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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

The DX200 operator’s manuals above correspond to specific usage. Be sure to use the appropriate manual.

Part Number: 165627-1CD
Revision: 1
MANDATORY

• This manual explains the JARCR-XFB01B-2 board of the DX200 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX200.

• General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instruction 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.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200.

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

- **DANGER**: Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **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.

**NOTE**: To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION”.
**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 front door of the DX200 and programming pendant are pressed. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is 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.

*Figure 1: 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.

*Figure 2: Release of Emergency Stop*

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – 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 P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the DX200 power
  – Moving the manipulator with the programming pendant
  – Running the system in the check mode
  – Performing automatic operations

• Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.
WARNING

- 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.

- 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.
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 cabinet of the DX200 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 Warning Labels in the DX200 Instructions before operating the manipulator:
- 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.

- No shock to the board.

The shock may damage the board.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.
The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 Controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td>Character Keys Symbol Keys</td>
</tr>
<tr>
<td></td>
<td>Axis Keys Numeric Keys</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>Displays</td>
</tr>
<tr>
<td></td>
<td>Displays</td>
</tr>
</tbody>
</table>

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, or that the item is directly selected by touching the screen.
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   2.2 Board Specifications ...................................................................................................... 2-1
   2.3 Communication Specifications ............................................................................................ 2-2
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8 Connections for DeviceNet Communications
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9 Error Indication by LED Indicators
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       9.1.1 MS Lamp ....................................................................................... 9-1
       9.1.2 NS Lamp ....................................................................................... 9-2
This manual gives the instructions for using the NADEX timer I/F board, JARCR-XFB01B-2 (hereinafter called the XFB01B-2 board), for the DeviceNet on the DX200. The application of this board allows the transmission of DX200’s general-purpose I/O data with the timer for the DeviceNet manufactured by NADEX Co., Ltd. and parameter settings of the timer.

The XFB01B-2 board is not compatible with the standard board for the DeviceNet, the JARCR-XFB01B board.

1.1 System Configuration

* A cable for DeviceNet, terminators that are to be connected externally, and communications power supply are not included with the XFB01B-2 board.

When the XFB01B-2 board is connected at the end of a network, connect a terminator externally. Correctly connect the terminators, or communication may not be performed correctly.

1.1.1 Connection Example

The following diagram shows an example of the system configuration when the XFB01B-2 board is used as a master for the NADEX timer.

One XFB01B-2 board (master) can be connected to one NADEX timer (slave) only. The node address setting must be fixed to “0” for the master and “1” for the slave.

DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association, Inc.).
2 Hardware Specifications

2.1 Board External View

- CN1: 24 VDC power supply connector
- CN2: I/O communication connector
  - SW5: Not used
  - SW4: Station setting SW
- CN4: Serial No. writing connector
- CN3: Connector for DeviceNet
  - TM1: Terminating resistance setting terminal
- SW3: Not used
- SW2: Not used
- SW1: Mode/Baud rate setting SW
- CN4: Serial No. writing connector
- SW1: Mode/Baud rate setting SW
- LED1: DeviceNet status display LED

- TM4: 16 or 17-byte transmission switching terminal
- TM5: Not used

2.2 Board Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface to the</td>
<td>DeviceNet</td>
</tr>
<tr>
<td>external device</td>
<td></td>
</tr>
<tr>
<td>Board mounting position</td>
<td>Optional board mounting space in the DX200</td>
</tr>
<tr>
<td>Error indicator</td>
<td>LED display</td>
</tr>
<tr>
<td>Number of transmission</td>
<td>Maximum number of I/O points Input: 16 points</td>
</tr>
<tr>
<td>I/O points</td>
<td>Output: 16 points</td>
</tr>
</tbody>
</table>
2.3 Communication Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting form</td>
<td>Multi-drop, T-branch (1:N communication)</td>
</tr>
<tr>
<td>Transmission speed</td>
<td>Selectable among 500/250/125 kbps</td>
</tr>
<tr>
<td>Transmission media</td>
<td>Dedicated 5 cables (2 cables for signals, 2 cables for power supply, 1 drain wire)</td>
</tr>
<tr>
<td></td>
<td>Use a DeviceNet cable such as DCA1-5C10 (made by OMRON).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication distance</th>
<th>Transmission speed</th>
<th>Network max. distance</th>
<th>Branch line length</th>
<th>Total length of branch lines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500 kbps</td>
<td>100m and less</td>
<td>6m and less</td>
<td>39m and less</td>
</tr>
<tr>
<td></td>
<td>250 kbps</td>
<td>250m and less</td>
<td>6m and less</td>
<td>78m and less</td>
</tr>
<tr>
<td></td>
<td>125 kbps</td>
<td>500m and less</td>
<td>6m and less</td>
<td>156m and less</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power supply voltage for communication</th>
<th>24 V&lt;sub&gt;DC&lt;/sub&gt; (supplied through the connector CN3 for connecting DeviceNet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum current consumption for communications</td>
<td>0.05A</td>
</tr>
</tbody>
</table>

2.4 Connector

*Table 2-1: CN3 (Connector for DeviceNet)*

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal Name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (black)</td>
<td>V-</td>
<td>0&lt;sub&gt;24&lt;/sub&gt;V power supply line connecting terminal</td>
</tr>
<tr>
<td>2 (blue)</td>
<td>CAN_L</td>
<td>DeviceNet signal line connecting terminal</td>
</tr>
<tr>
<td>3 (bare wire)</td>
<td>Drain</td>
<td>Drain wire connecting terminal (shield)</td>
</tr>
<tr>
<td>4 (white)</td>
<td>CAN_H</td>
<td>DeviceNet signal line connecting terminal</td>
</tr>
<tr>
<td>5 (red)</td>
<td>V+</td>
<td>+24V power supply line connecting terminal</td>
</tr>
</tbody>
</table>

The color mentioned in ( ) indicates the color of the DeviceNet cable to be connected.
3 Setting the Functions

3.1 Function Setting Switches

The switches to set the functions of the XFB01B-2 board are explained. Make the proper settings following the instructions. For details of setting, refer to "section 3.2 “Setting Switches” on page 3-2."

