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

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.
MANDATORY

• This manual explains the SST-DN4-PCU board (manufactured by Molex Inc.) 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.

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

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

Improper usage of the board may damage the board.
WARNING

• Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the 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.

*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:
  – 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.

• 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.
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>
</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:&lt;br&gt;The keys which have characters printed on them are denoted with [ ].&lt;br&gt;ex. [ENTER]</td>
</tr>
<tr>
<td>Symbol Keys</td>
<td>Symbol Keys:&lt;br&gt;The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.&lt;br&gt;ex. page key&lt;br&gt;The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td>Axis Keys Numeric Keys</td>
<td>&quot;Axis Keys&quot; and &quot;Numeric Keys&quot; are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>Keys pressed simultaneously:&lt;br&gt;When two keys are to be pressed simultaneously, the keys are shown with a &quot;+&quot; sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>Displays:&lt;br&gt;The menu displayed in the programming pendant is denoted with {}.&lt;br&gt;ex. {JOB}</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.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
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    1.1.2 SST-DN4-PCU Board in Master Mode ................................................................. 1-2  

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# SST-DN4-PCU Board

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      5.1.1 Network Connections
         5.1.1.1 Connection Form
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         5.1.1.3 Branching from the Trunk Line
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      5.1.2 Precautions for Wiring DeviceNet Cables
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   6.1 Location of Communication Power Supply
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      6.1.3 How to Decide the Location of the Power Supply
   6.2 Grounding
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8 Restrictions
   8.1 DN4-PCU Board
   8.2 Remarks when Replacing the Board
This manual describes the DeviceNet I/O board SST-DN4-PCU (manufactured by Molex Inc.) to be used in the DX100.

The application of the SST-DN4-PCU board allows the general-purpose I/O data exchange between a DeviceNet device and the DX100.

The SST-DN4-PCU board has two types: the SST-DN4-PCU-1 board and the SST-DN4-PCU-2 board.

Since the SST-DN4-PCU-2 board enables use of two DeviceNet channels, additional setting is required before using the SST-DN4-PCU-2 board compared with the SST-DN4-PCU-1 board. The setting method and the usage are the same as those of the SST-DN4-PCU-1 board.

1.1 System Configuration

1.1.1 SST-DN4-PCU Board in Slave Mode

The following diagram shows an example of the configuration of a system with an SST-DN4-PCU-1 board used in slave mode.
### 1.1.2 SST-DN4-PCU Board in Master Mode

The following diagram shows an example of the configuration of a system with an SST-DN4-PCU-1 board used in master mode.

* The SST-DN4-PCU board does not include a DeviceNet cable or an external terminator.

When the SST-DN4-PCU board is connected at the end of the network, connect the external terminator to the SST-DN4-PCU board.

If the terminator is not correctly connected, communications may not be performed.

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

2.1 Board External View

2.1.1 SST-DN4-PCU-1 Board

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HLTH LED</td>
</tr>
<tr>
<td>B</td>
<td>CAN Connector</td>
</tr>
<tr>
<td>C</td>
<td>COMM LED</td>
</tr>
</tbody>
</table>
2.1.2 SST-DN4-PCU-2 Board

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Channel 1 HLTH LED</td>
</tr>
<tr>
<td>2</td>
<td>Channel 1 CAN Connector</td>
</tr>
<tr>
<td>3</td>
<td>Channel 1 COMM LED</td>
</tr>
<tr>
<td>4</td>
<td>Channel 2 HLTH LED</td>
</tr>
<tr>
<td>5</td>
<td>Channel 2 CAN Connector</td>
</tr>
<tr>
<td>6</td>
<td>Channel 2 COMM LED</td>
</tr>
</tbody>
</table>
## 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>Option PCI slot of the CPU rack on the DX100 controller</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 for SST-DN4-PCU-1:</td>
</tr>
<tr>
<td></td>
<td>Input: 2000 points; Output: 2000 points</td>
</tr>
<tr>
<td></td>
<td>Maximum number of I/O points for SST-DN4-PCU-2:</td>
</tr>
<tr>
<td></td>
<td>Input: 1992 points; Output: 1992 points</td>
</tr>
</tbody>
</table>

### Note on Transmission I/O Points

1. Input points and output points cannot be configured individually.
2. DX100 has 2048 inputs and 2048 outputs prepared for the I/O board. Of these, 40 inputs and 40 outputs are pre-allocated. In addition, 8 I/O points per channel are required for SST-DN4-PCU communication status. The remaining number of I/O points are available for transmission.

