

LonMaker[®] User's Guide

TURBO Edition



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Preface

The LonMaker Integration Tool is a software package for designing, installing, and maintaining multi-vendor, open, interoperable LONWORKS[®] control networks. Based on Echelon's LNS[®] network operating system, the LonMaker tool combines a powerful, client-server architecture with an easy-to-use Visio user interface. The result is a tool sophisticated enough to design, commission, operate, and maintain a control network, yet economical enough to be left behind as an operation and maintenance tool. The LonMaker tool complies with the LNS plug-in standard, making it compatible with the wide variety of LNS plug-ins available from Echelon and many other vendors.

Purpose

This guide outlines the new features in the Turbo edition of the LonMaker Integration Tool, and it describes how to use the LonMaker Integration Tool to design, commission, monitor and control, maintain, and manage a network. The LonMaker Integration Tool includes an online help system that provides context-sensitive help that supplements the information in this guide.

Audience

This guide is intended for system designers and integrators with an understanding of control networks.

Related Reading

LNS Utilities and LONMARK Reference Help File—Describes the LNS utilities included with the LonMaker tool and provides reference documentation on LONMARK resource files, device interface files, and standard network variable and configuration property type definitions.

i.LON 100e3 User's Guide—Describes how to install, configure, use, and manage the *i.LON 100e3* Internet Server as a Web server, network interface, gateway, and controller.

i.LON™ 600 LonWorks®/IP Server User's Guide—Describes how to install, configure, use, and manage the *i.Lon 600 LONWORKS/IP Server* as an IP-852 router, and how to use the Echelon LONWORKS/IP Configuration Server.

Introduction to the LONWORKS System—Introduces the basics of the LONWORKS system.

NodeBuilder User's Guide—Describes how to use the NodeBuilder software with the LonMaker tool to develop and test device applications.

Mini EVK User's Guide—Describes how to use the Mini EVK Evaluation Kit to develop and test device applications.

Go to the LonMaker Web site at www.echelon.com/lonmaker for the latest versions of documentation and any available updates for your software. Go to types.lonmark.org for updated resource file documentation.

Content

This guide includes the following content:

- *Introduction*: Provides an introduction to the LonMaker Integration Tool, new features in the Turbo Editions; and the basics of LonMaker Network Designs, LONWORKS, and Visio.
- *Installing and Activating the LonMaker Tool*: Lists hardware requirements for installing the LonMaker Integration Tool; describes how to install the various software and components included in your copy of the LonMaker Integration Tool; and describes how to activate the LonMaker Turbo Integration Tool.
- *Getting Started*: Provides information on the planning a LonMaker network design; using the LonMaker Design Manager; setting up a network interface; creating and opening a LonMaker network design; LonMaker client types; using the LonMaker tool remotely; using Network Device shapes; and creating and using user profiles.
- *Designing Networks*: Describes how to design a network using the LonMaker tool. Covers how to create the following objects in a LonMaker drawing: application devices, functional blocks, network variables, routers, channels, and subsystems. Explains how to connect network variables. Explains working with LonMaker shapes and layers, customizing the LonMaker user interface, and using LonMaker with AutoCAD drawings.

- *Installing Networks*: Describes how to install devices using the LonMaker tool, including how to load applications into them, set the initial state of their applications, set the source of their configuration properties, and select how they manage device-specific configuration properties. It also explains the different methods for acquiring device Neuron IDs and how to alternatively use the device discovery method to install a network.
- *Monitoring and Controlling Networks*: Describes how you can monitor and control the devices in your network with the LonMaker tool. Describes the three methods you can use to read and/or write network variables and configuration properties: using monitored connections, browsing with the LonMaker Browser, and using Data Point shapes. Covers how to bind network variables to the host in order to receive event-driven updates. Describes how to change the types and formats of network variables and configuration properties. Explains how to create simple HMIs in your LonMaker drawing with Data Point and Visio shapes.
- *Maintaining Networks*: Provides an overview of network maintenance tasks that you can perform with the LonMaker tool. Describes loading, replacing, and decommissioning devices. Explains how to resynchronize and propagate configuration properties values. Explains how to back up and restore a LonMaker network; create a LonMaker network by recovering information from the physical network; and resynchronize the network database, LonMaker drawing, and physical devices. Explains how to merge two LonMaker networks.
- *Managing Networks*: Explains how to test and verify application devices, functional blocks, and routers; describes LonMaker styles; and details how to generate device status summary reports, network resource reports, and LNS network reports.
- *Exporting and Importing a Network Using XML*: Describes how to export a LONWORKS network to a LonMaker network XML file; view a LONWORKS network XML file in a web browser; edit a LonMaker network XML file; and import a LONWORKS network XML file to update a network.
- *LonMaker Credits*: Provides information on licensing the LonMaker tool; using, viewing, and adding LonMaker credits; licensing remote clients; transferring a LonMaker license; using LonMaker demo mode.
- *Using LNS Plug-ins*: Provides an overview of LNS Plug-ins and then describes how to start a plug-in, get plug-in information, and re-register, enable, and disable plug-ins.
- *Creating and Using LonMaker Shapes and Stencils*: Describes how to create a LonMaker stencil and create and use custom master shapes for devices, functional blocks, subsystems, and connections. Explains how to modify a master shape by changing its user-defined cells.
- *Appendices*: Includes information on setting LonMaker default options; instructions for installing network interfaces; a quick-start exercise you can use to quickly create a LonMaker network, and control and monitor devices; the LonMaker Credits Order Form; the LonMaker Software License Agreement; the LonMaker License Transfer Agreement; a glossary; and the index.

For More Information and Technical Support

- See the *LonMaker Turbo Editions Help* file for detailed information on using the LonMaker Turbo Integration Tool.
- See the *LonPoint Application and Plug-In Guide*, the *LonPoint Plug-In* help file, and the LonPoint plug-in for detailed information on using LonPoint devices.
- Adobe Acrobat versions of the *LonMaker User's Guide* and *LonPoint Application and Plug-In Guide* are also included in LonMaker and LonPoint program folders when you install the LonMaker Turbo Editions and LonPoint software. You'll need the Adobe Acrobat reader that is optionally installed by the LonMaker setup application to view these files.

The LonMaker and LonPoint Plug-In ReadMe files provide descriptions of known problems and their workarounds. To view the LonMaker Turbo Editions ReadMe file, click **Start**, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker Read Me**. To view the LonPoint ReadMe file, click **Start**, point to **Programs**, point to **Echelon LonPoint Software**, and then select **LonPoint Read Me First**. You can also find additional LonMaker and LonPoint information at the LonMaker Web page at www.echelon.com/lonmaker.

If you have technical questions that are not answered by the documentation, on-line help, or LonMaker Web page, you can get technical support from Echelon. Your LonMaker distributor may also provide customer support. You can also enroll in training classes at Echelon or an Echelon training center to learn more about how to use the LonMaker tool.

To receive technical support from Echelon for the LonMaker tool, you must register your copy with Echelon and you must purchase support services from Echelon or an Echelon support partner. See www.echelon.com/support for more information on Echelon support and training services.

There is no charge for software installation-related questions during the first 30 days after you receive the LonMaker CD.

You can obtain technical support via phone, fax, or email from your closest Echelon support center. The contact information is as follows:

Region	Languages Supported	Contact Information
The Americas	English Japanese	Echelon Corporation Attn. Customer Support 550 Meridian Avenue San Jose, CA 95126 Phone (toll-free): 800 258 4LON (258-4566) Phone: 408 938 5200 Fax: 408 790 3801 lonsupport@echelon.com
Europe	English German French Italian	Echelon UK 16, The Courtyards Hatters Lane Watford Herts. WD18 8YH United Kingdom Phone: 44 0 1923 430200 Fax: 44 0 1923 430300 lonsupport@echelon.co.uk
Japan	Japanese	Echelon Japan Holland Hills Mori Tower, 18F 5-11-2 Toranomom, Minato-ku Tokyo 105-0001 Japan Phone: 81 3 5733 3320 Fax: 81 3 5733 3321 lonsupport@echelon.co.jp

Region	Languages Supported	Contact Information
China	Chinese English	Echelon Greater China Rm. 1007-1008, IBM Tower Pacific Century Place 2A Gong Ti Bei Lu Chaoyang District Beijing 100027, China Phone: 86 10 6539 3750 Fax: 86 106539 3754 lonsupport@echelon.com.cn
Other Regions	English	Phone: 408 938 5200 Fax: 408 328 3801 lonsupport@echelon.com

Echelon will provide Visio support only for those Visio features that are required for use of the LonMaker tool. To receive support for Visio from Microsoft, you must purchase separately a retail version of the Microsoft Visio Professional or Standard 2003 drawing application. Echelon will not support use of the LonMaker Integration Tool with versions of Visio other than the version included on the LonMaker CD.

You can submit a feedback form with suggestions on how to improve the product's functionality and documentation at <http://www.echelon.com/company/feedback>. This feedback form is not forwarded to technical support and should not be used to submit technical or product support related issues—send technical support questions to your Echelon support center.

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Introduction

This chapter provides an introduction to the LonMaker Integration Tool, new features in the Turbo Editions; and the basics of LonMaker Network Designs, LONWORKS, and Visio.

Introduction to the LonMaker Tool

The LonMaker[®] Integration Tool is a LONWORKS[®] network tool that runs on the LNS[®] client/server network operating system and uses Microsoft Visio[®] (Professional or Standard 2003) as a graphical user interface. LNS provides the set of directory, installation, management, monitoring, and control services used by the LonMaker tool. In addition, the client/server architecture of LNS allows multiple users running the LonMaker tool on separate computers to access the LNS server simultaneously. This means that managers, system integrators, installers, and maintenance personnel can all work on the same LONWORKS network at the same time. The LonMaker tool is compatible with Windows XP Professional and Home editions, Windows 2003 Server, and Windows 2000.

The LonMaker tool can be used to manage all phases of a network's life cycle, from the initial design and commissioning to the ongoing operation, because it provides the functionality of several network tools in one single solution:

- *Network Design Tool.* You can design a network offsite (without actually being connected to the network) and/or onsite, and modify it anytime. The LonMaker tool can also learn an existing network's design through a process called *network recovery*.
- *Network Installation Tool.* You can rapidly install a network designed offsite once it is brought onsite. The device definitions can be quickly and easily associated with their corresponding physical devices to reduce on-site commissioning time. The LonMaker Browser provides complete access to all network variables and configuration properties.
- *Network Documentation Tool.* You can create a LonMaker drawing during the network design and installation process. This LonMaker drawing is an accurate, logical representation of the installed physical network. The LonMaker drawing is therefore an essential component of as-built reports.
- *Network Operation Tool.* You can operate the network using the operator interface pages contained within the LonMaker drawing.
- *Network Maintenance Tool.* You can easily add, test, remove, modify, or replace devices, routers, channels, subsystems, and connections to maintain the network.

What's New for LonMaker Turbo Editions

This section lists and then describes the new features that have been added to the LonMaker tool for the Turbo Editions.

LonMaker Design Manager	<ul style="list-style-type: none">• One-click network creation• New tabs for setting new network and LonMaker default options• Network Wizard accelerator
LonMaker Shapes	<ul style="list-style-type: none">• ToolTips for displaying shape data
Application Devices and Routers	<ul style="list-style-type: none">• Simplified wizards• Automatic channel selection• Channel re-assignment with the Connector tool• Simplified shape menus• Firmware upgrade• Device-specific configuration property support• Passive configuration mode• Enhanced subsystem recovery• Active device template and resource file updates• Accelerated device interface verification

Functional Blocks	<ul style="list-style-type: none"> • One-page wizard • Automatic device selection • Device re-assignment with the Connector tool • Simplified shape menu • Dynamic functional blocks • Dynamic network variables on application functional blocks
Connections	<ul style="list-style-type: none"> • Simplified Connector tool • Automatic connection type selection • Fast connection property modification • New connection descriptions • More default connection descriptions • New connection property modification • Connection hiding • Connection reference shape alignment
Monitoring	<ul style="list-style-type: none"> • New Data Point shape
Network Explorer	<ul style="list-style-type: none"> • Network variable access • Channel and device template views • Device template menu
Multi-User Modification	<ul style="list-style-type: none"> • Automatic drawing synchronization • LNS event tracking • LonMaker event log
Resource Usage Reports	<ul style="list-style-type: none"> • Network resource report • Alias table summary
Application Integration	<ul style="list-style-type: none"> • XML export to other applications and reports • XML import from other applications • LonMaker network report • Automatic extension record copying • Plug-in disable/enable
LNS network database	<ul style="list-style-type: none"> • Hot backup while the LNS Server is running • Scheduled backup • Automatic resynchronization • LNS network database validation and repair
Visio 2003 Integration	<ul style="list-style-type: none"> • Tablet PC support • LonMaker drawing markup with digital ink
Windows Compatibly	<ul style="list-style-type: none"> • Compatible with Windows XP Professional and Home Editions, Windows 2003 server, and Windows 2000
Performance	<ul style="list-style-type: none"> • Faster device, router, functional block, channel, and connection creation • Faster commissioning • Faster resynchronization

LonMaker Design Manager

The LonMaker Design Manager has been enhanced to provide greater flexibility in customizing your networks, and to speed up creating and opening networks.

One-Click Network Creation

You can now create new networks with only one mouse click from the LonMaker Design Manager. To use the one-click network creation feature, clear the **Show All Options** check box in the **New Network** box on the **General** tab, and select the options in the **New Network Options** tab to skip the pages for setting the management mode, network interface, registered plug-ins, and default LonMaker stencils.

New Network and LonMaker Default Options Tabs

The LonMaker Design Manager includes **New Network Options** and **LonMaker Default Options** tabs that let you select the default settings for new networks.

The **New Network Options** tab lets you set the default properties for the network interface, plug-ins, user logon, management mode, and network components pages that appear in the Network Wizard when you create a new network. The properties you set for these pages are then applied to each new network you create. You can also set options to skip these pages in order to create a new network with one click. See *New Network Options* in Chapter 3, *Getting Started*, for more information on the options you can set in the **New Network Options** tab.

The **LonMaker Default Options** tab lets you set the default options for LonMaker objects such as devices, functional blocks, and configuration properties and processes such as backup/restore, commissioning, network variable browser/monitoring, and synchronization. Each new network you create will use these default settings. You can change any of these settings after creating the network by opening the **LonMaker** menu and clicking **LonMaker Options**. See *LonMaker Default Options* in Chapter 3, *Getting Started*, for more information on the options you can set in the **LonMaker Default Options** tab.

Network Wizard Accelerator

When creating or opening a network with the Network Wizard, you can click the new **Finish** button to skip any remaining pages in the wizard. New networks will be created using the current settings in the **New Network Options** tab of the LonMaker Design Manager for those pages that you skip. Existing networks will be opened using the settings in the **Network Properties** dialog in the LonMaker drawing, which you can access by opening the **LonMaker** menu and clicking **Network Properties**.

LonMaker Shape Tooltips

You can enable a ToolTip to display selected data items when the mouse pointer is over application device, functional block, connection, channel, and network variable shapes. Using an application device for example, you can set a ToolTip to display any or all of the following data items when the mouse pointer is over the device shape: shape name, template name, network variable alias data, Neuron ID, Subnet/Node ID, and LNS handle. See *Shape ToolTips Options* in Appendix A for more information.

Application Devices and Routers

The new features in the LonMaker Turbo Editions for application devices and routers are described in the following sections.

Simplified Wizards

The New Device Wizard and New Router Wizard have been shortened. The channel selection page in both wizards and the device template page in the New Device Wizard have been eliminated, and the options from these pages have been added to the first page of the respective wizards. In addition, each page of the wizard now has a **Finish** button, which you can use to skip any remaining pages. Clicking **Finish** is the same as clicking through the remaining pages in the wizard without making any changes. These simplified wizards let you define and commission an application device or router with only one click.

See *Creating Application Devices* and *Creating Routers* in Chapter 4, *Designing Networks*, for more detailed information on using these simplified wizards.

Automatic Channel Selection

You can use automatic channel selection to enable the LonMaker tool to automatically select the appropriate channel or channels for a new application device or router, skipping their respective wizards. This feature lets you create a new device or router with a single click and drag. To enable automatic channel selection for all new LonMaker networks or for an existing LonMaker network, set the **Enable Automatic Channel Selection** check box in the network properties: **Device** options category.

See *Creating Application Devices* and *Creating Routers* in Chapter 4, *Designing Networks*, for information on using the automatic channel selection feature.

Channel Reassignment with the Connector Tool

You can move an application device to a different channel, preserving the device's configuration and all of its connections. You can do this to assign a device to a channel different from the one automatically selected by the LonMaker tool, or to physically move a device to a different compatible channel. To move a device to a different channel, you can either right-click the device and then click **Move Device** on the shortcut menu, or you can use the **Connector** tool on the Visio **Standard** toolbar to graphically move the device.

See *Creating Application Devices* and *Creating Routers* in Chapter 4, *Designing Networks*, for more information on moving application devices and routers.

Simplified Shape Menus

You can right-click an application device or router to display a shortcut menu for the device. The shortcut menus have been simplified to display hierarchical menus for commissioning and moving devices, and for starting plug-ins (application devices only). Visio-specific commands—such as cut, view, format, shape, and help—no longer appear in the device shortcut menus. You can disable the new LonMaker menus to display all Visio commands. To disable or enable the LonMaker shape menus, open the **LonMaker** menu and then click **Use LonMaker Shape Menus**.

See *Using LonMaker Shape Menus* in Chapter 4, *Designing Networks*, for information on enabling and using LonMaker shape menus.

Firmware Upgrade

When you load a new application image into a compatible device, you can upgrade (or downgrade) the device firmware to make the device compatible with the application image being loaded into it. The device and the existing device firmware must support firmware updates to use this option. This option is available when you commission, replace, or load an application file into a device. See Chapter 5, *Installing Networks*, for information on the firmware upgrade feature.

Device-Specific Configuration Property Support

The LonMaker tool now provides improved support for device-specific configuration properties. Unlike other configuration properties, device-specific configuration properties have values that can be modified independent of the LNS network database. For example, a thermostat may include a user interface to allow the user to locally change a setpoint configuration property. This change may occur independently of the LNS network database and therefore not be reflected in it. The setpoint configuration property should be defined as device-specific in the device to communicate to the LNS server that it may be changed independently of the LNS network database.

If the manufacturer does not specify that a particular configuration property is device-specific, but you know that it should be, you can now change the device-specific flag for that configuration property in a device template.

You can also set the initial values of device-specific configuration properties when commissioning or replacing a device, loading a new application image into the device, or resynchronizing configuration properties. For example, when commissioning or replacing the thermostat in the previous example, you may load the configuration property value from the LNS network database to assign the initial setpoint.

See Chapter 5, *Installing Networks*, for more information on managing device-specific configuration properties.

Passive Configuration Mode

You can now manually propagate configuration property value changes to one or more devices without affecting the network configuration of the devices. You can use this feature to enable a plug-in to operate as a passive configuration tool, which allows you to use plug-ins on devices installed by network tools not based on LNS. To use this passive configuration mode, attach the LonMaker tool to the network, keep it OffNet, and then recover the network. You can then configure any device in the network using plug-ins, and apply configuration property value changes to these devices by right-clicking a device (or selecting multiple devices and right-clicking one of the devices), pointing to **Commissioning**, and clicking **Propagate CP Values to Device** on the shortcut menu.

Enhanced Subsystem Recovery

You can now store subsystem data in application devices and routers. This improves the network recovery process (see *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*), as the LonMaker tool can use the saved subsystem data to place application devices and routers in their correct subsystems.

To enable subsystem data to be stored in devices, select one or both of the options in the network properties: **Recovery** options category (see Appendix A). The options consist of storing the subsystem ID in the location property of application devices and routers and storing the subsystem path in the **SCPTlocation** configuration property of application devices.

- If you select the **Set Location Property to Subsystem ID** option, the LonMaker tool stores the subsystem ID in application devices or routers when they are commissioned. This subsystem ID appears as a 6-character ASCII or 12-digit hex string in the **Location** field of the **Basic Properties** dialog box. The LonMaker tool automatically updates the subsystem ID when you move the device, and when you move or rename its subsystem and the **Update all Devices when Subsystem Name is Modified** option in the network properties: **Recovery** options category is set to **Yes**.
- If you select the **Set SCPT Location Value to Subsystem Path** option, the LonMaker tool stores the subsystem ID in the **SCPTlocation** configuration property of application devices when they are commissioned. The LonMaker tool automatically updates the subsystem path stored in the **SCPTlocation** configuration property when you move the application device, and when you move or rename its subsystem and the **Update all Devices when Subsystem Name is Modified** option in the network properties: **Recovery** options category is set to **Yes**.

Active Device Template and Resource File Updates

You can now update the device interface (XIF) file or the resource files for a device template currently being used by devices in the network. To update the XIF file or resource files of a device template, open the Network Explorer, click the new **Device Templates** tab, right-click a device template, point to **Import XIF** or **Resync to Resource Files**, and then select whether to update the device template and all the devices using that template, or just the device template.

See *Network Explorer* in Chapter 4, *Designing Networks*, for more information on updating device templates and resource files.

Accelerated Device Interface Verification

The LonMaker Turbo Editions let you disable any or all of the validation steps performed on the device interface when a device is commissioned. This may reduce the time required to install a network, especially for power line devices. To set the validation options, right-click a device template in the **Device Templates** tab in the Network Explorer, and then select **Properties** from the shortcut menu. Under the **Device Validation** box, clear the check boxes for those validation steps the LNS Server is to skip when you commission devices using that device template.

See *Network Explorer* in Chapter 4, *Designing Networks*, for more information on setting device interface validation options.

Functional Blocks

The new features in the LonMaker Turbo Editions for functional blocks are described in the following sections.

One-Page Functional Block Wizard

The functional block wizard has been reduced from two pages to one. The functional block name page has been eliminated, and the options have been added to the first page of the wizard. This one-page wizard lets you create a functional block with only one click. See *Creating Functional Blocks* in Chapter 4, *Designing Networks*, for more detailed information on using the simplified Functional Block wizard.

Automatic Device Selection

You can use automatic device selection to enable the LonMaker tool to automatically select the appropriate device for a new functional block, skipping the functional block wizard. This feature lets you create a new functional block with a single click and drag. To enable automatic device selection for all new LonMaker networks or for an existing LonMaker network, set the **Enable Automatic Device Selection** check box in the network properties: **Functional Block** options category. This option is cleared by default.

See *Creating Functional Blocks* in Chapter 4, *Designing Networks*, for more formation on using automatic device selection.

Device Re-assignment with the Connector Tool

You can move a functional block to a different device, preserving all of the functional block's configuration and connections. You can do this to assign a functional block to a different device than the one automatically selected by the LonMaker tool, or to re-assign any functional block to a different compatible device. To move a functional block to a different device, you can either right-click the functional block and use the **Move FB** command, or you can use the **Connector** tool on the Visio **Standard** toolbar to graphically re-assign the functional block.

See *Creating Functional Blocks* in Chapter 4, *Designing Networks*, for more formation on re-assigning functional blocks to different devices.

Simplified Shortcut Menu

You can right-click a functional block to display a shortcut menu for the functional block. The shortcut menu has been simplified to display a hierarchical menu for configuration properties, display options, moving the functional block, and for starting plug-ins. Visio-specific commands—such as cut, view, format, shape, and help—no longer appear in the functional block shortcut menu. You can disable the new LonMaker menus to display all Visio commands. To disable or enable the LonMaker menus, open the **LonMaker** menu and then click **Use LonMaker Shape Menus**.

See *Using LonMaker Shape Menus* in Chapter 4, *Designing Networks*, for information on enabling and using LonMaker shape menus.

Creating Dynamic Functional Blocks

You can create dynamic functional blocks on devices that support them. Device manufacturers can implement dynamic functional blocks on devices that support customized interfaces, such as programmable controllers. Within the LonMaker tool, dynamic functional blocks are similar to the more common static functional blocks except that they can only be added to a compatible device and they do not contain configuration properties. When you create a dynamic functional block, you can select whether to create shapes all for mandatory and optional network variables defined in that dynamic functional block.

See *Creating Functional Blocks* in Chapter 4, *Designing Networks*, for more formation on creating dynamic functional blocks.

Connections

The new features in the LonMaker Turbo Editions for connections are described in the following sections. See *Creating Connections* in Chapter 4, *Designing Networks*, for more detailed information on using these new features.

Creating a Connection with the Connector Tool

You can use the **Connector** tool on the Visio **Standard** toolbar to connect network variables and message tags on functional blocks and supernodes that are located in the same subsystem.

Automatic Connection Description Selection

You can use the LonMaker tool to automatically select the connection services for network variable connections. The LonMaker tool will select the connection service that optimizes network performance, while providing reliable message delivery and minimizing network resource usage. For example, you can use this feature to minimize the use of ANSI/CEA-709.1 (EN14908) groups in large networks.

Fast Connection Property Modification

You can manually change a connection type quickly by right-clicking the connection, pointing to **Set Connection Description**, and then selecting the new connection description. Selecting a connection description that does not start with “SCD_” disables automatic connection description selection. To automatically select the appropriate smart connection description (SCD), select <**Recompute**>.

New Connection Descriptions

To provide more flexibility when manually selecting a connection type, five new default connection descriptions have been added:

1. Acknowledged with Alias Multicast
2. Repeated with Alias Multicast
3. Repeated with Broadcast Multicast
4. Unacknowledged with Alias Multicast
5. Unacknowledged with Broadcast Multicast

Hiding and Showing Connector Shapes

You can hide connector shapes to simplify a LonMaker drawing, or you can selectively show the connector shapes attached to specific functional blocks or supernodes to examine their connections. You can also set an option on a functional block to not create connection shapes. See *Hiding and Showing Connector Shapes* in Chapter 4, *Designing Networks*, for more detailed information on the different ways you can hide and show connector shapes.

Automatic Reference Connection Shape Alignment

You can automatically align and keep aligned all the reference connection shapes in a subsystem or the reference connection shapes attached to a specific functional block. This feature eliminates the need to manually move functional block, connector, and connector reference shapes to keep your LonMaker drawing organized. See *Aligning Reference Connection Shapes* in Chapter 4, *Designing Networks*, for more detailed information on using this feature.

Monitoring—Data Point Shape

The LonMaker tool includes a new Data Point shape that you can use to monitor and control a network. You can use the Data Point shape to monitor and control the value of any network variable, configuration property, or functional block state (enabled or in override) in your network. In addition, you can use the Data Point shape to create simple human-machine interfaces (HMIs) in your LonMaker drawing.

The Data Point shape serves as a replacement for the LNS Text Box shape, which was introduced in LonMaker 3. The Data Point shape functions similarly to the LNS Text Box shape and has all the same functions, but it performs significantly better. The Data Point shape keeps Visio in design mode, does not crash Visio when a page is deleted, makes saving a LonMaker drawing easier, and improves security because it does not remove the digital signature associated with a LonMaker drawing. The LNS Text Box shape is still available for legacy drawings, but new drawings should use the Data Point shape because of its improved performance.

See *Using Data Point Shapes* in Chapter 6, *Monitoring and Controlling Networks*, for more detailed information on using the Data Point shape.

Network Explorer

The new features in the LonMaker Turbo Editions for the Network Explorer are described in the following sections. See *Network Explorer* in Chapter 4, *Designing Networks*, for more information on using these new features.

Network Variable Access

You can access network variables and view their properties from the Network Explorer. To show network variables in the Network Explorer for all new LonMaker networks or for an existing LonMaker network, select **Subsystems, Devices, FBs and NVs** in the network properties: **Network Explorer** options category. To access network variables from the Network Explorer, expand a device and then expand one of its functional blocks. The network variables appear listed alphabetically below their respective functional blocks, and they are marked with black arrows within a grey icon.

New Channel and Device Template Views

You can view the devices in a LonMaker drawing organized by subsystem, channel, or device template. You can click the new **Channels** and **Device Templates** tabs to find all the devices on a particular channel, or to find all the devices using a specific device template. In the **Channel** and **Device Template** tabs, the channels and device templates in your LonMaker drawing are listed alphabetically, and the objects that you selected to be displayed in the Network Explorer are listed in a hierarchal manner (in the order of devices, functional blocks, and then network variables) under their respective channel or device template.

Device Template Menu

To work with a device template, open the Network Explorer, click the **Device Templates** tab, and then right-click a device template to open the **Device Template** menu. This menu, previously located under the **LonMaker** menu, has been enhanced with several new options and features. It includes access to a new **Device Properties** dialog box where you can set new device validation options, and it contains new options for updating a device template.

Multi-User Modification

The new features in the LonMaker Turbo Editions for multi-user modification are described in the following sections. See *Resynchronizing a Network* in Chapter 7, *Maintaining Networks*, for more detailed information on using these new features.

Automatic Drawing Synchronization

You can make changes to a LonMaker drawing at the same time other users are modifying the network, even if the other users are modifying the same subsystem as you. The LonMaker tool uses LNS events and a new LonMaker event log described in the following subsections to keep the LonMaker drawings synchronized with the LNS network database and with each other. The LonMaker drawings will remain synchronized even as multiple users and applications access and modify the drawings and the LNS network database.

LNS Event Tracking

The LonMaker tool uses LNS events to detect changes to a LonMaker drawing made by LNS applications other than the LonMaker tool, as well as changes in the status of devices as reported by the LNS server. Actions tracked exclusively by LNS events consist of detecting and commissioning application devices and routers. LNS events track other actions that are also tracked in the LonMaker Event Log described in the next section. These actions include upgrading application devices; creating application devices, routers, subsystems, and connections; deleting application devices, routers, and connections; and renaming application devices, routers, functional blocks, and subsystems.

LonMaker Event Log

The LonMaker tool stores every change made to a LonMaker drawing in a shared log called the *LonMaker event log*. The LonMaker event log is kept in the LNS network database so that all LonMaker tools on a network can view the events logged by all other LonMaker tools on the same network—including tools that are not active at the same time. All LonMaker tools check the log when they open a LonMaker drawing and periodically thereafter (every 10 seconds by default), and update their copies of the LonMaker drawing based on the log entries.

Additional benefits of the LonMaker event log are that it can be used by the LonMaker tool to restore your work if your computer fails while you are updating a drawing, and it reduces the number of times that you need to resynchronize a LonMaker drawing. You may still need to resynchronize if applications other than the LonMaker tool make changes to the LNS network database that affect a LonMaker drawing, or if log entries are deleted.

You can view the LonMaker event log, and you can export it to an XML file. See *LonMaker Event Log* in Chapter 7, *Maintaining Networks*, for how to do this.

Resource Usage Reports

The LonMaker Turbo Editions include the following new features to help you determine usage of critical network resources such as group IDs, subnet IDs, selectors, and network variable alias table space. See *Using Resource Usage Reports* in Chapter 8, *Managing Networks*, for more information on using these new features.

Network Resource Report

You can display a summary of the usage of group IDs, subnet IDs, and selectors in your network. The usage of these resources is displayed in a *network resource report*. This report displays the number of group IDs, subnet IDs, and selectors that have been allocated out of those available in your LonMaker drawing. Individual color status bars indicate the percentage consumed and availability of each resource. As more network resources are consumed, the status bar fills up and changes color.

- **Green.** Resource is readily available (up to 75 percent used).
- **Yellow.** Resource is available, but beginning to run low (between 75 and 90 percent used).

- **Red.** Resource is critically low (over 90 percent used).

To view the network resources report, open the **LonMaker** menu and then click **LonTalk Network Resources**.

Alias Table Summary

You can display a summary of the usage and availability of alias table entries for a device in a ToolTip. The device shape ToolTip lists the total number of network variable aliases for the device, and the number of aliases currently available.

To view the alias table summary, move the pointer over the desired device shape and keep it there for the ToolTip delay (the default ToolTip delay is 2 seconds). The device shape ToolTip will then appear. The total and available network available alias counts are by default the last two items listed in the ToolTip.

Application Integration and XML Export/Import

The LonMaker Turbo Editions include the following new features to support integration with other applications and provide enhanced network reports.

Exporting a LONWORKS Network XML File

You can export your LonMaker network to a LONWORKS network XML file using the new LonMaker XML Plug-in. The export can be fully automated, or you can manually export your LonMaker network. You can export selected items, subsystems, or your entire network to an XML file. The XML file will consist of a report of all the devices, connections, network variables, configuration properties, and other data within the specified network scope. In addition, the exported XML file by default will include a reference to an XSLT style sheet that you can use to transform the file into a LonMaker Network Report. You can then view the LonMaker Network Report in your Web browser.

See *Exporting a LONWORKS Network XML File* in Chapter 9, *Exporting and Importing Networks with XML*, for more information on using the XML export feature.

Importing a LONWORKS Network XML File

You can import a LONWORKS network XML file from another application using the LonMaker XML Plug-in. The import can be fully automated, or you can manually import a LONWORKS network XML file using the LonMaker tool. Importing a LONWORKS network XML file will update or create a LonMaker drawing by creating, modifying, and deleting objects in the LNS network database.

See *Importing a LONWORKS Network XML File* in Chapter 9, *Exporting and Importing Networks with XML*, for more information on using the XML import feature.

Automatic Extension Record Copying

You can enable automatic extension record copying so that extension records will automatically be copied when you create a new subsystem, device, or functional block from a copy (a custom master shape or an existing shape). This is useful for integrating with other LNS applications that store device-specific data in extension records. When enabled, the LonMaker tool copies extension records that are identified in the LNS network database as records that should be copied. To enable automatic extension record copying, select the **Enable Configuration Properties** check box in the network properties: **Configuration Properties** options category.

Plug-in Enable/Disable

You can enable or disable plug-ins. This is useful for disabling plug-ins that you have installed but are no longer using. See *Enabling and Disabling Plug-ins* in Chapter 11, *Using LNS Plug-Ins*, for more information on enabling and disabling plug-ins.

LNS Network Database

The LonMaker Turbo Editions includes new features to help you backup, validate, repair, and synchronize your network database. These features are described in the following sections.

LNS Hot Backup

You can make a hot backup of the network database while you or another user is working in the same network—without disrupting the other LNS applications. A *hot backup* is a backup that is created while one or more LNS applications are accessing the LNS network database. The LonMaker tool creates the hot backup as a shadow copy of the LNS network database.

To use hot backups, select the **Use LNS Hot Backup** check box in the network properties: **Backup/Restore** options category. This check box is selected by default. When you attempt to back up your network in the LonMaker drawing and another application is accessing the LNS network database, the LonMaker tool automatically creates a hot backup of that database.

If this check box is cleared, you can still use the hot backup feature. When you attempt to back up your network in the LonMaker drawing, a prompt will open giving you the option to close all applications accessing the network database or make a hot backup. Click **Yes** to make a hot backup.

See *Manually Backing Up a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on using hot backups.

Scheduled Backups

You can use the LonMaker tool (and the Windows Task Scheduler) to automatically backup the network database periodically. To use the LonMaker tool to schedule automatic backups, open the network properties: **Backup/Restore** options category and enter the desired database backup interval in the **Database Backup** field under the **Auto Save Interval** box. The LonMaker tool will then create a hot backup of the network every n minutes, where n is the specified backup interval.

See *Scheduling Drawing Saves and Database Backups* in Chapter 7, *Maintaining Networks*, for more information on scheduling automatic database backups.

Automatic Resynchronization

The LonMaker tool will attempt to automatically resynchronize a LonMaker drawing to its network database when it detects an inconsistency internally or between the drawing and the database. This resynchronization will be transparent, except that you may notice a slightly lower response time during the resynchronization. The LonMaker tool will perform an automatic resynchronization when a Visio shape in the LonMaker drawing or a LonMaker object in the LNS database is missing or cannot be found, or when there is missing or incorrect information in the LonMaker drawing. If the automatic resynchronization fails for any reason, you will be prompted to manually resynchronize the LonMaker drawing to the network database.

See *Automatic LonMaker Drawing Synchronization* in Chapter 7, *Maintaining Networks*, for more information on this feature.

Database Validation and Repair

You can validate the structure of and repair the LNS network database and optionally resynchronize the LonMaker drawing to the repaired database. You must be using the LonMaker tool on a local client to use the database validation and repair features.

See *Manual Network Synchronization* in Chapter 7, *Maintaining Networks*, for more information on this feature.

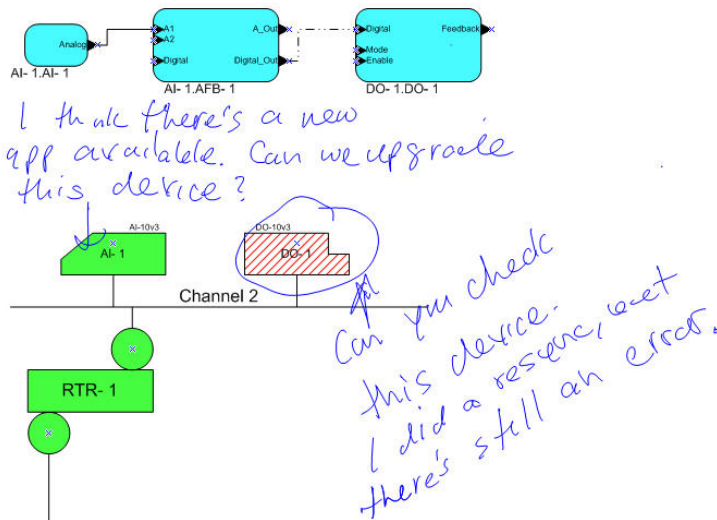
Visio 2003 Integration

Tablet PC Support

You can run the LonMaker tool on a Tablet PC. The ease of portability of a Tablet PC makes it ideal for installing a network under the ad-hoc system scenario, in which you both design and commission the network onsite. You can wirelessly connect the Tablet PC to an i.Lon IP-852 router that is attached to the physical network, and then carry the Tablet PC around the site, designing the LonMaker drawing and commissioning devices at the same time. Using the LonMaker tool on a Tablet PC also makes it easy to make last-minute changes or additions to an engineered design (a LonMaker network designed offsite and then installed), and upgrade and replace devices.

LonMaker Drawing Markup with Digital Ink

Using the digital ink feature in Visio 2003 on a Tablet PC, you can easily markup a LonMaker drawing with a special tablet pen, and save the markup as part of the drawing. The markups can be included in a LonMaker backup and then later restored. Digital ink provides an effective means for designers and integrators to communicate with each other as demonstrated in the following figure.



Windows Compatibility

You can use the LonMaker tool on a computer running Windows XP (Professional, Home, and Tablet PC 2005 Editions), Windows 2003 Server, or Windows 2000.

Professional, Standard, and Trial Editions

Three editions of the LonMaker Turbo Integration Tool are available: Professional, Standard, and Trial. These editions differ in the edition of Visio 2003 included (Professional or Standard), number of LonMaker credits included, and the expiration of the LonMaker tool software license. The advantage of Visio 2003 Professional is that it includes all of the business diagramming tools of the Standard edition, as well as additional comprehensive technical and drawing solutions.

Professional Edition

The professional edition ships with Visio 2003 Professional, comes with 64 LonMaker credits, and does not expire. You can purchase additional LonMaker credits for the professional edition (see *Adding LonMaker Credits*).

Standard Edition

The standard edition ships with Visio 2003 Standard, comes with 5 LonMaker credits, and does not expire. You can purchase additional LonMaker credits for the standard edition (see *Adding LonMaker Credits*).

Trial Edition

The trial edition ships with a 30-day evaluation copy of Visio 2003 Professional, does not come with any LonMaker credits, and requires licensing the professional or standard edition to continue using the LonMaker tool after the 30-day trial period ends. The trial edition also has the following restrictions:

- All drawings created with the trial edition include a “LonMaker Demonstration Network” banner in the background.
- Networks are limited to a maximum of six devices.
- You cannot add LonMaker credits using the trial edition.

LonMaker Network Designs

A LonMaker Network Design consists of an *LNS network database* and a *LonMaker drawing*.

LNS Network Database

An LNS network database contains definitions of the devices contained within a LonMaker drawing, including information such as the name, address, application configuration, and network connections for each device. Whenever you change a LonMaker drawing, the LonMaker tool automatically uses LNS services to update the information in the LNS network database associated with the LonMaker drawing.

Every LonMaker drawing is associated with an LNS network database, and the LNS network database is always located on the computer with the LNS Server. The LNS Server may be located on the same computer as the LonMaker tool, or it may be located on a different computer. You can maintain backup copies of the LNS network database, and you can move the LNS Server and LNS network database to a backup computer. See *Backing Up a LonMaker Network Design* in Chapter 7, *Maintaining Networks*, for more information.

LonMaker Drawing

A *LonMaker drawing* contains the graphical representation of the LONWORKS network. A LonMaker drawing consists of one or more drawing files, and the drawing files consist of one or more pages that each represent a *subsystem*. One drawing file is designated as the *top-level drawing file*; this drawing file is the one created when you create a new LonMaker network design. A subsystem within the top-level drawing file is designated as the top-level subsystem; this subsystem is represented by the first page of the drawing that you create when you create a new LonMaker network design.

A LonMaker drawing is always located on the computer running the LonMaker tool. If you are running multiple LonMaker tools on the same LonMaker drawing, each computer running a LonMaker tool must have a copy of the LonMaker drawing. The LonMaker tool automatically keeps these multiple copied synchronized. Multiple-user operation is described in *Managing Multiple Remote Clients* in Chapter 3, *Getting Started*.

LONWORKS Basics

This section provides an overview of the following topics and defines related terms:

- LONWORKS networks
- LonMaker client types

The *Glossary* in Appendix G provides a quick reference for specific terms.

LONWORKS Networks

A LONWORKS network consists of intelligent *devices* (such as sensors, actuators, and controllers) that communicate with each other using a common *protocol* over one or more *channels*. Network devices are sometimes called *nodes*.

Devices

Each *device* includes one or more processors and a *transceiver*. The processor(s) provide the device's intelligence and implement a communications protocol. The transceiver serves as the device's electrical interface to the communications channel.

Devices communicate by publishing and subscribing to information on the network. The applications on different devices are not synchronized, and thus it is possible that multiple devices may all try to publish information at the same time. Meaningful transfer of information between devices on a network therefore requires organization in the form of a set of rules and procedures. These rules and procedures are the *communication protocol*, which is referred to as the *protocol*.

Protocol

The protocol defines the format of the messages being transmitted between devices, and it defines the actions expected when one device sends a message to another. The protocol normally takes the form of embedded software or firmware code in each device on the network. The protocol used on LONWORKS networks is defined by the ANSI/CEA-709.1 (EN14908) standard. Echelon's implementation of this standard is called the *LonTalk[®] protocol*. This document refers to the ANSI/CEA-709.1 (EN14908) protocol as the LonTalk protocol, though all conforming implementations of the ANSI/CEA-709.1 (EN14908) protocol are compatible.

Device Templates

A *device template* contains all the attributes of a given device type, such as its functional blocks, network variables, and configuration properties.

Channels

A *channel* is the physical media between devices upon which the devices communicate. The LonTalk protocol is media independent; therefore, numerous types of media can be used for channels: twisted pair, power line, fiber optics, IP, and radio frequency (RF) to name a few. Channels are categorized into *channel types*, and the channel types are characterized by the device transceiver. Common channel types include TP/FT-10 (ANSI/CEA-709.3 twisted pair free topology channel), TP/XF-1250 (high-speed twisted pair channel), PL-20 (ANSI/CEA-709.2 power line channel), FO-20 (ANSI/CEA-709.4 fiber optics channel), and IP-852 (ANSI/CEA-852 IP channel).

Different transceivers may be able to interoperate on the same channel; therefore, each transceiver type specifies the channel type or types that it supports. The choice of channel type affects transmission speed and distance as well as the network topology.

Routers

Multiple channels can be connected using *routers*. Routers are used to manage network message traffic, extend the physical size of a channel (both length and number of devices attached), and connect different channel types. Unlike other devices, routers are always attached to two or more channels.

Applications

Every device contains an *application*, which helps determine how a device functions. The application may be in the device when you purchase it, or you may load it into the device from application files (.nld, .apb, and .nxe extensions) using the LonMaker tool.

Applications in devices are divided into one or more *functional blocks*. A functional block is a collection of *network variables* and *configuration properties* that are used together to perform one task. For example, a four-port digital input module may have four digital input functional blocks that contain the configuration properties and output network variable for each of the four hardware digital inputs on the device.

Network Variables

Network variables allow a device to send and receive data over the network to and from other devices. Network variables are data items (such as temperature, the state of a switch, or actuator position setting) that a particular device application program expects to receive from other devices on the network (an *input network variable*) or expects to make available to other devices on the network (an *output network variable*).

Configuration Properties

Configuration properties define how an application device behaves by determining the manner in which data is manipulated and when it is transmitted. Configuration properties determine the functions to be performed on the values stored in the network variables. For example, a configuration property may specify a minimum change that must occur on a physical input to a device before the corresponding output network variable is updated.

Standard Network Variable and Configuration Property Types

Every network variable and configuration property has a type, which determines the content and structure of the data. To enable devices from different manufacturers to interoperate, the following standard types are defined:

- *Standard Network Variable Types (SNVTs, pronounced snivits)*. SNVTs contain many common operational data types. For example, **SNVT_temp_p** is a network variable type for network variables containing temperature as a fixed-point number.
- *Standard Configuration Property Types (SCPTs, pronounced skipits)*. SCPTs contain many common configuration data types. For example, **SCPT_location** is a configuration property type for configuration properties containing the device location as a text string.

See types.lonmark.org/index for a list and description of all SNVTs and SCPTs.

User-defined Standard Network Variable and Configuration Property Types

Applications may use manufacturer-defined non-standard types—user network variable types (UNVTs) and user configuration property types (UCPTs)—which are defined in user resource files. Device manufacturers may provide additional resource files that define these types. See the *NodeBuilder Resource Editor User's Guide* for additional information on creating or using these files.

Network Variable Connections

The application program in a device does not need to know anything about where input network variables come from or where output network variables go. When the application program has a changed value for an output network variable, it simply passes the new value to the device firmware. Through a process called *binding* that takes place during network design and installation, the device firmware is configured to know the logical address of the other device or group of devices in the network expecting that network variable. It assembles and sends the appropriate packets to these devices. Similarly, when the device firmware receives an updated value for an input network variable required by its application program, it passes the data to the application program. The binding process thus creates logical *connections* between output network variables on one or more devices and input network variables on one or more devices. Connections may be thought of as “virtual wires.”

Subsystems

Devices, routers, and functional blocks are contained in *subsystems*. With the LonMaker tool, each subsystem corresponds to one page within a LonMaker drawing. Subsystems allow you to place devices, routers, and functional blocks onto separate pages for organizational purposes. You may also nest subsystems in other subsystems, allowing you to create a subsystem hierarchy for large networks. For example, a network may consist of HVAC, lighting, security, and operator subsystems. These may be further divided into subsystems for each floor, and each floor divided into subsystems for each room.

Supernodes

Using the LonMaker tool, you can also use subsystems to create *supernodes*. A supernode is a subsystem with its own network variable interface. You can use supernodes to organize groups of devices into logical units and to hide complex subsystem details, exposing only the most important network variables. This structure reduces errors and decreases the time required for network engineering and commissioning. A network variable interface for a supernode may contain any network variable on any device functional block found within the supernode or in any of its nested subsystems.

LonMaker Client Types

The LonMaker *client type* determines the location of the LonMaker tool in relation to the LNS server. The LonMaker tool supports the following three client types:

- A *local client* is a LonMaker computer that is also running the LNS Server.
- A *remote full client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) over a LonWorks channel (an IP-852 or TP/XF-1250 channel). On a remote full client, network management tasks are routed through the LNS Server, but monitoring and controlling tasks are sent directly to the network without going through the LNS Server.
- A *remote lightweight client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) using an LNS/IP interface. On a remote lightweight client, network management, monitoring, and controlling tasks are all routed through the LNS Server. This means that all network variable reads and writes are routed through the LNS Server. This routing creates a potential bottleneck in the LNS Server if there are multiple remote lightweight clients monitoring and control multiple data points simultaneously.

Visio Basics

The LonMaker tool is built on the Visio 2003 drawing tool to provide a robust technical drawing environment for network design. A LonMaker drawing consists of one or more drawing files, and each drawing file contains multiple subsystems that are each displayed on individual Visio pages. The Visio documentation provides detailed descriptions of Visio commands and capabilities.

Two key Visio concepts are *shapes* and *stencils*. Shapes are reusable drawing objects. A shape may represent a simple drawing object such as a line, arc, circle, or square, or it may represent a complex drawing object with special behavior such as a LonMaker device or functional block shape.

To simplify finding and reusing shapes, Visio defines a special type of drawing called a *stencil*. A shape contained on a stencil is called a *master shape*. When you drag a master shape from a stencil to one of your drawing pages, Visio automatically makes a copy of the master shape on your drawing and leaves the master shape unchanged on the stencil.

You can create *custom master shapes* and stencils for any set of LonMaker shapes. For example, the LonMaker tool includes custom master shapes and a custom stencil for LonPoint devices and functional blocks. You may wish to create your own custom master shapes and stencils to speed up network design. See Chapter 12, *Creating and Using Custom LonMaker Master Shapes*, for more information.

To simplify access to your most commonly used stencils and drawing options, Visio defines another type of drawing called a *template*. Templates are drawings that may be used as the starting point when you create a new drawing. The LonMaker tool includes a LONWORKS template that is used automatically when you create a LonMaker drawing. If you wish, you can create your own custom LonMaker template and select it as the default template in the *LonMaker Design Manager*.

Installing and Activating the LonMaker Tool

This chapter lists the hardware requirements for using the LonMaker tool; describes how to install the various software and components included in your copy of the LonMaker tool; and describes how to activate the LonMaker tool.

Hardware Requirements

This section describes the hardware requirements and recommendations for your computer when using the LonMaker tool. If you are engineering a network with more than 200 devices, see the additional recommendations for the LNS Server and the LonMaker computer in *Enhancements for Engineering Large Networks*.

Minimum Hardware Requirements

The LonMaker tool requires a personal computer that meets the following requirements:

- Microsoft Windows XP (Professional, Home, Tablet PC editions), Windows 2003 server, or Windows 2000
- Pentium III, Pentium 4, or better
- 350 megabytes (MB) free hard-disk space
- 512 MB RAM minimum
- 1,024 MB page file minimum
- CD-ROM drive
- Super VGA (800 × 600) or higher-resolution display with at least 256 colors
- Mouse or compatible pointing device

To commission, configure, replace, monitor, or control devices, a network interface that is compatible with IP or LNS is required. Compatible network interfaces include the *i*.LON 10 and *i*.LON 100 IP interfaces; U10 and U20 USB interfaces; PCC-10 PC Card, PCLTA-20 and 21 PCI Cards, SLTA-10 Serial LonTalk Adapter, and an Ethernet card used with an *i*.LON 100 with IP-852 routing or an *i*.LON 600 router.

The memory required is affected by the number of plug-ins, LNS applications, and other Windows applications that are running simultaneously. More than 512 MB may be required if you are running multiple plug-ins or applications.

A 100 MB or larger removable or remote storage media drive, such as a USB drive or a remote file server, is recommended for saving LonMaker backup files.

Enhancements for Engineering Large Networks

High-performance hardware is essential when engineering large networks. The disk for the LNS Server should have a sustained transfer rate greater than a 20 MB per second with an average seek time less than an 8 milliseconds (ms). This transfer rate can be met with an IDE drive using an SATA, UltraATA/100, Ultra SCSI, or faster interface. You can further increase performance and reliability by using a redundant striped disk configuration such as a RAID 5 disk array.

For large networks, the LonMaker computer should be at least a 2GHz Pentium 4 running Windows XP, Windows Server 2003, or Windows 2000 with at least 1 GB of memory and a 1,500 MB minimum page file. The speed, operating system, and memory size is not as important for commissioning the network; therefore, a slower and smaller laptop with at least 512 MB RAM is suitable for commissioning devices.

Installing the LonMaker Tool

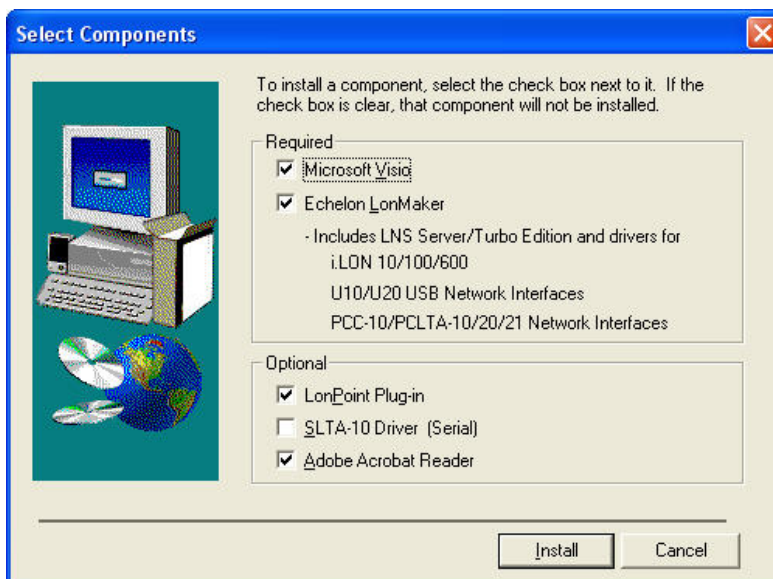
You can install a licensed copy of the LonMaker tool on up to two computers, a *primary* and a *secondary* computer, provided that the following requirements are met: only the LonMaker user on the primary computer can use the copy of the LonMaker tool on the secondary computer; the LonMaker software may only be used on one computer at a time; and the secondary computer cannot be used to

commission or recover LONWORKS devices. See the LonMaker Software License Agreement in Appendix E for additional restrictions. To begin your installation, follow these steps:

1. If you previously installed a LonMaker Trial Edition and you are now installing one of the full editions, you must first uninstall the Visio Trial software. If you do not uninstall the Visio Trial software first, the LonMaker software will be installed, but the full version of Visio will not.

If you already have a licensed copy of the LonMaker Integration Tool, you cannot install the LonMaker Trial Edition.

2. Close all running Windows applications.
3. Disable any LONWORKS services.
4. Insert the LonMaker CD into your CD-ROM drive.
5. If the LonMaker setup application does not launch immediately, click **Start** on the taskbar and then click **Run**. Browse to the LMWSetup application on the LonMaker CD and click **Open**. The **Select Components** dialog box opens.



6. Select the components that you wish to install by selecting the appropriate check boxes on the **Select Components** dialog box.

Visio: Installs the Visio 2003 drawing tool. If you have an existing installation of Visio, you still must install Visio from the LonMaker CD if you do not have Visio 2003.

LonMaker Integration Tool: Installs the required components of the LonMaker tool. Installing the LonMaker tool automatically installs the LNS Turbo Edition network operating system, and the drivers for the following network interfaces: the *i*.LON 10 Ethernet Adapter, *i*.LON 100 Internet Server, and *i*.Lon 600 LONWORKS/IP Server; U10/U20 USB network interfaces; and PCC-10 and PCLTA-10, 20, and 21 PCI network interfaces. One of these interfaces or another network interface that is compatible with LNS is required for using the LonMaker tool on a LONWORKS channel.

If you are using the LonMaker tool on an IP-852 channel, you will need an IP network interface (such as Ethernet) card or modem with PPP software. An IP network interface is also required if you are using an *i*.LON 10 or *i*.LON 100 Internet Server as an IP-852 interface.

If you are using another LNS or IP network interface, install the network interface hardware and driver following the instructions provided with the hardware.

Most network interfaces include an application that handles network interface configuration. You must perform this configuration before you can use the LonMaker tool attached to a network. The application handles host details such as IRQ assignment and also manages network parameters such as buffer counts and transceiver types.

To open the network interface application, click **Start** on the taskbar, point to **Programs** (Windows 2000), and click **Control Panel**. The available network interface applications include **LonWorks Interfaces**, **LonWorks NI**, and **LonWorks Plug 'n Play**.

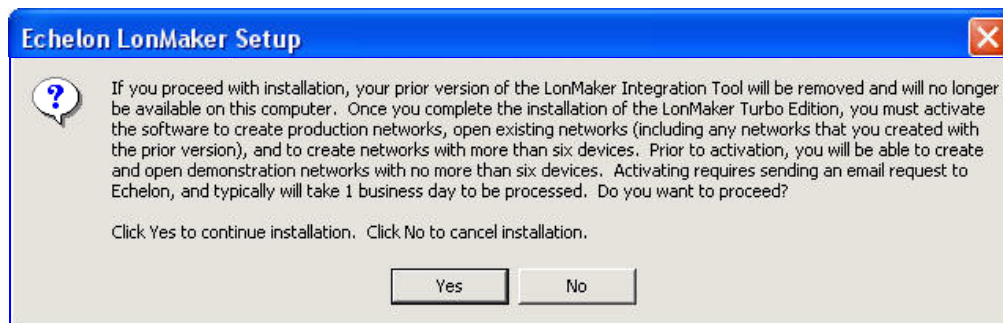
- You can use the **LonWorks Interfaces** application to configure IP-852 interfaces (the *i.LON* 10 Ethernet Adapter, *i.LONe3* 100 Internet Server, *i.LON* 600 LONWORKS/IP Server, and the *i.LON* 1000 Internet Server) and U10/U20 USB network interfaces.
- You can use the **LonWorks NI** and **LonWorks Plug 'n Play** applications to configure the PCLTA-10, 20, and 21 PCI network interfaces.

LonPoint Plug-In Installs the LonPoint plug-in. Click this checkbox if you are using LonPoint devices, or if you want to use any of the LonPoint examples.

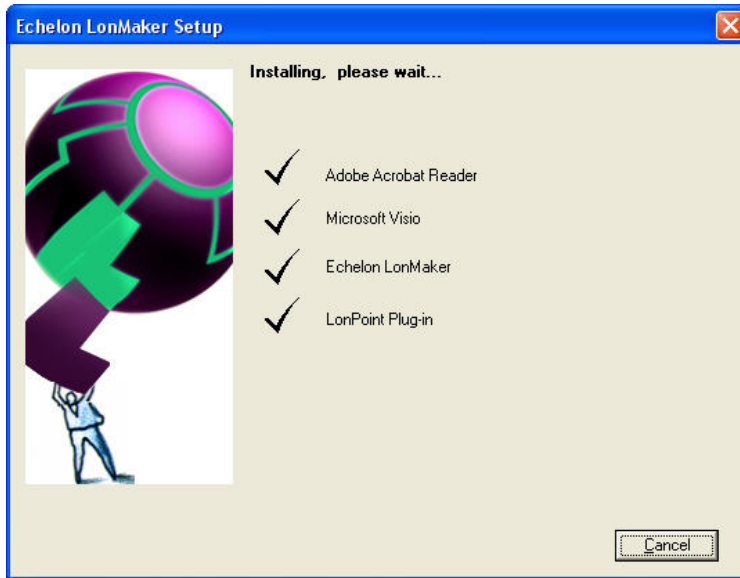
SLTA-10 Driver: Installs the network driver for the SLTA-10 serial network interface. Click this checkbox if you are using an SLTA-10 serial adapter as your network interface.

Adobe Acrobat Reader: Installs the Adobe Acrobat Reader which is a free program that allows you to read Adobe Acrobat portable document files (.pdf extension). Many of the LONMARK reference documents are exclusively in PDF format. You can clear this checkbox if you already have an Acrobat reader.

7. Click **Install**. A message appears informing you that installing the LonMaker Turbo Edition will remove any prior version of the LonMaker Integration Tool on your computer.



8. Click **Yes** to continue installing the LonMaker Turbo Integration Tool. The installation program installs the selected components sequentially, prompting you for required reboots.
9. If you are installing the trial edition of the LonMaker tool, you must activate Visio before you can use the LonMaker tool. See the activation instructions provided with the trial edition for details.
10. During the installation, the following dialog appears, displaying the current status of the LonMaker setup:



11. When all of the selected components have been installed, a dialog appears informing you that the setup has been completed and prompting you whether to reboot your computer now or later. You must reboot your computer before beginning to use the LonMaker tool.



Installing Visio

1. If you selected the Visio component in the Select Components window, The Microsoft Visio setup wizard appears when you click **Install**.
2. Follow the instructions in the installation program to complete the Visio setup. You will be asked to enter a Product ID if you have not previously installed Visio 2003. If you are installing the LonMaker Professional or Standard Edition, enter the Product ID shown on the back of your LonMaker CD case. If there are two serial numbers on the back of your CD case, the top number is the Visio product ID. If you are installing the LonMaker Trial Edition, enter the Product Key as described in the trial edition activation instructions. See your Visio documentation for more information on the Visio installation process.

The Visio installation may suggest that you exit LonMaker setup. You can safely disregard this message by clicking **Ignore**.

To keep an existing Visio installation, install the Visio program on the LonMaker CD into a new directory.

3. When the Visio installation has finished, the following dialog appears, informing you that the setup has been completed.



4. Click **Finish**.

Notes:

- Before you do any further required reboots, you should install the Visio 2003 Service Pack 2 on the LonMaker CD. To install this service pack, click **Start** on the taskbar, select **Run**, click **Browse**, double-click the **Visio SP2** folder on the LonMaker CD, and then double-click the **Visio2003SP2-KB887622-FullFile-ENU.exe** file. Follow the on-screen instructions to complete the installation. For more information on Visio 2003 Service Pack 2, go to www.microsoft.com/downloads/details.aspx?FamilyId=C36D4B49-1910-4FF3-A525-47368F6E5FDD&displaylang=en
- If multiple versions of Visio are installed on your computer, the LonMaker tool will use the last Visio program that you used. Therefore, if you use a version of Visio other than the one supplied on the LonMaker CD, you must start and exit the copy of Visio included with the LonMaker tool before you start the LonMaker tool. Alternatively, you can open your network from within the copy of Visio included with the LonMaker tool by opening the **File** menu, clicking **Open**, selecting a drawing directory, and then selecting the drawing file you want to open.

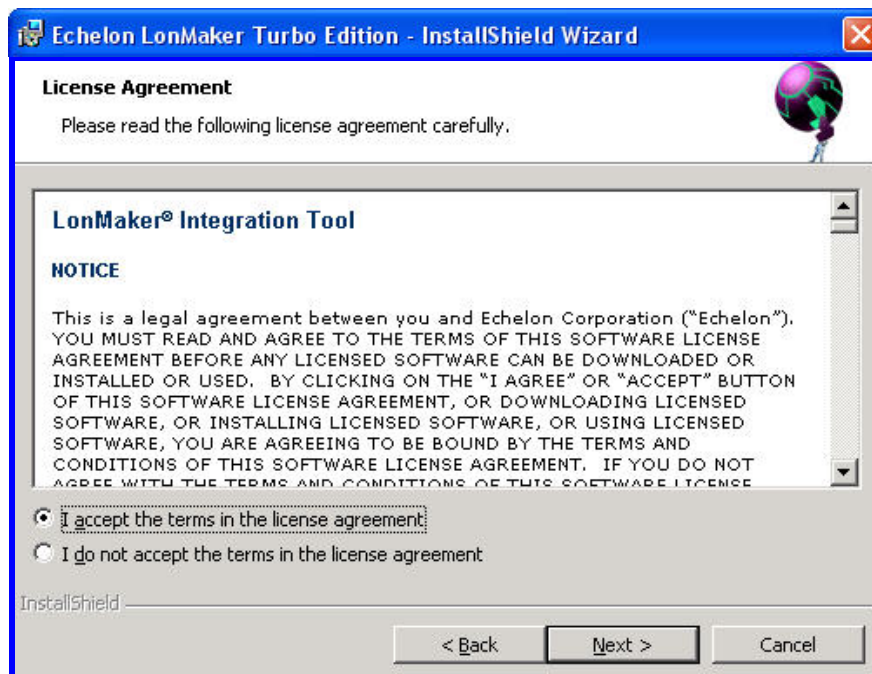
Once Visio installation is complete, the installation of the LonMaker tool automatically begins as described in *Installing the LonMaker Integration Tool*.

Installing the LonMaker Integration Tool

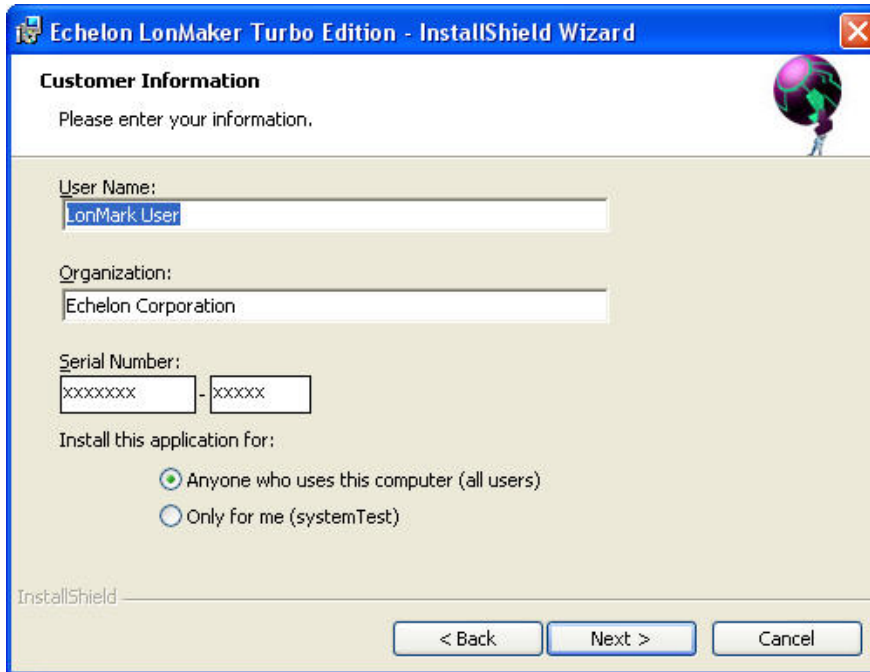
1. The LonMaker setup program begins automatically with the Welcome window opening.



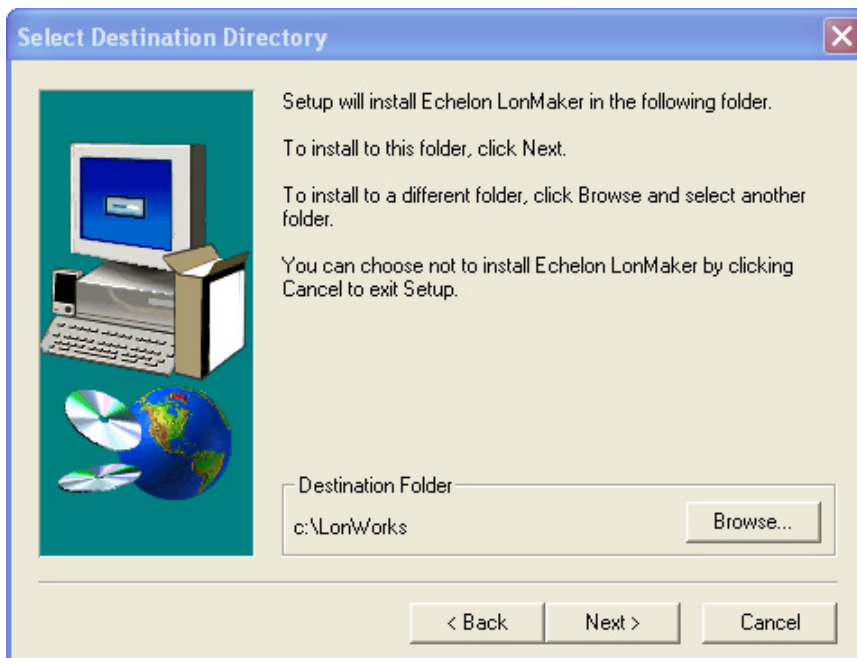
2. Read the information on the Welcome window and click **Next**. The License Agreement window appears.



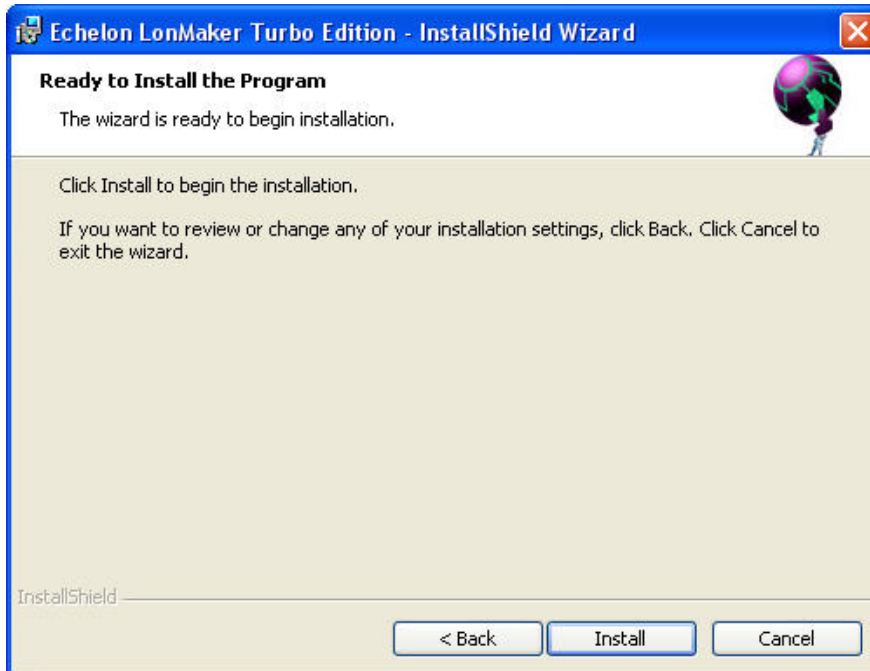
3. Read the license agreement and click **Yes** if you agree with the terms. The User Information window appears.



4. Enter your name, company name, and the LonMaker serial number in the appropriate fields. The name and company may be entered automatically based on the user currently logged on and whether other Echelon products are installed on your computer. If you did not license an upgrade version, the serial number is located on the back of your LonMaker CD case. If there are two serial numbers on the back of your CD case, the second number is the LonMaker serial number. Save this number. If you licensed an upgrade version, your serial number is located on the back of your original LonMaker CD case. It will be automatically displayed if you install your upgrade on the same computer as your original LonMaker software. If you are installing on a different computer, you must find the serial number that you saved from your original version of the LonMaker tool. Click **Next**. The Destination Location window appears if the LonWorks path was not set in the computer registry prior to installing the LonMaker CD.



5. If the Destination Location window appears, choose a LONWORKS folder in which you want the LonMaker software installed. The LonMaker software will be installed in a LonMaker folder below the LONWORKS folder that you specify. If you installed other Echelon software on this computer, use the same LONWORKS folder. The default LONWORKS folder is C:\LonWorks. If you previously installed other Echelon software on this computer, the last LonWorks folder that you selected will be displayed as the default, and you should not change this value.
6. The Ready to Install window appears. Click **Install** to begin the LonMaker installation.



7. If you need to reboot your computer, a window will appear prompting you to select to reboot your computer now or later. After the LonMaker tool installation and any required reboots have been completed, a window will appear, stating that the LonMaker tool has been installed successfully and providing you with the option to view the ReadMe file. The ReadMe file contains information that is not included in this user's guide.
8. Click **Finish**. The ReadMe file appears.
9. When you finish reading the ReadMe file, close the window.

Note: When you install the LonMaker tool, you may get a "Your license has expired" error if the LonMaker software was previously installed on the same computer and subsequently removed. To activate your license, add LonMaker credits.

Installing the LonPoint Applications, Plug-in, and Utilities

If you select the LonPoint Plug-in check box in the **Select Components** dialog, the LonPoint installation program automatically starts following the LonMaker installation. The LonPoint Installation window appears. Complete the following steps:

1. Read the information on the **Welcome** dialog, and click **Next**. A license agreement dialog appears.
2. Click **Yes** if you agree with the terms of the agreement. The Registration window appears.
3. Enter your name and company name, and click **Next**. The Choose Destination Directory window appears.

4. Choose a LONWORKS folder for the plug-in. You must use the same LONWORKS folder in which you installed the LonMaker tool. The default is C:\LonWorks. Click **Next**. The Select Echelon Application Image Version window appears.
5. If this is a new installation, use LonPoint firmware version 3 instead of version 2. This window allows you to install a copy of version 2 firmware if you need the capability to install devices with this older firmware. Do not select the option to install application image version 2 files unless you intend to install version 2 devices in new networks instead of upgrading to version 3. See the LonPoint Application and Plug-in help file for more information. Click **Next**. The select Program Folder window appears.
6. Select an existing LONWORKS program folder or type in the name of a new one. The default program folder name is Echelon LonPoint Software. Click **Next**.
7. The LonPoint applications, plug-in, and utilities install on your computer. View the ReadMe file when prompted to do so, and then click **Finish**.

Installing and Configuring Network Drivers

The LonMaker tool will automatically install the drivers for the *i*.LON 10 Ethernet Adapter, *i*.LON 100 Internet Server, and *i*.Lon 600 LonWorks/IP Server; U10/U20 USB LNS network interfaces; and PCC-10 and PCLTA 10, 20, and 21 LNS network interfaces.

If you are using an *i*.LON 10 or *i*.LON 100 as a network interface, configure the interface as described in the user manuals for those devices.

If you are using a PCC-10, PCLTA-10, or PCLTA-20 LONWORKS network interface, configure the network driver you installed per the instructions in Appendix B.

Installing Adobe Acrobat Reader

If you select the **Adobe Acrobat Reader** check box in the **Select Components** dialog, the Adobe Acrobat Reader setup program begins automatically. Follow the instructions in the setup program to complete your Adobe Acrobat Reader installation.

Activating the LonMaker Tool

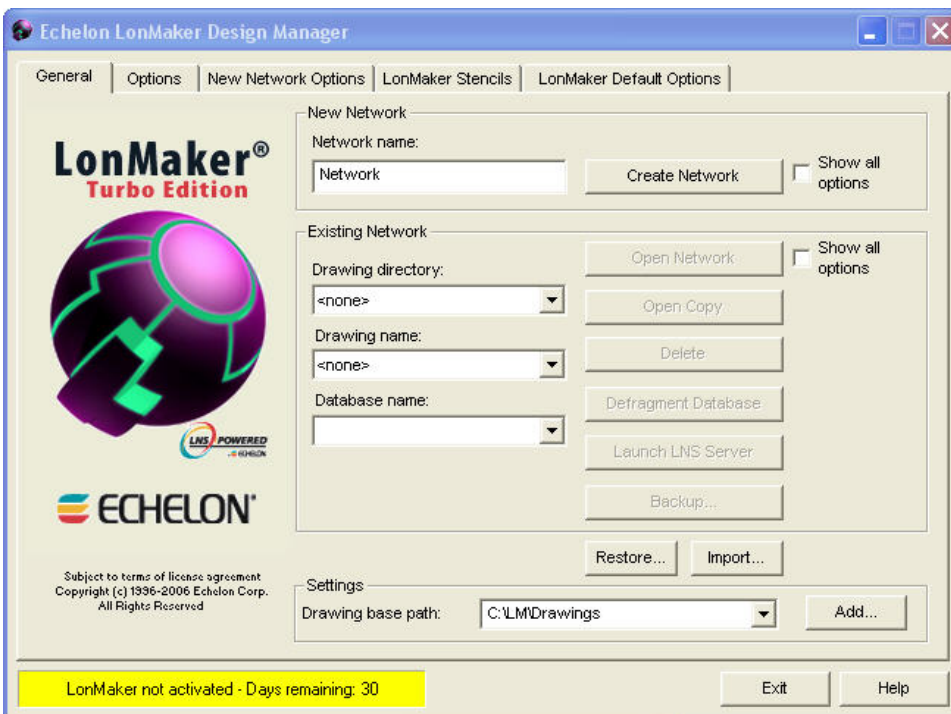
You must activate your copy of the LonMaker tool in order to access all of its features. Until it is activated, the LonMaker tool will run in demo mode for a maximum of 30 days. This means that during the 30-day demo period, you will not be able to open production networks and your demo networks will be limited to six devices. In addition, you will not be able to convert your demo networks into production networks after you activate the LonMaker tool. This means that demo networks are permanently limited to six devices.

Prior to activation, the **LonMaker Product Activation** dialog will appear each time you start the LonMaker Design Manager or open a LonMaker drawing. This dialog reminds you that your LonMaker tool has not yet been activated, and it will state the number of days that your LonMaker tool will continue to function.



Click **Run Activation Wizard** in the **LonMaker Product Activation** dialog to begin the activation process or click **Continue** to keep running the LonMaker tool in demo mode.

The LonMaker license status box in the bottom left-hand corner of the LonMaker Design Manager also indicates that your copy of the LonMaker tool has not been activated and the number of days your LonMaker tool will continue to function.



To activate your LonMaker tool, create and send an activation request to your license administrator, and then enter the activation key that the license administrator sends to you as described in the following sections.

Creating and Sending an Activation Request

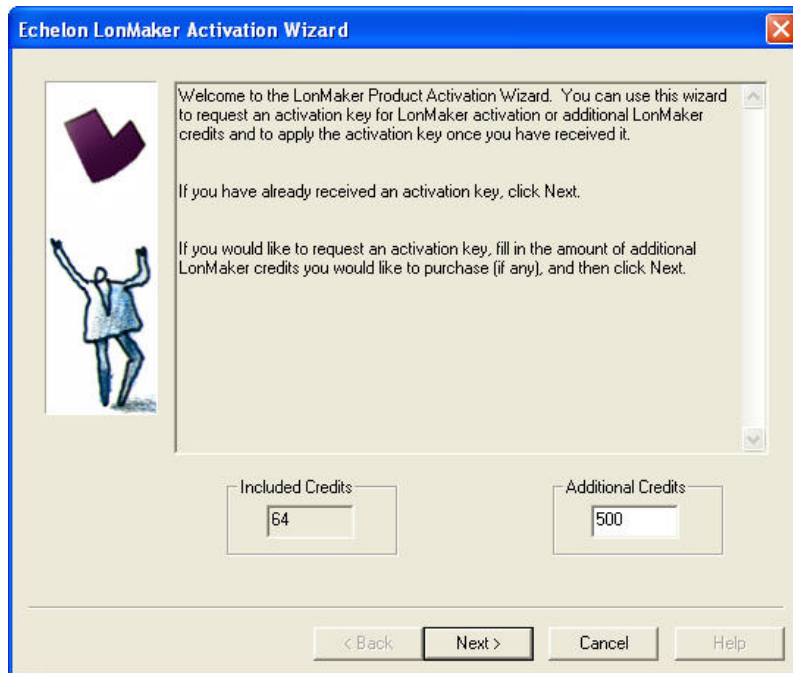
You can request one free activation key for each copy of the LonMaker software that you license. You can also purchase additional LonMaker credits with your activation request. There is no minimum order.

To create and send an activation request, follow these steps:

1. Start the LonMaker Design Manager or open a LonMaker drawing. The **LonMaker Product Activation** dialog appears.

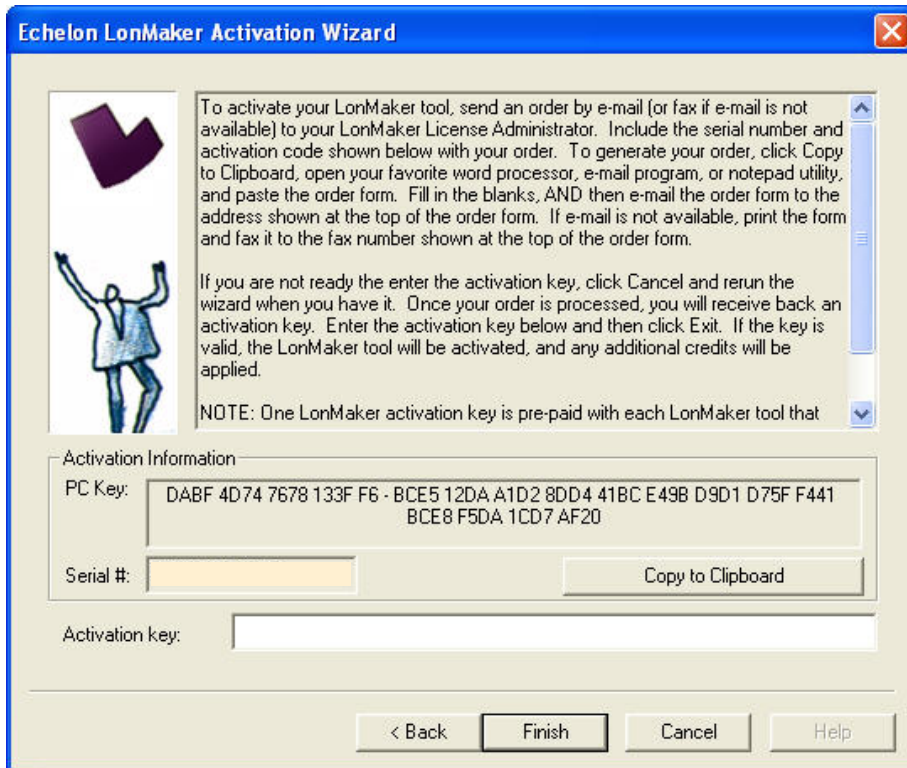


2. Click **Run Activation Wizard**. The LonMaker Activation wizard appears.



If you click **Continue**, you can still access this dialog and begin the activation process by completing the following steps:

- From the LonMaker Design Manager, double-click anywhere on the LonMaker license status box at the bottom left-hand corner, or right-click the title bar or taskbar button and then click **Activate LonMaker** on the shortcut menu.
 - In the LonMaker drawing, open the **LonMaker** menu, click **Activate LonMaker**, and then click **Run Activation Wizard** in the **LonMaker Product Activation** dialog.
3. The number of credits included with your copy of the LonMaker tool (64 for the Professional Edition or 5 for the Standard Edition) appears in the **Included Credits** box. To purchase additional credits, enter the number credits in the **Additional Credits** box. Click **Next**. The **Activation Information** dialog appears.



4. The wizard displays the **PC Key** (also called the *activation code*), which uniquely identifies your copy of the LonMaker tool and the computer running the LonMaker tool, and the **Serial number** of your LonMaker tool. Click **Copy to Clipboard**.
5. An activation request form is created that includes your request to activate your copy of the LonMaker software, the PC key (activation code), and the serial number.
6. Send the activation request form to your license administrator via e-mail, fax, or mail.
 - To e-mail the activation form, copy it to an e-mail message using your e-mail application and then e-mail it to the e-mail address at the top of the request form. You should receive an activation key within one business day.
 - To fax or mail the activation request form, copy it to a text file, print it, and then fax to the fax number or mail to the address on the activation request form.

If you are purchasing additional credits, make sure you provide your purchase order or credit card information in the activation request.

Entering an Activation Key

Once you receive your activation key from your license administrator, follow these steps to activate your copy of the LonMaker tool:

1. Start the LonMaker Design Manager or open a LonMaker drawing. The **LonMaker Product Activation** dialog appears.
2. Click **Run Activation Wizard**. The LonMaker Activation wizard appears.
3. Click **Next**. The **Activation Information** dialog appears.
4. Enter the activation key in the **Activation Key** box.
5. Click **Finish**. The following dialog appears, informing you that your LonMaker tool has been activated.



6. Click **OK**.
7. Exit and then re-open the LonMaker Design Manager to begin using your activated LonMaker tool. Any additional credits purchased will be applied.

Getting Started

This chapter provides information on the planning a LonMaker network design; using the LonMaker Design Manager; setting up a network interface; creating and opening a LonMaker network design; LonMaker client types; using the LonMaker tool remotely; using Network Device shapes; and creating and using user profiles.

Design Overview

To prepare to design a LonMaker network, follow these steps:

1. Define network requirements and organization.
2. Select a network installation scenario.
3. Determine user permissions for viewing and changing the network.
4. Optimize network performance.

Defining Network Requirements and Organization

You can define your network's requirements by evaluating which devices (sensors, actuators, and controllers) are needed to achieve the desired network functions and how the devices will be integrated into the network. For example, your network may need a simple fan coil unit, which could require a fan start/stop relay, a cooling coil valve, and a supply air temperature sensor. You could use DO-10, AO-10, and AI-10 LonPoint Interface Modules, respectively, to integrate these devices (the AO-10 module also includes a PID controller you can use to control the fan coil unit).

Once you define the network requirements, you can figure out how to organize the network in the LonMaker tool. You can help organize the network by answering the following questions:

- How will devices and functional blocks be grouped within subsystems?
- Which functional blocks are needed for the devices to accomplish desired tasks?
- How do functional blocks need to be configured and connected to correctly interpret values from sensors, perform any necessary calculations, and drive actuators?

Selecting a Network Installation Scenario

You can design your entire network without commissioning any devices until after your design is complete, or you can design your network and commission devices at the same time. These two approaches are called *installation scenarios*. The first network installation scenario is called the *engineered system* and the second is the *ad-hoc system*. You can use both scenarios within a single system, or you can use either exclusively. The best scenario for a given network depends on many factors including the skill level of the installer, desired flexibility for the network, and the end-user requirements.

Engineered System Scenario

The *engineered system scenario* allows you to design the network without having access to the physical devices

First, you design the network offsite using the LonMaker tool. You drag LonMaker shapes representing *devices*, *routers*, *i.LON IP-852 routers*, *functional blocks*, and *connections* from a LonMaker stencil to a LonMaker drawing and arrange them on the drawing, and into multiple subsystems if desired.

Once you are onsite and have attached a LonMaker computer to the network, you then commission the physical devices. The LonMaker tool commissions a device by configuring the physical device to match the configuration that you specified in the LonMaker drawing.

Engineered systems must often be modified during on-site installation due to differences between as-drawn plans and the physical network. The LonMaker tool supports on-site changes to the engineered system to allow for these changes during commissioning.

The advantage of the engineered system scenario is that it makes network installation quick, easy, and error-free because most of the time-consuming data entry and processing is done offsite during the design phase. This scenario is often used for building and industrial automation systems, in which the original design closely matches the actual installation.

Ad-Hoc System Scenario

The *ad-hoc system scenario* allows you to design and install the network onsite. In this scenario, the LonMaker tool loads the network configuration information into each device as you define devices, configurations, and connections. This is different from the engineered system scenario in that information is incrementally loaded to the physical devices.

The advantage of the ad-hoc system scenario is its flexibility, as the installer can make decisions onsite. It is most appropriate for simpler systems in which the details of the system to be installed are not known prior to commissioning.

The disadvantages of the ad-hoc system scenario are that it's slower for large systems and requires the same person to do both the network design and installation.

Determining User Permissions

When you create a LonMaker network design, the LonMaker tool does not assign any security to the network drawing. It defaults to one user—the administrator of the LonMaker drawing. While this default is permissible if one person is performing the network installation in a secure environment, it may not be suitable for multi-user or insecure environments. In these environments, you need to create and manage user profiles to control access to your LonMaker network design. This will prevent any unauthorized changes to your LonMaker network design and enable you to better manage the installation or repair of a system.

User profiles allow you to create access controls for a network drawing and its subsystems and set privileges for actions that can be performed on LonMaker objects. For example, you could have a scenario in which a system integrator has access to the entire network and can add or change application devices and routers, while the installers can also access the entire network, but only can commission the application devices and routers.

You might use a different scenario if you are working with multiple system integrators who are all supplying devices for your network. In this case, you can give each integrator access to their subsystem only but allow them to freely change the subsystem drawing and commission devices. This prevents one integrator from accidentally modifying a drawing created by another integrator.

By default, user profiles are not enabled for new networks. To enable user profiles, you must first assign an Administrator password and create new user profiles as described in *User Profiles*. The Administrator can create, modify, and delete user profiles.

Once you logon as a user other than the Administrator, you can still create new user profiles, as described in *Creating a New User Profile*, and you can change your password as described in *Changing Passwords*.

For information on using user profiles with LonMaker remotely, see *Using the LonMaker Tool Remotely with User Profiles*.

Optimizing LonMaker Network Performance

Many factors affect the performance of a LonMaker network design. The following are guidelines for several aspects of your LonMaker network design that can help optimize network performance—especially for large networks.

Drawing Files

A single drawing file should not be larger than 3MB, or consist of more than 20 typical pages or 10 complex pages. If you are creating a network exceeding these guidelines, design the subsystems in *multiple drawing files*. For optimum performance, devices and their associated functional blocks should be contained within the same drawing file, as should all members of the same connection.

When designing multiple drawing files, organize the individual drawing files as subsystems within the top-level drawing file, and limit the top-level drawing to contain only those subsystems. This minimizes the number of drawing files that must be opened as you descend the subsystem hierarchy.

Avoid deep subsystem hierarchies with long subsystem names that results in long subsystem paths. Subsystem paths may be stored in devices to help the network recovery process if you lose you the network database, but devices have limited memory available to store the network path. Furthermore, visualization tools such as Wonderware's InTouch® have limits to item name lengths that can be exceeded with long subsystem paths.

Network Changes

To improve network performance when making numerous network changes at one time, set the LonMaker tool OffNet. This will allow you to make the changes quickly, as the changes will be saved in the LNS network database instead of being sent to the physical devices. When you finish making the changes, set the LonMaker tool OnNet and the changes are propagated to the physical devices.

Connections

If you will be making changes to a subsystem, limit the number of connections monitored by the LonMaker tool to less than five per subsystem. Having more than five monitored connections in a subsystem will increase the time required to perform certain network management operations. Alternatively, you can turn off all monitoring while making changes by right-clicking a clear space in the subsystem page and clicking **Enable Monitoring** if it is currently set. You can turn monitoring on again after making the changes.

If you are using an LNS application that does not support monitor sets (groups of data points that the LonMaker tool uses to monitor and control network variables) and you are making many bound connections to the LNS application, make the bound connections persistent. This will improve network performance. Conversely, non-persistent bound connections, which can be created in a LonMaker network with LNS applications other than the LonMaker tool, can significantly increase the time required to open and close a LonMaker drawing. LNS tools that support monitor sets, such as the LonMaker tool, enable monitoring of monitor points to be setup quickly once a LonMaker network is opened. This is because points in monitor sets are always persistent. The LonMaker tool automatically creates monitor sets for connection monitoring when monitoring is enabled on a LonMaker network. To enable monitoring, right-click a clear space in the subsystem page and clicking **Enable Monitoring** if it is not currently set. For more information on monitor sets, see the *LNS Programmer's Guide*.

Sharing the LNS Interface with the LNS DDE Server

If the LNS DDE Server and the LonMaker tool are running concurrently and sharing the same LNS network interface, limit the polling rate of the LNS DDE server to 10 polls per second on a LONWORKS channel. Having the LNS DDE Server polling above this rate will degrade network performance. By default, the LNS DDE server polls active network variables every 1 second, so more than 10 active network variables running at the default poll interval can impact network performance.

You will see similar performance degradation if you have any other LNS monitoring application sharing the LNS network interface with the LonMaker tool, or if you are using connection monitoring in the LonMaker tool.

If you will be making numerous network changes, either disable the LNS DDE Server and any other LNS monitoring applications, or reduce the polling rate to a maximum of 10 polls per second while you are making changes.

Functional Blocks

If you have a large network with many unconnected network variables on the functional blocks, delete the unused network variable shapes. Network variable shapes add performance overhead, yet they are not required if they are not connected. You can re-add network variable shapes to a functional block if you need to connect them later. To simplify following this guideline, you can create functional block

master shapes with your most commonly used network variables. See *Creating a Functional Block Master Shape* in Chapter 4, *Designing Networks* for more information.

Subsystems

Subsystems allow you to divide a large network into more manageable parts. For example, in a building control network, one subsystem could contain lighting controls and another temperature controls. Each subsystem is represented by a page of a LonMaker drawing and by a subsystem shape on the drawing page of its parent subsystem. You can nest subsystems like directories on your computer, so the temperature control subsystem could contain other subsystems representing, for example, each floor of the building. You can also create subsystems in separate LonMaker drawings. Using this feature, you can create large networks while maximizing Visio's performance by limiting the number of pages in a single drawing. You can also create a separate LonMaker drawing for each user for large networks with multiple installers.

If you are creating a network that needs more subsystems than 20 typical pages or 10 complex pages, you should divide it into two or more drawing files. For optimum performance, devices and their associated functional blocks should be contained within the same drawing file, as should all members of the same connection.

A *supernode* is a special type of subsystem shape that has one or more network variable interfaces on it. Any network variable or message tag on any functional block in the subsystem may be exported to the subsystem shape. This does not create new network variables or message tags, but exports the network variable or message tag's connection point one or more levels up the subsystem hierarchy. Using a supernode allows you to provide a simple interface to an arbitrarily complex subsystem. For example, a supernode that contains lighting controls may have a network variable interface that allows the devices contained within it to be put into emergency override. This allows the integrator to easily identify the critical interfaces into the subsystem while ignoring those that are typically only used internally by the subsystem.

LonMaker Design Manager Overview

The LonMaker Design Manager is an essential tool for managing your LonMaker networks. With the LonMaker Design Manager, you can create, open, and delete networks; back up and restore networks to prevent against loss; configure default settings for new networks to speed up the network creation process; and configure defaults for the network properties, which are applied globally to new networks.

To open the LonMaker Design Manager, click **Start** on the taskbar, point to **Programs**, point to the **Echelon LonMaker** folder, and then click **LonMaker**. The LonMaker Design Manager opens.

The LonMaker Design Manager consists of five tabs that let you perform the following functions:

- **General.** Create, open, copy, delete, and backup/restore LonMaker network designs; start the LNS Server application; and import and defragment LNS network databases.
- **Options.** Set a prioritized list of languages for LONMARK resource files.
- **New Network Options.** Configure default properties for the pages in the Network Wizard and options to skip the pages, and set the network components.
- **LonMaker Stencils.** Add, remove, or modify the properties of LonMaker stencils.
- **LonMaker Default Options.** Configure the default properties for LonMaker objects.

Tip: The LonMaker license status box in the bottom left-hand corner of the LonMaker Design Manager indicates the number of LonMaker credits currently available for you to commission devices. To order additional LonMaker credits, click anywhere on the LonMaker license status box to open the LonMaker License Wizard. See *Adding LonMaker Credits* in Chapter 10 for more information on purchasing credits.

The following sections describe the functions and available options in each tab of the LonMaker Design Manager.



General

You can use the **General** tab in the LonMaker Design Manager to create, open, copy, delete, backup, restore LonMaker network designs; start the LNS Server application so remote clients can access the LNS network database; import a database and then create a new LonMaker drawing from it; and defragment LNS network databases. To use the **General** tab, enter the following data in the boxes and click the following buttons:

New Network

Network Name

Specifies the name of the new LonMaker network design to be created. The name must be unique to all the LonMaker networks on this computer. You can enter up to 17 characters and include embedded spaces. The name is not case sensitive; therefore, you cannot create two networks with names that differ only in capitalization.

The initial default network name is “Network 1”. The LonMaker tool automatically increments the index in the default network name so that the network names are unique for subsequent networks you create using the default name. After you create a network with a different name than the initial default, the default network name will become the last network created with an incremented index. For example, if you create a new network named “Test”, the default network name will be “Test 1”. If you create the “Test 1” network, the default network name will become “Test 2”, and so on.

Create Network

Creates and opens a new LonMaker network design consisting of a

new LNS network database and a new LonMaker drawing.

Show all options

Displays all the pages in the Network Wizard as the network is opened, regardless if the **Skip this Prompt** option is selected for a page in the **New Network Options** tab.

To create networks with one-click, clear this check box and select the options in the **New Network Options** tab to skip the pages in the Network Wizard.

Existing Network

Drawing Directory

Selects a file from the folder indicated in the **Drawing Base Path** list. To open an existing LonMaker network design, select the folder containing the LonMaker drawing file.

Drawing Name

Selects a LonMaker drawing from all the LonMaker drawings contained in the selected drawing folder. Select the LonMaker drawing you want to open, delete, or backup.

Database Name

Selects an LNS network database from all the LNS network databases on this computer. Select the database you want to defragment, delete, or backup, or from which you want to start the LNS Server. This field is not used for the **Open Network**, **Open Copy**, and **Restore** operations.

Open Network

Opens the LonMaker drawing and associated LNS network database specified in the **Drawing Name** list. The **Database Name** list is ignored by this operation.

Open Copy

Opens a copy of the LonMaker drawing specified in the **Drawing Name** list, making a copy of the LonMaker drawings and the associated LNS network database. This copy is created like a new network. (You will be prompted to choose a new top-level drawing name and database path. The **Database Name** list is ignored by this operation.)

Delete

Deletes the LonMaker drawing and LNS network database specified in the **Drawing Name** and **Database Name** lists, respectively. To delete only a drawing or a database, select **<none>** in the appropriate list.

Defragment Database

Defragments and recreates the index for the LonMaker database specified in the **Database Name** list. This can reduce the size of and decrease the access time to a network database that has grown in size because of many changes. Backup the database before defragmenting it in the event an error occurs during the defragmentation process.

Launch LNS Server

Starts the LNS Server application so that remote client computers can access the LNS network database.

Backup

Opens the **LonMaker Backup** dialog, in which you can back up the network database specified in the **Database Name** lists and all of associated drawing files.

See *Manually Backing Up a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on how to use the **LonMaker Backup** dialog. See *Backup/Restore Options* in Appendix A for the default backup options you can set.

Show all options

If this check box is selected, all of the network option windows will be presented as the network is opened regardless if the **Skip this**

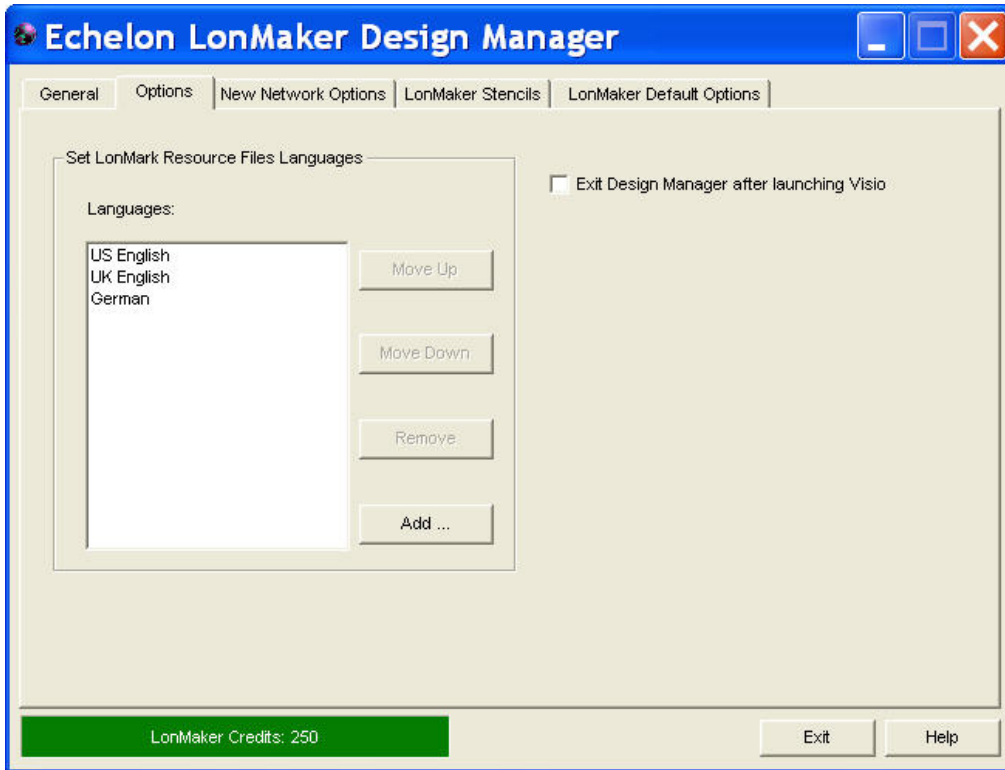
	Prompt option had been previously selected.
<i>Restore</i>	Restores a LonMaker drawing and LNS network database from a LonMaker backup file. See <i>Restoring a LonMaker Network</i> in Chapter 7, <i>Maintaining Networks</i> , for more information. See <i>Using LonMaker Backup Files</i> for more information on how to use the LonMaker Restore dialog. See <i>Backup/Restore Options</i> in Appendix A for the default restore options you can set.
<i>Import</i>	Imports an LNS network database (objects.dat file) into LNS so that it appears in the Database Name box. The imported database may have a LonMaker drawing associated with it. Select the folder containing the LNS network database you want to import. If the database does not have a LonMaker drawing associated with it, you can then click Create Drawing to create a LonMaker drawing based on the imported database.
Settings	
<i>Drawing Base Path</i>	Determines the directory that will be used by the Drawing Directory list. All of the folders in this directory will be listed in the Drawing Directory list. You can browse through the folders to find the desired path or enter the pathname.
<i>Add</i>	Lets you select a drawing folder to add to the Drawing Base Path list.
<i>Exit</i>	Closes the LonMaker Design Manager. This does not close Visio or any open networks. To automatically exit the Design Manager after opening a LonMaker drawing, click the Options tab in the LonMaker Design Manager and select the Exit Design Manager After Launching Visio checkbox.

Options

The LonMaker Design Manager's **Options** tab allows you to set a prioritized list of languages for LONMARK resource files. This list is then applied to all new networks you create.

When the LonMaker tool displays documentation for selected devices, functional blocks, and network variables, it uses the definitions contained in LONMARK resource files. You can display the LONMARK resource file information in different languages by specifying a prioritized list of languages for LONMARK resource files in the LonMaker tool.

You can set the resource file language for a specific network while in the LonMaker tool by opening the **LonMaker** menu, selecting **Network Properties**, and then clicking the **Resource File Language** tab.



The LonMaker Design Manager’s **Options** tab contains the following options:

Set LONMARK Resource Files Languages

Allows available language-specific LONMARK resource files to be added, removed, or reordered in the languages list. When searching for a resource definition such as an NV field name, the LonMaker tool searches the first language file in the list for the device information, then the second language file in the list, and so on until it finds the information for the specified device. If no match is found and the device information is found in the corresponding U.S. English file, the English text will be used to display the information. U.S. English is the default language and cannot be removed from the list. The language-specific LONMARK resource files added to the list must be installed and available to the LonMaker tool. Usually they will have been installed if available and you click **Add** to add them to the list. If you do not see language resource files you expected to see when you clicked **Add**, you can still install them. Click **Start**, highlight Echelon LNS Utilities, select the **LNS Resource File Utility**, and follow the prompts to install the desired language resource files.

Languages

Lists the languages in the order they will be searched for device information.

Move Up

Moves the selected language up one position in the list.

Move Down

Moves the selected language down one position in the list.

Remove

Removes the selected language from the list.

Add

Adds a language to the end of the list.

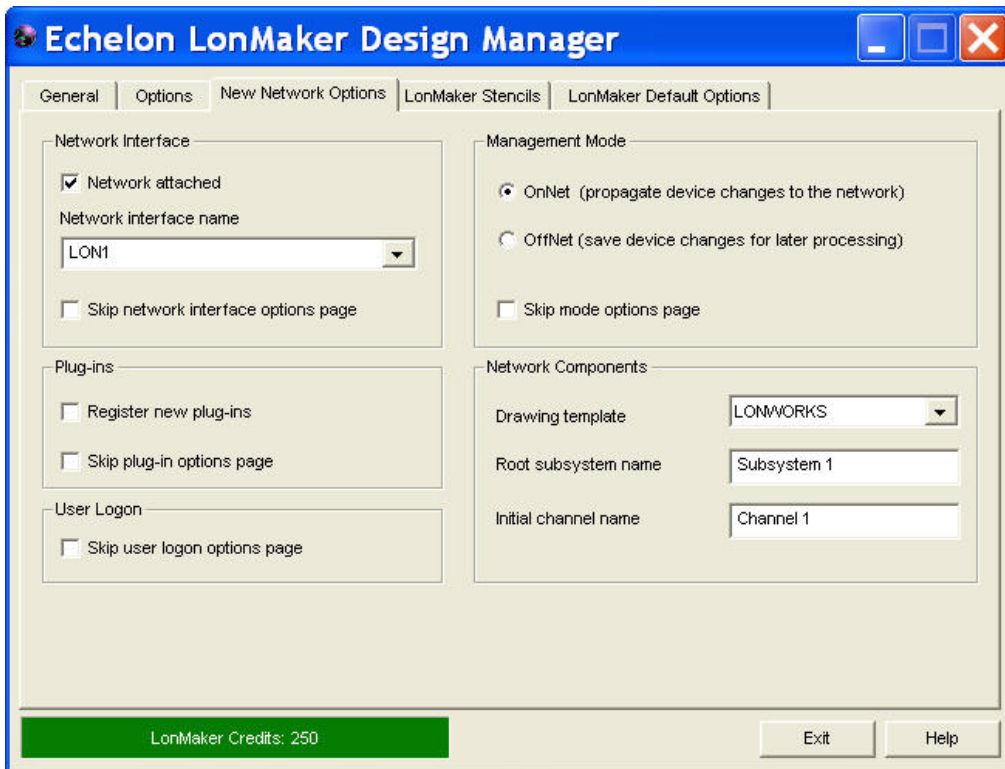
Exit Design Manager after Launching Visio

Selecting this option automatically closes the LonMaker Design Manager after launching Visio.

New Network Options

You can use the **New Network Options** tab to set the default properties for the network interface, plug-ins, user logon, and management mode pages in the Network Wizard, and set the default network components. The properties you set are then applied to each new network you create.

You can also select options to have the LonMaker tool skip the pages in the Network Wizard when opening a network. If you additionally clear the **Show all Options** check box under the **New Network** box in the **General** tab, you can create new networks with one-click, skipping all the pages in the Network Wizard.



The LonMaker Design Manager's **New Network Options** tab contains the following options:

Network Interface

Network Attached

Select this check box to specify that the LonMaker computer will be attached to the physical network so that the LonMaker tool can communicate with the physical devices.

Clear this check box if you the LonMaker computer will not be attached to the network. This check box is cleared by default.

Network Interface Name

Select the LNS network interface to be used for communication between the LonMaker computer and the physical network. This option is only available if you selected the **Network Attached** check box.

Skip Network Interface Options Page

Skips the network interface page in the Network Wizard when you create a new LonMaker network.

Plug-Ins

Register Plug-Ins

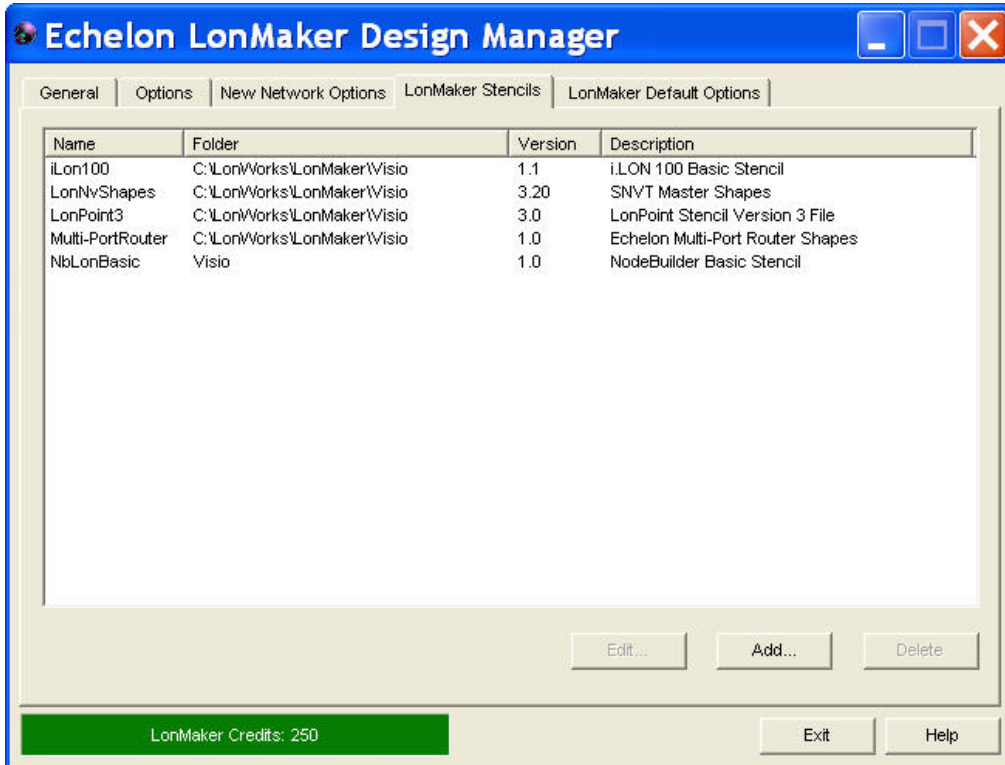
Select this check box to register all enabled plug-ins when you create a new LonMaker network.

<i>Skip Plug-ins Options Page</i>	Skips the plug-in registration page in the Network Wizard when you create a new LonMaker network.
User Logon	
<i>Skip Logon Options Page</i>	Skips the user logon page in the Network Wizard when you open a LonMaker network.
Management Mode	
OnNet	Changes to the LonMaker drawing are transmitted to the physical devices on the network.
OffNet	<p>Changes to the LonMaker drawing are sent immediately to the physical devices on the network. Select OnNet if you are commissioning an engineered system or if you are working on any phase of an ad-hoc system.</p> <p>Changes to the LonMaker drawing are saved in the LNS network database, but are not propagated to physical devices until the LonMaker tool is placed OnNet. Select OffNet if you are designing an engineered system.</p> <p>Once you have commissioned devices with the LonMaker tool OnNet, you can make real-time changes to network variables when the LonMaker tool is OffNet.</p> <p>You can read and make changes to configuration properties while the LonMaker tool is OffNet, but changes will not be propagated until you set the LonMaker tool OnNet or you manually propagate them (by right-clicking a device, pointing to Commissioning, and selecting Propagate CP Values to Device on the shortcut menu).</p>
<i>Skip Mode Options Page</i>	Skips the management mode page in the Network Wizard when you create a new LonMaker network.
Network Components	
<i>Drawing Template</i>	<p>Lists the templates available for new LonMaker networks. The template is an empty LonMaker drawing that specifies a default drawing background, styles, stencils, and other LonMaker settings. You can select from the following three default LonMaker templates that are listed:</p> <ul style="list-style-type: none"> • LONWORKS is the initial default template used for new networks. It uses U.S. measurement units. • LONDEMO is the template used to create a demonstration network. In a demo network, you can only create a maximum of six application devices and LonMaker credits are disabled. • LONWORKSMetric is a template that uses SI measurement units for drawing pages. <p>Custom LonMaker templates installed in the template directory are also listed.</p>
<i>Root Subsystem Name</i>	Specifies the top-level subsystem name, which appears on the title block on the top-center of the first page of each new LonMaker drawing. Subsystem names may be up to 85 characters, may include embedded spaces, but may not include the period, backslash, colon, forward slash, or double quote characters. Subsystem names are case sensitive. The default top-level subsystem name is "Subsystem 1".
<i>Initial Channel Name</i>	Specifies the name of the initial channel that is attached to the LNS Network Interface in each new network drawing. Channel names

may be up to 85 characters, may include embedded spaces, but may not include the period, backslash, colon, forward slash, or double quote characters. Channel names are case sensitive. The default root channel name is “Channel 1”.

LonMaker Stencils

The LonMaker Design Manager’s **LonMaker Stencils** tab lists the LonMaker stencils that are initially available in the LonWorks template upon opening or creating a network drawing. It allows you to add, remove, or modify the properties of LonMaker stencils.



The **LonMaker Stencils** tab contains the following options:

- Edit* Click the name of a LonMaker stencil you wish to modify and then click **Edit**. The **Edit Stencil Properties** dialog appears. You can change the name of the LonMaker version or modify the description associated with a LonMaker stencil file. Conversely, you can change the stencil file associated with the LonMaker version or description of a stencil file.
- Add* Click **Add** to open the **Add New Stencil** dialog. Click **Browse**, select a Visio stencils (.vss) file from C:\LonWorks\LonMaker\Visio or from another folder in your computer, and then click **Open**. You can then enter the LonMaker version and a description of the selected Visio stencil. There is no limit on the number of characters, and you can include embedded spaces, periods, backslashes, colons, forward slashes, and double quotes. When you are done, click **OK**.
- Delete* Click the name of a LonMaker stencil you want to remove from the list and then click **Delete** (the stencil file is not deleted).

LonMaker Default Options

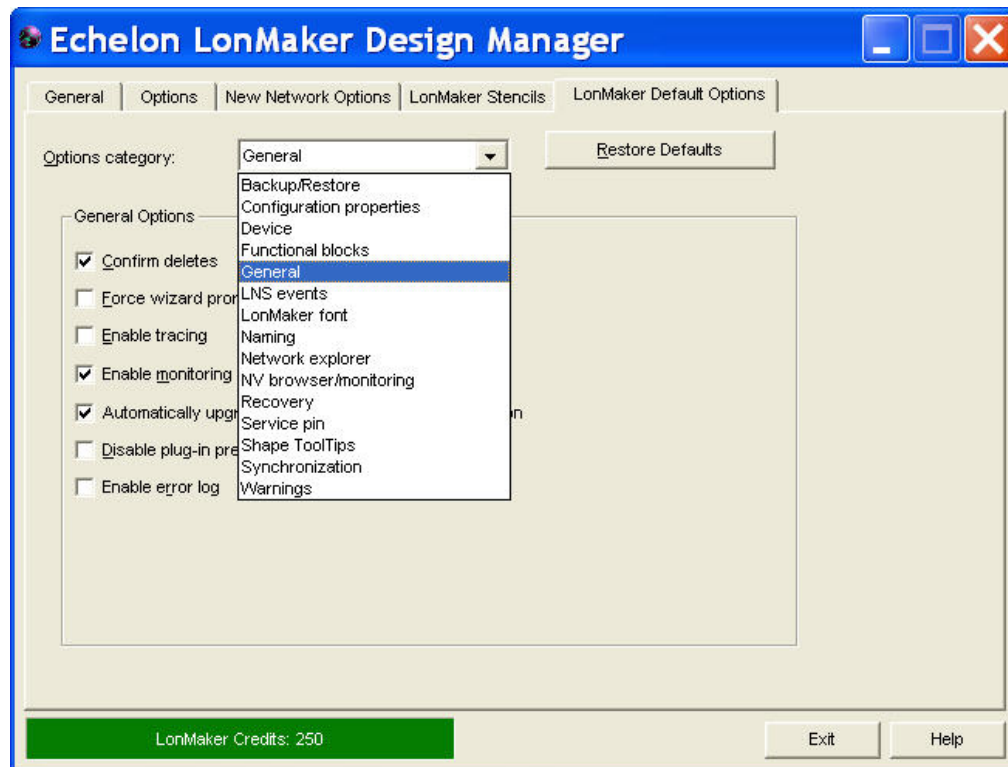
You can use the **LonMaker Default Options** tab to set the LonMaker default properties for the new networks you create. This tab contains a list of LonMaker options categories such as options for devices, functional blocks, and configuration properties. The default options you set will be applied to each new LonMaker network you create. Once you create a new network, you can change any of the default options in the LonMaker drawing by opening the **LonMaker** menu and clicking **LonMaker Options**.

Click **Restore Defaults** to reset the options and values in the currently displayed options category to their defaults.

You can set the default options for new networks in the following options categories:

- Backup/Restore
- Configuration Properties
- Device
- Functional Blocks
- General
- LNS Event Options
- LonMaker Font
- Naming Options
- Network Explorer
- NV Browser/Monitoring
- Recovery
- Service Pin
- Shape ToolTips
- Synchronization
- Warnings

Appendix A details the defaults you can set under each network properties options category.



Setting Up a Network Interface

You can directly attach your LonMaker computer to a LONWORKS network. To attach the LonMaker tool to the network, you must define and configure your network interface before starting the LonMaker tool. LNS network interfaces include the following: IP-852 interfaces (*i*.LON 10 Ethernet Adapters, *i*.LON 100 Internet Servers, and *i*.Lon 600 LonWorks/IP Servers); U10/U20 USB network interfaces; PCC-10 and PCLTA 10, 20, and 21 PCI network interfaces; and SLTA-10 and PL-SLTA serial interfaces.

If you are using an LNS network interface, install the network interface hardware and configure the network driver as described in its documentation, which is available online at www.echelon.com.

Optimizing Network Interface Performance

To optimize the performance of the LonMaker tool when your LonMaker computer is attached to a LONWORKS network, you should use an LNS Fast Network Interface (IP-852 or LonTalk layer 2) if one is available for your network interface (a fast option is not available for network interfaces used for remote access such as the *i*.LON 10 Ethernet Adapter, *i*.LON 100 Internet Server, *i*.LON 600 LONWORKS/IP Server, SLTA-10 serial interface, or the PL-SLTA serial interface). An exception to this is if you are using a slow channel such as a PL-20 power line channel. In that case, a legacy interface may limit network overhead, where a fast network interface may saturate the channel.

Using an IP-852 Network Interface

If you are attaching your LonMaker computer to an IP-852 channel, follow these steps to set up an IP-852 interface and create the IP-852 channel

1. Ensure that all of your IP-852 devices—which may include the LNS Server computer, one or more LonMaker computers, and one or more IP-852 routers—all have static IP addresses or have dynamic IP addresses that do not change. A static IP address is an address that is not dynamically assigned by a DHCP server.
2. Create an IP-852 interface on each computer that is to be connected to the IP-852 channel. This may include the LNS Server computer and one or more LonMaker computers. To create an IP-852 interface, follow these steps on each of the computers:
 - a. Click **Start** on the taskbar, point to **Settings**, and then click **Control Panel**.
 - b. Double-click the **LonWorks Interfaces** icon.
 - c. Click the **IP-852** tab.
 - d. Click **Add**. The **Network Interface Add** dialog opens.
 - e. Enter a unique name for this IP-852 interface and verify that the displayed IP address is correct.
 - f. Click **OK** twice.

See the **LONWORKS Interfaces** control panel application help file for more information.

3. Define the IP-852 channel and devices in the LonWorks/IP Configuration Server. To do this, follow these steps:
 - a. Click **Start** on the taskbar, point to **Programs**, and then click **Echelon LonWorks-IP Configuration Server**.
 - b. On the **Channel** menu, click **New Channel**. Enter a name for the new IP-852 channel.
 - c. Right-click the new IP-852 channel you just created and then click **New Device**. Enter a name for the new device.
 - d. Right-click the new device and then click **Device Properties**. Enter the IP address for the device.

- e. Repeat steps c and d for each LNS Server computer, LonMaker computer, and IP-852 router on the IP-852 channel

The devices on the IP-852 channel will not be fully commissioned until you run LNS applications such as the LNS Server or LonMaker tool on each of the LNS Server or LonMaker computers. For more information, see the *LonWorks-IP Configuration Server Help* file.

Creating and Opening a LonMaker Network

A LonMaker network consists of a *LonMaker drawing* and an *LNS network database*. The LonMaker tool provides several ways to create a LonMaker network, including the following methods:

- Create a new LonMaker network design. Use this method if you are engineering a new network, or if you want to redo the logical design of an existing network.
- Use an existing LNS database to create a LonMaker drawing. Use this method to use the LonMaker tool with a network that was previously installed with an LNS application other than the LonMaker tool.
- Create a LonMaker network design from an existing physical network, which creates a new LNS network database and a LonMaker drawing. This method is called *network recovery*. Use this method if the network is operational and was originally installed with an application not based on LNS or was self-installed. You can also use this method with a network that was previously installed with an LNS application, but does not have its original network database. The LonMaker tool can recover a network without changing the device applications or network configuration. See *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on how to use network recovery and for a summary of the limitations of network recovery.
- Copy an existing LonMaker network design. Use this method to create a new network that is similar to an existing network.

Creating a New LonMaker Network Design

You can create a new LonMaker network design to engineer a new network or to redo the logical design of an existing network. To create a new network design, you must use the LonMaker tool as a local client (the LonMaker tool is running on the same computer as the LNS server).

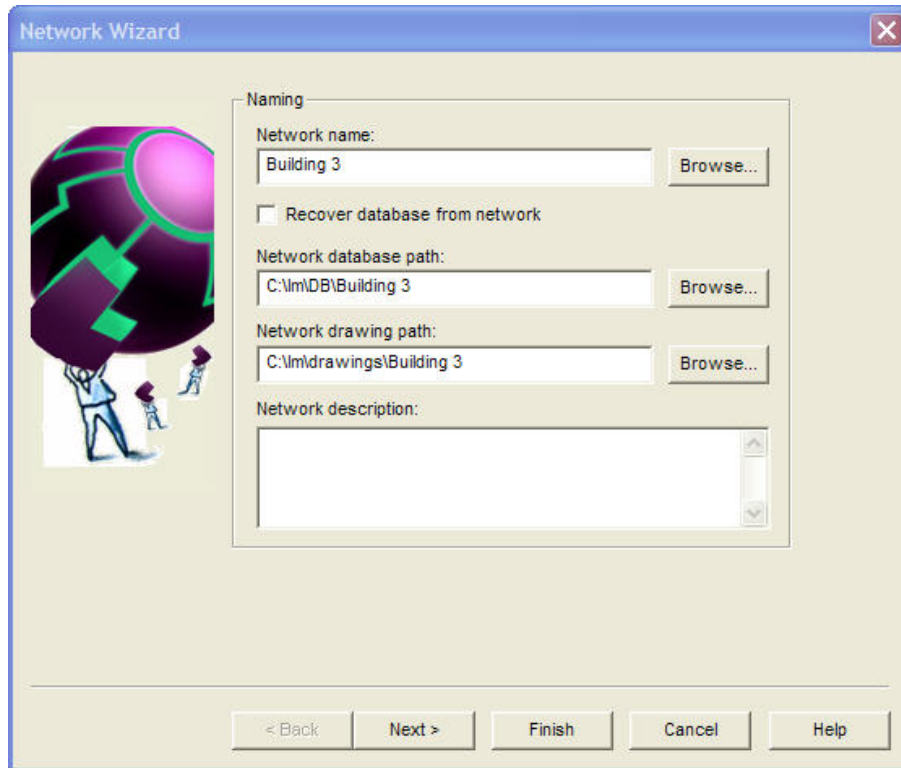
To create a new LonMaker network, follow these steps:

1. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The **LonMaker Design Manager** appears.
2. To use a name other than the default for the new network, enter it in the **New Network** box
3. Click **Create Network** to create the new network.

A message may appear informing you that Visio must be launched and initialized so that it can work with the LonMaker tool. Click **OK**.

A warning may appear asking you if you want to enable macros. You must enable macros for the LonMaker tool to function. See *Working with Digital Signatures* for more information.

