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

MOTOMAN INSTRUCTIONS
MOTOMAN-□□□ INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator’s manuals above correspond to specific usage. Be sure to use the appropriate manual.

Part Number: 157795-1CD
Revision: 0
MANDATORY

• This manual explains the JARCR-XFB01B board of the DX100 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX100.

• General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100.

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.

**NOTE** To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING.”
• 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 DX100 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.

Fig. : 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.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator
  – 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 DX100 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 DX100 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.
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 DX100 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 DX100 Instructions 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.

- 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>DX100 Controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>JARCR-XFB01B board</td>
<td>XFB01B board</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</td>
</tr>
</tbody>
</table>
|                          | 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 key       |
|                          | The cursor key is an exception, and a picture is not shown. |
|                          | Axis Keys          |
|                          | "Axis Keys" and "Numeric Keys" are generic names for the keys for axis operation and number input. |
|                          | Numeric Keys       |
|                          | 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}          |

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.
1 Outline ................................................................................................................................. 1-1
  1.1 System Configuration ........................................................................................................ 1-1
    1.1.1 XFB01B Board in Slave Mode .................................................................................. 1-1
    1.1.2 XFB01B Board in Master Mode .................................................................................. 1-2

2 Hardware Specifications ........................................................................................................ 2-1
  2.1 Board External View ......................................................................................................... 2-1
  2.2 Board Specifications ......................................................................................................... 2-1
  2.3 Communication Specifications ....................................................................................... 2-2
  2.4 Connector ....................................................................................................................... 2-2

3 Setting Functions .................................................................................................................. 3-1
  3.1 Function Setting Switches ................................................................................................ 3-1
  3.2 Setting Switches ............................................................................................................... 3-2
  3.3 Function Setting Terminals ............................................................................................ 3-4
  3.4 Setting Terminals ............................................................................................................. 3-5

4 Mounting XFB01B Board ...................................................................................................... 4-1
  4.1 Opening Front Door of the DX100 ................................................................................. 4-2
  4.2 Confirming Switch Settings on the XFB01B Board ......................................................... 4-2
  4.3 Mounting the XFB01B Board on the DX100 ................................................................. 4-2
  4.4 Connecting Each Cable .................................................................................................. 4-3
  4.5 Closing the Front Door of the DX100 ............................................................................ 4-4

5 Allocating I/O Signals .......................................................................................................... 5-1
  5.1 I/O Module Setting ......................................................................................................... 5-1
  5.2 Transmission Data ........................................................................................................... 5-7
  5.3 DeviceNet Slave Allocation (Only in Master Mode) ....................................................... 5-9
  5.4 Management of DeviceNet Slave Allocation (Only in Master Mode) ......................... 5-13
    5.4.1 Saving to External Memory ...................................................................................... 5-13
    5.4.2 Loading from External Memory .............................................................................. 5-15

6 Network Specifications ......................................................................................................... 6-1
  6.1 Network Configuration .................................................................................................... 6-1
    6.1.1 Network Connections ............................................................................................... 6-1
      6.1.1.1 Connection Form ................................................................................................. 6-1
      6.1.1.2 Configuration Elements ..................................................................................... 6-2
6.1.1.3 Branching from the Trunk Line .............................................................. 6-3
6.1.1.4 Branching from Drop Lines ................................................................. 6-3

6.1.2 Precautions for Wiring DeviceNet Cables .................................................... 6-4
   6.1.2.1 Maximum Network Length ................................................................. 6-4
   6.1.2.2 Drop Line Length .............................................................................. 6-5
   6.1.2.3 Total Drop Line Length ...................................................................... 6-6

7 Connections for DeviceNet Communications ................................................................................. 7-1
   7.1 Location of Communication Power Supply ................................................... 7-1
      7.1.1 Basic Precautions ............................................................................... 7-1
      7.1.2 Location of Power Supply ................................................................. 7-2
      7.1.3 How to Decide the Location of the Power Supply ................................. 7-3
   7.2 Grounding ..................................................................................................... 7-10
      7.2.1 Grounding Method ............................................................................. 7-10

8 Error Indication .............................................................................................................. 8-1
   8.1 LED Indicators ............................................................................................ 8-1
      8.1.1 MS Lamp ............................................................................................ 8-1
      8.1.2 NS Lamp ............................................................................................ 8-2
This manual gives the instructions for using the JARCR-XFB01B board (hereinafter called the XFB01B board) for the DeviceNet on the DX100. The application of this board allows the transmission of DX100’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 XFB01B board is used in slave mode.

