



# **MPR-50 Multi-Port Router User's Guide**



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### Safety

TÜV	Certified, per EN 60950, 2000, IEC60950, 2000
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## DECLARATION OF CONFORMITY

### MPR-50 Multi-Port Router

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**Application of Council Directive:** 89/336/EEC, Electromagnetic Compatibility Directive (EMC),  
73/23/EEC, Low Voltage Directive (LVD)

**Manufacturer's Name:** Echelon Corporation

**Manufacturer's Address:** 550 Meridian Avenue  
San Jose, CA 95126  
USA

**Manufacturer's Address:  
in Europe** Echelon BV  
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The Netherlands

**Product Model Number:** 42150

**Type of Equipment:** Information Technology Equipment

**Standards to which:  
Conformity is  
Declared**

EN 60950:2000	EN 61000-4-3
EN 55022:1998	EN 61000-4-5
EN 55024:1998	EN 61000-4-8
EN 61000-4-2	
EN 61000-4-4	
EN 61000-4-6	
EN 61000-4-11	

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I, Wim Meijer, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Place: Amersfoort, The Netherlands

Date: July 2005

Position: Controller, Echelon Europe

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# Preface

This document describes how to install and use Echelon's MPR-50 Multi-Port Router and is written for system designers and installers.

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## Content

This manual provides information about the MPR-50 Multi-Port Router.

- Chapter 1 introduces the MPR-50 Multi-Port Router and provides a quick overview.
- Chapter 2 describes the router hardware and how to connect it to a network. Software content is described, too.
- Chapter 3 describes how to install the router on a network.
- Chapter 4 introduces the built-in channel monitor.
- Chapter 5 provides troubleshooting symptoms and diagnoses.
- Appendix A describes the Buffer Management Utility.

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# 1

## Overview

This chapter introduces Echelon's MPR-50 Multi-Port Router.

## Introduction

Echelon's MPR-50 Multi-Port Router performs LonTalk® (ANSI/CEA-709.1 standard) routing between five LonTalk channels: one TP/XF-1250 channel and four TP/FT-10 channels. The MPR-50 may be used as a 2-way, 3-way, or 4-way TP/FT-10-to-TP/FT-10 router, or in any combination with the TP/XF-1250 router.

The MPR-50 helps reduce the number of routing devices in multi-channel networks, reducing both installation cost and time. The MPR-50 provides the highest possible messaging performance: all four of the TP/FT-10 channels operate at saturation, the maximum possible operating rate. The MPR-50 includes a flexible power supply, a LONMARK® certified Monitor that displays status locally on LEDs as well as provides status, and a time-stamped alarm log that is accessible via the network. In addition, the router includes an intelligent repeater mode that requires no tools to install and will typically be used in place of a four-way TP/FT-10 physical-layer repeater.

The MPR-50 can be installed by both LNS® and non LNS based network tools, including the LonMaker Integration Tool. The router is wall and 35mm DIN rail (EN 50 022) mountable, includes screw terminal connectors for power and channel wiring, and provides separate service switches and 3.5mm jacks for each channel. A CD included with the product provides documentation, LONMARK resource files, and a LonMaker stencil to simplify router installation with the LonMaker tool.

# 2

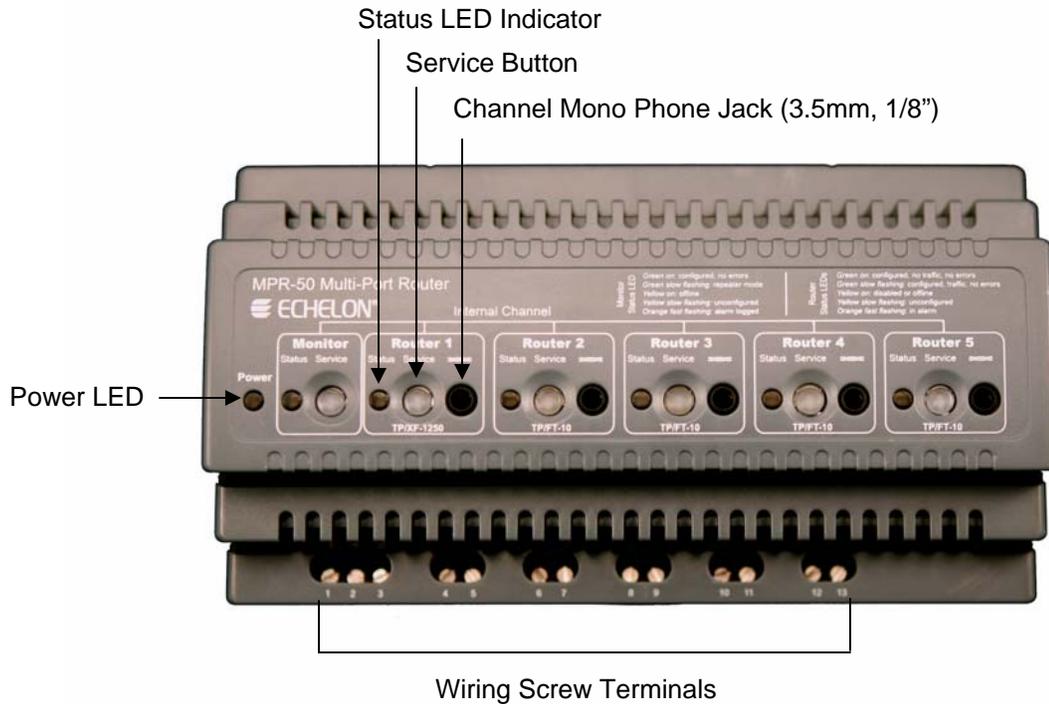
## MPR-50 Multi-Port Router Hardware and Software

This chapter provides a description of the MPR-50 Multi-Port Router hardware, including enclosure construction, mounting instructions, explanation of indicators and connectors, and wiring guidelines. In addition, the Multi-Port Router CD contents and installation instructions are described in this chapter.

