



DeviceNet Scanner Module

(Catalog Number 1771-SDN/B)

Contents

Use this document as a guide to installing your 1771-SDN/B Scanner Module.

To:	See page:
understand new features of the scanner module	2
identify related publications	3
prevent Electrostatic Discharge	3
understand the European Union Directive Compliance	4
identify scanner module features	5
prepare for installation	7
set data rate switches for channels 1 and 2	8
set I/O chassis addressing mode switches	9
set node address switches for channels 1 and 2	9
install your module into the chassis	10
understand how your module communicates with the PLC [®] processor	13
program your PLC-5 processor	14
configure your module for the DeviceNet™ network	22
use the Explicit Message Program Control feature	23
troubleshoot your module	30
For this reference information	See page:
Specifications	34

Before you install your module you must know how to:

- program and operate an Allen-Bradley PLC processor
- install and configure devices on your DeviceNet network

Understand New Features of the Scanner Module



For More Information...

The 1771-SDN/B has the following new features. For more information on these features, refer to your DeviceNet Manager Software User Manual (publication number 1787-6.5.3) and your 1771-SDN Scanner Configuration Manual (publication number 1771-6.5.118).

Change of State I/O

The scanner module can send and receive data on a change of state basis with slave devices that also have this feature. Data is sent:

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

Change of state increases system performance by reducing network traffic, since data is only sent on an as-needed basis. Use DeviceNetManager software to activate this feature in DeviceNet products that support change of state.

Cyclic I/O

The scanner module can send and receive data on a cyclic basis with slave devices that also have this feature.

Cyclic I/O increases system performance by reducing network traffic, since data is only sent at a user-configurable rate. Use DeviceNetManager software to activate this feature in DeviceNet products that support cyclic I/O.

Remote Scanner and Network Diagnostics

The scanner module has a node address/status indicator with a numeric display that indicates diagnostic information about the module and network.

The scanner module duplicates this diagnostic information in word 26 of the Device Failure Table and makes it available to the user PLC program.

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 left of this paragraph) to indicate the addition of new or revised information.

Identify Related Publications



For More Information...

For software configuration information, refer to your DeviceNetManager™ Software User Manual (publication number 1787-6.5.3) and your 1771-SDN/B Scanner Configuration Manual (publication number 1771-6.5.118).

For DeviceNet cable system 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.

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

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 the following Allen-Bradley publications:

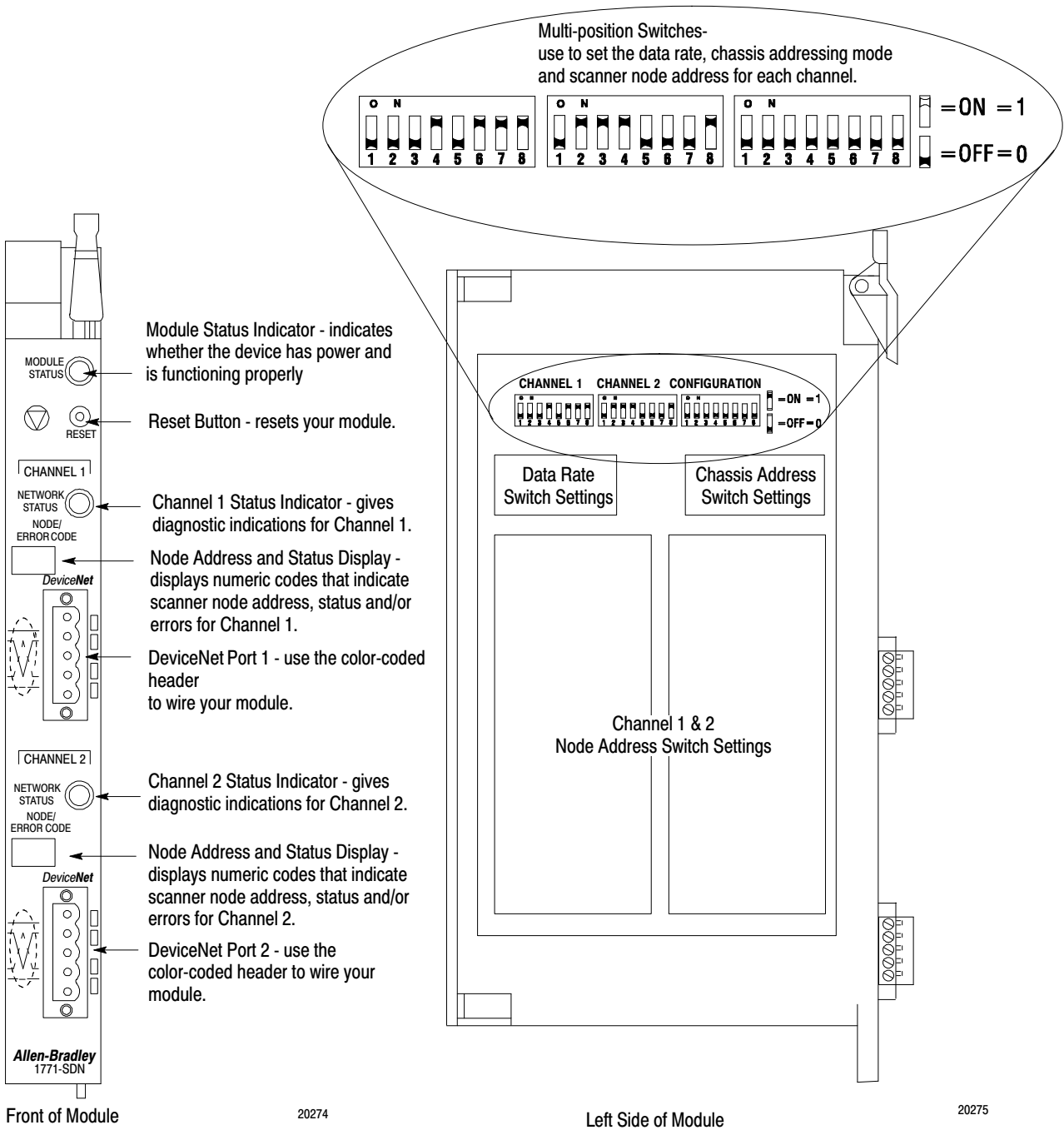
- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111



For More Information...

