



## DeviceNet Scanner Module

(Catalog Number 1747-SDN/B)

### Contents

Use this document as a guide when installing the 1747-SDN/B scanner module.

To	See page
prevent Electrostatic Discharge	3
understand compliance to European Union Directives	3
identify related publications	4
identify scanner module features	4
prepare for module installation	6
install the scanner module into the chassis	7
connect the scanner module to the DeviceNet™ drop line	8
apply chassis power	9
understand the data organization of the scanner module	9
program the scanner module using the M0 and M1 Files	11
upload input data from the scanner module	14
download output data from the scanner module	18
use the explicit message program control	20
troubleshoot the module and network	27
For this reference information	See page
Specifications	30

### Module Features



For More Information...

The 1747-SDN/B has the following features. You activate these features using DeviceNet Manager Software. For more information, refer to your DeviceNet Manager Software User Manual (publication number 1787-6.5.3) and your 1747-SDN Scanner Configuration Manual (publication number 1747-6.5.2).

#### Slave Mode

The slave mode feature allows processor-to-processor communication. Slave mode also allows the scanner to perform as a slave device to another master on the network.

Like any other slave, when the scanner module is in slave mode, it exchanges data with only one master. You control what information is exchanged through scan list configuration and associated mapping functions of DeviceNet Manager software.

The slave mode function has the following variations:

The scanner is in:	When:
Null Mode	it contains an empty or disabled scan list (out-of-box default)
Master Mode	it serves as a master to one or more slaves but is not simultaneously serving as a slave to another master
Slave Mode	it serves as a slave to another master
Dual Mode	it serves as both a master to one or more slaves and as a slave to another master simultaneously

### Change of State

The change of state function notifies the scanner module to perform a scan:

- whenever a network data change occurs, or
- at a user-configurable heartbeat rate

Because data is only sent on an as-needed basis, change of state increases system performance by reducing network traffic.

### Cyclic I/O

The cyclic I/O feature allows you to set the scanner module to perform a scan at a specific send rate.

Because data is only sent at a periodic rate, cyclic I/O increases system performance by reducing network traffic.

### Other New Information

Along with these new features are areas in this document that are different from the previous edition. These areas are marked with change bars (as shown to the right of this paragraph) to indicate the addition of new or revised information.

## Prevent Electrostatic Discharge

The scanner module is sensitive to electrostatic discharge.



**ATTENTION:** Electrostatic discharge can damage integrated circuits or semiconductors if you touch backplane connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential
- Wear an approved wrist-strap grounding device
- Do not touch the backplane connector or connector pins
- Do not touch circuit components inside the module
- If available, use a static-safe work station
- When not in use, keep the module in its static-shield bag

## Understand Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

### EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2EMC – Generic Immunity Standard, Part 2 – Industrial Environment

This product is intended for use in an industrial environment.

### Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as these Allen-Bradley publications:

Publication	Publication number
<i>Industrial Automation Wiring and Grounding Guidelines For Noise Immunity</i>	1770-4.1
<i>Guidelines for Handling Lithium Batteries</i>	AG-5.4
<i>Automation Systems Catalog</i>	B111

## Identify Related Publications



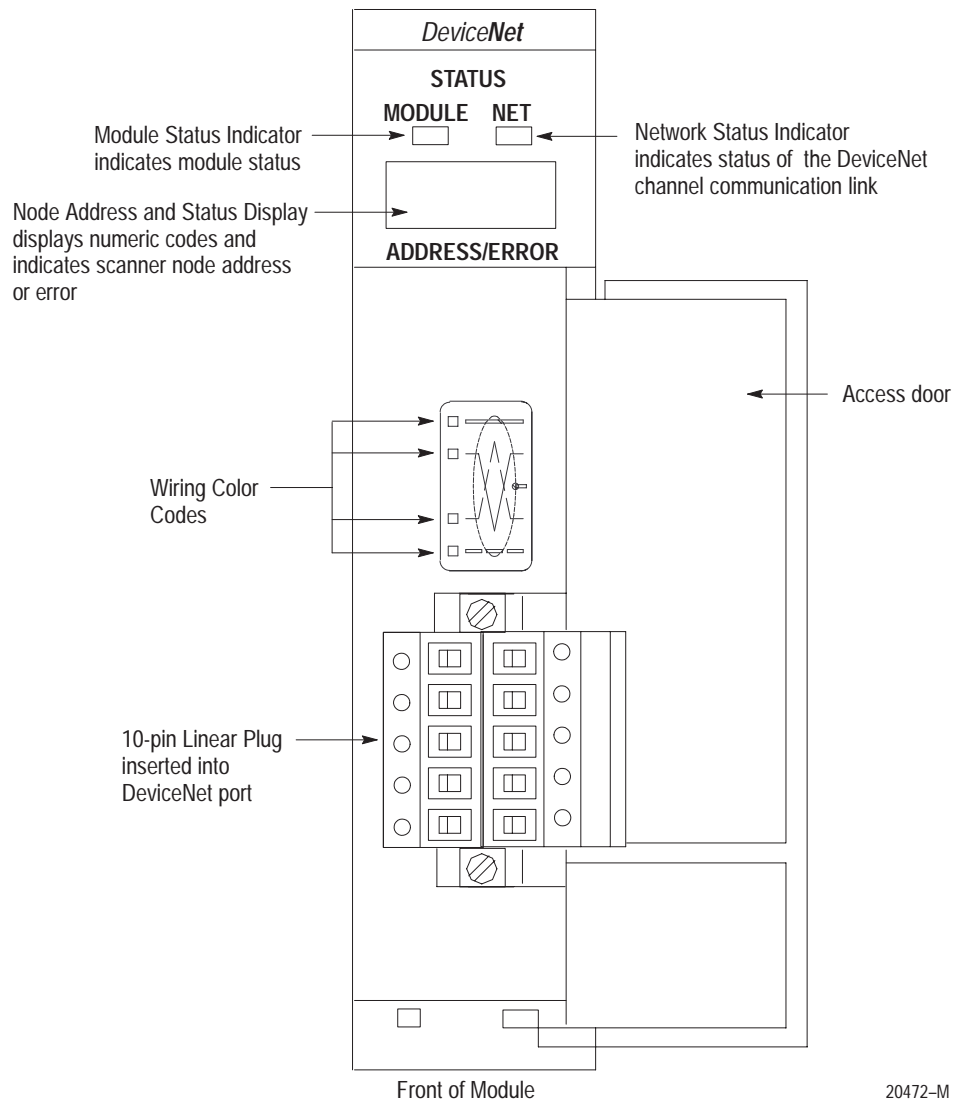
This icon is used when a related publication is referenced.

For software configuration information, refer to your DeviceNetManager™ Software User Manual (publication number 1787-6.5.3) and your 1747-SDN Scanner Configuration Manual (publication number 1747-6.5.2).

For planning and installation information, refer to the DeviceNet Cable System Planning and Installation Manual (publication number 1485-6.7.1). If you need a copy of this manual, fax the enclosed User Manual Request Card to 1-800-576-6340. If you are outside the U.S., fax the card to 1-330-723-4036.

## Identify Module Features

Use this illustration to identify the features of the 1747-SDN/B scanner module.

