2576

DEVICENET SCANNER

INSTALLATION AND OPERATION GUIDE

Version 1.2

CTI Part # 062-00230-012

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REVISION HISTORY

Version 1.0	10/28/98	Original Release
Version 1.1	02/12/99	Changed PLC Programming chapter name to Status Monitoring Added reference to scanner status data to Status Monitoring Chapter Added more performance tips to configuration chapter Included additional problem situations in Troubleshooting chapter Revised text in several places to improve clarity.
Version 1.2	12/16/99	Updated screen depictions and text to reflect changes in Dsc2576 configuration software, including deletion of the Response Timeout variable and change from user specified memory block update interval to PLC scan triggered memory block update Added CAN error message information.

PREFACE

This ***Installation and Operation Guide*** provides installation and operation instructions for the CTI 2576. The information in this manual is directed to individuals who will be installing, maintaining, and troubleshooting the module.

This manual assumes that you are familiar with the installation and operation of SIMATIC® 505 programmable controllers. Please refer to the appropriate SIMATIC® user documentation for specific information on SIMATIC® 505 programmable controllers and I/O modules. It also assumes that you are familiar with installing and configuring DeviceNet networks.

USAGE CONVENTIONS

NOTE:
Notes alert the user to special features or procedures.

CAUTION:
Cautions alert the user to procedures that could damage equipment.

WARNING:
Warnings alert the user to procedures that could damage equipment and endanger the user.

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CHAPTER 1. OVERVIEW

1.1. Product Summary

The 2576 DeviceNet Scanner is a SIMATIC® 505 module that enables the PLC to access devices on a DeviceNet network. The 2576 module writes data supplied by the PLC to DeviceNet devices and obtains data from these devices and presents it to the PLC as standard I/O.

Since DeviceNet data appears to the PLC as standard data types, no special PLC programming techniques are required to access the DeviceNet devices. Using a CTI-supplied configuration program, the user can specify how device data will appear to the PLC. Inputs from the device may be mapped to X, WX, or V memory locations. Outputs to the device may be mapped to Y, WY, or V memory locations.

To maximize performance and provide maximum flexibility, the 2576 logs into the PLC as two I/O slots - a high-density I/O slot and a special function slot. The high-density I/O interface provides 32 discrete-in (X), 32 discrete-out (Y), 32 word-in (WX) and 32 word-out (WY) data points. The Special Function interface can transfer up to 480 words per PLC scan. It can also be used by the PLC to send special commands to the module.

The module DeviceNet port can operate at baud rates up to 500Kb. A serial port provides a means to download configuration record and software updates. The front panel includes a complete set of LEDs that display module and DeviceNet status. The module also includes a DeviceNet power tap, which allows the user to connect a power supply to the network.

Figure 1. 2576 DeviceNet Scanner

1.2. CTI 2576 Operating Concepts

Data Transfer

The 2576 module utilizes two processor units. The DeviceNet Scanner processor (DNS) is dedicated to scanning the DeviceNet nodes while the DeviceNet Module processor (DNM) performs PLC interface and supervisory functions. A shared memory interface, containing the Data Table, allows the two processors to communicate with each other. See Figure 2 below.

The DeviceNet Scanner processor transfers data between the Data Table and the DeviceNet network. Configuration data passed to the DeviceNet Scanner processor at startup defines which devices will be accessed, how often they will be scanned, and where each device's data will be stored in the Data Table.

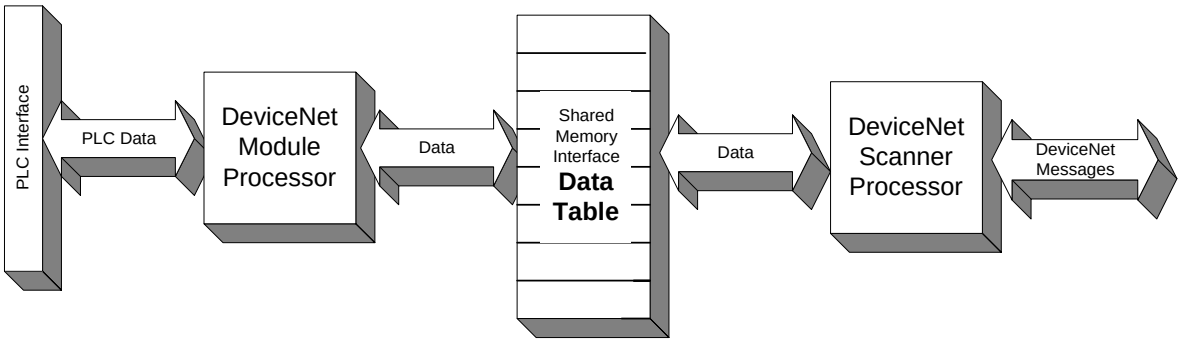


Figure 2. 2576 Block Diagram

The data table is organized into 32 blocks of 128 bytes each. The first eight blocks are used for transferring data via the Special Function interface. Block 31 contains I/O data which will appear as inputs to the high-density I/O interface (X and WX). Block 32 contains I/O output data from the high-density interface (Y and WY). The remaining blocks are reserved for future use.

The supervisory processor transfers data between the Data Table and the PLC. This processor also manages the operation of the entire module. All device data written to a single Data Table block will be transferred to the PLC at the same time. Thus, all I/O inputs (X and WX) and outputs (Y and WY) will be processed by the PLC as a group. All data within single memory block will also be transferred to the PLC at the same time.

High-Density I/O Interface

The High-Density I/O interface transfers data between the module data table and the PLC I/O image register every scan. PLC inputs (X, WX) are read from the data table and PLC outputs (Y, WY) are written to the data table. To the PLC, this interface appears to be a standard high-density module. This interface can transfer up to 32 X, 32 Y, 32 WX, and 32 WY data elements. Although limited in the number of elements transferred, the high-density interface provides the best I/O update performance.

Special Function I/O Interface

The Special Function I/O Interface transfers blocks of data between the module and the PLC using Special Function requests. Up to eight blocks of 60 data words can be read or written to the PLC in a single scan. Although this interface allows much more data to be transferred than the high-density interface, it may require additional PLC scans to transfer a block of data between the PLC and the module shared memory interface.

DeviceNet Scanning Characteristics

The DeviceNet scan operates asynchronously with the PLC scan. Thus, the 2576 can be reading data from DeviceNet nodes while the PLC is solving logic. When the PLC reads input data from the module data table, it receives the most recent data that has been read. Similarly, when the DeviceNet scanner reads output data from the data table, it receives the last value written by the PLC.

The scanner configuration includes a Scan List, which identifies all devices that the scanner should scan. When the scanner is started, it will attempt to connect to each active device in the Scan List. Upon connecting to each device, the scanner will read identity object attributes from the device and compare them with values specified by the user in the configuration program. If the values match, the scanner will begin I/O communications with the device.

The scanner configuration allows the user to specify a fixed scan interval. This interval is the elapsed time between the start of one scan and the start of following scan. The scanner begins a scan by sending out all strobe and poll messages defined in the configuration. As devices answer, their responses are placed in an input buffer. When all strobe and poll messages have been sent, the scanner retrieves the responses from the input buffer and maps this data to the shared memory interface as specified in the configuration program. Assuming the scan interval is longer than the time required for the I/O operation the module will remain idle until it is time to start the next scan.

CAUTION:

You must set the scan time to a value large enough to allow all messages to be sent and responses processed. If more time is required to send the polls and process the response than allotted in the scan time interval, the module will extend the scan long enough to process all of the responses in the input buffer and will indicate a Scan Over-run error condition.

The rate at which individual devices are polled is user configurable. For most devices in the control application, the devices should be polled every scan. However, for devices that are slow to respond, provide data that changes slowly, or serve as data collection devices, you may choose to poll the device less often. For example, you might choose to poll a certain device every 5th scan. A poll message would be sent to this device every 5th scan and the device would have up to five scans to respond before being polled again.

Device Connection Loss and Recovery

The scanner expects that a device will transmit data to the scanner within a timeout period, based on the rate at which the device is being scanned or the interval in which the device is expected to send a cyclic or change-of-state message. If the device fails to respond, the module will set the appropriate error bits and periodically attempt to re-connect to the device.

Data Mapping

The process of transferring data between DeviceNet messages and PLC data elements is called *data mapping*. DeviceNet data is contained in messages that consist of one or more eight-bit bytes. The device vendor determines the content of the message. The vendor may use an ODVA standard data assembly or use a vendor specific format.

For example, assume a proximity sensor transmits one byte of data where the first bit contains the Sensor State (On or Off) and the second bit contains the Device Status (OK or Fault). A data map will be used to specify which PLC data element will contain the Sensor State and which will contain the Device Status. Using the CTI-supplied configuration program, you choose to map the Sensor State bit to X20 and the Device Status bit to X21. See Chapter 3 for additional details.

1.3. DeviceNet Concepts

DeviceNet is an industrial I/O network based on CAN technology. CAN is a network in which any node may transmit if the bus is not busy. If two or more nodes begin transmitting at the same time, the message with the lowest CAN ID will complete the transmission. DeviceNet adds a layer above CAN that allows logical connections to exist among nodes and defines message formats. A single DeviceNet node may have up to 64 nodes, each with a unique address (MAC ID). DeviceNet supports baud rates of 125, 250, and 500 KB. As the baud rate increases, the maximum allowable distance decreases.

DeviceNet allows for explicit message connections and I/O message connections. Explicit messages are typically used for device configuration and diagnostics. I/O messages are used for transferring control information. Most devices use the predefined Master Slave connection set for I/O messaging. This set provides for strobed, polled, change of state, or cyclic transmissions. When a strobed connection is used, the master sends one strobe message to which all enabled slaves respond. With a polled connection, the master sends individual poll messages to each device and expects a response from each device. Change-of-State or Cyclic connections do not require a command from the master. A slave device using a change of state connection sends data when the device detects a change in the monitored value(s). A slave device with a cyclic connection sends data on a fixed time interval.

1.4. Getting Started

The following list may be used as a guideline in preparing for your DeviceNet installation.

Select DeviceNet devices

During the process of designing your application you will choose devices that meet your particular requirements. Since DeviceNet is an open network standard, you may choose any device that is DeviceNet compliant. If you have a question about device compliance you may consult your vendor or contact ODVA.

Obtain Data about the devices

The vendor of each device you select should provide information regarding its DeviceNet capabilities in the form of written data or an electronic data sheet. You will need to know the following device characteristics, if you wish to have the 2576 verify them before connecting:

- Device Type
- Device Vendor
- Product Code
- Revision Level
- Serial Number

You must know the following information to configure the 2576:

- How the device implements I/O connections (strobed, polled, cyclic, or change of state).
- The sizes of the I/O messages consumed and produced.
- The data format for the I/O messages or I/O assembly being used.
- Maximum baud rate of the device.

Chapter 3. Configuration describes the configuration process.

Determine Network Topology

You will need to determine whether all devices will be in one network or whether you will use multiple DeviceNet networks attached to your PLC. You may decide to have multiple networks per PLC for several reasons:

- You want to improve overall performance by distributing the devices over several networks.
- You want to attach more than 63 devices (excluding the scanner).

If you choose to attach multiple networks, you will need to install a CTI 2576 module for every network. Except for unusual cases, you will want to connect less than the maximum number of devices to leave room for attaching configuration tools and to allow for application expansion.

Once you have decided on the topology, you will want to decide how you will assign MAC IDs to the devices. Every device on one network must have a unique MAC ID from 0 – 63.

Determine how DeviceNet Data will be mapped to the PLC

The documentation for each device will indicate the format of the I/O messages it sends (produces) and receives (consumes). Many devices will allow you to select among several data formats. The selectable formats are called *I/O assemblies*. The particular I/O assembly that a device uses is established when the device is configured.

Install a test DeviceNet network

If this is the first time you have used certain devices, you will probably want to create a test network with at least one of each device. This will allow you to test your scanner configuration and determine how you will configure each device. Once you have tested each device, you can replicate much of the configuration information for additional devices. When establishing your test network, ensure that the physical topology meets the DeviceNet specifications, including installation of required termination resistors.

Configure the DeviceNet devices

For each device being used you will need to set its MAC ID and baud rate. Every device must have a unique MAC ID. All baud rates must be the same. Some devices may use switches to set these parameters; others will require a configuration program. Some devices will require additional configuration, such as setting the I/O assemblies used.

Install CTI 2576 Scanner

The CTI 2576 will be installed in a standard SIMATIC® 505 rack. For best PLC I/O performance, you should install it in a local rack. Chapter 2 explains how to install the scanner and how to include it in the PLC I/O configuration.

Configure CTI Scanner

Before you can use the 2576 module, you must configure it for use with your particular DeviceNet network and PLC application. Configuration is accomplished using a personal computer and a CTI supplied Windows program. *Chapter 3. Configuration* describes how to run the configuration program. The module is designed so that it can be configured off-line using a standard PC serial port. The module does not have to be attached to a network; the PC is not required to use any special network card.

Operational Testing

Initial testing may involve only a few devices and a test network. During this phase of testing you will want to ensure that the scanner is properly connecting to the devices and that the device data is mapped properly. If you have problems, refer to *Chapter 6. Troubleshooting* for suggestions in correcting the problem.

Final testing will include all nodes on the network. During this phase you will ensure that network loading and response time meets the application requirements. Obviously, you will also be testing the application logic and system operation.

CAUTION

You must ensure that the DeviceNet network has been installed according to ODVA specifications. Conditions such as incorrect termination, loose wiring, excessive length, or improper power, can affect operational reliability.

CHAPTER 2. INSTALLATION

The installation of the Module consists of the following steps:

1. Planning the installation,
2. Unpacking and configuring the module,
3. Physical installation,
4. Connecting cables,
5. Checking the module operation.

2.1. Installation Planning

Before you begin the installation, you should have completed your planning for your DeviceNet network. This activity includes:

- Selecting your devices, cabling, and power supply.
- Deciding on the number of networks required and the number of nodes on each network.
- Determining the data format (I/O Assembly) that will be used by each device.
- Selecting a software tool to configure your devices, if required.

You should ensure that you have adequate space and power available for the module. The 2576 module is a doublewide module that draws 7 watts at 5 VDC from the backplane. Multiple 2576 modules may be installed in the same rack, subject to space and power supply limitations. The 2576 module may be installed in a local base or a remote base using SIMATIC® 505 remote I/O. Installation in remote bases using Profibus DP is not supported, since this I/O link does not allow Special Function modules. Installation in a local base typically results in better PLC I/O performance. To comply with DeviceNet specifications, the DeviceNet transceiver draws power from the DeviceNet itself. This interface consumes a maximum of 100 milliamps.

You will need a serial cable to be used with a PC for configuring the module. A cable used to attach to the PLC programming port will also work with the 2576. You will also need to connect to a DeviceNet network. See Appendix A for cabling details.

2.2. Unpacking the Module

Open the shipping carton and remove the special anti-static bag that contains the module. After discharging any static build-up, remove the module from the static bag. Do not discard the static bag. Always use this bag for protection against static damage when the module is not inserted into the I/O base.

CAUTION:
The components on the 2576 module can be damaged by static electricity discharge. To prevent this damage, the module is shipped in a special anti-static bag. Static control precautions should be followed when removing the module from the bag and when handling the printed circuit card during configuration.