Fig. 1-1: System Configuration Example with XFB01B board as Slave

- A cable for DeviceNet and terminators connected externally are not packed with the XFB01B board.
- When the XFB01B board is connected at the end of a network, connect a terminator externally. Incorrect connections of the terminators may result in improper communications.
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.

**Fig. 1-2: System Configuration Example with XFB01B Board as Master**

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

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 Communications Connector
- SW5: Transmission I/O Points Setting SW
- SW4: Station Setting SW
- CN4: Serial No. Writing Connector
- SW3: Node Address Setting SW (x10)
- SW2: Node Address Setting SW (x1)
- SW1: Mode/Baud Rate Setting SW
- LED1: DeviceNet Status Display LED
- TM4: 16 or 17-byte Transmission Switching Terminal
- TM5: XFB01 or XFB01B Mode Switching Terminal

2.2 Board Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface to the external device</td>
<td>DeviceNet</td>
</tr>
<tr>
<td>Board mounting position</td>
<td>Optional board mounting space in the DX100</td>
</tr>
<tr>
<td>Error indicator</td>
<td>LED display</td>
</tr>
<tr>
<td>Number of transmission I/O points</td>
<td>Maximum number of I/O points</td>
</tr>
<tr>
<td></td>
<td>Input: 112 points</td>
</tr>
<tr>
<td></td>
<td>Output: 112 points</td>
</tr>
<tr>
<td></td>
<td>Note: The number of input points and the number of output points can not be set individually.</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 communications)</td>
</tr>
<tr>
<td>Transmission speed</td>
<td>Select 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 (manufactured by OMRON).</td>
</tr>
<tr>
<td>Communication distance</td>
<td></td>
</tr>
<tr>
<td>Transmission speed</td>
<td></td>
</tr>
<tr>
<td>Network max. distance</td>
<td></td>
</tr>
<tr>
<td>Branch line length</td>
<td></td>
</tr>
<tr>
<td>Total length of branch lines</td>
<td></td>
</tr>
<tr>
<td>500 kbps</td>
<td>100m and less</td>
</tr>
<tr>
<td>250 kbps</td>
<td>250m and less</td>
</tr>
<tr>
<td>125 kbps</td>
<td>500m and less</td>
</tr>
<tr>
<td>6m and less</td>
<td>6m and less</td>
</tr>
<tr>
<td>6m and less</td>
<td>6m and less</td>
</tr>
<tr>
<td>6m and less</td>
<td>6m and less</td>
</tr>
<tr>
<td>39m and less</td>
<td>39m and less</td>
</tr>
<tr>
<td>78m and less</td>
<td>78m and less</td>
</tr>
<tr>
<td>156m and less</td>
<td>156m and less</td>
</tr>
<tr>
<td>Power supply voltage for communication</td>
<td>24 VDC (supplied through the connector CN3 for connecting DeviceNet)</td>
</tr>
<tr>
<td>Maximum current consumption for communications</td>
<td>0.05 A</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>024V 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 Functions

3.1 Function Setting Switches

This section explains switches to set functions of the XFB01B board. Make the proper settings following the instructions. For more details of setting, refer to chapter 3.2 “Setting Switches” at page 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)
Switches the mode, slave or master, for the XFB01B board.

SW1-3 and 1-4 (DR0 and DR1)
Sets the baud rate.
The baud rate for communications can be selected among the following three rates.
- 125 kbps
- 250 kbps
- 500 kbps

SW2 and SW3: Sets the local node address of DeviceNet.
The setting range of local node address is from 0 to 63.