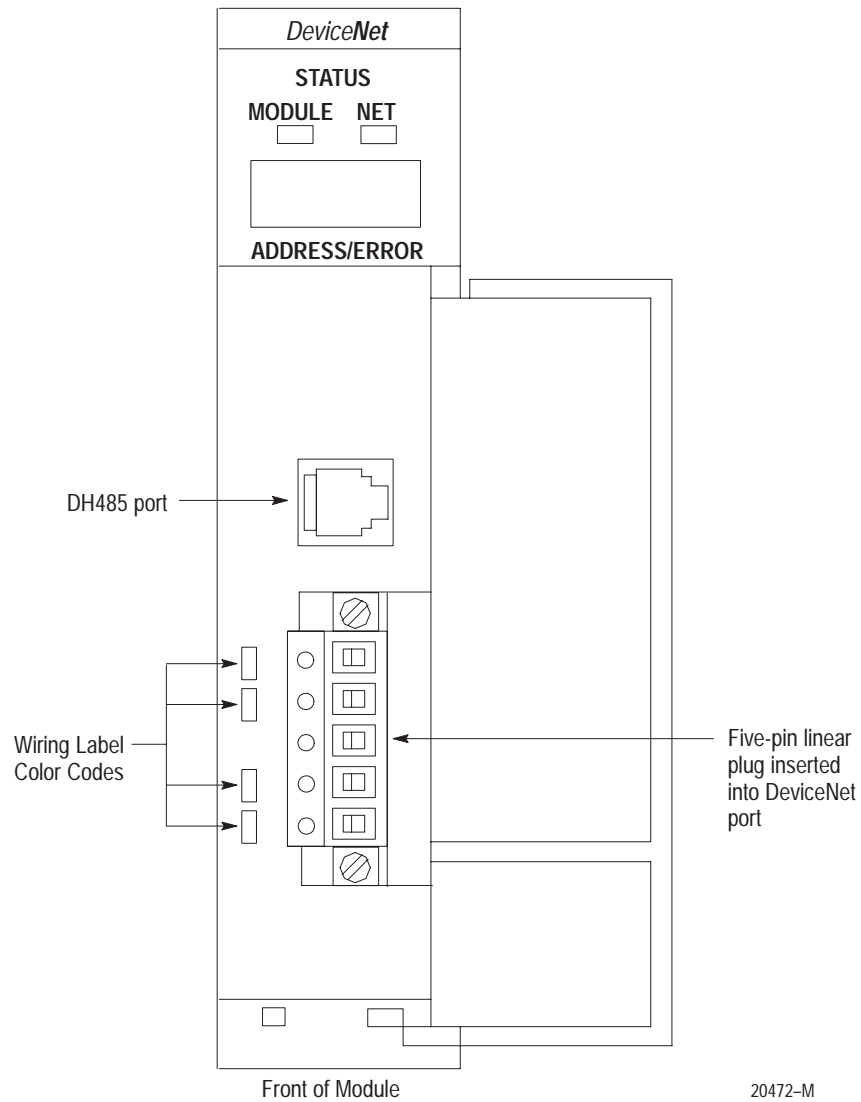


20472-M

## Series A Module Features

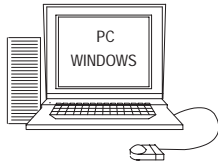
The Series A version of this module (1747-SDN) contains the following features:

- DH-485 port
- different wiring label
- five-pin linear plug



## Prepare for Module Installation

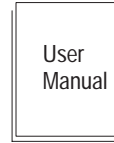
Before you install your module you need the following items:



Personal Computer with Microsoft Windows™ 3.1 or later Operating System



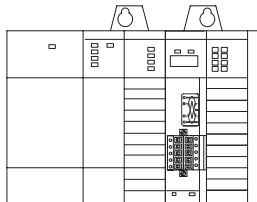
DeviceNet Manager for Windows Software  
Cat. No. 1787-MGR



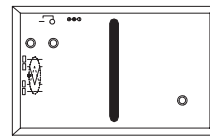
DeviceNet Manager for Windows Software User Manual  
Pub. No. 1787-6.5.3



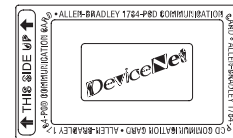
1747-SDN Scanner Configuration Manual  
Pub. No. 1747-6.5.2



SLC 1746 chassis with SLC 5/02, 5/03 or 5/04 processor



1770-KFD RS-232 DeviceNet Adapter or 1784-PCD DeviceNet PC Card



Before you install your module you must know how to:

- program and operate an Allen-Bradley SLC 500™ programmable controller
- install and configure the devices on your DeviceNet™ network

### Make Sure That Your Processor and Adapters are Compatible

You can use the 1747-SDN Scanner Module in a local I/O chassis with only the SLC 500 processor running in the leftmost slot.

**Important:** The 1747-SDN Scanner Module fits in any slot of the chassis except for the leftmost slot, which is reserved for the SLC 500 processor.

## Install the Module Into the Chassis

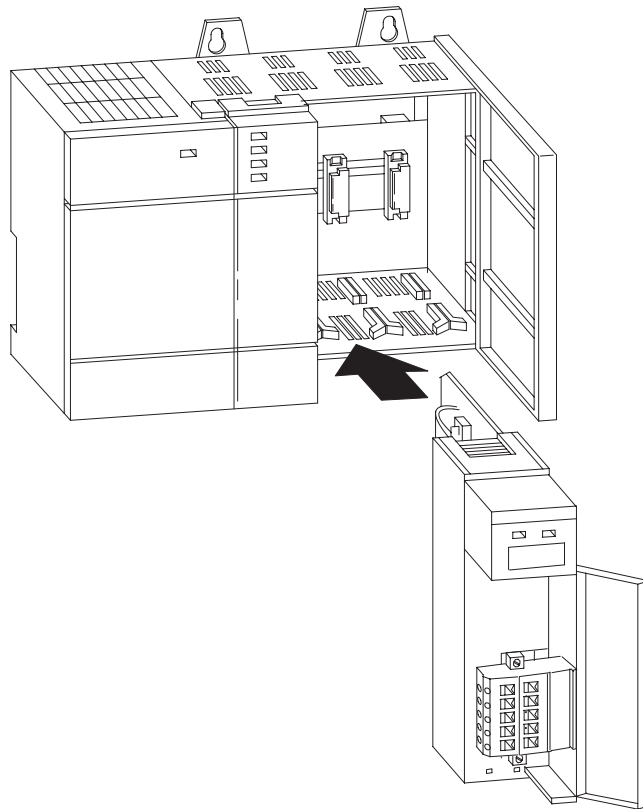
To install your module into the chassis:

1. Turn off the chassis power supply.



**ATTENTION:** Do not install the 1747-SDN Scanner Module with the chassis power supply on. Installing the module with the chassis power supply on may damage the module.

2. Select a slot for the module in the chassis. You may use any slot except the leftmost slot, which is reserved for the SLC 500 processor.



20442-M

3. Insert the module into the slot you have selected.
4. Apply firm, even pressure to seat the module in the I/O chassis backplane connectors.

## Connect the Module to the DeviceNet Drop Line

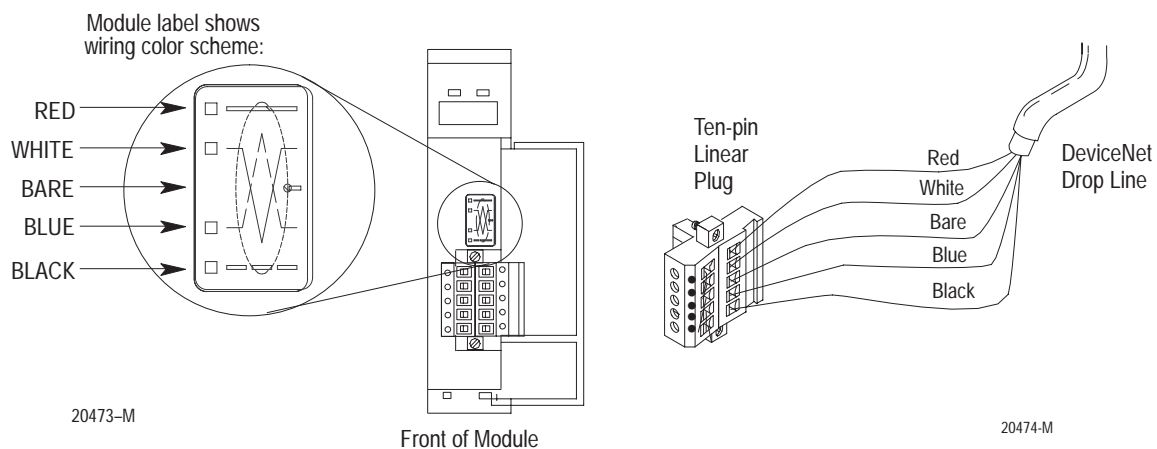
To connect your module to the DeviceNet drop line:

1. Turn off the network power supply.

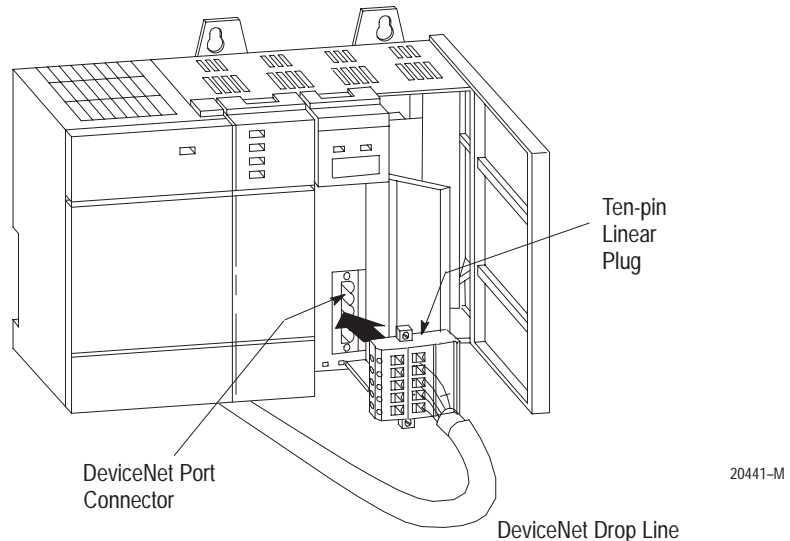


**ATTENTION:** Do not wire the 1747-SDN Scanner Module with the network power supply on. Wiring the module with the network power supply on may short your network or disrupt communication.

2. Connect the DeviceNet drop line to the ten-pin linear plug, by matching the wire insulation colors to the colors shown on the label:



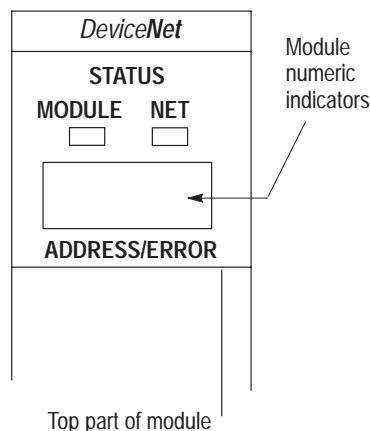
3. Locate the DeviceNet Port connector on the front of the module.
4. Insert the ten-pin linear plug into the DeviceNet Port connector.



You have installed and wired your module. To operate the module you must apply power and then configure and program the SLC processor to communicate with it. We describe how to do this in the next three sections.



## Apply Chassis Power



When you apply chassis power, the module numeric indicators cycle through the following displays:

1. Seven-segment lamp test (**88**)
2. Firmware major revision (**01** through **7F** hexadecimal)
3. Firmware minor revision (**01** through **FF** hexadecimal)
4. Baud rate (indicates **00** for the default of 125, **01** for 250 or **02** for 500 Kbits/s)
5. Node address (**00** to **63** with **63** as the default)

Use the DeviceNetManager software to change the baud rate and node address.

Refer to the Numeric Code Display Summary table on page 28 for a complete listing of numeric displays.

## Understand the Data Organization of the Module

The module has four data areas to transfer data, status and command information between the module and the processor:

- SLC input image table
- SLC output image table
- SLC M1 file
- SLC M0 file

### Input and Output Image Tables

The following table describes the mapping of the 1747-SDN input and output image tables and the M1 and M0 files.

Words	SLC Input Image	Words	SLC Output Image
0	Status	0	Command
1–31	DeviceNet Input Data (31 words)	1–31	DeviceNet Output Data (31 words)
Words	SLC M1 File	Words	SLC M0 File
0–149	DeviceNet Input Data (150 words)	0–149	DeviceNet Output Data (150 words)
150–209	Reserved (60 words)	150–223	Reserved (74 words)
210	Node Address/Status Indicator (1 word)		
211	Scan Counter (1 word)		
212–215	Device Idle Table (4 words)		
216–219	Device Failure Table (4 words)		
220–223	Auto Verify Failure Table (4 words)	224–255	Explicit Message Program Control (32 words)
224–255	Explicit Message Program Control (32 words)		

## SLC Memory Configuration ID Code



For More Information...

The ID code for the 1747-SDN scanner module is **13606**. Use this code to configure the memory of your SLC 5/02, 5/03 or 5/04 processor. Refer to the documentation supplied with your Advanced Programming Software User Manual for additional information on module ID codes and their use.

## Use Advanced Programming Software to Configure M0-M1 Files

Use Advanced Programming Software (APS) to configure the M0 and M1 files for the processor. After you have assigned the module to a slot, the following functions appear at the bottom of the APS screen (the procedure is the same as assigning other modules but you must specify the ID code (13606) of the scanner module):

MODIFY RACKS	MODIFY SLOT	DELETE SLOT	UNDEL SLOT	EXIT	SPIO CONFIG
F4	F5	F6	F7	F8	F9

Complete the following steps to configure the M0 and M1 files:

1. Press [**F9**], SPIO CONFIG. The following functions appear:

ISR NUMBER	MODIFY G FILE	ADVNC D SETUP	G FILE SIZE
F1	F3	F5	F7

2. Press [**F5**], ADVNC D SETUP. The following functions appear:

INPUT SIZE	OUTPUT SIZE	SCANNED INPUT	SCANNED OUTPUT	M0 FILE SIZE	M1 FILE SIZE
F1	F2	F3	F4	F5	F6

3. Press [**F5**], then enter 256 (the number of M1 file words required).
4. Press [**F6**], then enter 256 (the number of M0 file words required).



For More Information...

For more information on how to configure your module for DeviceNet operation and how to map data from DeviceNet nodes to M1, M0, input and output image files, refer to your DeviceNet Manager for Windows Software User Manual (publication number 1787-6.5.3) and your 1747-SDN Scanner Configuration Manual (publication number 1747-6.5.2).

## Program the Module Using the SLC M0 and M1 Files

The M0 and M1 files are data files that reside in the module. There is no image for these files in the processor memory. The M0 file is a module output file and the M1 file is a module input file. Both M0 and M1 files are read/write files.

M0 and M1 files can be addressed in your ladder program and they can also be acted upon by the module, independent of the processor scan.

**Important:** During the processor scan, M0 and M1 data can be changed by the processor according to ladder diagram instructions addressing the M0 and M1 files. During the same scan, the module can change M0 and M1 data, *independent* of the rung logic applied during the scan.

### Address the M0-M1 Files

The addressing format for M0 and M1 files is as follows:

$$Mf : S . w / b$$

Where M = module  
 f = file (0 or 1)  
 S = slot (1–30)  
 w = word (0–maximum supplied by the module)  
 b = bit (0–15)

### When You Cannot Use M0-M1 Data File Addresses

You can use M0 and M1 data file addresses in all instructions except the OSR instruction and the instruction parameters below.

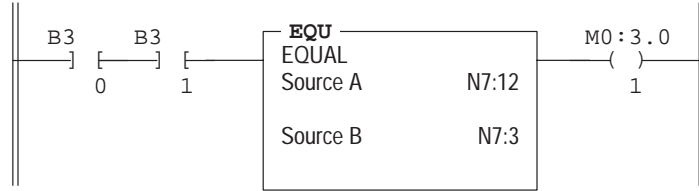
Instruction	Parameter (characterized by file indicator #)
BSL BSR	File (bit array)
SQO SQC SQL	File (sequencer file)
LFL LFU	LIFO (stack)
FFL FFU	FIFO (stack)

### Monitor Bit Instructions with M0 or M1 Addresses

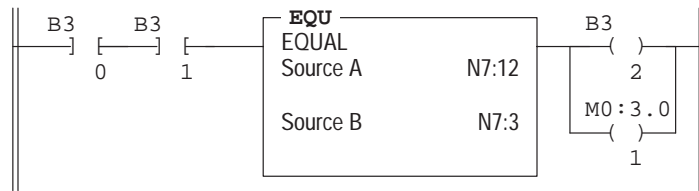
When you monitor a ladder program in the Run or Test mode, the following bit instructions, addressed to an M0 or M1 file, are indicated as false regardless of their actual true/false logical state.

