



ControlNet-to-DeviceNet Linking Device

Catalog No. 1788-CN2DN

Product Overview

The ControlNet-to-DeviceNet (CN2DN) linking device connects a ControlNet™ network to a DeviceNet™ network. The DeviceNet network consists of multiple DeviceNet devices, such as RediSTATIONS, photoeyes, etc. The ControlNet network consists of controllers, HMIs, drives, I/O devices, and so on. The CN2DN linking device has two broad functions, supporting closed-loop control, and configuration and monitoring.

To the Installer

Use this document as a guide when you install the 1788-CN2DN. These installation instructions cover the following topics:

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Note that you must configure the 1788-CN2DN Linking Device using RSNetWorx software before you can use it in a system. After you complete the installation described in this manual refer to the ControlNet-to-DeviceNet Linking Device User Manual, publication 1788-UM053A-EN-P, for information on how to configure the device.

Safety Considerations

Throughout this manual we use the following notes to make you aware of safety considerations:

WARNING

Identifies information about practices or circumstances that have the potential to create an explosion hazard.



ATTENTION

Identifies information about other practices or circumstances that can lead to personal injury or death, property damage or economic loss.



Warning and Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

We use the following note to call attention to critical information:

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

European Communities (EC) Directive Compliance

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 the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — 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 Allen-Bradley publication 1770-4.1, Industrial Automation Wiring and Grounding Guidelines.

Enclosure and Environmental Requirements

This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool.

This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

Precautionary Statements

We recommend that you adhere to this precautionary information.

WARNING



If you connect or disconnect the ControlNet or the DeviceNet cable with power applied to this device or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION



This module contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing or testing this assembly. Component damage may result if these procedures are not followed.

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes, and standards.

The illustrations and examples shown in these installation instructions are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

System Requirements

This section describes the required hardware and software components you need before you can use the CN2DN linking device.

Hardware

- 1788-CN2DN ControlNet-to-DeviceNet linking device
- PC access to ControlNet through RSLinx™
- ControlNet and DeviceNet cabling

Software

- Windows NT® 4.0 with service pack 3 or higher
- RSLinx 2.10 or later; this is the driver for the Allen-Bradley PC interfaces.
- RSNetWorx™ for ControlNet version 2.0 or later; this is the ControlNet configuration tool.
- RSNetWorx™ for DeviceNet version 2.11 or later; this is the DeviceNet configuration tool.
- Appropriate application software: RSLogix 5 (for PLC5), RSLogix 500 (for SLC500), or RSLogix 5000 (for ControlLogix)

Compatibility Information

The 1788-CN2DN linking device is compatible with DeviceNet and ControlNet specifications as of this writing.

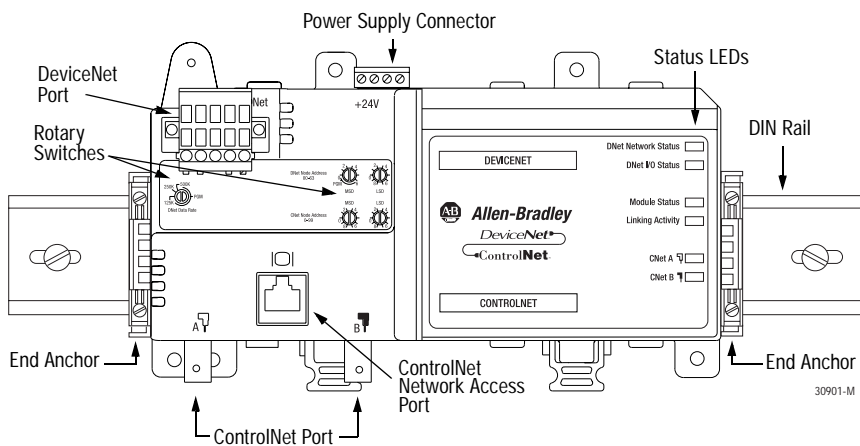
Related Publications

Title	Publication Number
ControlNet-to-DeviceNet Linking Device User Manual	1788-UM053A-EN-P
ControlNet Cable System, Planning and Installation Manual	1786-6.2.1
DeviceNet Cable System, Planning and Installation Manual	DN-6.7.2

CN2DN Hardware Description

Figure 1 shows the components of the CN2DN linking device.