4. Visio 2003 starts and the **Naming** page in the Network Wizard appears (unless you cleared the **Show all Options** check box under the **New Network** box, and you cleared the check boxes for skipping the network interface, management mode, and plug-in options pages of the Network Wizard in the **New Network Options** tab of the LonMaker Design Manager).



Tips:

- You can click **Finish** at any point in the Network Wizard. Doing so will skip the subsequent series of pages, and your new LonMaker network design will be created using the current settings in the **New Network Options** tab of the LonMaker Design Manager.
- By default, the subsequent pages in the Network Wizard will appear each time you re-open the LonMaker drawing. Select the **Skip This Prompt when Re-opening this Drawing** check box on any of the pages you want to skip when re-opening the drawing.
- You can change any options you set in the Network Wizard in the LonMaker drawing. Open the **LonMaker** menu, click **Network Properties**, and then click the tab containing the options you want to modify.

5. Edit the following information as required:

Network Name

Displays the network name. By default, this is the current name in the **Network Name** box under **New Network** in the **General** tab of the LonMaker Design Manager. The default network name is incremented if a naming conflict exists.

You can change the name of the network. The name must be unique to the network database, and it can have a maximum of 14 characters. The network name in the **Network Database Path** and **Network Drawing Path** fields will automatically be updated to match the name you specify.

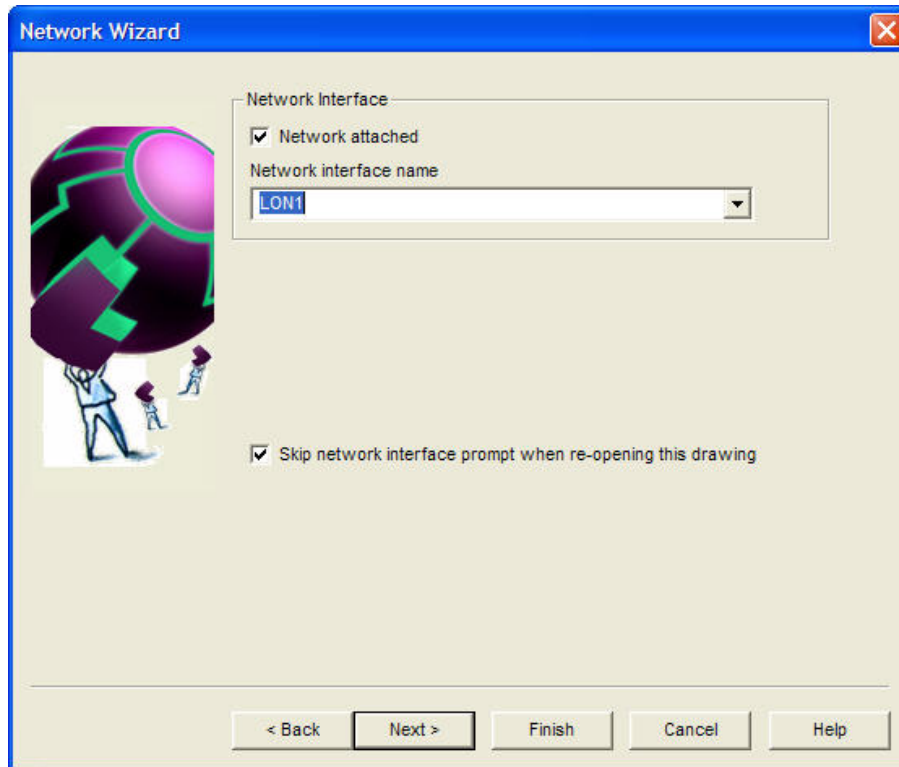
Recover Database from Network

Opens the LNS Database Recovery Wizard after completing the Network Wizard. You can use the recovery wizard to create a new LonMaker drawing and network database from an existing operational network.

See *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information.

<i>Network Database Path</i>	Specifies the folder that will contain the network database. By default, the database path is C:\LM\DB\ <i><network name></i> . You can specify a different to place the LonMaker network database; however, the network name in the database path must match the one in the Network Name box.
<i>Network Drawing Path</i>	Specifies the folder that will contain the LonMaker drawing. By default, the drawing path is C:\LM\Drawings\ <i><network name></i> . You can specify a different to place the LonMaker drawing; however, the network name in the drawing path must match the one in the Network Name box.
<i>Network Description</i>	Contains an optional description of the network being created. This field has no effect on network operation, but it can provide additional documentation for as-built reports.

6. Click **Next**. The Network Interface page appears.



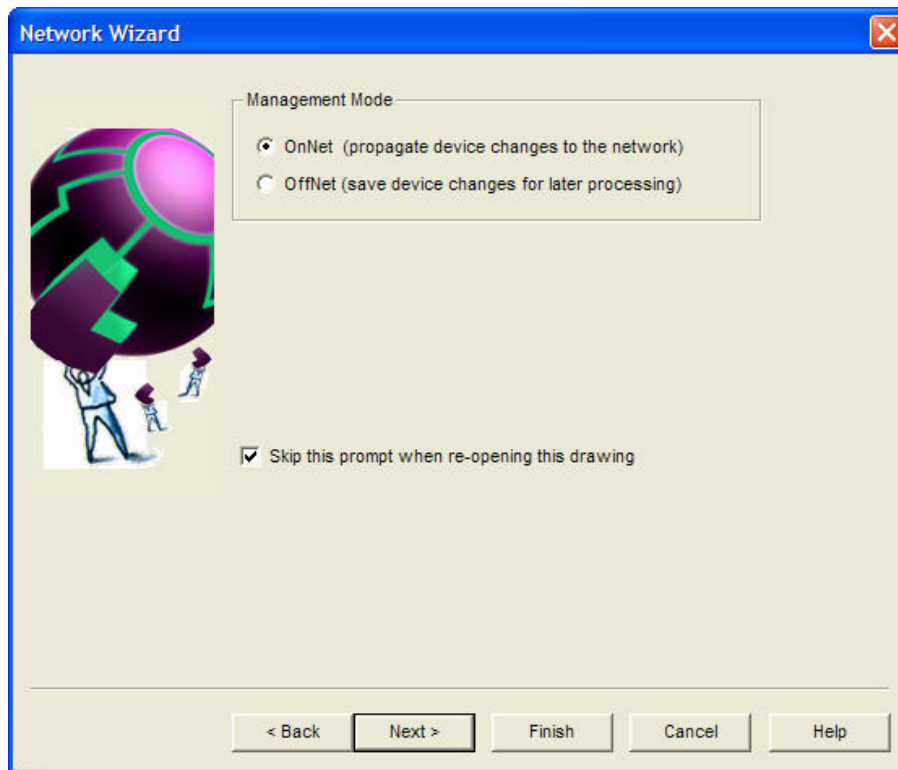
7. If your LonMaker computer is attached to the physical network and you want the LonMaker tool to communicate with the physical devices, select **Network Attached**. If you select this option and you have more than one network interface in your computer, select the name of the LNS or IP-852 network interface under **Network Interface Name**.

Notes:

- The network interface you select must already have been defined and configured, as described in *Setting up a Network Interface*.
- For the LonMaker tool to communicate on an IP-852 channel, the LonMaker computer must be configured as an IP-852 device on the target channel using the LONWORKS/IP Configuration Server. If an IP-852 device name has not been defined, create one in the

LONWORKS/IP Configuration Server, which you can access by clicking **Start** on the taskbar, pointing to **Programs**, and then clicking **Echelon LonWorks-IP Configuration Server**. Your computer must have a static IP address, or it must have a dynamic IP address that does not change (you cannot use an IP address that may be changed by a DHCP server). For more information on using the LonWorks-IP Configuration Server, see the *IP-852 Channel User's Guide* and the *LonWorks-IP Configuration Server Help* file.

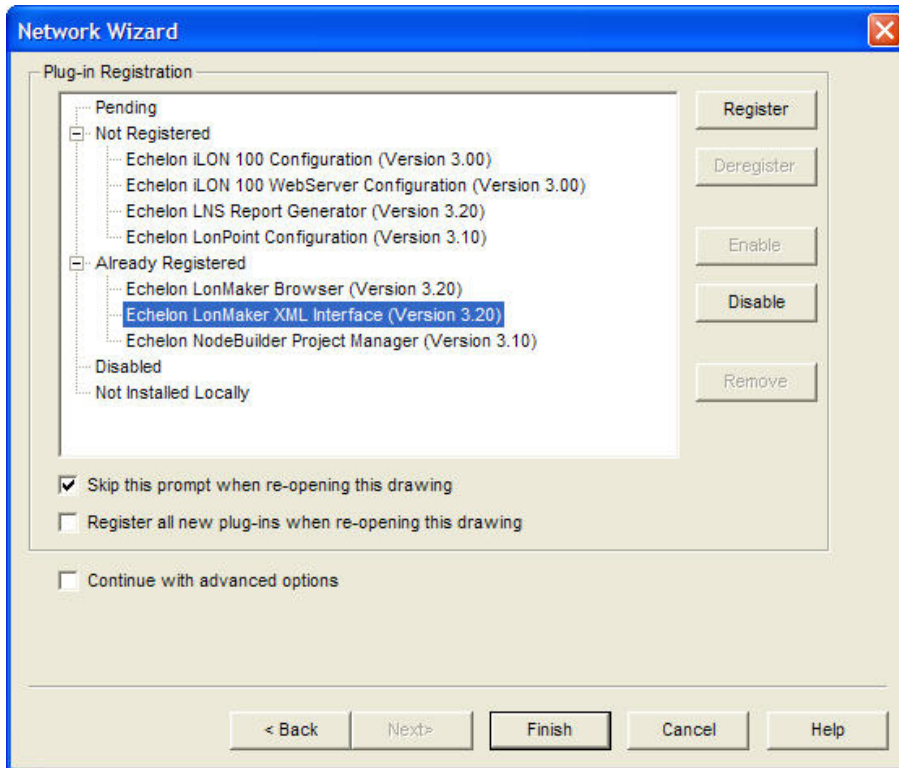
8. Click **Next**. If you specified that LonMaker computer is attached to the physical network, the Management Mode page appears. If it is not attached, the Plug-In Registration page appears and you can skip to step 11.



9. Select when changes made in your LonMaker drawing are sent to the physical devices on the network. You have two choices:
 - **OnNet**. Changes to the LonMaker drawing are sent immediately to the physical devices as you make the changes. Select OnNet if you are commissioning an engineered system or if you are working on any phase of an ad-hoc system.
 - **OffNet**. Changes to the LonMaker drawing are saved in the network database and then sent to the physical devices once the LonMaker tool is set OnNet. Select OffNet if you are designing an engineered system. You can make real-time changes to network variables when the LonMaker tool is OffNet once you have commissioned devices with the LonMaker tool OnNet. You can read and make changes to configuration properties while the LonMaker tool is OffNet, but changes will not be propagated until you set the LonMaker tool OnNet or you manually propagate them (by right-clicking a device, pointing to **Commissioning**, and selecting **Propagate CP Values to Device** on the shortcut menu).

Select this **Skip the Prompt** check box if you want the Network Wizard to skip the Management Mode page each time you open the LonMaker network. If the **Show all Options** check box under **Existing Networks** in the LonMaker Design Manager **General** tab is selected, the prompt will appear regardless if this check box is selected.

10. Click **Next**. The Plug-In Registration page appears.



11. Use the following commands to register, deregister, enable, and disable plug-ins in your LonMaker network.

Register Adds a plug-in to the Pending list, indicating that the plug-in is to be registered. A plug-in must be registered for it to be available within the LonMaker tool.

This button is available when a plug-in listed under any category or a category label (except Pending) is selected. If a category label is selected, all the plug-ins under it will be registered.

Deregister Adds a plug-in to the Pending list, indicating that the plug-in is to be deregistered. Once a plug-in is deregistered, it is no longer available within the LonMaker tool.

This button is available when a plug-in listed under Already Registered is selected, can be deregistered, and supports being deregistered.

Enable Adds a plug-in listed under Disabled to the Pending category, indicating that the plug-in is to be enabled. You can enable a plug-in that you previously disabled.

This button is available when a plug-in listed under Disabled or the Disabled category label is selected. If the Disabled category label is selected, all the plug-ins under it will be enabled.

Disable Adds a plug-in listed under Already Registered or Not Registered to the Pending category, indicating that the plug-in is to be disabled. You can disable a plug-in to prevent the LonMaker tool from prompting you to register the plug-in.

This button is available when a plug-in listed under Already Registered or Not Registered or either of the category labels is

	selected. If the Already Registered or Not Registered category label is selected, all the plug-ins under the selected category label will be disabled.
<i>Remove</i>	Removes a plug-in from the Pending list. This button is available when a plug-in listed under Pending or the Pending category label is selected. If the Pending category label is selected, all the plug-ins under it will be removed.
<i>Skip this Prompt when Re-opening Drawing</i>	Select this check box if you want the Network Wizard to skip the Plug-In Registration page each time you open the LonMaker network. If the Show all Options check box under Existing Networks in the LonMaker Design Manager General tab is selected, the prompt will appear regardless if this option is selected.
<i>Register all New Plug-ins when Re-opening this Drawing</i>	Select this check box if you want new plug-ins in the plug-in directory to be automatically registered each time you open the LonMaker drawing. New plug-ins must be registered with Windows. The installation program for the plug-ins typically does this automatically. If you are designing your own plug-ins see the <i>LCA Object Server User's Guide</i> for more information on how to create plug-ins and register them with Windows.
<i>Continue with Advanced Options</i>	Opens and lets you set options in the authentication, domain definition, timing, and resource file language pages in the Network Wizard. See <i>Recovering a LonMaker Network</i> in Chapter 7, <i>Maintaining Networks</i> , for setting the options in these pages.

12. Click **Finish** to open your new LonMaker drawing.

Working with Digital Signatures

Visio drawings can have VBA code associated with them through the use of macros and ActiveX objects. Visio drawings that use this capability use Microsoft VBA signatures to provide security from VBA viruses. Each time you create a LonMaker network design, the template that you selected in the LonMaker Design Manager (LonWorks.vst by default) is used to create the network drawing. This template uses VBA macros to implement the network drawing's LONWORKS functionality. This template and all Visio drawings created from it are signed by the Echelon Corporation.

When creating or opening a LonMaker network for the first time, a message appears informing you that the drawing being opened contains macros from the Echelon Corporation, and asking you if you would like to enable macros for this drawing. You **must** enable macros in order to use the LonMaker tool. If you set **Always Trust Macros from this Source** you will automatically enable macros for all LonMaker drawings that are signed by Echelon.

LonMaker network drawings created with LonMaker releases before 3.1 will not have a digital signature. LonMaker drawings created with LonMaker 3.1 or later may have expired digital signatures. In addition, you can cause a LonMaker drawing to lose its Echelon signature by adding VBA code to it. This can happen if you add an ActiveX object or VBA code to the LonMaker drawing. Once a network drawing has lost its signature, it cannot get it back automatically. If you have lost Echelon's signature on a network drawing, you have three options: (1) ignore the macro warnings as described in the next paragraph; (2) disable macro warnings as described in the next paragraph; or (3) sign the drawing with your company's digital signature as described at msdn.microsoft.com/library/default.asp?url=/library/en-us/odeopg/html/deovrusingdigitalcertificatesttoproductrustedolutions.asp.

If a LonMaker drawing does not have a digital signature, you will see the macro warning dialog and will have to enable macros every time the network drawing is opened, provided Visio's macro security

is set to medium (the default). In order to change Visio's macro security, open the **Tools** menu, point to **Macro** and then select **Security**. A dialog opens allowing you to select **Low**, **Medium**, or **High** security.

- If you select **Low** security, you will never see the macro warning.
- If you select **Medium** security, you will be prompted to enable macros for unsigned network drawings or network drawings signed by companies that have not been added to the trusted signatures list.
- If you select **High** security, macros will automatically be disabled (and the LonMaker tool will not function) for unsigned network drawings, and you will be prompted to enable macros for network drawings signed by companies that have not been added to the trusted signatures list.

Visio's security level is persistent. When you change Visio's security level, it will be the security level for Visio every time it is started until you change it again.

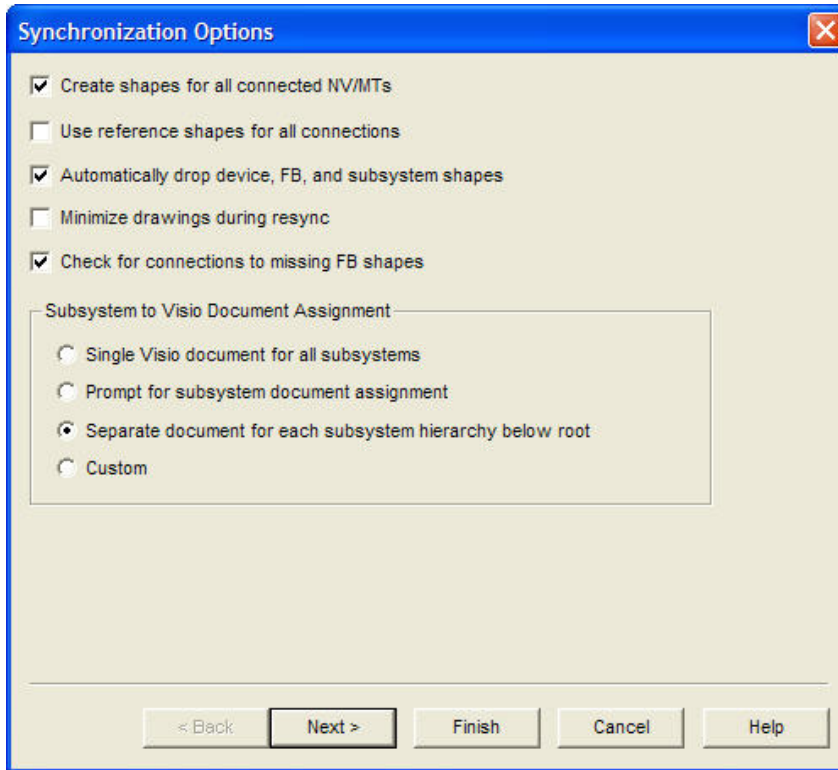
Tip: If your drawing contains ActiveX controls, change the security setting to **Low**. Otherwise, Visio will prompt you each time the drawing is opened as to whether to activate the controls.

Creating a New LonMaker Network from an Existing LNS Database

You can create a new LonMaker network design by opening an LNS network database that is not already associated with a drawing. The LonMaker tool will then create a drawing for the database. You can use this procedure to import an existing network into the LonMaker tool when the network was created with an LNS application other than the LonMaker tool. To create a new LonMaker network from an existing LNS network database, you must use the LonMaker tool on a local client.

To create a new LonMaker network design from an existing LNS database, follow these steps:

1. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager appears.
2. Select which database you want to open in the **Database Name** list and then select **<none>** in the **Drawing Directory** list. A **Create Drawing** command will appear in place of the **Open Network** command.
3. Click **Create Drawing**.
4. Visio 2003 starts and the **Naming** page of the Network Wizard appears.
5. Specify the folder that will contain the LonMaker drawing in the **Network Drawing Path** box. The folder must have the same name that appears in the **Network Name** box, but it may be contained within another folder. The **Network Name** and **Network Database Path** boxes are read-only, as these settings are determined by the LNS network database. Click **Next**. The Network Interface page appears.
6. Following steps 8 through 10 of *Creating a New LonMaker Network Design*, select whether the LonMaker tool is attached to the network, and if it is attached, select the management mode (OnNet or OffNet). Click **Finish**. The **Synchronization Options** dialog box appears.



7. Select the desired synchronization options and subsystem assignments.

Create Shapes for all Connected NVs/MTs

Adds shapes to functional blocks for all connected network variables or message tags created by the resynchronization.

If this check box is cleared, the LonMaker tool will use generic connections when possible. It will still create network variable or message tag shapes for connections to supernodes and for those functional blocks that already contain network variable or message tag shapes.

Use Reference Shapes for all Connections

Represents all network variable connections created by the resynchronization with reference connection shapes.

If this check box is cleared, the LonMaker tool will use standard connection shapes for connections for network variable hubs and targets located in the same subsystem. Reference connection shapes are always used for connections that span subsystems.

Automatically Drop Device, FB, and Subsystem Shapes

Automatically adds shapes to the drawing for all devices, functional blocks, and subsystems created by the resynchronization.

If this check box is cleared, the LonMaker tool will prompt the user to select whether a shape should be added for a device, functional block, or subsystem created by the resynchronization.

Minimize Drawings during Resync

Minimizes all the drawings in the LonMaker network during the resynchronization. This speeds up the resynchronization as it reduces the time Visio spends updating the drawings.

Check for Connections for Missing FB Shapes

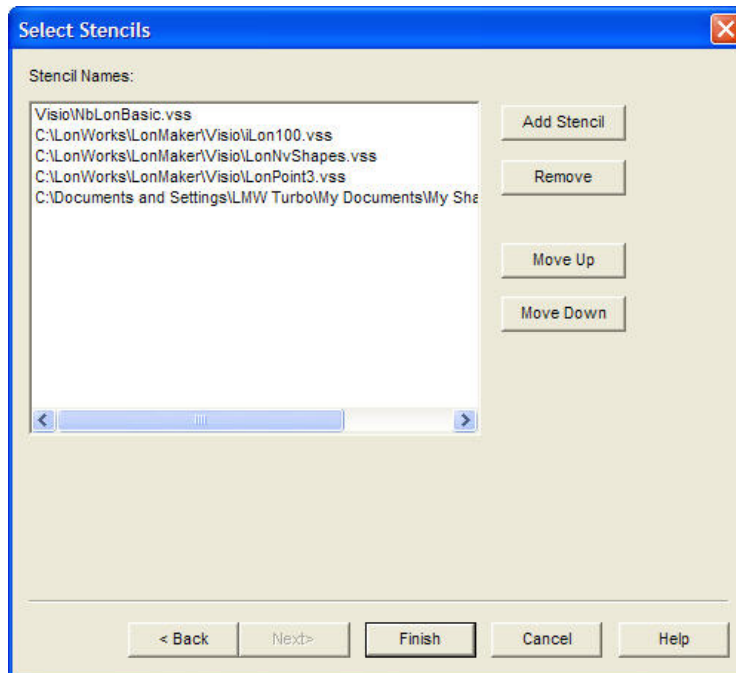
Enables the LonMaker tool to check for connections to functional blocks that are in the LNS database but not represented by a shape in the LonMaker drawing.

Subsystem to Visio Document Assignment

Select in which Visio drawing file to place the subsystems in your network. You have four choices:

- **Single Visio Document for all Subsystems.** Places all subsystems in a single Visio document.
- **Prompt for Subsystem Document Assignment.** Prompts you to specify the Visio document for each subsystem.
- **Separate Document for each Subsystem Hierarchy below Root.** Places each subsystem hierarchy below the top-level subsystem in a separate, new Visio document.
- **Custom.** Opens the **Subsystem Document Assignment** dialog. In this dialog, you specify the Visio document for each subsystem.

8. Click **Next**. If you selected the **Automatically Drop Device, FB, and Subsystem Shapes** check box, the **Select Stencil** dialog box appears. If it is not selected, skip to step 10.



9. Select the stencils that you want to be scanned for master shapes.
- To add a stencil, click **Add Stencil**, select the desired Visio stencil file (.vss), and then click **Open** or double-click the stencil.
 - To remove a stencil, select the desired stencil and then click **Remove**. You can also re-order the stencil positions by selecting a stencil and clicking **Move Up** or **Move Down**. Click **Finish**.

The LonMaker tool will then search, in order, all the listed stencils. When objects are found within the database that are not already represented in the drawing, the LonMaker tool scans the listed stencils and automatically adds the appropriate shape to the drawing. If the particular master shape for an object is not found, an appropriate generic shape (a LONWORKS Device shape, for example) will be used. After the LonMaker tool is done scanning stencils, the **Synchronization Status** dialog box appears.

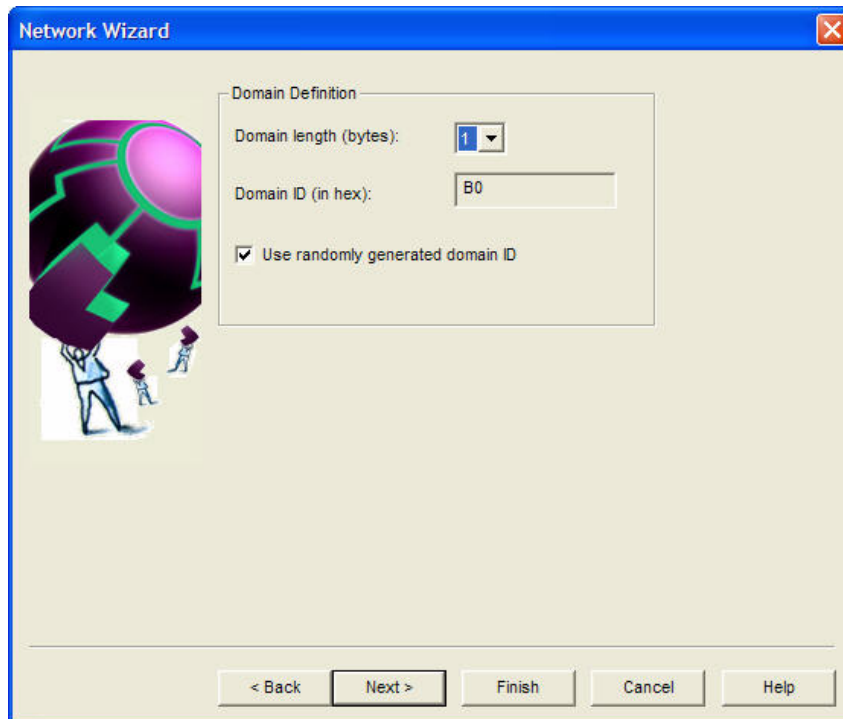
10. You can monitor the progress of the resynchronization. When the resynchronization is complete, click **OK** to open your LonMaker network.

Copying an Existing LonMaker Network Design

You can create a new LonMaker network design by copying an existing one. You can use this procedure to reuse the drawings, options, plug-ins, master shapes, and device templates of an existing network design. You can also use this procedure to reduce the time required to create a new network. To do this, create an empty network design with all your desired plug-ins already registered, and then copy the empty network design for each new network that you create. To copy an existing LonMaker network design, you must use the LonMaker tool on a local client

To create a new LonMaker network design by copying an existing one, follow these steps:

1. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager appears.
2. Choose a LonMaker network to copy. Under **Existing Network**, select a drawing directory from the **Drawing Directory** list, and then select the network you want to copy from the **Drawing Name** list. Click **Open Copy**. A message appears prompting you to confirm that you want to open a copy of the selected network, which will create copies of the LNS network database and all the drawings in the network.
3. Click **Yes**. The **Network Wizard** opens and the **Network Interface** page appears
4. Follow steps 7 through 11 in *Creating a LonMaker Network Design*. By default, the options selected in the existing network will be used in your new network; however, you can change any option. When you have completed the Plug-In Registration page, click **Next**. The **Network Properties: Domain** dialog box appears.



5. A new random domain ID is generated. To use a specific domain ID, clear the **Use Randomly Generated Domain ID** check box and enter your ID in hexadecimal format in the **Domain ID** box. Click **Finish**.

6. If you are copying a network created with a Turbo edition of the LonMaker Tool, your new LonMaker network will open and you can skip the remaining steps.
7. If the existing LonMaker network design you are copying was created in a previous version of the LonMaker tool, the **Synchronize LonMaker for Windows Drawing** dialog box appears. This is because the LonMaker shapes in the drawing need to be updated to reflect the current LonMaker Turbo edition.
8. In the **Synchronize LonMaker for Windows Drawing** dialog box, the **Update Shapes to Current LonMaker Version** check box will be selected by default. Select any other desired synchronization options and click **Next**. The **Choose Synchronization Scope** dialog box appears.
9. Accept the defaults and click **Next**. The **Choose Shapes and Items to Update** dialog box will appear.
10. Accept the defaults and click **Finish**. The **Synchronization Status** dialog box appears as the synchronization process begins.
11. The **Synchronization Status** dialog box displays the progress of the synchronization. Once “Synchronization Complete” appears, click **OK** to open your LonMaker network design.

For more information about the synchronization options in the preceding dialog boxes, see *Manual Network Resynchronization* in Chapter 7, *Maintaining Networks*.

Notes: If you open the copy of the LonMaker network with the LonMaker tool set OnNet, a message appears reminding you that the copy of the LonMaker network should not be attached to the physical network associated with the original. This is because the devices and routers will be updated to match the new network database. Verify that the LonMaker tool is not attached to the original network and then click **Yes** to proceed with your LonMaker tool set OnNet. Click **No** to return to the Management Mode page and set the LonMaker tool OffNet.

Any devices you created and commissioned in your original network will have the same Neuron IDs in the copied version. To avoid conflicts, make sure the domain IDs of the original and copied LonMaker network designs are unique, or make sure that the copied LonMaker network design is not attached to the physical network associated with the original version when you are using it.

Monitoring will be disabled in the copy of the LonMaker network. To enable monitoring, right-click a clear space in the drawing page and click **Enable Monitoring**. See Chapter 6, *Monitoring and Controlling Devices*, for more information on how to monitor and control application devices.

Opening an Existing LonMaker Network Design

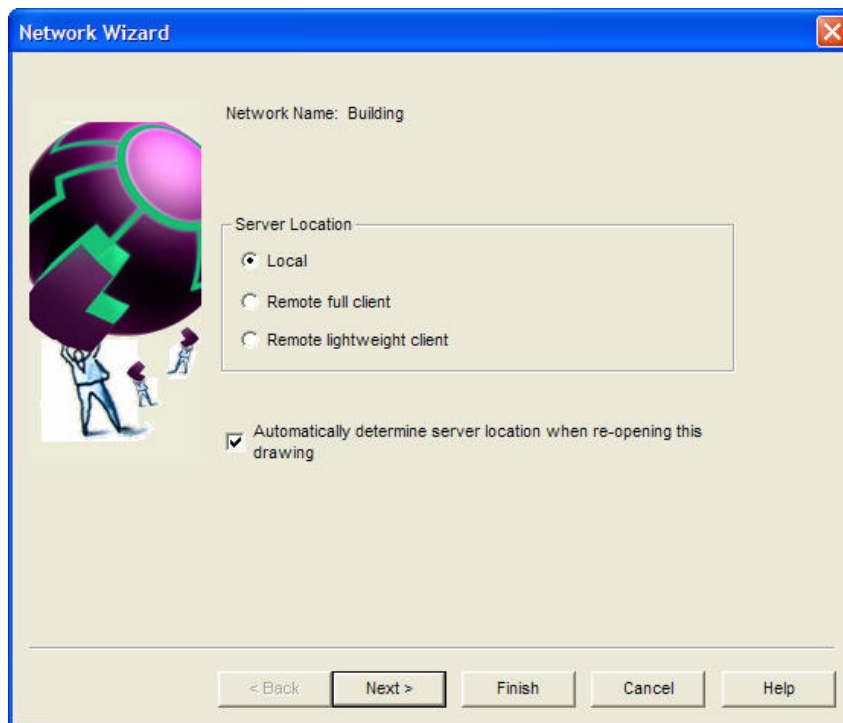
To open an existing LonMaker network, follow these steps:

1. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager opens.
2. Choose the LonMaker network you want to open. Under **Existing Network**, select the desired drawing directory from the **Drawing Directory** list, and then select the network you want to open from the **Drawing Name** list. For networks with multiple drawings files, you can select any of the drawing files associated with the network.
3. To skip any or all of the pages in the Network Wizard when opening the existing network, clear the **Show all Options** check box under the **Existing Network** box. The pages in the Network Wizard will be skipped when you re-open the network provided that you previously selected the check box at the bottom of the page (the **Automatically Determine Server Location** check box for the Server Location page and the **Skip This Prompt** check box for all other pages). You can also select the options to skip the pages in the Network Wizard from the **Network Properties** dialog in the LonMaker drawing (to access this dialog, open the **LonMaker** menu and click **Network Properties**). You cannot skip the User Logon page if you have defined user profiles for the network (see *User Profiles* in this chapter for more information).

4. Click **Open Network**.
5. If you are opening a LonMaker network after starting the LonMaker tool for the first time, a message may appear asking you if you want to enable macros. You must enable macros for the LonMaker tool to function. See *Working with Digital Signatures* for more information.
6. Visio 2003 starts, your LonMaker drawing opens, and the **Server Location** page of the Network Wizard appears (unless you selected the **Automatically Determine Server Location** check box at the bottom of this page when you previously opened the network).

By default, each subsequent page in the Network Wizard will appear every time you open the LonMaker drawing unless you previously selected the **Skip This Prompt** check box on the page from the Network Wizard or from the **Network Properties** dialog in the drawing.

Tip: You can click **Finish** at any point in the Network Wizard to skip the subsequent series of pages and open your LonMaker network. Your LonMaker network will be opened using the settings in the **Network Properties** dialog in the drawing at the time it was last saved.

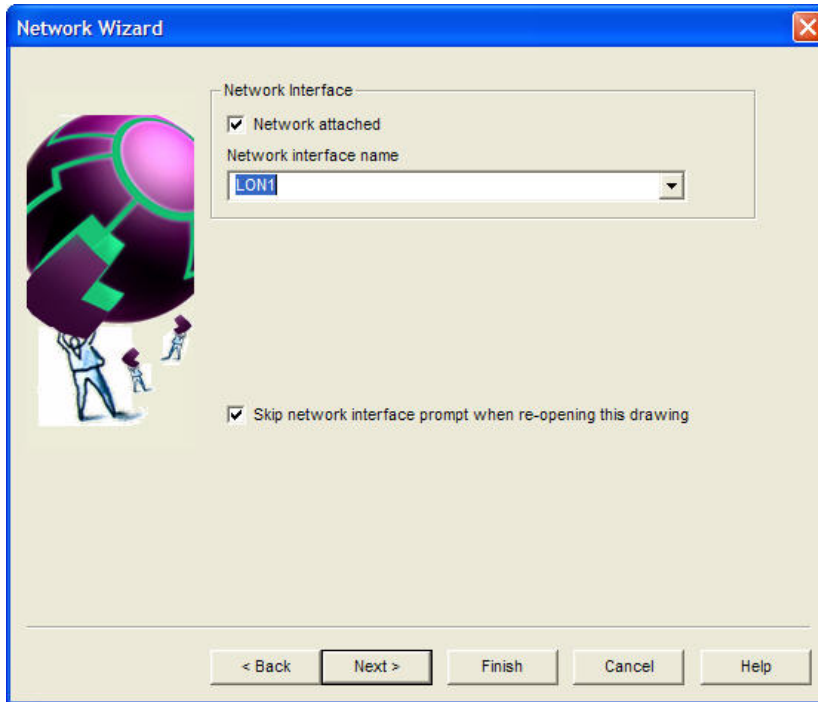


7. Under **Server Location**, select the client type of the computer on which the LonMaker tool is running.
 - Select **Local** if the LonMaker tool is running on the same computer as the LNS Server.
 - Select **Remote Full Client** if the LonMaker tool is running on a computer different than the LNS Server and the LonMaker computer is attached to a LONWORKS channel, including an IP-852 channel.
 - Select **Remote Lightweight Client** if the LonMaker tool is running on a computer different than the LNS Server and the LonMaker computer communicates with the LNS Server using an LNS/IP interface.

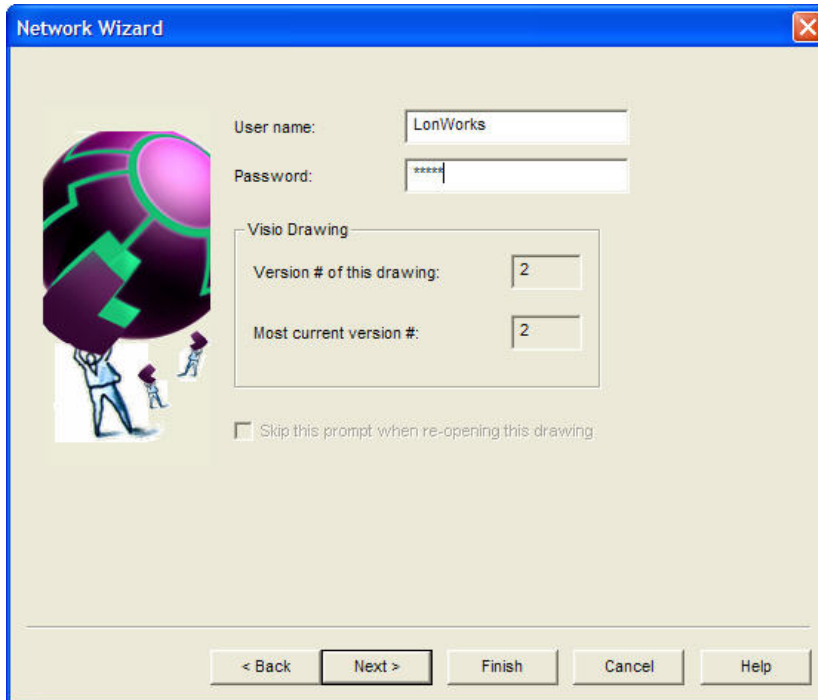
See *LonMaker Client Types* for more information on each of these client types.

Select the **Automatically Determine Server Location** check box to have the LonMaker tool automatically determine the location of the LNS Server when you re-open your LonMaker network. If this check box is cleared, the LonMaker tool will prompt you to select the server

location each time you open the drawing. Click **Next**. The Network Interface page appears, unless the **Skip this Prompt** check box was previously selected.



8. Select the **Network Attached** check box if the LonMaker computer is attached to the physical network and you want the LonMaker tool to communicate with the physical devices. If you select this check box and you have more than one network interface in your computer, select the name of the LNS network interface in the **Network Interface Name** list. Click **Next**. The User Logon page appears, unless user profiles have not been defined for the network and the **Skip this Prompt** check box was previously selected.

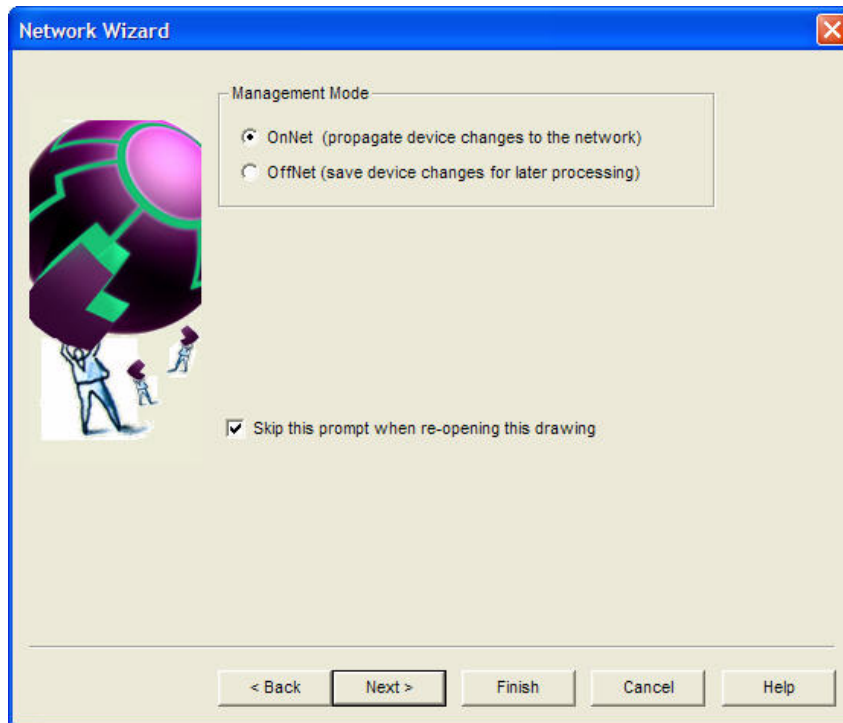


9. If user profiles have been defined for this network, enter the **User Name** and **Password** in their respective boxes.

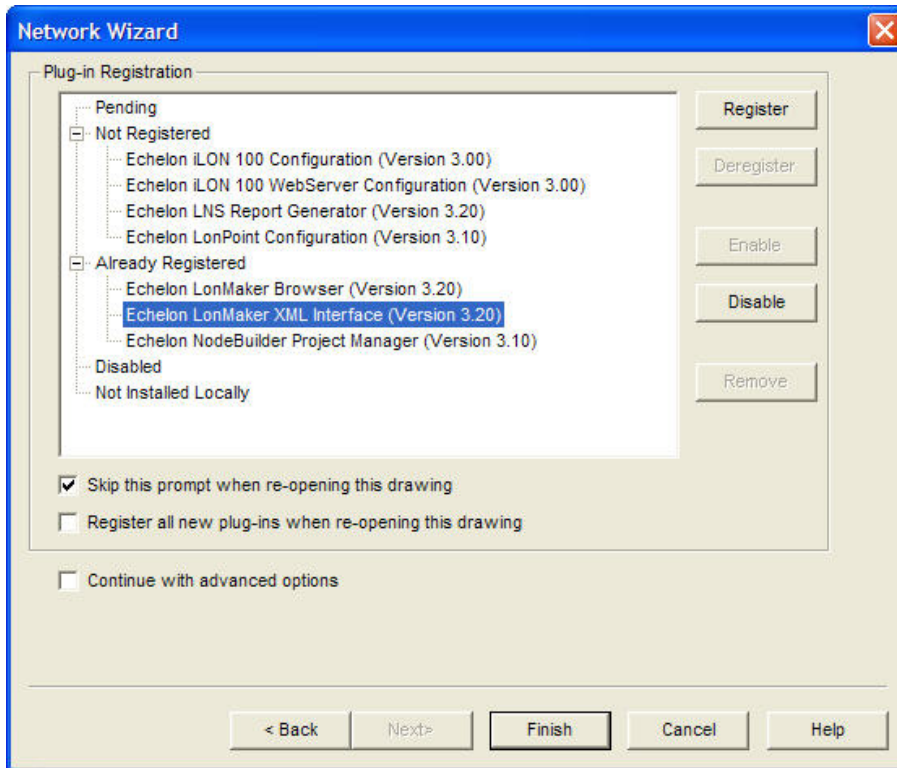
This page displays the version of the drawing, and the most current version of the network database; both are incremented each time you save your LonMaker network design. If the number in the **Version # of this Drawing** box does not match that in the **Most Current Version #** box, you should resynchronize the LonMaker network drawing with the LNS network database. See *Manual Network Resynchronization* in Chapter 7, *Maintaining Networks*, for information on how to do this.

Note: You can open a LonMaker drawing directly from Visio by opening the **File** menu, clicking **Open**, selecting a drawing directory, and then selecting a drawing file. However, if you are using Windows XP or Windows 2000 and you log on as a user other than the one who installed the LonMaker software, you must use the Design Manager to create or open a network at least once before opening a drawing directly from Visio.

Click **Next**. The Management Mode page appears, unless your LonMaker computer is not attached to the network or the **Skip this Prompt** check box was previously selected.



10. Select **OnNet** to automatically propagate all changes that you make to your LonMaker network design to the physical devices. Select **OffNet** to save changes that you make to your LonMaker network design to the network database and not propagate them to the physical devices until you place the LonMaker tool OnNet. Click **Next**. The Plug-in Registration page appears, unless the **Skip this Prompt** check box was previously selected.



11. Register, deregister, enable, and disable any plug-ins in your LonMaker network. If you are working on a remote client, plug-ins that are registered on the LNS Server computer but not installed on the remote client will be listed under the Not Installed Locally category. Click **Finish**.

Note: You may open multiple LonMaker network designs by repeating the preceding steps. Each LonMaker network design that you open will have its own instance of Visio.

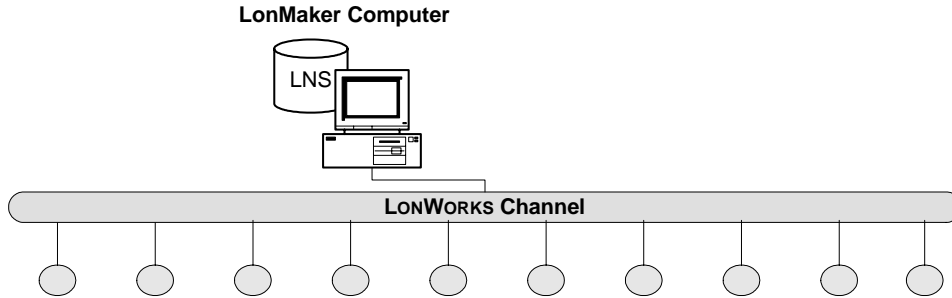
LonMaker Client Types

The LonMaker *client type* is determined by the relationship between the computer on which the LonMaker tool is running (the LonMaker computer) and the LNS server. The LonMaker tool has three client types: a local client, a remote full client, and a remote lightweight client.

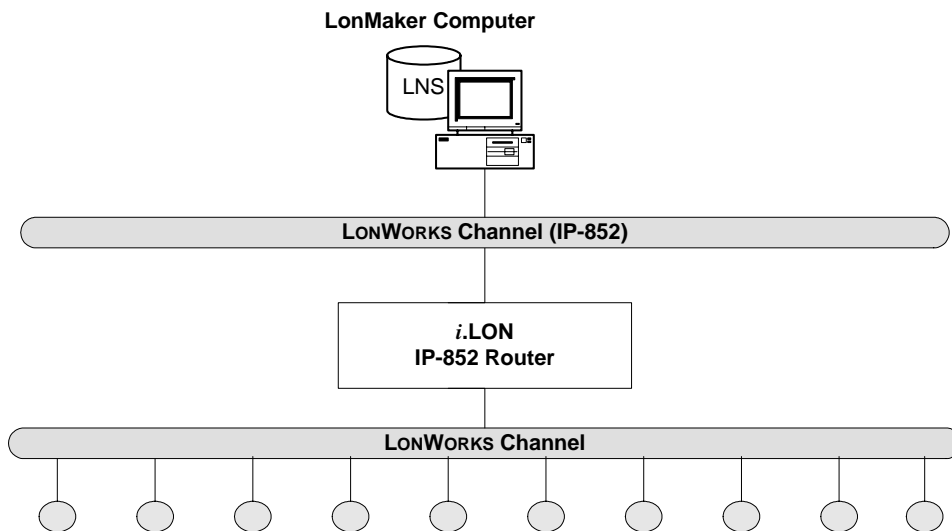
- A *local client* is a LonMaker computer that is also running the LNS Server.
- A *remote full client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) over a LonWorks channel (an IP-852 or TP/XF-1250 channel). On a remote full client, network management tasks are routed through the LNS Server, but monitoring and controlling tasks are sent directly to the network.
- A *remote lightweight client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) using an LNS/IP interface. On a remote lightweight client, network management, monitoring, and controlling tasks are all routed through the LNS Server. This means that all network variable reads and writes are routed through the LNS Server. This routing creates a potential bottleneck in the LNS Server if there are multiple remote lightweight clients monitoring and control multiple data points simultaneously.

Local Client

A *local client* is a LonMaker computer that is also running the LNS Server. To communicate with the network in this configuration, the LonMaker computer needs an LNS network interface such as the U10/U20 USB Network Interfaces; PCC-10 PC Card; or PCLTA-10, 20, and 21 PCI Interfaces.



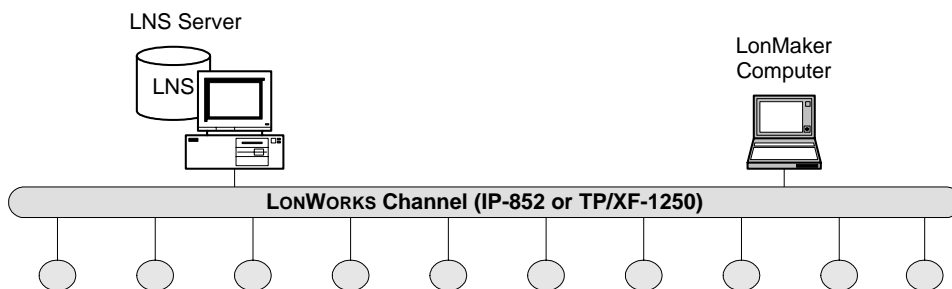
A local client can also be configured as a *local IP client*. In this configuration, the LonMaker computer is attached to a LonWORKS channel such as an IP-852 channel and communicates remotely with the network using an *i.LON* IP-852 router. The LonMaker computer is still a local client because the LNS Server is running on the same computer.



Remote Full Client

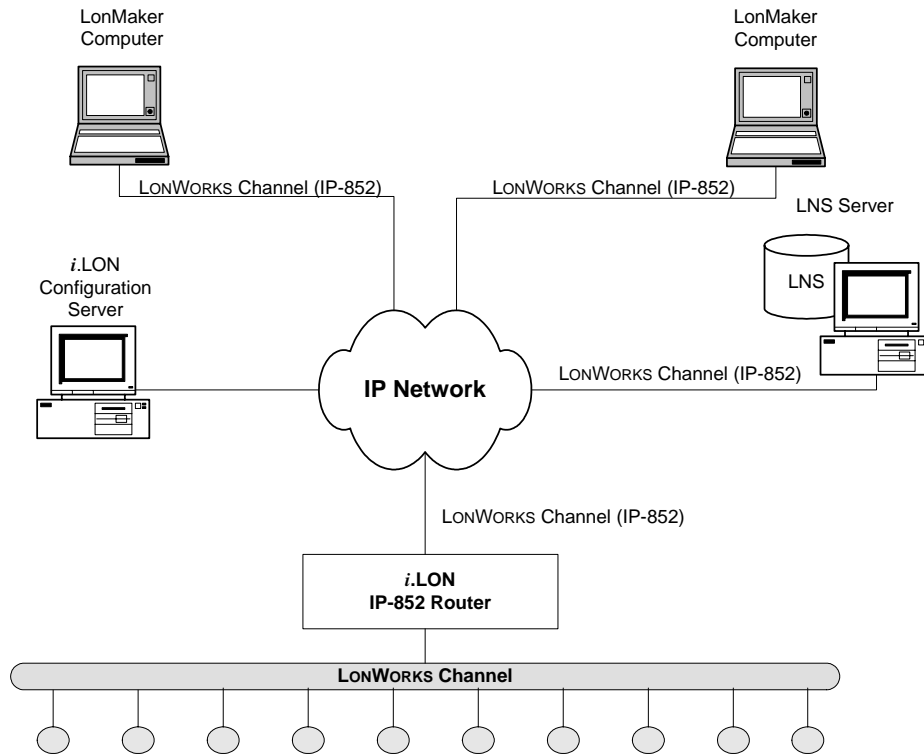
A *remote full client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) over a LonWORKS channel.

The simplest method for a remote full client to communicate with the LNS Server is to attach both to a LONWORKS channel (typically, a high-speed backbone such as an IP-852 or TP/XF-1250 channel). To communicate with the network in this configuration, the LonMaker computer needs a LNS network interface such as the U10/U20 USB Network Interfaces; PCC-10 PC Card; or PCLTA-10, 20, and 21 PCI Network Interfaces.



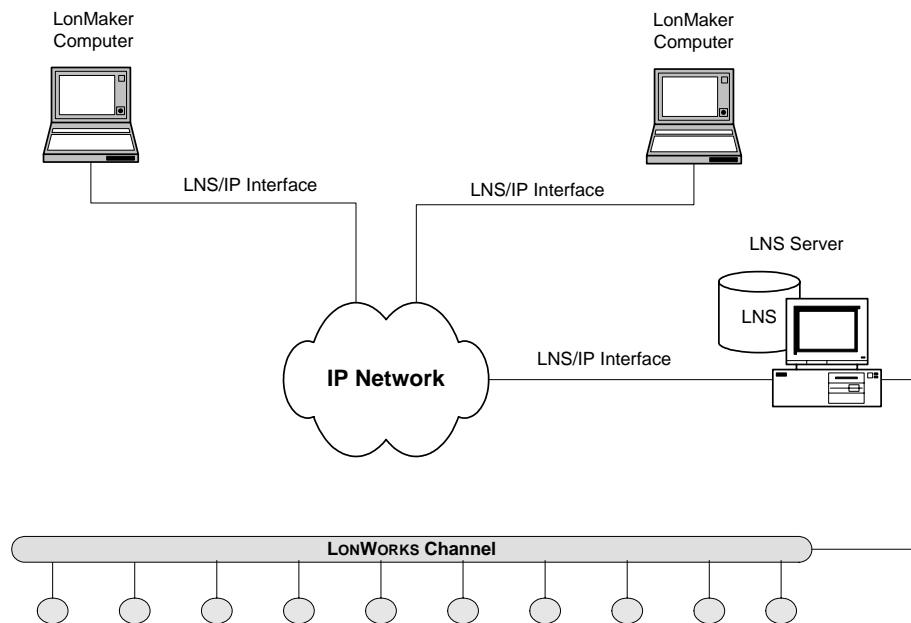
One or more LonMaker computers and the LNS Server may also be connected to the network using separate LonWorks channels. The LonMaker computers communicate over an IP network with the LNS Server, which routes management tasks to the network via an *i*.LON IP-852 router. The LonMaker computers communicate directly with the network via the *i*.LON IP-852 router to perform monitoring and controlling tasks. The *i*.LON configuration server creates virtual IP-852 channels that direct packet traffic and enable the LonMaker computers, the LNS Server, and the *i*.LON IP-852 router to communicate with each other over the IP network.

Creating the IP-852 channels in the *i*.LON configuration server requires that you setup the *i*.LON configuration server and configure and enter information for all the IP-852 devices (the LonMaker computer, LNS Server, and *i*.LON IP-852 router) connected to the IP network. Based on the effort required to do this, it is recommended that you connect to a LonWorks network as a remote full client only if IP-852 channels have already been setup on your IP network. Otherwise, you should connect to the network as a remote lightweight client.



Remote Lightweight Client

A *remote lightweight client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) using an LNS/IP interface. The LNS Server is attached to both the IP network and the LonWORKS channel. A remote lightweight client can connect to the network without an IP-852 router.



Using the LonMaker Tool on a Remote Client

The following sections describe how to use the LonMaker tool on a remote full client and on a remote lightweight client, and it provides tips on managing multiple remote clients.

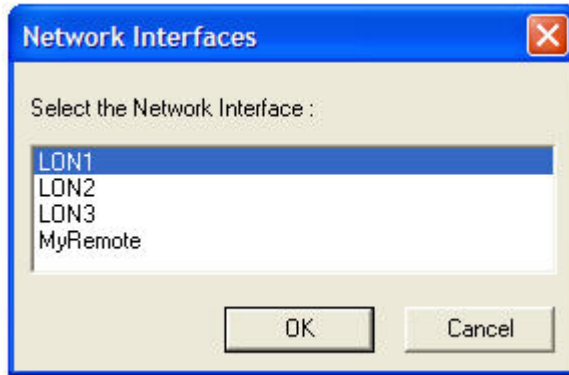
Using the LonMaker Tool on a Remote Full Client

A *remote full client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) over a LONWORKS channel, including IP-852 channels.

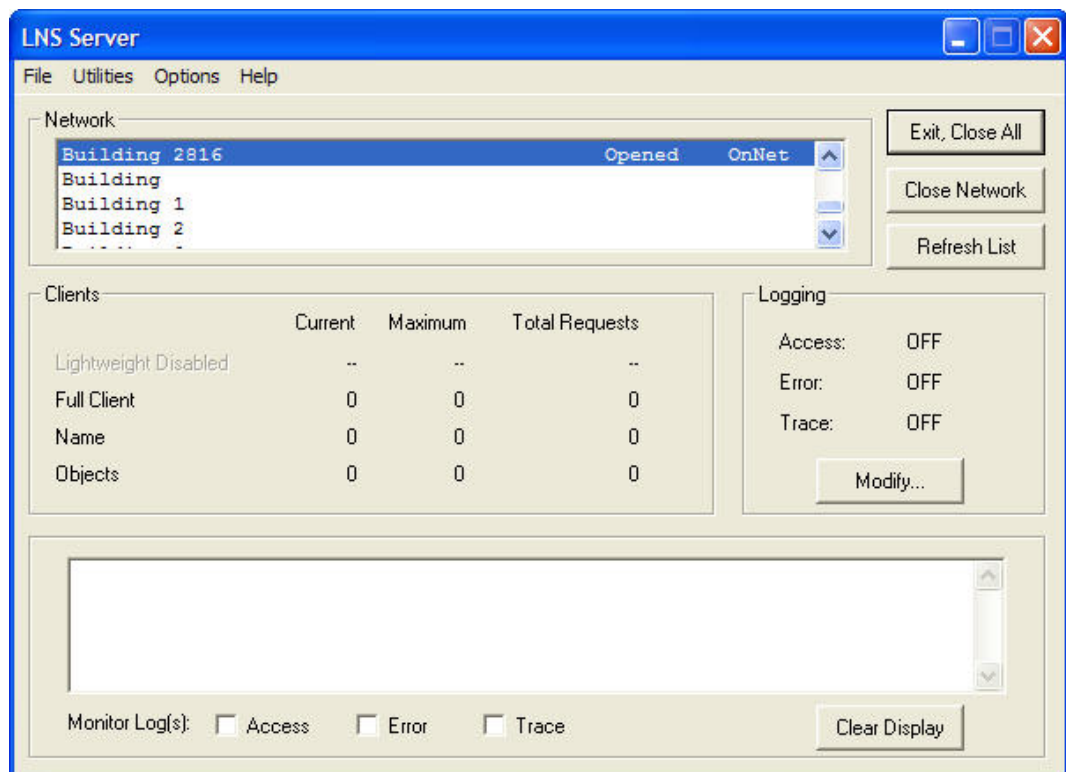
A computer is attached to a LONWORKS channel using either an LNS Network Interface (LonTalk layer 5), or an LNS Fast Network Interface (LonTalk layer 2 or IP-852). An IP-852 interface uses a standard IP interface such as an Ethernet network interface card (NIC) or a modem with PPP software. The network interface must be defined and configured before opening an existing LonMaker network on a remote full client.

To use the LonMaker tool on a remote full client follow these steps:

1. Prepare for remote operations.
 - a. Copy any custom stencils that you will need to the LonMaker drawing folder on the LNS Server computer.
 - b. Back up the LonMaker drawing for the network you will be using and all other files in the drawing directory. See *Backing Up a LonMaker Network Design* in Chapter 7, *Maintaining Networks*, for instructions.
 - c. Save the LonMaker backup file to a shared network folder. If you do not have a shared network folder, save the backup file to a CD, USB drive, floppy disk, or other storage media.
2. Start the LNS Server.
 - a. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager opens.
 - b. Choose the LNS network database you want to open from the **Database Name** list and click **Launch LNS Server**. The **Network Interfaces** dialog box opens.

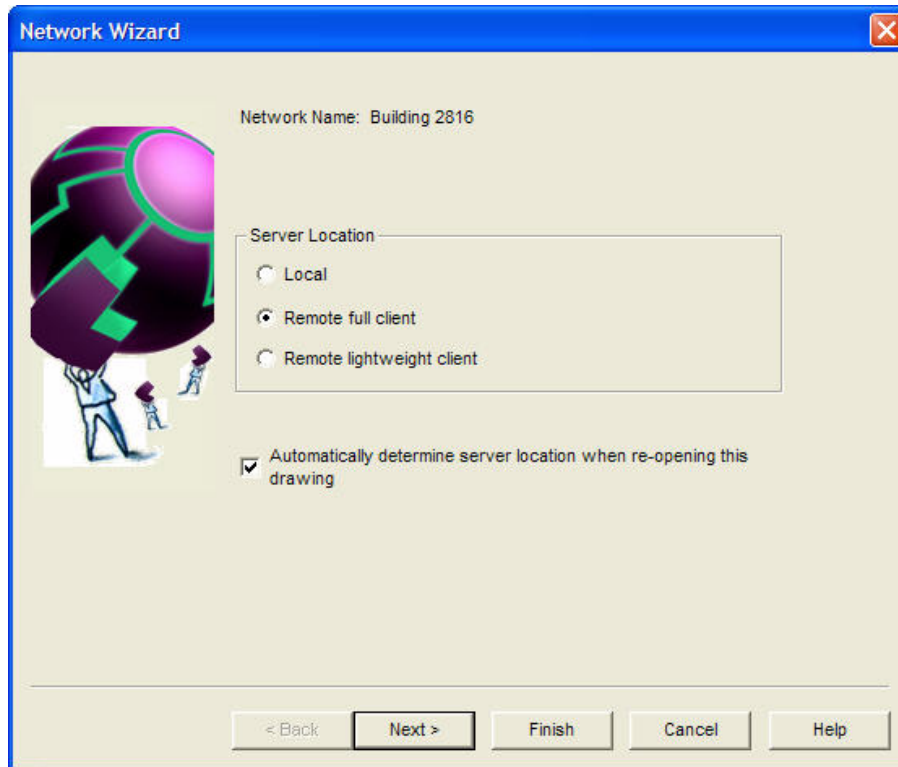


- c. Select the LNS Network Interface or an IP-852 Network Interface you want to use to connect to the LONWORKS channel. The LNS Server or remote client is attached to an IP-852 channel using an IP network interface, such as an Ethernet network interface card (NIC) or a modem channel with PPP software. The network interface to the LONWORKS channel must be defined and configured before opening an existing LonMaker network on a remote full client. Click **OK**. The **LNS Server** dialog appears.
- d. The **LNS Server** dialog displays the status for the open network. For more information on using the LNS Server, open the **Help** menu and click **LNS Server Help** to view the *LNS Utilities Online Help System* file.



- e. To open an additional network, click **Launch LNS Server** on the LonMaker Design Manager. The LNS Server window appears. Highlight the next network to open. Click **Open Network**. The Network Interface page appears. Select the network interface. Click **OK**. Repeat this process for each additional network you want to open.
3. Copy the LonMaker backup file that you created in step 1 to the remote client.

4. Start the LonMaker tool on the remote full client. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager opens.
5. Restore the LonMaker drawings from the backup you created in step 1. See *Restoring a LonMaker Network* in Chapter 7, *Maintaining Networks*, for instructions. After restoring the drawing files, a prompt appears asking whether you want to open the network drawing. Click **Yes** to open the network drawing. The Network Wizard opens with the Server Location page.



6. Select **Remote Full Client** to access the network and then click **Next**. The Network Interface page appears.
7. Select the correct **Network Interface Name** and make sure the network is attached to your computer. This window contains an additional checkbox called **Force LNS Server to be OnNet**. Remote full clients cannot log on with the LNS Server set OffNet. However, if there are no pending updates, the LNS Server will automatically go OnNet to allow the LNS network interface to be added. Normally, if there are pending updates and the LNS Server is OffNet, the LNS Network Interface add will fail. Setting this option enables the LNS network interface add in this case, but it will also cause all other pending updates to be performed. Click **Next**. The User Logon page appears.
8. If the network administrator has configured user names and passwords, login with your user name and password. Make sure they match your user name and password on the server.
9. On the Management Mode page, select **OnNet** if you want changes made to your LonMaker drawing immediately sent to the physical devices. Select **OffNet** if you want changes made to your LonMaker network saved to the LNS database and sent to the physical devices once you set the LonMaker tool **OnNet**. Click **Next**. The Plug-in Registration page appears.
10. Plug-ins registered for the LNS Server are already registered for clients as well. To use plug-ins on a remote client, make sure you have installed the plug-in executables on the remote client. You can add the unregistered plug-ins that are listed under the Not Registered category. For each plug-in you want to register, click the plug-in and then click **Register**. You can select all the plug-ins by clicking the Not Registered category and then clicking **Register**. Plug-ins that are

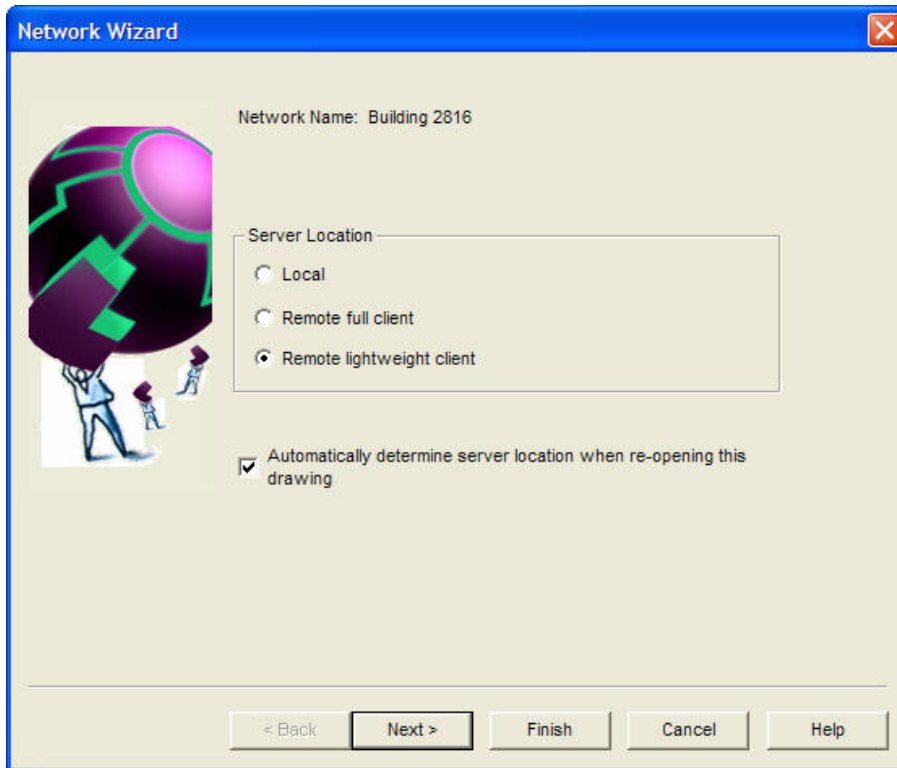
registered on the LNS Server computer but not installed on the remote client will be listed under the Not Installed Locally category. Click **Finish**.

Using the LonMaker Tool on a Remote Lightweight Client

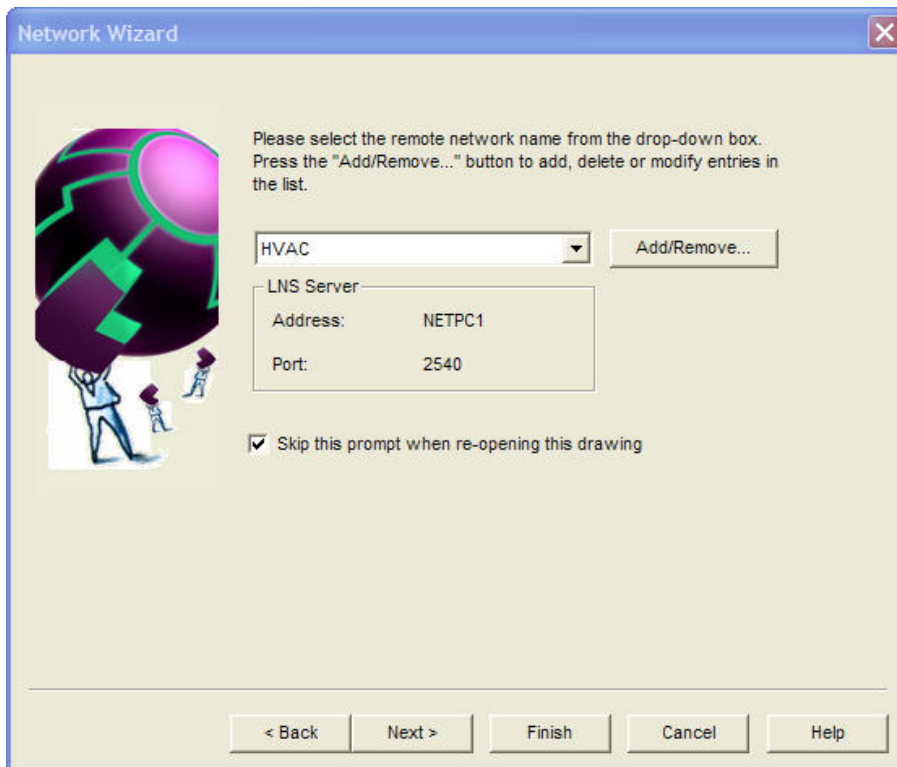
A *remote lightweight client* is a LonMaker computer that communicates with the LNS Server (running on a separate computer) over an IP network (such as the Internet) or local intranet using an LNS/IP interface. The network interface must be defined and configured before opening an existing LonMaker network on a remote lightweight client.

To use the LonMaker tool on a remote lightweight client follow these steps:

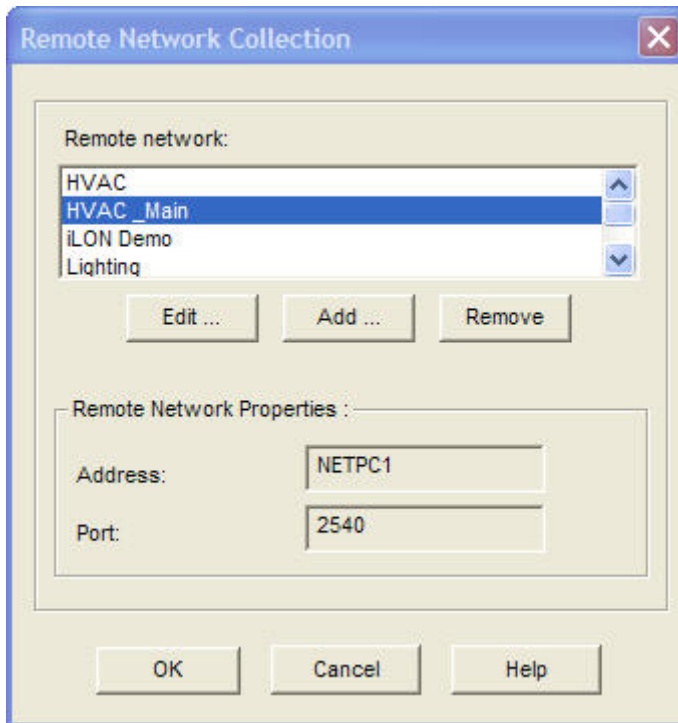
1. Prepare for Remote Operations.
 - a. Copy any custom stencils that you will need to the LonMaker drawing folder on the LNS Server computer.
 - b. Back up the LonMaker drawing for the network you will be using and all other files in the drawing directory. See *Backing Up a LonMaker Network Design* in Chapter 7, *Maintaining Networks*, for instructions.
 - c. Save the LonMaker backup file to a shared network folder. If you do not have a shared network folder, save the backup file to a CD, floppy disk, or other storage media.
2. Start the LNS Server application.
 - a. Ensure that the LNS Server computer is not set up to go into standby mode. Standby mode will prevent communication with remote clients.
 - b. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager opens.
 - c. Choose the LNS network database you want to open from the Database Name list and click **Launch LNS Server**. The **Network Interfaces** dialog box opens.
 - d. Select the LNS Network Interface or an IP-852 Network Interface you want to use to connect to the LONWORKS channel. Click **OK**. The **LNS Server** dialog appears.
3. Copy the LonMaker backup file that you created in step 1 to the remote lightweight client.
4. Start the LonMaker tool on the remote lightweight client. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The LonMaker Design Manager opens.
5. Restore the LonMaker drawings from the backup you created in step 1. See *Restoring a LonMaker Network* in Chapter 7, *Maintaining Networks*, for instructions. After restoring the drawing files, a prompt appears asking whether you want to open the network drawing. Click **Yes** to open the network drawing. The Network Wizard opens with the Server Location page.



6. Select **Remote Lightweight Client** to access the network and then click **Next**.
7. If the server address is configured correctly, you can skip to step 10, in which the User Logon window appears. If there is a problem with the server address, or you are opening a drawing created using LonMaker 1, the Selecting a Remote Network Name page appears.



8. Select a LonMaker network to open. If a connection to this network has already been established, click **Next**, and skip to Step 10. If you are accessing the selected network over an LNS/IP interface for the first time, click **Add/Remove**. The **Remote Networks Collection** dialog box appears.



9. Under **Remote Network Properties**, the **Address** box displays the address of the LNS Server, and the **Port** box displays the port used for the LNS/IP connection (the default is 2540, which is the default port for the LNS Server). Both boxes are read-only. Click **Add** or **Edit** to create a new remote network or modify an existing one. Click **OK**, select the newly created remote network, and then click **Next**. The User Logon window appears if user profiles have been set up for the network. Otherwise, skip to setting the management mode in step 11.
10. On the User Logon window, enter your user **Name** and **Password** if user profiles have been set up.
11. On the Management Mode page, select **OnNet** to automatically propagate changes made to your LonMaker network design to the physical devices. Select **OffNet** if you want changes made to your LonMaker network saved to the LNS database and not propagated until you set the LonMaker tool **OnNet**. Click **Next**. The Plug-in Registration page appears.
11. Plug-ins registered for the LNS Server are already registered for clients as well. To use plug-ins on a remote client, you must install the plug-in executables on the remote client. You can add the unregistered plug-ins that are listed under the Not Registered label. For each plug-in to be registered, click the plug-in and then click **Register**. You can select all the plug-ins by clicking the Not Registered category and then clicking **Register**. Plug-ins that are registered on the LNS Server computer but not installed on the remote client will be listed under the Not Installed Locally category. Click **Finish**.

Using Network Service Device Shapes


A *network service device* (NSD) is a local or remote client capable of monitoring and controlling the network. Every LNS Server and LonMaker remote full client in a network may be represented in a

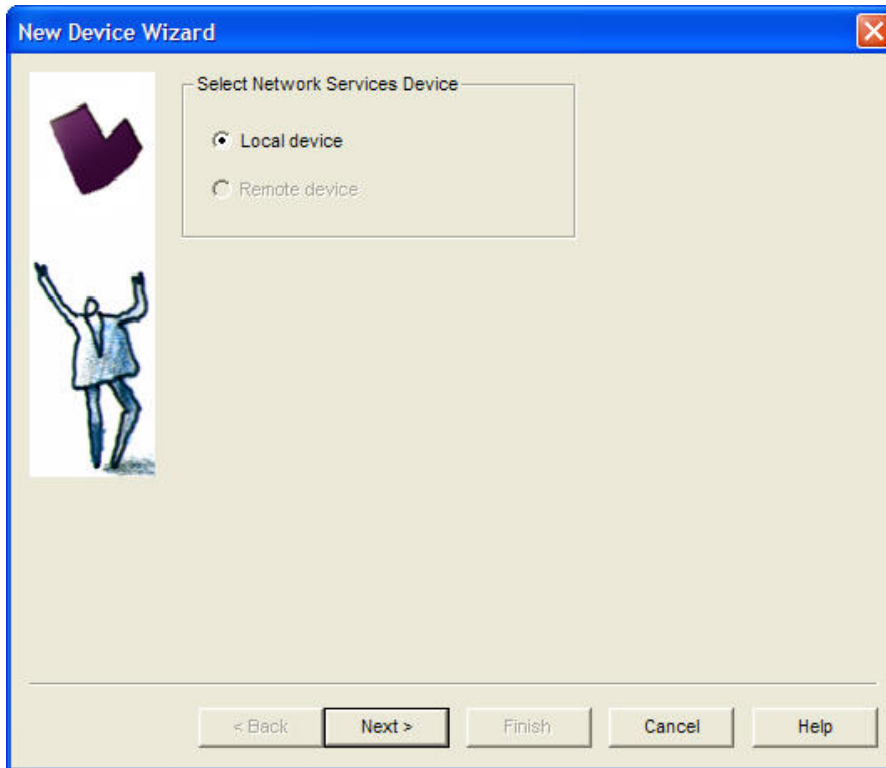
LonMaker drawing with an NSD shape. When a LonMaker network is created, it initially contains one NSD shape that represents the LNS Server—the LNS Network Interface.

If a remote full client is connected to a network, you can add an NSD shape to the LonMaker drawing to represent it. Creating an NSD shape makes that remote full client permanent in the drawing; otherwise, LNS automatically creates and deletes it each time you open and close the network.

After you have added a network service device, you can add a virtual functional block to that NSD, add network variables to the virtual functional block, and then connect the network variables. This enables the NSD to monitor devices directly as described in *Binding Network Variables to the Host* in Chapter 6, *Monitoring and Controlling Devices*. Additionally, this lets you perform the network management tasks described in Chapter 8, *Managing Networks*.

To add a network service device shape, follow these steps:

1. Drag the Network Service Device shape  from the LonMaker Basic stencil to your LonMaker drawing.
2. A dialog opens that allows you to select whether the network service device being added represents the local NSD (only available if you are a remote client and you are using a NSD that does not have a shape associated with it) or a remote NSD.

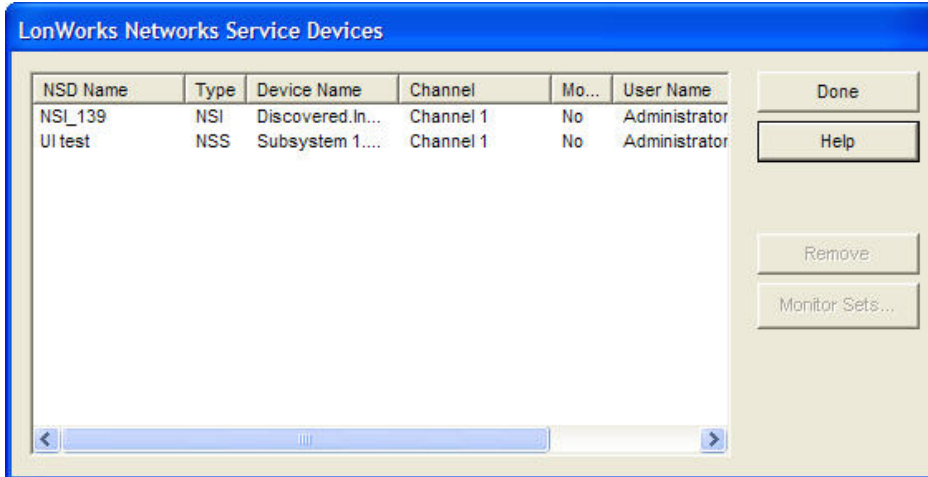


3. If you choose **Remote Network Service Device** in step 2, a dialog opens which allows you to select the local or remote network service device to be associated with this network service device shape. If there is only one network service device with no corresponding shape, it will be automatically selected.

Note: If you need to remove a NSD from the physical network, first remove the network service device shape from the drawing by right-clicking it and selecting **Delete** from the shortcut menu.

Listing Network Service Devices

If you are using the LonMaker tool with remote clients, you can view a list of all LNS clients connected to the network. Each client is represented by a network service device. To obtain a list of all NSDs in a network, open the **LonMaker** menu and select **Network Service Devices**. The **LONWORKS Network Service Devices** dialog box opens.



This dialog box lists all NSDs in this network, regardless of whether a shape has been created for each NSD. For each NSD, the following information is listed:

<i>NSD Name</i>	Specifies the name of the NSD, which is assigned by the LNS Server.
<i>Type</i>	Specifies the NSD type. This can either be NSS (the LNS Server) or NSI (a remote full client).
<i>Device Name</i>	Specifies the NSD name in the format of <i><subsystem name>.<network service device name></i> .
<i>Channel</i>	Specifies the channel on which the NSD is attached.
<i>Monitor Sets?</i>	Indicates whether monitor sets are defined on the NSD.
<i>User Name</i>	Specifies the user name associated with the NSD. See <i>User Profiles</i> for more information on user names.
<i>Application</i>	Specifies the name of the application currently active on the NSD. If there is no application, or the application does not provide its name, “Unknown” is displayed. If the network service device is not responding, “No Response” is displayed.

Click **Remove** to delete the selected network service device from the network. This option is generally used to remove remote network service devices that are no longer in use, which improves the performance of the LonMaker tool.

Click **Monitor Sets** to open the **Monitor Sets** dialog box, in which you can view and remove monitor sets in the LonMaker network. To delete a monitor set, locate the monitor set to delete from the list, right-click the monitor set, and then click **Remove** on the shortcut menu.

Upgrading Network Service Devices

When you upgrade the LonMaker tool or switch between an LNS fast network interface (LonTalk layer 2) and an LNS network interface (LonTalk layer 5), you must upgrade your network service

device. When you open the network and either of these conditions is detected, the LonMaker tool will ask whether you want to upgrade. You should typically perform the upgrade. However, if you are only using a different network interface temporarily, you may choose not to upgrade. In this case, communication with physical devices is limited until the network is reopened with the original network interface. If initially you choose not to upgrade the network service device and decide later to upgrade, select the NSD shape, right-click it, and then click **Upgrade NSD** on the shortcut menu.

When moving from an LNS fast network interface (LonTalk layer 2) to an LNS network interface (LonTalk layer 5), all connections and monitor sets may not be created on the new network interface. If this happens, a dialog displays the items that will be lost and gives you an opportunity to cancel the upgrade.

Replacing a Local Network Service Device

When working as a remote full client, you can configure your local NSD to assume the configuration (monitor sets, connections, and so on) of another, previously defined network service device. You can do this by replacing a local NSD with the desired NSD shape. The following conditions must be met:

- Your current local NSD cannot have an NSD shape associated with it. If it does, you must first delete the NSD shape from the drawing along with any associated functional block shapes and connections.
- The desired NSD must have a shape in the drawing. If necessary, select one from the template and drag it to the drawing.

When these conditions are met, select the desired NSD shape, right-click it, and then click **Make Local NSD** on the shortcut menu. You have full access to the configuration of the selected NSD.

Note: The selected NSD must not currently be in use by another remote client. If it is, performing this operation will disconnect the other user from the network.

User Profiles

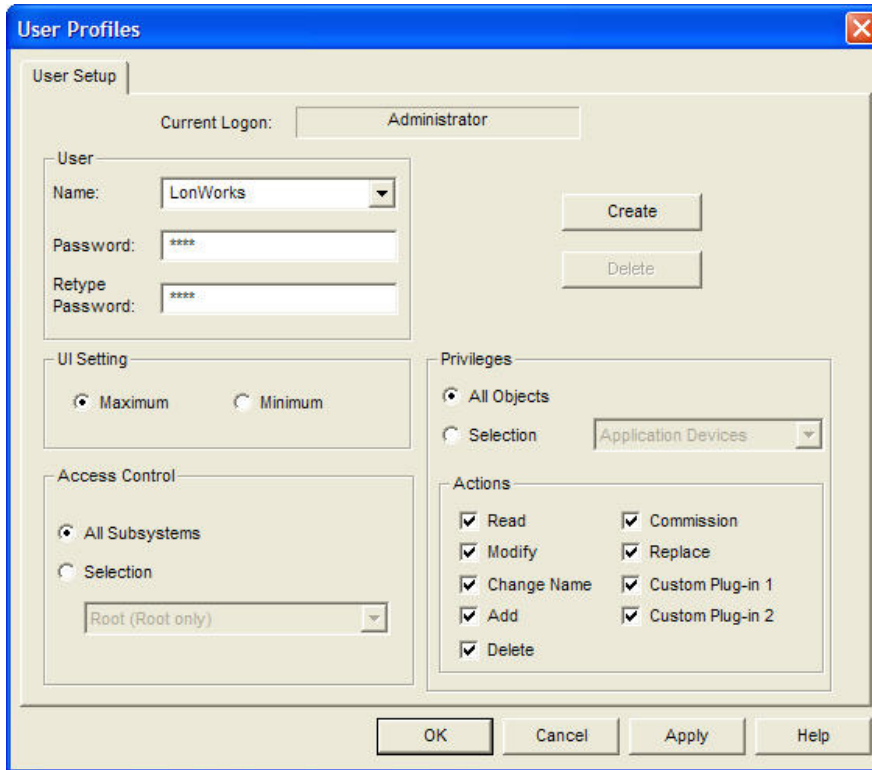
With user profiles, you can set which parts of a LonMaker drawing users can access and the actions they can perform. For example, you could have a scenario in which a system designer has access to the entire network and can add, delete, or change channels, routers, devices, functional blocks and all other objects. Integrators, though, would only be able to access the subsystem they are installing and be restricted to commissioning devices and routers in that subsystem.

To enable user profiles on a LonMaker drawing, you must first assign an administrator password. To set the administrator password, open the **LonMaker** menu in the network drawing, select **User Profiles**, enter the password in the **Password** and **Retype Password** boxes, and then click **Apply**. Note that the password is case sensitive.

Creating a New User Profile

To create a new user profile, follow these steps:

1. In the LonMaker drawing, open the **LonMaker** menu and select **User Profiles**. The **User Profiles** dialog box appears.



2. Enter the name of the new user name in the **Name** box, and the password in the **Password** and **Retype Password** boxes. Note that both the user name and password are case sensitive.
3. Set the user interface, access, and privileges of the new user.

UI Setting

Select the set of LonMaker and Visio menu that will be available to the user. You have two choices:

- **Maximum.** This setting provides the user a full set of toolbars, menus, and menu items for advanced use of the LonMaker tool.
- **Minimum.** This setting provides the user only the basic menus, menu items, and toolbars necessary to use the LonMaker tool.

You change the UI setting while the drawing is open by opening the **LonMaker** menu and then clicking **Select Minimum/Select Maximum UI**.

Access Control

Select the type of access the user has in the LonMaker drawing. You have two choices:

- **All Subsystems.** The user has unrestricted access to all of the subsystems in the network.
- **Selection.** The user's access is restricted to the selected subsystem. This option can only be applied to the root subsystem or any one of the subsystems one level below it. If you select the root subsystem, the user cannot access any of the subsystems below it.

Privileges

Select which actions the user can perform on objects in the LonMaker drawing.

You can set privileges for reading, modifying, changing the name, adding, deleting, commissioning, and replacing objects, as well as the use of plug-ins for the objects. The objects for which you can set

privileges consist of the network, subsystems, channels, application devices, routers, functional blocks, connections, network variables, and configuration properties.

While **All Objects** is selected, the privileges you set apply to all objects. For example, to prevent this user from modifying any object, click **All Objects** and then clear the **Modify** check box.

While **Selection** is selected, the privileges you set apply only to the object specified in the **Selection** list. For example, to enable this user to be able to modify functional blocks but not devices, click **Selection**, select **Functional Blocks**, and then select the **Modify** check box. Then select **Application Devices** from the **Selection** list and clear the **Modify** check box.

4. Click **Create** if you are logged on as the Administrator; otherwise, click **OK**.

Note: Once the new user profile has been created, that user can open the network drawing and then change their password or create new user profiles. A user can grant a new user only those privileges that they have themselves. After setting all user,

Changing Passwords

All users can change their passwords. To change a password, open the **LonMaker** menu, select **User Profiles**, and click the **Change Password** tab. Type the old password in the **Old Password** box, enter the new password in the **New Password** and **Retype Password** boxes, and then click **OK**. The password will be changed.

Modifying and Deleting User Profiles

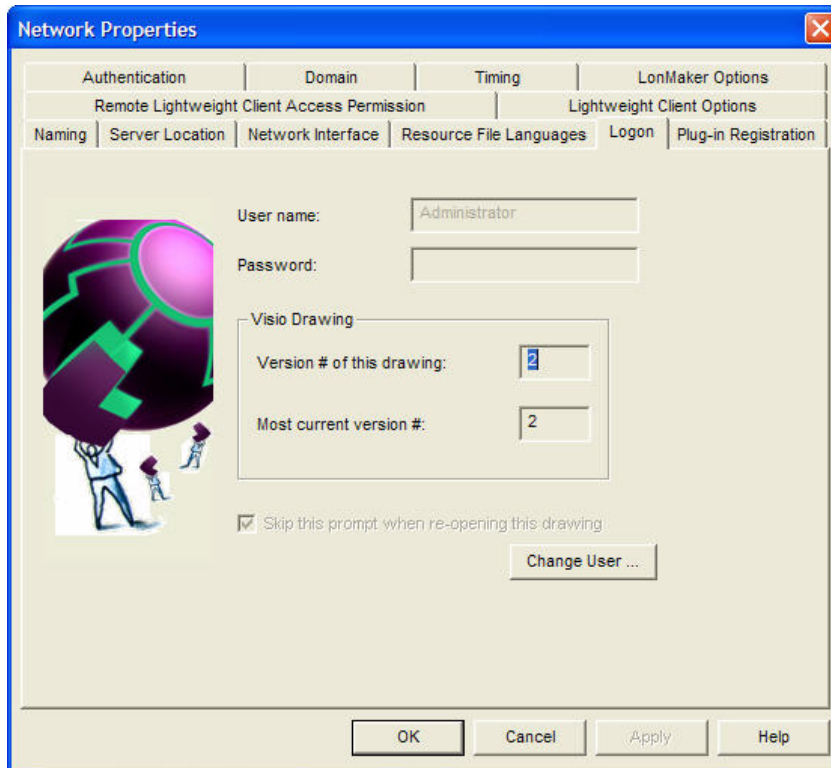
Only the Administrator can modify or delete a user profile. To modify a user profile, open the **LonMaker** menu, select **User Profiles**, and select a user profile to modify from the **Name** list. Change the options for the user interface, access and/or privileges, and then click **Apply**. The LonMaker tool saves the changes for the selected user. If the user is currently logged onto the network drawing from another computer, they must close and re-open the LonMaker tool for the changes to take effect.

To delete a user profile, select the user profile you want to delete from the **Name** list and click **Delete**. A confirmation prompt appears. Click **Yes** to delete the selected user.

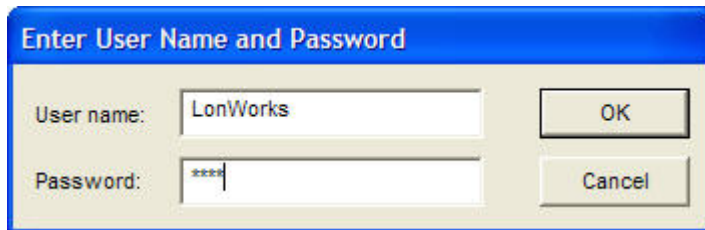
Changing User Profiles in a LonMaker Drawing

You can switch user profiles in a LonMaker drawing. To change users, follow these steps:

1. Open the **LonMaker** menu, select **Network Properties**, and click the **Logon** tab.



2. Click **Change User**. The **Enter User Name and Password** dialog box appears.



3. Enter the user name and password of the user you want to logon as.
4. Click **OK**. You will be logged on as the selected user.

Using the LonMaker Tool Remotely with User Profiles

When you open a LonMaker network on a remote client, you will be prompted for your user name and password (provided that the administrator password has been set for the network). After logging on to the network, you will have the same privileges as you do when working on a local client.

Designing Networks

This chapter describes how to design a network using the LonMaker tool. It covers how to create the following objects in a LonMaker drawing: application devices, functional blocks, network variables, routers, channels, subsystems, and *i*.LON servers. It explains how to connect network variables. It explains working with LonMaker shapes and layers, customizing the LonMaker user interface, and using LonMaker with AutoCAD drawings.

Creating a LONWORKS Network

You can create a LONWORKS network by designing the network and then commissioning application devices and routers using the LonMaker tool.

To design a LONWORKS network with the LonMaker tool, you create a LonMaker drawing. This involves adding LonMaker shapes for channels, routers, devices, and functional blocks; making logical connections between devices so they can send and receive data to and from each other; and organizing the network into subsystems. You can add LonMaker shapes at any time under any installation scenario: you can add LonMaker shapes while you are offsite designing the network, or while you are onsite commissioning devices and performing network maintenance.

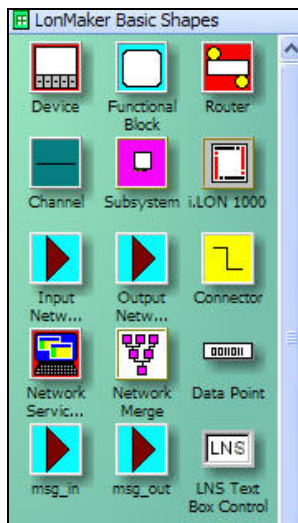
To install the network, you commission devices and routers. Commissioning associates the device shapes created in the LonMaker drawing with the physical devices on the network.

This chapter describes how to create a LonMaker drawing. Commissioning devices is covered in Chapter 5, *Installing Networks*.

Creating a LonMaker Drawing

To create a LonMaker drawing, you add devices, routers, functional blocks, and other LonMaker objects to the drawing page. To add a LonMaker object, you drag its LonMaker shape from a stencil onto the drawing page. If required, the appropriate wizard will then open and guide you through the process of creating that shape. After reading this section, you can complete the LonMaker quick-start exercise in Appendix C to create a simple network with the LonMaker tool.

The following sections describe how to create the objects in the LonMaker Basic Shapes stencil.



Notes:

- Several of the shapes in the LonMaker Basic Shapes stencil are discussed elsewhere in this user's guide. For creating Network Service Device shapes, see *Using Network Service Device Shapes* in Chapter 3, *Getting Started*; for creating Data Point shapes, see *Using Data Point Shapes* in Chapter 6, *Monitoring and Controlling Networks*; and for using the Network Merge shape, see *Merging LonMaker Networks* in Chapter 7, *Maintaining Networks*.
- If you have licensed the LonMaker tool as part of the NodeBuilder tool, the NodeBuilder Release and Development Target Device shapes will also be included in the LonMaker Basic Shapes stencil (see the *NodeBuilder User's Guide* for more information on creating devices with these shapes).

Creating Application Devices

An *application device* consists of hardware and software that runs an application and communicates with other devices using the ANSI/CEA-709.1 (EN14908-1) protocol. An application device in a LonMaker drawing corresponds to a physical device on the network.

To add an application device to your LonMaker drawing, you define and then commission it. To define a device, you choose the device shape and name, as well as the template, location, channel, and optional description for the device. You can define a device without the LonMaker tool being attached to the network. To commission a device, you associate the physical device on the network with the device shape that you created in the LonMaker drawing.

When you add a device to your LonMaker drawing, you must define it, but you do not have to commission the device until you are ready to install it. This is how you design an engineered system. You define and configure devices offsite; bring the network database onsite; and then commission the devices. Under the ad-hoc installation scenario, you define and commission the devices in one step while onsite.

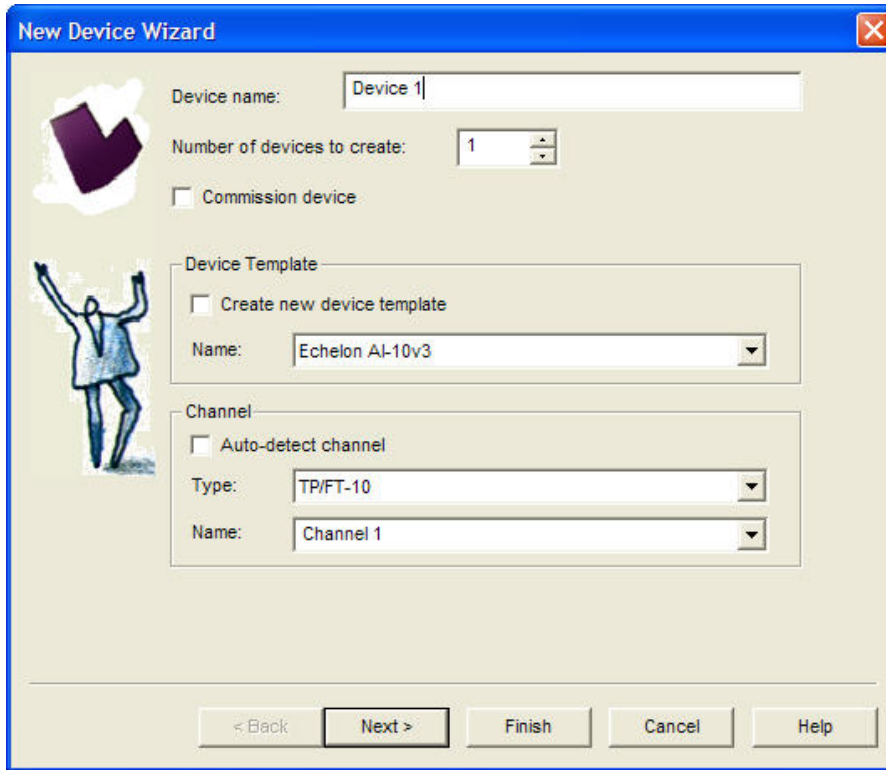
You can create an application device in one step. To do this, you enable automatic channel selection and then drag a custom device master shape to your LonMaker drawing, near the channel on which the device will be attached. Otherwise, the New Device Wizard appears when you add a device shape to your LonMaker drawing. See *Using Automatic Channel Selection* in this section for how to enable this feature. See Chapter 12, *Creating and Using LonMaker Shapes and Stencil*, for how to create and use custom device master shapes.

The first page of the New Device Wizard includes a **Commission Device** check box for commissioning the device. To commission the device immediately after defining it, select this check box. The wizard prompts you to identify the physical device before adding the Device shape to your LonMaker drawing (see *Commissioning Devices and Routers* in Chapter 5, *Installing Networks* for more information). Otherwise, the wizard will add the Device shape to your network drawing after you have finished defining it.

To create a device in a LonMaker drawing, follow these steps:



1. Drag a Device shape from the LonMaker Basic Shapes stencil or other stencil to the drawing page. The New Device Wizard appears unless you enabled automatic channel selection and dropped a custom device master shape near a channel shape.



2. Enter the following information for the device.

Device Name

Enter the name of the device. This name must be unique within the currently displayed subsystem. The device name may be up to 85 characters and include embedded spaces, but it may not include period, backslash, colon, forward slash, or double quote characters.

The default device name is the abbreviated device shape name followed by a dash, a space, and the instance number “1”. The instance number in the default device name is incremented one for each subsequent device of that type you create. For example, the default device name of the first analog input device you create is “AI- 1”, the second is “AI- 2”, and so on.

You can change this default naming convention by opening the **LonMaker** menu, clicking **LonMaker Options**, and then clicking **Naming Options**. See *Naming Options* in Appendix A for information on how to use the options on this page to change the default naming convention.

Number of Devices to Create

Select the number of devices to be created. If you create more than one device, the LonMaker tool will automatically increment the instance number in the default names of the additional devices and place them on the drawing adjacent to the first shape. If the device name does not contain an instance number at the end, the LonMaker tool will append the instance number 1 to the second device (for example, “Device” for the first device becomes “Device 1” for the second device), and it will increment the instance number for additional devices.

Commission Device

Select this check box to commission the device after defining it. This option is disabled if you are creating more than one device.

Device Template

Create a New Device Template

Select this check box to create a new device template for the device. If you select this check box, the Specify Device Template window appears after you click **Next**. In this window, you can define a new template by uploading the device interface definition from the device or importing an existing device interface (XIF) file from your computer.

This check box is unavailable for device shapes with pre-defined device templates such as the LonPoint device shapes.

Name

Displays the LNS device template that defines the device's interface. If the device shape has a pre-defined device template (such as the LonPoint device shapes), that template will appear in the box. Otherwise, this box will be blank.

If you are creating a new device template, enter a name for the new device template. If you are using an existing device template, select one from the list.

Channel

Auto-detect Channel

Select this check box to automatically detect the channel on which the device is attached. For this option to function, the LonMaker tool must be attached to the network, and all routers between the LonMaker drawing network interface and the device must be installed, commissioned, and online. Otherwise, an error will be returned during commissioning.

Selecting this check box disables the **Type** and **Name** boxes below.

Do not select this check box if you are using routers that are configured as repeaters or bridges.

If this check box is cleared, you must explicitly select which channel the device is on from the **Name** box.

Type

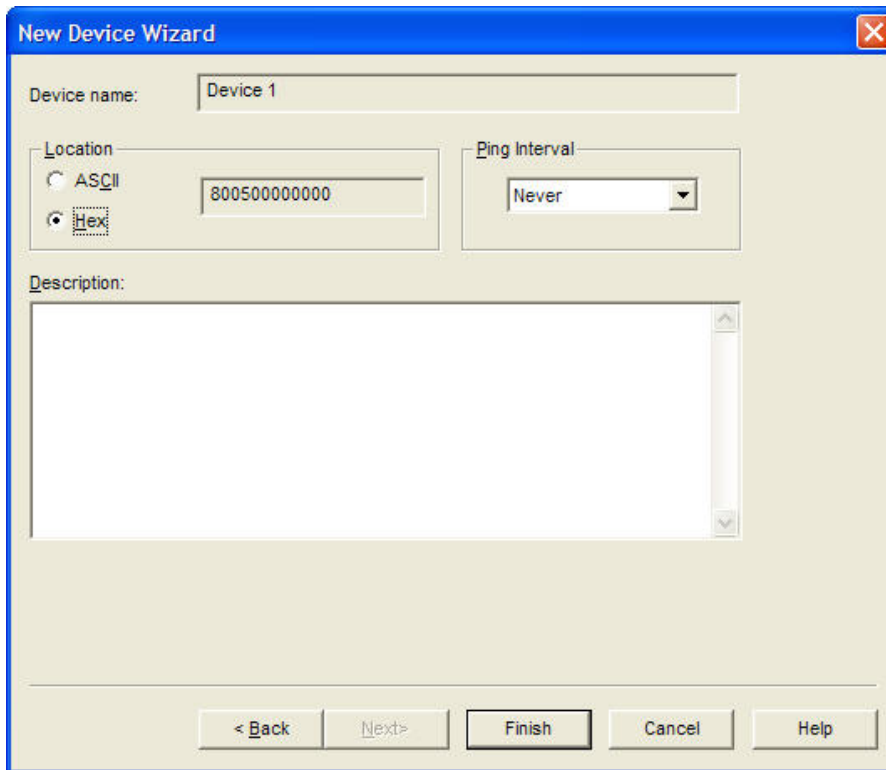
Select the channel type for the device. By default, this box displays the channel type of the channel currently displayed in the **Name** list. You can use it to filter the existing channels in the **Name** list to those with a specific channel type.

You can limit the channel types displayed by specifying the channel type in a custom device shape.

Name

Select the channel that you will attach to the device. You can create a new channel shape by entering a new channel name. The channel name must be unique within the network and be no more than 85 characters long. If you are creating a new channel, specify the channel type in the **Type** box.

3. Click **Next**. If you are creating a NodeBuilder device, a window appears allowing you to select the NodeBuilder device template; otherwise skip to step 4. After you have created and/or selected the NodeBuilder device template, click **Next** (see the *NodeBuilder User's Guide* for more information). The Device Properties window appears.



4. Enter the following information:

Location

Specifies a 6-byte location string that documents the device's location within the network.

Select the **Set Location Property to Subsystem ID** check box in the network properties: **Recovery** options category to store the device's subsystem ID in this field, which will be read-only. The LonMaker tool can then use this information to place devices in their correct subsystems in the event you need to use the LNS Database Recovery Wizard to recover a lost network database. See *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on the network recovery process.

If the **Set Location Property to Subsystem ID** check box is cleared, you can enter an optional location description for the device. You can enter up to 6 ASCII text characters, or up to 12 hex digits. Set the first bit (0x80 or higher for the first byte) to enter a hex value.

If you do not specify a value and the **Set Location Property to Subsystem ID** check box in the network properties: **Recovery** options category is cleared, the current value in the device will be uploaded into this field and stored in the LNS database when the device is commissioned.

Ping Interval

Enables the LNS Server to ping the device periodically. Pinging verifies that a device is still operating and communicating with the network.

Set the ping interval based on the expected movement of the device. Select **Never** to disable pinging. To enable pinging, change the ping interval to **15 minutes** if you expect the device will seldom move or

if the device is on a power line channel, **2 minutes** if you expect it will move somewhat frequently, and **1 minute** if you expect it will move frequently.

Any errors detected by pinging a device are displayed on the device shape in the LonMaker drawing. See *Using LonMaker Styles* for more information.

Description

Provides an optional description of the device. This description has no effect on network operation, but you can use it to provide additional documentation for as-built reports.

5. If you selected the **Commission Device** check box on the first page of the wizard, the first window for commissioning the device appears. See *Commissioning Devices and Routers* in Chapter 5, *Installing Networks*, for instructions on commissioning your device.

If you did not select the **Commission Device** check box, click **Finish** to complete the device definition process and add the device shape to your LonMaker drawing.

Using Automatic Channel Selection

You can use automatic channel selection to enable the LonMaker tool to automatically select the appropriate channel for a new application device, skipping the New Device Wizard. This feature lets you create a new device with a single click and drag.

To enable automatic channel selection in your LonMaker drawing, open the **LonMaker** menu, click **LonMaker Options**, select **Device** from the **Options Category** list, and then select the **Enable Automatic Channel Selection** check box. You can also have automatic channel selection enabled by default in each LonMaker drawing you create or open. In the LonMaker Design Manager, click the **LonMaker Default Options** tab, select **Device** from the **Options Category** list, and then select the **Enable Automatic Channel Selection** check box.

The order of the criteria used by the LonMaker tool to select the appropriate channel is as follows: (1) closest qualified channel to the device shape, in which the channel shape is within 1 ½ times the width of the device shape; (2) most recently used or created channel; and (3) other available defined channels. If no channel can be selected using the preceding criteria, the New Device Wizard will appear.

Automatic channel selection only applies to those device shapes that include a device template definition and channel type information such as master device shapes and copies of existing device shapes. The New Device Wizard therefore will always appear when you drag the generic Device shape from the LonMaker Basic stencil to your LonMaker drawing.

Changing the Channel of an Application Device

You can move an application device to a different channel, preserving the device's configuration and all of its connections. You can do this to assign a device to a channel different than the one that was automatically selected by the LonMaker tool, or to physically move a device to a different compatible channel. To move a device to a different channel, you can either right-click the device and then click **Move Device** on the shortcut menu, or you can use the **Connector** tool on the Visio **Standard** toolbar to graphically move the device.

To use the **Move Device** command, right-click the device shape and click **Move Device** on the shortcut menu. See *Moving LonMaker Shapes* in this chapter for how to move a device using the **Move Device** command.

To use the Visio **Connector** tool to move the device, follow these steps:

1. Select the **Connector** tool  on the Visio Standard toolbar.

2. Position the **Connector** tool over the “**x**” connection point of the device so that a red box appears over the “**x**”.
3. Click and hold the mouse button.
4. Drag the **Connector** tool to the center of the shape of the desired channel so that a red box appears around the channel shape.
5. Release the mouse button.
6. Select a different tool on the Visio toolbar if you will not be making additional connections or re-assignments (if you continue to use the **Connector** tool to add new devices, routers, or functional blocks shapes to your drawing, Visio will attempt to connect the shapes, which may not be desired or could generate errors.)


Creating Functional Blocks

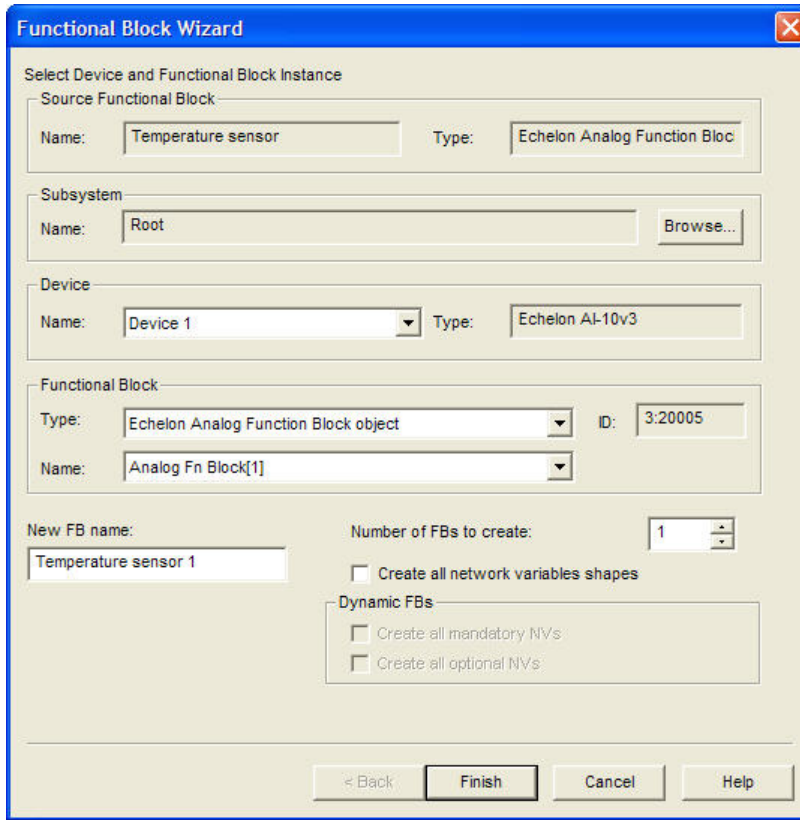
A *functional block* encapsulates a set of network variables and configuration properties that perform a specific device function. For example, a four-port digital input device could have functional blocks for each of its four switches. Each functional block would contain an output network variable representing the state or setting of a switch. In addition, each functional block could contain configuration properties that control how frequently the switch data is transmitted to other functional blocks. Ultimately, the task that the functional block performs in this example is transmitting the switch data to other functional blocks (another functional block receiving the switch data could then use it to turn a lamp on or off).

You can create a functional block in one step. To do this, you enable automatic device selection and then drag a custom functional block master shape to your LonMaker drawing, near the device to which you want to assign the functional block. Otherwise, the New Functional Block Wizard appears when you add a functional block shape to your LonMaker drawing. See *Using Automatic Device Selection* in this section for how to enable this feature. See Chapter 12, *Creating and Using LonMaker Shapes and Stencil*, for how to create and use custom functional block master shapes.

To create a functional block in a LonMaker drawing, follow these steps:



1. Drag a Functional Block shape  from the LonMaker Basic Shapes stencil to your LonMaker drawing. The Functional Block Wizard appears unless you enabled automatic device selection and dropped a custom functional block master shape near a device shape.



2. Enter the following information:

Source Functional Block

Name Displays the name of the source functional block (a master shape or an existing functional block) from which the new functional block was created.

This box will be empty if the functional block was created by dragging the generic functional block master shape to the LonMaker drawing.

Type Displays the functional profile represented by the source functional block (open loop sensor object, for example).

This box will be empty if the functional block was created by dragging the generic functional block master shape to the LonMaker drawing.

Subsystem

Name Specify the subsystem containing the functional block's device. The default is the subsystem containing the functional block.

Browse Click to browse the subsystem hierarchy and assign the functional block to a device in a different subsystem.

Device

Name Select a device from a list of all the devices in the selected subsystem that supports the functional block you are creating. If you are creating a generic functional block shape, all devices in the

	selected subsystem with available functional blocks will be listed.
<i>Type</i>	Specifies the device template associated with the functional block.
Functional Block	
<i>Type</i>	Select the functional profile for the functional block. The default is the functional profile for the functional block currently listed in the Functional Block Name box.
<i>Name</i>	Select the functional block. If you are creating a functional block from a custom shape that specifies a specific functional profile (such as one of the LonPoint functional block shapes), the number of functional blocks listed corresponds with the number of available functional blocks matching the functional profile on the associated device. For example, if you create a functional block for a 4-port digital input device that has four switches, four digital input functional blocks (one for each switch) will initially be listed. If you then create a second functional block for the same device, only three functional blocks will be available in the list. If you are creating a generic functional block shape, all possible functional blocks for the selected device will initially be listed.
<i>ID</i>	Displays the scope and functional profile number of the functional block using the form <i><Scope>:<Number></i> . If the functional block is a LonMark standard functional profile then the “ <i><Scope></i> .” is omitted because it is 0.
<i>New FB Name</i>	Enter the name of the functional block. This name must be unique within the device and should be descriptive of the task to be performed by the functional block. The name may be up to 85 characters, but it may not include the period, backslash, colon, forward slash, or double quote characters. If the functional block was created from a master shape or a copy of an existing functional block, the default functional block name is the name of the source functional block. If there is a naming conflict, a separator character and an instance number (starting at 1) are appended to the functional block name. For each subsequent functional block with the same name for the same device, the instance number is incremented by one. For example, the default name of a new functional block created from a digital output functional block master shape named “LED” would be “LED” if it was the only one named as such for the assigned device. If a copy of the LED functional block was created and assigned to the same device, the default name would be “LED 1”. A second copy would be named “LED 2”, and so on. If a functional block is created by dragging the generic functional block master shape to the LonMaker drawing, the default functional block name is the programmatic name of the functional block. The LonMaker tool by default inserts the name of the associated device and a period before the functional block name in the LonMaker drawing. Therefore, if the first digital output functional block named “LED” in the previous example was created for a device named “DO- 1”, the default functional block name would

actually be “DO- 1.LED”. The second functional block named “LED” assigned to that same device would be “DO- 1.LED- 1”, and so on. To enable or disable this feature for all new LonMaker network designs or for an existing LonMaker network design, set or clear the **Include Device Name in Default FB Name** check box in the network properties: **Functional Block** options category as described in Appendix A.

To change the default naming convention for all new LonMaker network designs or for an existing LonMaker network, set options in the network properties: **Naming** options category as described in Appendix A.

*Number of FBs
Create*

Enter the number of functional blocks to be created. When more than one functional block is created, the additional functional blocks will retain the same name as the first, and will be assigned to other devices in the same subsystem. For example, if the first functional block is assigned to **Device 1**, the second will be assigned to **Device 2**. If a matching device does not exist, you will be prompted to select the device.

*Create all Network
Variables Shapes*

Select this check box to automatically create shapes for all network variables defined in the functional block.
You can add unassigned network variables after the functional block has been created if this check box is cleared.

Dynamic FBs

*Create all Mandatory
NVs*

Select this check box to automatically create all mandatory network variables defined in the functional profile for a dynamic functional block. The network variables are created in the LNS network database.

To create the shapes in your LonMaker drawing, select the **Create all Network Variables Shapes** check box.

*Create all Optional
NVs*

Select this check box to automatically create all optional network variables defined the functional profile for a dynamic functional block. The network variables are created in the LNS network database.

To create the shapes in your LonMaker drawing, select the **Create all Network Variables Shapes** check box.

3. Click **Finish** to add the functional block shape to the LonMaker drawing.

Using Automatic Device Selection

You can use automatic device selection to enable the LonMaker tool to automatically select the appropriate device for a new functional block, skipping the Functional Block Wizard. This feature lets you create a new functional block with a single click and drag.

To enable automatic device selection in your LonMaker drawing, open the **LonMaker** menu, click **LonMaker Options**, select **Functional Block** from the **Options Category** list, and then select the **Enable Automatic Device Selection** check box. You can also enable automatic device selection for all new networks. In the LonMaker Design Manager, click the **LonMaker Default Options** tab, select **Functional Block** from the **Options Category** list, and then select the **Enable Automatic Device Selection** check box.

The order of the criteria used by the LonMaker tool to select the appropriate device is as follows: (1) closest qualified device shape to the functional block shape where the device shape is within 1 ½ times

the width of the functional block shape, and then (2) most recently created or assigned device. If no device can be selected using the preceding criteria, the Functional Block Wizard will appear.


Re-assigning a Functional Block

You can move a functional block to a different device, preserving all of the functional block's configurations and connections. You can do this to assign a functional block to a device different than the one that was automatically selected by the LonMaker tool, or to re-assign any functional block to a different compatible device. To move a functional block to a different device, you can either right-click the functional block and use the **Move FB** command, or you can use the **Connector** tool on the Visio **Standard** toolbar to graphically re-assign the functional block.

To use the **Move FB** command to re-assign a functional block to a different device, follow these steps:

1. Right-click the functional block you want to move, point to **Move FB**, and click **Change Assigned Device** to re-assign the functional block to a device on the current subsystem. The Functional Block Wizard appears
2. Under **Device**, select the device to which you want to re-assign the functional block. Then, under **Functional Block**, select the instance of the functional block to associate with the re-assigned device. Click **Finish**.

To use the connector tool to re-assign a functional block to a different device, follow these steps:

1. Select the **Connector** tool  on the Visio **Standard** toolbar, point to the functional block until a red box appears around the shape, and hold down the mouse button.
2. Point to the device shape and then release the mouse button. Alternatively, you can select the desired device first and then move the **Connector** tool to the functional block.
3. Select a different tool on the Visio **Standard** toolbar if you will not be making additional connections or re-assignments (if you continue to use the **Connector** tool to add new devices, routers, or functional blocks shapes to your drawing, Visio will attempt to connect the shapes, which may not be the desired action or may be an action that generates errors).

Configuring a Functional Block

You can configure a functional block by right-clicking the functional block shape and then clicking **Configure** on the shortcut menu. If the functional block has a registered configuration plug-in (such as the LonPoint plug-in for LonPoint functional blocks), that plug-in appears. If the functional block does not have a configuration plug-in, the LonMaker Browser appears.

If you are configuring a LonPoint functional block, see the *LonPoint Application and Plug-in Guide* and the *LonPoint Applications, Plug-in, and Utilities* help file for information on using the LonPoint Plug-In.

Copying a Functional Block Configuration

Once you have configured a functional block, you can create new functional blocks that use the same configuration or update existing functional blocks with the configured settings.

Creating a New Functional Block from a Configured Functional Block

You can create a new functional block from a configured functional block in two ways:

- Hold down CTRL and drag the functional block to a new location within the same network. The Functional Block Wizard appears, unless you enabled automatic device selection. Make any desired changes to the functional block information. Click **OK**. The new functional block shape will appear on your LonMaker drawing.
- Create a new custom functional block master shape. Drag the configured functional block to a LonMaker stencil to which you have write access. The master shape for the configured functional block will include all the settings for any configuration properties that you modified. You can then

re-use the configured functional block by dragging it from the LonMaker stencil on which it is saved to the same or any other LonMaker drawing.

Note: Functional blocks created using either of these methods will initially have the same configuration property settings as the source functional block. Any changes you make to a functional block afterwards will not affect other functional blocks of the same type.

Updating a Functional Block from a Configured Functional Block

You can update existing functional blocks with the settings of a configured functional block in two ways: use the **Copy Config** and **Paste Config** commands on the shortcut menu, or use the **Replicate Settings** commands on the functional block shortcut menu.

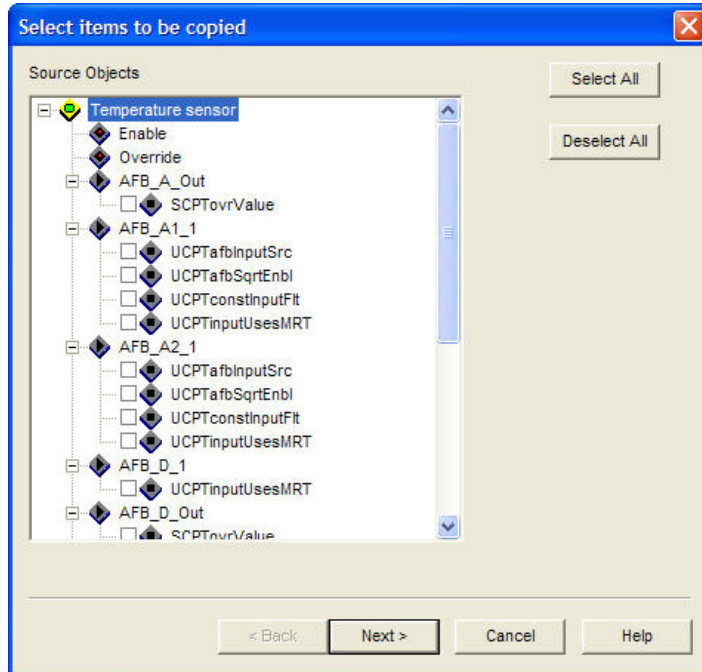
To use the **Copy Config** and **Paste Config** commands on the shortcut menu, follow these steps:

1. Right-click the configured functional block, point to **Configuration Properties** on the shortcut menu, and then click **Copy Config**.
2. Right-click the functional block you want to update with the configured settings, point to **Configuration Properties** on the shortcut menu, and then click **Paste Config**.

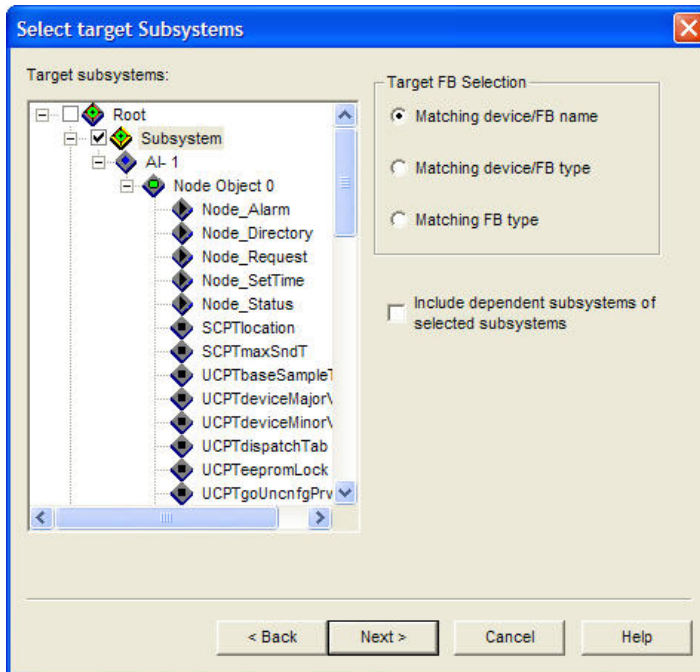
Tip: You can also paste the configuration properties to a text file to get a summary of the configuration property settings. Right-click the configured functional block, point to **Copy Config** from the shortcut menu, open a text editor or word processing application, and then paste the configuration properties.

To use the **Replicate Settings** command on the functional block shortcut menu, follow these steps.

1. Right-click the configured functional block, point to **Configuration Properties** on the shortcut menu, and then click **Replicate Settings**. The **Select Items to be Copied** dialog box appears.



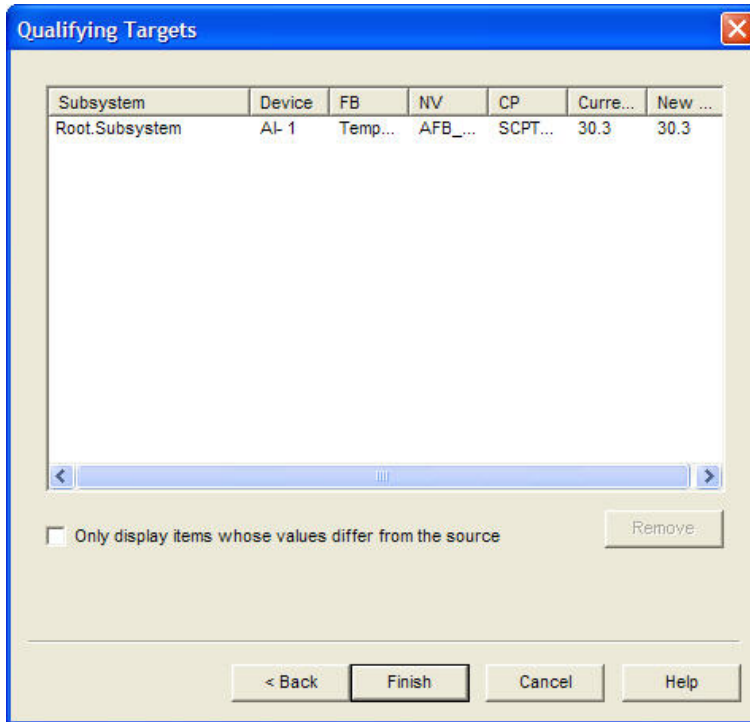
2. Select the configuration properties in the functional block to be copied. To select all the configuration properties in the functional block, click **Select All**.
3. Click **Next**. The **Select Target Subsystems** dialog box appears.