$\overline{\text{Mf : S . w}}$	$\text{Mf : S . w}$	$\text{Mf : S . w}$	$\text{Mf : S . w}$	$\text{Mf : S . w}$
—] [—	—] / [—	—( )—	—(L)—	—(U)—
b	b	b	b	b
XIC	XIO	OTE	OTL	OTU

To show the state of the M0 or M1 addressed bit, transfer the state to an internal processor bit. This is illustrated below, where an internal processor bit is used to indicate the true/false state of a rung.



This rung does not show its true rung state because the EQU instruction is always shown as true and the M0 instruction is always shown as false.

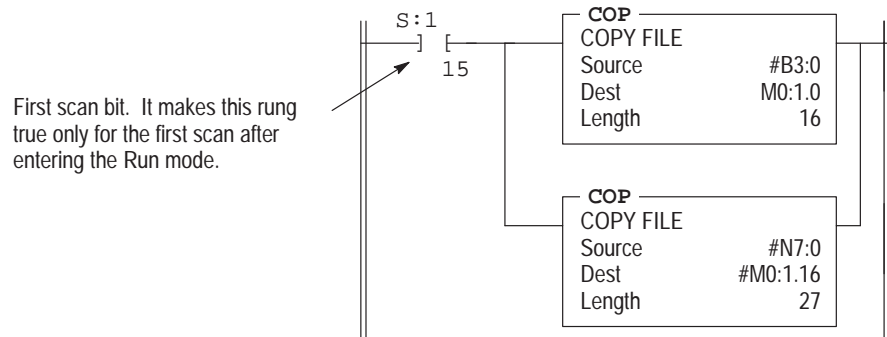


OTE instruction B3/2 has been added to the rung. This instruction shows the true or false state of the rung.

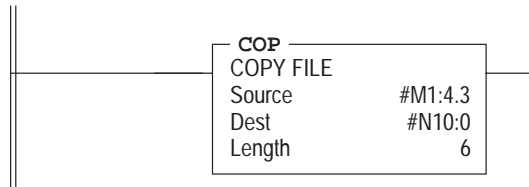
### Transfer Data Between Processor Files and M0 or M1 Files

The processor does not contain an image of the M0 or M1 file so you must edit and monitor M0 and M1 file data via instructions in your ladder program. For example, you can copy a block of data from a processor data file to an M0 or M1 data file or vice versa using the COP (copy) instruction in your ladder program.

The COP instructions below copy data from a processor bit file and integer file to an M0 file.



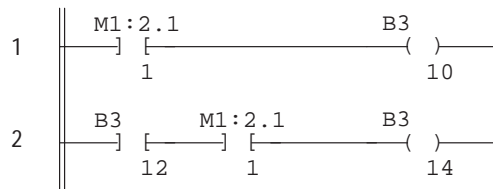
The COP instruction below copies six words of data from an M1 data file in a module positioned in slot four to an integer file (N1:0). This technique is used to monitor the contents of an M0 or M1 data file indirectly, in a processor data file. An update of these six words is made for each SLC program scan.



## Reduce Scan Time

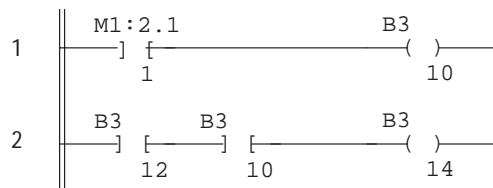
**Tip**

To reduce processor scan time, use discretion when you use instructions addressing the M0 or M1 files. For example, XIC instruction M1:2.1/1 is used in rungs 1 and 2 below, adding approximately 2 ms to the scan time if you are using a 5/02, Series B processor.



XIC instructions in rungs 1 and 2 are addressed to the M1 data file. Each of these instructions adds approximately 1 ms to the scan time (5/02, Series B processor).

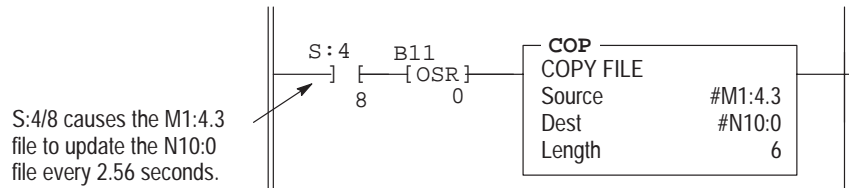
In the equivalent rungs below, XIC instruction M1:2.1/1 is used only in rung 1, reducing the scan time by approximately 1 ms.



These rungs provide equivalent operation to those of the previous diagram by substituting XIC instruction B3/10 for XIC instruction M1:2.1/1 in rung 2. Scan time is reduced by approximately 1 ms (5/02, Series B processor).

The first two ladder diagrams in the last section illustrate a technique you use to capture and use M0 or M1 data as it exists at a specific time. In the first diagram, bit M1:2.1/1 could change state between rungs 1 and 2. This could interfere with the logic applied in rung 2. The second diagram avoids the problem. If rung 1 is true, bit B3/10 captures this information and places it in rung 2.

The following diagram illustrates another economizing technique. The COP instruction addresses an M1 file, adding approximately 4.29 ms to the scan time if you are using a 5/02, Series B processor. You can save scan time by making this rung true only periodically. For example, you can use a clock bit S:4/8 (clock bits are discussed in the programming manual). A rung such as this might be used when you want to monitor the contents of the M1 file, but monitoring need not be continuous.



In this example, a COP instruction can be used to monitor the contents of an M1 file. When the instruction goes true, the six words of data in file #M1:4.3 is captured as it exists at that time and placed in file #N10:0. All subsequent logic should address the data in #N10:0. The data will be consistent and it shortens scan time by eliminating reads to the module each time an M0 or M1 address is encountered in the program.

## Upload Input Data from the Module to the SLC Processor

The SLC 500 processor reads input data from the module using two methods:

- input image table
- M1 file transfer

### Input Image Table

The input image table is a 32-word table for the module slot that is updated by the processor with each program scan. The first word (word 0) is reserved for the module status register. The remaining 31 words can be used to transfer DeviceNet input data to the SLC input image table. The addressing format is:

I : S . w / b

Where S = slot  
w = element (0–31)  
b = bit (0–15)

## Module Status Register

The module status register is located at word 0 in the input image area for the slot. Bits 0–5 echo back to the processor, the current state of bits 0–5 of the module command register. The echoes verify that the commands were executed. The module sets the remaining bits when it detects a problem. The bits latch in the ON state until the problem clears. Bits 6 and 8 indicate that you should read the device failure table for more specific information about which devices failed.

You can use bit 6 to keep the communication port in the idle mode until the bit clears. When the bit clears, this indicates that all devices in the scanner's scan list are up and available. When the devices are available, you can put the port in run mode. If a device failure is detected, you can put the communication into the idle mode, so that all output devices go to a safe state.

The SLC program can monitor the bits in the module status register and set the appropriate bits of the module command register to automatically control the operating mode of the module should a device failure occur.