2.3. Physical Installation

Inserting the Module into the I/O Base

Ensure that power to the base is off. Hold the top and bottom of the bezel and slide the module carefully into the slot, pushing it all the way into the base. If you have inserted the module correctly, you will feel a slight increase in resistance as the module mates with the base backplane connector. Once the module is fully seated in the slot, tighten the captive screws at the top and bottom to hold the module in place. To remove the module from the I/O base, remove power from the base, loosen the captive screws, and then remove the module. Take care not to damage the connector at the back of the module when inserting or removing the module.

Power Up

After power is applied, the module will complete a self-test and go through a series of start up phases. During each phase, the scanner will change the states of the front panel LEDs to indicate progress. See *Chapter 4. Operation* for a complete description of the module LEDs.

Checking PLC Login

When the module is first installed in the PLC, it must be entered in the PLC I/O configuration. The 2576 logs in as two slots, a high-density mixed I/O slot ***and*** as a Special Function slot. The first module slot will appear as a high-density module with 32X, 32Y, 32WX, and 32 WY. The second module slot will appear as a Special Function module with 2WX and 6WY. To view the PLC I/O configuration chart, refer to your SIMATIC® 505 Programming Manual.

NOTE:
You should record the beginning I/O address of the high-density slot. You will need this information when you configure the scanner data map.

2.4. Connecting Cables

Connect the DeviceNet cabling from the 2576 port to the DeviceNet network with which you wish to communicate. Optionally connect the external power cable if needed, to supply 24VDC to the network. See Appendix A for port pin-out and cable wiring examples.

2.5. Configuration

Before you can use the 2576 DeviceNet Scanner, you must configure it using a CTI supplied program. The configuration program will be used to specify which nodes will be scanned, how the devices will be accessed, and where DeviceNet data will be mapped within PLC memory. See *Chapter 3. Configuration*.

CHAPTER 3. CONFIGURATION

3.1. Overview

Before the 2576 can be used, it must be configured for use with your DeviceNet network. CTI supplies a PC application that you may use to create a configuration file for the 2576 module. The configuration may be created off-line then downloaded to the module. Once downloaded, the configuration file is stored in non-volatile (flash) memory on the 2576.

The configuration display includes a menu/button bar, a Scan List window, and a set of configuration tabs. The menu/tool bar lets you select the various program functions. The Scan List window displays a list of the devices in the scan list. The tabs allow you to specify:

- General Scanner Configuration Parameters
- Device Information
- Data Mapping Specifications

3.2. Scan List Window

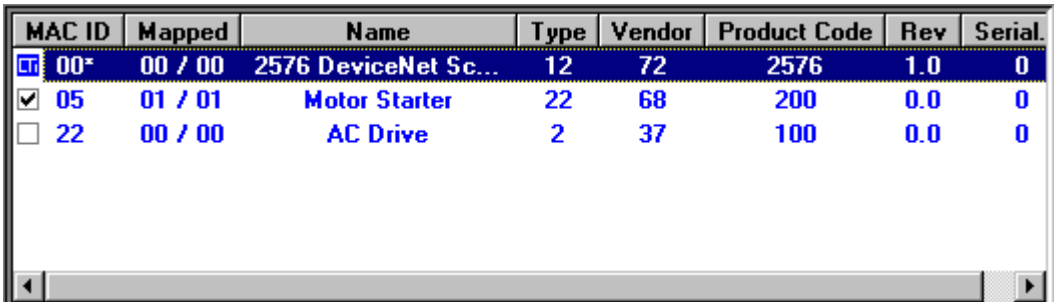


Figure 3. Scan List Window

The scan list window will display information about the devices in the scan list. The 2576 DeviceNet Scanner will always appear in the scan list. It is indicated by the CTI logo next to the device list entry. The Window displays the following information:

Check Box:	Checked if the device is active or not checked (blank) if the device is inactive.
MAC ID:	Displays the current MAC ID configuration setting for the device.
Mapped:	Indicates whether you have created mapping records for the device. The number to the left of the slash indicates the number of input maps in use. The number on the right side of the slash indicates the number of output maps in use. 00 indicates that no map of that type exists. Note: this value is not updated until changes have been applied.
Name:	Displays the descriptive name entered during configuration.
Type:	Displays the device type selected during configuration.
Vendor:	Displays the vendor number selected during configuration.
Product Code:	Displays the device product code entered during configuration.
Revision:	Displays the product revision entered during configuration.
Serial:	Displays the product serial number entered during configuration.

3.3. General Scanner Configuration Parameters

Scanner Parameters specify general operating conditions of the scanner. Select the Scanner Configuration tab to enter this data. See screen example in Figure 4 below.

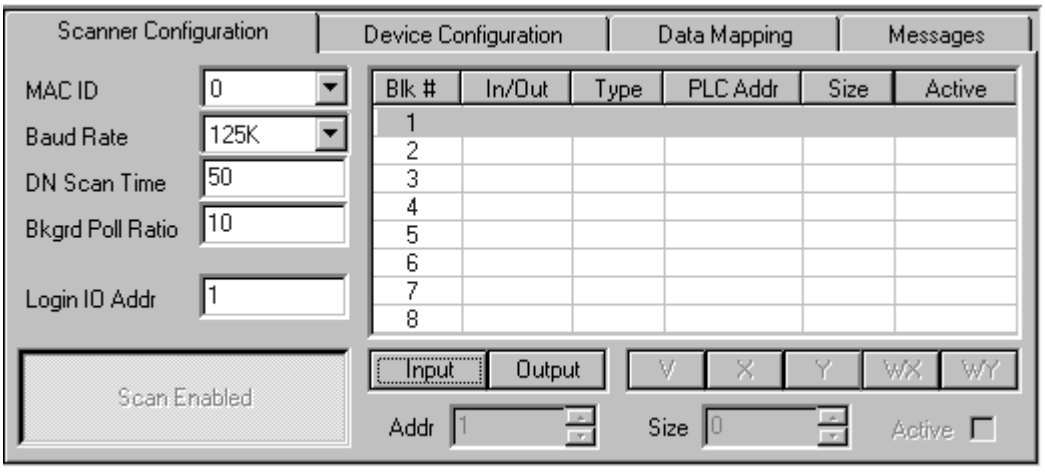


Figure 4. Scanner Configuration Tab

The following items may be entered:

MAC ID	(0 – 63). The MAC ID is the network address of the scanner. The MAC ID must be unique; no other device on the network may use it.
Baud Rate	(125KB, 250KB, or 500KB). Since all devices on the network must use the same baud rate, the slowest device on the network will determine the maximum baud rate that you may select. Many devices are limited to only 125KB data rates.
DN Scan Time	(10 - 1000 ms). This parameter specifies how often the scanner will start a new DeviceNet scan. You must set the scan time to a large enough value to allow all network devices which are expected to respond in one scan to do so and allow time for network configuration tools to run. As a rough estimate, you should allow about two milliseconds for each device on the network.
Background Poll Ratio	(1 - 100 scans). The background poll provides a default "slow poll" option for devices in the scan list. You might use this for a device where data needs to be updated less frequently. Polling less frequently reduces the network load. The background poll rate is specified as a ratio of the scan. For example, a value of 20 represents once every twenty DeviceNet scans. See Device Parameters for information on selecting background poll for a device.
Login I/O Address	(1 – 65535). The login address specifies the starting address of the first X (discrete input) location used by this module. You may determine this value by using your PLC programming software to view the I/O configuration data. The configuration program uses this value to calculate the offsets for data mapping display (see Data Mapping section).

NOTE:
Changing the Login I/O address affects only the mapping display. The actual PLC address is determined by the PLC I/O configuration. Make sure that the Login I/O Address you enter matches the PLC configuration so that what you see is what you get.

PLC Memory Transfer Blocks:
Using the Special Function interface, up to eight data blocks, each containing up to sixty words, can be transferred between the module and the PLC. The module will attempt to transfer the data as often as possible, depending on the PLC scan rate.

NOTE:
To ensure the best performance, do not enable any blocks that you are not going to use. Attempt to maximize the amount of data transferred in enabled blocks before enabling another one.

The lower right side of the window allows you to configure up to eight memory blocks. Once configured, you may map DeviceNet data to words within the block. Highlight the block you wish to configure and select the desired options:

Input / Output	The direction is viewed from the perspective of the PLC. Inputs will be written to PLC memory; outputs will be read from PLC memory.
Type	You may select the memory type to be accessed. For Input you may select V, X, or WX. For output you may select V, Y, or WY.
PLC Address	Indicate the starting PLC data address. For example, if you wanted data to be written to V memory starting at V1000, you would enter 1000.
Size	If you select V, WX, or WY you may specify up to 60 words to be transferred in the block. X or Y must be specified in word blocks of 16 bits. For example, if you need 32 discrete Y values, you should choose a word length of 2. The maximum size is 16 words (256 bits). The block size does not significantly affect performance; however, you may consider using a number smaller than the maximum to conserve PLC addresses. The number of blocks does affect performance. For example, it is more efficient to transfer one block of sixty words than two blocks of 30 words.
Active	Check the Active box to activate data transfer to the PLC. If the box is not checked, the module will not transfer the data block.

CAUTION:
When selecting data type, addresses, and block size, ensure that the above selections do not inadvertently overlap other data blocks or overwrite other PLC data. The Configuration Program will attempt to warn you if data overlap exists.

3.4. Device Data

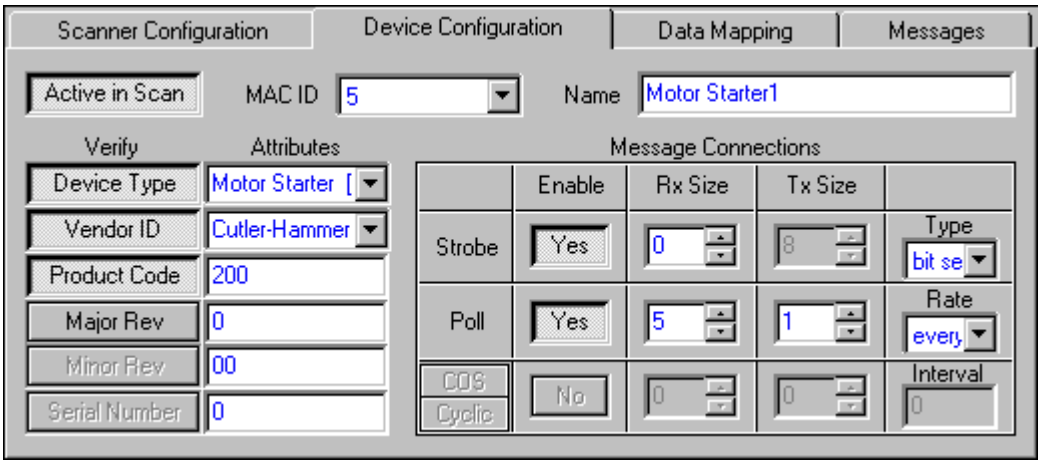


Figure 5. Device Configuration Tab

The 2576 Scan List contains one entry for each node that the scanner will use as a source or destination for PLC data. Any device that will be read or written by the PLC must appear in the Scan List.

This tab applies to the device highlighted in the Scan List window. If you wish to modify an existing device, select the device by clicking the appropriate Scan List entry, then modify the data. If you want to enter data for a new device, you must first create a new device (or copy an existing device), then enter the device data.

General Data

Active in Scan	If the device is not active, no connection will be made to the device and it will not be scanned. Deactivating a device is usually done when you are testing a configuration and don't want to delete all the device data.
MAC ID	Range = 0 – 63. The MAC ID is a unique network address set in the device. This value must match the MAC ID for which the device is configured.
Name	You may enter this information to further describe the device. The Configuration Program will display this name in the scan window and it will appear on printed reports. The scanner does not verify this data.

Identity Object Verification

This information can be used by the scanner to verify that the proper device is installed. Although entry of this data is optional, CTI recommends that you enter and verify at least some of the fields. These entries also improve configuration documentation. You may obtain the device data from vendor documentation, EDS files, or by using a configuration tool to query the module.

You may selectively enable verification of the device attributes by clicking the buttons in the Verify column to the left of the data field. Verification selection is hierarchical. For example, you cannot verify the Vendor ID without first verifying the Device Type.

Device Type	The Device Type indicates a class of device, such as a limit switch or a motor starter. When you select the Device Type description from the drop-down list, it will be translated to a standard ODVA code that will be displayed in the device list window. Except for certain test situations, you should always verify the Device Type.
Vendor ID	You may select the vendor name from a drop-down list. The description will be translated to a standard ODVA code that will be displayed in the device list window. You should verify the vendor if you are using vendor-specific features.
Product Code	The product code is assigned by the vendor. You should enter the data for configuration documentation. You may also wish to verify the information if the vendor makes logically different products with the same device type. *NOTE: Certain DeviceNet interfaces change the product code when communication is lost with the attached drive. In this case, you may need to verify product code in order to detect when a device has gone offline.*
Revision	DeviceNet vendors assign a revision to the product each time it changes. A major revision indicates a significant change that could affect the logical operation of the device. Minor revisions do not usually affect logical operation.
Serial Number	For some applications you may wish to enter and verify the device serial number. If you choose to verify the serial number, then each time you swap out one device for another, you must change the configuration before the 2576 will scan the device.

Message Connections

This section allows you to specify how each device will communicate with the scanner. You select a message type by enabling the appropriate pushbutton. Once enabled you may further describe the communications.

A device may implement I/O communications using strobe or poll messages. Strobed devices are usually simple input devices (such as limit switches or photo eyes) that return a small amount of data. The 2576 scanner sends one strobe message per scan. All devices for which the strobe bit is enabled respond. Polled devices are generally more complex. A separate poll message is sent to each poll device, which responds when polled. The documentation for a particular device will describe whether it is strobed or polled, the number of bytes produced or consumed, and the data format of the messages.

Strobed:
Strobed devices are triggered to send data by a strobe message sent by the scanner. The strobe message contains 8 bytes (64 bits). Each bit position corresponds to a particular MAC ID. One strobe message will trigger all devices for which the bit corresponding to its MAC ID is set.

Enabled	Determines whether Strobing is enabled for this device
Receive Size	The number of bytes received from the device when strobed
Trigger	Determines what type of strobe trigger is used by the device to cause it to send data.

NOTE:
Some devices ignore the strobe bit and respond to any strobe message.

Polled:
Polled devices consume a poll message transmitted by the scanner and produce a response received by the scanner. The poll message may contain data to be written to the device; the response message may contain data from the device.

