

**Motoman NX100 Controller**

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**DeviceNet PCI Card  
Instructions Manual**

Part Number: 151799-1CD  
Revision: 0



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## Chapter 1

# Introduction

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This manual provides instructions for the Motoman DeviceNet PCI Interface cards (P/N 150216-1, and 150217-1). The application of this board allows the transmission of NX100's general-purpose I/O data with other devices connected to DeviceNet.

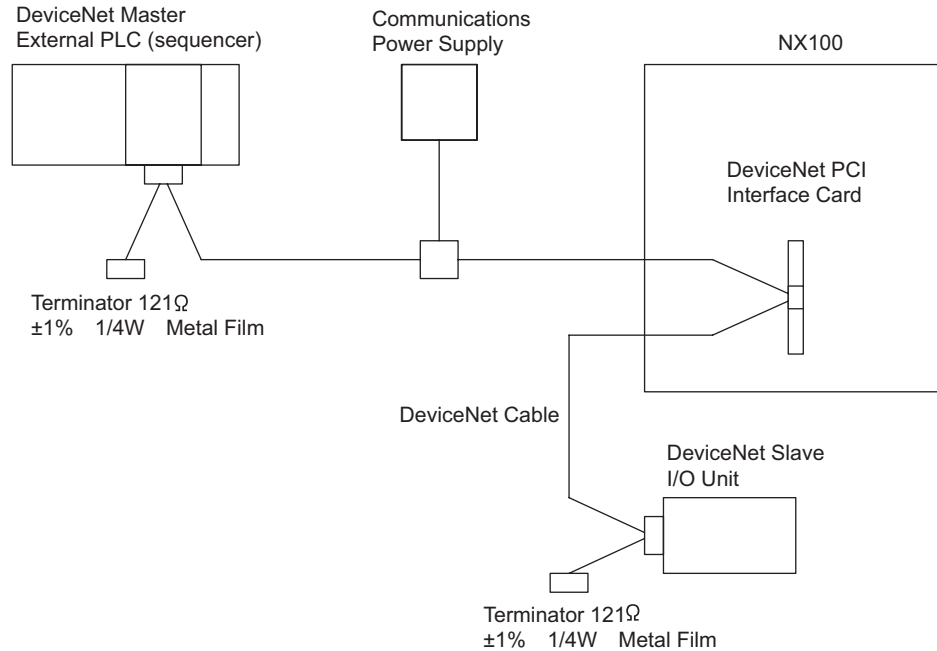
DeviceNet™ is an open low-level network that provides connections between simple industrial devices (such as sensors and actuators) and higher-level devices (such as robot controllers and computers). The DeviceNet network uses the proven Common Industrial Protocol (CIP) to provide the control, configure, and data collection capabilities for industrial devices. The DeviceNet network is a flexible network that works with devices from multiple vendors.

## 1.1 System Configuration

The PCI DeviceNet interface cards interface with the NX100 controller, and do not require an I/O expansion rack. The 150216-1 card has two channels, which allows the card to be configured simultaneously as a Master and/or Slave interface. The 150217-1 single-channel card can be configured either as a Master or Slave interface. Both cards are capable of addressing 64 words of input and output data, (robot available I/O is dependent on controller application). Each channel can be configured at 125 k, 250 k, or 500 k baud. Messaging type supported: Polled.