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## Mechanical Description

The MPR-50 is 35mm DIN rail compatible, 9 TE wide, and conforms to EN 50 022. The figure below presents the front view of the MPR-50 Multi-Port Router. The face of the MPR-50 includes a network diagram that shows how the five routers and the Monitor are externally and internally connected.



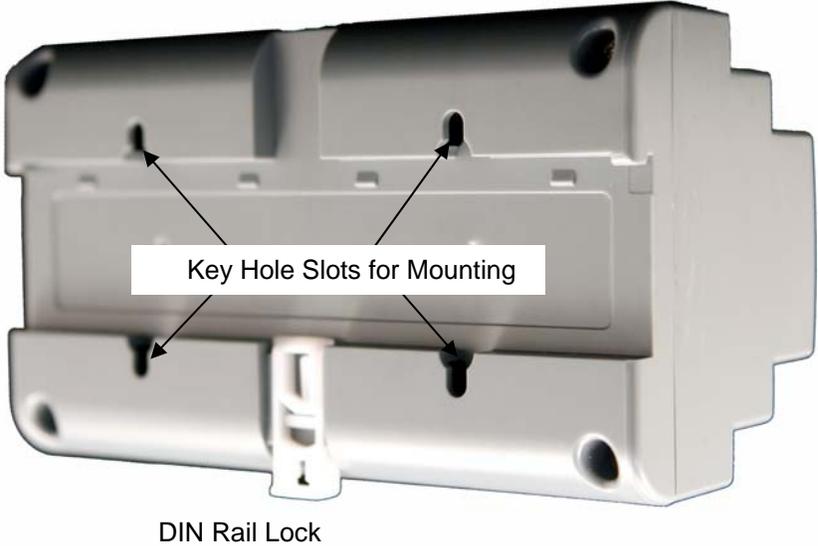
**Figure 2.1** MPR-50 Multi-Port Router Enclosure (front view)

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## Mounting and Connecting

The MPR-50 Multi-Port Router enclosure is designed for mounting on a DIN rail or wall/panel. A spring-loaded DIN rail lock securely grabs the DIN rail onto which the enclosure is mounted. Tabs in the DIN rail area present a pressure fit on the DIN rail, which prevents the MPR-50 from sliding. The DIN rail lock must be activated to either remove the MPR-50 from a DIN rail or to slide the router along the DIN rail. To release the enclosure from the DIN rail, insert a flathead screwdriver into the DIN rail locking tab and gently pull the tab downwards (away from the enclosure). Figure 2.2 shows the location of the DIN rail-locking tab.

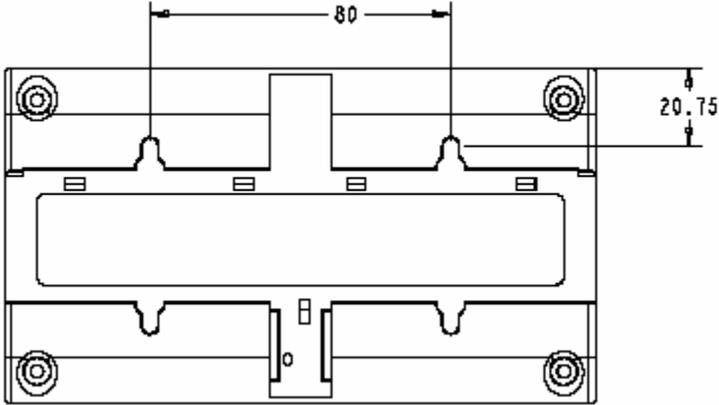
Four key hole slots in the rear of the enclosure are provided for wall/panel mounting the router. The key hole slots on each side of the DIN rail allow mounting normally or upside-down. The top of the MPR-50 includes two scored alignment guides for positioning the screws and for aligning the MPR-50 with the screws during mounting.



**Figure 2.2** MPR-50 Multi-Port Router Enclosure (back view)

Use the following steps to mount the router.

1. Insert two 6-32 flat-head screws into the surface upon which the MPR-50 is to be mounted. Mounting dimensions are shown in the following drawing, in millimeters.