Enabled	Determines whether Polling is enabled for this device
Receive Size	The number of bytes received from the device when polled
Transmit Size	The number of bytes sent to the device in a poll message
Poll Rate	(EVERY, BACKGROUND, AUTOPOLL, 2 – 254)
	EVERY: Specifies that the device will be polled every DeviceNet scan. If a device is polled every scan, it is expected to respond every scan. This setting is the default.
	BACKGROUND: Specifies that the device will be polled at the scanner background rate selected in the scanner parameters. Background is typically used for devices that need to be accessed occasionally or devices that respond slowly. Using a common background rate allows you to make a global change that affects all devices set to background.
	AUTOPOLL: Directs the scanner to poll a device as fast as it can respond. After polling a device, the scanner will wait for a response from the device or until the device timeout expires. When the device responds, the scanner will poll the device during the following scan. *NOTE: AutoPoll should not be used for I/O control devices because output updates are not deterministic. You should use a fixed interval poll rate instead.*
	(2-254) Selecting a number from 2 – 254 specifies a fixed poll ratio. For example, if you set the rate to 2, then the device would be polled every other scan and would be expected to respond within two scans. You might use this option when you encounter a device that responds slowly. Although you may set the poll rate individually for each device, you should use this feature sparingly, since it may be difficult to keep track of many different settings.

3.5. Device Data Mapping

Data mapping refers to the method used to define how data is moved between DeviceNet and data elements that can be accessed by PLC logic. Once data has been mapped, the PLC logic can access the DeviceNet data as if it were standard PLC I/O. The following sections present data mapping concepts and define how mapping is specified.

Data Mapping Overview

DeviceNet Messages

DeviceNet devices transfer data via messages over the network. Data received by a device is referred to as being consumed. Data transmitted by a device is referred to as being produced. DeviceNet is byte oriented; messages must be a multiple of a byte. Devices that produce data may send one or more bytes; devices that consume data may receive one or more bytes.

Each data byte contains eight bits. The bits are numbered 0 through 7, with 0 being the least significant bit (LSB) and bit 7 being the most significant bit (MSB). When multiple bytes are used, the first byte is numbered 0, the next byte 1, etc. See Figure 6 below:

MSB							LSB
7	6	5	4	3	2	1	0

Figure 6. DeviceNet Byte

The number of bytes produced / consumed by a device and the content of the data is defined by the device vendor. Devices that support multiple formats allow you to choose which one is used by selecting an I/O *Assembly*. The documentation for the device will specify the assemblies that can be selected for the device. The following illustrates an output assembly for a MagneTek AC drive. Note that bytes 0 and 1 contain bits that can be used to control motor operation while bytes 2 and 3 are combined to represent an analog speed value.

Assembly	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120 Speed Command	0	TF8	TF7	TF6	TF5	TF4	TF3	Run Reverse	Run Forward
	1							Fault Reset	External Fault
	2	Speed reference in Hz x 100 (Low Byte)							
	3	Speed reference in Hz x 100 (High Byte)							

Figure 7. Example Output Assembly

PLC Data Elements

The SIMATIC® 505 PLC series supports several different data types. The most common are Discrete Input (X), Discrete Output (Y), Word Input (WX), Word Output (WY), and User Variable (V) memory. X and Y data elements are single bit (Boolean) values. WX, WY and V memory are sixteen bit words structured as shown below.

Most Significant Byte (Byte 1)								Least Significant Byte (Byte 0)							
MSB															LSB
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Figure 8. SIMATIC® 505 Word

NOTE:
The PLC uses a different bit numbering nomenclature than DeviceNet. Each word contains 16 bits; bits are numbered 1 – 16 where 1 is the Most Significant Bit (MSB) and 16 is the least significant bit (LSB). In either case, the least significant bit (LSB) is the rightmost bit.

Input and output data elements are referenced by number, starting at the login address of the module. The PLC programming software allows you to specify the login address of each module in the system. The 2576 logs in as a high density mixed I/O module with 32 X, 32 Y, 32 WX and 32 WY. If the module is configured in the I/O starting with address 1, then the addresses will be as follows:

Data Element	# of Elements	Starting Address	Ending Address
X	32	1	32
Y	32	33	64
WX	32	65	96
WY	32	97	128

If the module is logged in at a different address, then all data element numbers will be offset by the login address. For example, if the 2576 were configured with login address 9, then the data element addresses would be as follows:

Data Element	# of Elements	Starting Address	Ending Address
X	32	9	40
Y	32	41	72
WX	32	73	104
WY	32	105	136

Data Mapping Implementation

For each device, you may specify the data to be read from the device (input) and/or the data to be written to the device (output). Inputs are read from the DeviceNet message and written to a PLC

input data element (X or WX) or to V memory. Outputs are read from a PLC output data element (Y or WY) or from V memory and written to the DeviceNet message.

For example, input data could be mapped from Byte 0, bit 1 of the DeviceNet message to bit X10 in the PLC. Output data could be mapped from WY 120 to Byte 2 and Byte 3 of the DeviceNet message.

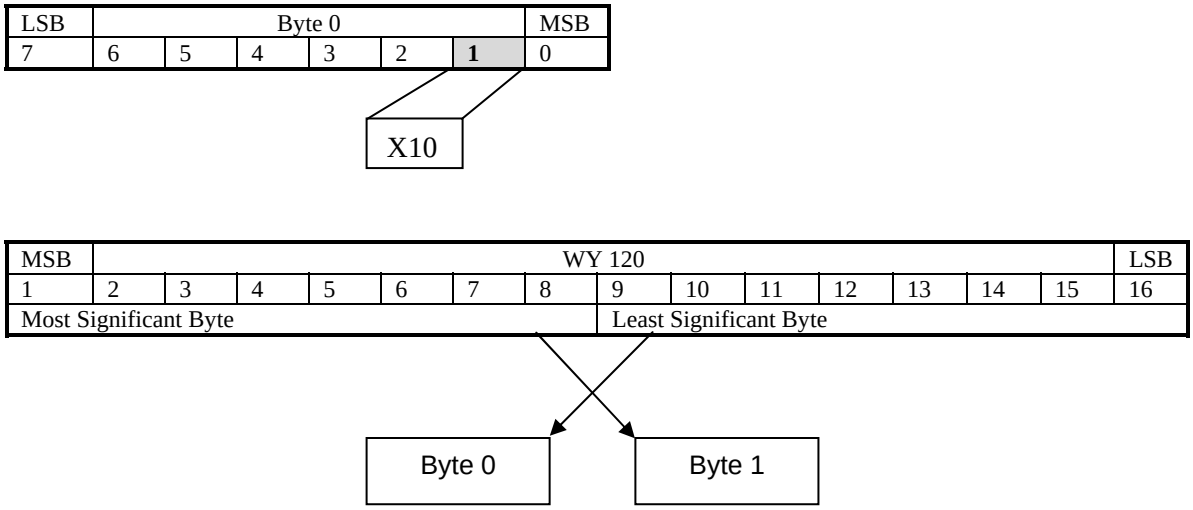


Figure 9. Discrete and Byte Mapping Examples

You may map more than one set of data relating to a single device. For example, in the output assembly shown in Figure 7 previously, you might map Y41 to the Run output bit in Byte 0 and map WY105 to the speed reference (Bytes 2 and 3). Then PLC logic would start/stop the drive via Y41 and would control the speed via a value in WY105.

Bit Mapping Order

Bit mapping is limited to a maximum of 8 bits. When more than one bit is mapped, ***mapping is always from least significant bit to most significant bit***. The following illustrates a mapping of four bits from a DeviceNet byte starting at bit 2 to a Data PLC word starting in bit 9:

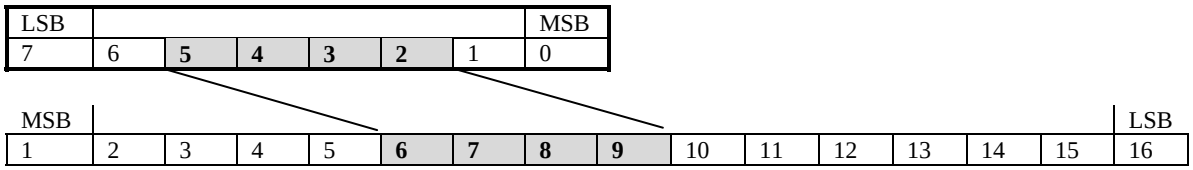


Figure 10. Bit Mapping Example

Byte Mapping Order (Byte Moves)

Byte Moves must be byte aligned within the DeviceNet message and the SIMATIC® 505 words. Although most byte moves typically start in the LSB of the PLC word (beginning with bit 16), they may start in the high order byte (beginning with bit 9). When a multiple byte move starts at a word boundary, the first DeviceNet byte will start in bit 16 and the next DeviceNet byte will start in bit 9. When a byte move crosses word boundaries, the least significant byte will be filled and then the most significant byte.

The following illustrates how two DeviceNet bytes are mapped to a PLC word when the data map specifies:

Direction: Input
Type: Byte Move
DeviceNet Message Type: (Doesn't Matter)
DeviceNet Message Location: Byte 0, Bit 0
Length: 2 Bytes
PLC Data Type: WX
Starting Location: WX10 - bit 16.

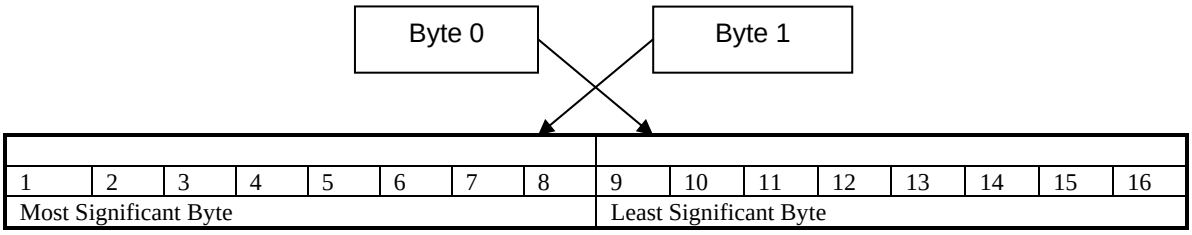


Figure 11. Byte Mapping Example

See the Configuration Program Help Text for additional information.

Data Mapping Configuration.

You can create data maps for a device by selecting the device in the Scan List window and clicking on the Data Mapping tab. The tab will display one of two data map views, based on the view option selected. Normally you will use the PLC Data view, illustrated in Figure 12 below. To examine how data is mapped to DeviceNet, use the DeviceNet Message view, shown in Figure 13.

The numbers in the column fields indicate the MAC ID of the device mapped to that address. If more than one map is made to the same device message bit, that bit will display an "M" to indicate multiple maps. Multiple maps can be made for the input direction only.

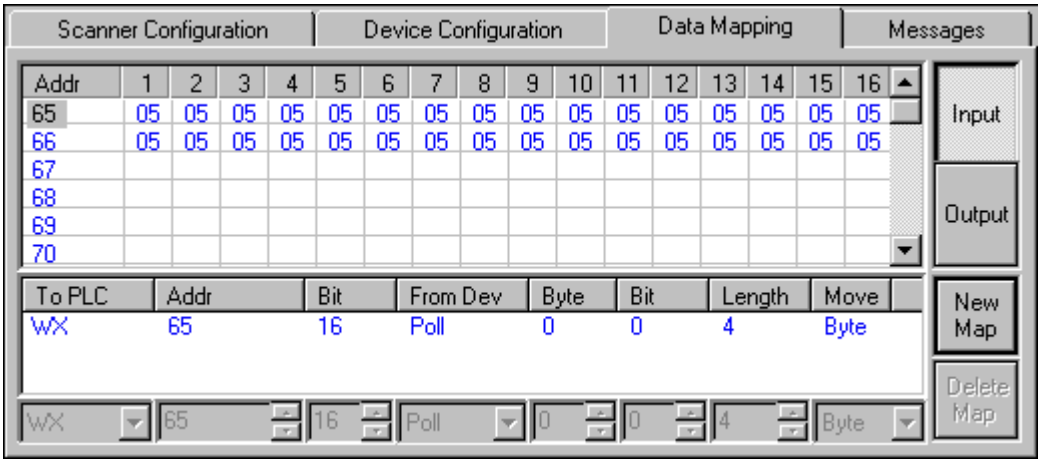


Figure 12. Data Mapping Tab – PLC Data View

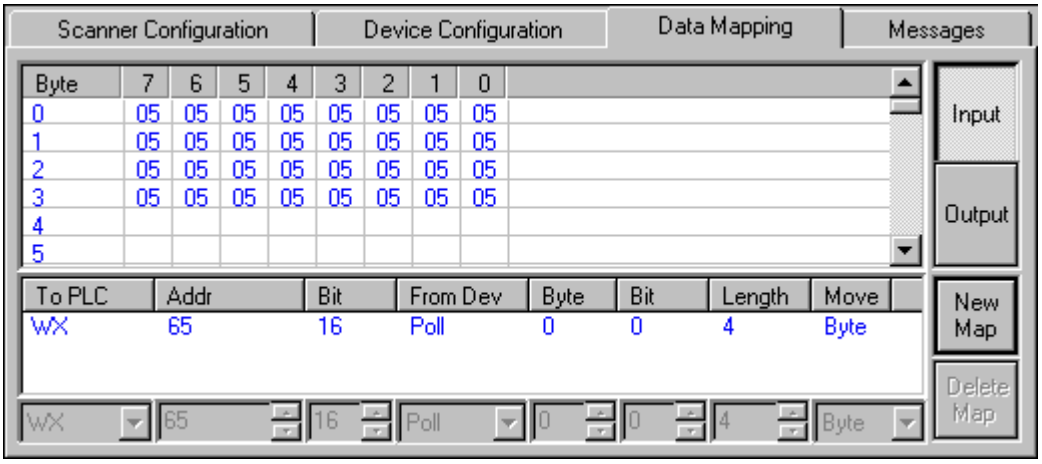


Figure 13. Data Mapping Tab - DeviceNet Message View

The lower part of the tab displays a list of all input or output data maps you have created for the selected device. Below the display window is a place to enter new data. To modify an existing

mapping specification, select the mapping direction (input or output), select an entry from the list of data maps, and modify the parameters. To add a data map, select the mapping direction, click the NEW MAP button, and make changes to the new record.

For each data map, you may specify:

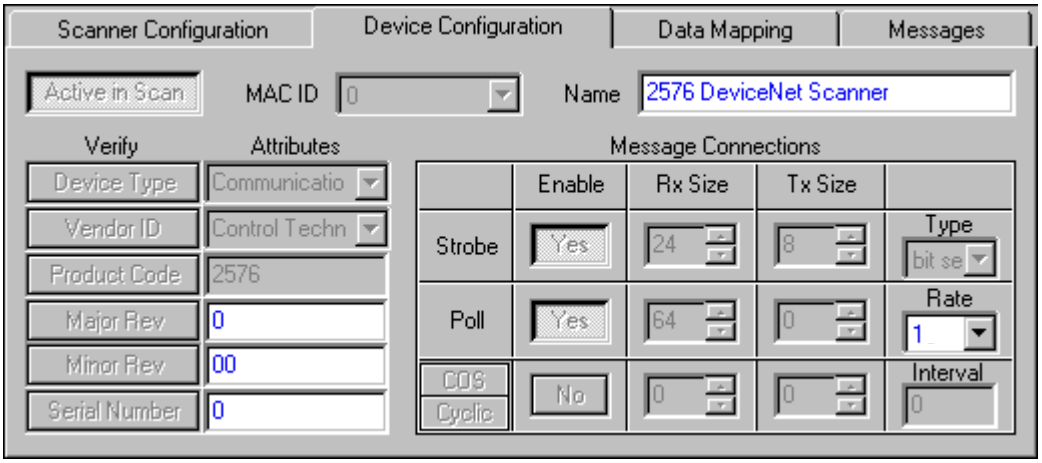
PLC Data Type	For an input map you may choose from X, WX, or one of the input memory transfer blocks you created in the Scanner tab. For an output map you may choose from Y, WY, or one of the output memory transfer blocks you created in the Scanner tab. If the move type selected is not bit, X and Y will be unavailable.
PLC Address	Specify the PLC address that will receive the first data element.
Bit Location	For word data elements, you may specify the starting bit into which the data will be mapped. For bit moves, you may specify any location that does not cause mapping to cross a word boundary. For byte moves you can select only byte boundaries (bits 8 or 16).
Device Message Type	You may select from Strobe or Poll message types. The device must be enabled for the message type before mapping will be permitted.
Message Byte	Specify the byte containing the first data element to be mapped.
Message Bit	Specify the bit location within the message byte selected that contains the first data element. You may select the bit location only when performing bit moves.
Length	Select the number of data elements to be mapped. For bit moves this is the number of bits. For byte moves, this is the number of bytes. The maximum number of bits is 8. The maximum number of bytes is limited by the size of the DeviceNet message.
Move Type	You may select either a bit move or a byte move. If you select a byte move, the move must start on byte boundaries.