Status Word I:s.0		Operating Mode Description
Bit	Operating Mode	
0	1 = run mode, 0 = idle mode (echoed from the module command register)	<b>Run</b> The scanner module maps output data from its scanner output table (M0) and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table (M1) and discrete inputs. Outputs on the network are under SLC program control.
1	1 = fault network (echoed from the module command register)	
2	Reserved	Placing the key switch on the SLC into the PROG position places the scanner into IDLE MODE regardless of the state of the bits in the module command register. Placing the key switch into the REM or RUN positions causes the state of the bits in the module command register to determine the scanner state.
3	Reserved	
4	1 = disable network (echoed from the module command register)	
5	Reserved	<b>Idle</b> The scanner does not map output data to the devices, but keeps network connections to devices open so device failures can be detected. Input data is returned from devices, and mapped into the scanner input table (M1) and the discrete inputs. Outputs on the network are not under program control and will be in their configured 'idle state.' The scanner must be put into this mode to perform offline configuration of the scanner database tables.
6	1 = device failure (at least one device failed)	
7	Reserved	<b>Fault Network</b> The scanner has stopped communicating with devices on the network. No outputs or inputs are mapped. Outputs on the network are not under program control. If scanner was in run mode, devices will go to their fault state.
8	1 = autoverify failure (at least one device has failed auto verify)	
9	Reserved	<b>Disable Network</b> The DeviceNet channel is disabled for communication. No communication may occur over this channel. Outputs on the network are not under program control. If scanner was in run mode, devices will go to their fault state.
10	1 = communication failure	
11	Reserved	<b>Device Failure</b> One or more of the devices in the scanner's scan list has failed to communicate with the scanner.
12	1 = duplicate node address failure	
13	Reserved	<b>Autoverify Failure</b> One or more of the devices in the scanner's scan list is returning an incorrect number of bytes of data in response to a strobe/poll, according to the information stored in the scanner's scan list.
14	Reserved	
15	1 = Explicit Message Program Control Response available in M1 file. 0 = Empty	<b>Communications Failure</b> There is no communication on the port.  <b>Duplicate Node Address Failure</b> There is another node with the same address as the scanner on the network.

## SLC M1 File

The SLC M1 file is a 256 word file that can be used to transfer a large quantity of information to the module with a single SLC instruction. Transferring data using this file takes more time than using the input image table.



The first 150 words are used for data transfer from the module. The remaining 106 words are reserved for:

- node status
- scan counter
- device idle table
- device failure table
- auto verify table
- explicit message program control

For a detailed description of the mapping of input and output image tables, refer to page 9.

### **Node Address/Status Indicator**

Word 210 is used for node address and scanner diagnostic information displayed in numeric codes. The descriptions of these codes are listed on page 28.

### **Scan Counter**

Word 211 is used for the module scan counter. The module increments this counter whenever a scan of the DeviceNet devices is completed. The counter rolls over when it reaches a maximum value of 65535. It is located at M1:S.211.

### **Device Idle Table**

Words 212 through 215 in the M1 file are used for the device idle table. This table indicates that there are devices on the network in idle mode. The module tracks devices in idle mode by assigning one of the 64 bits in the table to each device on the network. The bits are assigned in consecutive order to consecutive device addresses starting at mode 0 at M1.S.212/0.

### **Device Failure Table**

Words 216 through 219 in the M1 file are used for the device failure table. This table indicates communication failures of devices on the network. The module tracks device failures by assigning one of the 64 bits in the table to each device on the network. The bits are assigned in consecutive order to consecutive device addresses starting at mode 0 at M1.S.216/0.

### Auto Verify Failure Table

Words 220 through 223 in the M1 file are used for the auto verify failure table. The auto verify failure table is used to verify that data size received from the device matches the setting in the module input data map. The module tracks auto verify failures by assigning one of the 64 bits in the table to each device on the network. The bits are assigned in consecutive order to consecutive device addresses starting with node 0 at M1:S.220/0. If the bit is set, the corresponding node has failed to verify.

### Explicit Message Program Control

Words 224 through 255 are used for Explicit Message Program Control. Use this feature to configure device parameters on your DeviceNet network via the M0 and M1 files in the SLC processor that is controlling these devices. This feature is described in detail on page 20.

## Download Output Data to the Module

The SLC 500 processor writes output data to the module using two methods:

- output image table
- M0 file transfer

### Output Image Table

The output image table is a 32-word table for the module slot that is updated from the processor with each program scan. The first word (word 0) of this table is reserved for the module command register. The remaining 31 words can be used to transfer data from the SLC output table to the DeviceNet nodes.

### Module Command Register

The module command register is located at word 0 in the output image area for the slot. To execute a command, set the appropriate bits in the module command word using SLC ladder instructions. The following table describes the functionality of the command register bits.

Command Word 0:S.0		Operating Mode Description
Bit	Operating Mode	
0	1 = run mode, 0 = idle mode	<b>Run</b> The scanner module maps output data from its scanner output table (M0) and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table (M1) and discrete inputs. Outputs on the network are under SLC program control.
1	1 = fault network	<b>Idle</b> The scanner does not map output data to the devices, but keeps network connections to devices open so device failures can be detected. Input data is returned from devices, and mapped into the scanner input table (M1) and the discrete inputs. Outputs on the network are not under program control and will be in their configured 'idle state.' The scanner is put into this mode to perform online configuration of the scanner database tables.
2	Reserved <sup>1</sup>	Placing the key switch on the SLC into the PROG position places the scanner into IDLE MODE regardless of the state of the bits in the module command register. Placing the key switch into the REM or RUN positions causes the state of the bits in the module command register to determine the scanner state.
3	Reserved <sup>1</sup>	
4	1 = disable network	<b>Fault Network</b> The scanner stops communicating with devices on the network. No outputs or inputs are mapped. Outputs on the network are not under program control. If scanner was in run mode, devices will go to their fault state.
5	Reserved <sup>1</sup>	<b>Disable Network</b> The DeviceNet channel is disabled for communication. No communication may occur over this channel. Outputs on the network are not under program control. If scanner was in run mode, devices will go to their fault state.
6	1 = halt scanner	
7	1 = reboot	<b>Halt Scanner</b> All scanner operations stop when this command is issued. No communications occur over either DeviceNet port. No block transfer or discrete I/O mapping occurs. Outputs on the network are not under program control. If scanner was in run mode, devices will go to their fault state. and will be in their configured 'safe state.'
8-15	Reserved <sup>1</sup>	<b>Reboot</b> This command causes the scanner to reset as though power had been cycled. When this command is issued, all scanner communication stops for the duration of the scanner's initialization sequence. Outputs on the network are no longer under program control. If scanner was in run mode, devices will go to their fault state.

<sup>1</sup> All reserve bits must be set to zero or improper operation may result.

## SLC M0 File

The SLC M0 file is a 256 word file that can be used to transfer a large quantity of information to the module with a single SLC instruction. Transferring data using this file can take several scans and more time than using the output image table. The first 150 words are used for sending data to DeviceNet nodes. The next 74 words are reserved for future use and the last 32 words are used for explicit message program control.

For a detailed description of the mapping of input and output image tables, refer to page 9.