## 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>500/250/125 kbps</td>
</tr>
<tr>
<td>Transmission media</td>
<td>Dedicated 5-wire cable (2 wires for signals, 2 wires 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>500 kbps</td>
<td>Network max. distance:</td>
</tr>
<tr>
<td>250 kbps</td>
<td>100 m and less</td>
</tr>
<tr>
<td>125 kbps</td>
<td>250 m and less</td>
</tr>
<tr>
<td></td>
<td>Branch line length:</td>
</tr>
<tr>
<td></td>
<td>6 m and less</td>
</tr>
<tr>
<td></td>
<td>6 m and less</td>
</tr>
<tr>
<td></td>
<td>Total length of branch lines:</td>
</tr>
<tr>
<td></td>
<td>39 m and less</td>
</tr>
<tr>
<td></td>
<td>78 m and less</td>
</tr>
<tr>
<td></td>
<td>156 m and less</td>
</tr>
<tr>
<td>Power supply voltage for communication</td>
<td>24 VDC (supplied through the connector for DeviceNet connection)</td>
</tr>
<tr>
<td>Maximum current consumption for communications</td>
<td>0.05 A (1 channel)</td>
</tr>
</tbody>
</table>
2.4 Connector

Table 2-1: DeviceNet (Connector for DeviceNet Connection)

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Signal Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (black)</td>
<td>V-</td>
<td>0\textsubscript{24}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 (shielded)</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 a DeviceNet cable to be connected.
3 Mounting the SST-DN4-PCU 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.
3.1 Opening Front Door of the DX100

Mount the SST-DN4-PCU board in the following manner.

1. Open the front door of DX100.
   
   (1) Turn the two door locks on the front face of the DX100 clockwise for 90 ° with a coin or a flat tip screwdriver.

   ![Fig. 3-1: Door Unlock](image)

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

   ![Fig. 3-2: Open the Door "OFF" Position (Horizontal)](image)
3.2 Mounting the SST-DN4-PCU Board on the DX100

1. Remove the riser board from the CPU rack.
2. Mount the SST-DN4-PCU board to the riser board, then securely tighten the SST-DN4-PCU board with the board fixing screws.
3. Mount the riser board in the CPU rack.

*Fig. 3-3: (Mounting Example) When the SST-DN4-PCU-1 Board is Inserted into CN1: Slot1*
3.3 Cable Connection

1. Connect the DeviceNet cable with the DeviceNet connector on the SST-DN4-PCU board.

Fig. 3-4: (Mounting Example) When the SST-DN4-PCU Board is Inserted into CN1: Slot1
3.4 Closing Front Door of the DX100

1. Close the front door of DX100.
   (1) Close the door gently.
   (2) Turn the two door locks on the front face of the DX100 counterclockwise for 90°.

Fig. 3-5: Lock the Door

CAUTION

- Always keep the doors of the DX100 in the closed state except when you perform maintenance.
- Make sure to engage all the door locks.
- Intrusion of dust, dirt or water into the DX100 may cause electric shock or failure.
4 I/O Signal Allocation

4.1 Setting of Option Board and I/O Module

In order to use the SST-DN4-PCU board in the DX100, perform the setting of the option board and I/O module in the following manner.

- Up to two channels can be set when the SST-DN4-PCU-2 board with the two-channel type DeviceNet connector is mounted. As for the setting for each channel, it is same as the setting of SST-DN4-PCU-1.
  
Refer to chapter 4.1.1 “Setting of the SST-DN4-PCU-1 Board to Slave” on page 4-2 and chapter 4.1.2 “Setting of the SST-DN4-PCU-1 Board to Master” on page 4-8 for the details.

The channel setting, however, is optional. Two channels of the SST-DN4-PCU-2 board can be configured as follows; set the channel 1 and the channel 2 to "slave", set the channel 1 and the channel 2 to "master", or set the channel 1 to "slave" and the channel 2 to "master".

When settings are executed to both channels the upper limit of the IO size for the total of two channels is 249 byte (249 x 8 = 1992 points).

Set the option board and I/O module in the management mode.

In the operation mode and the editing mode, the settings are for reference only.
4.1.1 Setting of the SST-DN4-PCU-1 Board to Slave

1. Turn ON the power supply while pressing [MAIN MENU].
   – The Maintenance mode starts.

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 display appears.

5. Select "OPTION BOARD".
   - The OPTION BOARD display appears.
6. Select "DN4-PCU-1".
   - The DN4-PCU-1 setup display appears.
   - Set the following items:
     • "DN4-PCU-1": whether to use the DN4-PCU-1 board or not
     • "SLAVE OR MASTER": the board mode
     • "IO SIZE": the I/O size (byte)
     • "MAC ID"
     • "BAUD RATE"

   - Explanation of Setup Items
     
     (1) DN4-PCU-1
        Sets whether to use the SST-DN4-PCU-1 board or not. Set "USED".

     (2) SLAVE OR MASTER
        Sets "slave" or "master". Set "SLAVE".

     (3) IO SIZE (byte)
        Sets the I/O size (in bytes) reserved for I/O.
        The maximum setting value of the I/O size is 250 bytes
        \(250 \times 8 = 2000\) points.

     (4) MACID
        Sets the MACID. The MACID can be set by numbers from 0 to 63.

     (5) BAUD RATE
        Sets the baud rate. Set the baud rate among 500/250/125 kbps.

     (6) SCAN LIST
        "SCAN LIST" is not used for setting the SST-DN4-PCU-1 board to slave.
4. I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

7. Press [ENTER].
   – The confirmation dialog box appears.

8. Select "YES".
   – The IO MODULE display appears.
9. Press [ENTER].

- The rest of the IO MODULE display appears, and "DN4-PCU-1 (SLAVE)" is displayed.
- The I/O points is displayed under "DI/DO" according to the I/O size in bytes that is set on the "OPTION BOARD" display.