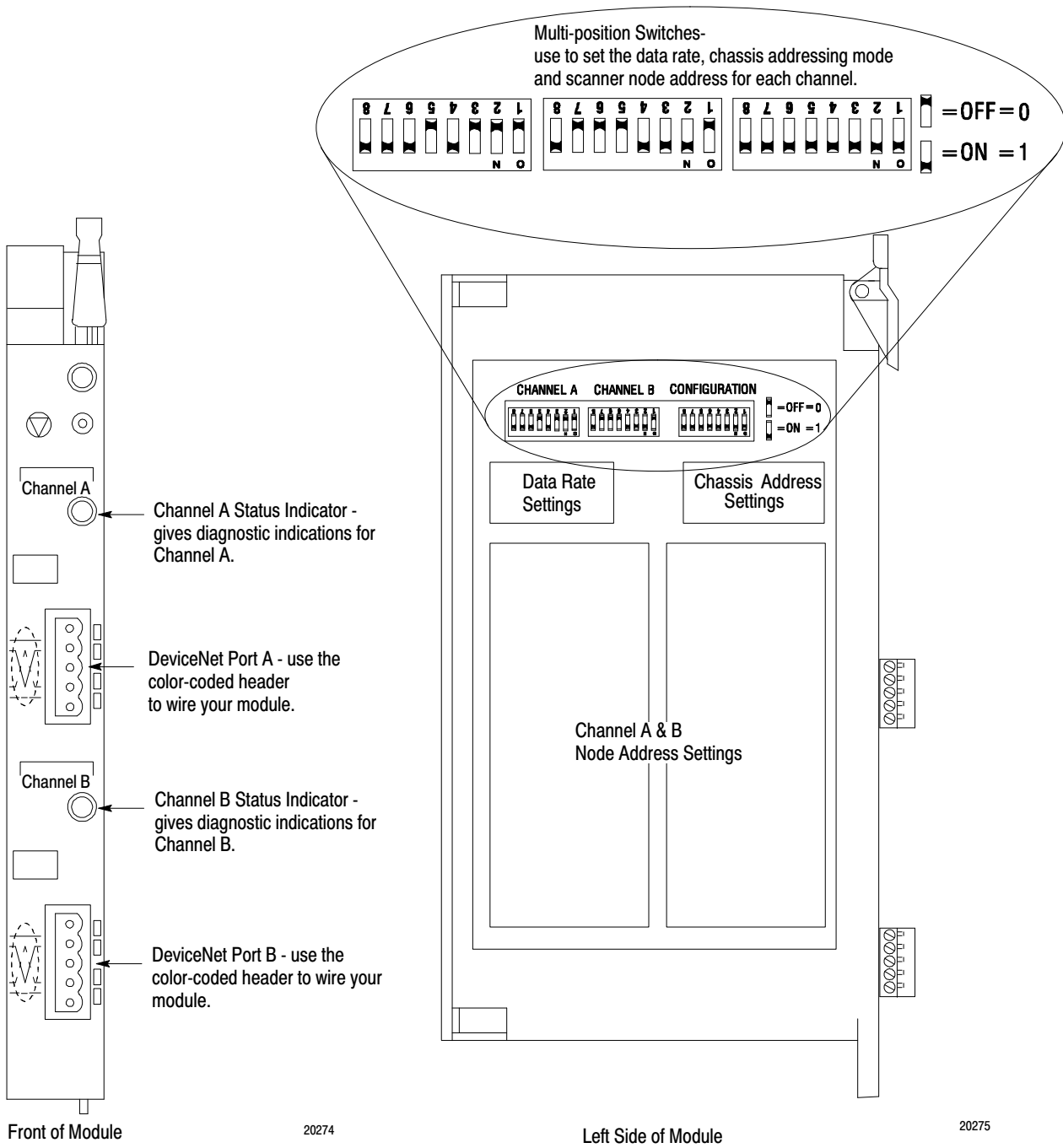
Identify Scanner Module Features

Use the drawing below to identify the features of the 1771-SDN/B Scanner Module.



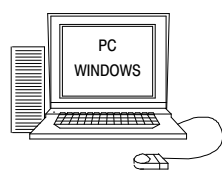
Series A Channel, Port and Switch Identification

The Series A version of this module (1771-SDN) uses different channel, port and switch identification as shown in the following figure:



Prepare for Installation

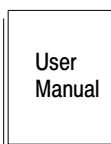
Before you install your module you will need the following items:



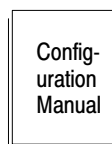
Personal Computer with Microsoft Windows™ 3.1 or later Operating System



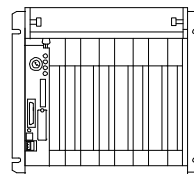
DeviceNetManager Software Cat. No. 1787-MGR



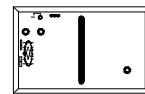
DeviceNetManager Software User Manual Pub. No. 1787-6.5.3



1771-SDN Scanner Configuration Manual Pub. No. 1771-6.5.118



1771-A1B through A4B (or later) I/O Chassis, power supply and PLC processor



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



Make Sure That Your Module and Chassis is Compatible

The 1771-SDN Scanner Module is compatible only with the 1771-A1B through 1771-A4B or later I/O chassis in any configuration supported by the 1771 family.

You can use the following chassis with the 1771-SDN Scanner Module:

- Local I/O Chassis with only the PLC processor running in the leftmost slot
- Extended Local I/O Chassis with any 1771-ALX Adapter Module running in the leftmost slot
- Remote I/O Chassis with a 1771-ASB Adapter Module running in the leftmost slot or a PLC processor running in the leftmost slot

Do not use the 1771-SDN Scanner Module with the following:

- Chassis configured for complementary I/O
- Remote I/O chassis connected to a preceding chassis using a 1771-SN Sub I/O Scanner Module

Important: The 1771-SDN Scanner Module fits in any slot of the chassis except for the leftmost slot, which is reserved for the PLC processor. The scanner module will not conflict with other 1771 I/O devices in the chassis. You can install multiple scanners in the same chassis.

The 1771-SDN Scanner Module is compatible with any PLC-2®, PLC-3® or PLC-5® processor that supports block transfer read and write instructions. The example configurations in these installation instructions use a PLC-5 processor.

Before you install your module you must set the following switches:

- data rate for each DeviceNet channel
- I/O chassis addressing mode (1/2, 1 or 2-slot addressing)
- scanner node address for each channel

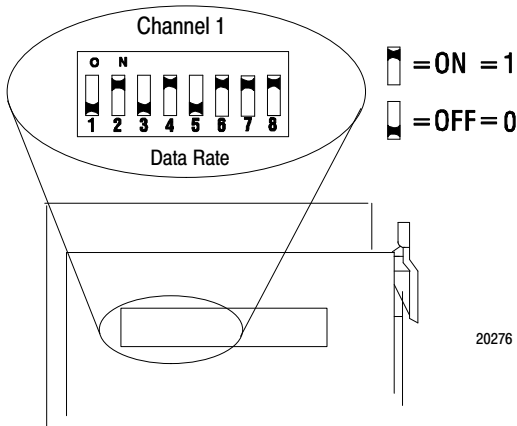
Set the Data Rate Switches for Channels 1 and 2

To set the DeviceNet data rate switches for Channels 1 and 2:

1. Locate the switchbank labeled “Channel 1” on the left side of the module.
2. Use the table below to determine the data rate you want to set for “Channel 1.” Record your choice in the fourth column.

Channel 1 and 2			
Data Rate	Switch Position		Note Your Data Rate
	1	2	
125K baud	0	0	
250K baud	0	1	
500K baud	1	0	
Not allowed	1	1	

3. Using a ball point pen or similar object, adjust switches 2 and 1 to your desired data rate setting. (**NOTE: Do not use a pencil to adjust switches. The lead may break off in the switchbank.**) Slide the switches up to denote an on or “1” position. Slide the switches down to denote an off or “0” position.



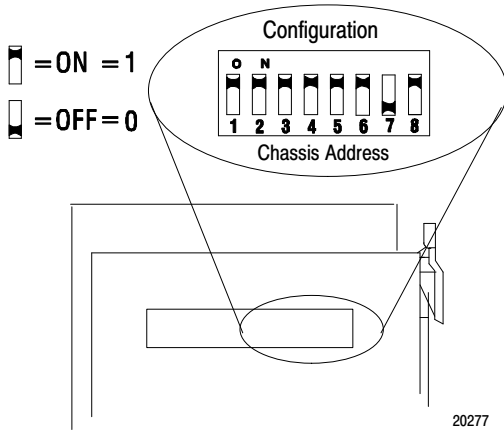
20276

For example, if you want to set DeviceNet data rate of 500K baud for Channel 1, then you set switch 2 to an off or “0” position and switch 1 to an on or “1” position.

Data Rate	Sw.1	Sw.2
500K	1	0

4. Repeat steps 1–3 to set the DeviceNet data rate for Channel 2, using the switchbank labeled “Channel 2”. Adjust the switches to your desired data rate setting.

Set I/O Chassis Addressing Mode Switches



To set the I/O chassis addressing mode switches:

1. Locate the switchbank labeled “Configuration” on the left side of the module.
2. Use the table below to determine the chassis addressing mode you want to set. Record your choice in the fourth column.

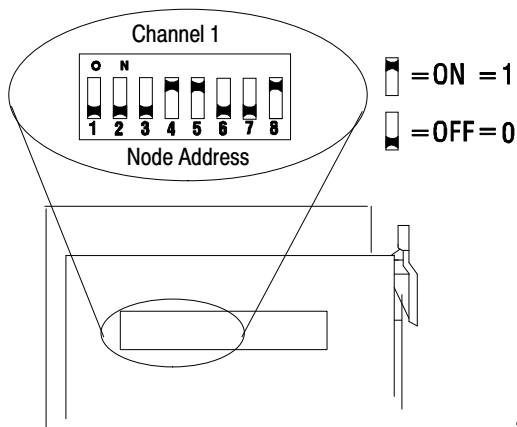
I/O Chassis Addressing Mode			
Mode	Switch Position		Note Your Mode
	7	8	
2-slot	0	0	
1-slot	0	1	
1/2-slot	1	0	
Not allowed	1	1	

3. Using a ball point pen or similar pointed object, adjust switches 7 and 8 to your desired chassis addressing mode. Slide the switches up to denote an on or “1” position. Slide the switches down to denote an off or “0” position. **Make sure switches 1 through 6 in the switch bank labeled “Configuration” always remain in the off position.**

Important: The I/O chassis address setting must match the chassis addressing mode setting for the 1771 chassis. If the switches do not match, data will be lost in the data transfer between the PLC-5 processor and the scanner module.

For more information about addressing, refer to your PLC processor system level installation manual and design manual.

