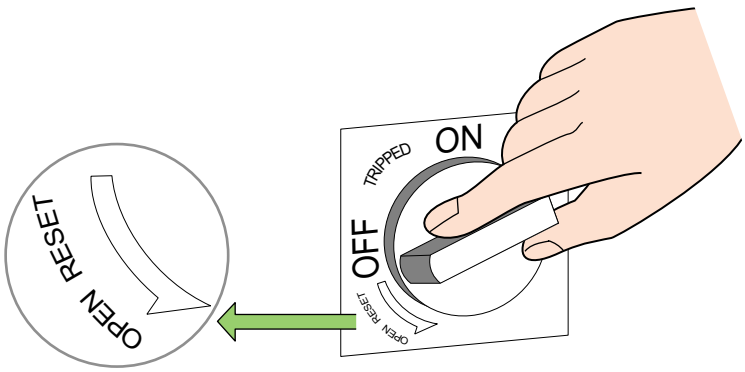
4.1 Opening the Front Door of the XRC

Mount the XFB01B board in the following manner.

1. Turn the two door locks on the front face of the XRC clockwise for 90 ° with a coin or a flat - tipped screwdriver.



2. With the door locks turned clockwise for 90 °, turn the main switch handle to the “OPEN RESET” position, and slowly open the door.



4.2 Confirming the Switch Settings on the XFB01B Board

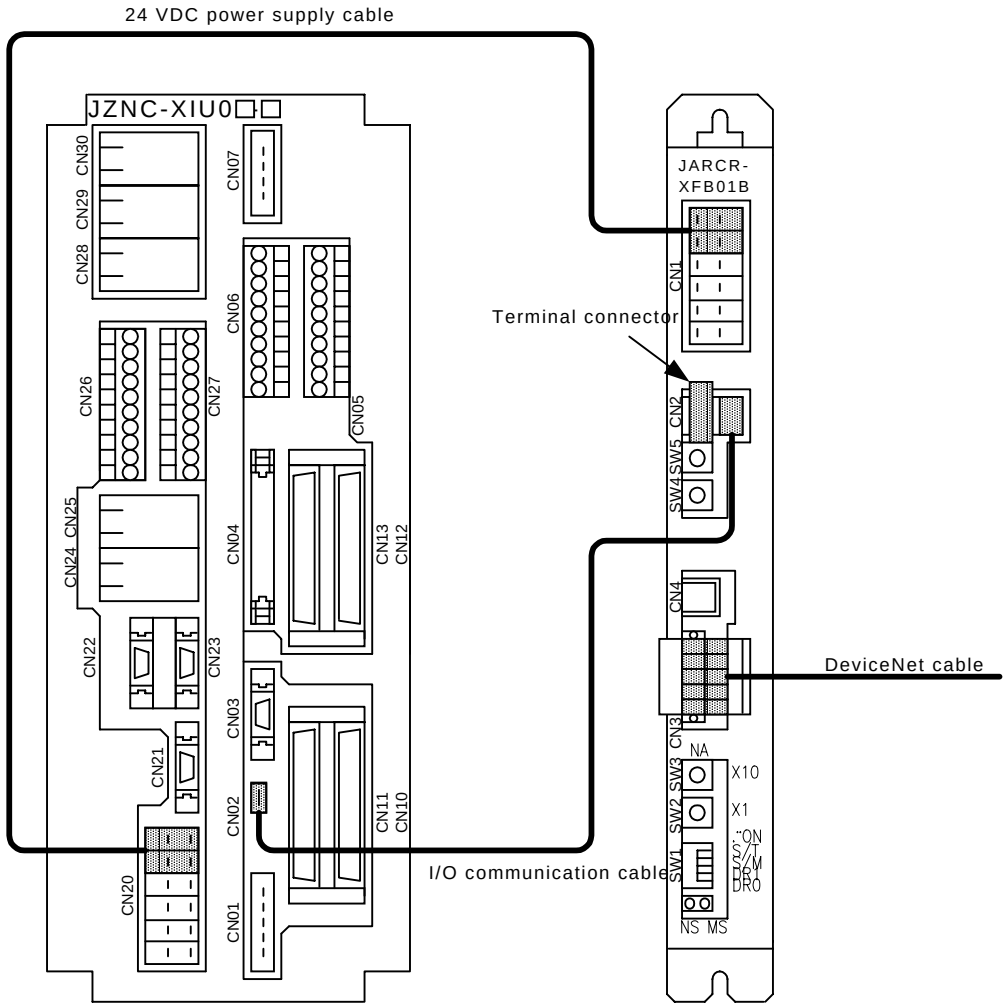
1. Be sure that the main power supply is turned OFF.
2. Be sure that the settings of switches on the board are correct.
3. For the switch settings, refer to Chapter 3 “Setting the Functions.”

4.3 Mounting the XFB01B Board on the XRC

Fix the XFB01B board on the XRC with the board fixing screws securely tightened.

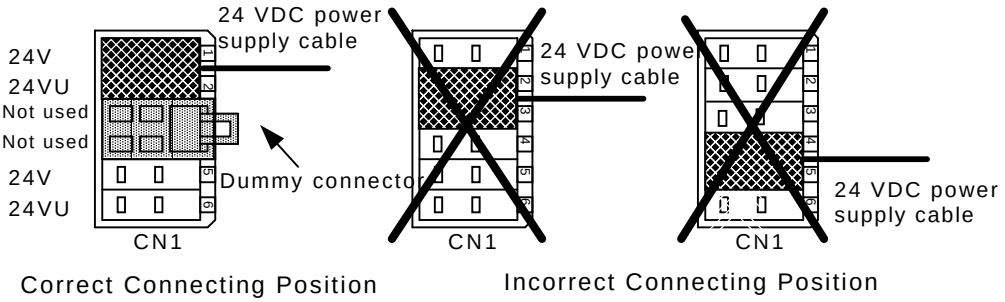
4.4 Connecting Each Cable

1. Connect the 24 VDC power cable to the CN1.
2. Connect the I/O communication cable to the CN2. Connect the terminal connector connected to the CN02 of the JZNC-XIU01 unit to the non-occupied CN2 on the XFB01B board.
3. Connect the cable for DeviceNet to CN3. (The color of the connected cable should be the same as the color of the connector and frame seal on the CN3.)



NOTE

A dummy connector is inserted into the CN1 of the 24 VDC power supply connector on the XFB01B board. Do not remove this connector because it is inserted to prevent incorrect cable connections. Removing this connector may result in incorrect connection of the 24 VDC power supply cable to the CN1. This prevents power from being supplied normally to the board, and the board may not start up.



Correct Connecting Position

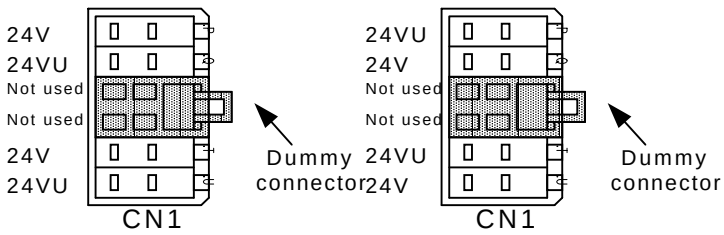
Incorrect Connecting Position

NOTE

When the XFB01B board is used instead of the XFB01 board, observe the following precautions.

As shown in the figure below, the positions of 24V and 24VU of the 24 VDC power supply connector CN1on the XFB01B board are different from those on the XFB01 board.

If only the board is replaced, the power is supplied to the XFB01B board from a power supply that is different from that for the XFB01 board. When a standard 24 VDC power supply cable is used, the XFB01B board operates with 24 V. However, when the dedicated power supply cable for the XFB01 board is used to operate with 24 V, also replace the cable with a standard 24 VDC power supply cable.

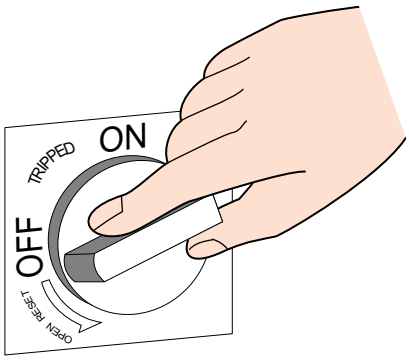


XFB01B

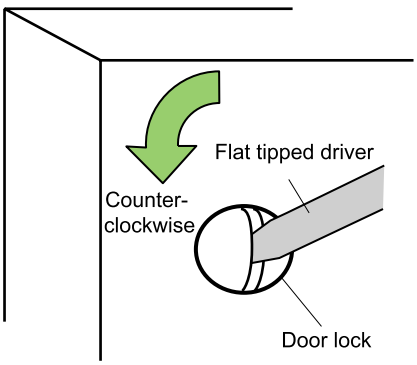
XFB01

4.5 Closing the Front Door of the XRC

1. Turn the main switch handle, which is now in the OFF position, to the “OPEN RESET” position, and then slowly close the door.