10. Press [ENTER].

- The confirmation dialog box appears.

The DI/DO points can be found using the following equation;

\[
\text{DI/DO points} = (\text{IO size} \times 8) + 8
\]

"+ 8" : the I/O points for status
4. I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

11. Select "YES".

- The SETUP display appears.
4 I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

4.1.2 Setting of the SST-DN4-PCU-1 Board to Master

1. Turn ON the power supply while pressing [MAIN MENU].
   - The Maintenance mode starts.

2. Set the security mode to the “MANAGEMENT MODE”.

3. Select {SYSTEM} under the main menu.
   - The sub menu appears.
4. I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

4. Select {SETUP}.
   – The SETUP display appears.

5. Select "OPTION BOARD".
   – The OPTION BOARD display appears.
6. Select "DN4-PCU-1".
   - The DN4-PCU-1 setup display appears.
   - Set the following items without fail:
     • "DN4-PCU-1": whether to use the DN4-PCU-1 board or not
     • "SLAVE OR MASTER": the board mode
     • "IO SIZE": the I/O size (byte)
     • "MAC ID"
     • "BAUD RATE"
     • As for SCAN LIST, refer to the following step 7 to step 11.
   For the settings other than mentioned above, execute settings as the need arises.

   ![Setup Display]

   - Explanation of Setup Items

   (1) DN4-PCU-1
      Sets whether to use the SST-DN4-PCU-1 board or not. Set "USED".

   (2) SLAVE OR MASTER
      Sets "slave" or "master". Set "MASTER".

   (3) IO SIZE (byte)
      Sets the I/O size (in bytes) reserved for I/O.
      The maximum setting value of the I/O size is 250 bytes
      \(250 \times 8 = 2000\) points.

   (4) MACID
      Sets the MACID. The MACID can be set by numbers from 0 to 63.

   (5) BAUD RATE
      Sets the baud rate. Set the baud rate among 500/250/125 kbps.

   (6) SCAN LIST
      "SCAN LIST" is used for setting the SST-DN4-PCU-1 board to master. Refer to the following step 7 to step 11.

   (7) TERMINAL OUTPUT FUNCTION
      When this board is set as a master, the numbers of non communicating slave terminal can be output to M register. Set ENABLE / DISABLE of this function. Refer to chapter 4.5 "Terminal Output Function (Only in Master Mode)" at page 4-30 for the details of this function.

4-10
4.1 Setting of Option Board and I/O Module

(8) M REGISTER
This item appears when “ENABLE” is selected to the above mentioned '(7) TERMINAL OUTPUT FUNCTION'. Set the M register’s leading number as the destination of the terminal output function. Before setting the number, confirm that M register is not used for the different purposes.

(9) TERMINAL OUTPUT SETTING
This item appears when “ENABLE” is selected to the above mentioned '(7) TERMINAL OUTPUT FUNCTION'. Set “ENABLE” or “DISABLE”. Refer to chapter 4.6 “TERMINAL OUTPUT SETTING (Only in Master Mode)” at page 4-32 for the details of this function.

(10) M REGISTER
This item appears when “ENABLE” is selected to the above mentioned '(9) TERMINAL OUTPUT SETTING'. Set the M register’s leading number as the destination of the terminal output setting. Before setting the number, confirm that M register is not used for the different purposes.

7. Select "DETAIL".
   – The SCAN LIST setup display appears.

![SCAN LIST setup display]

8. Move the cursor to each item on the SCAN LIST display, and select the desired item for setting.
9. Enter a desired value.

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

Each item in the display indicates as follows:

- **MAC ID**: Node address of the DeviceNet device
- **SIZE (IN)**: Number of bytes input from the slave device (1 byte = 8 points)
- **SIZE (OUT)**: Number of bytes output to the slave device (1 byte = 8 points)
- **TYPE**: I/O message type of the slave device. The message type "POLL", "COS", and "CYCLIC" are supported. Especially "POLL" is supported by most of the slave devices. For details of "POLL", "COS", and "CYCLIC", refer to the DeviceNet specifications.
- **INTERVAL**: Sets the DeviceNet scanning interval. The interval is displayed in the same row as the master device No. Set to a value between 10 ms to 300 ms in units of 10 ms. The default setting is 30 ms.
4. I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

10. Press [ENTER].
   – The confirmation dialog box appears.

![Confirmation Dialog]

11. Select "YES"
   – The IO MODULE display appears.

![IO Module Display]
4 I/O Signal Allocation
4.1 Setting of Option Board and I/O Module

12. Press [ENTER].
   - The rest of the IO MODULE display appears, and "DN4-PCU-1 (MASTER)" is displayed.
   - The I/O points is displayed under "DI/DO" according to the I/O size in bytes that is set on the "OPTION BOARD" display.

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

The DI/DO points can be found using the following equation:

DI/DO points = (I/O size × 8) + 8

"+ 8" : the I/O points for status
14. Select "YES".

- The SETUP display appears.
4.2 Transmission Data

The data to be transferred from the SST-DN4-PCU board to the inside of the DX100 is not only the I/O data from the external device connected to the DeviceNet, but also the status of the SST-DN4-PCU board. Therefore, inside the DX100, 8 points (1 byte) each for input and output are reserved for the SST-DN4-PCU-1 board status, and 16 points (2 bytes) each for input and output are reserved for the SST-DN4-PCU-2 board status, beside the area for the digital data. The output area, however, cannot be used.