3.6. DeviceNet Status Data Mapping

Many control applications need to monitor the status of the network devices so that, if a problem occurs, the PLC can take appropriate action. The 2576 module uses the same data mapping technique you would use to obtain I/O data from the devices. The scanner appears as a virtual device that has both a "strobed" I/O connection and a "polled" I/O connection. The strobed I/O connection provides device status flags and internal scanner status codes while the polled I/O connection provides status codes for each device.

The size of the "strobed" and "polled" data is fixed; however, you may change the rate at which the data is mapped to the PLC. To set the rate, select the scanner record in the scan list. When you select the Device Tab, you should see the following display.

The default scan rate is every scan. CTI recommends that you use this default setting unless you have a specific reason to do otherwise. Setting this value to a larger number may improve scanning performance but may have an undesirable effect because status information is updated less often. For example, if you are using the DEVICE OFFLINE bits in your control system, increasing the rate will increase the time it takes to detect a device going offline.



CAUTION

CTI recommends that you monitor the connection status of the DeviceNet devices in your PLC logic. While the device is offline, input values read by the PLC are not valid. In addition to the scanner status data, you can monitor the applicable bits in the Module Status Word (see Appendix C).

Strobed I/O Assembly

The strobed I/O assembly provides the following data:

DeviceNet Status Data									
Byte	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	I/O Processing Time (Low Byte)								
1	I/O Processing Time (High Byte)								
2	In-Scan-List MAC ID 0 - 7	MACID 7	MACID 6	MACID 5	MACID 4	MACID 3	MACID 2	MACID 1	MACID 0
3	In-Scan-List MAC ID 8 -15	MACID 15	MACID 14	MACID 13	MACID 12	MACID 11	MACID 10	MACID 9	MACID 8
4	In-Scan-List MAC ID 16-23	MACID 23	MACID 22	MACID 21	MACID 20	MACID 19	MACID 18	MACID 17	MACID 16
5	In-Scan-List MAC ID 24-31	MACID 31	MACID 30	MACID 29	MACID 28	MACID 27	MACID 26	MACID 25	MACID 24
6	In-Scan-List MAC ID 32-39	MACID 39	MACID 38	MACID 37	MACID 36	MACID 35	MACID 34	MACID 33	MACID 32
7	In-Scan-List MAC ID 40-47	MACID 47	MACID 46	MACID 45	MACID 44	MACID 43	MACID 42	MACID 41	MACID 40
8	In-Scan-List MAC ID 48-55	MACID 55	MACID 54	MACID 53	MACID 52	MACID 51	MACID 50	MACID 49	MACID 48
9	In-Scan-List MAC ID 56-63	MACID 63	MACID 62	MACID 61	MACID 60	MACID 59	MACID 58	MACID 57	MACID 56
10	Device Error MAC ID 0 - 7	MACID 7	MACID 6	MACID 5	MACID 4	MACID 3	MACID 2	MACID 1	MACID 0
11	Device Error MAC ID 8 -15	MACID 15	MACID 14	MACID 13	MACID 12	MACID 11	MACID 10	MACID 9	MACID 8
12	Device Error MAC ID 16-23	MACID 23	MACID 22	MACID 21	MACID 20	MACID 19	MACID 18	MACID 17	MACID 16
13	Device Error MAC ID 24-31	MACID 31	MACID 30	MACID 29	MACID 28	MACID 27	MACID 26	MACID 25	MACID 24
14	Device Error MAC ID 32-39	MACID 39	MACID 38	MACID 37	MACID 36	MACID 35	MACID 34	MACID 33	MACID 32
15	Device Error MAC ID 40-47	MACID 47	MACID 46	MACID 45	MACID 44	MACID 43	MACID 42	MACID 41	MACID 40
16	Device Error MAC ID 48-55	MACID 55	MACID 54	MACID 53	MACID 52	MACID 51	MACID 50	MACID 49	MACID 48
17	Device Error MAC ID 56-63	MACID 63	MACID 62	MACID 61	MACID 60	MACID 59	MACID 58	MACID 57	MACID 56
18	Scanner Status Code								
19	Scanner Error Code								
20	CAN Hardware Status Code								
21	Network Access Status Code								
22	DN Scan Counter (Low Byte)								
21	DN Scan Interval (High Byte)								

I/O Processing Time	The actual amount of time required to send out all strobe/poll messages and to process responses during the last DeviceNet scan. In normal operation, this value should be slightly less than your Configured Scan Time.
In-Scan List Flags	These flags indicate whether a device is included in the scan list. For a device to be in the scan list it must be active and mapped to the PLC. If a device is on the scan list, the corresponding bit will be set to 1.
Device Error Flags	These flags indicate whether a problem has been encountered with the I/O connection to the device. If an error exists, the corresponding bit will be set. Devices that are not in the scan list will have their bits set to 0. You may wish to use these flags to detect and report I/O problems. Note that these errors reflect problems in communicating with the device; other problems that may be reported by the device are contained in the I/O data returned by the device.
Scanner Status Code	See Appendix B. This code corresponds to the Node Status Codes
Scanner Error Code	See Appendix B. This code corresponds to the Scanner Error Codes (Node Address 91)
CAN Status Code	See Appendix B. This code corresponds to the CAN Controller Hardware Status Codes (Node Address 96)
Network Access Code	See Appendix B. This code corresponds to the DeviceNet Network Access Status Codes (Node Address 97)
DN Scan Counter	This counter increments every scan. After the maximum value (65,535) is attained, it wraps to 0.

Polled I/O Assembly

The Polled I/O Assembly provides a status code for each device on the network. The status code corresponds to the Node Status Codes in Appendix B. The byte number containing the status code is the same as the MAC ID of the device. For example, the status code for the device with MAC ID 5 would be located in byte 5 of this assembly. The scanner status code is also included in this assembly.

Device Status Codes	
Byte	**Description**
0	Status Code – MAC ID 0
1	Status Code – MAC ID 1
2	Status Code – MAC ID 2
3 - 63	Status Codes – MAC ID 3 – 63

Note that the code represents the status of communications between the scanner and the device. If communications are normal, the code will be 37 (hex 24). Otherwise, you may see the code transition between values as the scanner attempts to reconnect to the device.

3.7. Maximizing Performance

Data Mapping Techniques

The amount of data mapped to the PLC affects the Device Net scan time. When designing your application you should consider the following guidelines:

- Minimize the number of data maps. It is typically better to use one map to access a block of data, rather than multiple maps with individual data elements.
- Map only the data you need for your application. Mapping extraneous data consumes processing time.

Slave Device MAC ID Assignment

Your configuration may contain a few devices that respond slowly as compared to the rest. If this is true, the order in which devices are polled can affect overall performance. You may recall that the architecture of DeviceNet allows devices to be polled without waiting for a response to a previous poll. Thus, if you poll slow responding devices first, you can continue to poll the remaining devices while the first devices prepare the response.

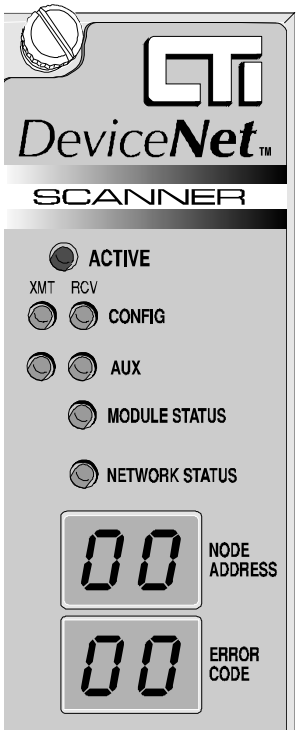
For example, assume that the scan list includes 30 devices, all devices except one respond within 1 millisecond, one device (Device-A) takes 20 milliseconds to respond, and it requires about one millisecond to send each poll. If you poll Device-A last, the total time will be 50 ms (30 ms to send the polls + 20 milliseconds for the last device to respond). If you poll Device-A first, the total time will be 31 ms (30 ms to send all the polls + 1 ms for the last device to respond). In the second case, it still took Device-A 20 milliseconds to respond; however, the response was received while other devices were being polled. Thus, the slow response did not increase the overall scan time.

Because the 2576 polls devices in MAC ID order, setting the slower devices to a low MAC ID will cause them to be polled first.

CHAPTER 4. OPERATION

4.1. Front Panel Indicators

Active Indicator



The Active LED is used to indicate general module status.

LED State	Description
Off	No Power / Not Started
Blinking (2Hz)	Not Logged In to the PLC
Blinking (3 short pulses)	Program loader in control
On	Module Operational

XMT and RCV Indicators

There are two pairs of XMT and RCV indicators, one for each serial port. These LEDs illuminate when a signal is present. The Transmit LED will light when output is sent from the module; the Receive LED will illuminate when a signal is received. During normal data communications activity the LEDs will appear to flicker at a rate that corresponds to the baud rate.

Module Status Indicator

The MODULE STATUS LED indicates the status of the DeviceNet scanner.

LED State	Description
Off	The DeviceNet scanner processor has not started.
Flashing Green	Scanner is waiting on configuration to be loaded or scan is disabled.
Solid Green	Actively scanning all devices in the Scan List.
Flashing Red	There is an error in the scanner configuration that prevents operation.
Solid Red	Fatal Error detected. Scanner will reset.

Network Status LED

The NETWORK STATUS LED indicates the status of the DeviceNet network interface.

LED State	Description
Off	No DeviceNet Power or Duplicate MAC ID check not completed.
Flashing Green	Scanner is on-line, connecting to devices in Scan List.
Solid Green	Scanner is on-line and connected to all devices in the Scan List.
Flashing Red	At least one device in the Scan List failed to connect or lost connection.
Solid Red	The module has detected a Duplicate MAC ID or is otherwise Bus-Off.

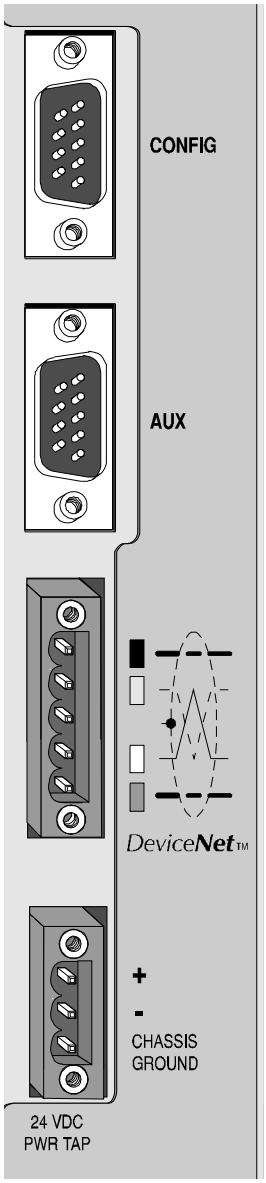
Numerical Status Displays

The seven-segment LEDs are used to provide additional status information. The NODE ADDRESS indicates the MAC ID of the device to which the error code applies. The ERROR CODE displays a reference number indicating the node status. Under normal operating conditions, the NODE ADDRESS will indicate the MAC ID of the scanner and the ERROR CODE will be 00. During startup, the 2576 will display various codes indicating progress. If multiple device errors are detected, the module will cycle through all nodes with an error. See Appendix B for a list of error codes.

Serial Communications Ports

The module has two serial communications ports. Both ports use a subset of the RS-232 electrical interface standard (TxD, RxD, and SG). The port configuration is designed to accept the same cables used for connecting SIMATIC® 505 PLCs to a PC. See *Appendix A* for additional details regarding cable assemblies.

The CONFIG port is used for downloading and uploading configuration data between the module and a PC, controlling the operation of the module, and performing diagnostic functions. CTI supplies software for performing these functions.



The AUX port is reserved for future use.

DeviceNet Port

The DeviceNet port uses the standard five pin DeviceNet connector. The inner pins are used for signals while the outer pins supply power to the local DeviceNet circuitry. Since most of the module electronics is powered from the PLC, the module draws only a small amount of current from the network (100ma maximum).

> *NOTE:*
> *Although the module obtains power from the PLC backplane, you must also apply 24VDC power to the DeviceNet connector. The DeviceNet standard requires that the DeviceNet interface be powered from the network in order to isolate module electronics from the network.*

Power Tap

The power tap provides a means to supply power to the DeviceNet network using a 24VDC power supply that conforms to DeviceNet standards. The power tap current draw is limited to four amps by an internal fuse.

4.2. Startup Sequence

When power is first applied to the module, the module will execute a power-on self-test (POST) routine, then begin to activate the scanner. During this process, you may note the module LEDs transition between states and the NODE and ERROR CODE LEDs displaying codes that indicate the progress in connecting to the DeviceNet nodes.

During the startup sequence the module will perform the following:

- Start the main processor and run a Power-On Self-Test (POST) routine.
- Load and start the scanner processor.
- Load the scanner configuration to the scanner processor.

- Perform a duplicate MAC ID check to ensure that there is not another node with the same MAC ID.
- If successful, go online and attempt to connect to all devices in the scan list.
- Begin scanning connected devices.

The normal startup LED states are indicated below.

Condition	Active LED	MS LED	NS LED	NODE	Error Code
Initial Power On	Off	Off	Off	Off	Off
Power–On-Self-Test complete. Scanner program loading	On	Off	Off	Off	Off
Scanner started - Reading configuration	On	Flashing Green	Off	*	*
Scanner configured. Duplicate MAC ID check not completed.	On	Solid Green	Off	*	*
Scanner Online – Connecting to devices	On	Solid Green	Flashing Green	*	*
Fully Operational: Scanner scanning all nodes in scan list	On	Solid Green	Solid Green	(MAC ID of scanner)	80

* These LEDs will display various codes indicating specific startup states (see Appendix B. LED Display C). If the module does not reach the Fully Operational state, refer to *Chapter 6. Troubleshooting* for information on correcting the error condition.

CHAPTER 5. CONFIGURATION EXAMPLE

This chapter illustrates how the CTI 2576 can be configured to communicate with I/O devices.

NOTE:
This example purposely uses several different PLC memory types in order to show different features of the configuration program.