2. Turn the two door locks counterclockwise for 90°.



5 Allocating I/O Signals

5.1 I/O Module Setting

In order to use the XFB01B board on the XRC, the system configuration should be set in the following manner.

Make sure that the power supply to the XRC is OFF. Then, mount the XFB01B board, for which all of its switches have been set, inside the XRC. For the board mounting method, refer to "4 Mounting the XFB01B Board."

SUPPLE-MENT

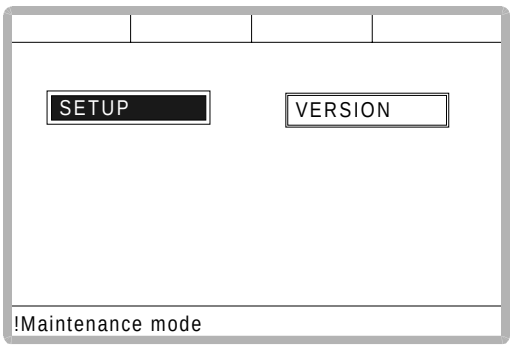
Add an I/O module in the management mode.
In the operation mode and the editing mode, the settings are for reference only.

Operation

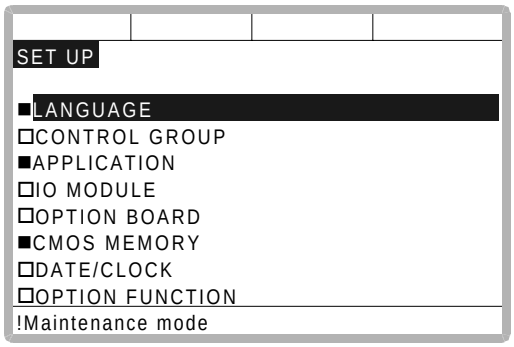
Turn on the power supply, pressing [TOP MENU] ➡ Set the mode to the “MANAGEMENT MODE” ➡ Select {SYSTEM} from the top menu *1 ➡ Select {SETUP}*2 ➡ Select “IO MODULE”*3 ➡ Confirm the status of the mounted I/O module *4 ➡ Press [ENTER]*5 ➡ Press [ENTER]*6 ➡ Select “YES” *7

Explanation

1 The system display appears.

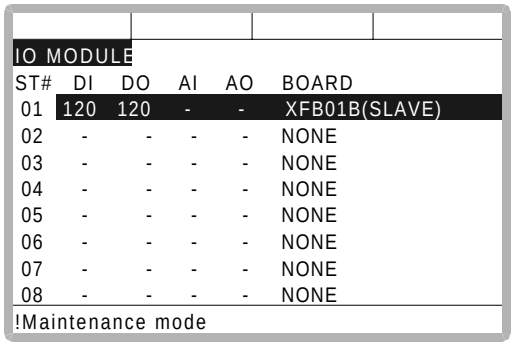


2 The SETUP display appears.



Items marked with■ cannot be used.

3 The current mounted status of the I/O modules appears as in the following example.



JARCR-XFB01B

NOTE

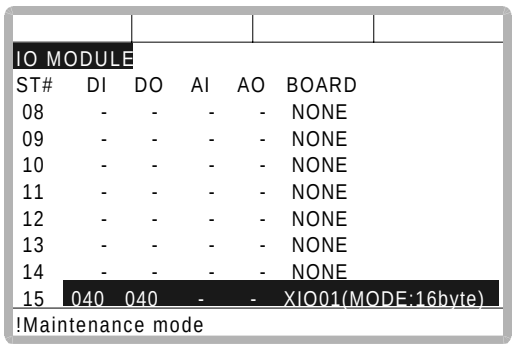
The following should be taken into consideration when reading the display.
For the XFB01B board, as the number of I/O points reserved for the board status exists other than the number of transmission I/O points set at SW5, the number of I/O points shown on the display is the number calculated by “the set value of SW5 + 1 (for the board status).”

<Example>
When SW5 is set to “E,” it is recognized as the I/O board with 120 points ((14 + 1) × 8). Confirm that each station displays correctly the actual mounted status of the I/O module.

SW5	Display
1	DI:016 DO:016
2	DI:024 DO:024
3	DI:032 DO:032
4	DI:040 DO:040
5	DI:048 DO:048
6	DI:056 DO:056
7	DI:064 DO:064
8	DI:072 DO:072
9	DI:080 DO:080
A	DI:088 DO:088
B	DI:096 DO:096
C	DI:104 DO:104
D	DI:112 DO:112
E	DI:120 DO:120

4 Confirm that each station (ST#) indicates the actual mounted status of the I/O module.

5 The mounted status of the I/O module for the rest of the stations (ST#) appear. Confirm that they correspond to the actual mounted status.



JANCD-XIO01

NOTE

If the display does not correspond to the actual mounted status, recheck the actual mounted status.
If the mounted status is correct (but the display does not correspond), the following causes are suspected.

• Improper I/O communication setting

The XFB01B board is set to16-byte mode (TM4) as default.
If the short pin CN10 of the JANCD-XIO01 board is set to 17-byte mode, the XRC cannot correctly recognize the XFB01B board. Set the XFB01B board to 16-byte mode.

• Improper or overlapped station setting

A single optional board can be selected for each station. Check if the station number set by SW4 is not used for a board other than the XFB01B board.
(SW4: F (ST#15) is only for the XIU01 unit. Do not select it for other boards.)

• Non-applicable system software versions

Old system software versions are not applicable for the XFB01B board. Check the sys tem software version number, and change to soft- ware applicable for the board. Use system software version 5.31A (xx)-00 or later.

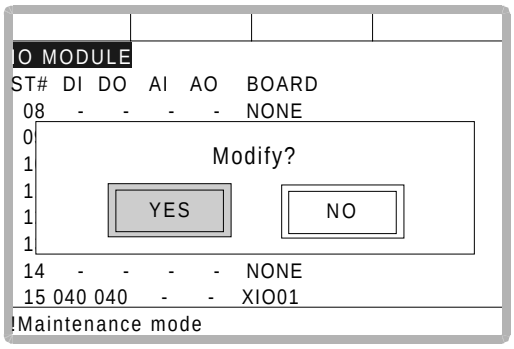
• Improper connection of the 24VDC power cable and the I/O communication cable

The 24VDC cable and the I/O communication cable may not be connected properly. Recheck the cable connection referring to "4.4 Connecting Each Cable." Improper connection of the 24VDC power cable to the CN3 may prevent the board from starting up.

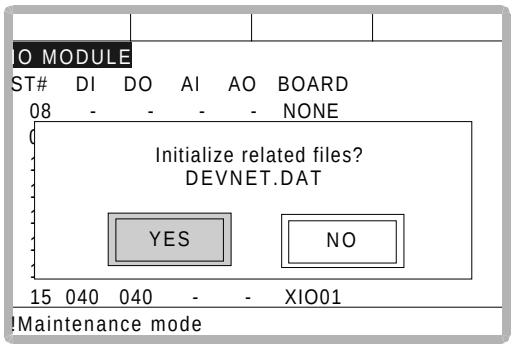
• I/O module failure

If the display does not correspond to the actual mounted status even after having corrected the above items, a failure of an I/O module is suspected. Contact your YASKAWA representative.
Note that two XFB01B boards (MASTER) can be mounted.

6 The confirmation dialog box appears.



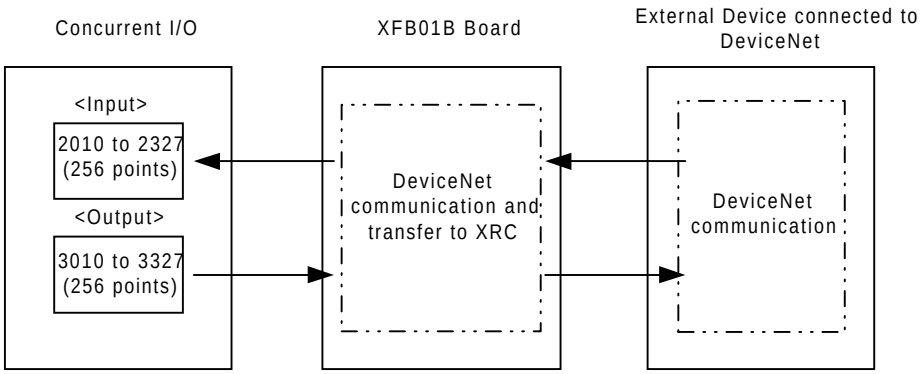
7 The system parameters are automatically set according to the current mounted status of the hardware.
The procedures to add I/O module are completed.
However, when the XFB01B board is set to MASTER, the following confirmation dialog box appears. Select “YES.”