**SW1:** Sets the DeviceNet operation mode and transmission baud rate.

- **SW1-1 (S/T)**
  - Always set to OFF (normal operation mode).
- **SW1-2 (S/M)**
  - Not used. (The DeviceNet operation mode is fixed to master.)
- **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

**SW2 and SW3:** Not used.

The node address setting is fixed to 0.

**SW4:** Sets the station number for the XFB01B-2 board on the DX200.

- The setting range of station number is 1 (ST#01) to D (ST#13).
- Do not set the station numbers 0 (ST#00), E (ST#14), and F (ST#15).

**SW5:** Not used.

The number of transmission I/O points is fixed to 16.
(There are eight other points for board status.)
### 3.2 Setting Switches

<table>
<thead>
<tr>
<th>Switches</th>
<th>Setting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SW1</strong></td>
<td><strong>Mode and baud rate setting</strong></td>
</tr>
<tr>
<td></td>
<td>Sets the baud rate and mode of DeviceNet. ( \square ) shows the default setting.</td>
</tr>
<tr>
<td>SW1-1: Operation mode (S/T)</td>
<td>ON: Test ( \square ) Always set to OFF (normal operation mode).</td>
</tr>
<tr>
<td>SW1-2: Not used.</td>
<td>ON: Invalid ( \square )</td>
</tr>
<tr>
<td>SW1-3: Baud rate setting (DR1)</td>
<td>OFF: 0 ( \square ) ON: 1</td>
</tr>
<tr>
<td>SW1-4: Baud rate setting (DR0)</td>
<td>OFF: 0 ( \square ) ON: 1</td>
</tr>
<tr>
<td>SW1-3  SW1-4</td>
<td>Baud Rate</td>
</tr>
<tr>
<td>0 0</td>
<td>: 125kbps</td>
</tr>
<tr>
<td>0 1</td>
<td>: 250kbps</td>
</tr>
<tr>
<td>1 0</td>
<td>: 500kbps</td>
</tr>
<tr>
<td>1 1</td>
<td>: Cannot be set.</td>
</tr>
<tr>
<td></td>
<td>Set the same value as for the other devices in the DeviceNet. Otherwise, DeviceNet communication cannot be established.</td>
</tr>
<tr>
<td><strong>SW2</strong></td>
<td>The settings for these switches are invalid. The node address setting is fixed to 0.</td>
</tr>
<tr>
<td><strong>SW3</strong></td>
<td>Not used</td>
</tr>
<tr>
<td><strong>SW4</strong></td>
<td>Station setting</td>
</tr>
<tr>
<td></td>
<td>Sets the station number. ( \square ) The following shows the relation between the switch setting and the station number. ( \square ) Turn the arrow to the number corresponding to the desired station. ( \square ) (Use a precision flat-tipped screwdriver.)</td>
</tr>
<tr>
<td>0</td>
<td>: Cannot be set. 8 : ST#08</td>
</tr>
<tr>
<td>1</td>
<td>: ST#01 9 : ST#09</td>
</tr>
<tr>
<td>2</td>
<td>: ST#02 A : ST#10</td>
</tr>
<tr>
<td>3</td>
<td>: ST#03 B : ST#11</td>
</tr>
<tr>
<td>4</td>
<td>: ST#04 (Default setting) C : ST#12</td>
</tr>
<tr>
<td>5</td>
<td>: ST#05 D : ST#13</td>
</tr>
<tr>
<td>6</td>
<td>: ST#06 E : Cannot be set.</td>
</tr>
<tr>
<td>7</td>
<td>: ST#07 F : Cannot be set.</td>
</tr>
<tr>
<td></td>
<td>The number after ST# is the station number displayed on the programming pendant of the DX200 when setting I/O modules.</td>
</tr>
<tr>
<td><strong>SW5</strong></td>
<td>This switch setting is invalid. The number of transmission I/O points is fixed to 16. Adding eight other points for the area for board status, total of 24 points is reserved inside the DX200.</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>When setting SW4 station, do not use “0”, “E”, or “F.” Be sure to set only one board to each station. Failure of this instruction may result in improper recognition of I/O module.</td>
</tr>
</tbody>
</table>
3.3 Function Setting Terminals

This section explains terminals used to set functions of the XFB01B-2 board and their roles. Following the instructions, be sure to set the terminals correctly.

TM1: This terminal is reserved for the manufacturer. TM 1 sets the resistance status (121 Ω).

Always set to "Without resistance."

Never set to "with resistance". "With resistance" is only for maintenance purposes.

TM4: Sets the transmission mode to 16-byte or 17-byte.

Always set to 17-byte.

Never set to 16-byte.

TM5: Not used.

The setting for this terminal is invalid.
## 3.4 Setting Terminals

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Setting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM1</td>
<td>Reserved for the manufacturer&lt;br&gt;Short-circuit between 1 and 2: With resistance&lt;br&gt;  * Setting unavailable&lt;br&gt;Short-circuit between 2 and 3: Without resistance (Default setting)&lt;br&gt;  * Setting indispensable&lt;br&gt;<strong>Always set to “Without resistance.”</strong>&lt;br&gt;Never set to “With resistance,” because this is used only for maintenance. When a terminator is required, install junction tap or a terminator externally, and do not use this resistance.</td>
</tr>
<tr>
<td>TM4</td>
<td>Transmission mode setting&lt;br&gt;Short-circuit between 1 and 2: 17-byte transmission&lt;br&gt;  * Setting indispensable&lt;br&gt;Short-circuit between 2 and 3: 16-byte transmission (default setting)&lt;br&gt;  * Setting unavailable&lt;br&gt;<strong>Always set to “17-byte transmission”</strong>&lt;br&gt;Remember to change the set mode to 17-byte transmission as the mode is set to 16-byte at the factory before shipping.</td>
</tr>
<tr>
<td>TM5</td>
<td>Not used&lt;br&gt;Short-circuit between 1 and 2 (XFB01): Invalid&lt;br&gt;Short-circuit between 2 and 3 (XFB01B): Invalid&lt;br&gt;The setting for this terminal is invalid.</td>
</tr>
</tbody>
</table>
3.5 Comparison with JARCR-XFB01B Board

The following table compares switches (SWs) and terminals (TMs) between the DeviceNet XFB01B board for the DX200 and the XFB01B-2 board.