Figure 1 - CN2DN Linking Device



The CN2DN module is designed to be mounted on a 35 mm steel DIN rail. End anchors are provided to keep the module in position.

The device has one ControlNet port with support for redundant media as well as a ControlNet network access port. Rotary switches are used to set the ControlNet node address. The CNet Status LEDs display the current status of each of the redundant media channels.

The CN2DN has one DeviceNet port. Rotary switches are used to set the DeviceNet node address and the data rate. DNet LEDs display the current status of the network and the I/O channel.

Module Status and Linking Activity LEDs are also provided. For information about the LEDs, see “Interpreting the Status LEDs” beginning on page 22.

The power supply connector is wired to 24V dc.

Installing the CN2DN Module

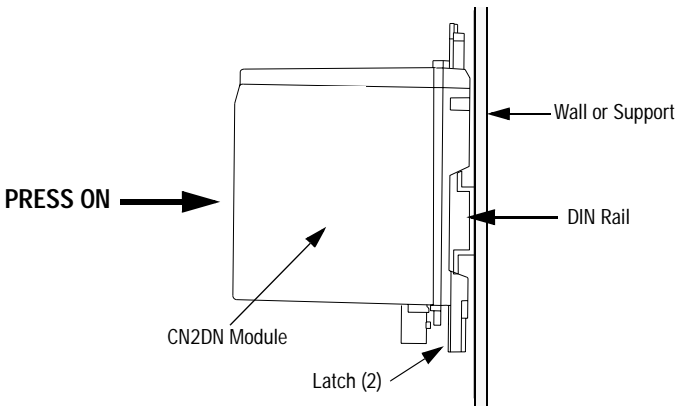
The CN2DN module should be mounted on a standard 35 mm steel DIN rail. Follow these steps to mount the CN2DN onto the DIN rail.

IMPORTANT

You must use a steel DIN rail (A-B P/N 199-DR1 or equivalent) to meet the 1788-CN2DN's vibration specifications. DO NOT use an aluminum DIN rail.

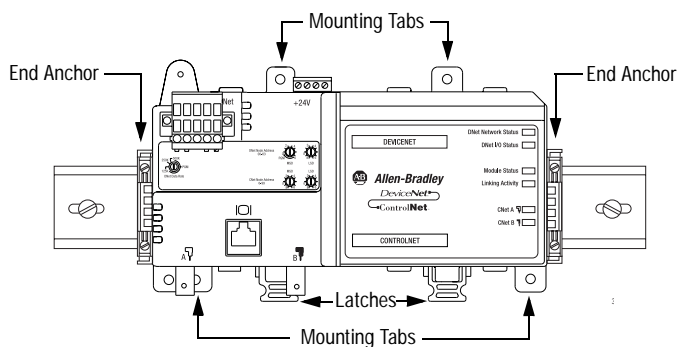
1. Press the module straight onto the DIN rail at the desired location. Be sure that both latches snap into place.

Figure 2 - Mounting the CN2DN Module on the DIN Rail



2. Use the supplied end anchors to lock the module into place.

Figure 3 - End Anchors and Mounting Tabs



Note that for very high shock applications the module may be bolted to the panel through the four mounting tabs on the base. See page 27 for dimensions.

Removing the CN2DN module

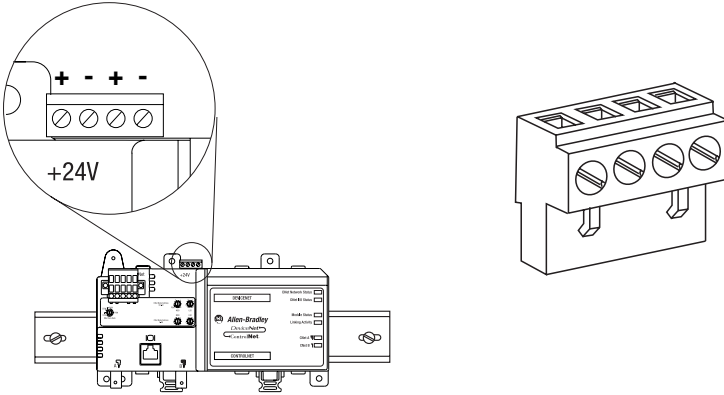
If you need to remove the CN2DN module from the DIN rail, simultaneously pull the 2 latches away from the rail, then take the module off the rail. (Note: It may require two screwdrivers to pry the latches open.)

