

NCB/EL™ Etherlon™
and
NCB/FL™ Fiberlon™

**Network Combiner Module
for Ethernet and Fiber Channels**

Wide Area Routers for LONWORKS® Networks

User Guide # S2-60759-200



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This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Limits specified in the standards listed below are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

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Location: **CTI Products, Inc**
1211 West Sharon Road
Cincinnati, OH 45240 USA

Phone: +1.513.595.5900

Fax: +1.513.595.5983

Web: www.ctiproducts.com

E-mail, Sales: info@ctiproducts.com

Technical Support: lwsupport@ctiproducts.com

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This manual covers NCB/EL and NCB/FL units of Revision 200 or higher and EtherPlug software revision 1.00 or higher. The NCB Unit Revision can be found on the rear of the unit following the letter "U". The EtherPlug software revision can be found on the Help/About screen of the program. If the revision of the product in hand is greater than that shown above, there may be additional features supported by the product that are not covered in this manual.

QUICK-START GUIDE

This Quick Start Guide provides a concise series of steps to get a pair of the NCB-Etherlon or NCB-Fiberlon modules “up and running” quickly so that initial operation may be confirmed.

It is highly recommended that a pair of NCB-Etherlon or NCB-Fiberlon modules be tested in your application by first connecting them “back-to-back” with the 10BaseT or fiber crossover cable included with this shipment. Once operation is confirmed using this connection scheme, continue by reconfiguring the IP addressing information and connecting the NCB modules to the actual Ethernet communications channel to be used.

NOTE: *DO NOT connect the NCB-Etherlon or NCB-Fiberlon modules to a live IP network until they have been reconfigured with new IP addresses and subnet mask supplied by the network manager. Network-wide problems could arise from connecting devices to a network without coordination of addressing information. See the **Installation** section of this manual for full information.*

Set Option Switches and Make Back-to-Back Connection

For the NCB-Etherlon:

- Set **OPTION** switch positions 1 through 8 on the rear of both NCB units to the UP position.
- Connect the NCB units “back-to-back” via the “**10BaseT**” connector on the rear of each NCB unit using the supplied 10BaseT crossover cable (#S2-60760-100).

For the NCB-Fiberlon:

- Set **OPTION** switch positions 1 through 6 on the rear of both NCB units to the UP position and positions 7 and 8 to the DOWN position.
- Connect the external fiber transceiver units to the **AUI** connector on the rear of the NCB unit. Secure the transceiver with the slide lock. Verify that the **SQE Test Switch** is in the OFF position.
- Connect the NCB units “back-to-back” by attaching the **XMT** port on one fiber transceiver to the **RCV** port of the other fiber transceiver, and vice-versa.

Connect LONWORKS Network and Power

Once the above steps are completed, proceed by:

- Connect LONWORKS network devices to the “**NETWORK**” connectors of each NCB unit (both RJ-45s and the screw-terminal connector are in parallel). If using the RJ-45 connector(s), connect to pins 1 & 2 (the right-most two pins).
- Connect power to the NCB units via the rear panel “DC IN” connector. The units can be powered-up in any sequence.

Once properly connected and powered, the “ERR” LED will be off on both units and they are now ready for use. Using the LONWORKS network devices attached to the *network* connectors of each NCB unit, verify that LONTALK packets entering one NCB unit exit the other and vice-versa.

1. INTRODUCTION

WHAT ARE NCB UNITS?

The Network Combiner NCB™ Module is a device that, when used in pairs, allows multiple LONWORKS networks to be connected in real-time, spanning distances from building-wide to worldwide. The communication channel spanning the distance between local networks can be any copper or fiber Ethernet channel that is capable of carrying IP (Internet Protocol) data. Data transfer between distant networks via NCB modules is "live", delayed only by the transit time through the routers and Ethernet channel.

The NCB module uses router technology so that no custom coding or additional hardware is necessary to seamlessly connect multiple networks across very large distances. The NCB module is self-contained, easily configured with standard network management tools, and requires no custom programming or coding changes in system nodes.

Both the NCB-Etherlon and the NCB-Fiberlon utilize the IP protocol over an Ethernet media and both can coexist on a wide-area IP network with other IP devices such as workstations, servers, and IP routers. Additionally, they can exist on *dedicated* Ethernet IP networks, where the only devices on the network are NCBs and (optionally) physical layer hubs. The most common occurrence of a dedicated network is a set of NCB-Fiberlons connected with dedicated fiber.

Basic Application

A basic application of the NCB module is where two multi-node LONWORKS networks, separated by a distance beyond the reach of conventional wired media, need to be interconnected, as in Figure 1. This distance could be across a large building, business campus, city, etc. Using the NCB module, this interconnection is accomplished using one NCB module local to each network site and an Ethernet channel connecting the NCB modules. Additional networks can be added to this unified network by simply adding an NCB module for each network.

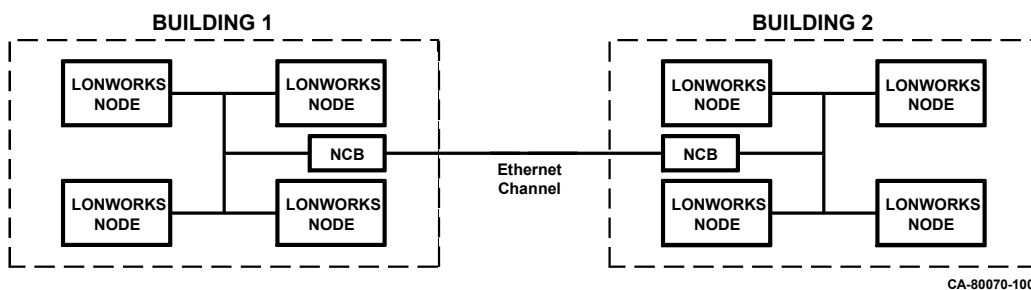


Figure 1 Networks in two buildings connected with NCB modules

Block Diagram

There are three sources of message packets within the NCB module. The first source is the LONWORKS NETWORK connector on the front of the unit. The second is the Ethernet media connectors on the rear of the unit. (Note that although 10BaseT and AUI connectors exist, only one can be used at a time.) The third source is the Control Neuron Processor. Message packets originating from any of these sources are sent to the other two. This message packet flow is shown in the block diagram of Figure 2.

Read this section to learn the general function and capabilities of an NCB Router

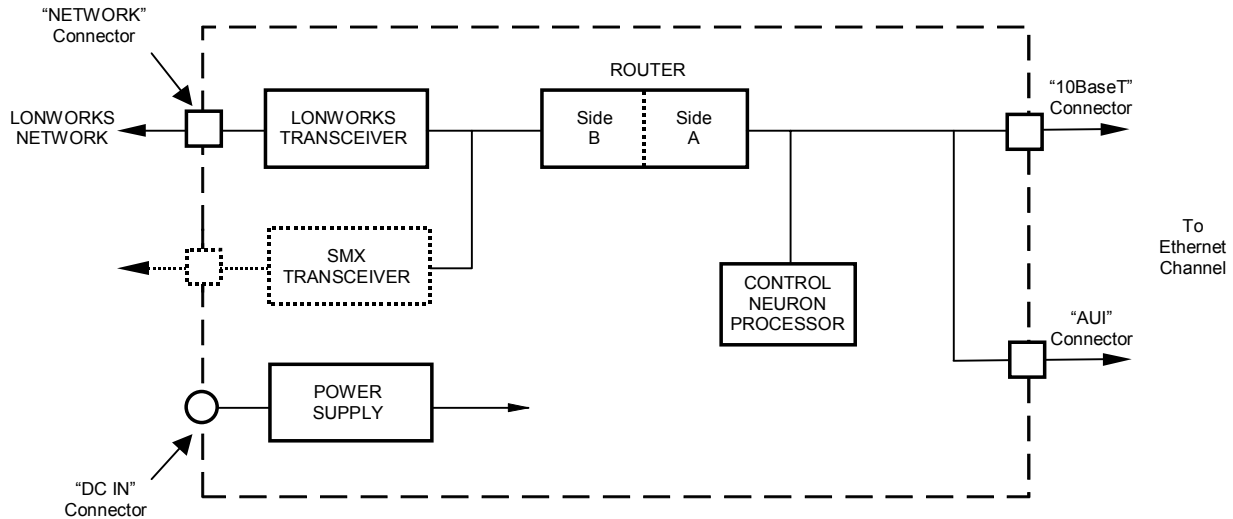


Figure 2 NCB Network Combiner Block Diagram

- The “NETWORK” connector attaches to the local LONWORKS network using a compatible transceiver internal to the NCB module and is associated with *Side B* of the internal router.
- One of the Ethernet connectors attaches to the Ethernet channel, providing communication to additional NCB modules at remote sites. These ports are associated with *Side A* of the internal router.
- The Control Neuron Processor allows network management messages to be sent to the NCB module for control and status monitoring and is associated with *Side A* of the internal router.

LONWORKS Network Transceivers

The local LONWORKS networks at different sites do not need to use the same network transceiver type. For example, an FTT-10A network, a TPT/XF-78 network, and a PLT-22 network can all be interconnected by using NCB modules with network transceivers matching the local network at each site.

NCB units are available with an option for LONWORKS network transceiver type. The ordering code on the rear of the NCB lists the installed options. For NCB-Etherlons, this ordering code is of the form:

NCB/EL-Txxx, where ‘T’ indicates the transceiver type.

For NCB-Fiberlons, this ordering code is of the form:

NCB/FL-Txxx, where ‘T’ indicates the transceiver type.

The following LONWORKS network transceiver options are available:

A = FTT-10A	K = SMX RS485
B = TPT/XF-78	M = SMX PL22
C = TPT/XF-1250	X = None (SMX ready)

Router Function

The router contained in each NCB module may be configured as a repeater, bridge, or configured router. The easiest configuration is as a repeater, where all messages which enter the NCB module (via any of the three data sources described above) are simply passed to the other two sources, regardless of the domain, subnet/node, or group destination address. A bridge forwards only messages that match one of the two domain IDs configured on the router. A configured router forwards only messages that match a domain ID as well as a set of subnet or group numbers. The proper choice of router mode depends on desired simplicity of installation versus required system performance.

Control Neuron Processor

The Control Neuron Processor provides access to IP address parameters. Ethernet channel parameters can be configured and displayed using the EtherPlug program. The Control Neuron Processor acts as another LONWORKS node on the network. It is connected to Side A of the router module, and appears to be located on the Ethernet channel.

Ethernet Port

The 10BaseT and AUI connectors implement IEEE standard Ethernet at 10 Mbps. OPTION switch positions 7 and 8 are used to select which connector is active. See *Step 6* in the INSTALLATION section.

The NCB-Etherlon Network Combiner utilizes IP (Internet Protocol) to implement the link to other NCB-Etherlon units. Both Unicast/Replicated and Multicast addressing is supported using UDP transport. "APPENDIX F. IP ADDRESSES" provides more detail about IP addressing.

The IP "port numbers" used by the NCB-Etherlon and NCB-Fiberlon are 1100 (destination) and 1283 (source).