<table>
<thead>
<tr>
<th>Setting</th>
<th>JARCR-XFB01B-2</th>
<th>JARCR-XFB01B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission baud rate</td>
<td>SW1</td>
<td>SW1</td>
</tr>
<tr>
<td>Slave/Master switching</td>
<td>None (Fixed to master.)</td>
<td>SW1</td>
</tr>
<tr>
<td>Operation mode</td>
<td>SW1</td>
<td>SW1</td>
</tr>
<tr>
<td>Node address</td>
<td>None (Fixed to 0.)</td>
<td>SW2 and SW3</td>
</tr>
<tr>
<td>Station</td>
<td>SW4</td>
<td>SW4</td>
</tr>
<tr>
<td>Number of transmission I/O points</td>
<td>None (Fixed to 16.)</td>
<td>SW5</td>
</tr>
<tr>
<td>Resistance</td>
<td>TM1</td>
<td>TM1</td>
</tr>
<tr>
<td>Transmission mode (16-byte or 17-byte)</td>
<td>TM4</td>
<td>TM4</td>
</tr>
<tr>
<td>Board setting (XFB01 or XFB01B)</td>
<td>None</td>
<td>TM5</td>
</tr>
</tbody>
</table>
4 Mounting the XFB01B-2 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.
• 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.

CAUTION

• 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.
• No shock to the board. The shock may damage the board.
4.1 Opening the Front Door of the DX200

Mount the XFB01B-2 board in the following manner.

1. Turn the two door locks on the front face of the DX200 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 “OFF” position, and slowly open the door.

4.2 Confirming the Switch Settings on the XFB01B-2 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-2 Board on the DX200

1. Fix the XFB01B-2 board on the DX200 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 to the non-occupied CN2 on the XFB01B-2 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.)
A dummy connector is inserted into the CN1 of the 24 VDC power supply connector on the XFB01B-2 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.

**NOTE**

* Keep the dummy connector inserted to this position.
(Do not remove.)

**24 VDC Power Cable Connection Position**

- CN1 (Correct Position)
- CN1 (Incorrect Position)

(*Removing the dummy connector leads to incorrect connection of the power cable. This results in insufficient 24 VDC power supply to the board.)*

### 4.5 Closing the Front Door of the DX200

1. Close the door gently.
2. Turn the two door locks on the front face of the DX200 clockwise for 90° with a coin or a flat tip screwdriver.
5 Allocating I/O Signals

5.1 I/O Module Setting

In order to use the XFB01B-2 board on the DX200, the I/O module should be set in the following manner.

Make sure that the power supply to the DX200 is OFF. Then, mount the XFB01B-2 board, for which all of its switches have been set, inside the DX200. For the board mounting method, refer to chapter 4 "Mounting the XFB01B-2 Board".

1. Turn the power supply ON again while pressing [MAIN MENU] simultaneously.
   – The main menu appears.

2. Set the security mode to management mode.

3. Select {SYSTEM} under the main menu.
   – The sub menu appears.

Add an I/O module in the management mode.
In the operation mode and the editing mode, the settings are for reference only.
4. Select {SETUP}.
   - The SETUP window appears.

5. Select {IO MODULE}.
   - The current status of the mounted I/O modules is shown as in the following.
   - Press [ENTER] to display the module mounted status for the rest of the stations.
6. Confirm the status of the mounted I/O module.
   – Only mounted I/O module is displayed. Confirm that each station (ST#) is the same as the I/O module’s actual mounting status.
   – The following information is shown for each station.

<table>
<thead>
<tr>
<th>ST#</th>
<th>Station address of I/O module</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI</td>
<td>Number of digital input points¹</td>
</tr>
<tr>
<td>DO</td>
<td>Number of digital output points¹</td>
</tr>
<tr>
<td>AI</td>
<td>Number of analog input points¹</td>
</tr>
<tr>
<td>AO</td>
<td>Number of analog output points¹</td>
</tr>
<tr>
<td>BOARD</td>
<td>Circuit board type²</td>
</tr>
</tbody>
</table>

¹ A hyphen “-” indicates the corresponding I/O module is not mounted.
² If the system cannot recognize the circuit board type, “*****” is shown. No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.

– The followings are the configurations of boards as examples shown in the above window in the Explanation 5.

   ST#00: JANCD-YIO21-E board
   This board is shown as YSF21 on the IO module display.
   (digital input 40 points, digital output 40 points)
   This board is fixed to ST#00.

   ST#04: JARCR-XFB01B-2 board
   (digital input 24 points, digital output 24 points)
   Switch SW4: Set to 4. (This value becomes the ST#.)

The following should be taken into consideration when reading the display.

For the XFB01B-2 board, as the number of I/O points reserved for the board status exists other than the number of transmission I/O points for the DeviceNet, the number of I/O points shown on the display is “24” which is calculated by “16 (I/O points for the DeviceNet) + 8 (for the board status).”

7. Press [ENTER].
   – The confirmation dialog box appears.
5 Allocating I/O Signals
5.1 I/O Module Setting

8. Select “YES.”

– Press “YES” if the display corresponds to the current mounted status of the I/O modules. The I/O module setting is updated, and the I/O MODULE window changes to the EXTERNAL I/O SETUP window.