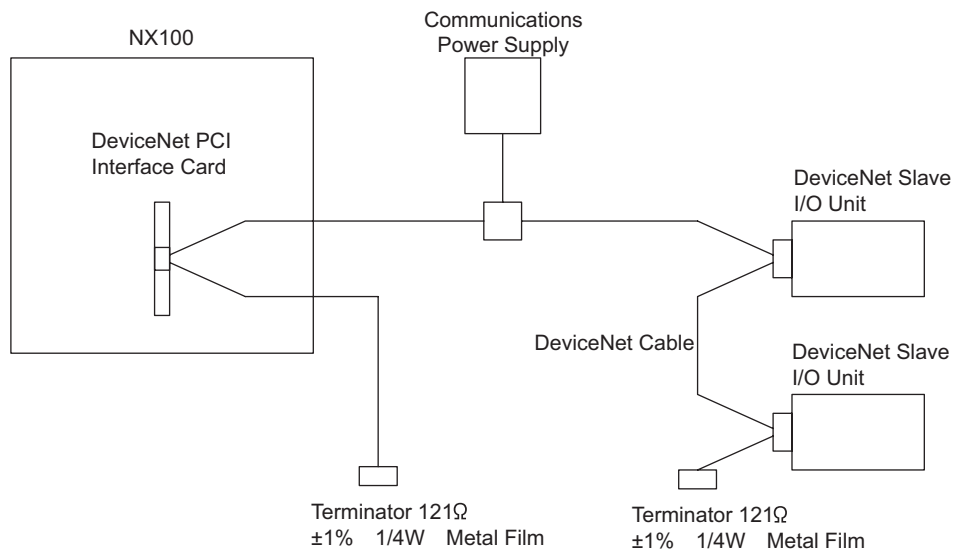
The following diagrams show sample DeviceNet PCI card trunk line configurations and are intended for study purposes only. For more information on DeviceNet configurations, please contact the Open DeviceNet Vendor Association, Inc. (ODVA) at [www.odva.org](http://www.odva.org).

DeviceNet PCI card trunk line configured as a Slave interface:



*Note: DeviceNet cables and terminators are not provided. When the DeviceNet PCI card is connected at the end of a network, connect a terminator externally. Incorrect connections of the terminators may result in improper communications. Power line and external power supply not shown.*

DeviceNet PCI card trunk line configured as a Master interface:



## 1.2 About This Document

This manual provides system information for the DeviceNet PCI interface cards and contains the following sections:

### **SECTION 1 - INTRODUCTION**

Provides general information about the structure of this manual, a list of reference documents, and customer service information.

### **SECTION 2 - SAFETY**

This section provides information regarding the safe use and operation of Motoman products.

### **SECTION 3 - DEVICENET PCI CARD INSTRUCTIONS**

Provides detailed instructions for DeviceNet PCI Card, including installation, specifications, and operation.

## 1.3 Reference to Other Documentation

For additional information refer to the following:

- NX100 Controller Manual (P/N 149201-1)
- Concurrent I/O Manual (P/N 149230-1)
- Operator's Manual for your application
- Vendor manuals for system components not manufactured by Motoman

## 1.4 Customer Service Information

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

- Product (DeviceNet PCI Card serial number)
- Robot Type (EA1900N, HP5, etc.)
- Application Type (arcwelding, spot welding, handling, general)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back of controller)

# NOTES



## Chapter 2

# Safety

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### 2.1 Introduction

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

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We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

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

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

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

This safety section addresses the following:

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

## 2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.



### **DANGER!**

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



### **WARNING!**

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



### **CAUTION!**

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



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

## 2.3 General Safeguarding Tips

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

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

## 2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

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

## 2.5 Installation Safety

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

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

## 2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.
- Check and test any new or modified program at low speed for at least one full cycle.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