SW4: Sets the station number for the XFB01B board on the DX100.
The setting range of station number is from 1 (ST#01) to D (ST#13).
Do not set the station numbers 0 (ST#00), E (ST#14) and F (ST#15).

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 from “1” (8 points) to “E” (112 points).

<Example>
When the SW5 is set to “E”, the number of I/O points are as follows.
- Input: 112 points
- Output: 112 points
### 3.2 Setting Switches

<table>
<thead>
<tr>
<th>Switches</th>
<th>Setting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1</td>
<td><strong>Mode and baud rate setting</strong></td>
</tr>
<tr>
<td></td>
<td>Shows the default setting.</td>
</tr>
<tr>
<td></td>
<td>Sets the baud rate and mode of DeviceNet.</td>
</tr>
<tr>
<td>SW1-1: Operation mode (S/T)</td>
<td>OFF: Normal</td>
</tr>
<tr>
<td></td>
<td>Always set to OFF (normal operation mode).</td>
</tr>
<tr>
<td>SW1-2: Slave/Master mode switching (S/M).</td>
<td>OFF: Slave</td>
</tr>
<tr>
<td>SW1-3: Baud rate setting (DR1)</td>
<td>OFF: 0</td>
</tr>
<tr>
<td>SW1-4: Baud rate setting (DR0)</td>
<td>OFF: 0</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>: Enable to set.</td>
</tr>
</tbody>
</table>

Set the same value as of the other devices in the DeviceNet. Otherwise, DeviceNet communications cannot be established.

<table>
<thead>
<tr>
<th>SW2 (× 1 setting)</th>
<th>SW3 (× 10 setting)</th>
<th>Node address setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sets the local node address of DeviceNet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The following shows the relations between the setting of switches and the actual number of I/O points.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn the arrow to the number corresponding to the desired node address. (Use a precision flat tip screwdriver.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<Example>

<table>
<thead>
<tr>
<th>SW3</th>
<th>SW2</th>
<th>Node address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>: 0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>: 1 (Default setting)</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>: 2</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>: 4</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>: 8</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>: 16</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>: 32</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>: 63</td>
</tr>
</tbody>
</table>

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 any of other devices.
### DX100

#### 3 Setting Functions

##### 3.2 Setting Switches

<table>
<thead>
<tr>
<th>Switches</th>
<th>Setting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW4</td>
<td>Sets the station number. The following shows the relations between the switch setting and the station number. Turn the arrow to the number corresponding to the desired station. (Use a precision flat tip screwdriver.)</td>
</tr>
<tr>
<td>Station setting</td>
<td></td>
</tr>
<tr>
<td>0: Unavailable</td>
<td>8: ST#08</td>
</tr>
<tr>
<td>1: ST#01</td>
<td>9: ST#09</td>
</tr>
<tr>
<td>2: ST#02</td>
<td>A: ST#10</td>
</tr>
<tr>
<td>3: ST#03</td>
<td>B: ST#11</td>
</tr>
<tr>
<td>4: ST#04 (Default setting)</td>
<td>C: ST#12</td>
</tr>
<tr>
<td>5: ST#05</td>
<td>D: ST#13</td>
</tr>
<tr>
<td>6: ST#06</td>
<td>E: Unavailable</td>
</tr>
<tr>
<td>7: ST#07</td>
<td>F: Unavailable</td>
</tr>
</tbody>
</table>

The number after ST# is the station number displayed on the programming pendant of the DX100 when setting I/O modules.

| SW5 | Sets the number of I/O points to be transferred. The following shows the relations 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 tip screwdriver.) |
| Number of transmission I/O points setting | |
| 0: Unavailable | 8: 64 [72] |
| 1: 8 [16] | 9: 72 [80] |
| 4: 32 [40] | C: 96 [104] |
| 5: 40 [48] | D: 104 [112] |
| 6: 48 [56] | E: 112 [120] (Default setting) |
| 7: 56 [64] | F: Unavailable |

The value in [ ] indicates the number of I/O points reserved for the XFB01B board inside the DX100. (This includes the area for board status).