4. Select the target subsystems into which you want the configuration properties to be copied. You can expand a subsystem to view any nested subsystems.
5. Select the criteria used to determine which functional blocks will be updated with the configured settings. You have three choices:
 - **Matching Device/FB name.** Both the device and functional block names must match for the functional block to be configured
 - **Matching Device/FB Type.** Both the device and functional block types must match
 - **Matching FB Type.** Only the functional block type must match).

Select the **Include Dependent Subsystems** check box if you want to replicate the configuration property settings in applicable functional blocks in the nested subsystems within the selected subsystems.

6. Click **Next**. The **Qualifying Targets** dialog box appears. This dialog lists all the functional blocks meeting the criteria selected in Step 5.



7. You can remove a functional block target from the list by selecting the target's subsystem name and then clicking **Remove**. If you only want to view those functional blocks in which the value of the configuration property in the target functional block differs from the source, click the check box at the bottom. You can sort the entries in a column by clicking the column header. Click the header again to toggle the order (ascending or descending).
8. Click **Finish**. The functional block targets will be updated.

Note: Functional blocks updated using either of these methods will initially have the same configuration property settings as the source functional block. Any changes you make to a functional block afterwards will not affect other functional blocks of the same type.

Creating a Functional Block Master Shape

You can create a custom functional block master shape to re-use a functional block that you have configured. When you create a new functional block using your custom functional block master shape, the Functional Block Wizard will be skipped (provided that automatic device selection is selected) and the functional block will be created with the same network variables and configuration property settings as the original functional block. To create a custom functional block master shape, drag the desired functional block shape onto a LonMaker stencil to which you have write access.

Manufacturers may also supply custom master shapes for their functional blocks. For example, Echelon provides LonPoint functional block master shapes that can be used with the LonPoint devices.

See Chapter 12, *Creating and Using Custom LonMaker Shapes and Stencils*, for more information on creating and using LonMaker master shapes.

Creating Dynamic Functional Blocks

A dynamic functional block is a functional block that is not pre-loaded on a device. Most devices use static functional blocks, which are statically defined by the device application. You can view the static functional blocks that are available on a device by right-clicking the device shape, selecting **Properties** on the shortcut menu, and then clicking the **Functional Blocks** tab.

Dynamic functional blocks are typically used by controllers that do not have a static interface. These controllers typically require the integrator to run a plug-in or other configuration software that defines

the control algorithm and configures the controller. The controller manufacturer can use dynamic functional blocks to enable a LonMaker user to add functional blocks to the controller using the LonMaker tool.

Dynamic functional blocks are created in the same manner as static functional blocks. To create a dynamic functional block, follow these steps:

1. Drag a functional block shape from a stencil to the LonMaker drawing, or copy an existing functional block shape. The functional block shape you drag or copy can be either the generic functional block shape, or a custom functional block master shape that specifies the device types and functional profiles for which it is valid. The New Functional Block Wizard opens.
2. When the New Functional Block Wizard opens, **<Dynamic Functional Block>** will appear as an option in the **Name** list under **Functional Blocks** if the device supports dynamic functional blocks. Select **<Dynamic Functional Block>**.
3. In the **Type** list under **Functional Blocks**, select a functional profile template to assign to the dynamic functional block.
4. Enter the name of the dynamic functional block in the **New FB Name** box. If the source functional block was the generic functional block shape, the default name will be the name of the selected functional profile template minus its SFPT or UFPT pre-fix.
5. If you want the network variables defined in the dynamic functional block to be represented with shapes, select the **Create all Network Variables Shapes** check box.
6. If the selected functional profile defines mandatory and/or optional network variables, the corresponding check boxes under **Dynamic FBs** for creating those network variables in the dynamic functional block will be enabled. By default, the **Create all Mandatory NVs** check box will be selected and the **Create all Optional NVs** check box will be cleared. Select the check boxes for the types of network variables for which you want the LonMaker tool to create.

You can still add or remove network variables after the dynamic functional block has been created.
7. Click **Finish** to add the dynamic functional block shape to the LonMaker drawing.

You cannot change the functional profile for a dynamic functional block after you create the functional block shape. Instead, you need to delete the dynamic functional block and then create a new dynamic functional block that implements the desired functional profile.

Deleting Dynamic FBs

You can only remove a dynamic functional block from a device when you delete the dynamic functional block shape from the LonMaker drawing. When you attempt to delete a dynamic functional block shape from the LonMaker drawing, the effect on the dynamic functional block on the device depends on the settings in the **Delete Dynamic FBs when FB shape is Deleted** check box in the network properties: **Functional Blocks** options category.

- If **Yes** is set, the dynamic functional block will be removed from the device when its shape is deleted.
- If **No** is set, the dynamic functional block will remain on the device. To delete the dynamic functional block, drag a shape for that functional block to your LonMaker drawing and then delete it. This is the same process to use if you want to delete a dynamic functional block created with an LNS application other than the LonMaker tool.
- If **Ask** is set, you will be prompted to select whether you want to delete the dynamic functional block. Select **Yes**.

To access the network properties: **Functional Blocks** options category, open the **LonMaker** menu, click **LonMaker** options, and select **Functional Blocks** from the **Options Category** list.

Creating Dynamic Functional Block Master Shapes

You can create master shapes for dynamic functional blocks in the same manner as static functional blocks. The dynamic functional block master shape will contain user cells indicating that the functional block is dynamic, the functional profile used to create the dynamic functional block, and whether to create mandatory and optional network variables (see *Editing Master Shape User-Defined Cells* in Chapter 12, *Creating and Using Custom LonMaker Shapes and Stencils* for more information). When you drag the dynamic functional block master shape to your LonMaker drawing, the values set in the user-defined cells will be the defaults. The values will also determine whether the New Functional Block Wizard opens when you drag the shape to your LonMaker drawing.

Dynamic network variables included on the functional block master shape will be created regardless of the settings in the check boxes under **Dynamic FBs**.

Creating a Virtual Functional Block

A *virtual functional block* is a static functional block that contains the network inputs and outputs for a device that are not part of other functional blocks on the device. Network inputs and outputs consist of network variables, configuration properties, and message tags.

To add a virtual functional block to your LonMaker drawing, follow these steps:

1. Drag a functional block shape from the LonMaker Basic Shapes stencil to your LonMaker drawing. The **Functional Block Wizard** appears.
2. Under **Device**, select the device to which you want to assign the virtual functional block from the **Name** list
3. Under **Functional Block**, select **Virtual Functional Block** from the **Name** list. This option only appears in the list if the device supports a virtual functional block
4. Click **Finish**.

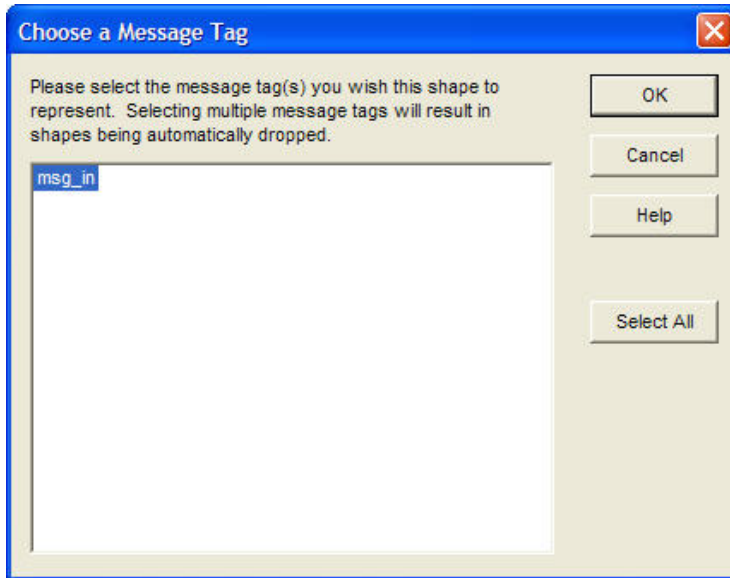
Adding a Message Tag Shape to a Virtual Functional Block

You can add a message tag shape to the virtual functional block of a device that supports message tags. Message tags are similar to network variables except that they do not have pre-defined types. They are used for standard data transfer mechanisms such as the LONWORKS file transfer protocol and the LONWORKS data log transfer protocol. In addition, they are used as a proprietary interface to devices such as factory calibration interfaces. There are no restrictions in regards to connecting message tags such as having compatible types as there are for network variables.

To add a message tag shape to a virtual functional block, follow these steps:



1. Drag an input or output message tag shape from the LonMaker Basic Shapes stencil onto the virtual functional block. The **Choose a Message Tag** dialog box appears.



2. Select one or more message tag shapes to add to the virtual functional block from the list of available message tags. If you select multiple message tags, additional shapes will automatically be added to the virtual functional block. To select all of the listed message tags, click **Select All**.
3. Click **OK**. The selected message tag shapes appear on the virtual functional block shape in the appropriate position.

Tip: You can change the name or position of a message tag shape in the same manner as a network variable shape. See *Changing Network Variable Name* and *Changing Network Variable Position* for how to do this.

Deleting Message Tag Shapes

You can remove message tag shapes from one or more virtual functional blocks in the same manner as network variable shapes. See *Deleting a Network Variable Shape* in the next section for how to do this.

Creating Network Variables

Network variables allow a device to send and receive data over the network to and from other devices. Network variables are data items (such as temperature, the state of a switch, or actuator position setting) encapsulated within functional blocks that a particular device application expects to receive from other physical devices (an *input network variable*) or expects to make available to other physical devices (an *output network variable*).

There are two types of network variables: static and dynamic. A *static network variable* is defined by the device application and is always available in the functional block. Most LONWORKS devices have functional blocks that include static network variables. A *dynamic network variable* is added to a functional block after the device has been commissioned. Some LONWORKS devices support dynamic network variables. Other types of devices that support dynamic network variables include controllers and gateways with dynamic interfaces.

Creating a Network Variable Shape

You can create a network variable shape and then use it to either create a new network variable master shape with an associated type and direction, or add a dynamic network variable with a specified type and direction to a functional block that supports dynamic network variables. To create a new network variable shape, follow these steps:

1. Select a functional block that contains a network variable with the desired network variable type that you want to use for the new network variable shape, and then select the network variable.
2. Right-click the network variable that you selected in step 1 and then select **Create Input NV Template** or **Create Output NV Template** on the shortcut menu to create an input or output network variable shape, respectively. The LonMaker tool creates a new network variable shape on the current drawing page.

The default name of this new network variable shape will be the name of the source network variable followed by its direction in brackets. For example, if you create an output network variable from a network variable named “SWITCH”, the default name of the new NV shape will be “SWITCH [Out]”.

If the source NV contains a direction in its name such as “nvo” or “nvi” and that direction does not match that of the new NV shape, the name of the direction will be reversed in the default name of the NV shape. Using the previous example, if the source NV is named “nvi SWITCH”, the default name of the new NV shape will be “nvo SWITCH [Out]”.

Creating a Network Variable Master Shape

Using a network variable shape, you can create a network variable master shape. You can then use the network variable master shape to add a dynamic network variable with a specified network variable type and direction to functional blocks that support dynamic network variables. To create a network variable master shape, follow these steps:

1. Create a network variable shape following the steps in *Creating a Network Variable Shape*.
2. Drag the network variable shape to a LonMaker stencil to which you have write access. If the stencil is read-only, you will be prompted to either change the stencil to be writeable or cancel the operation. A new master shape appears on the stencil. The default name of the network variable master shape is the name of the network variable shape without its direction suffix.
3. Save the stencil

Adding Network Variable Shapes to a Functional Block

You can automatically add all available static and/or dynamic network variables to a functional block when you create a new functional block shape, or you can selectively add them after you create the functional block.

To automatically add all available network variables to a functional block, select the **Create Shapes for all Network Variables** checkbox in the New Functional Block Wizard when you add a functional block shape to your drawing.

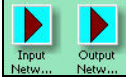
To selectively add network variables, clear the **Create Shapes for all Network Variables** checkbox in the New Functional Block Wizard. This creates a functional block with no network variable shapes. You then add one or more network variable shapes to the functional block using one of the following three methods:

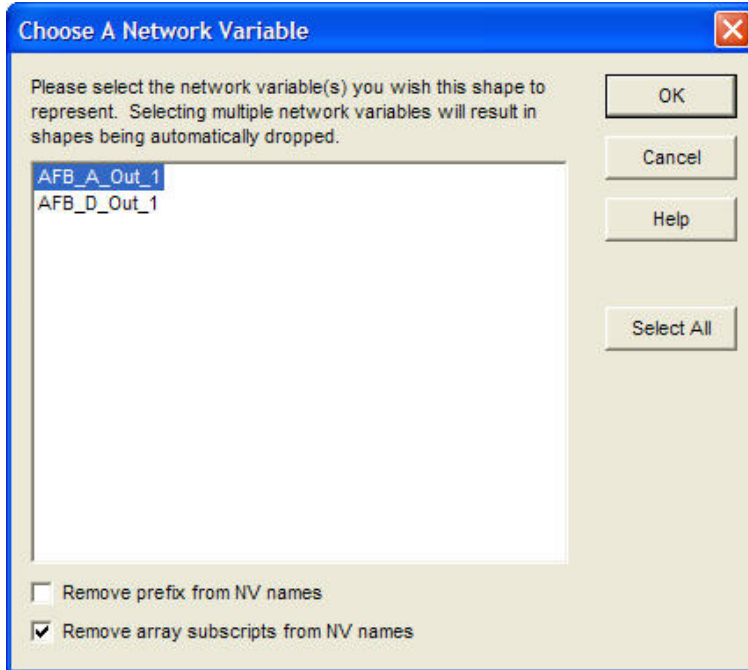
- Drag a generic network variable shape onto the functional block. This method can be used for adding both static and dynamic network variables to a functional block.
- Drag a network variable shape from the LonMaker NV Shapes stencil onto the functional block. This method can only be used for adding dynamic network variables to a functional block.
- Drag a network variable master shape onto the functional block. This method can only be used for adding dynamic network variables to a functional block.

Tip: You can quickly add a dynamic network variable to a functional block using any of last two methods.

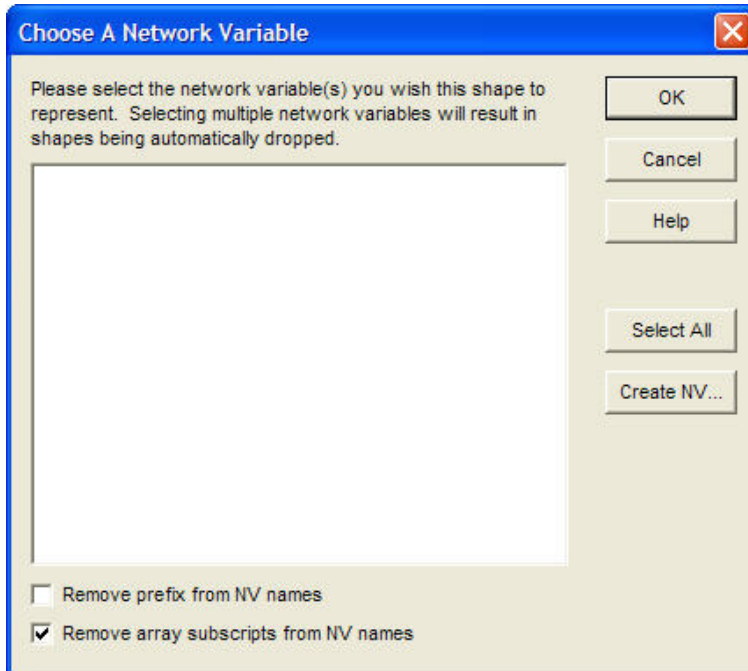
Creating Network Variables Using Generic Network Variable Shapes

Using generic network variable shapes, you can add an existing static network variable or create and add a dynamic variable to a functional block following these steps:

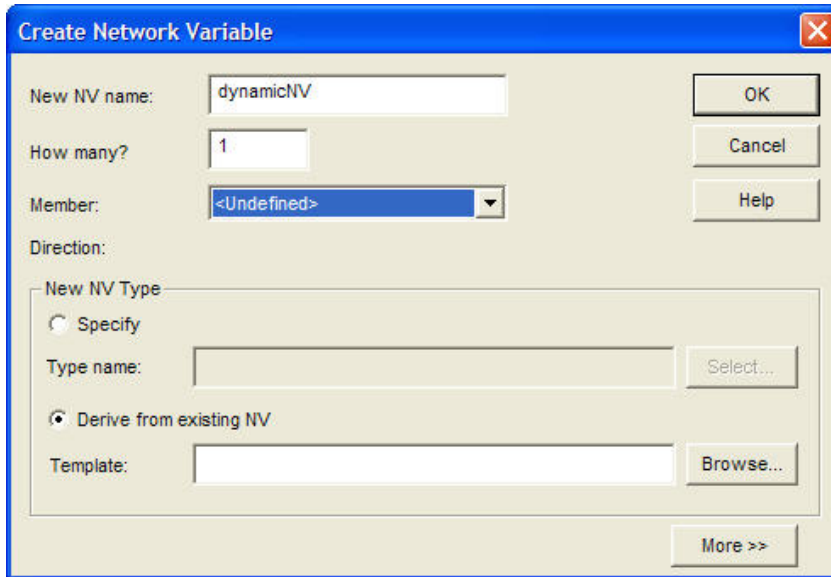
1. Drag an input or output network variable shape  from the LonMaker Basic Shapes stencil onto the functional block. The **Choose a Network Variable** dialog box appears.



If the device supports dynamic network variables, this dialog will also have a **Create NV** button.

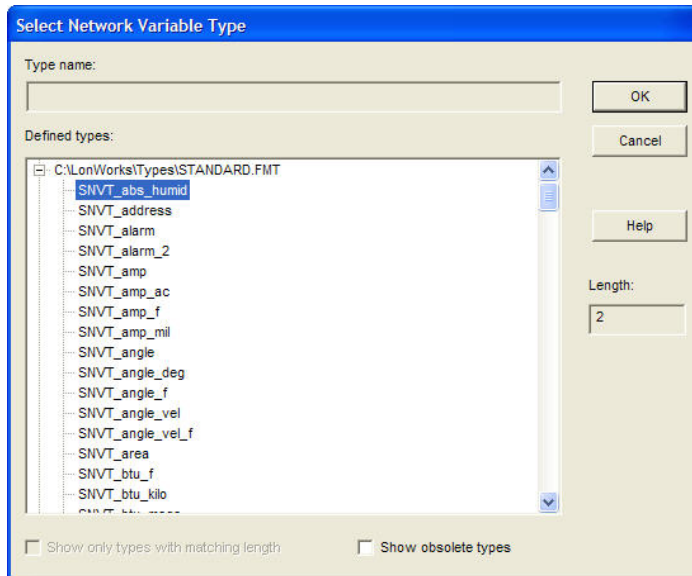


2. To add a static network variable to the functional block, skip to step 8. To create and add a dynamic network variable, click **Create NV**. The **Create Network Variable** dialog box appears.

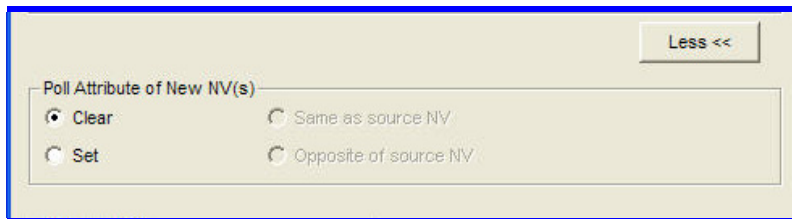


3. Enter the name, number, and type of the dynamic network variable(s) you are creating.
 - a. Enter the name of the dynamic network variable. This name must be unique within the functional block. It may be up to 85 characters long and may include embedded spaces, but it may not include period, backslash, colon, forward slash, or double quote characters.
 - b. Enter the number of dynamic network variables you are creating.
 - c. If you are creating more than one dynamic network variable, the LonMaker tool will automatically append an index, starting at 1, to the second dynamic network variable. The LonMaker tool will then increment the index for each additional dynamic network variable you are creating. For example, if the dynamic network variable name is “mynv” and you are creating three network variables, the names will be “mynv”, “mynv1”, and “mynv2”.

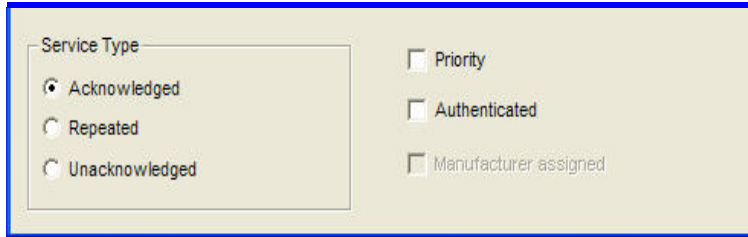
If you are creating 10 or more network variables, you should append a “01” to the dynamic network name (for example, mynv01). If you are creating three network variables, the names will be “mynv01”, “mynv02”, and “mynv03”. This ensures that the dynamic network variable names will be listed in numerical sequence in various LonMaker menus and reports.
 - d. Select the type of the dynamic network variable based on a defined type, or the type of an existing network variable in your LonMaker drawing.
 - To select a defined type, select **Specify** under the **New NV Type** box and then click **Select**. The **Select Network Variable Type** dialog box opens. This dialog box lists built-in data types and resource files. Expand the items listed to view the available built-in data types, SNVTs, and UNVTs. Then click the type you want the dynamic network variable to use. Click **OK**.



- To create a dynamic variable from the template of an existing network variable in your LonMaker drawing, select **Derive from Existing NV** under the **New NV Type** box and then click **Browse**. The Select Object window opens. Expand the listed objects to view the network variables in your LonMaker drawing. Click the network variable you want to use as the source for the dynamic network variable. Click **OK**.
4. Click **More** if you want to set the polling attributes for the dynamic network variable(s) you are creating.



5. Under **Poll Attributes of New NV(s)**, select whether the dynamic network variable(s) will by default use polled monitoring. You have four choices:
- Select **Clear** to disable polling.
 - Select **Set** to enable polling.
 - Select **Same as Source NV** to use the same poll attribute of the source network variable (enabled or disabled). This option is only available if the dynamic network variable you are creating is derived from an existing network variable.
 - Select **Opposite of Source NV** to use the opposite poll attribute (if the source network variable has polling enabled, the dynamic network variable will be non-polling). This option is only available if the dynamic network variable you are creating is derived from an existing network variable.
6. If you the dynamic network variable you are creating is based on a defined type, you can also select whether connections with the dynamic network variable use **Acknowledged**, **Repeated**, or **Unacknowledged** messaging service, and you can enable priority and/or authenticated messaging on the connections. See *Connection Description Properties* later in this chapter for more information on messaging service types and options.



7. Click **OK**. The new dynamic network variable appears in the **Choose a Network Variable** dialog box.
8. Select one or more static and/or dynamic network variables shapes to add to the functional block from the list of network variables available for the selected direction. If you select multiple network variables, additional shapes will automatically added to the functional block. To select all of the listed network variables, click **Select All**.
9. To remove any “**nvo**” or “**nvi**” prefixes, select the **Remove Prefix from NV Names** check box. To remove any indexes appended to NV names, select the **Remove Array Subscripts from NV Names** check box. The LonMaker tool will not remove indexes from network variable names if there is any chance of a naming conflict.
10. Click **OK**. The selected network variable shapes will appear on the functional block shape. Input network variable shapes are positioned on the left side of the functional block; output network variables are located on the right side.

Creating Dynamic Network Variables Using Network Variables Shapes from the LonMaker NV Shapes Stencil

To add a dynamic network variable to a functional block using a network variable shape in the LonMaker NV Shapes stencil, follow these steps:

1. Drag a network variable shape from the LonMaker NV Shapes stencil onto the desired functional block. This functional block must support dynamic network variables. The **Create Network Variable** dialog box opens.
2. Following steps 3–6 in *Creating Dynamic Network Variables Using Network Variable Shapes*, change the default name, if desired, enter the number of new dynamic network variable(s) you are creating, and set the poll attributes and the message service type and options.
3. Click **OK** to add the dynamic network variable to the functional block.

Creating Dynamic Network Variables Using Network Variable Master Shapes

To add a dynamic network variable to a functional block using a network variable master shape, follow these steps:

1. Drag a network variable master shape variable shape onto the desired functional block. This functional block must support dynamic network variables. The **Create Network Variable** dialog box opens.
2. Following steps 3–6 in *Creating Dynamic Network Variables Using Network Variable Shapes*, change the default name, if desired, enter the number of new dynamic network variable(s) you are creating, and set the poll attributes and the message service type and options.
3. Click **OK** to add the dynamic network variable to the functional block.

Changing Network Variable Name

You can change the network variable name on a functional block. The LonMaker tool will record the change in the LonMaker drawing and in the LNS network database. To change the name of a network variable, click its functional block and then click the network variable shape. Right-click the network variable shape, click **Properties** on the shortcut menu, and then enter the new name in the **Name** box.

The LonMaker tool only requires that network variable names be unique within a functional block; therefore, if you list all the network variables in a device, some may have duplicate names.

Changing Network Variable Position

Once a functional block has a network variable shape placed on it, the network variable shape becomes part of the functional block shape. If you move the functional block within the drawing or from one subsystem to another, the network variable will remain in the same position on the functional block.

You can change where a network variable shape is positioned on a functional block. To change the location of a network variable shape, click its functional block, click the network variable shape, right-click the network variable shape, and then clear **Automatic Positioning** if it is currently selected. You can then move the selected network variable shape up or down on the functional block.

Deleting a Network Variable Shape

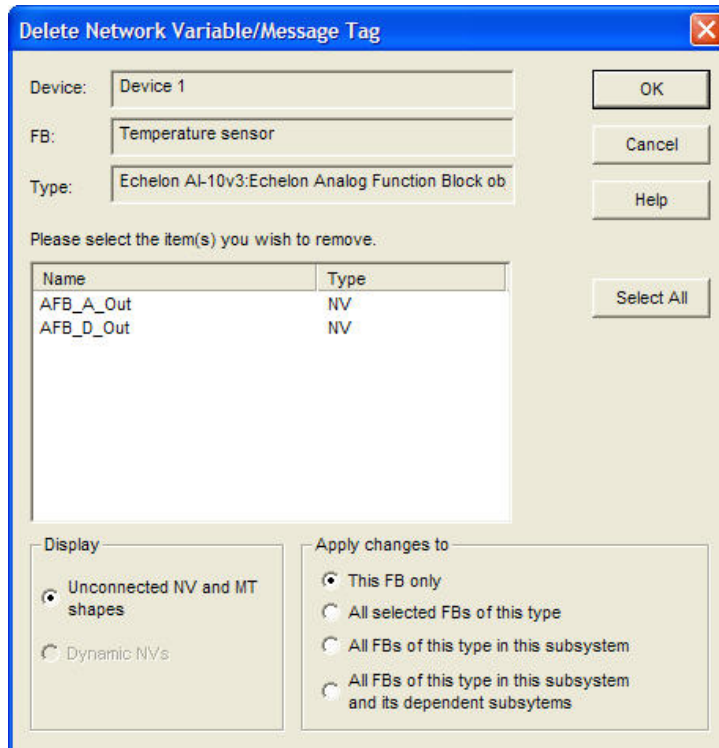
You can remove unconnected network variable shapes from one or more functional blocks.

To delete a network variable shape from a single functional block, follow these steps:

1. Click the functional block with the network variable you want to remove.
2. Click the network variable shape.
3. Right-click the network variable shape.
4. Click **Delete** on the shortcut menu.

To delete a network variable shape from multiple functional blocks, follow these steps:

1. Delete any connections to the network variable on all the functional blocks. You cannot remove a connected network variable from a functional block.
2. Right-click the functional block.
3. Click **Delete NVs and MTs** on the shortcut menu. The **Delete Network Variable/Message Tag** dialog box appears.



4. Select one or more network variable shapes to delete. To select multiple network variable shapes, hold down CTRL and click the shapes you want to delete. To select all of the listed network variables, click **Select All**.

5. Set the following options:

Display

Select which network variable and message tag shapes are displayed.

- Select **Unconnected NV and MT Shapes** to view all the unconnected network variable and message tag shapes on the functional block.
- Select **Dynamic NVs** to view all the unconnected dynamic network variable shapes on the functional block.

Apply Changes to

Select the scope of the removal of the selected network variable and message tags shapes. You have four choices:

- **This FB Only**. The selected network variable and message tag shapes will be deleted from the selected functional block only.
- **All selected FBs of this Type**. The selected network variable and message tag shapes will be deleted from all functional blocks in the LonMaker drawing with the same type of the selected functional block.
- **All FBs of this Type in this Subsystem**. The selected network variable and message tag shapes will be deleted from all functional blocks in the current subsystem with the same type of the selected functional block.
- **All FBs of this Type in this Subsystem and its Dependent Subsystems**. The selected network variable and message tag shapes will be deleted from all functional blocks in the current subsystem and from any of its nested subsystems with the same type of the selected functional block.

6. Click **OK**.

Deleting Dynamic Network Variables

You can delete a dynamic network variable from a functional block. When you delete a dynamic network variable, you can either delete the network variable shape, or you can delete both the network variable shape and the implementation. You can also delete a dynamic network variable by deleting the functional block containing it.

To choose the action that occurs when you delete a dynamic network variable or a functional block containing a dynamic network variable, set the **Delete Dynamic NVs when FB Shape is Deleted** and **Delete Dynamic NVs when NV Shape is Selected** boxes under **Functional Blocks Options** in the network properties: **Functional Blocks** options category as described in Appendix A. Select one of the following options:

- **Yes** to remove both the dynamic network variable shape and implementation from the functional block.
- **No** to remove only the dynamic network variable shape. The implementation remains on the functional block.
- **Ask** to be prompted each time a dynamic network variable is to be deleted

To access the network properties: **Functional Blocks** options category, open the **LonMaker** menu, click **LonMaker** options, and select **Functional Blocks** from the **Options Category** list.

Creating a Router

A *router* enables application devices on separate channels to communicate. The router may be a LonPoint router, an MPR-50 Multi-Port Router, an *i.LON 100* Internet Server with IP-852 routing, an *i.LON 600* LonWorks/IP Server, an *i.LON 1000* Internet Server, or other ANSI/CEA-709.1 (EN14908) or ANSI/CEA-852 compatible router. This section describes how to create a router in a LonMaker network design. See the *i.LON 100 User's Guide* and the *i.LON 600 LONWORKS/IP Server User's Guide* for instructions on IP-852 routing using those routers. See *Creating an i.LON 1000 Internet Server* in the LonMaker help file how to add an *i.LON 1000* Internet server to your LonMaker drawing.

You can use a single router to connect two channels or use multiple *redundant routers* between the same pair of channels. You can also use an MPR-50 Multi-Port Router to connect up to four TP/FT-10 free topology twisted-pair channels, or to connect one or more FT/TP-10 channels to a TP/XF-1250 high-speed backbone. See the *MPR-50 Multi-Port Router User's Guide* for more information on installing and using the MPR-50 Multi-Port Router.


A router in a LonMaker drawing corresponds to a physical router on the network. To add a router you first define the router, and then commission it. To define a router, you specify the router name, select the two channels it will connect, and specify the router properties. To commission a router, you associate the physical router on the network with the router shape that you created in the LonMaker drawing.

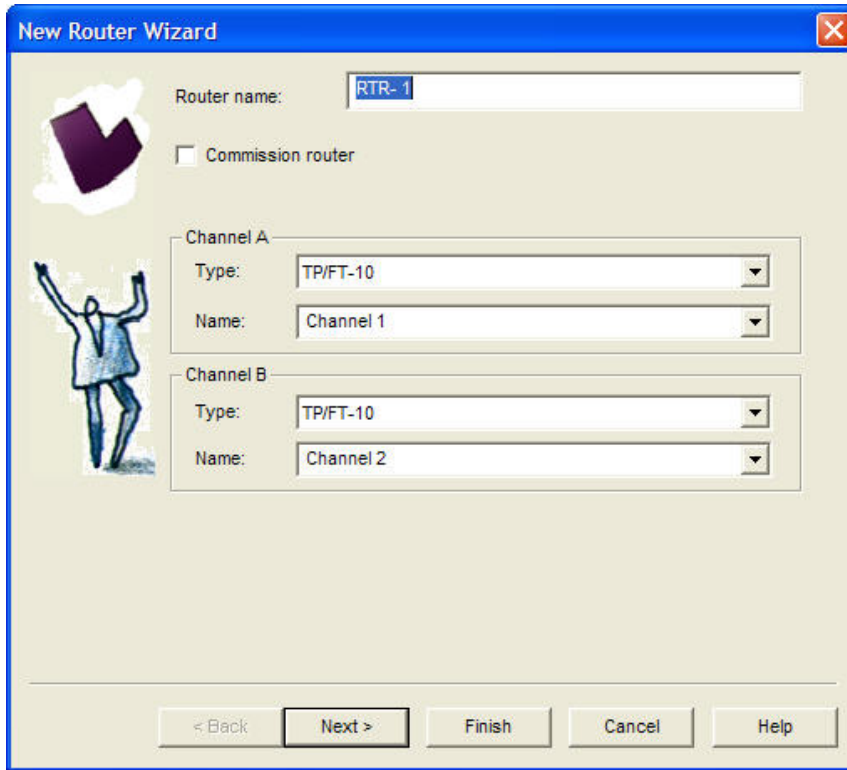
You can create a router in one step. To do this, you enable automatic channel selection and then drag a router shape to your LonMaker drawing, near the two channels the router will connect. Otherwise, the New Router Wizard appears when you add a device shape to your LonMaker drawing. See *Using Automatic Channel Selection* in this section for how to enable this feature.

The first page of the New Router Wizard includes a **Commission Router** check box for commissioning the router. To commission the router after defining it, select this check box. The wizard will prompt you to identify the physical router before adding the router shape to your network drawing. Otherwise, the wizard will add the router shape to your network drawing after you have finished defining it.

To create a router in a LonMaker drawing, follow these steps:



1. Drag a Router shape  from the LonMaker stencil to the drawing page. The New Router Wizard appears unless you enabled automatic channel selection.



2. Enter the following information:

Router Name

Enter the name of the router. This name must be unique within the network. The router name may be up to 85 characters and include embedded spaces, but it may not include period, backslash, colon, forward slash, or double quote characters.

The default router name is “RTR- 1”. The instance number in the default router name is incremented for each subsequent router you create.

You can change this default naming convention by opening the **LonMaker** menu, clicking **LonMaker Options**, and then clicking **Naming Options**. See *Naming Options* in Appendix A for information on how to use the options on this page to change the default naming convention.

Commission Router

Select this check box to commission the router after defining it.

Type

Select the channel type for each of the router’s two channels. By default, each of these boxes displays the channel type of the channel currently displayed in the **Name** list. You can use the **Type** list to filter the existing channels in the **Name** list to those with a specific channel type.

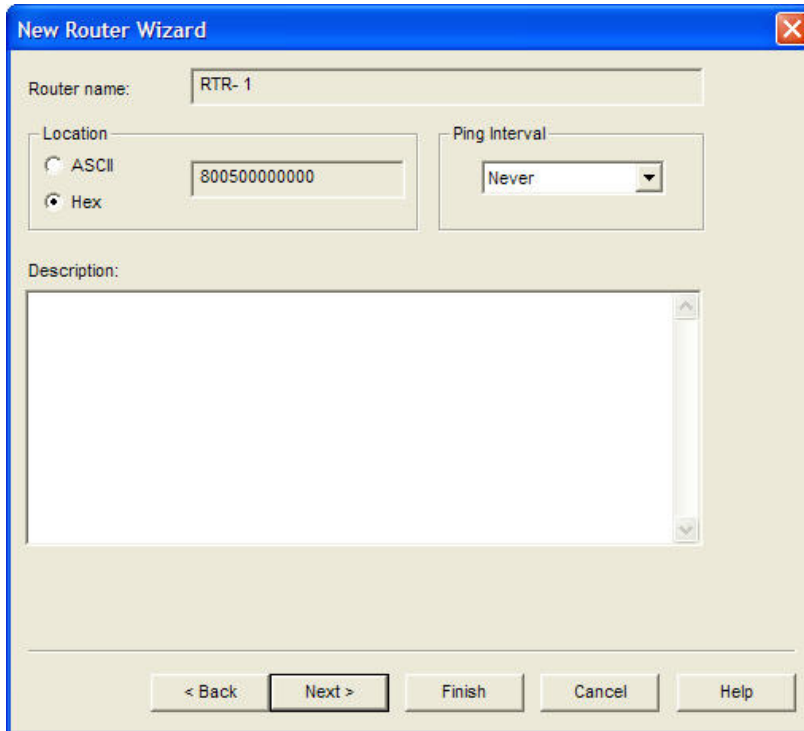
You can limit the channel types displayed by specifying the channel types in a custom router shape.

Name

Select the two channels that you will attach to the router. You can enter a new channel name for one or both of the channels to add new channel shapes to your LonMaker drawing.

The channel names must be unique within the network and be no more than 85 characters long. If you are creating one or two new channels, specify the channel type for each channel in the **Type** box.

3. Click **Next**. The Router Properties window appears.



4. Enter the following information:

Location

Specifies the 6-byte location string for the router, which documents the router's location within the network.

Select the **Set Location Property to Subsystem ID** check box in the network properties: **Recovery** options category to store the router's subsystem ID in this field, which will be read-only. The LonMaker tool can then use this information to place routers in their correct subsystems if you need to use the LNS Database Recovery Wizard to recover a lost network database. See *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on the network recovery process.

If the **Set Location Property to Subsystem ID** check box is cleared, you can enter a location description for the router. You can enter up to 6 ASCII text characters, or up to 12 hex digits. Set the first bit (0x80 or higher for the first byte) to enter a hex value.

If you do not specify a value and the **Set Location Property to Subsystem ID** check box in the network properties: **Recovery** options category is cleared, the current value in the router will be written to this field and stored in the LNS network database when the router is commissioned.

Ping Interval

Enables the LNS Server to ping the router periodically. Pinging verifies that a router is still operating and communicating with the network.

Set the ping interval based on the expected movement of the router. Select **Never** to disable ping. To enable ping,

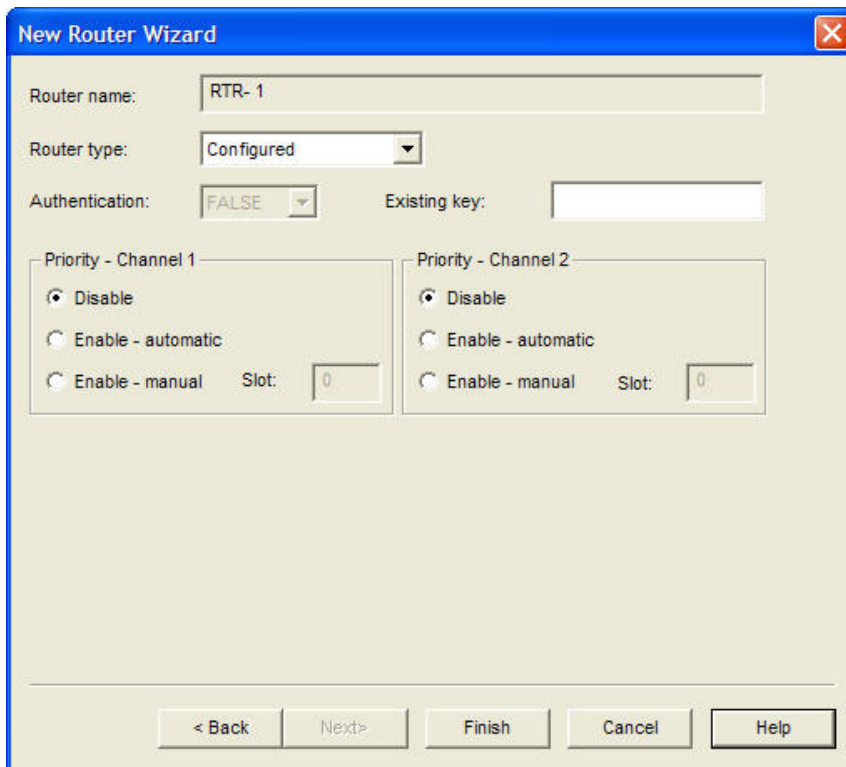
change the ping interval to **15 minutes** if you expect the router will seldom move or if the router is on a power line channel, **2 minutes** if you expect it will move somewhat frequently, and **1 minute** if you expect it will move frequently.

Any errors detected by pinging a router are displayed on the router shape in the LonMaker drawing. See *LonMaker Device Styles* in Chapter 8, *Managing Networks*, for more information.

Description

Provides an optional description of the router. This description has no effect on network operation, but you can use it to provide additional documentation for as-built reports.

5. Click **Next**. The Advanced Router Properties window appears.



6. Enter the following information:

Router Name

Displays the name of the router.

Router Type

Specify one of the following router types: **Configured**, **Repeater**, **Permanent Repeater**, **Bridge**, or **Permanent Bridge**.

The default mode is **Configured**, which means that the router determines which packets to forward based on internal routing tables that are configured by the LonMaker tool. This is the recommended type because it allows the LonMaker tool to optimize network traffic and determine automatically the channel to which each device is attached.

You can select **Repeater** to forward all valid packets received on one channel to the other channel. A **Permanent Repeater** behaves similarly, but its type cannot be changed in the network after the router is created.

You can select **Bridge** to forward all valid packets that match the network domain. A **Permanent Bridge** behaves similarly, but its type cannot be changed in the network after the router is created.

The LonMaker tool allows subnets to span permanent repeaters and bridges, but not non-permanent types. You can use permanent repeaters and bridges to preserve subnet IDs, and non-permanent types to maintain flexibility in order to change the router type later.

Authentication

Select whether authentication is enabled for communication with the LonMaker tool. Authentication can only be enabled for a router if authentication is enabled for the LonMaker drawing. To check whether authentication is enabled for the LonMaker drawing, open the **LonMaker** menu, click **Network Properties**, and click the **Authentication** tab.

Existing Key

Specify the authentication key if the router has already been installed on another network with an authentication key. The authentication key can be up to twelve hexadecimal digits. If you specify a key of less than twelve digits, the LonMaker tool adds leading zeroes to create a twelve-digit key.

Priority

Indicate whether priority messaging is enabled on one or both sides of the router. Priority messaging consumes network resources and bandwidth, and can degrade network performance. Select priority messaging when critical devices that use priority messaging are on one of the channels attached to the router and need to forward priority messages through the router. If you enable priority messaging, select whether the priority slot will be determined automatically or manually. If you select **Manual**, enter the priority slot in the **Slot** box.

7. If you selected the **Commission Device** check box on the first page of the wizard, the first window for commissioning the router appears. See *Commissioning Devices and Routers* in Chapter 5, *Installing Networks*, for instructions on commissioning the router.

If you did not select the **Commission Device** check box on the first page of the wizard, click **Finish** to add the router shape to your LonMaker drawing.

Using Automatic Channel Selection

You can use automatic channel selection to enable the LonMaker tool to automatically select the appropriate channels for a new router, skipping the New Router Wizard. This feature lets you create a new router with a single click and drag.

To enable automatic channel selection in your LonMaker drawing, open the **LonMaker** menu, click **LonMaker Options**, select **Device** from the **Options Category** list, and then select the **Automatic Channel Selection** check box. You can also have automatic channel selection enabled by default in each LonMaker drawing you create or open. In the LonMaker Design Manager, click the **LonMaker Default Options** tab, select **Device** from the **Options Category** list, and then select the **Enable Automatic Channel Selection** check box.


The order of the criteria used by the LonMaker tool to select the appropriate channels is as follows: (1) closest qualified channels to the router shape, in which the channel shapes are within 1½ times the width of the router shape; (2) most recently used or created channels; and (3) other available defined channels. If no channel can be selected using the preceding criteria, the New Router Wizard appears.

Changing a Router Channel

You can change one or both of the channels assigned to a router shape. You can do this to assign a router to a channel different from the one that was automatically selected by the LonMaker tool, or to physically move a router to a different compatible channel. To move a router to a different channel, you can either right-click the router and then click **Move Device** on the shortcut menu, or you can use the **Connector** tool on the Visio **Standard** toolbar to graphically move the router.

To use the **Move Device** command, right-click the router shape and click **Move Device** on the shortcut menu. See *Moving LonMaker Shapes* in this chapter for moving a device using the **Move Device** command.


To use the Visio **Connector** tool to move the device, follow these steps:

1. Select the **Connector** tool  on the Visio Standard toolbar.
2. Position the Connector tool over the “**x**” connection point of the router so that a red box appears over the “**x**”.
3. Click and hold the mouse button.
4. Drag the **Connector** tool to the center of the shape of the desired channel so that a red box appears around the channel shape.
5. Release the mouse button.
6. Select a different tool on the Visio **Standard** toolbar if you will not be making additional connections or re-assignments (if you continue to use the **Connector** tool to add new devices, routers, or functional blocks shapes to your drawing, Visio will attempt to connect the shapes, which may not be the desired action or could be an action that generate errors).

Creating a Channel

A *channel* is the physical media upon which devices communicate between each other. When you initially create a LonMaker drawing, it contains one channel named **Channel 1** by default. You can add additional channels to your LonMaker drawing. Doing so allows you to use different media within the same network, isolate network traffic for performance, isolate devices for reliability, and increase the number of devices beyond the limit of a specific transceiver.

To create a channel, follow these steps:

1. Drag the Channel shape  from the LonMaker Basic Shapes stencil to your LonMaker drawing. The **Channel Definition** dialog box appears.

2. Enter the following information:

<i>Channel Definition</i>	Select whether the shape represents a new or an existing channel. <ul style="list-style-type: none"> • Select Shape Represents a New Channel if you are adding a new channel to your LonMaker drawing. • Select Shape Represents an Existing Channel to place devices in different subsystems on the same channel. Each subsystem may have only one channel shape for a given channel, but the same channel shape may appear in many subsystems.
<i>Source Channel Name</i>	If you are creating a channel from a copy (a custom master shape that includes a channel or an existing channel), this field displays the name of the source channel.
<i>Channel Name</i>	If you are creating a new channel, enter the channel name. The name must be unique within the network and may be up to 85 characters long. The name may include embedded spaces, but it may not include periods, backslashes, colons, forward slashes, or double quotes. If you are adding an existing channel to the current subsystem, select which channel you want to add from the Channel Name list.
<i>Transceiver Type</i>	If you are creating a new channel, select the channel type from the list. If you are adding an existing channel to the current subsystem, the channel type will be displayed in a read-only box.
<i>Maximum Number of Priority Slots</i>	Displays the maximum number of priority slots available on the selected channel. This is a read-only box unless Transceiver Type is set to Custom .
<i>Channel Bit Rate</i>	Specifies the typical performance (packets per second) of the

	selected channel type.
<i>Round-Trip Delay</i>	Select whether to use the default round-trip delay or to specify a time for the channel in milliseconds. <ul style="list-style-type: none"> • Select Use Default to use the default of two packet cycles based on the average packet size. • Select Specify to set the value to the expected longest round-trip time of a message (for example, message and response). This option allows expected traffic patterns to be input into the system so that the timer calculations can be affected accordingly.
<i>Description</i>	If you are creating a new channel, you can enter an optional description of the channel. This description has no effect on network operation, but you can use it to provide additional documentation for as-built reports.

3. Click **Finish** to add the channel shape to your LonMaker drawing.


Creating a Subsystem

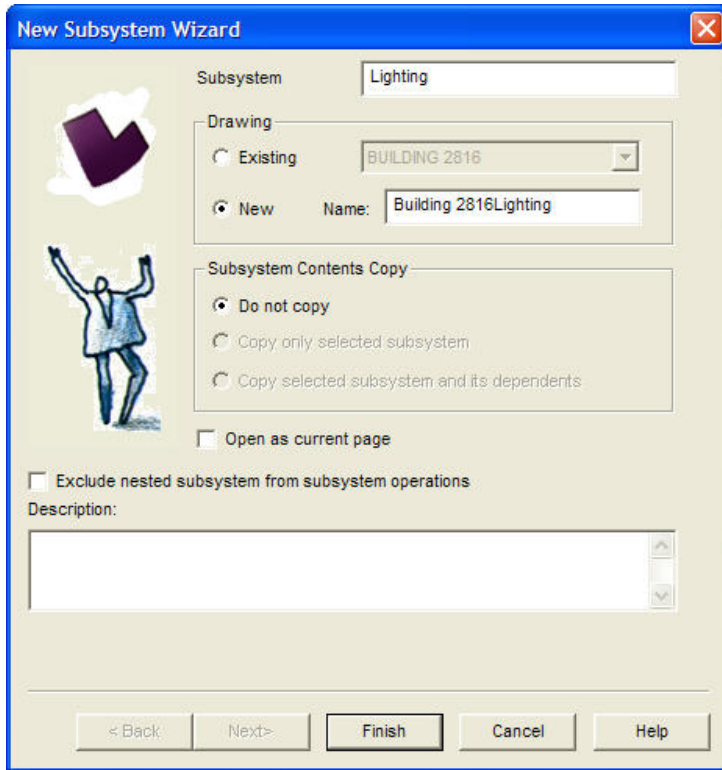
Subsystems allow you to break a large network into more manageable parts. In a building control network, for example, one subsystem could contain lighting controls and another temperature controls.

Each page of a LonMaker drawing represents a subsystem. Subsystems may be nested like directories on your computer, so the temperature control subsystem could contain other subsystems representing each floor of the building, for example.

You can also create subsystems in separate LonMaker drawings. Using this feature, you can create large networks while maximizing Visio's performance by limiting the number of pages in a single drawing. You can also create separate subsystems for large networks with multiple installers in which each installer works on their respective subsystem.

To create a subsystem, follow these steps:

1. Drag the Subsystem shape  from the LonMaker Basic Shapes stencil to your LonMaker drawing. The New Subsystem Wizard appears.



2. Enter the following information:

Subsystem

Enter the name of the subsystem. The name must be unique within the current subsystem and may be up to 85 characters long. The name may include embedded spaces, but it may not include periods, backslashes, colons, forward slashes, or double quotes. Subsystem names are case sensitive.

If you create a subsystem from a copy (a custom subsystem master shape or an existing subsystem shape), the LonMaker tool will automatically append a number, starting at 1, to the subsystem name in the page tab. The number will be incremented by one each time a subsystem with same name is created. The subsystem name in the page tab, though, may not match that in the title block at the top-center of the drawing.

Subsystems with same name can exist within different levels in the subsystem hierarchy of the same network.

Drawing

Select whether to create the new subsystem in an existing or a new LonMaker drawing.

- Select **Existing** to create the subsystem in an existing subsystem within the current LonMaker network. Select the existing subsystem in which the new subsystem will be placed. The current subsystem is listed by default.
- Select **New** to create the subsystem in a new drawing page within the current LonMaker network. Enter the name of the new drawing page in the **Name** box. The default name is *<Network Name> Subsystem [Index]*. An index will be appended to the name of the drawing page if a naming conflict exists.

<i>Subsystem Contents Copy</i>	Select which objects to copy in the subsystem and any nested subsystems. You have three choices: <ul style="list-style-type: none"> • Do not copy. Only the subsystem shape will be copied. None of the contents of the original subsystem will be copied into the new subsystem. This is the only option available when you create a new subsystem by dragging a Subsystem shape from the LonMaker Basic Shapes stencil to the drawing (all of the options are available when you create a new subsystem by copying an existing one). • Copy only Selected Subsystem. Only the contents of the original subsystem will be copied to the new subsystem. Nested subsystems and their contents will not be copied. • Copy Selected. All contents of the original subsystem, including nested subsystems and their contents, will be copied to the new subsystem.
<i>Open as Current Page</i>	Open the new subsystem after it has been created. If this check box is cleared, the LonMaker tool will create the new subsystem but remain in the current subsystem. This check box is cleared by default.
<i>Exclude Nested Subsystems from Subsystem Operations</i>	Applies subsystem operations to only the devices in the parent subsystem. This check box is cleared by default, which means that subsystem operations are applied to devices in the parent subsystem and all of its nested subsystems.
<i>Description</i>	Provides an optional description of the subsystem. This description has no effect on network operation, but you can use it to provide additional documentation for as-built reports.

3. If you are creating this subsystem in a network that uses user profiles and passwords, click **Next** to set *Guest Privileges* for this subsystem (see *User Profiles* in Chapter 3, *Getting Started* for more information). Otherwise, click **Finish** to add the subsystem to your LonMaker drawing.

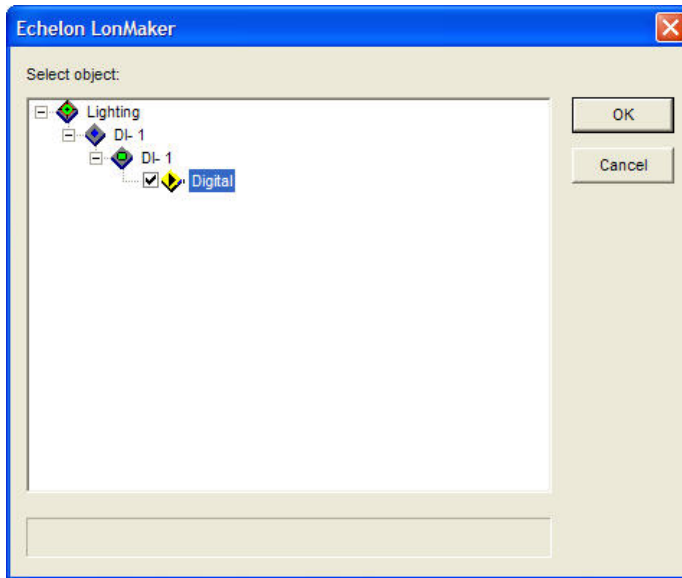
Creating a Supernode

A supernode is a subsystem with its own network variable interface. Using a supernode allows you to provide a simple interface to an arbitrarily complex subsystem. For example, a supernode that contains lighting controls may have a network variable interface that allows the devices contained within it to be put into emergency override. This allows the integrator to identify easily the critical interfaces into the subsystem while ignoring those that are typically only used internally by the subsystem.

Any network variable on any functional block in a subsystem may be exported one or more levels up the subsystem hierarchy to the subsystem shape and be used as a supernode.

To create a supernode, follow these steps:

1. Create a subsystem, and then create one or more devices and one or more functional blocks in that subsystem.
2. Go back to the parent subsystem and drag a network variable shape onto the subsystem shape you just created.
3. A dialog opens in which you select a network variable of the appropriate direction in that subsystem.



4. Right-click the subsystem and click **Expand** from the network navigator. All devices, functional blocks, and available network variables in the network hierarchy will be displayed. Select one or more network variables to be supernodes. To select all the available network variables, click **Select All** from the network navigator.
5. Click **OK**. Shapes for the selected network variables appear on the subsystem shape.

Tips: You can connect supernodes just as you would use network variables on a functional block. See *Creating Connections* in this chapter for more information on connecting network variables.

You should limit the number of network variables on a single supernode to 30. Having more than 30 network variables will degrade your network's performance.

Re-Naming and Deleting a Supernode Network Variable

You can change the name or delete an unconnected supernode network variable shape. Changing the name of or deleting a supernode network variable shape will not affect the naming or presence of the source network variable.

To change the name of a supernode network variable, click the subsystem shape and click the network variable shape you want to rename. Right-click the selected network variable shape, select **Properties** from the shortcut menu, and enter a new name in **Exported Name** box in the **Network Variables Properties** dialog box.

To delete a network variable from a supernode, click the subsystem shape and click the network variable shape you want to delete. Right-click the selected network variable shape and select **Delete** from the shortcut menu.

Copying a Subsystem or Supernode

You can copy a subsystem or supernode to create a new subsystem or supernode with the same devices, functional blocks, connections, and configuration as the original, including any nested subsystems and supernodes.

To copy a subsystem or supernode, follow these steps:

1. Right-click the subsystem or supernode shape to be copied and click **Copy** on the shortcut menu.
2. Right-click anywhere in the LonMaker drawing, in the same or in a different subsystem, and click **Paste** on the shortcut menu. The New Subsystem Wizard appears.

Instead of performing steps 1 and 2, you can hold down CTRL and drag the subsystem or supernode shape to the desired location.

3. Enter the information for the new subsystem following the instructions in *Creating a Subsystem*.
4. Click **Finish**. The LonMaker tool copies the subsystem or supernode. If only a single end of a reference connection is in a copied subsystem, the network variable will be connected to the existing connection specified by the reference. The copy operation does not require any user input, with the following exceptions:
 - The LonMaker tool prompts you to determine whether copied channel shapes represent an existing channel or a new channel.
 - If the copy causes functional blocks to be created that are not associated with any device, the LonMaker tool prompts you to determine on which devices the new functional blocks reside.

Creating Connections

Creating connections enables devices to exchange data. You can create *unicast* connections in which an output network variable is connected to a compatible input network variable, and you can create *multicast* connections in which a single output or input network variable is connected to multiple compatible input or output network variables, respectively. Network variables must have the same type to be compatible. Once you create a connection, the input network variables will receive all updates from the output network variables in the connection. You can also connect input and output message tags, and the input message tags will receive all updates from the output message tags in the connection. This process of connecting network variables and message tags is called *binding*, and the logical connections are thought of as *virtual wires*.

You can connect a network variable on any functional block or supernode in a network with a compatible network variable on any other functional block or supernode—even if the network variables are in different subsystems. You can also create a connection between input and output network variables on the same functional block. This is called a *turnaround connection*. A turnaround connection may be appropriate for a device that receives the data it transmits.

Every connection has one *hub* network variable and one or more *target* network variables. The end of the hub network variable is marked with an **x**; the target network variables are each marked with a **+**. When creating a unicast connection, it does not matter which end of the connection is the hub and which is the target. However, when creating large multicast *fan-in* connections (multiple output network variables connected to a single input network variable) or *fan-out* connections (a single output network variable connected to multiple input network variables), make the common network variable the hub. This will reduce the time required to make the connection. For example, in a fan-in connection, the single input network variable should be the hub; in a fan-out connection, the single output network variable should be the hub.

You can connect functional blocks in three ways:

- Use the Connector shape on the LonMaker Basic Shapes stencil.
- Use the **Connector** tool on the Visio **Standard** toolbar. This is the easiest way to create unicast connections.
- Use the **Network Variable Connection** dialog box. This is the easiest way to create multicast connections.

The following subsections explain how to use each of these three methods.

Creating a Connection with the Connector Shape



You can create a connection with the Connector shape in the LonMaker Basic Shapes stencil. You can only use this method to connect functional blocks or supernodes that are in the same subsystem. You can connect network variables or message tags on functional blocks or supernodes whether they have network variable or message tag shapes or not.

To connect functional blocks or supernodes with network variable or message tag shapes, drag a Connector shape from the LonMaker Basic Shapes stencil to your LonMaker drawing, placing one end of the Connector shape on the connection point on the end of the network variable or message tag you want to connect (a red square will appear around the 'x' connection point). Then drag the unconnected end of the Connector shape to the connection point of the other network variable or message tag. Connector shapes that have been properly connected on both ends will be black; otherwise, they will be red. To create a fan-out or fan-in connection, repeat the process with additional Connector shapes.

To attach a Connector shape to a functional block that does not have a network variable or message tag shape, place the end of the connector shape directly onto one of the four connection points around the functional block. Once a functional block is connected via one of its connection points, the **Network Variable Connection** dialog box opens. Follow the steps in *Creating a Connection with the Network Variable Connection Dialog Box* to finish creating the connection.

If you create a connection with multiple message tags, connect the output message tags together (instead of using the **msg_in** tag). Select one of the output message tags as the hub and connect it to all the other output message tags (do not daisy chain the connection). The resulting connection will be the same regardless of which message tag you select as the hub.

See *Connection Master Shapes* in Chapter 12, *Creating and Using Custom LonMaker Shapes and Stencils*, for information on creating multiple connections in a single operation.

Creating a Connection with the Connector Tool

You can create a connection using the **Connector** tool. This is the quickest way to create unicast connections. To create a connection with the **Connector** tool, follow these steps:



1. Select the **Connector** tool on the Visio **Standard** toolbar.
2. Point to the network variable or message tag shape of the first functional block or supernode to be connected until a red square appears around the shape.
3. Hold down the mouse button and then point to the network variable or message tag shape of the second functional block or supernode to be connected.
4. Release the mouse button.
5. Select a different tool on the Visio toolbar if you will not be making additional connections or re-assignments. If you continue to use the **Connector** tool to add new devices, routers, or functional blocks shapes to your drawing, Visio will attempt to connect the shapes, which may not be desired or could generate errors.

Creating a Connection with the Network Variable Connection Dialog Box

You can create a connection using the **Network Variable Connection** dialog box. This dialog box provides a powerful and flexible method for creating connections. It provides a hierarchical view of the devices, functional blocks, and network variables in your LonMaker network. You use this view to select the network variable hub and one or more targets to connect. It is the quickest method for creating fan-in or fan-out connections because you can select multiple network variable targets to

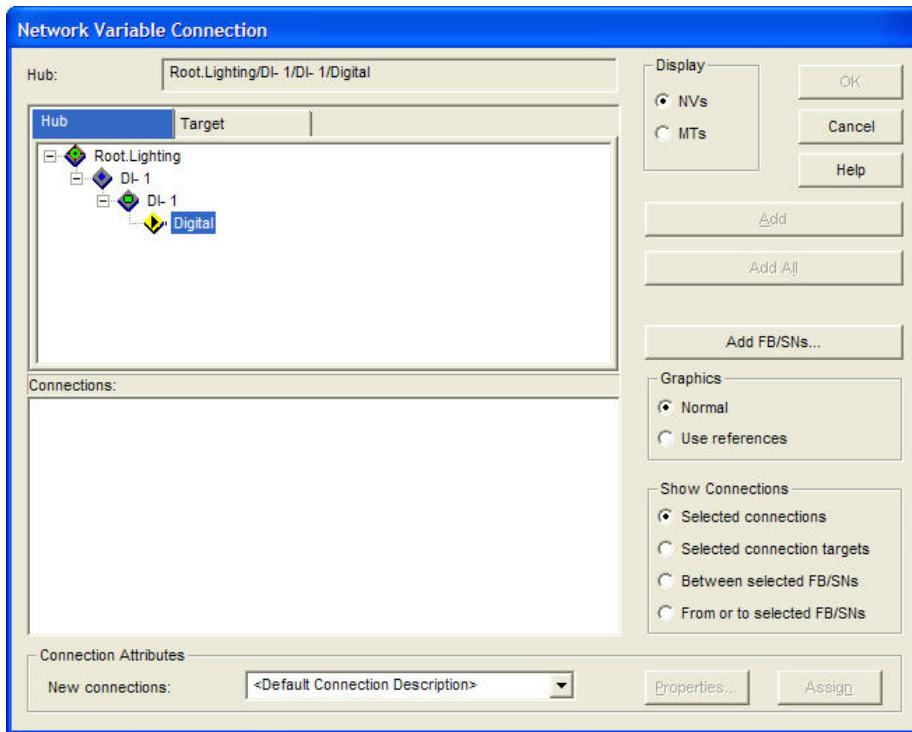
connect to a hub network variable with a few mouse clicks. You can change the properties of the connection while you are creating it (you can also change the properties after you create the connection).

You must use this dialog if you want to connect network variables or message tags that are located in different subsystems, or if you are connecting a functional block without network variable or message tag shapes.

To create a connection using the **Network Variable Connection** dialog box, follow these steps:

1. To connect two or more functional blocks or supernodes in the same subsystem, hold down CTRL and click the functional blocks and supernodes to be connected. The selected functional blocks and supernodes will be highlighted pink, and a green box will appear around them. Right-click one of the selected functional blocks or supernodes and then click **Connect** on the shortcut menu.
 - To connect functional blocks in different subsystems or to select network variables to be connected, right-click an empty space in your LonMaker drawing, and then click **Connect** on the shortcut menu. The Select Objects window appears. Use the network navigator to select the functional blocks and/or supernodes you want to connect and then click **OK**.
 - To create a turnaround connection, right-click a functional block or supernode and then click **Connect** on the shortcut menu. The Select Objects window appears. Use the network navigator to select the functional block or supernode to connect and then click **OK**.

The **Network Variable Connection** dialog box opens.



2. Create the network variable connection by selecting the following options:

Hub: (box) Displays the currently selected hub network variable. This is useful when you are selecting the target network variables.

Hub (tab) Displays a hierarchal view of the network, consisting of the subsystems, devices, functional blocks, and all available network variables that can be selected as the hub. Select the hub network variable on this tab before clicking the **Target** tab.

Target Displays a hierarchal view of the network, consisting of the subsystems, devices, functional blocks, and all compatible network variables that can be selected as targets. Select a target and then click **Add**.

Connections Lists the connections that are scheduled to be created.

Connection Attributes

New Connections Displays the connection description that will be assigned to all new connections created. Select **<Default Connection Description>** to use a smart connection description as described in *Using Automatic Connection Description Selection*.

Properties Opens the **Connection Details** dialog, which specifies the attributes of the selected connection description. You can also create new connection descriptions in this dialog.

Assign Assigns the currently selected connection description to all connections in the **Connections** box.

Display Select which types of connection points are displayed.

- **NV**. Displays available or compatible network variables.
- **MT**. Displays available message tags. This option is only available if you are connecting virtual functional blocks.

Add Adds a connection with the currently selected network variable target to the Connections pane.

Add All Adds connections with all compatible network variable targets to the Connection pane.

Add FB/SNs Opens the **Select Object** dialog box, which you can use to add functional blocks or supernodes to the hub and target tabs. This includes functional blocks or supernodes in different subsystems and those in the same subsystem that were not initially selected. Right-click any object in this dialog and use the network navigator to expand, select, and deselect functional blocks or supernodes. Click **OK** when finished.

Graphics Select the type of connector shape to be used in the LonMaker drawing for the connection.

- **Normal**. A connection shape will be used to represent the new connection.
- **Use References**. A reference connection shape will be used to represent the new connection. This option will automatically be selected if you are connecting functional blocks or supernodes in different subsystems.

Show Connections Select which connections are displayed in the Connections box. You have four choices:

- **Selected Connections**. Displays the connections that you selected in the LonMaker drawing when you opened the **Network Variable Connections** dialog box.
- **Selected Connection Targets**. Displays all connections to the selected targets.
- **Between Selected FB/SNs**. Displays connections between any

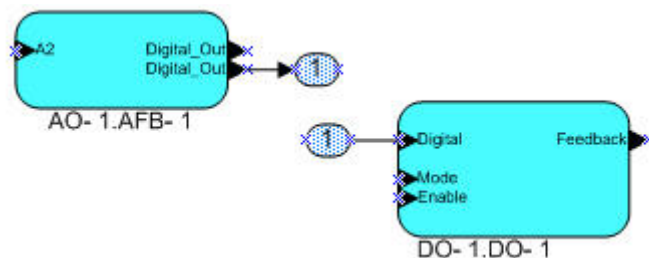
of the selected functional blocks and supernodes and displays connection between any pairs.

- **From or To Selected FB/SNs.** Displays all connections from or to all selected functional blocks and supernodes.
3. Under the **Hub** tab, select the hub network variable for the connection. The icon for the selected NV will be highlighted yellow. To connect a network variable on a functional block or supernode not listed in the **Hub** tab, including those in a different subsystem, click **Add FB/SNs** and add the desired functional block or supernode.
 4. Click the **Target** tab. Select the desired target network variable for the connection. The icon for the selected target network variable will be highlighted yellow. To connect a network variable on a functional block or supernode that is not listed in the **Target** tab, including those in a different subsystem, click **Add FB/SNs** to add the desired functional block or supernode.
 5. Click **Add**. The connection will be added to the **Connections** box below. Repeat steps 3 and 4 to create additional connections. Optionally, you can select one target network variable and then **Add All** to create connections to the selected hub with all compatible target network variables with the same name and type of the selected target network variable. This is useful for quickly creating large fan-in or fan-out connections.
 6. In the **New Connections** box, select a connection description to assign to all the new connections listed in the **Connections** box. You can click **Properties** to view and modify the properties of the connection description displayed in the **New Connections** box. See *Using Connection Descriptions* in this chapter for more information on using and creating connection descriptions.
 7. Click **OK**. The connections listed in the **Connections** box will be added to your LonMaker drawing.
 8. If the LonMaker tool is attached to the network and OnNet, and the devices participating in the connection have been commissioned, the connection information in the physical devices is also updated.

Using Reference Connection Shapes

You can use reference connection shapes to simplify a LonMaker drawing and connect functional blocks and supernodes in different subsystems. A reference connection replaces the single connector shape between a set of connected functional blocks or supernodes with a pair of identically named reference connection shapes that are attached to both ends of the connection. The reference connection functions in the same manner as a normal connection—the only difference is the graphics used to represent the connection.

Reference connection shapes by default are numbered, starting at 1. The numbering for each subsequent set of reference connector shapes used is incremented by one. You can rename the reference connector shapes to something meaningful; however, the name must be unique within the network. If a name is not unique, the LonMaker tool will suggest an alternative name that is unique (it will suggest a name with an index [starting at 1] appended to the name, or a name with the index incremented). If you change the name on one end of the connection, the name on the other end will automatically be updated. You cannot renumber reference connection shapes.



Reference connections are automatically used for connections between functional blocks or supernodes in different subsystems. You can also use reference connections to simplify your LonMaker drawing by reducing the number of crisscrossing connector shapes that can clutter a LonMaker drawing.

To use reference connection shapes, you can create new connections that are represented by reference connection shapes (see *Creating a Connection with the Network Variable Connection Dialog Box*), or you can right-click an existing connection represented by a connector shape and then click **Use Reference** on the shortcut menu to change the connector shape to a reference connection shape.

Aligning Reference Connection Shapes

You can automatically align and keep aligned all the reference connection shapes in a subsystem or the reference connection shapes attached to a specific functional block. This feature eliminates the need to manually move functional block, connector, and connector reference shapes to keep your LonMaker drawing organized.

To align all reference connection shapes in a subsystem, right-click an empty space in the subsystem, point to **Display Options**, and then click **Align All Reference Shapes** on the shortcut menu. This will set the **Align Reference Shapes** option on all the functional blocks in the subsystem and align all the reference connection shapes in the subsystem based on the settings in the network properties: **Functional Block** options category.

To enable automatic reference connection shape alignment for one or more functional blocks, right-click the functional block (or select multiple functional blocks and right-click one of them), point to **Display Options**, and then click **Align Reference Shapes** if it is not set. The reference connection shapes attached to the selected functional block(s) will then be aligned based on the settings in the network properties: **Functional Block** options category.

Once the automatic alignment feature is enabled on a functional block, all attached reference connection shapes will follow the functional block when it is moved. In addition, reference connection shapes will automatically be re-aligned when you make changes your LonMaker drawing (for example, if you add or remove network variables or reference connection shapes).

When this feature is disabled, the attached reference connection shapes are no longer locked to the location of the functional block shape. The attached reference connection shapes will initially still move with the functional block shape, but they can also be moved independently. However, once you move a reference connection shape, it will no longer follow the functional block shape.

See *Functional Block Options* in Appendix A for customizing the automatic reference connection shape alignment feature.

Using Connection Descriptions

You can set the properties for a connection by either manually selecting a connection description or having the LonMaker tool automatically select a connection description.

Connection Description Properties

A connection description is a set of properties, namely the message service type and addressing mode, that apply to a network variable connection. The message service type determines how network variable updates (messages) are delivered and verified. The addressing mode determines how a message packet travels over the network. There are three main message service types: acknowledged, repeated, and unacknowledged. Addressing modes include subnet/node ID for unicast connections, and alias, broadcast, or group for multicast (fan-out) connections.

Message Service Type

You can specify one of the following message service types for each connection description. The message service types vary in reliability and resources consumed.

- *Acknowledged* means that the sending device expects to receive confirmation from the receiving device or devices that a network variable update was delivered. The sending application is

notified when an update fails, but it is up to the developer of the sending device to handle the notification in the device application. While acknowledged service is very reliable, it can create excessive message traffic, especially for large fan-out or polled fan-in connections. When acknowledged messaging is used, every receiving device has to return an acknowledgment. Acknowledged messaging can be used with up to 63 receiving devices, but an acknowledged message to 63 devices generates at least 63 acknowledgements—more if any retries are required due to lost acknowledgements.

- *Repeated* means that the sending device sends out a series of network variable updates, but does not expect any confirmation from the receiving device. Repeated service with three repeats has a 99.999% success rate in delivering messages. Repeated service provides the same probability of message delivery as acknowledged messaging with the same number of retries, with significantly lower network overhead for large multicast fan-out connections. For example, a repeated message with three retries to 64 devices generates four packets on the network, whereas an acknowledged message requires at least 64 packets
- *Unacknowledged* means that the sending device sends out the network variable update only once and does not expect any confirmation from the receiving device. This message service type consumes the least amount of resources, but is the least reliable.

You can enable authentication for any acknowledged connection. With *authentication*, the receiving device challenges the sending device for verification in between receiving the network variable update and sending an acknowledgment to the sending device. This results in twice as much traffic as acknowledged service.

You can enable priority messaging for any connection. With *priority messaging*, the device with the highest priority sends its packet before any other devices can send theirs. This is accomplished by assigning each priority device a time slot where it can transmit before all other lower priority and non-priority devices. These time slots consume network bandwidth; therefore, priority messaging should only be used for critical devices and data.

Addressing Mode

You can specify the addressing mode for each connection description. The addressing mode specifies the type of destination addressed that is used for packets within the connection. Addressing modes include subnet/node ID for unicast connections, and broadcast, group, or alias for multicast (fan-out) connections. Each of these addressing modes is described as follows:

- *Subnet/Node ID addressing* means that a message packet travels from the sending device to the destination device using the 2-byte logical address of the destination device.
- *Broadcast addressing* means that message packets are sent to all devices within a domain (all devices in a network) or a subnet (a set of devices on one channel or a set of channels connected by permanent repeaters).
- *Group addressing* means that message packets are sent to devices assigned to a group, which requires a 1-byte address shared by all members of the group.
- *Alias addressing* means that message packets are sent to devices using network variable aliases and unicast addressing, if possible. Aliases behave like shadow copies of network variables and can be used to overcome connection limitations of non-alias network variables.

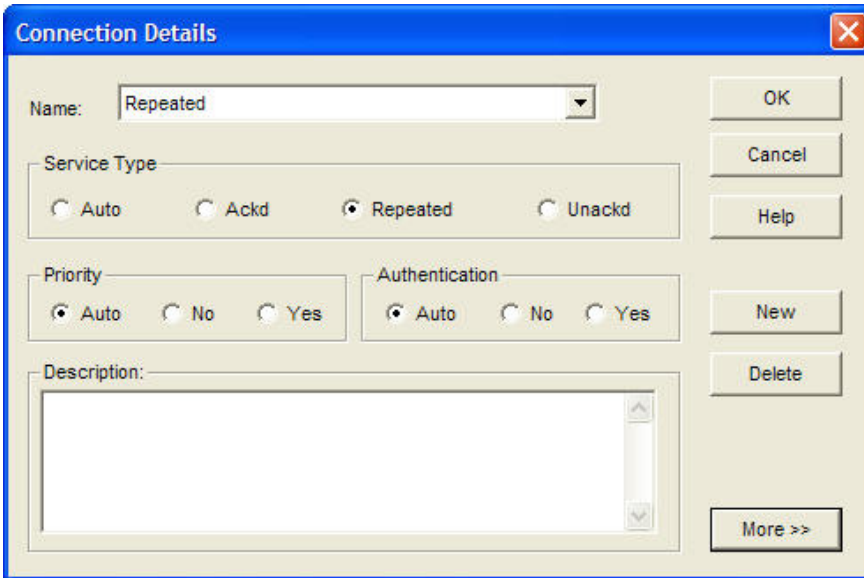
Subnet/node ID and broadcast addressing do not require an address table entry on the destination device or devices, whereas group addressing does. Alias addressing requires an address table entry on the destination device when used with group addressing.

Viewing and Creating Connection Descriptions

The LonMaker tool provides fifteen pre-defined connection descriptions, which vary in the message service type and addressing mode used. The following table details each of these pre-defined connection descriptions.

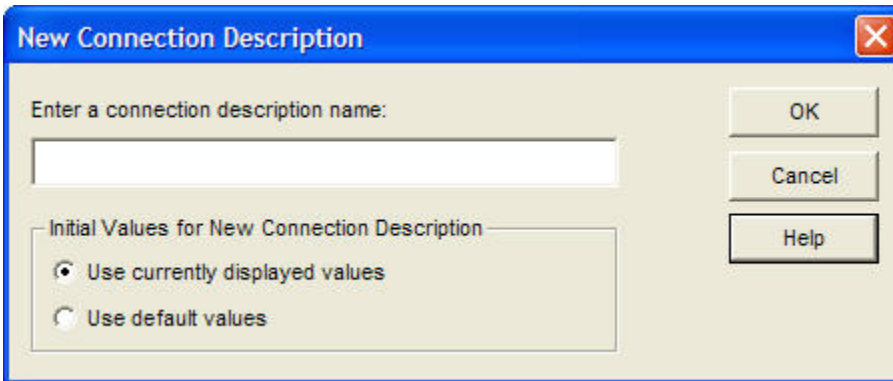
Connection Description	New	SCD	Messaging Service	Multicast Addressing Mode
Acknowledged			Acknowledged	Group
Acknowledged with Alias Multicast	●		Acknowledged	Alias
ConnectDescTemplate_0*			N/A	N/A
Repeated with Alias Multicast	●		Repeated	Alias
Repeated with Broadcast Multicast	●		Repeated	Broadcast
Repeated with Group Multicast Repeated**			Repeated	Group
SCD_Alias	●	●	Acknowledged	Alias
SCD_Default	●	●	Repeated	Group (if available); otherwise, domain broadcast
SCD_SubnetBcast	●	●	Repeated	Subnet broadcast
SCD_Unicast	●	●	Acknowledged	Group
Unacknowledged with Alias Multicast	●		Unacknowledged	Alias
Unacknowledged with Broadcast Multicast	●		Unacknowledged	Broadcast
Unacknowledged with Group Multicast Unacknowledged**			Unacknowledged	Group
<p>*ConnectDescTemplate_0 is the default connection description. It enables the LonMaker tool to automatically select a smart connection description that uses the most appropriate message service type and addressing mode for the connection. It cannot be modified or deleted.</p> <p>**Repeated and Repeated with Group Multicast are identical, as are Unacknowledged and Unacknowledged with Group Multicast. Repeated and Unacknowledged support connections using these connection descriptions in LonMaker networks that were created with previous releases of the LonMaker tool.</p>				

You can view the properties of these pre-defined connections and create new connection descriptions in the **Connection Details** dialog box. You can also use this dialog to change the properties of a pre-defined connection. To access this dialog box, right-click a connector shape, select **Properties** from the shortcut menu, and click **Properties** on the **Network Variable Connection** dialog box. Optionally, you can open the **LonMaker** menu, click **LonMaker Options**, select **Smart Connection Descriptions** from the options category list, and then click **Details**.



To view the properties of a connection description, select the connection description from the **Name** list. If you do make changes, click **OK** and the LonMaker tool then updates all network variable members of the connection with the modified connection description

To create a new connection description, click **New**. The **New Connection Description** dialog box opens.



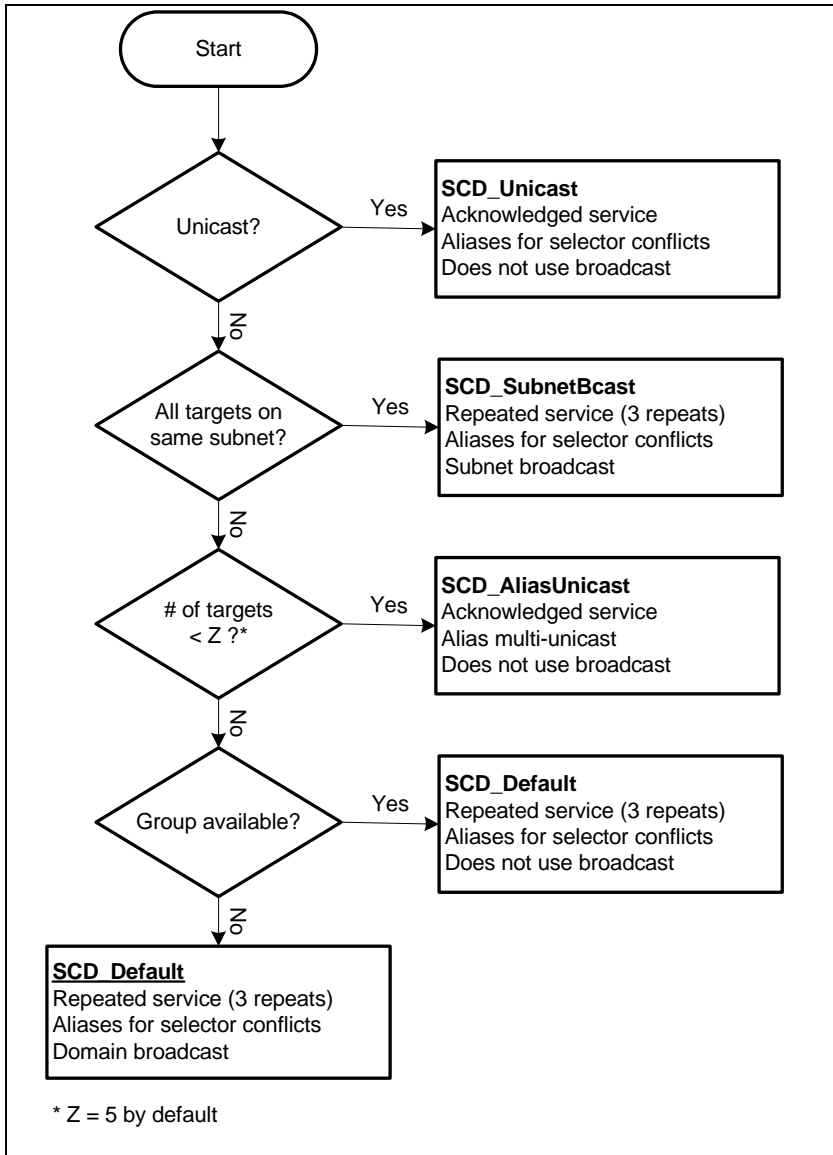
Enter the name of the new connection description and select whether the currently displayed or default attributes are used, and then click **OK**. Make any desired changes to the attributes of the new connection description and then click **OK**. The new connection description will appear in the **Name** list in the **Network Variable Connection** dialog box.

Using Automatic Connection Description Selection

You can use the LonMaker tool to automatically select the connection description for network variable connections. The LonMaker tool will select the connection description that optimizes network performance, while providing reliable message delivery and minimizing network resource usage.

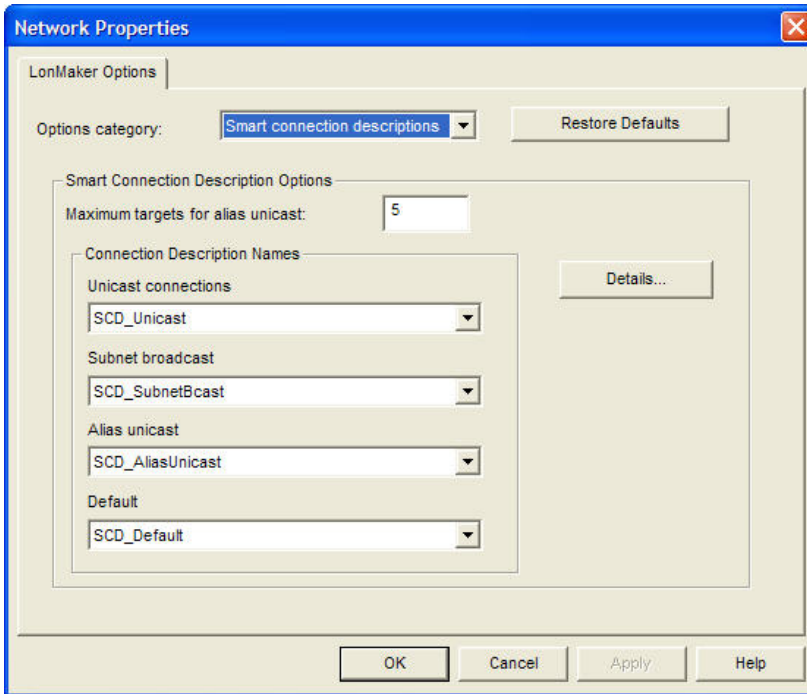
To support automatic connection description selection, the pre-defined connection descriptions include *smart connection descriptions* (SCDs). When a smart connection description is assigned to a connection, the LonMaker tool automatically selects the appropriate SCD when a connection is created or changed. The LonMaker tool determines the appropriate SCD based on the number of target network variables, whether the target network variables are located on the same or different subnet, and the availability of network variable aliases.

The following flow chart demonstrates the process the LonMaker tool uses to select the appropriate SCD.



These automatic SCD selection rules do not apply to message tag connections, fan-in connections (where the hub is an input network variable), or connections in which you specify a non-SCD for the connection description.

You can modify the automatic SCD selection rules by opening the **LonMaker** menu, clicking **LonMaker Options**, and then selecting the **Smart Connection Descriptions** options category. The network properties: **Smart Connection Descriptions** options category is not available from the **LonMaker Default Options** tab in the LonMaker Design Manager.

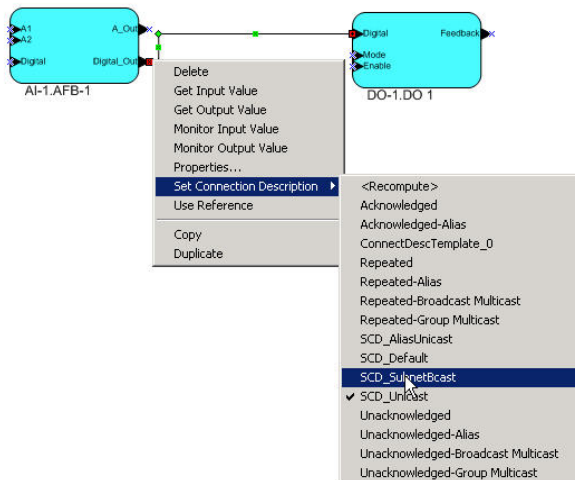


You can change or disable the connection description used for each condition in the automatic connection description selection process. If you disable the connection description for a given condition, the LonMaker tool will select the next defined connection description. You can also change the maximum number of target network variables used to select between the Alias Unicast and Default conditions. The default value of **5** provides a good balance between total transaction time and network resource usage.

Clicking **Details** opens the **Connection Details** dialog, in which you can modify pre-defined connection descriptions or create new ones.

Changing the Connection Description for a Connection

You can quickly change a connection description used for a connection by manually selecting a new one. To manually select a new connection description, right click the connection, point to **Set Connection Description**, and then click the desired connection description on the shortcut menu. To disable automatic connection description selection, select a connection description that does not start with “SCD_”. To enable automatic connection description selection, select **<Recompute>**.



Hiding and Showing Connector Shapes

You can hide connector shapes to simplify a LonMaker drawing, or you can selectively show connector shapes attached to specific functional blocks or supernodes to examine their connections.

You can hide or show all of the connector shapes in a subsystem; hide/show connector shapes attached to specific functional blocks or supernodes; or control the creation and hide/show connector shapes attached to a functional block using the functional block properties **Options** tab.

Hiding and Showing All Connector Shapes in a Subsystem

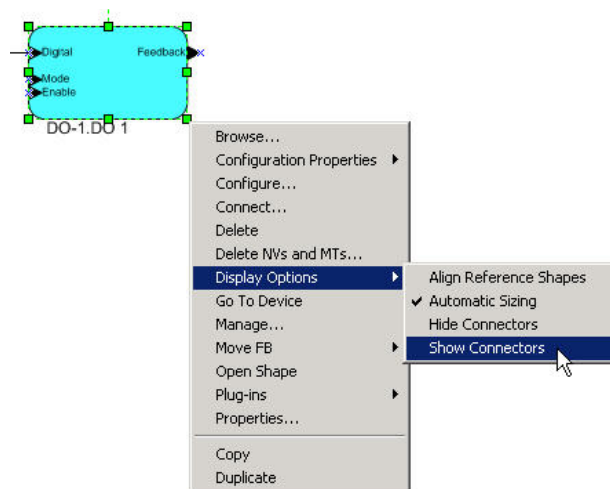
You can hide or show all of the connector shapes in a subsystem. To do this, right-click an empty space in the drawing, point to **Display Options**, and then click **Hide All Connections** or **Show All Connections**.

Monitored connections cannot be hidden using the **Hide All Connections** command. See *Using Monitored Connections* in Chapter 6, *Monitoring and Controlling Networks*, for more information on enabling and disabling connection monitoring.

Hiding and Showing Selected Connector Shapes Attached to Functional Blocks or Supernodes

You can hide or show the connector shapes attached to specific functional blocks or supernodes. To do this, right click the functional block or supernode, point to **Display Options**, and then click **Hide Connectors** or **Show Connectors**. The connector shape will be hidden if **Hide Connectors** was selected on the functional block at the other end of the connection, and neither end of the connection is being monitored (monitored connections cannot be hidden using the **Hide Connectors** command).

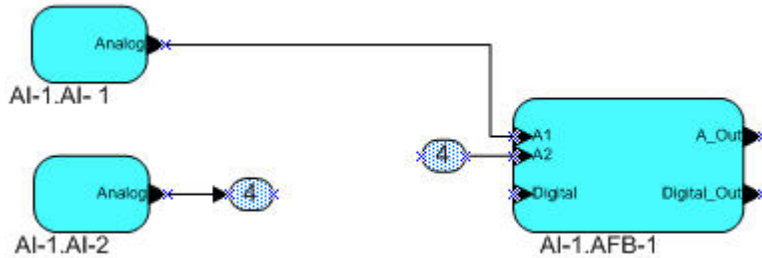
You can also hide or show connectors for multiple functional blocks or supernodes at one time. Drag a selection net around the functional blocks or supernodes with connectors you want to hide or show, or click one functional block, hold down CTRL, click all other functional blocks and supernodes, and then right-click one of the selected functional blocks; point to **Display Options**; and then click **Hide Connectors** or **Show Connectors**.



- To hide a connector shape directly attached to two functional block shapes (not attached using a reference shape), select **Hide Connectors** on both functional blocks. The connector shape will be hidden at both ends. To show the connector shape, you only need to select **Show Connectors** on one of the attached functional blocks.
- Unlike connector shapes attached directly to functional blocks, a connector shape attached via reference can be hidden on one end while being shown on the other. To hide a connector shape attached via a reference shape, select **Hide Connectors** on one of the attached functional blocks.

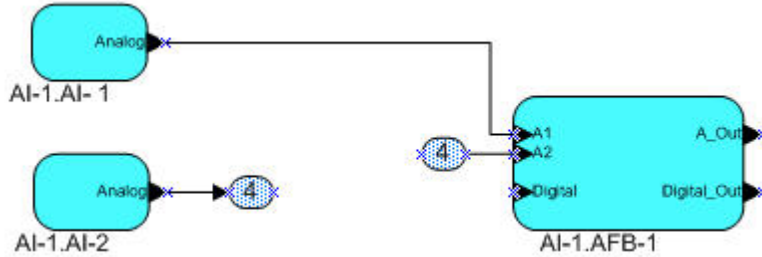
The connector shape and its reference shape will both be hidden on that end. Repeat this step on the other attached functional block to hide the corresponding shapes on the other end of the connection.

The following series of figures demonstrates how you can hide and show connections. This example uses two analog input functional blocks connected to an analog functional block. One connector shape is attached directly to both functional blocks; the other is attached via a reference shape.



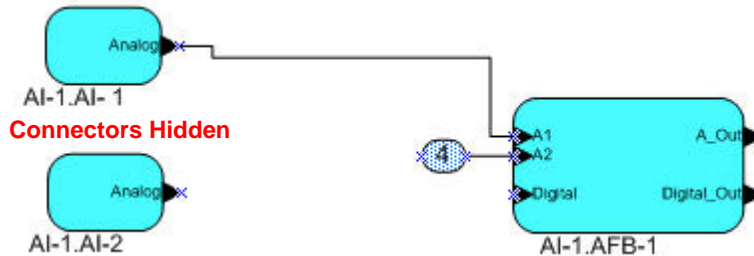
Show Connectors is set by default on all three functional blocks.

Connectors Hidden



Right click **AI-1.AI-1**, point to **Display Options**, and then click **Hide Connectors**. There is no change because **Show Connectors** is still set on functional block **AI-1.AFB-1**.

Connectors Hidden



Right click **AI-1.AI-2**, point to **Display Options**, and then click **Hide Connectors**. The connector and reference shapes attached to this functional block are hidden. There is no change to the connector and reference shapes attached to **AI-1.AFB-1** because connector shapes attached via reference are hidden/shown independently on each end.

Connectors Hidden



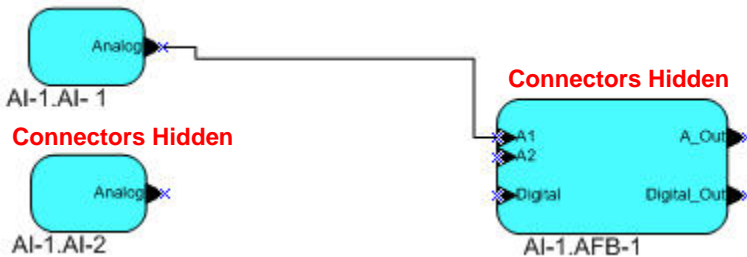
Connectors Hidden



Connectors Hidden



Right click **A1-1.AFB-1**, point to **Display Options**, and then click **Hide Connectors**. The connector shape between functional blocks **A1-1.AI-1** and **A1-1.AFB-1** is now hidden because **Hide Connectors** is selected on both attached functional blocks. The reference shape attached to functional block **A1-1.AFB-1** is now also hidden.



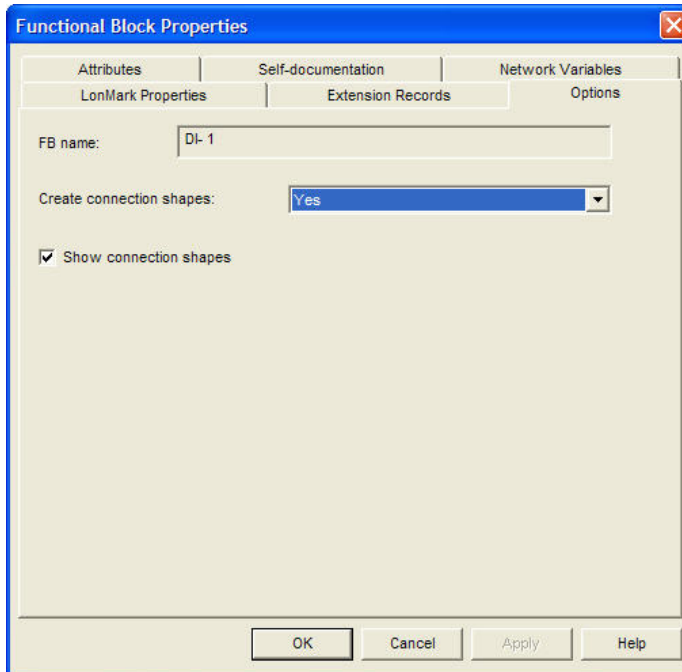
Right click **AI-1.AI-1**, point to **Display Options**, and then click **Show Connectors**. The connector shape between functional blocks **A1-1.AI-1** and **A1-1.AI-2** is now visible because **Show Connectors** is selected on one of the functional blocks to which it is directly attached.

Hiding and Showing Connector Shapes Attached to a Functional Block

You can control the creation of connector shapes and control whether they are hidden or displayed from the **Options** tab in the **Functional Block Properties** dialog. The settings in the dialog apply only to functional blocks (not to supernode). To use this dialog to control functional block connections, follow these steps:

1. Right-click a functional block, click **Properties** on the shortcut menu, and then click the **Options** tab.

To select multiple functional blocks, click one functional block, hold down CTRL, click all other functional blocks with connectors you want to hide or show, right-click one of the selected functional blocks, click **Properties** on the shortcut menu, and then click the **Options** tab.



2. Select the following options for creating and displaying connection shapes for the selected functional block or functional blocks.

Create Connection Shapes

Select whether shapes are created and displayed in the LonMaker drawing for connections with the selected functional block(s). You have three choices:

- **Yes.** Creates and displays shapes in the LonMaker drawing for connections with this functional block if **Yes** or **If Other FB has Connection Shapes** is set in the functional block on the other end of the connection. This is the default.
- **No.** Does not create or display shapes in the LonMaker drawing for connections with this functional block, regardless of the setting in the functional block on the other end of the connection. In addition, automatically clears and disables the **Show Connection Shapes** check box, which in turn hides all existing connections attached to the selected functional block(s). Connections involving this functional block will still be created in the network database, but they will not be represented by a connection shape.
- **If Other FB has Connection Shapes.** Creates and displays shapes in the LonMaker drawing for connections with this functional block only if **Yes** is set in the functional block on the other end of the connection. A connection shape is not created if **No** or **If Other FB has Connection Shapes** is set on in the functional block on the other end of the connection.

Show Connection Shapes

Select whether connection shapes attached to the selected functional block(s) are displayed. This check box is selected by default, but it is cleared and unavailable if **No** is selected in the **Create Connection Shapes** list.

If this check box is selected, connections with the functional block(s) will be represented with a connection shape provided that the following is true: **Yes** is selected in the **Create Connection Shapes** list for one of the functional blocks in the connection, and **Yes** or **If Other FB has**

Connection Shapes is selected in the functional block on the other end of the connection. If these conditions are true, a connection shape will be shown regardless if this option is cleared for the functional block on the other end of the connection.

If this check box is cleared, a connection shape will be hidden if this check box is cleared in the functional block on the other end of the connection.

Viewing and Navigating LonMaker Network Design

The LonMaker tool provides several methods for viewing and navigating your LonMaker network design. You can navigate through the network from within a drawing page, and you can use the Network Explorer to navigate, view, and modify the subsystems, devices, and device templates in your network design. The following describes how to view and navigate your network using the drawing page, and how to navigate, view, and modify your network design with the Network Explorer.

Navigating the Network within the Drawing Page

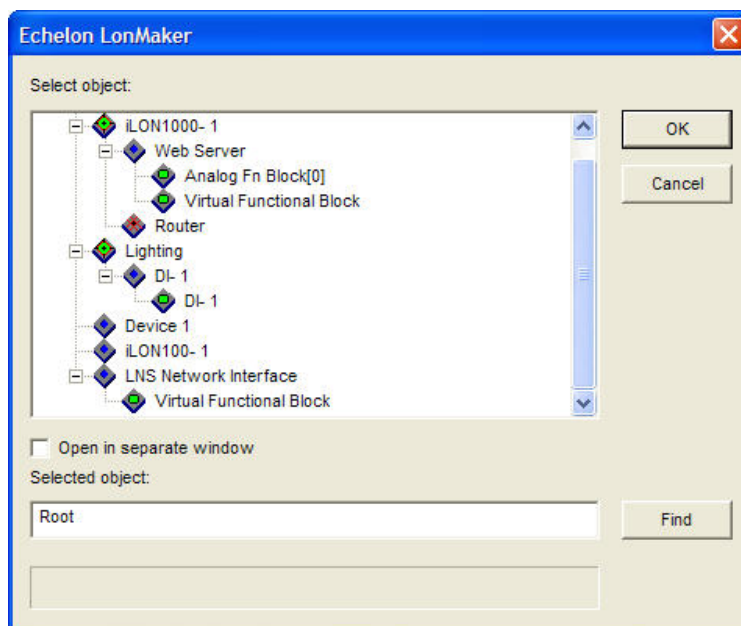
You can navigate through your network starting from any page of your network design. Each page in your network design represents a subsystem in the network. The initial page is called the *top-level (root) subsystem*. The top-level subsystem can have multiple subsystems nested below it, and those nested subsystems can have multiple subsystems nested below them, and so on (the subsystem directly above another is referred to as the *parent* subsystem). The result is that your drawing file represents a network hierarchy consisting of the top-level subsystem and potentially multiple levels of subsystems nested below it.

From the drawing page, you can open any subsystem in the network and go to any object in the subsystem, or you can move up one level in the network hierarchy and open the parent subsystem

Opening any Subsystem

You can open any subsystem of a network from any page within the network design. To open a subsystem in the network from the drawing page, follow these steps:

1. Right-click an empty spot in the drawing page and then click **Go to Subsystem** on the shortcut menu. The Select Object window opens.



2. The window displays a hierarchal view of the subsystems in your network, with the nested subsystems and devices in the top-level subsystem and the current subsystem shown. You can expand an object to view any others further down the network hierarchy such as nested subsystems, devices, and functional blocks. You can also right-click an object and use the Network Navigator to expand an object. Using the Network Navigator and expanding the top-level subsystem will cause the complete hierarchy of all subsystems in the network to be displayed. See *Using Network Navigators* for more information on using this tool.
3. Select a subsystem or an object in the subsystem.
4. To open the selected subsystem in a new window, select the **Open in Separate Window** check box.
5. Click **OK**. The subsystem or the subsystem containing the object you selected will open.

Opening a Parent Subsystem

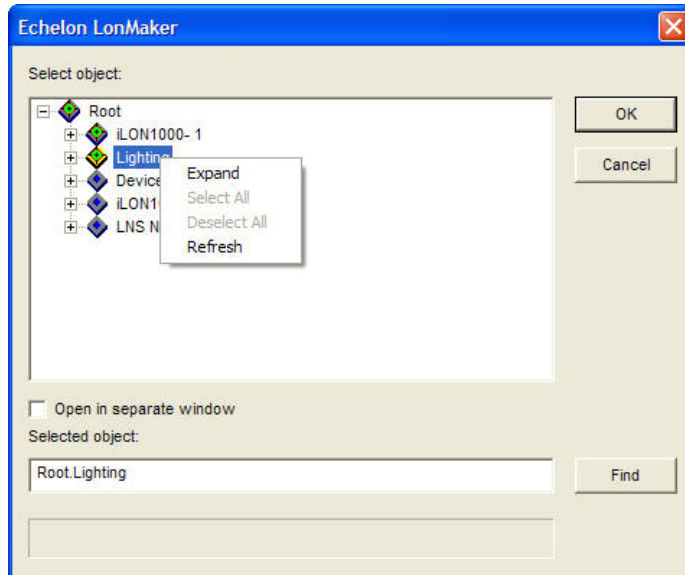
You can move up one level in the network hierarchy and open the parent subsystem using either of the following two methods:

- Double-click the title block. The title block is located at the top-center of the drawing page and contains the name of the subsystem.
- Right-click an empty spot in a subsystem and select **Go to Parent Subsystem** from the shortcut menu.

With either method, the parent subsystem opens in the same window if it is located in the same drawing. If the parent subsystem is located in a different drawing, it opens in a new window.

Using Network Navigators

You can use a network navigator to expand, select, and deselect items when viewing or configuring a LonMaker network. The network navigator displays a hierarchal view of the subsystems in your network. It is available in several scenarios including the following: selecting a subsystem to open, adding functional blocks or supernodes to a connection, selecting network variables to assign to a subsystem, and choosing the subsystem into which to replicate a connection.



To use the network navigator, right-click an object that can be expanded and then click one of the following commands in the shortcut menu:

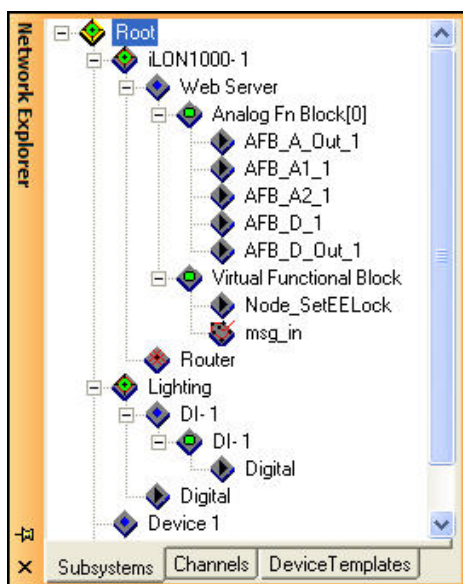
- | | |
|---------------|---|
| <i>Expand</i> | Displays all objects below the selected item. Selecting expand on the top-level subsystem will display all objects in the network |
|---------------|---|

	hierarchy.
<i>Select All</i>	Expands the item and selects the check boxes of all the objects below it. Click Select All on the top-level subsystem to select the check boxes of all the objects in the network hierarchy. This option is only available in scenarios in which multiple objects can be selected.
<i>Deselect All</i>	Expands the item and clears the check boxes of all the objects below it. Click Deselect All on the top-level subsystem to clear the check boxes of all the objects in the network hierarchy. This option is only available in scenarios in which multiple objects can be selected.
<i>Refresh</i>	Collapses and/or clears the check boxes of all the objects below the selected item.

Navigating and Managing a Network with the Network Explorer

You can navigate and manage your network using the Network Explorer. The Network Explorer is an auto-hide window that displays a hierarchical view of your LonMaker network and supports all of the commands available within the drawing pages. You can use the Network Explorer as a navigational tool or a network management tool. As a navigational tool, the Network Explorer simplifies and accelerates the task of navigating through a large LonMaker network. It does this by displaying the network as a single tree with the devices, routers, functional blocks, and network variables in the network listed in hierarchal order below their respective subsystems, channels, and device templates. As a network management tool, the Network Explorer lets you configure and modify the objects as you would in the drawing page. You just right-click an object in the Network Explorer and click commands on the object's shortcut menu.

To display or hide the Network Explorer, open the **View** menu and then select **Network Explorer**. The objects displayed in the Network Explorer depend on the settings in the network properties: **Network Explorer** options category. By default subsystems, devices, and functional blocks are displayed. To expand or reduce the scope of the objects displayed in the Network Explorer, open the **LonMaker** menu, click **LonMaker Options**, select **Network Explorer** from the **Options Category** list, and then select the desired scope under the **Displayed Objects** box. See *Network Explorer Options* in Appendix A for more information.



The Network Explorer provides separate subsystem, channel, and device template views, each on its own tab. To change views, click the appropriate tab.

- In the subsystem view, the top-level subsystem and all the subsystems it contains are displayed, and all the other objects in your LonMaker drawing are listed below their respective subsystems in a hierarchal structure (in the order of nested subsystems, devices, functional blocks, and then network variables).
- In the channel view, the channels in your LonMaker drawing are listed alphabetically, and the objects in the LonMaker drawing are listed in a hierarchal structure under the channels on which they are connected (in the order of devices, functional blocks, and then network variables).
- The device template view is similar to the channel view except that the device templates are listed alphabetically and the devices (and their functional blocks and network variables) are listed under the device templates they use. From the device template view, you access the **Device Template** menu and the **Device Template Properties** dialog box. See *Device Template Options* in this chapter for more information on updating and setting validation options for device templates.

Navigating a Network with the Network Explorer

You can navigate the subsystems, devices, device templates, and other objects in your network with the Network Explorer. Expand an object to display the objects below it in the network hierarchy; collapse an object to hide the objects beneath it. Double-click an object to open the drawing page containing the object. The object you double-clicked in the Network Explorer will be selected when the drawing page opens (if you double-clicked a subsystem, no object will be selected when the drawing page opens).

For example, in the subsystem view, the Network Explorer initially displays the nested subsystems and devices in the top-level and current subsystems. You can expand one of the devices to reveal its functional blocks and then expand one of the functional blocks to reveal its network variables. When you double-click a functional block of a device in the top-level subsystem, the drawing page for the top-level subsystem will open and the functional block will be selected.

Managing a Network with the Network Explorer

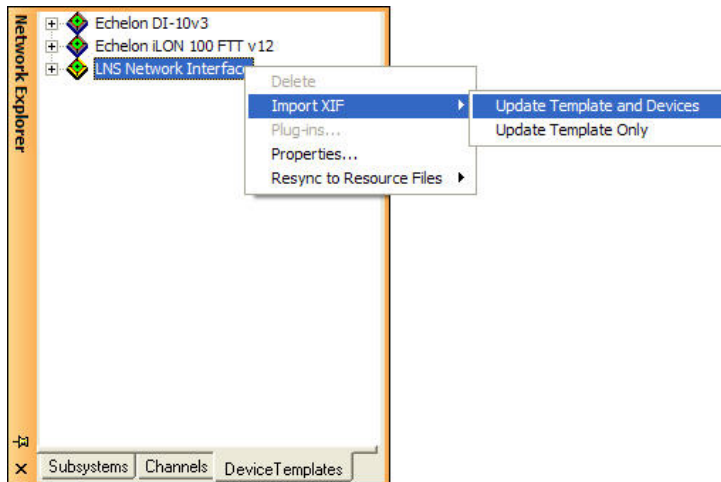
To use the Network Explorer as a network management tool, right-click a subsystem, device, router, functional block, or network variable shape and select a command from the shortcut menu. The shortcut menu that opens is the same shortcut menu you can access in the drawing page. See the sections on subsystems, devices, routers, functional blocks, and network variables in this document for a description of the commands

Managing and Editing Device Templates with the Network Explorer

You can edit, update, and delete a device template with the Network Explorer. A *device template* contains all the attributes of a given device type, such as its functional blocks, network variables, and configuration properties. You can create a device template by importing a device interface (XIF) file supplied by the device manufacturer, or by uploading the interface definition from the physical device. A device template is identified by its name and its program ID. Both must be unique within a network—you cannot have two device templates with the same name or the same program ID in a single network.

Managing Device Templates

You can manage device templates from the **Device Templates** tab. To edit, update, or delete a device template, click the **Device Templates** tab and then right-click the device template. The Device Template shortcut menu opens.



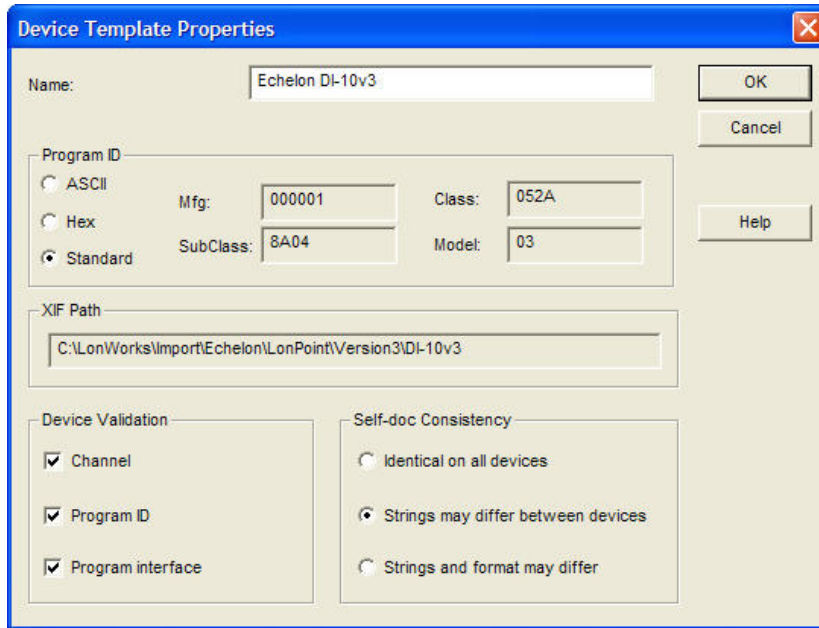
The Device Template shortcut menu contains the following options:

- | | |
|---------------------------------|--|
| <i>Delete</i> | Deletes the selected device template. This option is unavailable if there are any devices currently using the device template, or if there is a device that has been discovered by the LNS Server but does not yet appear in the LonMaker drawing. |
| <i>Import XIF</i> | Updates the device template (and optionally devices) with the data from the XIF that you select. |
| <i>Plug-ins</i> | Displays the list of LNS plug-ins registered for the selected device template. This option is unavailable if the device does not have any defined plug-ins.

If you remove a template with an associated plug-in and you later re-import the template, you must re-register the plug-in. |
| <i>Properties</i> | Opens the Device Template Properties dialog box. See <i>Device Template Properties</i> for more information on the options in this dialog box. |
| <i>Resync to Resource Files</i> | Updates the device template (and optionally devices) with the current data from the device resource files. |

Editing Device Template Properties

You can edit a device template. To edit a device template, right-click the template on the **Device Templates** tab in the Network Explorer, and then click **Properties** on the shortcut menu. The **Device Template Properties** dialog box opens, showing the attributes of the selected device template.



The **Device Template Properties** dialog box contains the following options:

- | | |
|--------------------------|--|
| <i>Name</i> | Specifies the name of the device template. You can change the device template name to any other valid, unique name. |
| <i>Program ID</i> | <p>Displays the program ID of the device template. You can select one of the following options for displaying the program ID (this selection does not change the program ID):</p> <ul style="list-style-type: none"> • ASCII. Displays the program ID as an ASCII string. Non-printable characters are displayed as “/xHH”, where HH is the hex value of the unprintable byte. • HEX. Displays the program ID as hexadecimal numbers • Standard. Displays the program ID as standard program ID fields. If the program ID is not a standard program ID (the leading nibble value is not 8 or 9), this display option is unavailable. |
| <i>XIF Path</i> | Displays the name of the XIF file used to create the device template (if known). The path specified is relative to the LonWorks Import folder on the LNS server computer. |
| <i>Device Validation</i> | <p>Selects which validation steps are performed by the LNS Server when you commission devices that use the selected device template.</p> <p>When you commission a device, the LNS Server by default will validate that the physical device is on the correct assigned Channel and that the device template has the same Program ID and Program Interface (XIF) defined in the network database.</p> <p>Clearing these check boxes may reduce the time required to commission a device. This may be useful when you are commissioning a large number of devices on a slow channel such as power line, or when commissioning time is very expensive such as a remote LNS Server communicating over a dial-up connection.</p> <p>If you clear the check boxes, make sure that all devices using the selected device template contain the correct program information</p> |

and are installed on the correct channel before commissioning them. Doing so will help prevent the devices from being improperly configured or having communication problems.

Self-doc Consistency Selects the required level of consistency for the self-documentation data (strings and format) of the devices using the selected device template.

Choose from three levels of consistency (listed from least to most flexible): **Identical on All Devices**, **Strings may Differ Between Devices**, or **Strings and Format may Differ**.

You can use the **Strings may Differ Between Devices** or **Strings and Format may Differ** options to install devices from a device manufacturer that have the same program ID but slightly different self-documentation strings. This typically happens when a device manufacturer makes changes to the descriptive part of a device's self-documentation data.

You can use the **Strings and Format may Differ** option to install devices from a device manufacturer that have the same program ID but use a different format for the self-documentation data. For example, if the manufacturer changed from the version 1 to version 2 format. **Note:** This option will not work for some devices. See the LonMaker ReadMe file for more information.

Working with LonMaker Layers

You can use LonMaker layers to hide and show parts of your drawing. LonMaker layers are separate views for the physical, logical, and data components of your LonMaker network. The physical layer includes the devices, routers, channels; the logical layer contains the functional blocks, network variables, and unmonitored connections; and the data layer consists of monitored connections. Subsystems and supernodes belong to both the physical and logical layers. To hide subsystems and supernodes, hide both the physical and logical layers. Hiding only the logical layer hides the supernode network variables.

You can show or hide a LonMaker layer using either of the following two methods:

- Click the icon of the corresponding layer in the LonMaker toolbar.



Physical Layer

Shows/hides all supernodes, subsystems, devices, routers, and channels.



Logical Layer

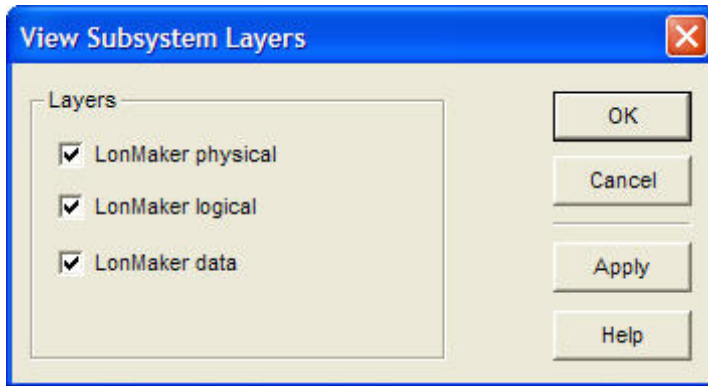
Shows/hides all supernodes, subsystems, functional blocks, message tags, network variables, and unmonitored connections.



Data Layer

Shows/hides all monitored connections.

- Right-click an empty space in your LonMaker drawing, point to **Display Options** on the shortcut menu, and select **View Subsystems Layers** from the shortcut menu. The **View Subsystem Layers** dialog box opens. Select or clear the LonMaker Layers you want displayed or hidden. You can click **Apply** if you want to see how your LonMaker drawing appears with the current settings. When you are done, click **OK**.



Working with LonMaker Shapes

You can view, edit, move, copy, and delete LonMaker shapes. A *LonMaker shape* is a shape within a LonMaker drawing that represents a physical component in a LONWORKS network such as device, channel, network variable, or connection. This section describes how to work with LonMaker shapes.

Viewing and Setting LonMaker Shape Properties

You can view and set the properties of a LonMaker shape. If you modify the properties with the LonMaker tool attached to the network and OnNet, the changes will be sent to the physical devices immediately. Otherwise, the changes will be stored in the LNS database and then propagated to the physical devices when the LonMaker tool is attached and placed OnNet.

To view the properties of a LonMaker shape, right-click the shape and select **Properties** from the shortcut menu. A **Properties** dialog box opens. For a description of the properties that you can view and modify, click **Help** in the dialog box.

Moving a LonMaker Shape

You can move a LonMaker shape within a LonMaker drawing. You can reposition it within the current subsystem; move it into a different subsystem; or change the channel in on which it is located, which can be in the same or in a different subsystem. You cannot move a LonMaker shape using Visio's cut and paste commands.

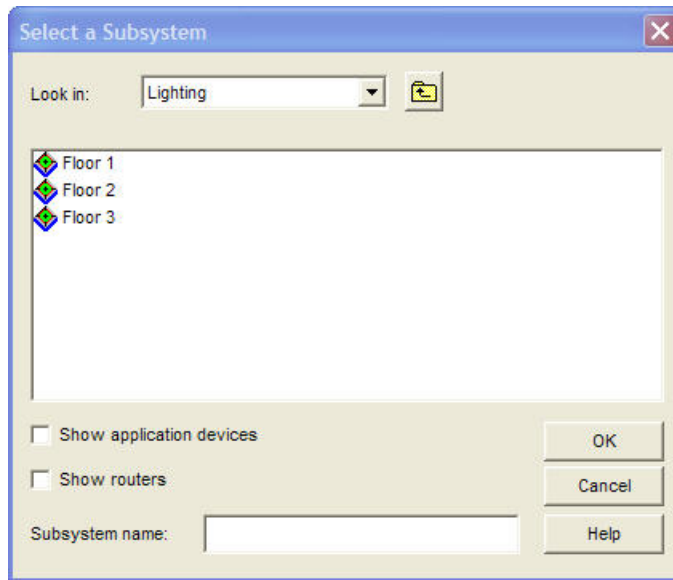
Repositioning a LonMaker Shape


You can re-position any LonMaker shape within a subsystem by dragging it to a different location on the same drawing page.

Changing the Subsystem for a LonMaker Shape

You can move a device, router, functional block, and subsystem shape into another subsystem. To do this, follow these steps:

1. Right-click the shape. You can select multiple shapes by holding down CTRL and clicking the shapes, or clicking an empty space in the drawing page and dragging a selection net around the shapes.
2. Point to **Move Device** (for device, router, and subsystem shapes) or **Move FB** (for functional block shapes) on the shortcut menu.
3. Click **Change Subsystem** (for device, router, and functional block shapes) or **Move** (for subsystem shapes). The **Select a Subsystem** dialog box opens. This dialog lists any subsystems nested within the current subsystem.



4. Click the **Up** button  to move up one level in the network hierarchy; double-click a subsystem to move down one level. Select the new subsystem.
5. Click **OK**.
6. If you move a functional block with any connector shapes, you will be prompted to have the LonMaker tool convert the connector shapes to reference connection shapes. Click **OK**.

Changing the Channel for a LonMaker Shape

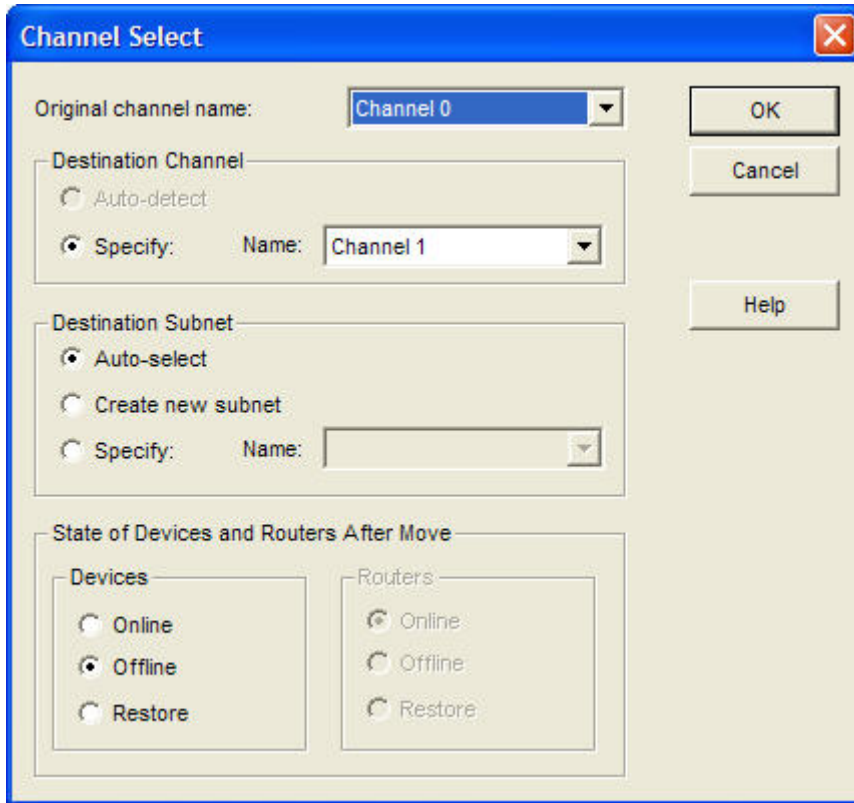
You can move a device, router, or LNS computer onto a different channel. LNS computers include LonMaker computers, the LNS Server, and other LNS clients.