# NOTES

## Chapter 3

# Hardware Specifications

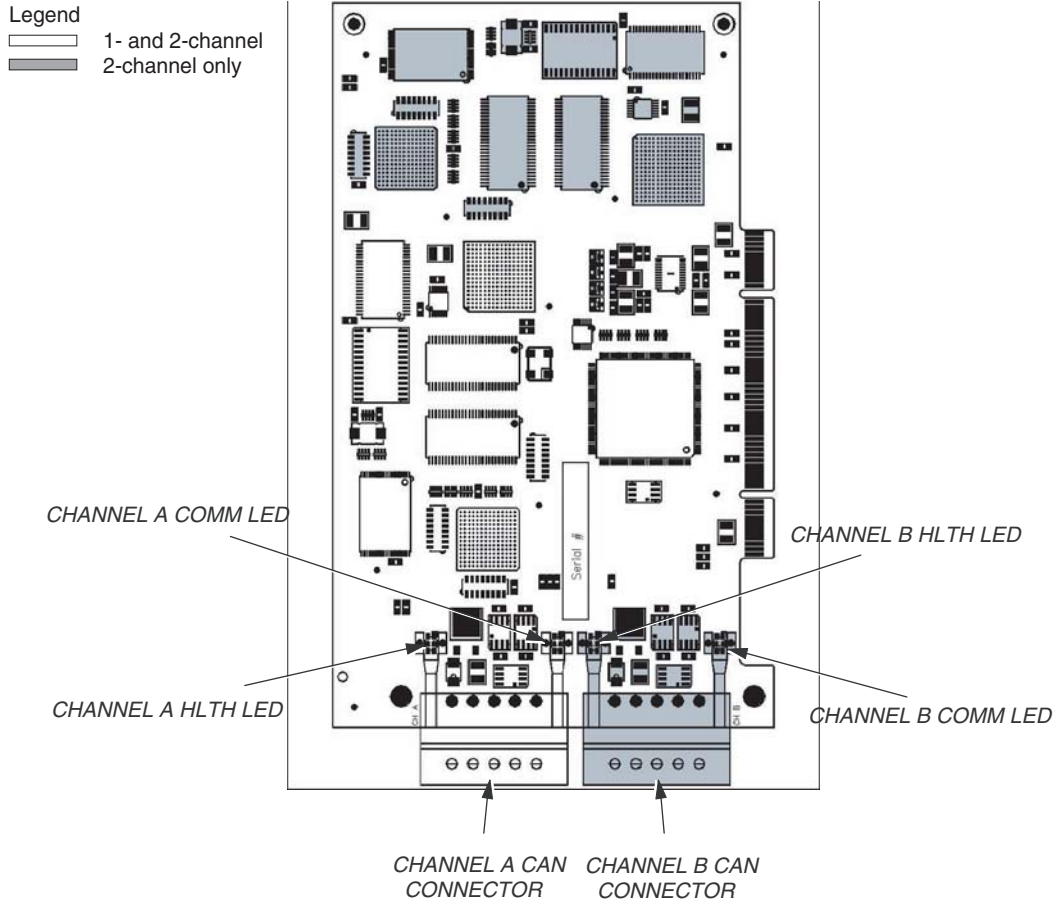
When the card is configured in the controller, the first byte of data from each channel is a status byte. The information defined in each byte is outlined in the chart below:

Signal	Description
2xxx0 2xxx3 (bit 0 to 3)	Reserved
2xxx4 (bit 4)	Not used, always set to zero
2xxx5 (bit 5)	In Slave mode Not used, always set to zero  In Master mode 0: Communication to all slave nodes normal 1: Communication error to slave node(s)
2xxx6 (bit 6)	DeviceNet Communication Status 0: Normal, 1: Error
2xxx7 (bit 7)	DeviceNet board status 0: Normal, 1: Error

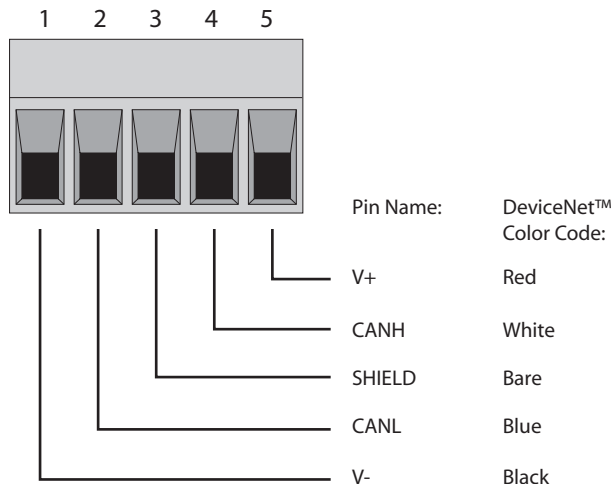


*Note: Not all PLC systems are capable of passing 64 words of data. Consult the PLC owner's manual to determine system maximum I/O capability.*