If the display does not indicate the actual mounted status, recheck the cable connection and the switch setting. The following causes are suspected.

• Improper setting of I/O communications
  Setting of TM4 on the XFB01B-2 board may be improper. XFB01B-2 board would not be recognized properly if this condition is applied.

• Improper or overlapped station settings
  SW4 might be set to 0, E, or F (impossible setting value). Additionally, only one optional board can be set for each station. Change the SW4 setting, and make sure that no stations overlap.

• 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. Incorrect connection of the 24VDC power cable to the position of CN1 may lead to improper power supply to the board. Recheck the cable connection referring to the chapter 4 “Mounting the XFB01B-2 Board”.

• I/O module failure
  When the above causes do not apply, and the display still does not correspond to the actual mounted status, failure of an I/O module is suspected. Contact your YASKAWA representative.
5-5

5 Allocating I/O Signals
5.1 I/O Module Setting

9. The EXTERNAL IO SETUP window appears.

10. Select {AUTO} or {MANUAL} in the ALLOCATION MODE.
   – The selection menu appears after selecting {AUTO} or {MANUAL}.

   ![EXTERNAL IO SETUP Window]

   **NOTE**
   If the allocation mode is changed from {MANUAL} to {AUTO}, the set allocation data is discarded. The data will be allocated by AUTO MODE again. Save the set allocation data to the external devices in advance, if needed.
11. Select the allocation mode to set up.
   - Select {AUTO} to allocate I/O signal allocation automatically.
     Select {MANUAL} to allocate I/O signal allocation manually.
   - The selected allocation mode is set up.

12. Select {DETAIL} of {EXTERNAL IO ALLOCATION}.
   - When select {AUTO}, the following procedures No.13 to 15 are not necessary. Operate the procedure from No.16.
   - When select {MANUAL}, operate the following procedures No.13 to 15 accordant with the setting manually.
5 Allocating I/O Signals

5.1 I/O Module Setting

13. Select the external I/O signal number (at the change source) to be changed. (In the setting example, select “#20060”.)

– The select menu appears.

14. Select {MODIFY], and input the external input signal number (at the change destination) to be changed. (In the setting example, enter “#20190”.)

– The external input signal number is changed.

15. Likewise, select/modify the number of the external input signal.

– Repeat select/modify until it becomes the desired allocation to set up.
5 Allocating I/O Signals

5.1 I/O Module Setting

16. Press {ENTER}.

   - The allocation window of the external output signal appears.

17. Select/modify the number of the external output signal same as the external input signal.

   - Repeat select/modify until it becomes the desired allocation to set up.

18. Press {ENTER}.

   - Confirmation dialog appears.

19. Select {YES}.

   - The settings are confirmed, and returns to the SETUP window.
5.2 Transmission Data

The data to be transferred from the XFB01B-2 board to the inside of the DX200 is not only the I/O data from the external devices connected to the DeviceNet, but also the status of the XFB01B-2 board.

Therefore, inside the DX200, 8 points (1 byte) each for input and output are reserved for the status of the XFB01B-2 board beside the area for the digital data. However, the output area cannot be used.

The transmission data from the XFB01B-2 board are allocated to the external I/O signals of concurrent I/O.

When only an XFB01B-2 board (Input: 16 points, Output: 16 points) is mounted as an optional I/O board, the concurrent I/O allocation of each board is as follows.

(20010 to 20057 are used for standard I/O of the DX200.)

For details on the contents of I/O data (Input: 16 points, Output: 16 points), refer to the instruction manual of the timer.
### 5.2.1 DX200 I/O Allocation Example (For Handling)

Note 1) The following example is for the standard setting. When change the allocation of the external output signal or the concurrent ladder program, the allocation changes in accordance with the changes.

Note 2) As for the input data/output data of JANCD-YIO21-E (standard I/O board), refer to DX200 INSTRUCTIONS MANUAL for more details.

Note 3) JANCD-YIO21-E (standard I/O board) is displayed as YSF21 (base board of YIO21) in the IO module setup display.

<table>
<thead>
<tr>
<th>JANCD-YIO21-E I/O Input</th>
<th>External input signal</th>
<th>User input signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Standard I/O)</td>
<td>20010 to 20017</td>
<td>None (allocated on the system)</td>
<td>Input data (1)</td>
</tr>
<tr>
<td></td>
<td>20010 to 20027</td>
<td>None (allocated on the system)</td>
<td>Input data (2)</td>
</tr>
<tr>
<td></td>
<td>20010 to 20037</td>
<td>00010 to 00017 (IN0001 to IN0008)</td>
<td>Input data (3)</td>
</tr>
<tr>
<td></td>
<td>20040 to 20047</td>
<td>00020 to 00027 (IN0009 to IN0016)</td>
<td>Input data (4)</td>
</tr>
<tr>
<td></td>
<td>20050 to 20057</td>
<td>None (allocated on the system)</td>
<td>Input data (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JANCD-YIO21-E I/O Output</th>
<th>External output signal</th>
<th>User output signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Standard I/O)</td>
<td>30010 to 30017</td>
<td>None (allocated on the system)</td>
<td>Output data (1)</td>
</tr>
<tr>
<td></td>
<td>30020 to 30027</td>
<td>None (allocated on the system)</td>
<td>Output data (2)</td>
</tr>
<tr>
<td></td>
<td>30030 to 30037</td>
<td>00010 to 00017 (OT0001 to OT0008)</td>
<td>Output data (3)</td>
</tr>
<tr>
<td></td>
<td>30040 to 30047</td>
<td>00020 to 00027 (OT0009 to OT0016)</td>
<td>Output data (4)</td>
</tr>
<tr>
<td></td>
<td>30050 to 30057</td>
<td>None (allocated on the system)</td>
<td>Output data (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JARCR-XFB01B I/O Input</th>
<th>External input signal</th>
<th>User input signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DeviceNet)</td>
<td>20060 to 20067</td>
<td>00030 to 00037 (IN0017 to IN0024)</td>
<td>Board status 1)</td>
</tr>
<tr>
<td></td>
<td>20070 to 20077</td>
<td>00040 to 00047 (IN0025 to IN0032)</td>
<td>Input data (1)</td>
</tr>
<tr>
<td></td>
<td>20080 to 20087</td>
<td>00050 to 00057 (IN0033 to IN0040)</td>
<td>Input data (2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JARCR-XFB01B I/O Output</th>
<th>External output signal</th>
<th>User output signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DeviceNet)</td>
<td>30060 to 30067</td>
<td>10030 to 10037 (OT0017 to OT0024)</td>
<td>Board status 1)</td>
</tr>
<tr>
<td></td>
<td>30070 to 30077</td>
<td>10040 to 10047 (OT0025 to OT0032)</td>
<td>Output data (1)</td>
</tr>
<tr>
<td></td>
<td>30080 to 30087</td>
<td>10050 to 10057 (OT0033 to OT0040)</td>
<td>Output data (2)</td>
</tr>
</tbody>
</table>