5.2 Transmission Data

The data to be transferred from the XFB01B board to the inside of the XRC is not only the I/ data from the external devices connected to the DeviceNet, but also the status of the XFB01B board.
Therefore, inside the XRC, 8 points (1 byte) each for input and output are reserved for the status of the XFB01B board beside the area for the digital data. However, the output area cannot be used.

The transmission data from the XFB01B board are allocated to the external I/O signals of concurrent I/O.



When only a XFB01B (SW5 : E Input: 112 points, Output: 112 points) is mounted as an optional I/O board, the concurrent I/O allocation of each board is as follows.
(2010 to 2057 are used for standard I/O of the XRC.)

Board	Input	Output
JARCR-XFB01B	2060 to 2067 board status* 1	3060 to 3067 can not be used
	2070 to 2077 input data (1)	3070 to 3077 output data (1)
	2080 to 2087 input data (2)	3080 to 3087 output data (2)
	2090 to 2097 input data (3)	3090 to 3097 output data (3)
	2100 to 2107 input data (4)	3100 to 3107 output data (4)
	2110 to 2117 input data (5)	3110 to 3117 output data (5)
	2120 to 2127 input data (6)	3120 to 3127 output data (6)
	2130 to 2137 input data (7)	3130 to 3137 output data (7)
	2140 to 2147 input data (8)	3140 to 3147 output data (8)
	2150 to 2157 input data (9)	3150 to 3157 output data (9)
	2160 to 2167 input data (10)	3160 to 3167 output data (10)
	2170 to 2177 input data (11)	3170 to 3177 output data (11)
	2180 to 2187 input data (12)	3180 to 3187 output data (12)
	2190 to 2197 input data (13)	3190 to 3197 output data (13)
	2200 to 2207 input data (14)	3200 to 3207 output data (14)

1 Explanation of board status 2060 to 2067

2060	Watchdog	Count from 0 to 7
2061		
2062		
2063	Not used	Always 0
2064	Not used	Always 1
2065	(In SLAVE mode) Not used (In MASTER mode) Communication status with slaves	Always 0 Communicating with all slaves: 0 Communicating with some slaves: 1
2066	DeviceNet communication	Normal: 0 Error: 1
2067	Board operation status	Normal: 0 Error: 1

[XFB01B Board Status]
The status of the XFB01B board (the first 8 points of the allocation area) is indicated as follows.
The value “xx” of the allocated input signals in the table indicates the first numbers of the XFB01B board allocation number. In the table on the previous page, where the allocation numbers were 2060 to 2067, 06 would be “xx.”

Signal	Contents
2xx0 to 2xx2	Watchdog counter. This bit repeats counting the value between 0 to 7. (approximately every 32 ms.)
2xx3	Not used Always set to 0.
2xx4	Not used Always set to 1.
2xx5	(In SLAVE mode) Not used Always set to 0. (In MASTER mode) Indicates if communicating with all the slaves or not through DeviceNet. Communicating with all slaves: 0, Communicating with some slaves: 1
2xx6	Indicates the DeviceNet communication status. (Even if communicating with some nodes, the normal status is indicated.) Normal: 0 Error: 1
2xx7	Indicates the operation status of the XFB01B board. Normal: 0 Error: 1

5.3 DeviceNet Slave Allocation (Only in Master Mode)

To use the XFB01B board in master mode, the slave stations in DeviceNet must be allocated, besides the setting of I/O modules explained in “5.1 I/O Module Setting.”

SUPPLE-MENT

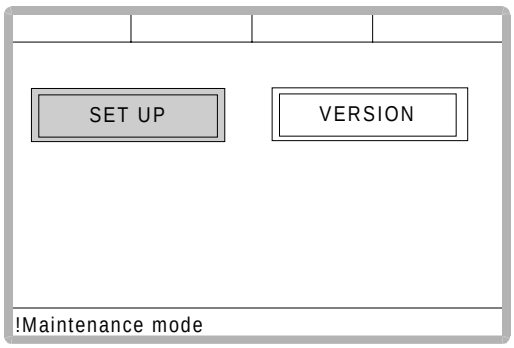
Add an I/O module in the management mode.
In the operation mode and the editing mode, the settings are for reference only.

Operation

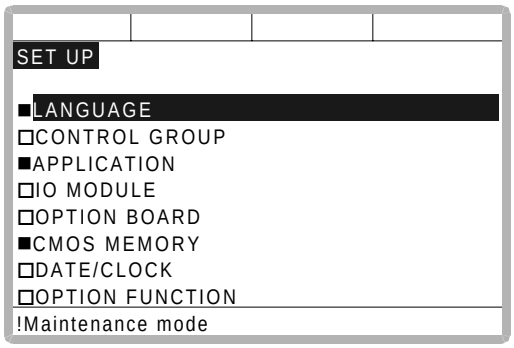
Turn ON the power supply, pressing [TOP MENU] ➡ Set the mode to the “MANAGEMENT MODE” ➡ Select {SYSTEM} from the top menu* 1 ➡ Select {SET UP} * 2 ➡ Select “IO MODULE”* 3 ➡ Select “XFB01B (MASTER)” * 4 ➡ Select “DETAIL” * 5 ➡ Select the desired item* 6 ➡ Enter the desired value ➡ Press [ENTER]* 7 ➡ Select “YES”* 8

Explanation

1 The system display appears.

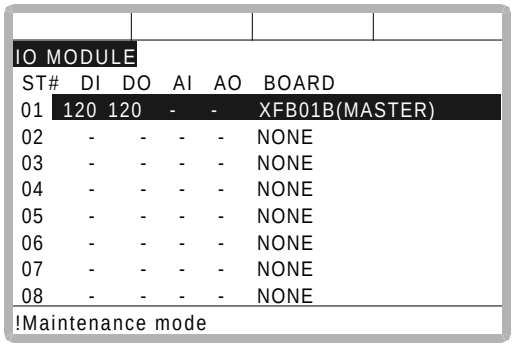


2 The SETUP display appears.



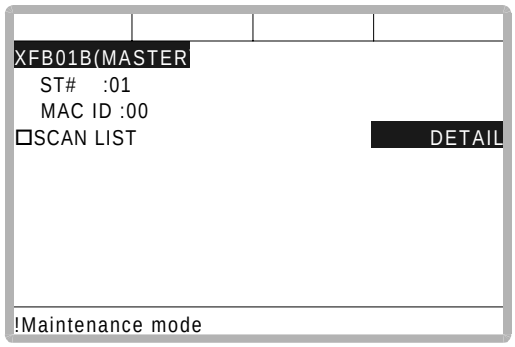
Items marked with■ cannot be used.

3 The current mounted status of the I/O modules appears as in the following example.

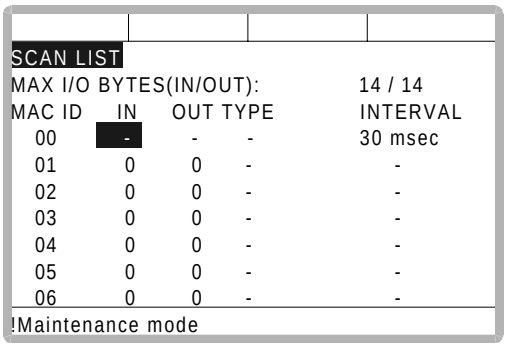


JARCR-XFB01B

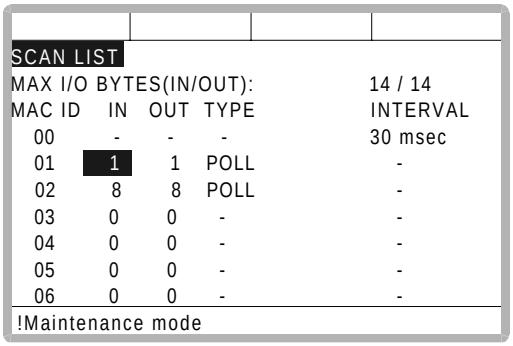
4 The current mounted status of DeviceNet modules appears as in the following example.