Set Node Address Switches for Channels 1 and 2



To set the scanner DeviceNet node address:

1. Locate the switchbank labeled “Channel 1”, on the left side of the module.
2. Use the following table to determine the node address you want to set for the module on Channel 1, and note your choice. The address range is 0 to 63.
3. Using a ball point pen or similar object, adjust switches 3 through 8 to your desired node address settings. Slide the switches up to denote an on or “1” position. Slide the switches down to denote an off or “0” position.
4. Repeat steps 1–3 to set the scanner node address for Channel 2, using the switchbank labeled “Channel 2”. Adjust the switches to your desired node address setting.

Important: The node address setting for DeviceNet Channel 1 must not conflict with the node address of any other device on the network.

Channel 1 and 2 Node Address							Channels 1 and 2 Node Address						
Node Address	Switch Position						Node Address	Switch Position					
	3	4	5	6	7	8		3	4	5	6	7	8
0	0	0	0	0	0	0	32	1	0	0	0	0	0
1	0	0	0	0	0	1	33	1	0	0	0	0	1
2	0	0	0	0	1	0	34	1	0	0	0	1	0
3	0	0	0	0	1	1	35	1	0	0	0	1	1
4	0	0	0	1	0	0	36	1	0	0	1	0	0
5	0	0	0	1	0	1	37	1	0	0	1	0	1
6	0	0	0	1	1	0	38	1	0	0	1	1	0
7	0	0	0	1	1	1	39	1	0	0	1	1	1
8	0	0	1	0	0	0	40	1	0	1	0	0	0
9	0	0	1	0	0	1	41	1	0	1	0	0	1
10	0	0	1	0	1	0	42	1	0	1	0	1	0
11	0	0	1	0	1	1	43	1	0	1	0	1	1
12	0	0	1	1	0	0	44	1	0	1	1	0	0
13	0	0	1	1	0	1	45	1	0	1	1	0	1
14	0	0	1	1	1	0	46	1	0	1	1	1	0
15	0	0	1	1	1	1	47	1	0	1	1	1	1
16	0	1	0	0	0	0	48	1	1	0	0	0	0
17	0	1	0	0	0	1	49	1	1	0	0	0	1
18	0	1	0	0	1	0	50	1	1	0	0	1	0
19	0	1	0	0	1	1	51	1	1	0	0	1	1
20	0	1	0	1	0	0	52	1	1	0	1	0	0
21	0	1	0	1	0	1	53	1	1	0	1	0	1
22	0	1	0	1	1	0	54	1	1	0	1	1	0
23	0	1	0	1	1	1	55	1	1	0	1	1	1
24	0	1	1	0	0	0	56	1	1	1	0	0	0
25	0	1	1	0	0	1	57	1	1	1	0	0	1
26	0	1	1	0	1	0	58	1	1	1	0	1	0
27	0	1	1	0	1	1	59	1	1	1	0	1	1
28	0	1	1	1	0	0	60	1	1	1	1	0	0
29	0	1	1	1	0	1	61	1	1	1	1	0	1
30	0	1	1	1	1	0	62	1	1	1	1	1	0
31	0	1	1	1	1	1	63	1	1	1	1	1	1

Install Your Module into the Chassis

Before you insert the module into the chassis, set all switches in accordance with the requirements of your networks. You must set the switches before you install the the 1771-SDN Scanner Module or it will not function properly.

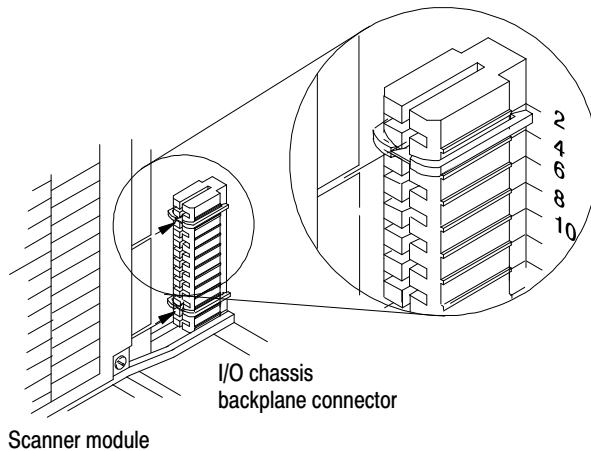


ATTENTION: Do not install the 1771-SDN Scanner Module with the chassis power supply on. Turn off the chassis power supply. You will disrupt backplane communication and may damage your module.

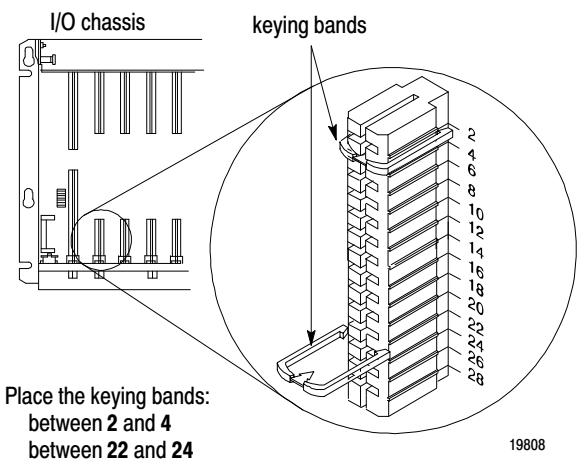
1. Select a slot for the module in the chassis. You may use any slot except the leftmost slot, which is reserved for the PLC processor.
2. Adjust the chassis' keying bands (see figures below).

The 1771-SDN Scanner Module uses keying bands to prevent placing modules into the wrong slot. You can key any connector in an I/O chassis to receive the module except for the leftmost connector, which is reserved for adapter or processor modules.

The 1771-SDN Scanner Module is slotted in two places on the rear edge of the circuit board. These slots are intended to mate with the plastic keying bands supplied with the I/O chassis.

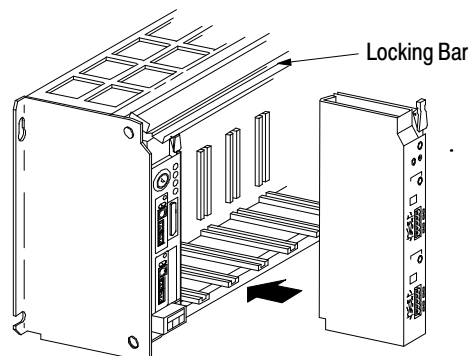


Position the keying bands in the backplane connectors to correspond to the key slots on the module.



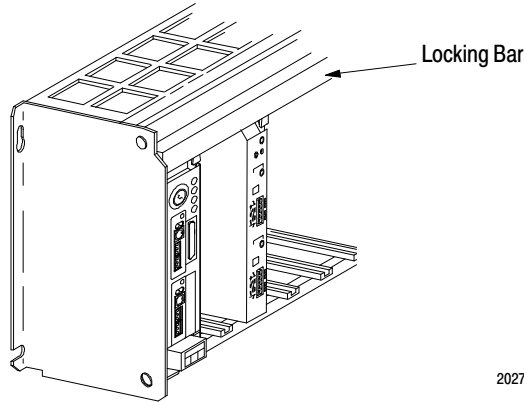
You can change the position of these bands if subsequent system design and rewiring makes insertion of a different type of module necessary.

3. Insert the 1771-SDN Scanner Module into the slot you have selected.



20278

4. Apply firm, even pressure to seat the module in the I/O chassis backplane connectors.
5. Swing the locking bar down until locked in place to make sure that you have secured the module in the slot.



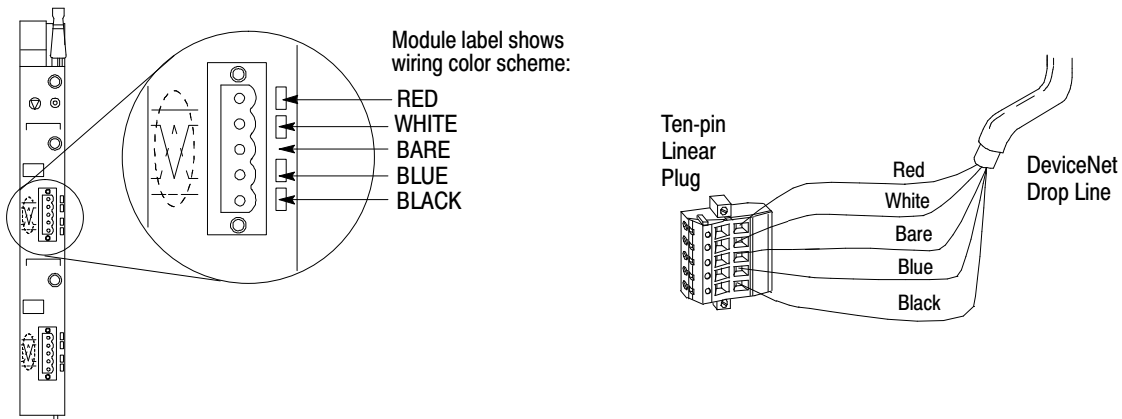
20279

To connect to DeviceNet:



ATTENTION: Do not wire your module with power applied to your network. You may short your network or disrupt communication.