1) Board status and system reservation cannot be allocated as I/O signal. Also, this data is not able to transmit by DeviceNet. (Unable to communicate with the main PLC.)
### 5.2.2 DX200 I/O Allocation Example (For Except Handling)

Note 1) The following example is for the standard setting. When change the allocation of the external output signal or the concurrent ladder program, the allocation changes in accordance with the changes.

Note 2) As for the input data/output data of JANCD-YIO21-E (standard I/O board), refer to DX200 INSTRUCTIONS MANUAL for more details.

Note 3) JANCD-YIO21-E (standard I/O board) is displayed as YSF21(base board of YIO21) in the IO module setup display.

<table>
<thead>
<tr>
<th>JANCD-YIO21-E</th>
<th>I/O Input</th>
<th>External input signal</th>
<th>User input signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Standard I/O)</td>
<td></td>
<td>20010 to 20017</td>
<td>None (allocated on the system)</td>
<td>Input data (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20020 to 20027</td>
<td>None (allocated on the system)</td>
<td>Input data (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20030 to 20037</td>
<td>00010 to 00017 (IN0001 to IN0008)</td>
<td>Input data (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20040 to 20047</td>
<td>00020 to 00027 (IN0009 to IN0016)</td>
<td>Input data (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20050 to 20057</td>
<td>00030 to 00037 (IN0017 to IN0024)</td>
<td>Input data (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JANCD-YIO21-E</th>
<th>I/O Output</th>
<th>External output signal</th>
<th>User output signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Standard I/O)</td>
<td></td>
<td>30010 to 30017</td>
<td>None (allocated on the system)</td>
<td>Output data (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30020 to 30027</td>
<td>None (allocated on the system)</td>
<td>Output data (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30030 to 30037</td>
<td>00010 to 00017 (OT0001 to OT0008)</td>
<td>Output data (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30040 to 30047</td>
<td>00020 to 00027 (OT0009 to OT0016)</td>
<td>Output data (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30050 to 30057</td>
<td>10030 to 10037 (OT0017 to OT0024)</td>
<td>Output data (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JARCR-XFB01B</th>
<th>I/O Input</th>
<th>External input signal</th>
<th>User input signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DeviceNet)</td>
<td></td>
<td>20060 to 20067</td>
<td>00040 to 00047 (IN0025 to IN0032)</td>
<td>Board status 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20070 to 20077</td>
<td>00050 to 00057 (IN0033 to IN0040)</td>
<td>Input data (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20080 to 20087</td>
<td>00060 to 00067 (IN0041 to IN0048)</td>
<td>Input data (2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JARCR-XFB01B</th>
<th>I/O Output</th>
<th>External output signal</th>
<th>User output signal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DeviceNet)</td>
<td></td>
<td>30060 to 30067</td>
<td>10040 to 10047 (OT0025 to OT0032)</td>
<td>Board status 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30070 to 30077</td>
<td>10050 to 10057 (OT0033 to OT0040)</td>
<td>Output data (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30080 to 30087</td>
<td>10060 to 10067 (OT0041 to OT0048)</td>
<td>Output data (2)</td>
</tr>
</tbody>
</table>

1 Board status and system reservation cannot be allocated as IO signal. Also, this data is not able to transmit by DeviceNet. (Unable to communicate with the main PLC.)

<table>
<thead>
<tr>
<th>Signal</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2xxx0 to 2xxx2</td>
<td>Watchdog counter. This bit repeats counting the value between 0 to 7. (approximately every 32 ms.)</td>
</tr>
<tr>
<td>2xxx3</td>
<td>Not used. Always set to 0.</td>
</tr>
<tr>
<td>2xxx4</td>
<td>Not used. Always set to 1.</td>
</tr>
<tr>
<td>2xxx5</td>
<td>Indicates if communicating with all the slaves (NADEX timers) or not through DeviceNet. Communicating with the slave: 0, Not communicating with the slave: 1</td>
</tr>
<tr>
<td>2xxx6</td>
<td>Indicates the DeviceNet communication status. (Even if communicating with some nodes, the normal status is indicated.) Normal: 0 Error: 1</td>
</tr>
<tr>
<td>2xxx7</td>
<td>Indicates the operation status of the XFB01B-2 board. Normal: 0 Error: 1</td>
</tr>
</tbody>
</table>
5.2.3 The Alarm when Communications Error Occurs Using the Board Status

When the optional board detects the communication error, by using the CIO ladder or the user alarm allows to occur the alarm.

The examples of the method are described in below.

There are three alarms of the occurrence alarms.

- IO Board operation error
- IO Communication error
- IO Communication error (SLAVE)

As for the user alarm registration, refer to section 13.7 “I/O Messages and I/O Alarms” in the "DX200 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O" (165294-1CD) for more details.