### 3.1 Card Components

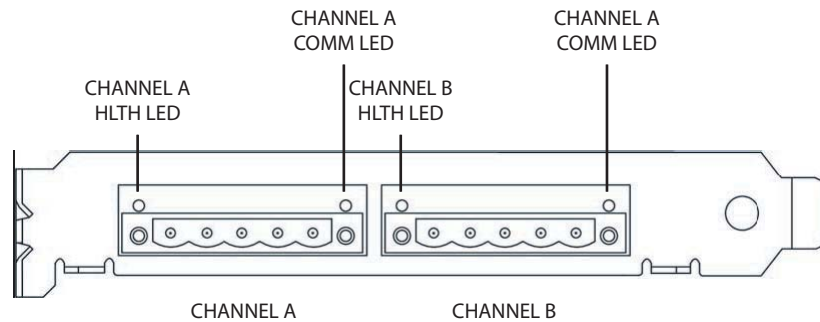


The 5-pin connector is a standard removable connector that conforms to the standard DeviceNet pinout. Pin numbers, names and color codes are identified in the figure below.





There are two LEDs per channel: Health (HLTH) and Communications (COMM).



The HLTH LED indicates the channel's health status. The HLTH LED's behavior is described in the following table.

Color	Status
Off	Card Initialization failed or the card is not powered.
Green	The firmware is loaded and running.
Red	The card has not loaded, an error occurred during the load or there is a firmware run-time error.
Amber	Startup self-test complete; no firmware loaded. The firmware must be reloaded.

The COMM LED indicates the network's health status. The COMM LED's behavior is described in the following table.

Color	Status
Green	Established Connection
Flashing Green	Ready for Connection
Flashing Red	Connection Time-Out
Red	Connection Not Possible

# NOTES

## Chapter 4

# Installation

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The following procedures outline how to configure the two channel DeviceNet card (P/N 150216-1) with Channel 1 in a Slave configuration, and Channel 2 in a Master configuration. Configuration of the single channel card (P/N 150217-1) can be accomplished in a similar method.

The settings below should only be used if the end-user has not specified the card configuration.

### 4.1 Materials

- Two Channel DeviceNet Card (P/N 150216-1)
- Single Channel DeviceNet Card (P/N 150217-1)

- Includes DeviceNet Card and SST User Manual on CD

#### 4.1.1 Board Settings

No board settings are required.

#### 4.1.2 Card Installation



**DANGER!**

**Remove all power from the controller before installing the DeviceNet PCI Card! Failure to remove power may result in injury or death!**



**WARNING!**

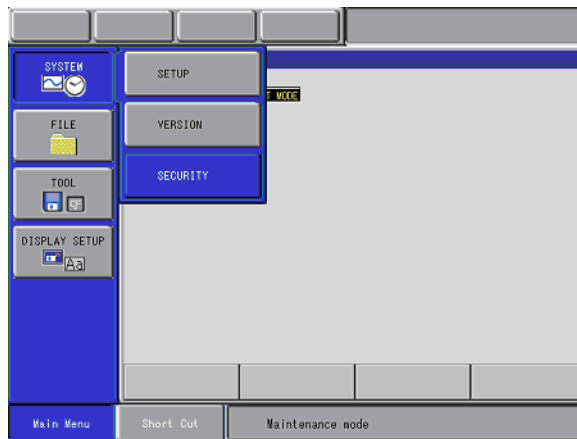
**Follow all Electrical Static Discharge procedures, including use of anti-static straps, to avoid damage to the board. Never touch the mounting surfaces of the board parts directly with fingers.**

1. Remove PCI card from static shielding bag.
2. Insert card in the NX100's CPU rack slot: CPU OPTION 1.
3. Secure card with M3 x 10 screw.

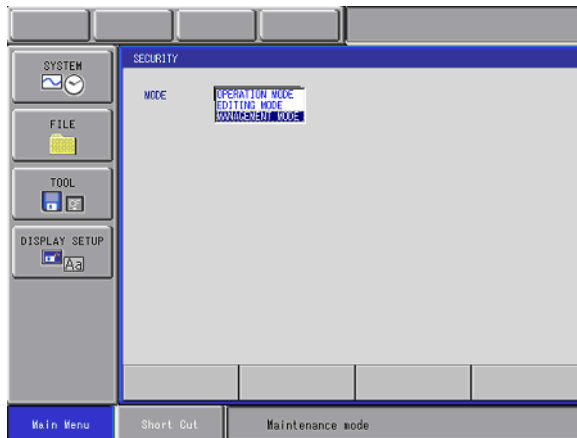
## 4.2 Card Configuration

The NX100 controller must be properly configured to use the DeviceNet PCI Card. The following modifications require the user to be in Maintenance Mode with Management Mode selected. Make certain DeviceNet PCI card is correctly mounted inside NX100 controller and NX100 main power supply is OFF before proceeding.