REFERENCE DOCUMENTS

The following additional information is available from the sources indicated.

Document	Source	Reference Number
Message Buffer Configuration	CD ROM or www.ctiproducts.com	Technical Note TN010
Combining Multiple LONWORKS Networks using Unicast/Replicated vs. Multicast IP Addressing	CD ROM or www.ctiproducts.com	Technical Note TN020
SMX Transceiver Installation	CD ROM or www.ctiproducts.com	Technical Note TN025
NCB Installation with Network Management Tools	CD ROM or www.ctiproducts.com	Technical Note TN026
LONWORKS Router User's Guide	Echelon	078-0018-01B

FRONT PANEL

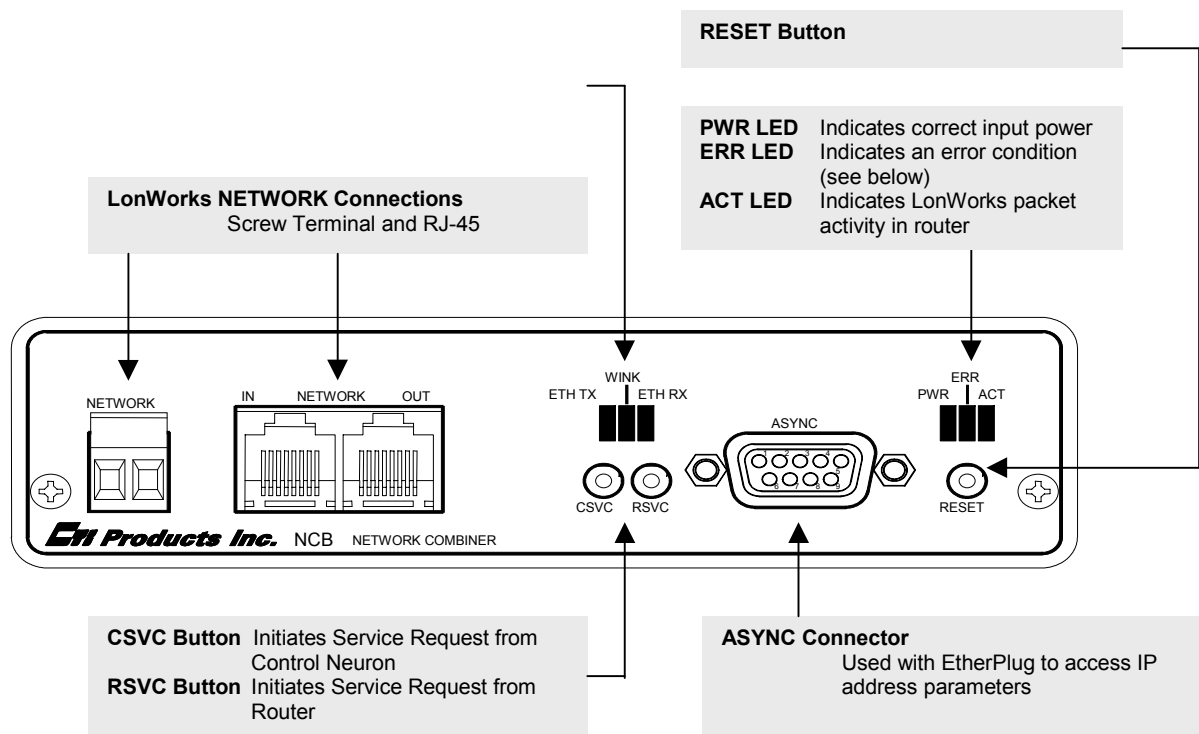


Figure 3 NCB-Etherlon and NCB-Fiberlon Front Panel

Front Panel Indicators – Additional Information

ETH RX LED (Yellow) – Indicates when a packet has been detected on the Ethernet port. NOTE: Flashing of this LED does NOT necessarily mean that a packet addressed to this Etherlon module has been received, just that a packet has been detected on the Ethernet network.

ERR LED (Red) – Indicates a possible error condition.

- **Always On:** A diagnostic error has been detected. Press the “RESET” button. If the “ERR” LED now stays off, the EEPROM contained invalid data and has been reinitialized. Any non-volatile information must be re-entered by using the EtherPlug program. If the LED stays on solid, a hardware problem is indicated. Contact technical support for assistance.
- **Slow Flash:** (once per second) LONWORKS configuration information is insufficient. Using a network management tool, re-commission the internal router nodes (and optionally, the Control Neuron Processor node).
- **Quick Flash:** (twice per second) IP address configuration is insufficient. Using EtherPlug, configure the IP addressing parameters.

REAR PANEL

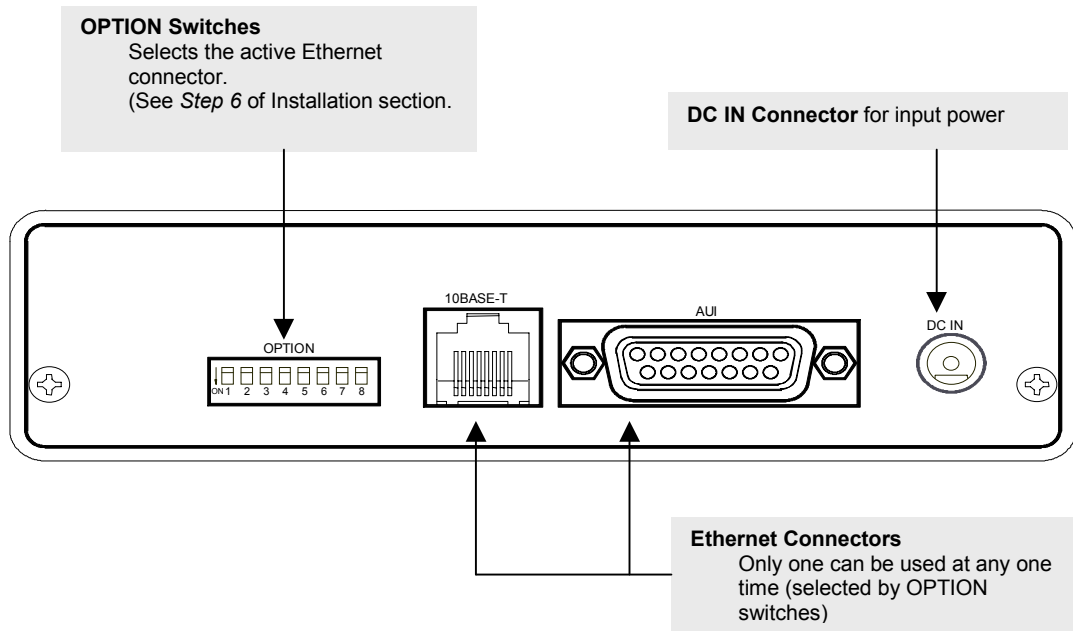


Figure 4 NCB-Etherlon and NCB-Fiberlon Rear Panel

2. INSTALLATION

This section describes the steps necessary to install NCB-Etherlon and NCB-Fiberlon modules into a LONWORKS system.

NOTE : *DO NOT connect the NCB-Etherlon or NCB-Fiberlon modules to a live IP network until they have been reconfigured with new IP addresses and subnet mask supplied by the network manager. Network-wide problems could arise from connecting devices to a network without coordination of addressing information. For usage with dedicated fiber segments, see the note below.*

Overall Installation Functions

Installation of an NCB-Etherlon or NCB-Fiberlon into an IP network that is shared by other IP devices (such as workstations, servers, etc.) requires performing the following three overall functions (not necessarily in this exact order) :

- A. Configure the IP address parameters for each NCB
- B. Physically install each NCB into the system
- C. Commission each NCB using a LONWORKS network management tool

Installation of an NCB-Fiberlon into a system using *dedicated fiber segments*, not shared by other IP devices requires performing only functions B and C above, as the default factory programmed IP address parameters can be used.

Configuration steps for function A above are performed by using the EtherPlug configuration software supplied with the NCB units. EtherPlug is a Windows program that can use a serial COM port and/or the LONWORKS network to configure the IP address parameters for each NCB. EtherPlug can be used as an LNS Plugin with programs such as LonMaker for Windows, or in a standalone mode requiring only Windows and a serial COM port. In preparation for function 1 above (not required for NCB-Fiberlons using dedicated fiber segments), basic IP addressing concepts must be understood. Appendix F of this manual provides a good overview. After determining which IP addressing mode will be used (Unicast/Replicated or Multicast), the following IP information must be gathered *for each NCB unit to be used* from the network administrator responsible for the IP network to which the NCB units will be attached :

- A Host IP Address
- A Subnet Mask
- A Default Gateway IP Address
- A Multicast IP Address (only if using Multicast Addressing Mode)

Configuration steps for function C above are typically performed by using standard LONWORKS network management software such as LonMaker for Windows or others. This document details these steps using LonMaker for Windows as the network management tool. For information on usage of other software, see Technical Note TN026 "NCB Installation with Network Management Tools".

This section continues with detailed steps for proceeding through the entire installation process. The term "NCB" applies equally to NCB-Etherlon and NCB-Fiberlon. Steps that are not required when installing NCB-Fiberlons using *dedicated fiber segments* are marked as such.

STEP 1 . INSTALL ETHERPLUG CONFIGURATION SOFTWARE

This step installs the .XIF file for the Control Neuron Processor and the EtherPlug configuration software. The EtherPlug configuration software will be used to configure IP address parameters of NCB modules, and is included on the CDROM shipped with the NCB units. EtherPlug is a Windows application compatible with Windows 95/98 and Windows NT. It can run in either *standalone mode* directly from the Windows Start menu and requiring only a serial COM port, or in *PlugIn mode* from within an LNS application such as LonMaker for Windows.

Install EtherPlug on your PC:

- Insert the EtherPlug CDROM in your CDROM drive.
- Click the Windows **Start** button, choose “Run...”, click **Browse...**, select the “Setup.exe” application in the EtherPlug directory on the CDROM, and click **Open**.
- Follow the instructions displayed by the “Setup” application.

STEP 2. ADD NCB UNITS TO THE NETWORK DATABASE

An NCB consists of a standard LONWORKS router *and* a Control Neuron Processor. Both of these devices should be added to the database of the network management tool. The XIF file for the Control Neuron Processor is copied to the *LONWORKS/import* directory by the EtherPlug installation process. If you did not install the EtherPlug software in Step 1, the XIF file can be copied directly from the EtherPlug CDROM.

The following actions are described assuming LonMaker for Windows is used as the network management tool. For information on usage of other network management tools, see Technical Note TN026 “NCB Installation with Network Management Tools”.

If LonMaker for Windows is being used as the network management tool, be sure that the EtherPlug plug-in is registered into the network when the network is created, or use the *LonMaker – Network Properties – Plugin Registration* menu within an existing LonMaker network database to register EtherPlug.

