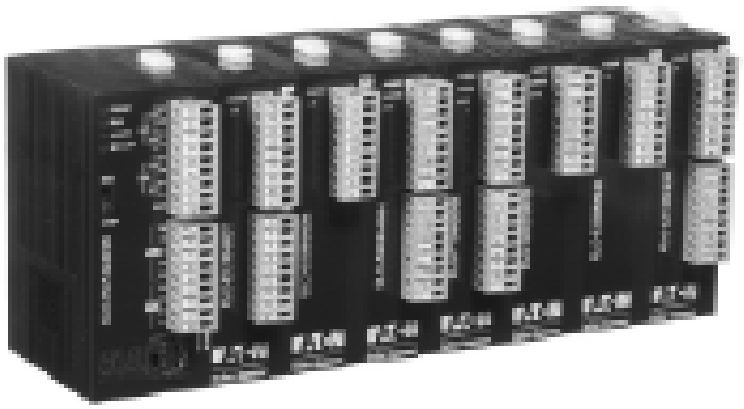
ELC-CODNETM

Effective December 2010

Users Manual



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Introduction

✓ This is an OPEN-TYPE device and therefore should be installed in an enclosure free of airborne dust, excessive humidity, shock and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g. key or specific tools are required to open the enclosure) to avoid potential equipment damage or personal injury. DO NOT touch any terminal when the power is switched on.

✓ Please read this manual carefully and follow the instructions to avoid damage to the product or personal injury.

Table of Contents

1 Introduction

DeviceNet is an international, open and vendor- independent communication protocol widely applied in industrial and process automation.

The ELC-CODNETM provides the ability for an ELC-PV processor to exchange data on a DeviceNet network. The ELC-CODNETM can act both as a DeviceNet master and as a DeviceNet slave.

- **Features**
  - Supports DeviceNet master and slave modes
  - As a master the CODNETM supports polled, bit-strobe, change of state and cyclic I/O messaging.
  - Provides continuous I/O scanning of slave devices
  - Provides explicit messages triggered by ELC program
  - Support EDS file configure in ELCSoft software
  - Connection size is flexible from 1 to 380 bytes in the input and output area

2 Specification

- **DeviceNet Physical and Transport layers**

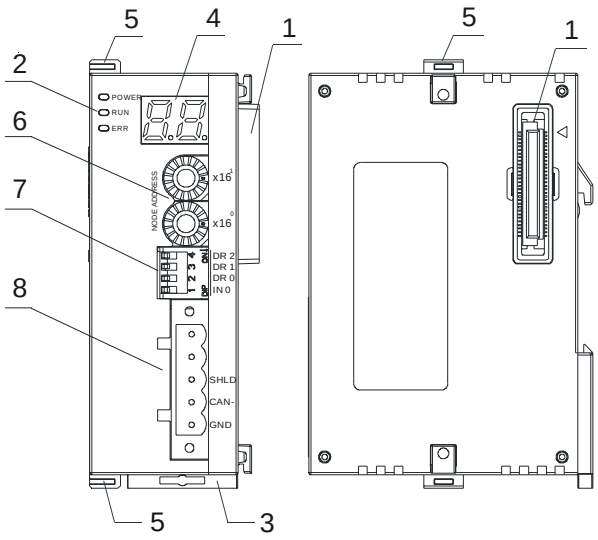
Interface	Removable connector (5.08mm)
Transmission method	CAN
Transmission cable	2-wire twisted shielded cable with 2-wire bus power cable and drain
Electrical isolation	500VDC
Current draw from DeviceNet supply	Less than 50mA . All other power provided from the ELC supply
Message type	I/O polled, bit-strobe, change of state/cyclic
Baud rates	125kbps, 250kbps, 500kbps
Product code	64
Product type	12
Vendor ID	Eaton

- **Environmental Specifications and agency certifications**

Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV, Analog & communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m
Environment	Operation: 0ºC ~ 55ºC (temperature); 50 ~ 95% (humidity); pollution degree 2 Storage: -25 ºC ~ 70ºC (temperature); 5 ~ 95% (humidity)

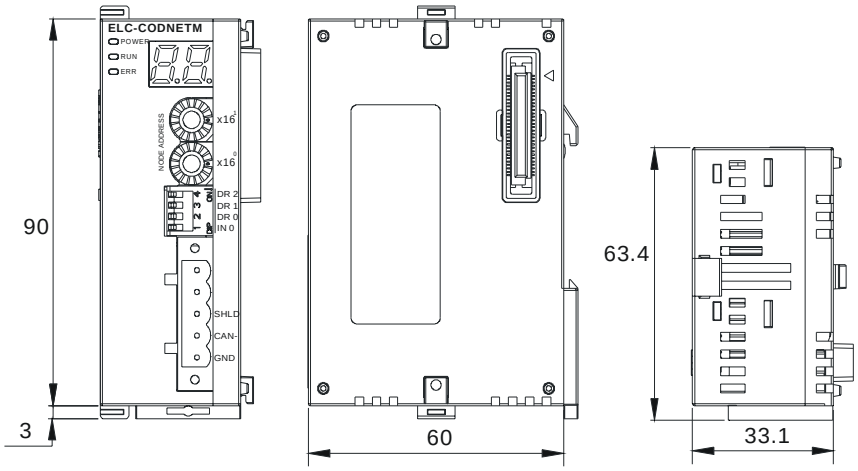
Vibration/shock resistance	Standard: IEC61131-2、IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)
Certificates	CE cULus

3 Product Profile and Outline



1. Extension port	2. Power, MS, NS LED
3. DIN rail clip	4. Digital indicator
5. Extension clip	6. Address switch
7. Function switch	8. DeviceNet connection port