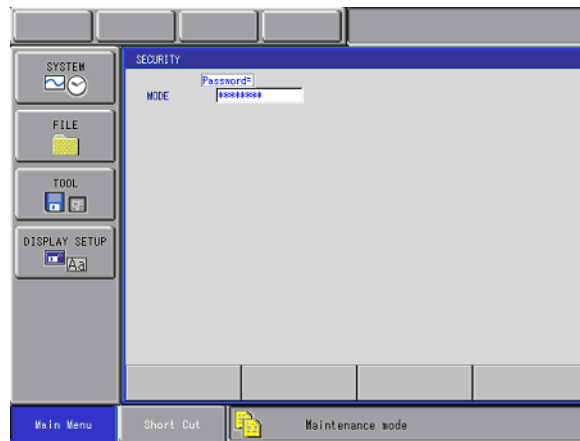
1. Turn ON main power to NX100 while simultaneously pressing the Main Menu button on the programming pendant. The Main Menu appears.
2. From the Main Menu select System > Security.



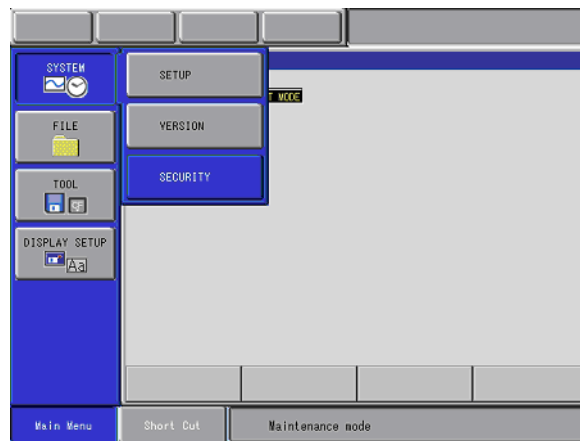
3. Select Management Mode.



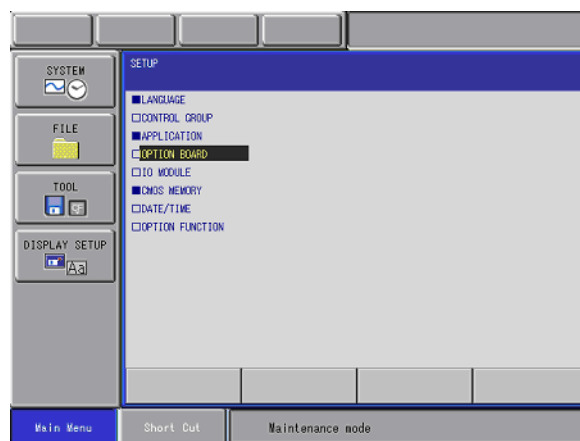
4. Enter password 999999.



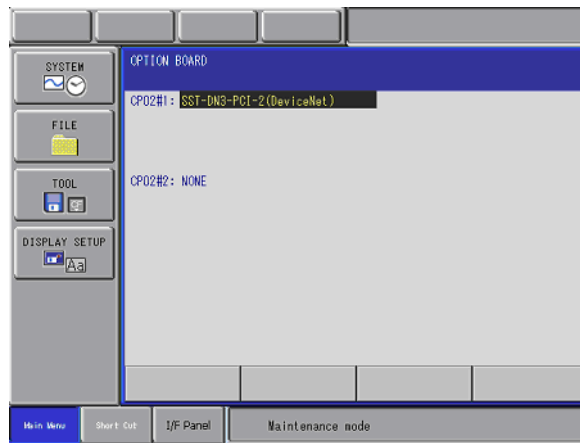
5. Select System > Setup.