Since the standard LONWORKS router portion of an NCB interfaces a LONWORKS channel to an Ethernet channel, it requires connection to two channels on the LonMaker drawing. A standard LONWORKS channel will be connected to **Side B** of the router (corresponding to the *NETWORK* connector on the front of the NCB), and a **CUSTOM** (Ethernet) channel will be connected to **Side A** of the router (corresponding to the 10BaseT or AUI connector of the rear of the NCB). The Control Neuron Processor is connected to the **CUSTOM** (Ethernet) channel.

A) Add a CUSTOM channel to the network drawing (this will be the Ethernet WAN channel):

- Drag the **Channel** shape to the drawing. The “*Channel Definition*” window will be displayed as shown to the right.
- Specify the desired “Channel Name”.
- In the “Transceiver Type” field, click the down arrow and select **CUSTOM**.
- In the “Delay” section, choose “Specify”, and enter an initial value of 150ms. This value will be optimized later: When the IP network is complete, the IP ping function can be used to determine the

worst case delay between NCB modules. See *Steps 7C and 7D*.

- Enter a channel “Description”, if desired. Then Click **OK** to continue.

B) Add the standard LONWORKS router portion of the NCBs to the network drawing:

- Drag the **Router** shape to the drawing. The “*New Router Wizard*” window will be displayed.
- Specify the desired router “Name”, and click **NEXT** to continue.
- In the “Channel A” **Name** field, choose the custom Ethernet channel created in *Step A* (if this custom channel does not appear, be sure the **Xcvr Type** field is set to **All**). In the “Channel B” **Name** field, choose the standard LONWORKS channel that the **NETWORK** connector on the NCB module is connected to. Click **NEXT** to continue.
- Specify a “Location” and “Description”, if desired. “Ping Interval” can be set as desired. Click **NEXT** to continue.
- Specify desired advanced router properties. *Router Type : Configured* is recommended.
- Click **FINISH** to complete the “*New Router Wizard*”.
- Repeat *Step B* for all NCB modules connected to the custom Ethernet channel created in *Step A*.

C) Add the Control Neuron Processor of the NCBs to the network drawing:

- Drag the **Device** shape to the drawing. The “*New Device Wizard*” window will be displayed.
- Specify the desired “Device Name”. These name given to each Control Neuron Processor should correlate directly with the name of each associated router defined in step B above. Click **NEXT** to continue.
- In the “**External Interface Definition**” section, choose “Existing Template”, click the down arrow and choose the “NCBEL20” template. This template is automatically transferred to the *LONWORKS\import* directory during installation of the EtherPlug software. Click **NEXT** to continue.
- In the “**Channel: Name:**” section, choose the custom Ethernet channel connected to *Side A* of the router that was created in *Step A* (if this custom channel does not appear, be sure the **Xcvr Type** field is set to **All**). Click **NEXT** to continue
- Specify a “Location” and “Description”, if desired. “Ping Interval” should be left at *Never*.
- Click **FINISH** to complete the “*New Device Wizard*”.
- Repeat *Step C* for all NCB modules connected to the custom Ethernet channel created in *Step A*.

There is no need to place Functional Blocks of the Control Neuron Processors on the LonMaker drawing unless network variables will be used to interact with this device (network variables are used only in very isolated cases). Network variables are discussed in section “3. NETWORK VARIABLE CONTROL”.

A portion of an example LonMaker network drawing is shown in Figure 5. This network may consist of a router at each floor of a multi-floor building. The drawing depicts the Ethernet channel for Building 100 and the routers and network channels for the first two floors. The routers named “*Router – Room ...*” are the routers inside each NCB. The devices named “*CNP – Room ...*” are the Control Neuron Processors inside each NCB.

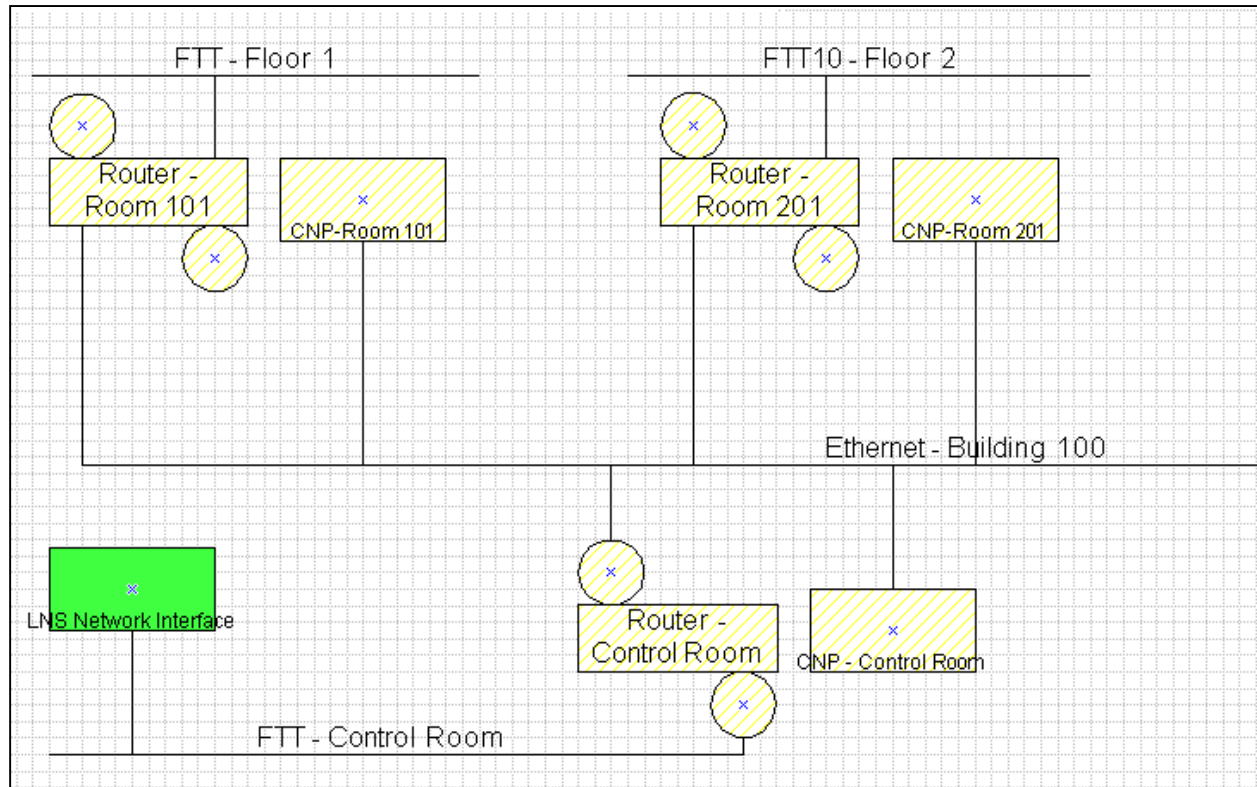


Figure 5 Example LonMaker Drawing

STEP 3. START ETHERPLUG

Note : If installing NCB-Fiberlons on dedicated fiber segments, skip to Step 6.

The EtherPlug configuration software provides access to IP address parameters for NCB-Etherlons and NCB-Fiberlons as a *standalone program* launched directly from the Windows Start menu or as an *LNS Plug-in* from within an LNS-based application such as LonMaker for Windows.

- If LonMaker for Windows is being used as the network management tool, launch EtherPlug as follows:
 - Right-click on the **CUSTOM** (Ethernet) channel created in *Step 2A* above.
 - In the drop-down list, click “Plug-Ins...” and select “Ether_Plug”.
 - Click **OK** . The plug-in will appear as shown in Figure 6 below.
- If a network management tool is being used that *cannot* launch LNS Plug-Ins, the EtherPlug must be launched as a standalone program directly from the Windows Start menu. Once EtherPlug is launched:
 - Select *File – Set Project Directory* function to select the path used to save the .elp datafile for the channel to be created. Any existing .elp files in this directory are shown in the *Channels* box.
 - Select *File – New Channel* function to create a new channel. Provide a name for the channel and Click **OK**.

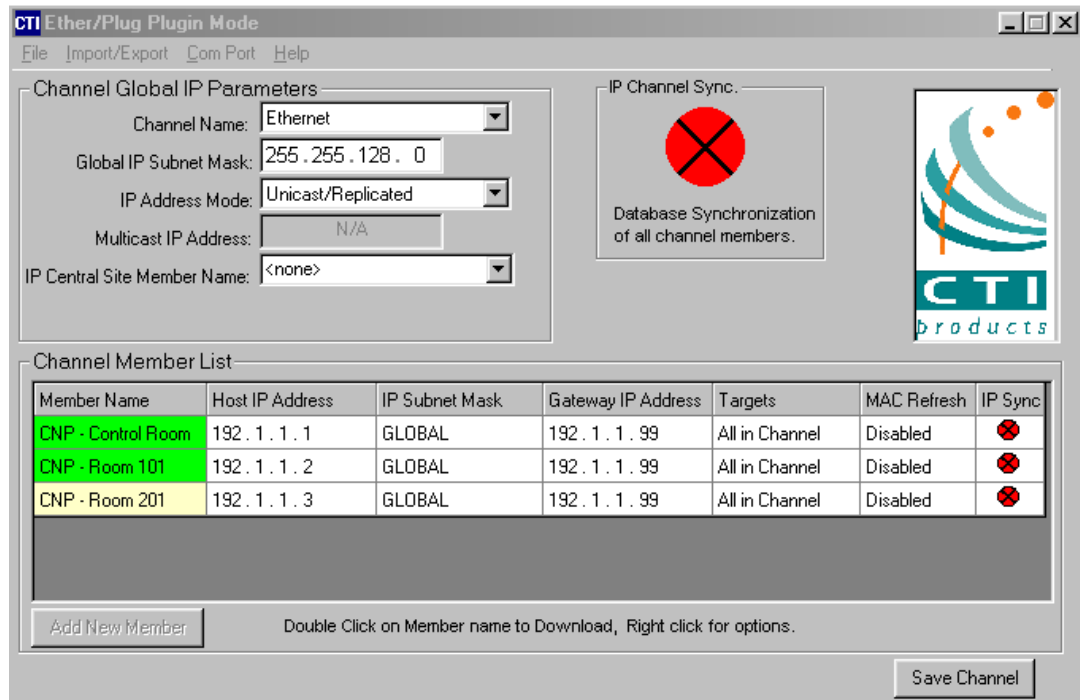


Figure 6 Main EtherPlug window (started as an LNS Plug-in)

When launched as an LNS Plug-in:

- EtherPlug retrieves information from the LNS database for the channel that was selected before starting EtherPlug.
- The name of the channel selected before launching the Plug-in is shown in the *Channel Name* box.
- All NCB Control Neuron Processor devices present on the custom Ethernet channel are automatically listed in the “Channel Member List”. Note that the NCB *router* names on the channel are not referenced in the Channel Member List, as EtherPlug manages IP address information exclusively via the Control Neuron Processors in each NCB.
- All data entered into and managed by EtherPlug is stored in the LNS database and is part of any LonMaker for Windows *Backup/Restore* operation.
- The *Add New Member* button and the *New Channel* function under the File menu are grayed out. Adding new NCB members and new Ethernet channels must be done within the LNS network management tool, then using the *File – Reload/Refresh Channel* function in the EtherPlug plug-in.