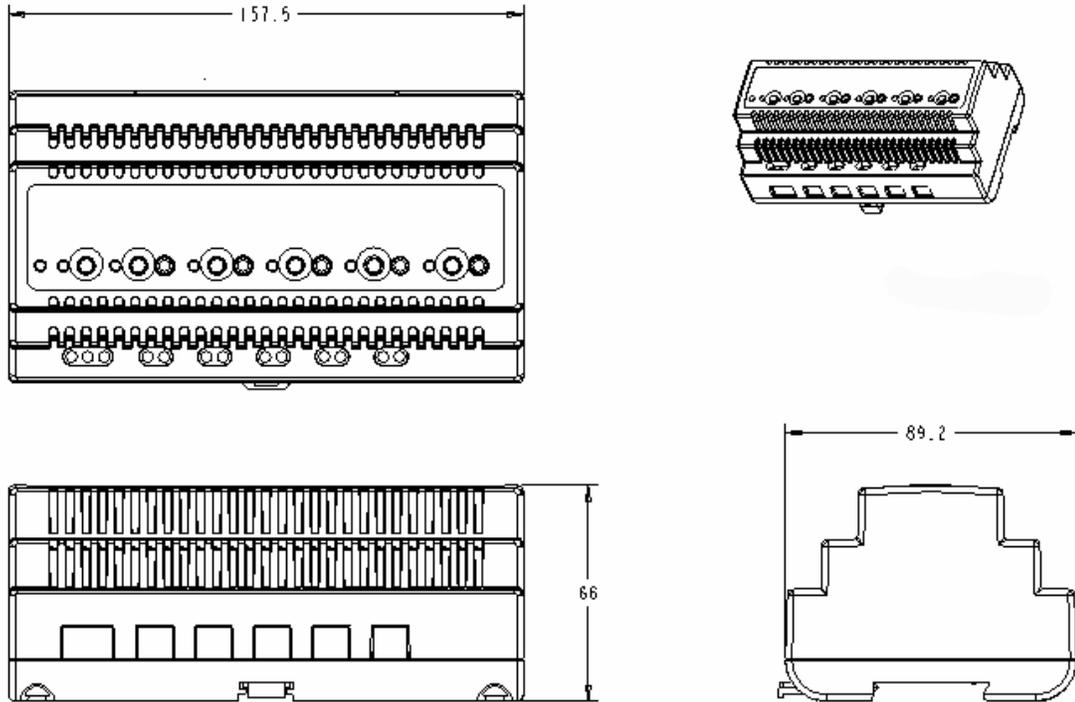


3. Be sure the heads of screws are protruding slightly from the mounting surface.
4. Slide the MPR-50 onto the screws. It may be necessary to adjust the screws into or out of the wall slightly to assure a secure mounting.

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## MPR-50 Multi-Port Router Dimensions

For mounting purposes, the following figure provides further dimensions of the router. All measurements below are in millimeters.



**Figure 2.3** MPR-50 Multi-Port Router Dimensions

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## Screw Terminal Connectors

The screw terminals for connecting power and network wires are located on the bottom edge of the enclosure. The screw terminals accept 0.34–4.0 mm<sup>2</sup> (22–12AWG) gauge wire. The optimum tightening torque for the screw terminals is 0.75mm (6 lbs. in.) maximum. The ideal flathead screwdriver tip width for use with the screw terminal connectors is 3mm (0.12"). Wires should be stripped to a length of 7mm (0.28"). A soldering iron may be used to tin the stripped lengths of any stranded wires to prevent fraying and inadvertent contact with adjacent terminals, although this is not required.

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## Applying Power to the MPR-50 Multi-Port Router

Connect earth ground, if available, to terminal 3. Then connect 9–28VAC (40–70Hz) or 9–35VDC power to terminals 1 and 2—the power terminals are polarity-insensitive so the polarity of the DC input is unimportant. The green Power LED will illuminate to indicate the unit is powered and the Status LEDs will begin operating within seconds.

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## Attaching the Router to a LONWORKS Network

Connect the screw terminals marked Router 1 through Router 5 to the desired channels. Router 1 is for the TP/XF-1250 channel, while Routers 2–5 are for the TP/FT-10 channels. TP/XF-1250 and TP/FT-10 channel wiring is polarity-insensitive, and the TP/FT-10 connections are link power compatible. Any router that is not going to be used may be left unconnected.



**Figure 2.4** Router Connections for the Multi-Port Router

For complete information about acceptable wire types, maximum stub lengths, termination requirements, and cable vendors, consult the *Junction Box and Wiring Guidelines for Twisted Pair LONWORKS Networks* Engineering Bulletin available from Echelon's Web site.

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## LED Legends

The Power LED will illuminate whenever power is connected to the MPR-50.

The following two tables describe the behavior of the Status LEDs for the Monitor and for Routers 1–5. For easy reference, shortened versions of the Status LED legends are printed on the front panel of the MPR-50.

The Status LEDs illuminate as green, orange, and yellow. When yellow is displayed, orange and green may appear illuminated together depending upon the lighting conditions.

**Table 2.1** Monitor Status LED Legend

Color	Description
Off	No power to MPR-50.
Green on steadily	The Monitor and Routers 1–5 are configured. Since power-up, no errors have been logged for Routers 1–5 or their externally connected channels.
Green slow flashing	Repeater mode. Routers 1–5 will repeat all valid traffic. This mode is useful for plug 'n play use without network management tools.  Slow flashing is defined as on-for-one-second/off-for-one-second.
Yellow on steadily	Monitor is offline. All of the router Status LEDs will also be yellow on, although the routers will still be routing if they were previously configured to do so. The router Status LEDs are yellow on since the Monitor, being offline, is unable to determine the states of the routers.
Yellow slow flashing	Monitor has not been commissioned. Slow flashing is defined as on-for-one-second/off-for-one-second. The router Status LEDs continue to indicate the current status for their associated routers and attached channels.
Orange fast flashing	Router alarm condition(s) logged.  Fast flashing is defined as on-for-one-half-second/off-for-one-half-second.

**Table 2.2** Routers 1–5 Status LED Legend

<b>Color</b>	<b>Description</b>
Off	No power to MPR-50.
Green on steadily	Router is configured. No errors have been detected on the router or on the external channel to which it attaches within the past 10 seconds. The channel has been idle for at least the past 10 seconds.
Green slow flashing	Router is configured. No errors have been detected on the router or on the external channel to which it attaches within the past 10 seconds. There has been traffic on the channel within the previous 10 seconds.  Slow flashing is defined as on-for-one-second/off-for-one-second.
Yellow on steadily	If the Monitor LED is also yellow on, the router Status LED does not indicate the router state—the router will still be routing if it was previously configured to do so. If the Monitor LED is not yellow on, then the router is disabled or offline, and is not routing messages.
Yellow slow flashing	Router unconfigured or not responding.  Slow flashing is defined as on-for-one-second/off-for-one-second.
Orange fast flashing	An alarm condition on the router or its attached external channel has been detected within the past 10 seconds. After the alarm condition clears, the router Status LED will revert to another status. The alarm condition will continue to be reported by the Monitor Status LED for as long as power is continuously applied to the router, even after the condition is cleared.  Fast flashing is defined as on-for-one-half-second/off-for-one-half-second.