5 The SCAN LIST display appears to allocate the slaves.

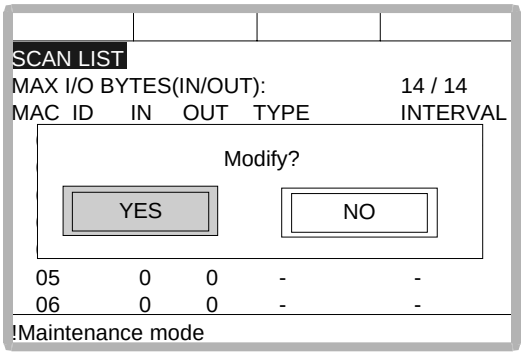


6 Set each parameter according to the actual mounted status of the slave device.



Each item in the display indicates as follows:
MAC ID: Node address of the DeviceNet device
IN: Number of bytes to be input from the slave device (1 byte = 8 points)
OUT: Number of bytes to be output to the slave device (1 byte = 8 points)
TYPE: I/O message type of the slave device, POLL or BITSTROBE.
The message type POLL can be set for any DeviceNet device.
"BITSTROBE" is only an input message and can be set for a DeviceNet device of 8 bytes or less.
For details of POLL and BITSTROBE, refer to the DeviceNet specifications.
INTERVAL: Set the scanning interval of DeviceNet. It is displayed in the same row as the master device number. Set to a value between 10 ms to 300 ms in units of 1 ms. The default setting is 30 ms.

7 The following confirmation dialog box appears.



8 The parameters for DeviceNet are stored in the XRC. Turn ON the power to the XRC, and then start up the XRC.

5.4 Management of DeviceNet Slave Allocation (Only in Master Mode)

The settings for allocating the slaves for DeviceNet which was set in “5.3 DeviceNet Slave Allocation,” can be saved to and loaded from an external memory. This section explains the saving and loading procedures. For information on operations using an external memory, refer to “Chapter 7 controlling Peripheral Devices” of “YASNAC XRC Operator’s Manual.”

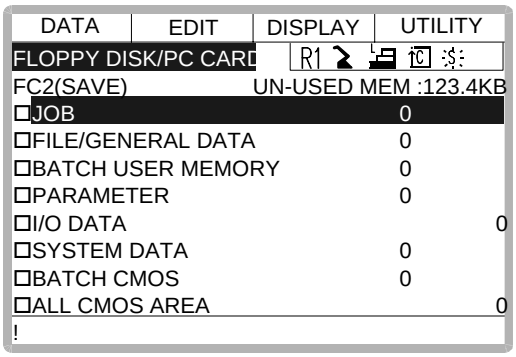
5.4.1 Saving to External Memory

Operation

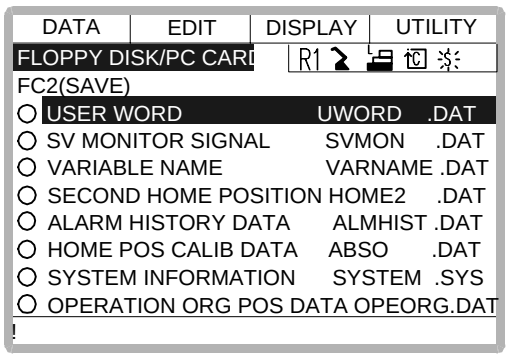
Turn ON the power to the XRC ➡ Select {FLOPPY DISK/PC CARD} from the top menu ➡ Select {SAVE}* 1 ➡ Select “SYSTEM DATA” * 2 ➡ Select “DEVICENET ALLOC DATA”* 3 ➡ Press [ENTER] * 4 ➡ Select “YES” * 5

Explanation

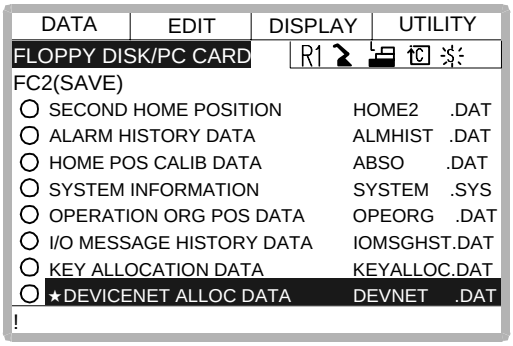
1 The FLOPPY DISK/PC CARD display appears.



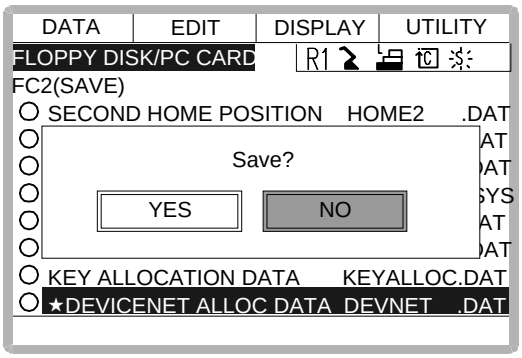
2 A list for selecting files appears.



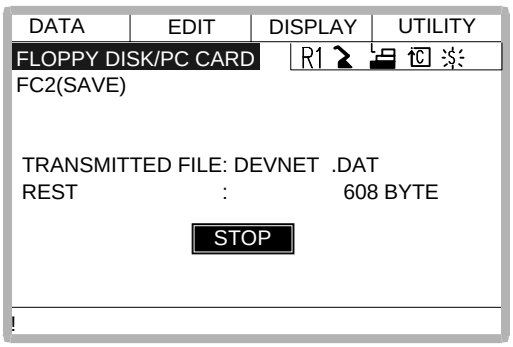
3 The selected file is marked with "★."



4 The following confirmation dialog box appears.



5 Saving of the selected file starts and its progress is displayed.



To interrupt the saving, select "STOP."
When the file is successfully saved or the saving of the file is interrupted, the list for selecting files reappears.

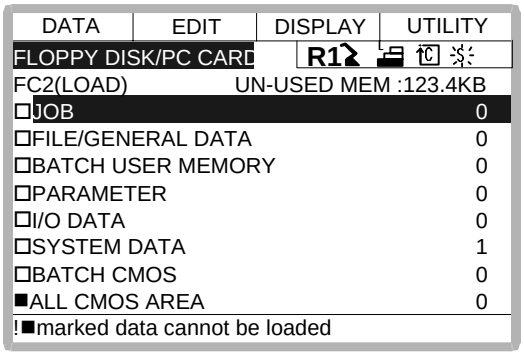
5.4.2 Loading from External Memory

Operation

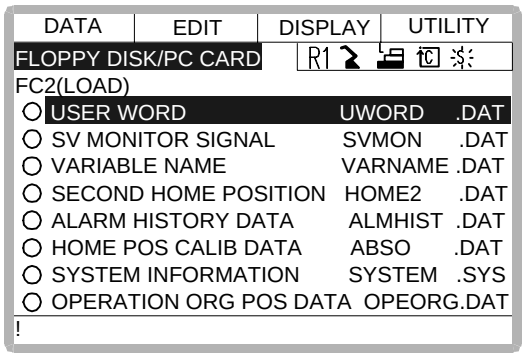
Turn ON the power to the XRC ➡ Set the mode to “MANAGEMENT MODE” ➡Select {FLOPPY DISK/PC CARD} from the top menu ➡ Select {LOAD}*1 ➡Select “SYSTEM DATA”*2 ➡Select “DEVICENET ALLOC DATA” *3 ➡Press [ENTER] *4 ➡Select “YES”*5 ➡After the file has been successfully loaded, turn ON the power to the XR

Explanation

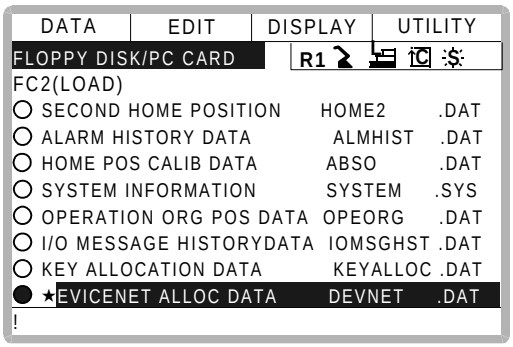
1 The FLOPPY DISK/PC CARD display appears.



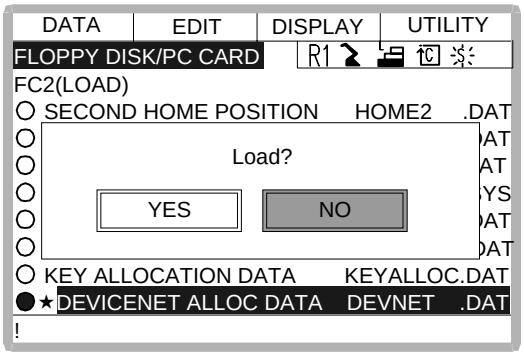
2 A list for selecting files appears.



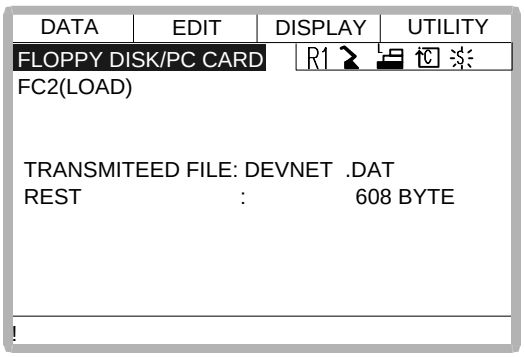
3 The selected file is marked with “★.”