---

**NOTE**

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.
3.3 Function Setting Terminals

This section explains terminals used to set functions of the XFB01B 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**: Sets the board to XFB01 or XFB01B.
- *Always set to “XFB01B mode”.*
- Never set to XFB01 mode.
### 3.4 Setting Terminals

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Setting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM1</td>
<td><strong>Reserved for the manufacturer</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 1 and 2:</strong> With resistance</td>
</tr>
<tr>
<td></td>
<td>* Setting unavailable</td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 2 and 3:</strong> Without resistance</td>
</tr>
<tr>
<td></td>
<td>(Default setting)</td>
</tr>
<tr>
<td></td>
<td>* Setting indispensable</td>
</tr>
<tr>
<td></td>
<td><strong>Always set to “Without resistance.”</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Never set to “With resistance,” because this is used only for maintenance.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>When a terminator is required, install a junction tap or a terminator externally, and do not use this resistance.</strong></td>
</tr>
<tr>
<td>TM4</td>
<td><strong>Transmission mode setting</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 1 and 2:</strong> 17-byte transmission</td>
</tr>
<tr>
<td></td>
<td>* Setting indispensable</td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 2 and 3:</strong> 16-byte transmission</td>
</tr>
<tr>
<td></td>
<td>(Default setting)</td>
</tr>
<tr>
<td></td>
<td>* Setting unavailable</td>
</tr>
<tr>
<td></td>
<td><strong>Always set to “17-byte transmission”</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Remember to change the set mode to 17-byte transmission as the mode is set to 16-byte at the factory before shipping.</strong></td>
</tr>
<tr>
<td>TM5</td>
<td><strong>Board setting</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 1 and 2:</strong> XFB01 mode</td>
</tr>
<tr>
<td></td>
<td>* Setting unavailable</td>
</tr>
<tr>
<td></td>
<td><strong>Short-circuit between 2 and 3:</strong> XFB01B mode</td>
</tr>
<tr>
<td></td>
<td>(default setting)</td>
</tr>
<tr>
<td></td>
<td>* Setting indispensable</td>
</tr>
<tr>
<td></td>
<td><strong>Always set to “XFB01B mode”</strong></td>
</tr>
<tr>
<td></td>
<td><strong>In XFB01B mode, either slave or master can be selected.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Never set to XFB01 mode.</strong></td>
</tr>
</tbody>
</table>
4 Mounting 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.
• No shock to the board.
The shock may damage the board.
4.1 Opening Front Door of the DX100

Mount the XFB01B board in the following manner.

1. Turn the two door locks on the front face of the DX100 clockwise for 90 ° with a coin or a flat tip 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 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 Functions” at page 3-1.

4.3 Mounting the XFB01B Board on the DX100

1. Fix the XFB01B board on the DX100 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 communications cable to the CN2. Plug the terminal connector connected to the CN300 of the JZNC-YIU01-E 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 one of the connector and frame seal on the CN3.)
4.5 Closing the Front Door of the DX100

1. Close the door gently.
2. Turn the two door locks on the front face of the DX100 counterclockwise for 90 ° with a coin or a flat tip screwdriver.

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.

**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.

---

**24 VDC Power Cable Connection Position**

- Correct Position
- 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.
5 Allocating I/O Signals

5.1 I/O Module Setting

In order to use the XFB01B board on the DX100, the system configuration should be set in the following manner.

Make sure that the power supply to the DX100 is OFF. Then, mount the XFB01B board, for which all of its switches have been set, inside the DX100. For more details on board mounting, refer to chapter 4 "Mounting XFB01B Board" at page 4-1.

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

2. Set the Security Mode to the “MANAGEMENT MODE”.
3. Select {SYSTEM} under the main menu.
   - The sub menu appears.
4. Select {SETUP}.
   – The SETUP window appears.