When launched as a standalone program:

- EtherPlug has no access to any LONWORKS database information.
- EtherPlug uses an external data file with the extension “.elp” to store all data. The name given to the channel is used as the root portion of the file name.
- The *File – Set Project Directory* menu item allows the path to the .elp files to be manipulated.
- The *File – New Channel* menu item allows a new channel to be created and named.
- The *Add New Member* button is used to add new NCB member names to the channel.

STEP 4. EDIT IP ADDRESS PARAMETERS

Note : If installing NCB-Fiberlons on dedicated fiber segments, skip to Step 6.

The IP information that was gathered from the IP Network Administrator, as described at the beginning of section 2 of this manual, must be entered into the EtherPlug program as follows:

A) Specify the Channel Global IP Parameters:

- After reviewing the information concerning *IP Addressing Modes* in Appendix F, choose either “Unicast/Replicated” or “Multicast” from the “IP Address Mode” drop-down list.
- If “Multicast” was selected above, enter the *Multicast IP Address* that the IP Network Administrator has assigned to this group of NCBs.
- Click on the “Global IP Subnet Mask” textbox, then enter the *Subnet Mask* assigned the the NCB units by the IP Network Administrator.
 - If different subnet masks are specified for different groups of NCB units, enter the subnet mask that is common to most of the NCB units in the group.
 - If a different subnet mask is assigned to every NCB unit, leave this field with its default value.

B) Specify the “Channel Member List” parameters:

If EtherPlug was launched as an LNS Plug-in, the names of all Control Neuron Processors attached to the custom Ethernet channel will already be listed in the *Channel Member List*.

If EtherPlug was launched as a standalone program, use the *Add New Member* button to add a line in the *Channel Member List* and enter the name for each NCB unit connected to the custom Ethernet channel.

Enter the following information for each NCB unit in the *Channel Member List* :

- Host IP Address
- IP Subnet Mask (if different than the “Global IP Subnet Mask”). With IP Subnet Mask set to GLOBAL, the value set in the Global IP Subnet Mask field is used as this member’s IP Subnet Mask
- Gateway IP Address
- Leave the **Targets** field set to *All in Channel* unless *Central Site* mode is to be used, see the bullet below for a description of this mode.
- Leave the **MAC Refresh** field to *Disabled* unless the NCB is connected to an Ethernet MAC layer switch or intelligent hub. See the bullet below for further information.

Several special cases should be considered, as discussed below:

- **Central Site Mode:** If *Unicast/Replicated* IP Addressing mode is being used and the system application using these NCB units requires LONWORKS messages to pass *only between devices connected to a single NCB unit at the host computer and devices connected to NCB units at remote locations*, **Central Site** mode can be used to reduce network traffic. To restate, if the system being constructed *does not require LONWORKS messages to flow between devices at different remote sites, but only between a remote site and a single central site*, use **Central Site** mode. If LONWORKS messages must flow between remote sites and the Central site *and also from one remote site to another remote site*, **do not** use Central Site mode.

To use Central Site mode :

- Set IP Central Site Member Name to the name of the NCB unit with its NETWORK port connected to the LONWORKS network from the Host Computer. This must be the same computer on which the network management software is being run.

- For all remote NCB units that need to exchange LONWORKS packets with only the Central Site NCB, set its **Targets** selection to *Central Site*.
- **MAC Refresh:** If the Ethernet port of an NCB is connected to an IP MAC layer switch, specify a **MAC Refresh** value other than Disabled for that member to cause the NCB to periodically notify that switch of the existence of this NCB. This is useful following a reset of the MAC layer switch, as the forwarding table of MAC addresses in the switch is emptied and may not know to forward an incoming message to an NCB. When the notification is sent from the NCB, the MAC layer switch forwarding table is updated, allowing the successful forwarding of an incoming message. A **MAC Refresh** can be enabled by specifying a value from 1 to 255 seconds. The **MAC Refresh** can be disabled by specifying a value of 0. Edit this field by double-clicking it.

Use the *File – Save As* or the *File – Save* (same as the *Save Channel* button on the main screen) to save the channel information entered. In LNS Plugin mode, *File – Save As* is not valid and the IP information is saved in the LNS database directly. In Standalone mode, the path to the file is specified by the Project Directory setting.

Status of commissioning (in Plug-in mode) and synchronization of IP Address parameters between the database and each physical NCB unit are indicated with color coding of the **Member Name** fields and the *IP Sync* (individual members) and *IP Channel Sync* (all NCB members in the channel collectively) “dots”. Use the *Help – Display Status Legend* function for color definitions.

A red ‘X’ in the “Sync” field indicates the IP address parameters on-screen are not the same as stored in the device. A green ‘✓’ indicates the IP address parameters on-screen are the same as stored in the device. A yellow ‘F’ indicates that factory default parameters are stored in the device.

When in LNS Plug-in mode, adding an NCB member to the “Channel Member List” requires the user to exit the EtherPlug plug-in, add the NCB router and Control Neuron Processor to the LonMaker drawing as in *Steps 2B* and *2C*, then reopen the EtherPlug plug-in as in *Step 3*.

STEP 5. DOWNLOAD IP ADDRESS PARAMETERS TO NCBs VIA SERIAL PORT

Note : If installing NCB-Fiberlons on dedicated fiber segments, skip to Step 6.

When first installing a set of NCB units to a network, the IP Address parameters entered into EtherPlug in step 4 must be downloaded to each NCB unit via a serial COM port on the PC. After all NCB units are configured and properly installed on the IP and LONWORKS networks as detailed in Step 6 below, changes in IP Address Parameters can be made via the LONWORKS and Wide Area Ethernet networks without the need to access each NCB unit directly for a serial port connection.

A) Select the serial communications port that will be used for downloading IP address parameters:

- Click the “**COM Port**” menu item, and the “*Com Select*” window will be displayed.
- Choose an available serial port on the PC from the drop-down list, then click **Select**.

B) Download IP address parameters to NCB:

- Double-click on the first “Member” name in the Channel Member List. The “*Download*” window will be displayed.
- Select :
 - *Database* from the Download drop-down list
 - *Channel* from the To ... Members drop-down list
 - *Serial* from the Via the ... Port drop-down list
- Click **Load**.
- The “*Instructions*” window will prompt to connect the selected COM port to the indicated NCB Member. A 9 pin to 9 pin “null modem” cable (supplied with NCB unit) is required. Click **OK**.

after the cable has been connected. The “**Downloading**” window will be displayed. When downloading has completed successfully, the “**Sync**” field will change to a green ‘✓’.

- The “**Instructions**” window will prompt to connect the selected COM port to the next NCB Member. Click **OK** the cable has been connected. Continue this process for all NCB units.
- When downloading is complete to all members, the “**Channel Sync**” indicator will change to a green ‘✓’.

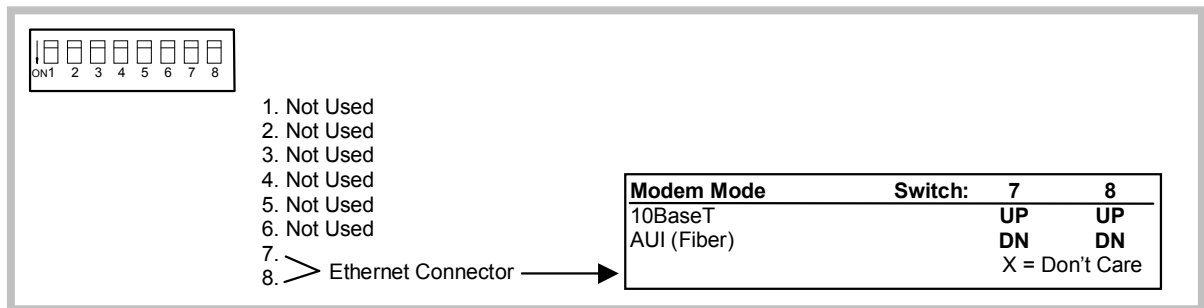
C) Exit EtherPlug:

- From the **File** menu, select Exit.

STEP 6. PHYSICALLY INSTALL NCBs INTO THE IP NETWORK

A) Select an Ethernet connector:

- OPTION switches are used to select the active Ethernet connector. Use the 10BaseT setting for the NCB-Etherlon and the AUI setting for the NCB-Fiberlon. The position of the OPTION switches are read by the NCB module at power-up or after pressing the “**RESET**” button on the front panel.



B) Mount the NCB units (See Appendix B for Mounting Option details):

Desk, Wall, or Rack Mounting

- Non-slip rubber feet are included on all NCB modules to allow them to conveniently rest on any horizontal surface. Four 6-32 threaded holes are also available on the bottom of the module to allow bolting of the module in any convenient orientation. **WARNING: Care should be taken to limit protrusion of the screw into the module to no more than 0.125 inch from the module bottom surface!**
- Mounting kits are available as options to allow wall or rack (19” EIA) mounting of the NCB module.

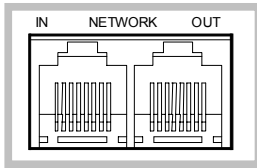
C) Make electrical connections (See Appendix C for connector details):

Grounding

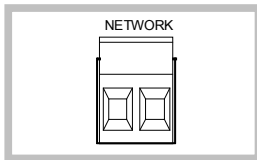
- When wall or rack mounting the NCB, a suitable safety and protective earth ground should be provided to the metal enclosure. The protective earth ground provides a path to ground for electrostatic discharge (ESD) energy. This connection is most conveniently made directly to the wall mount bracket or rack plate.

LONWORKS Network Connection

- The local LONWORKS network must be attached to the NCB module via the “NETWORK” connector following standard Echelon guidelines as to cable type, cable length, and termination appropriate for the selected transceiver.



The dual RJ-45 **NETWORK** connector allows a daisy-chained network connection method, as the network pins of the two RJ-45 connectors are directly paralleled.



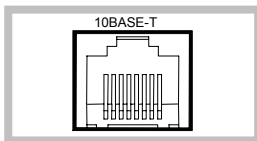
The 2 pin removable terminal strip is wired in parallel with the network connections on the dual RJ-45 connector.

NOTE: If your NCB module was purchased without a LONWORKS transceiver (SMX-ready), refer to Technical Note TN025 to install your SMX transceiver.

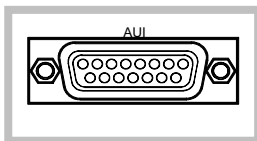
Ethernet Connection

- The Ethernet network must be attached to the NCB module via one of the Ethernet connectors. Be sure to set the OPTION switch positions 7 and 8 as shown in Step 6A to match the type of Ethernet physical media being used.

WARNING: DO NOT connect the NCB modules to a live Ethernet network until they have been reconfigured with IP parameters supplied by the Network Administrator. Network-wide problems could arise from connecting devices to a network without coordination of addressing information.