4 The following confirmation dialog box appears.



5 Loading of the selected file starts and its progress is displayed.



When the file is successfully loaded, the list for selecting files reappears.
Turn OFF the power to the XRC, and then turn ON.

NOTE If the switch settings (node address, station, transmission I/O points) of the XFB01B board are different from those in the data to be loaded from external memory, the data cannot be loaded. Set the switches on the XFB01B board to the same settings those in the data to be saved.

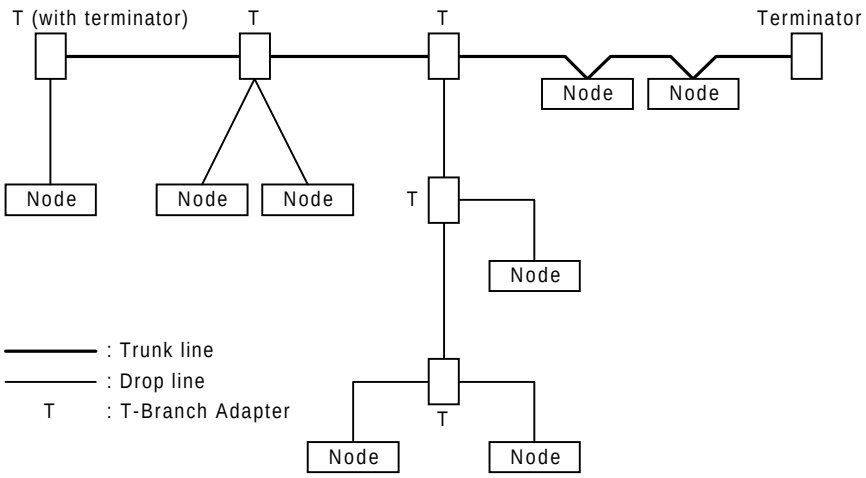
6 Network Specifications

6.1 Network Configuration

6.1.1 Network Connections

■ Connection Form

The following diagram shows the network connections.



Network Connecitions

■ Configuration Elements

The network is configured from the following elements.

Node

A node is either a slave that connects to an external I/O unit, or the master that manages the I/O of the slaves. There are no restrictions on the location of the master or slaves. Any node in the figure above can be the master or a slave.

Trunk line and drop lines

A cable with a terminator on each end is a trunk line. Any cable branching from the trunk line is a drop line.

Connection methods

A node is connected using the T-branch method or multi-drop method.
A T-Branch Adapter is used to connect a node with the T-branch method. A node is directly connected to the trunk line or a drop line with the multi-drop method.
Both T-branch and multi-drop methods can be used together in the same network, as shown in the figure above.

Terminator

both ends of the trunk line must connect to terminator to decrease signal reflection and ensure stable network communications.

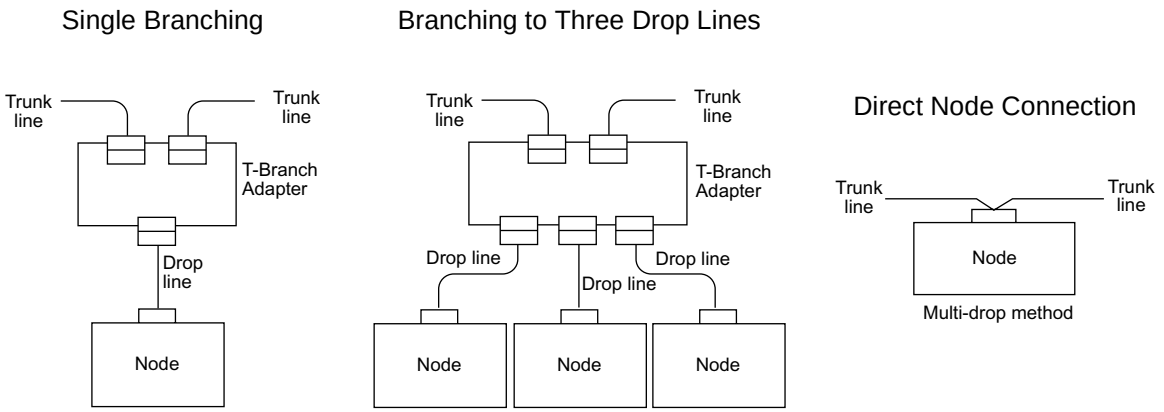
Communications power supply

The communications connector of each node must be provided with a communications power supply through the communications cable for DeviceNet communications.
Provide the communications power supply, the internal circuit power supply, and the I/O power supply separately.

NOTE
1. The communications cable must be a DeviceNet cable.
2. Both ends of the trunk line must connect to a terminator.
3. Only DeviceNet devices can be connected to the network. Do not connect any other devices,such as a lightning arrester.

■ Branching from the Trunk Line

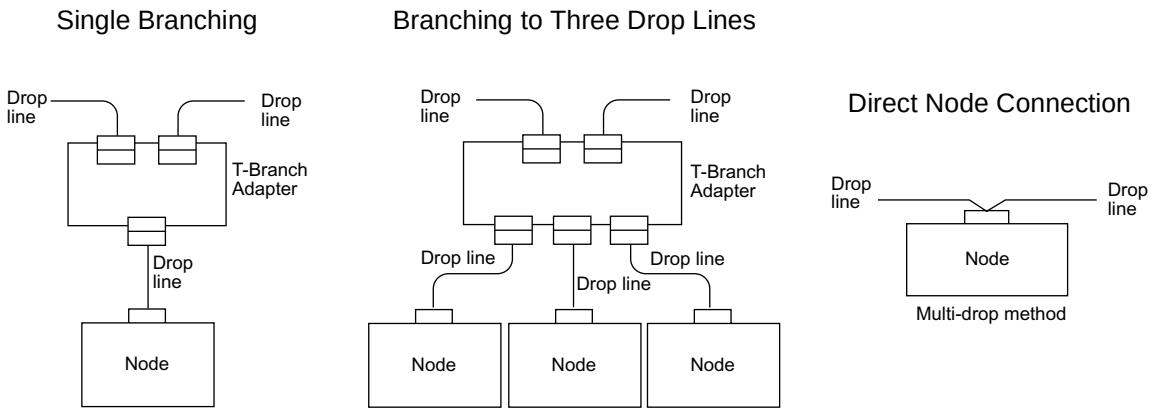
There are three methods that can be used to branch from the trunk line.



Branching from the Trunk Line

■ Branching from Drop Lines

There are three methods that can be used to branch from drop lines.

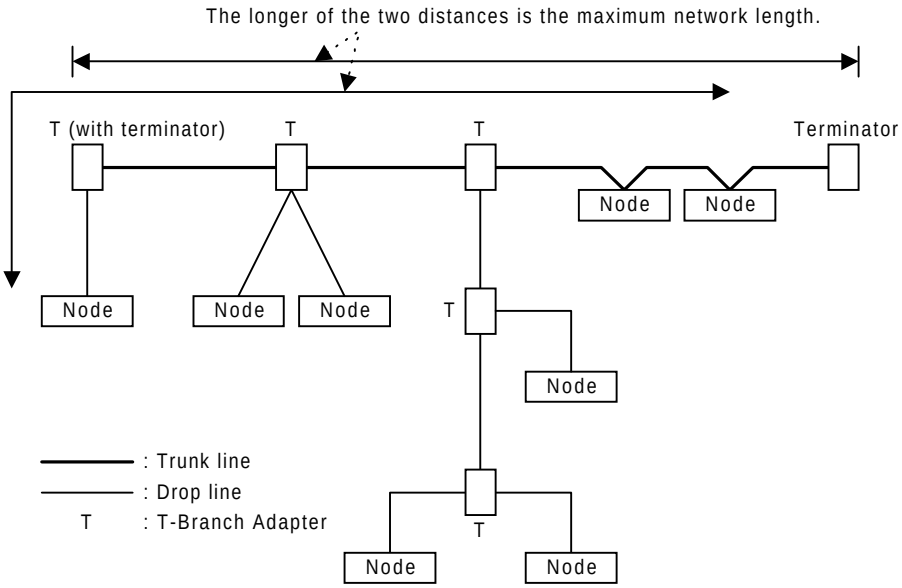


Branching from Drop Lines

6.1.2 Precautions for Wiring DeviceNet Cables

■ Maximum Network Length

The maximum network length is either the line length between two nodes located farthest from each other or the line length between the terminators on the ends of the trunk line, whichever is longer.



DeviceNet cables can be either thick cables or thin cables.
The thick cables can be used for relatively long distance communication with less signal attenuation distortion, however, they are rigid and difficult to bend.
The thin cables are pliable and easy to bend, however, they are not applicable for the long distance communication since the amount of signal attenuation distortion is considerablely big.
The maximum network length is determined by the type of cable, as shown in the following

table.

