

DeviceNet Troubleshooting

DeviceNet will not function correctly if design rules are not followed. Even a Network previously thought to be functioning correctly may begin to exhibit abnormal or anomalous operation due to incorrect system design. The following are tips to help locate and correct these abnormalities.

For specific DeviceNet System Installation Information. Please refer to publication DN-6.7.2 entitled "DeviceNet Planning and Installation Manual".

Manuals can be ordered via the Automation Bookstore on the Internet at "www.theautomationbookstore.com" or your local Allen-Bradley distributor or sales office.

Termination Resistors:

A termination resistor equal to 121 Ohms 1% , 1/4W must be attached at each end of the Trunk cable. The resistors must be connected across the Blue & White wires of the DeviceNet cable.

Resistor connection can be verified by disconnecting DeviceNet power and measuring the resistance across the Can_H & Can_L lines (Blue & White Wire).

This reading should be approximately 60 Ohms.

Important: The DeviceNet network will not operate correctly without terminating Resistors. Termination resistors can be ordered from your local Allen-Bradley Distributor using the *part number 1485A-C2*.

Network Grounding:

The DeviceNet cable must be grounded at only one location. This should be done closest to the center of the network. Connect the network Shield and Drain wire to an earth ground using #8 AWG wire up to a maximum 3m (10Ft) in length. Also connect the V- conductor (Black Wire) of the network trunk cable and the DC ground of the power supply to this ground connection.

Power Supplies:

DeviceNet requires 24VDC. Use a power supply rated 24VDC (+/- 1%). Make sure the power supply has its own current limit protection. Provide fuse protection for each segment of the cable system. DeviceNet requires a power supply to have a rise time of less than 250mS to within 5% of its rated output voltage. The power supply must be sized correctly to provide each device with its required power.

Important: The power supply should be used to power the DeviceNet network only. When multiple power supplies are required, verify that the V+ connection is broken between the supplies. Please refer to the " DeviceNet Planning and Installation Manual " for more specific installation procedures.

Examine the System Design of the Installation

- Walk the network if possible to determine the actual layout. (Make a sketch of the network)
- Check number of nodes
- Check cumulative drop length
- Check individual drop lengths
- Check branched drop length
- Check total trunk length, including long drop near the ends
- Check the termination location and measure the terminators
- Check the power supply cable length and gauge
- Check for one, and only one, earth ground of the V- and shield
- Break the combination shield/V- connection to frame ground and verify >1.0 Mohm to frame ground
- Check for one and only one V- to shield connection
- Break the shield/V- connection at the power supply and verify >1.0 Mohm shield to V- with 24VDC off
- Check for shorts of CAN- and/or CAN+ to shield or V- verify with an OHM meter
- Check the length and gauge of the earth ground connection
- Check total power load and its distribution points

Check the Power

Check trunk and drop current limits
Check type (size and length) of cable bringing power into the trunk
Measure the 24V supply at the middle and ends of the network
Consider spot checking the power for noise with an oscilloscope

The 24 VDC Network Power for DeviceNet Must be for the DeviceNet network only.

Check the Wiring

Check lead dress in junction boxes
Check that connectors are screwed together tightly
Check that glands are screwed tightly
Check for foreign material (electrical tape, RTV, etc.) in glands
Check that nodes are not touching extremely hot or cold surfaces
Check that cables are kept a few inches away from power wiring
Check that cables are not draped on electric motors, relays, contactors or solenoids
Check that cables are not constrained so as to place excessive tension on connectors
Wiggle connectors to provoke intermittent failures

Check the Scanner Configuration

Verify the scanlist
Baud Rate
Node Address
Series/Revision of the 1747/1771-SDN scanner

Check the Nodes

Drop 24V supply, re-power and reset the scanner to initialize the network
Examine the scanner display codes to identify problem nodes.
(Reference the SDN manual for a description of these codes)

At problem nodes

Blinking **GREEN** means the node is not being allocated by the scanner
Check that the node is in the scan list
Check that the scanner is not bus off
Check if connection is timing out

Blinking **RED** means no communication

- Check for missing power on all nodes

- Check if all other nodes are disconnected

- Check node baud rate (Bad baud rate does not always cause buss off)

Check scanner, if it is bus off (code 91) communications connection with the node has then timed out.

- Recycle 24V supply and then reset scanner.