1. Connect the DeviceNet drop line to the linear plug, by matching the wire insulation colors to the colors shown on the label:

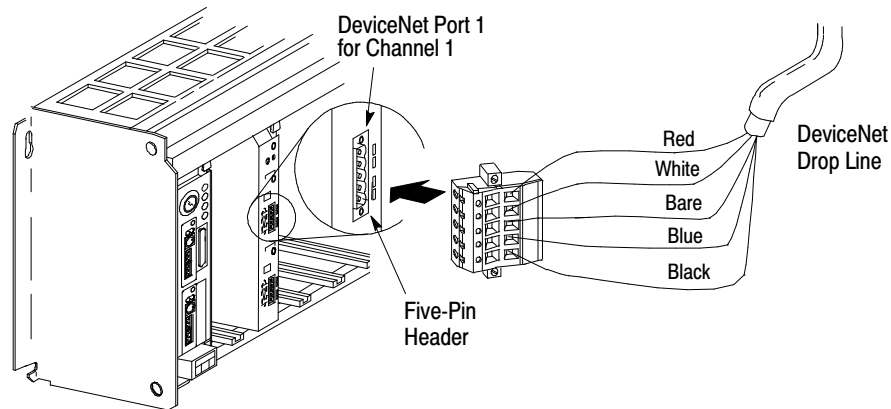


Front of Scanner Module

20298

2. Locate the DeviceNet Port 1 connector for Channel 1 on the front of the module.

3. Insert the linear plug into the five-pin header for Channel 1.



20298

4. Repeat steps 1–3 for Channel 2, if necessary.

You have installed and wired your module. To operate the module you must program the PLC processor to communicate with it. In the following two sections, we describe how your module communicates with the PLC-5 processor and how to program your processor.

How your Module Communicates with the PLC-5 Processor

The 1771-SDN scanner module uses four methods to transfer data, status and command information between the scanner and the PLC-5:

- DIO points for high-speed discrete outputs
- DIO points for high-speed discrete inputs
- BTW to send output data to the scanner
- BTR to upload input data from the scanner

Using DIO Points for High-Speed Discrete Inputs and Outputs

The following table describes chassis addressing modes and the number of discrete inputs and outputs assigned to the 1771-SDN Scanner Module slot.

Addressing Mode	Discrete Inputs	Discrete Outputs
1/2-slot	24	24
1-slot	8	8
2-slot	0	0

These inputs and outputs will appear in the PLC I/O image table in the location corresponding to the rack, group and slot the module is plugged into. Since the bits are in the I/O table, they can be forced.

For more information about chassis addressing modes, refer to your PLC-5 processor system level installation manual.

Program Your PLC-5 Processor

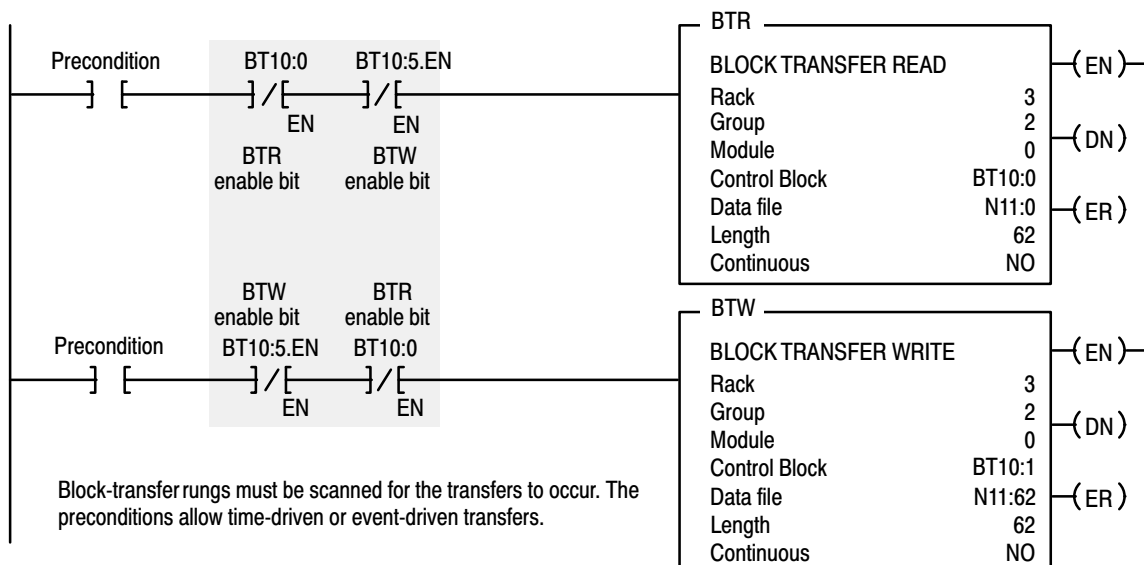
You must program your PLC-5 processor so it communicates with the 1771-SDN Scanner Module. Communication is possible when you program your processor through multiple block transfer instructions. The scanner uses the size of the block transfer to map the block transfer data words into the scanner’s internal data table. The scanner module accepts blocks of different sizes and knows that each block has a different meaning.

PLC-5 block transfer instructions use one integer file in the data table section for module location and other data to execute the instruction. This is the control block file. The block transfer data file stores data that you want to transfer **to** your module (when programming a block transfer write (BTW)) or **from** your module (when programming a block transfer read (BTR)). The address of the block transfer data file is stored in the control block file.

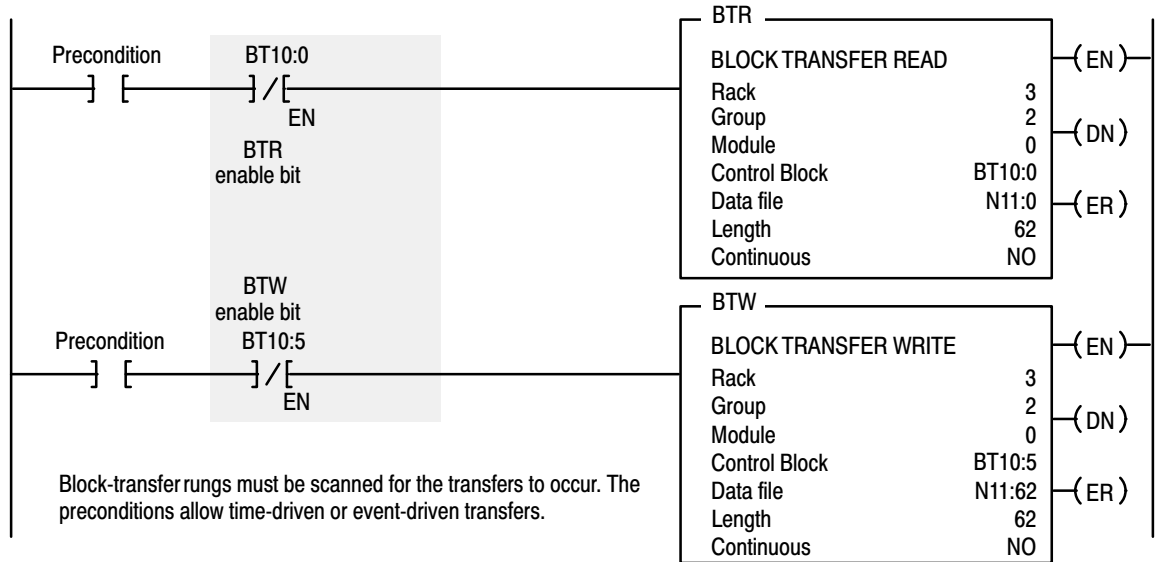
You must select a separate data file for each of the block transfer instructions. **You must also use separate 5-word block transfer control files for each of the block transfer instructions when an integer file is used.** This is not necessary when a control block file is a BT type.

To make sure the instruction is reset after the block transfer completes and recycles, you must use enable bits as the conditions on each rung with the PLC-5. The following figure shows a PLC-5 sample program.

Important: The module does not support continuous mode block transfer. Set **Continuous** to **NO** for each BTW or BTR.



When using rungs like those in the preceding figure, the processor alternates between the BTR and the BTW, waiting to request the next block transfer until the previous block transfer is completed. When only one block transfer is active at a time, it is considered a single-threaded block transfer. Single-threaded block transfers operate in an orderly sequence of read and write, however, they are slower than the asynchronous method, shown below:



As soon as an asynchronous block transfer completes, it is requested again, independent of other block transfers going to the same module. If you have programmed many block transfers to the same logical rack (especially a remote rack), you will fill the processor's queue. In this situation, the asynchronous method can result in irregular times between successive executions of the same block transfer.