Connecting Power

The CN2DN linking device requires 18-30V dc input power. The CN2DN filters and regulates the supplied power. The power connector is a 4-pin redundant screw terminal connector.

The pinout for the power connector is shown in Figure 4.

Figure 4 - Power Connector Pinout



Connect the primary power supply to the left + and - pair. The right + and - pair may be used to chain the primary power supply to downstream devices.

IMPORTANT

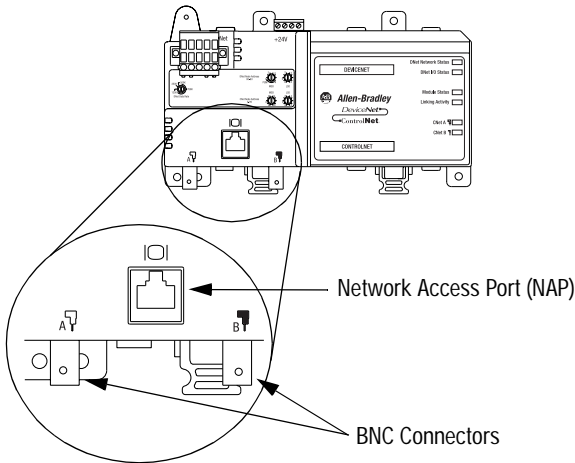
No connection will be made to downstream devices unless the connector is plugged into the CN2DN.

ControlNet Connections

BNC Connectors

The CN2DN linking device must be connected to the ControlNet network using the BNC connectors on the device. See figure 5. The BNC connectors should be connected to the ControlNet network through taps as shown in figure 6 on the following page.

Figure 5 - ControlNet Connections



IMPORTANT

Do not connect the CN2DN to more than one ControlNet network at a time. Attempting to connect to a second network will cause the CN2DN to operate erratically.

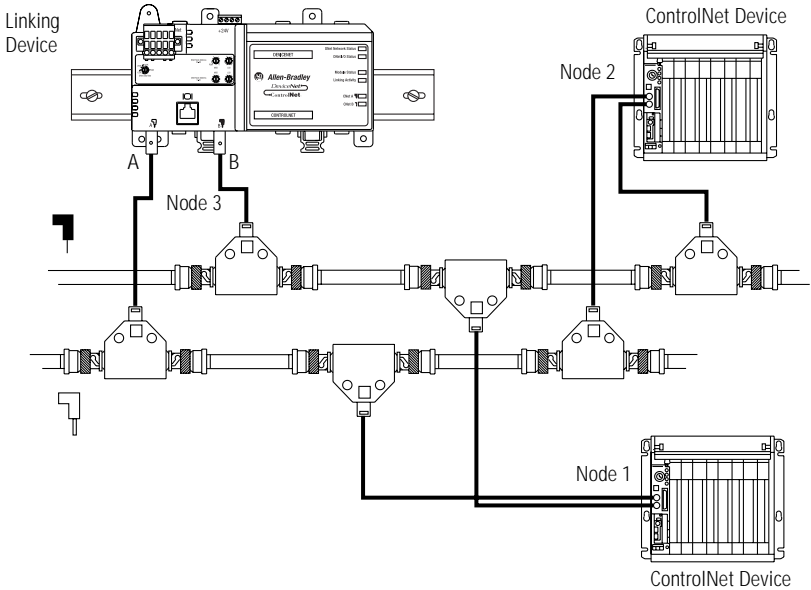
Network Access Port (NAP)

The CN2DN also includes a Network Access Port (NAP) with an RJ-45 connector for connecting programming terminals to devices on the ControlNet network. You can use the NAP to temporarily connect a device such as a laptop computer to the network.