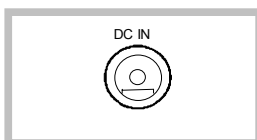


The **10BaseT** port utilizes a standard RJ-45 connector. Level 5 unshielded twisted pair cable should be used between the NCB-Etherlon module and the hub. The length of this cable should be less than 100 meters (328 feet).



The **AUI** port accepts standard Ethernet MAUs (Media Attachment Units) for 10BaseFL (fiber) and 10Base5 (“thicknet”).

DC Power Connection



DC power must be attached to the NCB module via the **DC IN** connector. **Apply DC power to the NCB module only after all other connections have been made.** A wall plug-in style power supply designed for the NCB module is an available option.

STEP 7. COMMISSION THE ROUTERS AND CONTROL NEURON PROCESSORS

Once the NCB unit IP Address Parameters are set (steps 4 and 5) and the NCB units are physically installed in the IP and LONWORKS networks (step 6), the router and control neuron processor portions of each NCB unit must be commissioned with the LONWORKS network management tool. Once all units have been commissioned, the Channel Delay parameter of the custom Ethernet channel should be adjusted to match actual conditions.

If using LonMaker for Windows, proceed as follows:

A) Commission the LONWORKS routers:

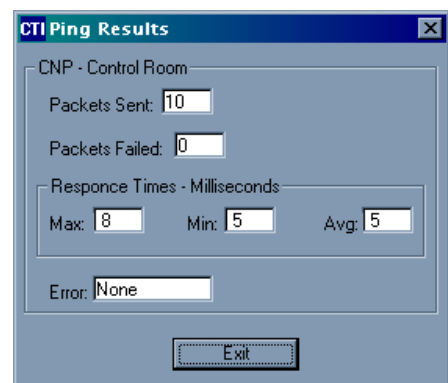
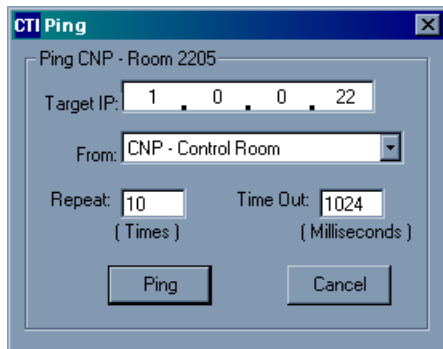
- Commission the router of the NCB whose NETWORK port is attached to the PC used for network management by right-clicking on the router shape, then clicking on the “Commission” function.
- click **NEXT**, then **FINISH** to commission the first router.
- Repeat the above to commission the router portion of all other NCB units on the channel.

B) Commission the Control Neuron Processors:

- Commission a Control Neuron Processor (in any order) by right-clicking on the device shape, then clicking on the “Commission” function.
- click **NEXT**, then **NEXT** again, then select *Online* and click **FINISH** to commission the device.
- Repeat the above to commission the Control Neuron Processors of all other NCB units on the channel.

C) Use the “Ping” function to determine message transit time over Ethernet IP channel:

- Launch EtherPlug. (See Step 3)
- Right-click on the first Member Name in the Channel Member List, then choose “Ping” from the selection. The “Ping” request window will be displayed as shown below (left).
- Click **Ping** to cause the ping to be initiated.
- From the “Ping Results” window (shown below right), record the “Max:” time (maximum round-trip message time) for this member.
- Ping the remainder of NCB members (except for the NCB unit connected to the PC on which the network management tool is being run), recording the “Max:” time for each



D) Update “CUSTOM Channel Delay” in LonMaker for Windows:

- Right-click on the **CUSTOM** (Ethernet) channel created in Step 2A above. In the drop-down list, click “Properties”. The “Channel Properties” window will be displayed.
- In the “Delay” section of the “Channel Properties” window, choose “Specify”, and enter a value that is twice that of the largest “Max:” time found in Step 7C. Then Click **OK**.

The installation of the NCB units is now complete.

INSTALLING ADDITIONAL NCB UNITS AFTER INITIAL INSTALLATION

Should additional NCB units need to be installed after the initial installation has been completed, use one of the two following sequences:

If using Multicast IP Address Mode:

1. Add the new NCB units to the network management tool per **Step 2** above.
2. Start EtherPlug and edit the IP Parameters for the new NCB units per **Step 3** and **Step 4** above.
3. Download IP Parameters to **all** new NCB units via the serial port per **Step 5** above.
4. Physically install all new NCB units into the IP Network per **Step 6** above.
5. Commission the Routers and Control Neuron Processors per **Step 7** above. Check the maximum Ping timing to the new NCB units and adjust the Custom Channel Delay if necessary.

If using Unicast/Replicated IP Address Mode:

1. Add the new NCB units to the network management tool per **Step 2** above.
2. Start EtherPlug and edit the IP Parameters for the new NCB units per **Step 3** and **Step 4** above.
3. Download IP Parameters to **all** new NCB units via the serial port per **Step 5** above.
4. Per **Step 5** above and using the Serial Port, re-download IP Parameters to the Central Site NCB unit (if using Central Site Mode), or to the NCB unit whose LONWORKS NETWORK port is connected to the network interface on the PC used to run the network management tool and EtherPlug.
5. Exit EtherPlug.
6. Physically install the new NCB units into the IP network per **Step 6** above.
7. Commission the new NCB Routers and Control Neurons per **Step 7** above. Check the maximum Ping timing to the new NCB units and adjust the Custom Channel Delay if necessary.
8. Restart EtherPlug and, per **Step 5** above, re-download *Database* parameters to *Channel* members via *LONWORKS*. This will put all NCB units in sync with the database.

3. NETWORK VARIABLE (NV) CONTROL

All commands sent to the NCB module are carried on the LONTALK network in the form of Network Variables bound to the Control Neuron processor inside the NCB module (connected to *Side A* of the internal router). This section details the network variables associated with the Configuration Object.

These network variables are not used in a typical application, but are documented here for specific cases requiring them.

This Section contains details of Network Variables and Bindings

CONFIGURATION OBJECT

The Configuration Object is used to control and monitor IP/Ethernet functions of the NCB-Etherlon and NCB-Fiberlon. Command functions include issuing either a ping or a router service pin request. Status and reporting functions include ping results, MAC address, and product name.

Network Variables

Pulse Router Pin (Input)

C Language Syntax

```
network input SNVT_switch nviPulseRtr;
```

Usage

This input network variable requests the toggling of the RSVC (Router Service) pin. This in turn sends a broadcast message on the LONWORKS network identifying the Neurons in the NCB's router core module with their Neuron ID numbers.

Valid Range

Value	Pulse Router Pin
Off	Disabled
On	Enabled

Default Value

Off (Disabled)

Product Name (Output)

C Language Syntax

```
network output SNVT_str_asc nvoProductName;
```

Usage

This output network variable contains an ascii string identifying the product.

When Transmitted

Unsolicited at power-up and reset, or when polled.

Ping Request (Input)

C Language Syntax

```

typedef struct U_PING_REQ
{
    unsigned char ip[4];           4 byte IP address
    unsigned char rpt;            repeat count
    unsigned short t_out;         time-out (ms)
                                16 bits (2 bytes)
    0;                            required zero
}

```

Usage

This input network variable structure requests an IP ping of the specified IP address. The Repeat Count specifies the number of pings issued and must have a value between 1 and 255. The Time-out parameter specifies the duration to wait for a ping response from a device. The last parameter must be the numeral zero.

Ping Results (Output)

C Language Syntax

```

typedef struct U_PING_STATUS
{
    U_PING_REQ request;           echoes Ping Request info
                                4 byte IP address
                                repeat count
                                time-out
                                required zero

    unsigned char n_tx, n_fail;   number of actual ping
                                transmissions and failures

    unsigned short mx, mn, avg, err; ping response times
                                (maximum, minimum, average,
                                and 16 bit error code)
}

```

Usage

This output network variable structure contains the Ping Request information such as IP address, repeat count, and time-out. It also reports the actual number of ping transmissions and number of ping response failures. Finally, ping response times are reported in terms of maximum, minimum, and average. An error code is also returned.

When Transmitted

On Ping Request.

MAC Address (Output)

C Language Syntax

```

typedef struct MacAddress
{
    unsigned char mac[6];        6 byte MAC address
}

```

Usage

This output network variable contains 6 decimal bytes representing the MAC address.

When Transmitted

Unsolicited at power-up and reset, or when polled.

4. ETHERPLUG ADDITIONAL FUNCTIONS

Basic usage of the EtherPlug configuration software is described in SECTION 2 of the manual. This section covers additional features of EtherPlug not described in SECTION 2.

PRINTING INFORMATION FROM ETHERPLUG

The *File – Print* and *File – Print to File* functions can be used to print Channel information (from the main window) or detailed member information (from the View Details window) either directly to a printer, or to the default Windows editor.

UPDATING FIRMWARE IN THE NCB UNIT

The *File – Flash Loader* function is used to update the firmware in the NCB-Etherlon or NCB-Fiberlon unit. This is possible on NCB units of revision 200 or greater. Contact CTI Products technical support should the firmware need upgrading.

IMPORTING/EXPORTING ETHERPLUG CONFIGURATION DATA

The *Import/Export – Export File* function is used (only in LNS Plugin Mode) to save the EtherPlug configuration data in a file outside the LNS database to be used by EtherPlug in standalone mode, or when transporting the EtherPlug data from one LNS database to another LNS database.

The *Import/Export – Import File* function is used to import EtherPlug data from an *ETHERCON* data file with a “.el” file extension.

OTHER RIGHT-CLICK MEMBER FUNCTIONS

Other functions available on the menu presented after right-clicking on a member name are as follows:

- *View Details* : Shows the Ethernet/IP data as stored in the NCB unit compared to that in the database for that unit.
- *Rename Member & Delete Member* : Allowed only in Standalone mode.
- *Wink, Pulse Router Service Pin, Soft Reboot* : Allowed only in LNS Plugin mode.

APPENDIX

APPENDIX A. FACTORY DEFAULT CONFIGURATION

Control Neuron Processor

Restoring Factory Default Communication Parameters

If the Control Neuron Processor or router module communication parameters are overwritten by a network management tool, they can be restored as follows:

- Press the “RESET” button on the front of the NCB unit
- After the “ERR” LED goes off, press the “RESET” button a second time.

The Control Neuron communication parameters are now restored to factory defaults.

IP Address Parameters

The units are factory programmed as follows:

- IP Address: Unique address based on MAC address of module
- IP Address Mode: Multicast
- IP Multicast Address: 224.000.001.016
- Subnet Mask: 255.255.255.0

Router

The router portion of the NCB module may be configured for various operational characteristics. The factory default configuration is as a **repeater**, where all messages entering the NCB module (via any of the three data ports described in section “1. INTRODUCTION”) are simply passed through, regardless of the domain, subnet/node, or group destination address of the message. Other algorithms, can be selected using standard LONWORKS network management tools such as the LonBuilder, LonMaker, or LNS.

Further details of router operation and configuration are contained in the Echelon document entitled “LONWORKS Router User's Guide”, Echelon part number 078-0018-01B.