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## Service Buttons

The MPR-50 Multi-Port Router has six service buttons: one for the Monitor and one for each of the routers. To reset the MPR-50 Multi-Port Router to factory defaults, hold the Monitor service button down for 10 seconds.

Note that service pin messages are broadcast onto any attached channels when the unit is put into factory default state. Some tools that listen for service pin messages and perform automatic configuration may recognize the MPR-50 and begin configuring it, potentially unexpectedly.

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## Channel Connectors

The MPR-50 front panel includes a separate 3.5mm (1/8") mono phone jack for each of the five external channels. The jack is compatible with the connector used on the LonPoint® Routers, LonPoint Modules, and various third-party products.

Echelon manufactures cables for connecting the MPR-50 to Echelon network interfaces such as the PCC-10 PC Card Network Interface and the U10 USB Network Interface.

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## Software

The MPR-50 Multi-Port Router CD includes the following content:

- ReadMe
- Quick Start Guide
- User's Guide
- Software installer to install the above-listed content as well as LONMARK resource files for the Monitor and the LonMaker stencil

The MPR-50 software does not need to be installed in order to commission Routers 1–5; however, the software must be installed in order to access the MPR-50's status over the network.

To install the MPR-50 software, first insert the CD into a CD-ROM drive. The installation program starts automatically. If not, run setup.exe. Follow the prompts to complete the software installation. After installation completes, documentation is available from the Echelon Routers program shortcut. The LONMARK resource files for the Monitor are installed into the folders recommended by LONMARK International, and the LonMaker stencil is installed into the default LonMaker stencils folder.

# 3

## Connecting to the Network

This chapter demonstrates how to install the MPR-50 Multi-Port Router on a network.

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## Installing the MPR-50 on a Network

Once the MPR-50 is physically attached to a network and powered-up, it must be logically installed on the network. The MPR-50 is by default unconfigured and will not route messages in this state. The MPR-50 can either be put into repeater mode (which requires no network management tools), or it can be commissioned using standard network management tools such as the LonMaker tool.

The Monitor within the MPR-50 only needs to be commissioned to interact with it over the network. If the Monitor will not be accessed over the network, it does not need to be commissioned.

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### *Repeater Mode*

To use the MPR-50 on a network without using network management tools, it must be put into the repeater mode. Repeater mode is useful for the following:

- Self-installed networks where physical length of the network or node density per-channel requires the use of a router
- Replacing free topology physical-layer repeaters, as physical-layer repeaters are susceptible to noise which can halt traffic not just on the noisy channel, but on the entire network
- Networks that have low traffic density and protocol routing is not required.

When in the repeater mode, the MPR-50 does not segregate traffic and may not be appropriate for larger networks, or networks with traffic levels that in aggregate approach saturation for the slowest channel.

To put the MPR-50 into repeater mode, hold down the Monitor Service button continuously for 20 seconds. The Monitor Status LED will slowly flash green after repeater mode is entered. To take the MPR-50 out of repeater mode, either hold down the Monitor Service button continuously for 10 seconds (this will set the MPR-50 to the factory default state), or commission Routers 1–5 with a network management tool (in this case it is not necessary to first take the MPR-50 out of repeater mode).

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### *Commissioning with Network Tools other than the LonMaker Tool*

The MPR-50 contains five routers and a Monitor. Before installing the Monitor, install the software as described in the previous chapter. The LONMARK resource files for the Monitor are installed into the LONMARK recommended folders. See the following chapter for a detailed description of the Monitor.

---

## Commissioning with the LonMaker Integration Tool

The LonMaker tool is an easy-to-use integration tool that supports both routers and application devices. According to the protocol specification, devices on separate channels cannot communicate unless the channels are connected by a router. This section describes how to create a router in a LonMaker network design.

These instructions assume the use of LonMaker 3.1. Newer versions of the LonMaker tool may operate differently; in particular, there may be fewer dialogs presented to the user during router definition and commissioning.

Routers, like devices, are created in two steps: definition and commissioning.

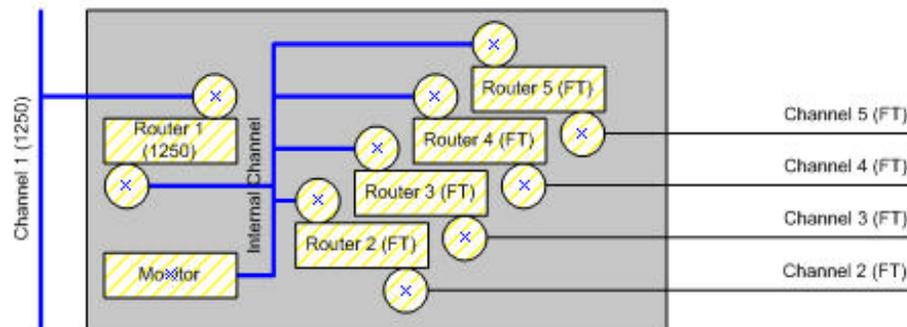
### Defining an MPR-50 Router

To define the MPR-50, follow these steps:

1. If the Multi-Port Router Shapes stencil is not open, open it from File->Stencils.



2. Drag a MPR-50 master shape from the Multi-Port Router Shapes stencil onto the drawing.



3. The Channel Definition dialog appears. Most users will want to click OK repeatedly thus accepting all of the defaults presented. The most common exception to accepting the defaults is choosing to connect to a pre-existing channel. Accept all other default values in this case. The routers are defined in reverse order, from Router 5 to Router 1.

**Note:** When defining multiple MPR-50 routers within a drawing, make certain that the Internal Channel of each MPR-50 is defined as a separate channel.

4. To monitor and control the status and logging objects on the Monitor, drag the MPR-50 Node Object and MPR-50 Channel Monitor objects onto the drawing. Note that there is one Node Object and five Channel Monitor objects. Drag onto the drawing Channel Monitor objects that correspond to the channels you are using with the MPR-50.