Using Redundant Media

Figure 6 shows an example of a typical ControlNet network using redundant media.

Figure 6 - CN2DN on ControlNet (Redundant Media)



ATTENTION



When using redundant media, connect all channel A connectors to one cable, and all channel B connectors to the other cable.

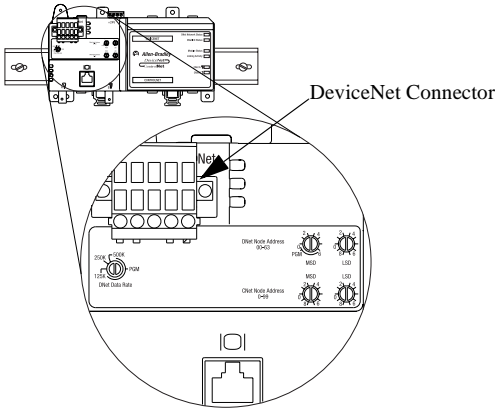
If you connect the product to a cable system that does not support redundant media, connect the tap dropline to the BNC connector labeled channel A. Leave Channel B open when using single media.

Refer to publication number *1786-6.2.1, ControlNet Cable System, Planning and Installation Manual*, for further information.

DeviceNet Connections

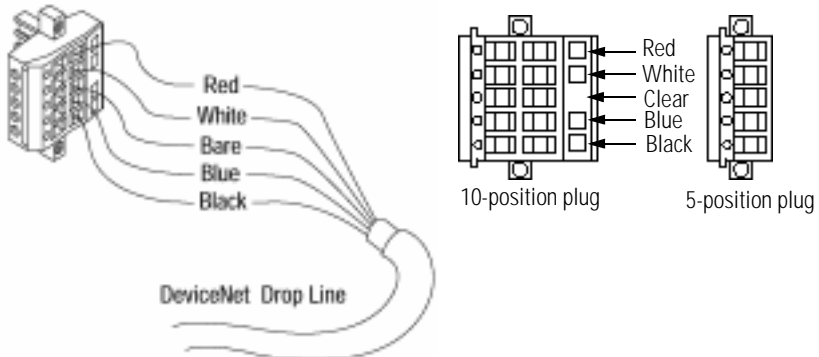
The location of the DeviceNet connector is shown in figure 7.

Figure 7 - DeviceNet Connector on the CN2DN



Use an open-style 5 or 10-position linear plug to connect to the DeviceNet network. An open-style 10-position linear plug is provided with your CN2DN. Wire the connector as shown in figure 8.

Figure 8 - Connector Pinout to CN2DN



Refer to publication number *DN-6.7.2, DeviceNet Cable System, Planning and Installation Manual*, for further information.

Setting the Node Address Switches

IMPORTANT

When using a 1788-CN2DN, the ControlNet network must have an “Active Keeper” to keep track of network scheduling, clock synchronization, etc. The Active Keeper can be a 1785-PLC5C, 1756-CNB, 1784-KTCS, 1784-PCICS, or 1747-SCNR.

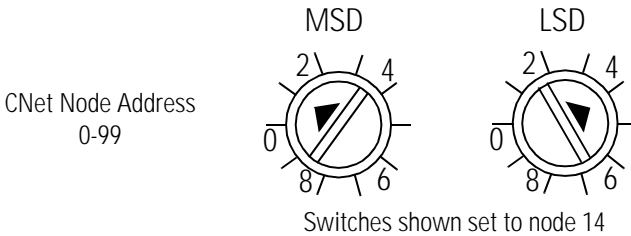
CN2DN ControlNet Address

Choose and set a ControlNet network address for the CN2DN. Refer to figure 9.

IMPORTANT

ControlNet addresses must be in the range 01-99.