5. Select {I/O 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 points(^a)</td>
</tr>
<tr>
<td>DO</td>
<td>Number of digital output points(^a)</td>
</tr>
<tr>
<td>AI</td>
<td>Number of analog input points(^a)</td>
</tr>
<tr>
<td>AO</td>
<td>Number of analog output points(^a)</td>
</tr>
<tr>
<td>BOARD</td>
<td>Circuit board type(^b)</td>
</tr>
</tbody>
</table>

\(^a\) A hyphen "-" indicates the corresponding I/O module is not mounted.

\(^b\) 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#04: JARCR-XFB01B board  
(digital input 120 points, digital output 120 points)  
Switch SW4: Set to 4. (This value becomes the ST#.)

ST#14: JZNC-YIU01-E unit  
(digital input 40 points, digital output 40 points)  
This unit is fixed to ST#14.

**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 in the display is the number calculated by "the set value of SW5 + 1 (for the board status)".
5 Allocating I/O Signals

5.1 I/O Module Setting

**<Example>**

When the SW5 is set to “E”, it is understood that 120 ((14+1) × 8) I/O points are reserved for the I/O board.

Accordingly, “DI : 120  DO : 120” is displayed.

The relationship between the set value of SW5 and the I/O module display is shown below:

<table>
<thead>
<tr>
<th>SW5</th>
<th>Display (I/O point)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DI</td>
</tr>
<tr>
<td>1</td>
<td>016</td>
</tr>
<tr>
<td>2</td>
<td>024</td>
</tr>
<tr>
<td>3</td>
<td>032</td>
</tr>
<tr>
<td>4</td>
<td>040</td>
</tr>
<tr>
<td>5</td>
<td>048</td>
</tr>
<tr>
<td>6</td>
<td>056</td>
</tr>
<tr>
<td>7</td>
<td>064</td>
</tr>
<tr>
<td>8</td>
<td>072</td>
</tr>
<tr>
<td>9</td>
<td>080</td>
</tr>
<tr>
<td>A</td>
<td>088</td>
</tr>
<tr>
<td>B</td>
<td>096</td>
</tr>
<tr>
<td>C</td>
<td>104</td>
</tr>
<tr>
<td>D</td>
<td>112</td>
</tr>
<tr>
<td>E</td>
<td>120</td>
</tr>
</tbody>
</table>

7. Press [ENTER].

- The confirmation dialog box appears.

![Confirmation Dialog Box Image]
8. Select “YES”.

– Press “YES” if the display corresponds to the current mounted status of the I/O modules. The system parameters are automatically set according to the current mounted status of the hardware. The procedures to add I/O modules are completed.

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 board may be improper. XFB01B board would not be recognized properly if this condition is applied.

• Improper setting of switching boards.
  Setting of TM5 on the XFB01B board may be improper. XFB01B 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 right position of CN1 may lead to improper power supply to the board. Recheck the cable connection referring to the chapter 4 “Mounting XFB01B Board” at page 4-1.

• 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.

• The number of XFB01B(MASTER) which can be mounted is two boards at the maximum.
9. Select “YES”.

– The confirmation dialog box appears when the XFB01B board is set to “MASTER”. Select “YES”.

![Confirmation Dialog Box Image]
5.2 Transmission Data

The data to be transferred from the XFB01B board to the inside of the DX100 is not only the I/O data from the external devices connected to the DeviceNet, but also the status of the XFB01B board.

Therefore, inside the DX100, 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.