In this example we will proceed through the following steps:

- Choose Input and Output Assemblies for DeviceNet messages used by the devices.
- Determine how to map data between the DeviceNet devices and PLC data elements.
- Specify the scanner characteristics such as MAC ID and baud rate.
- Specify the characteristics of slave I/O devices.
- Map DeviceNet message data to PLC data elements.
- Save the file and download the configuration file to the 2576 DeviceNet Scanner.

5.1. Assumptions

For this example we will make the following assumptions:

- The 2576 DeviceNet Scanner is installed and logged in with the Special Function module starting address as WX1 and the high-density module logged in starting with X9.
- The DeviceNet devices are configured and installed, ready to communicate over the DeviceNet network. The motor starter MAC ID is set to 21 using online configuration tools and the AC drive MAC ID is set to 20 by properly setting its dipswitches.

5.2. Device Characteristics

The example application uses two types of devices:

1. A Cutler-Hammer Advantage motor starter with a WPONIDNA interface board,
2. A MagneTek AC Motor Drive (GPD 515).

Advantage Motor Starter

The Instruction Leaflet for the WPONIDNA board describes how it interfaces to DeviceNet. This information indicates that it operates at 125KB only and supports Polled I/O connections. The user has a choice of input and output assemblies which provide different data contents. After examining the possibilities, we decide to use the following I/O assemblies:

Input Assembly 102								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Aux_FB		CntrlFromNet	Ready		Running1	Running2	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

Output Assembly 3								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0						Fault Reset		Run 1

AC Drive

The DeviceNet Manual for the AC Drive indicates that it is a polled device that can operate at either 125, 250, or 500KB. It also allows a choice of input and output I/O assemblies. We select the following:

Input Assembly 132								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Drive Fault	Drive Alarm	Drive Ready	At Speed	Fault Reset Active	Drive Reversing	At Zero Speed	Running
1	Zero Servo Complete	Motor Selection	Term 26 Output	Term 25 Output	Term 9,10 Output	Local/Remote	Fault	External Fault
2	Actual Current in Amps x100 (Low Byte)							
3	Actual Current in Amps x100 (High Byte)							
4	Actual Speed in Hz x100 (Low Byte)							
5	Actual Speed in Hz x100 (High Byte)							

Output Assembly 120								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Terminal 8 Function	Terminal 7 Function	Terminal 6 Function	Terminal 5 Function	Terminal 4 Function	Terminal 3 Function	Run Reverse	Run Forward
1							Fault Reset	External Fault Reset
2	Speed Reference in Hz X 100 (Low Byte)							
3	Speed Reference in Hz X 100 (High Byte)							

5.3. 2576 DeviceNet Scanner Configuration

With the DeviceNet Scanner installed and logged in to the PLC, we can now use any standard PC meeting the requirements for the 2576 DeviceNet Scanner Configuration software to configure the Scanner.

Setup

To download a configuration to the module, connect a cable from a serial port on the PC to the 2576 configuration port. The cable must comply with the specifications in *APPENDIX A. CONNECTORS AND CABLING*.

Configuring the 2576 DeviceNet Scanner Module Parameters

Start the CTI 2576 DeviceNet Scanner Configuration software. Click the NEW file icon or select NEW from the FILE command menu. This will create a new template in which to put all our configuration information. You will notice that the program automatically puts the Scanner in the Scan List to display default information about the scanner. The Scan List should look like this:

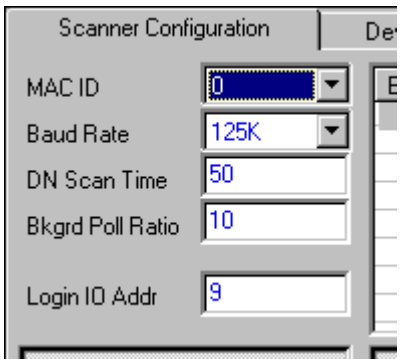
NOTE:
The name column has been stretched by dragging the right border of the column to make viewing the device name easier.

With the SCANNER CONFIGURATION tab selected, we can begin configuring the Scanner. For our example we will set the MAC ID to zero and the baud rate to 125K. Since we only have two devices to our small example network, we will set the DeviceNet (DN) scan time to 20 milliseconds. We will use the default value for the BACKGROUND POLL RATIO.

The LOGIN IO ADDRESS is the first discrete input (x) location that the PLC will use to read data from the module. In this example, we assumed that the PLC I/O was configured to access the module at X9. Enter this value 9 into the LOGIN IO ADDR box.

NOTE:
The configuration program uses the Login I/O address to calculate X, Y, WX, and WY addresses displayed for high-density I/O. If the Login I/O address does not match your PLC configuration, then the display addresses will be wrong.

After all this information has been entered, the Scanner Configuration tab should look like this:



Establish Data Mapping Requirements

At this point we must determine how we want to map data between the PLC data elements and the devices. For this example, assume that our application requires the following data from the devices to be mapped to the PLC.

Advantage Motor Starter:
We decide to map the first four bytes in the Input Assembly as follows:

- Byte 0, containing the status bits, will be read into the first available WX73.
- Byte 1 will map to V1000.
- Bytes 2 and 3, containing the AVERAGE CURRENT, will be mapped to V1001.
- For this example, we will ignore Byte 4.

Input Assembly 102								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Aux_FB		CntrlFromNet	Ready		Running1	Running2	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

We also decide to map the RUN1 bit and FAULT RESET bit in the output assembly to Y41 and Y42.

Output Assembly 3								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0						Fault Reset		Run 1

MagneTek AC Motor Drive:

As indicated below, five of the six bytes of the Input assembly will be used in our example. The first byte, Byte 0, will be read into WX74. The second byte, Byte 1, will be skipped. Byte 2 through Byte 5 will be read into V memory locations 1002 and 1003, where byte pairs will be transferred into the appropriate low and high order bytes of the V memory words.

Input Assembly 132								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Drive Fault	Drive Alarm	Drive Ready	At Speed	Fault Reset Active	Drive Reversing	At Zero Speed	Running
1	Zero Servo Complete	Motor Selection	Term 26 Output	Term 25 Output	Term 9,10 Output	Local/Remote	During Ride Thru	
2	Actual Current in Amps x100 (Low Byte)							
3	Actual Current in Amps x100 (High Byte)							
4	Actual Speed in Hz x100 (Low Byte)							
5	Actual Speed in Hz x100 (High Byte)							

From the output assembly, the RUN FORWARD and RUN REVERSE bits (Byte 0, bit 0 and bit 1) will be mapped to Y43 and Y44 respectively. Byte 1 will be skipped. The low and high bytes of the SPEED REFERENCE (Byte 2 and 3) will be mapped into WY105.

Output Assembly 120								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Terminal 8 Function	Terminal 7 Function	Terminal 6 Function	Terminal 5 Function	Terminal 4 Function	Terminal 3 Function	Run Reverse	Run Forward
1							Fault Reset	External Fault
2	Speed Reference in Hz X 100 (Low Byte)							
3	Speed Reference in Hz X 100 (High Byte)							

Configuring Memory Transfer Blocks

Based on the data mapping requirements above, we can configure the memory transfer blocks. Since less than 61 input words are required, only one Input block is needed. Go to the right side of the SCANNER CONFIGURATION window and select Block #1 to highlight it. Click the INPUT button to assign the block as input. V memory is the only type of transfer supported currently and is therefore selected for you. Change the address of the starting V memory location to 1000. You can edit the box directly instead of using the up/down spinners. Since we are using four V memory words for transfer, we will set the SIZE value to 4. Ensure that the Active box is checked to enable data transfer.

NOTE:
Although we used a value of four in this example, you could reserve more; the only penalty is that you waste some V memory locations that you could use for other purposes.

The window should look like this:

Blk #	In/Out	Type	PLC Addr	Size	Active
1	Input	V	1000	4	Yes
2					
3					

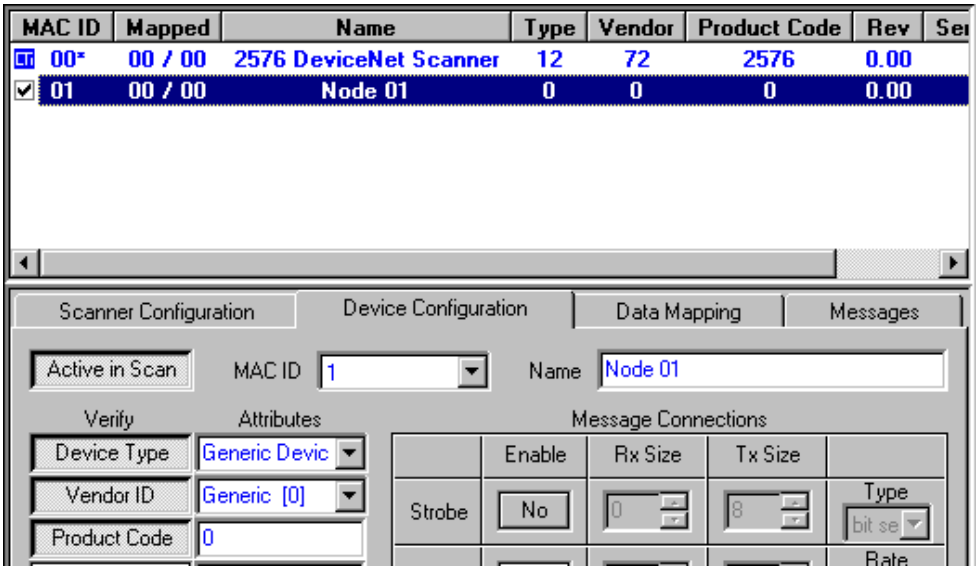
Had there been outputs to map to V memory, we would have configured a separate memory transfer for transferring information from V memory to DeviceNet devices. Also, if more than 60 words of V memory were mapped, additional V memory blocks would be needed.

Configuring DeviceNet Devices

Click the DEVICE CONFIGURATION tab to select the Device Configuration window. We will describe below how to configure the Motor Starter and the AC Drive.

Motor Starter

The first step to configure a new device is to add it to the Scan List. Click on DEVICES in the menu bar to open the Devices menu and select NEW. A new line should appear in the Scan List window just below the scanner record. Default values are given until data is entered. Note that the new device has a checkmark in the MAC ID column and that in the Device Configuration window the ACTIVE IN SCAN button is depressed. The program assumes that if you are going to add a device, you will put it into scan. Since the program also automatically assigns the next available MAC ID to a new device, a MAC ID of 1 is displayed.



Let's begin entering configuration data for the device.

Active in Scan: Since we want to access this device, ensure that the ACTIVE IN SCAN button is depressed.

MAC ID: Change the MAC ID to 21 by opening the list box and selecting a value of 21.

NOTE:
You may notice that the MAC ID in the Scan List display did not change. Changes are not reflected in the Scan List until the Apply button (Green Check Mark) is pressed or you change screens.

Name: Change the device name in the edit box to "Motor Starter 1," which is more descriptive than "Node 1."

Next, enter information about the device in the Device tab. This information serves two purposes. First, it provides a means for you to identify the type of device with which you are working. Second, it provides a basis for verifying that the network device using this MAC ID is what you expected (see **Verify** below).

Now click on the APPLY button and see the updated Scan List display. The display should look like this:

Attributes: From the DEVICE TYPE box, select "Motor Starter." From the VENDOR box, pick "Cutler-Hammer." Enter a value of 200 in the PRODUCT CODE box. For this example, we will not enter information for MAJOR REV, MINOR REV, or SERIAL NUMBER.

Verify: The VERIFY buttons allow you to select which attributes will be checked when the scanner connects to the device. In this example, we will verify that the device is a Motor Starter made by Cutler-Hammer that has a product code of 200. Thus, we want to ensure that the DEVICE TYPE, VENDOR, and PRODUCT CODE verify buttons are depressed.

Message Connections:

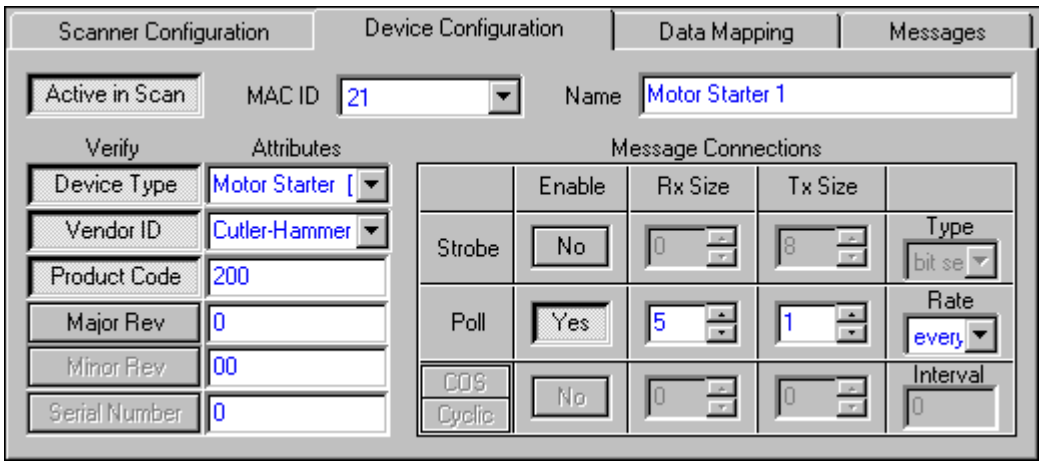
As stated in the *Device Characteristics* section of this chapter, the motor starter uses a poll connection that expects the scanner to send 1 byte of information and that returns five bytes of status data.

To configure this connection, click on the Poll button and enter the applicable data.

NOTE:
The data direction is described from the viewpoint of the scanner. Rx (receive) Size indicates the number of bytes received by the scanner from the device. Tx (transmit) indicates the number of bytes the scanner will send to the device.

Rate: This parameter allows you to poll some devices at a slower rate. In this case, leave the scan rate to poll the device every DeviceNet scan.

The screen should now look like this:



Press the Apply button to record the data you entered.

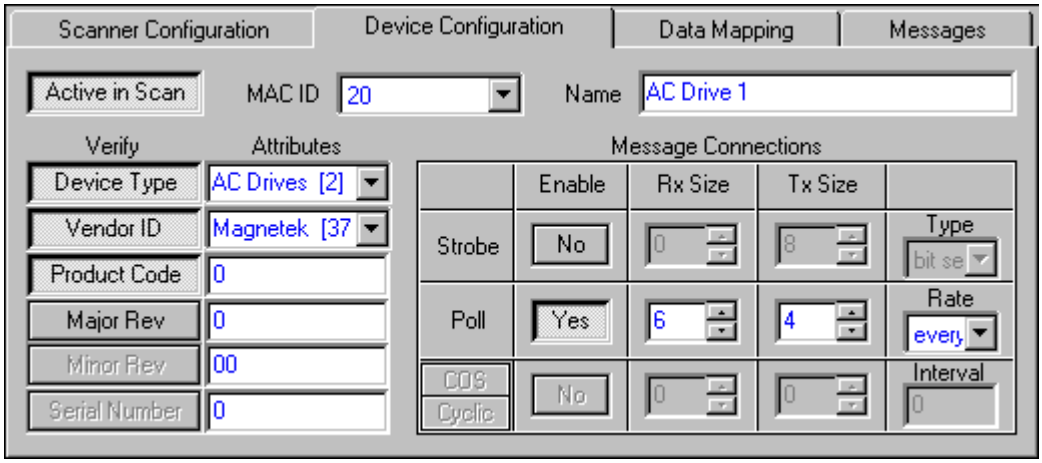
AC Drive

Select new device and follow the same procedure described above. Enter the following data:

MAC ID 20
DESCRIPTION AC Drive 1
DEVICE TYPE AC Drive
VENDOR ID MagneTek

Verify:
Notice the three top categories under the Verify heading are all selected. In this example we will check only the Device Type and Vendor ID. Click on the PRODUCT CODE button to deselect it. Now the scanner will not check the product code of the device.