The transmission data from the SST-DN4-PCU board are allocated to the external I/O signals of concurrent I/O.

Where only an SST-DN4-PCU-1 board or an SST-DN4-PCU-2 board is mounted as an optional I/O board, the concurrent I/O allocation of the board is shown in the following table.

Furthermore, the following table shows the concurrent I/O allocation of the board when the I/O size is set to 16 bytes (input: 128 points, output: 128 points) per one channel.

The I/O area: 20010 to 20057 and 30010 to 30057 is reserved for the standard I/O board of the DX100.
## Concurrent I/O Allocation of the SST-DN4-PCU-1 Board

<table>
<thead>
<tr>
<th>Board</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-DN4-PCU-1</td>
<td>20060 to 20067 board status(^1)</td>
<td>30060 to 30067 cannot 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>
<tr>
<td></td>
<td>20210 to 20217 input data (15)</td>
<td>30210 to 30217 output data (15)</td>
</tr>
<tr>
<td></td>
<td>20220 to 20227 input data (16)</td>
<td>30220 to 30227 output data (16)</td>
</tr>
</tbody>
</table>

\(^1\) [SST-DN4-PCU-1 Board Status]

The status of the SST-DN4-PCU-1 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 number of the SST-DN4-PCU-1 board allocated number. In the table above, 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 2xxx3</td>
<td>Reserved for the manufacturer. The user cannot use these signals.</td>
</tr>
<tr>
<td>2xxx4</td>
<td>Not used  &lt;br&gt; Always set to 0.</td>
</tr>
<tr>
<td>2xxx5</td>
<td>In SLAVE mode  &lt;br&gt; Not used  &lt;br&gt; Always set to 0.  &lt;br&gt;  In MASTER mode  &lt;br&gt; Indicates if communicating with all the slaves or not through DeviceNet. &lt;br&gt; Communicating with all slaves: 0, &lt;br&gt; Communicating with some slaves: 1</td>
</tr>
<tr>
<td>2xxx6</td>
<td>Indicates the DeviceNet communication status.  &lt;br&gt; Normal: 0 Error: 1</td>
</tr>
<tr>
<td>2xxx7</td>
<td>Indicates the operation status of the SST-DN4-PCU-1 board.  &lt;br&gt; Normal: 0 Error: 1</td>
</tr>
</tbody>
</table>
## Concurrent I/O Allocation of the SST-DN4-PCU-2 Board