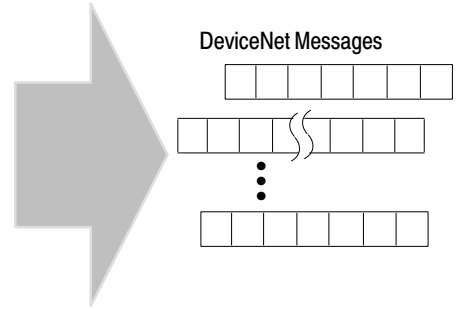


For more information on programming and block transfers, refer to your PLC-5 Programming Software Instruction Set Reference Manual.

Using BTW to Send Outputs to the Scanner

The PLC-5 downloads output data to the scanner using block transfer write instructions over the 1771 backplane. The scanner module can update a maximum of 357 output words by internally linking together six different sized block transfers as shown in the following table.

Block Transfer Size	Accessed Scanner Output Block	Scanner Output Data Table
62 words	Block 62	Word 0 – Module Command Register Word
		Words 1–61
61 words	Block 61	Words 62–122
60 words	Block 60	Words 123–182
59 words	Block 59	Words 183–241
58 words	Block 58	Words 242–299
57 words	Block 57	Words 300–356



Each individual block transfer is independent, but always updates the same output bytes in the scanner's memory table. Of the scanner output words 0 through 61, the word 0 is reserved for the Module Command Register. Block transfer sizes 1 through 50 update scanner output words 0 through 49, thus reducing the required BTW time when 50 or fewer output words are needed. Sizes 51 thru 56 are illegal, size 63 is reserved and size 64 is used for Explicit Message Program Control. For more details on Explicit Message Program Control, refer to page 23.

If the scanner receives a BTW of 62 words, then it knows that it contains the first block of the table. A BTW of 61 words, if necessary, contains the second block of the table and so on for 60, 59, 58 and 57 words.



For More Information...

You determine the data that is exchanged with a given node on channel 1 or 2 by creating custom configurations using the DeviceNetManager software (Cat. No. 1787-MGR). Refer to your DeviceNetManager Software User Manual (publication number 1787-6.5.3) and your 1771-SDN Scanner Configuration Manual (publication number 1771-6.5.118) for more information on custom configurations.

Module Command Register

The first word of the BTW downloaded from the PLC-5 to block 62 is reserved as the module command register. The register is downloaded with every 1 through 50 and 62 word block transfer write. This modifies the scanner's operation.

To execute a command, you set the appropriate bits in the module command word, then perform a block transfer write to the first block (the 62 word block) of the scanner output table. When the scanner receives the command it immediately executes it. You latch bits 0 through 5 in your program to maintain the scanner's desired state.

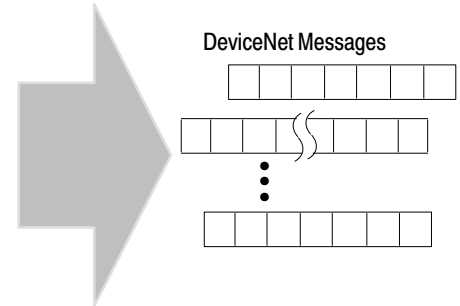
The following table outlines the module command register's bit numbers and descriptions.

Module Command Register – Word 0, Block 62				
Bit Number	Bits		Operating Mode	Operating Mode Description
	01	00		
00 - 01	0	0	DeviceNet Channel 1 in idle mode	<p>Idle 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 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 configuration of the scanner database tables.</p> <p>Run The scanner module maps output data from its scanner output table and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table and discrete inputs. Outputs on the network are under program control. Placing the PLC-5 into PROG or REM_PROG mode places the scanner into idle mode regardless of the state of the bits in the module command register. Placing the PLC-5 into RUN or REM_RUN mode causes the state of the bits in the module command register to determine the scanner state.</p> <p>Fault Network 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 the scanner was in run, devices will go to their configured 'fault state.'</p> <p>Enable The DeviceNet channel is enabled for communication. This is the normal operating state of the channel.</p> <p>Disable The DeviceNet channel is disabled for communication. No communication may occur over this channel. Outputs on the network are not under program control. If the scanner was in run, devices will go to their configured 'fault state.'</p> <p>Scanner Active This is the normal operating mode of the scanner.</p> <p>Scanner Halt 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 the scanner was in run, devices will go to their configured 'fault state.' You must reset the scanner or cycle power to the scanner to recover from this state.</p> <p>Scanner Reboot This command causes the scanner to reset as though the reset button had been pressed. 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 the scanner was in run, devices will go to their configured 'fault state.'</p>
	0	1	DeviceNet Channel 1 in run mode	
	1	0	DeviceNet Channel 1 in fault mode	
	1	1	Reserved	
02 - 03	0	0	DeviceNet Channel 2 in idle mode	
	0	1	DeviceNet Channel 2 in run mode	
	1	0	DeviceNet Channel 2 in fault mode	
	1	1	Reserved	
04		0	Enable DeviceNet Channel 1	
		1	Disable DeviceNet Channel 1	
05		0	Enable DeviceNet Channel 2	
		1	Disable DeviceNet Channel 2	
06		0	Scanner run	
		1	Scanner halt	
07		0	Scanner Active	
		1	Scanner reboot	
08 - 15		0	Reserved for future use	

Use BTR to Upload Input Data from the Scanner

The PLC-5 uploads input data from the scanner using block transfer read instructions over the 1771 backplane. The scanner interprets BTRs of length 1 through 50 and 62 words as being from the first block of the scanner input table. The scanner module can update a maximum of 357 input words by internally linking together six different sized block transfers. See the table below.

Block Transfer Size	Accessed Scanner Input Block	Scanner Input Data Table
62 words	Block 62	Word 0 – Module Status Register Word
		Words 1–61
61 words	Block 61	Words 62–122
60 words	Block 60	Words 123–182
59 words	Block 59	Words 183–241
58 words	Block 58	Words 242–299
57 words	Block 57	Words 300–356



Each individual block transfer is independent, but always retrieves the same input bytes from the scanner's input data table. The types of information that a PLC-5 program will upload from the scanner via the BTR are the:

- Device Input Data Table (6 blocks, 62 through 57 words)
- Device Failure Table (1 block, 52 words)
- Device Active Table (1 block, 51 words)

When the scanner receives a BTR, it automatically knows which block of data is desired by the size specified.

You may upload portions of the scanner input table rather than the entire table, to support higher-speed operations. The scanner will interpret any BTR of length 1 through 50 with the words 0 thru 49 of block 62 of the scanner input table. BTRs of sizes 57 through 61 represent full blocks of the table. A BTR of 52 words contains the Device Failure Table. Sizes 53 through 56 and 63 are reserved. Size 64 is used for Explicit Message Program Control. For more details on Explicit Message Program Control, refer to page [23](#).

To reduce block transfer time and increase system performance, use only the words you need.

Use the DeviceNetManager software to map data from a DeviceNet node into the scanner input table. Data from a DeviceNet node can be split and put into as many as four different locations in the scanner input table.

Module Status Register

In the Module Status Register (word 0, block 62), bits 0 through 5 indicate to the PLC-5 the current state of the scanner module. When a Module Command Register command is sent to the scanner module, the respective bits are set in the Module Status Register when the command executes. Depending on network load, the scanner may take several moments to detect network status changes. The bits latch on in the “on” state until the command clears.

Bits 6 and 7 indicate that you should read the device failure table for more specific information about which devices failed. Bits 8 and 9 indicate that you should read the device autoverify table to determine which device has incorrect device keying or a misconfigured data size in the scanner configuration tables. Use the DeviceNetManager software to correct this error.

You can use bits 6 and 7 of the Module Status Register to enable the scanner module’s Module Command Register to react to certain conditions. An example reaction to a condition is to keep the communication ports in the “idle” mode until the bits clear. When the bits clear, this indicates that all devices on the networks are operational. When the devices are operational, you can put the ports in the “run” mode, so that output data goes to the devices.

If a device failure is detected, you can put the communication into the “idle” mode, so that all devices would go into their idle state. You may tie these inputs to the Module Command Register, so that you may use them to adjust the operating mode of the scanner when devices fail or go online at startup.

You can also modify your control logic to run differently to compensate for the loss of communication with a certain node. An alarm message to alert an operator of the problem is also possible.

The following table lists Module Status Register bit numbers and their descriptions.