<table>
<thead>
<tr>
<th>Board</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>JARCR-XFB01B</td>
<td>20060 to 20067 board status*1</td>
<td>30060 to 30067 can not be used</td>
</tr>
<tr>
<td></td>
<td>20070 to 20077 input data (1)</td>
<td>30070 to 30077 output data (1)</td>
</tr>
<tr>
<td></td>
<td>20080 to 20087 input data (2)</td>
<td>30080 to 30087 output data (2)</td>
</tr>
<tr>
<td></td>
<td>20090 to 20097 input data (3)</td>
<td>30090 to 30097 output data (3)</td>
</tr>
<tr>
<td></td>
<td>20100 to 20107 input data (4)</td>
<td>30100 to 30107 output data (4)</td>
</tr>
<tr>
<td></td>
<td>20110 to 20117 input data (5)</td>
<td>30110 to 30117 output data (5)</td>
</tr>
<tr>
<td></td>
<td>20120 to 20127 input data (6)</td>
<td>30120 to 30127 output data (6)</td>
</tr>
<tr>
<td></td>
<td>20130 to 20137 input data (7)</td>
<td>30130 to 30137 output data (7)</td>
</tr>
<tr>
<td></td>
<td>20140 to 20147 input data (8)</td>
<td>30140 to 30147 output data (8)</td>
</tr>
<tr>
<td></td>
<td>20150 to 20157 input data (9)</td>
<td>30150 to 30157 output data (9)</td>
</tr>
<tr>
<td></td>
<td>20160 to 20167 input data (10)</td>
<td>30160 to 30167 output data (10)</td>
</tr>
<tr>
<td></td>
<td>20170 to 20177 input data (11)</td>
<td>30170 to 30177 output data (11)</td>
</tr>
<tr>
<td></td>
<td>20180 to 20187 input data (12)</td>
<td>30180 to 30187 output data (12)</td>
</tr>
<tr>
<td></td>
<td>20190 to 20197 input data (13)</td>
<td>30190 to 30197 output data (13)</td>
</tr>
<tr>
<td></td>
<td>20200 to 20207 input data (14)</td>
<td>30200 to 30207 output data (14)</td>
</tr>
</tbody>
</table>

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.

(20010 to 20057 are used for standard I/O of the DX100.)
The status of the XFB01B board (the first 8 points of the allocation area) is indicated as follows. The value “xxx” 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 20060 to 20067, “xxx” would be 006.

<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</td>
</tr>
<tr>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>2xxx4</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td>Always set to 1.</td>
</tr>
<tr>
<td>2xxx5</td>
<td>(In SLAVE mode) Not used</td>
</tr>
<tr>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td></td>
<td>(In MASTER mode) Indicates if communicating with all the slaves or not through DeviceNet. Communicating with all slaves: 0, Communicating with some slaves: 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 board. Normal: 0  Error: 1</td>
</tr>
</tbody>
</table>
5 Allocating I/O Signals
5.3 DeviceNet Slave Allocation (Only in Master Mode)

The additional operation must be done in the management mode.
In the operation mode and the edit mode, only reference of status setting is possible.

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

2. Set the Security Mode to the “MANAGEMENT MODE”.

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

6. Select {XFB01B (MASTER)}.  
   - The current status of the mounted DeviceNet is shown as in the following.
7. Select {DETAIL}.
   – The SCAN LIST window appears.

   ![SCAN LIST Window](image)

8. Select the desired item.
9. Enter the desired value.
   – Set each parameter according to the actual status of the mounted slave device.

   ![Parameter Settings](image)

Each item in the display indicates as follows:

<table>
<thead>
<tr>
<th>MAC ID</th>
<th>Node address of the DeviceNet device</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>Number of bytes to be input from the slave device (1byte = 8 points)</td>
</tr>
<tr>
<td>OUT</td>
<td>Number of bytes to be output to the slave device (1byte = 8 points)</td>
</tr>
<tr>
<td>TYPE</td>
<td>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.</td>
</tr>
<tr>
<td>INTERVAL</td>
<td>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.</td>
</tr>
</tbody>
</table>
10. Press [ENTER].
   – The confirmation dialog box appears.

11. Select “YES”.
   – The parameters for DeviceNet are stored in the DX100. Turn ON the power to the DX100, and then start up the DX100.
5.4 Management of DeviceNet Slave Allocation (Only in Master Mode)

The settings for allocating the slaves for DeviceNet which was set in chapter 5.3 “DeviceNet Slave Allocation (Only in Master Mode)” at page 5-9 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 “DX100 Operator's Manual.”

5.4.1 Saving to External Memory

1. Turn ON the power to the DX100.
2. Select {EX. MEMORY} under the main menu.
3. Select {SAVE}.
   - The following window appears.