Moving a Device or Router to a Different Channel

To change the channel on which devices and routers are located, follow these steps:

1. Right-click the device or router shape, or a subsystem containing the device or router, point to **Move Device**, and then click **Change Channel** on the shortcut menu.

You can move multiple device and router shapes attached to the same channel by holding down CTRL and clicking the shapes, or clicking an empty space in the drawing page and dragging a selection net around the shapes. The **Channel Select** dialog box opens.



2. Set the following options:

Original Channel Name

Specifies the current channel on which the devices or routers are attached.

If you are moving devices or routers from a subsystem shape that has devices or router shapes connected on two or more channels, select the channel with the devices or routers you want to move. Only those devices or routers located on the selected channel will be moved.

Select the **Exclude Nested Subsystems from Subsystem Operations** check box in the **Subsystem Properties** to limit the scope of the move to the current subsystem. To select or clear this check box, right-click a Subsystem shape and select **Properties** from the shortcut menu, or right-click an empty space in the drawing page and select **Subsystem Properties** from the shortcut menu.

Destination Channel

Specifies the new channel.

- Select **Auto Detect** to have the LonMaker tool automatically discover the new channel. The LonMaker computer must be attached to the network to use this option. You cannot move routers using this option.
- Select **Specify** to manually select the channel from the **Name** list.

Destination Subnet

Specifies the new subnet (routers cannot have their subnet changed).

- Select **Auto-Select** to have the LonMaker tool choose an appropriate subnet.
- Select **Create New Subnet** to create a new subnet and place the

device on it.

- Select **Specify** to manually choose an existing subnet from the **Name** list.

State After Move

Specifies the desired state of the devices or routers after they have been moved.

- Select **Online** to put the devices or routers in the online state. This is the default for routers. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been moved.
- Select **Offline** to put the devices or routers in the offline state. This is the default for devices. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application after it has been moved. Devices in the offline state still respond to Online, Wink, and Test commands. The devices also receive network variable updates; however, their applications will not process these values, and the devices will not send network variable updates.
- Select **Restore** to return the devices or routers to their states before they were moved.

3. Click **OK**. If the LonMaker tool is OnNet and any of the devices or routers have been commissioned, the **Move Devices and Routers** dialog box appears.



4. Physically move the device or router onto the channel you selected.
5. Click **OK**. The LonMaker tool completes the channel change.
6. If the channel change fails, a **Re-commission Prompt** will open in which you can re-commission the devices that you tried to move. Click **Yes** to re-commission the devices. Re-commissioned routers will be put in the online state; devices will be placed offline. Click **No** to leave the devices deconfigured.

Moving an LNS Computer to a Different Channel

You can move an LNS computer (LonMaker computer, LNS Server, or other LNS client) to a different channel following these steps:

1. Right-click the LNS Network Interface shape for the LonMaker computer, or the NSD shape for another LNS computer, and then click **Change Channel** from the shortcut menu.
2. Change the channel on which the LNS computer is attached following step 2 in *Moving a Device or Router to a Different Channel*.
3. If you are moving a LonMaker computer and you will be using a different network interface, open the **LonMaker** menu, select **Network Properties**, select the **Network Interface** tab, and then select the name of the new network interface.
4. Click **OK**.

Copying a LonMaker Shape

You can copy a LonMaker shape in your LonMaker drawing to create a new shape with the same properties of the original. For example, if you copy a device shape, the LonMaker tool creates a new device shape with the same device template, configuration properties, and device properties as the shape from which it was copied. *Extension records* (data records created by LNS tools such as the LonMaker tool to store tool-specific information) that indicate they can be copied will also be copied.

You can copy a LonMaker shape in two ways:

- Right-click the LonMaker shape, select **Copy** from the shortcut menu, right-click an empty space in your LonMaker drawing, and then click **Paste**.
- Select the LonMaker shape, hold down CTRL, and then drag the shape to a new location within the current drawing page.

You can copy multiple shapes at the same time by holding down CTRL and clicking the shapes you want to copy, or clicking an empty space in the drawing page and dragging a selection net around the shapes.

If you copy a device shape, the copy represents a different physical device than the original. You must assign a new Neuron ID to the new device shape when it is commissioned. You cannot use this method to copy a network variable or message tag shape. See *Creating a Network Variable Shape* for instructions on how to copy a network variable shape. You can only copy a connection reference shape in conjunction with the attached Connector shape.

Tip: To copy a LonMaker shape from one to network to another, create a custom master shape in the current LonMaker drawing and then drag the master shape to the destination drawing. See Chapter 12, *Creating and Using a Custom LonMaker Master Shape*, for more details on creating master shapes.

Deleting a LonMaker Shape

You can delete a LonMaker shape. To do this, either right-click the shape and then click **Delete** on the shortcut menu, or click the shape and then press DELETE. If you selected the **Confirm Deletes** check box in the network properties: **General** options category (see Appendix A), click **Yes** to confirm the change.

If you remove a shape that requires deleting other shapes associated with it (a device with one or more functional blocks assigned to it, for example), a message appears warning you that the associated shapes will also be deleted. Click **Yes** to delete the shape and the additional shapes; click **No** to cancel the operation.

When you delete a LonMaker shape, the physical devices on the network may be affected. In this case, the LonMaker tool and LNS Server change the network configuration of the devices when the LonMaker tool is OnNet and the LNS server can communicate with the devices. The following table summarizes how physical devices are affected when you delete various LonMaker shapes.

Deleted LonMaker Shape	Affect on Physical Device
Commissioned Application Device	Application device is decommissioned and no longer has a network address.
Commissioned Router	Router is decommissioned and no longer has a network address.
LNS Network Interface or NSD	LNS attempts to decommission the NSD. If the NSD is using a Layer 2 interface, it cannot be decommissioned. Disconnects any remote full clients using the NSD.
Functional block (static)	No change.
Dynamic functional block	No change; however, a device plug-in may remove the functional block from the application device.
Network variable (static)	No change.
Dynamic network variable	Dynamic network variable is removed from application device.
Connection	Connection information is deleted from application device.
Channel	No change to devices attached to the channel. You cannot delete a channel shape that has one or more devices attached to it on the same page.

Customizing the User Interface Overview

You can customize the LonMaker user interface. You can change the title block that appears on each page of a LonMaker drawing, the commands that appear on the LonMaker menus, the appearance of the LonMaker shortcut menus.

Editing the Title Block

You can change the title block that appears on each page of a LonMaker drawing. The default LonMaker templates create a title block at the bottom right corner of each page. The title block provides the following information about the drawing: drawing title, page number, name of the drawing's creator, date the drawing was created, full file name of the drawing, and a brief description of the drawing or network.

To edit the title block, open the **Edit** menu, point to **Go To**, and select **Background**. Select the part of the title block you want to edit (no cursor appears) and then enter the information you want displayed. To return to the main drawing, open to the **Edit** menu, point to **Go To**, and select **Foreground**. The changes you made to the title block are displayed.

Tip: You can use the same method to add your company logo to your LonMaker drawing.

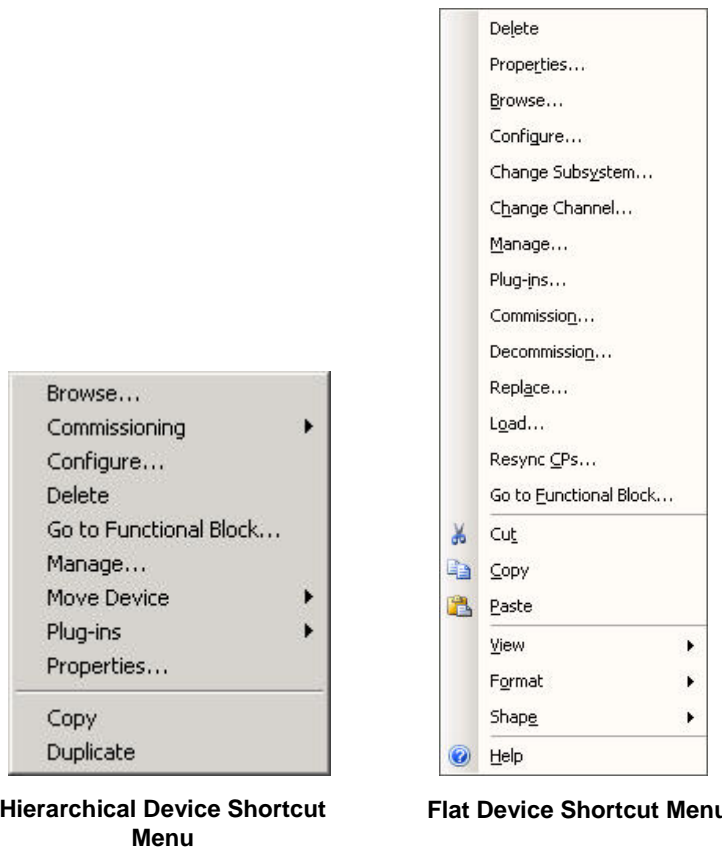
Changing the Commands on the LonMaker Menus

You can change the commands that appear on the LonMaker menus. You can either display all Visio and LonMaker commands, or you can display a basic set of commands. Users who only need to perform common operations like commissioning devices can use the basic set; advanced users will typically use the full set. To change the displayed commands, open the **LonMaker** menu and click **Select Minimum UI/Maximum UI**. The default setting is **Maximum UI**, which displays all Visio and LonMaker commands. You can set the initial UI setting for each LonMaker user as described in *Creating a New User Profile* in Chapter 3, *Getting Started*.

Using LonMaker Shape Menus

You can change the appearance of the LonMaker shortcut menus. You can select either a hierarchical menu that removes Visio commands not typically used with LonMaker shapes, or you can select a flat menu that includes all Visio shape commands. The hierarchical menus provide a compact top-level shortcut menu for each LonMaker shape with hierarchical sub-menus. For example, the device shape menu has sub-menus for commissioning, moving, managing, and plug-ins, and the commissioning sub-menu contains the commands for commissioning, decommissioning, loading, and replacing devices; propagating configuration property values; and resynchronizing configuration properties.

The hierarchal LonMaker shortcut menus are set by default. To enable or disable hierarchal LonMaker shortcut menus, open the **LonMaker** menu and select or clear **Use LonMaker Shape Menus**. The following figures illustrate the difference of a device shape menu with **LonMaker Shape Menus** selected and cleared.



Using AutoCAD Drawings

You can import AutoCAD drawings into your LonMaker drawing and export your LonMaker drawing as an AutoCAD drawing.

Importing an AutoCAD Drawing

You can import an AutoCAD drawing. You can do this to use a drawing created by a mechanical system designer as a background for your LonMaker drawing. This allows you to show the physical placement of devices within the mechanical system.

To import an AutoCAD drawing into the background of a LonMaker drawing, follow these steps:

1. Open the **Edit** menu, point to **Go To**, and select **Background**.
2. Open the **Insert** menu and select **CAD Drawing**.
3. Select the AutoCAD drawing (.dwg or .dxf extension).
4. In the **AutoCAD Drawing Layer Status** dialog, specify which layers to convert from the AutoCAD file. Because the LonMaker tool only supports importing an AutoCAD drawing as a background, you can choose to convert layers as Displayed Layers only. Layer 0 indicates unlayered data.
5. Specify the drawing page size and scale for the AutoCAD drawing in the Page Size/Scale dialog. These settings do not affect the size of LonMaker shapes in the drawing.
6. Open the **Edit** menu and select **Go To Foreground**.
7. The AutoCAD drawing appears in the LonMaker drawing as a background.

Exporting an AutoCAD Drawing

You can export a LonMaker drawing as an AutoCAD drawing. This lets you create an as-built report in the same format as your other system blueprints. A LonMaker drawing saved in AutoCAD drawing format can be marked up by AutoCAD tools, but not manipulated as an AutoCAD object.

To export a LonMaker drawing as an AutoCAD drawing, follow these steps:

1. Open the **File** menu and select **Save As AutoCAD Drawing**.
2. Enter a name for the AutoCAD file. You can only export to .dwg format.
3. In the **Visio Drawing Layer Status** dialog, select the layers to export. Click **Options** to select a different AutoCAD output file version or LonMaker drawing mapping scheme.
4. The LonMaker tool saves the drawing in AutoCAD format, and you can open the drawing using AutoCAD software. If your network contains multiple LonMaker drawings, you must export each drawing as a separate AutoCAD drawing to export the entire network.

Installing Networks

This chapter describes how to install devices using the LonMaker tool, including how to load applications into them, set the initial state of their applications, set the source of their configuration properties, and select how they manage device-specific configuration properties. It also explains the different methods for acquiring device Neuron IDs and how to alternatively use the device discovery method to install a network.

Network Installation Overview

You can install the devices that you added to your LonMaker network design in *Designing Networks*. To install devices, you commission the devices and routers in your LonMaker network design. Commissioning associates the device shape created in the LonMaker drawing with a physical device on the network and updates the physical device to match the configuration in your network design.

You can commission devices after you design the network (engineered system installation) or as you add them to the network design (ad-hoc installation). You can also partially design a network and commission devices, and then incrementally add and commission more devices to the network.

You can add and commission a device in one step by selecting the **Commission Device** check box in the New Device or New Router Wizard. You can set this check box to be selected by default by selecting the **Commission after Creation** check box in the network properties: **Device** options category (see Appendix A).

To commission a device, you specify its Neuron ID. The LonMaker tool then updates the network address of the device, loads the device application (if necessary), sets the initial state of the device application (running or not), and updates the device's configuration properties. You can specify the Neuron ID by pressing the service pin on a device, manually entering (typing or scanning) it, or manually discovering the device (see *Commissioning using Device Discovery* for more information on using this method). A device is automatically commissioned when you load a new application into it or install it as a replacement for another commissioned device on the network.

When you commission a device, the network design is updated to include the Neuron ID of the device and its network configuration. The physical device may also be updated depending on whether the LonMaker tool is attached to the network and whether it is OnNet or OffNet.

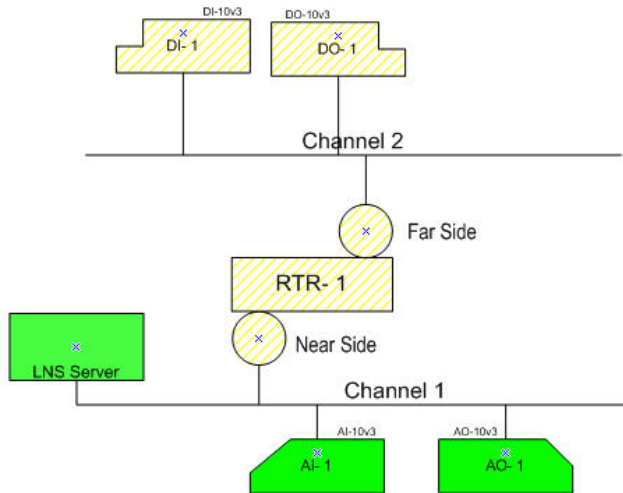
- If the LonMaker tool is attached to the network and OnNet, commissioning updates the physical device. The LonMaker tool associates the Neuron ID with the device; downloads all network variable connections and configuration properties; and deducts a LonMaker credit (unless you are running the LonMaker tool in demo mode). A LonMaker credit is not deducted when you commission a router. See *Using LonMaker Credits* for information about LonMaker credits.
- If the LonMaker tool is unattached to the network or attached but OffNet, commissioning associates the Neuron ID with the device, but the physical device is not updated. To update the physical device, you need to attach the LonMaker tool to the network, set the LonMaker tool OnNet, and then recommission the device. Recommissioning is the same as commissioning except that you do not have to specify the Neuron ID because it is already stored in the network database. If the LonMaker tool is unattached, you can only manually enter the Neuron ID (you cannot press the service pin or use device discovery to specify the Neuron ID).

Commissioning a Device

To commission a device, you do the following:

1. Select the device shape. You can select multiple device shapes to commission more than one device at a time.
2. Load the application image, if necessary (application devices only).
3. Set the initial state of the application and select the source of configuration property values (application devices only).
4. Set the Neuron ID.

Note: You must commission a router before commissioning any devices on its far side (the side furthest away from the LNS Server). The following figure demonstrates a network in which the devices on the far side of the router cannot be commissioned because the router has not yet been commissioned.

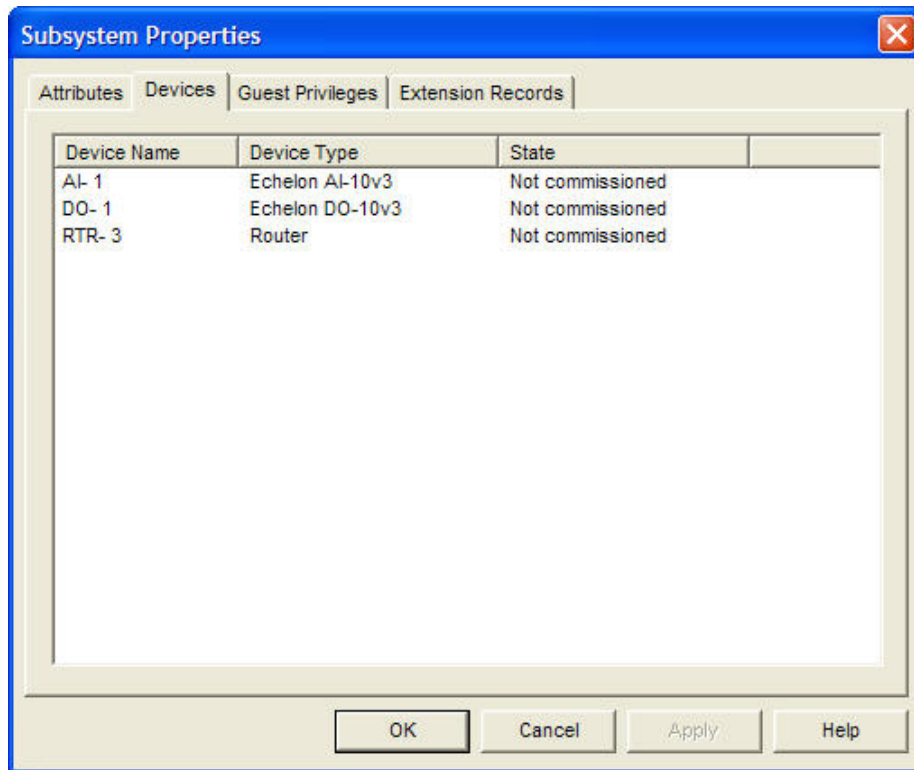


Selecting Devices for Commissioning

To select the device or devices to be commissioned, follow these steps:

1. Right-click the device shape of the device you want to commission, point to **Commissioning**, and then click **Commission** on the shortcut menu. To select multiple devices, do one of the following:
 - To select multiple devices within a subsystem, hold down CTRL and click the device shapes, or click an empty space in the drawing page and drag a selection net around them. Then right-click one of the selected device shapes, point to **Commissioning**, and click **Commission** on the shortcut menu.
 - To select all the devices within a subsystem, select the **Exclude Nested Subsystems from Subsystem Operations** check box (to access this option, right-click the Subsystem shape, or an empty space in the network if you are in the top-level subsystem, and select **Subsystem Properties** from the shortcut menu). Then right-click the Subsystem shape, or an empty space in the drawing page if you are in the top-level subsystem, point to **Commissioning**, and then click **Commission** on the shortcut menu.
 - To select all the devices within a subsystem and all of its nested subsystems, clear the **Exclude Nested Subsystems from Subsystem Operations** check box, right-click the Subsystem shape, or an empty space in the drawing page if you are in the top-level subsystem, point to **Commissioning**, and then click **Commission** on the shortcut menu.
 - To select all the devices within a network, clear the **Exclude Nested Subsystems from Subsystem Operations** check box, right-click an empty space in the drawing page of the top-level subsystem, point to **Commissioning**, and then click **Commission** on the shortcut menu.

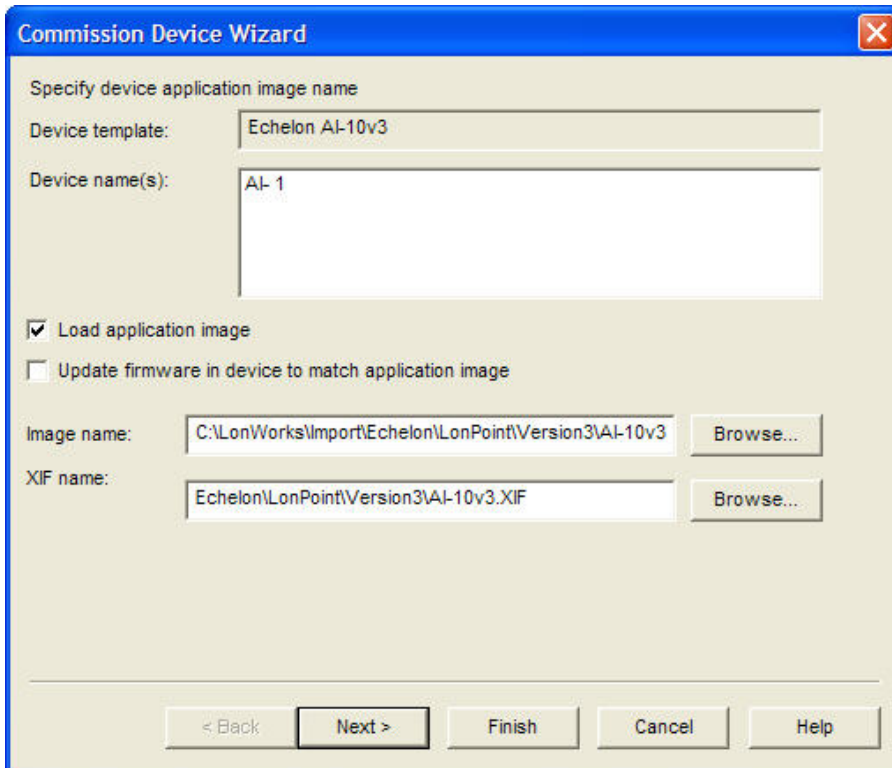
Tip: To view the state of the devices in a subsystem (configured and online or offline, or not commissioned), right-click a subsystem shape or empty space in the drawing page, select **Subsystem Properties** from the shortcut menu, and click the **Devices** tab. If subsystems are nested within the selected subsystem, the **Devices** tab will have an additional pane displaying the subsystem hierarchy. From this pane, select the subsystem with the devices you want to view.



2. The Commission Device Wizard opens. Where you start in the wizard depends on whether you are commissioning an application device or router, and whether the LonMaker tool is attached to the network and OnNet or OffNet.
 - If the LonMaker tool is unattached to the network or attached but OffNet, the wizard will skip the Device Application Image and Initial State windows and begin with the Device Identification window.
 - If the LonMaker tool is attached to the network and OnNet, and you are commissioning at least one application device, the wizard will begin with Device Application Image window. If you are only commissioning routers, the wizard will begin with the Initial State window.

Loading a Device Application Image

You can load an application image into an application device that supports application loading (some application devices have a fixed application image that cannot be changed). For application devices that support application loading, the device manufacturer may load the application into the application device when it is manufactured, or they may give you the option to either load the initial application, a different application, or an upgraded application.



1. Specify the device application by setting the following options:

Load Application Image

Select this check box to load an application image into a Neuron-hosted application device that has writeable application memory and comes with an application file (.ndl, .nxe or .apb extensions).

Update Firmware in Device to Match Application Image

Select this checkbox to upgrade or downgrade the Neuron firmware in the application device to make the firmware compatible with the application image being loaded into the device.

Each application image requires a specific version of the Neuron firmware. If the application image requires a different version of the Neuron firmware than the one already loaded in the device, you can load the correct version of the Neuron firmware by selecting this check box.

For a device to support firmware updates, it must be hosted on a Neuron 3150 core with at least 32 KB of nonvolatile memory starting at address 0.

If this check box is cleared, and the folder containing the selected application file contains a version of the file that matches the current device Neuron firmware with a file name of `<appImage>fw<n>.apb`, where n is the firmware version, the LonMaker tool will automatically load that application file into the device. Otherwise, the LonMaker tool will load the selected application file into the device.

Note: A device may become inoperable if there is a power failure during a firmware update.

Image Name

Specify the pathname of the application file. If you specified a device interface (XIF) file in the **Device Template** dialog (see *Creating a Device* in Chapter 4) and you are creating and commissioning the device at the same time, you cannot specify a

different XIF file. If an application image file is found in the same directory as the XIF file of the device template, that directory is the default.

XIF Name

If you are loading an application file with an .nxe extension, select the pathname of the XIF file.

The LonMaker tool only requires the binary application file (.apb extension) and the binary device interface file (.xfb extension); however, it automatically creates binary files from existing text files (.nxe and .xif) and saves them in the application file folder that contains the corresponding .nxe file.

Note: If you are working on a remote client, the LonMaker tool looks for the application and device interface files on the LNS Server. Make sure you specify the full pathname (including drive) of the application and device interface files on the LNS Server. You cannot load an application file directly from a remote client computer onto a device.

2. Click **Next** to continue. If you are commissioning multiple devices with different device templates, additional windows for each device template and the associated devices will open. Repeat this process for each device template. When there are no more device templates, the Setting the Device Initial State window appears.

When you load an application image, verify that the Device Name field contains the name of the device to be loaded to ensure that the application is being loaded into the correct device. If the device already has an application, the LonMaker tool will compare the program ID of the new application with the program ID of the application in the device. If both applications use a type 8 or 9 program ID, a warning message is displayed if the device Class or Subclass are different. A warning message is also displayed if a program ID that is not a type 8 or 9 program ID will be overwritten with a type 8 or 9 program ID, or vice versa. If you see this warning, verify that you have the correct device and application. If you do, you can safely ignore the warning message.

Setting the Initial Device State and Source of Configuration Property Values

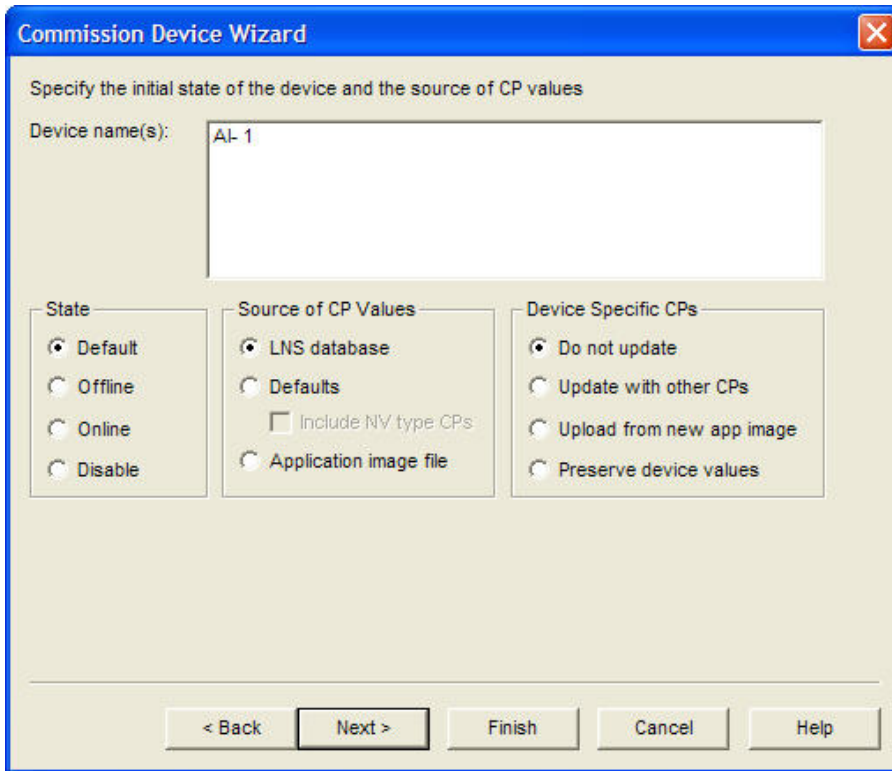
You can set the initial device state and the source of configuration property values (application devices only) when you commission a device. You can also specify how device-specific configuration properties are managed. Unlike other configuration properties, device-specific configuration properties have values that can be modified by tools not based on LNS or by the device itself.

Alternatively, you can have the LonMaker tool skip the Setting the Device Initial State window and use the default settings in the network properties: **LonMaker Options** dialog. You can set the default initial state of devices under the **New Device State** box in the network properties: **Device** options category. You can set the default source of the configuration property values under the **CP Value Source** box in the network properties: **Configuration Properties** options category.

When commissioning a router, this window contains only the options to set the initial state of the router application, as routers do not have configuration properties. When you are commissioning application devices and routers together, the initial state window will appear for the devices first and then for the routers.

Setting the Initial Application Device State and Source of Configuration Property Values

When the Device Initial State window appears, follow these steps:



1. Specify the initial state of the device applications, source of the configuration property values, and management of device-specific configuration properties by setting the following options:

State

Set the state of the device application after it has been commissioned. You have four choices:

- **Default.** The state of the device application is determined by the current setting under the **New Device Options** box in the network properties: **Device** options category. If the device was previously commissioned and is able to communicate, the default state is the state of the device before the current operation.
- **Online.** Places the device in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been commissioned.
- **Offline.** Places the device in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application after it has been commissioned. This is the default and can be used to bring up a system incrementally.

When a device is offline, portions of its application may still function and it will still respond to Online, Wink, and Test commands. An offline device still receives network variable updates, but it typically does not process updated network variable values or send network variable updates.

Resetting an offline device makes it go online, unless the device is

in the hard offline state, in which case it will remain offline after a reset.

- **Disable.** Keeps the device application disabled even if the device is reset. For a device to be disabled, it must contain a Node Object functional block. If **Disable** is selected and the device does not contain a Node Object, the device is placed offline. As with offline operation, portions of a disabled device's application may continue to function.

Source of CP Values

Specify the source of initial values for the device's configuration properties.

- **LNS Database.** The current configuration property values stored in the LNS network database will be written to the device.
- **Default.** The default configuration property values stored in the device template will be written to the device. This option requires a device template based on a version 4 or higher XIF file with specified default values. See the *LONMARK Device Interface File Developer's Guide* in the LNS Utilities and LONMARK Reference help for more details. This is the default.

If you select **Default**, select whether network variable type configuration properties (**SCPTnvType**) are restored to their default values when the device is commissioned. If you want them to be restored, select the **Include NV Type CPs** checkbox. This check box is cleared by default. This operation will not work if any of the affected network variables are connected.

- **Current Device Values.** The current configuration property values set in the device will be written to the LNS network database.

This option is only available if you cleared the check box to load an application image into the device in the Device Application Image window.

- **Application Image File.** The current configuration property values in the selected application image file will be written to the device.

This option is only available if you selected the check box to load an application image into the device in the Device Application Image window.

Device Specific CPs

Select how device-specific configuration properties are managed when a device is commissioned.

- **Do Not Update.** Device-specific configuration properties will not be modified in the device or the LNS network database. This is the default.
- **Update with Other CPs.** The device-specific configuration property values will be set based on the option selected in the **Source of CP Values** box. For example, if you select **LNS Database** in the **Source of CP Values** box, the device-specific configuration property values stored in the LNS network database will be written to the device.

- **Upload from Device.** The current device-specific configuration property values stored in the device will be written to the LNS network database.

This option is only available if you cleared the check box to load

an application image into the device in the Device Application Image window.

- **Upload from New App Image.** The current device-specific configuration property values in the selected application image file will be written to the device.

This option is only available if you selected the check box to load an application image into the device in the Device Application Image window.

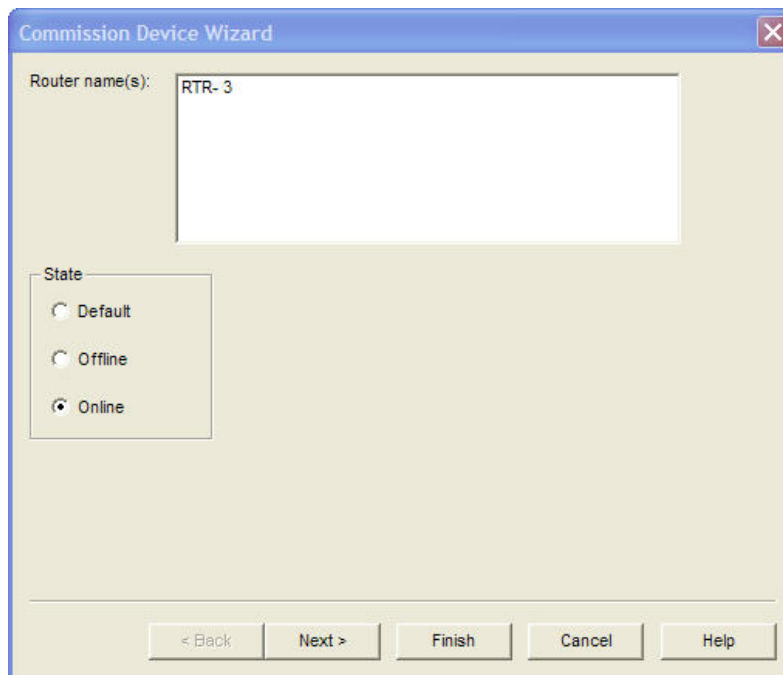
- **Preserve Device Values.** The current device-specific configuration property values set in the device will be written to the LNS network database before the new application image is loaded into the device. Once the new application image has been installed, the device-specific configuration property values in the LNS network database are written to the new device.

This option is only available if you selected the check box to load an application image into the device in the Device Application Image window.

2. Click **Next**. If you are commissioning routers, the Initial Router State window appears. Otherwise, the Device Identification Method window opens (in this case, see *Installing Devices* to continue installing the devices).

Setting the Initial Router State

When the Router Initial State window appears, follow these steps:



1. Specify the initial state of the router by setting the following option:

State

Set the initial state of the router. You have three choices:

- **Default.** The state of the router is determined by the current setting in the **New Device Options** box located in the network properties: **Device** options category. If the router was

previously commissioned and is able to communicate, the default state is the state of the router before the current operation.

- **Offline.** The router will not forward packets.
- **Online.** The router will forward packets between the channels connected to it. This is the default. If the network will have devices installed on the far side of a router (the side furthest away from the LNS Server), you must commission the router before any of the application devices connected on its far side.

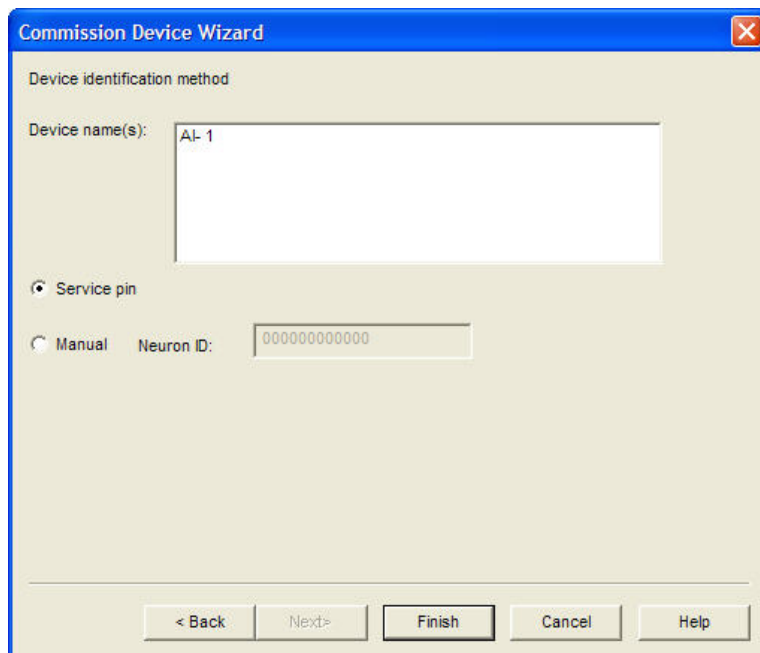
2. Click **Next** to continue. The Device Identification Method window appears. See *Installing Devices and Routers* to continue installing the router.

Setting the Neuron ID

You must set the Neuron ID when you commission a device. You can have the LonMaker tool acquire the Neuron ID by pressing a service pin on the device, or you can manually enter the Neuron ID. You can manually enter a Neuron ID by typing a 12-digit hex string or scanning a bar code on the device, if available. If the LonMaker tool is not attached to the network, you can only enter the Neuron ID manually.

Selecting the Device Identification Method

When the Device Identification Window appears, follow these steps:



1. Select the method for acquiring the Neuron ID by setting the following option.

*Device
Identification
Method*

Specify the method for acquiring the Neuron ID of the devices. You have two choices:

- **Service Pin.** The Neuron ID is acquired by pressing the service pin on the device. See *Using the Service Pin Method*.
- **Manual.** If you are commissioning one device or router, type or scan the Neuron ID into the **Neuron ID** box. If you are commissioning multiple devices or routers, you will enter the

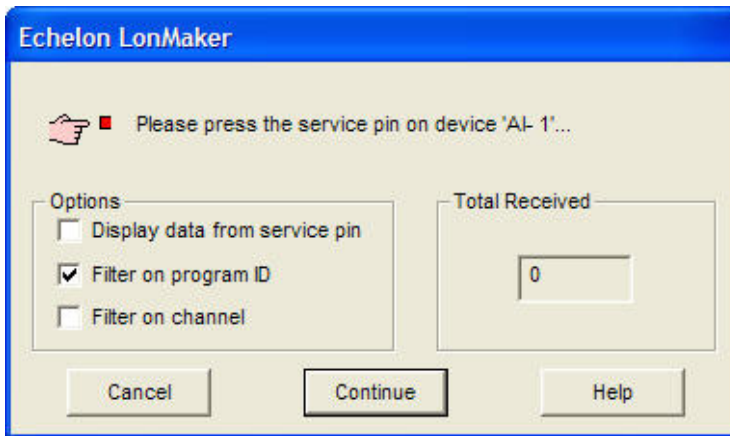
Neuron IDs in the subsequent dialog box. See *Using the Manual Entry Method*.

Manual entry is recommended if the device or its service pin are difficult to access.

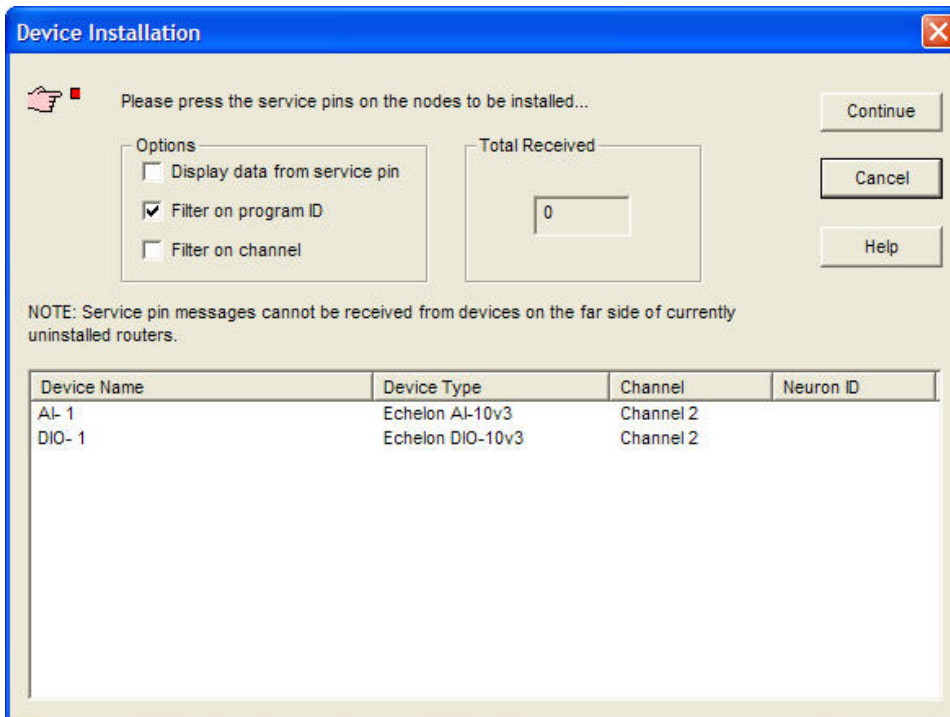
2. Click **Finish**. If you selected the **Service Pin** method, you are prompted to press the service pin as described in *Using the Service Pin Method*. Once the Neuron ID is specified or acquired, the LonMaker tool commissions the device, deducts a LonMaker credit, if applicable, and changes the color of the device shape to green to indicate it has been commissioned.

Using the Service Pin Method

If you selected **Service Pin** as the device identification method, a prompt appears instructing you to press the service pin of the devices or routers you are installing.



If you are installing multiple devices, the prompt will also include a pane listing the names, types, channels, and Neuron IDs (as you push service pins and acquire them) of the devices you are installing.



To acquire the Neuron IDs and finish installing the devices, follow these steps:

1. Select any of the following service pin options

Options

<i>Display Data from Service Pin</i>	Select this check box to display a dialog that contains the information returned in the service pin message. This check box is cleared by default.
<i>Filter on Program ID</i>	Select this check box to ignore service pin messages that do not include the same program ID as the device being commissioned. This option is selected by default. This option is cleared if the application image will be loaded during commissioning.
<i>Filter on Channel</i>	Select this check box to ignore service pin messages that do not originate from the same channel as the device being installed. This check box is cleared by default. On networks that use repeaters, the LonMaker tool cannot always determine the source channel of the service pin message. For these networks, it may be necessary to clear this checkbox in order to commission the device. The default value for this check box is set in the network properties: Service Pin options category.
<i>Total Received</i>	Indicates the total number of service pin messages received by the LonMaker tool (including those ignored due to mismatched program ID or channel). If this number is incrementing when you press the service pin, but LonMaker is ignoring the service pin message, clear both filter options and select the Display Data from Service Pin check box. You may then compare the data received against the expected data to analyze the problem.

2. Press the service pins of the devices you are commissioning.
3. If you are installing one device, the LonMaker tool will begin commissioning the device. The total number of service pin messages received from the network will appear in the **Total Received** box. When the LonMaker tool is done commissioning the device, it will return to the LonMaker drawing. The device shape will be solid green (online) or crosshatched green (soft offline), indicating that the physical device has been commissioned.
4. If you are installing multiple devices, the LonMaker tool will attempt to determine which device you are commissioning based on the service pin message. If multiple devices qualify, the LonMaker tool will select the first one that does not already have an assigned Neuron ID.

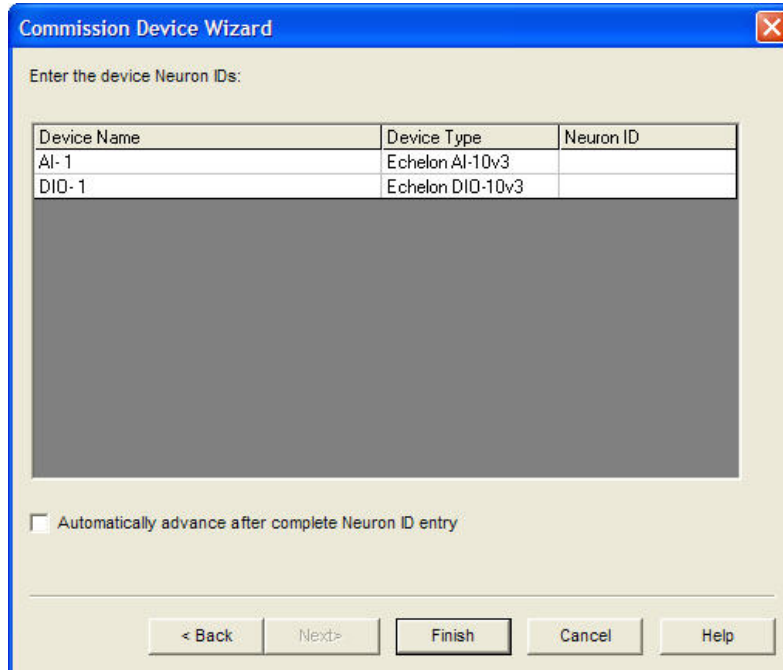
You can specify which device or router you are commissioning by clicking its name under the device name column and then pressing its service pin. If a service pin message is filtered or the LonMaker tool is unable to identify the device, the number in the **Total Received** box will be incremented, but no new Neuron ID will appear in the device list.

As you press service pins, the total number of service pin messages received from the devices you are commissioning will appear in the **Total Received** box. When all the Neuron IDs have been acquired, the LonMaker tool will commission the devices. When the LonMaker tool is done commissioning, it will return to the LonMaker drawing. The device shapes will be solid green (soft online) or crosshatched green (offline), indicating that the physical device has been commissioned.

5. Click **Continue** to quit pressing service pins and to commission the devices that have already been acquired. Click **Cancel** to quit pressing service pins and not commission any devices.

Using the Manual Entry Method

If you selected **Manual** as the device identification method or if the LonMaker tool is not attached to the network, and you are commissioning multiple devices, a prompt appears instructing you to enter the Neuron IDs of the devices you are installing.



The device Neuron ID is provided by the manufacturer as a 12-digit hex string or as a bar code label on the device that can be scanned.

Entering a Neuron ID Manually

To enter a device's Neuron ID follow these steps:

1. Click within the **Neuron ID** box of the desired device.
2. Type or scan in the device's Neuron ID.
3. After all the Neuron IDs have been entered, click **Finish** to commission the devices. When the LonMaker tool is done commissioning, the device shapes will be solid green (online) or crosshatched green (soft offline), indicating that the physical devices have been commissioned.

You can select the **Automatically Advance** check box to automatically move to the next listed device after you enter a Neuron ID.

Entering a Neuron ID Using a Bar Code Scanner

Some device manufacturers provide a bar code label on their devices that has the Neuron ID. You can use several methods to scan the bar code and store the device Neuron ID in the LNS database.

A *wedge* interface scanner provides the easiest method of transmitting bar code information from the bar code label to the LonMaker tool. This type of scanner is connected to your computer by a wedge inserted between the keyboard and the system unit. The computer interprets the scanned bar code the same as if you entered the Neuron ID on the keyboard. Most wedge interface scanner vendors supply all necessary cables and connectors along with the scanner itself.

You can choose from three other types of scanners: a gun-style laser scanner, a gun-style LED scanner, and pen-style scanner. The price of these scanners correlates with their effectiveness. A gun-style laser scanner is the most expensive, but provides the best accuracy and reliability. Gun-style LED scanners are moderately priced and fairly reliable. Pen-style scanners are the lowest priced, but are typically not reliable on the fine-line bar codes typically used for Neuron IDs. Check with your

scanner vendor for prices on the different scanner types. If you are using a LonPoint device, or a device with a similar bar code label, it is recommended that you use a gun-style laser or LED scanner. One scanner that you can use with the LonMaker tool and LonPoint devices is the Symbol Technologies LS 3000, which is made available by Barcode Logics. The Neuron IDs for LonPoint devices are printed on their labels in Code 39 format. See your scanner documentation for instructions on programming the scanner.

Commissioning an *i*.LON IP-852 Router

To commission an *i*.LON IP-852 router such as an *i*.LON 100 *e*3 Internet Server with IP-852 routing, *i*.LON 600 IP/LonWorks Server, or *i*.LON 1000 Internet Server, follow these steps:

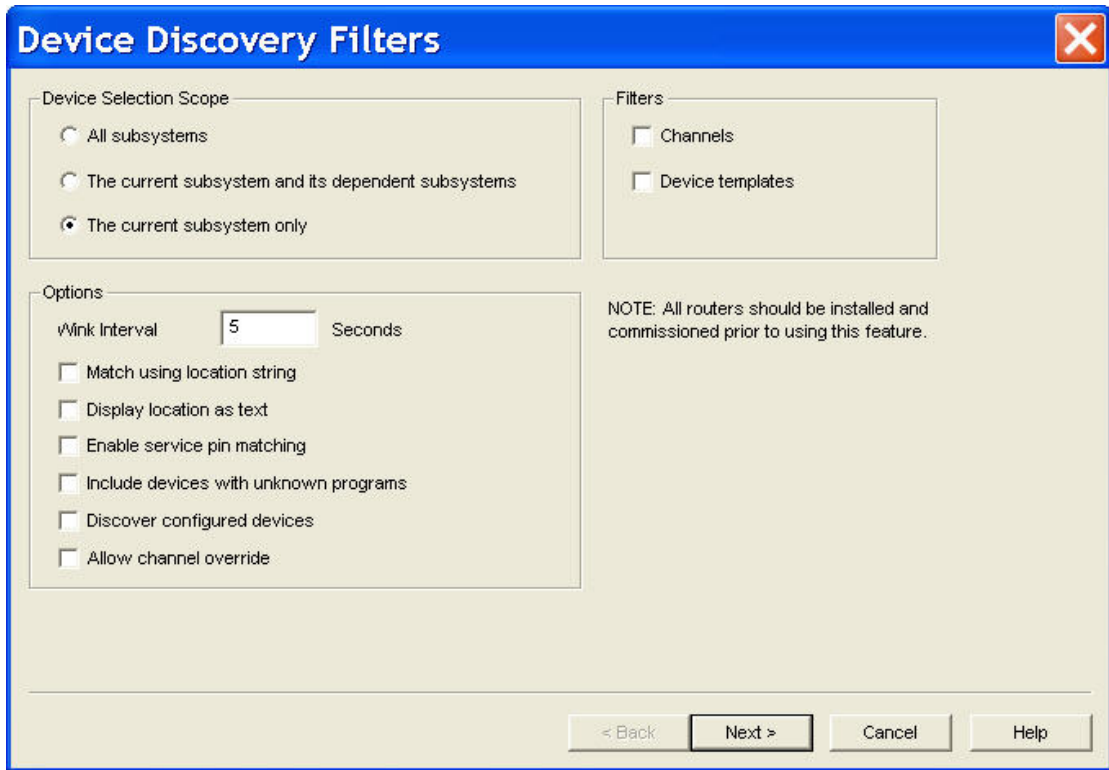
1. Start the LONWORKS/IP Configuration Server. To start the LONWORKS/IP Configuration Server, click **Start** on the taskbar, point to **Programs**, then point to the **Echelon LonWorks-IP Configuration Server** folder, and select **Echelon LonWorks-IP Configuration Server**.
 2. Right-click the router shape and then select **Commission** from the shortcut menu. The Commission Device Wizard appears.
 3. If you are commissioning an *i*.LON 1000 Internet Server, select the initial state and source of the configuration property values for the web server.
 4. Select the initial state of the *i*.LON IP-852 router. Click **Next**.
 5. Select the device identification method. Click **Next**.
 6. Press the service pin of the *i*.LON IP-852 router, or manually enter its Neuron ID and click **Finish**. The *i*.LON IP-852 router will be commissioned.
-

Commissioning Using Device Discovery

You can install a network by automatically discovering the devices to be commissioned. With the device discovery method, the LonMaker tool searches the physical network for uncommissioned devices that match device shapes defined in your LonMaker drawing. Devices are matched based on their program ID and channel. If there is no unique match, you can select the appropriate device by winking it or by pressing a service pin. After discovered devices are matched with defined shapes, you can have the LonMaker tool commission the devices. You can use the device discovery method to quickly install networks that have been designed with the engineered system installation scenario.

To install a network using the device discovery method, follow these steps:

1. Open the **LonMaker** menu and Select **Discover Devices**. The **Device Discovery Filters** dialog box opens.



2. Select the following options:

Device Selection Scope

Selects which subsystems will be searched for uncommissioned device shapes. You have three choices:

- **All Subsystems.** The entire LonMaker drawing will be searched for uncommissioned device shapes.
- **The Current Subsystem and Dependent Subsystems.** The current subsystem and any subsystems nested in it will be searched for uncommissioned device shapes.
- **The Current Subsystem only.** Only the current subsystem will be searched for uncommissioned device shapes.

Options

Wink Interval

Specifies the number of seconds to wait between winking devices when more than one is selected.

Match using Location String

Uses location string in addition to channel and program ID to match devices. This option is useful for networks that have a unique location string for each device, or if you have a handheld tool that assigns a unique location string to each device.

Display Location as Text

Interprets location string as ASCII text. The default is to display the location string as hex digits.

Enable Service Pin Matching

Enables matching to be done by selecting a device shape in the **Defined Devices** list and pressing the service pin of a physical device. The physical device does not need to be in the list of discovered devices; therefore, this method can be used to commission configured devices. However, the physical device may not already be assigned to a device shape. You can only select one

device in the **Defined Devices** list when you press the service pin.

Include Devices with Unknown Programs

Adds physical devices to the discovered device list that are applicationless or have an unrecognized application. Such physical devices can then be matched to any device shape with a matching channel. However, after matching, you must click **Details** and specify an application image to load into the device.

Discover Configured Devices

Discovers devices that have previously been configured. If you select this option, a dialog appears and you must indicate the domain of the configured devices to be discovered.

Allow Channel Override

Allows matching of physical devices and device shapes with different channels. If you select this option, you must make sure that the device shape and physical device are located on the same channel in order to commission the device.

This option is useful if your network has routers configured as repeaters, in which case a physical device could be discovered on the wrong channel. This option allows you to match the device in this scenario.

Filters

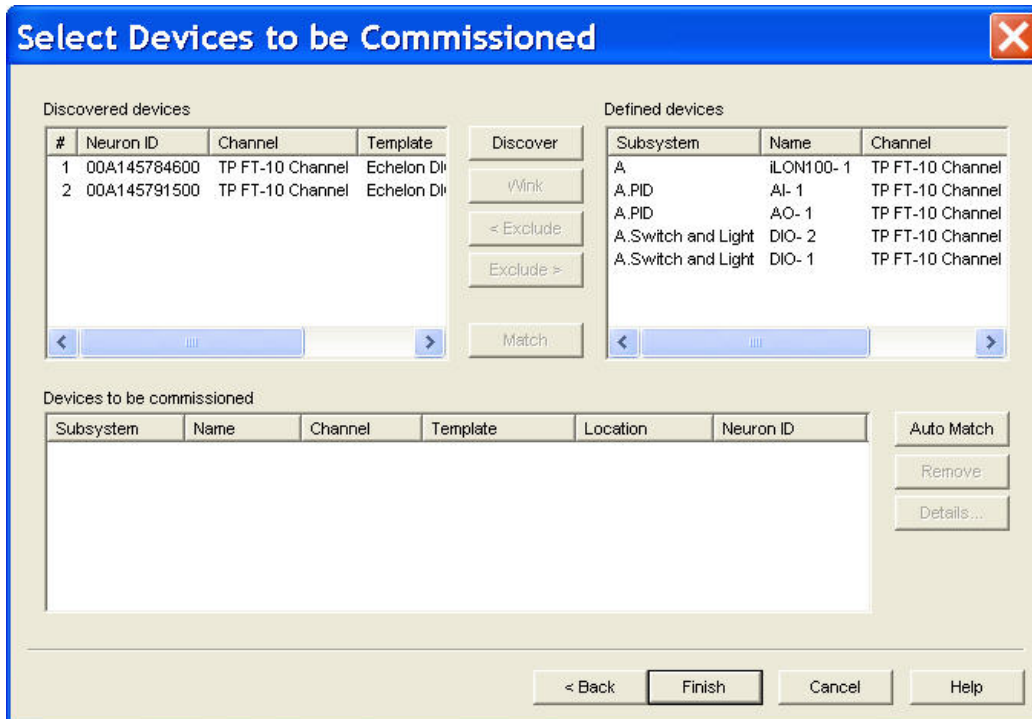
Channels

Limits the devices discovered based on the channel on which they are attached.

Device Templates

Limits the type of devices discovered based on the device template used.

3. Click **Next**. If you selected the discover configured devices option or the channel or device filtering options, complete steps 4–6, as needed. Otherwise, skip these steps and go to step 7 to select which devices to match and commission.
4. If you selected the channel filtering option, select the channel that the LonMaker tool will search for devices. To select multiple channels, hold down CTRL and click the desired channels. Click **Next**.
5. If you selected the device template filtering option, select the type of device that the LonMaker tool will attempt to discover. To select multiple device templates, hold down CTRL and click the desired channels. Click **Next**.
6. If you selected the **Discover Configured Devices** option, select the domain ID of the devices to be re-installed in the current network. These devices were self-installed or previously installed on another network. If you need to discover configured devices on multiple domains, select the first domain, click **Next**, click **Back**, and then select the next domain ID.
7. If there is a router between the LNS Server and the configured device(s) to be discovered, this router must be configured with the same domain as the device(s), unless the router is configured as a repeater. If the network has configured routers, you can temporarily change them to repeaters, complete the device discovery process, and then change them back. Click **Next**.
8. The **Select Devices to be Commissioned** dialog box opens.



This dialog box allows you to manually or automatically match the discovered devices on the network with the defined device shapes in the LonMaker drawing. To select a device from any of the lists, click the entry in the leftmost column (the # column in the **Discovered Devices** list, and the **Subsystem** column in the **Defined Devices** and **Devices to be Commissioned** lists). After selecting a device, its field in the leftmost column will be shaded blue. Once you click a device in the other list, the field will be shaded gray. When the devices in each column are compatible, the match command will become available.

If you selected the **Include Devices with Unknown Programs** option and such devices are discovered, they will be listed under Discovered devices. However, the **Template** field will be empty if the device is applicationless, or it will display the device's program ID in hex format if there is no corresponding device template.

- Use the following commands to match device shapes in your LonMaker drawing to physical devices on the network:

Discovered and Defined Device Lists

- Discover* Searches for devices. If one or more physical devices were not discovered, you can force their discovery by pressing their service pins and then pressing the **Discover** button. Devices that were removed from the **Discovered Devices** list using the **Exclude** button are not rediscovered.
- Wink* Winks the selected device(s) in the **Discovered Devices** list. The action performed by the device is application dependent. For example, some devices may blink their power LED when winked. This command is only available if one or more devices are selected in the **Discovered Devices** list.
- Exclude* Removes the selected device(s) from the **Discovered Devices** or **Defined Devices** list. Once a device has been excluded, it can only be re-listed by restarting the device discovery process.

This command is only available if a device is selected in the appropriate device list.

Match

Matches the device selected in the **Defined Devices** list to the device selected in the **Discovered Devices** list. The devices are removed from their respective lists and the matched device is added to the **Devices to be Commissioned** list. This command is only available if one device is selected from each list and the selected devices are compatible.

Compatible devices have the same program ID and channel unless the **Allow Channel Override** or **Include Devices with Unknown Programs** options have been selected. Discovered devices with an unknown program can be matched to any defined device.

However, after the device is matched, you must click **Details** and specify an application image to be loaded into the device before you click the **Finish** button.

If the **Enable Service Pin Matching** option was selected, you can also match devices by selecting a device from the **Defined Devices** list and then pressing the service pin of a compatible device to which it should be matched.

Devices to be Commissioned

Auto Match

Matches all discovered and defined devices that can be uniquely matched. The devices are removed from their respective lists and the matched devices are added to the **Devices to be Commissioned** list.

In the previous graphic, the DI-10 and DO-10 LonPoint devices would be matched, but the AI-10 devices would not. This is because the LonMaker tool cannot determine which of the two defined device shapes should be matched with the discovered AI-10 device.

Remove

Removes the selected devices from the **Devices to be Commissioned** list. The devices are returned to the **Discovered Devices** and **Defined Devices** lists.

This command is only available if one or more devices are selected in the **Devices to be Commissioned** list.

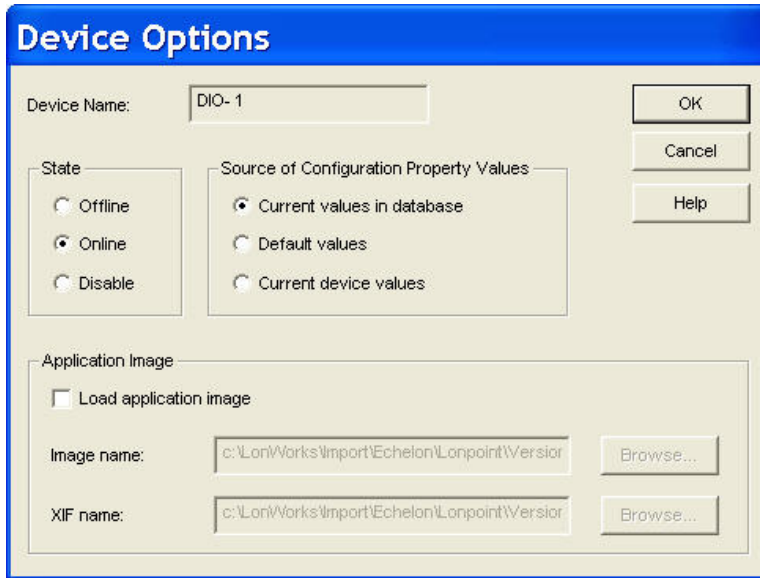
Details

Opens the **Device Options** dialog box.

Click **Details** to set the initial application state and the source of the configuration property values for the selected matched devices. By default, the devices will be set in a soft offline state.

You must click **Details** to specify an application image to load into an applicationless device that has been discovered and subsequently matched.

10. Click **Details** to set the initial application state and the source of the configuration property values of a matched device, or to specify an application image to load into a matched device that is applicationless. The **Device Options** dialog box opens.



11. Select an application image and set the options for the initial application state and source of configuration property values. See *Loading a Device Application Image* and *Setting the Initial Application Device State and Source of Configuration Property Values* for information on setting these options. Click **OK**.
12. Click **Finish**. The LonMaker tool commissions the devices in the **Devices to be Commissioned** list and sets the state of their applications. When the LonMaker tool is done commissioning, it returns to the LonMaker drawing. The device applications will be in a soft offline state, unless you specified the application state in the **Device Options** dialog box. The device shapes will be green indicating that the devices have been commissioned, or crosshatched green if an application state was not specified or the device application was set offline.

Monitoring and Controlling Networks

This chapter describes how you can monitor and control the devices in your network with the LonMaker tool. It describes the three methods you can use to read and/or write network variables and configuration properties: using monitored connections, browsing with the LonMaker Browser, and using Data Point shapes. This chapter covers how to bind network variables to the host in order to receive event-driven updates. It also describes how to change the types and formats of network variables and configuration properties. Explains how to create simple HMIs in your LonMaker drawing with Data Point and Visio shapes.

Monitoring and Controlling Overview

You can monitor and control the physical devices in a network by reading and writing the network variables on the devices. You can also read configuration property values. You can use any of the following three methods to read and/or write network variables and configuration properties:

- *Monitored connections.* Monitored connections provide a simple means to view network variable values within your network. Using monitored connections, you can view the values of network variables on your LonMaker drawing. This capability is useful for monitoring and debugging your installation, as monitored connections provide an easy way to visualize the flow of data through your functional blocks. You can also display a network variable value without monitoring a connection.
- *LonMaker Browser.* The LonMaker Browser is an LNS plug-in that can be used to read and write network variables and configuration properties on any functional block on any device. This is useful for getting a detailed view of the operation of any functional block, and for setting configuration properties on functional blocks that do not have *plug-ins*.
- *Data Point shape.* The Data Point shape is a LonMaker shape that you can use to monitor and control the value of any network variable, configuration property, or functional block state (enabled or in override) in your network. You can also create simple human-machine interfaces (HMIs) within your LonMaker drawing using the Data Point shape.

The LonMaker tool is also compatible with other LNS monitoring and control applications, such as the LNS DDE Server.

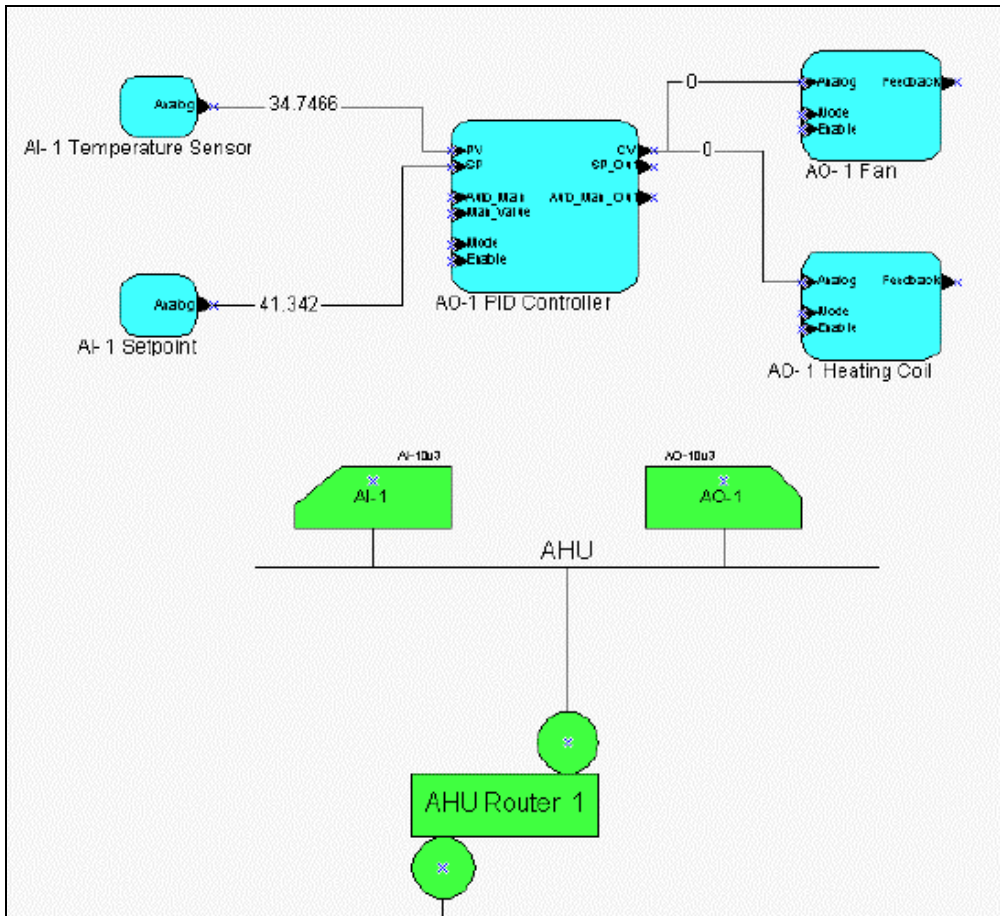
Using Monitored Connections

You can use a monitored connection to monitor the value of a network variable that is attached to a connector or reference connection shape. You can monitor one end of a connection or both ends at the same time.

To monitor a connection, follow these steps:

1. Right-click an empty space in the drawing page and set **Enable Monitoring** on the shortcut menu.
2. To enable monitoring for a connector shape, use one of the following two methods:
 - Double-click the connector shape. The input network variable value appears on the connector shape in black text. Double-click the connector shape again to display both the output and input network variable values. Double-click again to display just the output network variable. Double-click again to cycle through the same choices.
 - Right-click the connector shape and select either **Monitor Input Value** or **Monitor Output Value**. The network variable value on the side of the connection you selected appears on the connector shape. To monitor both ends of the connection, right-click the connector shape again and set monitoring on the other end of the connection.
3. To enable monitoring for a reference connection shape, use one of the following two methods:
 - Double-click the reference connection shape. The network variable value on the side of the connection you selected appears. To monitor both ends of the connection, double-click the reference connection shape on the other end of the connection.
 - Right-click the reference connector shape and then click **Monitor Value** on the shortcut menu. The network variable value appears on the reference connector shape. To monitor both ends of the connection, right-click the reference connection shape on the other end of the connection and click **Monitor Value**.

The following figure illustrates monitored connections on a PID controller. The values shown on the connection shapes represent the actual network variable values within the operational system.



When you enable monitoring on a connection, the network variable values are continuously polled. The default poll interval is **1** second. You can change the default poll interval in the network properties: **Timing** dialog, which you can access by opening the **LonMaker** menu, selecting **Network Properties**, and clicking the **Timing** tab. Excessive polling can create heavy network traffic and consequently degrade network performance.

Monitoring connections can interfere with the successful completion of network installation and maintenance operations such as commissioning devices; therefore, the LonMaker tool disables monitoring during these types of operations.

For more information on monitoring network variable values, see *Monitoring Network Variables* in this chapter.

Displaying a Network Variable Value

You can display the value of a network variable without monitoring a connection as described in the previous section. The network variable must be attached to a connector or reference connection shape, but the connector or reference connection shape does not have to be connected to any other network variables. To display the value of a network variable with a connector shape, right-click the connector shape and then click **Get Input Value** or **Get Output Value** on the shortcut menu. For a reference connection shape, right-click the reference connection shape and then click **Get Value** on the shortcut menu. The network variable value on the side of the connection you selected appears on the connector shape.

By default, the network variable value is displayed for **15** seconds. You can change the display duration in the network properties: **NV Browser/Monitoring** options category. You can access this

dialog by opening the **LonMaker** menu, clicking **LonMaker Options**, and selecting **NV Browser/Monitoring** from the **Options Category** list.

Using the LonMaker Browser

You can use the LonMaker Browser to monitor and control the network variables and configuration properties in your network. The LonMaker Browser provides a table view of the selected network variables and configuration properties. You can add all the network variables and configuration properties for a functional block or device to the Browser, and you can delete selected network variables and configuration properties from it.

The LonMaker Browser is an LNS plug-in included with the LonMaker tool. To use the LonMaker Browser, you must register it when you open a network as described in *Creating a New LonMaker Network Design* in Chapter 3, *Getting Started*, or you can register it after you open the network, as described in *Re-registering Plug-ins* in Chapter 9, *Using LNS Plug-ins*. You only have to register the LonMaker Browser once per computer. This is because once the LonMaker Browser is registered on one computer, it is available to all other networks on the same computer.

Many functional blocks, such as those provided with Echelon's LonPoint devices, may come with their own device plug-ins that provide a custom interface for their network variables and configuration properties. A device plug-in provides an application-specific view of a functional block or device. The LonMaker Browser, though, is a generic plug-in that you can use with any functional block or device.

Starting the LonMaker Browser

To start the LonMaker Browser, select one or more functional block and device shapes, right-click one of the selected shapes, and then click **Browse** on the shortcut menu. When the LonMaker Browser opens, it lists all the network variables and configuration properties for the selected functional blocks, and it lists all the network variables and configuration properties on all the functional blocks for the selected devices.

After the LonMaker Browser is open, you can invoke the **Browse** command on other functional blocks and devices. The network variables and configuration properties are added to the bottom of the existing LonMaker Browser window.

Once a browser window is opened, it remains open until you close it. Even if you close the LonMaker drawing, the browser continues to run until you close it. If you open a Browser window, close the LonMaker drawing, then open another browser, both Browser windows run concurrently.

Note: If a plug-in other than the LonMaker Browser opens when you click **Browse**, the other plug-in was registered after the LonMaker Browser, and it is currently specified as the default browser. To change the status of the plug-in as the default browser, follow these steps:

1. Right-click a functional block, point to **Plug-ins**, then click **Plug-ins** on the shortcut menu. The **LonMaker Plug-ins** dialog opens.
2. Locate and select the current default browser and then click **Info**. The **LonMaker Information** dialog opens.
3. Under the **Options** box, clear the **Default Plug-in** check box, and then click **OK**. The selected plug-in is no longer the current default browser.

Subsystem	Device	Functional Block	Network Variable	Config Prop	Mon	Value
A.Switch and Light	DIO- 1	Digital Encoder[0]		UCPTdebounceT	N	0 0:00:00.015
A.Switch and Light	DIO- 1	Digital Encoder[0]		UCPTdeLookupTab	N	0, 0
A.Switch and Light	DIO- 1	Digital Encoder[0]		UCPTobjectMajorVer	N	2
A.Switch and Light	DIO- 1	Digital Encoder[0]		UCPTobjectMinorVer	N	
A.Switch and Light	DIO- 1	Digital Encoder[0]		UCPTobjectType	N	3, 20002
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D_Out_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D_Out_1	SCPTovrValue	N	0.0 0
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D1_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D1_1	UCPTinputUsesMRT	N	TRUE
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D2_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D2_1	UCPTinputUsesMRT	N	TRUE
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D3_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D3_1	UCPTinputUsesMRT	N	TRUE
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D4_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_D4_1	UCPTinputUsesMRT	N	TRUE
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_Index_Out_1		N	
A.Switch and Light	DIO- 1	Digital Encoder[0]	DE_Index_Out_1	SCPTovrValue	N	HVAC_AUTO
A.Switch and Light	DIO- 1	Digital Encoder[1]		SCPTmaxRcvT	N	0 0:00:00.000
A.Switch and Light	DIO- 1	Digital Encoder[1]		SCPTmaxSndT	N	0 0:00:10.000

The LonMaker browser color codes the configuration properties and network variables in the following manner:

- Blue** Input network variables. You can write values to these network variables. See *Updating Network Variable and Configuration Property Values*.
- Green** Writeable configuration properties. You can write values to these configuration properties. See *Updating Network Variable and Configuration Property Values*.
- Grey** Output network variables and read-only configuration properties. You cannot write to these objects.

Each row in the browser contains the following information about a network variable or configuration property:

- Subsystem* Displays the name of the subsystem in which the functional block containing the network variable or configuration property is located.
- Device* Displays the name of the device associated with the functional block containing the network variable or configuration property.
- Functional Block* Displays the name of the functional block containing the network variable or configuration property.
- Network Variable* Displays the name of the network variable if described in the row. If the row describes a configuration property associated with a specific network variable, this column shows that network variable. Otherwise, this column is blank.
- Config Prop* Displays the standard or user-defined type of the configuration

property if the row describes a configuration property. (see types.lonmark.org) If a row describes a network variable, this column is blank.

Mon

Indicates whether the network variable is monitored. A “Y” indicates that monitoring is on; a status indicator follows the “Y”, indicating when a new value is received by the browser. Configuration properties cannot be monitored.

Value

Contains the value of the network variable or configuration property. For monitored network variables, the value is updated through network variable polling or bound updates as described under *Monitoring Network Variables*.

The LonMaker Browser Toolbar

You can use the LonMaker browser toolbar to perform many browser functions quickly. The toolbar contains the following buttons:



Open

Opens an existing browser file. See *Customizing the Browser*.



Save

Saves changes to a browser file. If the browser file is new, the Save As dialog opens. Name the file and choose a folder in which to save the file. See *Customizing the Browser* for more information.



Print

Prints the data in the Browser window.



Monitor All On

Turns monitoring on for all network variables displayed in the current Browser window. See *Monitoring Network Variables* for more information.



Monitor All Off

Turns monitoring off for all network variables in the current Browser window. See *Monitoring Network Variables* for more information.



Adjust Columns

Automatically sizes each column displayed in the Browser window to fit the longest string in that column.



Refresh All

Updates the Browser window with all current network variable and configuration property values. If any names of the displayed objects have been changed using another tool, the displayed names are updated.



Properties

Allows you to view and set properties for the currently selected network variable or configuration property object. See *Updating Network Variable and Configuration Property Properties* for more information.



Get Value

Refreshes the value for the currently selected network variable or configuration property. You can only update network variable values if you are attached to the network.



Set Value

Changes the value of the currently selected input network variable or writeable configuration property to the value indicated in the **Value** box located right of this button. For enumerated values, click the down arrow to select from the possible values. Network variable values can only be modified if you are attached to the network.



Table

Opens a dialog that displays the selected configuration property values in a table (only for configuration properties that contain a list or table of values). See *Updating Network Variable and*



Details

Configuration Property Values for more information.

Displays the details of the selected network variable or configuration property. See *Updating Network Variable and Configuration Property Values* for more information.



Display Messages

Displays a log of error messages received while the browser is active. The Display Messages button is located at the bottom left corner of the browser. See *Displaying Error Messages* for more information.

Customizing the Browser:

You can hide rows and columns in the browser to make it easier to view just the data you want to monitor and control. For example, you may be viewing data from devices in a single subsystem; therefore, you would hide the subsystem column. In another example, you may want to monitor and control only a few of the network variables listed in the browser; therefore, you would hide the rows of all the other network variables that you do not want to monitor and control.

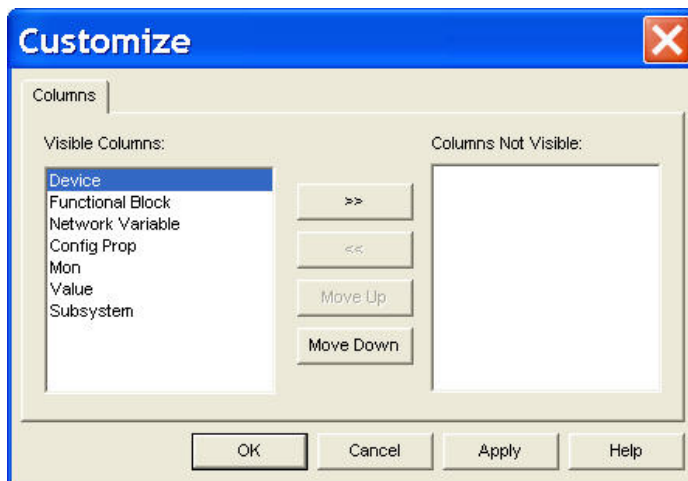
Customizing Browser Columns

You can hide, change the order, or adjust the width of the columns in the LonMaker Browser.

Hiding or Changing the Order of Browser Columns

To hide or change the order of the browser columns, follow these steps:


1. Open the **Browse** menu and select **Customize**. The **Customize** dialog box appears.



2. To hide columns, select the columns in the **Visible Columns** list you want to hide and then move them to the **Columns Not Visible** list. You cannot hide the **Value** column. The LonMaker Browser displays only the columns you did not hide.
3. To change the order of the columns in the browser, select the column you want to move and click **Move Up** or **Move Down** based on the desired order.
4. Click **OK**. The LonMaker Browser will reflect the changes you made.

Adjusting the Width of Browser Columns

You can adjust the width of the columns in the browser to display the information efficiently. To adjust the column widths, open the **Browse** menu and click **Adjust Columns** or click the **Adjust**

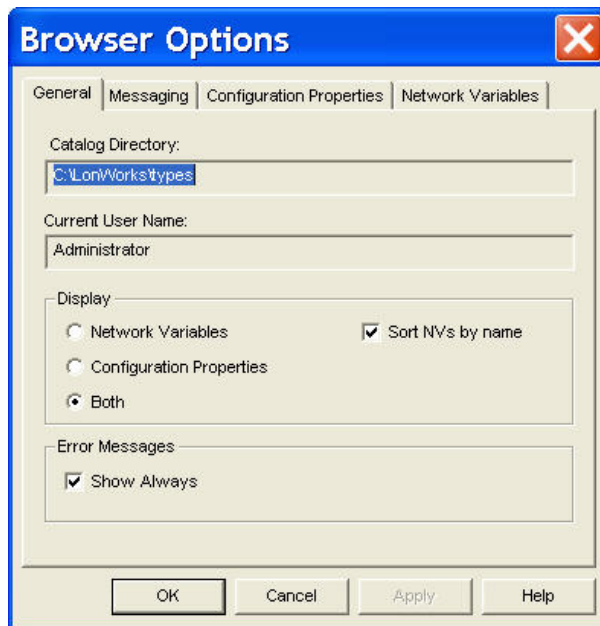
Columns button  in the browser toolbar. The browser automatically resizes the columns to display the longest text string in each column.

Customizing Browser Rows

You can customize the LonMaker Browser so that it only displays rows containing network variables or configuration properties, or you can hide specific network variables or configuration properties by deleting the rows on which they appear.

Selecting Browser Rows to be Displayed

To select which objects are displayed in the LonMaker Browser (network variables and/or configuration properties), open the **Browse** menu and click **Options**. The **Browser Options** dialog opens on the **General** tab.



Under the display box, select which objects you want displayed in the browser. You have three choices:

- **Network Variables.** Only network variables are displayed in the browser.
- **Configuration Properties.** Only configuration properties are displayed in the browser.
- **Both.** Network variables and configuration properties are displayed in the browser.

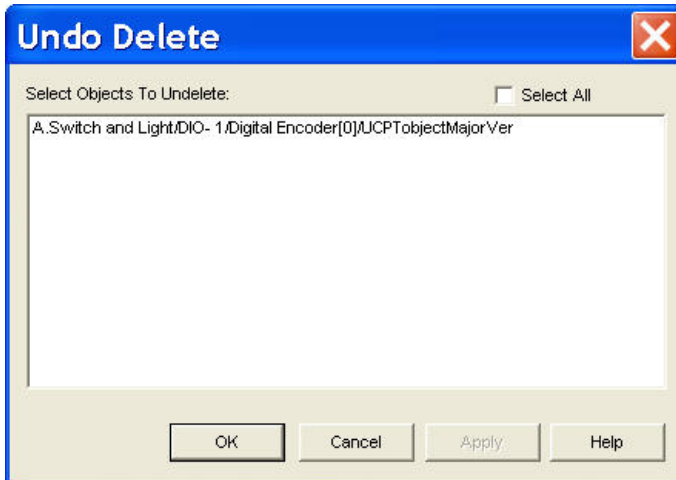
Select the **Sort NVs by Name** check box if you want network variables to be listed alphabetically in the browser. If this option is cleared, they are listed by network variable index. Changes to this option do not affect the current browser window. To update the display, close and restart the browser.

Hiding Browser Rows

To hide a network variable or configuration property in the LonMaker Browser, click anywhere in the row containing the object you want to hide, open the **Edit** menu, and then click **Delete Row**. Alternatively, you can click a row and then press DELETE. The browser hides the selected row. This selection does not affect the network variable or the configuration property itself.

To hide all configuration properties and network variables, open the **Edit** menu, click **Delete All Rows**, and then click **OK** on the warning dialog that appears.

To re-display a network variable or configuration property row that is currently hidden, open the **Edit** menu, and then click **Undelete Row**. The **Undo Delete** dialog appears.




This dialog lists all the hidden objects in the browser. Select the object or objects you want to show, or select the **Select All** check box to select all the objects, and then click **OK**. The selected objects appear in the browser again.

Saving Browser Customization:

You can save and later restore the rows and columns that you customize in the LonMaker Browser to a browser (.brw extension) file. To save your rows and columns to a browser file, open the **File** menu and select **Save** or **Save As**. Browse to the folder in which browser file is to be stored and enter the name of the browser file.

To re-open a browser file, open the LonMaker Browser from a LonMaker drawing (right-click a functional block or device and then click **Browse** on the shortcut menu) or open the LonMaker Browser as a standalone application (click **Start** on the taskbar, point to **Programs**, point to the **Echelon LonMaker** folder, and then select **LonMaker Browser**). In the LonMaker Browser, open the **File** menu, click **Open**, browse to the folder in which the browser file is stored, and then select the browser file. Alternatively, you can locate the desired browser file in Windows Explorer and then double-click the file.


To print a browser file, click the **Print** button  on the browser toolbar, or open the **File** menu and select **Print**. To preview the file as it will be printed, open the **File** menu and select **Print Preview**. To return to the browser window from print preview, click the **Close** button.

Monitoring Network Variables

You can use the LonMaker Browser to monitor network variables.

Enabling Network Variable Monitoring

To enable the LonMaker Browser to monitor a network variable, right-click the network variable row you want to monitor and then click **Monitor** on the shortcut menu. When a selected network variable is being monitored, this option is set in the shortcut menu. To monitor all network variables, right-click any network variable and then click **Monitor All On**, on the shortcut menu, or click the


Monitor All On button  on the browser toolbar.

The **Mon** column for monitored network variables changes to 'Y' and the **Value** column displays the current network variable value. The browser blinks a status indicator next to the 'Y' when a new value for the monitored network variable appears.


The LonMaker Browser polls network variables at the interval specified on the Network Variables tab of the **Browser Options** dialog. The default poll interval is 1 second. To change how frequently network variables are polled, open the **Browse** menu, click **Options**, click the **Network Variables** tab,


and enter the desired poll interval in the **Poll Interval** box. The browser does not poll monitored output network variables if they are connected to the browser computer as described in *Using Bound Updates*.

Disabling Network Variable Monitoring

To stop the LonMaker Browser from monitoring a network variable, right-click the network variable row and then clear the **Monitor** option on the shortcut menu. To disable monitoring for all network variables, right-click any network variable and then click **Monitor All Off** on the shortcut menu, or click the **Monitor All Off** button  on the browser toolbar.

Getting Network Variable Values

You can get the value of a network variable manually without using polling. Right-click a network variable row and then click **Get Value** on the shortcut menu, or click anywhere in the network variable row and click the **Get Value** button  on the browser toolbar.

You can update all network variable values by clicking the **Refresh All** button  on the browser toolbar or opening the **Browse** menu and selecting **Refresh All**.

Using Bound Updates

You can use bound updates with the LonMaker Browser to reduce the network overhead of polling many network variables. Bound updates use a connection between the network variable being monitored and the browser. To enable bound updates for a network variable, right-click a network variable row, click **Properties** on the shortcut menu, click the **Monitoring** tab and then select the **Bind this Network Variable to the Browser** check box. This creates an *implicit connection* to the browser. An implicit connection is a network variable connection that is automatically created by the browser. You can also explicitly create bound connections to the LonMaker browser which are in turn automatically used by the browser instead of polling as described in *Binding Network Variables to the Host*.

Each implicit connection requires a network variable on the LonMaker computer, and consumes network variable binding resources on the sending device or devices. This creates unnecessary network variables and consumes unnecessary resources if you are using bound monitoring with many network variables of the same type. To reduce the number of network variables on your computer and reduce network variable binding resource consumption, try one of the following methods:

- Use polled monitoring by clearing the **Bind this Network Variable to the Browser** check box.
- Explicitly bind the network variable to the host as described in *Binding Network Variables to the Host*.
- Use aliases on the devices that are bound to the fan-in connection.
- Define more aliases on the device containing the network variable with the fan-in connection.

Binding Network Variables to the Host

You can bind network variables to the LonMaker host to receive event-driven updates for monitoring. You can use event-driven updates to minimize the monitoring network overhead associated with inputs that change infrequently such as digital sensors. For inputs with rapidly changing values, such as analog sensors, you should use polling.

You can set up event-driven updates using the LonMaker Browser, as described in *Using Bound Updates*. The method described there implicitly creates a new network variable on the LonMaker host for each network variable to be monitored using bound monitoring. If a network variable or connection cannot be created, bound connections are not used and no error message is displayed.

To optimize host network variable usage, it is better to bind many network variables into a single host network variable. This is called a *fan-in connection*. For example, in a system containing several thousand devices, each of which has an output network variable that indicates its alarm state, separate

connections between each of these network variables and the host would consume a significant amount of system resources. It is more efficient to create just one network variable on the host and bind all of the output network variables to it. Network variables bound to the host may be monitored by an LNS application such as the LNS DDE Server. LNS allows the individual network variables to be monitored, even though they are received on the same network variable input on the host. Therefore, there is no disadvantage to using a fan-in connection. To differentiate between the different inputs, LNS applications should monitor the network variables on the remote devices instead of the network variables created on the LonMaker computer. LNS automatically uses event-driven updates if a connection to the LonMaker computer exists.

To create a network variable on the host, follow these steps:



1. Add a virtual functional block to your LonMaker drawing.
 - a. Drag the generic functional block shape from the LonMaker Basic Shapes stencil to the LonMaker drawing. The Functional Block Wizard opens
 - b. Under the **Device** box, select **LNS Network Interface** from the **Name** list.
 - c. Under the **Functional Block** box, select **Virtual Functional Block** from the **Name** list.
 - d. Enter the name of the Virtual Functional Block in the **New FB Name** box.
2. Drag an Input Network Variable shape from the LonMaker Basic Stencil to the virtual functional block. The **Choose a Network Variable** dialog appears.
3. Click **Create NV**. Create a dynamic network variable, as described in *Adding Network Variables to a Functional Block* in Chapter 4, *Designing Networks*. Select a network variable type that is compatible with the network variable you are binding to your compute.
4. Connect the input dynamic network variable you added to the virtual functional block to the output network variable that you want your computer to monitor.

Updating Network Variable and Configuration Property Values

You can control the values of input network variables and writeable configuration properties for the devices in your network. You cannot change output network variable values and read-only configuration properties.

Setting Values

To set the value of an input network variable or writeable configuration property, follow these steps:

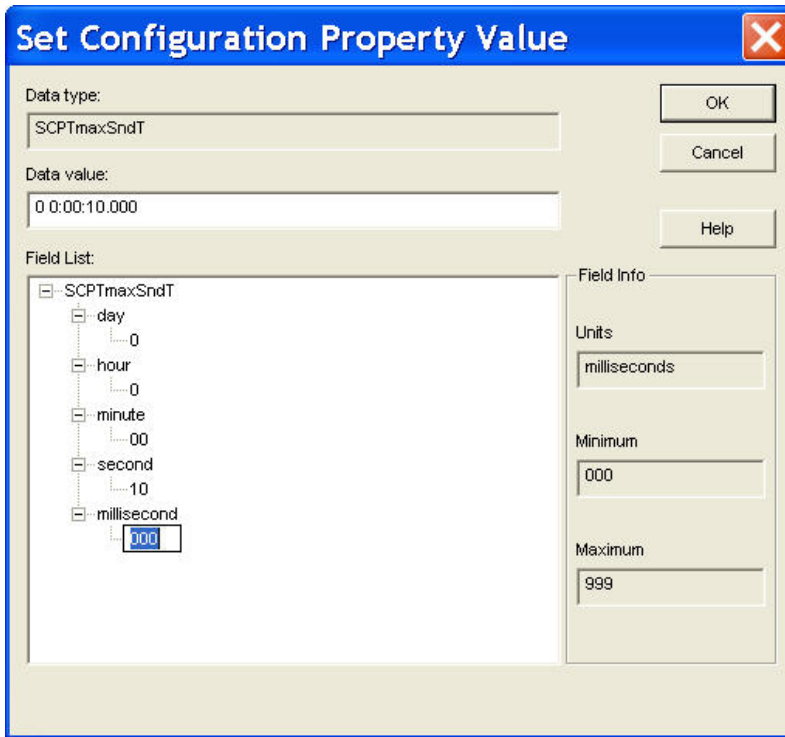
1. Click anywhere in the row containing the input network variable (colored blue) or writeable configuration property (green).
2. Enter a valid value in the **Value** box on the Browser toolbar , or choose a value from the drop-down list if you are changing an enumerated value.
3. Click the **Set Value** button  on the Browser toolbar, or right-click the object you are changing and then click **Set Value** on the shortcut menu. The value is updated in the **Value** column. If you have entered an invalid value, an error message is displayed in a **Display Message** dialog.

Setting Values for Structured Objects

You can use the **Set Network Variable/Set Configuration Property** dialog to set the value of one or more of the fields of a structured input network variable or writeable configuration property (structured means that the object has multiple fields). This dialog displays the name, units, and maximum and minimum values for each of the fields. For example, **SCPTmaxSend Time** appears in the Value field in the Browser with a value of 0 0:00:05.000. If you are not familiar with this configuration property and try to set it in the **Value** box, you may enter an invalid value or enter a value that causes a device to behave in an undesired manner. If you open the **Set Configuration Property** dialog box, you can

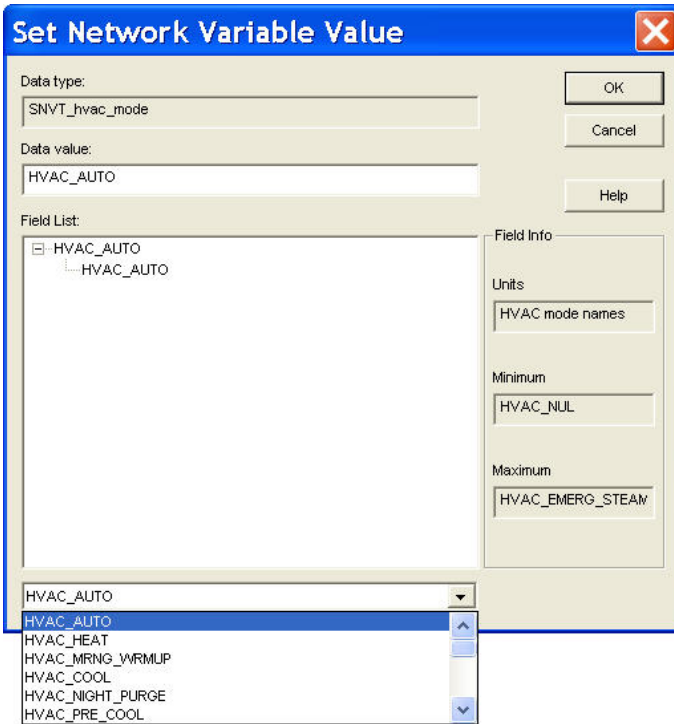
see that this configuration property has **day**, **hour**, **minute**, **second**, and **milliseconds** fields and view the minimum and maximum values for each of these fields.

To open the **Set Network Variable/Set Configuration Property** dialog, right-click the object and click **Details** on the shortcut menu.



All the fields for the selected object are listed in structural order in the **Field List** box. To set the value for a field, expand that field and then click twice slowly on the value that appears below it. Enter a valid value for the field (the minimum and maximum values appear in the **Field Info** box to the right). Click **OK** to apply the changes.

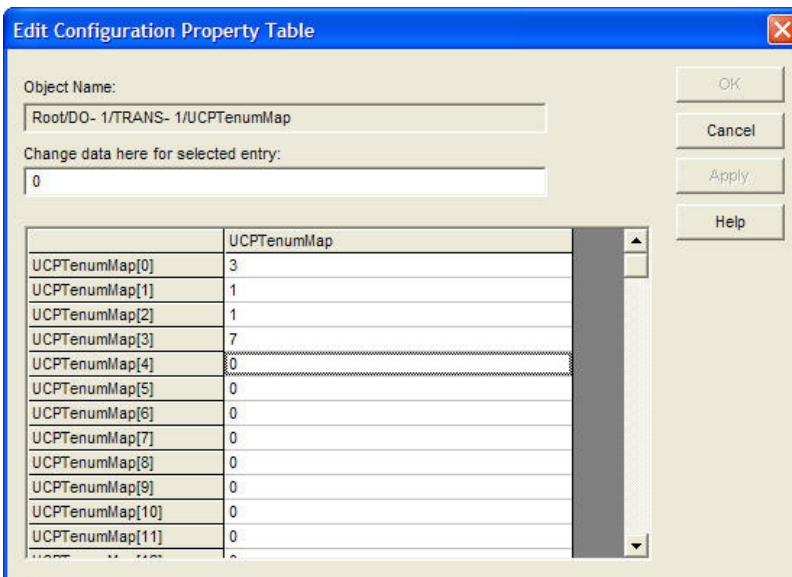
If a network variable or configuration property has an enumerated type such as **SNVT_hvac_mode** and **SCPT_hvac_type**, a list of all the possible enumerations for the selected object appears the bottom of the dialog. Select the desired enumeration from the list and then click **OK**. Alternatively, you can click twice slowly on the value that appears below the object in the **Field List** box and enter a valid enumeration for the object.



Setting Values for Configuration Property Arrays

You can view and set values for a configuration property array using a table instead of using the **Value** box or the **Set Configuration Properties** dialog. To view a configuration property array, right-click a configuration property array and then click **Table** on the shortcut menu. The **Edit Configuration Property Table** dialog appears.

This dialog contains a table listing the values for each element in the configuration property array. To change a value, double-click the value of the element you want to change, enter the new value in the **Change Data Here for Selected Entry** box, or for enumerated types, select the desired value from the **Change Data Here for Selected Entry** list, and then click **Apply** to make the change or click **OK** to make the change and exit the dialog.





Clearing Values

You can clear the displayed value of a network variable or configuration property by right-clicking the object you want to clear and then clicking **Clear Value** on the shortcut menu.

To clear all values in the browser display, open the **Browse** menu and select **Clear All Values**. Clearing the values in the browser display does not affect the values in the functional block.

Getting Values

You can get the current value of a network variable or configuration property. To do this, right-click the network variable or configuration property and then click **Get Value** on the shortcut menu, or click the object and then click the **Get Value** button  on the browser toolbar. The new value appears in the **Value** column.

To get the current values for all the network variables and configuration properties in the browser window, open the **Browse** menu and select **Refresh All**, or click the **Refresh All** button  on the browser toolbar. The new values are displayed in the **Value** column.

Changing a Network Variable or Configuration Property Type

You can change the type of a network variable or configuration property. The network variable or configuration property type specifies the units and structure of the data contained within the network variable or configuration property. A network variable or configuration property type is typically fixed for most devices; however, devices may support network variables and configuration properties with changeable types as described by the *LONMARK Application Layer Interoperability Guidelines*.

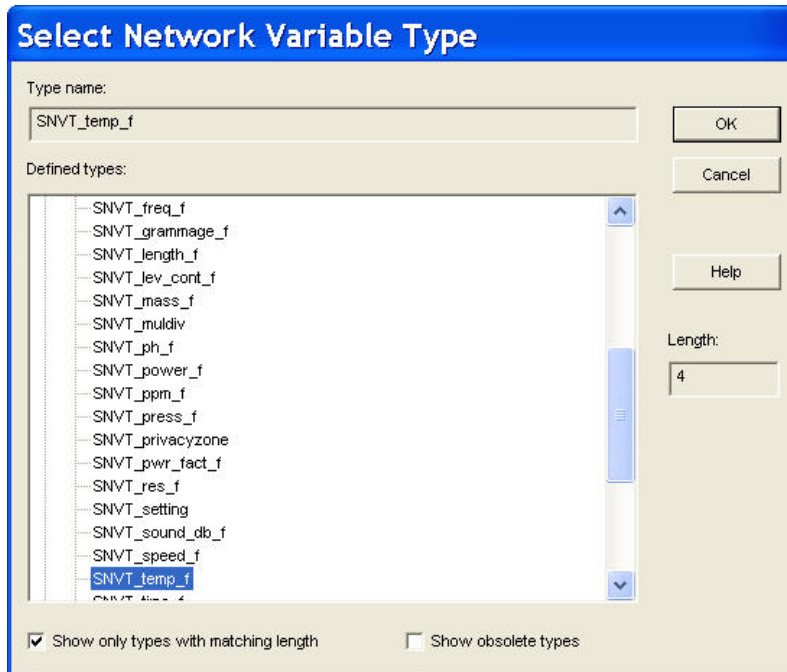
You can use the LonMaker Browser to change a network variable type. When you change the network variable type, the browser updates the type in the LNS network database, updates the type in the physical device if the LonMaker tool is OnNet, and automatically chooses a format for displaying the network variable data that matches the type, provided one is available. When you change a network variable type, the Browser also changes the type of any configuration properties that inherit their type from the network variable. For example, an analog input device may be connected to a variety of input devices, such as temperature sensors, pressure sensors, or dials. If the input device measures temperature, a **SNVT_temp_f** type may be used for its output network variable to define the value as a temperature. If the device measures air pressure, a **SNVT_press_f** may be used for its output network variable to define the value as a pressure. The same device may have **SCPTlowLimit1** and **SCPTHighLimit1** configuration properties that inherit their types from the output network variable. The browser will change the configuration property type for these SCPTs when you change the output network variable type.

Not all network variables have changeable types, so you should check the documentation of the device and functional block you are browsing to determine whether the Browser will allow you to change the type of a specific network variable. For example, many of the network variables on the LonPoint devices support changeable types as described in *LonPoint Application and Plug-in Guide*.

Network variables with a changeable type will always have an associated **SCPTnvType** configuration property (in the case of some Echelon devices, a **UCPTnvTypeInfo** configuration property defined in the Echelon resource file set) that keep track of their type. When you change a network variable type using the LonMaker Browser, the LonMaker tool updates this configuration property.

To change a network variable type in the LonMaker Browser, right-click the network variable and then click **Change Type** on the shortcut menu. This menu item is only available for network variables with changeable types. The **Select Network Variable Type** dialog appears.

Note: You cannot change a network variable type if the network variable is connected or being monitored by the LonMaker tool. Trying to change the type of a network variable that is connected or being monitored by the LonMaker tool generates an error in the Browser.



This dialog lists built-in data types, and resource files containing defined network variable types (SNVTs and UNVTs). Expand the items listed to view the available data types. Click the type for the network variable and then click **OK**.

- Select the **Show Only Types with Matching Length** check box to display only those types with the same size as the current network variable type.
- Select the **Show Obsolete Types** check box to display network variable types that are marked obsolete in the current standard resource file set.
- The **Length** box displays the size (in bytes) of the currently selected type. You can customize the sizes for the **RAW**, **RAW_HEX**, **RAW_HEX_PACKED**, and **STRING** built-in data types and for the **SNVT_scene_cfg** configuration property.

Notes:

- Resource files for both the LONMARK standard types and Echelon user-defined types are included with the LonMaker tool. Device manufactures may also supply their own resource files for their user-defined types and formats. These are typically installed with the manufacturer's plug-in.
- For more information on specific standard network variable types (SNVTs) and standard configuration property types (SCPTs), see types.lonmark.org.
- For more information on user network variable types (UNVTs) and user configuration property types (UCPTs), see the documentation included with the functional blocks containing the network variable or configuration property. For information on Echelon's UNVTs and UCPTs, see types.echelon.com. For information on creating and using user types, see the *LONMARK Resource File Developer's Guide* in the *LNS Utilities and LONMARK Reference* Help file.

Changing a Network Variable or Configuration Property Format

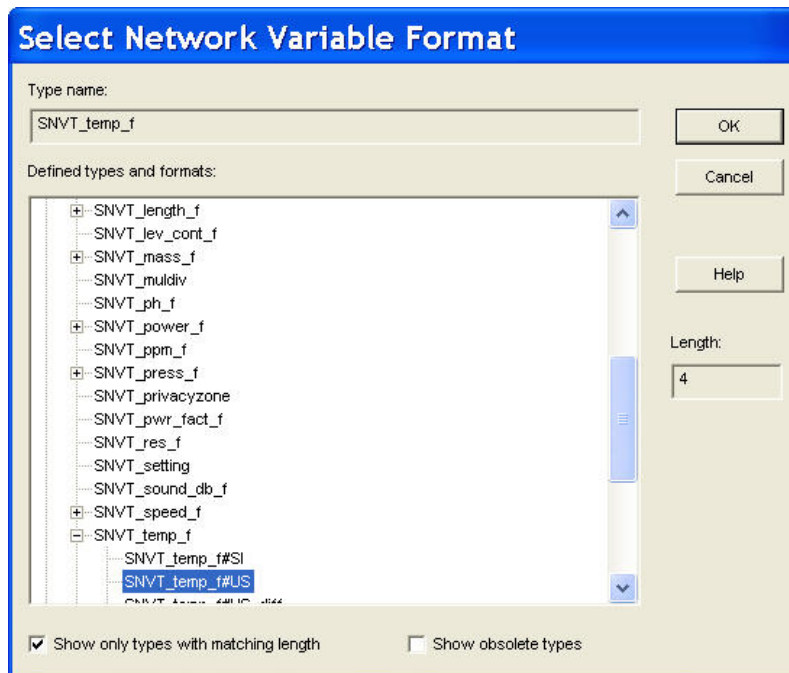
You can change the format of a network variable or configuration property. A network variable or configuration property format specifies how the raw data contained within a network variable or configuration property is translated for display or for use by an application. The format also specifies how data entered by you or an application is translated to the raw data to be transmitted on a LONWORKS network.

The format may include scaling and offset values to convert one type of data to another such as Celsius to Fahrenheit or kilograms to pounds, localized formatting specifications, or text strings that are to be displayed as part of the value. For example, a temperature sensor may report a temperature value with a type of **SNVT_temp_f**. The **SNVT_temp_f** type is defined as a 32-bit signed floating-point value representing a Celsius temperature. You can change the format of **SNVT_temp_f** type to Fahrenheit or differential Fahrenheit (the Fahrenheit format has an offset of 32; differential Fahrenheit has an offset of 0). You can modify network variable and configuration property formats or create your own using the NodeBuilder Resource Editor.

If you change a network variable type, the format is automatically changed to the default format for the new type. You can change the format to a format associated with a different type than the actual network variable type. For example, a network variable may have a fixed type of **SNVT_count_f**, but you may set its format to **SNVT_temp_f#SI** to interpret the count value as a Celsius temperature.

A network variable or configuration property format does not affect how the corresponding value is encoded for transmission on the network. For example, a **SNVT_temp_f** value is always transmitted in Celsius format, but it can appear in Celsius, Fahrenheit, or differential Fahrenheit formats.

You can use the LonMaker Browser to change the format of network variables and configuration properties. To do this, right-click the network variable or configuration property in the browser window and then click **Change Format** on the shortcut menu. The **Select Network Variable Format** dialog appears.



This dialog lists available types and formats. Each format is associated with a type. If a type supports multiple formats, you can expand the type to see all the associated formats. By default, the dialog opens to the current type with its formats listed underneath it (if it has more than one) and the current format highlighted.

To change the format, click the desired format and then click **OK**. In addition to the formats contained in the standard format file and other format files included in this dialog, you may choose to format the data in one of five built-in data types: **RAW**, **RAW_HEX**, **RAW_PACKED**, **STRING**, or **UNIT_TEXT**. To choose one of these formats, expand the **Built-in Data Types** header and select the desired format.

- Select the **Show Only Types with Matching Length** check box to list only those network variable types with the same size as the current SNVT, UNVT, or built-in data type.

- Select the **Show Obsolete Types** check box to list those network variable types that are marked obsolete in the current standard resource file set.
- The **Length** box displays the size (in bytes) of the currently selected type.

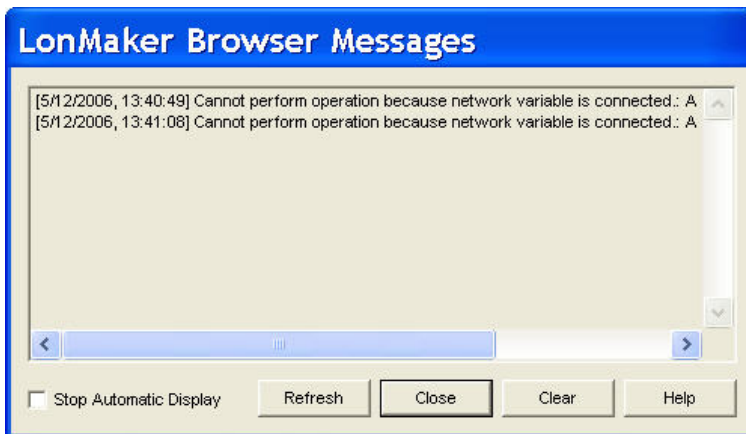
Tip: Many standard network variable types include formats with “#US” and “#SI” format specifiers. You can use these specifiers to identify default formats when the appropriate default is determined by the regional settings on the computer running the LonMaker tool. The LonMaker tool uses the #US formats when your Windows regional settings specify a US measurement system, otherwise the LonMaker tool uses the #SI formats. To view the measurement system used on your computer, follow these steps:

1. Open the Windows Control Panel.
2. If you are running Windows 2000, double-click **Regional Options**. The **Regional Options** dialog opens. Click the **Numbers** tab.

If you are running Windows XP or Windows Server 2003, double-click **Regional and Language Settings**. The **Regional and Language Settings** dialog opens. Click **Customize**. The **Customize Regional Settings** dialog opens.
3. The **Measurement System** box displays the units that will be used (US or Metric).

Displaying Error Messages

You can display error messages when monitoring and updating network variable and configuration property values in the LonMaker Browser. By default, the **LonMaker Browser Messages** dialog automatically opens when an error occurs.



This dialog displays all browser errors. Select the **Stop Automatic Display** check box and click **Close** to stop automatically displaying this dialog. If you have disabled automatic display and an error occurs, the **Display Messages** button at the bottom left corner of the Browser window turns red and a description of the error appears to the right of the button.



To delete all the current messages listed in the dialog, click **Clear**. All error messages are cleared from the window and the Display Message button is unavailable if you close the cleared dialog.

You can disable or enable automatic display of the LonMaker Browser Messages dialog by opening the **Browse** menu, clicking **Options**, and under the **General** tab, clearing or selecting the **Error Messages: Show Always** check box.

If there are no error or warning messages, the **Displays Messages** command in the **Browse** menu and the **Display Messages** button are unavailable.

Managing Functional Blocks


You can disable, override, and test a functional block from the LonMaker Browser. To do this, open the **Browse** menu and then click **Manage**. See *Managing Functional Blocks* in Chapter 8, *Managing Networks*, for more information.

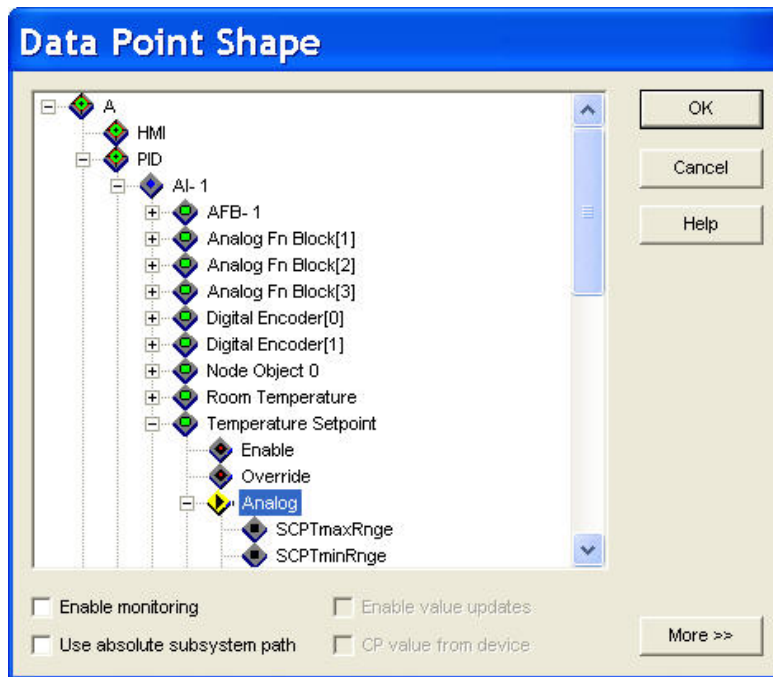
Using Data Point Shapes

You can use a Data Point shape in a LonMaker drawing to monitor the value of any network variable configuration property, or functional block state (enabled or in override). You can also use a Data Point shape to update the value of an input network variable or configuration property. You can use Data Point shapes to create simple human-machine interface (HMI) applications within your LonMaker drawing.

Adding and Monitoring a Data Point Shape

You can add a Data Point shape to your LonMaker drawing, and use it to monitor a network variable configuration property, or functional block state. To add a Data Point shape to your LonMaker drawing, follow these steps:

1. Drag a Data Point shape  from the LonMaker Basic Shapes stencil to your LonMaker drawing. The **Data Point Shape** dialog box opens.



This dialog provides a hierarchal view of your LonMaker network, listing the objects in your network in the order of subsystems, devices, functional blocks, functional block states, network variables, and then configuration properties.

2. Select the network variable, configuration property, or functional block state to monitor by browsing through the network hierarchy. You can also right-click a subsystem and click **Expand** from the network navigator to display all the objects in that subsystem, including any nested subsystems and their objects.
3. Optionally, you can select the following basic attributes for the selected data point.

Enable Monitoring

Enables monitoring for the selected data point. Creates a monitor set and monitor point for a network variable data point if one is selected. All network variable Data Point shapes and monitored network variable connections in the same subsystem are placed in one LNS monitor set.

This check box is cleared by default.

Use Absolute Subsystem Path

Controls how the LonMaker tool interprets a new Data Point shape created from a copy (an existing Data Point shape or a master shape). This check box is cleared by default.

If this check box is selected, the same data point will be monitored in a new Data Point shape.

If this check box is cleared, the LonMaker tool will attempt to locate the appropriate data point using the relative subsystem\device\functional block path of the source. In addition, you can create a Data Point shape that you can copy to a different subsystem and have it refer to a data point in that subsystem.

Enable Value Updates

Allows you to enter a new value for the selected data point, which will then be updated in the LNS network database. This check box is cleared by default.

If the selected data point is an input network variable, a device-specific configuration property, or a functional block state, the device will be updated in addition to the LNS network database. If the selected data point is a non-device-specific configuration property, only the LNS network database will be updated. This option is unavailable for output network variables.

If this check box is cleared, you can double-click the Data Point shape to update it with the current value of the selected data point.

CP Value from Device

Enables configuration property values to be updated and queried directly to and from the device. This option is only available if the selected data point is a configuration property.

This check box is selected by default for device-specific configuration properties, and it is cleared for non-device-specific configuration properties.

4. To set advanced options, click **More**. The dialog expands to include the following advanced properties for the selected data point.

The screenshot shows a dialog box with the following fields and options:

- Label:** A dropdown menu with the selected value "<FB.NV>".
- Format:** A text input field containing "SNVT_temp_f#US" and a button with three dots to the right.
- Field name:** A dropdown menu that is currently empty.
- Polling interval:** A text input field containing "5" followed by the text "Second(s)".
- Report value changes only:** An unchecked checkbox.
- Use bound connection:** An unchecked checkbox.

Label

Selects the text displayed underneath the Data Point shape. The options available depend on the selected data point. You can also enter your own label for the Data Point shape. If you enter your

own label and later create an instance of the Data Point shape (a master shape or a copy), that label will be selected by default in this list.

If the selected data point is a network variable, the following options are available:

- **None** (no label).
- **NV** (the network variable name).
- **FB.NV** (the functional block name, network variable name, and field name [if defined]). This is the default.
- **Device.FB.NV** (the device name, functional block name, network variable name, and field name [if defined]).

If the selected data point is a functional block state, the following options are available:

- **None** (no label).
- **Status** (the status name [enable/override]).
- **FB.Status** (the functional block name and status name). This is the default.
- **Device.FB.Status** (the device name, functional block name, and status name).

If the selected data point is a functional block configuration property, the following options are available:

- **None** (no label).
- **CP** (the configuration property name).
- **FB.CP** (the functional block name and configuration property name). This is the default.
- **Device.FB.CP** (the device name, functional block name, and configuration property name).

If the selected data point is a functional block network variable, the following options are available:

- **None** (no label).
- **CP** (the configuration property name).
- **NV.CP** (the network variable name, configuration property name, and field name [if defined]).
- **FB.NV.CP** (the functional block name, network variable name, configuration property name, and field name [if defined]). This is the default.
- **Device.FB.NV.CP** (the device name, functional block name, network variable name, configuration property name, and field name [if defined]).

Format

Specifies the network variable or configuration property format for the value displayed in the Data Point shape. By default, the LNS default format is used. You can change the format by clicking the button to the right of the format field.

This option is unavailable if the selected data point is a functional block state.

Field Name

Specifies whether the Data Point shape displays the entire structure of a network variable or configuration property value or just one or more fields within that structure.

For example, **SNVT_switch** has a value and a state field. If you

select an input network variable with a **SNVT_switch** type as the data point, the switch is off, and you select **<all>** (the default) from the field name list, the Data Point shape displays the entire structure, which would be “0.0 0”. If you select **value**, the value displayed in the Data Point shape will be “0.0”, and if you select **state**, the value displayed will be “0”.

This option is unavailable if the network variable or configuration property type does not have a structure, or the selected data point is a functional block state.

Polling Interval

Specifies how frequently (in seconds) the data point is polled. The default is **5** seconds for polled network variables and **15** seconds for monitored configuration properties and functional block states.

If you change the polling interval, the value you enter becomes the default for new Data Point shapes of that object type until you close the drawing and then re-open it from the LonMaker Design Manager. For example, if you change the polling interval for a network variable to 8 seconds, all new network variable data points that you create will be polled every 8 seconds. The default monitoring rate for functional block states and configuration properties, though, would not be affected.

Report Value Changes Only

Select whether a network variable Data Point shape is updated anytime a poll (or update) occurs, or is only updated when the network variable value has changed. This check box is cleared by default, which means that the network variable Data Point shape is updated anytime the network variable is polled (or updated).

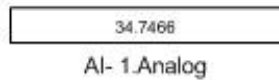
This option is only available if the selected data point is a network variable.

Use Bound Connection

Selects whether the LNS server monitors a network variable data point by creating a connection from the LNS Network Service Device (NSD) to the network variable, or by polling. This check box is cleared by default, which means the LNS server uses polling.

This option is only available if the selected data point is an output network variable. If an input network variable is selected, the LNS server automatically uses polling.

5. Click **OK**. The Data Point shape is added to your LonMaker drawing. The data point value appears in the Data Point shape if monitoring is enabled in the LonMaker drawing and in the Data Point shape.



6. If no data point value appears in the Data Point shape, verify that monitoring is enabled in both the network and in the Data Point shape. Right-click the Data Point shape and select **Monitor Value** on the shortcut menu if it is not already selected. If the data point value appears in brackets, right-click a clear space in the drawing page and select **Enable Monitoring** on the shortcut menu.

Updating a Data Point

You can update the value of a Data Point shape that represents an input network variable, configuration property, or functional block state. A Data Point shape may represent a scalar value, a structured value, or an enumerated value.

- A *scalar value* is a single number such as a temperature or a pressure.
- A *structured value* is a value that contains multiple fields such as a switch value with state and level fields.
- An *enumerated value* is a value with multiple states each represented by an enumeration string, such as an occupancy state with occupied and unoccupied values or an HVAC mode. A functional block state is also an enumerated value.

Updating a Scalar Data Point

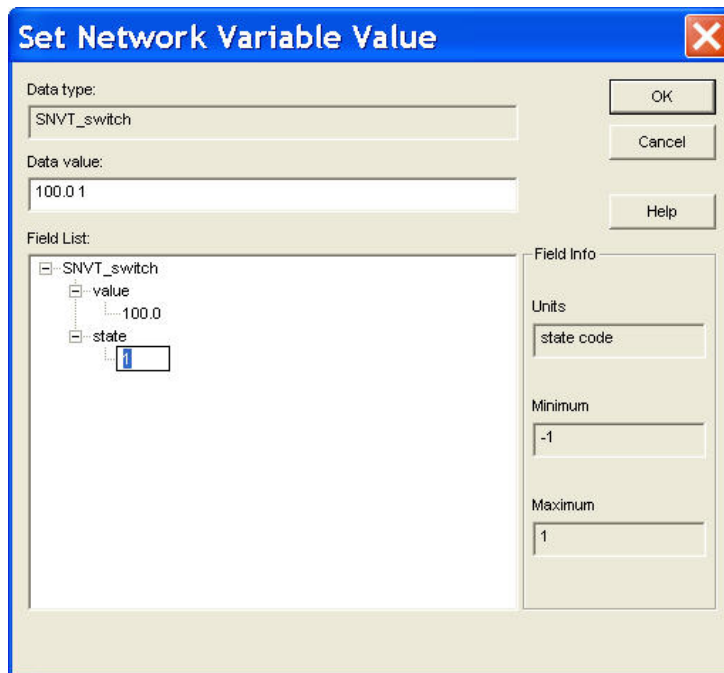
To set the value of a scalar data point, follow these steps:

1. If updates are not enabled, right-click the Data Point shape, select **Properties** on the shortcut menu, and then select the **Enable Value Updates** check box in the **Data Point Shape** dialog. Click **OK**.
2. Double-click the Data Point shape and then enter the desired value.

Updating a Structured Data Point

To set the value of an input network variable or configuration property data point that has a structure (a type with multiple fields), follow these steps:

1. If updates are not enabled, right-click the Data Point shape, select **Properties** on the shortcut menu, and then select the **Enable Value Updates** check box in the **Data Point Shape** dialog. Click **OK**.
2. Double-click the Data Point shape and then enter the desired value for one or more of the data point fields. Alternatively, you can use the **Set Network Variable Value** dialog to set the values for the fields. The benefit of using this dialog is that it displays the name, unit type, and maximum and minimum values for each of the fields, which makes it easier to enter a valid value. To use the **Set Network Variable Value** dialog, follow steps 3–5.
3. Right-click the Data Point shape and click **Value Details** on the shortcut menu. The **Set Network Variable Value** dialog box opens.



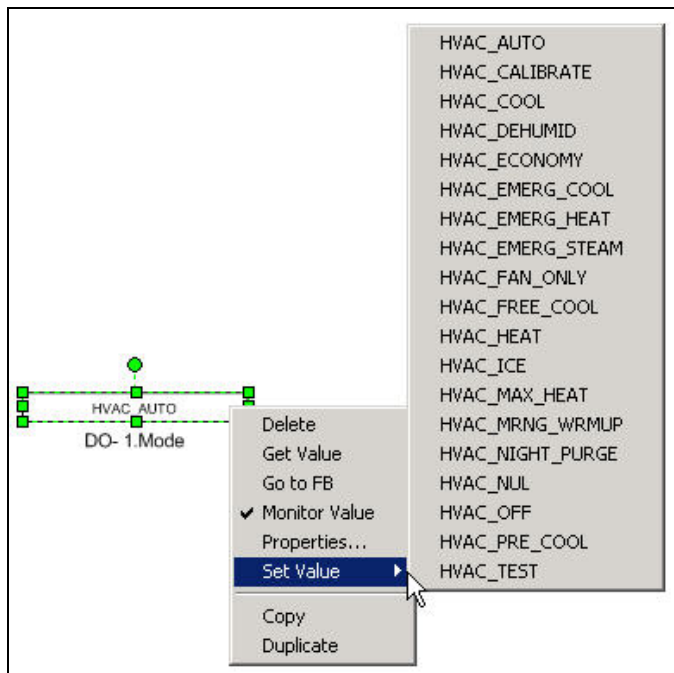
4. All the fields for the selected data point are listed in structural order in the **Field List** box. You can set the value for a structured data point in two ways:
 - Expand a field in the **Field List** box and then click twice slowly on the value that appears below the field. Enter a valid value for the field (the minimum and maximum values appear in the **Field Info** box to the right). Repeat for any other fields for which you want to set the value.
 - Enter a valid value in the **Data Value** box for one or more of the fields in the structured data point.
5. Click **OK** to apply the changes

Note: If you update an input network variable that is connected to an output network variable on another device, updates from the other device to the output network variable may overwrite your changes.