Address Assignments

The router inside the NCB module contains two Neuron chips, each with its’ own subnet/node number assignment. The default factory configuration of the router Neurons is subnet 255 node 126 and subnet 255 node 127. If any other nodes in the system to which the NCB is connected are configured with either of these subnet/node addresses, the router should be reconfigured to different addresses using any standard network management tool. The Control Neuron processor default address setting is subnet 255 node 1.

Buffer Configuration

The NCB module utilizes buffers to store incoming messages and route them out to other ports. The configuration of these buffers (the number of bytes in each buffer as well as the number of buffers) determine the maximum size message that can be passed and the performance of the NCB module under conditions of bursty traffic. In the standard configuration, the NCB router restricts the maximum size message that can be passed to a length of 40 to 50 bytes of user data, depending on the addressing overhead in the packet.

Technical Note TN010 discusses the topic of buffers and buffer sizes in detail, and should be referenced if messages to be passed through the NCB module could exceed the maximum default size.

Querying, Defaulting, and Unconfiguring Router Configuration using SETRTR.EXE

The SETRTR.EXE DOS utility provided with each NCB can be used to query the router for its current configuration, force the router to certain default states, or force the router to *unconfigured* mode. If the router will be installed with the *configured* router algorithm, it is highly recommended that the router module is set to *unconfigured* mode before being installed into the system (this step is mandatory if redundant routers are to be configured).

Refer to Technical Note TN025 for more information on configuration of the router with standard network management tools such as LonBuilder, LonMaker, LNS, and others.

The SETRTR program requires a network interface to be connected to the personal computer. This network interface can be an Echelon SLTA, PCLTA, PCNSS, or any other device conforming to Echelon network interface standards. Network interface driver software must be loaded in the personal computer and configured with a device name (typically "LONn" where n is a number). Documentation that is provided with the network interface device details how to install the unit and driver software. The network interface device must contain a network transceiver compatible with the network transceiver in the NCB module to be controlled.

NOTE: *If you are using the PCLTA card as a network interface and the NCB is not performing the commands as expected, the PCNSS has probably not been configured for network interface mode. See Technical Note TN024 for information on configuring the PCNSS card into network interface mode.*

After the network interface and its software driver are properly configured on the personal computer, connect its network port to the front panel "NETWORK" connector on the NCB.

Querying an NCB's Router for its Current Configuration

Start the SETRTR program with the following command line:

```
SETRTR [-ddevicename] -L <cr>
```

where *devicename* is the name assigned to the network interface on the command line of the device driver (typically "LON1" or "LON2"). If this parameter is omitted, the default name of LON1 is used.

The -L parameter instructs SETRTR to List the current configuration of the router module.

After the signon message appears, press the "RSVC" button on the front of the connected NCB module. SETRTR will report the current router configuration to the screen.

Returning an NCB's Router to Factory Default Configuration

Start the SETRTR program with the following command line:

```
SETRTR [-ddevicename] -F <cr>
```

where *devicename* is the name assigned to the network interface on the command line of the device driver (typically "LON1" or "LON2"). If this parameter is omitted, the default name of LON1 is used.

The -F parameter instructs SETRTR to set the RTR-10 to full Factory defaults, including router algorithm, domain tables, and buffer settings.

After the signon message appears, press the "RSVC" button on the front of the connected NCB module. SETRTR will send the required messages to the router and exit. Press the "RESET" button on the front of the NCB module to complete the reconfiguration.

Setting an NCB's Router to Unconfigured Mode

Start the SETRTR program with the following command line:

```
SETRTR [-ddevicename] -U <cr>
```

The -U parameter instructs SETRTR to set both sides of the NCB's router to Unconfigured mode.

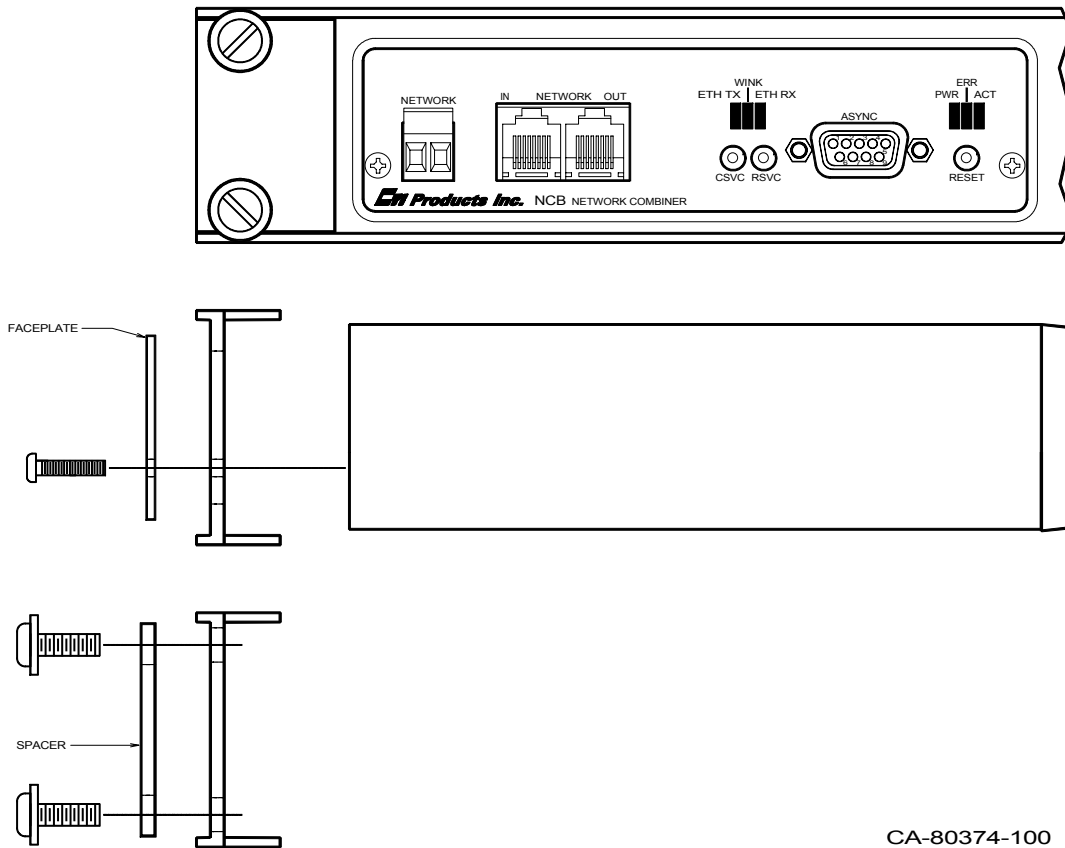
After the signon message appears, press the "RSVC" button on the front of the connected NCB module. SETRTR will send the required messages to the router and exit.

APPENDIX B. MOUNTING OPTIONS

Wall mount and EIA 19" rack mount kits are available as options for the NCB from CTI Products, Inc. The wall mount kit includes brackets to allow a single NCB module to be mounted to any flat surface. The rack mount kit includes an adapter allowing up to three NCB modules to be mounted in a single rack unit height.

Rack Mount Option

The rack mount option allows up to three NCB modules to be mounted in a one rack unit height (1.75 inches) of a standard 19 inch rack. The modules are mounted in the rack plate by removing its' front bezel and remounting the module into the rack plate. Figure 7 shows an exploded view of the rack mount installation. The top diagram shows the front view of the bracket with one module installed. The bottom two diagrams show a side view of the module installation into the rack adapter and rack adapter installation into the rack, respectively.



CA-80374-100

Figure 7 NCB Module Rack Mounting

To attach a module to the rack adapter, and then mount the rack adapter into the rack, follow the steps below.

WARNING

Do not allow the PC board to slide out of the housing when the front panel is removed. If it does, **DO NOT** slide the PC board back into the housing from the front of the module. Doing so may damage the unit, causing the unit to malfunction when powered on. Doing so will void the unit's warranty.

Rack Mounting Instructions

Step	Operation
1	Remove the front panel from the module, including the bezel, by removing the two Philips head screws in the faceplate. The bezel is not used when rack mounting the module.
2	Position the module behind the rack adapter, lining up the holes in the rack adapter with the front panel screw holes on the module.
3	Position the front panel in front of the rack adapter, lining up the front panel with the module.
4	Fasten the front panel and module to the rack adapter with the Philips head screws that were previously removed.
5	Position the rack adapter into your rack, lining up the four mounting holes of the rack adapter with mounting holes in the rack frame.
6	Position the two spacers in the front of the rack adapter, aligning the cutouts in the spacers with the holes of the adapter.
7	Install mounting screws (customer provided) into the rack.

When the module's front panel is removed, do not allow the PC board to slide out of the housing. If the PC board does slide out of the housing, you must follow the steps below to replace the PC board in the housing. **DO NOT RE-INSTALL THE PC BOARD FROM THE FRONT OF THE HOUSING !**

Re-Installing a PC Board in its housing

Step	Operation
1	From the front of the module, slide the PC board out of the housing.
2	Remove the back panel of the module.
3	From the rear of the module, slide the PC board back into the housing (there are markings on the PC board to indicate which edge to insert into the rear of the housing first).
4	Install the back panel of the module.

Wall Mount Option

The wall mount option allows an NCB module to be mounted to any flat surface. The NCB module has four screw holes on the bottom. Simply attach the two mounting plates to the bottom of the module using the four flat-head screws provided with the wall mount kit. This assembly is then attached to the flat surface with user-provided fasteners. Figure 8 shows a dimensioned view of the wall mount installation.

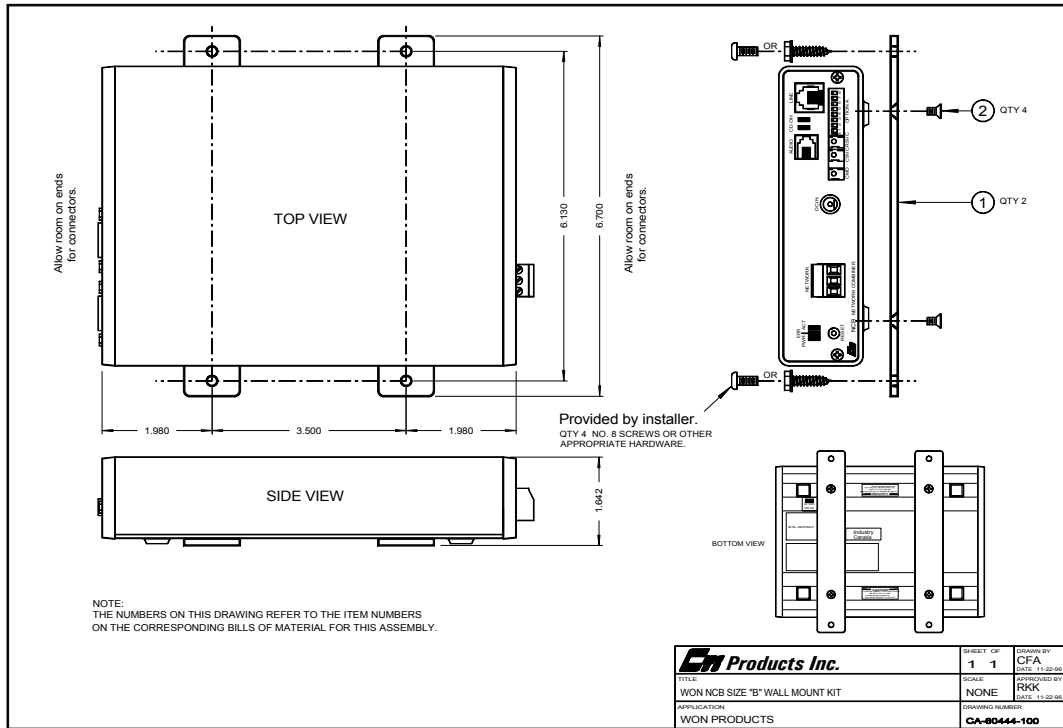


Figure 8 NCB Module Wall Mounting

CAUTION

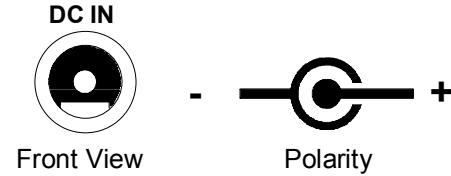
Be sure to use the flat head screws provided with the wall mount kit. If you are not using the wall mount kit from CTI Products, Inc., make sure that the screws do not protrude into the enclosure more than 0.125 inches from the bottom surface of the module.