## Moving a LonMaker Shape

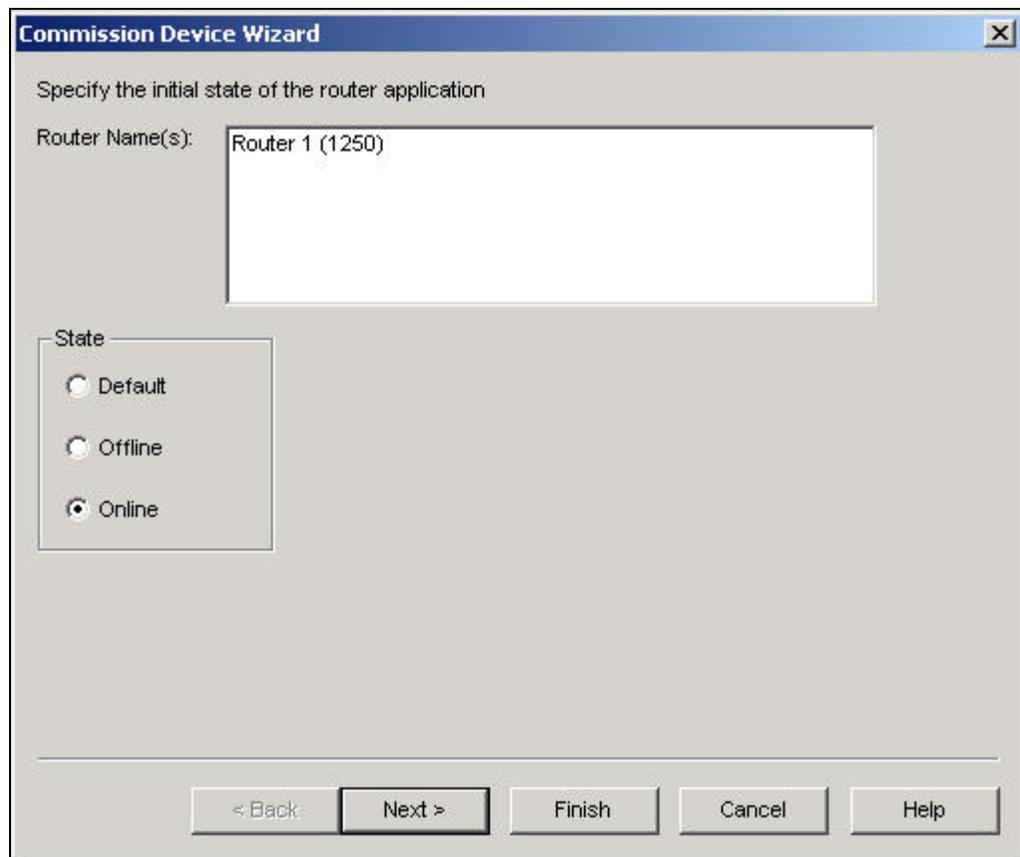
The MPR-50 shape can be moved within a LonMaker drawing; the MPR-50 shape moves as a unit that includes the five router shapes, the Monitor shape, and the internal channel.

- To move the MPR-50 shape within a subsystem (page), drag the shape to its desired location.
- To move an individual router to another subsystem, right-click the shape to move and then click **Change Subsystem** on the shortcut menu.

*Note:* You cannot move LonMaker shapes using Visio's cut and paste commands.

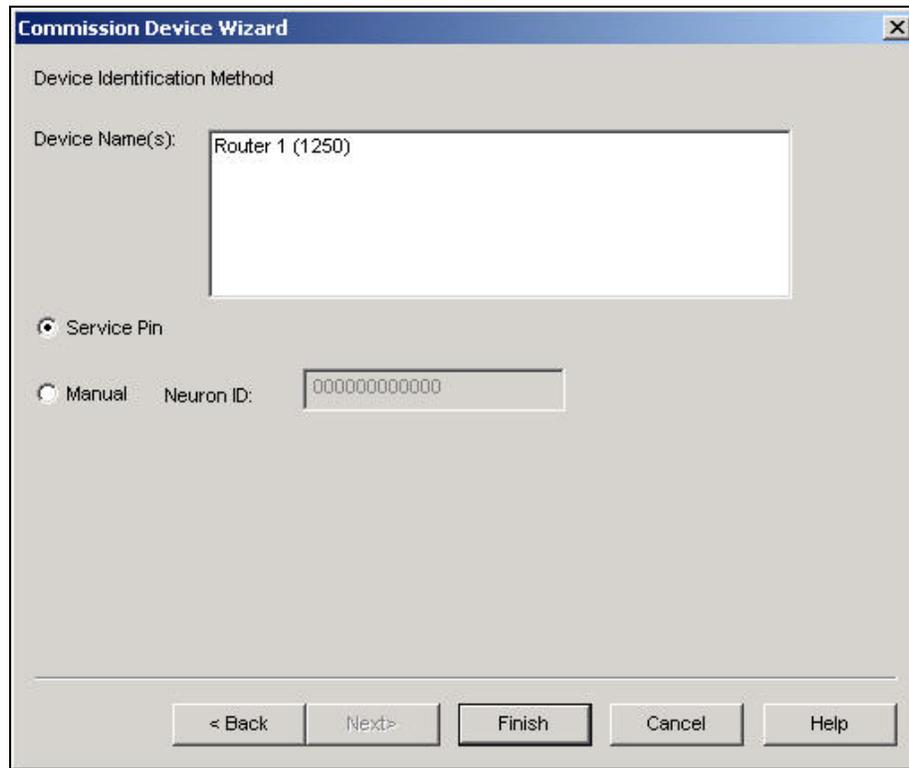
## Commissioning an MPR-50 Router

1. Right-click the shape of the router that you have connectivity to from your LonMaker tool, and then click **Commission**. The Commission Device Wizard appears. Note that you may have connectivity to any of the five routers—it is not necessarily Router 1 as shown below.