<table>
<thead>
<tr>
<th>Board</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-DN4-PCU-2</td>
<td>20060 to 20067 CH1 board status(^1)</td>
<td>30060 to 30067 cannot be used</td>
</tr>
<tr>
<td></td>
<td>20070 to 20077 CH1 input data (1)</td>
<td>30070 to 30077 CH1 output data (1)</td>
</tr>
<tr>
<td></td>
<td>20080 to 20087 CH1 input data (2)</td>
<td>30080 to 30087 CH1 output data (2)</td>
</tr>
<tr>
<td></td>
<td>20090 to 20097 CH1 input data (3)</td>
<td>30090 to 30097 CH1 output data (3)</td>
</tr>
<tr>
<td></td>
<td>20100 to 20107 CH1 input data (4)</td>
<td>30100 to 30107 CH1 output data (4)</td>
</tr>
<tr>
<td></td>
<td>20110 to 20117 CH1 input data (5)</td>
<td>30110 to 30117 CH1 output data (5)</td>
</tr>
<tr>
<td></td>
<td>20120 to 20127 CH1 input data (6)</td>
<td>30120 to 30127 CH1 output data (6)</td>
</tr>
<tr>
<td></td>
<td>20130 to 20137 CH1 input data (7)</td>
<td>30130 to 30137 CH1 output data (7)</td>
</tr>
<tr>
<td></td>
<td>20140 to 20147 CH1 input data (8)</td>
<td>30140 to 30147 CH1 output data (8)</td>
</tr>
<tr>
<td></td>
<td>20150 to 20157 CH1 input data (9)</td>
<td>30150 to 30157 CH1 output data (9)</td>
</tr>
<tr>
<td></td>
<td>20160 to 20167 CH1 input data (10)</td>
<td>30160 to 30167 CH1 output data (10)</td>
</tr>
<tr>
<td></td>
<td>20170 to 20177 CH1 input data (11)</td>
<td>30170 to 30177 CH1 output data (11)</td>
</tr>
<tr>
<td></td>
<td>20180 to 20187 CH1 input data (12)</td>
<td>30180 to 30187 CH1 output data (12)</td>
</tr>
<tr>
<td></td>
<td>20190 to 20197 CH1 input data (13)</td>
<td>30190 to 30197 CH1 output data (13)</td>
</tr>
<tr>
<td></td>
<td>20200 to 20207 CH1 input data (14)</td>
<td>30200 to 30207 CH1 output data (14)</td>
</tr>
<tr>
<td></td>
<td>20210 to 20217 CH1 input data (15)</td>
<td>30210 to 30217 CH1 output data (15)</td>
</tr>
<tr>
<td></td>
<td>20220 to 20227 CH1 input data (16)</td>
<td>30220 to 30227 CH1 output data (16)</td>
</tr>
<tr>
<td></td>
<td>20230 to 20237 CH2 board status(^2)</td>
<td>30230 to 30237 cannot be used</td>
</tr>
<tr>
<td></td>
<td>20240 to 20247 CH2 input data (1)</td>
<td>30240 to 30247 CH2 output data (1)</td>
</tr>
<tr>
<td></td>
<td>20250 to 20257 CH2 input data (2)</td>
<td>30250 to 30257 CH2 output data (2)</td>
</tr>
<tr>
<td></td>
<td>20260 to 20267 CH2 input data (3)</td>
<td>30260 to 30267 CH2 output data (3)</td>
</tr>
<tr>
<td></td>
<td>20270 to 20277 CH2 input data (4)</td>
<td>30270 to 30277 CH2 output data (4)</td>
</tr>
<tr>
<td></td>
<td>20280 to 20287 CH2 input data (5)</td>
<td>30280 to 30287 CH2 output data (5)</td>
</tr>
<tr>
<td></td>
<td>20290 to 20297 CH2 input data (6)</td>
<td>30290 to 30297 CH2 output data (6)</td>
</tr>
<tr>
<td></td>
<td>20300 to 20307 CH2 input data (7)</td>
<td>30300 to 30307 CH2 output data (7)</td>
</tr>
<tr>
<td></td>
<td>20310 to 20317 CH2 input data (8)</td>
<td>30310 to 30317 CH2 output data (8)</td>
</tr>
<tr>
<td></td>
<td>20320 to 20327 CH2 input data (9)</td>
<td>30320 to 30327 CH2 output data (9)</td>
</tr>
<tr>
<td></td>
<td>20330 to 20337 CH2 input data (10)</td>
<td>30330 to 30337 CH2 output data (10)</td>
</tr>
<tr>
<td></td>
<td>20340 to 20347 CH2 input data (11)</td>
<td>30340 to 30347 CH2 output data (11)</td>
</tr>
<tr>
<td></td>
<td>20350 to 20357 CH2 input data (12)</td>
<td>30350 to 30357 CH2 output data (12)</td>
</tr>
<tr>
<td></td>
<td>20360 to 20367 CH2 input data (13)</td>
<td>30360 to 30367 CH2 output data (13)</td>
</tr>
<tr>
<td></td>
<td>20370 to 20377 CH2 input data (14)</td>
<td>30370 to 30377 CH2 output data (14)</td>
</tr>
<tr>
<td></td>
<td>20380 to 20387 CH2 input data (15)</td>
<td>30380 to 30387 CH2 output data (15)</td>
</tr>
<tr>
<td></td>
<td>20390 to 20397 CH2 input data (16)</td>
<td>30390 to 30397 CH2 output data (16)</td>
</tr>
</tbody>
</table>

\(^1\) [SST-DN4-PCU-2 Board Status]

The status of the SST-DN4-PCU-2 board is indicated as follows.

The value “xxx” of the allocated input signals in the table indicates the first number of the SST-DN4-PCU-2 board allocated number. In the table above, where the allocation numbers were 20060 to 20067, “xxx” would be “006” and where the allocation numbers were 20230 to 20237, “xxx” would be “023”.

\(^2\) Board Status

Board status for SST-DN4-PCU-2 cannot be used.
### Signal Allocation

#### 4.2 Transmission Data

<table>
<thead>
<tr>
<th>Signal</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2xxx0 to 2xxx3</td>
<td>Reserved for the manufacturer. The user cannot use these signals.</td>
</tr>
<tr>
<td>2xxx4</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td>2xxx5</td>
<td>In SLAVE mode</td>
</tr>
<tr>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td>Always set to 0.</td>
</tr>
<tr>
<td></td>
<td>In MASTER mode</td>
</tr>
<tr>
<td></td>
<td>Indicates if communicating with all the slaves or not through DeviceNet.</td>
</tr>
<tr>
<td></td>
<td>Communicating with all slaves: 0,</td>
</tr>
<tr>
<td></td>
<td>Communicating with some slaves: 1</td>
</tr>
<tr>
<td>2xxx6</td>
<td>Indicates the DeviceNet communication status.</td>
</tr>
<tr>
<td></td>
<td>Normal: 0 Error: 1</td>
</tr>
<tr>
<td>2xxx7</td>
<td>Indicates the operation status of the SST-DN4-PCU-2 board.</td>
</tr>
<tr>
<td></td>
<td>Normal: 0 Error: 1</td>
</tr>
</tbody>
</table>
4.3 Management of DeviceNet Slave Allocation (Only in Master Mode)

The use of an external memory device such as a floppy disk/a compact flash memory card allows a user to save or load the DeviceNet allocation that was set with "SCAN LIST" in the "SST-DN4-PCU (DeviceNet)" setup display.

The following show operational procedures.

For the overall operation using an external memory device, refer to "7. Controlling Peripheral Devices" in "DX100 Operator's Manual".