Module Status Register – Word 0, Block 62				
Bit Number	Bits		Operating Mode	Operating Mode Description
	01	00		
00 - 01	0	0	DeviceNet Channel 1 in idle mode	<p>Idle 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 and the discrete inputs. Outputs on the network are not under program control and will be in their configured 'safe state.' The scanner must be in this mode to perform configuration of the scanner database tables.</p>
	0	1	DeviceNet Channel 1 in run mode	
	1	0	DeviceNet Channel 1 in fault mode	
	1	1	Reserved	
02 - 03	0	0	DeviceNet Channel 2 in idle mode	<p>Run The scanner module maps output data from its scanner output table and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table and discrete inputs. Outputs on the network are under program control.</p>
	0	1	DeviceNet Channel 2 in run mode	
	1	0	DeviceNet Channel 2 in fault mode	
	1	1	Reserved	
04		0	Enable DeviceNet Channel 1	Placing the PLC-5 into the PROG or REM PROG mode places the scanner into IDLE MODE regardless of the state of the bits in the module command register. Placing the PLC-5 into RUN or REM_RUN mode causes the state of the bits in the module command register to determine the scanner state.
		1	Disable DeviceNet Channel 1	
05		0	Enable DeviceNet Channel 2	Placing the PLC-5 into the PROG or REM PROG mode places the scanner into IDLE MODE regardless of the state of the bits in the module command register. Placing the PLC-5 into RUN or REM_RUN mode causes the state of the bits in the module command register to determine the scanner state.
		1	Disable DeviceNet Channel 2	
06		0	No failures detected	<p>Fault 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 the scanner was in run, devices will go to their fault state.</p>
		1	DeviceNet Channel 1 device failure detected	
07		0	No failures detected	<p>Device Failure One or more of the devices in the scanner's scan list has failed to communicate with the scanner.</p>
		1	DeviceNet Channel 2 device failure detected	
08		0	No failures detected	<p>Autoverify Failure 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.</p>
		1	DeviceNet Channel 1 autoverify failure detected	
09		0	No failures detected	<p>Communications Failure There is no communication on the port.</p>
		1	DeviceNet Channel 2 autoverify failure detected	
10		0	No failures detected	<p>Duplicate Node Address Failure There is another node with the same address on the network.</p>
		1	DeviceNet Channel 1 communications failure detected	
11		0	No failures detected	<p>Scanner Configuration Missing or Corrupted Either the I/O chassis addressing mode is set to an illegal position or, the chassis addressing mode switch does not match the value stored in the scanner's scan list.</p>
		1	DeviceNet Channel 2 communications failure detected	
12		0	No failures detected	<p>Client/server transaction response queued The client/server response is loaded and available with a 64-word Block Transfer Read.</p>
		1	DeviceNet Channel 1 duplicate node address failure	
13		0	No failures detected	
		1	DeviceNet Channel 2 duplicate node address failure	
14		0	No failures detected	
		1	Scanner configuration missing or corrupted	
15		0	No failures detected	
		1	Client/server transaction response queued	

Device Active Table

The Device Active Table is located in words 0–7 of a 51 word BTR. The scanner assigns one bit of the first 128 bits to each device on the networks. The scanner assigns one bit to consecutive Device Addresses.

Devices on Channel 1 are indicated by a single bit in consecutive order in words 0–3. Devices on Channel 2 are indicated by a single bit in consecutive order in words 4–7.

If a bit is set, it indicates that the node is in the scanner's scan list and has successfully communicated with the scanner. These bits are not cleared if the slave node goes off-line. The bits are cleared by resetting the scanner.

Device Failure Table

The scanner maintains one Device Failure Table accessed with a 52-word BTR. The table consists of:

- Communications Failure Bitmap – the scanner tracks device failures in its scan list by assigning one bit of the first 128 bits in the table to each device on the networks. The scanner assigns one bit to consecutive Device Addresses. Devices on Channel 1 are indicated by a single bit in consecutive order in words 0–3. Devices on Channel 2 are indicated by the bits in words 4–7. If a bit is set, it indicates that the node is in the scanner's scan list and it is either not present, not communicating or failed autoverify.
- Autoverify Failure Bitmap – the scanner tracks autoverify failures by assigning one bit of the second 128 bits in the table to each device on the networks. A value of 1 in the bit position indicates a failure is detected and a value of 0 indicates normal operation. The scanner assigns one bit to consecutive Device Addresses. Devices on Channel 1 are indicated by a single bit in consecutive order in words 8–11. Devices on Channel 2 are indicated by the bits in words 12–15. If a bit is set, it indicates that the device is returning device keying or a data size that does not match the keying or data size in the scanner configuration table.
- DeviceNet 1 Scan Counter (word 16) – the scanner increments a one-word counter whenever a scan of the DeviceNet 1 devices is completed. The counter rolls over when it reaches its maximum value.
- DeviceNet 2 Scan Counter (word 17) – the scanner increments a one-word counter whenever a scan of the DeviceNet 2 devices is completed. The counter rolls over when it reaches its maximum value.

- Device Idle State Bitmap (words 18-25, 4 words for Channel 1, four words for Channel 2) – the scanner assigns one bit to consecutive Device Addresses. Devices on Channel 1 are indicated by a single bit in consecutive order in words 18–21. Devices on Channel 2 are indicated by the bits in words 22–25. If a bit is set, it indicates that the scanner received a valid DeviceNet idle indication from this node. A device in idle mode does not return updated I/O data to the scanner because the device is not in its run mode.
- Node Address/Status Indicator (word 26) – Channel 1 and Channel 2 node address and scanner diagnostic information is copied to the low and high bytes of Word 26, respectively. The descriptions of these codes are listed on page 31.
- 25 words of pad data (zeroes, words 27–51), to complete the table for a total of 52 words.

Configure Your Module for the DeviceNet Network



For More Information...

To operate your 1771-SDN Scanner Module, you must configure the two tables listed below, using the DeviceNetManager software (cat. no. 1787-MGR). For more information, refer to your DeviceNetManager for Windows Software User Manual (publication 1787-6.5.3) and your 1771-SDN Scanner Configuration Manual (publication 1771-6.5.118).

Configure this table:	To:
Scanner Configuration Table	Control how the scanner gathers DeviceNet messages. The information you configure for this table includes: <ul style="list-style-type: none"> • frequency of background poll messages on each DeviceNet channel • DeviceNet port disable/enable
Scan List Table	Use the information gathered from the scan list table to map the I/O data between the scanner's I/O data table and DeviceNet nodes. A device must have a configuration table entry in the scanner's database before its I/O messages are mapped to the PLC. The information you configure for this table includes: <ul style="list-style-type: none"> • the size of data in each node's DeviceNet messages • location of a device's data in the data tables that are transferred to and from the PLC