2. Select whether the router application will be online or offline upon commissioning. The router can forward packets between its channels only when it is online. Most end-users will want to choose online.

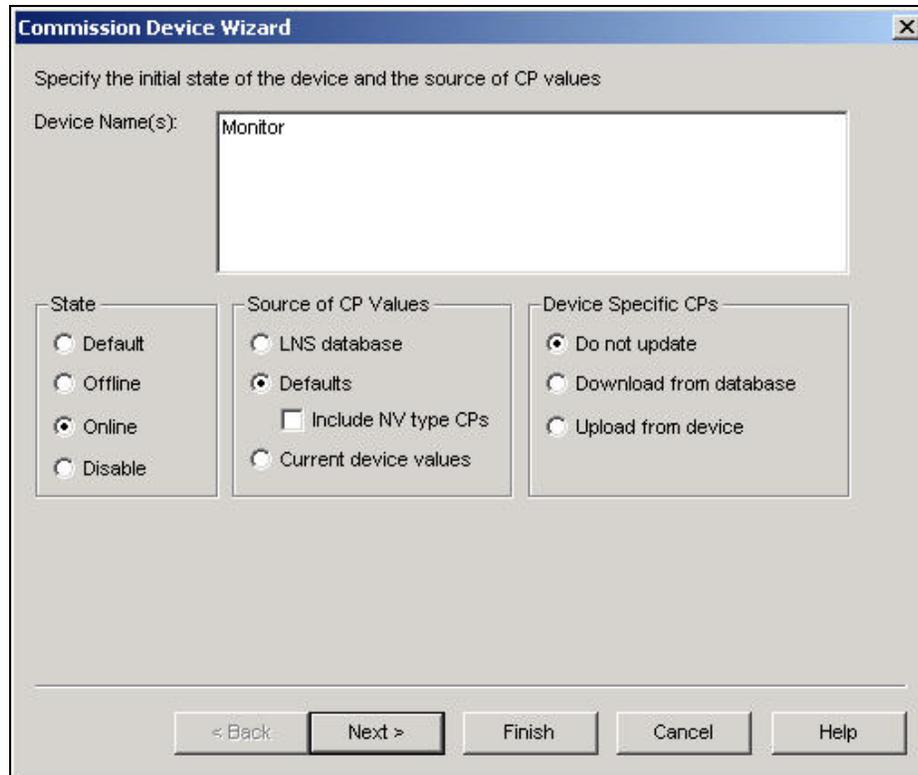
3. Click **Next**. The Device Identification Method window appears.



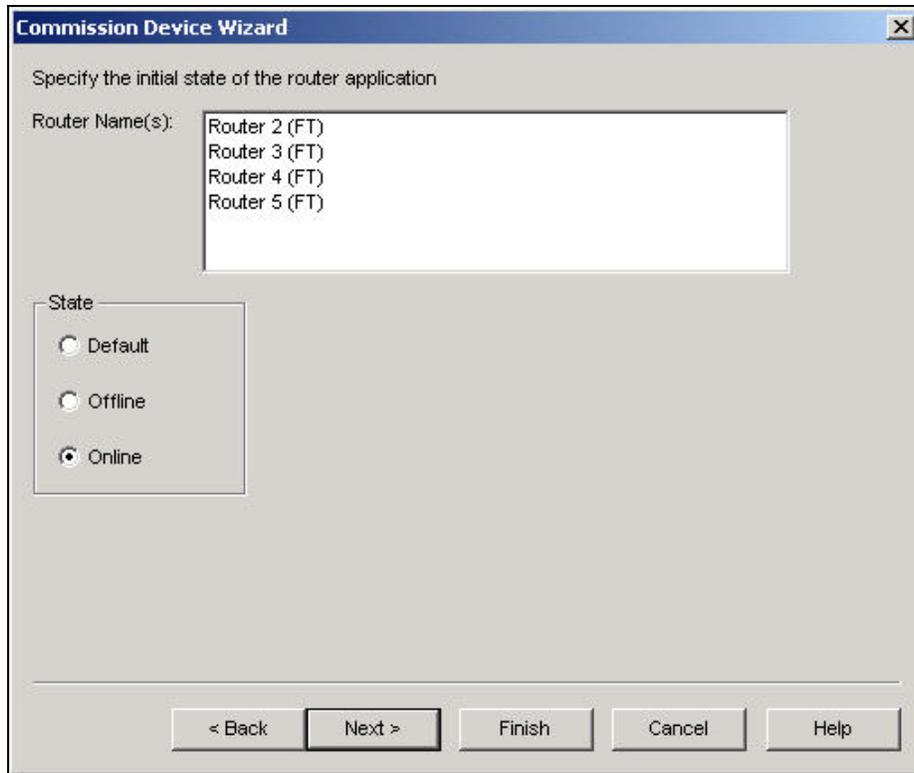
4. Select a method for obtaining the Neuron<sup>®</sup> ID of the router. You can choose to either press the service pin of the router when prompted or directly enter its Neuron ID.
5. Click **Finish**. The Press Service Pin window appears.



6. Press the service pin of the router. The LonMaker tool commissions the router.
7. Click the Monitor shape and hold down **SHIFT**. Click the router shapes for all of the other routers you want to commission. Right click, and then click **Commission**. The Commission Device Wizard appears.