Updating an Enumerated Data Point

To set the value of an enumerated data point, follow these steps:

1. If LonMaker shape menus are not enabled, open the **LonMaker** menu and select **Use LonMaker Shape Menus**.
2. If updates are not enabled, right-click the Data Point shape, select **Properties** on the shortcut menu, and then select the **Enable Value Updates** check box in the **Data Point Shape** dialog. Click **OK**.
3. Right-click the enumerated data point and point to **Set Details** on the shortcut menu. A list of all the possible enumerations for the data point appears.
4. Select the desired enumerated value.



Getting a Data Point Value

You can get the value of any data point by double-clicking the Data Point shape or right-clicking the Data Point shape and clicking **Get Value** on the shortcut menu. The Data Point shape value is updated

with the current value of the data point. The LonMaker tool must be attached to the network to use this option.

If monitoring on the Data Point shape is disabled, the value displayed in the Data Point shape will be cleared in n seconds, where n is the value set in the ‘**Get Value**’ **Display Duration** box in the network properties: **NV Browser/Monitoring** options category. By default, the value is **15** seconds. You can disable the clearing of the Data Point shape by setting this value to **0**. See *NV Browser/Monitoring Options* in Appendix A for more information on setting this value.

Creating and Using a Custom Data Point Master Shape

You can create a custom data point master shape from an existing Data Point shape, and you can include a Data Point shape with other shapes in a custom LonMaker master shape. All the properties of the Data Point shape—including the selected data point, label, fonts, and colors—are saved in the custom master shape. You can then re-use the custom data point master shape to add new Data Point shapes to your LonMaker drawing.

Creating a Custom Data Point Master Shape

To create a custom functional block master shape, drag the desired Data Point shape or a set of shapes that includes a Data Point shape onto a LonMaker stencil to which you have write access.

If the **Use Subsystem Absolute Path** check box in the **Data Point Shape** dialog box is selected when you create the custom data point master shape, the monitored data point will be the same as the one in the original Data Point shape when you drag the master shape to your drawing.

If this option is cleared, the LonMaker tool will store a relative reference in the custom data point master shape of the subsystem path from the location of the original (source) Data Point shape to that of the monitored object. The LonMaker tool will then use this information to determine the data point to be monitored when you create a new Data Point shape from the custom master shape.

Using a Custom Data Point Master Shape

You can create a custom Data Point shape by dragging a custom Data Point master shape from a LonMaker stencil to your drawing. The custom Data Point shape has the same properties as the original Data Point shape that you used to create the master shape. To create a new Data Point shape from a master shape, follow these steps:

1. Drag the custom data point master shape from its stencil to your LonMaker drawing. The **Data Point Shape** dialog box opens with a default data point selected.
2. The default data point depends on whether the **Use Subsystem Absolute Path** option was selected in the original Data Point shape. If this option was selected, the default data point is the same as the one in the original Data Point shape. If this option was cleared, the LonMaker tool will try to identify the appropriate default data point based on the subsystem in which the new Data Point shape was created and the relative path to the original Data Point shape.
3. Accept the default data point or select a different data point to be monitored in the new Data Point shape.
4. Click **OK**. The Data Point shape is added to your LonMaker drawing.

If you drag a custom LonMaker master shape that includes a Data Point shape to your LonMaker drawing, the new Data Point shape will be created without the **Data Point Shape** dialog opening.

Note: If the **Use Subsystem Absolute Path** option was cleared, and you change the name of any of the objects (subsystem, device, functional block, or the data point object) referenced by the master shape, and you drag the master shape to a different subsystem, the LonMaker tool may not be able to determine the appropriate data point for the new Data Point shape. If the LonMaker tool cannot determine the data point, the new Data Point shape will be outlined red (the default style for Connection Unbound).

Example: A subsystem named “Subsystem 1, Building 1, Floor 1, Room 1” contains a Data Point shape, and the **Use Subsystem Absolute Path** check box for the Data Point shape is cleared. The Data Point shape references a data point on a functional block in the “Subsystem 1, Building 1, Floor 2, Room 10” subsystem. The subsystem path stored in the Data Point shape is therefore “^.^.Floor2.Room10”. This indicates that when the custom Data Point master shape is added to a drawing, the LonMaker tool is to attempt to locate the monitored object by moving two subsystem levels up the network hierarchy and then down to the “Floor2.Room10” subsystem in the network.

A custom Data Point master shape is created by dragging the original shape to a LonMaker stencil. If the custom Data Point master shape is dragged to a “Subsystem 1, Building 2, Floor 1, Room 1” subsystem, it will reference a data point in the “Subsystem 1, Building 2, Floor 2, Room 10” subsystem.

Copying and Creating a Data Point Shape

You can create a new Data Point shape by copying an existing one following these steps:

1. Copy an existing Data Point shape. You can do this three different ways:
 - Right-click a Data Point shape, click **Copy** on the shortcut menu, right-click an empty space in the desired subsystem, and click **Paste** on the shortcut menu.
 - Right-click a Data Point shape and then click **Duplicate** on the shortcut menu.
 - Select a Data Point shape, hold down CTRL, drag the Data Point shape to any location in the subsystem, and then release the mouse.
2. The **Data Point Shape** dialog box opens with a default data point selected.
3. Accept the default data point or select a different data point to be monitored in the new Data Point shape.
4. Click **OK**. The Data Point shape is added to your LonMaker drawing.

Note: If you change the name of the original data point and paste a new Data Point shape in a different subsystem, the LonMaker tool will be able to determine the appropriate data point for the new Data Point shape. This is because the LonMaker tool first checks the handles of the original data point when creating a new Data Point shape from a copy.

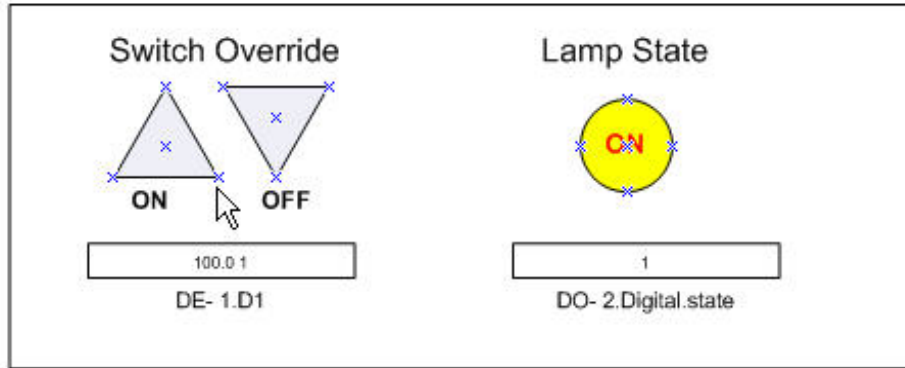
Deleting a Data Point Shape

You can delete a Data Point shape from a LonMaker drawing. To do this, follow these steps

1. Right-click the Data Point and then click **Delete** on the shortcut menu. If confirmed deletes are enabled, you will see a dialog asking you to confirm the deletion.
2. If prompted, click **Yes** to delete the shape.

Creating an HMI with Data Point Shapes

You can use data point and Visio shapes to design simple human machine interfaces (HMIs) in your LonMaker drawing. An *HMI* provides a graphical interface for monitoring and controlling a network. For example, you can create an HMI for a lighting system. The HMI could display the current state of a lamp, and it could include override switches that let you manually turn the lamp on and off.



You can use high-end HMI tools, such as Wonderware’s InTouch or Intellution FIX, to represent more complex types of network interactions. These tools are developed with a scripting language tuned to specifically address HMI tasks. In addition, these tools offer components that provide reporting and analysis, history, alarm logging, event handling, and Internet-enabling.

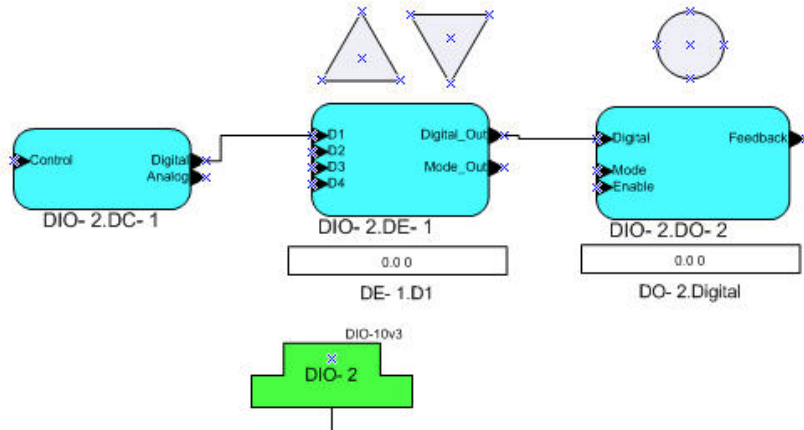
To create a simple HMI with Data Point and Visio shapes, you do the following:

1. Add Data Point shapes to your drawing as described in *Adding and Monitoring a Data Point Shape*. You use the Data Point shapes to monitor and control data points.
2. Add Visio shapes to your drawing (you can use any Visio shape—the previous lighting HMI example uses shapes in the Visio Basic Shapes stencil). You use the Visio shapes to read and write to the Data Point shapes.
3. Customize the ShapeSheets of the Data Point and Visio shapes so that they can interact with each other. You insert functions in the ShapeSheets that are executed when a supported event occurs (for example, when a Visio shape is clicked or the value in a Data Point shape changes). You can easily create functions using Add-Ons, Macros, or both. For more information on customizing ShapeSheets go to www.msdn.microsoft.com/library/default.asp?url=/library/en-us/vissdk11/html/viconAboutSSRef_HV01045900.asp.

The following two sections describe how to customize the ShapeSheets of the Data Point and Visio shapes using the previous lighting HMI example. The first section explains how to make a Visio shape write a value to a Data Point shape; the second explains how to make a Visio shape read a value from the Data Point shape.

The lighting system that this HMI represents includes the following physical and logical components:

- Digital input/output device.
- Digital input and digital encoder functional blocks. The **Digital** output network variable on the digital input functional block is connected to the **D1** input network variable on the digital encoder functional block.
- A digital output functional block. The **Digital_Out** output network variable on the digital encoder functional block is connected to the **Digital** input network variable on the digital output functional block.
- A Data Point shape that controls the **D1** input network variable on the digital encoder functional block.
- A Data Point shape that monitors the **Feedback** output network variable on the digital output functional block.
- Two Visio shapes that write to the Data Point shape that controls the **D1** input network variable.
- One Visio shape that reads the Data Point shape that monitors the **Feedback** output network variable.



Writing to a Data Point Shape Value

You can use a Visio shape to write a value to a Data Point shape. You can write to a Data Point shape using an Add-On or a Macro.

Using the lighting HMI example, when you double-click one of the Visio shapes, the following occurs:

1. The switch value and/or state is updated in the Data Point shape that controls the **D1** input network variable on the Digital Encoder functional block.
2. The **Digital_Out** output network variable on the Digital Encoder functional block passes the updated switch value and/or state to the **Digital** input network variable on the digital output functional block.
3. The lamp turns on or off, or it is brightened or dimmed.

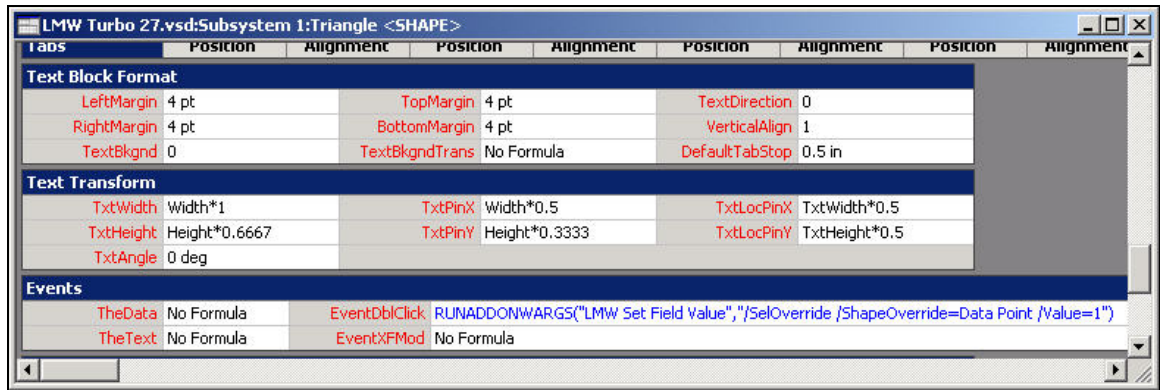
Using an Add-On

To use an Add-On to have a Visio shape write a value to a Data Point shape, follow these steps:

1. Click the Visio shape that will write a value to an input network variable.
2. Open the **Windows** menu and click **Show ShapeSheet**. The ShapeSheet of the selected Visio shape opens.
3. For a scalar data point, enter the following function in the **EventDbClick** cell of the **Events** section: **RUNADDONWARGS("LMW Set Value","/SelOverride /ShapeOverride=<Data Point Shape ID> /Value= <n>")**.

For a field in a structured data point, enter the following function in the **EventDbClick** cell of the **Events** section: **RUNADDONWARGS("LMW Set Field Value","/SelOverride /ShapeOverride=<Data Point Shape ID> /Value= <n>")**.

- The Data Point shape ID is the name that appears following the subsystem name in the title bar of the ShapeSheet. An index is appended to the shape ID when you add a second shape of a given type to your drawing. For example, the ID of the first Data Point shape added in the lighting HMI example is **Data Point**; the ID of the second data point is **Data Point.50**. If the shape has an index, you can use the following naming convention to enter the Data Point shape ID: **Sheet.<index>**.
 - *n* is a valid value or value for a field to be written to the Data Point shape.
4. Press ENTER.



5. To have some logic performed on the data point value instead of specifying a value, replace *n* with **&Scratch.X**. The function is as follows: **RUNADDONWARGS("LMW Set [Field] Value", "/SelOverride /ShapeOverride=<Data Point Shape ID> /Value=" &Scratch.X)**. You can use this type of formula to incrementally change the value of a data point when you double-click the Visio shape.
6. Press ENTER.
7. In the **X** cell of the **Scratch** section, enter a formula. For example, to create a formula that brightens a lamp when you double-click the Visio shape, enter the following:
=FORMAT(MODULUS("<Data Point Shape ID>!User.MonValue"+10,110), "0").
8. Press ENTER.

Using a Macro

To write to a value to a Data Point shape using a Macro, follow these steps:

1. Open the **Tools** menu, point to **Macros**, and then click **Macros** on the shortcut menu. The **Macros** dialog box opens.
2. In the **Macros Name:** dialog box, enter a name for the Macro. Click **Create**. The **Network Passwords** dialog appears if this is the first time you are creating a Macro or entering VBA code in your LonMaker drawing.
3. Enter **enumerate** in the **Password** box.
4. The Visio VBA editor appears. The left pane of the editor displays the LonMaker drawing; the right pane displays the VBA code associated with the Macro you are creating.
5. To insert a Macro to write to a scalar data point, enter the following VBA code:

```
Set myaddon = Application.Addons("LMW Set Value")
myaddon.Run ("/doc=<document ID> /page=<page ID> /SelOverride /ShapeOverride=<Data Point Shape ID> /Value= n")
```

 - *Document ID* is the document in which the Visio shape resides.
 - *Page ID* is the page in which the Visio shape resides.
6. To insert a Macro to write to a field in a structured data point, enter the following VBA code:

```
Set myaddon = Application.Addons("LMW Set Field Value")
myaddon.Run ("/doc=<document ID> /page=<page ID> /SelOverride /ShapeOverride=<Data Point Shape ID> /Value= n")
```
7. Enter additional code for any other functions to be performed when you double-click the Visio shape.
8. In the LonMaker drawing, click the Visio shape.

9. Open the **Windows** menu and click **Show ShapeSheet**. The ShapeSheet of the selected Visio shape opens.
10. In the **EventDbClick** cell of the **Events** section, enter the following function:
RUNMACRO("<Macro name>"), where *Macro Name* is the name of the Macro you entered in step 2.

Reading from a Data Point Shape Value

You can use a Visio shape to read a value in a Data Point shape. You can read a Data Point shape using an Add-On or a Macro. If you want to perform a function based on the data point value, create a Macro; otherwise, use an Add-On.

Using the lighting HMI example, the color and text (with the Macro only) of a Visio shape is updated when the value in the Data Point shape monitoring the **Feedback** output network variable on the digital output functional block changes.

Using an Add-On

To use an Add-On to have a Visio shape read from a value in a Data Point shape, follow these steps:

1. Click a Visio shape that is reading a Data Point shape monitoring an input or output network variable.
2. Open the **Windows** menu and click **Show ShapeSheet**. The ShapeSheet of the selected Visio shape opens.
3. Enter the following function the **FillForegnd** cell of the **FillFormat** section: ("**<Data Point Shape ID>!User.MonValue**"). For a Visio shape that is reading the state of a lamp, the color of the Visio shape will toggle between black (off) and white (on).
 - To change the color for the "on" state, you can perform some arithmetic function on the Data Point shape value. For example, to change the color of the Visio shape to yellow when the lamp is on, enter the following function: ("**<Data Point Shape ID>!User.MonValue**")*5.
 - If you are monitoring the lamp value, you can change the color of the Visio shape based on the brightness of the lamp. To do this, enter the following function: ("**<Data Point Shape ID>!User.MonValue**")/10.
4. Press ENTER.

Using a Macro

To read from a Data Point shape value using a Macro, follow these steps:

1. Open the **Tools** menu, point to **Macros**, and then click **Macros** on the shortcut menu. The **Macros** dialog box opens.
2. In the **Macros Name:** dialog box, enter a name for the Macro. Click **Create**. The **Network Passwords** dialog appears if this is the first time you are creating a Macro or entering VBA code in your LonMaker drawing.
3. Enter **enumerate** in the **Password** box.
4. The Visio VBA editor appears.
5. In the right pane, enter VBA code for the Visio shape to read from a data point. The following code is used to change the text in the Visio shape to "On" and the shape color to yellow when the state of the lamp is on (1). If the state of the lamp is off (0), the text in the Visio shape changes to "Off" and the shape color changes to black.

```
Sub LAMP_ON_OFF( )
Dim vsoPage As Visio.Page
Dim myshape As Shape
```

```

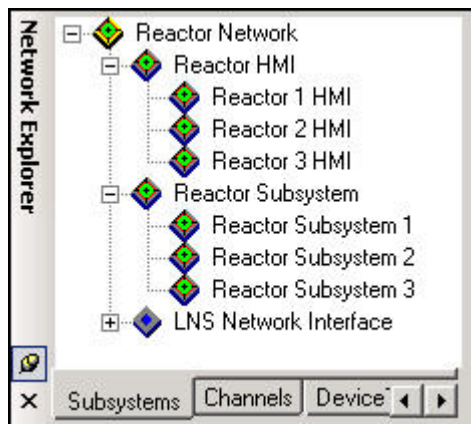
Dim myshape2 As Shape
Set myshape = ActivePage.Shapes("Circle")
Set myshape2 = ActivePage.Shapes("Data Point.50")
If myshape2.Text = 1 Then
myshape.Text = "ON"
Else
myshape.Text = "OFF"
End If
If myshape2.Cells("User.MonValue") = 1 Then
myshape.Cells("FillForegnd") = 5
Else
myshape.Cells("FillForegnd") = 0
End If
End Sub

```

6. In the LonMaker drawing, click the Data Point shape that is monitoring the value that the Visio shape is to read.
7. Open the **Windows** menu and click **Show ShapeSheet**. The ShapeSheet of the selected Data Point shape opens.
8. Enter the following function the **FillForegnd** cell of the **FillFormat** section:
RUNMACRO("<Macro name>"), where *Macro Name* is the name of the Macro you entered in step 2.
9. Press ENTER.

Organizing HMIs

When you create an HMI, place all the controls comprising the HMI in a single subsystem that is separate from the subsystem containing the devices and functional blocks it represents. If you have multiple subsystems that each have HMIs, establish a naming convention to correlate each HMI with the subsystem it monitor and controls. This makes it easier for you to use, modify, and maintain the network as you add more HMIs and subsystems to the network. For example, a reactor network could contain multiple reactor subsystems that each have their own HMIs. You would place the reactor subsystems in one subsystem, and the HMI subsystems in another. The following figure demonstrates how you can organize the reactor network using this naming convention.



Maintaining Networks

This chapter provides an overview of network maintenance tasks that you can perform with the LonMaker tool. It describes loading, replacing, and decommissioning devices. It explains how to resynchronize and propagate configuration properties values. It explains how to back up and restore a LonMaker network; create a LonMaker network by recovering information from the physical network; and resynchronize the network database, LonMaker drawing, and physical devices. It explains how to merge two LonMaker networks.

Maintaining Networks Overview

You can perform routine maintenance to update, repair, and optimize an installed network. You can maintain the network and its components, the LonMaker drawing, and the LNS network database. For example, if a device or router fails, you can replace it on the physical network and then logically replace it in the LonMaker network, preserving the device's configuration and all of its connections.

This chapter describes the following device and network maintenance tasks:

- Loading devices
- Replacing devices
- Decommissioning devices
- Resynchronizing device configuration properties
- Propagating device configuration property values by using the LonMaker tool as a passive configuration tool
- Backing up and restoring the network
- Recovering the network
- Synchronizing the network
- Merging networks

Tip: You can perform device maintenance tasks on multiple devices at one time. The manner in which you select multiple devices depends on the desired network scope of the task.

- To select multiple devices within a subsystem, hold down CTRL and click the devices, or click an empty space in the drawing page and drag a selection net around them. Then right-click one of the selected devices, point to **Commissioning** on the shortcut menu, and select the desired maintenance task.
- To select all the devices within a subsystem, select or clear the **Exclude Nested Subsystems from Subsystem Operations** check box to exclude or include, respectively, the subsystems nested within the selected subsystem (to access this option, right-click the Subsystem shape, or an empty space in the network if you are in the top-level subsystem, and select **Subsystem Properties** from the shortcut menu). Then right-click the Subsystem shape, or an empty space in the drawing page if you are in the top-level subsystem, point to **Commissioning** on the shortcut menu, and select the desired maintenance task.
- To select all the devices within a network, right-click an empty space in the drawing page of the top-level subsystem, point to **Commissioning** on the shortcut menu, and then select the desired maintenance task.

Loading Devices

You can load a new application image, and optionally a new Neuron firmware image, into an application device.

You can load an application with a device template that is the same as or different from the original device. When you load an application, you can create a new device template from a device interface (XIF) file on the LNS Server or a XIF file in the device. If you load an application with a new or different device template, the new application must use a different program ID than the original application.

If you load a compatible application image into a device that you have configured and connected to other devices, the LonMaker tool will preserve all compatible configuration and connection information. You can load an application image file with an .apb or .nxe extension.

To load a new application into a device, the devices must have writeable application memory and the LonMaker tool must be attached to the network and OnNet.

To load a new application into a device, follow the five steps described in the subsequent sections:

1. Select the device or devices to upgrade.
2. Select or create a device template.
3. Select an application image to load into the device(s).
4. Select the initial state of the device(s), source of configuration property values, and management of device-specific configuration properties.
5. Install the device(s), if necessary.

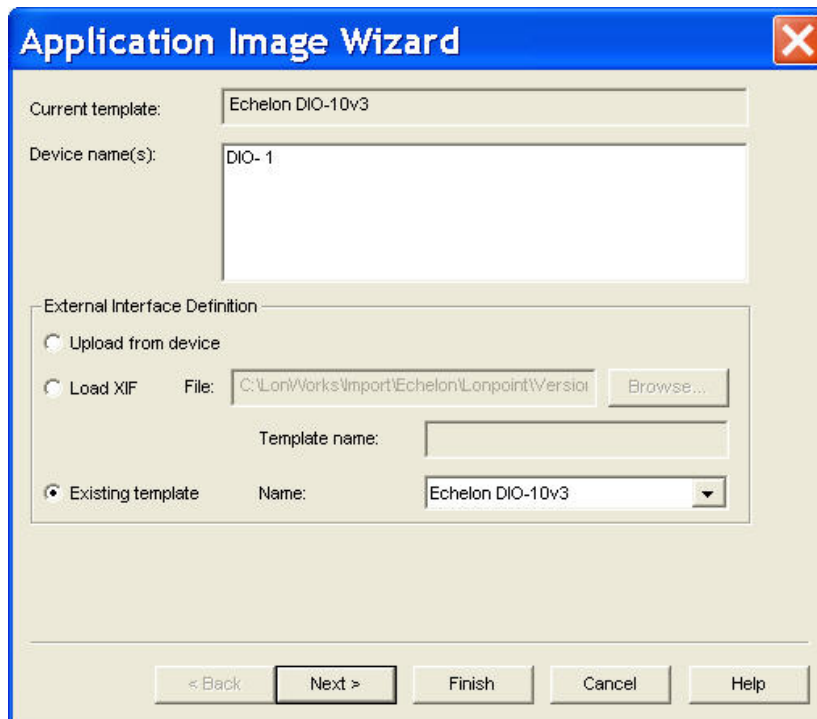
Selecting the Devices to Load

To select devices to load, follow these steps:

1. Select one or more applications devices to load.
2. Right-click the device to load (or one of the devices if you are loading multiple devices), point to **Commissioning**, and then click **Load** on the shortcut menu.
3. The Application Image Wizard opens. The device template page lists all the selected devices associated with the device template displayed in the **Current Template** box.

Selecting or Creating a Device Template

To select or create a device template, follow these steps:



1. Choose a method for selecting or creating a device template. You have three choices:
 - **Upload From Device.** Creates a device template by uploading the device interface (XIF) from the device. This option is only available if the LonMaker tool is attached to the network. Enter a name for the new device template in the **Template Name** box. The name must be unique to this network and may be up to 85 characters long.

- **Load XIF.** Creates a device template by reading an XIF file on the LNS Server. You can either enter the path or click **Browse** to locate the desired XIF file. You can enter the file name without a path only if the XIF file is in the folder specified in the **XIF Search Path** box network properties: **Device** options category. The device template name in the **Template Name** box is automatically set to the name of the XIF file (without the extension), but you can change it to any name that is unique to the network.
- **Existing Template.** Uses an existing device template. This is the default. By default, the current device template is displayed in the **Existing Template Name** list. You can select any device template currently defined in the network from this list.

If you select **Upload From Device** or **Load XIF**, the change is applied to all the devices listed in the **Device Names** box. The LonMaker tool then maps all the functional blocks, network variables, message tags, and connections from the old device template to the new one, attempting to preserve as much of the original device configuration as possible. If objects cannot be mapped into the new device template, the LonMaker informs you which objects will be lost and lets you cancel the operation.

2. Click **Next**. The Device Application Image page opens, unless you are loading new application files into multiple devices with different device templates. In this case, this page is repeated for each unique device template used by the selected devices. Once you have defined the device template for all the selected devices, the wizard will then proceed to the Device Application Image page.

Selecting an Application Image and a Neuron Firmware Image

In the Device Application Image page, you select an application image to load into the device.

1. Select the device application you want to load into the device by setting the following options:

Load Application Image Select this check box to enable loading a new application image into the device.

Update Firmware in Device to Match Application Image Select this check box to load a new Neuron firmware image to make the Neuron firmware on the device compatible with the new application image file.

For a device to support Neuron firmware updates, it must be based on a Neuron 3150 core with a nonvolatile memory layout supporting at least 32K starting from address 0.

If this check box is cleared, and there is a version of the selected application image file that matches the current device firmware (*<appImage>fw<n>.apb*, where *n* is the firmware version) in the same folder of the selected application image file, the LonMaker tool automatically loads that application image file into the device. Otherwise, the LonMaker tool will load the selected application image file into the device.

Note: A device may become inoperable if there is a power failure during a firmware update.

Image Name Specify the pathname of the application image file (.apb or .nxe extension).

If you are working on a remote client, the LonMaker tool looks for the application image file on the LNS Server. Specify the full pathname (including the drive) of the application image file on the LNS Server. You cannot load an application image file directly from a remote client computer onto a device.

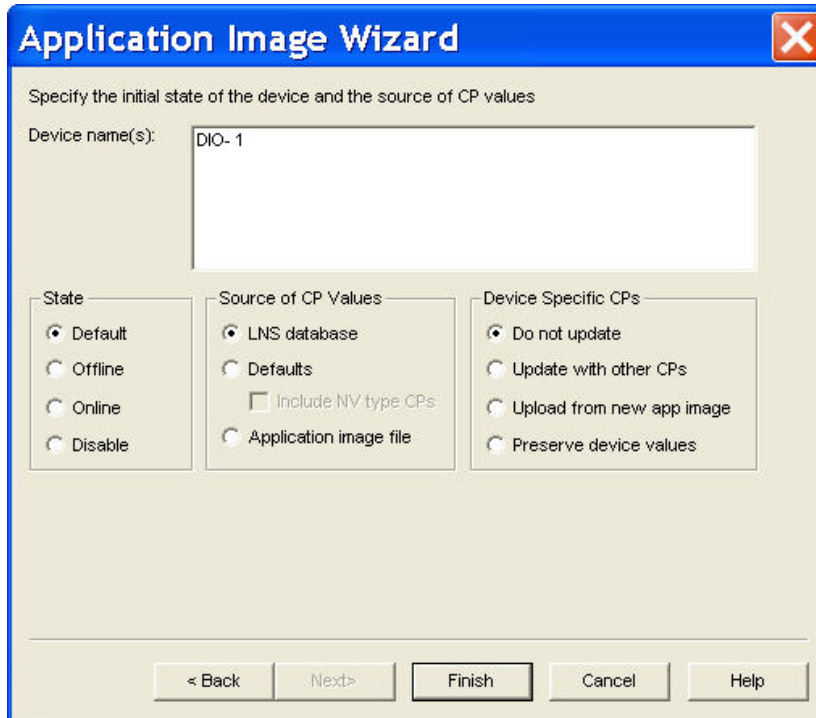
XIF Name If you are loading an application image file with an .nxe extension, select the pathname of the XIF file. The LonMaker tool only requires the binary application and device interface files (.apb and .xfb); however, it automatically creates binary files from existing text application and device interface files (.nxe and .xif) and saves them in the application file folder that contains the corresponding .nxe file.

If you specified a XIF file for the device in the previous page in the wizard (the Device Template page), you cannot select a different XIF file. If an application image file is found in the same directory as the XIF file of the device template, that directory is the default.

2. Click **Next** to continue. The Device Initial State page appears, unless you are loading new application files into multiple devices with different device templates. In this case, this page is repeated for each unique device template used by the selected devices. Once you have defined the application image for all the selected devices, the wizard will then proceed to the Device Initial State page.

Selecting Initial Device State and Source of Configuration Property Values

To select the initial device state and the source of configuration property values, follow these steps:



1. Specify the initial state of the device applications, and select the source of the configuration property values and management of device-specific configuration properties as follows:

State

Specify the state of the device application after it has been commissioned. You have four choices:

- **Default.** The state of the device application is determined by the current setting under the **New Device Options** box in the network properties: **Device** options category. If the device was previously commissioned and is able to communicate, the default state is the state of the device before the current operation.
- **Online.** Places the device in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been commissioned.
- **Offline.** Places the device in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application after it has been commissioned. This is the default and can be used to bring up a system incrementally.

When a device is offline, portions of its application may still function and it will still respond to Online, Wink, and Test commands. An offline device still receives network variable updates, but it typically does not process updated network variable values or send network variable updates.

Resetting an offline device makes it go online, unless the device is in the hard offline state, in which case it will remain offline after a reset.

- **Disable.** Keeps the device application disabled even if the device is reset. For a device to be disabled, it must contain a Node Object functional block. If **Disable** is selected and the device does not contain a Node Object, the device is placed offline. As with offline operation, portions of a disabled device's application may continue to function.

Source of CP Values

Specify the source of the device's configuration property values. You have three choices:

- **LNS Database.** The current configuration property values stored in the LNS network database will be written to the device.
- **Default.** The default configuration property values stored in the device template will be written to the device. This option requires a device template based on a version 4 or higher XIF file with specified default values. See the *LONMARK Device Interface File Developer's Guide* for more details. This is the default.

If you select **Default**, select whether network variable type configuration properties (**SCPTnvType**) are restored to their default values when the device is commissioned. If you want them to be restored, select the **Include NV Type CPs** checkbox. This check box is cleared by default. This operation will not work if any of the affected network variables are connected.

- **Application Image File.** The configuration property values specified in the application image file will be written to the LNS network database.

Device Specific CPs

Select how device-specific configuration properties are managed when a device is commissioned. Device-specific configuration properties are configuration properties that may be changed independently from the LNS network database (by the device itself or by a tool not based on LNS, for example) .

- **Do Not Update.** Device-specific configuration properties will not be modified in the device or in the LNS network database. This is the default.
- **Update with Other CPs.** The device-specific configuration property values will be set based on the option selected in the **Source of CP Values** box. For example, if you select **LNS Database** in the **Source of CP Values** box, the device-specific configuration property values stored in the LNS network database will be written to the device.
- **Upload from New App Image.** New device-specific configuration property values are read from the updated device application and written to the LNS network database.
- **Preserve Device Values.** The current device-specific configuration property values set in the device will be written to the LNS network database before the new application image is written to the device. Once the new application image has been

installed, the device-specific configuration property values in the LNS network database are written into the new device.

2. Click **Next**. The Device Identification Method window opens. Follow the steps in *Installing Devices and Routers* in Chapter 5, *Installing Networks*, to continue loading the devices.

Replacing Devices

You can replace a device with a new device if the device fails or a newer version of the device becomes available.

The replacement device can use the same device template used by the old device or it can use a different device template. You can also create a new device template for the replacement device using a device interface (XIF) file on the LNS Server or an XIF file stored in the replacement device. If the replacement device uses a new or different device template, the new device application must use a different program ID than the original application.

If you replace a device that is configured and connected to other devices, the LonMaker tool will preserve all compatible configuration and connection information. You can use the same procedure to replace multiple devices at the same time.

To replace a device, follow the three steps described in the subsequent sections:

1. Attach the new device to the network.
2. Replace the device in the LonMaker network.
3. Remove the old device.

Attaching a New Device to the Network

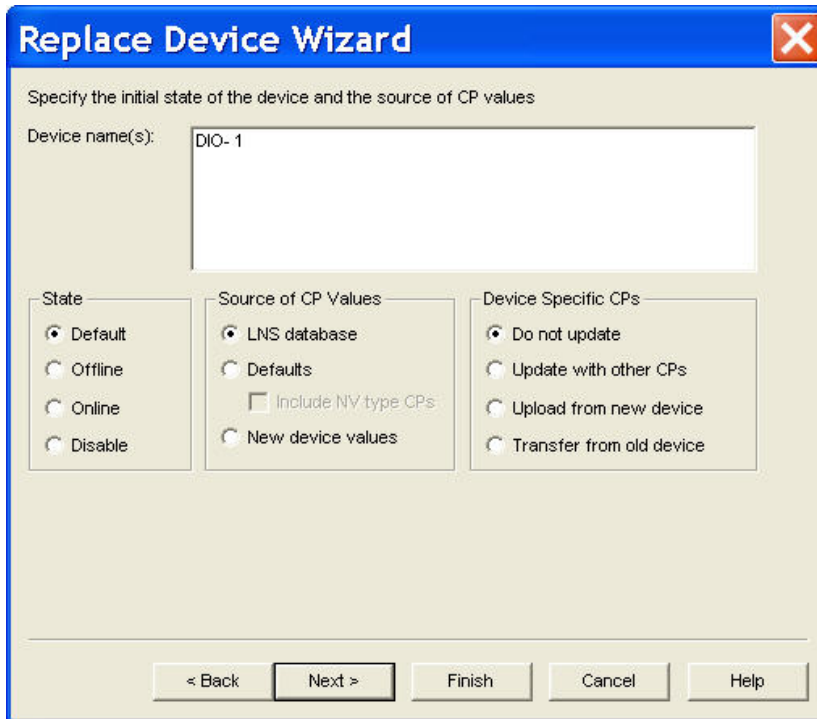
To attach a new device to the network, follow these steps:

1. Set any hardware settings on the new device to match those on the device you are replacing.
2. Attach the replacement device to the network by applying power to the device and attaching its network connection as documented by the device manufacturer.

Replacing a Device in the LonMaker Network

To replace a device in a LonMaker network, follow these steps:

1. If you are replacing an uncommissioned NodeBuilder device, delete the device from the NodeBuilder **Devices** folder.
2. Right-click the device, or select multiple devices and right-click one of them, point to **Commissioning**, and then click **Replace** on the shortcut menu. The Replace Device Wizard opens on the device template page.
3. Select the device template that is associated with the replacement device following the steps in *Selecting or Creating a Device Template* in this chapter. The Specify Device Application Image page opens.
4. Select an application image, and optionally a Neuron firmware image, to load into the replacement device following the steps in *Selecting an Application Image and a Neuron Firmware Image* in the previous *Loading Devices* section in this chapter. The Device Initial State page opens.



- Specify the initial state of the replacement device's application, and select the source of the configuration property values and management of device-specific configuration properties as follows:

State

Set the state of the device application after the replacement device has been commissioned. You have four choices:

- **Default.** The state of the replacement device's application is determined by the current setting under the **New Device Options** box in the network properties: **Device** options category. If the device was previously commissioned and is able to communicate, the default state is the state of the device before the current operation.
- **Online.** Places the replacement device in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been commissioned.
- **Offline.** Places the replacement device in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application after it has been commissioned. This is the default and can be used to bring up a system incrementally.

When a device is offline, portions of its application may still function and it will still respond to Online, Wink, and Test commands. An offline device still receives network variable updates, but it typically does not process updated network variable values or send network variable updates.

Resetting an offline device makes it go online, unless the device is in the hard offline state, in which case it will remain offline after a reset.

- **Disable.** Keeps the replacement device's application disabled

even if the device is reset. For a device to be disabled, it must contain a Node Object functional block. If **Disable** is selected and the device does not contain a Node Object functional block, the device is placed offline. As with offline operation, portions of a disabled device's application may continue to function. This option is not available for routers.

Source of CP Values

Specify the source of the replacement device's configuration property values. You have three choices:

- **LNS Database.** The configuration property values stored in the LNS network database for the old device will be written to the replacement device.
- **Defaults.** The default configuration property values stored in the device template will be written to the replacement device. This option requires a device template based on a version 4 or higher XIF file with specified default values. See the *LONMARK Device Interface File Developer's Guide* for more details. This is the default.

If you select **Defaults**, select whether network variable type configuration properties (**SCPTnvType**) are restored to their default values when the device is commissioned. If you want them to be restored, select the **Include NV Type CPs** checkbox. This check box is cleared by default. This operation will not work if any of the affected network variables are connected.

- **New Device Values.** The configuration property values set in the replacement device will be written to the LNS network database.

Device Specific CPs

Select how device-specific configuration properties are managed when an application is loaded into the replacement device. Device-specific configuration properties are configuration properties that may be changed independently from the LNS network database (by the device itself or by a tool not based on LNS, for example).

- **Do Not Update.** Device-specific configuration properties will not be modified in the device or in the LNS network database. This is the default.
- **Update with Other CPs.** The device-specific configuration property values in the replacement device will be set based on the option selected in the **Source of CP Values** box. For example, if you select **LNS Database** in the **Source of CP Values** box, the device-specific configuration property values stored in the LNS network database will be written to the device.
- **Upload from New Device.** The current device-specific configuration property values set in the replacement device will be written to the LNS network database.
- **Transfer from Old Device.** If the old device is available, its device-specific configuration property values will be written to both the LNS network database and the replacement device. If the old device is not available, the device-specific configuration property values in the replacement device will not be changed.

6. Click **Next**. If you are replacing application devices and routers at the same time, the Initial Router State window appears. Otherwise, the Device Identification Method window opens. In this case, follow the steps in *Installing Devices and Routers* in Chapter 5, *Installing Networks*, to continue installing the devices).

Removing the Old Device

If the old device still functions, and if physically possible, leave the old device connected to the network until the device replacement has been completed. This allows the LonMaker tool to deconfigure the old device so that you can easily reuse it in a new network. This step is not required if the device has failed.

Decommissioning Devices

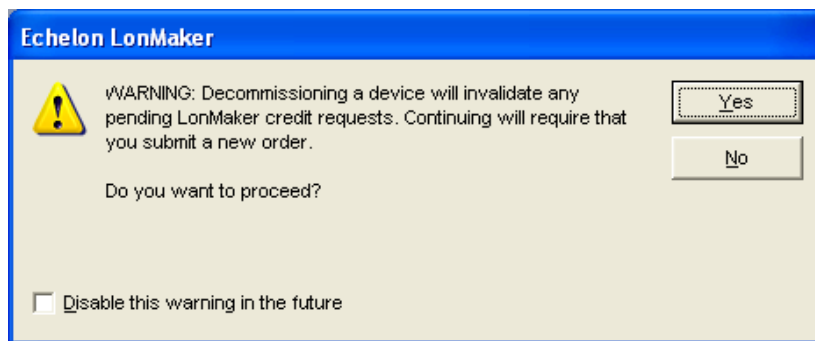
You can decommission a device if you are no longer using it or you are moving it to a new network. In addition, you can temporarily decommission a device to optimize, troubleshoot, or repair your network. Decommissioning logically removes the device from the network.

You can preserve the Neuron ID of the decommissioned device in the LNS network database so that you can subsequently recommission the device. All configuration information, including configuration properties and connections, are preserved in the LNS network database. You can then later recommission the same or different devices without re-entering the configuration data.

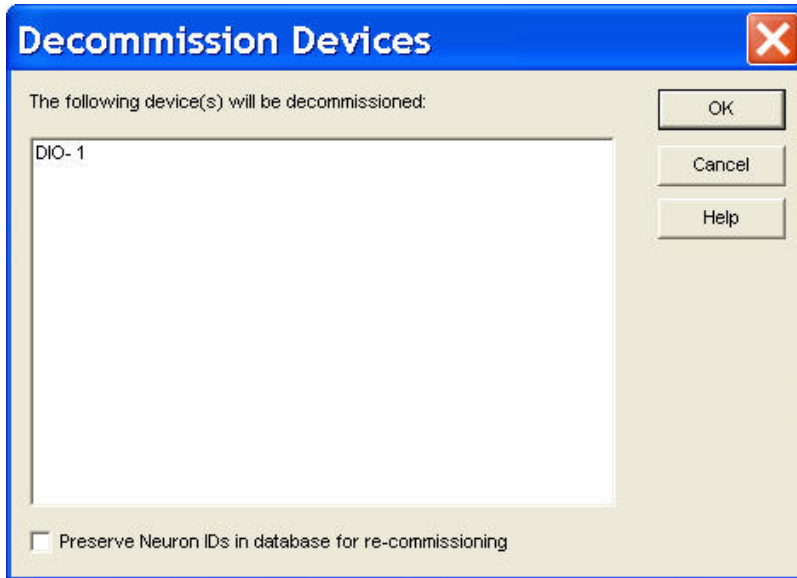
To decommission a device, follow these steps:

1. Attach the LonMaker tool to the network and set the management mode to OnNet (open the **LonMaker** menu, click **Network Properties**, click the **Network Interface** tab, and under the **Management Mode** box, select **OnNet**).
2. Right-click the device you want to decommission, or select multiple devices and right-click one of them, point to **Commission**, and then click **Decommission** on the shortcut menu.

If you are decommissioning an application device, the following message appears (unless you previously selected the option to disable it), informing you that decommissioning a device invalidates any pending LonMaker credit requests.



- If you have any pending LonMaker credit requests, click **No**, wait for the response to your request, process the response, and then restart this procedure.
 - If you do not have any pending LonMaker credit requests, click **Yes**.
3. The **Decommission Devices** dialog opens.



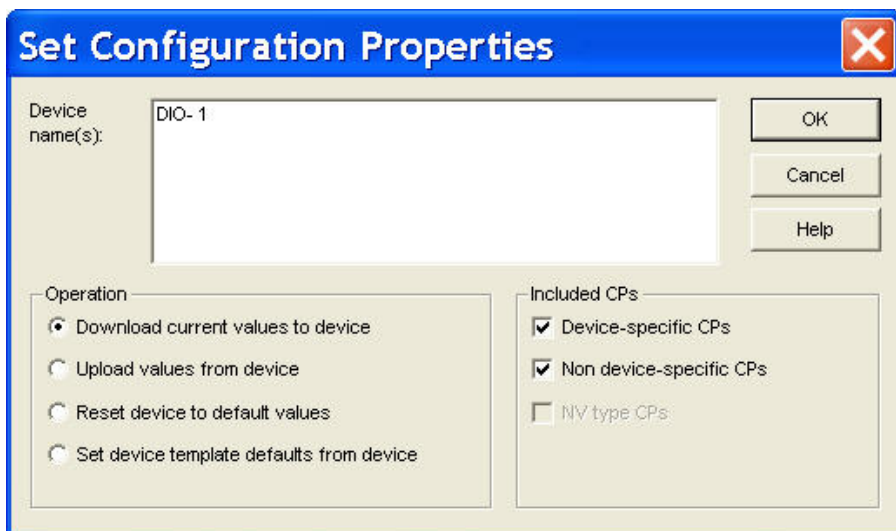
4. Select the **Preserve Neuron ID** check box to re-commission the same device or router later without re-entering the configuration data.
5. Click **OK**. The color of the device shape changes to crosshatched yellow, indicating that the device is unconfigured.

Resynchronizing Configuration Properties

You can resynchronize the configuration property values in the LNS network database with those in the physical devices. You may need to do this if the values get out of synchronization when a network tool not based on LNS is used to update the physical devices, or if the devices themselves update their own configuration properties.

To resynchronize the configuration properties for a device, follow these steps:

1. Right-click the device, or select multiple devices and right-click one of them, point to **Commissioning**, and then click **Resync CPs** on the shortcut menu. The **Set Configuration Properties** dialog appears.



2. Select a synchronization operation and which types of configuration properties to synchronize.

Operation

Select a synchronization operation. You have four choices:

- **Download Current Values to Device.** Writes the configuration property values stored in the LNS network database to the physical device. This is the default.
- **Upload Values from Device.** Writes the current configuration property values in the physical device to the LNS network database.
- **Reset Device to Default Values.** Writes the default values defined in the device template to the device and the LNS network database.
- **Set Device Template Defaults from Device.** Sets the default configuration property values in the device template to the current values in the physical device, and writes the configuration property values to the LNS network database.

Included CPs

Select which configuration properties are resynchronized. You can include the following configuration properties:

- **Device-Specific CPs.** Updates device-specific configuration properties. This check box is selected by default.
- **Non Device-Specific CPs.** Updates non–device-specific configuration properties. This check box is selected by default.
- **NV Type CPs.** Updates configuration properties which specify the network variable type (**SCPTnvType**). This check box is only available if **Reset Device to Default Values** is selected in the **Operation** box. If any of the affected network variables are connected (with a different NV type), the resynchronization operation will fail.

3. Click **OK**. The LonMaker tool updates the device and the LNS network database, as required.

Using the LonMaker Tool as a Passive Configuration Tool

You can use the LonMaker tool as a passive configuration tool. A *passive configuration tool* is a tool that configures the application in a device without affecting its network configuration. A passive configuration tool is required when a network tool not based on LNS is being used to manage the configuration of a network. This mode is useful when you need to use an LNS plug-in in passive mode to configure a device on a network managed with a network tool not based on LNS. To use the LonMaker tool and one or more LNS plug-ins as a passive configuration tool, follow these steps:

1. Attach the LonMaker tool to the network. If you do not already have a LonMaker network for the network, recover the network as described in *Restoring a LonMaker Network*. In the final steps of the procedure, do not synchronize the network to the database, and leave the management mode OffNet.

If you synchronize or change the management mode to OnNet, the LonMaker tool will become an active management tool and will no longer be passive. Skip to step 3.

2. If you have a LonMaker network design for the network, open it. Set the management mode to OffNet (open the **LonMaker** menu, click **Network Properties**, click the **Network Interface** tab, and under the **Management Mode** box, select **OffNet**). If you set the management mode to OnNet, the LonMaker tool will become an active management tool and will no longer be passive.

3. To configure a device with a manufacturer's plug-in that supports passive configuration, right-click the device or a functional block on the device and then click **Configure** on the shortcut menu. The plug-in starts.
4. Configure the device using the manufacturer's plug-in.
5. Right-click the device, point to **Commissioning**, and then click **Propagate CP Values to Device** on the shortcut menu.

Backing up a LonMaker Network Design

You can back up a LonMaker network design to a LonMaker backup file to protect against accidental file corruption or hardware failure, copy a LonMaker network design from one computer to another, or replicate a LonMaker network design in a new installation. You can also use a LonMaker backup file to archive a LonMaker network design at a site without an LNS Server or to archive multiple network configurations so a previous configuration can quickly be restored, if necessary.

A LonMaker backup file may contain the following components:

- LonMaker drawing
- LNS network database
- NodeBuilder project (only if you are using the NodeBuilder tool)
- External interface (XIF) files in the Import folder
- Resource files in the Types folder
- All files in the LonMaker drawing directory. Backing up files in the LonMaker drawing directory provides an easy way to back up and copy files associated with a LonMaker network design such as HMI application files or schedule design files.

You can manually back up a LonMaker network design, or you can have the LonMaker tool schedule periodic backups.

Manually Backing Up a LonMaker Network

You can back up a LonMaker network design from a LonMaker drawing or from the LonMaker Design Manager.

When you back up the network database, you can close the network database and create a *standard backup*, or you can create a *hot backup*, which is a shadow copy of the network database created while it is open. You can use a hot backup to create a backup without disrupting any remote clients or other LNS applications accessing the network database.

When you backup a LonMaker drawing, the LonMaker tool temporarily closes the drawing while making the backup.

The following sections describe how to create a standard LonMaker backup and how to create a hot backup.

Note: Utilities such as Google Desktop Search may cause backups to fail if they have any of the database or drawing files open at the time of the backup. If you receive a backup failure error, disable the utilities during the backup, or exclude the LM and LonWorks folders from the search of the utility.

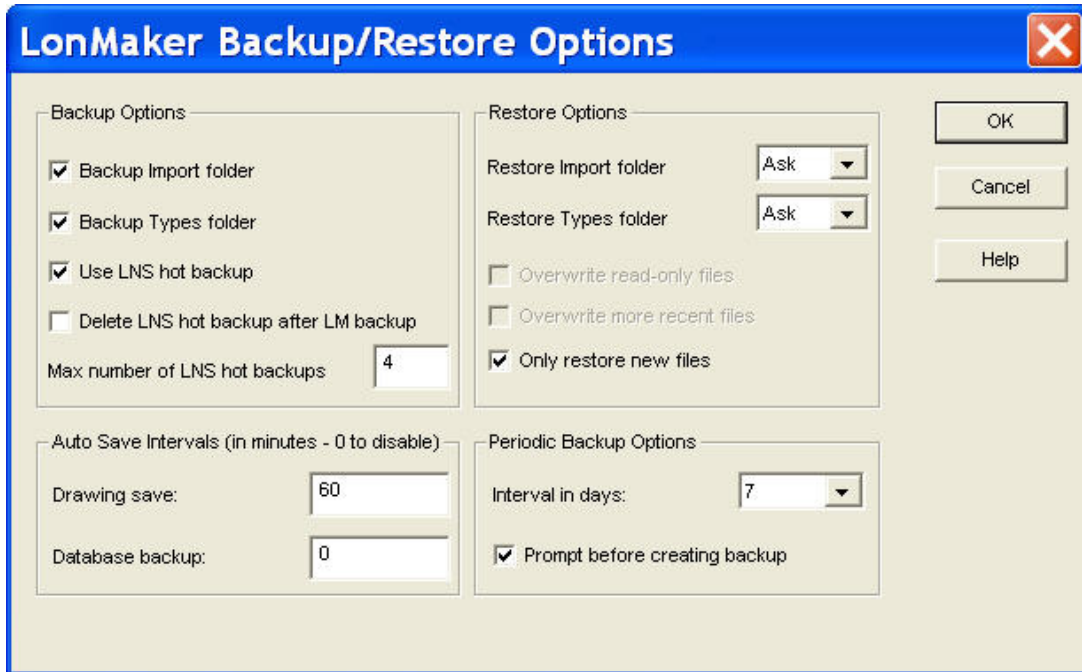
Creating a Backup from a LonMaker Drawing

To create a backup while working in a LonMaker drawing, follow these steps:

1. Open the **File** menu, point to **LonMaker Documents**, and then click **Backup**. The **LonMaker Backup** dialog box appears.



2. Select which components of the LonMaker network design to back up.
 - Select both the **Backup Drawing** and **Backup Database** check boxes to back up the entire LonMaker network design. Use this option to move a LonMaker network design from one computer to another, replicate the LonMaker network design for another installation, or to store a backup of the LonMaker network design to protect against accidental file corruption or hardware failure.
 - Select the **Backup Drawing** check box to back up only the LonMaker drawing. Use this option to create a backup of the drawing for use by a LonMaker remote client.
 - Select the **Backup Database** check box to back up the LNS network database only. Use this option to move the network database to an LNS Server computer that does not have the LonMaker tool installed.
 - Select the **Backup NodeBuilder Project** check box to back up the NodeBuilder project associated with the LonMaker network, if there is one. This option is only available if you are using the NodeBuilder Development Tool.
3. If you are backing up the LonMaker drawing, select which drawing files to back up under the **Drawing Files to Backup** box.
 - Select **Backup Visio (*.vs*) Files only** to back up only the Visio files in the drawing directory.
 - Select **Backup all Files in the Drawing Directory** to backup all the files in the drawing directory. This may include HMI projects and documentation. You can also include the plug-ins used by the network by copying them to the drawing directory.
4. To create a hot backup, or to include or exclude the Import and Types folders in the backup file, click **Options**. The **Backup/Restore Options** dialog opens.

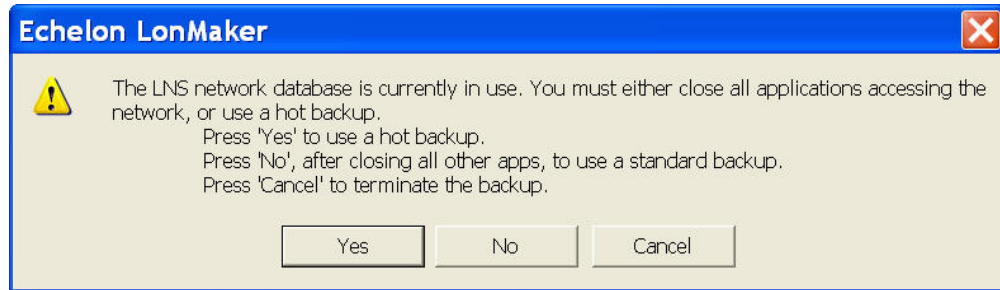


- a. To enable hot backups, select the **Use LNS Hot Backups** check box under **Backup Options**. If you select this check box, the LonMaker tool creates a hot backup of the network database if an application is accessing the LNS network database when you attempt to back up the network. Creating a hot backup prevents remote clients or other LNS applications accessing the network database from being disrupted. If you clear this check box, you can still create a hot backup (see step 6 for more information)
- b. Select or clear the **Backup Import Folder** check box to include or exclude the Import folder (includes XIF and .APB files) in the backup file, and select or clear the **Backup Types Folder** check box to include or exclude the Types folder (includes LONMARK resource files).

Tip: You can set whether the options for using LNS hot backups and backing up the Import and Types folders are enabled by default in the network properties: **Backup/Restore** options category (see Appendix A for more information on setting these options).

5. To change the default backup file name, click **Browse** and navigate to a different directory and enter the file name, or enter the file name in the **Backup File** field. The default backup directory is C:\LM\ Backup*<LonMaker network>*. The default backup file depends on the which components you included in the backup file:
 - If the backup file includes the drawing and database, the default backup file is *<LonMaker network>[_index].zip*.
 - If the backup file includes only the drawing, the default backup file is *<LonMaker network>Dwg[_index].zip*.
 - If the backup file includes only the database, the default backup file is *<LonMaker network>Db[_index].zip*.
6. Click **OK**.
 - If the LNS network database is not being accessed, the LonMaker tool automatically creates a standard backup of the database.
 - If the LNS network database is being accessed and hot backups are enabled, the LonMaker tool automatically creates a hot backup of the database.

- If the database is being accessed and hot backups are disabled, a prompt will open giving you the option to create a hot backup of the LNS network database, or to create a standard backup after closing all applications accessing the database, including the LNS Server.



- Click **Yes** to make a hot backup of the network database.
 - Click **No** to create a standard backup of the network database after you have closed all other LNS applications accessing the network database, including the LNS Server. The LonMaker tool will then temporarily close the LonMaker drawing and/or database and then re-open them after creating the backup.
 - Click **Cancel** to stop the backup and return to the LonMaker drawing.
7. The selected LonMaker drawing, database, and associated files will be archived to a LonMaker backup file (.zip extension) in the specified backup directory.

Creating a Backup from the LonMaker Design Manager

To create a LonMaker backup from the LonMaker Design, follow these steps:

1. Close all drawing files of the network you want to back up.
2. Open the LonMaker Design Manager. Click **Start** on the taskbar, point to **Programs**, point to the **Echelon LonMaker** folder, and then click **LonMaker**. The **General** tab of the LonMaker Design Manager appears.
3. Select the network to back up by selecting the corresponding network database from the **Database Name** list. If your network contains multiple drawing files, all drawing files in the network will be backed up regardless of which one is selected in the **Drawing Name** list.
4. Click **Backup**. The **LonMaker Backup** dialog box appears.
5. Follow steps 2–7 in the previous section, *Creating a Backup from a LonMaker Drawing*.

Scheduling Drawing Saves and Database Backups

You can schedule regular backups of a LonMaker network using the LonMaker tool or the Windows Task Scheduler.

Scheduling Backups with the LonMaker Tool

You can schedule the LonMaker tool to automatically save a LonMaker drawing and back up the network database. To use this feature, you set an interval in which the LonMaker drawing is to be saved and the network database backed up.

To set the automatic LonMaker drawing save interval, enter the desired number of minutes between the automatic saves in the **Drawing Save** field under the **Auto Save Interval** box in the network properties: **Backup/Restore** options category. The default value is **60**, which means that the LonMaker drawing is saved every hour by default.

To set the automatic database backup interval, enter the desired number of minutes between the automatic backups in the **Database Backup** field under the **Auto Save Interval** box in the network properties: **Backup/Restore** options category. The default value is **0**, which means that automatic

backups are disabled by default. Once you set a database backup interval, the LonMaker tool will make the automatic hot backups on the specified interval as long as changes have been made to the network database since the previous backup, the changes were made using the LonMaker tool or reported by an LNS event, and you are using the LonMaker tool on a local client. The hot backup will be stored in the DbBackup<dd>\<network name> folder, where <dd> is the number in the sequence of hot backups made for that network (for example, the third hot backup made for a network named “Building” would be stored in the DbBackup03 \Building folder, provided that the maximum number of hot backups is set to 3 or more).

You can set the maximum number of hot backups that are saved for all LonMaker networks (includes hot backups created automatically and manually). By default, the LonMaker tool will save five hot backups of a given network database before deleting older hot backups to create new ones. To change the maximum number of hot backups, enter the desired maximum in the **Max Number of LNS Hot Backups** box in the network properties: **Backup/Restore** options category.

You can also set a periodic backup interval, in which the LonMaker tool creates a standard LonMaker backup of the network drawing and database. When you close a LonMaker drawing and the periodic backup interval has elapsed, the LonMaker tool automatically creates a network backup or prompt you as to whether you want to create a backup (you can select whether you want to be prompted to create the backup in the **Periodic Backup Options** box in the network properties: **Backup/Restore** options category). If you create the network backup, the backup will be stored in the LM\Backup\<network name> folder and the backup file will include the date on which it was created and an index (if necessary to make the file unique).

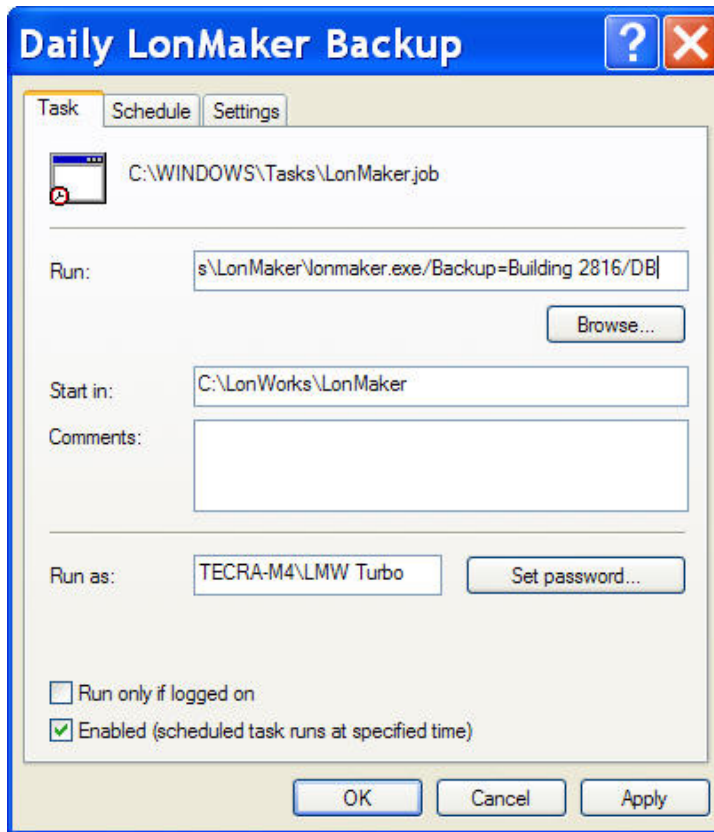
To set the periodic backup interval, select the desired number of days between backups in the **Interval in Days** list under the **Periodic Backup Options** box in the network properties: **Backup/Restore** options category. The default value is 7, which means that a standard LonMaker backup of the network drawing(s) and database is created every week by default. For networks created with a previous release of the LonMaker tool, you will be prompted as to whether to create a backup the first time you close the LonMaker drawing. The **Periodic Backup Options** box also includes a **Prompt before Creating Backup** check box that you can clear so that the LonMaker tool automatically creates the backup without prompting you. This option is selected by default.

Scheduling Backups with the Windows Task Scheduler

To schedule a regular backup of a network with the Windows Task Scheduler, you create a scheduled task that runs LonMaker.exe (in the LonWorks\bin directory). To create the task, follow these steps:

1. Open the Windows Task manager. Click **Start** on the taskbar, click **Run**, and the enter **C:\Windows\tasks**. The **Windows Task** dialog opens.
2. Double-click **Add Scheduled Task**. The Scheduled Task Wizard opens.
3. Click **Next**.
4. Under the **Application** column, locate and then click **LonMaker**. Click **Next**.
5. Modify the task name, if desired, and select how often you want the backup performed. Click **Next**.
6. Select the time, frequency, and date you want to begin running the backup task.
7. Optionally, you can enter a user name and password.
8. Select the **Open Advanced Properties** check box and then click **Finish**. The **Task Scheduler** dialog opens.
9. In the **Run** field, append the following to the command line: **/Backup=<network name>[/Quiet] [/DB||/Drawing]**. The following are explanations for the command line options.
 - **/Quiet**. Specifies that the network is to be backed up without any prompts.

- */DB*. Specifies that only the LNS network database is to be backed up (the default is to backup both the LNS network database and the drawing).
- */Drawing*. Specifies that only the LonMaker drawing is to be backed up.



Restoring a LonMaker Network

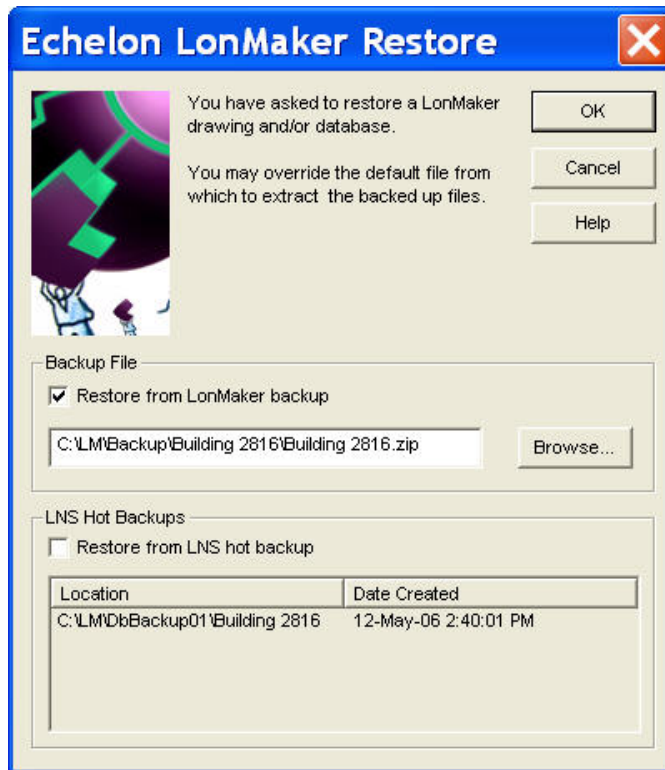
You can restore a LonMaker network from a standard LonMaker backup or a hot backup. If you restore a LonMaker network containing only a network database or a LonMaker drawing, the LonMaker tool replaces the current drawing file and/or database with the backup copy (unless the network does not already exist on a local client). If you restore a backup containing both components, the LonMaker tool replaces the existing files with the backup copies and then lets you open the LonMaker drawing to recommission any devices that have changed since the LonMaker network was backed up.

The following sections describe how to restore a network database backup (standard LonMaker backup or hot backup), a LonMaker drawing backup, and a full network backup containing both network database and LonMaker drawing files.

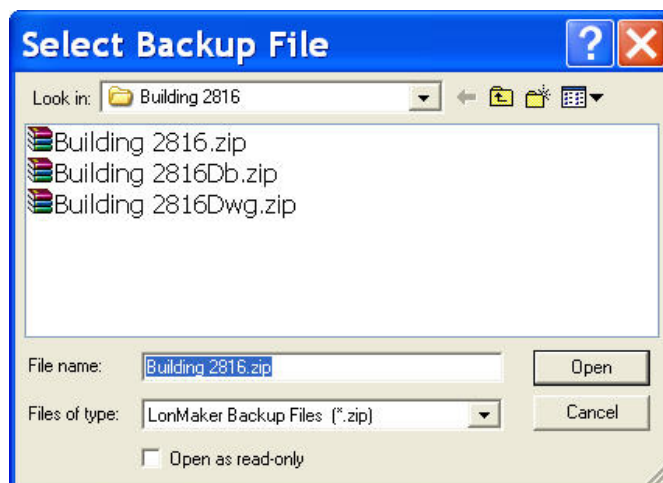
Restoring a Network Database Backup

To restore a network database backup, follow these steps:

1. Open the LonMaker Design Manager. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**.
2. Select the network database to restore from the **Database Name** list.
3. Click **Restore**. The **LonMaker Restore** dialog box opens, unless the currently selected network does not have any backups saved in the default location. In this case, proceed to step 4 in which the **Select Backup File** dialog opens.



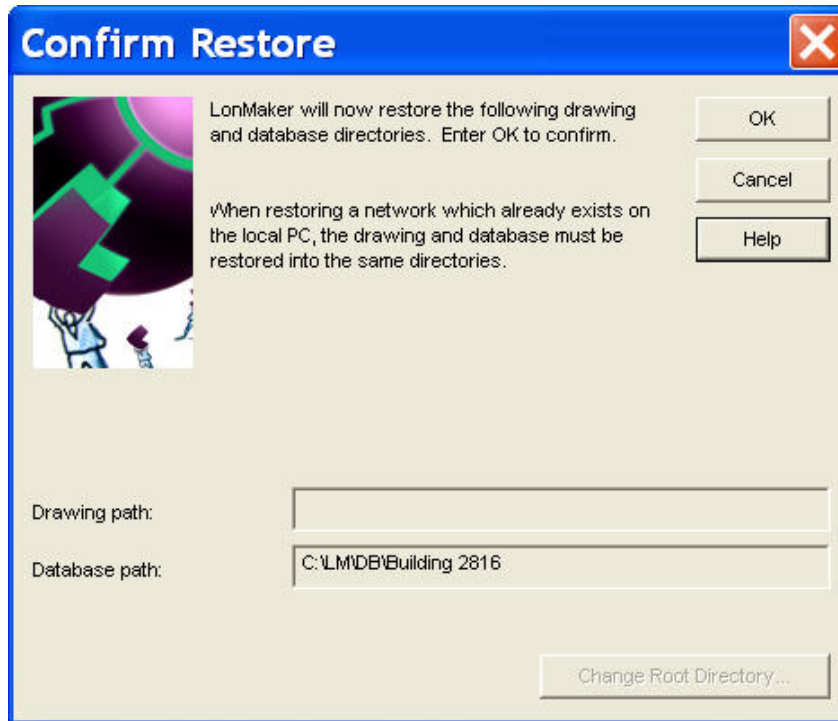
4. Select whether to restore a standard LonMaker backup or an LNS hot backup (backup made while the LNS Server is running).
 - If you select the **Restore from LonMaker Backup** checkbox, specify the backup you want to restore. By default, the last file containing both a network database and LonMaker drawing backup is selected (unless one does not exist). To select a network database backup, click **Browse**. The **Select Backup File** dialog opens. By default, LonMaker backup files are located in the C:\LM\Backup<network> folder. Select the LonMaker backup file (.zip extension) of the desired database backup (the database backup file names are in the following format by default: <network name>Db[_index].zip), and click **Open** or double-click the LonMaker backup file.



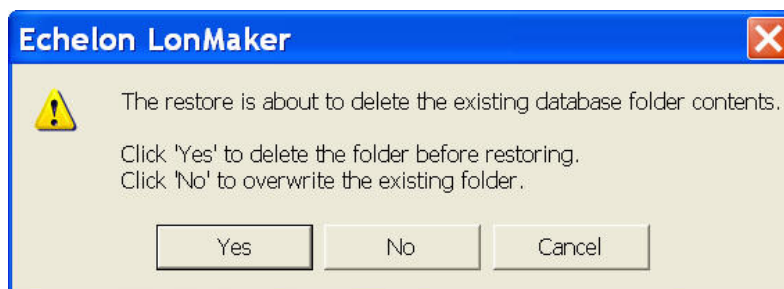
- If you select the **Restore from LNS Hot Backup** checkbox, select the LNS hot backup to restore. The LNS hot backups appear in the order they were created. By default, the first

LNS hot backup created is selected. To select a different LNS hot backup, click the file name of the LNS hot backup you want to restore.

5. Click **OK** in the **LonMaker Restore** dialog box.
6. The LonMaker tool checks for user privileges. If this LonMaker network is password protected (see *User Profiles* in Chapter 3, *Getting Started*), enter your user name and password. Your user profile must have the **Modify** privilege selected for the network object to restore a network. The **Confirm Restore** dialog box appears.



7. This dialog box displays the paths where the restored network database will be saved. You cannot change the directory if the database already exists on your computer. Click **OK**. A message will appear prompting you to select whether to delete or overwrite the existing directory.



8. Click **Yes** to delete the existing drawing folder before restoring the network, or click **No** to overwrite it. The database restore operation begins.
9. When the network database has been restored, the following message appears.



Note: When you open a network restored from a hot backup of the network database, a message may appear prompting you to resynchronize the LonMaker drawing to match the database. This occurs if changes were made to the drawing after the hot backup of the network database was created.

Restoring a LonMaker Drawing Backup

To restore a LonMaker drawing backup, follow these steps:

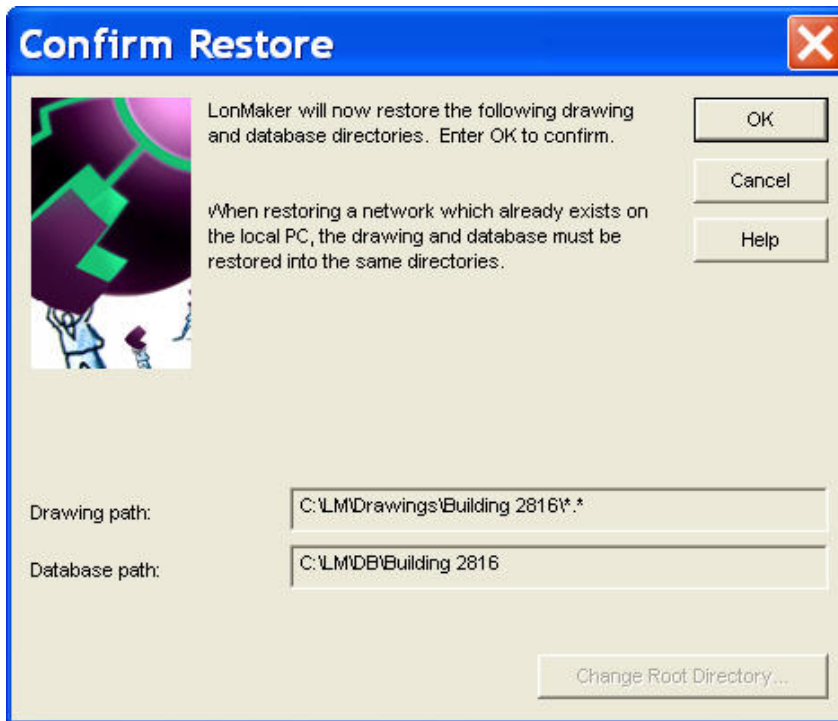
1. Open the LonMaker Design Manager. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**.
2. Select the LonMaker drawing to restore from the **Drawing Directory** list.
3. Click **Restore**. The **LonMaker Restore** dialog box opens, unless the currently selected network does not have any backups saved in the default location. In this case, proceed to step 6 to select the drawing backup to restore in the **Select Backup File** dialog.
4. Select the **Restore from LonMaker Backup** checkbox.
5. If there is no file containing both network database and LonMaker drawing backups, the **Select Backup File** dialog opens. Otherwise, click **Browse** to open this dialog.
6. Select the LonMaker backup file (.zip extension) of the desired LonMaker drawing to restore (the drawing backup files are in the following format by default: <network name>Dwg[_index].zip), and click **Open** or double-click the LonMaker backup file.
7. Click **OK** in the **LonMaker Restore** dialog box.
8. The LonMaker tool checks for user privileges. If this LonMaker network is password protected (see *User Profiles* in Chapter 3, *Getting Started*), enter your user name and password and then click **OK**. Your user profile must have the **Modify** privilege selected for the network object to restore a LonMaker drawing. The **Confirm Restore** dialog box appears.
9. Click **OK**. A message appears prompting you to select whether to delete or overwrite the existing directory.
10. Click **Yes** to delete the existing drawing folder before restoring the network, or click **No** to overwrite it. The drawing restore operation begins.
11. When the drawing has been restored, a message appears informing you that the drawing was restored successfully.

Restoring a Full Network Backup

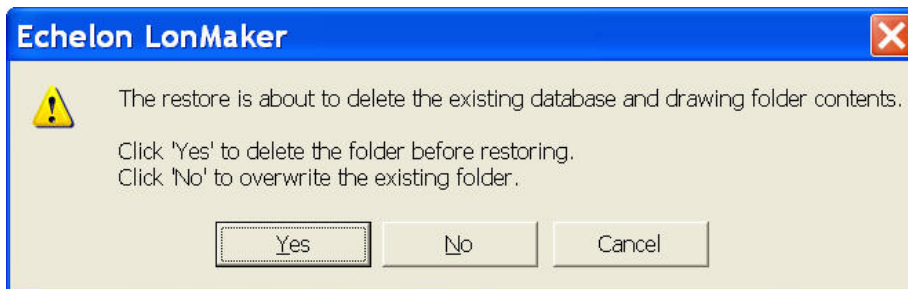
To restore a full network backup containing both the network database and LonMaker drawing files, follow these steps:

1. Open the LonMaker Design Manager. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**.
2. Select the network to restore by selecting either the database from the **Database Name** list or the LonMaker drawing from the **Drawing Directory** list.
3. Click **Restore**. The **LonMaker Restore** dialog box opens.

4. Select the **Restore from LonMaker Backup** checkbox.
5. By default, the last file containing both a network database and LonMaker drawing backup for the selected network appears in the **Restore from LonMaker Backup** box. To select a different LonMaker backup file (.zip extension), click **Browse**. The **Select Backup File** dialog opens. Select the LonMaker backup file to restore (the full network backup files are in the following format by default: <network name> [_index].zip), and click **Open** or double-click the LonMaker backup file.
6. Click **OK** in the **LonMaker Restore** dialog box.
7. The LonMaker tool checks for user privileges. If this LonMaker network is password protected (see *User Profiles*), enter your user name and password and then click **OK**. Your user profile must have the Modify privilege selected for the network object to restore a network. The **Confirm Restore** dialog box appears.



8. This dialog box displays the paths where the restored network drawing and database will be saved. You cannot change the directory if the database or the drawing already exists on your computer. Click **OK**. A message appears prompting you to select whether to delete or overwrite the existing directory.



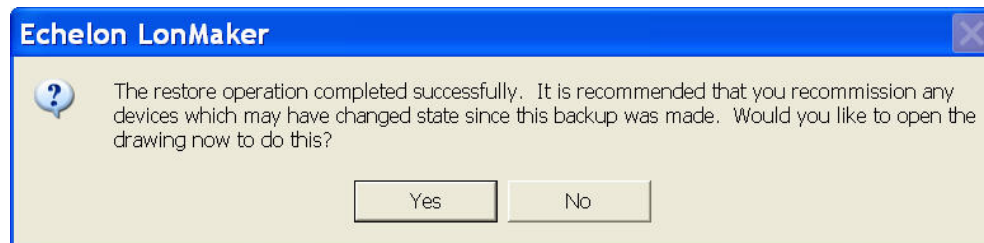
9. Click **Yes** to delete the existing drawing folder before restoring the network, or click **No** to overwrite it. The full network restore begins.

10. By default, the LonMaker tool will prompt you to select whether to install any new files in the Import folder (includes LONMARK resource files) and then any new files in the Types folder (includes XIF and .APB files) .

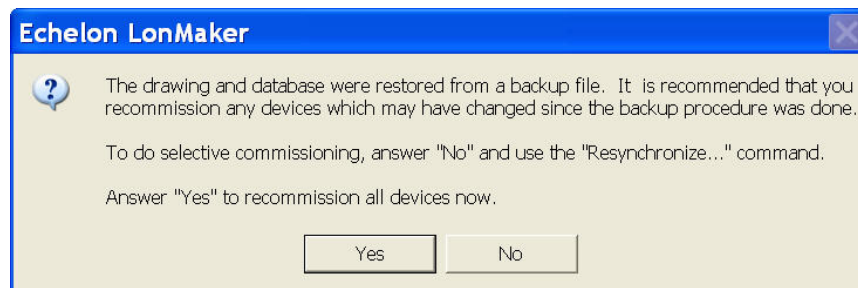
Click **Yes** to restore the files; click **No** to skip restoring the files; or clear the **Only Restore New Files** checkbox, select one or both of the **Overwrite Read-only Files** and **Overwrite more Recent Files** check boxes, and click **Yes**. The overwrite options will replace existing files with backup versions.

If you do not want to be prompted, in the network properties: **Backup/Restore** options category, you can set whether the LonMaker tool automatically installs the backup files in the Import and Types folders.

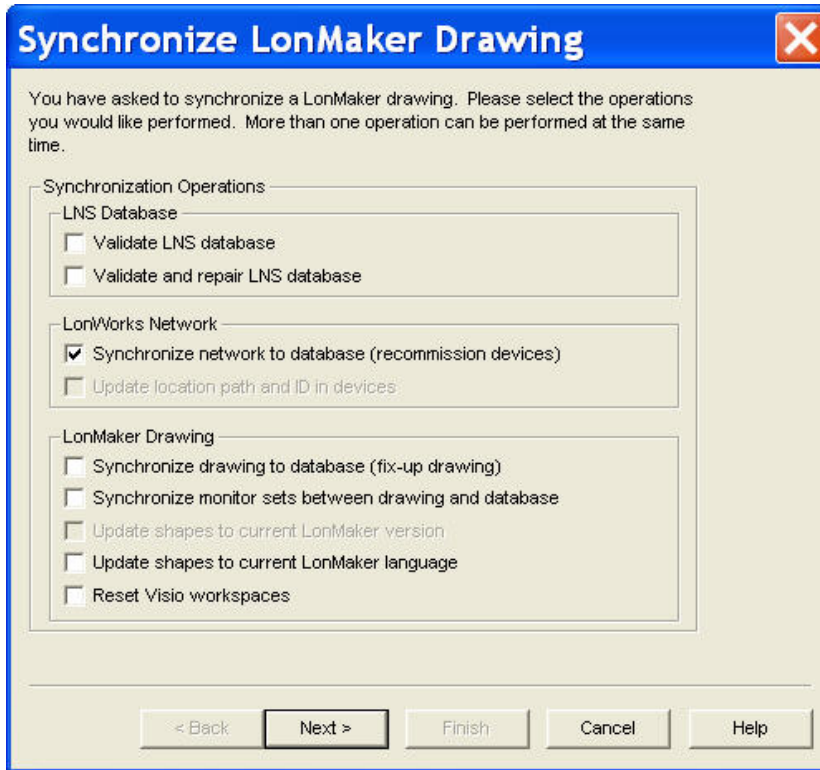
11. A message appears informing you that the network restore operation has been completed, and prompting you to select whether to open the LonMaker network in order to recommission devices that have changed since the network was backed up.



- Click **Yes** if you made *any* changes to the network since it was backed up. This prevents the network from behaving unpredictably if the LonMaker network design is not in sync with the physical devices.
 - Click **No** only if changes have not been made to the configuration of the existing physical devices on the network since it was backed up. This happens if the LonMaker tool was OffNet the entire time, or if you added new devices and functional blocks but did not modify any existing devices or functional blocks. The LonMaker drawing will not be opened.
12. When you open a LonMaker drawing after restoring the database from a backup file, a message appears recommending that you recommission devices that have changed since the network was backed up.



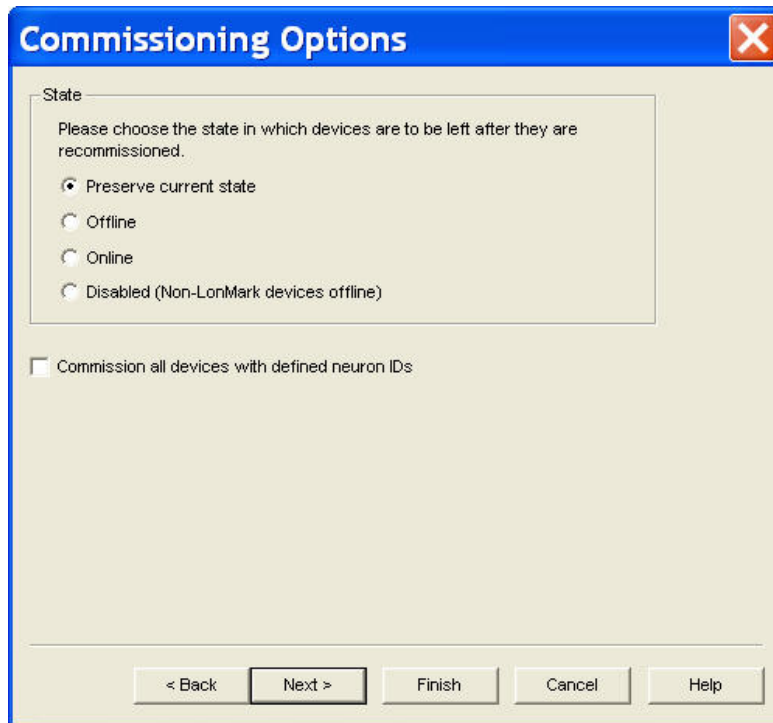
- Click **Yes** if you want the LonMaker tool to recommission all the devices in the network. The LonMaker tool opens the restored network and starts the Network Wizard.
 - Click **No** if you want to use the **Resynchronize** command after the drawing has been opened and select the desired scope of the recommissioning process. To recommission devices after the drawing has been opened, open the **LonMaker** menu, point to **Synchronization**, click **Resynchronize**, and follow steps 14–18.
13. Complete the Network Wizard by following the steps in *Opening an Existing LonMaker Network Design* in Chapter 3, *Getting Started*. The **Synchronize LonMaker Drawing** dialog box opens.



14. Click **Next** to next to accept the default synchronization operation, which is **Synchronize Network to Database** (the option for recommissioning devices). The **Choose Synchronization Scope** dialog opens.



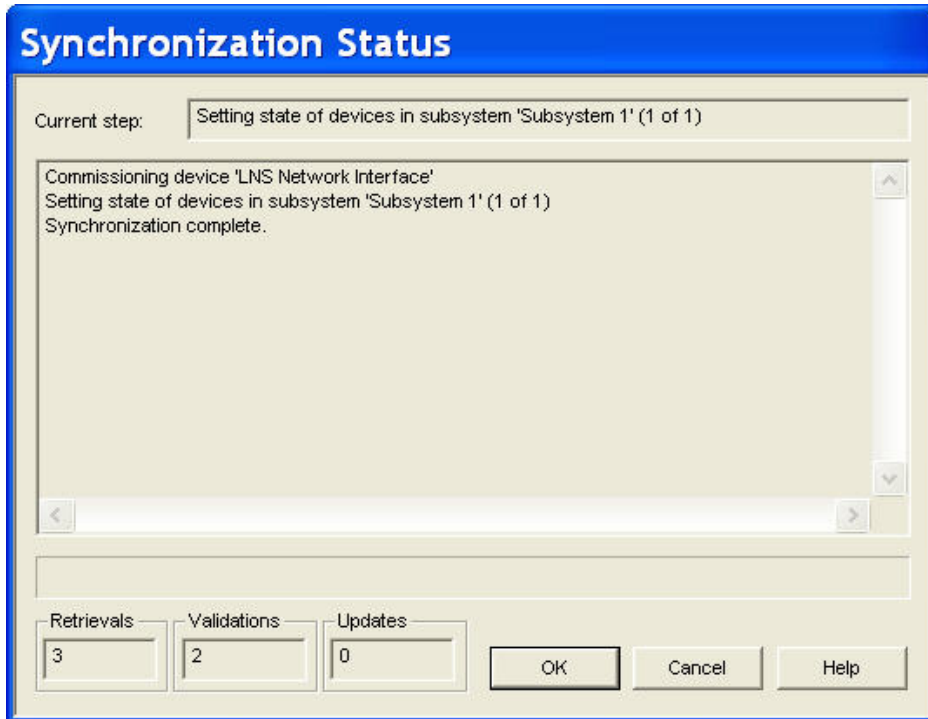
15. Click **Next** to accept the default synchronization scope (all the subsystems and drawing files in the network). The **Commissioning Options** dialog box opens.



16. Select the state of the devices after they have been recommissioned. You have four choices:
- **Preserve Current State.** The devices will be restored to the state they were in prior to being recommissioned. This is the default.
 - **Offline.** All devices will be left in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application. It is most common to set all device offline so the system may be recommissioned incrementally. Resetting a device in the offline state puts the device in the online state.
 - **Online.** All devices will be put in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been recommissioned, sending and responding to network and external inputs.
 - **Disabled.** All devices with a Node Object functional block will be disabled; all other devices will be placed offline. Selecting **Disabled** keeps the device's application disabled even if the device is reset.

Select the **Commission all Devices with Defined Neuron IDs** check box to commission all the previously commissioned devices as well as any unconfigured devices within the selected synchronization scope.

17. Click **Finish**. The **Synchronization Status** dialog opens.



18. This window displays the status of the resynchronization. Resynchronization events will be listed in the order they occur. Click **OK** when the resynchronization is complete. The resynchronization events, including any errors, are shown in the status pane and recorded in a log file (Resync.log). The resync log is stored in the drawing directory of the current LonMaker network.

Notes:

- Recommissioning a device may temporarily interrupt its operation. Recommission devices when the network can tolerate brief service interruptions.
- When recommissioning the network, the LonMaker tool is placed OnNet and it remains OnNet after the recommissioning process has been completed.
- If you defined and commissioned new devices in between backing up and restoring the network, recommissioning the network does not modify the new devices. You can redefine and commission those devices so that they communicate properly with existing devices after you have restored and recommissioned your network.

Recovering a LonMaker Network

You can recover a LonMaker network design from a physical network. The network recovery creates a new LonMaker drawing and LNS network database based on the devices recovered. This is useful for networks that were installed with legacy network tools not based on LNS; self-installed networks, including ISI networks; and LonMaker networks or networks installed with LNS in which the original network database has been lost.

To recover a network, follow these steps:

1. If you are recovering a network that was originally installed with a tool based on the LonManager API, you can use the LonManager CSV utility to create a comma-separated value (CSV) file from the LonManager database. This file will provide names from the LonManager database to enhance the recovery.

2. Ensure that all components of the network are present and functioning properly before starting recovery. Any missing devices or routers will cause portions of the network design to be missing. For example, if a router is not recovered, all devices on the router's far side will not be included in the recovered network design.
3. Run the LNS Network Database Recovery Wizard. The recovery wizard includes an option to automatically generate the LonMaker drawing.
4. Verify that the recovered network appears to be correct. The recovery wizard logs the recovery tasks as well as any errors that occurred in the detailed recovery log. A trace log lists the steps, with the times and dates, that the wizard took to recover the database. You can view the logs after the database has been recovered. These logs are useful for tracking any errors that the recovery process encounters, such as connection errors or lost data.
5. To actively manage the recovered network, change the management mode to OnNet (open the **LonMaker** menu, click **Network Properties**, click the **Network Interface** tab, and under the **Management Mode** box, select **OnNet**).

The following sections detail each of these steps. The subsystem recovery options that you can set in a LonMaker network design are also described. These subsystem recovery options help you recover your network in the event you lose the network design and all backups.

Subsystem Recovery Options

You can make your LonMaker network designs easier to recover and enhance a recovered network design by storing recovery data in the physical devices. You can store the subsystem ID of a device in its location string and its subsystem path in its **SCPTlocation** configuration property (if it has one). This recovery data is not part of the network configuration of a device.

When you recover a network, the following data is used in the listed order:

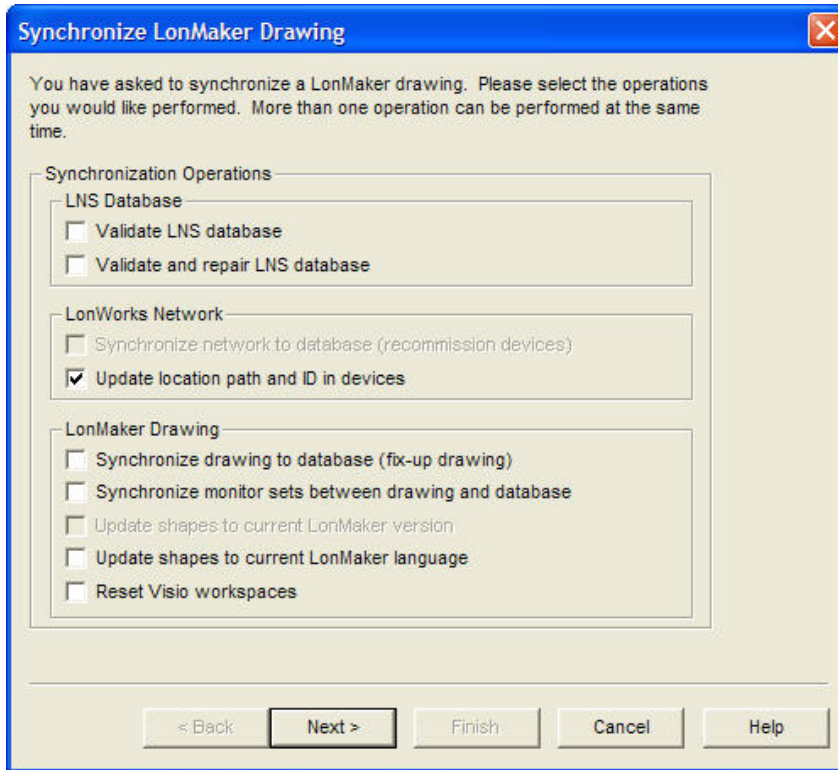
1. Subsystem path stored in a CSV file.
2. Subsystem path stored in a **SCPTlocation** configuration property that is associated with the Node Object, if present, or associated with the application device.
3. Subsystem ID stored in the location property (the most-significant bit of the first byte of the location string must be set).
4. The "Recovered" subsystem. A device is placed in a subsystem named "Recovered" if a CSV file is not imported or subsystem data is not included in the file, and the device does not have a valid subsystem ID or a valid **SCPTlocation** configuration property.

By default, both subsystem recovery options are enabled in new networks. For LonMaker network designs created with previous versions of the LonMaker tool, they are disabled. To enable the subsystem recovery options and update existing devices in a network, follow these steps:

1. Open the **LonMaker** menu and then click **LonMaker Options**.
2. Select **Recovery** in the **Options Category** list.
3. Select the check boxes under the **Subsystem Recovery Options** box. This will enable subsystem location data to be stored and updated in all future application devices and routers you create.

You can update the recovery data in the physical devices in a network after setting the subsystem recovery options and after recovering a network. To update the recovery data, follow these steps:

1. Open the **LonMaker** menu, point to **Synchronization**, and then click **Resynchronize**. The **Synchronize LonMaker Drawing** dialog opens.



2. Under **LonWorks Network**, select the **Update Location Path and ID in Devices** check box (this option is only available if at least one of the subsystem recovery options is selected). Click **Next**. The **Choose Synchronization Scope** dialog appears.
3. Select the subsystems and drawing files to update.
4. Click **Finish**. The **Synchronization Status** dialog opens and the LonMaker tool begins updating the subsystem data in the devices within the specified network scope.
5. When the synchronization operation has been completed, click **OK**.

Using Subsystem Paths

If you select the **Set SCPT Location Value to Subsystem Path** option, the LonMaker tool stores the subsystem path in the **SCPTlocation** configuration property of application devices when they are commissioned. The LonMaker tool automatically updates the subsystem path stored in **SCPTlocation** when the application device is moved. If you set the **Update all Devices when Subsystem Name is Modified** option in the network properties: **Recovery** options category to **Yes**, the LonMaker tool also automatically updates the subsystem path of the device when you move or rename its subsystem.

If you do not import a CSV file that includes the subsystem location data for an application device, the recovery wizard places application devices in the subsystem path specified in the **SCPTlocation** configuration property. If the device also has a subsystem ID, the recovery wizard will link the subsystem path to it so that all devices with same subsystem ID but no subsystem path can be placed in that subsystem path.

Tip:

To optimize the accuracy of the network recovery, keep subsystem paths under 32 characters. If you are storing subsystem IDs in the **SCPTlocation** configuration property of devices and you commission a device that has a subsystem path longer than 31 characters, the LonMaker tool truncates the subsystem path to fit within 31 characters. This may result in the recovery wizard losing part of the subsystem path, which may cause the device to be moved to a parent subsystem.

Using Subsystem IDs

If you select the **Set Location Property to Subsystem ID** option, the LonMaker tool stores the subsystem ID in application devices or routers when they are commissioned. The subsystem ID is equal to the lower 15 bits of a device's subsystem handle, and it appears as a 6-character ASCII or 12-digit hex string in the **Location** field of the **Basic Properties** dialog box. The LonMaker tool automatically updates the subsystem ID when you move the device. If you set the **Update all Devices when Subsystem Name is Modified** option in the network properties: **Recovery** options category to **Yes**, the LonMaker tool also automatically updates the subsystem ID of the device when you move or rename its subsystem.

The recovery wizard will place devices in the subsystem path specified by the subsystem ID if the following is true: you do not import a CSV file that includes the subsystem data; the device does not have a valid **SCPTlocation** configuration property; and no other devices that have the same subsystem ID have a valid **SCPTlocation** configuration property. In this case, the device will be placed in a subsystem named "Subsystem <subsystemID>".

If there are one or more discovered devices that have a subsystem ID or a valid **SCPTlocation** configuration property, the following occurs, listed in order of precedence:

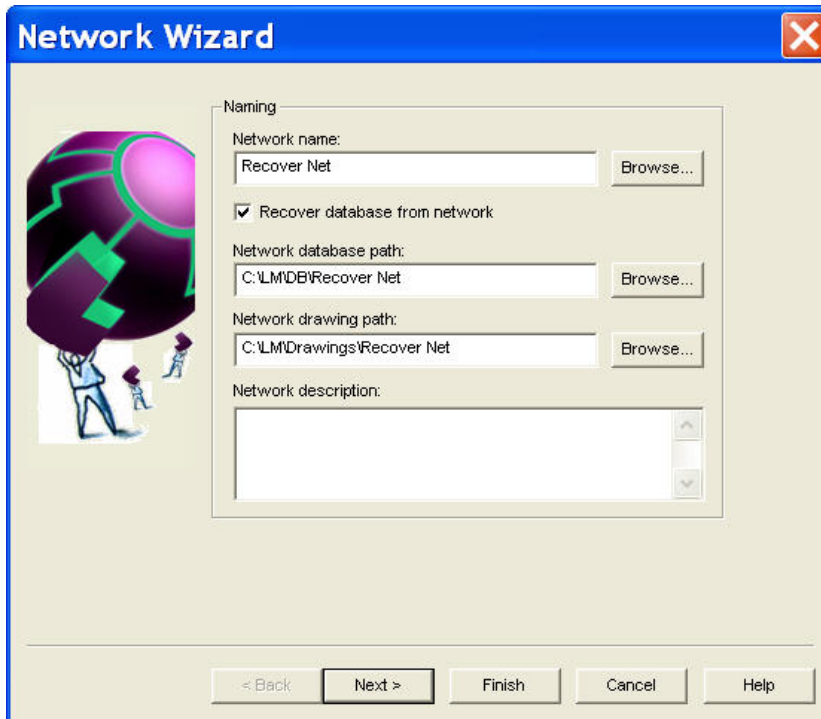
- A discovered device with the same subsystem ID but no valid **SCPTlocation** configuration property is placed in the subsystem path specified by the first **SCPTlocation** configuration property value discovered.
- A discovered device with the same **SCPTlocation** configuration property but no valid subsystem ID is placed in the subsystem specified by the first subsystem ID value discovered. If there is no discovered device that has a valid subsystem ID, all discovered devices with the same **SCPTlocation** configuration property are assigned the same new subsystem ID.

Based on this, if the LonMaker tool discovers both devices with the same subsystem ID but different **SCPTlocation** configuration properties and devices with the same **SCPTlocation** configuration property but different subsystem IDs, the LonMaker tool places the discovered devices in the subsystem path specified by the first valid **SCPTlocation** configuration property value discovered. The LonMaker tool then assigns the discovered devices the first subsystem ID value discovered. The LonMaker tool resolves any conflict that occurs in this scenario.

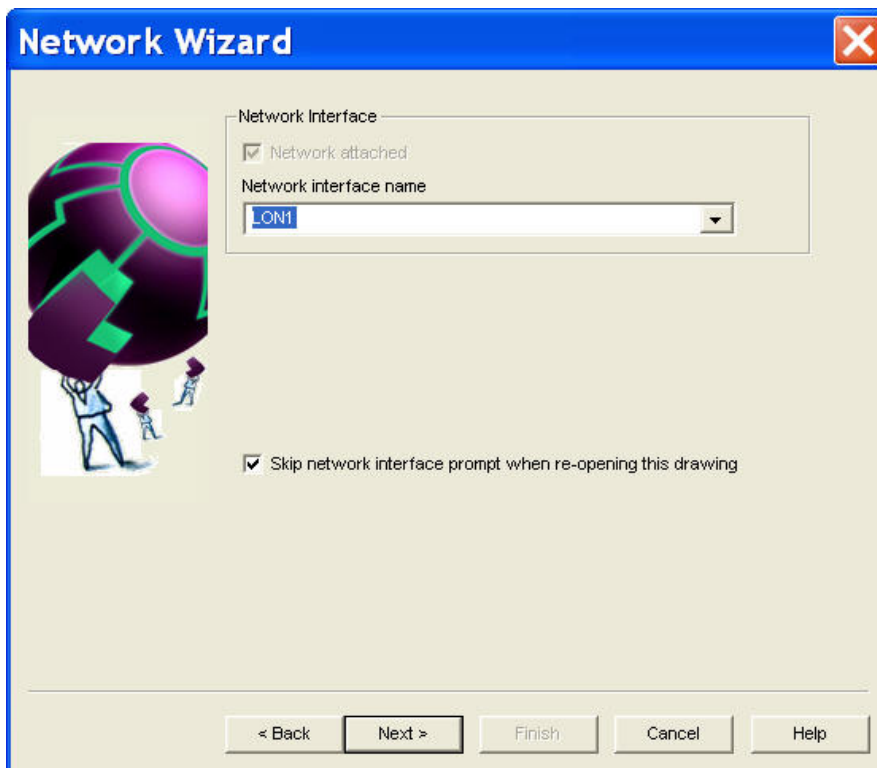
Using the LNS Database Recovery Wizard

To run the LNS Database Recovery Wizard in order to recover a network, follow these steps:

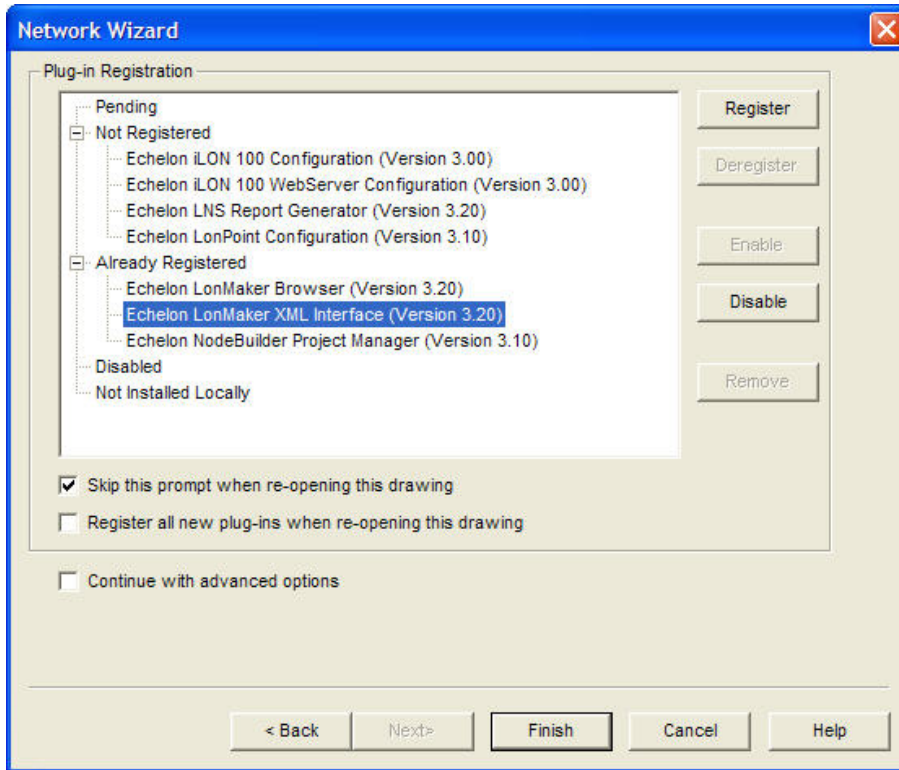
1. Click **Start** on the taskbar, point to **Programs**, point to **Echelon LonMaker**, and then select **LonMaker**. The **General** tab of the LonMaker Design appears.
2. Under **New Network**, select the **Show all Options** check box and then click **Create Network**. The LonMaker tool opens the new network, the Network Wizard opens, and the Naming page appears.



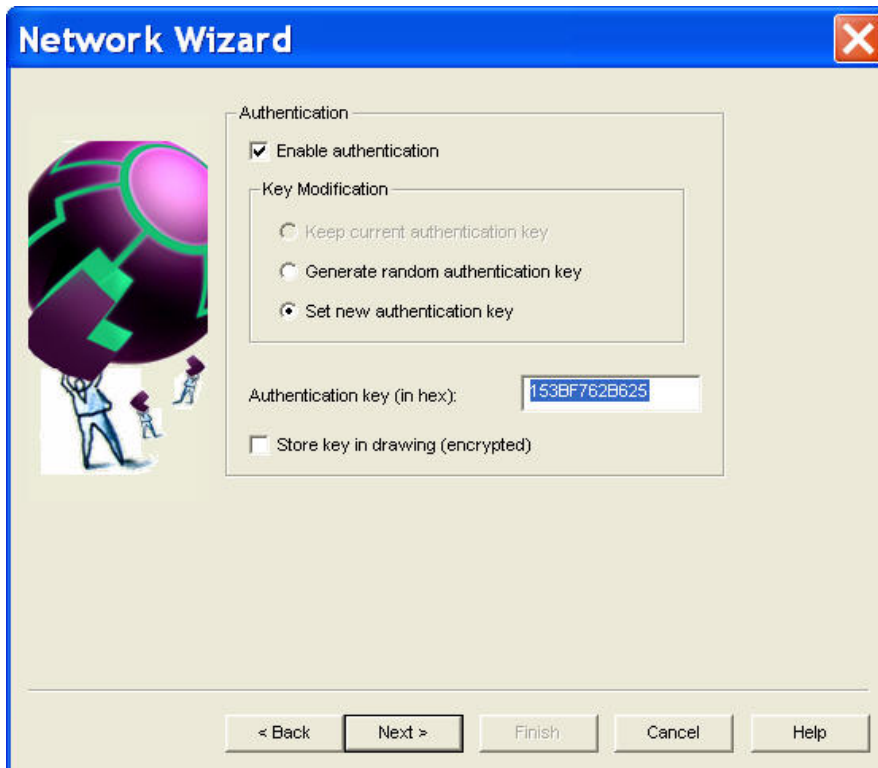
3. Enter a unique network name, and select the **Recover Database from Network** check box. Click **Next**. The Network Interface page appears.



4. Select the **Network Interface** and click **Next**. The Plug-In Registration page appears.

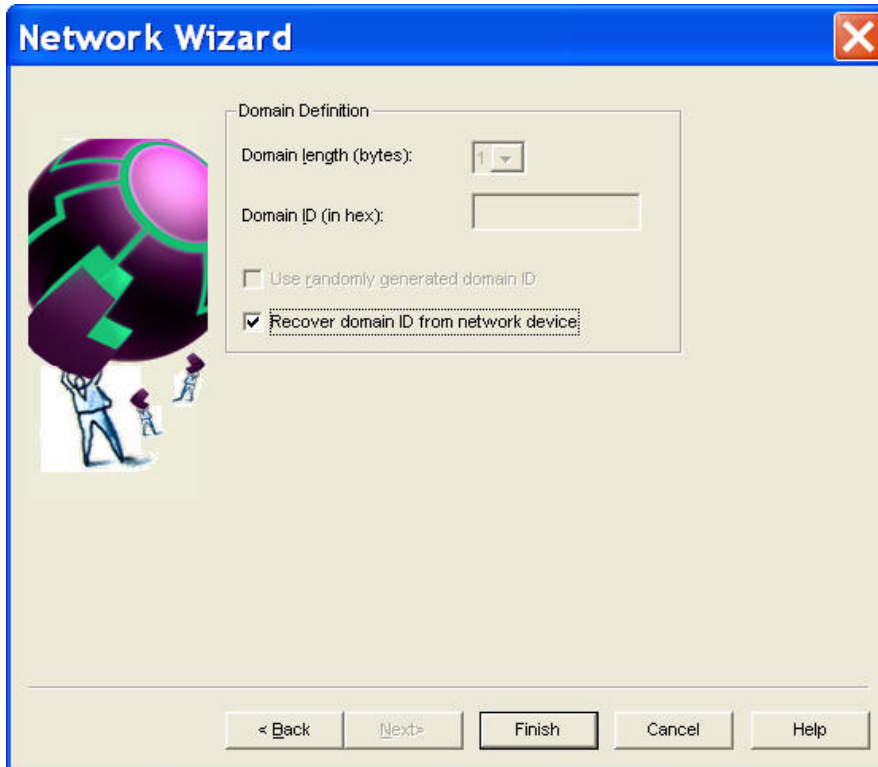


5. Register or disable plug-ins as desired and click **Next**. The Authentication window appears.

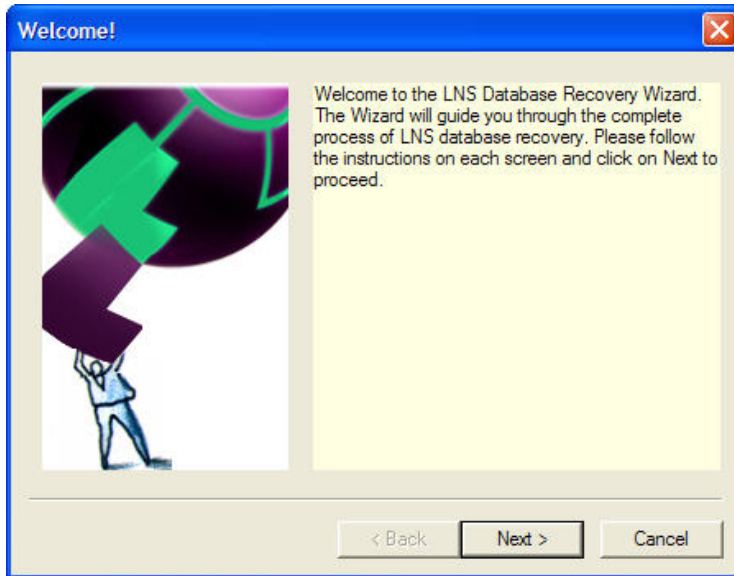


6. If you use authentication on your network, select the **Enable Authentication** check box and click **Set New Authentication Key**. Enter the correct authentication key for your network (the

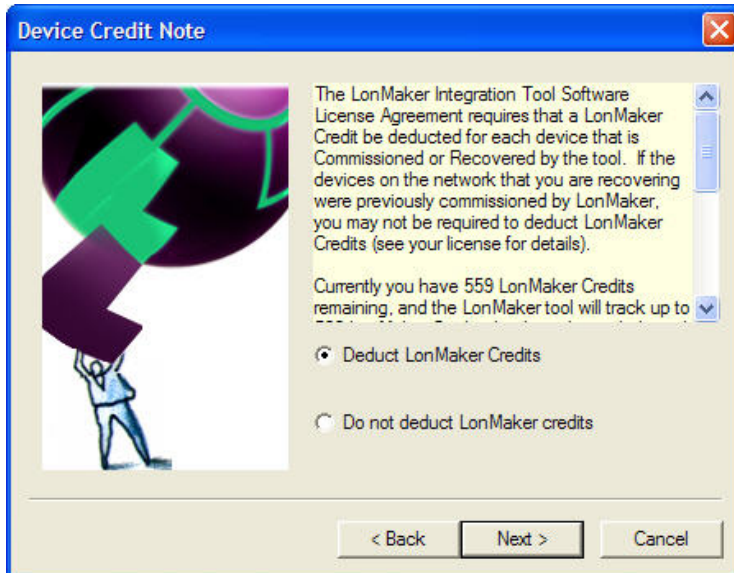
LonMaker tool cannot recover your database without the authentication key). Click **Next**. The Domain Definition window appears.



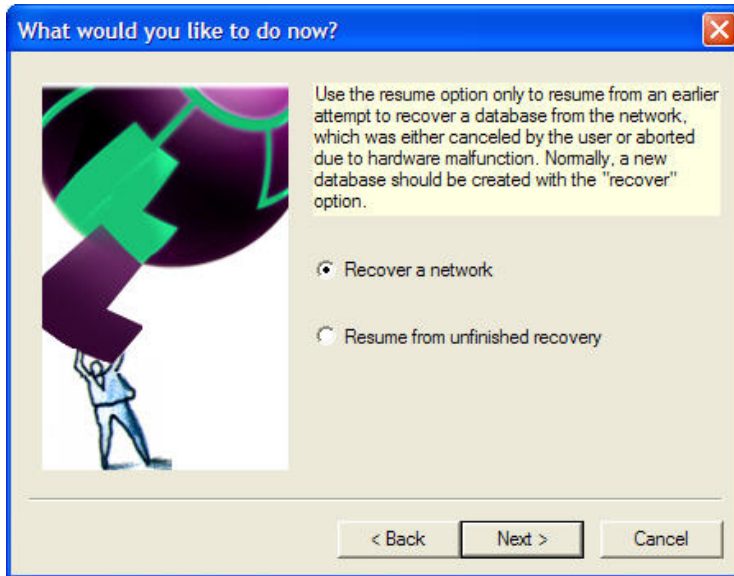
7. If you know the Domain ID of the network that you want to recover, enter it in hexadecimal format into the **Domain ID** box. If you do not know the Domain ID, select the **Recover Domain ID from Network Device** check box. To recover a domain ID, you must have access to the service pin of an unauthenticated device that is on the same channel as the network interface.
8. Click **Finish**.
9. If you selected the **Recover Domain ID from Network Device** check box, the **Service Pin** dialog box appears. Press the service pin on one of the unauthenticated devices that are on the same channel as the network interface.
10. Click **OK**. The Database LNS Database Recovery Wizard opens.



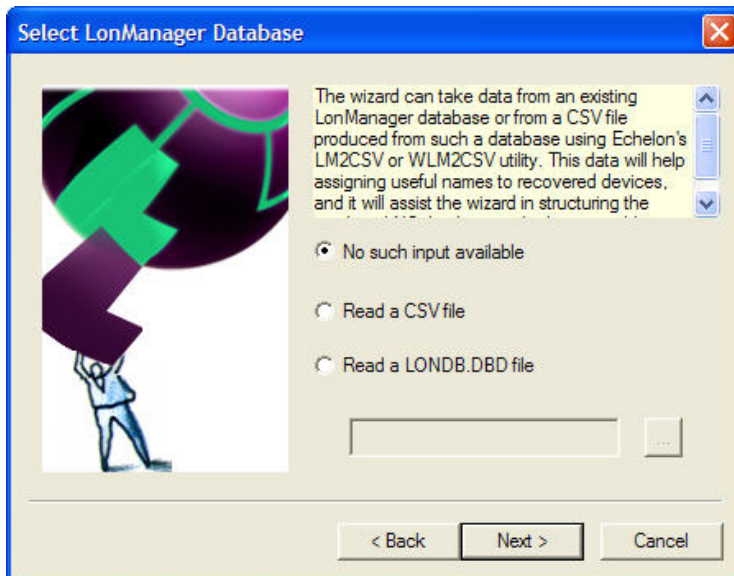
11. Click **Next** to continue. The **Device Credit Note** dialog box appears.



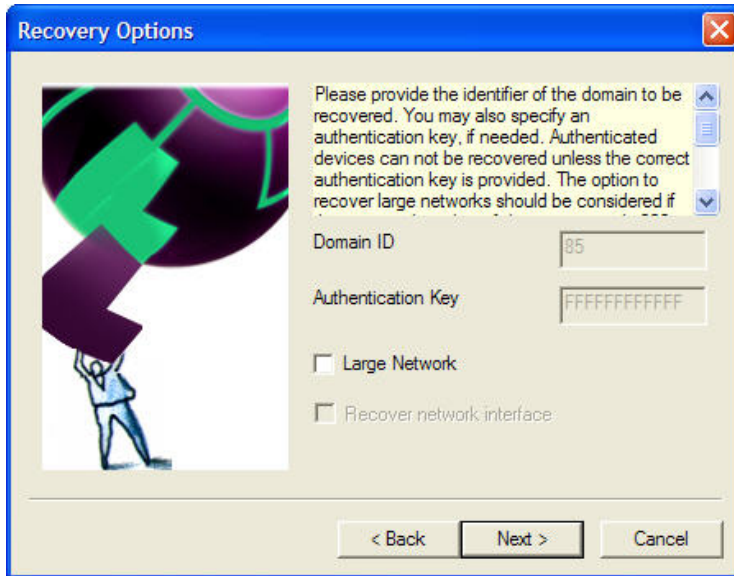
12. Select whether LonMaker credits are to be deducted for application devices that are recovered. Select **Deduct LonMaker Credits** if the devices on the network that you are recovering were not commissioned previously with the LonMaker tool. Select **Do Not Deduct LonMaker Credits** if the devices on the network were commissioned previously with the LonMaker tool. Click **Next**. The **What Would You Like To Do Now?** dialog box appears.



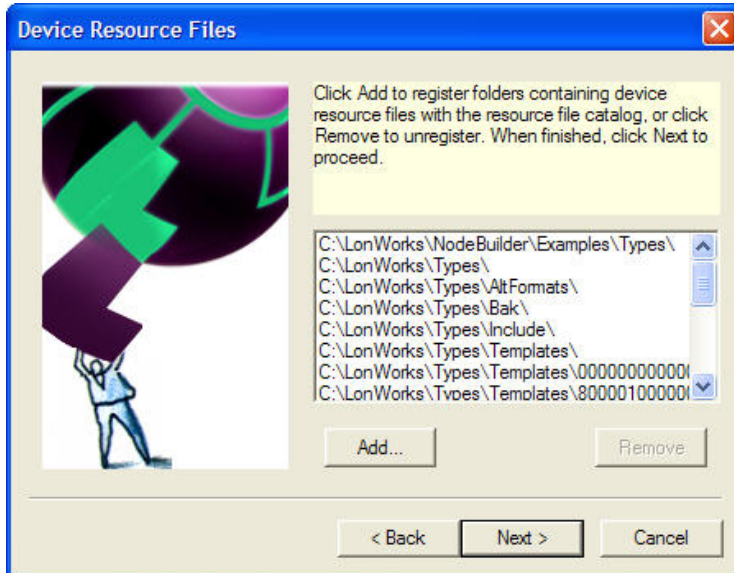
13. Click **Recover a Network** and click **Next**. The **Select LonManager Database** dialog box appears.



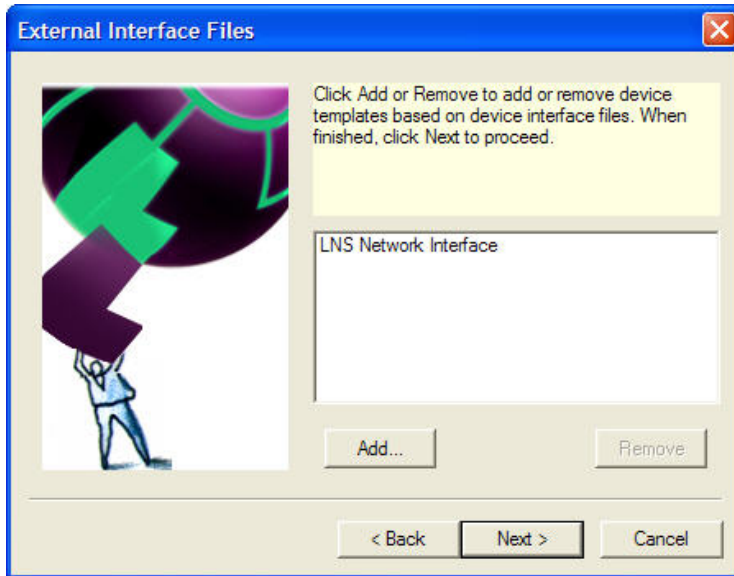
14. If you have a LonManager database or CSV file, select the corresponding option; otherwise, click **No Such Input Available**. Click **Next**. The **Recovery Options** dialog box appears.



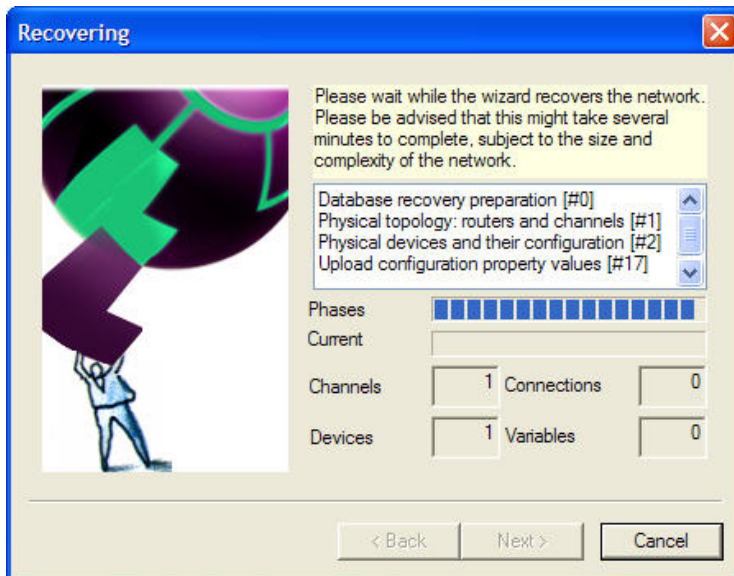
15. If you expect your network to have more than 200 devices, select the **Large Network** check box. The **Domain ID** and **Authentication Key** boxes are read-only, as these settings are determined by the input from step 6. Click **Next**. The **Device Resource Files** dialog box appears.



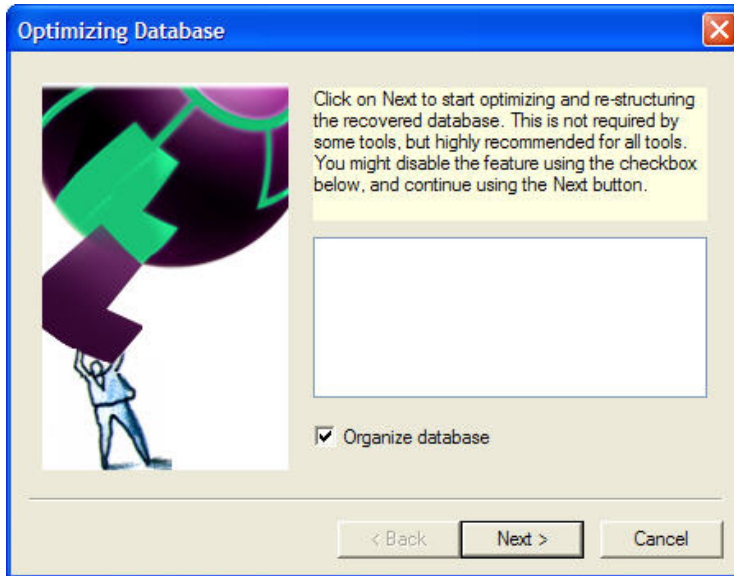
16. Before proceeding, check if any LONMARK resource files are contained in directories not displayed in this dialog box. If there are any such LONMARK resource files, create a new folder in **C:\LONWORKS Types\User** and then copy the LONMARK resource files to it. To add the device resource files, click **Add**, and then select the folders containing the device resource files and click **Open**, or double-click the folders. Click **Next** when all desired folders containing the device resource files are displayed. The **External Interface Files** dialog box appears.