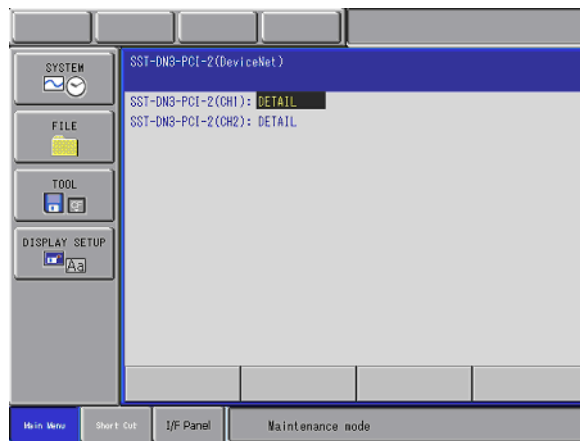
6. Select Option Board.



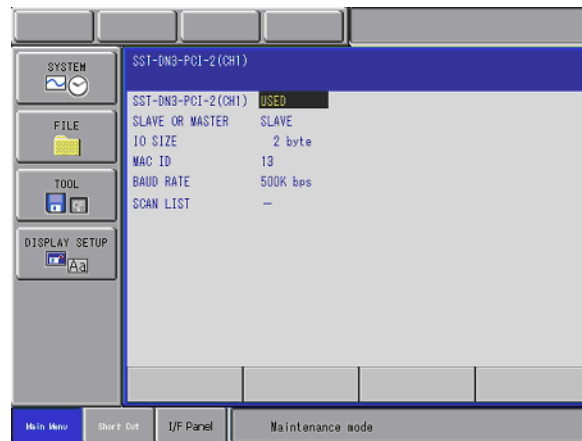
7. Board should be identified in slot CP02#1. Select card.



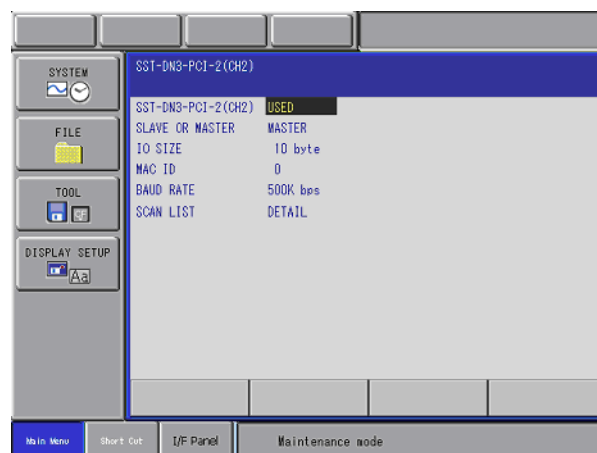
8. CH1 and CH2 should be displayed. Select CH1.



9. Configure Slave Channel as follows:



- a. Change SST-DN3\_PCI-2(CH1) from UNUSED TO USED.
  - b. At SLAVE OR MASTER select SLAVE.
  - c. Set IO SIZE to 2 (number of bytes to be transferred).
  - d. Set MAC ID to 13 (device's network ID#).
  - e. Set BAUD RATE to 500 ((125, 250, 500) must match master setting).
  - f. SCAN LIST not used in slave device.
  - g. Press Enter to return to previous menu.
10. Configure Master Channel as follows:



- a. Change SST-DN3\_PCI-2(CH2) from UNUSED TO USED
- b. At SLAVE OR MASTER select Master
- c. Set IO SIZE to 10 (number of bytes to be transferred).
- d. Set MAC ID to 0 (Since this channel is Master of the network)
- e. Set BAUD RATE to 500 (125, 250, or 500)
- f. Select SCAN LIST. The SCAN LIST screen appears.