Configure the device to be polled every scan, transmitting 4 bytes of data from the scanner and receiving 6 bytes back in return. When complete, the Device Configuration window should look like this:



Mapping Device Data for the Motor Starter

Now that the type and length of the DeviceNet messages have been configured, we can now map the data in those messages to PLC data elements. To do this, click on the DATA MAPPING tab.

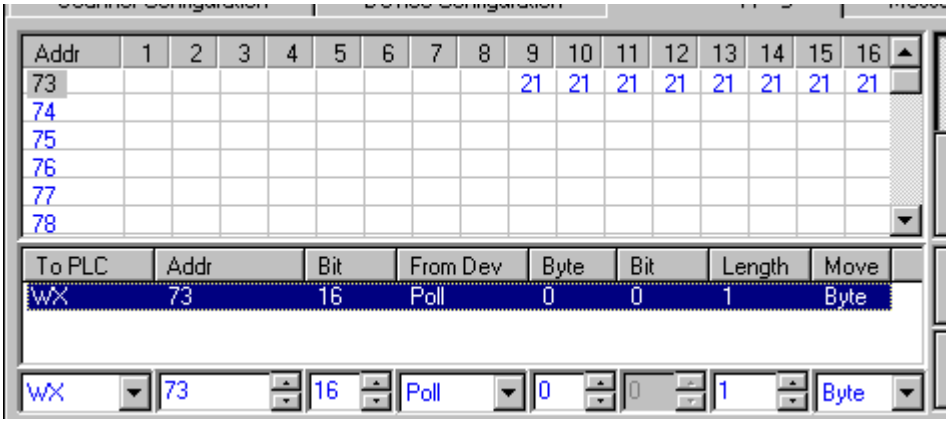
To map the data for the Advantage Motor Starter, select it again in the Scan List window. The information displayed in the Data Mapping window always relates to the device selected in the Scan List. Be sure that you are viewing the data in the Shared Memory Buffer view by selecting that view in the View dropdown menu list.

Referring to the input assembly below, the first byte (Byte 0) will be mapped to WX73.

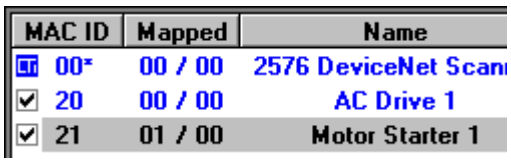
Input Assembly 102								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Aux_FB		CntrlFromNet	Ready		Running1	Running2	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

To start a new map, press the NEW MAP button. Next you must select the type of map. Since this will be an Input map, select the INPUT button in the window. Now enter the information for the new map in the edit boxes along the bottom of the window.

Since we will be transferring the entire byte to the PLC, select Byte in the Move column's list box. Starting with the PLC, set the data type to WX, the address to 73, and the starting bit to 16, if these values are not already set. To tell the scanner where the data is located in the DeviceNet message, set the message to Poll, Byte 0, with a length of 1 byte. Now click on the APPLY Toolbar button to accept the map and update the data map list window. The Data Mapping window should look like this:



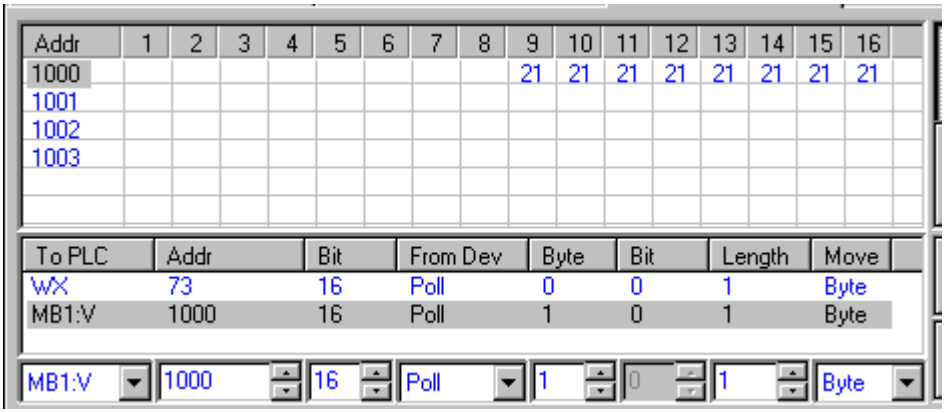
You will notice that the number 21 appears in the locations just mapped. This indicates that those locations in the PLC are mapped to the device with a MAC ID of 21 (the motor starter). Also, the value on the left in the Mapped column of the motor starter record in the Scan List window is now 01, indicating that one input map exists for that device, as seen here:



Next we will map the "% Thermal Capacity" data to V1000.

Input Assembly 102								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Aux_FB		CntrlFromNet	Ready		Running1	Running2	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

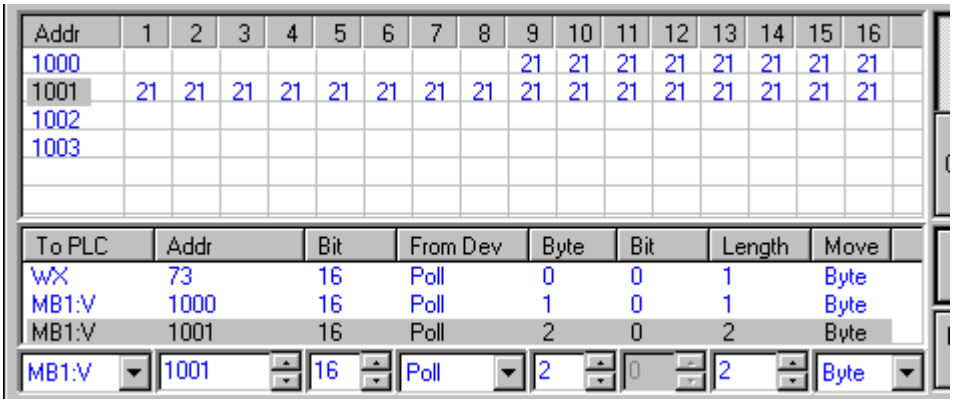
Click NEW to start a new map. Change the WX selection to MB1:V for the destination of the data. You will notice that the table displayed automatically changes to show the available V memory locations. Set the PLC starting address to 1000, select Poll message Byte 1 and length of 1. Click APPLY to update the display. The Mapped column in the Scan List for the motor starter should show 02 and the Device Configuration screen should look like this:



Finally, we will map the two bytes indicating the Average Current. Bytes 2 and 3 contain this information, as seen below:

Input Assembly 102								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Aux_FB		CntrlFromNet	Ready		Running1	Running2	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

Enter the proper values to indicate that this will be a Byte move to V memory starting at location 1001 from the poll message Byte 2 with a length of 2 bytes. The screen should look like this:



The last data to be mapped for the motor starter are the two bits in the output message that will be mapped to Y41 and Y42. See below:

Output Assembly 3								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0						Fault Reset		Run 1

Select the OUTPUT button and press New Map. Since we are going to place data from the DeviceNet message into discrete points, the type of move must be a Bit move. Select Bit from the list box list. We are going to map Y41 to the DeviceNet message's Byte 0, bit 0 (Run 1). Only one bit will be transferred. Set the values in the edit boxes to match the figure below:

Click the APPLY button. The motor starter record in the Scan List should now show 01 on the right side of the Mapped column. Click NEW MAP, change the address to 42 and the bit to be mapped to 2 and a length of one bit. Click the APPLY button. The Fault Reset bit of the DeviceNet message is now mapped.

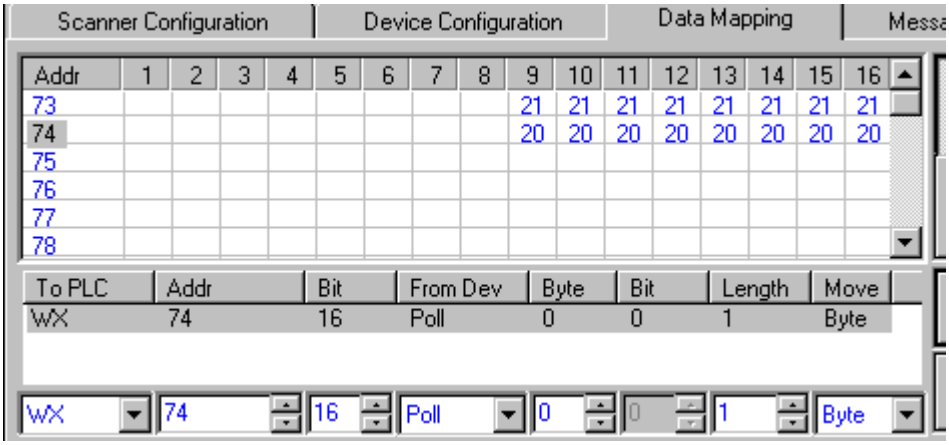
Change the map table view to the Device Message View by selecting that view in the View command menu. You should see that the two bits (bit 0 and 2) are shown with the value 21, indicating that they are mapped. The data messages to be mapped for the motor starter are now complete.

Mapping Device Data for the AC Drive

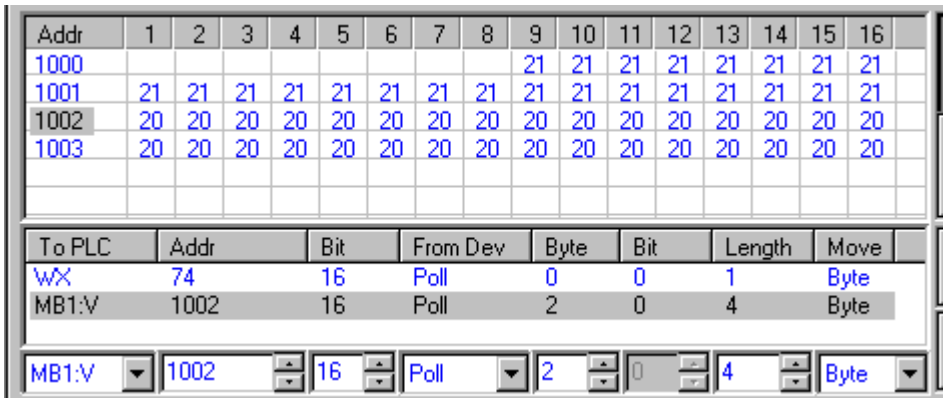
Select AC Drive 1 from the Scan List and go back to the PLC WX Memory view. As previously determined, the first byte from the input assembly will be mapped to WX74 and the last four bytes will be mapped to V memory locations 1002 and 1003.

Input Assembly 132								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Drive Fault	Drive Alarm	Drive Ready	At Speed	Fault Reset Active	Drive Reversing	At Zero Speed	Running
1	Zero Servo Complete	Motor Selection	Term 26 Output	Term 25 Output	Term 9,10 Output	Local/Remote	During Ride Thru	
2	Actual Current in Amps x100 (Low Byte)							
3	Actual Current in Amps x100 (High Byte)							
4	Actual Speed in Hz x100 (Low Byte)							
5	Actual Speed in Hz x100 (High Byte)							

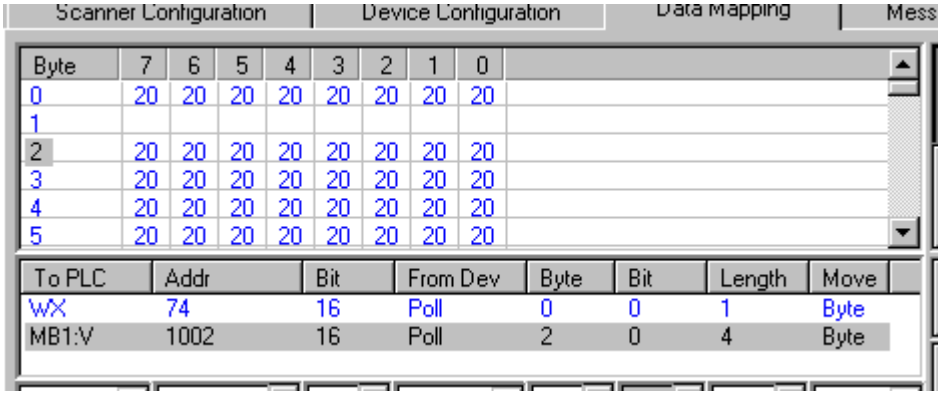
To map Byte 0 press New Map; then set the values to show that this will be a single byte move to WX74 from byte zero of the Motor starter. Click APPLY to accept the new map. The Data Mapping window should now look like this:



Click NEW MAP again to map the last four message bytes to V memory. Set up the parameters to show that this is a byte move to V memory, starting with address 1002. Indicate that the move will start with Byte 2 and will be four bytes long. Click APPLY. The screen should look like this:



Switch to the Device Message view and see how all the message bytes indicate that they are mapped, except Byte 1, which we intentionally left untouched.

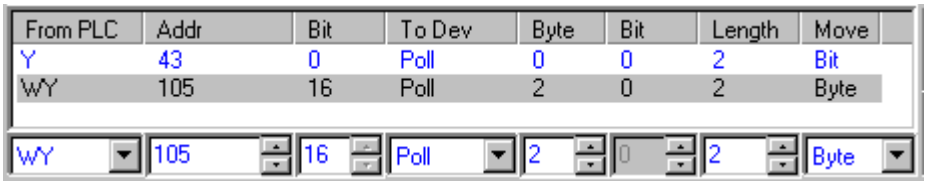


Finally, we are ready to map the AC Drive output.

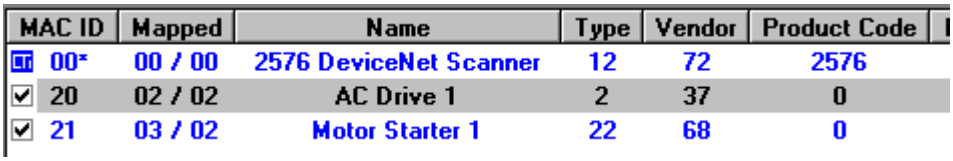
Output Assembly 120								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Terminal 8 Function	Terminal 7 Function	Terminal 6 Function	Terminal 5 Function	Terminal 4 Function	Terminal 3 Function	Run Reverse	Run Forward
1							Fault Reset	External Fault
2	Speed Reference in Hz X 100 (Low Byte)							
3	Speed Reference in Hz X 100 (High Byte)							

Select OUTPUT and press NEW MAP. Unlike the two bits in the motor starter output assembly, the two bits we want to use in the first byte of the AC drive output assembly are contiguous. Therefore, we can map the two bits in one map. Change the data table by selecting this to be a map to Y. Now set the map to send the data to the PLC starting with Y43. Make sure that the values in the edit boxes indicate Poll, Byte 0, and Bit 0. Since we are going to move both bits 0 and 1, we need to set the length of the move to 2. Click APPLY.