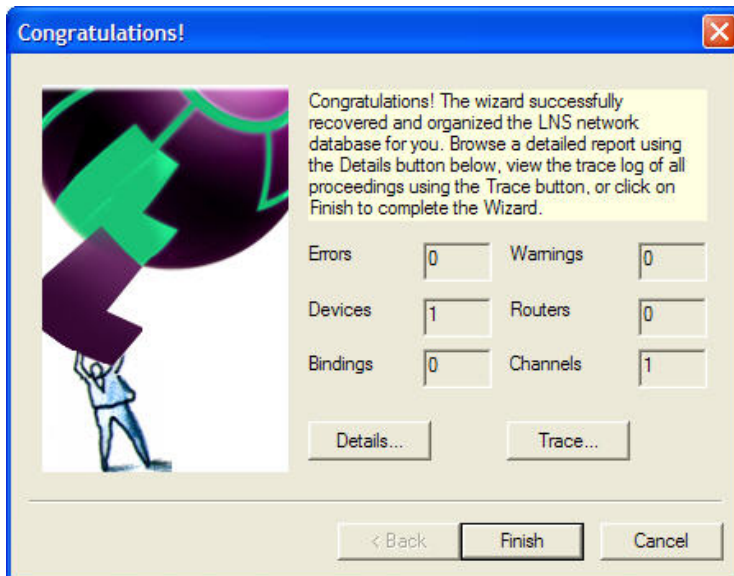
17. Add or remove device templates based on device interface (XIF) files. When finished, click **Next**. The **Recovering** dialog box appears.



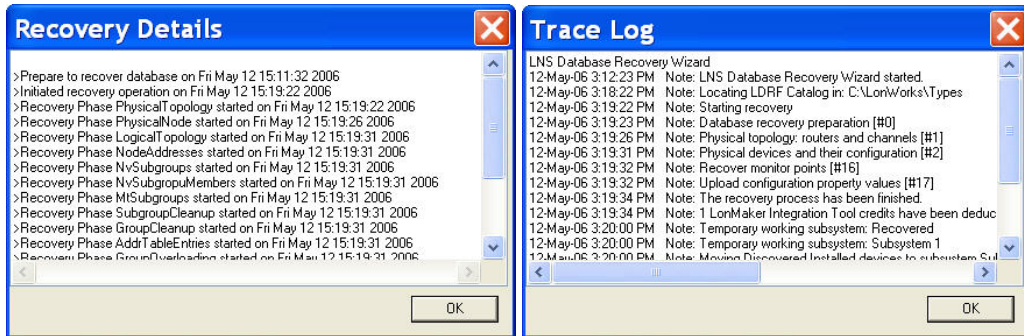
18. Click **Next** to begin the network recovery. The time of the recovery process depends on the size and complexity of the network. Throughout this process, messages will appear. When the data recovery is complete, the **Optimizing Database** dialog box appears.



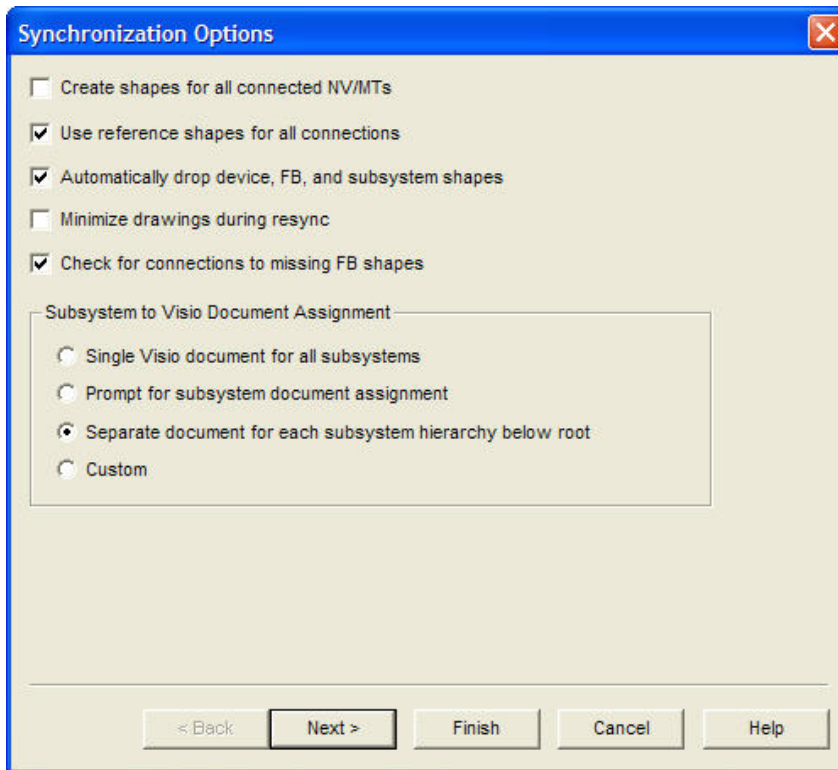
19. Select the **Organize Database** check box and click **Next**. Throughout this process numerous messages will appear. When the database organization is complete, a **Congratulations** dialog box appears.



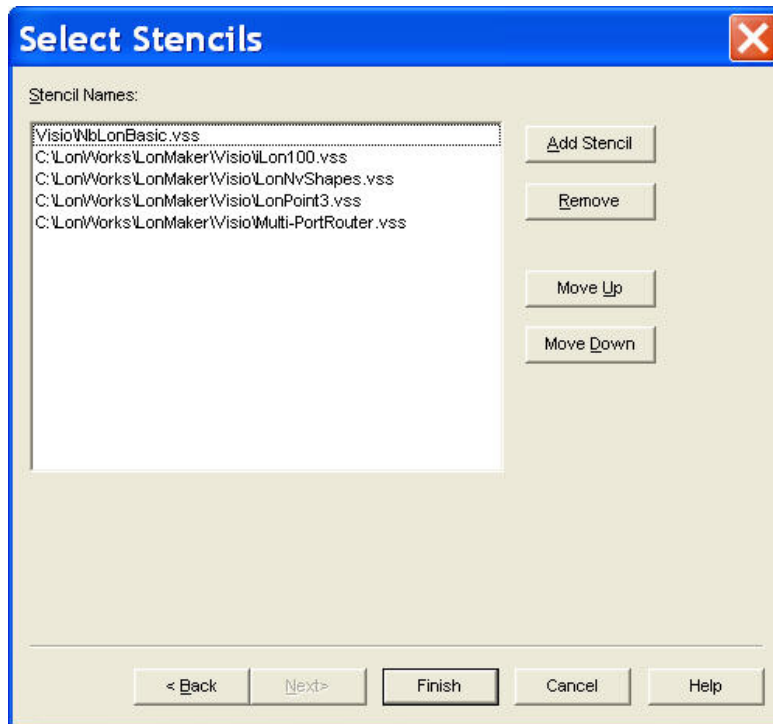
20. The **Congratulations** dialog box displays the number of errors and warnings, and the number of devices, bindings, warnings, routers, and channels found. This window provides valuable information to help you validate your LonMaker network design after it has been synchronized. Verify that the number of devices, routers, bindings, and channels found match your physical network.
21. If there are any errors or warnings, click **Details** to view the recovery log listing each recovery phase initiated and any problems encountered. Investigate any errors before you set the final network design OnNet. You should also research warnings, but they are not considered as serious as errors. Click **Trace** to view the trace log listing the steps taken by the LNS Database Recovery Wizard to recover your network. The trace log file is placed in C:\LM\Db*< network >* or in the network database path you specified in the naming window of the Network Wizard.



22. Click **Finish** to continue. The **Synchronization Options** dialog box appears.



23. Select the **Automatically Drop Device, FB, and Subsystem Shapes** check box to automatically add the appropriate shapes from the stencils to the drawing. You can clear the **Create Shapes for all Connected NVs/MTs** check box to simplify the drawing (alternatively, you can add the connection shapes and then hide them temporarily as described in *Hiding and Showing Connector Shapes* in Chapter 4, *Designing Networks*. Select the **Use Reference Shapes for all Connections** check box to prevent a drawing with many connections from becoming too complex. Click **Next**. The **Select Stencils** dialog box appears.



24. Add, remove, or re-order stencils. Click **Finish**.
25. The **Synchronization Status** dialog box appears as the synchronization process begins. It then displays the progress of the synchronization. Once “Synchronization Complete” appears, click **OK** to open your LonMaker network.
26. Verify that your LonMaker drawing accurately represents the network. Ensure that all devices on the physical network and all the connections between the devices appear on the drawing. You can refer to the trace log created during the synchronization process. The trace log file is located in C:\LM\Db*<network>* or in the network database path you specified in the naming window of the Network Wizard. Make changes to your LonMaker network, if necessary, until it matches the physical network.
27. Compare the recovered LNS network database to your expected results. Because network recovery occurs while the LonMaker tool is OffNet, required changes to device configuration properties are stored in the LNS network database instead of being propagated to the network. Once you have checked the recovered LNS network database and validated your LonMaker network design, change the management mode to OnNet. To do this, Open the **LonMaker** menu, click **Network Properties**, click the **Network Interface** tab, and under **Management Mode**, select **OnNet**. If changes to device configurations are required, the LonMaker tool will prompt you to resynchronize the network with the LNS network database (recommission devices).

Network Recovery vs. Database Backup

Even though you can use network recovery to rebuild an entire network database, you should not use recovery as a replacement for backing up your LonMaker network design. A backup is faster, more accurate, and more reliable than using network recovery. You should therefore regularly backup your LonMaker network design as the primary means of protecting against drawing and database loss. If your application warrants greater protection, you can use a redundant array of independent disks (RAID) for the LNS Server. For maximum performance and reliability, use a RAID 5 disk array.

Some of the advantages of regularly performing database backups over using network recovery are as follows:

- **Speed.** Creating and restoring a LonMaker backup file is much faster than recovering a network. To recover the network, the LNS Server must scan the network to discover all the devices, upload a small portion of the overall network configuration stored in each device, and then create a drawing and network database based on the data collected from the physical devices. This data collection and reconstruction process generally grows with the complexity of the network (the more devices, network variables, channels, and connections in a network, the more complex the network is considered to be).
- **Accuracy.** Recovery only recovers attributes and properties stored in the devices themselves; information that is not stored in devices, such as device names and the specified hubs and targets in connections, may not be recovered.

Recovery may fail to create an exact duplicate of the original database. Specifically, if you compare a recovered database to the original database, there will be differences because there are many objects, properties, and attributes that cannot be identified uniquely and unambiguously. For example, the handles assigned to devices, routers, and so on will probably differ, and connection hubs and targets may change.

Recovery may also be incomplete if the network itself is inconsistent. A network may become inconsistent if, for example, some of the devices have failed, or if the network tool failed while updating the configuration of a series of devices. In such a case, some devices would contain new configuration data while others would have the old data. When recovering this network, the LonMaker tool will not be able to distinguish the new configuration data from the old.

- **Reliability.** Although recovery is designed to be as reliable as possible, the successful recovery of a given network depends on that network being fully functional, properly configured, and not saturated by regular network traffic. Additionally, authentication can prevent parts of a network from being recovered.

In the event you cannot restore a network from a database backup or your LNS database and LonMaker drawing files are lost, you can use recovery. However, the following inconsistencies may result in changes to network variable and address table entry configurations:

- If a bound source network variable does not have any associated source or target, it is marked as unbound and removed from the associated connection.
- If a bound dedicated message tag does not have any targets, its address table entry is marked as empty and removed from the associated connection.
- Any address table entries that are not associated with a network variable or message tag (source or target) are marked as empty. A lost source or a lost target may create this scenario. Group use counts are updated as necessary, and group IDs are freed as necessary.
- When recovering a network, the LonMaker tool cannot determine which network variables are hubs and which ones are targets. These relationships are arbitrarily assigned.
- Because the hub and target relationships may change, the recovery may not accurately restore all connection descriptions. If the recovery is unable to determine the correct connection description for a connection, it uses the default connection description.

Resynchronizing a LonMaker Network

You can resynchronize a LonMaker drawing and the physical devices in a network with the LNS network database. The LonMaker tool keeps a LonMaker drawing and its network database synchronized by tracking and processing LNS events. In the case where multiple LonMaker users are simultaneously accessing the same network database, it uses an event log that keeps all copies of the LonMaker drawing synchronized with the LNS network database and with each other.

A LonMaker drawing and its network database, though, can lose synchronization due to a hardware or software failure. When the LonMaker tool detects that a LonMaker drawing and its network database have lost synchronization or that an inconsistency exists in the drawing, it will automatically try to

resynchronize the LonMaker drawing to the network database. This resynchronization will be transparent, except that you may notice a slightly lower response time during the resynchronization.

However, the automatic resynchronization may fail or other scenarios may occur in which you need to manually resynchronize the network. For example, some types of changes to the LNS network database by an LNS application other than the LonMaker tool, an improperly saved drawing, or deleted entries in the LonMaker event log can cause a LonMaker drawing to lose synchronization with its LNS network database. You may also need to manually resynchronize physical devices with the LNS network database (to recommission all the devices on the network, for example).

The following sections describe how the LonMaker tool automatically keeps a LonMaker drawing synchronized with its network database when one or more users are making changes to the drawing and how to manually resynchronize the physical network, network database, and the LonMaker drawing when automatic resynchronization fails.

Automatic LonMaker Drawing Synchronization

You can make changes to a LonMaker drawing at the same time that another user is modifying the network, even if the other user is modifying the same drawing page as you. The LonMaker tool uses LNS events and the LonMaker event log described in the following sections to keep the LonMaker drawings synchronized with the LNS network database and with each other. The LonMaker drawings will remain synchronized even as multiple users and applications access and modify the drawings and the network database.

The LNS events and LonMaker event log events enable multiple LonMaker users to stay synchronized, even if they are not operating at the same time. For example, if two users start working on a network and one of the users shuts down their computer to move to another location while the other user continues to work, the first user's LonMaker tool will automatically pick up all changes created by the other user once the first LonMaker tool is restarted—even if the other user is no longer using the LonMaker tool.

While it is possible for multiple users to be modifying the same page of a LonMaker drawing at the same time, if the users are working in the same subsystem, it is possible for one user to delete a LonMaker object that the other user is trying to modify at the same time. As a result, multiple users will typically be more productive if they are working in different subsystems.

LNS Event Tracking

The LonMaker tool uses LNS events to detect changes to a LonMaker drawing made by LNS applications other than the LonMaker tool, as well as changes in the status of devices as reported by the LNS server. Actions tracked exclusively by LNS events consist of detecting and commissioning application devices and routers. LNS events track other actions that are also tracked in the LonMaker event log described in the next section. These actions include upgrading application devices; creating application devices, routers, subsystems, and connections; deleting application devices, routers, and connections; and renaming application devices, routers, functional blocks, and subsystems. The LonMaker tool can only process LNS events if it is active when the events are generated.

LonMaker Event Log

The LonMaker tool stores every change made to a LonMaker drawing by every user in a log called the *LonMaker event log*. The LonMaker event log is kept in the LNS database so that all LonMaker tools on a network can view the events logged by all other LonMaker tools on the same network—including tools that are not active at the same time. All LonMaker tools check the log when they open a LonMaker drawing and periodically thereafter (every 10 seconds by default), and update their copies of the LonMaker drawing based on the log entries. The LonMaker event log stores up to a fixed number of entries per drawing file (100 by default). Once the limit is reached, older entries will be deleted to enable new entries to be added.

You can change the defaults for how frequently your LonMaker tool checks the LonMaker event log, and the maximum number of entries it stores in the log. To change the default synchronization settings, select the network properties: **Synchronization** options category.

Additional benefits of the LonMaker event log are that it can be used by the LonMaker tool to restore your work if your computer fails while you are updating a drawing, and it can reduce the number of times that you need to resynchronize a LonMaker drawing. You may still need to resynchronize if applications other than the LonMaker tool make changes to the LNS database that affect a LonMaker drawing but are not reported by LNS events, or if log entries are deleted.

You can view the LonMaker event log, and you can export it to an XML file.

Viewing the LonMaker Event Log

You can view the LonMaker event log to see a summary of the changes made by LonMaker users to the objects and subsystems in a LonMaker network. To view the LonMaker event log, open the **LonMaker** menu, point to **Synchronization**, and then click **Display Event Log**.

Date/Time	Document	Seq#	User	Event	Object Type	Subsystem	Object Name
2006/05/12 15:12:05	<Global Event>	1	[1]	Created	Document	<Subsystem Root>	RECOVER NET
2006/05/12 15:12:06	RECOVER NET	1	[1]	Created	Subsystem	<Subsystem Root>	Subsystem 1
2006/05/12 15:12:12	RECOVER NET	2	[1]	Created	Channel	Subsystem 1	Channel 1
2006/05/12 15:12:14	<Global Event>	2	[1]	Renamed	AppDevice	<Subsystem Root>	LNS Network Interface
2006/05/12 15:23:10	RECOVER NET	3	[1]	Created	Channel	Subsystem 1	Channel_2

You can sort the LonMaker event log by any of the column headers. To sort by a column header, click the header. Click the header again to toggle the order (ascending or descending) in which the data in that column is listed.

The columns contain the following data:

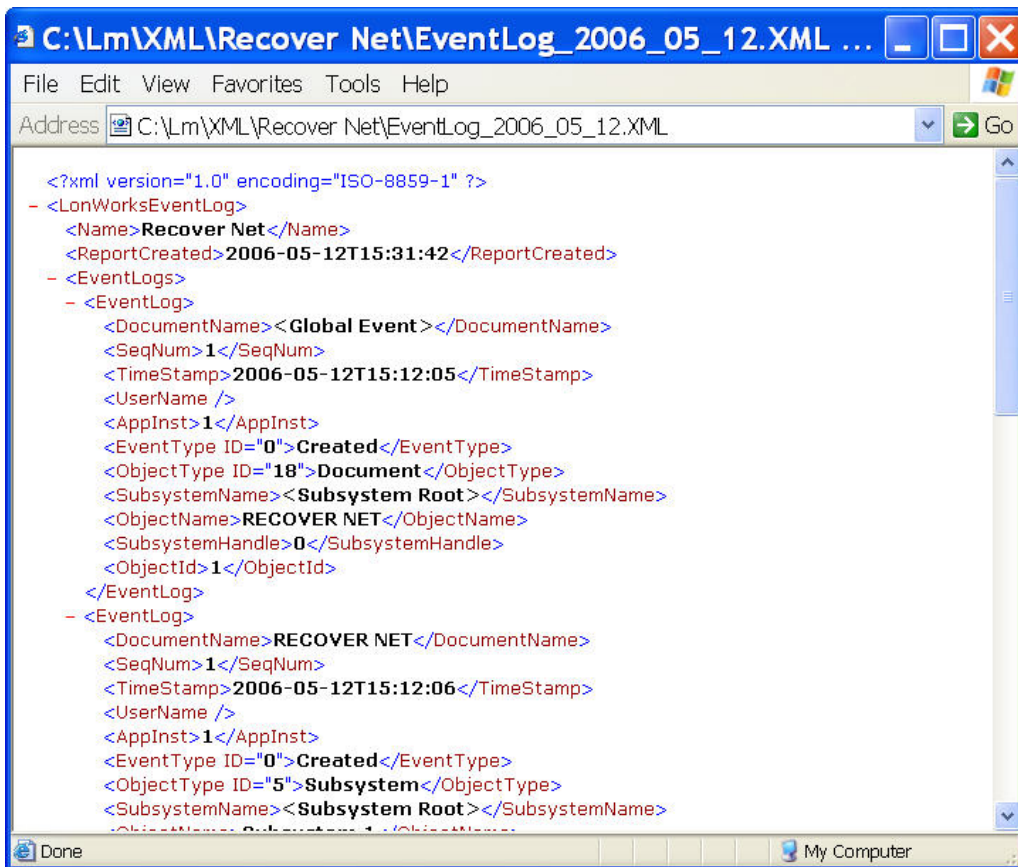
- *Date/time.* The date and time the event occurred. By default, the LonMaker Event Log lists the changes by date/time in ascending order.
- *Document.* The name of the document in which the change occurred.
- *Sequence #.* The sequence number of the event. Each LonMaker drawing has its own sequence numbers.
- *Event.* The type of event that occurred.
- *User name.* The user name, or if not specified, the application instance (in square brackets).
- *Object Type.* The type of the object affected by the event.
- *Subsystem.* The subsystem in which the event occurred.
- *Object name.* The name of the object affected by the change. If the object is no longer defined in the LNS database, its handle will be listed.

Exporting the LonMaker Event Log

You can export the LonMaker event log to an XML file to work with the log information in another application. To export the LonMaker event log to an XML file, open the **LonMaker** menu, point to **Synchronization**, and then click **Export Event Log**. A message appears stating that the LonMaker event log has been successfully exported, and displaying the full path of the XML file. The XML file will be exported to `C:\XML\<network name>\EventLog_year_month_date_[version]`.



To view the exported LonMaker event log, find the XML file in `C:\XML\<network name>` and double-click it. The file opens in your default XML viewing application, which is Internet Explorer unless you change it. You can also open the XML file from a text or XML editor or report generator.



The exported XML version of the LonMaker event log contains the following information for each log entry.

- *DocumentName*. Name of the LonMaker drawing in which the event occurred.
- *SeqNum*. The unique ID (within the LonMaker drawing) of the event.
- *TimeStamp*. Date and time at which event occurred in the format *year-month-date-time*.
- *UserName*. The user who generated the event.

- *AppInst.* The instance of the LonMaker application that generated the event.
- *EventType ID.* The type of event that occurred (for example, created, deleted, renamed, shape moved, connection added).
- *ObjectType ID.* The type of object modified by the event (for example, AppDevice, Channel, Router, Subnet, NSI, Subsystem, Device template, LonMark Object).
- *SubsystemName.* The name of the subsystem in which the object is defined. This field can be empty if the object spans multiple subsystems (for example, channels), or if the subsystem no longer exists.
- *SubsystemHandle.* The handle of the subsystem in which the object is defined. Can be 0 for objects that span multiple subsystems.
- *ObjectName.* The name of the object that was modified. If the object no longer exists, the name will be “Object ID:<n>” where <n> is the handle of the object. For events related to network variables and message tags, the name will be that of their functional block.
- *ObjectId.* The handle of the object that was modified. For events related to network variables and message tags, the object ID will be the index of their functional block.
- *DeviceHandle.* The handle of the device in which the object is defined. This field only applies to events related to network variables, message tags, and functional blocks.
- *NvHandle.* The index of the network variable in the device. This field only applies to events related to network variables.
- *Mthandle.* The index of the message tag in the device. This field only applies to events related to message tags.

Manual Network Resynchronization

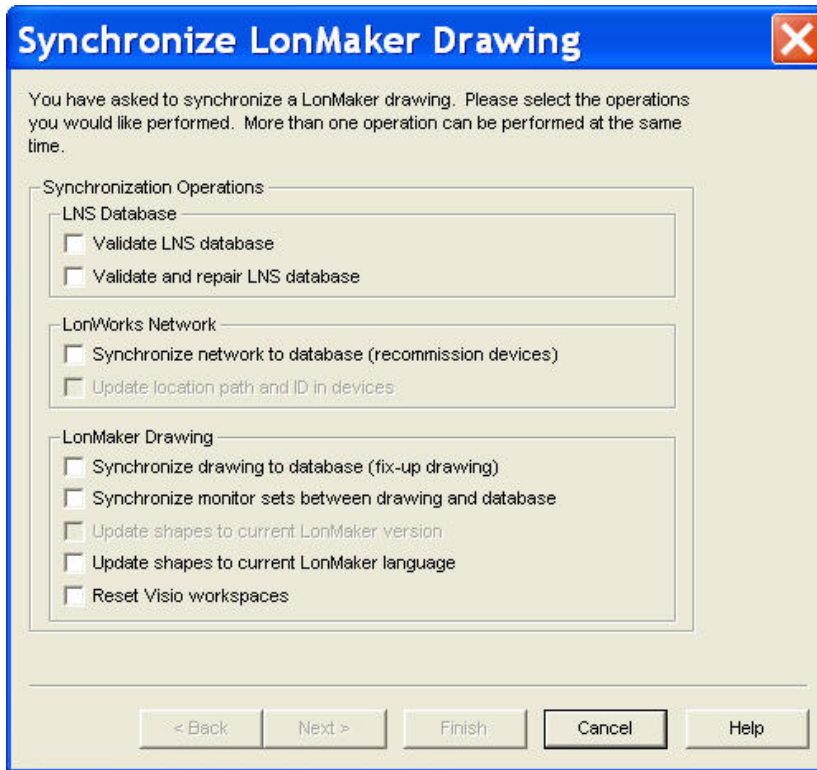
You may need to manually resynchronize the LNS network database, the network, or the LonMaker drawing if automatic resynchronization fails or if one of the following scenarios occur:

- An LNS application other than the LonMaker tool makes changes to the LNS network database that are not tracked by LNS events.
- A LonMaker drawing is saved improperly.
- Log entries are deleted from the LonMaker event log before they are applied to a LonMaker drawing.
- Changes are made to a LonMaker drawing in between creating and restoring a hot backup of the network database.
- A LonMaker backup file containing an LNS network database and LonMaker drawing files is restored and devices need to be recommissioned.
- A LonMaker network design is created using network recovery.

To manually resynchronize a LonMaker network, follow these steps:

1. Back up the LonMaker network following the steps in *Backing up a LonMaker Network Design* in this chapter. This enables you to restore the LonMaker network design in the event a serious resynchronization error occurs.
2. In the LonMaker drawing, open the **LonMaker** menu, point to **Synchronize**, and then click **Resynchronize**. The **Synchronize LonMaker Drawing** dialog appears.

If you did not back up the network and changes have been made since the last backup, a message appears recommending that you back up the network before proceeding. If this occurs, you should click **No**, close the drawing, and back up the network.



3. Choose the synchronization operation(s) you want to perform by selecting the following options.

LNS Database

The network database resynchronization options are only available if the LonMaker tool is running on the same computer as the LNS Server.

Validate LNS Database

Validates the structure of the LNS network database.

Validate and Repair LNS Database

Validates the structure of the LNS network database and repairs the database if any errors are detected.

LonWorks Network

Synchronize Network to Database (recommission devices)

Commissions the physical devices in the LonWorks network to make them consistent with the LNS network database. To use this option, the LonMaker tool must be OnNet.

Update Location Path and ID in Devices

Stores the current subsystem path in the **SCPTlocation** configuration property of application devices that have a **SCPTlocation** configuration property, and stores the current subsystem ID in the **Location** field of application devices and routers. This option is only available if at least one of the check boxes in the network properties: **Recovery** options category is selected.

If an application device and its functional blocks span multiple subsystems, the LonMaker tool updates the **SCPTlocation** configuration property with the subsystem path in which the device shape is located.

The subsystem ID is the first 15 bits of the LNS subsystem handle (in a very large network with many subsystems where more than

32,767 subsystems have been created and deleted, this could result in multiple unique subsystems having the same ID; however, this is very unlikely).

LonMaker Drawing

Synchronize Drawing to Database (fix-up Drawing)

Updates the LonMaker drawing to be consistent with the LNS database.

Synchronize Monitor Sets between Drawing and Database

Updates the monitor sets in the LonMaker drawing to be consistent with the LNS database. A monitor set is a group of point definitions that the LonMaker tool uses to monitor and control network variables. If the type or format of a monitored point has changed, the value displayed will be updated when the point is monitored with the LonMaker tool.

Update Shapes to Current LonMaker Version

Updates shapes to the current version of the LonMaker tool if the LonMaker drawing was originally created with an earlier version of the LonMaker tool.

Update Shapes to Current LonMaker Language

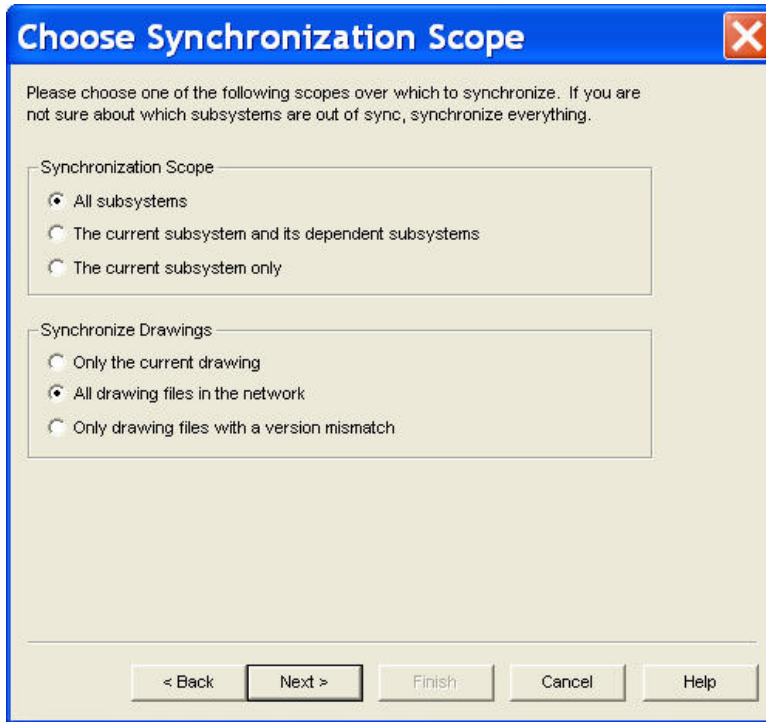
Updates shape menus to current LonMaker language. For example, if you open a network with the German version of the LonMaker tool that was created with the English version, this option will convert the shape menus to German. All the dialogs are in the language of the respective version of the LonMaker tool. The language conversion may take some time; therefore, this option should not be used frequently.

Reset Visio Workspaces

Corrects instances in which Visio has added multiple documents and stencils to the drawing in a LonMaker network. For each drawing in the network, the LonMaker tool opens the drawing file, closes all other open drawings, opens the standard set of stencils, and saves the drawing as a workspace.

This option also automatically upgrades the drawings in the LonMaker network to the current version of Visio.

4. If you are only validating or repairing the LNS network database, click **Finish** to begin the resynchronization process and skip to step 16 in which the **Synchronization Status** dialog appears. Otherwise, click **Next**. The **Synchronization Scope** dialog box appears.



5. Select the scope of the selected synchronization operation(s) by choosing which subsystems and drawing files to resynchronize. If you know that the current subsystem is the only one needing resynchronization, resynchronize just that subsystem. If you aren't sure which subsystem needs to be resynchronized, resynchronize all subsystems. The same logic applies if your LonMaker network contains multiple drawing files. If you know which drawing file requires resynchronization, resynchronize just that drawing to save time. However, if you aren't sure which drawing file needs to be resynchronized, resynchronize all the drawings.

Synchronization Scope

Select which subsystems to resynchronize. You have three choices:

- **All Subsystems.** All the subsystems in the LonMaker network design are resynchronized. This is the default.
- **The Current Subsystem and Dependent Subsystem.** Only the current subsystems and any subsystems nested within it are resynchronized.
- **The Current Subsystem Only.** Only the current subsystem is resynchronized.

Synchronize Drawings

Select which drawings files to resynchronize. You have three choices:

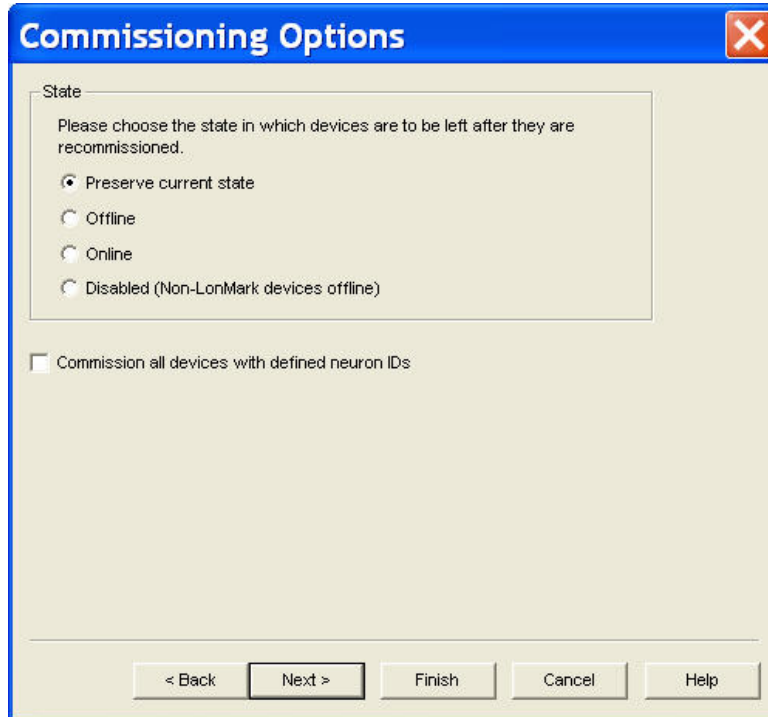
- **Only the Current Drawing.** Only the current drawing file is resynchronized.
- **All Drawing Files in the Network.** All the drawing files in the LonMaker network are resynchronized.
- **Only Drawing Files with a Version Mismatch.** Only drawing files with IDs not matching the version number of the network database are synchronized. This option is only available if you are resynchronizing all subsystems.

6. If you are re-commissioning devices (you selected the **Synchronize Network to Database** check box in the **Synchronize LonMaker Drawing** dialog), click **Next**. The **Commissioning Options** dialog box appears.

Otherwise, if you are synchronizing the network or the LonMaker drawing to the network database, click **Next** and skip to step 10 in which the **Synchronization Options** dialog appears.

If you are performing any other synchronization operation, click **Finish** to begin resynchronization. Skip to step 16 in which the **Synchronization Status** dialog appears.

7. If you are recommissioning devices, the **Commissioning Options** dialog box appears.

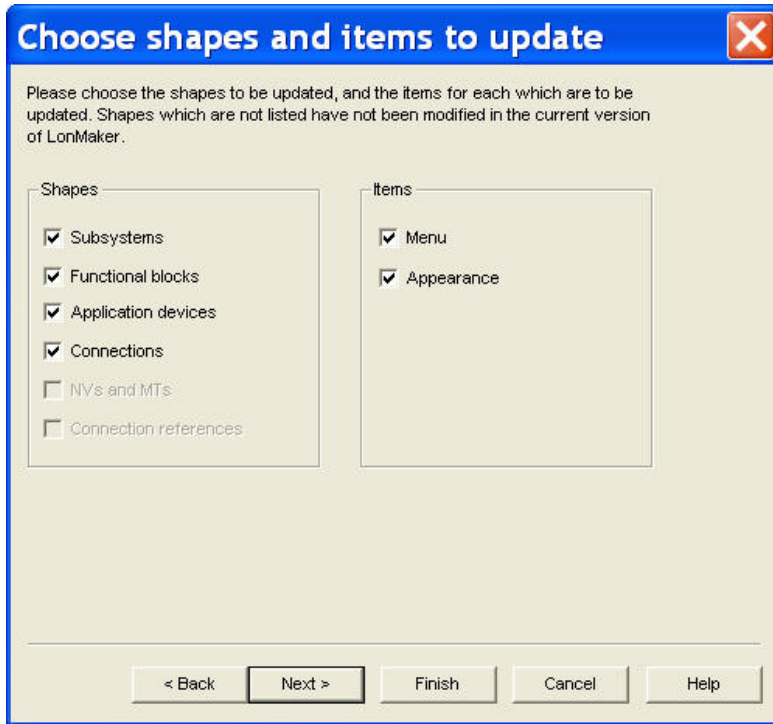


Select the state of the devices after they have been recommissioned. You have four choices:

- **Preserve Current State.** The devices will be restored to the state they were in prior to being recommissioned. This is the default.
- **Offline.** All devices will be left in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application. It is most common to set all device offline so the system may be recommissioned incrementally. Resetting a device in the offline state puts the device in the online state.
- **Online.** All devices will be put in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been recommissioned, sending and responding to network and external inputs.
- **Disabled.** All devices with a Node Object functional block will be disabled; all other devices will be placed offline. Selecting **Disabled** keeps the device's application disabled even if the device is reset.

Select the **Commission all Devices with Defined Neuron IDs** check box to recommission all the previously commissioned devices as well as any unconfigured devices within the selected synchronization scope.

8. If you are resynchronizing the LonMaker drawing, click **Next**. The **Choose Shapes and Items to Update** dialog box appears if you selected the **Update Shapes to Current LonMaker Version** check box in the **Synchronize LonMaker Drawing** dialog.



Otherwise, the **Synchronization Options** dialog appears. Skip to step 10.

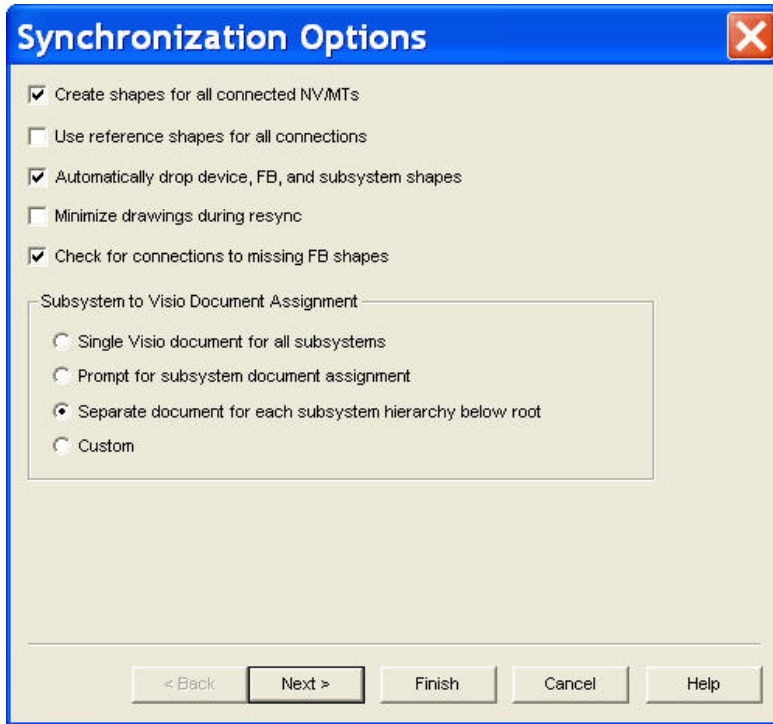
If you are not resynchronizing the LonMaker drawing, click **Finish** to begin resynchronization. Skip to step 16 in which the **Synchronization Status** dialog appears.

9. Select the following options and then click **Next**.

Shapes All shapes that have newer versions available than the ones currently in the drawing are listed. Select the shapes to update.

Items Select **Menu** to update the shortcut menus for the selected shapes. Set **Appearance** to have the appearance of the shapes updated.

10. The **Synchronization Options** dialog opens.



11. Select the options to be applied during the synchronization of the LonMaker drawing to the network database.

Create Shapes for all Connected NVs/MTs

Adds shapes to functional blocks for all connected network variables or message tags created during resynchronization. If this check box is cleared, the LonMaker tool uses generic connections when possible. It only creates network variable or message tag shapes for connections to supernodes and for those functional blocks that already contain network variable or message tag shapes.

Use Reference Shapes for all Connections

Represents all network variable connections created during resynchronization with reference connection shapes. If this check box is cleared, the LonMaker tool uses standard connection shapes for network variable connections in the same subsystem. The LonMaker tool always uses reference connection shapes for connections that span subsystems.

Automatically Drop Device, FB, and Subsystem Shapes

Automatically adds shapes to the drawing for all devices, functional blocks, and subsystems created during resynchronization. If this check box is cleared, the LonMaker tool prompts the user to select whether a shape should be added for a device, functional block, or subsystem created during resynchronization.

Minimize Drawings during Resync

Minimizes all the drawings in the LonMaker network during resynchronization. This speeds up resynchronization, as it reduces the time Visio spends updating the drawings.

Check for Connections for Missing FB Shapes

Enables the LonMaker tool to check for connections to functional blocks that are in the network database but are not represented by functional block shapes in the LonMaker drawing.

Subsystem to Visio Document Assignment

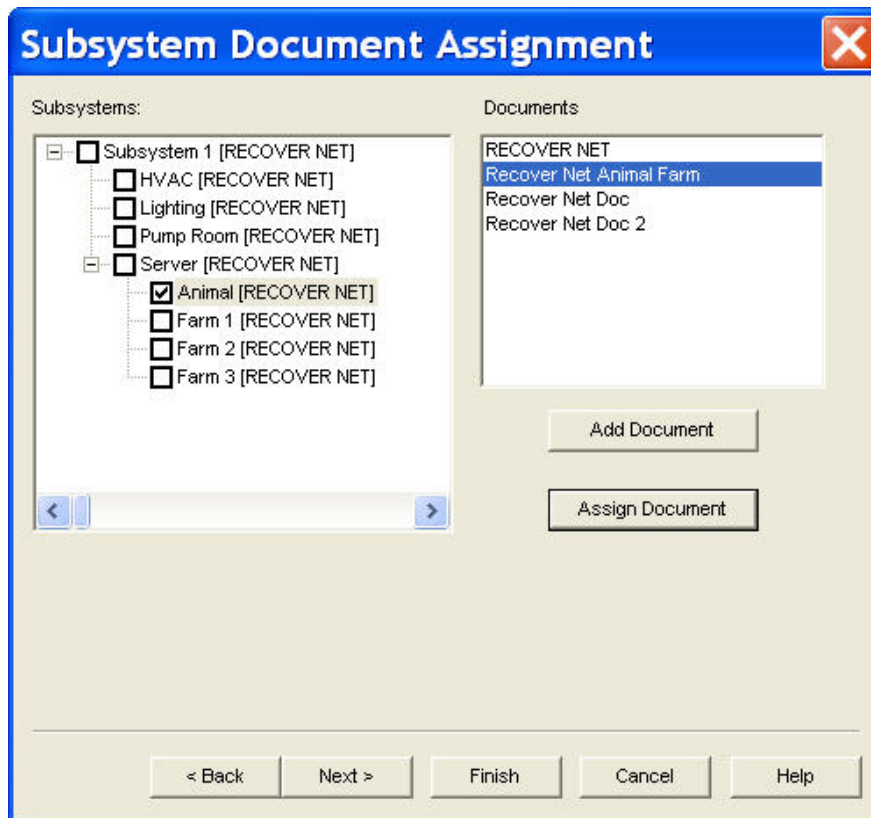
Select in which Visio drawing file to place the subsystems in your network. You have four choices:

- **Single Visio Document for all Subsystems.** Places all

subsystems in a single Visio document.

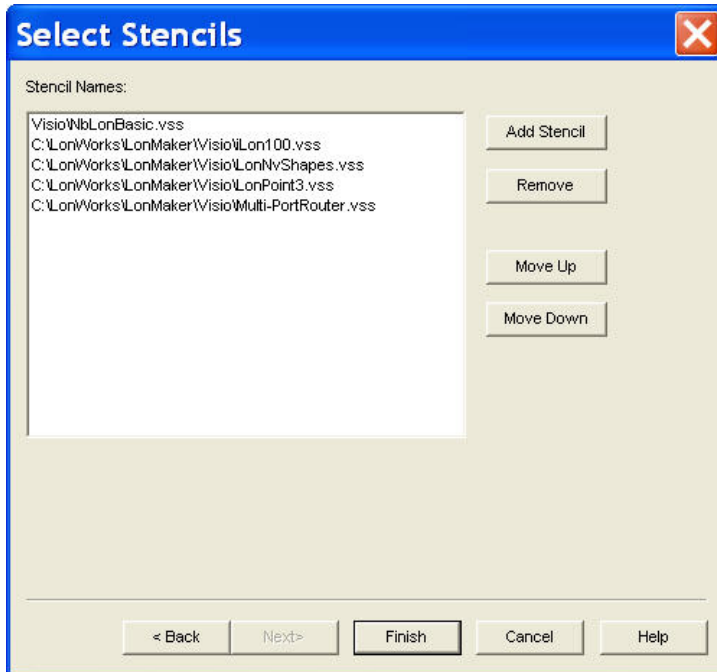
- **Prompt for Subsystem Document Assignment.** Prompts you to specify the Visio document for each subsystem.
- **Separate Document for each Subsystem Hierarchy below Root.** Places each subsystem hierarchy below the top-level subsystem in a separate, new Visio document.
- **Custom.** Opens the **Subsystem Document Assignment** dialog. In this dialog, you specify the Visio document for each subsystem.

12. Click **Next**. If you selected the **Custom** subsystem document assignment option, the **Subsystem Document Assignment** dialog opens. Otherwise, skip to step 15 in which the **Select Stencils** dialog appears.



13. Customize the drawing document assignment of subsystems found during resynchronization. Subsystems are listed in the left hand pane listed under **Subsystems**, while the Visio drawing documents are listed in the right hand pane listed under **Documents**. To assign a subsystem, select the subsystem name, select the desired document name, and then click **Assign Document**. To add additional drawing documents, click **Add Document**.

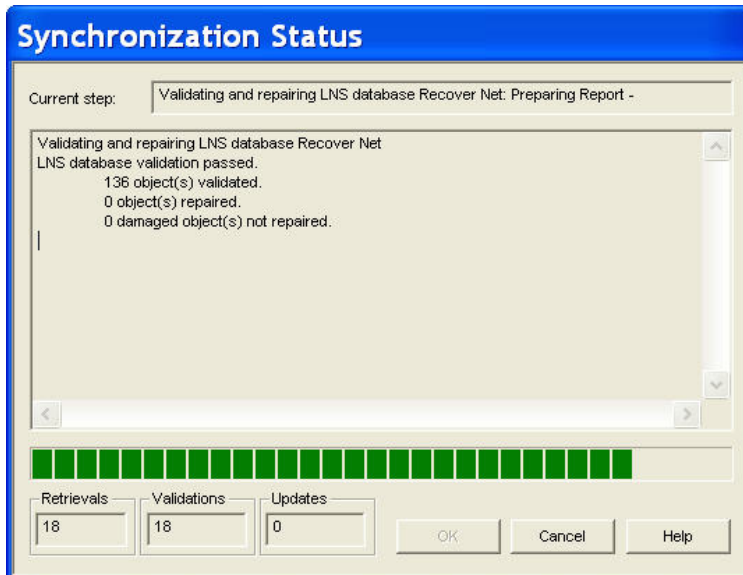
14. Click **Next**. The **Select Stencils** dialog appears.



15. Specify the stencils that will be scanned for master shapes during resynchronization. When objects are found within the LNS network database that are not already represented in the drawing, the LonMaker tool scans the listed stencils and automatically adds the appropriate shape to the drawing. If the object's particular master shape is not found, an appropriate generic master shape (e.g., a LonWorks device shape) will be used.

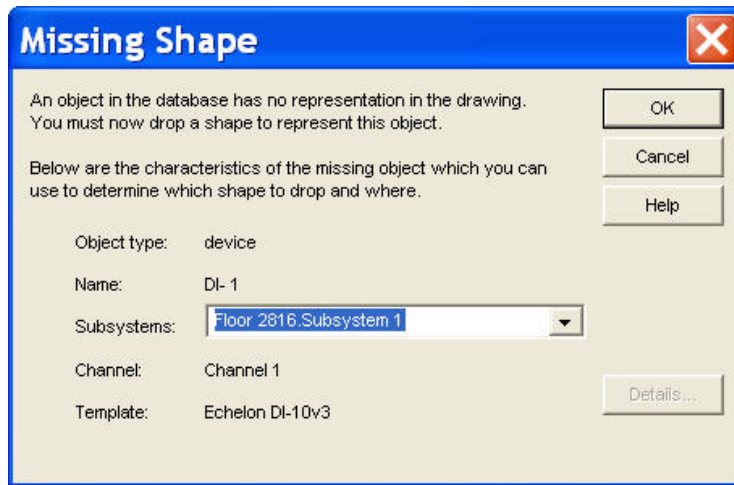
To add additional stencils, click **Add Stencil**. To remove a stencil, select the desired stencil and then click **Remove**.

16. Click **Finish**. Resynchronization begins and the **Synchronization Status** dialog appears.



This dialog displays the status of the resynchronization. Resynchronization events are listed in order as they occur. Click **OK** when the resynchronization is complete. The resynchronization events, including any errors, are shown in the status pane and recorded in a log file (Resync.log). The resync log is stored in the drawing directory of the current LonMaker network design.

17. If the LonMaker drawing is being synchronized to match the network database and the **Automatically Drop Device, FB, and Subsystem Shapes** check box was cleared, the **Missing Shape** dialog appears for each object in the network database that is not represented in the LonMaker drawing.



- Click **OK**. The **Missing Shape** dialog closes and you are returned to the LonMaker drawing.
- Drag a single shape from a LonMaker stencil to the LonMaker drawing to represent the missing shape. The LonMaker tool assigns the shape to the specified object in the LNS network database.
- Open the **LonMaker** menu, point to **Synchronize**, and then click **Resynchronize** to re-open the **Missing Shape** dialog and assign the next missing shape.
- Repeat steps a–c for each missing shape. Once all missing shapes have been added and the connections have been updated, resynchronization will be complete.

Tips:

- The first time you resynchronize a LonMaker drawing created with a previous version of the LonMaker tool, most connections that span multiple documents will automatically be deleted and then re-created. This speeds up any subsequent resynchronizations.
- The first time you resynchronize a LonMaker drawing created with an older version of Visio, select the **Reset Visio Workspaces** option in the **Synchronize LonMaker Drawing** dialog. This automatically saves the documents in your drawing to the Visio 2003 format. Otherwise, the LonMaker tool prompts you whether to save the documents in your drawing in Visio 2002 format or the current Visio format. If you answer Visio 2002, the LonMaker tool will continue to prompt you every time you resynchronize the drawing.
- If you have stencils from an older version of Visio that you want to use, open and save the stencils individually in Visio 2003. Otherwise, Visio will prompt you each time the drawing is closed as to whether to save the changes to the stencil, but it won't save any changes because it opens these stencils as read-only.

Refreshing the LonMaker Network

The LonMaker tool caches data from the LNS network database to improve performance. If another LNS application or plug-in updates data that has been cached by the LonMaker tool and does not generate an appropriate LNS event, the LonMaker cache may lose synchronization with the LNS network database. You can force the LonMaker tool to process and release the cache by opening the **LonMaker** menu, pointing to **Synchronize**, and then clicking **Refresh**.

Merging LonMaker Networks

You can initially install a large LonWorks network as a number of smaller independent networks—each with their own network database—and then later merge the networks into one network.

Examples of installations that may use this technique include the following scenarios:

- **Multiple systems.** When multiple systems are being installed, the installers for each system want to install and debug their installation without interference from other systems. When each system has been correctly installed, they can be merged into a single network.
- **Incomplete infrastructure.** Portions of a building, such as the floors of a high-rise, may need to be installed before connectivity exists for the entire site (before there is a backbone channel connecting the floors together, for instance). You can install each floor of the network as part of a single network using a portable network server under a sequential network installation scenario, in which no permanent server is needed. In most cases, however, it may be easier (if not necessary) to install each floor as a separate network. Once the entire site has connectivity, the individual floor networks can be merged into a single network representing the high rise.

To support these scenarios, the LonMaker tool provides the ability to merge LonMaker networks.

Network Merge Considerations

When you create a new LonWorks network that will entail merging individual networks, minimize the number of objects in the top-level subsystem. When you merge two LonMaker network designs, the merge process will be disruptive to the operation of the networks. For example, devices in the source network will be assigned new subnet/node addresses, connections will be recreated, and authenticated devices will have authentication disabled for a period of time. Devices in the destination network will generally be impacted less, but they can be affected if their connections are modified to accommodate the new devices from the source networks.

Limitations

The network merge process has several limitations:

- **Server support only.** You can only merge networks from a local client. You cannot merge networks from a remote client.
- **Single direction only.** You cannot stop the merge process once it has begun. You can, however, restore a network from a LonMaker backup file, if needed.
- **Single root subsystem.** You can only merge networks that have a single top-level subsystem (this is the default for LonMaker drawings). If the network has more than one top-level subsystem, as may be the case when using an LNS network database created by another network tool, the pre-merge utility will fail. You must remove or relocate all but one of the top-level subsystems, before retrying the pre-merge utility.

Information Loss

When you merge networks, the following information in the source network will be lost:

- **Registered plug-ins.** Plug-ins registered in the source database but not in the destination database must be re-registered following the merge.
- **Non-channel object descriptions.** Channel descriptions are stored in the channel shapes as well as in the network database; therefore, they are transferred to the destination database. Other object descriptions that are not stored in the shapes are lost.
- **Source network addresses, group IDs, NV selectors, and other related information.** All devices in the source network are assigned new addresses in the destination network domain and all connections are reconstructed. Therefore, all subnet/node IDs, group IDs, and NV selectors,

will likely change. In addition, all previously commissioned devices in the source network must be recommissioned.

- **Commission Status.** Devices in the source network are unconfigured in the destination network upon the completion of the network merge. However, the Neuron IDs of the devices are preserved in the destination network and the LonMaker credits needed to commission them are added.
- **Network service devices.** All network service devices (and their functional blocks and connections) in the source network are removed during the merge.
- **Unreferenced device templates.** Device templates that have been imported but do not have any corresponding devices are not created in the destination network.
- **Unreferenced connection descriptions.** Connection descriptions that have been created but do not have any corresponding connections are not created in the destination network.
- **User profiles.** User profiles in the source network are not created in the destination network.
- **Non LonMaker extension records.** Non LonMaker extension records will only be copied if you selected the **Enable Configuration Properties** check box the network properties: **Configuration Properties** options category, and the extension record is marked for copying

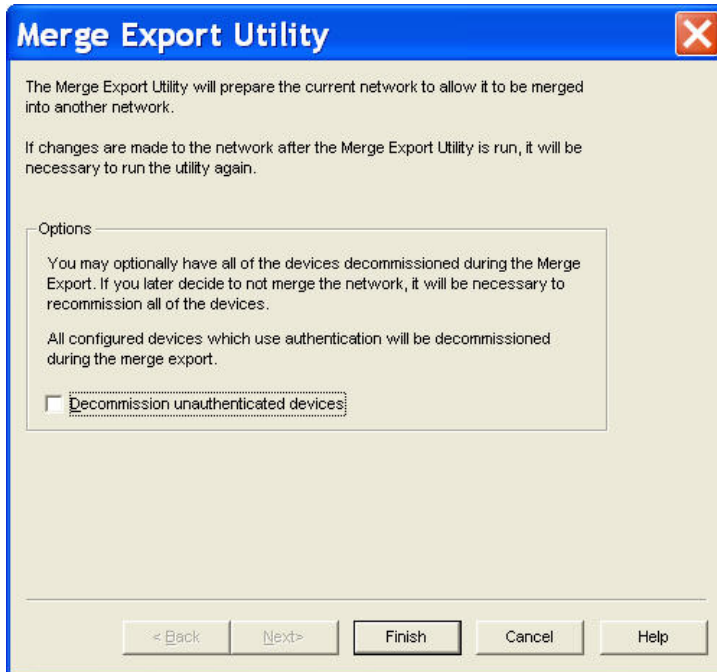
Merging LonMaker Networks

To merge LonMaker networks, follow these steps:

1. Identify the source and destination networks. The supernodes, subsystems, devices, functional blocks, and connections in the source network are added to the destination network. The devices in the destination network are not modified.
2. Back up the source LonMaker network design following the steps in *Manually Backing Up a LonMaker Network Design* in this chapter. You can use the backup to restore the network if the merge process fails for any reason. You can also use it to restore the network if you later choose not to merge the networks after running the pre-merge utility.

In the event that you do not merge the networks after running the pre-merge utility in the source network, restore the LonMaker backup file. This is because the pre-merge utility adds significant data to the LonMaker drawing that will degrade the performance of the network database.

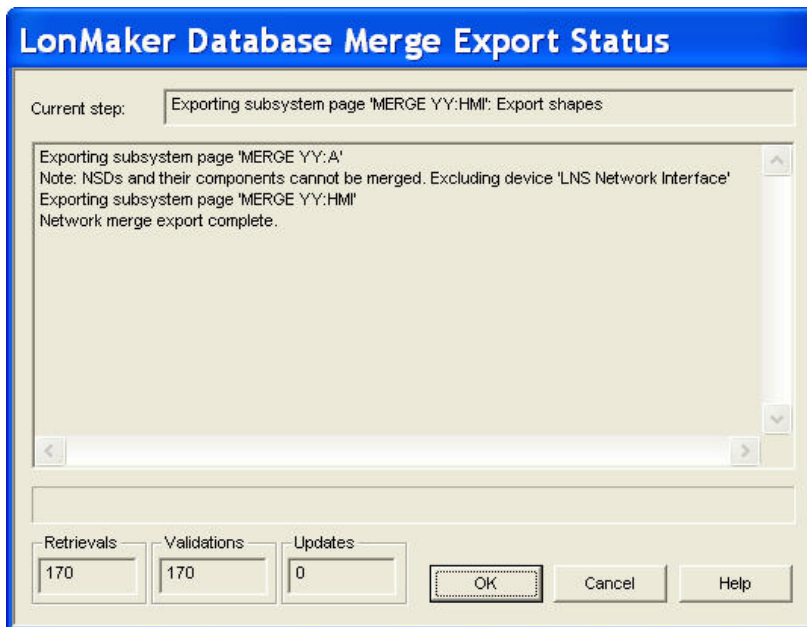
3. Open the source LonMaker network design following the steps described in *Opening an Existing LonMaker Network Design* in Chapter 3, *Getting Started*.
4. Open the **LonMaker** menu, point to **Synchronization**, and click **Database Merge Export Utility**. The **Merge Export Utility** dialog box opens.



The merge export utility prepares the network to be merged into another network. The utility adds data from the source LNS network database to the source LonMaker drawing.

The merge export utility also automatically decommissions all configured devices in the network that use authenticated message service so that they can be recommissioned in the new network. Select the **Decommission Unauthenticated Devices** check box to decommission all the configured devices in the network.

5. Click **Finish** to prepare the LonMaker network design for merging. The **LonMaker Database Merge Export Status** dialog opens. This dialog displays the export status and lists merge export events in the order they occur.

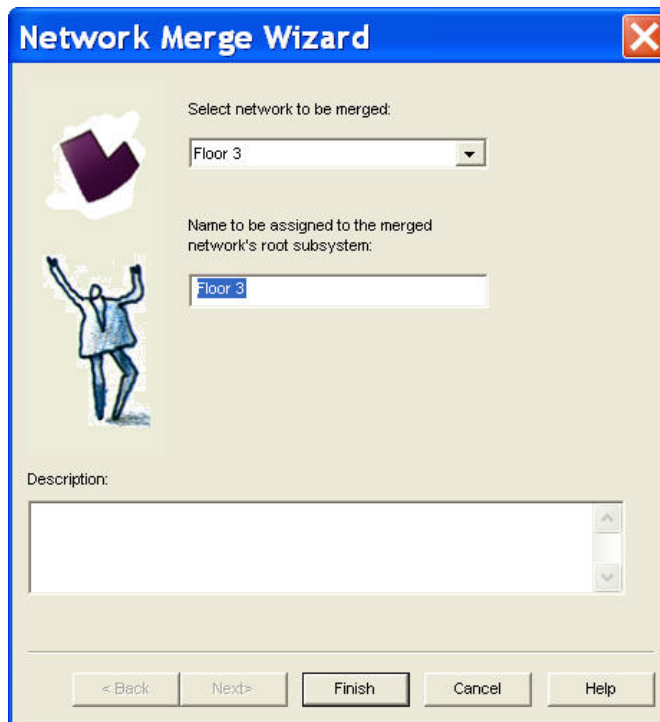


6. Click **OK** when the merge export is complete. Click **Cancel** at any time to terminate the merge export.

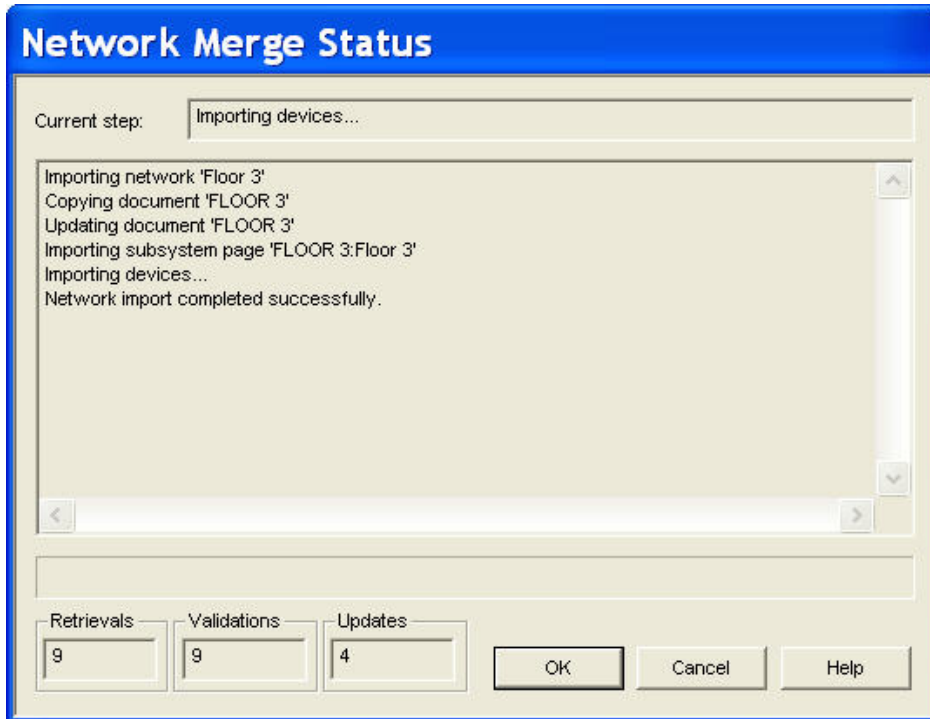
7. Exit the LonMaker drawing of the source network.
8. Back up the destination LonMaker network design following the steps in *Manually Backing Up a LonMaker Network Design* in this chapter. You can use the backup to restore the network if the merge process fails for any reason. If a failure occurs during the merge process, the destination network will be left in a partially merged state and the LonMaker tool will not let you access the network. To return the network to its original state, restore the backup of the destination network.
9. Ensure that the device interface (XIF) files for all the devices in the source network are available in the directory specified in the **XIF Search Path** field in the network properties: **Device** options category.
10. Open the destination LonMaker network design following the steps described in *Opening an Existing LonMaker Network Design* in Chapter 3, *Getting Started*.



11. Drag the Network Merge shape from the LonMaker Basic Stencil to a subsystem page within the destination network. The Network Merge Wizard opens.



12. Select the source network you exported in steps 4–6 from the **Select Network to be Merged** list. This list contains only those networks that have been exported using the Merge Export Utility.
13. Enter a name for the root subsystem of the source network in the **Name to Be Assigned** box.
14. Click **Finish** to begin the network merge. The source network and its underlying subsystem hierarchy will be added as a new subsystem. The merge process copies all documents from the source drawing directory into the destination drawing directory and renames them, as required. The shapes are then scanned and added to the destination network database. A network merge status window appears and indicates the progress of the merge.



This dialog displays the status of the network merge and lists the events in the order they occur. Any errors encountered are shown in the status pane, and they are also available in a log file for the network merge. The log file is named Merge_<merged network>.log. The merge log is stored in the drawing directory of the destination network.

15. During the network merge, the LonMaker tool prompts you to specify whether the channels in the merged network already exist in or are new to the current network. The **Channel Definition** dialog appears.
16. If the channel already exists in the current network, select its name from the **Channel Name** list. If the channel is new to the current network, enter a unique name for the channel in the **Channel Name** box and select the channel type from the **Channel Type** list. Click **OK** to advance to the next channel.
17. When the network merge is complete, click **OK**. Click **Cancel** at any time to terminate the network merge.

Managing Networks

This chapter explains how to test and verify application devices, functional blocks, and routers; describes LonMaker styles; and details how to generate device status summary reports, network resource reports, and LNS network reports.

Using the LonMaker Device Manager

You can manage application devices, functional blocks, and routers using the LonMaker Device Manager. You can switch between performing management tasks and making changes in your LonMaker drawing without having to close the LonMaker Device Manager.

You can perform the following tasks using the LonMaker Device Manager:

- Test application devices, functional blocks, and routers to ensure they are operating and are configured correctly. Testing generates an error log that you can use to evaluate the performance of the object, and it updates the shape status of the tested objects in the LonMaker drawing.
- Wink application devices to identify them on the network and verify that they are communicating properly.
- Place application devices and routers online and offline.
- Disable application devices and functional blocks to isolate network problems.
- Force functional blocks into an override state to keep segments of the network running while disabling others portions of the network.

To use the LonMaker Device Manager, the LonMaker tool must be attached to the network. The LonMaker tool can either be OnNet or OffNet for testing, winking, and setting the application state of devices and routers, but it must be OnNet to disable application devices, and to disable and override functional blocks.

Opening the LonMaker Device Manager

To open the LonMaker Device Manager, right-click the application device, functional block, or router you want to manage and then click **Manage** on the shortcut menu.

You can perform management tasks on multiple objects at one time. You can use any of the following methods to select the objects to be managed:

- To select multiple devices within a subsystem, hold down CTRL and click the devices, or click an empty space in the drawing page and drag a selection net around them. Then right-click one of the selected devices and click **Manage** on the shortcut menu.
- To select all the devices within a subsystem, select the **Exclude Nested Subsystems from Subsystem Operations** check box for the subsystem (to access this option, right-click the subsystem shape, or an empty space in the network if you are in the top-level subsystem, and select **Subsystem Properties** from the shortcut menu). Then right-click the subsystem shape, or an empty space in the drawing page if you are in the top-level subsystem, and click **Manage** on the shortcut menu.
- To select all the devices within a subsystem and all of its nested subsystems, clear the **Exclude Nested Subsystems from Subsystem Operations** check box for the subsystem, right-click the Subsystem shape, or an empty space in the drawing page if you are in the top-level subsystem, and click **Manage** on the shortcut menu.
- To select all the devices within a network, right-click an empty space in the drawing page of the top-level subsystem and then click **Manage** on the shortcut menu.

The LonMaker Device Manager contains individual tabs with distinct functions for managing application devices, functional blocks, and routers. The tab that appears when you initially open the LonMaker Device Manager depends on the objects selected.

Managing Devices

To manage a device, right-click a device (or select multiple objects including at least one application device or functional block and right-click one of them), and then select **Manage** on the shortcut menu.

You can also select the **Devices** tab after you have opened one of the other tabs with one or more application devices or functional blocks selected. The **Devices** tab of the LonMaker Device Manager appears.

You can use this tab to manage the selected application devices. The tab contains an **Object List** that displays the selected devices, and a **Results Log** that lists the results of any commands or tests.



Click one or more devices listed in the **Object List** and then click any of the following buttons:

Test Tests the device to ensure that it is operating and configured correctly. The tests run are determined by the options set in the **Device Manager Settings** dialog, which you can open by clicking **Settings**. The test results are displayed in the **Results Log**.

Clear Status Clears the network error statistics for the device and the error log, which are displayed after you click **Test**.

Online Places the device in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application. If the device was previously online, the device state does not change.

Offline Places the device in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will stop running its application.

When a device is in the offline state, it still responds to **Online**, **Wink**, and **Test** commands and receives network variable updates. The device application, though, will not process the updated network variable values or send network variable updates.

If the device was previously offline, the device state does not change. If the device is reset while offline, it will be placed in the online state.

Enable Activates all functional blocks on a disabled device. The device

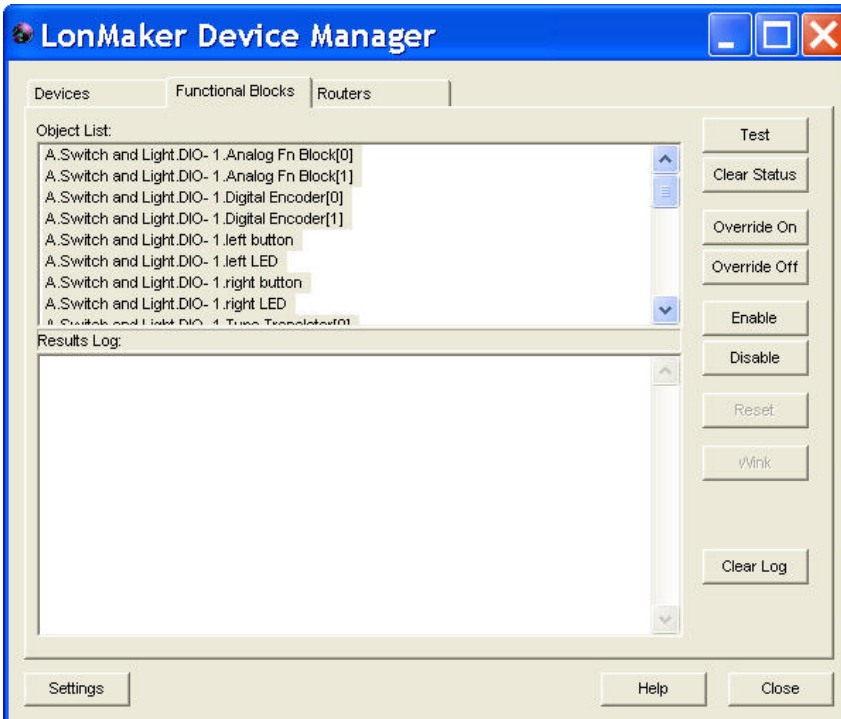
	must be online to be enabled. This command only applies to devices containing a Node Object functional block.
<i>Disable</i>	Keeps the device application disabled even if the device is reset. The device must be online to be disabled. This command only applies to devices containing a Node Object functional block. If Disable is selected and the device does not contain a Node Object functional block, the device is placed offline.
<i>Reset</i>	Stops the device application, terminates all incoming and outgoing messages, sets all temporary settings to their initial values, and then restarts the device application. If the device was in the soft offline state, it will be put online; if the device was in the hard offline state, it will remain offline.
<i>Wink</i>	Requests that the device generate an application-dependent audio or visual feedback such as a beep or a flashing service LED. The device must support the Wink function to use this command. This command is useful for identifying devices.
<i>List FBs</i>	Switches to the Functional Blocks tab and adds the functional blocks assigned to the selected devices to the object list.
<i>Clear Log</i>	Clears the Results Log .

Click **Settings** to open the **Device Manager Settings** dialog box. This dialog lets you set options for testing and winking devices. See *Device Manager Settings* in this section for more information on using this dialog.

Managing Functional Blocks

To manage a functional block, right-click a functional block (or select multiple objects including at least one functional block or application device and right-click one of them), and then select **Manage** on the shortcut menu. You can also select the **Functional Block** tab after you have opened one of the other tabs with one or more application devices or functional blocks selected. The **Functional Blocks** tab of the LonMaker Device Manager appears.

You can use this tab to manage the selected functional blocks. The tab contains an **Object List** that displays the selected devices, and a **Results Log** that lists the results of any commands or tests.



The commands in this dialog require that the device application associated with the functional block includes a Node Object functional block and that the device is online.

Click one or more functional blocks in the **Object List** and then click any of the following buttons:

- | | |
|---------------------|---|
| <i>Test</i> | Tests the functional block to ensure that it is operating correctly. The tests run are determined by the options set in the Device Manager Settings dialog, which you can open by clicking Settings . The test results are displayed in the Results Log . |
| <i>Clear Status</i> | Clears the network error statistics for the functional block and the error log, which are displayed after you click Test . |
| <i>Override On</i> | Puts the functional block into override mode. The output network variables output their configured override value, even if part of the network is not yet operating and there is no input to the functional block. The override values are set using the configuration properties in the functional block.

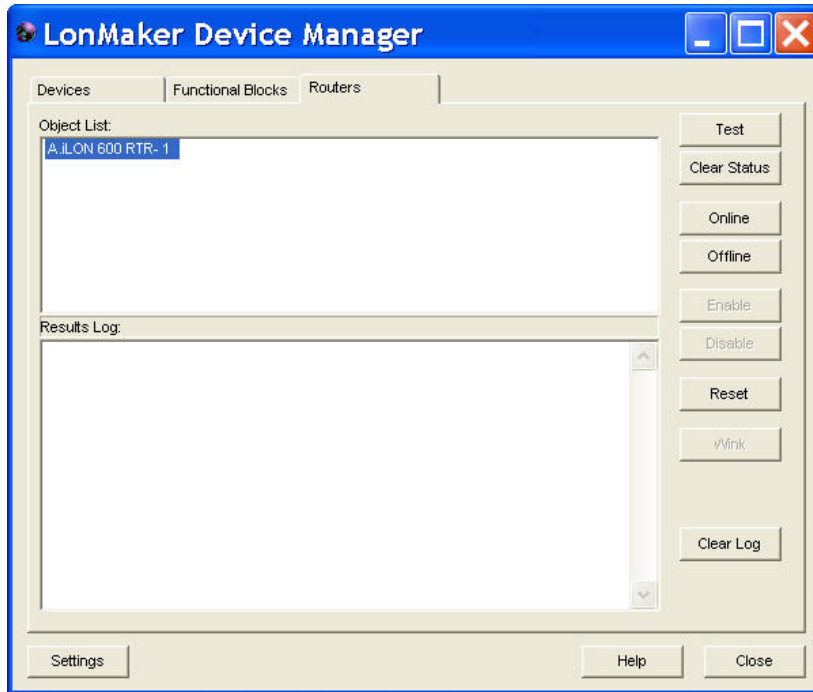
See the functional block's documentation for more information on how the override command affects the functional block. |
| <i>Override Off</i> | Takes the functional block out of override mode so that it functions normally. |
| <i>Enable</i> | Activates a disabled functional block. |
| <i>Disable</i> | Disables the functional block. The functional block will send its configured output network variable defaults. |
| <i>Clear Log</i> | Clears the Results Log . |

Click **Settings** to open the **Device Manager Settings** dialog box. In this dialog, you can set options for testing functional blocks.

Managing Routers

To manage a router, right-click a router (or select multiple objects including at least one router and right-click one of them), and then select **Manage** on the shortcut menu. You can also select the **Routers** tab after you have opened one of the other tabs with one or more routers selected. The **Routers** tab of the LonMaker Device Manager appears.

You can use this tab to manage the selected routers. The tab contains an **Object List** that displays the selected routers, and a **Results Log** that lists the results of any commands or tests.



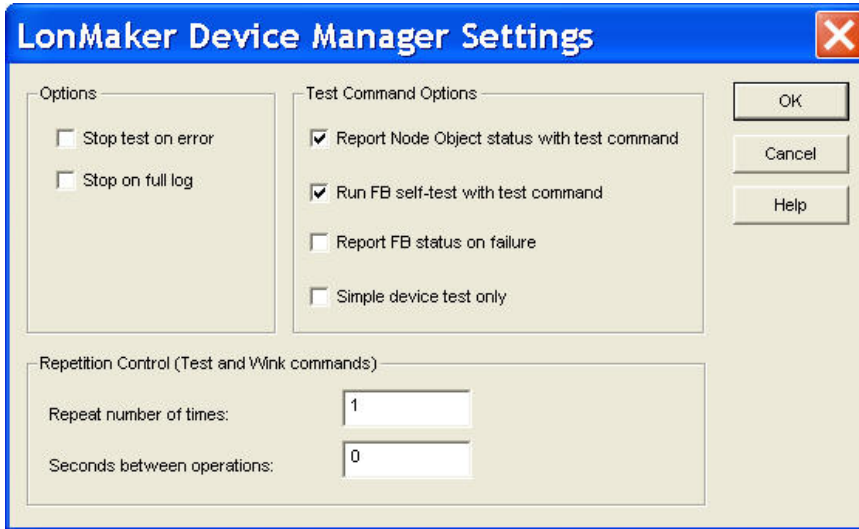
Click one or more routers in the **Object List** and then click any of the following buttons:

- | | |
|---------------------|--|
| <i>Test</i> | Tests the routers to ensure that they are operating and configured correctly. The tests run are determined by the options set in the Device Manager Settings dialog, which you can open by clicking Settings , and by the device application. The test results are displayed in the Results Log . |
| <i>Clear Status</i> | Clears the network error statistics for both sides of the router. |
| <i>Online</i> | Enables the routers to forward packets between the channels connected to them. If any of the routers were previously online, the router state does not change. |
| <i>Offline</i> | Stops the routers from forwarding packets. If any of the routers were previously offline, their states do not change. If a router is reset while offline, the router will go online, unless it is in the hard offline state. |
| <i>Reset</i> | Stops the routers from forwarding packets, sets all temporary settings to their initial values, and then restarts the router application. If any of the routers were offline, they will be go online after being reset, unless they were in the hard offline state. |
| <i>Clear Log</i> | Clears the Results Log . |

Click **Settings** to open the **Device Manager Settings** dialog box. There, you can set options for testing routers and options for the results log.

Device Manager Settings

You can customize the error reporting, testing, and winking operations performed by the LonMaker Device Manager. To customize these setting, click the **Settings** button on any of the tabs in the Device Manager. The **Device Manager Settings** dialog appears.



Set the following options and then click **OK** to apply any changes.

Options

Stop Test on Error

Stops tests immediately when an error is reported. This option is cleared by default.

Stop on Full Log

Stops tests immediately when the results log becomes full. You cannot click the **Test** command again until you click **Clear Log**. This option is cleared by default.

Test Command Options

Report Node Object Status with Test Command

Displays the status of the Node object for the device being tested in the results log of the **Device** tab. This command only applies to devices containing a Node Object functional block. This option is selected by default.

Run Object Self-Test with Test Command

Sends a self-test command to the object being tested and displays the results of the self-test in the **Results Log**. If cleared, no self-test will be sent as part of the testing procedure. This option is selected by default.

Report Object Status on Failure

Reports an object's status in the **Results Log** when it fails a management command. This option is cleared by default.

Simple Device Test

Limits the device test to a simple **Query Status** command. This option reduces the amount of network traffic generated by the **Test** command, and it may be useful when communication is performed over low-bandwidth channels such as a power line. This option is cleared by default.

Repetition Control

Repeat Number of Times

Specifies how many times a **Wink** or **Test** command will be repeated. The default is **1**, which means that these commands are not repeated.

Wait Between

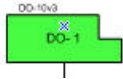
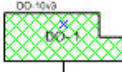

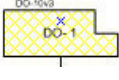


Specifies how long the LonMaker Device Manager waits between

Using LonMaker Styles Overview

You can use Visio styles to view the state of each device, functional block, connection, and network variable/message tag. The LonMaker tool automatically updates shape styles as events are received that indicate changes in shape status. You can change how states are depicted in a LonMaker drawing. If you modify the current drawing file styles, only the styles in the drawing file that you modified will be affected. If you modify the styles in the template (LONWORKS.vst by default), all networks created after the template modification will use the new styles.

LonMaker Device Styles

Device styles indicate the state of the application devices and routers in a LonMaker drawing. The LNS Server monitors the state of devices that have been enabled, and notifies the LonMaker tool of any changes. The following list describes the device styles:

Device State	Default Style	Description
Normal	Solid green 	All changes made to the network database have been successfully written to the physical device. The device and the database are synchronized.
Soft Offline	Green crosshatching 	The device has an application loaded and is configured, but it is offline. The device will go online when either the online command is invoked on the device or the device is reset.
Uninstalled	Yellow diagonal 	Changes have been made in the network database, but the physical device has not been updated. Devices may not be up to date because the LonMaker tool is unattached or is OffNet. Once the device is commissioned and updated, the device style changes to Normal.
State Failure	Yellow crosshatching 	The LNS Server has detected that the device is not in the expected state.
Error	Red diagonal 	Changes have been made in the network database, but an error has occurred while updating the device. The device may not be responding properly, a router or channel between the LNS Server and the device may have failed, or a physical connection may be faulty. If the LonMaker tool is OnNet, the LNS Server periodically tries to update the device. Once the device has been updated to match the network database, the device style changes to Normal.
Detached	Red crosshatching 	The LNS Server has detected that the device is not attached or is otherwise unable to communicate with the network. If a router becomes detached, the devices on the other side of the router will not show up as detached on the drawing.

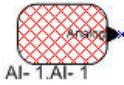



Note: Devices that have a Ping Interval of **Never** are not monitored; therefore, the device shapes may not indicate the correct detached or failure states.

LonMaker Functional Block Styles

The LonMaker tool reflects the last known state of functional blocks. You may update that information in two ways:

- From the **LonMaker** menu, select **Status Summary** (see *Status Summary* in this chapter for more information about this feature).
- Select one or more functional blocks, right-click one of the selected functional blocks, and then click **Manage** on the shortcut menu. The **Functional Block** tab of the LonMaker Device Manager appears. Click **Test** (see *Managing Functional Blocks* in this chapter for more information.)

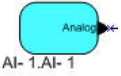


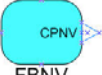
The LonMaker drawing indicates the current functional block states using the following styles:

Functional Block State	Default Style	Description
Self-Test Fail	Red crosshatching 	The functional block has reported a self-test failure.
Disabled	Yellow crosshatching. 	The functional block has been disabled.
Override	Dark blue crosshatching. 	The functional block has been placed in override mode.
Normal	Solid cyan. 	The functional block is in a normal state and none of the states listed above are active.

When multiple functional blocks states are concurrently active, the style displayed is based on the order of the states listed above. For example, a functional block in the normal state that is disabled and placed in override mode will be crosshatched yellow, indicating the disabled state (disabled is the highest-order state of the three). If multiple states are active and the highest-order state is then cleared, the functional block style will be updated to display the next applicable state. Using the previous example, if you enable the functional block, it will be crosshatched dark blue, indicating that it is in override mode.

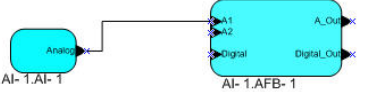
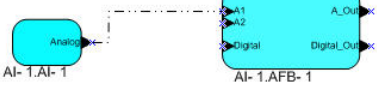

Network Variable and Message Tag Shape Styles

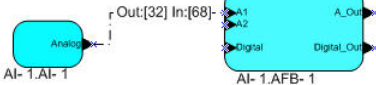

The LonMaker tool indicates the state of network variable and message tag shapes using the following styles:

Connection Point State	Default Style	Description
Connection Point Normal	Solid black fill 	The network variable or message tag shape is normal (not currently exported to a supernode).
Connection Point Exported	Solid blue fill 	The network variable or message tag shape has been exported to one or more supernodes.
Configuration Property Normal	Solid black line with a transparent fill 	The configuration network variable is normal (not currently exported to a supernode).
Configuration Property Exported	Solid blue line with a transparent fill. 	The configuration network variable is currently exported to one or more supernodes.

LonMaker Connector Shape Styles

The LonMaker tool indicates the messaging service used for a connection and whether monitoring is enabled with the following styles:

Messaging Service/Monitoring State	Default Style
Acknowledged Messaging Service	Solid line. 
Repeated Messaging Service	Dash separated by two dots. 
Unacknowledged Messaging Service	Dash separated by one dot. 

Monitoring Enabled	Text is black. 
Monitoring Disabled	Text is magenta. 

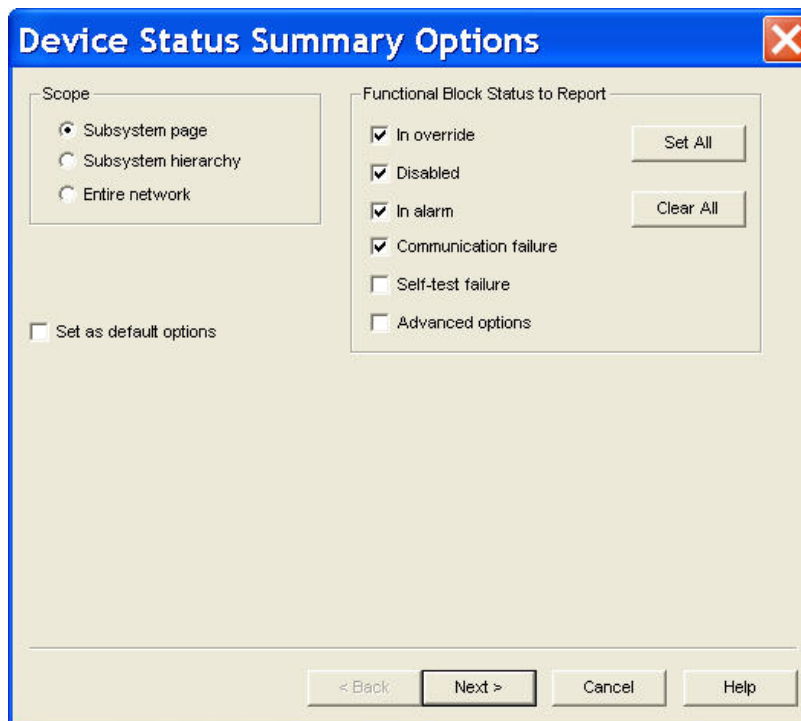
The LonMaker tool updates the style of the connection shapes, as required, if changes are made to the connections that affect the service type used.

Generating a Device Status Summary Report

You can generate a status summary report listing the devices and routers that are unconfigured and offline, and selected functional blocks that are in the override, alarm, or disabled states or have reported communication or self-test failures. For a functional block to be listed in the report, it must be associated with a device that is configured and online.

To generate a status summary report, follow these steps:

1. Open the **LonMaker** menu and click **Device Status Summary**. The **Device Status Summary Options** dialog box opens.



2. Select the scope of the Device Status Summary and the types of functional blocks to include in the report.

Scope

Select the scope of the Device Status Summary Report. This determines which applicable application devices, routers, and functional blocks will be included in the report. You have three

choices:

- Select **Subsystem Page** to include the application devices, routers, and functional blocks in the current subsystem. This is the default.
- Select **Subsystem Hierarchy** to include the application devices, routers, and functional blocks in the current subsystem and subsystems nested in it.
- Select **Entire Network** to include all the application devices, routers, and functional blocks in the current LonMaker network.

Functional Block Status to Report

Select which functional blocks with a specific status to include in the Device Status Summary.

For a functional block to be included in the report, its device must be configured and online.

Status reporting is not supported by all functional blocks. If an expected functional block does not appear in the summary, it means that the functional block does report the selected status. In this case, the LonMaker tool treats the functional block as if the status was reported as not set by the device.

Override

Includes functional blocks in the override state in the Device Status Summary Report. This check box is selected by default.

Disabled

Includes disabled functional blocks in the Device Status Summary Report. This check box is selected by default.

Alarm

Includes functional blocks in the alarm state in the Device Status Summary Report. This check box is selected by default.

Communication Failure

Includes functional blocks that have had a communication failure in the Device Status Summary Report. This check box is cleared by default.

Self-Test Failure

Includes functional blocks that have had a self-test failure in the Device Status Summary Report. This check box is cleared by default.

Advance Options

Opens a dialog containing additional status summary options when you click **Next**.

Set All

Selects all the functional block status options.

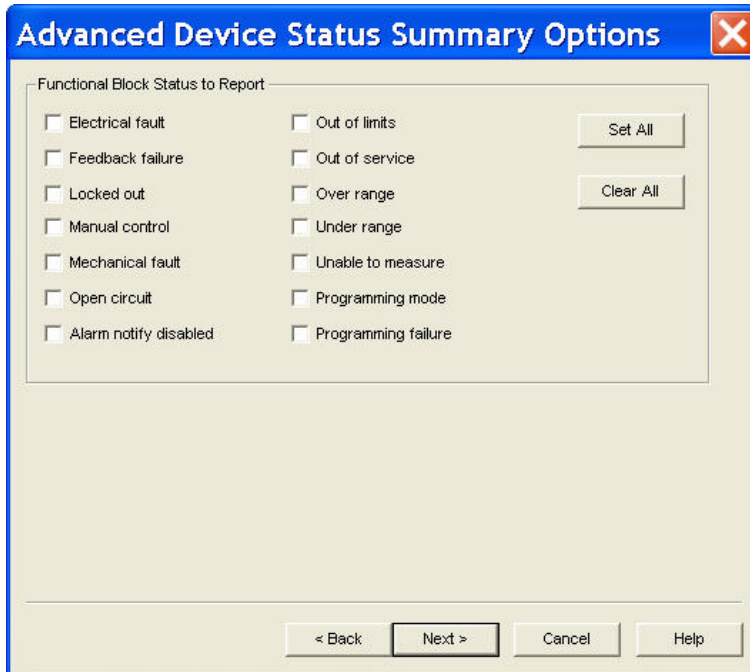
Clear All

Clears all the functional block status options.

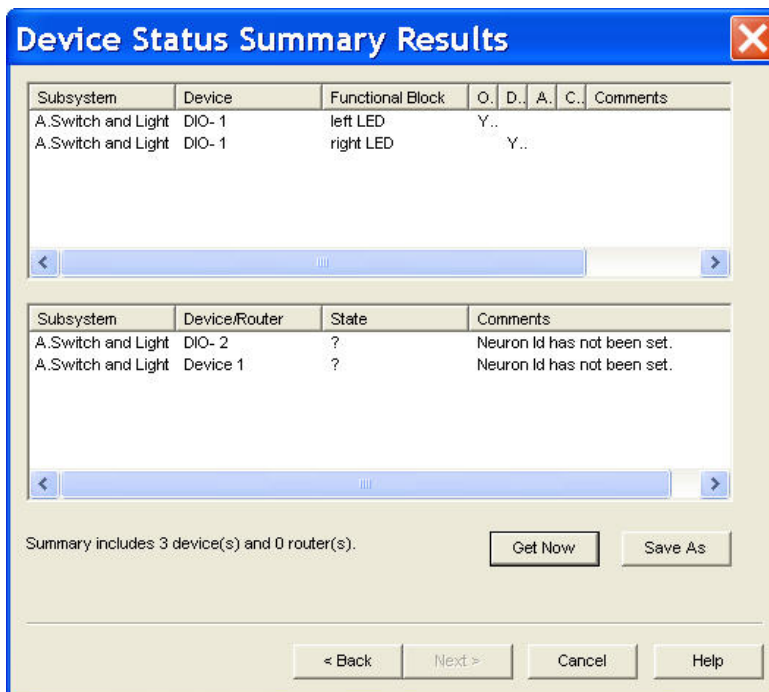
Set as Default Options

Causes the options set in this window to become the defaults for this LonMaker network. The default options are set when you click **Next**.

3. Click **Next**. If you selected the **Advanced Options** check box, the **Advanced Status Summary Options** dialog box opens. Otherwise, you can skip to step 5, in which the **Device Status Summary Results** dialog appears.



4. Select additional functional blocks to include in the status summary based on the type of errors or exceptions they have reported. For more information on the status items themselves, refer to hardware manuals or LONMARK documentation.
5. Click **Next**. The **Device Status Summary Results** dialog appears. This dialog displays the status of devices, routers, and specified functional block types within the scope specified in the **Device Status Summary Options** dialog. The functional blocks are listed in the top pane; the devices and routers are listed in the bottom pane.
6. Click **Get Now** to generate the status summary. A one-line summary states the number of devices and routers included in the summary.



For functional blocks, this dialog displays the following data in the top pane: subsystem, device, functional block name, applicable status (indicated by "YES"), and any comments about the functional block.

For application devices and routers, this dialog displays the following data in the bottom pane: subsystem, device name, state, and any comments about the device or router.

7. To save the status summary to a text file (.txt extension), click **Save As**.

Using Resource Usage Reports

You can generate a *network resource report* to get a summary of group ID, subnet ID, and selector usage in your network. You can display a summary of the usage and availability of alias table entries for a device.

Network Resource Report

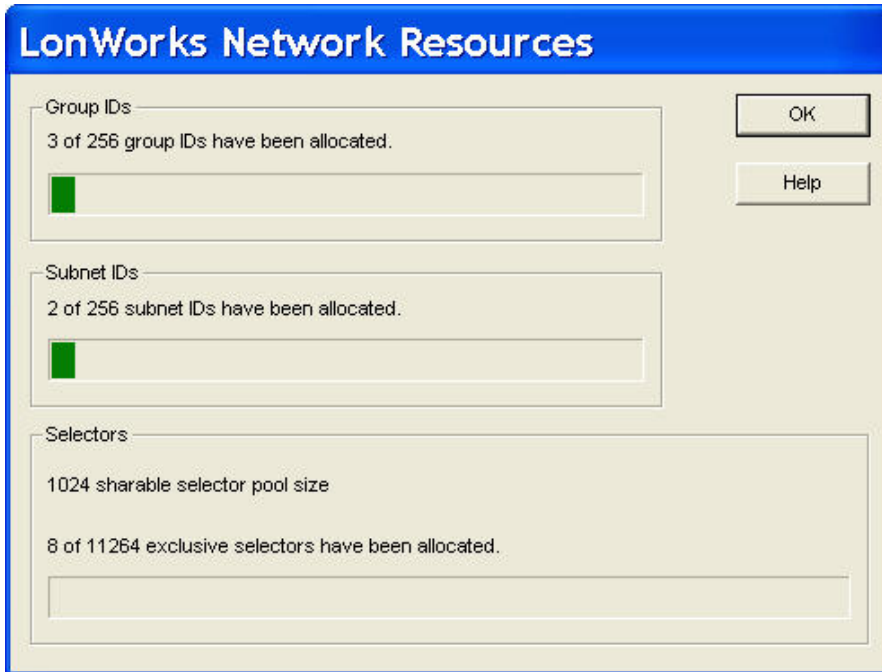
You can display a summary of the usage of group IDs, subnet IDs, and selectors in your network. The usage of these resources is displayed in a network resource report. This report displays the number of group IDs, subnet IDs, and selectors that have been allocated out of those available in your LonMaker drawing. Individual color status bars indicate the percentage consumed and available for each resource. As more network resources are consumed, the status bar fills up and changes color. The status indicated by each color is as follows:

- **Green**. Resource is readily available (up to 75 percent used).
- **Yellow**. Resource is available, but beginning to run low (between 75 and 90 percent used).
- **Red**. Resource is critically low (over 90 percent used).

Each of these resources is described as follows:

- *Group ID*. A group ID is allocated when you create a multicast connection with a group broadcast. Once a group ID is allocated for a connection, it cannot be reused. There are 256 group IDs available per network. You will not be able to create connections with group multicast once all group IDs are allocated. You can prevent group ID usage by using other forms of multicast such as subnet or domain broadcast, or alias multi-unicast.
- *Subnet ID*. A subnet ID is allocated when you create a new channel, when you add more than 127 devices to an existing subnet, or when you explicitly create a subnet. Once a subnet ID is allocated, it cannot be reused for a different channel. There are 127 subnet IDs per network. You will not be able to add new channels or subnets once all subnet IDs have been allocated.
- *NV Selector*. An NV selector is allocated when you create a new network variable connection. A pool of NV selectors may be shared among multiple connections, but the remaining NV selectors are exclusive and can only each be used for one connection. You will not be able to create more connections once all exclusive NV selectors are allocated unless the LonMaker tool can successfully share one of the shared selectors. The network resource report shows the size of the shareable NV selector pool, and it shows the size and consumption of the exclusive selector pool.

To view the network resources report, open the **LonMaker** menu and then click **LonWorks Network Resources**.



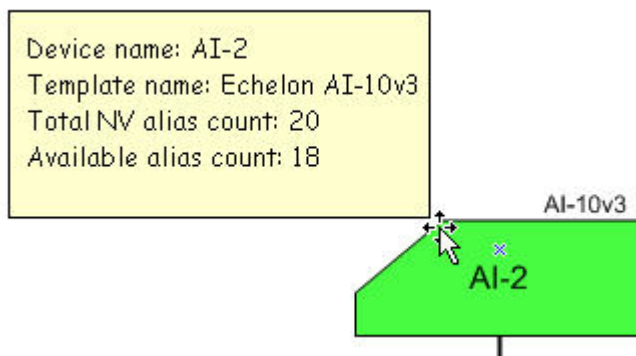
Alias Table Summary

You can display a summary of the usage and availability of alias table entries for a device. The usage and availability is displayed in a ToolTip for a device. The device shape ToolTip lists the total number of network variable aliases for the device, and the number of aliases currently available.

An alias table entry is allocated on a sending device when you create an alias multi-unicast connection and is also consumed on either the sending or destination device when required to resolve network variable selector conflicts. The number of alias table entries available on a device is determined by the device manufacturer. The LonMaker tool will use alias table entries on a device when required if they are available.

To view the alias table summary, move the pointer over the desired device shape and keep it there for the ToolTip delay. The default ToolTip delay (number of milliseconds the pointer needs to be positioned over a LonMaker shape for the ToolTip to appear) is two seconds. The device shape ToolTip will then appear. The total and available network available alias counts are by default the last two items listed in the ToolTip.

You can set the data displayed by the ToolTip and the default delay in the network properties: **Shape ToolTips** options category (see *Shape ToolTips Options* in Appendix A for more information).



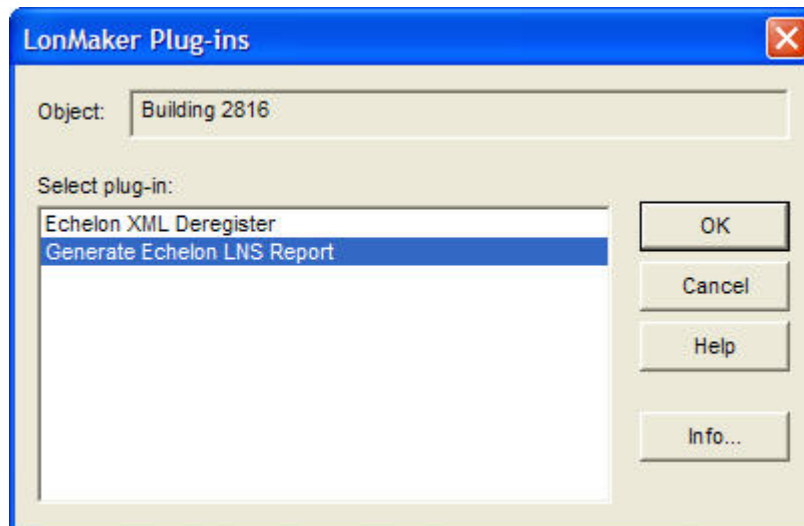
Generating LNS Reports

You can create a report detailing selected objects in your LonMaker network using the *LNS Report Generator* or by generating a LonMaker network report as described in Chapter 9, *Exporting and Importing Networks with XML*. The LonMaker network report is typically faster and more flexible.

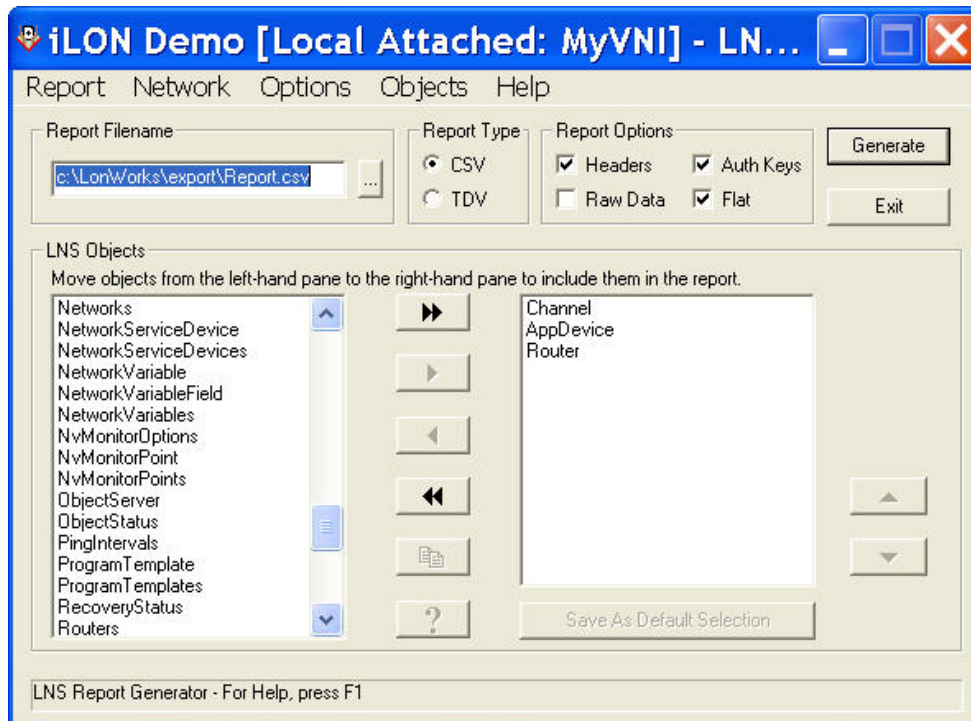
The LNS Report Generator is an LNS plug-in that generates customized reports for a LONWORKS network. You can start it as a standalone application or from the LonMaker tool, and you can use it on a local or remote client.

To create an LNS report for your network, follow these steps:

1. If you have not registered the *LNS Report Generator* plug-in for the network, register it. Otherwise, skip to step 2.
 - a. Open the **LonMaker** menu, point to **Plug-Ins**, and then select **Register Plug-Ins**. The network properties: **Plug-in Registration** dialog opens.
 - b. Under **Not Registered**, locate and select **Echelon LNS Report Generator**.
 - c. Click **Register**.
 - d. Click **OK**. The LonMaker tool registers the LNS Report Generator plug-in.
2. Start the LNS Report Generator plug-in.
 - a. Open the **LonMaker** menu, point to **Plug-Ins**, and then select **Network Plug-Ins**. The LonMaker Plug-ins dialog opens.



- b. Select **Generate Echelon LNS Report** and then click **OK**. The LNS Report Generator opens.



3. Under the **Report Type** box, select the format of the report: **CSV** (comma delimited values) or **TSV** (tab delimited values).
4. Enter the name of the report file in the **Report Filename** box.
5. Under **Report Options**, select the following report options:

<i>Headers</i>	<p>Outputs a header record before each new block of property data. This option is selected by default.</p> <p>The header record will contain the name of each property along with the units of that property. (In Excel this header block can be used as a data filter selector). When not selected, there will be no inter-block headers or gaps. There will always be a partial header at the top of the report (in Excel, this allows you to more easily filter the report data).</p>
<i>Raw Data</i>	<p>Outputs property values in raw format. Symbolic constants are not displayed. This option is cleared by default.</p> <p>If this option is cleared, further processing will be performed on the property values depending on their type. Typically, symbolic constants will replace constant values.</p>
<i>Auth Keys</i>	<p>Displays authentication keys in the report. This option is selected by default</p> <p>If this option is cleared, authentication keys will be hidden in the report as a security measure.</p>
<i>Flat</i>	<p>Generates a flat report, in which similar objects will be grouped in the order specified under LNS Objects. This option is selected by default</p> <p>If this option is cleared, a hierarchical report will be generated. Objects will be grouped near their parent objects in a hierarchical arrangement.</p>

6. Under **LNS Objects**, select which objects to include in the report by moving them from the left to the right pane.

You can get information about any object by choosing the object and then selecting **Object Help** from the **Objects** menu, or by clicking the help icon.

7. To reorder the selected LNS objects in the right pane, select the object to move and then click the Up or Down button, or select **Move Up** or **Move Down** from the **Objects** menu. The order displayed is the order that objects will appear in the final report. The hierarchical report (the type of report that will be created if you cleared the **Flat** check box) partially overrides this ordering.
8. Click **Generate** to start the report generation. A comma or tab delimited text file listing the selected objects is created. By default, this file will be stored in the **C:\LonWorks\export** folder
9. To generate additional reports, repeat the above steps. Enter a different file name to prevent overwriting a previously generated report.

Tip: Once you create an LNS report, you can analyze, format, or print it by importing it into or processing it with other programs such as Perl, Excel, and Access.

For more information on using the LNS Report Generator, see the *LNS Report Generator* topic in the *LNS Utilities* help file.

Exporting and Importing Networks with XML

This chapter describes how to export a LONWORKS network to a LonWorks network XML file, view a LonWorks network XML file in a web browser, edit a LonWorks network XML file, and import a LonWorks network XML file to update a network.

Using XML Export/Import Overview

You can export your LONWORKS network to a LONWORKS network XML file that contains all the devices, connections, network variables, and configuration properties within a specified network scope (from selected devices to the entire network). You can also include device templates, connection description templates, and channels in the XML file.

You can then use an XML editor to view or modify the exported XML file; view the exported XML file as a LonMaker network report; or view or edit the exported XML file with another application.

In an exported LONWORKS network XML file, you can create, update, and delete most LonMaker objects, including the following: subsystems, application devices and routers, functional blocks, network variables, connections, and channels. In addition, you can commission application devices and routers. If you commission a device, you can specify the application image to load into it, set the initial state of its application, and specify the source of configuration property value and how device-specific configuration properties are handled. See the *LonWorks Network XML Programmer's Guide* for more information on editing a LONWORKS network XML file.

After editing the LONWORKS network XML file, you can import it back into your network. The LonMaker tool updates the network based on the attributes and actions specified for the LonMaker objects in the file.

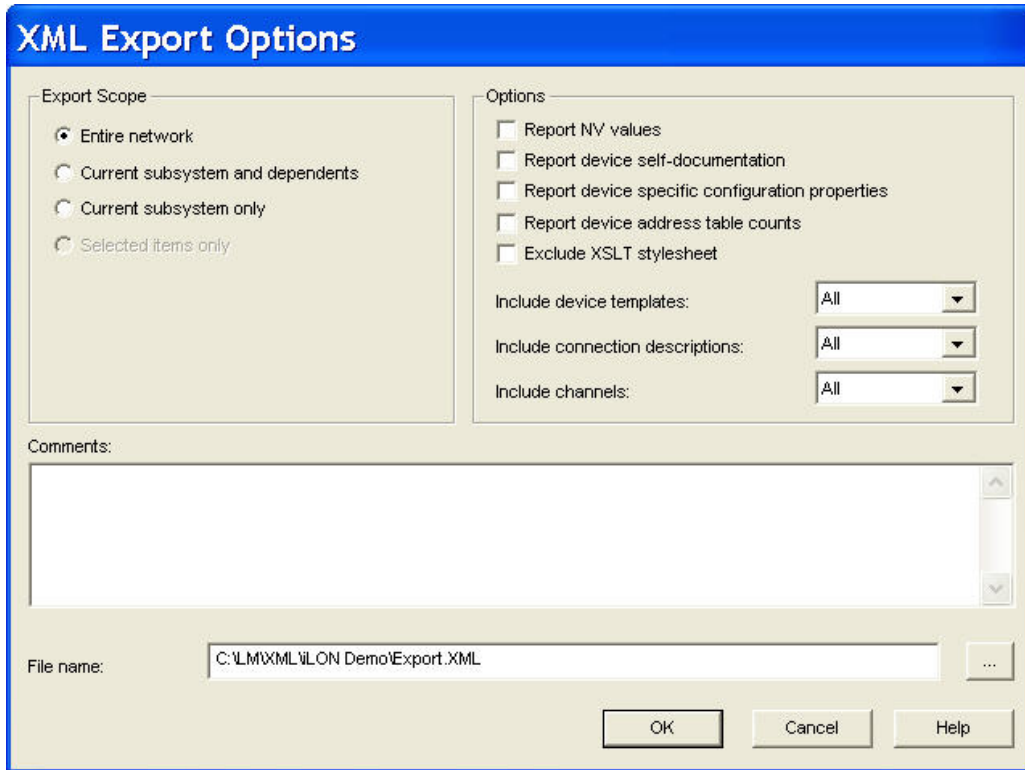
Exporting a LONWORKS Network XML File

You can export your LONWORKS network to an XML file using the LonMaker XML Plug-in included with the LonMaker tool, or you can manually export your LonMaker network using the LonMaker tool. You can export selected items, subsystems, or your entire network to the XML file. The XML file consists of a report of all the devices, connections, network variables, configuration properties, and other data that you select within a specified network scope. In addition, the exported XML file by default includes a XSLT style sheet that you can use to transform the file into a LonMaker network report, which you can view in your Web browser (see *Viewing a LonMaker Network Report* for more information).

If you are using an LNS application other than the LonMaker tool, you can use the LonMaker XML Plug-in to automate exporting your LONWORKS network to the other application. The LonMaker XML Plug-in provides a programmatic interface to the XML import and export features in the LonMaker tool. The LonMaker XML Plug-in is registered at the network level; therefore, it only needs to be registered once on a computer for it to be used to import or export any LONWORKS network. See the *LonWorks Network XML Programmer's Guide* for details on how applications can use the plug-in and the schema used for the XML file.

To manually export your LonMaker drawing to a LONWORKS network XML file, follow these steps.

1. Open the **File** menu, point to **LonMaker Documents**, and then click **Export to XML**. The **XML Export Options** dialog box appears.



2. Set the following options to select the data to be included in the XML file:

Export Scope

Select the portion of the network to be included in the XML file. There are four choices:

- **Entire Network.** All application devices and routers in all subsystems in the network will be exported. This is the default.
- **Current Subsystem and Dependents.** Application devices and routers in the currently displayed subsystem and those in any nested subsystems will be exported.
- **Current Subsystem Only.** Only application devices and routers in the currently displayed subsystem will be exported.
- **Selected Items Only.** Only selected application devices, routers, and subsystems in the currently displayed subsystem will be exported. This option is only available if you select one or more items before opening the **XML Export Options** dialog box. To select an item click it. To select multiple items, click one, hold down SHIFT, and click all other desired items.

Options

Report NV Values

Includes the current values of all exported NVs. This option is unavailable if the LonMaker computer is not attached to the physical network. This option can add significant processing time to the export if there are many network variables within the export scope.

Report Self-Documentation

Includes the self-documentation data for all exported devices and their network variables. This option is unavailable if the LonMaker computer is not attached to the physical network. This option can add significant processing time to the export if there are many network variables within the export scope.

Report Device

Includes the values of all device-specific configuration properties. Device-

<i>Specific CP Values</i>	specific CPs are CPs that may be changed by the device itself or by another device that is not based on LNS. The LonMaker tool reads device-specific values from the devices in the network—this option is unavailable if the LonMaker computer is not connected to the physical network. This option can add significant processing time to the export if there are many device-specific CPs within the export scope.
<i>Report Device Address Table Counts</i>	Includes the address table counts of all exported devices. This option is unavailable if you are using the LonMaker tool on a remote client. This option can add significant processing time to the export if there are many devices within the export scope
<i>Exclude XSLT Stylesheet</i>	Includes the XSLT style sheet. See <i>LonMaker Network Report</i> later in this chapter.
<i>Include Channels</i>	Selects which channels are reported in the XML file. Choose All , None , or Referenced . Referenced means that only channels referenced by devices within the selected network scope will be reported.
<i>Include Device Templates</i>	Selects which device templates are reported in the XML file. Choose All , None , or Referenced . Referenced means that only device templates referenced by devices within the selected network scope will be reported.
<i>Include Connection Descriptions</i>	Selects which connection descriptions are reported in the XML file. Choose All , None , or Referenced . Referenced means that only connection descriptions referenced by connections within the selected network scope will be reported.
<i>Comments</i>	Specifies optional comments that you can use to document the export file. The comments are inserted as a set of comment tags containing the comments in the XML file.
<i>File Name</i>	Specifies the name of the XML file. The default name is C:\XML\network\Export[_version].xml .

3. Click **OK**. The **LonMaker XML Export Status** window displaying the report status appears, and the LonMaker tool generates the XML file. You can click **Cancel** to stop the XML export. When “Export complete” appears, click **OK** to close the window.
4. You can open the exported LONWORKS network XML file in an XML editor and begin viewing, creating, deleting, or modifying items; view the exported XML file as a LonMaker network report; or view or edit the LonMaker XML file with another application. If you make changes to the XML file, save the file. You can then import the updated XML file back into the network as described in *Importing a LonMaker XML File*

Viewing a LonMaker Network Report

You can view a LONWORKS network XML file as a LonMaker network report in your Web browser. This report is available as long as the **Exclude XSLT Stylesheet** option in the **XML Export Options** dialog box is cleared.

To view a LonMaker network report, follow these steps:

1. Generate a LONWORKS network XML file.
2. Clear the **Exclude XSLT Stylesheet** check box in the **XML Export Options** dialog box.
3. Optionally modify the LONWORKS network XML file directly or with another application.
4. Either open the LonMaker XML file from Internet Explorer, or open the folder containing the LonMaker XML file and double-click the file (Internet Explorer must be your default Web browser for this method to work). The LonMaker network report appears.

This report consists of a main network page with the network name, export date and time, and tables with hyperlinks to view the exported data for subsystems, channels, device templates, and connection descriptions.

You can view the exported data following the network hierarchy—starting from the root subsystem through the contained subsystems, devices, functional blocks, and network variables down to the configuration properties associated with a network variable. For example, click the **Subsystems** link to open a page with tables displaying basic data for all the routers, devices, and nested subsystems in the selected subsystem.

Router Name	Near Channel	Far Channel
RTR-9	Channel 1	Channel 2

Device Name	Template Name	Channel Name
LNS Network Interface	LNS Network Interface	Channel 1
AI-2	Echelon AI-10v3	Channel 2
DO-1	Echelon DO-10v3	Channel 2
AO-1	Echelon AO-10v3	Channel 2

Subsystem Name
Subsystem

Click a device link to open a page with detailed data on that device and a table listing its functional blocks, with links to view detailed data on each one.

ECHELON LonMaker Network Report

Object path name: //Subsystem 1/AI-2 [Up](#) [Ro](#)

Device Name: AI-2
 Template: Echelon AI-1br3
 Neuron ID: 000181621700
 Channel: Channel 2
 Authenticated?: False
 Commission status: Updates Current
 Attachment status: Attached
 Ping class: Permanent
 Description:

Functional Blocks

FB Name	Profile
AI-1	Echelon Analog/Digital Input
AI-2	Echelon Analog/Digital Input
AFB-1	Echelon Analog Function Block object
AFB-2	Echelon Analog Function Block object

Click a functional block link to open a page with detailed data on that functional block and a table listing its network variables and configuration properties, with links to view detailed data on each one.

ECHELON LonMaker Network Report

Object path name: //Subsystem 1/AI-2/AI-1 [Up](#) [Ro](#)

FB Name: AI-1
 Index: 1
 Scope: Manf
 Profile: Echelon Analog/Digital Input
 Virtual?: False
 Dynamic?: False

Network Variables

NV Name	Direction	Type
Analog	Output	SNVT_temp_f

Configuration Properties

CP Name	Dimension	Device Specific?	Constant?	Value[0]
UCPTObjectType	1	False	True	3, 20003
UCPTObjectMajorVer	1	False	True	2
UCPTObjectMinorVer	1	True	True	<Unknown>
UCPTTaskFilter	1	False	False	TRUE
UCPTTaskCufg	1	False	False	OHMS1X25
SCPTLocation	1	False	False	
UCPTsampleIntervalMult	1	False	False	1
UCPTdeviceOffset	1	False	False	0

You can continue moving down the network hierarchy until reaching the end, which is at the network variable/configuration property or configuration property paths. Click **Up** to go back one level in the network hierarchy, or click **Root** to return to the main network page.

Importing a LONWORKS Network XML File

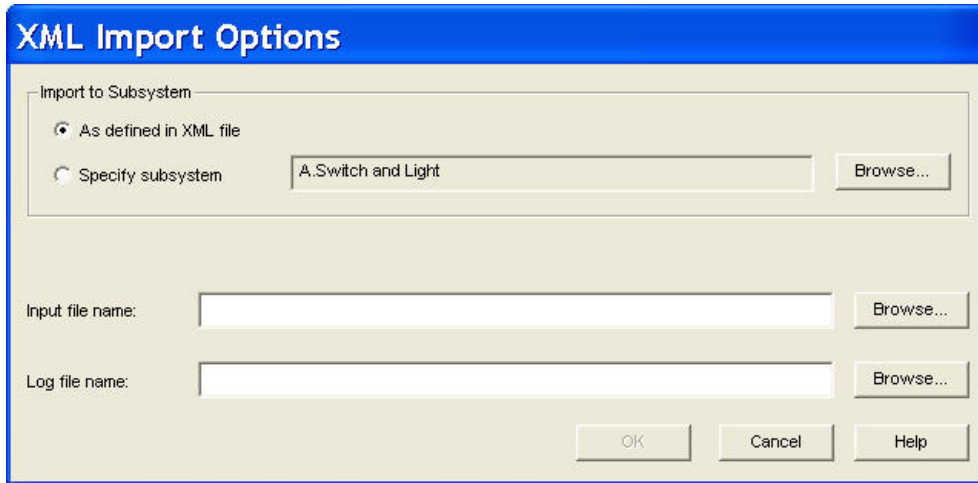
You can import a LONWORKS network XML file from another application using the LonMaker XML Plug-in, or you can manually import a LONWORKS network XML file into an existing network using the LonMaker tool. Importing a LONWORKS network XML file will update the network based on the actions and attributes specified for the objects in the XML file. Objects in the LNS network database are created or updated and the LonMaker drawing is updated accordingly.

As described in *Exporting a LONWORKS Network XML File*, if you are using an LNS application other than the LonMaker tool, you can use the LonMaker XML Plug-in to automate importing your LONWORKS network from the other application. The LonMaker XML Plug-in provides a programmatic interface to the XML import and export features in the LonMaker tool. See the *LonWorks Network XML Programmer's Guide* for details on how applications can use the plug-in and the schema used for the XML file.

When the LonMaker tool imports a LONWORKS network XML file, it attempts to match each object in the XML file with an object in the LNS database and LonMaker drawing. The LonMaker tool matches objects based on Neuron ID, name, or handle (in that order). For each matching object, the LonMaker tool updates the attributes of the object based on any changes in the XML file. For each object that cannot be matched, the LonMaker tool creates a new matching object in the LNS network database and the LonMaker drawing. As a result, it is possible to create a new network from a LONWORKS network XML file by starting with a new LonMaker drawing and importing the XML file. It is also possible to export a LonMaker XML file from an existing network, make changes in the XML file, and then re-import the XML file to make the changes.

To manually import an XML file, follow these steps:

1. Open the **File** menu, point to **LonMaker Documents**, and then click **Import from XML**. The **XML Import Options** dialog box appears.



2. Set the following options:

Import to Subsystem Select the root subsystem for the XML file. There are two choices:

- **As Defined in XML File.** Imports the XML file into the subsystem specified in the XML file.
- **Select Subsystem.** Imports the XML file into the subsystem you specify. By default, the top-level root subsystem will be selected. To change the subsystem, click **Browse**.

Input File Name Specifies the name of the XML file to import.

Log File Name Specifies the name of the output XML log file that is generated during the XML import. This log lists the objects created, modified, or deleted, and any errors encountered. The default name is **C:\XML\network\Export[_version]Log.xml**.

If this field is clear, an XML log file is not created.

3. Click **OK**. The **LonMaker XML Import Status** window displaying the report status appears, and the LonMaker tool imports the XML file. You can click **Cancel** to stop the XML import. When “Import complete” appears, click **OK** to close the window.

Tips:

- If you are making changes that affect the LonMaker drawing, set the LonMaker event log limit high enough to hold all of the events that may be generated by the XML file import. You can set the maximum number of log entries in the network properties: **Synchronization** options category (see Appendix A for more information on this option). Alternatively, in the **<LonWorksNetwork>** section of the XML file, you can insert the limit between a pair of **EventLimit** tags, using the following format: **<EventLimit>n</EventLimit>**, where *n* is the maximum number of log entries saved per drawing file.
- To reduce the time required to import a LONWORKS network XML file, do the following: remove entries from the LONWORKS network XML file that do not need to be updated before importing the network (especially collections of objects); import the XML file with the LonMaker tool OffNet; close any remote applications if you are importing a large amount of data.

LonMaker Credits

This chapter provides information on licensing the LonMaker tool; using, viewing, and adding LonMaker credits; licensing remote clients; transferring a LonMaker license; and using LonMaker demo mode.

Licensing with the LonMaker Tool

Your licensed copy of the LonMaker software includes 64 (for LonMaker Professional Edition) or 5 (for LonMaker Standard Edition) free *LonMaker credits*. A LonMaker credit is a token representing a prepaid fee to commission a device. You can use LonMaker credits to commission devices in one network or in multiple networks. LonMaker credits are associated with the LonMaker application and the computer running it and are stored in a file called the *LonMaker license file*. The LonMaker tool keeps track of the number of credits you have available. You can use the LonMaker tool to commission devices even if you have a credit deficit, but only for two weeks. See *Using Deficit Credits* for more information.

Defragmenting the LonMaker Disk

You can defragment the disk where you installed the LonMaker software as long as you do not move the LonMaker license files.

Note: Certain after-market disk defragmenters such as Symantec's Norton Utilities Speed Disk or Executive Software's Diskeeper can break the LonMaker license if the disk defragmentation software is not configured properly. Other disk utilities that bypass the operating system's file system can also break the license.

The disk defragmenters built into Windows XP, Windows Server 2003, and Windows 2000 do not break the license.

Prior to defragmenting your disk using an after-market disk defragmenter, configure it not to move files with .ent, .key, or .rst extensions. How you do this is based on the after-market disk defragmenter you are using. For example, if you are using the Norton Speed Disk utility on the LonMaker computer, you must set the following option or you will lose your LonMaker license file: Start Speed Disk, open the **File** menu, click *Options > Customize > Unmovable Files* command, and specify *.ent, *.key, and *.rst. Then open the **File** menu and select the *Options > Optimization > Save* command to save the change.

If the after-market disk defragmentation program that you are using is not configurable, either use the disk defragmentation built into Windows, or use after-market disk defragmentation software that is configurable

Using LonMaker Credits

You can purchase LonMaker credits to commission more devices after you have used up the LonMaker credits included with your LonMaker tool. Each time you commission a device with the LonMaker tool while it is attached to the network and OnNet, one LonMaker credit is deducted.

LonMaker credits are not deducted when you commission routers, network service devices, or an LNS Server device. Credits are also not deducted when you replace devices that have already been commissioned by the LonMaker tool, or when you recommission devices that are already in the database—even if you change the application image or program IDs in the devices.

LonMaker credits are not used while you design a network under the engineered system installation scenario. Although you can commission a device by manually entering its Neuron ID in engineered mode, a LonMaker credit is not deducted until you recommission the device with the LonMaker computer attached to the network.

LonMaker credits will be returned if you delete a commissioned device with the LonMaker tool. The maximum number of credits that can be returned is the number of devices you have commissioned or 32,767, whichever is less.