Figure 9 - CNet Node Address Switches



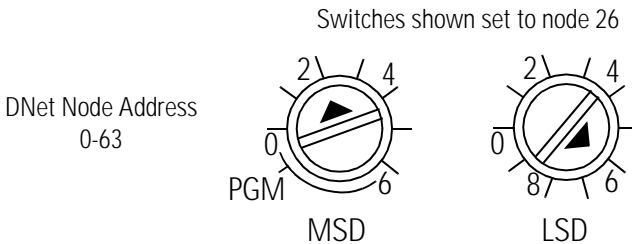
CN2DN DeviceNet Address

Choose and set a DeviceNet network address for the CN2DN. Refer to figure 10:

IMPORTANT

DeviceNet addresses must be in the range 00-63. The default address is 63. DeviceNet address settings in the PGM area are not supported.

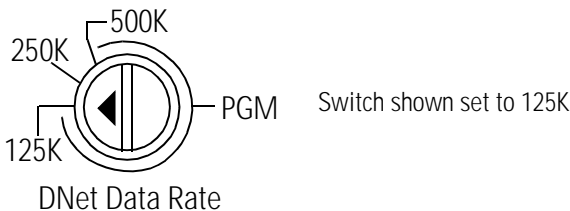
Figure 10 - DNet Node Address Switches



Setting the DNet Data Rate

Set the data rate for your DeviceNet network: 125K, 250K, or 500K. Data rate settings in the PGM area are not supported. Refer to figure 11:

Figure 11 - DNet Data Rate Switch



Controller Interface

The 1788-CN2DN module supports several different size input, output, and status structures. These I/O structures were created to reduce the complexity of connecting DeviceNet I/O and status data with ladder programs. The module creates all 3 structures whether or not DeviceNet nodes are configured or online.

The RSNetWorx for DeviceNet software configures scanlist map segments that are used to copy specific portions of I/O data between the I/O structures and DeviceNet network packets.

Output Structure

The controller sends output by writing output data to the output structure in the 1788-CN2DN module. The CN2DN then delivers a copy of these output values to modules on DeviceNet. The output structure consists of a 32-bit command register and a variable size 32-bit array of up to 123 words for output data.

The output structure consists of these data regions:

Output Structure Element	Description	Data Type
module command register	This 32-bit register consists of several bits that affect the module's behavior on the network.	1 x 32-bit register
output_data		123 x 32-bit data array

Module Command Register Bit Definitions

The Module Command Register bits are defined as follows:

Bit	Name	Description
0	Run	1 = run mode 0 = idle mode
1	Fault	1 = fault network
2	DisableNetwork	1 = disable network
3	HaltScanner	1 = halt module (the CN2DN module ceases all operation)
4	Reset	1 = reset module (put back to 0 to resume operation)
5 - 31	Reserved	<i>unused</i>

IMPORTANT

If a module is halted because the HaltScanner bit is set, power must be physically recycled to restart the module.

Input Structure

The controller receives input by reading input data from the input structure in the 1788-CN2DN module. The scanner (i.e., the CN2DN) receives input data from DeviceNet modules and delivers a copy of these values to the controller. The input structure consists of one 32-bit status register and a variable 32-bit array of up to 124 words for input data. The 32-bit status register reflects the current state of several key module-level operational parameters.

The input structure consists of these data regions.

Input Structure Element	Data Type
module status register	1 x 32-bit register
input_data	124 x 32-bit data array

Module Status Register Bit Definitions

The Module Status Register bits are defined as follows:

Bit	Name	Description
0	Run	1 = in run mode 0 = in idle mode
1	Fault	1 = network is faulted
2	DisableNetwork	1 = network is disabled
3	DeviceFailure	1 = device failure exists (examine the status structure for causes)
4	Autoverify	1 = device I/O size mismatch exists (examine the status structure for details)
5	CommFailure	1 = communication failure exists
6	DupNodeFail	1 = failure due to duplicate node address
7	DnetPowerDetect	1 = DeviceNet power failure
8 - 31	Reserved	<i>unused</i>

Status Structure

The controller receives status information concerning the 1788-CN2DN module's ability to exchange DeviceNet messages with other nodes by reading from the status structure in the 1788-CN2DN module. The CN2DN periodically updates the contents of the status structure and copies its contents to the controller. The status structure consists of several tables. The bit position of each of the 64 bits that make up a given status table directly corresponds to the node address of a device.