Baud Rate (kbps)	Maximum Network Length (m)	
	Thick Cable	Thin Cable
500	100	100
250	250	100
125	500	100

SUPPLE-MENT

The line connecting two nodes located farthest from each other can use both thick and thin cables provided that the length of each cable satisfies the conditions in the following table.

Baud Rate (kbps)	Maximum Network Length (m)
500	$L_{THICK} + L_{THIN} <= 100$
250	$L_{THICK} + 2.5 \times L_{THIN} <= 250$
125	$L_{THICK} + 5.0 \times L_{THIN} <= 500$

L_{THICK}: thick cable length, $_{THIIN}$: thin cable length

■ Drop Line Length

The drop line length is the line length between a branch point on the trunk line to the farthest node that is located on the drop line. The maximum drop line length is 6 m. A drop line can be branched out into other drop lines.

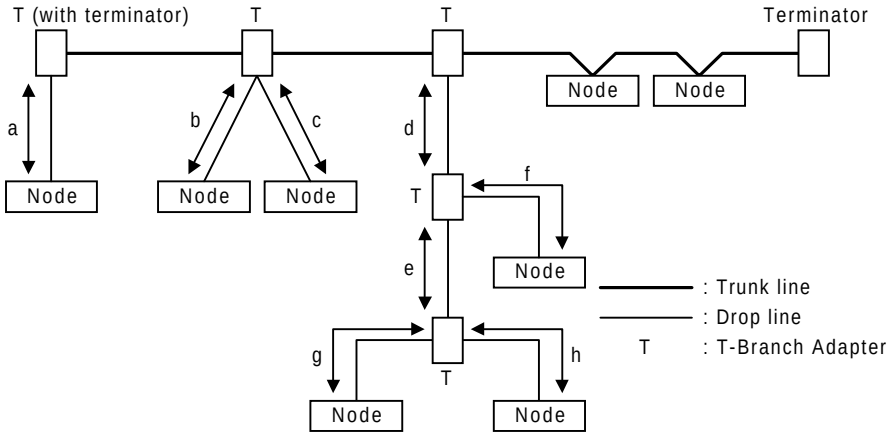
■ Total Drop Line Length

The total drop line length is a total of all drop line lengths.
The total drop line length must be within the allowable range and even then, each drop line must be 6 m or less.

The allowable range of total drop line length varies with the baud rate as shown in the following table.

Baud Rate (kbps)	Total Drop Line Length (m)
500	39 max.
250	78 max.
125	156 max.

The following examples is for a baud rate of 500 kbps.



The above example must satisfy the following conditions.

a <= 6 m, b <= 6 m, c <= 6 m, d <= 6 m, d + f <= 6 m,
d + e + g <= 6 m, d + e + h <= 6 m

The total drop line length must satisfy the following condition.

Total drop line length = a + b + c + d + e + f + g + h <= 39 m

7 Connections for DeviceNet Communications

7.1 Location of Communications Power Supply

7.1.1 Basic Precautions

Basic precautions are as follows:

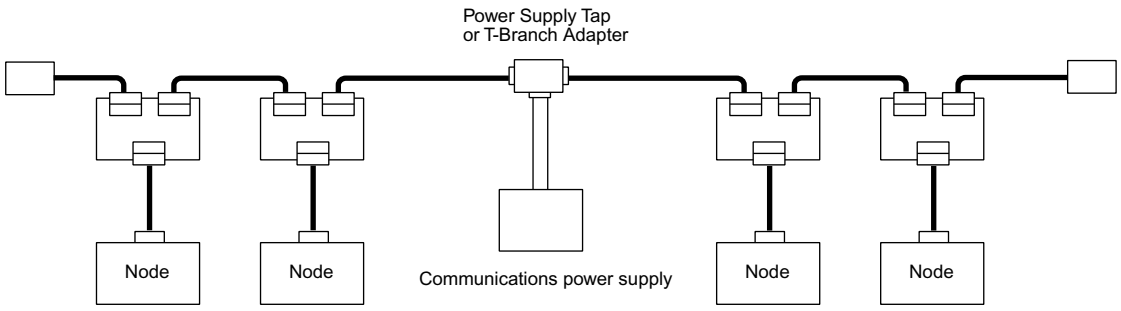
1. The communications power supply to the network must be 24 VDC.
2. The communications power supply must have a sufficient margin in the capacity.
3. Connect the communications power supply to the trunk line.
4. If many nodes are provided with power from a single power supply, locate the power supply as close as possible to the middle of the trunk line.
5. The allowable current flow in a thick cable is 8 A and that in a thin cable is 3 A.
6. The power supply capacity for a drop line varies with the drop line length.
   The longer a drop line is, the lower the maximum current capacity of the drop line will be regardless of the thickness of the drop line. Obtain the allowable current (I) of the drop line (i.e., the allowable current consumption of the drop line and devices connected to it) from the following equation.

   $I = 4.57 / L$ I: Allowable current (A)
   L: Drop line length (m)
7. If only the communications power supply is turned OFF while the network is operating, errors may occur in the nodes that are communicating at that time.

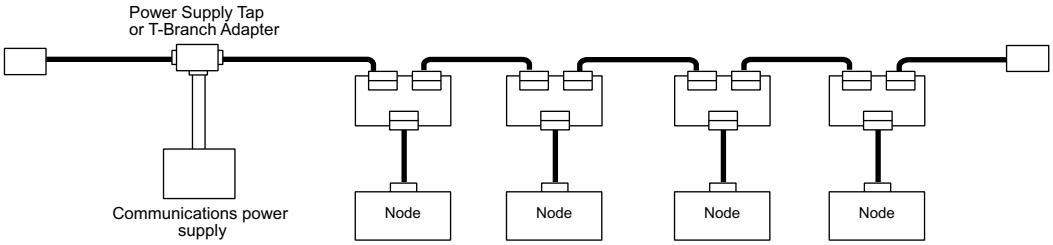
7.1.2 Location of Power Supply

The following two types of configuration are possible for the location of the power supply.

■ Nodes on Both Sides of the Power Supply



■ Nodes on One Side of the Power Supply



Note: The “Nodes on Both Sides of the Power Supply” method is recommended if a single power supply is connected to many nodes.

7.1.3 How to Decide the Location of the Power Supply

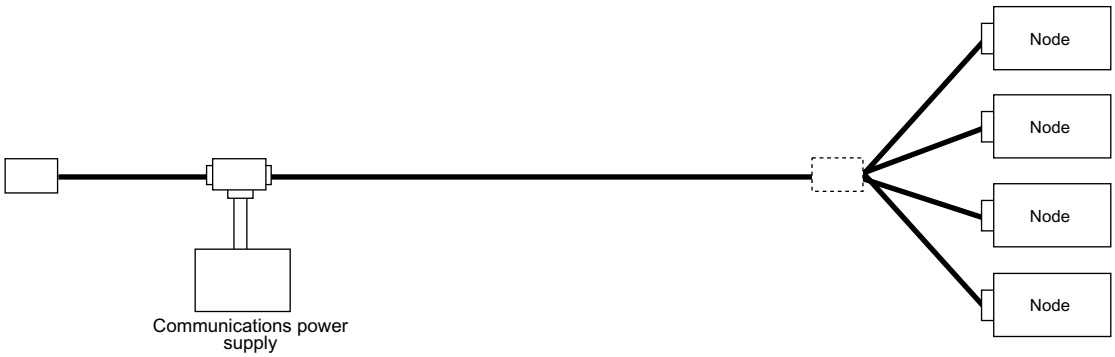
1. To provide a sufficient flow of current to each node, the power supply capacity required for each node and the voltage drop caused by the cable length must be taken into consideration. Calculate the following values:

   • The power supply capacity required for each node
   • The distance from the power supply

2. There are two methods to calculate the power supply capacity for the trunk line.
   • Simplified calculation with the estimated values from the graph
   • Calculation with the actual values (the voltage drop calculated according to the resistance value and the current consumption of the communications cable.)

   Each drop line must satisfy the equation between the drop line’s length and the drop line’s power supply capacity described in 6 of “7.1.1 Basic Precautions.”

   • The values shown in the graph are obtained under unfavorable conditions, such as the configuration which results in the maximum voltage drop. Therefore, the network operates correctly if the result of the simplified calculation based on the graph satisfies the condition for the required power supply capacity.



- Even if the result of the simplified calculation based on the graph does not satisfy the condition for the required power supply capacity, the result of the calculation with the actual values may satisfy the condition. The network operates correctly as long as either of the results by simplified calculation based on the graph or by the calculation with the actual values satisfies the condition.