<table>
<thead>
<tr>
<th>[Alarm No.]</th>
<th>Alarm name</th>
<th>Signal No.</th>
<th>Description of the alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>[9065]</td>
<td>IO BOARD OPERATION ERROR</td>
<td>20067 (Board status signal: 2xxx7)</td>
<td>The operation status of the board is abnormal.</td>
</tr>
<tr>
<td>[9066]</td>
<td>IO COMMUNICATION ERROR</td>
<td>20066 (Board status signal: 2xxx6)</td>
<td>The communication status is abnormal.</td>
</tr>
<tr>
<td>[9067]</td>
<td>IO COMMUNICATION ERROR (SLAVE)</td>
<td>20065 (Board status signal: 2xxx5)</td>
<td>There is an unused slave.</td>
</tr>
</tbody>
</table>

When the optional board detects and alerts the error by the board status signal, the ladder program, which raises an alarm, is created according to the error signal.

The procedures to register the alarms above as the user alarm and the ladder program, which alert an alarm, are described below.
5 Allocating I/O Signals
5.2 Transmission Data

- **Register the User Alarm**
  1. Change the security mode to the “Management Mode”.
  2. Select the (I/O ALARM) from the (IN/OUT) in the main menu.
  3. The I/O alarm (system) window appears.

    ![I/O alarm (system) window](image)

    4. Press the [PAGE] key.
      - I/O alarm (user) window appears.

    ![I/O alarm (user) window](image)

    5. Move the cursor over the desired No. to register, and press [SELECT].
      - The window changes to the character string entry window.

    ![Character string entry window](image)
6. Enter the I/O alarm name.

7. Press [ENTER].
   – The entered alarm is registered.

8. Register the other alarms.
   – Repeat the same procedures to register the alarm to use.
5 Allocating I/O Signals
5.2 Transmission Data

### IO Allocation and the Ladder Program
Create the ladder program to alert the alarm by using the following signals when the optional board detects an error.

**External input**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20065</td>
<td>Optional board status (existence of the non-communication slave)</td>
</tr>
<tr>
<td>20066</td>
<td>Optional board status (IO communication status)</td>
</tr>
<tr>
<td>20067</td>
<td>Optional board status (Board operation status)</td>
</tr>
</tbody>
</table>

**System input signal**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40012</td>
<td>User part alarm requirement</td>
</tr>
<tr>
<td>40220</td>
<td>User part alarm code d0</td>
</tr>
<tr>
<td>40221</td>
<td>User part alarm code d1</td>
</tr>
<tr>
<td>40222</td>
<td>User part alarm code d2</td>
</tr>
<tr>
<td>40223</td>
<td>User part alarm code d3</td>
</tr>
<tr>
<td>40224</td>
<td>User part alarm code d4</td>
</tr>
<tr>
<td>40225</td>
<td>User part alarm code d5</td>
</tr>
</tbody>
</table>

**Assistant relay**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70017</td>
<td>Turned ON the control power supply (continuously ON)</td>
</tr>
</tbody>
</table>
The ladder program (the figure of the ladder)

Creating the following ladder allows to alert the alarm according to the status error signals of the optional board.
6 Timer Setting using the DX200

6.1 Settings for Connecting the Timer

When the timer is connected to the XFB01B-2 board for the first time, the timer information data must be uploaded to the internal memory of the DX200. This section describes how to upload the timer information.

Once it is uploaded, the uploading is not necessary when the power of the DX200 is turned ON.

When connecting a welding timer, set the timer node address to 1.

1. Turn ON the power to the welding timer and then the DX200.
2. Set the security mode to management mode.
3. Select {SETUP} under the main menu.
4. Select {WELD TIMER SETUP}.
   - The WELD TIMER SETUP display appears.
5. Select “DATA from TIMER” and press [ENTER].
   - The confirmation dialog box appears.
6. Select “YES.”

– The timer information starts to be uploaded to the DX200 and the current execution status appears. It takes a few minutes to complete the execution.

7. Wait until the state changes to “SELECTING.”

– When the status returns to “SELECTING,” the uploading to the DX200 has been completed. After the completion of the uploading, other items will appear on the display, however, they are usually not used.

1. **DATA from TIMER:**
   Uploads all the information data of the timer to the internal memory of the DX200.
   Execute this uploading for the first time when the timer is connected to the DX200.

2. **DATA to TIMER:**
   Usually not used.
   After initializing the timer, downloads the internal data of the DX200 to the timer.
6.2 Operation for the Timer Data

For the timer connected to the XFB01B-2 board, the data can be set and called up using the programming pendant of the DX200. The following describes the operation procedure.

Make the timer settings in the management mode.
In the operation mode and the editing mode, the settings are for reference only.

1. Select {NADEX} under the main menu.
   – The sub menu display related to the timer data settings appears. (Other settings are also displayed.)

2. Select the sub menu of desired timer data setting.
   (In this example, {COMMON PROGRAM} is selected.)
   – The setting display for the timer data appears. (The following display is an example.)

For details on the items of the timer data, refer to the instruction manual of the timer.

3. Enter the desired number and press [ENTER].
6.3 Management of the Timer Data

The settings that were made for the XFB01B-2 board and the connected timer using the DX200 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 “External Memory Devices” of the “DX200 Operator’s Manual.”

**NOTE**

Make sure that the timer information has been uploaded as described in section 6.1 “Settings for Connecting the Timer” on page 6-1 before saving or loading the timer data.