The status structure consists of these data elements:

Status Structure Element	Description	Data Type	DINTS
ScanCounter	counter incremented each I/O scan	32-bit	10
DeviceFailureRegister	device failed bit table	64-bit	
AutoverifyFailureRegister	device I/O size does not match scanner's internal table	64-bit	
DevicIdleRegister	device's idle bit table	64-bit	
ActiveNodeRegister	node online bit table	64-bit	
ScannerAddress	DeviceNet address of CN2DN module	8-bit BCD	
ScannerStatus	status of CN2DN module	8-bit BCD	
ScrollingDeviceAddress	scrolls through DeviceNet nodes once per second by address and status (0 = no faults)	8-bit BCD	
ScrollingDeviceStatus		8-bit BCD	
ReservedArray	future expansion (20 bytes)	20 x 8-bit	16
DeviceStatus	DeviceNet node status array, 1 byte per device	64 x 8-bit	24/32

You can view the status structure by monitoring the controller tags in RSLogix 5000, or by mapping the status structure to a file in a PLC-5 or SLC 500 processor and viewing the file in RSLogix 5 or RSLogix 500. See the ControlNet-to-DeviceNet User Manual, publication number 1788-UM053A, for details.

Diagnostic Codes

The ScannerStatus member displays numeric codes providing diagnostic information about the module. The ScrollingDeviceStatus member provides diagnostic information about slave devices. The following table summarizes the meanings of the numeric codes.

Numeric Status Codes

Numeric Code	Description	Action
70	Module failed Duplicate Node Address check.	Change the module address to another available one. The node address you selected is already in use on that network.
71	Illegal data in scan list table.	Reconfigure the scan list table and remove any illegal data.
72	Slave device stopped communicating.	Inspect the field devices and verify connections.
73	Device's identity information does not match electronic key in scan list table entry.	Verify that the correct device is at this node number. Make sure that the device at the scrolling node address matches the desired electronic key (vendor, product code, product type, etc.).
74	Data overrun on port detected.	Modify your configuration and check for invalid data. Check network communication traffic.
75	No traffic detected on the network.	Check the network configuration.
76	No direct network traffic for module detected.	None. The module hears other network communication.
77	Data size expected by the device does not match scan list entry.	Reconfigure your module for the correct transmit and receive data sizes.
78	Slave device in scan list table does not exist.	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.
80	Module is in IDLE mode.	Put controller in RUN mode. Enable RUN bit in module command register.
81	Module is in FAULT mode.	Check Module Command Register for fault bit set.
82	Error detected in sequence of fragmented I/O messages from device.	Check scan list table entry for slave device to make sure that input and output data lengths are correct. Check slave device configuration.