■ **Dimension**

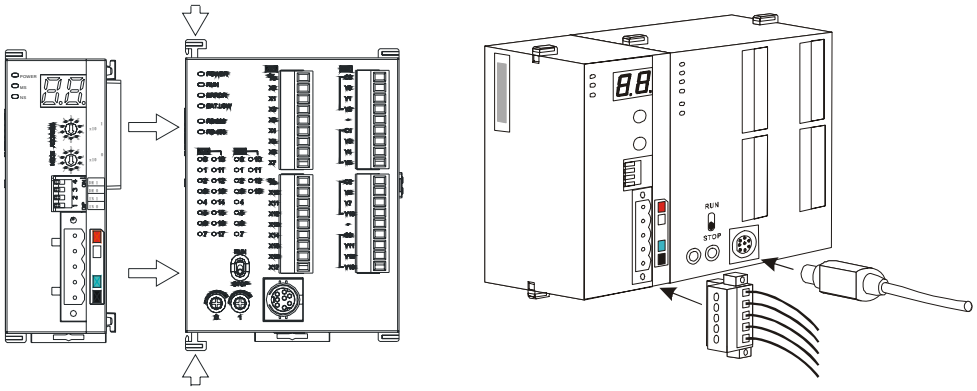


Unit: mm

4 Installation and Wiring

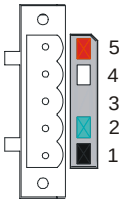
■ Installing ELC-CODNETM With an ELC Controller

1. Adjust the extension clip on the left side of the controller.
2. Connect the extension port of the controller with ELC-CODNETM as the figure below.
3. Fasten the extension clip.



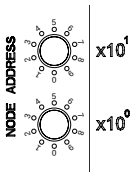
■ PIN Definition Of DeviceNet Connection Port

PIN	Signal	Color	Content
1	V-	Black	0 VDC
2	CAN_L	Blue	Signal-
3	Drain	-	Shield
4	CAN_H	White	Signal+
5	V+	Red	24 VDC



■ MAC ID Setting

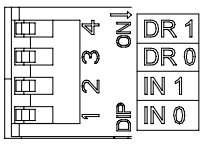
Switch setting	Content
0…63	Valid DeviceNet MAC ID setting
Others	Invalid DeviceNet MAC ID setting



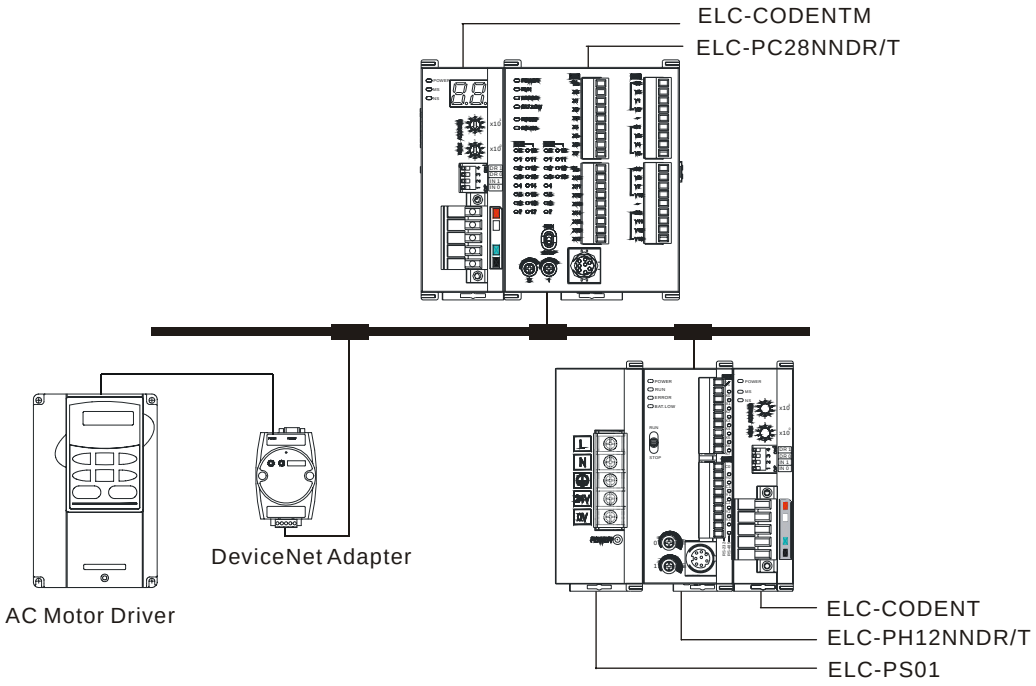
■ Function Switch Setting

DR1	DR0	Baud rate
OFF	OFF	125kbps
OFF	ON	250kbps
ON	OFF	500kbps

IN0	Hold the I/O data	
	ON	Hold the input and output buffer data when unit losses DeviceNet communication
	OFF	Clear the input and output buffer data when unit losses DeviceNet communication.
IN1	Reserved	



- **Connecting the ELC-CODNETM Scanner With Slave Devices**



- **Cable Length and Baud Rates**

The maximum cable length in a segment depends on the transmission speed. DeviceNet communicates at speeds from 125kbps to 500kbps over distances from 100 to 500 meters.

Baud rates (bps)	125k	250k	500k
Length (m)	500	250	100

If you need more information on installing a DeviceNet network, see "DeviceNet Planning and Installation Manual" available from ODVA.org.

5 Input and Output Image mapping

- **Data exchange between ELC-CODNETM Scanner and the ELC processor**

When the ELC-CODNETM scanner is connected to the ELC processor, it will map to a section of the ELC processor data area (D registers).

Index of ELC-CODNETM scanner	Mapped d registers	
	Output image table	Input image table
1	D6250 ~ d6497	D6000 ~ d6247
2	D6750 ~ d6997	D6500 ~ d6747
3	D7250 ~ d7497	D7000 ~ d7247
4	D7750 ~ d7997	D7500 ~ d7747
5	D8250 ~ d8497	D8000 ~ d8247
6	D8750 ~ d8997	D8500 ~ d8747
7	D9250 ~ d9497	D9000 ~ d9247
8	D9750 ~ d9997	D9500 ~ d9747

The index is the relative position of the ELC-CODNETM module to the left side of the ELC processor. The 1st module left of the ELC processor is index number 1. The next module to the left is number 2. The others are indexed as 3, 4, and so on.