4.3.1 Saving to External Memory Device

1. Turn ON the DX100 power.
2. Select (EX. MEMORY) under the main menu.
3. Select {SAVE}.
   – The following display appears.

4. Select "SYSTEM DATA".
   – The system data selection display appears.
5. Select "SST 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, press "STOP".

- Once the saving is completed or cancelled, the system data selection display appears.
4.3.2 Loading from External Memory Device

1. Turn ON the DX100 power.
2. Set the security mode to the "MANAGEMENT MODE".
3. Select {EX. MEMORY} under the main menu.
4. Select {LOAD}.
   - The following display appears.

5. Select "SYSTEM DATA".
   - The system data selection display appears.
4.3 Management of DeviceNet Slave Allocation (Only in Master Mode)

6. Select "SST DEVICENET ALLOC DATA".
   - The selected system data are marked with "★".

7. Press [ENTER].
   - The confirmation dialog box appears.
4.3 Management of DeviceNet Slave Allocation (Only in Master Mode)

8. Select "YES".

– Loading the file starts. The transfer display appears.

– Once the loading is completed, the system data selection display appears.

– Turn OFF the DX100 power and turn ON again.

**NOTE**

The data cannot be successfully loaded if any inconsistency was found between the setting status (node address: MAC ID, station, I/O size) of the SST-DN4-PCU board and the file data to be loaded from the external memory.
Set the SST-DN4-PCU board as in the same manner as the setting when the file has been saved, then load the file.
4.4 Generation of EDS File (Only in Slave Mode)

For setting the communication setting of a DeviceNet, an electronic data sheet (EDS) file is sometimes needed depending on a communication master (or a configurator). In this case, please use the EDS file generated in the following procedure.

Please complete chapter 4.1 “Setting of Option Board and I/O Module” at page 4-1 before generating the EDS file. The EDS file cannot be correctly generated before the completion of the setting of the option board and the I/O module.

Please refer to the DeviceNet specification for the details of the configurator and the EDS file. For the use method of the communication master and the generated EDS file, please refer to the operating manual of the communication master.

4.4.1 Generation Procedure of EDS File

1. Turn ON the power supply while pressing [MAIN MENU] simultaneously.

   – The maintenance mode window appears.

2. Select {EX. MEMORY} under the Main Menu.

   – A sub menu appears.
3. Select {SAVE}.
   – The following window appears.

4. Select “EDS FILE SAVE”.
   – The EDS file save window appears.
   Among of the DeviceNet boards, a list of the boards, which have been set as slaves, is displayed as the following examples of the screens.
5. Select [DN4-PCU] to save an EDS file.
   - The selected system data is marked with “★”.

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

7. Select “YES”.
   - An EDS file is generated in an effective device (CompactFlash or USB memory).
4.4 Generation of EDS File (Only in Slave Mode)

- The name of the file generated is as follows.

  SST-DN4-PCU-1: Node_Classification_Board_Points.eds
  SST-DN4-PCU-2: Node_Classification_Board_Channel_Points.eds

  Node: The number of 'ST#' displayed on IO module window.
  Classification: Network classification (DevNet)
  Board: Board name (DN4-PCU-1, DN4-PCU-2)
  Channel: CH1, CH2
  Points: Input-and-output Points

  <Example>
  ST16_DevNet_DN4-PCU-1_IO16.eds
  ST16_DevNet_DN4-PCU-2_CH1_IO16.eds
  ST16_DevNet_DN4-PCU-2_CH2_IO26.eds
4.5 Terminal Output Function (Only in Master Mode)

This function enables to output the number of non communicating slave terminals to M register when SST-DN4 board is used in the DeviceNet master mode.

To utilize this function, set “TERMINAL OUTPUT FUNCTION” enable on the DN4-PCU setting window, then, to “M register”, set the M register’s leading number as the destination of the terminal output function.

The communication status is output to 4 registers (64 bits) from the designated M register.

The bit equivalent to the non communicating slave terminal (ID) is ‘1’ and that of master, communicating or non allocated terminals are ‘0’.

Following is an example of setting.
### 4. I/O Signal Allocation

#### 4.5 Terminal Output Function (Only in Master Mode)

**Leading number of the register**
(MAC ID 0 to 15 error information: register 850 on the above window)

<table>
<thead>
<tr>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
</tr>
</tbody>
</table>

**Leading number of the register +1**
(MAC ID 16 to 31 error information: register 851 on the above window)

<table>
<thead>
<tr>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
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<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
</tr>
</tbody>
</table>

**Leading number of the register +2**
(MAC ID 32 to 47 error information: register 852 on the above window)

<table>
<thead>
<tr>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
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<tbody>
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<td>ID</td>
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<td>ID</td>
<td>ID</td>
</tr>
</tbody>
</table>

**Leading number of the register +3**
(MAC ID 48 to 63 error information: register 853 on the above window)

<table>
<thead>
<tr>
<th>15</th>
<th>14</th>
<th>13</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
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<td>ID</td>
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<td>ID</td>
<td>ID</td>
<td>ID</td>
</tr>
</tbody>
</table>
4.6 TERMINAL OUTPUT SETTING (Only in Master Mode)

This function enables to specify the number of non communicating slave terminals to M register when TERMINAL OUTPUT FUNCTION is used.