6.3.1 Saving to External Memory

1. Select (EX. MEMORY) under the main menu.
2. Select (SAVE).
   - The EXTERNAL MEMORY DEVICE display appears.
3. Select “FILE/GENERAL DATA.”
   - A list for selecting files appears.
6. Timer Setting using the DX200

6.3 Management of the Timer Data

4. Select "WELDER TIMER CONDITION."
   - The selected file is marked with “★.”

5. Press [ENTER].
   - The confirmation dialog box appears.

6. Select “YES.”
   - 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.
6.3.2 Loading from External Memory

1. Set the mode to management mode.
2. Select (EX. MEMORY) under the main menu.
3. Select (LOAD)
   - The EXTERNAL MEMORY DEVICE display appears.
4. Select “FILE/GENERAL DATA.”
   - A list for selecting files appears.
5. Select “WELDER TIMER CONDITION.”
   - The selected file is marked with “★.”
6. Press [ENTER].

   – The confirmation dialog box appears.

   ![Confirmation Dialog Box]

7. Select “YES.”

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

   ![Loading Progress]

   – When the file is successfully loaded, the list for selecting files reappears.

6.4 Others

6.4.1 Errors and Alarms

   When an error occurs at the timer, the error information is sent to the DX200 by I/O signals. The error information appears on the programming pendant as “Alarm 93□□.” The “□□” indicates the error code of the timer, which is from 01 to 99. For details on the error codes and the contents, refer to the timer’s instruction manual.

   When the alarm number is 9300, the DeviceNet communications may not be established. Check the wirings and settings for DeviceNet.

6.4.2 Parameters

   The command-response waiting time for the timer can be set in units of 10 ms with the parameter S3C1215. Normally, this parameter need not be changed.

   (The initial value is set to 0. However, “0,” in this case, means 1 s of command-response waiting time.)
7 Network Specifications

7.1 Network Configuration

7.1.1 Network Connections

7.1.1.1 Connection Form

The following diagram shows the network connections. When using the XFB01B-2 board, note that one XFB01B-2 board (master) can be connected to one NADEX timer (slave) only.

Fig. 7-1: Network Connections
7.1.1.2 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.

1. The communications cable must be a DeviceNet cable.
2. Both ends of the trunk line must connect to a terminator.
   The Resistance Value is 121Ω.
   The Allowable Difference of Resistance Value is ±1%.
   The Rating Power is 1/4W.
   The Type is Metal Film Resistor.
3. Only DeviceNet devices can be connected to the network. Do not connect any other devices, such as a lightning arrester.
7.1.3 Branching from the Trunk Line

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

Fig. 7-2: Branching from the Trunk Line

1. Single Branching
2. Branching to Three Drop Lines
3. Direct Node Connection

Fig. 7-3: Branching from Drop Lines

1. Single Branching
2. Branching to Three Drop Lines
3. Direct Node Connection
7.1.2 Precautions for Wiring DeviceNet Cables

7.1.2.1 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 considerably big.

The maximum network length is determined by the type of cable, as shown in the following table.

<table>
<thead>
<tr>
<th>Baud Rate (kbps)</th>
<th>Maximum Network Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thick Cable</td>
</tr>
<tr>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>125</td>
<td>500</td>
</tr>
</tbody>
</table>
7.1.2.2 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.

---

The line connecting two nodes located farthest from each other can use both thick and thin cables together. Compared to the case of only a thick cable, the maximum network length is short. In this case, the length of each cable needs to fulfill the conditions in the following table.

<table>
<thead>
<tr>
<th>Baud Rate (kbps)</th>
<th>Maximum Network Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>$L_{thick} + L_{thin} \leq 100$</td>
</tr>
<tr>
<td>250</td>
<td>$L_{thick} + 2.5 \times L_{thin} \leq 250$</td>
</tr>
<tr>
<td>125</td>
<td>$L_{thick} + 5.0 \times L_{thin} \leq 500$</td>
</tr>
</tbody>
</table>

$L_{thick}$: thick cable length, $L_{thin}$: thin cable length
7.1.2.3  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.

<table>
<thead>
<tr>
<th>Baud Rate (kbps)</th>
<th>Total Drop Line Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>39 max.</td>
</tr>
<tr>
<td>250</td>
<td>78 max.</td>
</tr>
<tr>
<td>125</td>
<td>156 max.</td>
</tr>
</tbody>
</table>

Fig. 7-4: Configuration example (for 500 kbps transmission speed)

The above example must satisfy the following conditions.

\[
a \leq 6 \text{ m}, \ b \leq 6 \text{ m}, \ c \leq 6 \text{ m}, \ d \leq 6 \text{ m}, \ d + f \leq 6 \text{ m}, \\
d + e + g \leq 6 \text{ m}, \ d + e + h \leq 6 \text{ m}
\]

The total drop line length must satisfy the following condition.

Total drop line length = \(a + b + c + d + e + f + g + h \leq 39 \text{ m}\)
8 Connections for DeviceNet Communications

8.1 Location of Communication Power Supply

8.1.1 Basic Precautions

1. The communications power supply to the network must be 24 V\text{DC}.
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 8A and a thin cable is 3A.
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.
   \[ I = \frac{4.57}{L} \]
   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.
8.1.2 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.
8.1.3 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.
   1. Simplified calculation with the estimated values from the graph
   2. 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 dropline’s power supply capacity described in 6 of section 8.1.1 “Basic Precautions” on page 8-1.

   • 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.

   ![Diagram of DeviceNet Communications]

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.
3. Simplified Calculation with the Estimated Values from the Graph

The voltage of the communications power supply to each node must be 11 V\(_{\text{DC}}\) 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

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>0</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. current (A)</td>
<td>8.00</td>
<td>8.00</td>
<td>5.42</td>
<td>2.93</td>
<td>2.01</td>
<td>1.53</td>
<td>1.23</td>
<td>1.03</td>
<td>0.89</td>
<td>0.78</td>
<td>0.69</td>
<td>0.63</td>
</tr>
</tbody>
</table>

b) For a thin cable

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. current (A)</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>2.06</td>
<td>1.57</td>
<td>1.26</td>
<td>1.06</td>
<td>0.91</td>
<td>0.80</td>
<td>0.71</td>
<td>0.64</td>
</tr>
</tbody>
</table>
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.