Finally, we need to map Bytes 2 and 3 of the AC drive output assembly. Press NEW MAP and select a Byte move. Enter the data to map data from Bytes 2 and 3 to WY105 and click APPLY. With the two maps entered, the Device configuration screen should look like this:



The Scan List window should display three lines with the values indicated in the figure below:



With the configuration work complete, let's save the data to a file. Go to the FILE command menu and select SAVE from the list. Select any directory in which you wish to place the file. Name the file "example1.dsc."

Downloading the Configuration File to the DeviceNet Scanner Module

Use the Communications Port command in the Module dropdown menu to establish a connection from the PC to the module. To download the configuration file to the Scanner's Flash memory, select DOWNLOAD CONFIGURATION in the Module dropdown menu list and complete the dialogs. Assuming a connection can be established, the configuration file will be downloaded to the Scanner.

Once the download is complete, you will need to reset the scanner before the new configuration takes effect. Go to the Module menu again and select RESET SCANNER. The module should connect to the devices and you should be able to monitor and control them from the PLC.

CHAPTER 6. TROUBLESHOOTING

This chapter describes some of the problems that may occur during your installation and offers possible solutions. Typical causes of problems include:

- Module not configured in PLC I/O table
- DeviceNet power not present
- Devices improperly configured/installed
- Scan List configuration errors
- Data Mapping Errors
- Network "noise" caused by improper installation.

Module LEDs:
The LEDs are used to indicate the status of the module. If you are having a problem with your installation, these can be used to determine the general cause.

Diagnostic Information:
You can use the Configuration program to retrieve various diagnostic data from the module. Important diagnostic information includes:

- **Event Log**: The Event Log maintains a list of the last 2000 events in RAM. This log is cleared each time power to the module is removed.
- **Fatal Error Log**: The fatal error log maintains a list of critical events in flash memory. This log will not be cleared when power is cycled.
- **Scanner Operational Statistics**: This includes vital statistics about the scanner and the attached DeviceNet network.

If you are unable to solve your problem using these tools, you should contact CTI customer support for additional assistance. Information is also available from the CTI Web site, http:\\www.controltechnology.com.

6.1. General Module Problems

This set of problems includes situations where the module fails to start up properly. See the table below:

SYMPTOM	POSSSIBLE CAUSE	CORRECTIVE ACTION
Active Indicator not lit.	Power has not been applied to the module.	Ensure that power is supplied to the rack and that the module is securely inserted.

SYMPTOM	POSSSIBLE CAUSE	CORRECTIVE ACTION
Active Indicator flashes continuously (approximately 2 times per second). NOTE: This indicator will temporarily flash during module startup.	Module is not logged into the PLC.	Using the PLC programming software, configure the PLC I/O table to include the 2576.
Active Indicator flashes three short flashes, followed by a short pause	There is no valid DeviceNet Module (supervisory) program in flash memory. Program loader is in control.	Use the 2576 Configuration Program to download a new DeviceNet Module program (DNM).
Active Indicator flashes and the module periodically resets.	A fatal error has occurred in the module.	Cycle the power. If the ACTIVE light does not remain on, replace the module.
Module Status Indicator is red. Module periodically resets.	A fatal error has occurred in the DeviceNet Scanner processor.	Cycle the power. If the problem persists, download another copy of the DeviceNet Scanner (DNS) software.
Module Status Indicator is Flashing Red.	Error in scanner configuration.	Download another configuration to the scanner. If the problem persists, download another copy of the DeviceNet Scanner (DNS) software.
Module Status Indicator is Flashing Green.	The scanner has no configuration file or contains a configuration file with no active devices.	Download another configuration to the scanner.

6.2. Device Communications Problems

This set of problems includes those where one or more devices cannot be accessed by the PLC. The most likely cause of these problems is incorrect configuration of either the scanner or the device.

No Communication with any Device

LED CONDITIONS	POSSIBLE CAUSES	CORRECTIVE ACTION
Network Status LED is Red. Status Code 96 – 01 is displayed.	Duplicate MAC ID. Another device on the network has the same MAC ID as the scanner.	Using the configuration program, change the MAC ID of the device or scanner to an unused address.
	Invalid Scanner Baud Rate setting. The scanner is set to a baud rate different from the network devices.	Using the configuration program, change the baud rate of the scanner to match the devices.
	Invalid Device Baud Rate setting. At least one device on the network is set to a baud rate different from the rest.	Change the baud rate of the offending device(s).
Network Status LED is Off. Status Code 96 – 02.	DeviceNet power is not present at the module.	Check that the DeviceNet cable is attached and properly wired. Ensure that power has been applied to the DeviceNet network.
Other	Configuration Error.	See Following Section.

One or more devices cannot be accessed by the PLC

MODULE LED CONDITION	POSSIBLE CAUSES	CORRECTIVE ACTION
LED Conditions: Normal Active LED – On Solid Module Status LED – Solid Green Network Status LED – Solid Green No Device Error Codes on module display.	Device is not in the scan list.	Review the configuration file to ensure that an entry exists for the device. If no entry exists, add the device, create appropriate maps, download the new configuration to the scanner, and restart the scanner.
	Device is not active in the scan list.	Review the scan list to ensure that the device is active in the scan. If the device is not active in the scan, activate it in the configuration, download the new configuration to the scanner, and restart the scanner.
	No map has been created for the device.	Review the scan list to ensure that at least one data map has been created for the device. If there is no data map, create at least one, download the configuration to the scanner, and restart the scanner.
	The device is not mapped to the proper location in the PLC.	Review the data map for the device. For WX, WY, X, or Y maps, make sure that the configuration login address matches the actual starting address of the module in the PLC I/O configuration. If there is a problem, make changes as required, download, and restart the scanner. For V memory maps, make sure the memory block starting address matches the desired V memory location.

LED CONDITIONS	POSSIBLE CAUSES	CORRECTIVE ACTION
Network Status LED is Flashing Red. Status Code for the Device MAC ID is 8, 9, 10, 11,12, or 13. (Scanner is attempting to connect to the device.)	Device is not operational.	Check the status LED(s) on the device. Ensure that power and DeviceNet signal cabling is properly connected. Replace device, if necessary.
	Device MAC ID is improperly set.	Verify that the MAC ID matches the entry in the scanner configuration. Ensure that the MAC ID is not a duplicate.
Network Status LED is Flashing Red. Status Code for the Device MAC ID is 50 through 65.	Reported device attributes do not match scanner configuration.	Verify actual device identity, connection, and assembly attributes preferably using an on-line configuration tool. Compare the actual device attributes with the scanner configuration. Change scanner or device configuration as required. *NOTE: You may temporarily suspend all identity object checking by the scanner to test the device connection*

Intermittent loss of communications with various devices

LED CONDITIONS	POSSIBLE CAUSES	CORRECTIVE ACTION
Network Status LED changes from Solid Green to Flashing Red.	Physical Network Problems. The network may be improperly terminated, maximum lengths exceeded, or improperly wired.	Ensure network topology meets the DeviceNet specifications. Review the scanner diagnostics (Scanner Statistics and Event Log) for possible causes. Temporarily decrease network baud rate and observe the results.
	Faulty Device. A faulty device may be causing DeviceNet errors.	Review the scanner diagnostics (Scanner Statistics and Event Log) for possible causes. Systematically remove/replace devices on the network to locate faulty device. Use network diagnostic tools to locate the problem.

Intermittent loss of communications with the same device

LED CONDITIONS	POSSIBLE CAUSES	CORRECTIVE ACTION
Network Status LED changes from Green to Flashing Red.	The Device is faulty The device cannot operate reliably at higher baud rates.	Replace the device. Reduce the network baud rate.
	Physical Network Problems	See above.

6.3. Serial Communications Problems

This set of problems may occur when using the configuration program to access the module via the serial configuration port. Common sources of communications problems are bad or improperly wired cables and improperly set communications parameters. The receive (RCV) and transmit (XMT) indicators can be a valuable aid in troubleshooting these errors. The RCV LED illuminates when a signal is received at the serial port receive line. The XMT LED illuminates when the 2576 module sends a signal to the serial port.

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
Configuration program reports a Communications Timeout. Neither module XMT nor RCV LEDs illuminate.	Defective Cable.	Verify integrity of the cable. Note: If the cable can be used to access the PLC via the serial port, it should be OK.
Configuration program reports a Communications Timeout. Module XMT LED flashes but RCV LED does not illuminate.	Invalid communications parameter setting in the configuration program.	Set the communications parameters to: Baud = 19200 Parity = None Data Bits = 8 Stop Bits = 1.

APPENDIX A. CONNECTORS AND CABLING

Configuration Port Cabling

The configuration port on the 2576 uses a DB9 male connector to provide an RS-232C interface. The following pins are used:

Pin #	RS-232 Signal
2	RxD: Received Data (input)
3	TxD: Transmitted Data (output)
5	SG: Signal Ground

Figure 14 illustrates how to construct an RS-232C cable typically used for connecting the DeviceNet Scanner's Configuration port to a PC's DB9 serial port connector. A cable used to connect to the PLC programming port may be used.

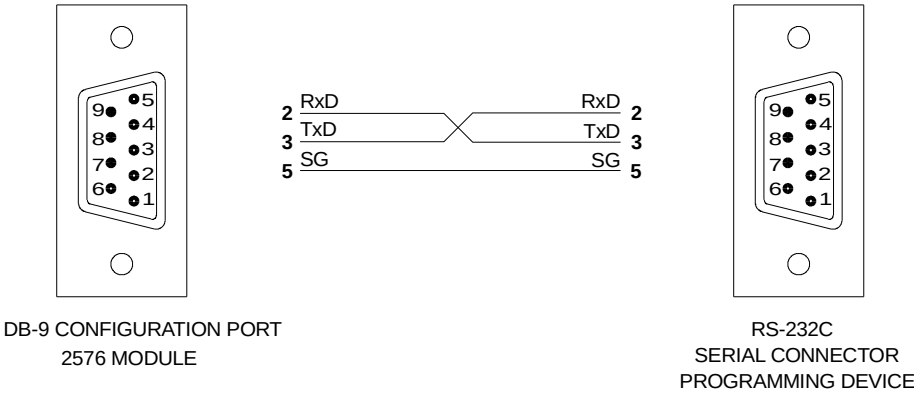


Figure 14. 2576 Configuration Port Cable

DeviceNet Cabling

The 2576 module uses an in-line 5-pin male (Phoenix style) connector to connect to the DeviceNet network. To provide a connection to the 2576 from the DeviceNet network, build a cable with a standard Tap or drop-line connection at the network end of the cable. At the 2576 end, strip back the cable insulation and connect the five leads, which must have their insulation stripped back also, to a female, 5-pin, screw type, Phoenix style connector using the diagram below:

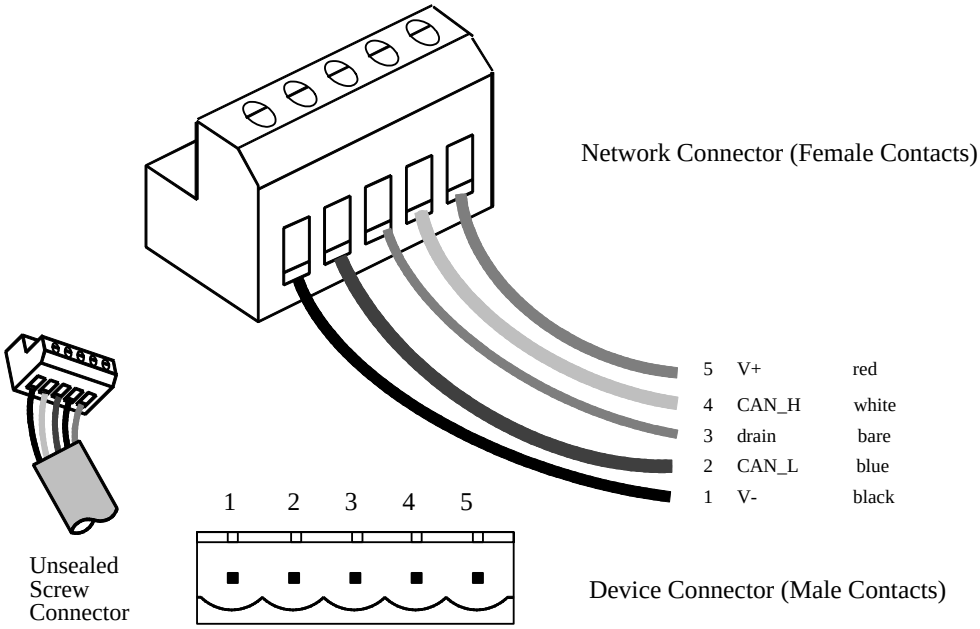


Figure 15. 2576 DeviceNet Cable

On the front panel of the 2576 DeviceNet Scanner is a color-coded diagram. Before connecting the cable to the scanner, verify that the colors of the wires in the connector match that of the module's overlay. This will ensure a correct wiring and orientation of the cable, provided the other end of the cable is also wired correctly.

APPENDIX B. LED DISPLAY CODES

This appendix describes the error/status codes that may be produced by the 2576 module. In addition to this display, additional error/status information can be obtained from the Module Status Word and CTI diagnostic software. The use of the Module Status Word is described in the PLC Programming Appendix. The use of diagnostic software is described in *Chapter 6. Troubleshooting*.

The 2576 will use the set of 7 segment LEDs to report certain module, network or device errors. The top LED set is used to report the node in error or the class of error. The bottom LED set is used to display the actual error/status codes. When multiple devices have errors and/or multiple classes of errors exist, the 2576 will cycle through the current status of all nodes or error classes.

The LED display is designed to assist the user in diagnosing persistent errors. The LED display is updated only once per second to provide enough time for the user to view it. The display indicates the current device status at the time the display is updated. Consequently, when the device status is changing quickly, the status transitions may not appear on the display.

LED Display Use

NODE ADDRESS Display

The NODE ADDRESS display is used to display either a MAC ID or an error code category. Values 0 through 63 refer to a MAC ID. The code shown in the Error Code display applies to this device. Values greater than 63 represent additional categories of scanner errors.

ERROR CODE Display

The ERROR CODE display is used to present numerical codes, which indicate module status or error conditions. The interpretation of the ERROR CODE depends on the value in the Node Address display. See the table below:

Error Code / Status Code Group Values

The following table illustrates the NODE ADDRESS and related status information:

Node Address	Error/Status Code Group
0 - 63	Device Status Codes (including scanner)
88	Lamp Test
91	Scanner Errors
96	CAN Controller Hardware
97	DeviceNet Network Access
98	Application Thread
99	Module Status Monitor

Node Status Codes (Node Address 0 - 63)

When the Node Address LED contains a value less than 64, the Status Code applies to a particular MAC ID. Codes will be displayed during initial startup and if an error condition occurs. If startup has been completed and there are no errors, the Node Address will display the MAC ID of the scanner and the Status Code will be 80.