   ![Window with options for saving system data]

4. Select {SYSTEM DATA}.
   - The selection window for system data appears.

   ![Selection window for system data]
5. Select “DEVICENET ALLOC DATA”.
   - The selected system data are marked with “★”.

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

7. Select “YES”.
   - Saving the file starts. The transfer display appears.
   - To cancel saving, select “STOP”.
   Once saving is completed or cancelled, the file selection window appears.
5.4.2 Loading from External Memory

1. Turn ON the power to the DX100.
2. Set the Security Mode to the “MANAGEMENT MODE”.
3. Select {EX. MEMORY} under the main menu.
4. Select {LOAD}.

– The following window appears.

5. Select {SYSTEM DATA}.

– The selection window for system data appears.

6. Select “DEVICENET ALLOC DATA”.

– The selected system data is marked with “★”.

[Diagram of system data selection process]
5 Allocating I/O Signals

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

7. Press [ENTER].
   – The confirmation dialog box appears.
   ![Confirmation Dialog Box](image)

8. Select “YES”.
   – Loading the file starts. The transfer display appears.
   ![Transfer Display](image)
   – Once loading is completed, the selection window for system data appears.

   **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.

9. After the file has been successfully loaded, turn ON the power to the DX100.
6 Network Specifications

6.1 Network Configuration

6.1.1 Network Connections

6.1.1.1 Connection Form

The following diagram shows the network connections.

*Fig. 6-1: Network Connections*

- T (with terminator)
- Trunk Line
- Drop Line
- T-Branch Adapter
- Node
- Terminator

The diagram illustrates the network connections.
6.1.2 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.

### NOTE

1. The communications cable must be a DeviceNet cable.
2. Both ends of the trunk line must connect to a terminator. The following is the specification for the terminator.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance Value</td>
<td>121Ω</td>
</tr>
<tr>
<td>Allowable Difference of Resistance Value</td>
<td>±1%</td>
</tr>
<tr>
<td>Rating Power</td>
<td>1/4W</td>
</tr>
<tr>
<td>Type</td>
<td>Metal Film Resistor</td>
</tr>
</tbody>
</table>

3. Only DeviceNet devices can be connected to the network. Do not connect any other devices, such as a lightning arrester.
6.1.1.3 Branching from the Trunk Line

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

**Fig. 6-2: Branching from the Trunk Line**

(1) Single Branching

(2) Branching to Three Drop Lines

(3) Direct Node Connection

6.1.1.4 Branching from Drop Lines

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

**Fig. 6-3: Branching from Drop Lines**

(1) Single Branching

(2) Branching to Three Drop Lines

(3) Direct Node Connection
6.1.2 Precautions for Wiring DeviceNet Cables

6.1.2.1 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>
6.1.2.2 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>$L_{\text{thick}} + L_{\text{thin}} \leq 100$</td>
</tr>
<tr>
<td>250</td>
<td>$L_{\text{thick}} + 2.5 \times L_{\text{thin}} \leq 250$</td>
</tr>
<tr>
<td>125</td>
<td>$L_{\text{thick}} + 5.0 \times L_{\text{thin}} \leq 500$</td>
</tr>
</tbody>
</table>

$L_{\text{thick}}$: thick cable length, $L_{\text{thin}}$: thin cable length
6.1.2.3 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. 6-4: 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 = \( a + b + c + d + e + f + g + h \leq 39 \text{ m} \)
7 Connections for DeviceNet Communications

7.1 Location of Communication Power Supply

7.1.1 Basic Precautions

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.
   \[ I = \frac{4.57}{L} \]
   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.
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.
   (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 chapter 7.1.1 “Basic Precautions” at page 7-1.
   • 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.

**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.
3. 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

<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>
7 Connections for DeviceNet Communications
7.1 Location of Communication Power Supply

(1) 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 ≤ 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.

(2) 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 fol-
lowing 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 sup-
  ply, 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 210 m is used and the power supply is connected at the end of the trunk line.