NOTE

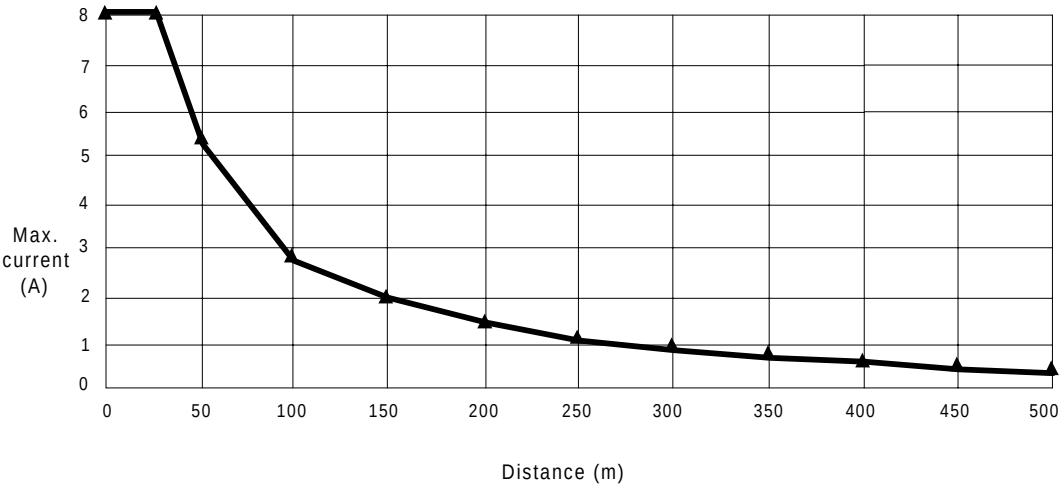
1. It is recommended to use separate power supplies for communications and for the internal circuit.
2. If the communications power supply is also used as the internal circuit power supply, the simplified calculation based on the graph is not applicable. Calculate the power supply capacity with the actual values.

■ Simplified Calculation with the Estimated Values from the Graph

The voltage of the communications power supply to each node must be 11 VDC or more. If not, the communications will be unstable.
A current flowing to the communications cable causes a voltage drop. The longer the communications cable is or the greater the current is, the bigger the voltage drop will be.
The following tables show the maximum allowable current that can supply sufficient voltage to the communications power supply regardless of a voltage drop for a thick cable and a thin cable.

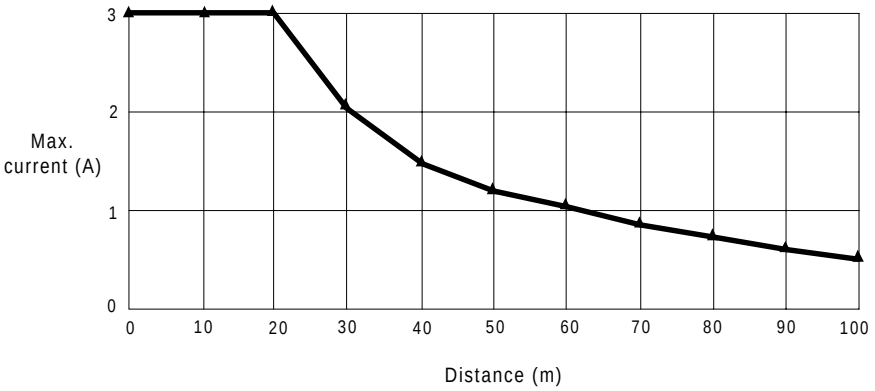
a) **For a thick cable**

Distance (m)	0	25	50	100	150	200	250	300	350	400	450	500
Max. current (A)	8.00	8.00	5.42	2.93	2.01	1.53	1.23	1.03	0.89	0.78	0.69	0.63



b) **For a thin cable**

Distance (m)	0	10	20	30	40	50	60	70	80	90	100
Max. current (A)	3.00	3.00	3.00	2.06	1.57	1.26	1.06	0.91	0.80	0.71	0.64



How to confirm sufficient power supply capacity

Check the following for each node.
When nodes are located on both sides of the power supply, check for the nodes on each side.
The graph to be referred to differs depending on the cable type (thick or thin cable) of the trunk line.

1. Calculate the total current consumption, “A,”of all the nodes located for each side.
2. From the graph, obtain the maximum current ,“B,” that may flow to the cable according to the cable type and the distance from the power supply to the end of trunk line.
3. If A ≤ B:
   the total current consumption “A” calculated in step 1 is equal to or less than the allowable maximum current “B” obtained in step 2, and the power supply capacity is sufficient for all the nodes.
4. When the nodes are located on both sides of the power supply, repeat steps 1 to 3 for the nodes on the other side.

Corrective actions

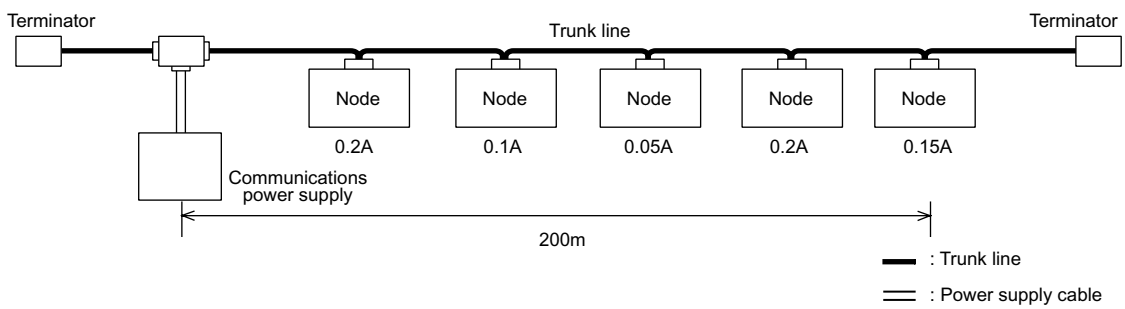
If A > B,
the total current consumption “A” calculated in step 1 is more than the maximum current “B” obtained in step 2, so
consider the following corrective actions to satisfy the conditions for the required power supply capacity.

- Move the power supply to the middle of the trunk line, so that the nodes are located on both sides of the power supply.
- When the nodes are located on both sides of the power supply, move the power supply to the side where the bigger power supply capacity is required.
- When a thin cable is used, replace it with a thick cable.

If A > B after having taken these corrective actions, recalculate the power supply capacity taking the actual arrangement of nodes into consideration.

Example 1: Where the power supply is at the end of the trunk line

The following diagram shows an example where the thick cable with the total length of 200 m is used and the power supply is connected at the end of the trunk line.

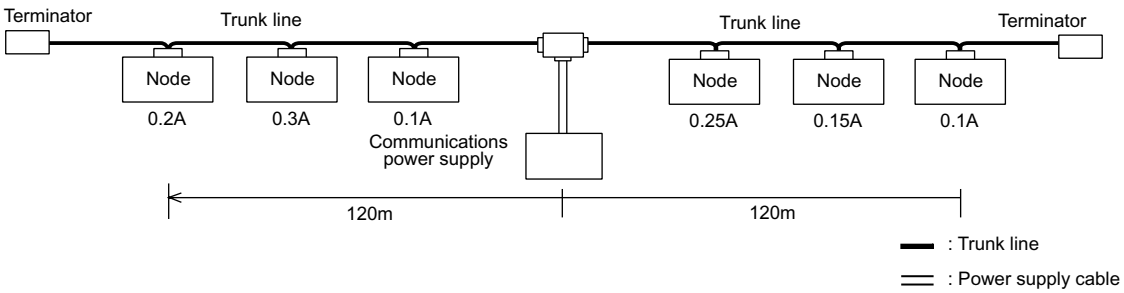


Total length of the power supply cable = 200 m

Total current consumption of nodes = 0.2 A + 0.1 A + 0.05 A + 0.2 A + 0.15 A
= 0.7 A
Max. current obtained from the graph = 1.53
As A (total current consumption) < B (max. current), sufficient communications power can be supplied to all nodes.

Example 2: Where the power supply is in the middle of the trunk line

The following diagram shows an example where the thick cable with the total length of 240 m is used and the power supply is connected in the middle of the trunk line.



Total length of the power supply cable on the left of the power supply
= Total length of power supply cable on the right of the power supply
= 120 m

Total current consumption of the nodes on the left of the power supply
= 0.2 A + 0.3 A + 0.1 A = 0.6 A
Total current consumption of the nodes on the right of the power supply
= 0.25 A + 0.15 A + 0.1 A = 0.5 A

The maximum current on the left obtained from the graph = approx. 2.5
The maximum current on the right obtained from the graph = approx. 2.5 A

As A (total current consumption) < B (maximum current on the left) and A (total current consumption) < B (maximum current on the right), sufficient power can be supplied to all nodes.

■ Calculation with Actual Values

If the result of the simplified calculation based on the graph still does not satisfy the conditions, check by detailed calculations using the following equation.