- **Input and Output Image Table contents**

The table below shows the contents of the register map for an ELC-CODNETM with index=1

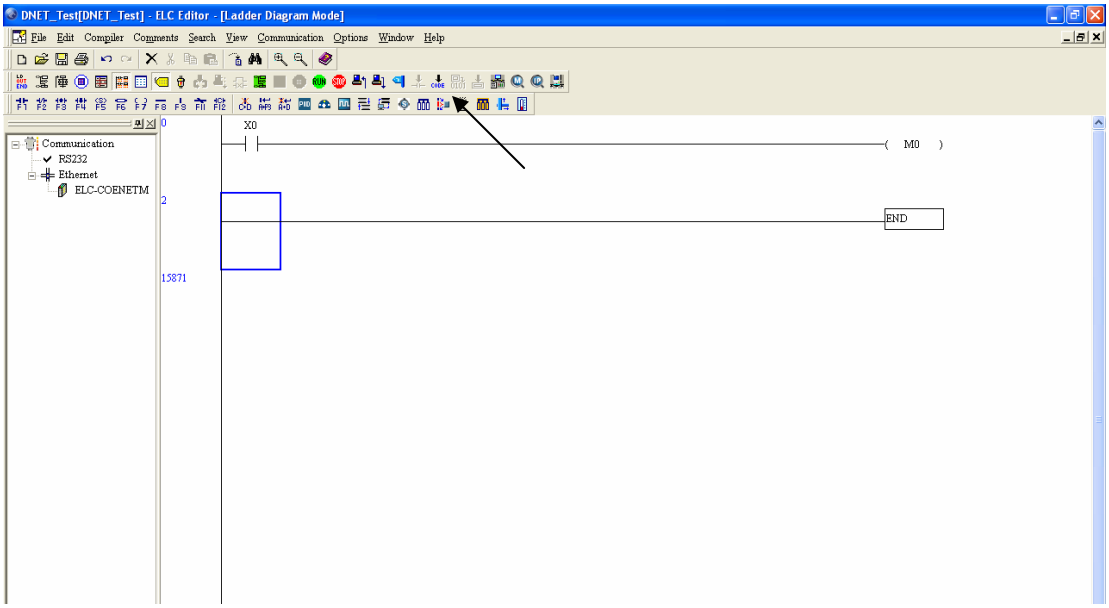
Output image		
D register	Image mapping	Length
D6250 ~ D6281	Explicit message program request	32 words
D6282 ~ D6285	Bit-strobe command	4 words
D6286	Reserved	1 word
D6287 ~ D6476	DeviceNet output data	190 words
D6477 ~ D6497	Reserved for other function (do not use these devices in user program)	21 words

Input image		
D register	Image mapping	Length
D6000 ~ D6031	Explicit message program response	32 words
D6032 ~ D6035	Scan list node status indication	4 words
D6036	Scanner module status indication	1 word
D6037 ~ D6226	DeviceNet input data	190 words
D6227 ~ D6247	Reserved for other function (do not use these devices in user program)	21 words

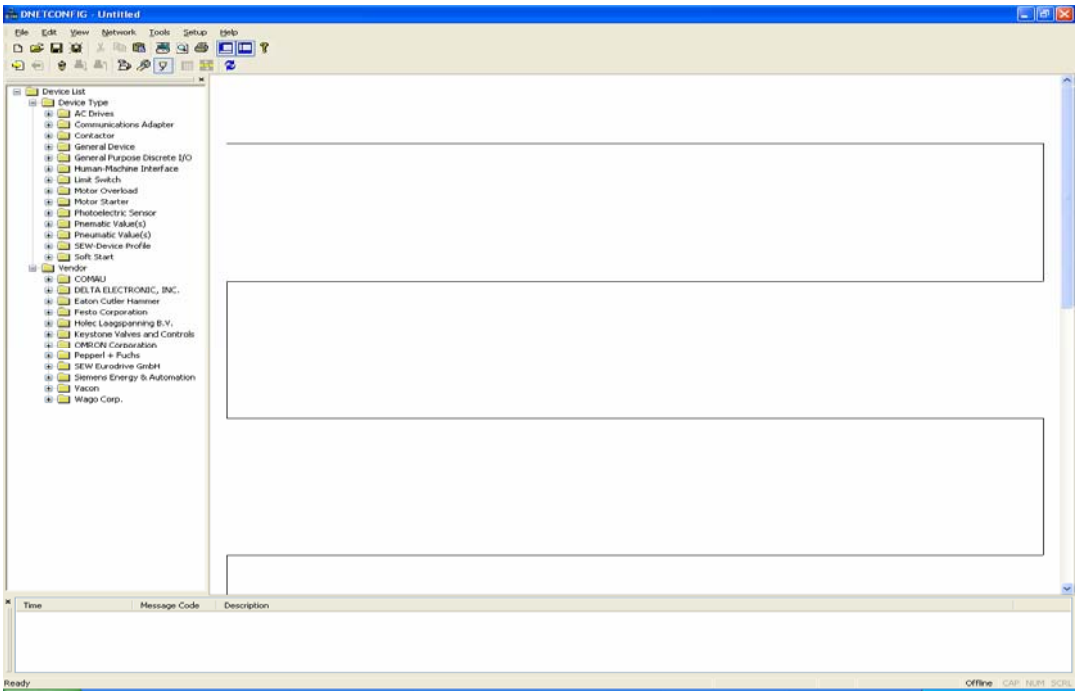
6 Application

6.1 Using the CODNETM module as a polling master

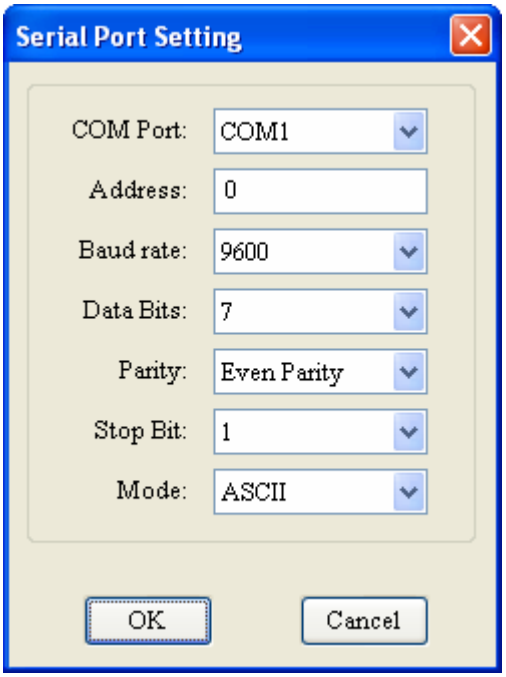
The ELC-CODNETM module is a polling master on DeviceNet that also supports slave mode at the same time. The CODNETM module is configured using the DNET CONFIG tool located in ELCSoft. Click the icon shown below to run DNET CONFIG.