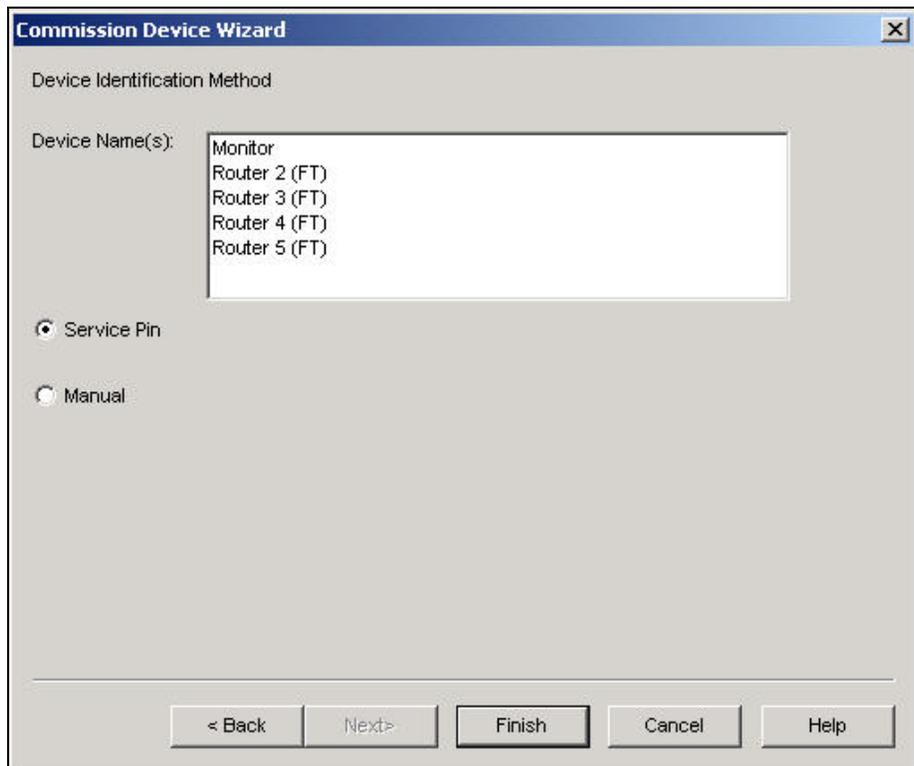


8. Set the *State*, *Source of CP Values* and *Device Specific CPs* options as appropriate. See the LonMaker User's Guide for an explanation of the effects of the various options.
9. Click **Next**. The Commission Device Wizard appears.

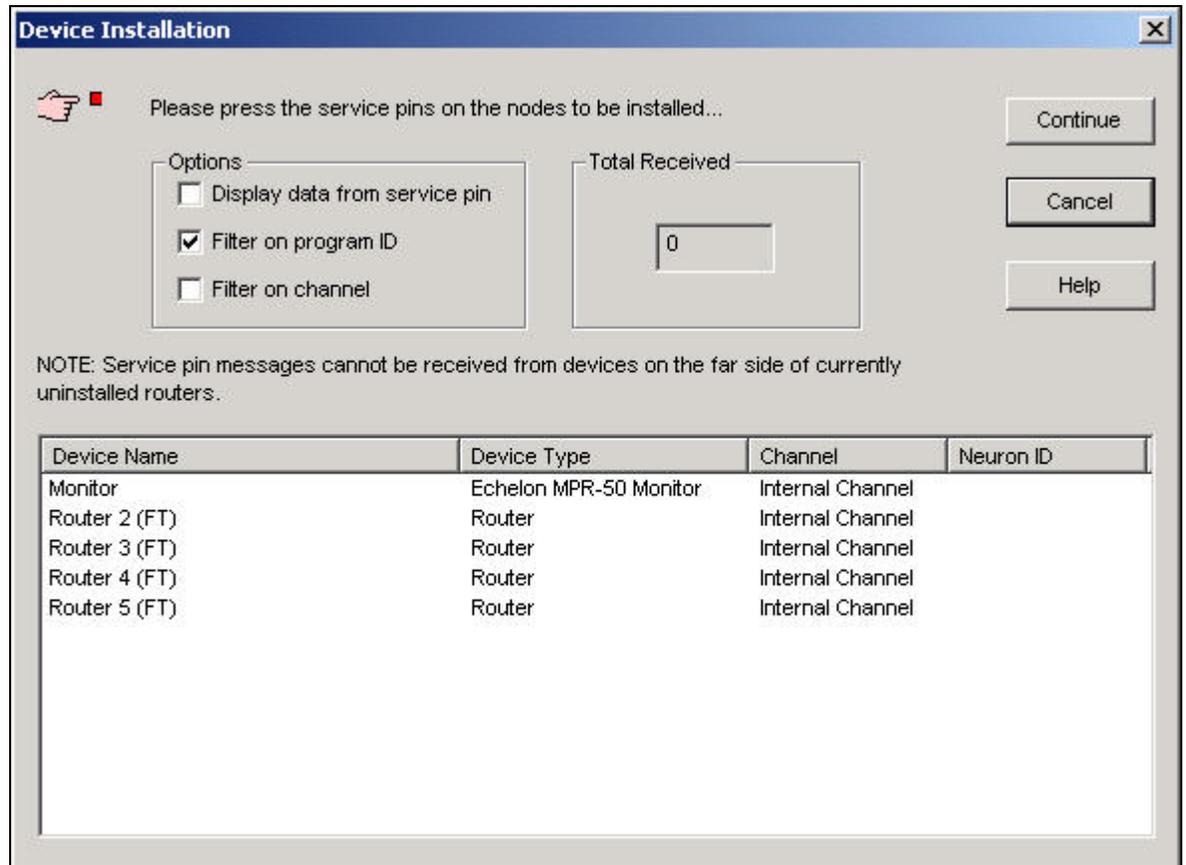


10. Select the initial states of the routers being commissioned. Most end-users will want to choose online.

11. Click **Next**. The Device Identification Method window appears.



12. Select the method for obtaining the Neuron IDs of the Monitor and the routers being commissioned.
13. Click **Finish**. The Device Installation window appears.