Equation

- **When a communications power supply and an internal circuit power supply are separate**
  Check the distance between the power supply and each node in addition to the current consumption for the communications unit of each node.

If these values satisfy the following equation, sufficient power can be supplied to the node.
However, the current must not exceed the maximum allowable current to the cable, 8 A for a thick cable and 3 A for a thin cable.

Equation $\Sigma [(Ln \times Rc + Nt \times 0.005) \times In] \leq 4.65\ V$

Ln: Distance between the power supply and a node (excluding the length of the drop line)
Rc: Maximum resistance of the cable (0.015 Ω/m for a thick cable, 0.069 Ω/m for a thin cable)
Nt: Number of adapters between the power supply and a node
In: Current consumption required for the communications unit of node
0.005 Ω= Contact resistance value of an adapter

- **When the communications power supply is also used as the internal circuit power supply**

Because the allowable voltage range of the communications power supply is different from that of the internal circuit power supply as shown below, avoid using the power supply for both communications and the internal circuit.

- Allowable voltage range for the communications power supply: 11VDC to 25 VDC
- Allowable voltage range for the internal circuit power supply: 24 VDC - 15 % to + 10 %

Check the distance between the power supply and each node in addition to the total current consumption for the communications unit and the internal circuit of each node.
If these values satisfy the following equation, sufficient power can be supplied to the node.
However, the current must not exceed the maximum allowable current to the cable, 8 A for a thick cable and 3 A for a thin cable.

Equation $\Sigma [(Ln \times Rc + Nt \times 0.005) \times In] \leq 0.65\ V$

Ln: Distance between the power supply and a node (excluding the length of the drop line)
Rc: Maximum resistance of the cable (0.015 Ω/m for a thick cable, 0.069 Ω/m for a thin cable)
Nt: Number of adapters between the power supply and a node
In: Current consumption required for the communications unit and the internal circuit of a node
0.005 Ω= Contact resistance value of an adapter

Corrective actions

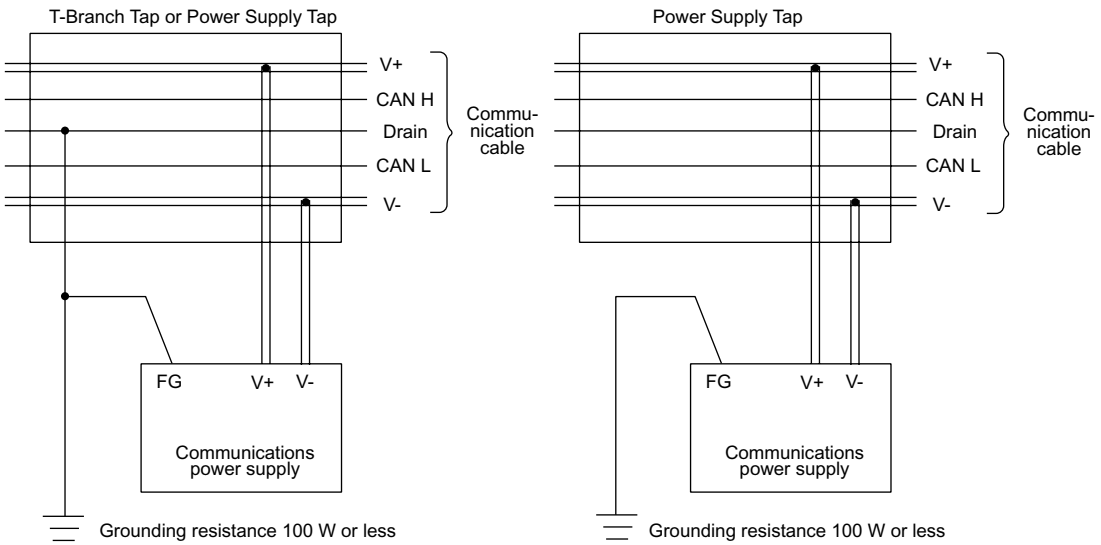
If the obtained values do not satisfy the equation, consider the following corrective actions.

- Place a node with a large current consumption close to the power supply.
- Move the power supply to the middle of the trunk line so that the nodes are located on both sides of the power supply.
- When nodes are located on both sides of the power supply, move the power supply to the side where the bigger power supply capacity is required.
- When a thin cable is used, replace it with a thick cable.

7.2 Grounding

7.2.1 Grounding Method

Ground the point closest to the middle of network, so a ground loop is not made. Perform the one line grounding.
As shown below, connect the drain wire of the cable to the FG terminal of the communications power supply and ground the drain wire to a resistance of 100 Ω or less.



Power supply with single-point ground

Power supply without ground

If more than one communications power supply is used, ground only the power supply that is located closest to the middle of the network through the drain wire. Do not ground the power supply through the drain wire at any other point.
If more than one communications power supply is connected to the network, connect them using a Power Supply Tap each.

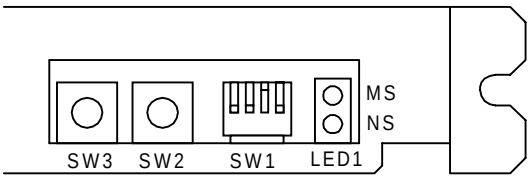
NOTE

1. Power supplies are not counted as nodes.
2. Ground the network to a resistance of 100 Ω or less.
3. Do not ground the network together with servodrivers or interters.
4. Do not ground the network through the drain wire at more than one point; ground at a single point only.

8 Error Indication

8.1 LED Indicators

On the XFB01B board, the board status display LED and the DeviceNet status display LED are provided. They are indicated with MS (module status) and NS (network status) respectively. In startup after the power is turned ON, MS and NS lamps light up in green and red alternately for LED test and then in green. If MS and NS lamps do not light up in green after a specified time with the power ON, the communication is not being performed correctly.



8.1.1 MS Lamp

The MS LED indicates the status of the XFB01B board.

LED	Status	Indications and Corrective Actions
MS unlit	Power loss	• Check the connection of the power supply to CN1 of XFB01 board.
MS lit in green	Module in normal state	• The Module operates normally.
MS blinks in green	Communication error with the XRC (In waiting status)	• Check the connection of the I/O communication cable to CN2 on the XFB01B board.
MS blinks in red (cyclically)	Communication error with the XRC	• Check the connection of the I/O communication cable to CN2 on the XFB01B board.
MS blinks in red (twice)	Communication error with the XRC	Incorrect settings of the switches on the XFB01B board. • Check the settings of the switches on the front of the XFB01B board.
MS lit in red	Error in module	ROM/RAM check error or watchdog time-out error occurs. • Turn the XRC main power supply from OFF to ON. • Replace the XFB01B board.

8.1.2 NS Lamp

The NS LED indicates the status of DeviceNet.

LED	Status	Indications and Corrective Actions
NS unlit	In offline status	XFB01B board power supply failure, communication power supply failure, or DeviceNet line failure occurs. • Check the connection of the power supply to CN1 of the XFB01B board. • Check the wiring and connection of the DeviceNet cable and connector. • Check the voltage and connection of the communication power supply. • Check the transmission speed of each device. • Check the resistance value (121 Ω) of the mounted terminator and its mounted status. • Check the operation status of the DeviceNet master device.
NS blinks in green	Communication is not established.	In online status, but communication is not established. • Check the wiring and connection of the DeviceNet cable and connector. • Check the voltage and connection of the communication power supply. • Check the transmission speed of each device. • Check the resistance value (121 Ω) of the mounted terminator and its mounted status. • Check the operation status of the DeviceNet master device. • Check if the number of I/O points for the connected master or slave corresponds to the number of I/O allocated points.
NS lit in green	Communication in normal status	Communication is established in online.

LED	Status	Indications and Corrective Actions
NS blinks in red	Time-out error	A time-out error occurs between the XRC and the connected device. • Check the wiring and connection of the DeviceNet cable and connector. • Check the voltage and connection of the communication power supply. • Check the transmission speed of each device. • Check the resistance value (121 Ω) of the mounted terminator and its mounted status. • Check the operation status of the DeviceNet master device. • Check if the number of I/O points for the connected master or slave corresponds to the number of I/O allocated points. • Raise the setting for the communications cycle of the master device, and recheck communications.
NS lit in red	Communication fatal fault	A node address is overlapped, or a bus OFF is detected on the network. • Reset the node address so that the node address is not overlapped. • Check the wiring and connection of the DeviceNet cable and connector. • Check the voltage and connection of the communication power supply. • Check the transmission speed of each device. • Check the resistance value (121 Ω) of the mounted terminator and its mounted status. • Check the transmission distance. • Check if there is no noise generating factor. • Replace the XFB01B board.

YASNAC XRC OPTIONS
INSTRUCTIONS

FOR JARCR-XFB01B BOARD

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