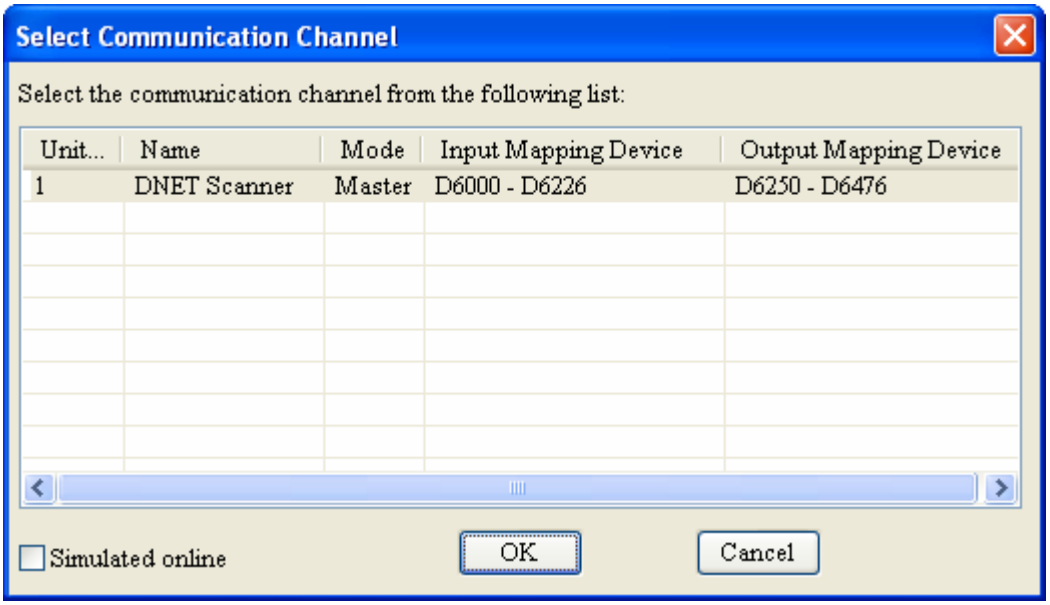
When the DNET CONFIG icon is clicked, the following screen will open:



To go online with the DeviceNet network, the computer must be connected to the ELC controller which in turn is connected to the CODNETM module via the controller's left-side bus. In the DNET CONFIG software, select Setup, followed by Communication Setting, then System Channel. The following screen will open:

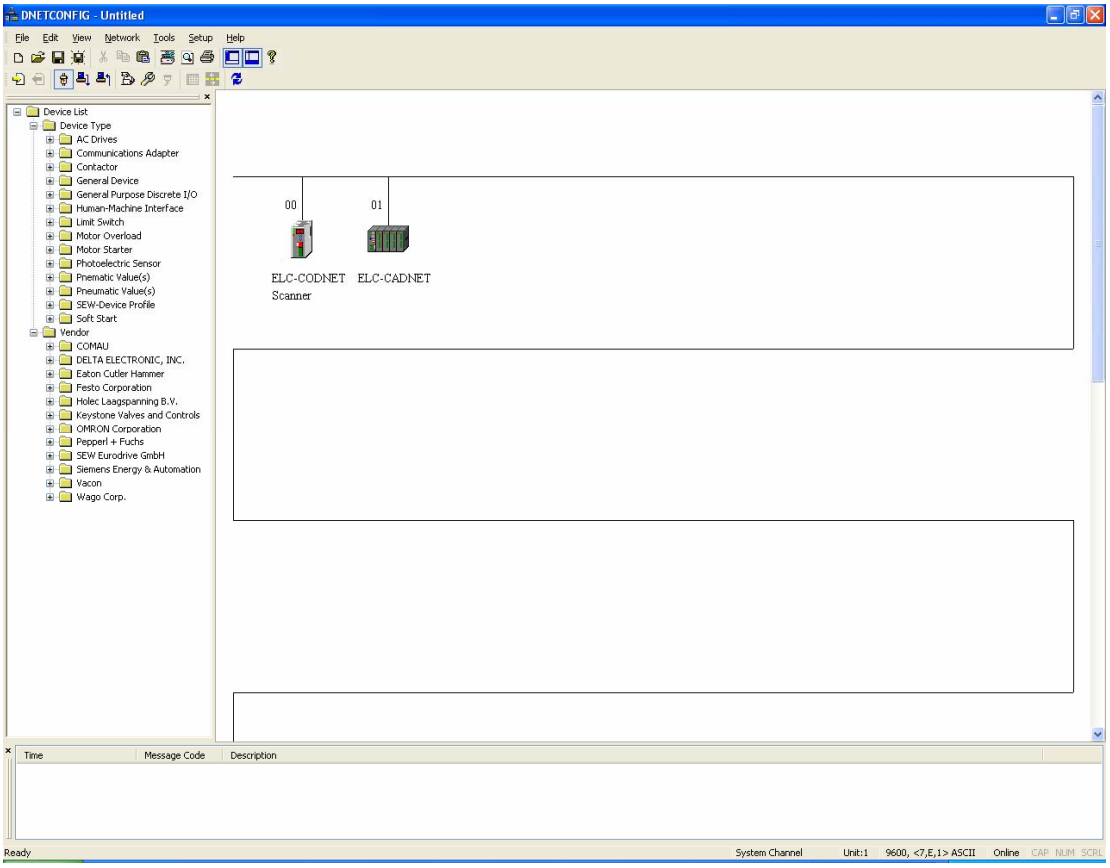


These are the default communication parameters. Be sure to select the correct COM port on your computer that is being used to connect to the ELC controller with the ELC-CBPCELC3 programming cable. When the cable is connected and the interface parameters are set, click the Network drop down menu and select Online and the following screen will open:



In this case there is only one master communication module connected to the left-side bus

of the ELC controller. Up to 8 communication modules are allowed. Click the module to select it, then click OK and the software will scan the network for all connected DeviceNet devices and display their icons as shown below. If a device is displayed as “Unrecognized”, the eds file for that device must be registered into the DNET CONFIG software so the module can be configured and placed into the CODNETM modules scan list. The eds files for all Eaton DeviceNet devices can be found on the Eaton website. The eds files for third-party DeviceNet products can be found on the manufacturer’s website. To register an eds file into DNET CONFIG, click the Tools drop down menu, select “eds operation” and follow the instructions to browse for the eds file and register it.



For this example, Eaton’s DeviceNet adapter for distributed I/O (ELC-CADNET) is the slave device to be mapped into the CODNETM module’s scan list. When commissioning a DeviceNet network, the following procedure should be used:

1. Configure each device with a unique MAC ID (0-63) and the same data rate (125K, 250K or 500K).
2. Configure each slave device for the amount of I/O needed for the application. Some slave devices have fixed I/O sizes, but most have a list to choose from.
3. Map each slave device into the scanner’s (master’s) scan list and note the block of D-registers in both the input and output image assigned to each slave device’s data.
4. Download the information to the scanner.

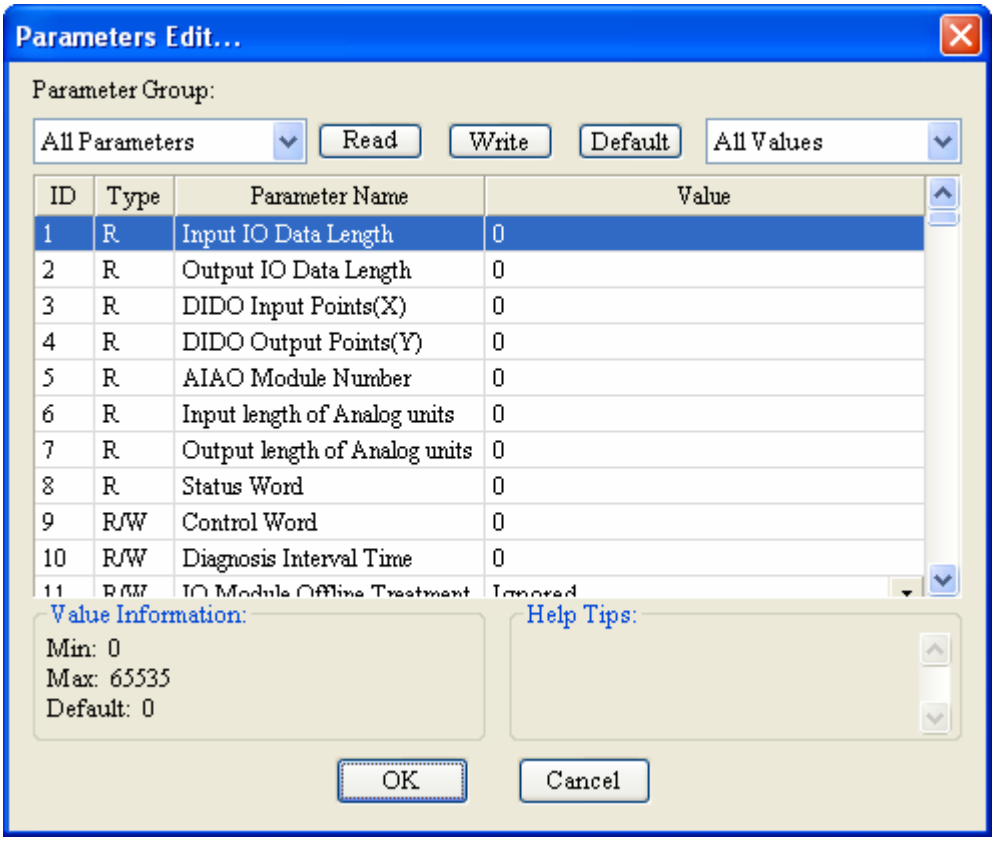
The following is an example to illustrate the four points above.

Assume there are 2 devices on the DeviceNet network:

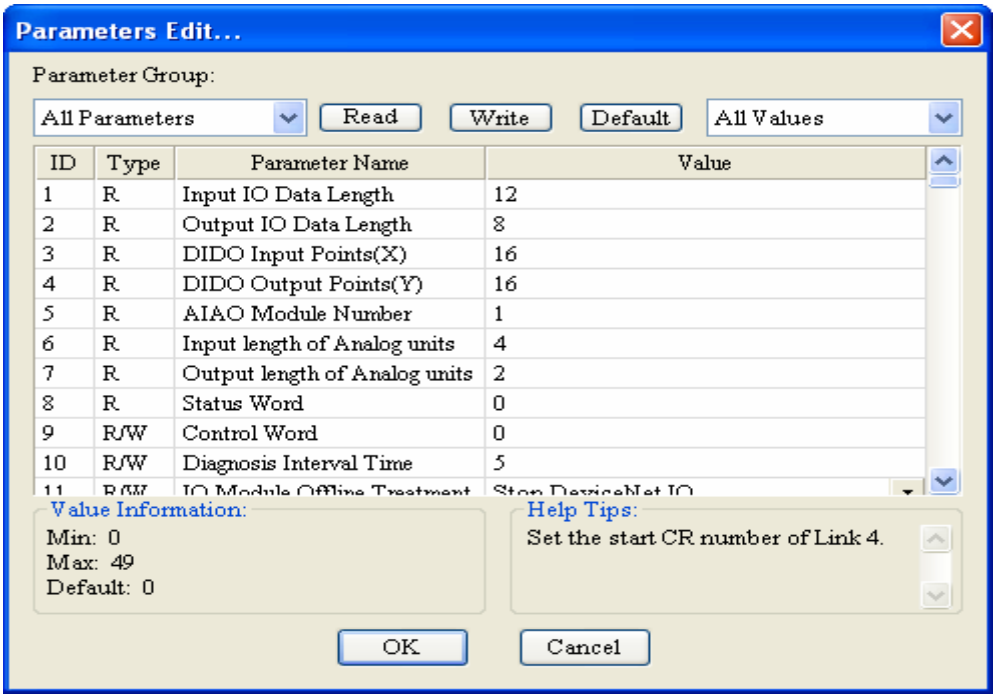
ELC-CODNETM Scanner

ELC-CADNET I/O Adapter

Right click the ELC-CADNET module's icon and choose Parameter Edit and the following will open:

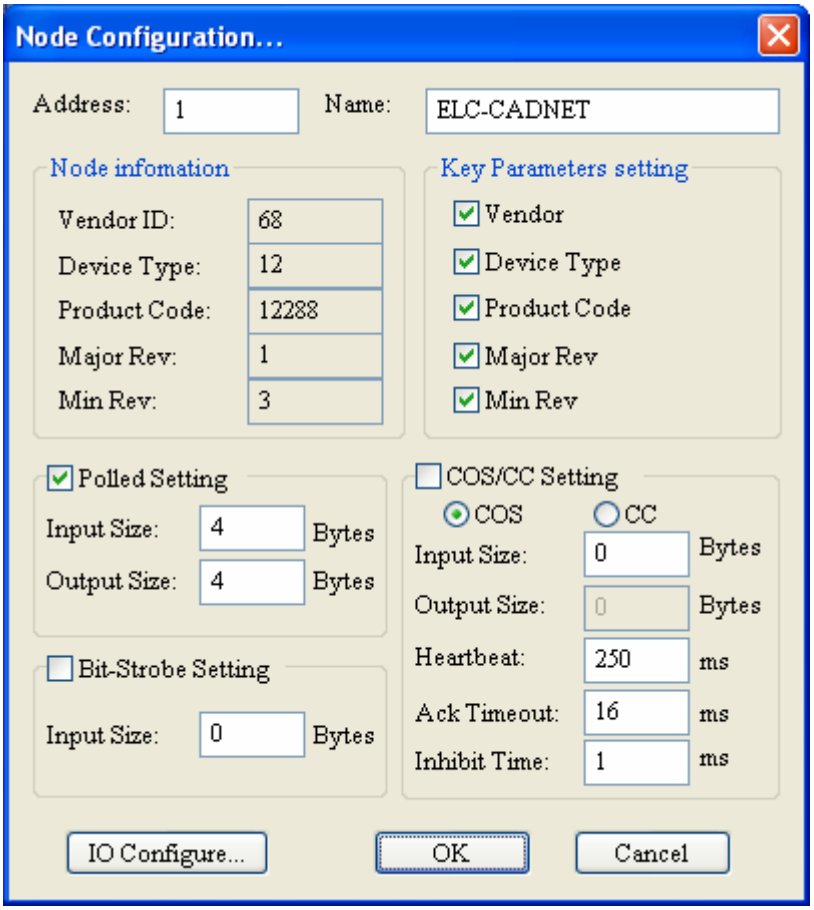


Click "Read" and the software will begin reading each parameter listed from the device and populate the entire list of parameters with the data from the device. When the upload is complete, this parameter page will look like the following:



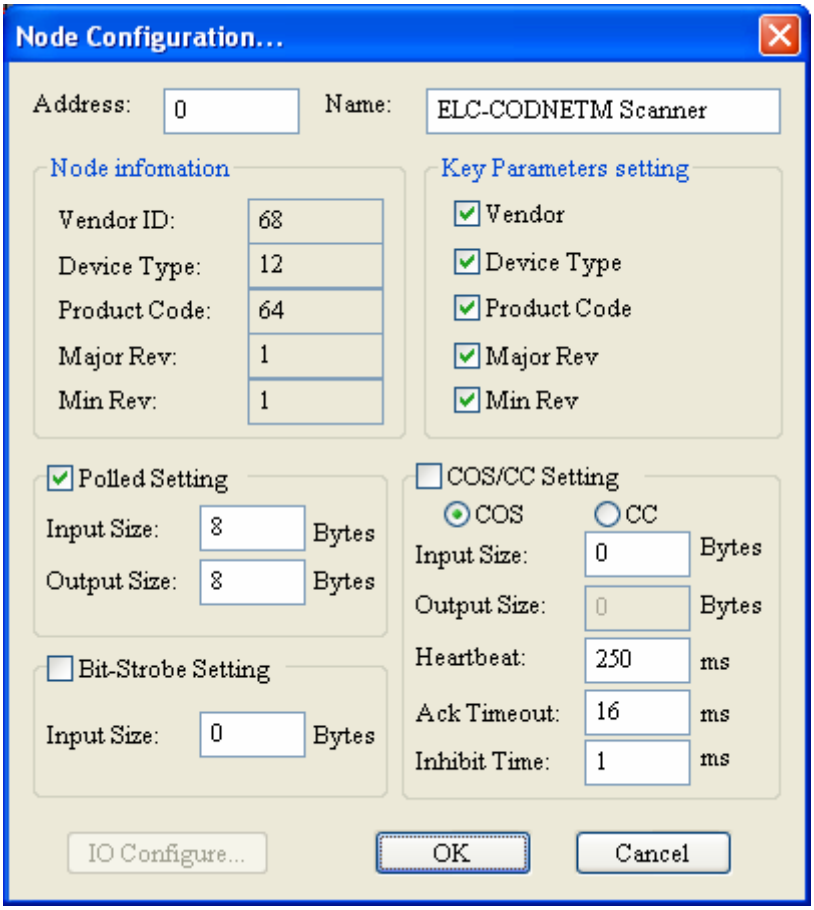
It turns out that the CADNET module contains the following numbers of Input and Output bytes of data for this example: 12 Input Bytes and 8 Output Bytes.