To utilize this function, set “ENABLE” to “TERMINAL OUTPUT FUNCTION” on the DN4-PCU setting window, then, to “M register” which is directly under “TERMINAL OUTPUT FUNCTION” column, set the M register’s leading number as the destination of the terminal output setting.

Then, set “ENABLE” to “TERMINAL OUTPUT SETTING”, then, to “M register” which is directly under “TERMINAL OUTPUT SETTING” column, set the M register’s leading number as its destination.

From the designated M register, the communication status is designated to output to 4 registers (64 bits).

Communication error is output when the bit equivalent to the non communicating slave terminal (ID) is set to ‘1’, and the error will not be output when the bit is set to ‘0’.

Following is an example of setting.
## I/O Signal Allocation

### 4.6 TERMINAL OUTPUT SETTING (Only in Master Mode)

Leading number of the register
(MAC ID 0 to 15: designation of output terminal: register 854 on the above window)

<table>
<thead>
<tr>
<th>ID</th>
<th>ID</th>
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<th>ID</th>
<th>ID</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Leading number of the register +1
(MAC ID 16 to 31: designation of output terminal: register 855 on the above window)

<table>
<thead>
<tr>
<th>ID</th>
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<th>ID</th>
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<th>ID</th>
<th>ID</th>
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<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>30</td>
<td>29</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>22</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>18</td>
</tr>
</tbody>
</table>

Leading number of the register +2
(MAC ID 32 to 47: designation of output terminal: register 856 on the above window)

<table>
<thead>
<tr>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
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<th>ID</th>
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<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>46</td>
<td>45</td>
<td>44</td>
<td>43</td>
<td>42</td>
<td>41</td>
<td>40</td>
<td>39</td>
<td>38</td>
<td>37</td>
<td>36</td>
<td>35</td>
<td>34</td>
</tr>
</tbody>
</table>

Leading number of the register +3
(MAC ID 48 to 63: designation of output terminal: register 857 on the above window)

<table>
<thead>
<tr>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>62</td>
<td>61</td>
<td>60</td>
<td>59</td>
<td>58</td>
<td>57</td>
<td>56</td>
<td>55</td>
<td>54</td>
<td>53</td>
<td>52</td>
<td>51</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>48</td>
<td>47</td>
<td>46</td>
<td>45</td>
<td>44</td>
<td>43</td>
<td>42</td>
<td>41</td>
<td>40</td>
<td>39</td>
<td>38</td>
<td>37</td>
<td>36</td>
</tr>
</tbody>
</table>
5 Network Specifications

5.1 Network Configuration

5.1.1 Network Connections

5.1.1.1 Connection Form

The following diagram shows the network connections.

Fig. 5-1: Network Connections

5.1.1.2 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.
5.1 Network Configuration

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 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.

5.1.1.3 Branching from the Trunk Line

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

Fig. 5-2: Branching from the Trunk Line

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

5.1.1.4 Branching from Drop Lines

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

Fig. 5-3: Branching from Drop Lines

(1) Single Branching
(2) Branching to Three Drop Lines
(3) Direct Node Connection
5.1.2 Precautions for Wiring DeviceNet Cables

5.1.2.1 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>
5  Network Specifications

5.1  Network Configuration

5.1.2.2 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.

5.1.2.3 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>

$L_{THICK}$: thick cable length, $L_{THIN}$: thin cable length
5. Network Specifications
5.1 Network Configuration

The above example must satisfy the following conditions.

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

The total drop line length must satisfy the following condition.

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

6.1  Location of Communication Power Supply

6.1.1  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.
6.1.2 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**

  ![Diagram 1](image1)

- **Nodes on One Side of the Power Supply**

  ![Diagram 2](image2)

Note: The “Nodes on Both Sides of the Power Supply” method is recommended if a single power supply is connected to many nodes.
### 6.1.3 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 6.1.1 “Basic Precautions” at page 6-1.
     - 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.

   ![Diagram of DeviceNet Communications Power Supply](https://via.placeholder.com/150)

   • 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.
Connections for DeviceNet Communications

6.1 Location of Communication Power Supply

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>

   ![Graph for thick cable](image1)
   ![Graph for thin cable](image2)
6 Connections for DeviceNet Communications

6.1 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 \leq B:

   the total current consumption “A” calculated in step 1 is equal to or less than the allowable maximum current “B” obtained in step 2, and the power supply capacity is sufficient for all the nodes.

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 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 210 m is used and the power supply is connected at the end of the trunk line.

**Diagram:**

- Terminator
- Trunk Line
- Node
- Communications Power Supply
- Total length of the power supply cable = 210 m
- Total current consumption of nodes = 0.2 A + 0.1 A + 0.05 A + 0.2 A + 0.15
6 Connections for DeviceNet Communications
6.1 Location of Communication Power Supply

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.

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

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

The maximum current on the left obtained from the graph = approx. 2.5 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 \( \sum [(Ln \times Rc + Nt \times 0.005) \times In] \leq 4.65 V \)
6 Connections for DeviceNet Communications

6.1 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: 11VDC to 25 VDC
• Allowable voltage range for the internal circuit power supply: 24 VDC - 15 % to + 10 %

Check the distance between the power supply and each node in addition to the total current consumption for the communications unit and the internal circuit of each node. If these values satisfy the following equation, sufficient power can be supplied to the node.