## Explicit Message Program Control

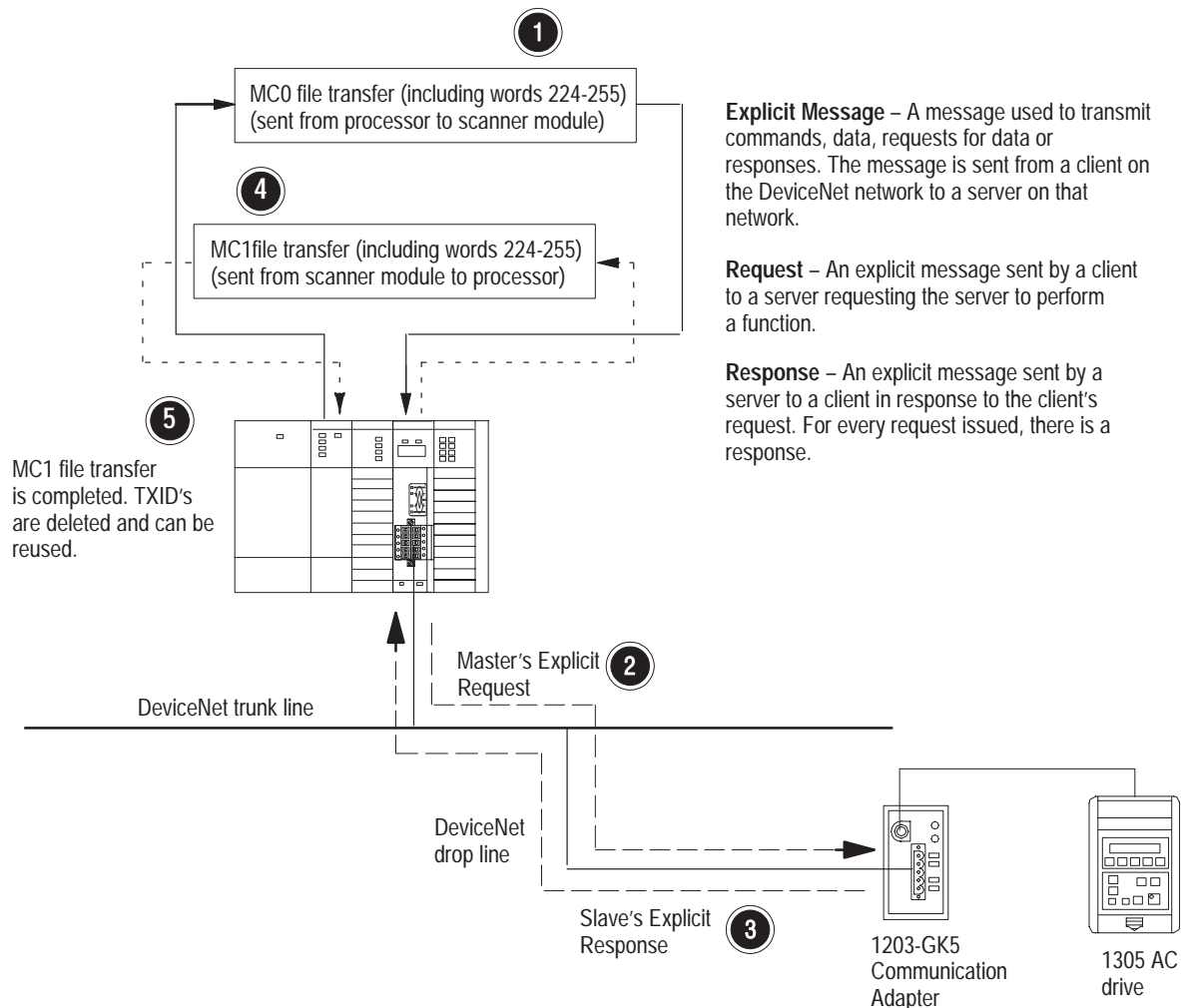
Use the Explicit Message Program Control feature to configure device parameters on your DeviceNet network via the M0 and M1 files in the SLC processor that is controlling these devices.

You can use Explicit Message Program Control only with devices that are slaves of your 1747-SDN Scanner Module. These slave devices must be mapped in the scanner module's scan list.

Use the Explicit Message Program Control feature to:

- transmit configuration data from your scanner module to its slave devices on your DeviceNet network
- receive status and diagnostics from these devices on your DeviceNet network
- make runtime adjustments to device parameters according to changing conditions detected by your processor

### How the Explicit Message Program Control Feature Works



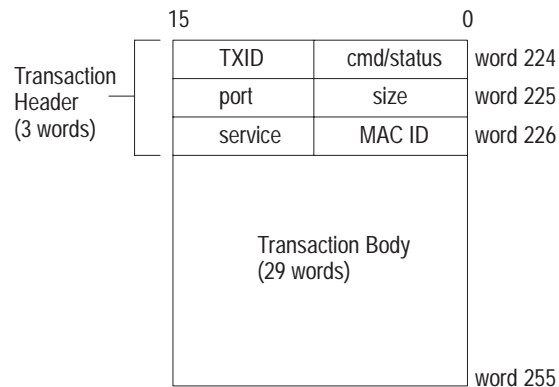
1. Format an M0 file transfer in the processor to send an Explicit Message Request to the scanner module (**download**).
2. The scanner module transmits the Explicit Message Request to the slave device over the DeviceNet network.
3. The slave device transmits the Explicit Message Response back to the scanner and is queued into a file transfer buffer.
4. The processor uses an M1 file transfer to retrieve the Explicit Message Response from the scanner's buffer (**upload**).
5. Format an M0 file transfer with a Delete Response Command and the current transaction ID read in step 4. The transaction IDs are deleted and can be reused.

The scanner module requires a precisely-formatted M0 and M1 file transfer size of 32 words including words 224-255. The scanner module uses the file memory content as a client/server request.

### How to Format the Explicit Message Transaction Block

Up to ten 32-word transaction blocks may be queued within the scanner module for Explicit Message Program Control. The transaction blocks accommodate both the download of Explicit Message Requests and the upload of Explicit Message Responses.

The scanner module can accommodate one request or response for each transaction block. You must format each transaction block as shown in the following figure:



One word = two bytes = 16 bits

The transaction block is divided into two parts:

- **transaction header** – contains information that identifies the transaction to the scanner and processor

- **transaction body** – in a request, this contains the DeviceNet Class, Instance, Attribute and Service Data portion of the transaction. In a response, this contains only the response message.

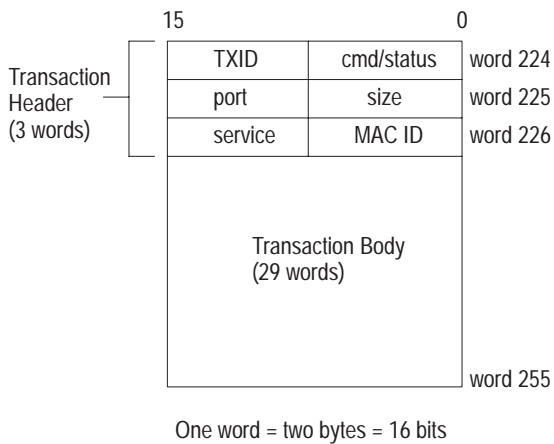
Each of the data attributes in the transaction header are one byte in length:

- **command/status** – for each download, you assign a command code to instruct the scanner how to administer the request:

Command Code	Description
0	Ignore transaction block (block empty)
1	Execute this transaction block
2	Get status of transaction TXID
3	Reset all client/server transactions
4	Delete transaction from response queue
5-255	Reserved

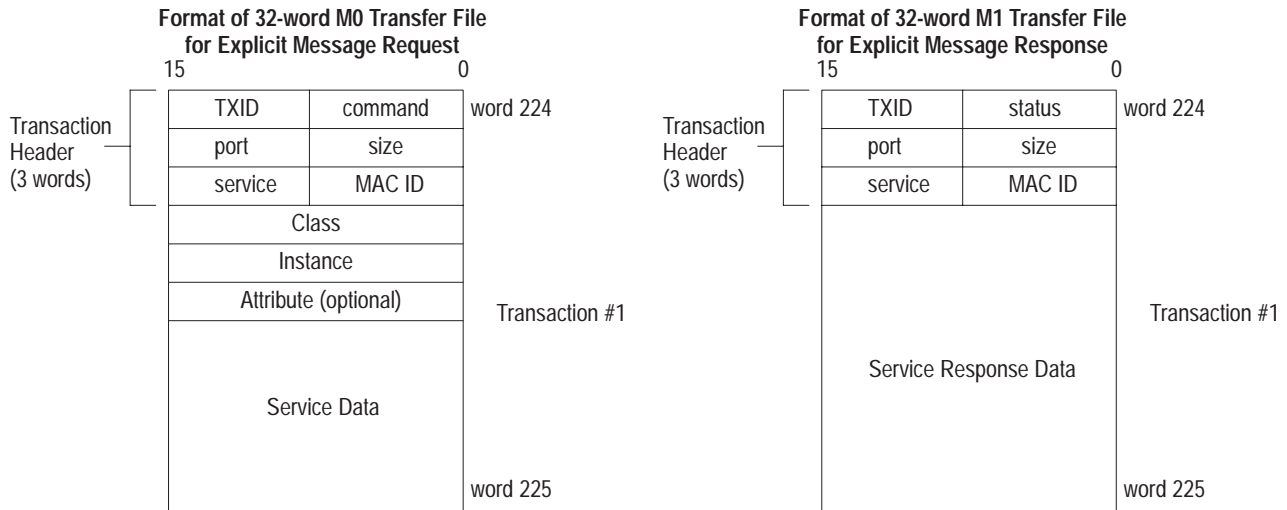
For each upload, the status code provides the processor with status on the device and its response:

Status Code	Description
0	Ignore transaction block (block empty)
1	Transaction completed successfully
2	Transaction in progress (not ready)
3	Error – slave not in scan list
4	Error – slave offline
5	Error – DeviceNet port disabled/offline
6	Error – transaction TXID unknown
7	Error – slave not responding to request
8	Error – Invalid command code
9	Error – Scanner out of buffers
10	Error – Other Client/server transaction in progress
11	Error – could not connect to slave device
12	Error – response data too large for block
13	Error – invalid port
14	Error – invalid size specified
15	Error – connection busy
16–255	Reserved



- **TXID (transaction ID)** – when you create and download a request to the scanner, the processor’s ladder logic program assigns a TXID to the transaction. This is a one-byte integer in the range of 1 to 255. The scanner uses this value to track the transaction to completion, and returns the value with the response that matches the request downloaded by the processor. The ladder logic program monitors rollover and usage of TXID values.
- **size** – the size of the transaction body in bytes. The transaction body can be as many as 29 words (58 bytes) in length. If the size exceeds 29 words, an error code will be returned.
- **port** – the DeviceNet port (zero) where the transaction is routed.
- **MAC ID (node address)** – the DeviceNet network address of the slave device where the transaction is sent. This value can range from 0 to 63. The port and MAC ID attributes coupled together identify the target slave device. The slave device must be listed in the scanner module’s scan list and be online for the Explicit Message transaction to be completed successfully.
- **service** – for each Explicit Message Request and Response, the service attribute contains the service request and response codes that match the corresponding request for the TXID.

The following figure describes the format and mapping of transaction blocks for request and response messages in the scanner module:



## How the Processor and Scanner Module Manage Messages

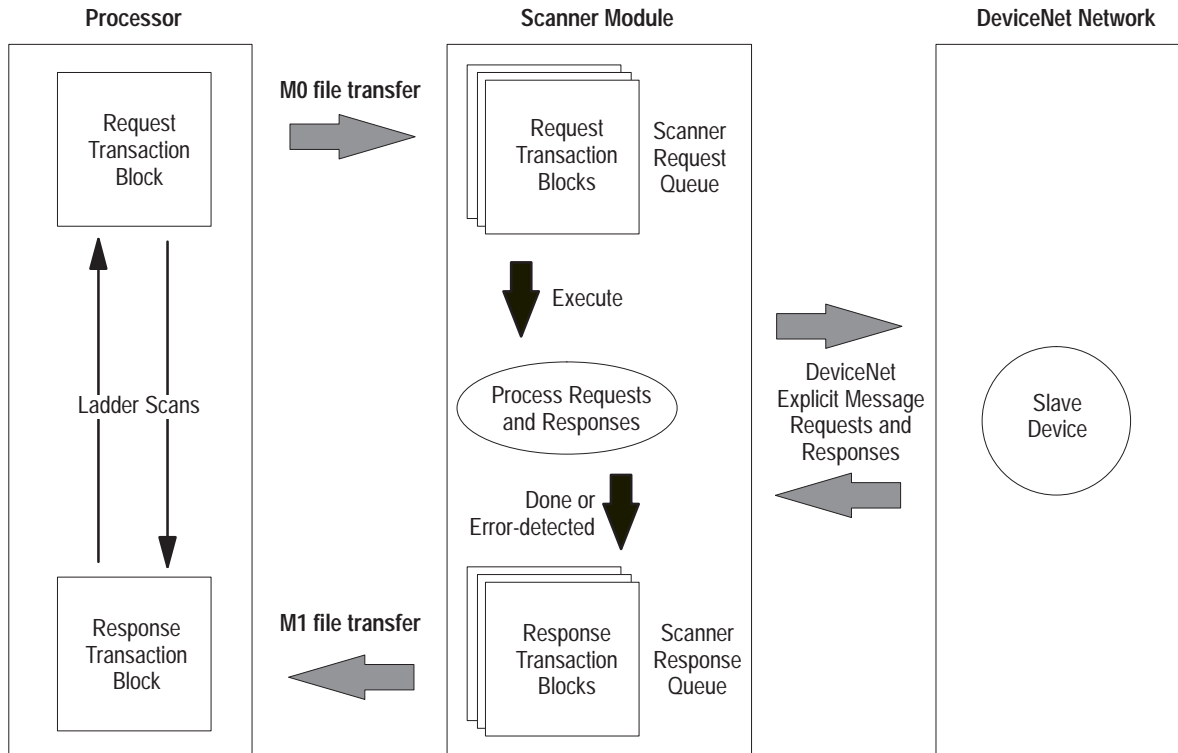
File transfer operations between the processor and the scanner always originate in the processor. The scanner module can only wait for the processor to download a transaction block to the module or request an upload of a transaction block from the module.

Once an Explicit Message Request transaction block is downloaded to the scanner module, a ladder logic program in the processor polls the scanner module for the transaction block containing the Explicit Message Response for that request. This is done by the processor with an M1 file transfer on the scanner module. Depending on the network load, the scanner could take a few seconds to complete the request. When a response is loaded, bit 15 of the module status register is set to 1. The program may have to poll the scanner module a number of times before the scanner returns a Response Transaction Block.

The scanner module recognizes I/O data and control as higher priorities over explicit messaging on DeviceNet.



Message lengths and slave device types impact transaction message completion times. If the processor has queued multiple Explicit Message Transactions to the scanner module for multiple slave devices, the transactions with the slaves may not complete in the order in which the requests were received. The slave responses are queued to the 32 word M1 file transfer in the order in which they are received. As response transaction blocks are uploaded, the processor's program matches the responses to the requests using the TXID field.



### Explicit Message Program Control Limitations

- The processor is always the DeviceNet client and the slave is always the DeviceNet server.
- A maximum of **ten** Explicit Message Request Transaction Blocks with the execute command can be queued to the scanner module at any time. For example, **ten** M0 file transfers containing one transactions each, can be queued at any time. The scanner module receives and deletes any additional client/server requests with the execute command over the maximum of **ten**.

As transactions are removed from the queue and response transaction blocks are returned to the processor, additional transaction blocks can be issued in their place, as long as the total does not exceed ten.

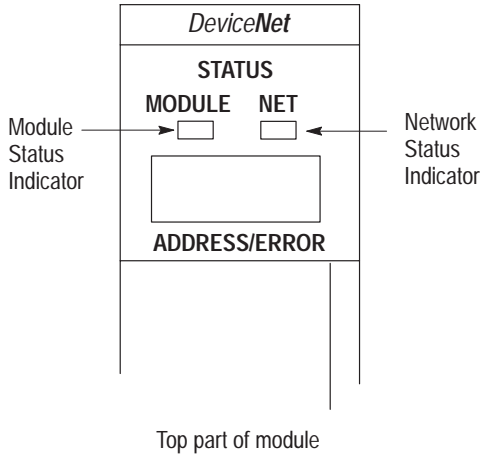
- The scanner module supports **one** transaction block per upload and download.
- Request Transaction Blocks can only be queued for slave devices of the scanner module and must appear in the scanner module's scan list.
- If a slave device is not communicating at the time the scanner module processes its Request Transaction Block, the scanner module will return an error status for that transaction.
- At a minimum, the scanner module supports the following DeviceNet services in Request Transaction Blocks:

Service Name:	Service Code:	Example:
Get_Attribute_Single	0E <sub>hex</sub>	Upload a single parameter value from a device
Set_Attribute_Single	10 <sub>hex</sub>	Download a single parameter value to a device
Get_Attribute_All	01 <sub>hex</sub>	Upload all parameter values from a device
Set_Attribute_All	02 <sub>hex</sub>	Download all parameter values to a device

- All transaction blocks are processed, therefore, an unused transaction block must be left blank.
- Client/Server commands and requests with transaction IDs that are in use are ignored by the scanner module.
- If a slave device returns a DeviceNet error in response to the request downloaded from the processor, the scanner recognizes the error as a successful transaction (status code =1).