Using a longer screw that touches the PC board inside the module may damage the module. Doing so will void the unit's warranty.

APPENDIX C. CONNECTOR DETAILS

DC IN Connector

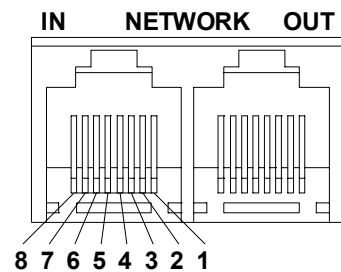
Connector type: 2.5 x 5.5 mm coaxial
 Mating Connector: Switchcraft 760 or equivalent
 Connector pinout: CTI Products, Inc. standard power supply is wired with center pin positive, NCB module can accept either pin positive, polarity routing is provided internal.



NETWORK Connectors

RJ-45 Connectors:

Pins 1 and 2 of both RJ-45 connectors as well as the screw-terminal connector are all wired in parallel. The dual RJ-45 connector designates "IN" and "OUT". These designations apply only to DC power that is passed down unused pairs of the 4 pair network cable. The two pins carrying the network pair are straight-through.



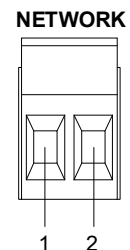
Connector Type: Standard RJ-45 telephone connector, 8 position 8 contact.

Pin	Function	Notes
1	Network	Network connection is NOT polarity sensitive
2	Network	Pins 1,2 of IN and OUT connectors tied parallel
3	No Connection	Pin 3 of IN and OUT connectors tied together
4	No Connection	Pin 4 of IN and OUT connectors tied together
5	No Connection	Pin 5 of IN and OUT connectors tied together
6	No Connection	Pin 6 of IN and OUT connectors tied together
7	No Connection	Pin 7 of IN and OUT connectors tied together
8	No Connection	Pin 8 of IN and OUT connectors tied together

2-Position Screw-Terminal:

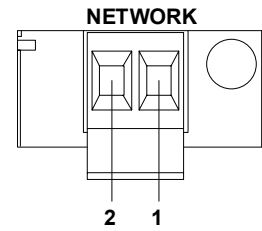
Mating Connector: Weidmuller 128176

Pin	Function
1	Network
2	Network



SMX Transceiver units:

SMX network connections are described in the documentation with the SMX transceiver.



Ethernet Connectors

10BaseT Connector:

Connector type: Standard RJ-45 female.

Pin	Function
1	Ethernet TX
2	Ethernet TX
3	Ethernet RX
4	N/C
5	N/C
6	Ethernet RX
7	N/C
8	N/C

AUI Connector:

Connector type: Standard D-Subminiature 15 pin female.

Pin	Function
1	Chassis Ground
2	Collision
3	Ethernet TX
4	Chassis Ground
5	Ethernet RX
6	Signal Ground
7	N/C
8	N/C
9	Collision
10	Ethernet TX
11	Chassis Ground
12	Ethernet RX
13	+12V
14	Chassis Ground
15	N/C

ASync Connector

When this port is connected to a PC's serial port, the EtherPlug program can be used to configure the IP address parameters.

Connector type: Standard D-Subminiature 9 pin male.

Pin	Function
1	Data Carrier Detect
2	RX
3	TX
4	Data Terminal Ready
5	Signal Ground
6	Data Set Ready
7	Clear to Send
8	Request to Send
9	N/C

APPENDIX D. TROUBLESHOOTING

Table D1

If the PWR LED . . .	REASON	CORRECTIVE ACTION
Is always illuminated.	Normal operation indicating that NCB unit is receiving proper DC input power.	Go to next Table.
Does not illuminate.	NCB unit is not receiving DC input power.	Check for proper voltage at “DC IN” connector (10-32VDC).

Table D2

If the ERR LED . . .	REASON	CORRECTIVE ACTION
Is always off.	Normal operation indicating no error condition was detected.	Go to next Table.
Occasionally blinks on, then off.	Normal operation when “CSVC” button or “RSVC” button is pressed.	Go to next Table.
Flashes slowly, at a rate of once every 2 seconds.	The Router Neurons are unconfigured.	Use a network management tool to ‘Replace’ or ‘Commission’ router, or Use NODEUTIL to change the mode/state to ‘Configured’ and ‘On-line’, or Use SETRTR –F to configure the router to Factory default conditions (Repeater Mode).
Flashes quickly, at a rate of once every second.	The Control Neuron Processor detects missing IP address information.	Use EtherPlug to update the IP address parameters. (See Installation section for instructions.)
Is always illuminated.	Router module, or Control Neuron Processor, or Microprocessor is not functioning.	Call CTI Products, Customer Support (+1-513-595-5900), to arrange to return unit for evaluation/repair.

Table D3

If the ETH TX LED (on local NCB) . . .	REASON	CORRECTIVE ACTION
Occasionally blinks on, then off.	Normal operation indicating a message packet has been transmitted from the Ethernet port.	Go to next Table.
Does not illuminate when “RSVC” button on local NCB is pressed.	Ethernet port is not terminated correctly to the IP network.	<ol style="list-style-type: none"> Verify that OPTION switch positions 7 and 8 are set correctly for the Ethernet connector being used. See <i>Step 6A</i> in Installation section. Verify that the cable from NCB Ethernet port is terminated correctly to IP network. Check the ‘connection’ LED that is found near each port on most IP interconnect devices. Verify that the correct cross or straight-through cable is being used. See “Appendix F. IP Addresses”.

Table D4

If the ETH RX LED (on local NCB) . . .	REASON	CORRECTIVE ACTION
Occasionally blinks on, then off.	Normal operation indicating a message packet has been detected on the IP network.	Go to next Table.
Does not illuminate when "RSVC" button on remote NCB is pressed.	<ol style="list-style-type: none"> 1. Ethernet port is not terminated correctly to the IP network. 2. If Unicast/Replicated addressing mode is being used, IP addresses for local and remote NCB are not compatible. 3. If Multicast addressing mode is being used, IP network routers or switches are not configured properly. 	<ol style="list-style-type: none"> 1a. Verify that OPTION switch positions 7 and 8 are set correctly for the Ethernet connector being used. See <i>Step 6A</i> in Installation section. b. Verify that the cable from NCB Ethernet port is terminated correctly to IP network. Check the 'connection' LED that is found near each port on most IP interconnect devices. c. Verify that the correct cross or straight-through cable is being used. See "Appendix F. IP Addresses". 2a. Verify that portion of IP addresses identified by Subnet Mask for both local and remote NCBs are identical. 3a. Verify that IP routers and switches have Multicast mode enabled. b. Verify that IP routers are programmed to pass the IP multicast address of the NCB-Etherlon. c. Verify that IP routers are programmed to pass the NCB-Etherlon multicast port numbers of 1100 (destination port) and 1283 (source port).

Table D5

If the ACT LED (on local NCB) . . .	REASON	CORRECTIVE ACTION
Occasionally blinks on, then off.	Normal operation indicating a message packet has passed through the router module of the NCB.	Go to next Table.
Does not illuminate when “RSVC” button on remote NCB is pressed.	<ol style="list-style-type: none"> 1. LONWORKS Service Pin message from remote NCB is not reaching the local NCB. 2. LONWORKS Service Pin message from remote NCB is not passing through the local router module. 	<ol style="list-style-type: none"> 1a. Verify that “ACT” and “ERR” LED’s on remote NCB flash once. If not, return remote unit for evaluation/repair. b. Verify that “ETH TX” LED flashes on the remote NCB and that “ETH RX” LED flashes on the local NCB. 2a. Place the remote router in Repeater mode and verify that the local “ACT” LED illuminates when “RSVC” button on remote NCB is pressed. b. If ‘2a’ is ok, re-commission the local NCB router. c. If ‘2a’ is not ok, swap either the local or remote unit with a known-good-unit to determine the faulty unit.
Does not illuminate when local LONWORKS nodes are transmitting messages.	1. LONWORKS message packets from local nodes are not passing through the local router module.	<ol style="list-style-type: none"> 1a. Verify the connection between the local LONWORKS nodes and the local NCB. b. Place the local router in Repeater mode and verify that its “ACT” LED illuminates when local LONWORKS nodes are transmitting messages. c. If ‘1b’ is ok, re-Commission the local NCB. d. If ‘1b’ is not ok, return the local NCB unit for evaluation/repair.
Does not illuminate when remote LONWORKS nodes are transmitting messages.	<ol style="list-style-type: none"> 1. LONWORKS message packets from remote nodes are not passing through the remote router module. 2. LONWORKS message packets from remote nodes are not reaching the local NCB. 3. LONWORKS message packets from remote nodes are not passing through the local router module. 	<ol style="list-style-type: none"> 1a. Verify the connection between the remote LONWORKS nodes and the remote NCB. b. Verify that “ACT” LED on remote NCB illuminates when remote LONWORKS nodes are transmitting messages. c. Place the remote router in Repeater mode and verify that its “ACT” LED illuminates when remote LONWORKS nodes are transmitting messages. d. If ‘1c’ is ok, re-commission the remote router. e. If ‘1c’ is not ok, return unit for evaluation/repair. 2. See this Table above and verify step “ACT” LED “Does not illuminate when “RSVC” button on remote NCB is pressed”. 3. See this Table above and verify step “ACT” LED “Does not illuminate when “RSVC” button on remote NCB is pressed”.