If any parameters were changed on the Parameter Edit screen, click the “Write” button to download it to the CADNET module. Then, double click the ELC-CADNET icon and the following screen will open:



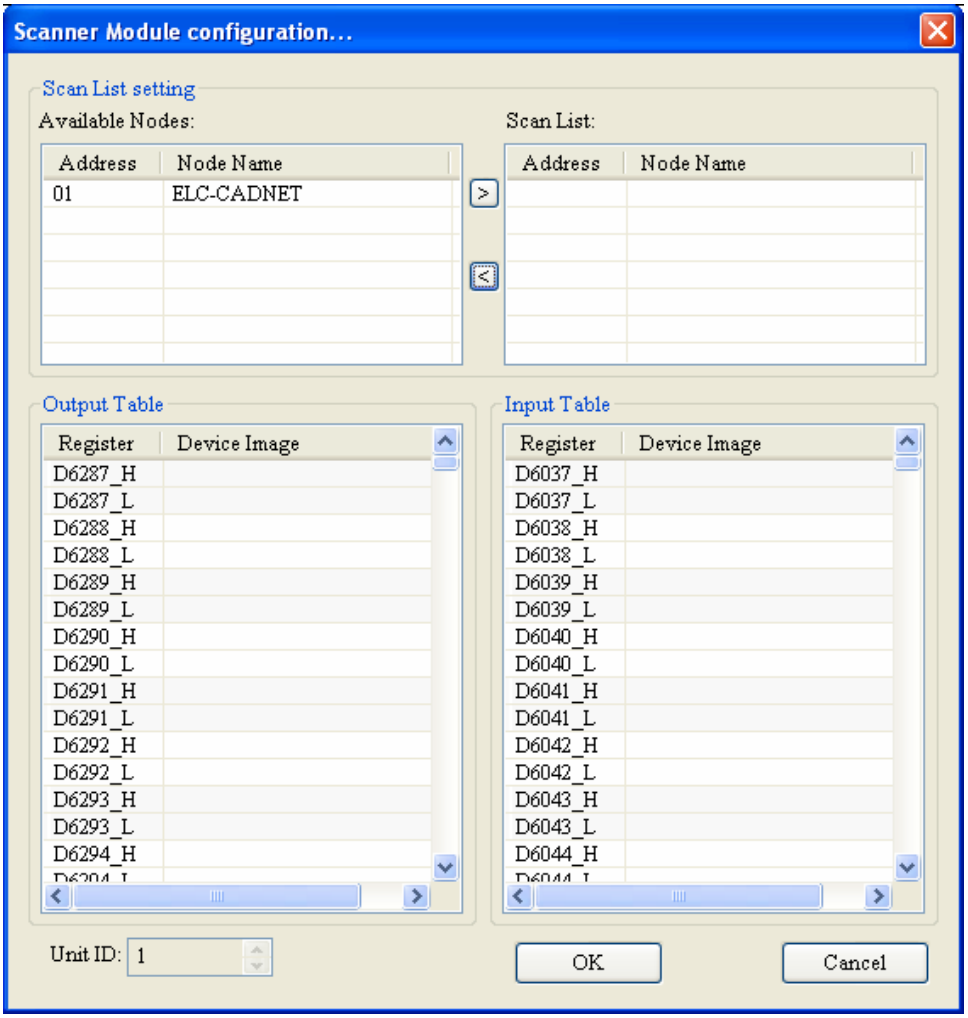
For polled operation, the only parameters that must be changed on this screen are under “Polled Setting”. Be sure the Polled Setting box is checked. Then, per this example, change the Input Size to 12 bytes and the Output Size to 8 bytes. Click OK to save and close this window.

Right click on the scanner (ELC-COENETM) and choose Properties. The following screen will open.



The Polled Setting is where the CODNETM module can be configured as a DeviceNet slave, assuming there is another DeviceNet scanner on the network to poll it. If there isn't, disregard this Properties page.

Click Cancel or OK to close the CODNETM Properties screen. Then double click the CODNETM's icon and the Scan list page will open as follows:



All DeviceNet slave devices that are on the network will appear in the scanner's Available Nodes box above. Single click the ELC-CADNET module to select it, then click the arrow pointing to the right to place the CADNET module into the Scan list. The I/O bytes previously entered in the Properties page for the CADNET module (12 input bytes and 8 output bytes) will be mapped to D-registers. These D-registers are read from the ELC controller (D6287 – D6476) and written to the ELC controller (D6037 – D6226) by the CODNETM scanner module. The module also writes the output data to the appropriate DeviceNet slave devices and reads the input data from the appropriate DeviceNet slave devices. These D-registers are addressable in the ELC program, allowing it to control devices via their output data and monitor status data via the devices input data.

- **Bit-strobe Command**

Bit-strobe is one of the standard I/O transmission method for DeviceNet. The length of the command is fixed to 8 bytes, i.e. 64 bits. Every bit corresponds to 1 slave.

Device in ELC	Corresponding slave in network					
	b15	b14	b13	… …	b1	b0
D6282	Node15	Node14	Node 13	… …	Node 1	Node 0
D6283	Node 31	Node 30	Node 29	… …	Node 17	Node 16

Device in ELC	Corresponding slave in network					
	b15	b14	b13	… …	b1	b0
D6284	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D6285	Node 63	Node 62	Node 61	… …	Node 49	Node 48

In the bit-strobe mode, the master does not send data to the slave. However, when the corresponding bit is set to “0”, the slave has to respond with I/O data to the master. When the corresponding bit is set to “1”, the slave does not need to respond with I/O data to the master.

- **Network Node Status Indication**

  - Scan List Node Status Indication

    The scan module conducts real-time monitoring on the nodes in the scan list and maps the status of each slave to a bit. The user can acquire the status of the slave in the network by monitoring the contents in D6032 ~ D6035. See the table below for the devices in the ELC and their corresponding nodes in the network.