However, the current must not exceed the maximum allowable current to the cable, 8 A for a thick cable and 3 A for a thin cable.

**Equation** \( \sum [(L_n \times R_c + N_t \times 0.005) \times I_n] \leq 0.65 \text{ V} \)

\( L_n \) : 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
6.2 Grounding

6.2.1 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 Ω 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 Ω 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 Ω 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.
7  Error Indication

7.1  LED Indicators

On the SST-DN4-PCU board, the board status display LED: HLTH LED and the DeviceNet status display LED: COMM LED are provided.

In startup after the power is turned ON, HLTH LED and COMM LED light up in green and red alternately for LED test and then in green. If HLTH LED and COMM LED do not light up in green after a specified time with the power ON, the communication is not being performed correctly.

Even though the SST-DN4-PCU board is inserted into the PCI slot on the DX100, HLTH LED lights up in orange if the channel has been set to "NOT USED" in the option board setup.

HLTH LED also lights up in orange until the application software is activated after the power to the DX100 is turned ON, even though the option board and the I/O module are normally configured so that the SST-DN4-PCU board can be used in the DX100.
7.1.1 HLTH LED

HLTH LED indicates the status of the SST-DN4-PCU board.

<table>
<thead>
<tr>
<th>HLTH LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLTH unlit</td>
<td>Power loss</td>
<td>Check the connection of the SST-DN4-PCU board and the DX100 PCI slot.</td>
</tr>
<tr>
<td>HLTH lit in green</td>
<td>SST-DN4-PCU</td>
<td>The SST-DN4-PCU board operates normally.</td>
</tr>
<tr>
<td></td>
<td>board in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>normal state</td>
<td></td>
</tr>
<tr>
<td>HLTH lit in red</td>
<td>Error state</td>
<td>The SST-DN4-PCU board does not operate correctly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Turn OFF and ON the DX100 main power to start the system again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the connection of the SST-DN4-PCU board and the DX100 PCI slot.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace the SST-DN4-PCU board.</td>
</tr>
<tr>
<td>HLTH lit in orange</td>
<td>Pre-operation</td>
<td>Although the self-diagnosis at the start-up has finished successfully, the following processes</td>
</tr>
<tr>
<td></td>
<td>state</td>
<td>have not been performed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check the DeviceNet communication settings.</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 (\Omega)) 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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I/O allocated points.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace the SST-DN4-PCU board.</td>
</tr>
</tbody>
</table>
### 7.1.2 COMM LED

The COMM LED indicates the status of DeviceNet.

<table>
<thead>
<tr>
<th>COMM LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
</table>
| COMM unlit          | In offline status             | The connection failure between the SST-DN4-PCU board and the DX100 PCI slot, communication power supply failure, or DeviceNet line failure occurs.  
• Check the connection of the SST-DN4-PCU board and the DX100 PCI slot.  
• 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 terminator value (121 Ω) of the mounted terminator and its mounted status.  
• Check the operation status of the DeviceNet master device. |
| COMM 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 terminator 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. |
| COMM lit in green   | Communication in normal status | Communication is established in online.                                                                                                                                                                                                                  |
## Error Indication

### 7.1 LED Indicators

<table>
<thead>
<tr>
<th>COMM LED</th>
<th>Status</th>
<th>Indications and Corrective Actions</th>
</tr>
</thead>
</table>
| COMM blinks in red        | Time-out error      | A time-out error occurs between the DX100 and the connected device.  
• Turn OFF and ON the DX100 main power to start the system again.  
• 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 terminator 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.  
• Extend the scanning interval for the communications cycle of the master device, and recheck communications. |
|                           |                     |                                    |
| COMM lit in red           | Communication fatal error | A node address is overlapped, or a Bus-off is detected on the network.  
• Turn OFF and ON the DX100 main power to start the system again.  
• 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 terminator value (121 Ω) of the mounted terminator and its mounted status.  
• Check the transmission distance.  
• Check if there is no noise generating factor.  
• Replace the SST-DN4-PCU board. |

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**SST-DN4-PCU Board**

**7** Error Indication  
**7.1 LED Indicators**

**COMM LED**

**COMM blinks in red**

**COMM lit in red**
8 Restrictions

8.1 DN4-PCU Board

Those are the restrictions on the DX100 software versions DN4-PCU board is available.

<table>
<thead>
<tr>
<th>Software version</th>
<th>DN4-PCU board</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earlier than DS3.30-00</td>
<td>Not available</td>
<td>Use DN3-PCU board in this software version.</td>
</tr>
<tr>
<td>DS3.30-00 or later</td>
<td>Available</td>
<td>In this software version, DN3-PCU board and DN4-PCU board are available.</td>
</tr>
</tbody>
</table>

8.2 Remarks when Replacing the Board

The board must be the same type of the board to replace. (DN3-PCU board should be replaced by DN3-PCU board, and DN4-PCU board should be replaced by DN4-PCU as well.)
Specifications are subject to change without notice for ongoing product modifications and improvements.