I) Calculate the total current consumption, “A,” of all the nodes located for each side.

II) 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.

III) If $A \leq B$:
the total current consumption “A” calculated in step I) is equal to or less than the allowable maximum current “B” obtained in step II), and the power supply capacity is sufficient for all the nodes.

IV) When the nodes are located on both sides of the power supply, repeat steps I) to III) for the nodes on the other side.

Corrective actions

If $A > B$,
the total current consumption “A” calculated in step I) is more than the maximum current “B” obtained in step II), 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 210m is used and the power supply is connected at the end of the trunk line.

Total length of the power supply cable = 210m

Total current consumption of the nodes =
0.2A + 0.1A + 0.05A + 0.2A + 0.15A
= 0.7A

Max. current obtained from the graph = 1.5A

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 240m 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 = 120 m
Total length of the 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 =
0.2A + 0.3A + 0.1A = 0.6A
Total current consumption of the nodes on the right of the power supply =
0.25A + 0.15A + 0.1A = 0.5A

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

As A (total current consumption on the left) < B (maximum current on the left) and A (total current consumption on the right) < B (maximum current on the right), sufficient power can be supplied to all nodes.
4. 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.

(1) Equation

I) 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, 8A for a thick cable and 3A for a thin cable.

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

Ln : Distance between the power supply and a node (excluding the length of the drop line)
Rc : Maximum resistance of the cable (0.015 \( \Omega \)/m for a thick cable, 0.069 \( \Omega \)/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 \( \Omega \) : Contact resistance value of an adapter
8 Connections for DeviceNet Communications
8.1 Location of Communication Power Supply

II) 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: 11V<sub>DC</sub> to 25V<sub>DC</sub>
- Allowable voltage range for the internal circuit power supply: 24V<sub>DC</sub> - 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, 8A for a thick cable and 3A for a thin cable.

**Equation** \[ \sum [(L\times R_c + N_t \times 0.005) \times I_n] \leq 0.65V \]

- \( L_n \) : Distance between the power supply and a node (excluding the length of the drop line)
- \( R_c \) : Maximum resistance of the cable (0.015 \( \Omega \)/m for a thick cable, 0.069 \( \Omega \)/m for a thin cable)
- \( N_t \) : Number of adapters between the power supply and a node
- \( I_n \) : Current consumption required for the communications unit and the internal circuit of a node

0.005 \( \Omega \) = Contact resistance value of an adapter

(2) 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.
8.2 Grounding

8.2.1 Grounding Method

1. The DeviceNet cable system must be grounded at only one location in the network in order to avoid a ground loop. Ground the DeviceNet cable system closest to the center of the network. As shown below, connect the drain wire of the communication cable to the FG terminal of the communication power supply and ground the power supply connected to the drain wire to a resistance of 100Ω or less.

2. If more than one power supply is used, connect the drain wire of the cable only to the power supply closest to the center of the network. Ground the power supply to a resistance of 100Ω or less. Do not connect the drain wire to the other power supplies other than that. For connecting multiple power supplies to the network, use a power supply tap for each power supply. (Power supplies are not counted as nodes.)

- Grounding resistance must be 100Ω or less.
- Grounding location must be reserved only for the DeviceNet cable system. The same location cannot be used for grounding of servo drivers or grounding of inverters.
- Ground the drain wire at only one place. Do not ground the drain wire at several locations in the network.
9 Error Indication by LED Indicators

9.1 LED Indicators

On the XFB01B-2 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.

9.1.1 MS Lamp

The MS LED indicates the status of the XFB01B-2 board.

<table>
<thead>
<tr>
<th>LED Status</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS unlit</td>
<td>Power loss</td>
<td>• Check the connection of the power supply to CN1 of XFB01B-2 board.</td>
</tr>
<tr>
<td>MS lit in green</td>
<td>Module in normal state</td>
<td>The Module operates normally.</td>
</tr>
<tr>
<td>MS blinks in green</td>
<td>Communication error with the DX200</td>
<td>• Check the connection of the I/O communication cable to CN2 on the XFB01B-2 board.</td>
</tr>
<tr>
<td></td>
<td>(In waiting status)</td>
<td></td>
</tr>
<tr>
<td>MS blinks in red</td>
<td>Communication error with the DX200</td>
<td>• Check the connection of the I/O communication cable to CN2 on the XFB01B-2 board.</td>
</tr>
<tr>
<td></td>
<td>(cyclically)</td>
<td></td>
</tr>
<tr>
<td>MS blinks in red</td>
<td>Communication error with the DX200</td>
<td>Incorrect settings of the switches on the XFB01B-2 board.</td>
</tr>
<tr>
<td></td>
<td>(twice)</td>
<td>• Check the settings of the switches on the front of the XFB01B-2 board.</td>
</tr>
<tr>
<td>MS lit in red</td>
<td>Error in module</td>
<td>ROM/RAM check error or watchdog time-out error occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Turn the DX200 main power supply from OFF to ON.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace the XFB01B-2 board.</td>
</tr>
</tbody>
</table>
### 9.1.2 NS Lamp

The NS LED indicates the status of DeviceNet.

<table>
<thead>
<tr>
<th>LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
</table>
| NS unlit | In offline status | XFB01B-2 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-2 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. |
| NS blinks in red | Time-out error | A time-out error occurs between the DX200 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. |
### Error Indication by LED Indicators

#### 9.1 LED Indicators

<table>
<thead>
<tr>
<th>LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
</table>
| 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 (121Ω) of the mounted terminator and its mounted status.   
• Check the transmission distance.   
• Check if there is no noise generating factor.   
• Replace the XFB01B-2 board. |
DX200 OPTIONS
JARCR-XFB01B-2 BOARD INSTRUCTIONS

NADEX TIMER I/F BOARD FOR DeviceNet

Specifications are subject to change without notice
for ongoing product modifications and improvements.