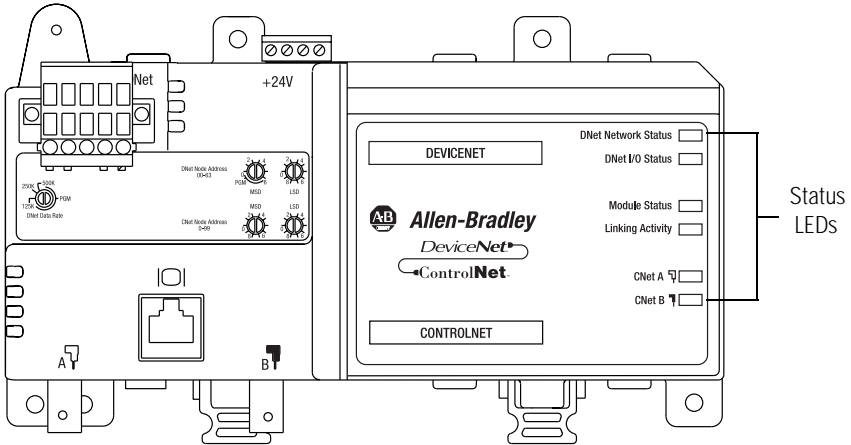
Numeric Status Codes

Numeric Code	Description	Action
83	Slave device is returning error responses when module attempts to communicate with it.	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	Module is initializing the DeviceNet network.	None. This code clears itself once module attempts to initialize all slave devices on the network.
85	Data size was incorrect for this device at runtime.	Slave device is transmitting incorrect length data. Try replacing the device.
86	Device is producing zero length data (idle state) while module is in Run Mode.	Check device configuration and slave node status.
87	The primary owner has not allocated the slave.	Put the primary owner on line.
88	The connection choices (polled, strobed, etc.) between the primary connection and the shared input only connection do not match.	Reconfigure the shared input only connection's choice(s) to be the same as, or a subset of, the primary connection's choice(s).
89	Slave device initialization using Auto Device Replacement parameters failed.	<ul style="list-style-type: none"> • Put the slave device into configurable mode. • Check the slave's EDS file, if the slave is configured offline. • Check to see if the slave device has been replaced with an incompatible device.
90	User has disabled communication port.	Check Module Command Register for DISABLE bit set.
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 communication 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 operation halted by user command.	Check Module Command Register for HALT bit set.
98	General firmware error	Replace module.

Interpreting the Status LEDs

The Status LEDs are located on the front of the CN2DN module, as shown in figure 12.

Figure 12 - Status LEDs



Module Status LED

The Module Status LED indicates whether the CN2DN is powered, configured, and operating properly. The following table shows how to interpret the Module Status LED states.

LED State	Meaning
Off	No power to device.
Flashing green	Standby state. The CN2DN module has passed all self tests and is ready to operate, but is not configured.
Steady green	Operational state. The CN2DN module has been configured.
Flashing red	Module has recoverable faults, or the DNet Data Rate or DNet Node Address switches are set in the PGM range.
Steady red	Unrecoverable fault(s)

Linking Activity LED

The Linking Activity LED indicates the rate of traffic through the linking device. The following table shows how to interpret the Linking Activity Status LED.

LED State	Meaning
Off	No traffic
Flashing green	Traffic present (flash rate reflects amount of traffic)
Flashing red and green	Module is running boot code only (reduced functionality code only for FLASH upgrading)

ControlNet Network Status LEDs (CNet A, CNet B)

The ControlNet Network Status LEDs indicate the state of the ControlNet network connected to the BNC connectors. If more than one state is present, the LEDs always reflect the highest priority status present on the network. Note that these LEDs do not reflect the status of the network access port (NAP). The following table describes the LED states and the priority of each status LED.

LED State	Priority	How to View	Cause
Both steady off	1 (highest)	View together	Reset or no power
Both steady red	2		Failed to link interface to ControlNet
Alternating red & green	3		Self testing
Alternating red	4		Bad node configuration (such as duplicate ControlNet network address)
Steady off	5	View independently	Channel disabled or not supported
Flashing red & green	6		Invalid link configuration
Flashing red	7		Link fault or no frames received
Flashing green	8		Temporary channel error or listen only
Steady green	9 (lowest)		Normal operation

DNet Network Status LED (including Slave Mode)

The DNet Status LED indicates the functional states of the DNet port. The following table describes each state.

LED State	Meaning
Off	Not online, no network power, or no device power.
Flashing green	No connections established, or timed-out.
Steady green	At least one connection established, none timed-out.
Flashing red	At least one connection in timed-out state.
Steady Red	Bus off, or duplicate MAC ID.

DNet I/O Status LED

The DNet I/O Status LED indicates the functional state of the I/O on the DeviceNet. The following describes each state.

LED State	Meaning
Off	Not online, no network power, or no device power.
Flashing green	Scanner is in Program (Idle) mode.
Steady green	Scanner is in Run mode.

Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:

Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.



WARNING: Explosion hazard -

- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Substitution of components may impair suitability for Class I, Division 2.
- If this product contains batteries, they must only be changed in an area known to be nonhazardous.

Informations sur l'utilisation de cet équipement en environnements dangereux:





Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.