Use the Explicit Message Program Control Feature

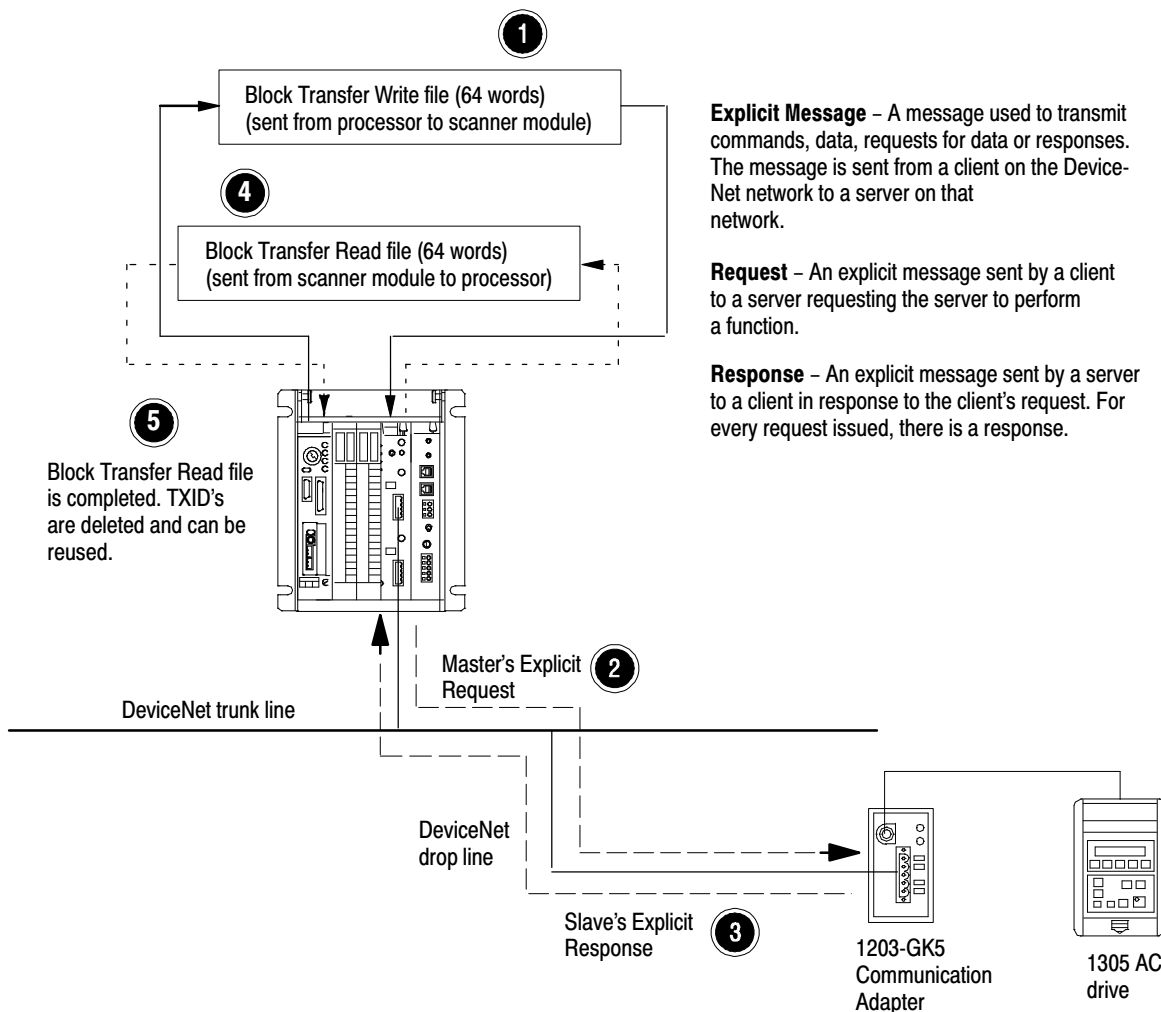
Use the Explicit Message Program Control feature to configure device parameters on your DeviceNet network via the ladder logic program in the PLC-5 processor that is controlling these devices.

You can use Explicit Message Program Control only with devices that are slaves of your 1771-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



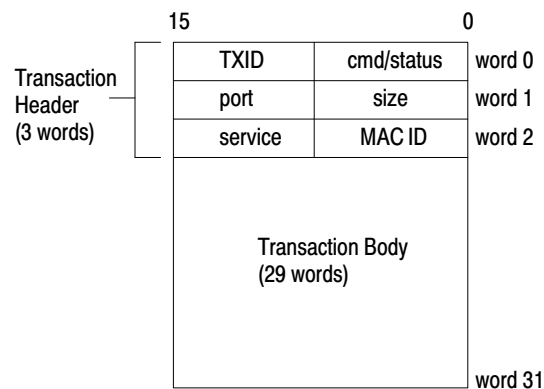
1. Format a Block Transfer Write file in the processor to send an Explicit Message Request to the scanner module (**download**).
2. The scanner module transmits the Explicit Message Request to the slave device over the DeviceNet network.
3. The slave device transmits the Explicit Message Response back to the scanner and is queued into a block transfer buffer.
4. The processor uses a Block Transfer Read file to retrieve the Explicit Message Response from the scanner's buffer (**upload**).
5. The Block Transfer Read file is completed. The transaction IDs are deleted and can be reused.

The scanner module requires a precisely-formatted block transfer read and write size of 64 words. The Explicit Message Control table in the scanner module is 64 words. The scanner module uses the block transfer size as an indicator that the content is a client/server request.

How to Format the Explicit Message Transaction Block

Ten 32-word transaction blocks within the scanner module are reserved 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 and can transfer two blocks for each upload and download. 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.

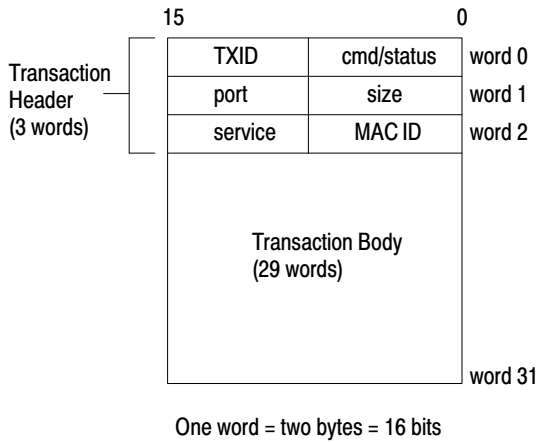
Each of the data attributes in the transaction header are one byte in length:

- **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
4-255	Reserved

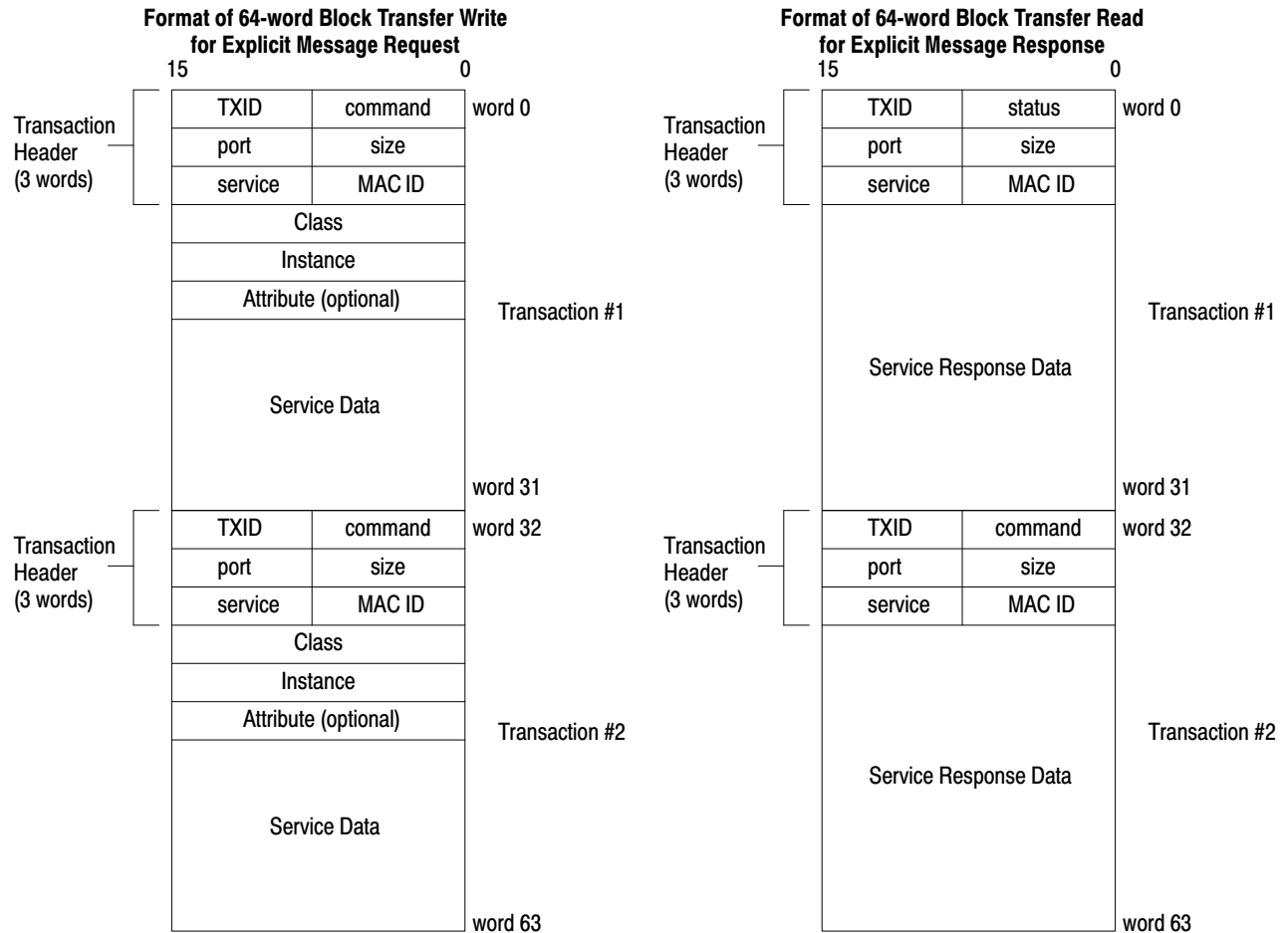
For each upload, the status code provides the processor with status on the device and its response:

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 where the transaction is routed. The port can be zero (Channel 1) or one (Channel 2).
- **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.
- **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:



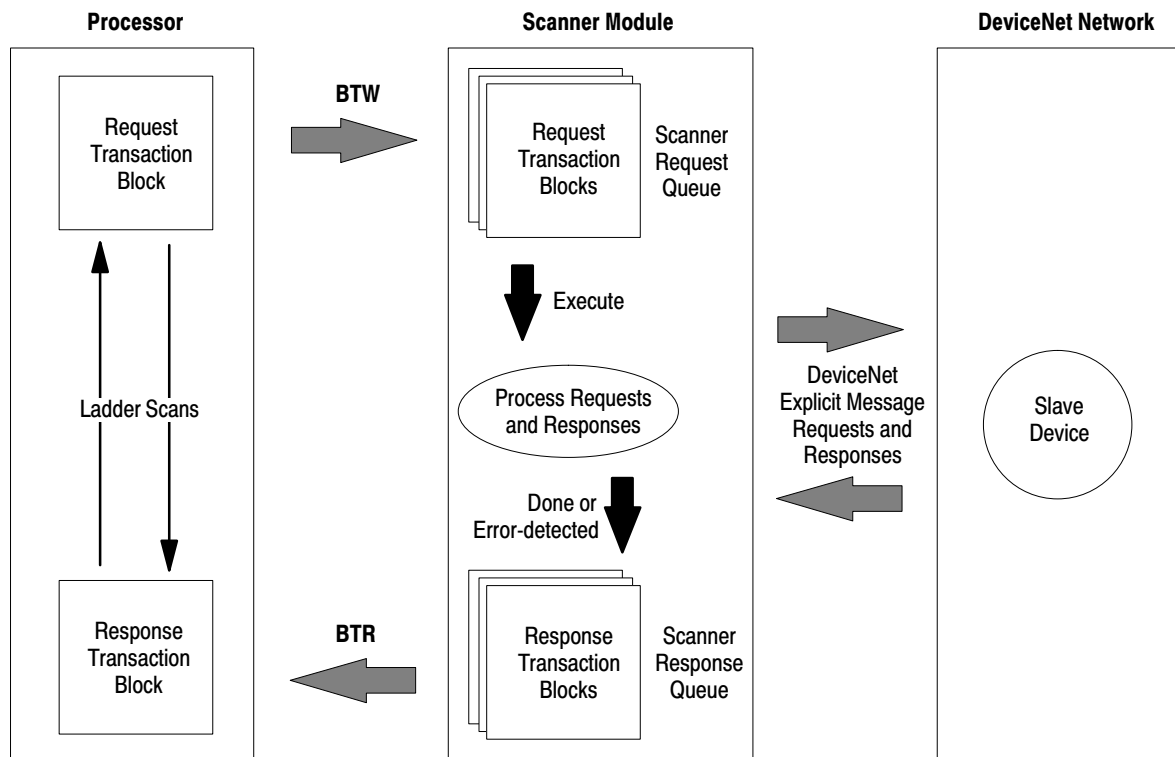
How the Processor and Scanner Module Manage Messages

Block 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 a Block Transfer Read 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 64 word Block Transfer Read 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, **five** Block Transfer Write files containing two transactions each, can be performed 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 **two** transaction blocks 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:

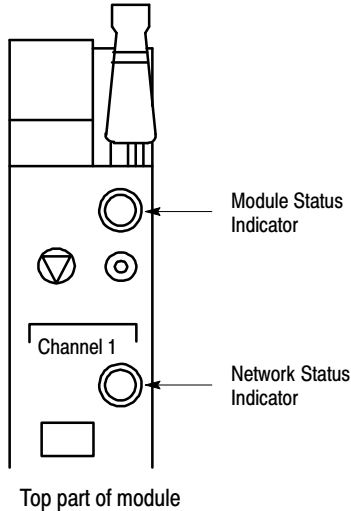
Service Name:	Service Code:	Example:
Get_Attribute_Single	0E _{hex}	Upload a single parameter value from a device
Set_Attribute_Single	10 _{hex}	Download a single parameter value to a device
Get_Attribute_All	01 _{hex}	Upload all parameter values from a device
Set_Attribute_All	02 _{hex}	Download all parameter values to a device

- Continuous Block Transfers of 64 words are not supported.
- All transaction blocks are processed, therefore, any unused transaction blocks must be left blank.
- Client/Server commands and requests with transaction IDs that are in use are deleted 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 Your Module

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

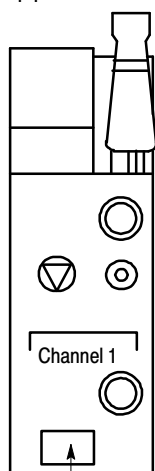


If your indicator is:	Then:	Take this action:
Off	There is no power applied to the device.	Apply power.
Green	The device is operating in normal condition.	Do nothing.
Flashing Green	The device needs configuring.	Configure the device.
Flashing Red	There is an invalid configuration.	Verify dip switch settings. Check configuration setup.
Red	The device has an unrecoverable fault.	Replace the module.

Channels 1 and 2 each have a bicolor (green/red) network status indicator. The following table provides troubleshooting information about the Channel 1 and 2 communication links.

If your 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 scanner, provide network power to channel, and make sure channel is enabled in both the scanner 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 scanner.	Do nothing.
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 scanner may be defective.	Reset module. If failures continue, replace module.
Flashing Red	The two-digit numeric display for the channel display an error code that provides more information about the condition of the channel.	At least one of the slave devices in the scanner's scan list table has failed to communicate with the scanner. The network has faulted.	Examine the failed device and check the scan list table for accuracy.

Top part of module

Node Address /
Status Indicator

Your 1771-SDN Scanner Module has a node address/status indicator that uses numeric displays to indicate diagnostic information about your module. The display flashes at approximately 1 second intervals, depending on network traffic. The following table summarizes the meanings of the numeric codes.

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.	Do nothing.
70	Scanner failed Duplicate Node Address check	Change the scanner 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's identity information does not match electronic key in scan list table entry (node number alternately flashes).	Verify that the correct device is at this node number. Make sure that the device at the flashing node address matches the desired electronic key (vendor, product code, product type).
74	Data overrun on port detected.	Modify your configuration and check for invalid data. Check network communication traffic.
75	No scan list is active in the module.	Enter a scan list.
76	No direct network traffic for scanner detected.	None. The scanner hears other network communication.
77	Data size expected by the device does not match scan list entry (node number alternately flashes).	Reconfigure your module for the correct transmit and receive data sizes.
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	Scanner has failed to transmit a message.	Make sure that your module is connected to a valid network. Check for disconnected cables.
80	Scanner is in IDLE mode.	Put PLC-5 in RUN mode. Enable RUN bit in module command register.
81	Scanner is in FAULT mode.	Check ladder program for cause of fault bits.
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 scanner attempts to communicate with it (node number alternately flashes).	Check accuracy of scan list table entry. Check slave device configuration. Slave device may be in another master's scan list. Reboot slave device.
84	Scanner is initializing the DeviceNet channel.	None. This code clears itself once scanner attempts to initialize all slave devices on the channel.

Numeric Code:	Description:	Take this action:
85	Data size larger than 255 bytes (node number alternately flashes).	Configure the device for a smaller data size.
86	Device is producing zero length data (idle state) while channel is in Run Mode.	Check device configuration and slave node status.
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 Module Command Register.
91	Bus-off condition detected on comm port. Scanner 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 scanner drop cable is providing network power to scanner 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 scanner's memory.
97	Scanner halted by user command.	Check ladder program for cause of fault bits.
98	Unrecoverable firmware failure.	Service or replace your module.
99	Unrecoverable hardware failure.	Service or replace your module.

Notes

Notes

Specifications

Module Location	1771-A1B through -A4B or later I/O chassis
Backplane Current	1.2amps @ 5Vdc (maximum)
DeviceNet Power Requirements ¹	24Vdc @ 90mA each channel (maximum)
Isolation Voltage	Optical Isolation between: <ul style="list-style-type: none"> • Backplane and Channel 1 • Backplane and Channel 2 • Channel 1 and Channel 2 1 Megohm resistor from Channels 1 and 2 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
Keying	between 2 and 4 between 22 and 24
Shock Unpackaged	30g operational 50g non-operational
Vibration Unpackaged	5g from 10-500Hz
Immunity Radiated Fields	10V/m 27mHz-1000mHz
Agency Certifications	CSA Class 1, Division 2, groups A, B, C, D UL Listed CE marked for all applicable directives
Associated Manual	DeviceNet Cable System Planning and Installation Manual Publication Number 1485-6.7.1

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

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