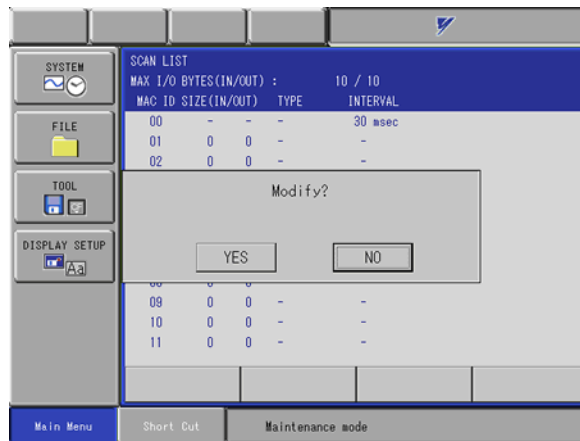


- g. Scroll to desired MAC ID address.
- h. Arrow over to IN/OUT column and press Select.
- i. Enter device size for IN/OUT.
- j. Select TYPE.

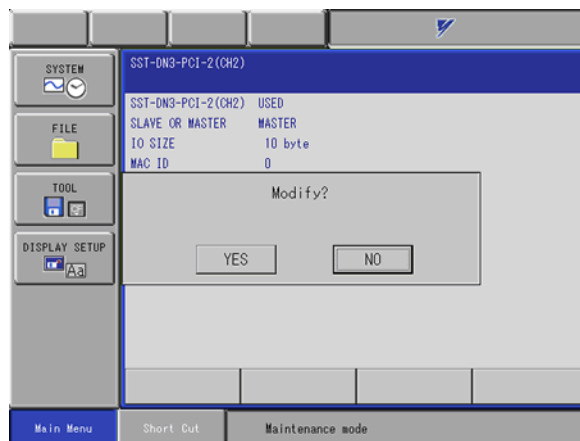




- k. When all devices have been added to the list, Press Enter. The Modify prompt appears.

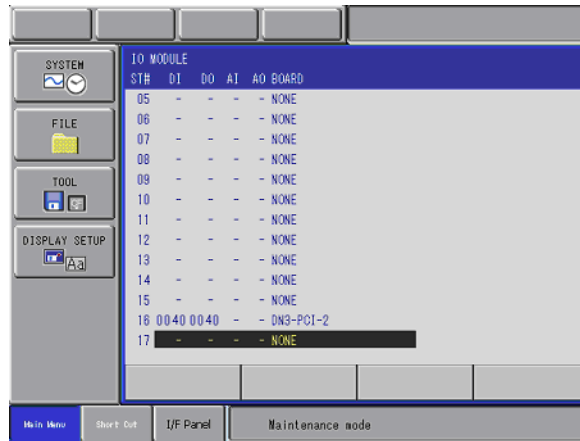


- l. Select YES and press Enter.



- m. Select YES again and press Enter.

11. I/O MODULE MENU
  - a. I/O Module menu appears below.
  - b. I/O should equal (2)Status Bytes + Slave I/O + Master I/O
  - c. Press Enter ->YES -> Enter



## 4.2.1 EDS FILE FOR SLAVE MODE

When the card is setup for the master mode as described above, EDS files are not required for each slave device. However the user must know how much I/O is consumed by each device. If the board is setup for slave mode and a PLC is the master, a high level network setup software will probably be used (RSNetworkx™), which will require an EDS file for each slave device.



*Note: Generic EDS files have been supplied with the DeviceNet PCI card.*

Without the card connected to a network, complete validation of the card is not possible. However, card health can be determined by verifying that LED1 and LED2 are green.

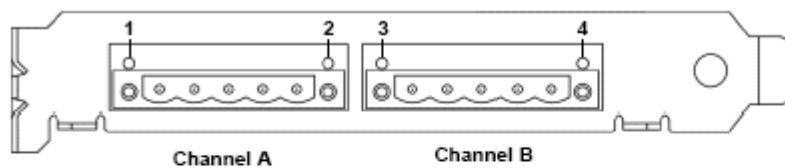


Table 3: LED Descriptions

Feature	Description
1	Channel A HLTH LED
2	Channel A COMM LED
3	Channel B HLTH LED
4	Channel B COMM LED

# NOTES

## Chapter 5

# Network Configurations and Connections

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For information on network configurations and connections for DeviceNet communications, please refer to the ODVA Planning and Installation Manual DeviceNet™ Cable System (PUB00027R1) located at [www.odva.org](http://www.odva.org).

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