RISQUE D'EXPLOSION –

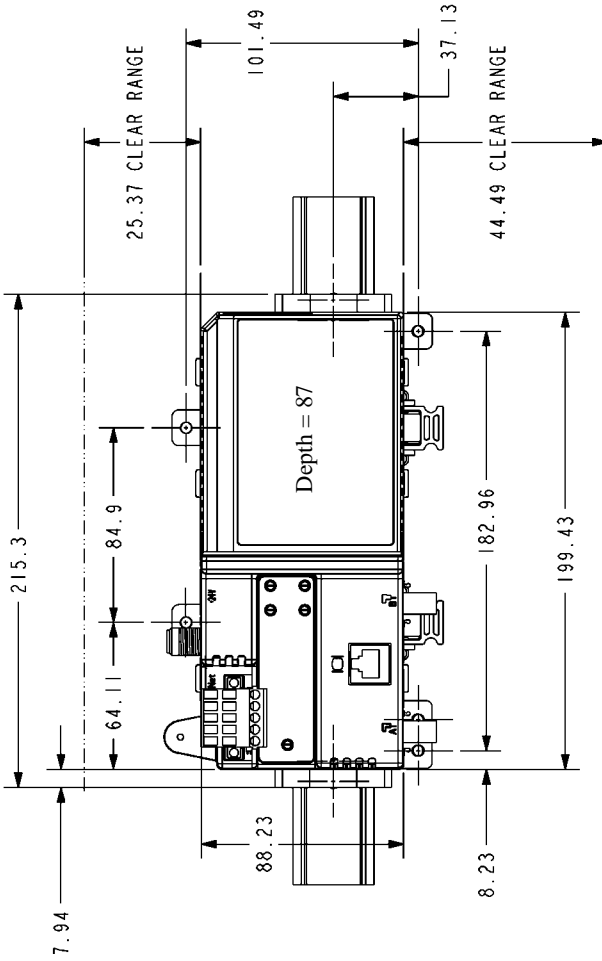
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.
 - Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit.
 - La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe 1, Division 2.
 - S'assurer que l'environnement est classé non dangereux avant de changer les piles.
-

Specifications

Parameter	Specifications	
Dimensions	Height: 120mm (4 11/16 in) Depth: 87mm (3 7/16 in) Width: 200mm (7 7/8 in)	
Environmental	Operating Temperature: 0 to 60° C (32 to 140° F) Storage Temperature: -40 to 85° C (-40 to 185° F) Relative Humidity: 5 to 90% (non-condensing)	
Vibration	Operating - 2Gs each axis Tested 2Gs @ 10 - 500 Hz per IEC 68-2-6	
Communication	ControlNet - redundant media and network access port DeviceNet - 1 channel	
Power Requirements	Main Power - 18-30V dc (24V dc nominal), 500 mA DeviceNet Power - 11-25V dc (24V dc nominal), 90 mA, Class2	
Indicators	Module Status Linking Activity DNet Network Status DNet I/O Status CNet Status, 1 each channel	
Connectors	ControlNet - BNC connectors Network Access Port - RJ45 DeviceNet - 5-pin open connector Power - 4-pin redundant screw terminal connector	
Conductors/Wire Size/ Category	Category 2 ⁽¹⁾	
ControlNet Taps	Cat Nos. 1786-TPR, -TPYR, -TPS, -TPYS	
NAP cable assembly	Cat No.1786-CP	
Mounting	35 mm steel DIN rail (A-B P/N 199-DR1 or equivalent)	
CNet Channel Selection	two 10-position rotary switches	
DNet Channel Selection	two 10-position rotary switches	
Agency Certification (when product is marked)		Listed Industrial Control Equipment
		Certified Process control Equipment Certified Class I, Division 2, Group A,B,C,D
		Marked for all applicable directives
		Marked for all applicable acts

⁽¹⁾ Refer to the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Mounting Dimensions



All dimensions in millimeters (mm)

Allen-Bradley is a trademark of Rockwell Automation.

ControlNet is a trademark of ControlNet International.

DeviceNet is a trademark of Open Device Vendors Association (ODVA).

RSLinx and RSNetWorx are trademarks of Rockwell Software.

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