A failure to respond to the request within the number of retries or timeout period specified for the Explicit Message Connection is recognized by the scanner module as an error. The error code is returned in the status attribute of the transaction header.

## Troubleshoot the Module and Network



The bicolor (green/red) module status indicator (MODULE) displays module status. It indicates whether the module has power and is functioning properly.

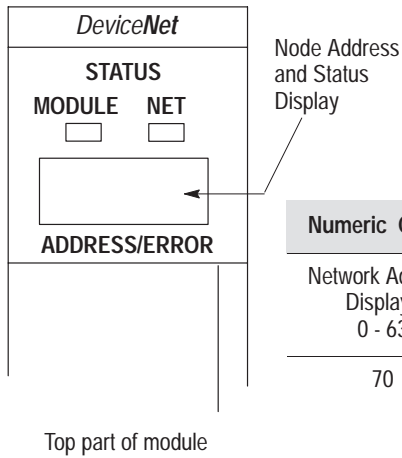
**Table 1**  
Module Status Troubleshooting

If MODULE indicator is:	Then:	Take this action:
Off	There is no power applied to the module.	Apply power.
Green	The module is operating in normal condition.	Do nothing.
Flashing Green	The module is not configured.	Configure the module.
Flashing Red	There is invalid configuration.	Check configuration setup.
Red	The module has an unrecoverable fault.	Replace the module.

The DeviceNet channel has a bicolor (green/red) network status indicator (NET). Table 2 provides troubleshooting information about the DeviceNet channel communication link.

**Table 2**  
DeviceNet Channel Communications Troubleshooting

If NET indicator is:	Then :	Which Indicates:	Take this action:
Off	The device has no power or the channel is disabled for communication due to bus off condition, loss of network power, or has been intentionally disabled.	The channel is disabled for DeviceNet communication.	Power-up the module, provide network power to channel, and be sure channel is enabled in both the module configuration table and module command word.
Flashing Green	The two-digit numeric display for the channel indicates an error code that provides more information about the condition of the channel.	The channel is enabled but no communication is occurring.	Configure scan list table for channel to add devices.
Solid Green	There's normal operation.	All slave devices in the scan list table are communicating normally with the module.	None.
Solid Red	The communications channel has failed. The two digit numeric display for the channel displays an error code that provides more information about the condition of the channel.	The module may be defective.	Reset module. If failures continue, replace module.
Flashing Red	The two-digit numeric display for the channel displays an error code that provides more information about the condition of the channel.	At least one of the slave devices in the module's scan list table has failed to communicate with the module.	Examine the failed device and the scan list table for accuracy.






Your module uses numeric displays to indicate diagnostic information about the status of your module. The display flashes at 1 second intervals. Table 3 summarizes the meanings of the numeric codes.

**Table 3**  
**Numeric Code Display Summary**

Numeric Code:	Description:	Take this action:
Network Address Displays 0 - 63	Normal operation. The numeric display matches the scanner's node address on the DeviceNet network.	None.
70	Module failed Duplicate Node Address check	Change the module channel address to another available one. The node address you selected is already in use on that channel.
71	Illegal data in scan list table (node number alternately flashes).	Reconfigure the scan list table and remove any illegal data.
72	Slave device stopped communicating (node number alternately flashes).	Inspect the field devices and verify connections.
73	Device key parameters do not match scan list table entry (node number alternately flashes).	Enter a matching scan list device ID. Make sure that the device at the flashing node address matches the desired key parameters (vendor, product code, product type).
74	Data overrun on port detected.	Modify your configuration and check for invalid data.
75	No scan list is active in the module.	Enter a scan list.
76	No direct network traffic for module detected.	None. The module hears other network communication.
77	Data size returned does not match scan lists entry (node number alternately flashes).	Reconfigure your module and change the addressing.
78	Slave device in scan list table does not exist (node number alternately flashes).	Add the device to the network, or delete the scan list entry for that device.
79	Module has failed to transmit a message.	Make sure that your module is connected to a valid network. Check for disconnected cables. Verify baud rate.
80	Module is in IDLE mode.	None.
81	Module is in FAULT mode.	None.
82	Error detected in sequence of fragmented I/O messages from device (node number alternately flashes).	Check scan list table entry for slave device to make sure that input and output data lengths are correct. Check slave device configuration.
83	Slave device is returning error responses when module attempts to communicate with it (node number alternately flashes).	Check accuracy of scan list table entry. Check slave device configuration.
84	Module is initializing the DeviceNet channel.	None. This code clears itself once module attempts to initialize all slave devices on the channel.
85	Data size returned is bigger than expected.	Check accuracy of scan list table entry. Check slave device configuration.

Numeric Code:	Description:	Take this action:
86	Device is producing idle state data while the scanner is in Run Mode.	Check device configuration/slave node status.
87	Available for allocation. Scanner has not yet been detected by allocated master, or slave mode is enabled but scanner is not allocated to a master.	Monitor scanner to determine if error code clears when master detects scanner. If error remains, check scanner slave mode configuration.
88	This is not an error. At power-up and reset, the module displays all 14 segments of the node address and status display LEDs.	None.
90	User has disabled communication port	Reconfigure your module. Check the disable bit in the Module Command Register.
91	Bus-off condition detected on comm port. module is detecting communication errors.	Check DeviceNet connections and physical media integrity. Check system for failed slave devices or other possible sources of network interference.
92	No network power detected on comm port.	Provide network power. Make sure that module drop cable is providing network power to module comm port.
95	Application FLASH update in progress.	None. Do not disconnect the module while application FLASH is in progress. You will lose any existing data in the module's memory.
97	module halted by user command.	None.
98	Unrecoverable firmware failure.	Service or replace your module.
99	Unrecoverable hardware failure.	Service or replace your module.
E9	Non-volatile configuration corrupt.	Cycle power to module. Download configuration to module.

## Specifications

Module Location	SLC 5/02, 5/03 or 5/04 chassis
Module Defaults	Node Address – 63 Baud Rate – 125 Kbits/s
Backplane Current	500 mA @ 5Vdc
DeviceNet Power Requirements <sup>1</sup>	24Vdc @ 90mA each channel (maximum)
Isolation Voltage	Optical Isolation between backplane and DeviceNet channel 1 Megohm resistor from DeviceNet channel to chassis
Environmental Conditions: Operational Temperature Storage Temperature Relative Humidity	0-60°C (32-140°F) -40 to 85°C (-40 to 185°F) 5-95% without condensation
Shock Unpackaged	30g operational 50g non-operational
Vibration Unpackaged	5g from 10-150Hz
Immunity Radiated Fields	10V/m 27mHz-1000mHz
Agency Certification (when product or packaging is marked)	<ul style="list-style-type: none"> <li>•   Class 1 Division 2, groups A, B, C, D 2</li> <li>•  marked for all applicable directives</li> </ul>
User Manual	1747-6.5.2

<sup>1</sup>To remain compliant with UL/CSA certification, the DeviceNet power supply must meet NEC Class II requirements.

DeviceNet is a trademark of the Open DeviceNet Vendors Association.

SLC, SLC 500, SLC 5/02, SLC 5/03 and SLC 5/04 are trademarks of Allen-Bradley Company, Inc.

Windows is a trademark of Microsoft Corporation.



Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the world's leading technology companies.



### Worldwide representation.

Argentina • Australia • Austria • Bahrain • Belgium • Brazil • Bulgaria • Canada • Chile • China, PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic • Denmark • Ecuador • Egypt • El Salvador • Finland • France • Germany • Greece • Guatemala • Honduras • Hong Kong • Hungary • Iceland • India • Indonesia • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Malaysia • Mexico • Netherlands • New Zealand • Norway • Pakistan • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia–CIS • Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • United Arab Emirates • United Kingdom • United States • Uruguay • Venezuela • Yugoslavia

Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444