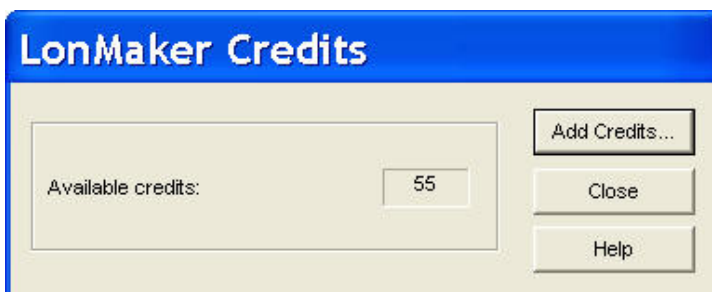
Viewing LonMaker Credits

You can view the number of LonMaker credits you have available to commission devices from the LonMaker Design Manager or in a LonMaker drawing.

The LonMaker Design Manager includes a LonMaker license status box in the bottom left-hand corner that indicates the number of LonMaker credits available (if you have more than 10 credits, the status bar is green; if you have 10 credits or less, it is yellow). To add credits, double-click anywhere in the LonMaker license status box, or right-click the **Echelon LonMaker Design Manager** title bar or taskbar button, and then click **View Credits** on the shortcut menu.



In a LonMaker drawing, you can view the number of LonMaker credits you have available to commission devices. Open the **LonMaker** menu and select **LonMaker Credits**. The **LonMaker Credits** dialog opens. To add LonMaker credits to your license, click **Add Credits**.



See *Adding LonMaker Credits* in this chapter for how to purchase additional LonMaker credits.

Using Deficit Credits

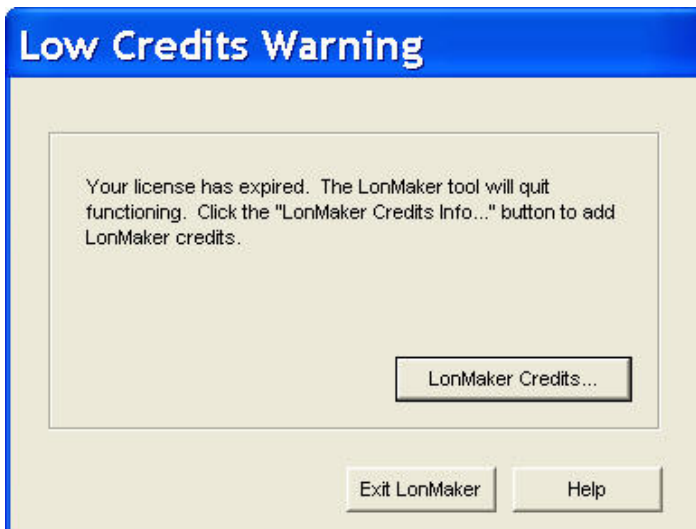
If you use all of your LonMaker credits and you still need to commission additional devices, the LonMaker tool will continue to function and you will be able to continue commissioning devices for up to two weeks or until you have used up an additional 500 credits, whichever comes first. This gives you time to purchase additional credits.

During the two-week deficit credit period, the **Low Credits Warning** dialog appears each time you open or create a network, switch to a different drawing page, or commission a new device. In addition, this dialog appears after every hour of use.



This dialog displays the number of days and deficit credits remaining before your license expires. The LonMaker tool updates the days remaining and number of deficit credits to accurately reflect the current state of your license.

To add LonMaker credits to your license, click **LonMaker Credits** (see *Adding LonMaker Credits* in this chapter for how to purchase additional LonMaker credits). To continue running the LonMaker tool without purchasing LonMaker credits, click **OK**. You must purchase enough LonMaker credits to cover all the deficit credits used before the license expires. If you do not purchase the LonMaker credits in time, the LonMaker tool becomes disabled and the following dialog appears:



Viewing Deficit Credits

If you are using deficit credits, you can view the status of your license from the LonMaker Design Manager or in a LonMaker drawing.

When you are using deficit credits, the LonMaker license status box in the LonMaker Design Manager will become orange, and then it will turn red when you only have five days remaining to purchase

credits. To add credits, double-click anywhere in the LonMaker license status box, or right-click the **Echelon LonMaker Design Manager** title bar or taskbar button, and then click **View Credits** on the shortcut menu (see *Adding LonMaker Credits* in this chapter for how to purchase additional LonMaker credits).

In a LonMaker drawing, you can view the status of your license by opening the **LonMaker** menu and selecting **LonMaker Credits**. The **LonMaker Credits** dialog opens.



This dialog displays the number of deficit credits used, the maximum and available number of deficit credits, and the number of days remaining that you can use the LonMaker tool without purchasing credits before your license expires.

To add LonMaker credits to your license, click **Add Credits** (see *Adding LonMaker Credits* in this chapter for how to purchase additional LonMaker credits). To continue running the LonMaker tool without purchasing LonMaker credits, click **Close**.

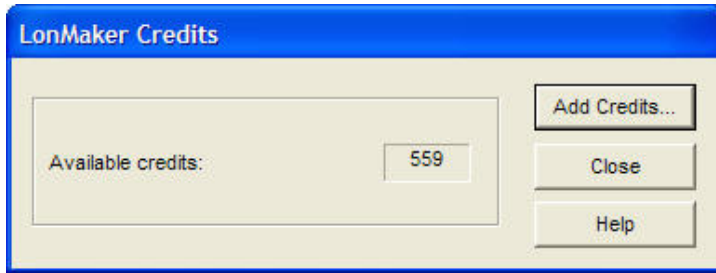
Adding LonMaker Credits

You can purchase LonMaker credits to add LonMaker credits to your license from Echelon or another authorized LonMaker credit reseller. You cannot purchase additional LonMaker credits if you are using the Trial Edition of the LonMaker tool. Free LonMaker credits are available for development, test, support, replacement, or training purposes.

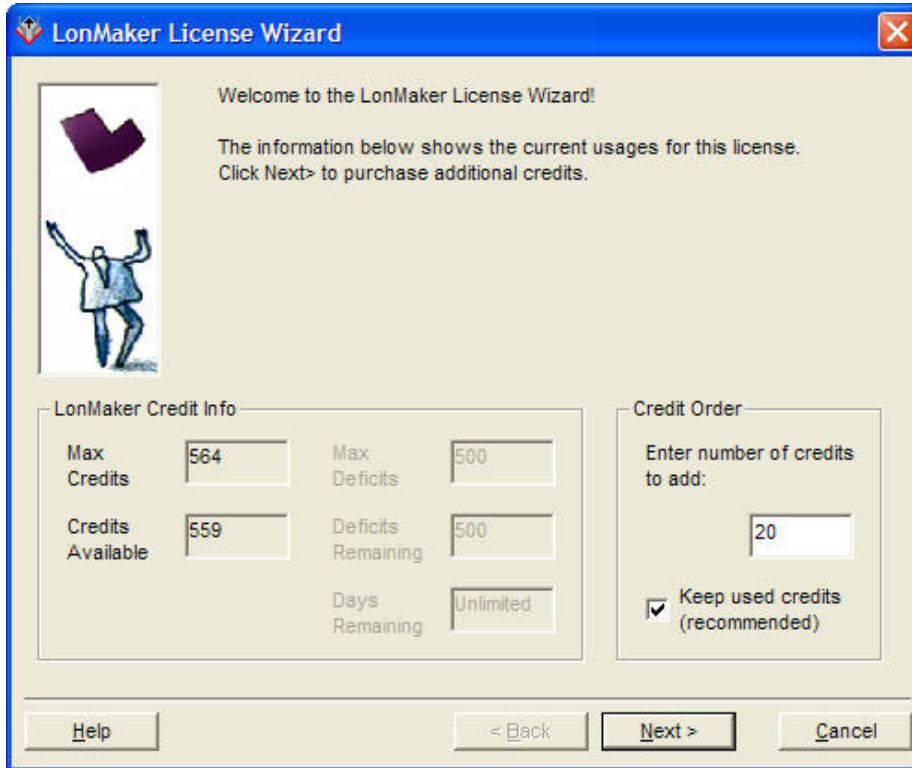
To purchase additional LonMaker credits, follow these steps:

1. From the LonMaker Design Manager, double-click anywhere in the LonMaker license status box, or right-click the **Echelon LonMaker Design Manager** title bar or taskbar button, and then click **View Credits** on the shortcut menu. The LonMaker License Wizard opens. Skip to step 3.

In a LonMaker drawing, open the **LonMaker** menu and select **LonMaker Credits**. The **LonMaker Credits** dialog appears.



1. Click **Add Credits**.
2. The LonMaker License Wizard opens.



The first page of the LonMaker License Wizard displays the maximum and available number of LonMaker credits, provides deficit credit information (if you are commissioning devices without having any LonMaker credits—see *Using Deficit Credits* in this chapter for more information on using deficit credits), and lets you submit an order for additional LonMaker credits.

3. Under **Credit Order**, enter the number of credits you want to purchase in the **Enter Number of Credits to Add** box. The minimum order is 20 LonMaker credits.
4. Select the **Keep Used Credits** check box so that credits you already used for commissioning devices can be returned if you remove a commissioned device. For example, if you start with 564 credits and then commission 5 devices, you have a maximum of 564 credits and 559 available credits. If you purchase 100 additional credits and select this option, you will have a maximum of 664 credits and 659 available credits. If you clear this option, the number of available and maximum credits will both be 659, and you will not recover any credits when you remove any previously commissioned devices.
5. Click **Next**. The second page of the LonMaker License Wizard appears.



The second page of the LonMaker License Wizard displays the **PC Key** (also called the activation code), which uniquely identifies your copy of the LonMaker tool and the computer running it, and it shows the **Serial Number** of your LonMaker tool.

6. Click **Copy to Clipboard** to create a LonMaker Credits Order Form. This form includes your request to order LonMaker credits, the PC key, and the Serial number.
7. Send the LonMaker Credits Order Form to Echelon or other authorized LonMaker credit reseller via e-mail, fax, or mail. The address is included at the top of the order form.
 - To e-mail the form, copy it to an e-mail message using your e-mail application and then send it to the e-mail address at the top of the request form.
 - To fax or mail the form, copy it to a text file, print it, and then fax to the fax number or mail to the address on the order form.

Make sure you provide your purchase order or credit card information in the LonMaker Credits Order Form.

Once your order is processed, you will receive an application key (if you e-mail the form, you should receive the application key within one business day). Until you receive the application key, do not delete any devices that are commissioned, decommission any devices, or merge networks. These actions invalidate your PC Key and require the generation of a new key. You may add new devices, commission devices, or delete devices that are not currently commissioned while waiting for the application key.

8. When you receive the application key, enter it in the **Application Key** box and click **Next**. A window appears confirming that you have successfully added LonMaker credits to your license.
9. Click **Finish**. The following dialog appears, confirming that you have successfully added LonMaker credits to your license.



This dialog includes a License Authorization Report that shows the current and previous number of maximum, available, and maximum deficit credits; the current and previous edition of the LonMaker tool licensed (Professional, Standard, or Trial); and the PC and application keys. Click **Copy to Clipboard** to paste the report into another Windows application.

10. Click **Exit**. You are returned to the LonMaker credits dialog.
11. Click **Close**. If you previously had any LonMaker credits, you are returned to the LonMaker drawing. Skip the remaining steps.
12. If you did not have any credits, you are returned to the **Low Credits Warning** dialog. Click **Exit LonMaker**.
13. Restart the LonMaker tool.

Note: If you run the LonMaker License Wizard again after successfully entering and using the application key, the License Wizard will generate a new PC Key.

Licensing Remote Clients

You can run the LonMaker tool on one or more remote clients; however, you must purchase a valid license for each remote client.

Once licensed, a remote client has its own pool of LonMaker credits. This allows multiple integrators to install and commission devices on the same network from different computers on the network. In this case, each integrator manages the credits on their remote client.

Transferring a LonMaker License

You can transfer your LonMaker license from one computer to another using the *LonMaker License Transfer Utility*. Transferring your license lets you upgrade or switch your LonMaker computer without losing your license.

You can also use the LonMaker License Transfer Utility to add LonMaker credits to your license from another computer. You must transfer all credits plus the LonMaker license. You cannot transfer a portion of the LonMaker credits. When you transfer a LonMaker license, the source computer can no longer run the LonMaker software except in Trial mode, and any LonMaker credits that were previously on the target computer will be lost.

A license must contain LonMaker credits in order to transfer it. You cannot transfer a license on which you are using deficit credits.

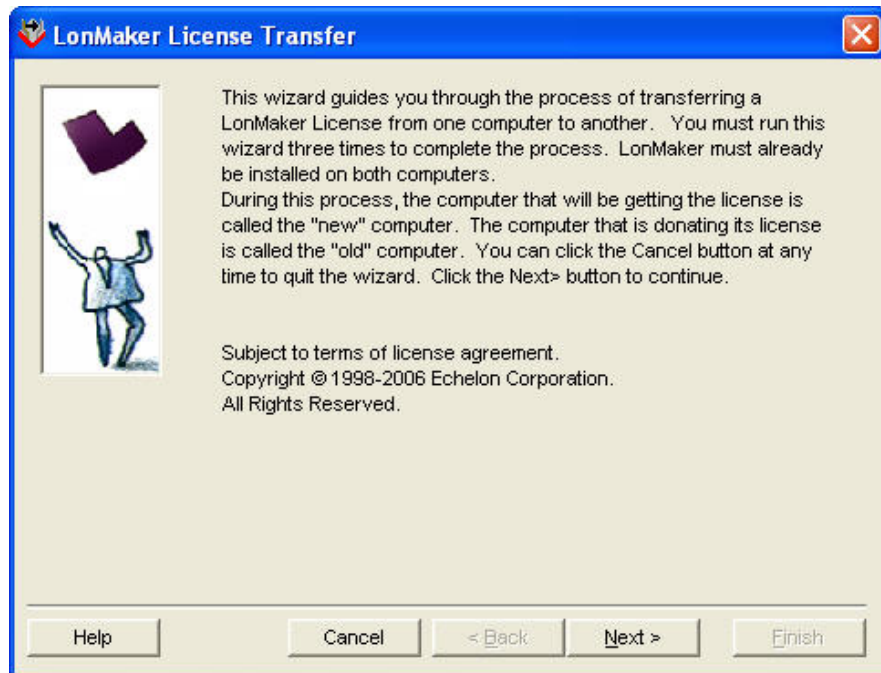
You cannot use the LonMaker License Transfer Utility to install one LonMaker license on multiple computers.

Before starting the LonMaker License Transfer Utility, first make sure that you have the LonMaker tool installed on the computer to which you want to transfer your license (the *target computer*). You can use a USB drive, floppy disk, other removable media, or a shared network drive with read/write permissions to make the transfer.

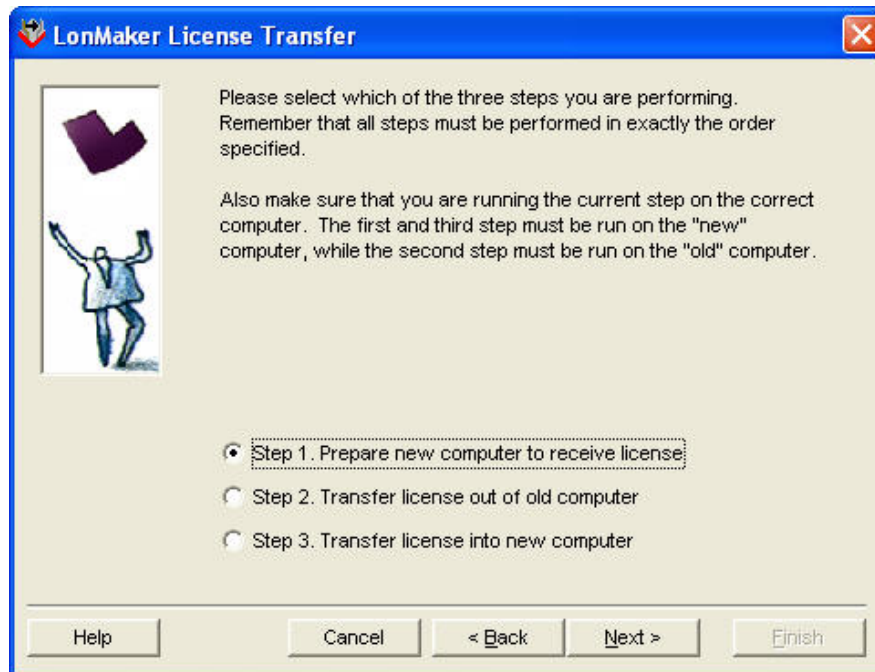
Note: Be sure to perform each step of the transfer in order, and on the correct computer or you will lose your license. The *target computer* (or *new computer*) is the computer you want to license. The *source computer* (or *old or donor computer*) currently contains the license you want to transfer to the target computer. If you lose your license, you can order free replacement credits.

To transfer your LonMaker license, follow these steps:

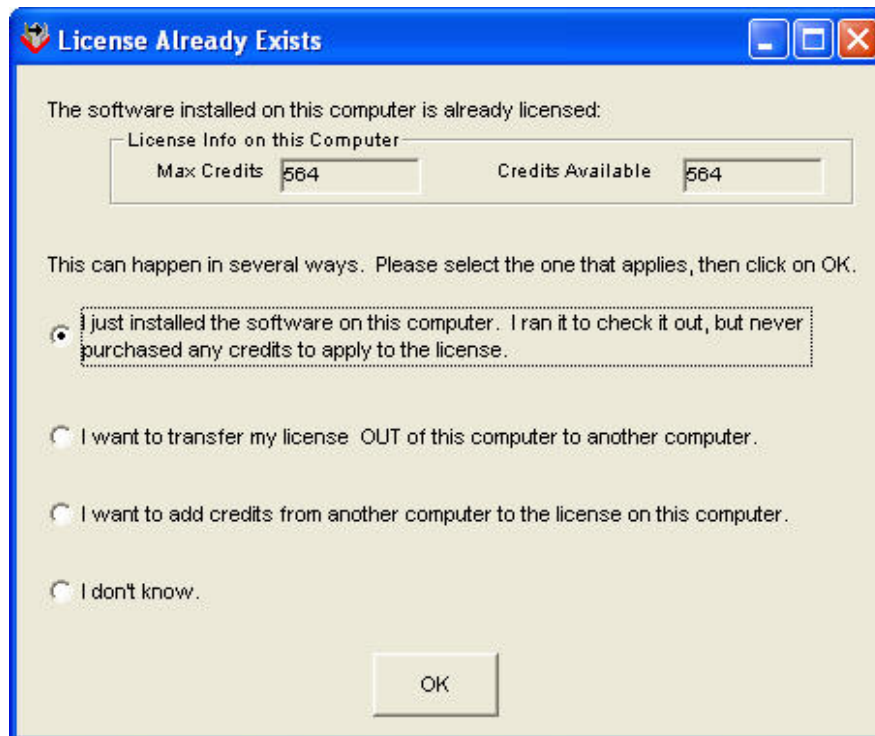
1. Prepare the target computer to receive the LonMaker license.
 - a. On the target computer, click **Start**, point to **Programs**, point to **Echelon LonMaker**, and then click **LonMaker License Transfer Utility**. The LonMaker License Transfer wizard opens.



- b. Read the information on the first page of the wizard and then click **Next** when done.

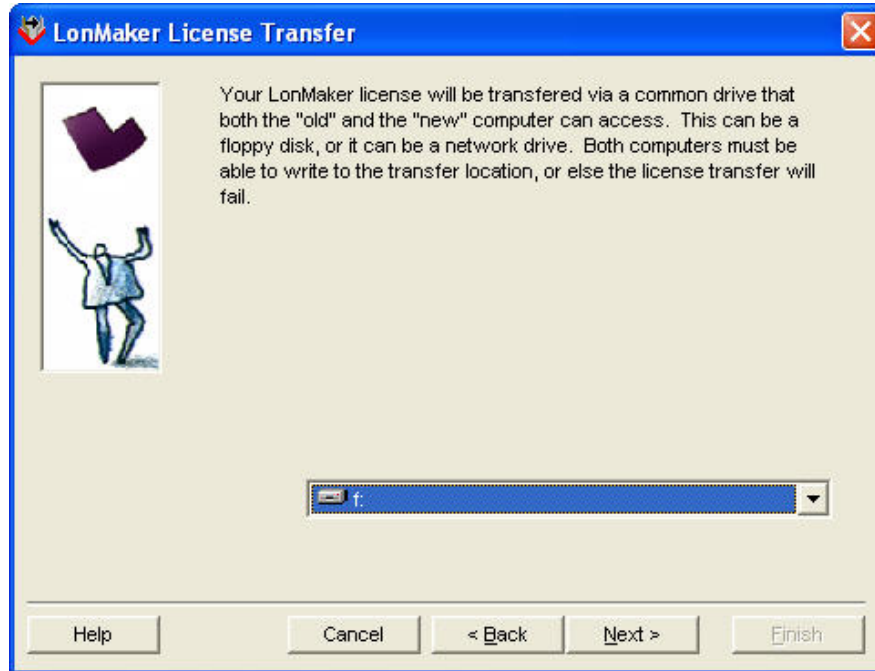


- c. Make sure you are currently on the target computer. If you proceed with the following steps on the source computer, you will lose your LonMaker license.
- d. Click **Step 1. Prepare New Computer to Receive License** and then click **Next**. If the License Transfer Utility detects a LonMaker license on the target computer, the **License Already Exists** dialog box opens:



- e. Select the first option to confirm that you are on the target computer and that you can overwrite the LonMaker credits already on the target computer.

- f. Perform any actions specified by the License Transfer Utility. The following window appears.

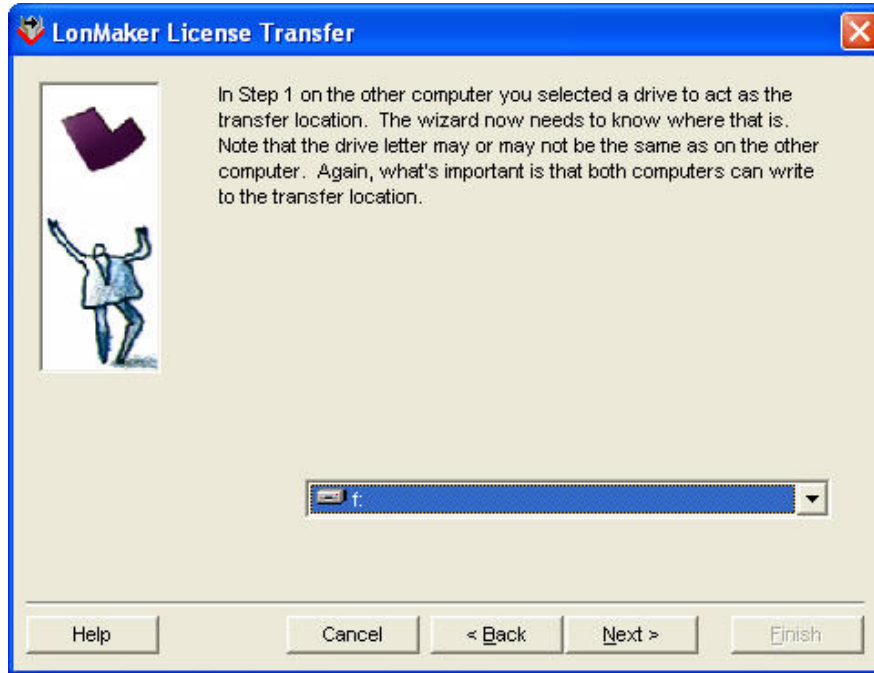


- g. Specify the drive to which you want to transfer your LonMaker license. You can use a USB drive, floppy disk, other removable media, or a shared network drive with read/write permissions. Click **Next**. A window appears telling you to go to the source computer and run the wizard again.

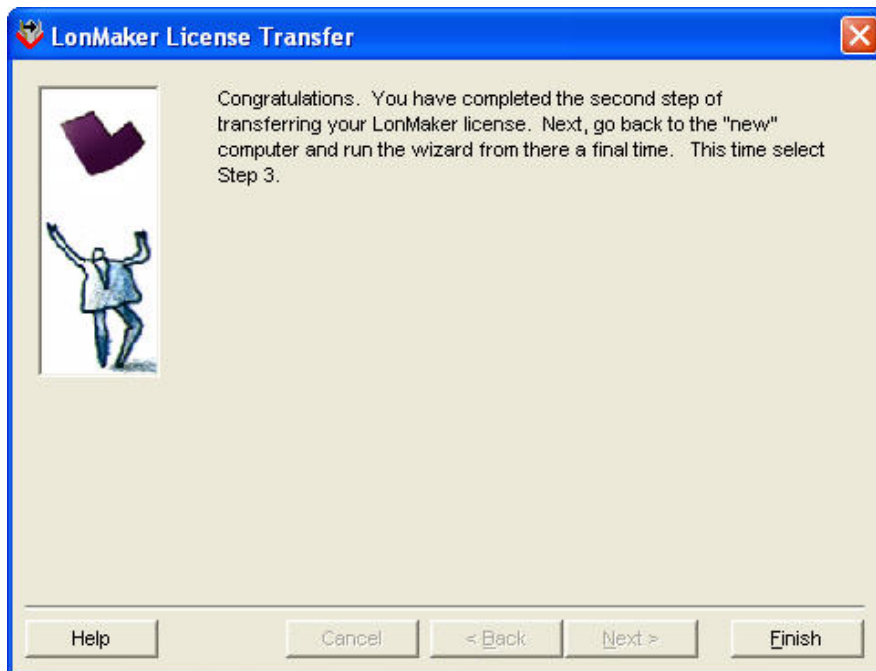


- h. Click **Finish** and go to the source computer.
2. Transfer the LonMaker license out of the source computer.

- a. On the source computer, if you are using a USB drive, floppy disk or other removable media to transfer the license, insert it into the source computer.
- b. Click **Start**, point to **Programs**, point to **Echelon LonMaker**, and then click **LonMaker License Transfer Utility**. The LonMaker License Transfer wizard opens. Click **Next**.
- c. Click Step 2. Transfer License Out of Old Computer. The following window appears.



- d. Specify the temporary drive you specified in step 1 and then click **Next**. A window appears telling you to go to the target computer and run the wizard again.



- e. Click **Finish** and go to the target computer.

3. Transfer the LonMaker license into the target computer.
 - a. On the target computer, if you are using a USB drive, floppy disk or other removable media to transfer the license, insert it into the target computer.
 - b. Click **Start**, point to **Programs**, point to **Echelon LonMaker**, and then click **LonMaker License Transfer Utility**. The LonMaker License Transfer wizard opens. Click **Next**.
 - c. **Note:** If the target computer already contains a license, the transfer will replace this license and delete any credits on the target computer.
 - d. Click **Step 3. Transfer License into New Computer** and then click **Next**. The License Transfer Utility transfers the license to the target computer and the following dialog appears:



- e. Click **Finish**. You can now run the LonMaker tool on your target computer.

The LonMaker tool is disabled on the source computer. To install a new LonMaker tool on the source computer, you must license a new copy of the LonMaker tool and order a new LonMaker license. You can order a new LonMaker license by opening the **LonMaker** menu and clicking **LonMaker Credits**.

Creating LonMaker Demonstration Networks

You can use the LonMaker tool in *demo mode* to create LonMaker demonstration networks, which are typically used for training or sales demonstrations. In a LonMaker demonstration network, you can commission a maximum of six devices without using LonMaker credits. If you are using an activated copy of the LonMaker tool in demo mode, a “LonMaker Demonstration Network” banner appears in the background of each page of the demo network.

LonMaker demonstration networks have the following restrictions:

- They cannot be used for existing production LonMaker networks.
- They cannot be converted to a production network.
- They are limited to a maximum of six devices.
- They cannot be accessed remotely.
- They cannot be used to purchase LonMaker credits.

If you are using the LonMaker Trial Edition or an unactivated copy of the LonMaker tool, you can only run the LonMaker tool will in demo mode and create demo networks.

To create a LonMaker demo network with an activated copy of the LonMaker tool, click the **New Network Options** tab in the LonMaker Design Manager, and then under the **Network Components** box, select **LonDemo** from the **Drawing Template** box. All new networks you create will be LonMaker demo networks until you restore the setting in the **Drawing Template** box.

Using LNS Plug-ins

This chapter provides an overview of LNS Plug-ins and then describes how to start a plug-in, get plug-in information, and re-register, enable, and disable plug-ins.

Using LNS Plug-ins Overview

LNS plug-ins are applications that you can start from within the LonMaker tool to perform a specialized task, often relating to a specific type of device or functional block. For example, the LonPoint Plug-in that is included with the LonMaker tool provides LonPoint-specific user interfaces for reading and setting the configuration properties on LonPoint devices. The LonPoint Plug-in may be optionally installed when you install the LonMaker tool as described in *Installing the LonPoint Applications, Plug-in, and Utilities* in Chapter 2, *Installing and Activating the LonMaker Tool*. The LonPoint Plug-in is documented in the *LonPoint Application and Plug-In User's Guide*. Other device manufacturers may provide plug-ins that you can use with the LonMaker tool to configure their devices. Any plug-in conforming to the LNS plug-in guidelines may be used with the LonMaker tool. You can view and download free Echelon and third-party LNS plug-ins at www.echelon.com/products/networktools/plugin.

Plug-ins do not have to be specific to a device or a functional block type. System-wide plug-ins can provide generic services that may be used with multiple device types. For example, the *LonMaker Browser* is a generic plug-in that can be used on any functional block to view and modify its network variables and configuration properties.

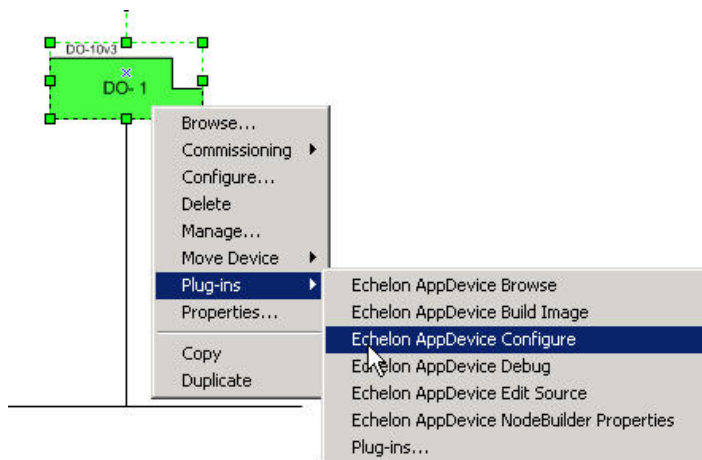
Each plug-in can implement multiple commands. For example, the LonPoint Plug-in implements a **Configure** command for each functional block type used in LonPoint devices. Each plug-in command may be associated with a device type, functional block type, a subsystem, or an entire network.

Starting a Plug-in

You can start a plug-in from a plug-in command list or by using a default command.

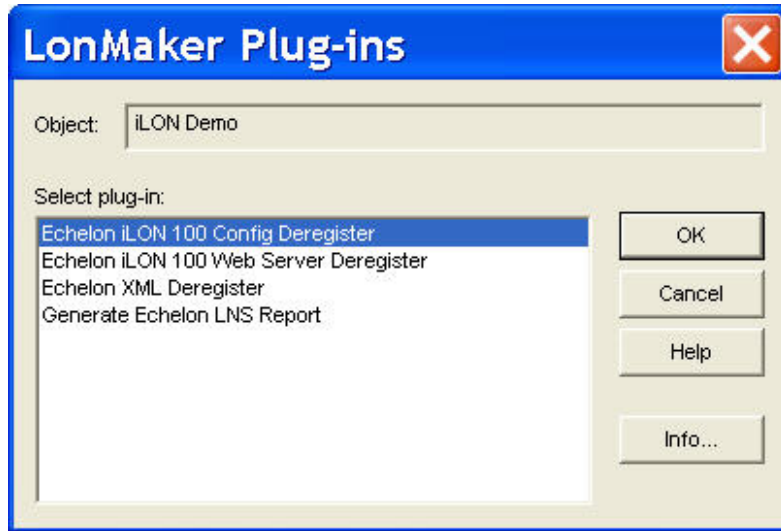
A plug-in command lists provides all the available plug-ins for an object within your LonMaker drawing. Plug-in command lists are available for any device shape, functional block shape, subsystem, LonMaker system, or LonMaker network. To start a plug-in for a device or functional block shape, subsystem, or network, do one of the following:

- For a device or functional block shape, right-click the shape, point to **Plug-Ins**, and click the desired plug-in on the shortcut menu.

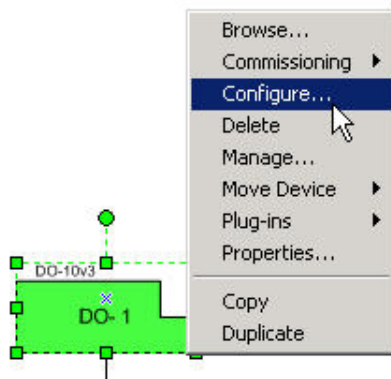


- For a subsystem, right-click an empty space in the drawing page, point to **Plug-Ins**, and click the desired plug-in on the shortcut menu.

- For the network, open the **LonMaker** menu, point to **Plug-Ins**, and click **Network Plug-Ins**. The **LonMaker Plug-ins** dialog appears. This dialog lists the plug-ins that have been registered for the network. Select the desired plug-in and then click **OK**.



To start a plug-in using a default command, right click a device or functional block shape, and then select **Configure** or **Browse**. If a plug-in is registered for the selected command and functional block type, the plug-in window opens.



If you are using LonPoint functional blocks, open the LonPoint Plug-in by right-clicking a LonPoint functional block shape and then clicking **Configure** on the shortcut menu. See the *LonPoint Application and Plug-in* for more information about the LonPoint Plug-in.

You can display information about the plug-in commands that are installed on your computer and registered for the network, and which commands are default commands, as described in *Getting Plug-in Information*.

Notes:

- If you try to use a functional block plug-in on a virtual functional block, the plug-in may fail. Plug-ins are typically designed to be used with functional blocks. A virtual functional block is how the LonMaker tool represents the network variables and configuration properties that are not contained by a functional block. The virtual functional block is not a real functional block, but a convenient way provided by the LonMaker tool to access the portions of a device interface that are not part of a functional block.
- To use a plug-in, it must be properly installed and registered. See *Re-Registering Plug-ins* and your plug-in documentation for more information.

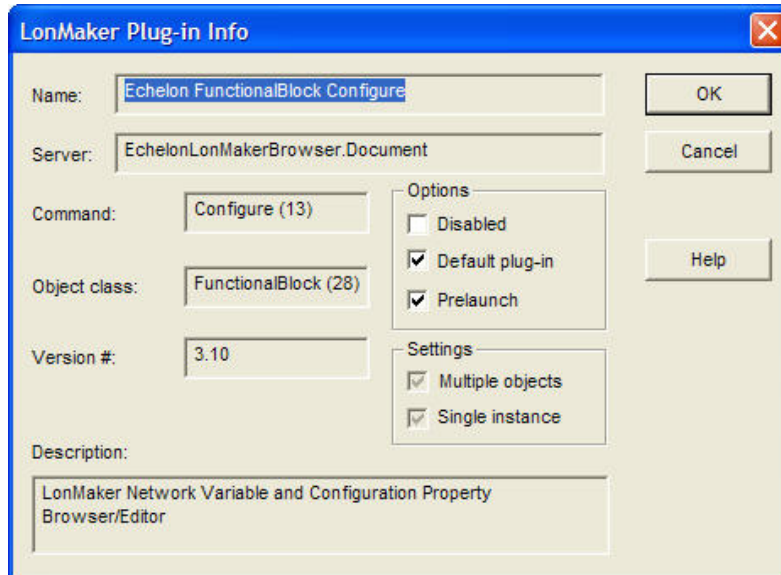
Viewing Plug-in Information

You can perform the following operations for registered plug-ins:

- View general information about the selected plug-in.
- Disable the plug-in.
- Set whether the plug-in is the default for a given command.
- Select whether the plug-in is pre-launched for commands that invoke it.
- View whether the plug-in supports multiple objects and single instance use.

To perform any of these operations, open the **LonMaker Plug-in Information** dialog from the drawing page or the LonMaker menu.

- To open the **LonMaker Plug-in Information** dialog from the drawing page, right-click a device shape, functional block shape, or empty space in the drawing page, point to **Plug-Ins**, and click **Plug-ins**. The **LonMaker Plug-ins** dialog appears. Click **Info**.
- To open the LonMaker Plug-In Information from the drawing page the network, open the **LonMaker** menu, point to **Plug-Ins**, and click **Network Plug-Ins**. The **LonMaker Plug-ins** dialog appears. Click **Info**.



This dialog provides the following information for the selected plug-in:

<i>Name</i>	Specifies the name of the plug-in.
<i>Server</i>	Specifies the registered ActiveX name for the plug-in.
<i>Command</i>	Specifies the command name or number that the plug-in implements.
<i>Object Class</i>	Specifies the class of the object on which the plug-in operates.
<i>Version #</i>	Indicates the version of the plug-in.

Options

<i>Disabled</i>	Disables the selected plug-in so that it cannot be opened when the command for the object class of the plug-in is selected. If the default or first available plug-in is disabled, the LonMaker tool will open the next available plug-in for the object class.
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<i>Default Plug-In</i>	Registers the plug-in as the default application for the specified command and object class. The LonMaker tool removes the default attribute, if set, from all other plug-ins registered for that command and object class. If this check box is cleared, the LonMaker tool does not change the attribute on any other plug-ins. If multiple plug-ins are registered for the same command and object class, the plug-in with this check box selected will be the one invoked. If multiple plug-ins have this check box selected, the LonMaker tool invokes the first plug-in that it finds with this option set.
<i>Prelaunch</i>	Keeps one instance of the plug-in program pre-launched (if registered) so that it is immediately available for commands that invoke it. When you select or clear this check box, the LonMaker tool will select or clear it for all LonMaker networks on your computer. If you clear this option, the change is not effective until you close and then re-open the network. If the plug-in does not support pre-launch capability, this checkbox is disabled.

Settings

<i>Multiple Objects</i>	Indicates whether the plug-in supports multiple objects. For example, the LonMaker Browser supports browsing multiple functional blocks.
<i>Single Instance</i>	Indicates whether the plug-in supports using a single instance of the plug-in when it is requested for the same object multiple times.
<i>Description</i>	Provides a brief description of the plug-in.

Click **OK** to return to the **LonMaker Plug-ins** dialog.

Viewing Plug-in Status

You can view the status of plug-ins that the LonMaker tool has launched and to which it still holds a reference. The LonMaker tool holds a reference to a plug-in after launching one if the plug-in was pre-launched, and it is a single-instance, multi-object plug-in. When the LonMaker tool holds a reference to a plug-in, it will typically prevent the plug-in from being terminated unless you release the plug-in.

To access the **LNS Plug-in Status** dialog, open the **LonMaker** menu, point to **Plug-Ins**, and then click **Plug-In Status**.

Server Name	Multi-object?	Single Instance?	Prelaunch?	Failures	State	Command	Object
EchelonNodeBui...	Yes	Yes	Yes	0	Prelaunch		
EchelonLonPoin...	No	Yes	Yes	0	Prelaunch		
EchelonLonMak...	Yes	Yes	Yes	0	Inactive	Browse	Building 2816/...

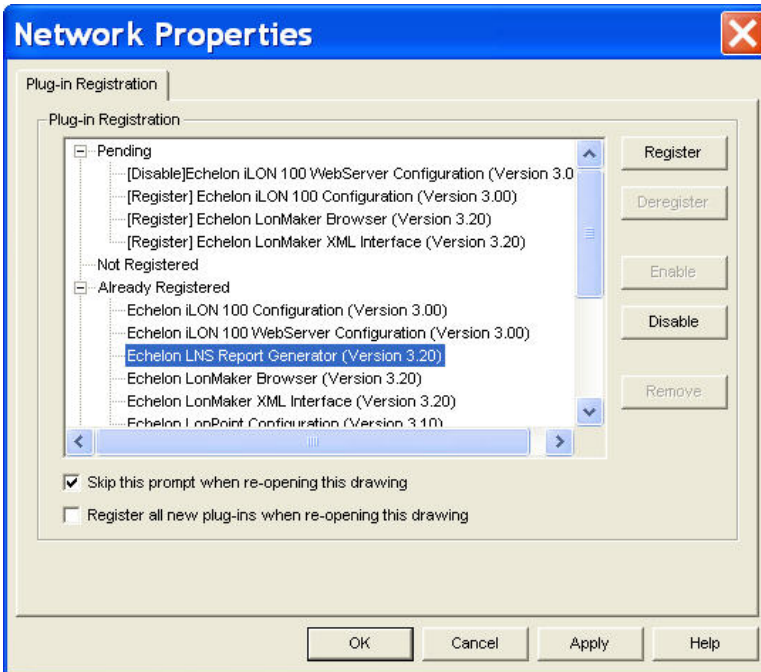
The columns contain the following data. You can sort the data by clicking a column header. Click a header again to toggle the order (ascending or descending) in which the data in that column appears.

<i>Server Name</i>	The registered ActiveX name for the plug-in.
<i>Multi-Object</i>	Whether the plug-in supports multiple objects simultaneously.
<i>Single Instance</i>	Whether the plug-in supports using a single instance of the plug-in when it is requested for the same object multiple times.
<i>Pre-Launch</i>	Whether the LonMaker tool has pre-launched an instance of the plug-in.
<i>Failures.</i>	The number of times in the current session that the plug-in has been pre-launched but has failed to launch or has terminated unexpectedly. If this number exceeds five, the LonMaker tool will stop trying to pre-launch the plug-in.
<i>State</i>	The current state of the plug-in (pre-launch or released).
<i>Command</i>	The command name or number that the plug-in implements.
<i>Object</i>	The class of the object on which the plug-in operates for the command.

To terminate a plug-in to which the LonMaker has a reference, click the Server Name field of the desired plug-in and click **Release**.

Re-Registering Plug-ins

You can register a plug-in that you chose not to register when opening a LonMaker network, or re-register a plug-in due to an update to it. You can register or re-register a plug-in from the network properties: **Plug-in Registration** dialog in the LonMaker drawing. To access this dialog, open the **LonMaker** menu, point to **Plug-Ins**, and then click **Register Plug-Ins**.



Follow these steps to register or re-register a plug-in:

1. Choose the plug-in to register from the **Already Registered** or the **Not Registered** list. You can register all the plug-ins listed under these lists by clicking the category label.
2. Click **Register**. The plug-in or plug-ins are added to the **Pending** list (they also remain under their existing lists), and their status, “[Register]”, is indicated.
3. Once you have chosen all the plug-ins to register or re-register, click **Apply**. The selected plug-ins will be added to the **Already Registered** category and be removed from the **Pending** category.
4. After the plug-ins are registered, click **OK** to return to the LonMaker drawing.

Disabling and Enabling Plug-ins

You can disable or enable plug-ins when or after you open or create a LonMaker network. You can disable a plug-in that you are no longer using to prevent it from being automatically registered when you create or open a network with automatic plug-in registration. If you enable or disable a plug-in, it will be enabled or disabled for all networks on your computer (remote clients are not affected).

You can disable and enable plug-ins when you open or create a LonMaker network using the Plug-In Registration page that appears in the Network Wizard (unless you selected the **Skip Plug-in Options Page** in the **New Network Options** tab in the LonMaker Design manager, or previously selected the check box at the bottom of the page to have it skipped when re-opening the network).

If you skip the Plug-in Registration page in the Network Wizard, you can still disable and enable plug-ins in the network properties: **Plug-In Registration** dialog in the LonMaker drawing. To access this dialog, open the **LonMaker** menu, point to **Plug-ins**, and then click **Register Plug-Ins**.

Disabling a Plug-in

To disable a plug-in, follow these steps:

1. Select the plug-in under the **Not Registered** or **Already Registered** lists. You can disable all the plug-ins listed under these lists by clicking the category label.

2. Click **Disable**. The plug-in or plug-ins are added to the **Pending** list (they also remain under their existing lists), and their status, “[Disable]”, is indicated.
3. Click **Apply** to disable the selected plug-in or plug-ins.
4. After the plug-ins are disabled, click **OK** to return to the LonMaker drawing.

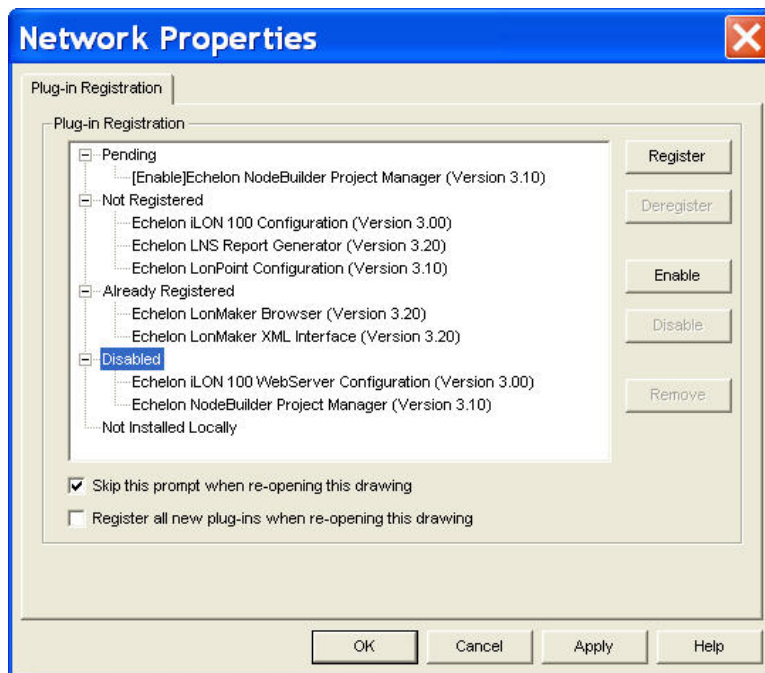
When a registered plug-in is disabled, it will not open when you select a default command that would otherwise invoke it. For example, if the LonPoint Configuration plug-in is disabled and you right-click a LonPoint functional block and click **Configure**, the next available plug-in, which is typically the LonMaker Browser, opens instead of the LonPoint Configuration plug-in. You can still use a disabled plug-in by manually invoking it. To do this, right-click the object on which you want to use the plug-in or an empty space in the drawing page, point to **Plug-ins**, and then select the desired plug-in from the shortcut menu.

If you disable an unregistered plug-in, it will not be registered in new or existing networks, even if the **Register New Plug-ins** check box is selected in the **New Network Options** tab of the LonMaker Design Manager or the **Register All New Plug-ins** check box is selected in the **Plug-in Registration** dialog. You can still manually register a disabled plug-in in the network properties: **Plug-In Registration** dialog in the LonMaker drawing.

Enabling a Plug-in

To enable a plug-in, follow these steps:

1. Select the plug-in under the **Disabled** list. You can enable all of the disabled plug-ins by clicking the category label.
2. Click **Enable**. The selected plug-in or plug-ins are added to the **Pending** list (they also remain under their existing categories), and their pending status, “[Enable]”, is indicated.
3. Click **Apply** to enable the selected plug-in or plug-ins.
4. After the plug-ins are enabled, click **OK** to return to the LonMaker drawing.



Creating and Using Custom LonMaker Shapes and Stencils

This chapter describes LonMaker stencils and the process to create them; creating and using custom master shapes for devices, functional blocks, subsystems, and connections; using additional user cells for devices, functional blocks, and routers; and setting user-defined functional block modes and types.

LonMaker Stencils


The LonMaker tool uses Visio *stencils* to speed your network engineering. A stencil is a collection of *master shapes* (also called *masters*) that you can easily reuse in your drawings. To add a master shape to your drawing, you drag the master shape from the stencil to your drawing. The LonMaker tool includes LONWORKS specific master shapes called *LonMaker shapes*. For more information on Visio stencils and master shapes, see your Visio documentation. Stencils allow you to combine multiple shapes into larger master shapes. If you include LonMaker shapes in a master shape, the LonMaker tool saves the configuration of these shapes with the master shape, including information such as device template name and configuration property settings. This allows you to create master shapes that represent, for example, all of the functional blocks in a device, or all of the devices in a subsystem. You can also create a master shape that is based on a single shape.

You can create custom LonMaker stencils to further customize the LonMaker tool. See *Creating a Custom LonMaker Stencil* for more information. You can save custom stencils you create for a specific network in the drawing folder of that network. If you create a custom stencil to use across many networks, you can save it to a global location such as the LONWORKS LonMaker\Visio directory (C:\Lonworks\LonMaker\Visio by default).

You can create custom LonMaker stencils to further customize the LonMaker tool. See *Creating a Custom LonMaker Stencil* for more information.

Creating a Custom LonMaker Stencil


To create a new custom LonMaker stencil, follow these steps:

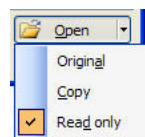
1. Open the **File** menu, point to **Stencils**, and then select **Blank Stencil**. This opens a blank stencil with the default name of Stencil.
2. Create new LonMaker master shapes as described in *Creating Custom LonMaker Master Shapes*.
3. Right-click the title bar of the new stencil and then click **Save** on the shortcut menu. Select a folder, assign a name for the stencil file, and click **Save**. Save the stencil to the LONWORKS LonMaker\Visio directory to easily access it with the open stencil () button, or save the stencil to the drawing folder for simplified backup.

Creating Custom LonMaker Master Shapes

You can create a custom LonMaker master shape to reuse any part of a design within the same drawing or in many LonMaker drawings. To create a master shape, you must first open a stencil as an original file, with read/write access. Normally, stencils open with read-only access. To work with a read/write stencil while maintaining the original, open a copy of the original.

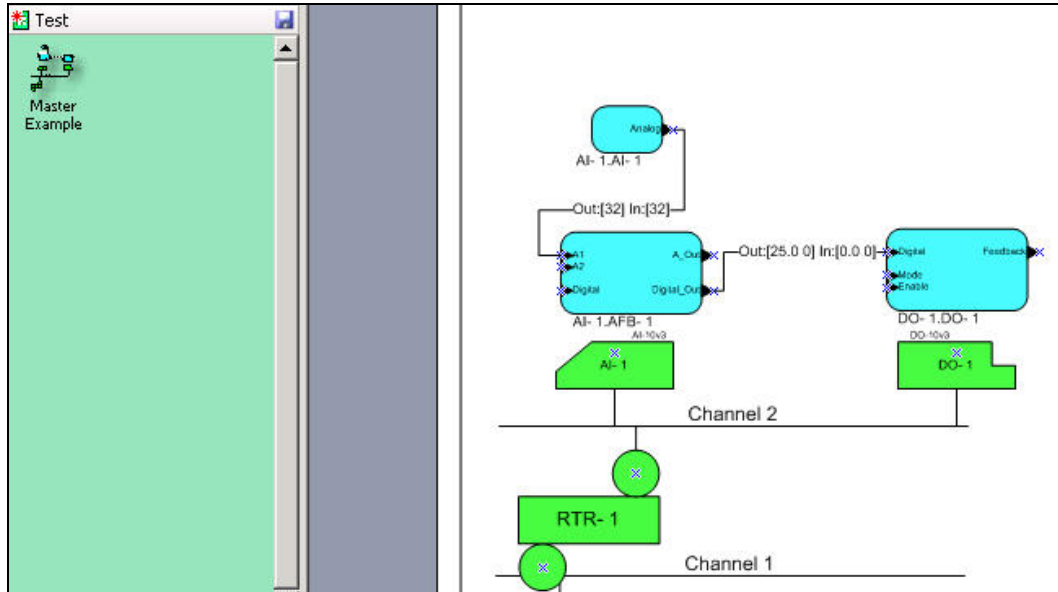
To open an original stencil, follow these steps:

1. Open the **File** menu, point to **Shapes**, and then select **Open Stencil**. You can also click the Shapes button  on the Visio **Standard** toolbar and then select **Open Stencil**.
2. Open the folder that contains the stencil and select the stencil.



3. Click the **Open** arrow and then select **Original** to modify the original stencil, or select **Copy** to modify a copy of the original stencil. The stencil window opens, with a red asterisk in the title bar indicating that you can modify the stencil. Once you have a stencil open for editing, you can create new master shapes in it.

- Select the object or objects to be included in the master shape. You can create a master shape that contains routers, channels, devices, functional blocks, connections, subsystems, and Data Point shapes. To select multiple objects you can either drag a selection net around the objects or hold down CTRL and click the objects.
- Drag the selected object or objects to the stencil you opened. A new master shape representing the selected object or objects appears in the stencil.



- Save the stencil by clicking the **Save** button. You can then rename, modify, or edit the icon of the master shape.

Note: To copy any number of shapes between LonMaker networks, use a custom LonMaker stencil with custom LonMaker shapes as described in this section. Do not hold down CTRL and drag or use copy/paste between drawings from different networks.

Using Custom LonMaker Master Shapes

You can reuse a custom LonMaker shape that you create (see *Creating Custom LonMaker Master Shapes*). The custom LonMaker master shape may contain any number of the standard LonMaker shapes described in *Designing LonMaker Networks*. The following sections describe how the LonMaker tool processes each of the standard LonMaker shapes when you include them in a custom LonMaker shape.

If you drag a master shape containing multiple shapes and the creation of any of the shapes fails, that shape will not be added, and all subsequent shapes in the master shape will not be processed.

Device Master Shapes

You can include one or more LonMaker Device shapes in a custom master shape. Each of these is called a *device master shape*. Each device master shape includes the device template name, device interface (XIF) file name, and the configuration property settings from the original device. The Neuron ID is not included so that you can reuse the master shape with multiple devices.

When you drag a master shape that includes any device master shapes to a drawing and automatic channel selection is enabled in the network properties: **Device** options category, the master shape is added to the drawing without any wizards opening. If automatic channel selection is disabled, the New Device Wizard appears and you select the channel for the new device. You can select the same channel as the original device, another existing channel, or create a new channel. If the custom master shape includes multiple devices on the same channel, the Device Wizard appears for the first device

only on each channel. The LonMaker tool places all subsequent devices that are on the same channel in the master shape on the channel that you select for the first device on the channel, and have their properties set as specified in the master shape. To manually set the channels and properties for each device, select the **Force Wizard Prompts** check box in the network properties: **General** options category as described in Appendix A.

When you drag a master shape that includes a device shape to a drawing, the LonMaker tool does the following for each device master shape:

1. If the master shape includes a program ID in a ProgramID user cell (see *Additional Device User Cells*), the LonMaker tool looks up the device template using the program ID. If the master shape does not include a program ID but includes a device template name in a TmplName user cell (see *Additional Device User Cells*), it looks up the device template based on the specified device template name.
2. If the LonMaker tool does not find a device template in step 1, it looks for the device interface (XIF) file specified in the XifName user cell. If the device interface file is found, the LonMaker tool looks up the device template by the program ID specified in the device interface file. If a device template with a matching program ID is found, the user is given the option of changing the name of the device template to the name specified by the device shape, or using the existing device template name. In either case, the existing device template is associated with the device shape.
3. If the LonMaker tool does not find a device template in steps 1 and 2, but it does find the device interface file, it creates a new device template by importing the device interface file. The LonMaker tool gives the new device template the name specified in the device shape, and associates it with the device shape.
4. If the LonMaker tool does not find a device template or device interface file in steps 1 through 3, it prompts you to select an existing device template or to define a new device template by importing a device interface file. The resulting device template is associated with the device shape.

A functional block shape may include a device template name and/or program ID. The device template name assigned by the above procedure must match the name in any functional block shapes that will be used with the newly created device shape. See *Additional Functional Block User Cells* for more information.

Functional Block Master Shapes

You can include one or more LonMaker Functional Block shapes in a custom master shape. Each of these is called a *functional block master shape*. Each functional block master shape includes the device template and/or program ID as well as the network variable and configuration property types, formats, and values associated with the original functional block. To eliminate configuration property values, clear **Copy Values on Functional Block Copy**. See *Configuration Property Properties* for more information.

By default, custom functional block master shapes always apply to the device type for which they were created. For example, if you create a master functional block shape to be used with a LonPoint AO-10 device, that shape can only be used with AO-10 LonPoint devices. To create a functional block shape that can be used with multiple device types, edit the shape as described in *Editing Master Shape User Defined Cells*.

When you drag a custom master shape that includes any functional block shapes to a drawing, the following conditions apply:

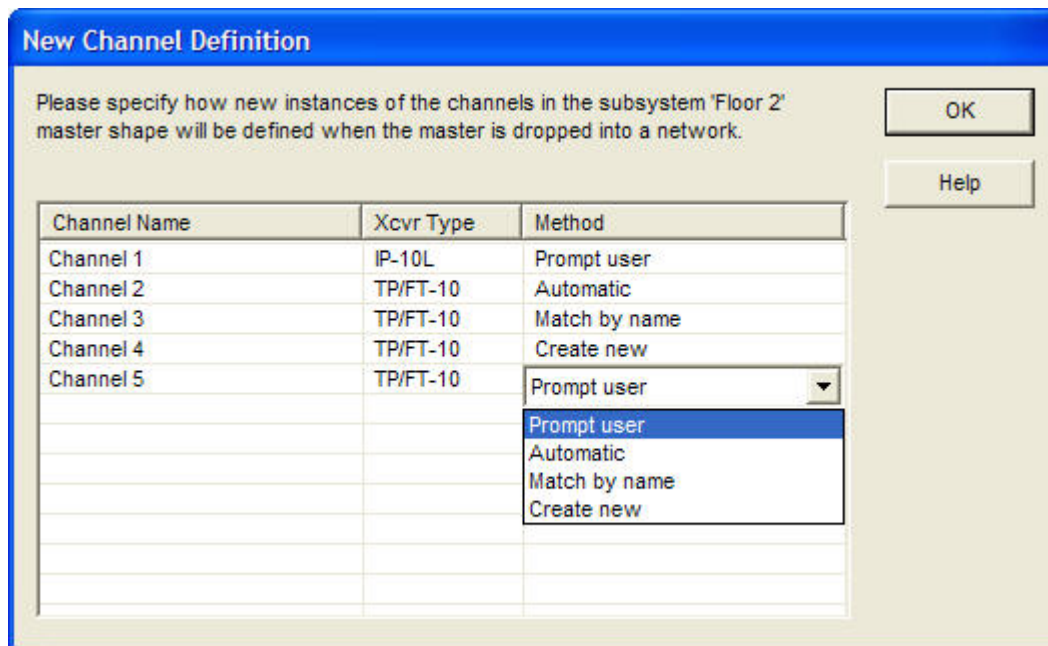
- If a custom master shape contains functional blocks, but not their associated devices, you must create the devices to be associated with the functional blocks before dragging the custom master shape to the drawing.
- If you drop a custom master shape containing a functional block and its associated device, the functional block wizard does not appear because it knows its associated device.

- If a custom master shape contains several functional blocks associated with the same device, but not the device itself, the functional block wizard appears for the first functional block only. You must associate the functional block with its device. The remaining functional blocks are assigned to the same device, unless no more functional blocks of the correct type are available on the device. To be prompted for the device to be assigned to each functional block, set **Force Wizard Prompts** in the network properties: **General** options category.

Subsystem or Supernode Master Shapes

You can include one or more LonMaker subsystem or supernode shapes in a custom master shape. When you create a custom LonMaker shape from a subsystem or supernode shape, the LonMaker tool copies the information for all the devices, functional blocks, connections, routers, channels, and nested subsystems and supernodes to the master.

If you create a custom subsystem or supernode master shape that contains one or more channels the **New Channel Definition** dialog box appears.



For each channel listed, click anywhere in the **Method** field and then select how the channel is to be defined when the subsystem or supernode master shape is added to your LonMaker drawing. You have four choices:

- **Prompt User.** The **Channel Definition** dialog box will appear, enabling you to select whether the channel represents a new or an existing channel. This is the default.
- **Automatic.** The LonMaker tool will define the channel based on where you drop the subsystem shape in the LonMaker drawing. If you drop the subsystem master shape on top of an existing channel, the channel will be created as an instance of the existing channel. If you do not drop the subsystem master shape on top of an existing channel, the **Channel Definition** dialog box will appear and you select whether the channel represents a new or an existing channel.
Only one channel can have this option selected.
- **Match by Name.** The LonMaker tool will attempt to match the channel with an existing channel in the network that has the same name. If it finds a match, the channel will be created as an instance of that existing channel. If the LonMaker tool cannot find a match, the channel will be created as a new channel.

- **Create New.** The channel is created as a new channel. The channel name will be modified if there is a naming conflict (if the channel name ends with a number, the channel number will be incremented; if the channel name does not end with a number, an index, starting at 1, will be appended to the channel name).

Notes:

- When creating a subsystem or supernode master shape, the LonMaker tool requires that the stencil has a name. If you just created a new blank stencil, save it before creating the master shape.
- When creating a subsystem or supernode master shape, the LonMaker tool creates one or more hidden master shapes that are placed in the same stencil as the original master shape. Therefore, you cannot copy subsystem or supernode master shapes from one stencil to another.

Connection Master Shapes

You can include one or more LonMaker Connector shapes in a custom master shape. Each of these is called a *connection master shape*. Each connection block master shape includes the connection attributes for the original connection. One connection master shape can represent several connections in your LonMaker drawing, allowing you to quickly and easily establish multiple network connections with one operation.

You can use connection master shapes to do the following:

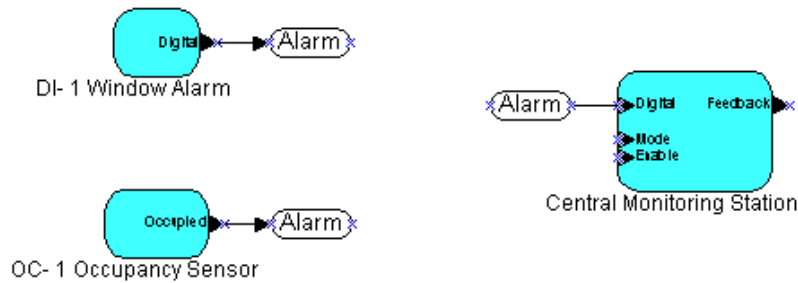
- Specify a connection with a connection description other than the default connection description. A connection description is a set of properties that apply to a connection, such as protocol service, retry count, priority, and authentication.
- Establish multiple connections in a single operation. For example, instead of dropping several individual Connector shapes to establish multiple connections (digital output to digital input, analog input to analog output, and so on), you can create a connection master shape to represent all these connections. The connection is displayed on the LonMaker drawing as a connection between the functional blocks on which the connections exist.
- Append a connection to an existing reference connection. For example, if you have a reference connection between an input and output network variable representing time, you can create a connection master shape to quickly create connections to additional output network variables representing time.

If you include one or more LonMaker Connector shapes in a custom LonMaker master shape, the connections associated with each connector will be saved in the master shape if either of the following conditions is met:

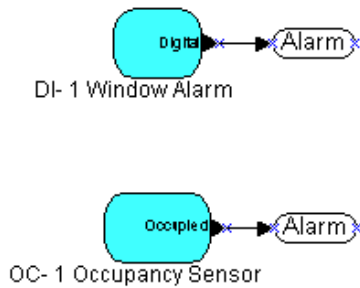
- The functional blocks on both sides of the connection are included.
- The master shape contains the connection, reference shape (if any), and the functional block shape.

You can use reference connections in master shapes to create fan-in or fan-out connections. If all of the members in the reference connection are included in a master shape, the LonMaker tool will create a new connection (with a unique reference name) when you drag the master shape to a drawing.

If you create a master shape with only a subset of a referenced connection, (i.e. Functional Block, Connector, and Reference shapes), when you use the master shape the new functional block is added to the same connection as the other reference shapes. For example, assume you have a reference connection as shown in the following figure:



To create a master shape that allows you to fan-in additional inputs to the Central Monitoring Station functional block, copy the following shapes to a new master shape:



If you drag this master shape to any subsystem in the same network, the LonMaker tool creates two new functional blocks, and adds their outputs to the same Alarm connection for the Central Monitoring Station. If you also include the Central Monitoring Station in the master shape, the LonMaker tool creates three new functional blocks and a new reference connection when you drag the master shape to a drawing.

You can also create a master shape containing a connection not attached to any functional blocks. The information in the connection description is saved and becomes part of the master shape. If you create a master shape of a connector and a reference shape (without any associated functional blocks) you can use the master shape to create reference connections without opening the connection dialog.

You can use a master shape that contains reference connections only on the network on which you created it. This is an exception to the general rule that you can use master shapes on more than one network.

Tip: To speed up making connections, put the LonMaker tool OffNet before using a master shape with many connections in it. Updates to devices involved in the connections will be done when you go OnNet.

Creating Additional Channels

If you drag a master shape that includes a channel shape and device shapes to your drawing, the master shape may limit the channel types that can be used. In that case, only the valid channel names and channel types will be listed.

Editing Master Shape User Defined Cells

This section is for advanced LonMaker and Visio users who want to create custom LonMaker shapes for use in their networks. This is an advanced feature for advanced LonMaker and Visio users.

You can change the properties of a master shape by changing its user-defined cells. For example, you can extend the list of device types to which a functional block can be applied, as described in *Functional Block Master Shapes*.

User defined cells are contained within a page called the ShapeSheet.

To view a shape's ShapeSheet, select the shape, open the **Window** menu and click **Show ShapeSheet**. This opens the ShapeSheet window.

Shape Transform			
Width	GUARD(1 in*ThePageDi	PinX	10.2778 in
Height	GUARD(0.5 in*ThePage!	PinY	7.1389 in
Angle	0 deg	LocPinX	Width*0.5
		LocPinY	Height*0.5
		FlipX	0
		FlipY	0
		ResizeMode	0

User-defined Cells	Value	Prompt
User.LonMakerShapeType	4	"AI-10 Device shape"
User.AutoLoad	2	"Ask app image name"
User.BitmapFile	"lca_app.bmp"	No Formula
User.Auth	0	""
User.NonGrpRcvTimer	4	""
User.PingClass	4	""
User.Priority	0	""
User.TmplName	"Echelon AI-10v3"	""
User.XifName	"Echelon\LonPoint\Version3\AI-10v3	No Formula
User.ChanType	4	""
User.NxeName	"Echelon\LonPoint\Version3\AI-10v3	No Formula
User.Locn	"000000000000"	""
User.RequiresVFB	1	No Formula
User.ChanTypeList	"4"	No Formula
User.NetworkId	"{298ABE4F-A1CF-4EFF-BABE-0A4D	""
User.LonMakerStyle	0	""
User.ProgramId	"80000105188A0403"	No Formula
User.ChanHandle	1	""
User.Handle	2	""
User.MasterStencilName	"LonPoint3"	""
User.MasterShapeName	"AI-10v3"	""
User.ShapeLmwVersion	4	""
User.NeuronIdValue	"000000000000"	""

Every LonMaker shape has a **LonMakerShapeType** user cell. The value of this cell specifies the LonMaker shape type. You are most likely to use the DEVICE (LonMakerShapeType 4), FUNCTIONAL_BLOCK (type 5), and FB_NAME (type 13) shape types.

You can use the **FB_NAME** value to include a functional block within a group that may include other functional block shapes. Set the **LonMakerShapeType** value to 13 for shapes in the group with text that reflects the functional block name.

You can create custom functional block master shapes with network variables by creating a functional block instance in the LonMaker tool, adding the appropriate network variables, and then dragging the shape to a stencil.

Additional Device User Cells

You can include the following additional user cells in a device shape. Not every device has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting **Insert Row**.

Auth A value of **1** indicates that authentication will be enabled for devices created from this master shape.

AutoLoad Indicates whether an application will automatically be loaded into

the device when the device is commissioned or replaced.

- A value of **0** indicates no.
- A value of **1** indicates yes.
- A value of **2** indicates that the LonMaker user will be prompted.

The default value is **2** to prompt the user.

ChanTypeList

A semicolon-separated list of valid channel type IDs for the device. A value of **-1** in the list indicates that the user has the option of selecting from all channels in addition to the channels of the specific types defined. Channel type IDs correspond to the **ChannelTypeNumber** values contained in the **StdXcvr.xml** file available from www.lonmark.org/spid. By default, all channel types are allowed.

EditAdvPropCap

Specifies handling of the advanced properties tab in the device properties dialog.

- A value of **0** specifies that the advanced properties dialog is not to be displayed.
- A value of **1** indicates that the advanced properties dialog is to be displayed, but cannot be modified.
- A value of **2** indicates that the advanced properties dialog is displayed and changes can be made.

The default value is **2** (the advanced properties dialog is displayed and changes are allowed).

EditPropCap

Specifies handling of the basic properties tab in the device properties dialog.

- A value of **0** specifies that the basic properties dialog is not to be displayed.
- A value of **1** indicates that the basic properties dialog is to be displayed, but cannot be modified.
- A value of **2** indicates that the basic properties dialog is displayed and changes can be made.

The default value is **2** (the basic properties dialog is displayed and changes are allowed).

FbModes

Specifies a semicolon-separated list of the scopes for each of the functional blocks in this device. This cell's data must be ASCII text in the format `<scopeSelector0>;<scopeSelector1>;...` where `scopeSelector0` applies to the functional block with index 0 (the Node Object), `scopeSelector2` applies to the functional block with index 1, and so on. You can see what functional block in a device has what index by right-clicking the device, selecting **Properties** from the shortcut menu, and clicking the Functional Blocks tab of the device properties dialog.

If this cell is not specified, the LonMaker tool uses scope **0** for functional profile numbers 1–19999, and scope **3** for all other functional profiles. This means that functional block shapes based on user functional profiles with numbers of 20000 and above, as well as all inherited profiles, must either set this value

or must include a plug-in that sets the appropriate value.

The scope selector definitions are:

- 0** Standard functional profile defined in the standard type file set.
- 3** User-defined functional profile, defined in a manufacturer-specific resource file set.
- 4** User-defined functional profile, defined in a manufacturer and device class specific resource file set.
- 5** User-defined functional profile, defined in a manufacturer and device class/subclass specific resource file set.
- 6** User-defined functional profile, defined in manufacturer, and device class/subclass/model number specific resource file set.

See *Setting User Functional Block Scopes and Types* for more information.

InitOnline

- Specifies the initial state of the device application when it is first commissioned.
- A value of **0** indicates that the device is to be placed offline.
- A value of **1** indicates the device is to be placed online.
- A value of **2** specifies that the device is to be disabled (only applies to devices with a Node Object functional block, otherwise, the devices are placed offline).
- A value of **3** indicates that the initial state of the device will be based on the default value set in the network properties: **Device** options category.

The default value is **3** (the network properties value is used).

InstallMethod

- Specifies the default device installation method (service pin or manual entry).
- A value of **0** specifies service pin installation method.
- A value of **1** specifies manual installation method.

LmwStyle0

- Specifies the coloring style applied to a device shape when it is in the Updates Pending state. The default style is **Node Uninstalled**.

LmwStyle1

- Specifies the coloring style applied to a device shape when it is up-to-date. The default style is **Node Normal**.

LmwStyle3

- Specifies the coloring style applied to a device shape when it is in the Update Failed state. The default style is **Node Error**.

LmwStyle7

- Specifies the coloring style applied to a device shape when the LonMaker tool detects that it is detached from the network.

LmwStyle8

Specifies the coloring style applied to a device shape when the LonMaker tool detects it to be in an unexpected state. For further information about Visio styles, see the Visio documentation.

Locn

A 12-digit hex string that specifies the default value of the

device's location string. By default, the location string is initialized to all zeroes unless you enable the **Set Location Property to Subsystem ID** check box in the network properties: **Recovery** options category.

NewAdvPropCap

- Specifies handling of the advanced properties dialog in the new device wizard.
- A value of **0** specifies that the advanced properties dialog is not to be displayed.
- A value of **1** indicates that the advanced properties dialog is to be displayed, but cannot be modified.
- A value of **2** indicates that the advanced properties dialog is displayed and changes can be made.
- The default value is **0** (the advanced properties dialog is not displayed).

NewPropCap

- Specifies handling of the basic properties dialog in the new device wizard.
- A value of **0** specifies that the basic properties dialog is not to be displayed.
- A value of **1** indicates that the basic properties dialog is to be displayed, but cannot be modified.
- A value of **2** indicates that the basic properties dialog is displayed and changes can be made.
- The default value is **2** (the basic properties dialog is displayed and changes are allowed).

NonGrpRcvTimer

Specifies the default non-group receive timer; a value of **-1** indicates that the LNS default value will be used. Otherwise, the value is encoded as follows:

Encoded	
Value	Seconds
0	0.016
1	0.024
2	0.032
3	0.048
4	0.064
5	0.096
6	0.128
7	0.192
8	0.256
9	0.384
10	0.512
11	0.768
12	1.024
13	1.536
14	2.048
15	3.072

<i>NxeName</i>	Specifies the file name or full path of the application file. If it is not specified here, the LonMaker user will be prompted for an application file when a request is made to load the application image.
<i>ObjStateStyle</i>	<p>Specifies whether the coloring style is applied to the shape's fill, line, text, or a combination of the three.</p> <ul style="list-style-type: none"> • A value of 1 indicates that the style applies to the shape's lines. • A value of 2 indicates that the value applies to the shape's fill. • A value of 4 indicates that the style applies to the shape's text. • You can add values together to specify combinations. For example, a value of 6 indicates that the style applies to the shape's fill and text, but not its lines. By default, the style applies to all three shape attributes.
<i>PingClass</i>	<p>Specifies the ping interval.</p> <ul style="list-style-type: none"> • A value of 0 specifies that the default ping interval is used for this shape. • A value of 1 specifies that the 1-minute ping interval be used. • A value of 2 specifies that the 2-minute ping interval be used. • A value of 3 specifies that the 15-minute ping interval be used. • A value of 4 specifies that the Never ping interval be used.
<i>Priority</i>	A value of 1 indicates that priority will be enabled for devices created from this master shape.
<i>ProgramId</i>	Device program ID. The LonMaker tool uses this value first to find the device template by name. If not specified, the <i>TmplName</i> value is used.
<i>RequiresVFB</i>	<ul style="list-style-type: none"> • Specifies whether the device requires a virtual functional block. • A value of 0 specifies that the device does not require a virtual functional block. • A value of 1 specifies that the device requires virtual functional blocks. • A value of -1 specifies that the LonMaker tool should determine this value based on the device's set of network variables, configuration properties, and message tags. • The default value is -1.
<i>TmplName</i>	<p>Device template name. This must be specified if XifName is specified. Be sure to specify a unique device template name for each unique device interface (XIF) file.</p> <p>If the LonMaker tool does not first find a device template based on the ProgramId value, it uses the value in TmplName to look up the device template by name. If neither is found, the LonMaker tool searches for a device interface file based on the</p>

XifName value and the XIF search path. If found, the XIF file is loaded and used. If it is not found, the LonMaker user is prompted to enter a device interface file when the device master shape is dragged to the LonMaker drawing.

XifName

File name or full path of the device interface (XIF) file. If it is not specified here, the LonMaker user may be prompted for a device interface when the device master shape is dragged to the to the LonMaker drawing, depending on the **ProgramId** and **TmplName** values.

Additional Functional Block User Cells

You can include the following additional user cells in a functional block shape. Not every functional block has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting **Insert Row**.

<i>DevProgIDList</i>	Specifies a semicolon-separated list of program IDs that are valid for this functional block. If both DevProgIDList and DevTypeList values are specified, the DevTypeList value takes precedence.
<i>DevTypeList</i>	Specifies a semicolon-separated list of device types (device template names) that are valid for this functional block. If both DevProgIDList and DevTypeList values are specified, the DevTypeList value takes precedence.
<i>FbInstanceList</i>	Specifies the functional blocks on each device type that are valid for this functional block shape. This cell can be used to further restrict which functional blocks are valid beyond what is possible with the FbTypeList user cell. The syntax is <code><i1>,<i2>.<in>;<j1>,<j2>,<jn>;...</code> , where the sequence of the semicolon-separated lists corresponds to the device types specified in either the ProgIdList or DevTypeList fields (the ProgIdList field has precedence when both are defined). The comma-separated list indicates the indices of the valid functional blocks for that device type.
<i>FbTypeName</i>	Specifies the functional profile name for this functional block, e.g. "Open loop sensor object."
<i>FbTypeList</i>	Specifies a semicolon-separated list of functional profiles that are valid for this functional block shape. This cell's data must be ASCII text in the following format: <code><scopeSelector>:<profileNumber>;<scopeSelector>:<profileNumber>;...</code> The scope selector definitions are as follows: <ol style="list-style-type: none">0 Standard functional profile defined in the standard resource file set.3 User-defined functional profile, defined in a manufacturer-specific resource file set.4 User-defined functional profile, defined in a manufacturer and device class specific resource file set.5 User-defined functional profile, defined in a manufacturer

and device class/subclass specific resource file set.

- 6 User-defined functional profile, defined in manufacturer, and device class/subclass/model number specific resource file set.

See *Setting User Functional Block Scopes and Types* for more information.

Additional Router Shape User Cells

You can include the following additional user cells in a router shape. Not every router has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting **Insert Row**.

<i>Class</i>	Specifies the type of router. Valid values are as follows:
	0 Configured router
	1 Learning router
	2 Repeater
	3 Bridge
	4 Permanent Repeater
	5 Permanent Bridge

The default and recommended value is **0** for a configured router.

The router shape supports the following fields defined for device shapes: **Auth**, **Priority**, **PingInterval**, **InstallMethod**, **BitmapFile**, **ChanTypeList**, **Locn**, **NewPropCap**, **NewAdvPropCap**, **EditPropCap**, **EditAdvPropCap**, and **InitOnline**. In addition, the router shape has the following fields you can use to specify defaults for Side B of the router.

<i>PriorityB</i>	A value of 1 indicates that priority will be enabled on the B-side for shapes created from this master shape.
<i>ChanTypeListB</i>	A semicolon-separated list of valid channel type IDs for the device as described in the ChanTypeList device user cell.

Setting User Functional Block Scopes and Types


All functional blocks have scope selectors, which specify the context in which the network variables and configuration properties are interpreted. The scope selector provides a reference to a resource file set that defines data types and display formats. Scope selector **0** is a reference to the LONMARK standard resource file set. If you are developing devices with user-defined functional profiles, network variables, or configuration properties, the LonMaker tool automatically sets the scope of the functional blocks as long as it can find an appropriate scope 3, 4, 5, or 6 resource file set. If this fails for any reason, you can set new scope selectors for the functional blocks that failed.

You can change a scope selector by creating a custom device master shape or by creating a device plug-in that sets your scope selectors. To set the scope selector using a custom device master shape, create a master shape for your device, and then create and set an **FbModes** user cell that sets the scope for each functional block as described in *Additional Device User Cells*.

Adding a Bitmap to a Device Master Shape

You can change the appearance of a device master shape by adding any bitmap to the shape and then optionally changing its name. When you add a bitmap, you can leave part of the original form of the shape open so that a LonMaker user can see the fill style that the LonMaker tool uses to represent the device state.

To add a bitmap to a master device shape, follow these steps:

1. Open a new (non-LonMaker) drawing in Visio.
2. Open the LonBasic stencil. Open the **File** menu, point to **Shapes**, and then click the **LonBasic** stencil.
3. Drag the generic Device shape  to the drawing.
4. Open the **Edit** menu and then click **Open Device**. The Group window opens for the device.
5. Open the **Insert** menu, point to **Picture**, and then click **From File**. Select a bitmap file. Position the bitmap on the device as desired. Close the Group window.
6. Click the bitmap subshape, open the **Format** menu, and then click **Behavior**. Clear the three checkboxes under the **Selection Highlighting** box.
7. Open the **Windows** menu and then click **Show ShapeSheet**. The ShapeSheet opens. In the **Protection** section, enter **1** in the **LockTextEdit** cell. Close the ShapeSheet.
8. Drag the shape to a stencil to which you have write access. To change the name of the shape, right-click it, point to **Edit Master**, and then click **Master Properties** on the shortcut menu. Modify the name and then click **OK**.
9. Save the stencil.

Viewing and Editing VBA Code Associated with a LonMaker Network Drawing

Each LonMaker drawing has VBA code associated with it that implements its LonMaker functionality. You should not edit this code, as this may cause loss of LonMaker functionality. However, you can add your own VBA code to the drawing (to create HMIs with the Data Point shape, for example). To avoid unintentional changes to LonMaker's VBA code and protect the LonMaker digital signature, the VBA code in the LonMaker templates and drawings is password protected. See *Working with Digital Signatures* in Chapter 3, *Getting Started*, for information on the consequences on modifying VBA code.

To view and edit the VBA code associated with a LonMaker drawing, follow these steps:

1. Open the **Tools** menu, point to **Macros**, and then select **Visual Basic Editor**. The Visual Basic development environment opens. You must have Visual Basic installed on your computer to view and edit VBA code.
2. On the left pane of the Visual Basic window, open the network project. You will be prompted for a password.
3. Enter the password, which is **enumerate**. You can then view and edit the Visual Basic code associated with the LonMaker drawing.

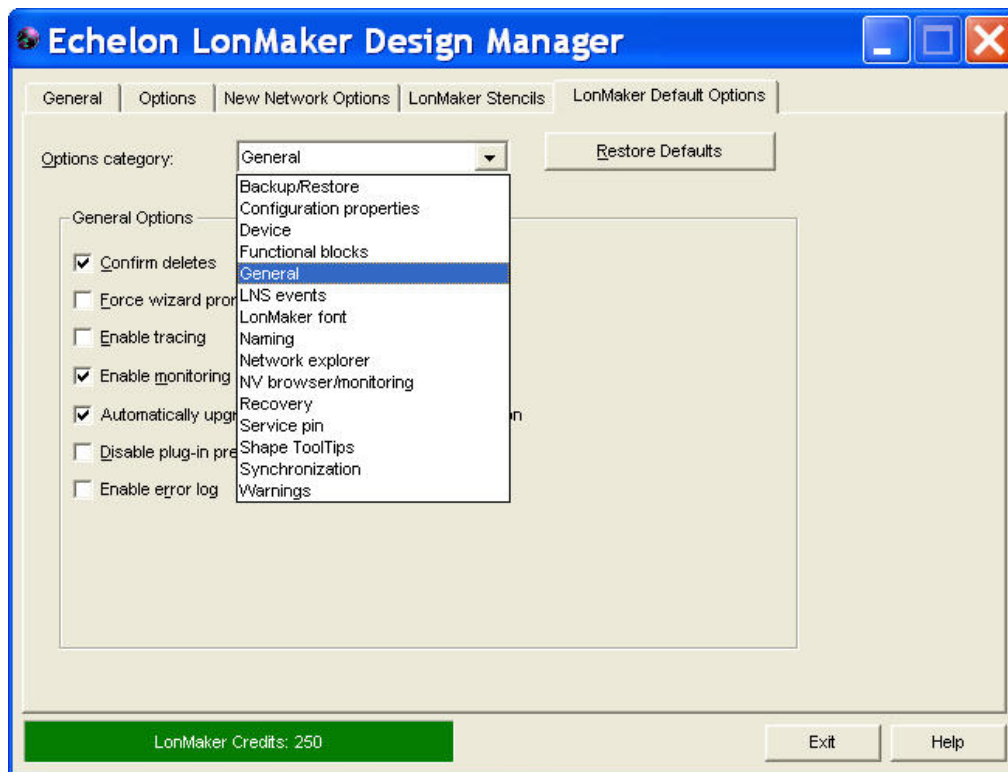
Appendix A - Setting LonMaker Default Options

This appendix documents the LonMaker Default Options you can set either in the LonMaker Design Manager or in your LonMaker drawing.

Setting LonMaker Default Options

You can set LonMaker Default Options either in the LonMaker Design Manager or in your LonMaker drawing. For new networks, you can set the default options in the **Default LonMaker Options** tab in the LonMaker Design Manger. For an existing network, you can set them by opening the **LonMaker** menu and clicking **LonMaker Options** in the LonMaker drawing. The dialog that appears lists options that you can set for the following options categories:

- Backup/Restore
- Configuration Properties
- Devices
- Functional Blocks
- General
- LNS Events
- LonMaker Font
- Naming
- Network Explorer
- NV Browser/Monitoring
- Recovery
- Service Pin
- Shape ToolTip
- Smart Connection Descriptions (this options category is only available in the network properties: **LonMaker options** dialog in the LonMaker drawing; see *Automatic Connection Description Selection* for the options you can set)
- Synchronization
- Warning



You can click **Restore Defaults** to reset all the options and values in the currently displayed options category to their defaults.

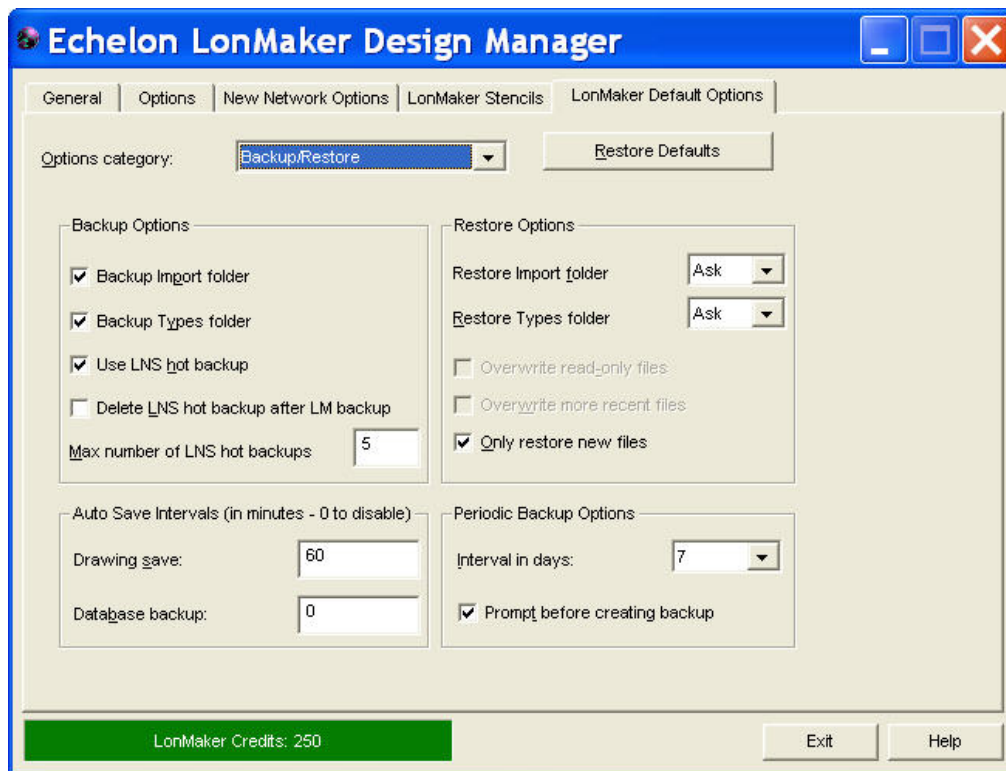
Note: Every default LonMaker option has one of the following three scopes that determine which networks and LonMaker computers are updated when you change the value of an option:

- Current network, current LonMaker computer. Value is updated in the network on the LonMaker computer in which the change was made.
- Current network, all LonMaker computers. Value is updated in the network for all LonMaker computers accessing the network database
- All networks, current LonMaker computer. Value is updated in all networks, and to the LonMaker Design Manager, on the LonMaker computer in which the change was made.

When you change LonMaker options that have the “All Networks” scope from the LonMaker Design Manager, the new values are updated in all existing networks when you re-open them. When you change these types of options in a LonMaker drawing, the new values are updated immediately in that network and all other existing networks on your computer, and they are updated in the LonMaker Design Manager when you re-open it.

The following sections describe the LonMaker default options you can set for each options category. The scope for each LonMaker default option is listed at the end of its description.

Backup/Restore Options



The Backup/Restore category contains the following options. The changes you make in the Backup/Restore options category are applied to all LonMaker network designs on your computer.

Backup Options

Backup Import Folder Includes application files, device interface (XIF) files, and all other files in the LONWORKS **Import** folder when creating a LonMaker backup file. This option is selected by default.

If selected, a new **Import** folder will be inserted in the network database directory, and all the files in the LONWORKS **Import** folder (even those files that are not resource files or are not used in the LonMaker drawing) will be copied into that new **Import** folder prior to creating the LonMaker backup.

Files outside the LONWORKS **Import** folder will not be backed up, even if they have been used in the LonMaker drawing.

Scope: All networks, current LonMaker computer

Backup Types Folder

Include resource files and all other files in the LONWORKS **Types** folder when creating a LonMaker backup file. This option is selected by default.

If selected, a new **Types** folder will be inserted in the network database directory, and all the files in the LONWORKS **Types** folder (even those files that are not resource files or are not used in the LonMaker drawing) will be copied into that new **Types** folder prior to creating the LonMaker backup.

Files outside the LONWORKS **Types** folder will not be backed up, even if they have been used in the LonMaker drawing.

Scope: All networks, current LonMaker computer

Use LNS Hot Backup

Automatically creates a hot backup copy of the LNS network database, if required, when creating a LonMaker backup. This option is selected by default.

If this check box is cleared and the LNS network database is being accessed while attempting to create a LonMaker backup, a prompt appears and offers the following three choices:

- Exit all applications accessing the database and try again.
- Use the LNS hot backup (creates an LNS hot backup).
- Cancel the backup request.

Scope: All networks, current LonMaker computer

Delete LNS Hot Backup after LM Backup

Deletes the hot backup copy of the network database once a standard LonMaker backup has been created. The LonMaker tool may create an LNS hot backup of the LNS network database when creating a LonMaker backup file. When an LNS hot backup copy is created, a copy of it is placed in the LonMaker backup file. Select this check box to delete the extra copy.

If this check box is cleared, the hot backup copy of the network database created by the LNS hot backup will be preserved.

This option is cleared by default.

Scope: All networks, current LonMaker computer

Max Number of LNS Hot Backups

Sets the maximum number of unique hot backup copies of an LNS database that will be preserved. An LNS hot backup copy of the LNS network database may be created when an LNS backup file is created. If the **Delete LNS Hot Backup after LM Backup** check box is cleared, the LNS hot backup copies are preserved. Select a value between 1 and 99. The default value is **5**.

Scope: All networks, current LonMaker computer

Auto Save Intervals

Drawing Save

Sets how frequently (in minutes) the LonMaker drawing (.VSD) file is automatically saved. The default value is **60** minutes. To disable this feature, set the interval to **0**.

Scope: All networks, current LonMaker computer

Database Backup

Sets how frequently (in minutes) the LonMaker tool will automatically create a hot backup of the LNS database. The default value is **0** (never).

Scope: All networks, current LonMaker computer

Restore Options

Restore Import folder

Selects how device interface (**XIF**) files, device application files, and other files saved in the **Import** folder are restored when restoring a LonMaker backup. You have three choices:

- **No.** The device files are not installed.
- **Yes.** The device files are automatically installed.
- **Ask.** The LonMaker tool will prompt you to decide whether to install the device files upon restoring the network. This is the default.

Scope: All networks, current LonMaker computer

Restore Types folder

Selects how resource files and other files saved in the **Types** folder are restored when restoring a LonMaker backup. You have three choices:

- **No.** The resource files are not restored.
- **Yes.** The resource files are automatically restored.
- **Ask.** The LonMaker tool will prompt you to decide whether to restore the resource files upon restoring the network. This is the default.

Scope: All networks, current LonMaker computer

Overwrite Read-only Files

Automatically replaces existing read-only device application, device interface, and resource files with backup versions of the files.

This option is cleared by default, and it is unavailable if the **Only Restore New Files** check box is selected.

Scope: All networks, current LonMaker computer

Overwrite More Recent Files

Automatically replaces the existing device application, device interface, and resource files with backup versions of the files that are not as recent as the existing ones.

This option is cleared by default, and it is unavailable if the **Only Restore New Files** check box is selected.

Scope: All networks, current LonMaker computer

Only Restore New Files

Automatically restores unique backup device application, device interface, and resource files. Backup files with the same name as an existing version will not be installed.

If this check box is not selected, the LonMaker tool will install

backup device application, device interface, and resource files based on the settings of the **Overwrite Read-only Files** and **Overwrite More Recent Files** check boxes

This option is selected by default, and it is unavailable if either the **Overwrite Read-only Files** or **Overwrite More Recent Files** check boxes are selected.

Scope: All networks, current LonMaker computer

Periodic Backup Options

Interval in Days

Sets the number of days between periodic LonMaker backups. The backup will be automatic or manual depending on the **Prompt Before Creating Backup** setting. You can select 1, 2, 3, 7, 14, or 28 days, or never. The default is 7 days.

Scope: All networks, current LonMaker computer

Prompt Before Creating Backup

Prompts you to create a LonMaker backup when the backup interval has elapsed. This option is selected by default.

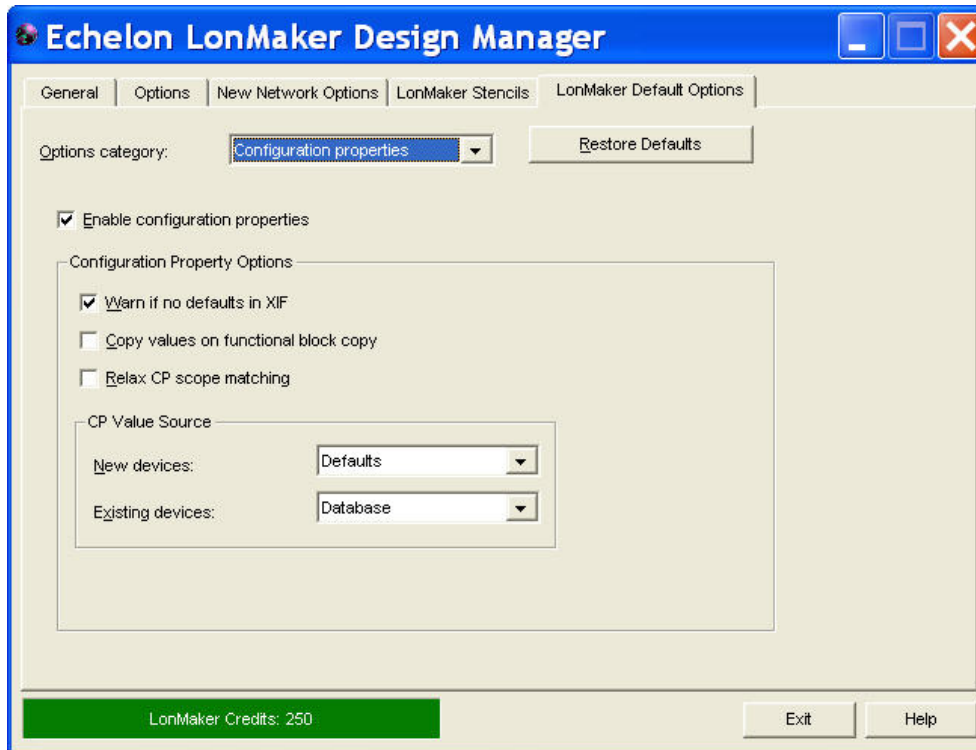
If you choose create a LonMaker backup when prompted, specify the backup settings (such as the backup file name and whether to back up the LonMaker drawing and/or database) and set any desired options (such as backing up the files in the Types and Import folders, and using an LNS hot backup).

If you do not create a LonMaker backup when prompted, you will be prompted again the next time you close your network.

If this check box is clear, the LonMaker tool automatically creates a LonMaker backup when the backup interval has elapsed.

Scope: All networks, current LonMaker computer

Configuration Properties Options



The Configuration Properties category contains the following options.

Enable Configuration Properties

Enables access to configuration properties. This option is selected by default.

Also enables automatic extension record copying. When this check box is selected, a device's extension records that are marked for copying will automatically be copied when you create a new device by copying an existing one and when you create a new custom device master shape.

If this check box is cleared, you will not be able to view or modify configuration properties from the LonMaker tool. This speeds up the LonMaker Browser, but reduces your ability to configure your devices from the LonMaker tool.

Scope: Current network, all LonMaker computers

Configuration Property Options

Warn if no Default in XIF

Notifies you if you have requested to copy default configuration property values to a device, but the device template was created from a device interface (XIF) file with no default configuration property values. The device manufacturer must include default configuration property values in their XIF file for default configuration property values to be used.

This check box is only available if the **Enable Configuration Properties** check box has been selected, and it is selected by default.

Scope: Current network, all LonMaker computers

*Copy Values on
Functional Block
Copy*

Copies CP values when creating a new functional block from a master shape or from another functional block.

This check box is only available if the **Enable Configuration Properties** check box has been selected, and it is selected by default.

Scope: Current network, all LonMaker computers

*Relax CP Scope
Matching*

Enables the LonMaker tool to re-attempt the validation of the creation of a functional block from a custom master shape or the replication of configuration property values from one functional block to another using a lower scope selector if the initial validation operation fails using the defined scope selector.

For example, if you attempt to create a functional block from a custom master shape that has a defined scope selector of 6 but the validation operation fails, the LonMaker tool will then try to validate the functional block again using scope 3. If the validation re-attempt succeeds, the operation will be allowed.

Scope: All networks, current LonMaker computer

CP Value Source

New Devices

Selects the source of configuration property values for new devices. You have two choices:

- **Defaults.** The default configuration property values from the device template will be copied to the device. The default configuration property values in the device template may have been copied from the original manufacturer's device interface (XIF) file, or may have been updated from a device. This is the default
- **Device.** The current configuration properties in the device will be kept and will be copied to the device template.

A new device may have settings different from the defaults if the device configuration properties were set on a network other than the current network.

Scope: Current network, current LonMaker computer

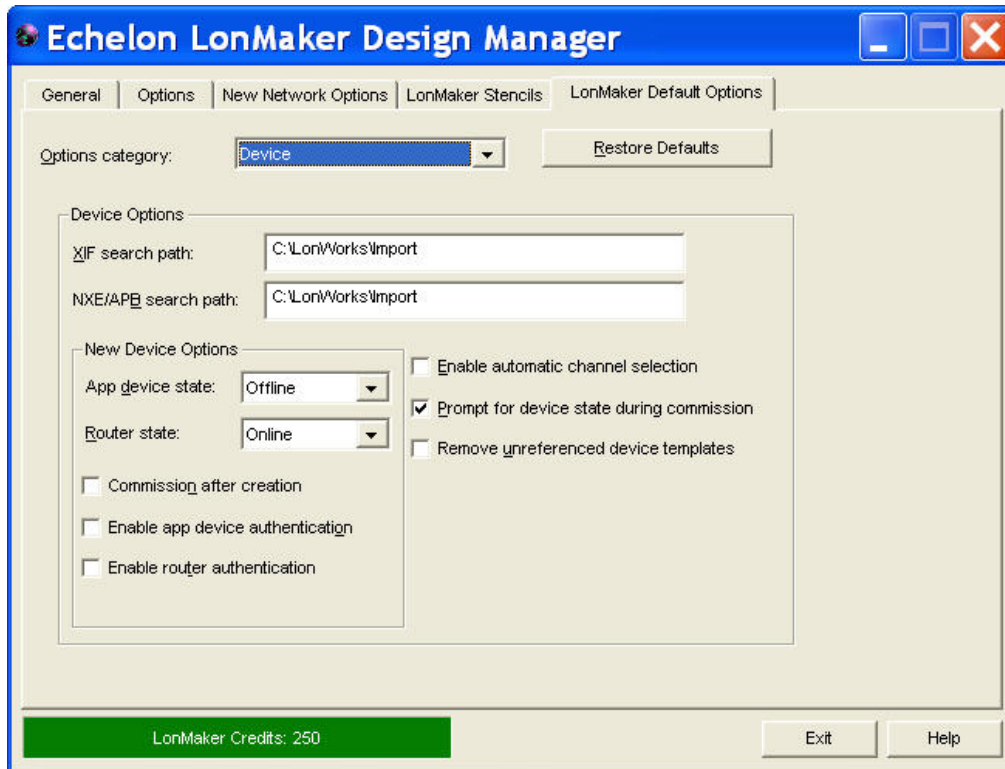
Existing Devices

Selects the source of configuration property values for existing devices. You have three choices:

- **Database.** The configuration property values stored in the LNS database will be copied to the device when a device is commissioned, replaced, or loaded. This is the default
- **Defaults.** The default configuration property values from the device template will be copied to the device when a device is commissioned, replaced, or loaded.
- **Device.** The current configuration properties in the device will be kept and will be copied to the device template when a device is commissioned, replaced, or loaded.

Scope: Current network, current LonMaker computer

Device Options



The Device category contains the following options.

Device Options

XIF Search Path

Specifies the path that the LonMaker tool uses to search for device interface (**XIF**) files. You can enter multiple directories by separating them with semicolons.

Scope: All networks, current LonMaker computer

NXE/APB Search Path

Specifies the path that the LonMaker tool uses to search for device application files (**.NXE** and **.APB** extensions). You can enter multiple directories by separating them with semicolons.

Scope: All networks, current LonMaker computer

Enable Automatic Channel Selection

Automatically assigns the appropriate channel to a new device shape, thereby skipping the Device Wizard. This option is cleared by default.

The device shape must contain both the definition of the device template that will be used and the channel type information. This feature will therefore not work for the Device shape in the LonMaker Basic Shapes stencil. To accelerate network design, create custom device master shapes for each of the device types that you typically use.

The order of the criteria used by the LonMaker tool to select the appropriate channel is as follows: (1) closest qualified channel to device shape where the channel is within 1 ½ times the width of the device shape; (2) most recently used or created channel; and (3) other available defined channels. If no channel can be selected using

the preceding criteria, the Device Wizard will appear.

Scope: All networks, current LonMaker computer

*Prompt for Device
State During
Commissioning*

Includes the window in the Commissioning Device Wizard for setting the initial state of application device/router applications and the source of device configuration property values. This option is selected by default.

If this check box is cleared, this window will be skipped. The initial device state will be determined by the current setting in the **New Device Options** box. The source of the device configuration property values will be determined by the current setting in the **CP Value Source** box located in the **Configuration Properties** options category.

Scope: Current network, current LonMaker computer

*Remove Unreferenced
Device Templates*

Removes a device template when all devices using that template have been deleted. This option is cleared by default.

Registered plug-ins associated with a device template will become unregistered if that device template is removed. You will need to re-register the plug-ins using the **Plug-In Registration** tab in the **Network Properties** command under the **LonMaker** menu.

Scope: Current network, all LonMaker computers

New Device Options

App Devices

Specifies the initial state of a new application device after it has been commissioned. You have three choices:

- **Online.** Places the device in the online state. The behavior in the online state depends on the device. A Neuron-hosted device, for example, will run its application after it has been commissioned.
- **Offline.** Places the device in the offline state. The behavior in the offline state depends on the device. A Neuron-hosted device, for example, will not run its application after it has been commissioned. This is the default and can be used to bring up a system incrementally.

When a device is offline, portions of its application may still function and it will still respond to Online, Wink, and Test commands. An offline device still receives network variable updates, but it typically does not process updated network variable values or send network variable updates.

Resetting an offline device makes it go online, unless the device is in the hard offline state, in which case it will remain offline after a reset.

- **Disable.** Disables the device's application. The device application will remain disabled, even if the device is reset. For a device to be disabled, it must contain a Node Object functional block. If **Disable** is selected and the device does not contain a Node Object functional block, the device is placed offline. As with offline operation, portions of a disabled device's application may continue to function.
- **Scope:** Current network, all LonMaker computers

Routers

Specifies the initial state of a new router after it has been commissioned. You have two choices:

- **Online.** The router will forward packets between the channels connected to it. Use this setting to ensure routers are operational as they are commissioned. This is the default.
- **Offline.** The router will not forward packets between the channels connected to it.

Scope: Current network, all LonMaker computers

Commission After Creation

Selects the check box to commission new devices and routers on the first page of their respective wizards. This option is cleared by default.

Scope: Current network, current LonMaker computer

Enable App Device Authentication

Enables authentication for new devices. Authentication must be enabled for the network for it to be used by a device. This option is cleared by default.

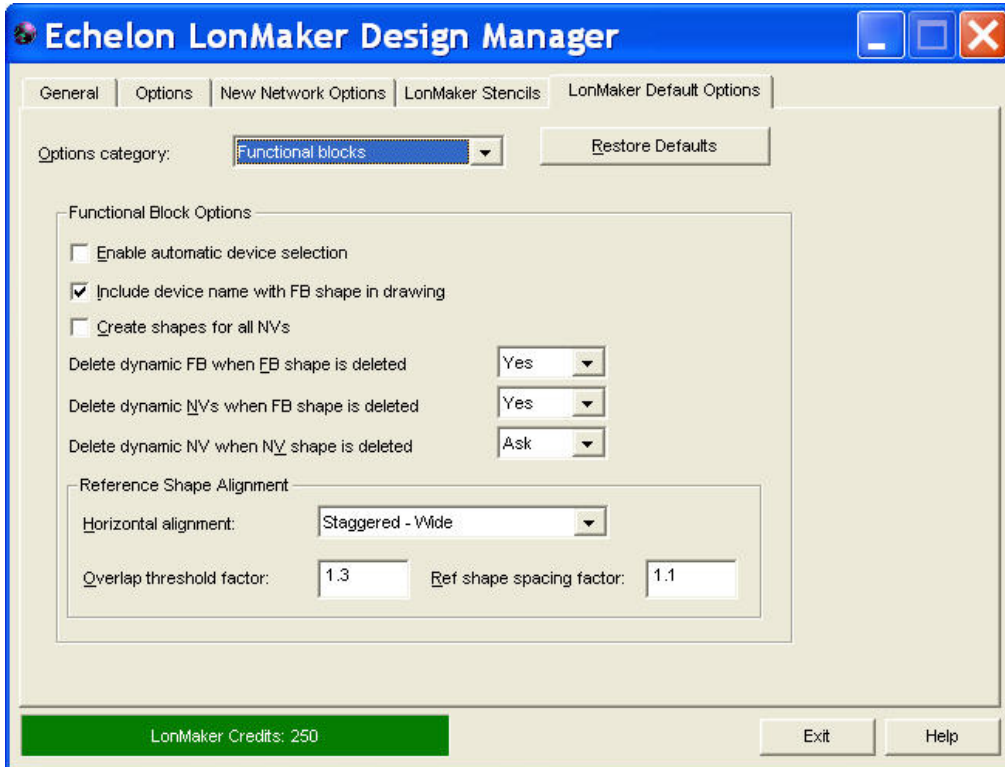
Scope: Current network, all LonMaker computers

Enable Router Authentication

Enables authentication for new routers. Authentication must be enabled for the network for it to be used by a router. This option is cleared by default.

Scope: Current network, all LonMaker computers

Functional Block Options



The Functional Block category contains the following options.

Functional Block Options

Enable Automatic Device Selection

Automatically assigns the appropriate device to a new functional block shape, thereby skipping the Functional Block wizard. This option is cleared by default.

The functional block shape must contain a functional block type specification for this feature to work. This feature will therefore not work for the Functional Block shape in the LonMaker Basic Shapes stencil. To accelerate network design, create custom device master shapes for each of the functional block types that you typically use.

The order of the criteria used by the LonMaker tool to select the appropriate device is as follows: (1) closest qualified device to functional block shape where the device is within 1 ½ times the width of the functional block shape, and then (2) device most recently created or device that has most recently been assigned a functional block. If no device can be selected using the preceding criteria, the Functional Block wizard will appear.

Scope: All networks, current LonMaker computer

Include Device Name with FB Shape in Drawing

Includes the device name in the name displayed for a functional block in the LonMaker drawing. The device name followed by a period will precede the functional block name. For example, the default name of a functional block shape associated with a second LonPoint analog output device created in the LonMaker drawing would be **AO- 2. AO- 1**. This option is selected by default.

Scope: Current network, all LonMaker computers

Create Shapes for all NVs

Adds network variable shapes for all network variables on a functional block. This option is cleared by default.

Scope: Current network, all LonMaker computers

Delete Dynamic FB when FB Shape is Deleted

Deletes a dynamic functional block from a device when its functional block shape is deleted from a LonMaker drawing. You have three choices:

- **No.** The dynamic functional block is not deleted.
- **Yes.** The dynamic functional block is automatically deleted. This is the default.
- **Ask.** The LonMaker tool will prompt you to decide whether to delete the dynamic functional block.

Scope: All networks, current LonMaker computer

Delete Dynamic NVs when FB Shape is Deleted

Deletes a dynamic network variable from a device when its functional block shape is deleted from a LonMaker drawing. You have three choices:

- **No.** The dynamic network variable is not deleted.
- **Yes.** The dynamic network variable is automatically deleted. This is the default.
- **Ask.** The LonMaker tool will prompt you to decide whether to delete the dynamic network variable.

Delete Dynamic NV when NV Shape is Deleted

Scope: All networks, current LonMaker computer

Deletes a dynamic network variable from a device when its network variable shape is deleted from a functional block shape. You have three choices:

- **No.** The dynamic network variable is not deleted.
- **Yes.** The dynamic network variable is automatically deleted.
- **Ask.** The LonMaker tool will prompt you to decide whether to delete the dynamic network variable. This is the default.

Scope: All networks, current LonMaker computer

Reference Shape Alignment

Select how the LonMaker tool aligns reference connection shapes. The alignment settings are applied if the **Align Reference Shapes** option is set on the functional block. To set this option, right-click a functional block, point to **Display Options**, and click **Align Reference Shapes** if it is not already set.

Horizontal Alignment

Selects how the LonMaker tool aligns overlapping connector reference shapes. You have three choices:

- **Staggered Wide.** Connector reference shapes are staggered horizontally, in two columns, with their centers aligned. This is the default.
- **Staggered Narrow.** Connector reference shapes are staggered horizontally, in two columns, with the outermost reference shapes located close to the functional block shape and somewhat overlapping with reference shapes above and below them.
- **Overlapped.** Connector reference shapes are not staggered and will overlap.

Scope: Current network, current LonMaker computer

Overlap Threshold Factor

Determines the point at which the LonMaker tool will overlap multiple connector reference shapes that are attached to the same network variable shape on one side of a functional block. Overlapping connector reference shapes cannot be aligned with the network variable shapes to which they are connected.

If the overlap threshold factor multiplied by the height of the functional block shape is greater than the total height of the reference connector shapes (including spacing), the reference connector shapes will not be overlapped.

The default overlap threshold factor is **1.3**. For the best appearance, keep this value below 2.

Scope: Current network, current LonMaker computer

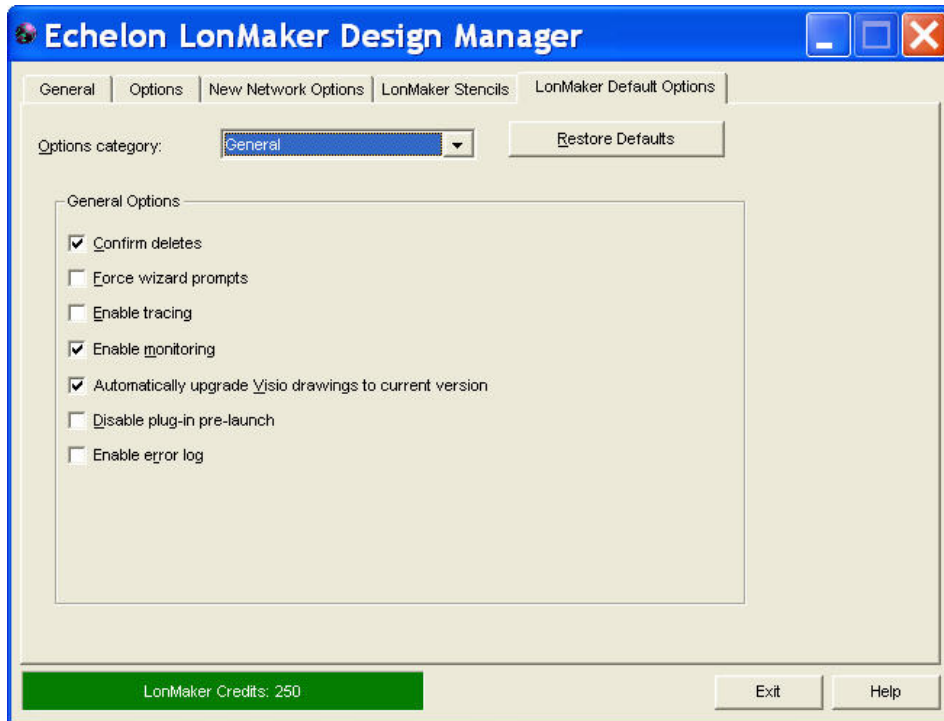
Ref Shape Spacing Factor

Determines the vertical spacing between multiple connector reference shapes when they are not aligned with the network variable shapes to which they are connected.

The default reference shape spacing value is **1.1**.

Scope: Current network, current LonMaker computer

General Options



The General category contains the following options.

- | | |
|-----------------------------|--|
| <i>Confirm Deletes</i> | Prompts you to confirm the deleting of a LonMaker shape. This option is selected by default.
Scope: Current network, current LonMaker computer |
| <i>Force Wizard Prompts</i> | Displays all wizards when you create a new LonMaker shape, regardless of the settings of any other options. This option is cleared by default.

If this check box is selected, and you create a functional block with automatic device selection enabled, for example, the Functional Block Wizard will still open.

If this check box is cleared and a functional block and its associated device are copied, for example, the new functional block will automatically be associated with the new device and the Functional Block Wizard will not open.
Scope: Current network, current LonMaker computer |
| <i>Enable Tracing</i> | Enables LonMaker tracing. You should only enable this option when requested to do so by Echelon support personnel. This option is cleared by default.

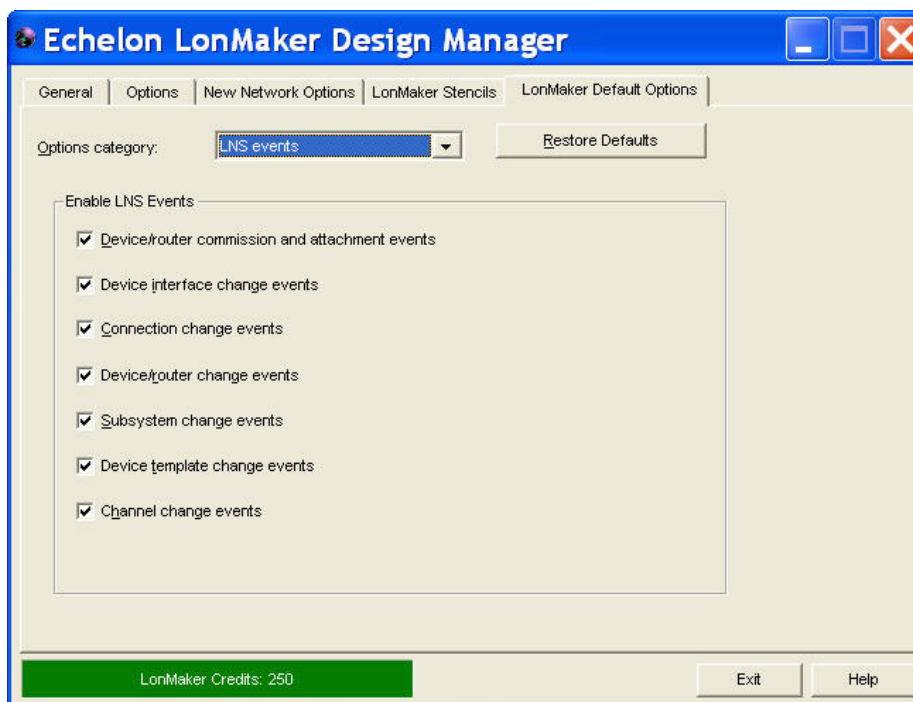
The LonMaker tracing output is saved in a file called trace.log , which is stored in the LM\Drawings\ <i><network></i> folder.
Scope: Current network, current LonMaker computer |
| <i>Enable Monitoring</i> | Enables connection monitoring, LonMaker text box monitoring, and LNS text box monitoring. Clear this check box to disable all NV polling by the LonMaker tool. This check box does not affect the |

	LonMaker Browser. This option is selected by default.
	Scope: Current network, current LonMaker computer
<i>Automatically upgrade Visio drawings to current version</i>	Automatically upgrades a LonMaker drawing to the current version of Visio you are using, if possible. This option is selected by default.
	Scope: All networks, current LonMaker computer
<i>Disable plug-in pre-launch</i>	Disables the pre-launching of plug-ins when a LonMaker drawing is opened. This option is cleared by default.
	Scope: All networks, current LonMaker computer
<i>Enable Error Log</i>	Writes all displayed error messages to the error log, which is stored in the drawing directory of the LonMaker network. This option is cleared by default.
	The error log is circular and has a maximum size of 100K; therefore, error messages at the beginning of the log will be overwritten to store new error messages.
	Scope: All networks, current LonMaker computer

LNS Event Options

The LNS Event options category contains a set of check boxes for enabling and disabling LNS events that are used to update the LonMaker drawing. Generally, you should enable all the LNS events. If you are using an LNS application or plug-in other than the LonMaker tool to make changes to the LNS network database, the LonMaker tool uses LNS events to keep the LonMaker tool synchronized with that LNS application or plug-in.

If you are only using the LonMaker tool, you can disable all the LNS events except for the device/router commission and attachment events, as the LonMaker tool tracks these events itself. A benefit of disabling the LNS events is that it may improve network performance.



The LNS Event category contains the following options. The changes you make in the LNS Events options category are all applied to the current network on your computer.

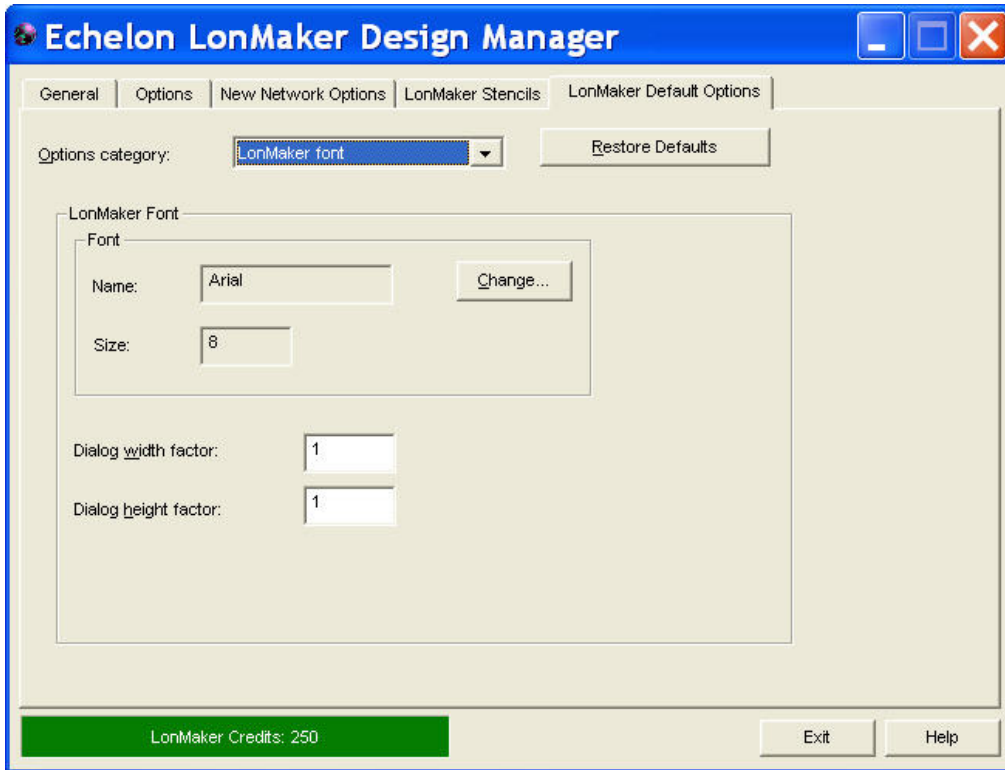
<i>Device/router Commission and Attachment Events</i>	Updates the LonMaker drawing when devices or routers are attached to the network, detached, commissioned, or decommissioned. This option is selected by default. Scope: Current network, current LonMaker computer
<i>Device Interface Change Events</i>	Updates the LonMaker drawing when a device's functional blocks, network variables, or configuration properties are added, removed, or modified. This option is selected by default. Scope: Current network, current LonMaker computer
<i>Connection Change Events</i>	Updates the LonMaker drawing when a connection is created or modified, or when a connection description template being used in your network is modified. This option is selected by default. Scope: Current network, current LonMaker computer
<i>Device/router Change Events</i>	Updates the LonMaker drawing when new devices or routers are detected. This option is selected by default. If selected, a device will be automatically upgraded when a new application is loaded into a device or when a device is replaced. The LonMaker tool will automatically make the device compatible with the updated device template, and it will maintain existing compatible connections and configuration property settings. Scope: Current network, current LonMaker computer
<i>Subsystem Change Events</i>	Updates the LonMaker drawing when subsystems are added, removed, or modified. This option is selected by default. Scope: Current network, current LonMaker computer
<i>Device Template Change Events</i>	Updates the internal copies of device templates maintained by the LonMaker tool when device templates are added, removed, or modified. This option is selected by default. Scope: Current network, current LonMaker computer
<i>Channel Change Events</i>	Updates the LonMaker drawing when channels are added, removed, or modified. This option is selected by default. Scope: Current network, current LonMaker computer

LonMaker Font Options

The LonMaker Font options category lets you adjust the font and the size of the LonMaker Design Manager and the dialogs in the LonMaker drawing. This is useful in the event you need to re-size dialogs that have become truncated, which may occur if you are using an Asian version of Windows. Otherwise, you will not likely need to change the settings in this options category.

To apply changes in the LonMaker Font options category to the LonMaker Design Manager, exit and then re-open the LonMaker Design Manager.

The changes you make in the LonMaker Font options category are applied to all networks on your computer.