If scanner goes bus off again, The problem is some combination of

- Defective node

- Node baud rate

- Bad topology

- Bad connections

- Bad scanner

- Bad power

- Bad grounding

- Bad electrical noise

Solid **RED** light at power-up means two nodes have the same address Solid **RED** after allocation means bus off Check baud rate -

If the problem persists, replace node (Be sure to set the address and baud rate on the replacement node)

If the symptoms persist

- Replace T-Tap

- Check topology

- Check power for noise with oscilloscope or power disturbance analyzer

Points to Remember

Pressing the reset button on the scanner does not reset the network

Cycling the rack power does not reset the network

When using a DeviceLink a bus off (solid **RED**) condition can only be cleared by cycling the 24V power

Cycling power on the network will cause the scanner to go bus off

DeviceNet 9000 bus off (solid **RED**) condition can be cleared by cycling the 24V power or by pressing the program button for several seconds

Extreme care must be given to the task of setting initial addresses and baud rates because one incorrect node address or incorrect baud rate will cause other nodes to appear to be bad (solid **RED**).

If the scanner is bus off (code 91), nodes will not reallocate (flashing **GREEN** or **RED**) even if they are functioning correctly

DeviceNet manager and a 1770-KFD can be used to identify the functioning nodes on the network.

If a node goes bus off (solid **RED** for DeviceLink), and is replaced and still goes bus off, the problem is not the node but rather the setting of the address or baud rate OR a network wide problem related to topology, grounding, electrical noise or an intermittent node

MORE TROUBLESHOOTING TIPS

Try to distinguish, as soon as possible, a device problem from a media problem.

Try to reduce the system to the smallest size which still exhibits the problem.

This can be done by removing nodes, drops, taps, or lengths of trunk.

Use substitution where possible to rule things out, But be careful!

Real Case:

Product A works with Product B and not with Product C.

We conclude that the problem is with Product C -- WRONG!!

The problem was with product A., Product C was operating correctly, But just happened to be susceptible to the fault in the product A.

Do not assume to much!

If you suspect a media problem, inspection is always a good first step. Verify lengths, topology, the proper termination (*VERY IMPORTANT*). Most of all check connections.

Opens or shorts may be the biggest problem. On an idle bus (without traffic) voltages can indicate problems. CAN_L and CAN_H should be about 2.5 to 3.0 volts relative to V-. If there is traffic, CAN_L will be a little lower, CAN_H a little higher.

Use an OHM meter to check resistance between CAN_H and CAN_L when idle. This should be about 60 ohms (two 120 ohm terminators in parallel). This value may be as low as 50 ohms if there are many nodes attached. Make sure all wires are well attached to the right places. The V+ level, relative to V-, should always be between 11 to 25 volts.

One common problem people run across is incorrect setting of baud rates and node addresses. Always verify the nodes address and baud rate before installing it on a network. and try not to change a nodes baud rate while on the network. Do all baud changes on a point to point only connection.

Ground Loops

Before trying this make sure only one side of the shield is grounded.

Use the oscilloscope to determine if there are ground loops in your system. You should NOT see 60 Hz or Harmonics in your signal. Assuming you use DC coupling on the oscilloscope you should see....

2.8 VDC offset on both Can_High & Can_Low NO Sinusoidal signal ;ie 60 Hz components.

DeviceNet Cable

BLACK	Common	-- COM
BLUE--	Signal Low	-- CAN_L
Uninsulated	Shield	-- SHIELD
WHITE	Signal High	-- CAN_H
RED	Power Supply	-- VDC+
GREEN	Chassis Ground	-- EARTH GROUND

DeviceNet Connector

Examining the connector with the keyway pointing down. Number the pins starting at the pin right most to the keyway (1) and continue counter clockwise until you reach pin (5).

PIN 1	SHIELD	GREEN
PIN 2	VDC+	RED
PIN 3	COM	BLACK
PIN 4	CAN_HIGH	WHITE
PIN 5	CAN_LOW	BLUE

DeviceNet Scanner Status / Error Codes

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

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.

The network status indicator is a bicolor (GREEN/RED) LED. The following table provides troubleshooting information about communication links.

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	The scanner may be defective.	Reset module. If failures continue, replace module.

	code that provides more information about the condition of the channel		
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.

Your 1747/1771-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 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 network traffic at all has been detected.	Verify connections.
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.	Enable RUN bit in SDN module command register. Put PLC/SLC in RUN mode.
81	Scanner is in FAULT mode.	Check ladder program for fault bits being set in SDN.

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.
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.

E2	RAM Test Failure	Return/Replace module
E4	Lost Power During FLASH Upgrade	Return/Replace module
E5	No Boot or Main Code	Return/Replace module
E9	The 1747-SDN scanner has been flushed From the command register.	Cycle Power on SDN to recover

Internal:

*** END OF DOCUMENT ***