Device in ELC	Corresponding slave in network					
	b15	b14	b13	… …	b1	b0
D6032	Node 15	Node 14	Node 13	… …	Node 1	Node 0
D6033	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D6034	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D6035	Node 63	Node 62	Node 61	… …	Node 49	Node 48

    When the node in the scan list is in normal (abnormal) status, its corresponding bit will be Off (On).

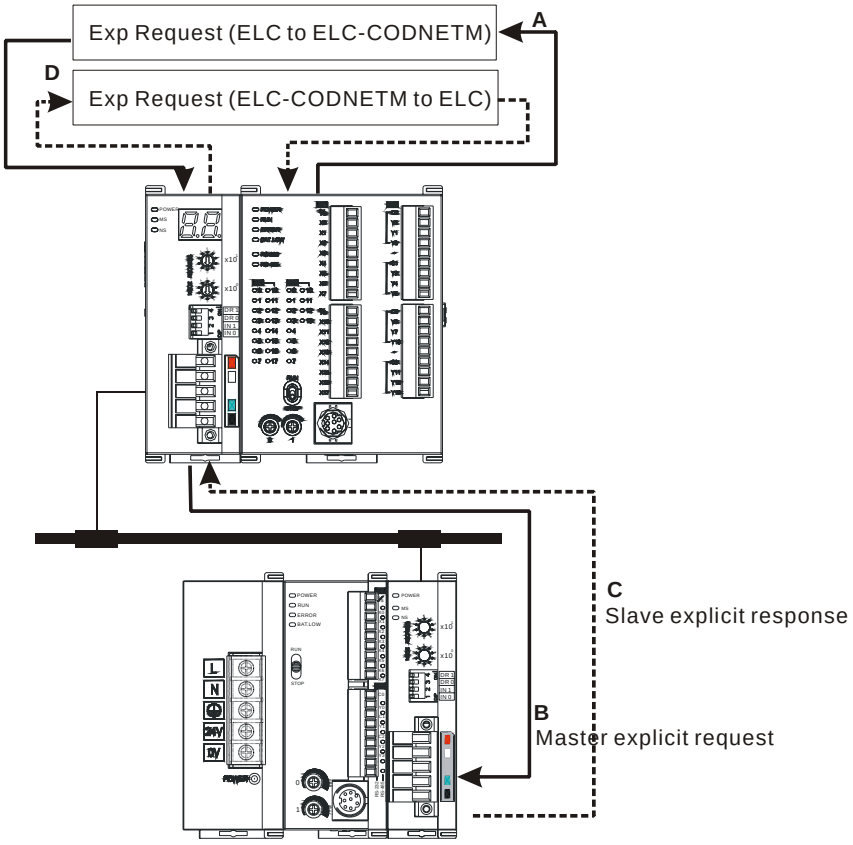
  - Scanner Module Status Indication

    The user can acquire the status of the scanner module by monitoring D6036. When the scanner module is working normally, D6036 = 0. When the scanner module is being initialized, the high byte of D6036 = 1 and the low byte of D6036 = 0. When error occurs in the scanner module, the high byte of D6036 = 2. See the low bytes of D6036 for error codes.

Device in ELC	Explanation															
	b15	b14	b13	b12	B11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D6036	Status of the scanner module (0: normal 1: initialize 2: error)								Error codes of the scan module							

6.2 Using Explicit Messages in the Application Program

Instructions in the ELC program can be used to trigger explicit messages from the CODNETM module to another DeviceNet device.



Step A: The ELC processor transfers the explicit message data to the ELC-CODNETM scanner.

Step B: The ELC-CODNETM scanner sends the explicit request to the target devices.

Step C: The target devices process the request and send the response to the ELC-CODNETM scanner.

Step D: The ELC processor receives the explicit response data.

- **Explicit Message Structure**

The explicit message request and response are transferred between the ELC processor and the ELC-CODNETM in D registers of the ELC processor.

Output image			Input image		
D register	Image mapping	Length	D register	Image mapping	Length
D6250 ~ D6281	Explicit message program request	32 words	D6000 ~ D6031	Explicit message program response	32 words

The user can move the data of explicit request message to D6250 ~ D6281 and the ELC-CODNETM scanner will send the response data to D6000 ~ D6031. The explicit message request format is shown in the table below.

PLC device	Request Message															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
D6250	Message Header		ReqID						Command							
D6251			Port						Size							
D6252			Service Code						MAC ID							
D6253	Message Data		High byte of Class ID						Low byte of Class ID							
D6254			High byte of Instance ID						Low byte of Instance ID							
D6255			Reserved						Attribute ID (optional)							
D6256 ~ D6281		Service Data														

- ReqID: When sending every explicit message, the user has to assign a Request ID for this explicit message. ELC-CODNETM scanner identifies the response message by this ID. Therefore, the user has to change the ID value when completing an explicit message communication for the next transmission.
- Command code: Fixed to 01 for every message transmission.
- Port: Reserved as 0 for every message transmission.
- Size: The length of the message, starting from D6253. The high bytes of D6255 are reserved. When the data length is being calculated, D6255 is counted as 1 byte. The maximum data length is 58 bytes. Errors will occur when the length is longer than 58 bytes. Unit: byte..
- Service code: The service code of this explicit message.
- MAC ID: The node address of target devices.

The format of explicit message response:

	Words	Input explicit response	
Message Header	D6000	ReqID	Status
	D6001	Port	Size
	D6002	Service code	MAC ID
Message Data	D6003 ~ D6031	Service response data	

- The definitions of ReqID, Port, Service Code and MAC ID are the same as their definitions in request message.
- Size: The length of the message, starting from D6003. Max. 58 bytes. Errors will occur when the length is longer than 58 bytes. Unit: byte.
- See the table below for the meanings of Status (status codes):

Status	Explanation
0	No explicit message is sent out.
1	The communication of explicit message is successful.
2	The explicit message is being sent out.

Status	Explanation
3	Error: No response from the target equipment.
4	Error: Command is invalid.
5	Error: Size of request message is invalid.
6	Error: Size of response message is invalid.
7	Error: Failing to establish a connection to the target equipment.
8 ~ 255	Reserved