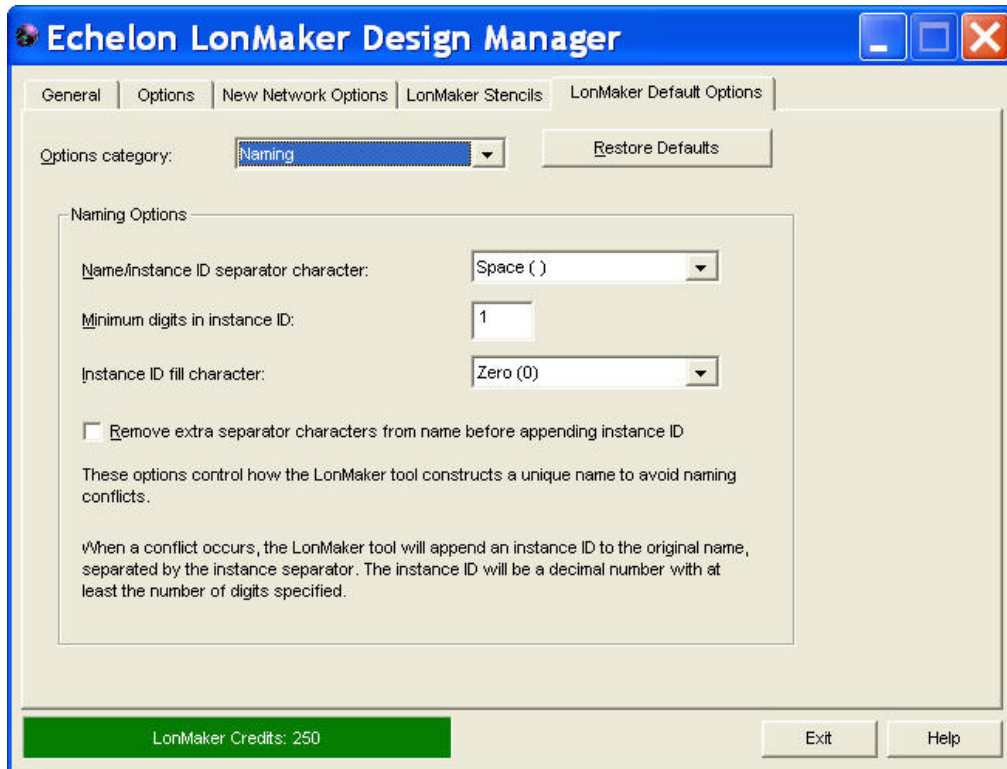


The LonMaker Font category contains the following options.

LonMaker Font

<i>Name</i>	Displays the name of the current LonMaker font. The default value is Arial . Scope: Current network, current LonMaker computer
<i>Size</i>	Displays the size of the current LonMaker font. The default value is 8 points. Scope: Current network, current LonMaker computer
<i>Change</i>	Opens a dialog in which you can change the font, size, or style of the LonMaker font. Scope: Current network, current LonMaker computer
<i>Dialog Width Factor</i>	Sets the width of all dialogs in the LonMaker drawing and the width of the LonMaker Design Manager. You can use this setting to adjust the dialog and Design Manager width when changing the LonMaker font. The default value is 1 . Scope: Current network, current LonMaker computer
<i>Dialog Height Factor</i>	Sets the height of all dialogs in the LonMaker drawing and the height of the LonMaker Design Manager. You can use this setting to adjust the dialog and Design Manager height when changing the LonMaker font. The default value is 1 . Scope: Current network, current LonMaker computer

Naming Options



The Naming category contains the following options. The changes you make in the Naming options category are applied to the current network on your computer.

Naming Options

Controls how the LonMaker tool constructs a unique name for new LonMaker shapes. If there is a naming conflict, the LonMaker tool will append to a new LonMaker shape name a space, dash, or other selected separator character followed by an instance ID. The instance ID starts at 1 and is incremented by one each time a new shape of a given type (device, router, functional block, and so on) with an identical name of an existing shape is added to your LonMaker drawing.

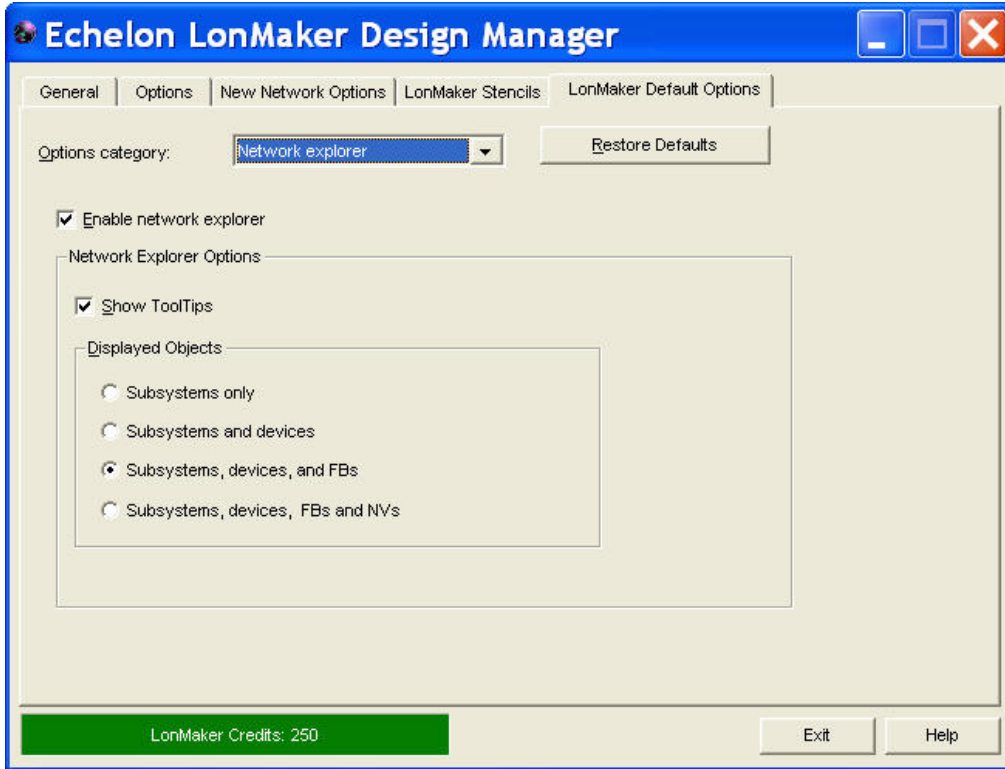
For example, the default name of the first generic device shape added to your LonMaker drawing is **Device**. The second generic device shape is **Device 1**, but you can change this to **Device1**, **Device-1**, or **Device-001** based on the naming options you set.

Scope: Current network, current LonMaker computer

<i>Name/instance ID Separator Character</i>	<p>Selects the character to be inserted between the LonMaker shape name and the instance ID. The choices are Space (), Underscore (_), Dash (-), Exclamation Point (!), and Hash (#). The default separator character is Space ().</p> <p>For example, the default name of the first analog input (AI-) LonPoint device added to your LonMaker drawing with a space () selected as the separator character is AI- 1. If you select a dash as the separator character, the default name is AI--1.</p> <p>Scope: Current network, current LonMaker computer</p>
<i>Minimum Digits in Instance ID</i>	<p>Sets the minimum number of digits to be used in the instance ID. The default value is 1.</p> <p>For example, the default name of the first analog input (AI-) LonPoint device added to your LonMaker drawing with the minimum digits set to 2 is AI- 01, set to 3 it is AI- 001, and so on.</p> <p>To ensure that objects are listed numerically in various LonMaker menus and reports, set the minimum digits in the instance ID to accommodate the maximum number of a specific type of object you plan on creating in a subsystem. For example, if you plan on creating 10 or more of a certain device in a subsystem, you should set the minimum digits to two; if you plan on creating 100 or more of a device, set it to three; and so on.</p> <p>Scope: Current network, current LonMaker computer</p>
<i>Instance ID Fill Character</i>	<p>Selects the characters to be inserted between the separator character and the instance ID when the number of digits in the instance ID is less than minimum digits set. The choices are Space () or Zero (0). The default fill character is Space ().</p> <p>For example, the default name of the first analog input (AI-) LonPoint device added to your LonMaker drawing with the minimum digits set at 2 and a space selected as the fill character is AI- 1. If a zero (0) was selected as the fill character, the default name is AI- 01.</p> <p>Scope: Current network, current LonMaker computer</p>
<i>Remove Extra Separator Characters from Name before Appending Instance ID</i>	<p>Automatically deletes any separator characters appended to LonMaker shape names. This option is cleared by default.</p> <p>For example, the default name of the first analog input (AI-) LonPoint device added to your LonMaker drawing with this check box cleared is AI- 1. If this check box was selected, the default name would be AI 1.</p> <p>Scope: Current network, current LonMaker computer</p>

Network Explorer Options

The Network Explorer is an auto-hide window that displays a hierarchical view of the LonMaker drawing. You can use the Network Explorer to navigate, view, and modify the subsystems, devices, and device templates in your network design.



The Network Explorer category contains the following options. The changes you make in the Network Explorer options category are applied to all networks on your computer.

Enable Network Explorer

Enables the network explorer to appear in your LonMaker drawing. This option is selected by default.

Scope: All networks, current LonMaker computer

Network Explorer Options

Show ToolTips

Enables the name of the LonMaker object and its absolute path to appear in a ToolTip when the mouse pointer is positioned over the object. This option is selected by default.

Scope: All networks, current LonMaker computer

Displayed Objects

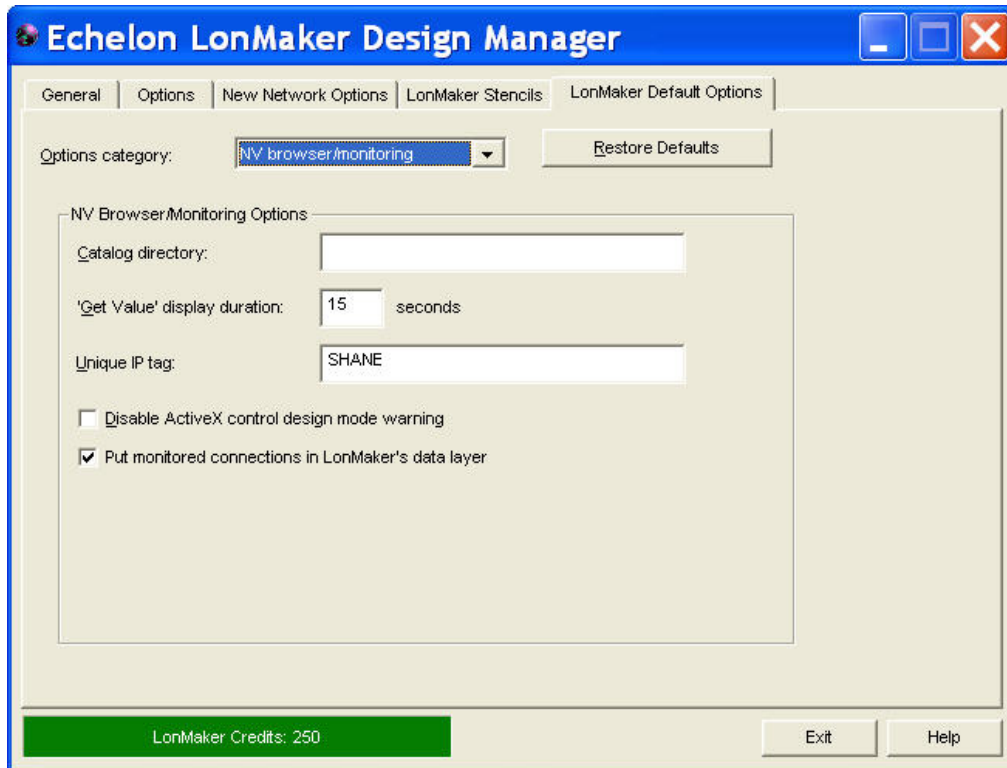
Select the scope of the objects displayed within the network explorer. You have four choices:

- **Subsystems Only.** Lists only the subsystems in the LonMaker network.
- **Subsystems and Devices.** Lists the subsystems and devices in the LonMaker network.
- **Subsystems, Devices, and FBs.** Lists the subsystems, devices, and functional blocks in the LonMaker network.

- **Subsystems, Devices, FBs, and NVs.** Lists the subsystems, devices, functional blocks, and network variables in the LonMaker network.

Scope: All networks, current LonMaker computer

NV Browser/Monitoring Options



The NV Browser/Monitoring category contains the following options.

NV Browser/Monitoring Options

Catalog Directory

Specifies the directory containing resource files (.TYP, .FMT, .FPT, and language files). The default directory is LonWorks\Types. You should not modify this path, as the resource file catalog should always be located in the LonWorks\Types folder.

Scope: Current network, all LonMaker computers

'Get Value' Display Duration

Specifies the number of seconds that a value will be displayed when you right-click a Connector shape and then click **Get Input Value** or **Get Output Value**. If you set this option to 0, the value will be displayed indefinitely. The default time is **15** seconds.

Scope: All networks, current LonMaker computer

Unique IP Tag

Specifies a tag that identifies a remote lightweight client to the LNS server for accessing its monitor sets. A monitor set is a group of point definitions that the LonMaker tool uses to

monitor and control network variables. The tag is used to correlate a lightweight client to its monitor sets. By default, this tag is the computer's Windows network name.

If you have existing monitor sets and you change this tag, the existing monitor sets can no longer connect to the lightweight client. To remove the monitor sets, use the **Remove Monitor Sets** command from the **Network Service Devices** command on the **LonMaker** menu.

Scope: All networks, current LonMaker computer

*Disable ActiveX Control
Design Mode Warning*

Disables the warning that appears when you drag an ActiveX control to your LonMaker drawing. Dragging an ActiveX control to your LonMaker drawing puts the LonMaker tool in design mode, which affects the behavior of all ActiveX controls. This check box is cleared by default.

Scope: Current network, current LonMaker computer

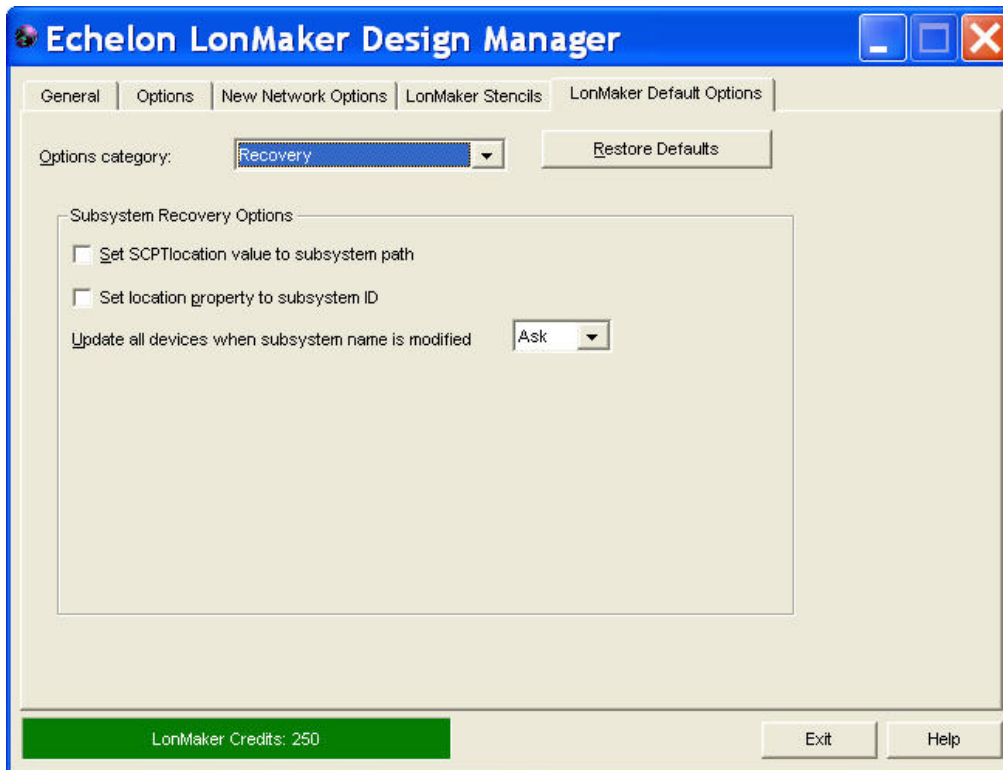
*Put Monitored Connections
in LonMaker's Data Layer*

Automatically displays monitored connections in the LonMaker Data Layer, in addition to displaying them in the LonMaker Logical Layer. If cleared, monitored connections will only be displayed in the LonMaker Logical Layer. This check box is selected by default.

Scope: All networks, current LonMaker computer

Recovery Options

The Recovery options category lets you store and automatically update subsystem data in application devices and routers. This is useful in the event you need to recover your LNS network database from the network. Setting these options enables the LonMaker tool to use the saved subsystem data to place application devices and routers in their correct subsystems. See *Recovering a LonMaker Network* in Chapter 7, *Maintaining Networks*, for more information on the network recovery process.



The Recovery category contains the following options. The changes you make in the Recovery options category are applied to the current network on all LonMaker computers.

Subsystem Recovery Options

If you select either of the following subsystem recovery options in the LonMaker drawing, you need to resynchronize your drawing and select the **Update Location Path and ID in Devices** check box in the **Synchronize LonMaker Drawings** dialog box in order to update the devices with the current subsystem location data.

To resynchronize your drawing, open the **LonMaker** menu, point to **Synchronization**, and click **Resynchronize**.

Set SCPT Location Value to Subsystem Path

Stores the subsystem path in the **SCPTlocation** configuration property of an application device when it is created. Automatically updates **SCPTlocation** when the application device is commissioned. The **SCPTlocation** configuration property must apply to the Node Object functional block if the device has a Node Object functional block, or it must apply to the entire device if the device does not have a Node Object functional block.

Automatically updates the **SCPTlocation** configuration property when the application device is moved or its subsystem is moved or renamed (provided that the **Update all Devices when Subsystem Name is Modified** option is set to **Yes**), or you select the **Update Location Path and ID in Devices** check box in the **Synchronize LonMaker Drawing** dialog. This check box is cleared by default.

If an application device and its functional blocks span multiple subsystems, the LonMaker tool will use the subsystem path in which the application device shape is located.

If the LonMaker tool cannot locate the applicable **SCPTlocation** configuration property in an application device, the subsystem path

will not be stored in the device.

Scope: Current network, all LonMaker computers

*Set Location Property
to Subsystem ID*

Stores the subsystem ID in the location field of an application device and router when the device is commissioned. Automatically updates the subsystem ID in the location field when the application device or router is moved or its subsystem is moved or renamed (provided that the **Update all Devices when Subsystem Name is Modified** option is set to **Yes**), or you select the **Update Location Path and ID in Devices** check box in the **Synchronize LonMaker Drawing** dialog. This check box is selected by default.

The subsystem ID is the first 15 bits of the LNS subsystem handle (in a very large network, with many subsystems where more than 32767 subsystems have been created and deleted this could result in multiple unique subsystems having the same ID).

Scope: Current network, all LonMaker computers

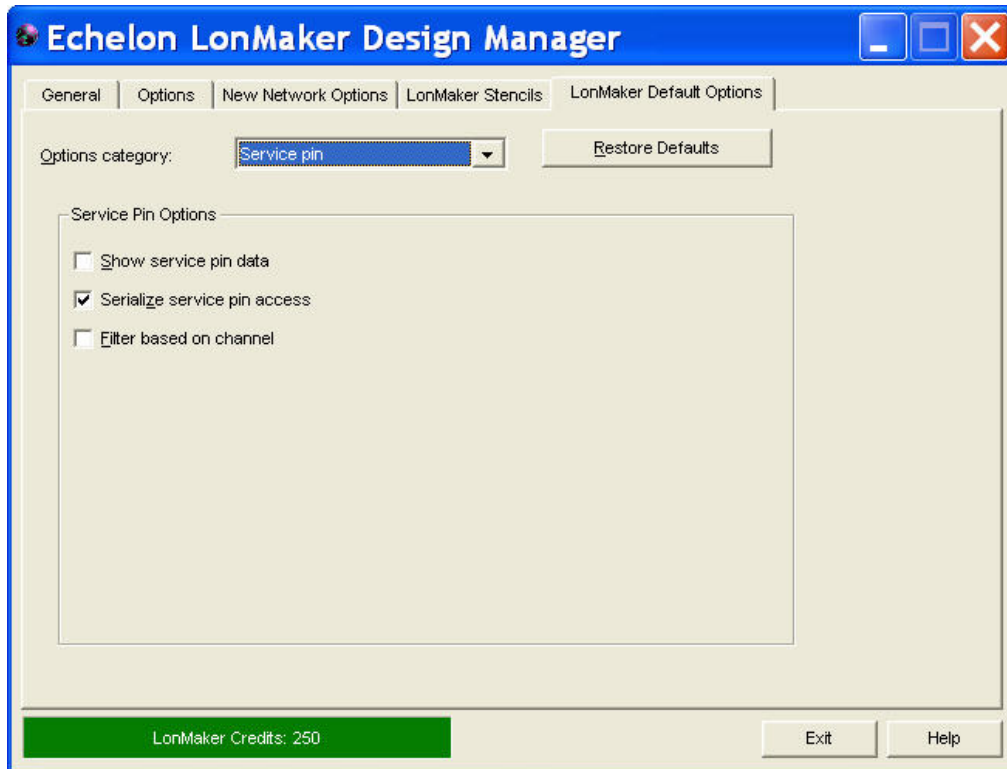
*Update all Devices
when Subsystem Name
is Modified*

Select whether the LonMaker tool updates the SCPTlocation configuration property and location field in an application device or router when the path or ID of its subsystem changes. You have three choices:

- **No.** Devices are not updated. You will need to resynchronize your LonMaker drawing to update devices with the current subsystem path and ID.
- **Yes.** Application devices and routers are automatically updated to reflect the new subsystem path or ID.
- **Ask.** The LonMaker tool will prompt you whether to update devices. This is the default.

Scope: Current network, all LonMaker computers

Service Pin Options



You can set options for using the service pin when commissioning a device.

Show Service Pin Data

Displays the service pin data received by the LonMaker tool when you press the device's service pin. This option is cleared by default.

You can change this option when you commission a device or router in the Commission Device/Router Wizard.

Scope: Current network, current LonMaker computer

Serialize Service Pin Access

Limits service pin installation to only one installer looking for a service pin message at a time. This option is recommended if repeaters are used in the network or if multiple installers are installing devices on the same channel. This option is selected by default.

Clear this check box if multiple users are commissioning devices at the same time and are working on different channels connected by configured routers.

Select this check box if multiple users are commissioning devices at the same time and are working on channels connected by logical repeaters, or if multiple users are installing devices on the same channel.

Either setting can be used if you have a single user commissioning devices at a time on the network.

Scope: Current network, all LonMaker computers

Filter Based on Channel

Ignores service pin messages not originating from the same channel on which the device being installed is located. This option is cleared by default.

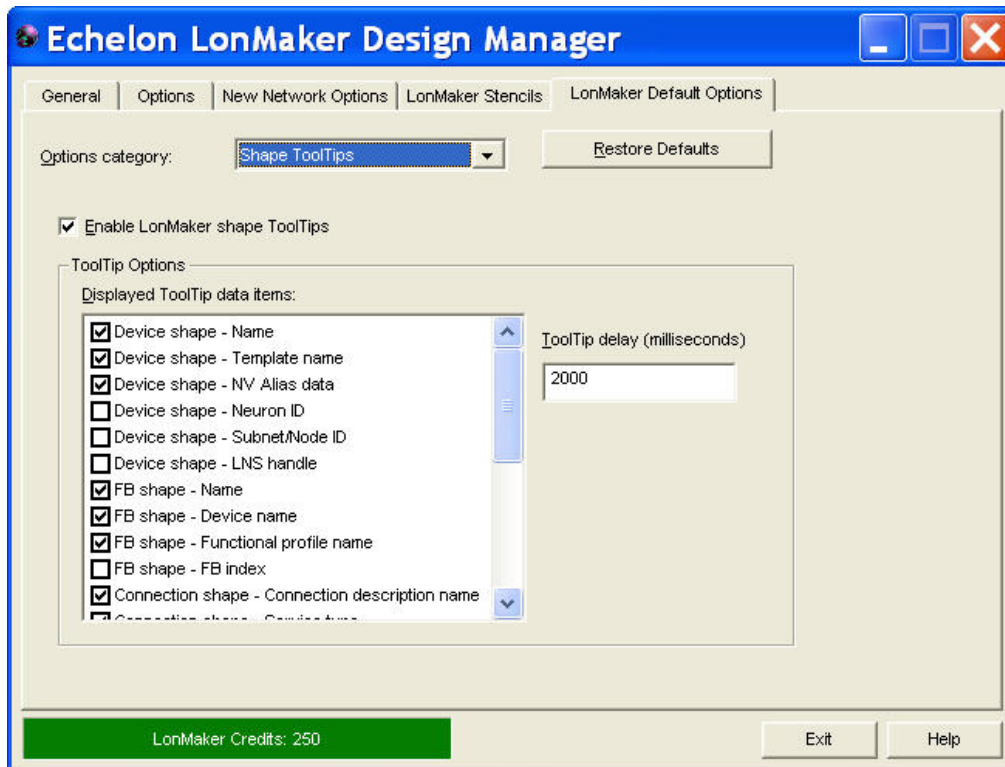
Select this check box if the network does not contain any logical repeaters.

Clear this check box if the network includes any logical repeaters.

Scope: Current network, all LonMaker computers

Shape ToolTips Options

You can enable a ToolTip to appear when the mouse pointer is over a LonMaker shape in your LonMaker drawing and select the type of data that appears in the ToolTip. Using a device for example, you can set a ToolTip to display any or all of the following data items when the mouse pointer is over its shape: shape name, template name, network variable alias data, Neuron ID, Subnet/Node ID, and LNS handle.



The Shape ToolTips category contains the following options. The changes you make in the Shape ToolTips options category are applied to all networks on your computer.

Enable LonMaker Shape ToolTips

Displays a ToolTip when the mouse pointer is positioned over a LonMaker shape. This check box is selected by default.

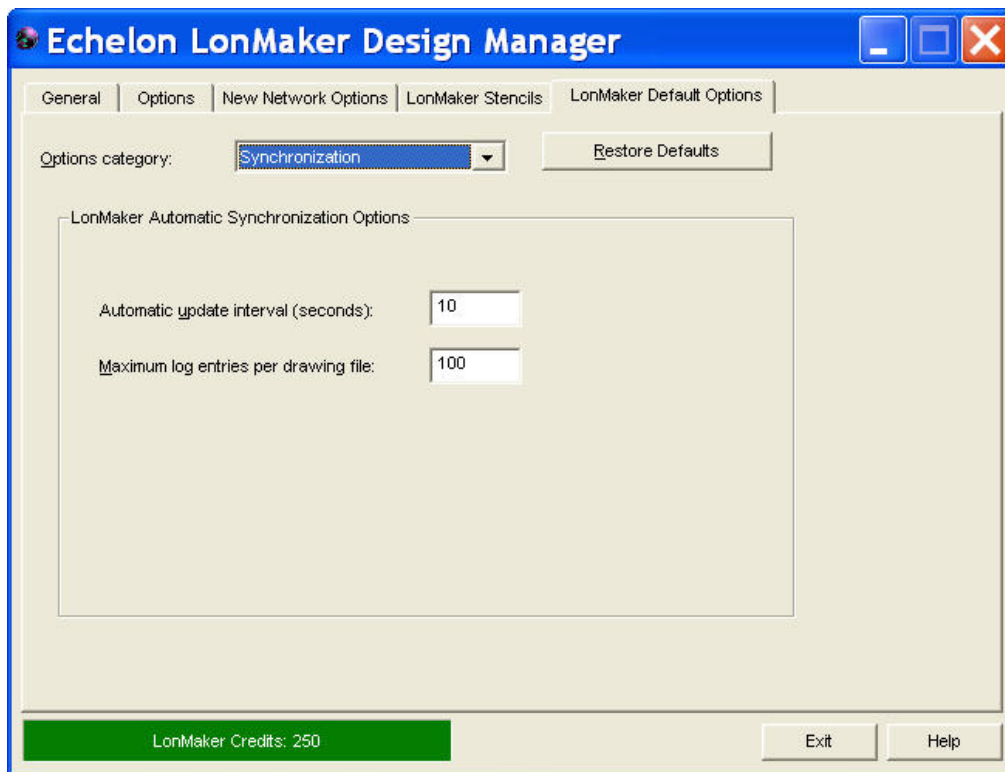
Scope: All networks, current LonMaker computer

ToolTip Delay

Specifies the number of milliseconds the mouse pointer needs to be positioned over a LonMaker shape for the ToolTip to be displayed. The default value is **2000** ms (2 seconds).

Scope: All networks, current LonMaker computer

Synchronization Options



The Synchronization category contains the following options.

Automatic Update Interval (Seconds)

Sets how frequently (in seconds) a LonMaker client checks the LonMaker Event Log and updates its copy of a LonMaker drawing to incorporate any changes made by other clients. The default automatic update interval is **10** seconds.

Set the interval to 0 to disable automatic updates. You can then apply updates when you open a drawing, or you can manually apply updates by opening the **LonMaker** menu, pointing to **Synchronization**, and then clicking **Apply Events**.

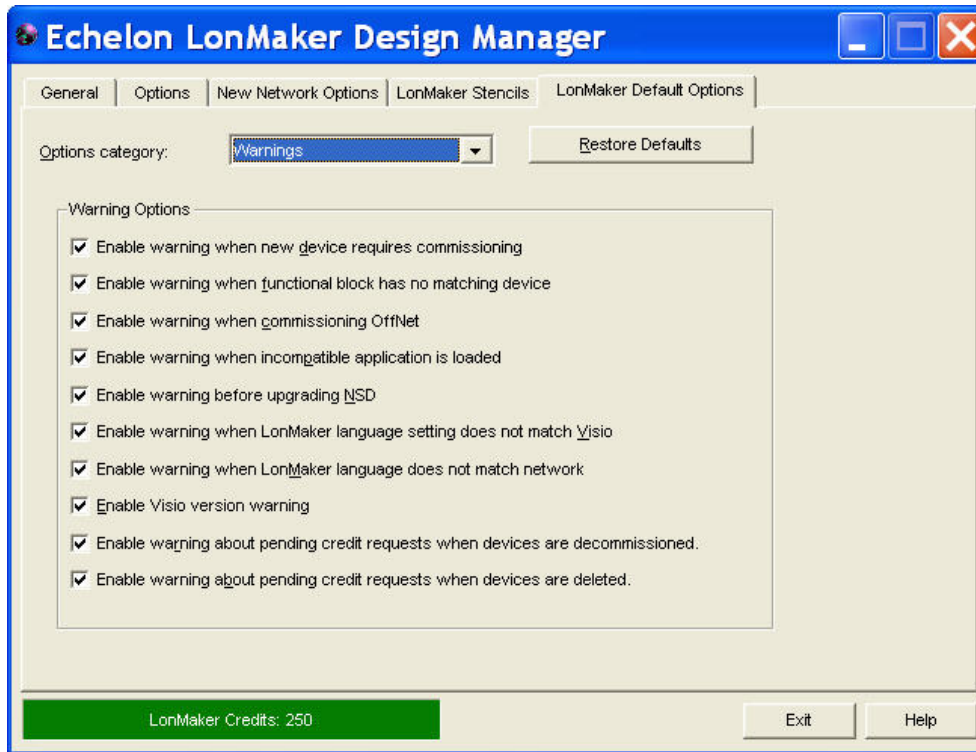
Scope: Current network, current LonMaker computer

Maximum Log Entries per Drawing File

Sets the maximum number of entries to be stored in the LonMaker Event Log. Once the limit is reached, older entries will be deleted to enable new entries to be logged. The default limit is **100** entries. To disable the event log, set the limit to **0**.

Scope: Current network, all LonMaker computers

Warnings Options



The Warnings category contains the following options, which are all selected by default.

Enable Warning When New Device Requires Commissioning

Displays a message when you create a new device that needs to be commissioned.

Scope: Current network, current LonMaker computer

Enable Warning When Functional Block has no Matching Device

Displays a message when you drag a functional block shape onto a drawing but there is no compatible device on the drawing page. You will be prompted to select another subsystem.

Scope: Current network, current LonMaker computer

Enable Warning When Commissioning OffNet

Displays a message when you commission a device or router while the LonMaker tool is OffNet. Commissioning while the LonMaker tool is OffNet sets the Neuron ID of the device shape, but it does not affect the physical device.

Scope: Current network, current LonMaker computer

Enable Warning When Incompatible Application is Loaded

Displays a message if you attempt to load an incompatible application image into a device.

Scope: Current network, current LonMaker computer

Enable Warning Before Upgrading NSD

Displays a message when upgrading the LNS network interface, which is represented by the network service device (NSD) shape in the LonMaker drawing.

The LonMaker tool upgrades the network interface when you upgrade from a version of the LonMaker tool before Release 3, or if you are switching between a fast LNS network interface (layer 2) and a legacy LNS network interface (layer 5). If you attempt to do either of these, the LonMaker tool will ask whether to upgrade

the NSD. In most cases, you should perform the upgrade. However, if you are only temporarily using a different network interface, you may choose not to upgrade. In this case, communication with physical devices is limited until you reopen the network with the original network interface. If initially you choose not to upgrade the NSD and decide later to upgrade, right-click the NSD shape, and then click **Upgrade NSD** on the shortcut menu.

When moving from an LNS fast (layer 2) network interface to a legacy LNS (layer 5) network interface, all connections and monitor sets may not be created on the new network interface. If this happens, a dialog displays the items that will be lost and gives you an opportunity to cancel the upgrade.

Scope: Current network, current LonMaker computer

Enable Warning When LonMaker Language Setting does not Match Visio

Displays a message when the language set in the LonMaker tool and the currently installed language in Visio do not match.

Scope: All networks, current LonMaker computer

Enable Warning When LonMaker Language Setting does not Match Network

Displays a message when the languages set in the LonMaker tool and the LonMaker drawing do not match.

This can occur if the installed languages are different between the LonMaker tool that created the LonMaker drawing and the one opening it.

Scope: Current network, current LonMaker computer

Enable Visio Version Warning

Displays a message if the version of Visio installed on your computer is incompatible with your version of the LonMaker tool.

This applies only to versions of Visio newer than Visio 2003. If an older version of Visio is installed on your computer and you do not also have Visio 2003 installed, the LonMaker tool will not run on your computer.

Scope: All networks, current LonMaker computer

Enable Warning About Pending Credits Request When Devices are Decommissioned

Displays a message when you have ordered LonMaker credits, and you are trying to decommission one or more devices prior to receiving a new application key.

Decommissioning devices before receiving your application key will invalidate your activation code (also called the PC key). If you proceed with decommissioning a device, you will need to submit a new request for an activation key (also called the application key).

Scope: All networks, current LonMaker computer

Enable Warning About Pending Credits Request When Devices are Deleted

Displays a message when you have ordered LonMaker credits, and you are trying to delete one or more devices prior to receiving a new application key.

Deleting devices before receiving your activation key will invalidate your activation code (PC key). If you proceed with deleting a device, you will need to submit a new request for an activation key (application key).

Scope: All networks, current LonMaker computer

Appendix B - Installing Network Interfaces

You can use any compatible IP or LNS network interface with the LonMaker tool. Compatible network interfaces include the *i*.LON 10 and *i*.LON 100 IP interfaces, U10 and U20 USB interfaces, PCC-10 PC Card, PCLTA-20 and 21 PCI Cards, SLTA-10 Serial LonTalk Adapter, and an Ethernet card used with an *i*.LON 100 with IP-852 routing or an *i*.LON 600 router. This appendix explains how to install the hardware for and configure the PCLTA-10, PCLTA-20, and PCC-10 network interfaces. If you are using one of the other network interfaces, see the documentation for the network interface for installation instructions.

Installing the PCLTA-10 Network Interface

The following section describes how to install and configure the hardware for the PCLTA-10 network interface. The driver software is installed automatically when you install the LonMaker tool. Make sure the driver software is installed before installing the hardware and configuring the network interface.

Installing the PCLTA-10 Hardware



ESD Warning

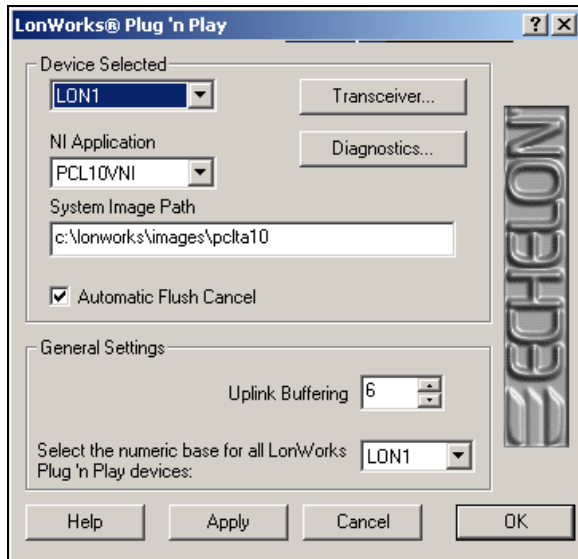
This product contains devices which are sensitive to static electricity. Before installing or removing the PCLTA-10 adapter or the network cables, discharge any static electricity which may have accumulated to earth ground.

1. Turn off the computer and remove the power cord.
 2. Open the computer case and locate an empty 16-bit slot with room for a half-length, half-height ISA-card. Remove the corresponding blank panel from the rear of the computer. Set aside the screw.
 3. Insert the PCLTA-10 network interface into the slot, ensuring that the edge connectors are fully mated and the slot in the rear panel-mounting lug of the PCLTA-10 network interface is aligned with the threaded hole in the computer chassis.
 4. Replace the screw to hold the PCLTA-10 network interface firmly in place.
 5. Reinsert the power cord and then restart the computer. A New Hardware Found window will be displayed briefly when the operating system recognizes the PCLTA-10 network interface.
-

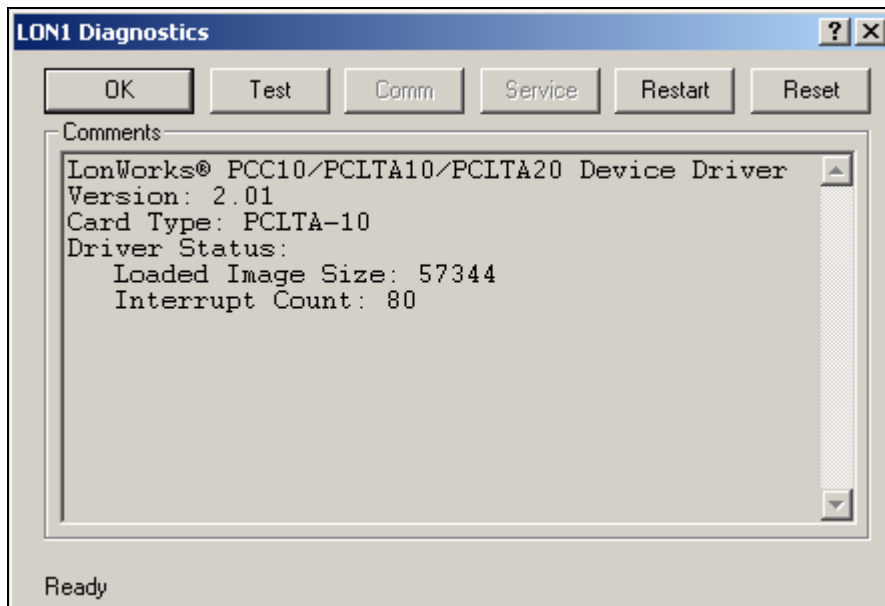
Configuring the PCLTA-10 Network Interface

Once the PCLTA-10 hardware has been installed, you must load the PCC10VNNI firmware image to the PCLTA-10 device. To accomplish this, follow these steps:

1. Click **Start** on the taskbar, point to **Settings**, and then click **Control Panel**.
2. Open **LONWORKS Plug 'n Play**. The following dialog appears:



3. Ensure that the System Image Path matches the one used during software installation.
4. Select **PCC10VNI** from the **NI Application** list and then click **Apply**.
5. Click **Diagnostics**. If the PCLTA-10 software and hardware installation has proceeded correctly, the following dialog appears (refer to the PCLTA-10 online help if it does not appear):



6. Click **Test**. The following statistics should appear.

```
-- Network Interface Status
--
CRC Errors: [00000]
TX Timeouts: [00000]
Lost (APP) Messages: [00000]
Missed (NET) Messages:
[00000]
Node State: Unconfigured
Most recent error: 0
Reset Cause: External
```

If the test passes, the computer can communicate with the PCLTA-10 network interface. If you receive an error message or your system hangs after clicking the **Test** button, uninstall the driver, reboot your computer, reinstall the software, and try running this diagnostic again.

7. Click **COMM** to make sure that the interface network interface can communicate with a test device.
8. Click **OK**. The control panel will enter a receive-ready state and will display the following message while waiting for a service pin message from another device on the network: "Now waiting for a service pin message."
9. Press the service pin on any device attached to the same network as the PCLTA-10. After you press the service pin and the control panel receives the service pin message, the control panel sends a request/response diagnostic message to the device originating the service pin message using Neuron ID addressing. It will repeat this operation, referred to as a "ping, every second until you click **OK** or **Quit**. Results will be displayed similar to the following:

```
Received service pin, pinging node:
Neuron ID: 01 23 45 67 89 10
Program ID: A_NODE
** Ping Passed **
** Ping Passed **
** Ping Passed **
...
```

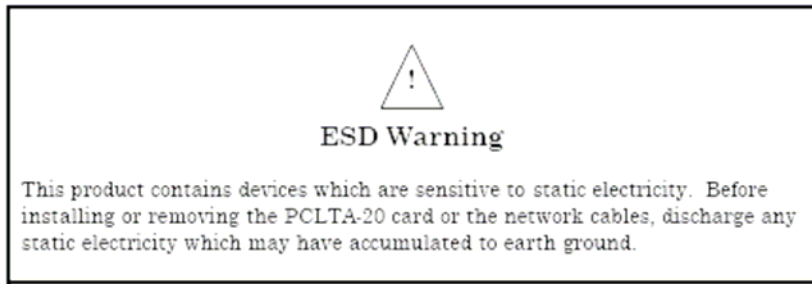
This series of tests is intended to confirm that the network interface card is properly configured and can communicate with a device on the network.

10. Click **OK** to close the dialog, and then click **OK** again to close the **LONWORKS Plug N' Play** application.

Installing and Configuring the PCLTA-20 Network Interface

The following section describes how to install and configure the hardware for the PCLTA-20 network interface. The driver software is installed automatically when you install the LonMaker tool. Make sure the driver software is installed before installing the hardware and configuring the PCLTA-20 device.

Installing the PCLTA-20 Hardware



1. Turn off the computer and remove the power cord.
2. Open the computer case and locate an empty 32-bit PCI slot. Remove the corresponding blank panel from the rear of the computer. Set aside the screw.
3. Insert the PCLTA-20 card into the slot, ensuring that the edge connectors are fully mated and the slot in the rear panel-mounting lug of the PCLTA-20 card is aligned with the threaded hole in the computer chassis. If you are using a Model 74405 PCLTA-20/SMX Interface, or a Model 33100-20 PCLTA-20 Protocol Analyzer, insert the SMX transceiver in accordance with the manufacturer's instructions before installing the PCLTA-20—see the *LONWORKS® SMX™ Transceiver Installation Instructions* document 078-0145-01 version D or later if using an Echelon SMX transceiver. **The height of the PLM-10, PLM-2X, and PLM-30 Power Line SMX Transceivers is such that two (2) PCI slots must be allocated for a PCLTA-20 equipped with a PLM transceiver, even though the card will be plugged into only one slot.**
4. Replace the screw to hold the PCLTA-20 card firmly in place.
5. Reinsert the power cord and then restart the PC. A New Hardware Found window will be displayed briefly when Windows recognizes the PCLTA-20 card.

Configuring the PCLTA-20 Network interface

Once the PCLTA-20 hardware has been installed, you must load the PCC10VNNI firmware image to the PCLTA-20 device. Configure the PCLTA-20 device in the same manner as described in *Configuring the PCLTA-10 Network interface*.

Installing and Configuring the PCC-10 Network Interface

The following section describes how to install and configure the hardware for the PCC-10 network interface. The driver software is installed automatically when you install the LonMaker tool. Make sure the driver is installed before installing the PCC-10 card and then configuring it.

Installing the PCC-10 Card Hardware

The PCC-10 card conforms to the Personal Computer Memory Card International Association's (PCMCIA) standard for hot plug-in. The PCC-10 card will not be harmed if it is inserted into, or removed from, a PC Card slot that conforms to this standard, whether the computer is on or off. In addition, the PCC-10 card is recognized as an Underwriter's Laboratories (UL) Listed Accessory and is designed to be used with UL Listed equipment.

Do not force the insertion of a PCC-10 card. You can only insert the PCC-10 card one way into a PC Card slot. The keyed notches prevent the card from being inserted upside down. If you reboot the computer after installing the software, insert the PCC-10 card into an open PC Card slot. Otherwise, reboot the computer before inserting the card.

Windows does not load the device driver for the PCC-10 card until it discovers the first PCC-10 card. Likewise, when you remove the last PCC-10 card, Windows unloads the device driver, thus freeing any system resources it was using.

Each PCC-10 card requires a single, dedicated interrupt request (IRQ) and four contiguous bytes of I/O address space starting on a modulo-4-based address.

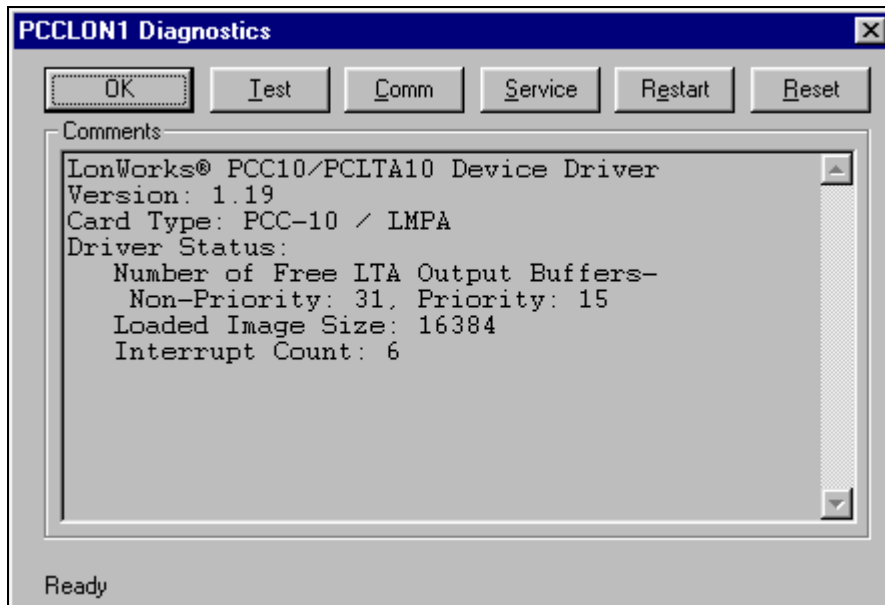
If you remove a PCC-10 card while an application is using the card, Windows will lose communication with the device, which cannot be restored by re-inserting the card. Some applications will display unusual behavior, and will not properly function. Any application using the PCC-10 card must be restarted if a PCC-10 card has been removed to ensure proper operation of the device and software.

The first time you insert a PCC-10 card into a running computer, a window will appear with the words "Echelon Corp.- PCC-10." Another window will appear stating that the Windows operating system is building a new database from the device information installed by the PCC-10 installation diskette. You can configure the new hardware when the computer has finished writing the device information.

Configuring the PCC-10 Network interface

Once the PCLTA-10 hardware has been installed, you must load the PCC10VNNI firmware image to the PCLTA-10 device. To accomplish this, follow these steps:

1. Click **Start** on the taskbar, point to **Settings**, and then click **Control Panel**.
2. Open LONWORKS Plug 'n Play.
3. Ensure that the **System Image Path** matches the one used during software installation.
4. Select **PCC10VNI** from the **NI Application** list and then click **Apply**.
5. Click **Diagnostics**. If the PCC-10 software and hardware installation has proceeded correctly, the following dialog appears (refer to the PCC-10 online help if it does not appear).



6. Click the **Test** button. The following statistics should appear.


```
-- Network Interface Status
--
CRC Errors: [00000]
TX Timeouts: [00000]
Lost (APP) Messages: [00000]
Missed (NET) Messages:
[00000]
Node State: Unconfigured
Most recent error: 0
Reset Cause: External
```

If the test passes, the computer can communicate with the PCC-10 network interface. If you receive an error message or your system hangs after clicking the **Test** button, uninstall the driver, reboot your computer, reinstall the software, and try running this diagnostic again.

7. Click **COMM** to make sure that the interface network interface can communicate with a test device.
8. Click **OK**. The control panel will enter a receive-ready state and will display the following message: "This procedure will configure the Network Interface for a zero-length domain. Do you want to proceed?"
9. Click **OK**. The control panel enters a receive-ready state and displays the following message while waiting for a service pin message from another device on the network: "Now waiting for a service pin message."
10. Press the service pin on any device attached to the same network as the PCC-10. After you press the service pin and the control panel receives the service pin message, the control panel sends a request/response diagnostic message to the device originating the service pin message using Neuron ID addressing. It will continue pinging the device every second until you click **OK** or **Quit**. Results will be displayed similar to the following:

```
Received service pin, pinging node:
Neuron ID: 01 23 45 67 89 10
Program ID: A_NODE
** Ping Passed **
** Ping Passed **
** Ping Passed **
...
```

This series of tests is intended to confirm that the network interface card is properly configured and can communicate with a device on the network.

11. Click **OK** to close the dialog, and then click **OK** again to close the **LONWORKS Plug N' Play** application.

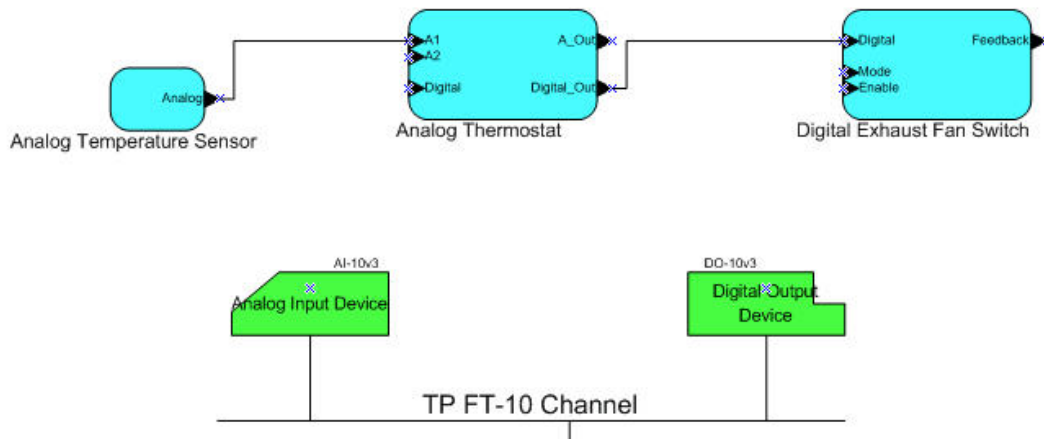
Appendix C- LonMaker QuickStart Exercise

This appendix contains a quick exercise in which you create a simple network that monitors and controls the temperature in a system using two devices and three functional blocks.

LonMaker QuickStart Exercise

This section shows you how to quickly create a basic, fully functioning control network using the LonMaker tool and the LonPoint Plug-in. The LonPoint Plug-in, which is included with the LonMaker tool, provides LonPoint-specific user interfaces for configuring properties on LonPoint devices. The LonPoint Plug-in must be installed on your computer for this quick-start exercise, but you do not need any physical devices.

In this quick-start exercise, you will design the following small network that monitors and controls the temperature in a system. This is a common operation required in many control networks, and the LonMaker tool simplifies this capability with its network design and installation features.



You will create and configure two devices: (1) an analog input device that monitors the temperature of a system by measuring the resistance of a thermistor, and (2) a digital output device that controls an exhaust fan. The analog input device starts the exhaust fan if the system temperature exceeds a certain set point. After adding the devices, you will assign functional blocks to them.

For the analog input device, you will create two functional blocks: one that represents a temperature sensor and another that represents a thermostat. The temperature sensor functional block translates raw input values from the analog-to-digital converter on the analog input device to temperature output values, and then passes the temperature output value to the thermostat functional block.

For the digital output device, you will create a functional block that represents the on/off switch on the exhaust fan.

To create the quick-start example, follow these steps:

1. If you plan on working with the LonMaker tool attached to the network, install and configure your network interface. If you are using an LNS network interface such as the *i*.LON 10 Ethernet Adapter, *i*.LON 100 Internet Server, *i*.LON 600 LonWorks/IP Server, U10, U20, PCC-10, PCLTA-10, PCLTA-20, PCNSI, SLTA-10, or PL-SLTA, install the network interface hardware and configure the network driver as described in the documentation for the network interface, which is available online at <http://www.echelon.com>
2. Place the LonMaker tool in demo mode as described in *Creating LonMaker Demonstration Networks* in Chapter 10, *LonMaker Credits*, to prevent using credits for this exercise.
3. Create a new LonMaker demo network. See *Creating a New LonMaker Network Design* in Chapter 3, *Getting Started* for instructions on creating a new network.
4. Optionally, you can assign a descriptive name (such as the channel type as in the figure above) for the default channel that appears when you open your LonMaker drawing. To change the channel

name, right-click the channel shape, click **Properties** on the shortcut menu, enter the new channel name in the **Name** box, and then click **OK**.

5. Define and commission (optional) the analog input and digital output LonPoint devices.
 - a. Enable one-click device creation. Open the **LonMaker** menu and then click **LonMaker Options**. Select **Device** from the **Options Category** list. Select the **Enable Automatic Channel Selection** check box.
 - b. To commission the devices, under **New Device Options**, select the **Commission after Creation** check box Prompt for Device State.



- c. Drag an AI-10 device shape from the LonPoint Shapes 3.0 stencil to the drawing. Press the service pin on the device if you are commissioning it.



- d. Drag a DO-10 device shape from the LonPoint Shapes 3.0 stencil to the drawing. Press the service pin on the device if you are commissioning it.

6. Assign Functional Blocks to the LonPoint Devices.

- a. Enable one-click functional block creation. Open the **LonMaker** menu and then click **LonMaker Options**. Select **Functional Block** from the **Options Category** list. Select the **Enable Automatic Device Selection** check box.



- b. Drag an analog input functional block from the LonPoint Shapes 3.0 stencil to the drawing. The functional block will automatically be assigned to the AI-10 device.

This functional block represents the temperature sensor. Optionally, you can rename the functional block to “Analog Temperature Sensor” or to another descriptive name. Right-click the functional block, select **Properties** from the shortcut menu, enter the desired name in the **FB Name** box, and then click **OK**.



- c. Drag an analog functional block from the LonPoint Shapes 3.0 stencil to the drawing. The functional block will automatically be assigned to the AI-10 device. This functional block represents the thermostat. Optionally, you can rename the functional block to “Analog Thermostat” or to another descriptive name.



- d. Drag a digital output functional block from the LonPoint Shapes 3.0 stencil to the drawing. The functional block will automatically be assigned to the DO-10 device. This functional block represents the exhaust fan switch. Optionally, you can rename the functional block to “Digital Exhaust Fan Switch” or to another descriptive name.

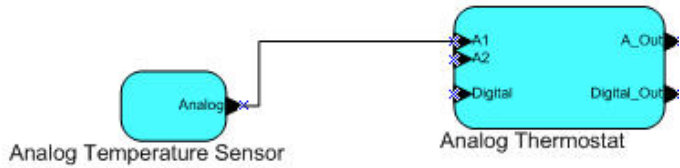
7. Connect the network variables.

- a. Connect the temperature sensor (AI) functional block to the thermostat (AFB) functional block.



Select the **Connector** tool on the Visio **Standard** toolbar. Point to the **Analog** network variable on the temperature sensor (AI) functional block until a red square appears around the

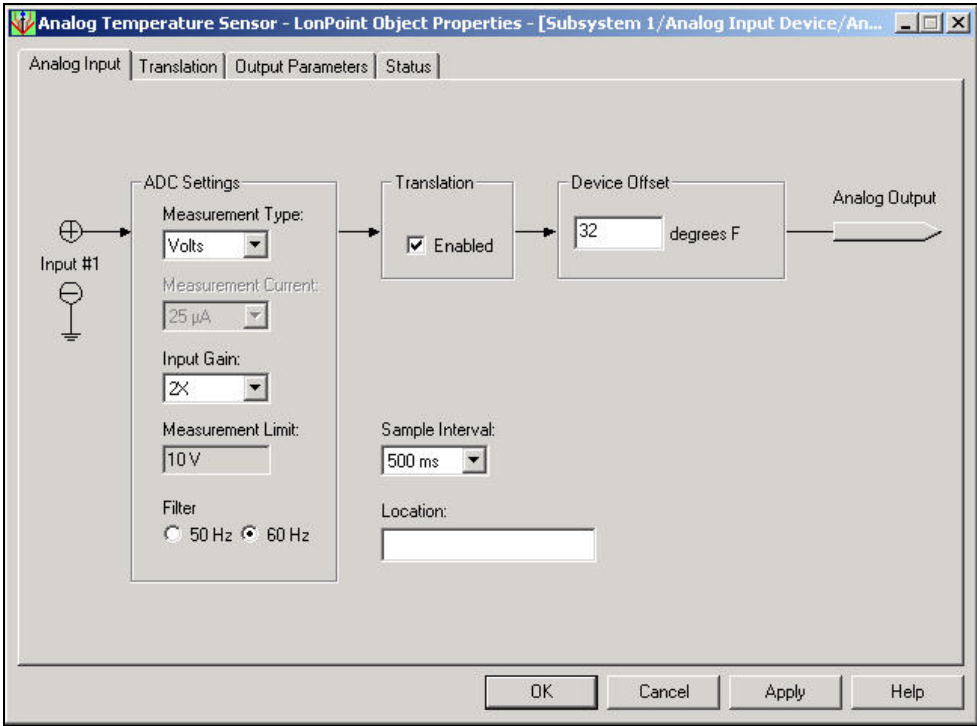
shape. Hold down the mouse button and then point to the **A1** network variable on the thermostat (AFB) functional block.



- b. Connect the thermostat (AFB) functional block to the exhaust fan (DO) switch functional block. Connect the **Digital_Out** network variable on the Thermostat (AFB) functional block to the **Digital** input network variable on the Exhaust Fan Switch (DO) functional block. Select a different tool on the Visio toolbar



- 8. Configure the temperature sensor (AI) functional block. This functional block translates the raw measured input data representing the resistance of the thermistor to output values representing temperatures.
 - a. Right-click the Temperature Sensor (AI) functional block and then click **Configure** on the shortcut menu. The LonPoint Object Properties dialog opens with the **Analog Input** tab selected.



- b. Under the **Translation** box, select the **Enabled** check box.

- c. In the **Device Offset** box, enter **32** if the temperature is displayed in Fahrenheit (*degrees F*), or enter **0** if the temperature is displayed in Celsius (*degrees C*). The temperature displayed depends on the Regional Settings in Windows.
- d. Click the **Translation** tab. A translation table appears. The translation table maps a set of input values for a thermistor to a set of temperature output values. The temperature values are then sent to the **Analog** output network variable on the Thermostat (AI) functional block. The values that lie between defined input/output pairs are determined by the LonPoint software, which automatically interpolates the values linearly.
- e. Enter the following values into the translation table and then click **OK**. Fahrenheit values are shown first and then the Celsius values.

The screenshot shows the 'Translation' tab of the 'Analog Temperature Sensor' dialog. The 'Output Units' are set to 'degrees F'. The translation table contains the following data:

Measured Value	Output Value	Measured Value	Output Value
0	32	10	86
1	45.5	11	86
2	49.1	12	86
3	72.5	13	86
4	86	14	86
5	86	15	86
6	86	16	86
7	86	17	86
8	86	18	86
9	86	19	86

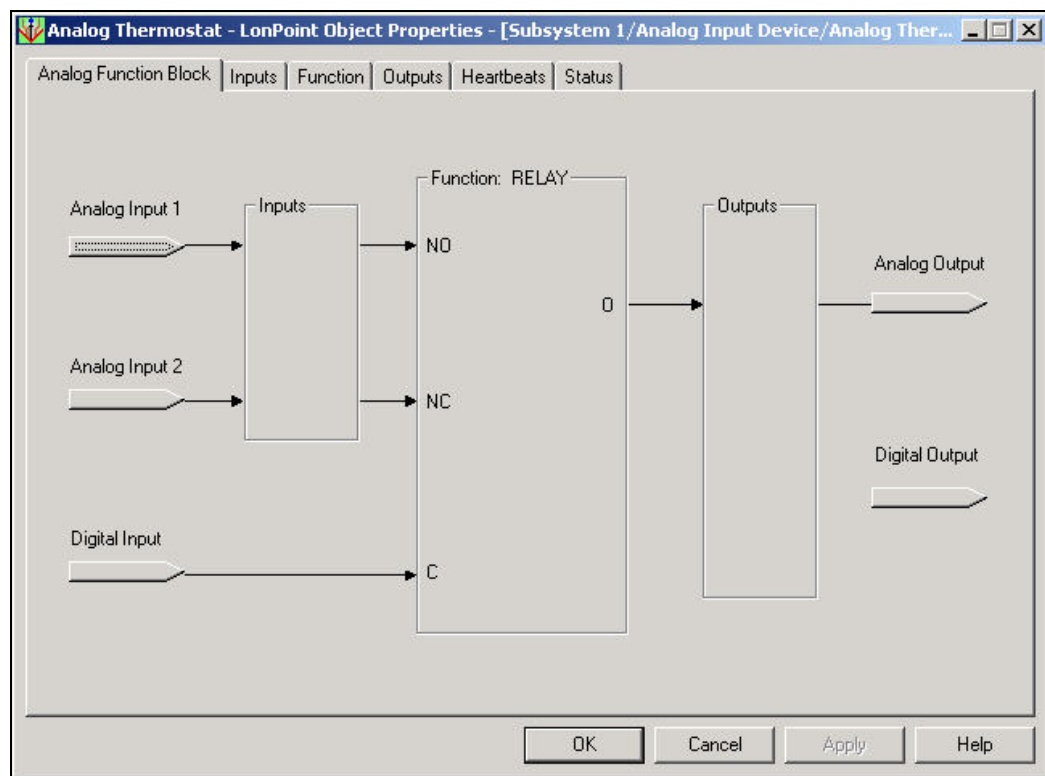
Buttons: Load, Save, OK, Cancel, Apply, Help.

The screenshot shows the 'Translation' tab of the 'Analog Temperature Sensor' dialog. The 'Output Units' are set to 'degrees C'. The translation table contains the following data:

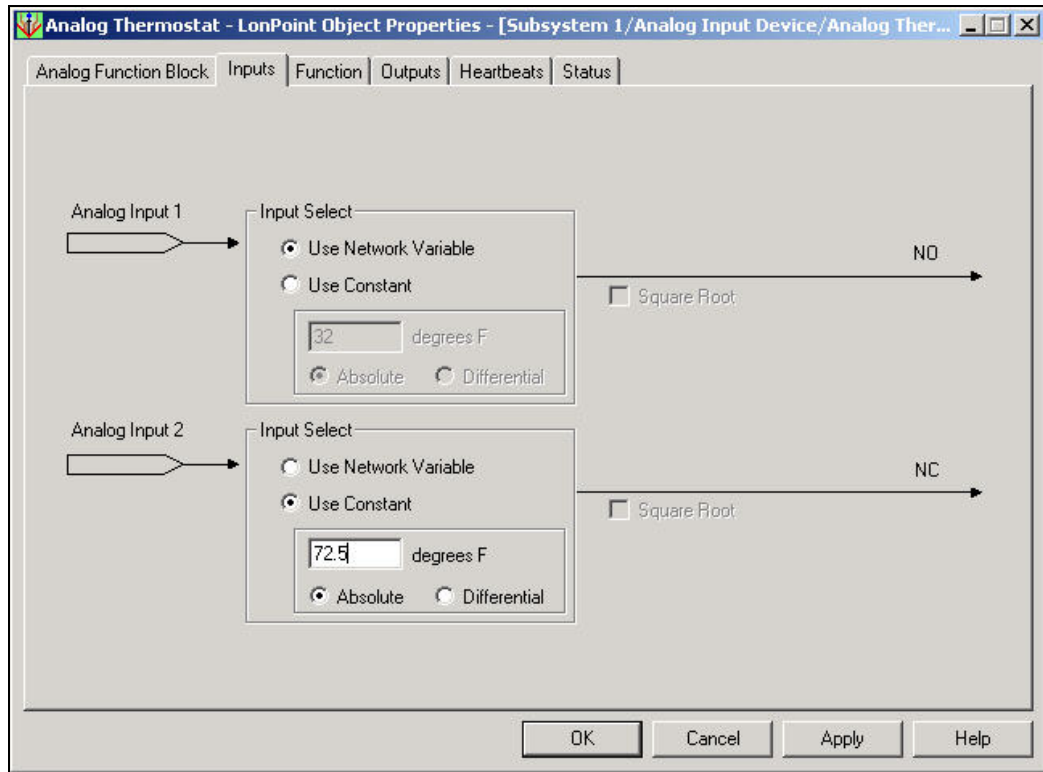
Measured Value	Output Value	Measured Value	Output Value
0	0	10	30
1	7.5	11	30
2	9.5	12	30
3	22.5	13	30
4	30	14	30
5	30	15	30
6	30	16	30
7	30	17	30
8	30	18	30
9	30	19	30

Buttons: Load, Save, OK, Cancel, Apply, Help.

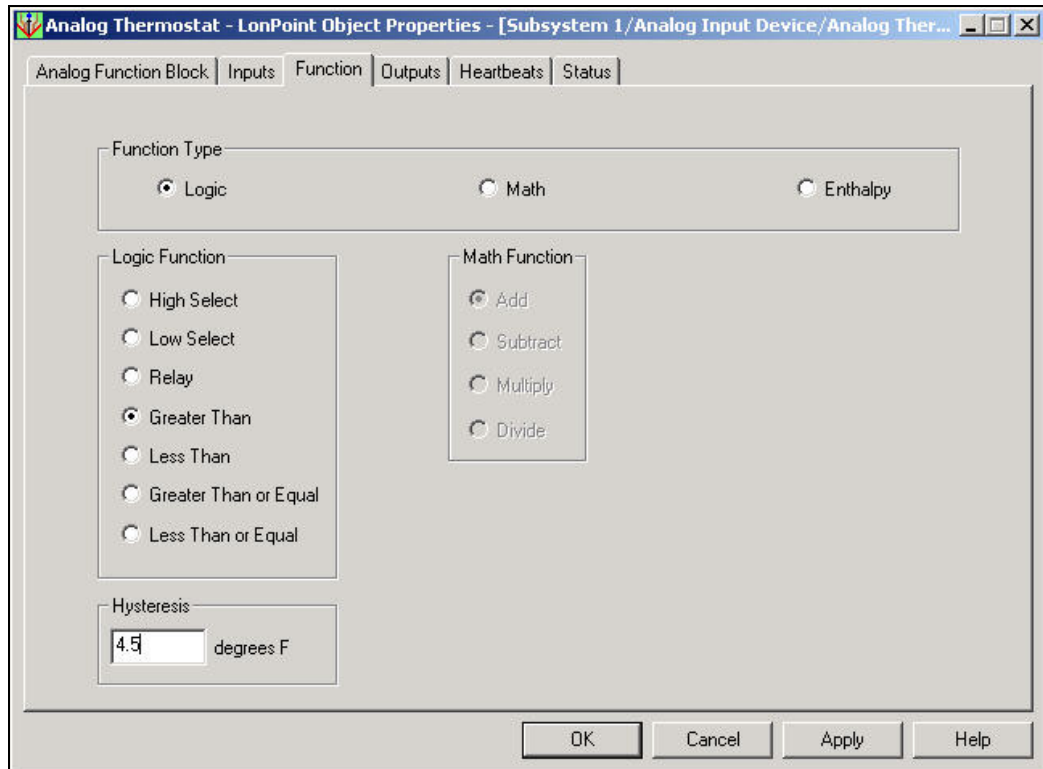
- f. If you do not have a thermistor, you can send a value onto the network by entering an override value and then enabling the override. To enter the override value, click the **Output Parameters** tab, and then in the **Override** box, enter the value that you wish to send onto the network. To enable the override, click the **Status** tab, and then under **Object Status**, click **Override On**.
 - g. Click **OK**.
9. Configure the thermostat (AFB) functional block. This functional block enables the definition of the hysteresis and the setpoint that the temperature must reach before an action is taken. In this quick-start exercise, the action is turning on or shutting off the fan.
- a. Right-click the thermostat (AFB) functional block and then click **Configure** on the shortcut menu. The LonPoint Object Properties dialog opens with the **Analog Function Block** tab selected.



- b. Click the **Inputs** tab. The following dialog appears:



- c. For the **Analog Input 2** network variable, click **Use Constant** and then enter the setpoint, which for this example, is **72.5** for Fahrenheit or **22.5** for Celsius.
- d. Click the **Function** tab. The following dialog appears:



- e. Under **Logic Function**, click **Greater Than**.

Now, if the value from Analog Input 1 (the temperature) is greater than or equal to the value from Analog Input 2 (the setpoint), the **Digital_Out** output network variable on the thermostat (AFB) functional block will transmit a value of On. After the **Digital** input network variable on the fan exhaust switch (DO) functional block receives and processes the On value, the exhaust fan turns on. If the temperature is less than setpoint, the **Digital_Out** network variable on the thermostat (AFB) functional block transmits a value of Off to the **Digital** input network variable on the fan exhaust switch (DO) functional block and the fan shuts off.

- f. In the **Hysteresis** box, enter the hysteresis value, which for this example, is **4.5** for Fahrenheit or **2.5** for Celsius.

The hysteresis value affects the digital output value. The hysteresis value determines how great a difference, as a floating-point number, must exist between the network variables (operands) in the selected function to change the value passed by the digital output network variable. Using the previous example, the temperature now must be more than 4.5° above the setpoint (72.5° F or 22.5° C) for the **Digital_Out** network variable on the thermostat (AFB) functional block to transmit an On value. Conversely, the temperature must drop more than 4.5° below 72.5° F or 22.5° C for the **Digital_Out** network variable to transmits an Off value.

- g. Click **OK**.

10. If you physically have the analog input and digital output LonPoint devices, you can monitor the network variables to verify that the network is functioning properly. You can do this by monitoring the connections, using the LonMaker Browser, or creating a Data Point shape (see Chapter 6, *Monitoring and Controlling Networks*, for how to use each of these network monitoring tools).

Raise or lower the temperature on the analog input device. The network variable values representing the temperature should change accordingly. As the temperature rises, the fan (represented by a LED on the DO-10 device) should illuminate. As the room cools down, the fan (LED) should turn off.

Appendix D - LonMaker Credits Order Form

This appendix provides a printed copy of the order form for LonMaker credits. See Chapter 10, LonMaker Credits for information on using and adding LonMaker credits and instructions for using this order form. The order form in this appendix is only for use when you cannot automatically generate an e-mail or printed form as described in Chapter 10.

LonMaker Credits Order Form

TO ORDER LONMAKER(R) CREDITS, PLEASE FILL IN ALL THE BLANK FIELDS IN THE TOP PART OF THE FOLLOWING FORM, SELECT ONE OF THE BILLING OPTIONS BY FILLING IN A CHECKBOX IN THE BOTTOM PART OF THE FORM, AND FILL IN THE BLANK FIELDS IN THE SELECTED BILLING OPTION. IF YOU ARE ORDERING NO CHARGE CREDITS, YOU MUST FILL IN ONE OF THE CHECKBOXES EXPLAINING THE REASON FOR THE ORDER. IF YOU ARE REQUESTING NO CHARGE REPLACEMENT CREDITS, YOU MUST FILL IN A REASON AT THE BOTTOM OF THIS FORM.

A BLANK FIELD IS A FIELD WITH A COLON (":") AT THE END OF THE LINE. IF ANY OF THIS INFORMATION IS MISSING, YOUR ORDER WILL BE DELAYED. A VALID SERIAL NUMBER AND PC KEY IS REQUIRED.

TO: Echelon License Administrator
E-mail: credits@echelon.com
Fax: +1-408-790-3833 (please use e-mail if available)

FROM: Name:
Company:
Address Line 1:
Address Line 2:
Phone:
Fax:
E-mail:

SUBJECT: Order for LonMaker Credits (Form 3.20)

Please process the following order:

Number of LonMaker credits ordered:
Number of LonMaker credits to be delivered (if less than the quantity ordered):
Product: LonMaker Credits
Model Number: 37100
Price Each:
Total Price:

Following are the list prices. These prices are subject to change. Contact your distributor for current and local pricing. Your distributor may also provide you with an alternate mailing address for this order.

List price: US\$5.00
List price when upgrading a device previously commissioned with an LNS Device Credit: US\$3.50
Price for authorized free uses: No charge (see agreement below)

The following serial number and PC key values are filled in automatically by the LonMaker tool when you generate a LonMaker credit order as described in Chapter 6 of the LonMaker User's Guide. You should always use the order form generated by the software, include the entire form, and send the form by e-mail

(or fax if e-mail is not available) to ensure that there are no errors in transcribing the serial number and key values.

LonMaker Serial Number:

PC Key:

Select one of the following payment methods and fill in the information for the requested method:

- Credit Card (minimum order of 20 credits; only required if you are ordering LonMaker credits without a purchase order)

Type of Credit Card:

American Express

MasterCard

Visa

Name on Credit Card:

Credit Card Number:

CSC or CVC Number:

Expiration Date:

Credit Card Billing Address (if different than above):

Name:

Address Line 1:

Address Line 2:

City:

State/Province/Region:

ZIP/Postal Code:

Country:

- Purchase Order (minimum order of 20 credits; only required if you are ordering LonMaker credits without a credit card)

Purchase Order Number:

Authorized By:

Company Billing Address (if different than above):

Name:

Address Line 1:

Address Line 2:

City:

State/Province/Region:

ZIP/Postal Code:

Country:

- No charge evaluation, development, test, support, production, training, or replacement credits (check all that apply). By submitting an order for free credits, you agree that you will use these free credits only for the authorized purposes that you have selected below, and you agree that you will provide Echelon with information as reasonably requested by Echelon to verify that the use of these LonMaker Credits is limited to the authorized uses. There is no minimum order size; maximum order size is indicated below.

- [] Evaluation use. LonMaker Credits used for evaluating the LonMaker Integration Tool. Limited to 500 free credits per company per year.
- [] Internal development and test use. LonMaker Credits used for the development and testing of devices that will solely will be used for development, or that will be shipped in the unconfigured state. Limited to 500 free credits per device type per year.
- [] Support use. LonMaker Credits used by a support engineer to provide support to a customer using the LonMaker tool. The customer must have paid for the LonMaker Credits used for the customer's devices. Limited to 500 free credits per support engineer per year.
- [] Production use. LonMaker Credits used for manufacturing test. Devices must be shipped in the unconfigured state. Limited to 1 free credit per manufactured device shipped in the unconfigured state.
- [] Training use. LonMaker Credits used solely for training. Any devices installed during training must not be used in a production or operational system. Limited to 500 free credits per class.
- [] Replacement use. LonMaker Credits used to replace LonMaker Credits that were lost due to a PC hardware or software failure. Limited to the number of credits that were lost as a result of the failure. PLEASE ENTER A DESCRIPTION OF HOW THE CREDITS WERE LOST (THIS INFORMATION IS REQUIRED TO GET A NO CHARGE REPLACEMENT KEY):

Your LonMaker credits will be sent to you as an application key that will be sent to you by e-mail or fax.

Appendix E - LonMaker Software License Agreement

This appendix provides a printed copy of the LonMaker Turbo Integration Tool Software License Agreement.

LonMaker Software License Agreement

LonMaker® Integration Tool

NOTICE

This is a legal agreement between you and Echelon Corporation (“Echelon”). YOU MUST READ AND AGREE TO THE TERMS OF THIS SOFTWARE LICENSE AGREEMENT BEFORE ANY LICENSED SOFTWARE CAN BE DOWNLOADED OR INSTALLED OR USED. BY CLICKING ON THE “I AGREE” OR “ACCEPT” BUTTON OF THIS SOFTWARE LICENSE AGREEMENT, OR DOWNLOADING LICENSED SOFTWARE, OR INSTALLING LICENSED SOFTWARE, OR USING LICENSED SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS AND CONDITIONS OF THIS SOFTWARE LICENSE AGREEMENT. IF YOU DO NOT AGREE WITH THE TERMS AND CONDITIONS OF THIS SOFTWARE LICENSE AGREEMENT, THEN YOU SHOULD EXIT THIS PAGE AND NOT DOWNLOAD OR INSTALL OR USE ANY LICENSED SOFTWARE. BY DOING SO YOU FOREGO ANY IMPLIED OR STATED RIGHTS TO DOWNLOAD OR INSTALL OR USE LICENSED SOFTWARE.

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In consideration of Your agreement to the terms of this Agreement, Echelon grants You a limited non-exclusive, non-transferable license to use up to two (2) copies of the Licensed Software and accompanying documentation and any updates or upgrades thereto provided by Echelon according to the terms set forth below. If the “Trial Edition” of the Licensed Software is being provided to You, then Your use of the Licensed Software is limited to thirty (30) days from the time the Licensed Software is installed on a computer. If the Licensed Software is being provided to You as an update or upgrade to software which You have previously licensed, then You agree to destroy all copies of the prior release of this software within thirty (30) days after installing the Licensed Software; provided, however, that You may retain one (1) copy of the prior release for backup, archival and support purposes.

DEFINITIONS

For purposes of this Agreement, the following terms shall have the following meanings:

- “Commission” means to assign and write any part of the LONWORKS® Network Configuration for a LONWORKS Device.
- “Commissioned Device” means a LONWORKS Device that (i) has a valid LONWORKS Network Configuration and (ii) has an entry in an LNS Server’s database.
- “Documentation” means the documentation included with the Licensed Software.
- “Licensed Software” means all computer software and associated media, printed materials, and online or electronic documentation that accompany the LonMaker Integration Tool product; including, without limitation, any and all executable files, add-ons, stencils, templates, SmartShapes® symbols, filters, tutorials, help files and other files, that accompany such software or the Documentation.
- “LonMaker Credits” means credits that are purchased from Echelon or an Echelon-approved LonMaker Credit reseller for the purpose of Commissioning or Recovering more than sixty four (64) (for the “Professional Edition”) or more than five (5) (for the “Standard Edition”) LONWORKS Devices with the Licensed Software.
- “LONWORKS Network Configuration” means a valid ANSI/CEA-709.1 Domain, Subnet, and Node address, as well as valid Group, Network Variable Selector, and Message Tag values, as defined by the ANSI/CEA-709.1 Protocol.
- “LONWORKS Device” means a product designed for use in a network based upon Echelon’s LONWORKS platform, including without limitation LONWORKS Application(s) as set forth in the LONWORKS OEM License Agreement between You and Echelon.

- “Multi-Port Router” means any of Echelon’s family of products that contain multiple Routers, including but not limited to the MPR-50 Multi-Port Router.
- “Network Service Device” means a LONWORKS Device that is executing the Echelon LNS software as described in the Echelon LNS documentation.
- “Recover” means to read the LONWORKS Network Configuration from a LONWORKS Device and to use such information to create an entry or entries in an LNS Server’s database.
- “Remove” means to remove a Commissioned Device from an LNS Server’s database, such that no further use by the LONWORKS Device of any part of the LONWORKS Network Configuration that was assigned to the Commissioned Device by the LNS Server is possible.
- “Replace” means to Commission a LONWORKS Device using the LONWORKS Network Configuration from a second LONWORKS Device (the “Replaced Device”), with no further use by the first LONWORKS Device of any part of the LONWORKS Network Configuration in the Replaced Device.
- “Router” means a device that forwards ANSI/CEA-709.1 messages between two ANSI/CEA-709.1 channels-or an ANSI/CEA-709.1 and an ANSI/CEA-852 channel-and does not implement layer 7 of the ANSI/CEA-709.1 Protocol or execute an application other than the routing firmware.
- “You(r)” means Licensee, i.e. the company, entity or individual who has rightfully acquired the Licensed Software.

LICENSE

You may:

- install and use the Licensed Software on one (1) primary computer (the “Primary Computer”);
- use the Licensed Software on the Primary Computer to Commission or Recover up to sixty four (64) (for the “Professional Edition”) or up to five (5) (for the “Standard Edition”) LONWORKS Devices and to Commission or Recover additional LONWORKS Devices up to the number of LonMaker Credits that You purchase from Echelon or an Echelon-approved LonMaker Credit reseller;
- install and use a second copy of the Licensed Software for design purposes only on one (1) additional computer (the “Additional Computer”) for the exclusive use of the individual who is the primary user of the copy of the Licensed Software installed on the Primary Computer, provided that (i) the Licensed Software may only be used on one (1) computer at a time; (ii) the Additional Computer is not used to Commission or Recover LONWORKS Devices and (iii) such installation and use otherwise comply with all the terms and conditions of the Agreement;
- make one (1) copy of the Licensed Software in machine readable form solely for backup purposes, provided that You reproduce, unaltered, all proprietary notices on or in the copy;
- physically transfer any authorized copy of the Licensed Software from one (1) computer to another, provided that such copy is removed from the computer on which it was previously installed, the Licensed Software is used on only one (1) computer at a time, all unused LonMaker Credits associated with the Licensed Software are transferred at the same time, and all unused LonMaker Credits associated with the Licensed Software are removed from the computer on which they were previously installed;
- notwithstanding (b) above, use the Licensed Software on the Primary Computer, without additional charge, to Commission or Recover additional LONWORKS Devices up to the number of LonMaker Credits automatically issued by the Licensed Software upon Removing or Replacing LONWORKS Devices that were previously Commissioned or Recovered with a licensed copy of the Licensed Software;
- notwithstanding (b) above, use the Licensed Software on the Primary Computer, without additional charge, to Recover any number of LONWORKS Devices that were previously Commissioned or Recovered with a licensed copy of the Licensed Software or other Echelon LNS application;
- notwithstanding (b) above, use the Licensed Software on the Primary Computer, without additional charge, to Commission or Recover any number of Network Service Devices, Routers, and Multi-Port

Routers; and

- (i) transfer Your rights under this Agreement (including all unused LonMaker Credits) to an end user of the Licensed Software; provided that (i) You require the transferee to execute both copies of the Software License Transfer Agreement included with the Licensed Software and (ii) You retain one (1) signed original thereof and furnish Echelon with a copy of same upon request. This right of transfer is exercisable on a one-time-only basis, and Your transferee shall have no right whatsoever to further transfer any rights to the Licensed Software.

You may not, and shall not permit others to:

- (a) install the Licensed Software on more than one (1) Primary Computer and one (1) Additional Computer, use the Licensed Software on more than one (1) computer at a time, allow any individual other than the primary user to use the Licensed Software on the Additional Computer, or use the Licensed Software on the Additional Computer to Commission or Recover LONWORKS Devices;
- (b) copy the Licensed Software or Documentation (except as expressly permitted above);
- (c) except for the limited rights granted above, use the Licensed Software to perform any part of the process required to Commission or Recover more than sixty four (64) (for the “Professional Edition”) or more than five (5) (for the “Standard Edition”) LONWORKS Devices unless LonMaker Credits are purchased from Echelon or an Echelon-approved LonMaker Credit reseller within fourteen (14) days of such commissioning or recovery;
- (d) modify, translate, reverse engineer, de-compile, disassemble or otherwise attempt (i) to defeat, avoid, bypass, remove, deactivate, or otherwise circumvent any software protection mechanisms in the Licensed Software, including without limitation any such mechanism used to restrict or control the functionality of the Licensed Software, or (ii) to derive the source code or the underlying ideas, algorithms, structure or organization from the software from the Licensed Software (except to the extent that such activities may not be prohibited under applicable law), or
- (e) except for the limited rights granted above, distribute, rent, loan, lease, transfer or grant any rights in the Licensed Software or modifications thereof or accompanying documentation in any form to any person without the prior written consent of Echelon.

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Title: _____	Title: _____
Address: _____	Address: _____
City, State/Province, Country, Postal Code	City, State/Province,
Country, Postal Code	
Telephone: _____	Telephone: _____
(Fax or email address)	(Fax or email address)
Date: _____	Date: _____

For a copy of the appropriate Software License Agreement, call Echelon Corporation at +1-408-938-5200.

Appendix G - Glossary

This appendix provides definitions for many terms commonly used with the LonMaker tool.

Glossary

Acknowledged Service

A service of the LonTalk protocol that ensures a message was received by the addressee(s). After a configurable number of retries, failures are logged in a status register in the device, which can be accessed by network management tools.

Actuator

Any component that affects a physical variable of the system under control or indicates the values of system variables for human operators. Some examples are pumps, fans, heaters, alarm annunciators, and operator displays. This term may apply only to the component that converts electrical or pneumatic control signals into a physical force that causes a mechanical component such as a damper or valve to move, or it may apply to both components as a unit.

Ad-Hoc System Scenario

An installation scenario in which physical devices are configured and commissioned on-line as network data is entered. The network database is built simultaneously.

Alias Network Variable

An alias network variable behaves like a shadow copy of a network variable. An alias shares the value of the original network variable, but it maintains its own NV selector. In addition, an alias maintains its own address table index if it is an alias for an output network variable or polling input network variable. Alias network variables are used to overcome connection limitations of non-alias network variables.

Application Configuration

A process by which the application program in each physical device is tailored to the desired functionality by selecting the appropriate configuration properties. LONWORKS Network Services (LNS) provides a platform for manufacturers to create easy-to-use graphical configuration interfaces, called plug-ins, that are compatible with any other LNS-based network tool.

Application Device

A LonWorks device that runs a LonTalk Application (OSI Layer 7). The application may run on a Neuron Chip, in which case the device is called a “Neuron Chip-Hosted” device.

Application Image

Device firmware that consists of the object code generated by the Neuron C compiler from the user’s application program and other application-specific parameters, including the following:

- Network variable fixed and self-identification data
- Network variable external interface data (XIF file)
- Program ID string
- Optional self-identification and self-documentation data
- Number of address table entries
- Number of domain table entries
- Number and size of network buffers
- Number and size of application buffers
- Number of receive transaction records
- Input clock speed of target Neuron Chip
- Transceiver type and bit rate

Application Program

The software code in a LONWORKS device that defines how it functions. The application program, also referred to as the application or the application layer, may be in the device when you purchase it,

or you may load it into the device from application files (.nld, .apb, and .nxe extensions) using the LonMaker tool. The application program interfaces with the LonTalk firmware to communicate over the network. It may reside completely in the Neuron Chip, or it may reside on an attached host processor (in a host-based device).

Applicationless

A state a device enters when it has determined that it does not have a valid application image. Program or hardware failure may cause a device to become applicationless. To restore an applicationless device, you must reload the application image into the device.

Attached

The state of the LonMaker tool when it is connected to a LONWORKS network.

Authentication

A messaging service that ensures that a received message was sent by an authorized source. Authentication is implemented by distributing 48-bit keys to the participating devices when they are installed. For an authenticated message to be accepted by the receiving device, both the sending and receiving device must possess the same key.

Backbone Network

A high-speed network channel connecting several lower speed channels. An example of a backbone network is shown below. Common backbone channels include IP-852 and TP/XF-1250 channels.

Backup

A .zip file containing a saved version of a LonMaker drawing and/or LNS network database. Backup files are used to protect against accidental file corruption or hardware failure, or to copy a LonMaker network design from one computer to another.

Binding

Process of connecting network variables and message tags. Binding creates logical connections (virtual wires) between LONWORKS devices. Connections define the data that devices share with one another. Tables containing binding information are stored in the Neuron Chip's EEPROM, and may be updated by the LonMaker tool.

Bit Rate

The rate in bits at which the packet frame is transferred across the communication medium.

Bound Update

A connection between a monitored network variable and the LonMaker Browser or a LonMaker host. Bound updates are ideal for monitoring slowly changing network variables.

Changeable Type Network Variable

A network variable for which there is no SNVT type or length information available. Changeable type network variables can be bound to any other network variable type.

Channel

The physical media between devices upon which the devices communicate. The LonTalk protocol is media independent; therefore, numerous types of media can be used for channels: twisted pair, power line, fiber optics, IP, and RF, and other types.

Channel Segment

A portion of a channel. A single segment can be comprised of multiple sections connected by physical layer repeaters.

Channel Type

Channels are categorized into channel types, which are characterized by the device transceiver. Common channel types include the following: TP/FT-10 (ANSI/CEA-709.3 twisted pair free topology channel), TP/XF-1250 (high-speed twisted pair channel), PL-20 (ANSI/CEA-709.2 power line channel), FO-20 (ANSI/CEA-709.4 fiber optics channel), and IP-852 (ANSI/CEA-852 IP channel).

Client/Server Architecture

In a LONWORKS network, LNS (the server) provides a set of directory, installation, management, monitoring, and control services for computers running the LonMaker tool (clients). The client/server architecture of LNS allows multiple users running the LonMaker tool on separate computers to access the LNS server simultaneously. This means that managers, system integrators, installers, and maintenance personnel can all work on the same LONWORKS network at the same time.

Commissioning

The process in which the LonMaker tool downloads network and application configuration data into a physical device. For devices whose application programs are not contained in ROM, the LonMaker tool also downloads the application program into non-volatile RAM in the device. Devices are usually either commissioned and tested one at a time, or commissioned and then brought online and tested incrementally.

Configuration Properties (CPs)

Configuration properties define the behavior of an application device by determining the manner in which data is manipulated and when data it is transmitted. Configuration properties can be applied at the device, functional block, or network variable level. Configuration properties determine the functions to be performed on the values stored in network variables. For example, a configuration property may specify a minimum change that must occur on a physical input to a device before the corresponding output network variable is updated.

Configured

A device state where the device has both an application image and a network image. This indicates that the device is ready for network operation.

Connection

The implicit addressing established during binding. A connection links one or more logical outputs (network variables or message tags) to one or more logical inputs. A connection may be represented with a connector shape or a reference connection.

Connection Description

A set of properties, namely the message service type and addressing mode, that apply to a network variable connection.

Connector Shape

A single connector used to connect a pair of network variables (or message tags) within the same subsystem.

Controller

A high-level component that takes a sensor value and selects an appropriate setting on an actuator to achieve a desired function.

Custom Master Shape

A configured LonMaker shape or group of LonMaker shapes saved to a stencil. Custom master shapes enable common devices and functions to be re-used easily. Custom master shapes are used to speed up network design, as they already contain configuration data when they are added to a LonMaker drawing. A custom device master shape, for example, may contain the device template name and configuration property settings.

Data Point

A network variable, configuration property, or functional block state (enabled or in override) that the LonMaker tool can monitor and/or control.

Decommissioning

Process in which devices are temporarily uninstalled. Decommissioning devices is useful when optimizing, troubleshooting, or repairing a network. All the configuration data of a decommissioned device, including configuration properties and connections, are preserved in the LNS network database. The LonMaker tool can also preserve the Neuron ID of a decommissioned device to speed up the recommissioning process.

Deficit Credit

A LonMaker credit used to commission a device when a LonMaker license has no credits.

Destination Address

The logical address contained in every LonTalk packet of the device or group of devices designated to receive the packet. The destination address can be the unique Neuron ID, the logical device address, a group address, or a broadcast address.

Device

A device that communicates on a LONWORKS network. A device may be an application device, network service device, or a router. Devices are sometimes referred to as nodes in LONWORKS documentation.

Device Interface

The logical interface to a device. A device's external interface specifies the number and types of functional blocks; number, types, directions, and connection attributes of network variables; and the number of message tags. The program ID field is used as the key to identify each external interface. Each program ID uniquely defines the static portion of the interface. However, two devices with identical static portions may differ if dynamic network variables are added or removed, or if the types of changeable network variables are changed. Thus it is possible to have devices with the same program ID but different external interfaces.

Device Interface File (XIF)

A file that documents a device's interface with a network. The file can be a text file (.XIF extension), or it can be a binary file (.XFB extension).

Device Discovery

Commissioning process in which the LonMaker tool searches the network for unconfigured devices and matches them to device shapes defined in the LonMaker drawing.

Device-Specific Configuration Property

A configuration property that has values that can be modified independent of the network database. Changes made to a device-specific configuration property are not updated in the network database.

Device Template

A device template contains all the attributes of a given device type, such as its functional blocks, network variables, and configuration properties. You can create a device template by importing a device interface (XIF) file supplied by the device manufacturer, or by uploading the device interface definition from the physical device. A device template is identified by its name and its program ID. Both must be unique within a network—you cannot have two device templates with the same name or the same program ID in a single network.

Device Upgrade

The process in which a new application (.nxe or .apb extensions) is loaded into a device.

Disable

For a device, disabled is a device state in which the device application does not run even if the device is reset. For a functional block, disable is a management command that causes output network variables to send their configured default values.

Domain

A logical collection of devices on one or more channels. Communications can only take place among devices configured in the same domain.

Domain ID

The top level of the LonTalk addressing hierarchy of domain/subnet/node. The domain ID can be 0, 1, 3, or 6 bytes long. The zero-length domain is reserved for the use of the LNS architecture and cannot be used as the system's domain.

Download

An installation process in which data, such as the application program, network configuration, and/or application configuration, is transferred over the network from the LNS network database into a device.

Dynamic Data Exchange (DDE)

A standard protocol built into the Macintosh, Windows, and OS/2 operating systems. DDE enables two running applications to share the same data. For example, DDE makes it possible to insert a spreadsheet chart into a document created with a word processor. Whenever the spreadsheet data changes, the chart in the document changes accordingly. When applications share information with each other using DDE, they are said to be holding a DDE conversation. Each conversation has a well-defined beginning, middle, and end. To begin a conversation, one application, known as the client or destination application asks another application, known as the server or source application to open a communications channel. Once a conversation is established, the client can send and receive data from the server on the DDE channel. For example, an Excel spreadsheet (the client or destination) may ask the LonManager DDE Server (the server or source) for the current fuel consumption from a flow sensor for use in an automated billing system. Alternately, an InTouch operator interface (the client or destination) may tell the LonManager DDE Server (the server, or source) to change the state of a valve in a LONWORKS network in response to a request issued by the user interface.

Dynamic Functional Block

A functional block that is not pre-loaded on a device. Dynamic functional blocks are typically used by controllers that do not have a static interface. These controllers typically require the integrator to run a plug-in or other configuration software that defines the control algorithm and configures the controller. The controller manufacturer can use dynamic functional blocks to enable a LonMaker user to add functional blocks to the controller using the LonMaker tool.

Dynamic Network Variable

A network variable that is added to a functional block after the device has been commissioned. Devices that support dynamic network variables include controllers and gateways with dynamic interfaces.

Engineered System Scenario

An installation scenario in which configuration data is collected into the network database when the system is being designed with the LonMaker tool and downloaded into the physical devices when the network is installed.

Enumerated Object

A network variable, configuration property, or functional block state that has enumerated types. Examples of enumerated objects include `SNVT_hvac_mode`, `SCPT_hvac_type`, and functional block states enable and override.

Fan-in Connection

A multicast connection in which multiple output network variables (or message tags) are connected to a single input network variable (or message tag).

Fan-Out Connection

A multicast connection in which multiple input network variables (or message tags) are connected to a single output network variable (or message tag).

Firmware

Firmware required to implement the LonTalk protocol. This firmware is contained in the VERxxx subdirectories of the LONWORKS images folder (c:\lonworks\images) in files with the name S*.NX*. Other custom firmware images are available for special purposes. Use of the Neuron Chip firmware is subject to terms and conditions defined in the NodeBuilder software license agreement and the LONWORKS OEM license agreement.

Free Topology

A connection scheme for the communication bus that removes traditional transmission line restrictions of trunks and drops of specified lengths and at specified distances, and terminations at both ends. Free topology allows wire to be strung from any point to any other, in bus, daisy chained, star, ring, or loop topologies, or combinations thereof. It only requires one termination anywhere in the network. This can reduce the cost of wiring by a factor of two or more.

Functional Block (FB)

A collection of network variables, configuration properties, and associated behavior that defines a desired system functionality. Functional blocks define standard formats and semantics for how information is exchanged between devices on a network.

Functional Block State

An indication whether a functional block is enabled or disabled, or whether it is in override mode.

Functional Profile

A LONMARK specification that enables equipment specifiers to select the functionality they need for a system. A functional profile is a template for a type of functional block that defines mandatory and optional network variable and configuration property members along with their intended usage. A small number of functional profiles are available for generic devices such as simple sensor and actuators. Many industry-specific functional profiles are available for industry-specific applications. Industry-specific profiles are developed through a review and approval process, including a cross-functional review to ensure the profile will interoperate within an individual subsystem and also provide interoperability with other subsystems in the network.

Group

A logical collection of devices within a domain. Unlike a subnet, devices are grouped together without regard for their physical location in the domain. The number of groups to which a device may belong is determined by the number of available address table entries. This number is set by the Neuron application, but may not exceed 15. Groups and group membership are defined by the NSS during binding.

Group Addressing

A logical addressing mode in the LonTalk protocol that allows a message to be sent simultaneously to a pre-configured group of devices. Each group has an 8-bit group ID. Each domain can have up to 256 groups defined.

Host

A device implementing layer 7 of the LonTalk protocol. A host may be based on the Neuron Chip, in which case it is called a Neuron Chip Hosted Device. A host may be based on another processor, in

which case it is called a host-based device. A host-based device uses the Neuron Chip as a network interface to talk to the LONWORKS network.

Host Processor

The application processor for a host-based device. The host processor is typically a micro-controller, microprocessor, or computer.

Host-Based Device

A device in which the device application program runs on a processor other than the Neuron Chip.

Hot Backup

A shadow copy of the LNS network database made while one or more LNS applications are accessing it.

Hub

The center of a connection, which is specified by the device handle and network variable index (or message tag index). Each connection is defined in terms of a hub and a set of targets. The hub must be either the only input or the only output network variable (or message tag) in the connection. For example, if the hub is an output network variable, all the other members in the connection must be input network variables.

Human-Machine Interface (HMI)

A network management tool that provides services for human monitoring and supervisory control of systems. The HMI usually runs on a workstation or desktop/portable computer.

***i*.LON IP-852 Router**

An *i*.LON IP-852 router forwards ANSI/CEA-709.1 (EN14908) packets enveloped in ANSI/CEA-852 packets over an IP-852 channel. *i*.LON IP-852 routers include the *i*.LON 10 Ethernet Adapter, *i*.LONe3 100 Internet Server with IP-852 routing, *i*.LON 600 LONWORKS/IP Server, and the *i*.LON 1000 Internet Server.

IP

Acronym for Internet protocol, the basic programming foundation that carries computer messages around the globe on the Internet. Sometimes called TCP/IP (Transmission Control Protocol/Internet Protocol), even though ECP is a protocol that runs on top of IP, and IP supports other protocols besides TCP.

IP-852 Channel

Also known as an ANSI/CEA-852 LONWORKS/IP channel, an IP-852 channel carries ANSI/CEA-709.1 (EN14908) packets enveloped in ANSI/CEA-852 packets. An IP-852 channel is a LONWORKS channel that uses a shared IP network to connect IP-852 devices and is defined by a group of IP addresses. These IP addresses form virtual wires that connect IP-852 devices so they can communicate with each other. IP-852 devices include the LNS Server computers, LonMaker computers, and *i*.LON IP-852 routers. An IP-852 channel enables a remote full client to connect directly to a LONWORKS network and perform monitoring and control tasks.

IP-852 Network Interface

Formally called VNI, an IP-852 network interface enables IP-852 devices such as LNS Server computers, LonMaker computers, and *i*.LON IP-852 routers to be attached to IP-852 channels. An IP-852 network interface requires that the LonWorks-IP Configuration Server be configured before trying to communicate with remote devices or remote computers.

LAN

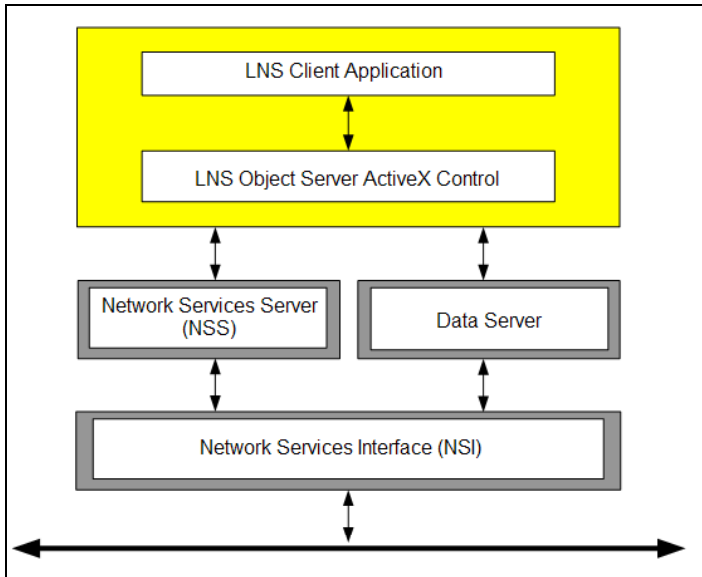
Local area network. A LAN is a communications network that links a number of different workstations in the same area. The local Area may be defined as the same building or campus of buildings. Using

the LAN, individual workstations or computers can send messages and files to each other and to shared devices, such as printers, disk storage, and other computer systems. LAN performance is measured in the amount of data that can be transmitted and received, usually expressed as megabits transmitted per second, so its critical factor is speed.

LNS

A network operating system that provides services for interoperable LONWORKS installation, maintenance, monitoring, and control tools such as the LonMaker tool. Using the services provided by the LNS client/server architecture, tools from multiple vendors can work together to install, maintain, monitor, and control LONWORKS networks. The LNS architecture consists of the following elements:

1. The LNS Client application program, which can be used to develop, monitor and control LonWorks networks.
2. The LNS Object Server ActiveX Control, which is a language-independent programming interface to access the LonWorks network.
3. The Network Services Server (NSS), which maintains an image of the network.
4. The Data Server, which provides services for monitoring and control.
5. The Network Services Interface (NSI), which is the physical interface to the network.



LNS Event

An action handled by LNS that updates a LonMaker drawing. LNS events are used to track changes made by an LNS application other than the LonMaker tool or a change in the status of device reported by the LNS server. The LonMaker tool uses LNS events to keep it synchronized with other LNS applications or plug-ins that are making changes to the network database.

LNS Network Database

Each LONWORKS network has its own LNS network database (also referred to as the network database), which includes the network and device configuration data for that network. The network database also contains extension records, which are user-defined records for storing application data.

LNS Server

The computer containing the LNS global database acts as the LNS Server. The LNS global database contains the group of LONWORKS networks being managed with the LNS Server.

Local Client

A LonMaker computer that is also running the LNS Server.

LonMaker Browser

An LNS plug-in that provides a table view of the network variables and configuration properties of selected devices and/or functional blocks. The LonMaker Browser can be used to monitor and control the network variables and configuration properties in a network.

LonMaker Credit

A pre-paid fee for commissioning an application device.

LonMaker Device Manager

A modeless dialog that lets you test, wink, disable, change the application state, and override application devices, functional blocks, and routers. When one of the aforementioned management commands is selected, the LonMaker Device Manager generates a report listing the status of the object and describing any errors.

LonMaker Drawing

A LonMaker drawing contains the graphical representation of a LONWORKS network.

LonMaker Event Log

A shared log in which the LonMaker tool stores every change made to a LonMaker drawing by every user. All LonMaker tools check the log when they open a LonMaker drawing and periodically thereafter, and update their copies of a LonMaker drawing based on the log entries. The LonMaker Event Log enables multiple LonMaker tools to stay synchronized with the LNS database and with each other, and it reduces instances in which a LonMaker drawing needs to be manually resynchronized.

LonMaker Integration Tool

An LNS network tool that uses Visio as its graphical user interface. The LonMaker tool is used to design, commission, maintain, and document distributed control networks comprised of both LONMARK and other LONWORKS devices.

LonMaker Layers

Separate views for the physical, logical, and data components in a LonMaker network that can be used to hide and show parts of a LonMaker drawing. The physical layer includes devices, routers, channels; the logical layer contains the functional blocks, network variables, and unmonitored connections; and the data layer consists of monitored connections. Subsystems and supernodes belong to both the physical and logical layers.

LonMaker Network Design

A LonMaker network design consists of an LNS network database and a LonMaker drawing.

LonMaker Shape

A reusable drawing object related specifically to a LONWORKS device.

LonMaker Style

A defined shape style indicating the state of a device, functional block, connection, or network variable/message tag.

LonManager Protocol Analyzer

A protocol analyzer for field use that provides LONWORKS manufacturers, system integrators, and end-users with a rich set of Windows-based tools and a high performance PC interface card to allow users to observe, analyze, and diagnose the behavior of installed LONWORKS networks. This card accepts any two SMX compatible transceivers, so that you may diagnose protocol-related problems on any

type of medium. The LonManager Protocol Analyzer includes three tools for network analysis and monitoring:

- Packet monitor tool
- Network traffic statistics tool
- Network diagnostics tool

LonMark

A distinctive logo applied to LONWORKS devices that have been certified to the interoperability standards of the LONMARK Interoperability Association.

LonTalk File Transfer Protocol

An interoperable way for devices to share data files. The file types— 0, 1, and 2—are defined by the LonMark program for specifying configuration parameters.

LonTalk Protocol

Echelon's implementation of the ANSI/CEA-709.1 (EN14908) standard. The LonTalk protocol provides a standard method for devices on a LonWorks network to exchange data. The protocol defines the format of the messages being transmitted between devices, and it defines the actions expected when one device sends a message to another. The protocol normally takes the form of embedded software or firmware code in each device on the network.

LonWorks-IP Configuration Server (Config Server)

The LonWorks-IP Configuration Server maintains an IP routing table database required for IP-852 channels. It is used for networks using an IP-852 channel. Only one Config Server is required or allowed per LNS server or IP network.

LONWORKS Technology

The technology that allows for the creation of open, interoperable control networks that communicate with the LonTalk protocol. LONWORKS technology consists of the tools and components required to build intelligent device and to install them in control networks.

Message Tag

Logical input and output ports that devices use to send and receive explicit messages. Message tags are used for standard data transfer mechanisms such as the LONWORKS file transfer protocol and the LONWORKS data log transfer protocol. In addition, they are used as a proprietary interface to devices such as factory calibration interfaces. Message tags can only be added to the virtual functional block of a device that supports message tags. A device always contains a **msg_in** tag and may contain declared message tags as well. Declared message tags are bi-directional (the device can both send and receive messages with them). The **msg_in** tag can only be used to receive messages. Generally, devices use network variables to communicate with one another since they are interoperable and produce more efficient code. Message tags are similar to network variables except that they do not have pre-defined types.

Monitor Set

A group of data points that the LonMaker tool uses to monitor and control network variables.

Monitored Connection

A connector shape or reference connection on which network variable values are displayed and updated.

Network Configuration

The process of converting a network design into the data elements required by the LonTalk protocol in each device of the network. This includes:

- Assigning domain ID and logical addresses to all devices and groups of devices.

- Binding network variables to create logical connections between devices.
- Configuring the various LonTalk protocol parameters in each device for the desired features and performance, including channel bit rate, acknowledgement, authentication, priority service, etc.

Network Image

A device's network address and connection information. For Neuron Chip hosted devices, the device's network image is stored in EEPROM on the Neuron Chip. For host-based devices, the entire network image except the network variable configuration table is stored in EEPROM on the Neuron Chip.

Network Interface

A LONWORKS device that provides a layer 6 LonTalk interface to an external host computer such as a computer or a handheld maintenance tool. Network interfaces include IP-852 interfaces (the *i.LON 10* Ethernet Adapter, *i.LONe3 100* Internet Server with IP-852 routing, *i.LON 600* LONWORKS/IP Server, and the *i.LON 1000* Internet Server); U10/U20 USB network interfaces; and PCC-10 and PCLTA-10, 20, and 21 PCI network interfaces

Network Service Device (NSD)

A local or remote client capable of monitoring and controlling the network.

Network Services Interface (NSI)

The component in the LNS architecture that provides the physical connection to the LONWORKS network, manages transactions with the NSS, and provides transparent remote access to the NSS.

Network Services Server (NSS)

The component in the LNS architecture that processes network services, maintains the network database, and enables and coordinates multiple points of access.

Network Variable (NV)

Network variables allow a device to send and receive data over the network to and from other devices. Network variables are data items (such as temperature, the state of a switch, or actuator position setting) that a particular device application program expects to receive from other devices on the network (an *input network variable*) or expects to make available to other devices on the network (an *output network variable*).

Network Variable/Configuration Property Format

The network variable or configuration property format specifies how the raw data contained within a network variable or configuration property is translated for display or for use by an application. The format also specifies how data entered by a user or application is translated to the raw data to be transmitted on a LONWORKS network.

Network Variable/Configuration Property Types

A network variable or configuration property type defines the structure and contents of the object. A network variable type can be either a standard network variable type (SNVT) or a user-defined network variable type (UNVT). A configuration property type can be a standard configuration property type (SCPT) or a user-defined configuration property type (UCPT)

Neuron Chip

A family of VLSI components that implements the LonTalk protocol. Each Neuron Chip contains three 8-bit, in-line CPUs, on-board memory, eleven general-purpose I/O pins, and a complete, interoperable implementation of the LonTalk protocol. The Neuron Chip can manage I/O devices and execute user-written application code, or alternatively it can be used to create a network interface to a host processor.

Neuron ID

A 48-bit number assigned to each Neuron Chip at manufacture time. Each Neuron Chip has a unique Neuron ID, making it like a serial number.

Network Explorer

An auto-hide window that displays a hierarchical view of your LonMaker network and supports all of the commands available within the drawing pages. The Network Explorer can be used in a LonMaker drawing as a navigational tool or as a network management tool.

Network Merge

Process in which one LonMaker network design is merged into another existing network design.

Network Navigator

A dialog displaying a hierarchal view of the subsystems in a network that can be used to expand, select, and deselect items when viewing or configuring a LonMaker network.

Network Recovery

Process in which a new LonMaker drawing and LNS network database are created from an existing LONWORKS network. Network recovery is useful for networks that were installed with legacy tools not based on LNS, self-installed networks, and installed networks in which the LNS network database has been lost

Node Address

A unique 15-bit logical identifier for each device in a domain. The node address consists of two parts: a 7-bit subnet address and an 8-bit Node ID. The Node ID is unique within the subnet.

Node ID

The third part of the LonTalk addressing hierarchy of domain/subnet/node. At installation time, each device is assigned a unique node ID within its subnet by the NSS.

Node Object

A functional block that monitors the status of all functional blocks in a device and makes the status information available for monitoring by the LonMaker tool. A LONMARK-compliant device that has more than one functional block must have a node object.

NodeBuilder Tool

A hardware and software platform used to develop applications for Neuron Chips and Echelon Smart Transceivers.

Non-Volatile RAM

Read/write processor memory that does not lose its contents when electrical power is removed. Two widely used semiconductor technologies are EEPROM (electrically erasable programmable read-only memory) and Flash memory.

NV Selector

A 14-bit number used to identify connected network variables. When placing the network variable in a connection, the LNS Object Server connection binder assigns a value representing that connection. All network variables in a given connection use the same network variable selector. The LNS Server shares a network variable selector among connections if the connections share one or more network variables.

OffNet

A management mode in which network configuration changes are stored in the network database, but not propagated to the devices on the network. To send the changes to the devices, you place the

LonMaker tool OnNet. If the LonMaker tool is OffNet and attached to the network, you can still perform read operations on the network.

OnNet

A management mode in which network configuration changes are propagated immediately to the devices on the network.

Override

A management command used on a functional block that causes output network variables to send their configured override values. The override values are set using the configuration properties in the functional block. The override values are sent even if part of the network is not yet operating or there is no input to the functional block.

Passive Configuration Mode

A mode in which changes to configuration property values are manually propagated to one or more devices without affecting the network configuration of the devices. Passive configuration mode enables a plug-in to be used on devices installed by network tools not based on LNS.

PCC-10

A type II PC (formerly PCMCIA) card network services interface (NSI) that includes an integral FTT-10 transceiver. Other transceiver types can be connected to the PCC-10 via external transceiver "pods". The PCC-10 is the best NSI to use with laptop, notebook, or embedded PCs.

PCLTA-10/20

A ½ size ISA card network services interface (NSI). Unlike the PCNSI, it includes a twisted pair transceiver onboard, eliminating the need to attach a separate SMX transceiver assembly. The PCLTA-10 also supports the Windows plug-and-play standard. The PCLTA-10/20 is the best NSI to use on a host computer attached to a twisted-pair channel.

PCNSI

A half-length ISA card network services interface (NSI). Requires an SMX transceiver to interface to any LONWORKS communications channel. The PCNSI has two modes of operation – NSI mode and network interface mode. In NSI mode, the host treats the PCNSI card as a smart peripheral device that provides access to an NSS either locally on the PC or remotely via the LONWORKS network. In network interface mode, the host uses the PCNSI card as a standard LONWORKS network interface.

Peer-To-Peer

A control strategy in which independent intelligent devices share information directly with each other and make their own control decisions without the need or delay of using an intermediate, central, or master controller. Because of the enhanced system reliability introduced by eliminating the master (a single point of failure) and the reduced installation and configuration cost inherent in peer-to-peer designs, LONWORKS technology is intended to implement a peer-to-peer control strategy.

Physical Medium

A communication environment that carries the modulated signals from sources to destinations in a network. LONWORKS supports many media types, including twisted pair, power line, fiber optic cable, radio frequencies, infrared, and coax.

Plug-in

An easy-to-use ActiveX automation server (*.EXE) that is compatible with LNS and implements the LNS Plug-in API. It is an application that can be launched by an LNS director application and adds functionality to that application. Typically, LNS plug-ins add device-specific functionality to an LNS tool, but they can also add system level functionality. Device-specific plug-ins are usually graphical software tools for configuring an application program in a LONWORKS device.

Priority

A LonTalk protocol service for messages sent from LONWORKS devices that allow a message priority access to a channel. Priority traffic is delivered before other traffic. Priority is a resource of the channel.

Protocol Analyzer

A tool that can read every packet on a LONWORKS channel. A protocol analyzer is different from a device containing the complete LonTalk protocol stack in that it can receive every packet on the network, not just packets that are addressed to it. Protocol analyzers allow users to observe, analyze, and diagnose the behavior of installed LONWORKS networks. Both the LonBuilder Protocol Analyzer and the LonManager Protocol Analyzer include the following tools for network analysis and diagnosis:

- Packet monitor tool
- Network traffic statistics tool
- Network diagnostics tool

Recommissioning

Process in which the LonMaker tool downloads network and application configuration data into a physical device without a Neuron ID being specified (the Neuron ID has already been stored in the network database).

Reference Connection

A connection represented by a pair of identically named shapes attached to both ends of the connection. Reference connection shapes can be used to simplify a LonMaker drawing and connect functional blocks and supernodes in different subsystems.

Remote Full Client

A LonMaker computer that communicates with the LNS Server (running on a separate computer) over a LonWorks channel (an IP-852 or TP/XF-1250 channel). On a remote full client, network management tasks are routed through the LNS Server, but monitoring and controlling tasks are sent directly to the network without going through the LNS Server.

Remote Lightweight Client

A LonMaker computer that communicates with the LNS Server (running on a separate computer) using an LNS/IP interface. On a remote lightweight client, network management, monitoring, and controlling tasks are all routed through the LNS Server.

Repeated Service

A service of the LonTalk protocol with which a message is sent more than once to help ensure message delivery to the addressee(s). The message is sent with a configurable number of retries. There is no acknowledgement from the addressee(s) that the message has been delivered.

Reset

Management command that stops a device application, terminates all incoming and outgoing messages, sets all temporary settings to their initial values, and then restarts the device application. If a device was offline, it is placed online.

Resource File

A file included with a LONWORKS device that defines the components of the device interface to be used by the LonMaker tool. Defined components include network variable types, configuration property types, and functional profiles implemented by the device application. Resource files allow for the correct formatting of the data, and they are necessary for LONMARK certification of a device.

Replacement

Process in which a failed or obsolete device is replaced on the network and in a LonMaker drawing with a new or upgraded device. The LonMaker tool preserves the device's functional blocks, network variables, configuration properties, and connections and transfers them into the new device.

Router

Routers manage network message traffic, extend the physical size of a channel (both length and number of devices attached), and connect different channel types. Unlike other devices, routers are always attached to two or more channels. Each router side can be addressed by its Neuron ID or by a subnet/node address. The side of the router closest to the LNS Server is referred to as the near side; the other side of the router is referred to as the far side. Each router side can receive a packet, decide whether the packet needs to be transmitted, and transmit the packet on the other side's channel, if required. A router can be use in one of the following configurations:

- Repeater – all packets are forwarded
- Permanent Repeater – all packets are forwarded. Subnets can span permanent repeaters.
- Bridge – all packets in a given domain are forwarded
- Permanent Bridge – all packets in a given domain are forwarded. Subnets can span permanent bridges.
- Learning Router – packets are routed only for a given domain. The router starts as a bridge and reduces forwarding as it learns the topology. Learning routers are vulnerable to failures if configured devices are incorrectly moved within the topology.
- Configured Router – packets are routed only for a given domain. Configured routers forward packets based on configured tables. This is the most reliable and efficient form of router.

Self-Documentation

A mechanism that a device can use to provide descriptive information about itself. Self-documentation can be provided for the device's program and network variables. A provider of user-defined services and events may also support self-documentation for itself, its services, events, objects, and properties. When possible, the NSS makes self-documentation information available to the host application through properties.

Sensor

Any component that is used to determine the condition or value of a physical system variable, or to accept commands from a human operator.

SLTA-10

A serial NSI interface with built-in twisted pair transceiver that connects to any host with an EIA-232 (formerly RS232) port. It can also connect to the host remotely using a Hayes-compatible modem. The SLTA-10 is the best NSI to use for remote application or for portable hosts that do not contain a type II PC slot.

Service Pin

Each Neuron Chip has a service pin used during installation to acquire the Neuron Chip's Neuron ID. When this pin is grounded, the Neuron Chip sends a broadcast message containing its Neuron ID and program ID, which is called service pin message or packet. The method used to ground the service pin varies from device to device. Examples of mechanical methods include grounding via a push button or using a magnetic reed switch. By attaching one of the device's I/O pins to the service pin, the service pin can also be put under software control as long as the device is configured. For example, the device can ground the pin when the device is moved or when a predefined series of I/O occurs. The service pin can also be used to drive an LED that indicates the Neuron Chip's state. The service LED is solid on when the Neuron Chip is applicationless, blinks slowly when the Neuron Chip has an application

and is unconfigured, is off when the Neuron Chip has an application and is configured, and blinks once quickly each time the Neuron Chip is reset.

Smart Connection Description (SCD)

A pre-defined connection description that the LonMaker tool automatically assigns to a connection being created or changed based on the number of target network variables, whether the target network variables are located on the same or different subnet, and the availability of network variable aliases.

Source Address

The logical node address of the transmitting device contained in every packet transmitted over a LONWORKS network.

Standard Configuration Property Type (SCPT)

A standard set of configuration property types defined by the LONMARK Association to facilitate interoperability. SCPTs are defined for a wide range of configuration properties used in many kinds of functional profiles, such as hysteresis bands, default values, minimum and maximum limits, gain settings, and delay times. SCPTs should be used in a LONWORKS network wherever applicable. In situations where there is not an appropriate SCPT available, manufacturers may define UCPTs for configuring their devices. See the LONMARK web site for a current list and documentation.

Standard Network Variable Type (SNVT)

A standard set of network variable types defined by the LONMARK Association to facilitate interoperability by providing a well-defined interface for communication between devices made by different manufacturers. See the Echelon or LONMARK website for a current list and documentation.

Stencil

A collection of master shapes that can be reused in Visio.

Structured Object

A network variable or configuration property that has a type with multiple fields. Examples of structured objects include **SCPTmaxSend Time** (has fields for day, hour, minute, second, and millisecond in the following format: 0 0:00:00.000) and **SNVT_switch** (has fields for value and state in the following format: 0.0 0).

Subnet

A logical collection of up to 127 devices within a domain. Up to 255 subnets can be defined within a single domain. All devices in a subnet must be on the same segment. Subnets cannot cross non-permanent type routers.

Subsystem

A collection of application devices, routers, and functional blocks. With the LonMaker tool, each subsystem corresponds to one page within a LonMaker drawing. Subsystems allow you to place application devices, routers, and functional blocks onto separate pages for organizational purposes. You can place a subsystem within another subsystem, allowing you to create a subsystem hierarchy for large networks. For example, a network may consist of HVAC, lighting, security, and operator subsystems. These may be further divided into subsystems for each floor, and each floor divided into subsystems for each room.

Supernode

A subsystem with a network variable interface. Supernodes enable a group of devices to be organized into logical units and complex subsystem details to be hidden; therefore, only the desired network variables are exposed. This reduces errors and decreases the time required for network engineering and commissioning. A supernode's network variable interface may contain any network variable on any device found within the supernode or its nested subsystems.

Synchronized

The state of a LonMaker network design when a LonMaker drawing and the physical devices on the network match the LNS network database.

Target

The destination of a connection specified by a device handle and network variable (or message tag) index. Each connection is defined in terms of a hub and a one or more targets connected to the hub. For network variable connections, the hub may only be a single input or output network variable in the connection. For example, if the hub is an output network variable, all the targets in the connection must be input network variables.

Terminator

Provides electrical termination for twisted pair channels. Properly placed terminators prevent signal reflections.

Test

A management command used to ensure that a device or functional block is operating and is configured correctly.

TP/FT-10

The free topology twisted pair LONWORKS channel type, 78Kbps bit rate.

TP/XF-1250

A bus twisted pair LONWORKS channel type, 1.25Mbps bit rate.

TP/XF-78

A bus twisted pair LONWORKS channel type, 78Kbps bit rate.

Transceiver

A device that is both a transmitter and a receiver for a communications channel. In a LONWORKS network, it is the component that physically connects a Neuron Chip to its channel. The transceiver implements layer 1 of the LonTalk protocol.

Unacknowledged Service

A service of the LonTalk protocol sends a message once to the addressee(s). There is no acknowledgement from the addressee(s) that the message has been delivered.

Unattached

The state of the LonMaker tool when it is not connected to a LONWORKS network.

Unconfigured

A device state where the device has an application image, but no network image. The device must be configured before it can operate on the network.

User-defined Configuration Property Type (UCPT)

A non-standard data structure used for configuration of the application program in a LONMARK device. UCPTs should be used only when there is no appropriate standard configuration property type (SCPT) defined. LONMARK-certified devices must have UCPTs documented in resource files according to a standard format, in order to allow the devices to be configured without the need for proprietary configuration tools.

User-defined Network Variable Type (UNVT)

A non-standard network variable type defined by the manufacturer of a device. UNVTs should be used only when there is no appropriate standard network variable type (SNVT) defined. LONMARK-certified

devices must have UNVTs documented in resource files according to a standard format, in order to allow the devices to be interoperable.

Virtual Functional Block

A static functional block that contains the network inputs and outputs for a device that are not part of other functional blocks on the device.

Wink

A management command used to identify a device on the network and verify that is communicating. Winking a device causes it to generate application-dependant audio or visual feedback such as a beep or a flashing service LED.

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