Code	Description
01	Node Presence Detected
02	Node is not connected
03	Node being configured
05	A connection timeout has occurred
06	A connection error has occurred
07	Need to establish connection
08	First attempt to connect via UCMM
09	Second attempt for a UCMM connection
10	First attempt to use M/S connect
11	Second attempt to use M/S connect
12	Failed second attempt to use M/S connect
13	Node did not respond with connection
14	Missing node was noticed via DUP MAC
15	Node rejected UCMM connection
16	Set explicit message connection EPR
17	Waiting reply to Get Vendor ID
18	Waiting reply to Get Device Code
19	Waiting reply to Get Product Code
20	Waiting reply to Get Product Revision
21	Waiting reply to Get Serial Number
22	Waiting reply to Get Configuration Consistency Value
23	Waiting reply to Get Heartbeat attribute
24	Invalid Product Name attribute
25	Waiting reply to Get Identity Status attribute
26	Waiting reply to Get Identity State attribute
27	Invalid Strobe Message Size
28	Set Strobe connection EPR
29	Waiting reply to Get Poll production size
30	Waiting reply to Get Poll consumption size
31	Set Poll Connection EPR
32	Waiting reply to Get COS/Cyclic production size
33	Waiting reply to Get COS/Cyclic consumption size
34	Set device's COS/Cyclic connection EPR
35	Set device's COS/Cyclic Acknowledgement Timer
36	Set device's COS/Cyclic Production Inhibit Timer
37	Opening M/S I/O connection(s)
38	Reset M/S connections: close connections
39	Retry open M/S I/O connection(s)

Code	Description
40	Node is operating normally (will display as “00” on the segment LEDs)
44	Disconnect from node (M/S)
45	Disconnect transaction active
46	Failed to disconnect (M/S)
47	Disconnect from node (UCMM)
48	Disconnect transaction active (UCMM)
49	Failed to disconnect (UCMM)
50	Some other error encountered
52	Fault in state machine re: this node
53	Invalid Vendor Id
54	Invalid Device Type
55	Invalid Product Code
56	Invalid Product Revision
57	Invalid reply to Get Serial Number
58	Invalid Get Configuration Consistency Val
59	Invalid Heartbeat attribute
60	Invalid Product Name attribute
61	Invalid Identity Status attribute
62	Invalid Identity State attribute
63	Invalid Strobe Message Size
64	Rejected strobe EPR
65	Invalid Polled production size
66	Invalid Polled consumption size
67	Rejected poll EPR
68	Invalid Change-of State/Cyclic (COS/Cyclic) production size
69	Invalid COS/Cyclic consumption size
70	Rejected COS/Cyclic EPR
71	Invalid DeviceNet protocol response
72	Invalid DeviceNet protocol response
73	Unexpected M/S message body
74	Unexpected error during MS explicit message open
75	Unable to open M/S I/O connection(s)
76	Unable to get identity object
80	Scanner OK; in run or scanning state
81	Scanner has not been started
82	Scanner not configured
83	Scanner does not have network access
84	Scanner starting operation
85	Transition STARTUP to RUN
86	Scanner in Run State
88	Scanner in Scanning State
89	Scanner IDLE
90	Self detected FAULT
91	Operator directed FAULT
92	Logic state error
93	Operator directed STOP
94	Scanner is STOPPED

Program Logic Fault Codes (Node Address 90)

Contact CTI if these errors are encountered.

Code	Description
1	Semaphore Locked
2	Messages Discarded
3	Display Index Greater than 99

Scanner Error Codes (Node Address 91)

Code	Description
1	Scan Overrun. The fixed scan setting is too short to allow all polls to be sent and all responses to be processed. The start of next scan is being deferred to allow processing of device responses. If this error persists you should increase the configured scan time.
2	Duplicate MAC ID response message received while the scanner was ONLINE.
3	Duplicate MAC ID request received while the scanner was not ONLINE.

CAN Controller Hardware Status Codes (Node Address 96)

Code	Description
1	BUS OFF: Abnormal rate of occurrences of errors on the CAN Bus. No messages are being received or transmitted.
2	DeviceNet Network power (24V) is not present.
3	DeviceNet voltage is out of the acceptable range.
4	BUS WARNING: Abnormal rate of occurrences of errors on the CAN Bus. Messages are still being received and transmitted.
13	Acknowledgement Error (AckError): The message transmitted by this device was not acknowledged by another node.

DeviceNet Network Access Status Codes (Node Address 97)

When the Node Address display shows the virtual node address 97, then the status codes shown are the DeviceNet Network Access Status Codes. These codes are shown in the following table:

Code	Description
0	Disconnected from DeviceNet
1	DeviceNet fault: Duplicate MAC ID check request/response received -or- CAN bus-off detected
2	DeviceNet Access off-line
3	Duplicate MAC ID response message received
4	Duplicate MAC ID request message received
5	Node is in Bus Off condition
6	Power-up in progress
7	Power-up/reset has just occurred
8	First DUP MAC ID check message send
9	First DUP MAC ID check message wait
10	Second DUP MAC ID check message sent
11	Second DUP MAC ID check message wait
14	Online transition successful
15	Online transition successful
16	Scanner ONLINE and scanning at least one node
17	Scanner RESET required
18	Scanner is performing RESET activities

DeviceNet Application Thread Codes (Node Address 98)

Code	Description
1	Main Initialization
3	Performing Configuration Check
13	Thread Stopped

APPENDIX C. STATUS MONITORING

The 2576 module provides several ways in which the PLC can monitor the status of the module and its connection to DeviceNet devices. The Module Status Word is available to the PLC as soon as the module is configured in the PLC I/O table. Other status information may be transferred to the PLC using standard data mapping procedures.

Module Status Word

The Module Status Word, located in first Special Function input word, is used to communicate the overall status of the module. Your PLC logic should monitor certain status bits to ensure the validity of input data. The Module Status Word is structured as follows:

Bit	Description	Comments
1	Module Fail	Set on when the supervisory processor detects a fatal error. When this bit is set, bits 9-16 will contain an 8 bit error code.
2	Scanner Fail	Set on when the DeviceNet Scanner Processor (DNS) detects a fatal scanner error.
3	Config Required	Set by DNS to indicate scanner configuration is not loaded. This bit will remain on until all configuration data has been downloaded to the scanner and there is no configuration error. If there is no DNS valid program then this bit will be off and Config Err will be on (see below).
4	Config Err	On when: 1) There is no valid DNS code (Bit 3 is off)). 2) The configuration file is bad (Bit 3 is on).
5	Scanner Offline	On when the scanner is not operational (capable of sending/receiving DeviceNet messages).
6	Scan Stopped	On when the scanner is not scanning.
7	D/N Begin of Scan	This bit is set to 1 by the DNS at the beginning of each scan. It will remain present for only one PLC scan. The Supervisory Processor will set this to 0 on the subsequent scan.
8	Network Error	Indicates that there is an error that prevents any communications on the DeviceNet network. This may include a no power to the network or scanner duplicate MAC ID.
9	Device Offline	At least one device in the scan list is offline (not connected). This may occur either before the scanner has attempted to connect or if the device loses communications (times out).
10	Block Xfer Error	Set if an error is present transferring at least one memory block. Typically due to a configuration error (invalid memory address).
11	Scan Overrun	Set when the actual scan interval exceeds the user specified scan time.
12	Reserved	Not used, Set to 0.
13 – 16	Module Counter	The counter increments approximately once per second and wraps at 0xF back to 0. Used as an indication that the supervisory processor is alive.

Scanner / Device Status Information

The 2576 DeviceNet scanner maintains additional status information that can be transferred to the PLC. The status data is available in two virtual I/O assemblies that can be mapped to the PLC using the same data mapping techniques used with the slave devices. See Section *3.6. DeviceNet Status Data Mapping* on page 24 for implementation details.

Strobed I/O Assembly

DeviceNet Status Data									
Byte	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	I/O Processing Time (Low Byte)								
1	I/O Processing Time (High Byte)								
2	In-Scan-List MAC ID 0 - 7	MACID 7	MACID 6	MACID 5	MACID 4	MACID 3	MACID 2	MACID 1	MACID 0
3	In-Scan-List MAC ID 8 -15	MACID 15	MACID 14	MACID 14	MACID 12	MACID 11	MACID 10	MACID 9	MACID 8
4	In-Scan-List MAC ID 16-23	MACID 23	MACID 22	MACID 21	MACID 20	MACID 19	MACID 18	MACID 17	MACID 16
5	In-Scan-List MAC ID 24-31	MACID 31	MACID 30	MACID 29	MACID 28	MACID 27	MACID 26	MACID 25	MACID 24
6	In-Scan-List MAC ID 32-39	MACID 39	MACID 38	MACID 37	MACID 36	MACID 35	MACID 34	MACID 33	MACID 32
7	In-Scan-List MAC ID 40-47	MACID 47	MACID 46	MACID 45	MACID 44	MACID 43	MACID 42	MACID 41	MACID 40
8	In-Scan-List MAC ID 48-55	MACID 55	MACID 54	MACID 53	MACID 52	MACID 51	MACID 50	MACID 49	MACID 48
9	In-Scan-List MAC ID 56-63	MACID 63	MACID 62	MACID 61	MACID 60	MACID 59	MACID 58	MACID 57	MACID 56
10	Device Error MAC ID 0 - 7	MACID 7	MACID 6	MACID 5	MACID 4	MACID 3	MACID 2	MACID 1	MACID 0
11	Device Error MAC ID 8 -15	MACID 15	MACID 14	MACID 14	MACID 12	MACID 11	MACID 10	MACID 9	MACID 8
12	Device Error MAC ID 16-23	MACID 23	MACID 22	MACID 21	MACID 20	MACID 19	MACID 18	MACID 17	MACID 16
13	Device Error MAC ID 24-31	MACID 31	MACID 30	MACID 29	MACID 28	MACID 27	MACID 26	MACID 25	MACID 24
14	Device Error MAC ID 32-39	MACID 39	MACID 38	MACID 37	MACID 36	MACID 35	MACID 34	MACID 33	MACID 32
15	Device Error MAC ID 40-47	MACID 47	MACID 46	MACID 45	MACID 44	MACID 43	MACID 42	MACID 41	MACID 40
16	Device Error MAC ID 48-55	MACID 55	MACID 54	MACID 53	MACID 52	MACID 51	MACID 50	MACID 49	MACID 48
17	Device Error MAC ID 56-63	MACID 63	MACID 62	MACID 61	MACID 60	MACID 59	MACID 58	MACID 57	MACID 56
18	Scanner Status Code								
19	Scanner Error Code								
20	CAN Hardware Status Code								
21	Network Access Status Code								
22	DN Scan Counter (Low Byte)								
23	DN Scan Interval (High Byte)								

The strobed I/O assembly provides information that includes the operational status of all devices on the network. Your PLC logic could use this information to monitor individual device failures.

I/O Processing Time Bytes 0 – 1	Indicates the amount of time actually required to read / write all devices in the scan list.
In-Scan List Bytes 2 – 9	The bit corresponding to the device MAC ID is set to 1 for every device that is active in the scan list.
Device Error Bytes 10 – 17	The bit corresponding to the device MAC ID is set to 1 for every active device that is not communicating properly with the scanner.
Status Codes Bytes 18 – 21	See Appendix B for a complete description.
DN Scan Counter Bytes 22 – 23	Wraps to 0 after 65,535 scans. PLC update interval depends upon PLC scan time and rate set with Configuration program.

Polled I/O Assembly

Device Status Codes	
Byte	**Description**
0	Status Code – MAC ID 0
1	Status Code – MAC ID 1
2	Status Code – MAC ID 2
3 - 62	Status Codes – MAC ID 3 - 62
63	Status Codes – MAC ID 63

The Polled I/O Assembly provides a status code for each device on the network, including the scanner. The status code corresponds to the Node Status Codes in Appendix B.

HARDWARE SPECIFICATIONS

Configuration Port:

Connector: Male DB9
Electrical Interface: RS –232 subset (TxD, RxD, SG)

DeviceNet Port:

Connector: 5-pin Phoenix Style
Pinout: DeviceNet Standard
Baud Rate: 125, 250, 500 KB

Power tap:

Connector: 2-pin Phoenix style
Rating: 4 amps @ 24VDC

Status LEDs

Active: Red
Module Status: Bicolor (Red/Green)
Network Status: Bicolor (Red/Green)
Node Address: Two 7 segment LED
Error Code: Two 7 Segment LED

Module Size: Double-Wide Siemens® SIMATIC® 505 I/O

Power Consumption:

Backplane: 7.0 watts @ 5VDC
DeviceNet: 100 ma @ 24VDC

Environmental:

Operating Temperature: 0 to 60 C (32 to 140 F)
Storage Temperature: -40 to 85 C (-40 to 185 F)
Relative Humidity: 5% to 95% (non-condensing)
Shipping Weight: 3lbs (approximate)

Agency Approvals: UL and FM Pending

LIMITED PRODUCT WARRANTY

CTI warrants that this CTI Industrial Product shall be free from defects in material and workmanship for a period of one (1) year after purchase from CTI or from an authorized CTI Industrial Distributor. This CTI Industrial Product will be newly manufactured from new and/or serviceable used parts which are equal to new in the Product.

Should this CTI Industrial Product fail to be free from defects in material and workmanship at any time during this (1) year warranty period, CTI will repair or replace (at its option) parts or Products found to be defective and shipped prepaid by the customer to a designated CTI service location along with proof of purchase date and associated serial number. Repair parts and replacement Product furnished under this warranty will be on an exchange basis and will be either reconditioned or new. All exchanged parts or Products become the property of CTI. Should any Product or part returned to CTI hereunder be found by CTI to be without defect, CTI will return such Product or part to the customer.

This warranty does not include repair of damage to a part or Product resulting from: failure to provide a suitable environment as specified in applicable Product specifications, or damage caused by an accident, disaster, acts of God, neglect, abuse, misuse, transportation, alterations, attachments, accessories, supplies, non-CTI parts, non-CTI repairs or activities, or to any damage whose proximate cause was utilities or utility like services, or faulty installation or maintenance done by someone other than CTI.

Control Technology Inc. reserves the right to make changes to the Product in order to improve reliability, function, or design in the pursuit of providing the best possible Product. CTI assumes no responsibility for indirect or consequential damages resulting from the use or application of this equipment.

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SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

REPAIR POLICY

In the event that the Product should fail during or after the warranty period, a Return Material Authorization (RMA) number can be requested orally or in writing from CTI main offices. Whether this equipment is in or out of warranty, a Purchase Order number provided to CTI when requesting the RMA number will aid in expediting the repair process. The RMA number that is issued and your Purchase Order number should be referenced on the returning equipment's shipping documentation. Additionally, if the product is under warranty, proof of purchase date and serial number must accompany the returned equipment. The current repair and/or exchange rates can be obtained by contacting CTI's main office at 1-800-537-8398.

When returning any module to CTI, follow proper static control precautions. Keep the module away from polyethylene products, polystyrene products and all other static producing materials. Packing the module in its original conductive bag is the preferred way to control static problems during shipment. Failure to observe static control precautions may void the warranty. For additional information on static control precautions, contact CTI's office at 1-800-537-8398.