Table D6

Miscellaneous:	REASON	CORRECTIVE ACTION
Cannot communicate with Control Neuron Processor of local NCB when using NODEUTIL.	<ol style="list-style-type: none"> 1. In Bridge or Configured modes, router neurons and network interface are not in the same domain. 2. In Repeater mode, the network interface may be defective. 	<ol style="list-style-type: none"> 1. Verify that NODEUTIL can communicate with another LONWORKS node. 2a. Place the local router in Repeater mode and verify that communications is possible, or <ol style="list-style-type: none"> b. Use NODEUTIL to change the network interface Domain to match the router neurons' domains.
Cannot communicate with the Control Neuron Processor of local NCB.	<ol style="list-style-type: none"> 1. In Bridge or Configured modes, the Control Neuron, the router neurons, and the network interface are not all in the same domain. 2. In Repeater mode, the Control Neuron and network interface are not in the same domain. 	<ol style="list-style-type: none"> 1. Place the local router neurons in Repeater mode. 2. Change the network interface Domain to match the Control Neuron domain.
Cannot commission the Control Neuron Processor when using LonMaker for Windows.	Incorrect external interface definition (.xfb or .xif file) was specified when commissioning node.	Use NCBEL20 for Version 2 NCB-Etherlon or NCB-Fiberlon.

APPENDIX E. SPECIFICATIONS

NCB-Etherlon and NCB-Fiberlon

<i>DC Power Input:</i>	10 to 32 VDC, unregulated (10BaseT) 15 to 32 VDC unregulated (AUI) 5 watts maximum without SMX transceiver 10 watts maximum with SMX power line transceiver
<i>Size:</i>	7.5" D x 5.6" W x 1.6" H
<i>Operating Temperature:</i>	0 to 60 °C
<i>Humidity:</i>	10-95% non-condensing
<i>Mounting:</i>	Desktop with integral non-slip feet Wallmount or 19" rack mount with optional adapters
<i>Configuration:</i>	
<i>Integral Router</i>	Factory default router mode is set to Repeater. Configured or Bridge mode can be selected using standard LONWORKS network management tools capable of configuring routers.
<i>Ethernet IP Parameters</i>	Using supplied EtherPlug (stand-alone Windows program or LNS application plug-in)
<i>Transceivers Supported:</i>	
<i>LONWORKS</i>	FTT-10A, TPT/XF-78, TPT/SF-1250, SMX
<i>Ethernet</i>	10BaseT, AUI (10BaseFL for NCB-Fiberlon)
<i>IP Addressing Modes:</i>	Unicast/Replicated, Multicast
<i>IP Transport:</i>	UDP
<i>Maximum LONTALK Packet Size:</i>	66 bytes (factory default router configuration) 255 bytes (maximum with software re-configuration)

APPENDIX F. IP ADDRESSING

Conventions

Any node connected to an IP (Internet Protocol) network must be identified with a unique 32-bit address. These 32-bit addresses are commonly written *in dotted decimal* notation as four decimal numbers (referred to as octets because each decimal number represents 8 bits) separated by decimal points. Each octet can be a number from 1 to 255. For example, 131.9.1.2 is a valid IP address. The IP address assigned to a network device is commonly called the *Host IP Address*. By having unique addresses on a network, you can identify individual stations (also called hosts or nodes) on the network.

The NCB-Etherlon and NCB-Fiberlon modules are provided from the factory with default addressing to allow simple “quickstart” testing by connecting them back-to-back. See “APPENDIX A. FACTORY DEFAULT CONFIGURATION”.

IP Address Classes

There are five types of IP addresses. Three are associated with networks – Class A, B, and C.

- **Class A** addresses are for networks that have a large number of hosts, up to a maximum of 16,777,216 on a single IP network. The first octet is between 1 and 126. (127 is reserved for loopback and is used for internal testing on the local machine.)
- **Class B** addresses are for medium-sized networks. The first octet is between 128 and 191.
- **Class C** addresses are for small networks, up to 255 hosts. The first octet is between 192 and 223.
- **Class D** addresses are reserved for multicasting and the first octet is between 224 and 239.
- **Class E** addresses (240 to 255) are reserved and should not be used.

An IP address consists of two parts – one part identifies the network, and one part identifies the host (or node). The NetID portion of the IP address identifies the physical network segment. The HostID portion of the IP address identifies the node within the network segment. The following table lists the capacities of each IP address and the bits used as NetID and HostID.

IP Class	Net ID (Beginning Bits)	# of Networks	Host ID (Ending Bits)	# of Hosts or Subnets	1 st byte Range
A	8	126	24	16.7 million	1-126
B	16	16,000	16	65,000	128-191
C	24	2 million	8	254	192-293

Subnetting using Subnet Masks

A portion of the host bits can be used to “subnet the network”. The subnet mask identifies the “NetID” and “HostID” portions of the IP address in a bitwise fashion. The mask is constructed by placing a “1” in any bit that is part of a subnetwork address. So subnet mask bits that are SET define the NetID, and CLEARED subnet mask bits define the HostID.

A subnet mask of 255.255.255.0 defines the NetID as the first three octets, and the HostID as the last octet. For example, for the address 192.47.73.111 and the subnet mask of 255.255.255.0, the subnetwork can be identified as 192.47.73.0.

Summary of Important Networking Details

- A specific “NetID” can exist on only ONE port of ONE IP router.
- The “NetID” portion of the Host Address and the Gateway Address **MUST BE THE SAME**.
- If a functional router (such as a NCB Router) is moved to a different location, its Host IP Address and Default Gateway IP Address **MUST BE CHANGED** to match the “NetID” at the new location.

IP Addressing modes

Unicast/Replicated

Unicast/Replicated addressing mode allows point-to-point or point-to-multipoint communications in any IP network. A table of *Target IP Addresses* is configured into each of the NCB-Etherlon™ Routers, the table in each containing the IP addresses of the other modules in the group. The maximum number of NCBs that can be configured into one Unicast/Replicated group is 96.

Each NCB is programmed with a *Host IP Address*, a list of *Target IP Addresses*, and optionally, a *Default Gateway IP Address*. The *Default Gateway IP Address* is the address of the IP router to which the respective NCB-Etherlon is attached and allows for IP routers or gateways that may exist between NCB-Etherlon units.

Using Unicast/Replicated mode, a single LONTALK packet entering any of the NCB modules of the group will be sent out the Ethernet port of that module as multiple Unicast IP messages, one to each of the other NCB modules in the group.

Multicast

Multicast addressing mode allows efficient point-to-multipoint communications in a network. Each NCB is assigned a *Host IP Address*, a *multicast Target IP Address*, and optionally, a *Default Gateway IP Address*. A single *multicast Target IP Address* is assigned to all NCB in the network within the range 224.0.1.0 through 239.255.255.255.

A single LONTALK packet entering any one of the NCB modules results in a **single** multicast IP packet being sent out the Ethernet port of that module to be received by *all* other NCB members configured to the same Multicast IP address.

Multicast addressing mode can be used with a very large number of NCB-Etherlon modules, allowing combinations of very large number of LONWORKS network. Because only one IP packet is generated for every LONTALK packet, multicast addressing mode uses far less network bandwidth than Unicast/Replicated.

Before choosing multicast addressing mode, it is important to determine the following capabilities of the IP network to which the NCB units will be connected:

- IP routers must be capable of handling IP multicast traffic.
- IP routers must have IP multicast enabled
- IP routers must forward the NCB multicast port numbers of 1100 (destination port) and 1283 (source port).

MAC Addresses

Whereas IP uses Logical Addresses to identify a host (node), other protocols use Hardware Addresses called Media Access Control addresses, or MAC addresses. MAC addresses are set at the factory at time of manufacture and cannot be changed. (IP addresses can be changed at any time.) A MAC address consists of six octets, in hexadecimal notation, separated by colons. An example would be: 00:10:EE:00:02:34.

The first three octets in a MAC address identify the manufacturer. In the above example, 00:10:EE identifies CTI Products as the manufacturer of this device. The last three octets are sequentially assigned by the manufacturer to form a type of serial number. In this way, no two devices have the same MAC address.

Multicast addressing is also possible using MAC addresses, just as in IP addressing. MAC addresses reserved for broadcast messages start at: 00:01:5E:00:00:00.

Address Resolution Protocol (ARP)

Since IP uses Logical Addresses at the OSI Network Layer (Layer 3) and Ethernet uses MAC addresses at the OSI Data Link Layer (Layer 2), Address Resolution Protocol is used whenever IP is used over the Ethernet. ARP is needed to convert an IP address to a MAC address. The client then stores this resolved address for a period of time in its ARP cache. An ARP cache is a lookup table, typically in a router, that will store a quantity of resolved addresses for devices that it must communicate with.

When a message is destined for an IP address whose MAC address has not yet been resolved, an ARP REQUEST is sent from the local host as a broadcast message, asking for MAC identification. A remote host with the IP address in question generates an ARP RESPONSE. This ARP RESPONSE contains the requested MAC address. The local host receives the message, and places the IP Address and the matching MAC Address in its ARP Cache. The original message is then sent using the MAC Address found previously. Any additional messages to this remote IP address will be sent using the MAC address found in the local host's ARP cache.

Ethernet 10BaseT Cables

When connecting two IP devices together, either a straight-through cable or a crossover cable may be required.

If interconnecting similar devices, then a crossover cable is needed. Examples would be interconnecting two NCB routers, or two IP routers, or two hubs, or two computers. Generally, if the two devices are both Layer 3 devices, then a crossover cable is required. Routers operate at Layer 3. Similarly, if the two devices are Layer 1 or 2 devices, they would also require a crossover cable. Bridges, switches, and Network Interface Cards (NIC) operate at Layer 2, and hubs, repeaters, and concentrators operate at Layer 1.

If interconnecting dissimilar devices, then a straight-through cable is needed. Dissimilar devices would involve one Layer 3 device and a Layer 1 or Layer 2 device.

The following table summarizes devices in each layer.

Layer 3	Layer 2	Layer 1
IP Router	Bridge	Hub
NCB Router	Switch	Repeater
	NIC	Concentrator

The following table lists the connections for a straight-through cable.

Standard End				Standard End		
Signal Name	Wire Color	Pin		Pin	Wire Color	Signal Name
TD+	White/Orange	1	↔	1	White/Orange	TD+
TD-	Orange	2	↔	2	Orange	TD-
RD+	White/Green	3	↔	3	White/Green	RD+
Not used	Blue	4	↔	4	Blue	Not used
Not used	White/Blue	5	↔	5	White/Blue	Not used
RD-	Green	6	↔	6	Green	RD-
Not used	White/Brown	7	↔	7	White/Brown	Not used
Not used	Brown	8	↔	8	Brown	Not used

The following table lists the connections for a crossover cable.

Standard End				Crossover End		
Signal Name	Wire Color	Pin		Pin	Wire Color	Signal Name
TD+	White/Orange	1	↔	3	White/Green	RD+
TD-	Orange	2	↔	6	Green	RD-
RD+	White/Green	3	↔	1	White/Orange	TD+
Not used	Blue	4	↔	5	Blue	Not used
Not used	White/Blue	5	↔	4	White/Blue	Not used
RD-	Green	6	↔	2	Orange	TD-
Not used	White/Brown	7	↔	8	White/Brown	Not used
Not used	Brown	8	↔	7	Brown	Not used

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