![Diagram of Example 1](image)

Total length of the power supply cable = 210 m

Total current consumption of the 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 = 1.5 A

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.

![Diagram of Example 2](image)

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 = 0.2 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 A
The maximum current on the right obtained from the graph = approx. 2.5 A

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

Equation: \[ \Sigma [(L_n \times R_c + N_t \times 0.005) \times I_n] \leq 4.65 \text{ V} \]

\( L_n \): 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 of node

0.005 \( \Omega \) = Contact resistance value of an adapter
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: 11 VDC 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** \[ \Sigma [(L_n \times R_c + N_t \times 0.005) \times I_n] \leq 0.65 \text{ V} \]

- \( L_n \): 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.
7.2 Grounding

7.2.1 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 100 $\Omega$ 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 100 $\Omega$ 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 100 $\Omega$ 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.
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.

<table>
<thead>
<tr>
<th>LED</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 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 DX100 (In waiting status)</td>
<td>• Check the connection of the I/O communication cable to CN2 on the XFB01B board.</td>
</tr>
<tr>
<td>MS blinks in red (cyclically)</td>
<td>Communication error with the DX100</td>
<td>• Check the connection of the I/O communication cable to CN2 on the XFB01B board.</td>
</tr>
<tr>
<td>MS blinks in red (twice)</td>
<td>Communication error with the DX100</td>
<td>Incorrect settings of the switches on the XFB01B board. • Check the settings of the switches on the front of the XFB01B board.</td>
</tr>
<tr>
<td>MS lit in red</td>
<td>Error in module</td>
<td>ROM/RAM check error or watchdog timeout error occurs. • Turn the DX100 main power supply from OFF to ON. • Replace the XFB01B board.</td>
</tr>
</tbody>
</table>
8.1.2 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>
<tbody>
<tr>
<td>NS unlit</td>
<td>In offline status</td>
<td>XFB01B board power supply failure, communication power supply failure, or DeviceNet line failure occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the connection of the power supply to CN1 of the XFB01B board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring and connection of the DeviceNet cable and connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the voltage and connection of the communication power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the transmission speed of each device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the terminator value (121 Ω) of the mounted terminator and its mounted status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the operation status of the DeviceNet master device.</td>
</tr>
<tr>
<td>NS blinks in green</td>
<td>Communication is not established.</td>
<td>In online status, but communication is not established.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring and connection of the DeviceNet cable and connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the voltage and connection of the communication power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the transmission speed of each device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the terminator value (121 Ω) of the mounted terminator and its mounted status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the operation status of the DeviceNet master device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check if the number of I/O points for the connected master or slave corresponds to the number of I/O allocated points.</td>
</tr>
<tr>
<td>NS lit in green</td>
<td>Communication in normal status</td>
<td>Communication is established in online.</td>
</tr>
</tbody>
</table>
### LED Indicators

<table>
<thead>
<tr>
<th>LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS blinks in red</td>
<td>Time-out error</td>
<td>A time-out error occurs between the DX100 and the connected device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring and connection of the DeviceNet cable and connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the voltage and connection of the communication power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the transmission speed of each device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the terminator value (121 Ω) of the mounted terminator and its mounted status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the operation status of the DeviceNet master device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check if the number of I/O points for the connected master or slave corresponds to the number of I/O allocated points.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Raise the setting for the communications cycle of the master device, and recheck communications.</td>
</tr>
<tr>
<td>NS lit in red</td>
<td>Communication fatal error</td>
<td>A node address is overlapped, or a bus OFF is detected on the network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reset the node address so that the node address is not overlapped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the wiring and connection of the DeviceNet cable and connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the voltage and connection of the communication power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the transmission speed of each device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the terminator value (121 Ω) of the mounted terminator and its mounted status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the transmission distance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check if there is no noise generating factor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace the XFB01B board.</td>
</tr>
</tbody>
</table>
DX100 OPTIONS
JARCR-XFB01B BOARD
INSTRUCTIONS

FOR DeviceNet

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