14. Press the service pins of the Monitor and the routers being commissioned, in the order presented in the window.

---

## Buffers

The default buffer sizes for the MPR-50 Multi-Port Router support LONMARK standard message sizes. The sizes and counts are found on the next page.

See Appendix A, Buffer Management Utility, for instructions on how to use the Buffer Management Utility to change your buffer configuration.

### TP/XF-1250 External Side (Router 1)

Type	Size/Count
app_buf_out_size	42
app_buf_in_size	42
app_buf_out_count	2
app_buf_in_count	2
app_buf_out_priority_count	1
net_buf_out_size	114
net_buf_in_size	114
net_buf_out_count	127
net_buf_in_count	47
net_buf_out_priority_count	31

### TP/FT-10 External Side (Routers 2-5)

Type	Size/Count
app_buf_out_size	42
app_buf_in_size	42
app_buf_out_count	2
app_buf_in_count	2
app_buf_out_priority_count	1
net_buf_out_size	114
net_buf_in_size	114
net_buf_out_count	3
net_buf_in_count	5
net_buf_out_priority_count	1

### Internal Channel Side (Routers 1-5)

Type	Size/Count
app_buf_out_size	42
app_buf_in_size	42
app_buf_out_count	2
app_buf_in_count	2
app_buf_out_priority_count	0
net_buf_out_size	114
net_buf_in_size	114
net_buf_out_count	5
net_buf_in_count	3
net_buf_out_priority_count	0



# 4

## MPR-50 Monitor

This chapter describes the interfaces and functionality of the MPR-50's Monitor.

---

## Introduction

The MPR-50's Monitor observes and reports on the health of Routers 1–5 through Status LEDs and through the network. The Monitor can be commissioned by a network management tool and operates independently from the MPR-50's five routers.

The Monitor is a LONMARK certified application organized as six functional blocks. In addition to the Node Object, it contains one Channel Monitor functional block each for Routers 1–5.

For the sake of efficiency, bit arrays, network variable arrays, and configuration property arrays are used. It is important to understand that the LONMARK resource file and LonMaker tool indices start at zero while, for ease-of-use, the Routers are numbered one through five on the enclosure, as well as on the LonMaker shapes. The following table shows the indices to these arrays:

<b>Array Index</b>	<b>Enclosure Markings</b>	<b>Visible Router and Channels Names in the LonMaker Stencil</b>
0	Router 1 – TP/XF-1250	Router 1 (1250) and Channel 1 (1250)
1	Router 2 – TP/FT-10	Router 2 (FT) and Channel 2 (FT)
2	Router 3 – TP/FT-10	Router 3 (FT) and Channel 3 (FT)
3	Router 4 – TP/FT-10	Router 4 (FT) and Channel 4 (FT)
4	Router 5 – TP/FT-10	Router 5 (FT) and Channel 5 (FT)

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## Self-Installation

The Monitor self-installs and does not need to be installed by a network management tool in order to provide status via the front panel LEDs. To obtain status from the Monitor remotely, it should be installed by a network management tool. The Monitor intelligently manages its own installation state so that the user does not need to manage it.

---

## Service Button

Momentarily pressing any of the Service buttons causes the associated Monitor or router to transmit a service pin message (a router transmits two service pin messages—one onto the MPR-50's internal channel and one onto its external channel). Since the Monitor is attached to the internal channel, a service pin message from the Monitor will be routed onto a particular external channel only if the associated router that connects the internal channel to the external channel is configured to route messages.

To reset the MPR-50 to factory defaults, hold the Monitor Service button down for 10 seconds. Release the Service button as soon as the Status LEDs change after 10 seconds have elapsed. The Monitor will self-install and Routers 1–5 will indicate that they are unconfigured.

Note that when resetting the MPR-50 to factory defaults, service pin messages are broadcast onto any attached channels. Some tools that listen for service pin messages and perform automatic configuration may recognize the MPR-50 and begin configuring it, potentially unexpectedly.

To put the MPR-50 into repeater mode, hold down the Monitor Service button continuously for 20 seconds. The Monitor Status LED will slowly flash green after repeater mode is entered. To take the MPR-50 out of repeater mode either hold down the Monitor Service button continuously for 10 seconds (this will set the MPR-50 to the factory default state), or commission Routers 1–5 with a network management tool (in this case it is not necessary to first take the MPR-50 out of repeater mode).

Two configuration properties on the Monitor's Node Object functional block (`UCPTfactoryDefaultsEnable` and `UCPTrepeaterModeEnable`) determine whether the Monitor's Service button can be used to reset the MPR-50 to factory defaults, or put it into repeater mode. By default these two configuration properties are set to `True`. However, one or both of these configuration properties can be set to `False` with a network management tool in order to prevent tampering with the configuration of the MPR-50 via access to the front panel.

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## Wink Request

A network tool may send a wink message to the MPR-50 to help physically identify it. When a wink request is received, the Monitor will illuminate the Router 1–5 Status LEDs in a distinctive sequence.

A wink request is ignored if a wink sequence is currently in progress.

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## Node Object Functional Block

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### Network Variables

The Node Object implements the following network variables.

**Note:** *The programmatic Network Variable name appears first. The LonMaker Node Object's Network Variable shape name is located under it, in parentheses.*

Network Variable	Type	Description
nviRequest (Request)	SNVT_request	Standard LONMARK status request variable. Used by network management tools to request current status of the Monitor. See the LONMARK Application Layer Interoperability Guidelines for details on how to use this variable.
nvoStatus (Status)	SNVT_status	Standard LONMARK status response variable. Used by network management tools to read the current status of the Monitor. See the LONMARK Application Layer Interoperability Guidelines for details on how to use this variable.
nvoFileDirectory (File Directory)	SNVT_address	Contains the memory address for the file directory containing descriptors for configuration files. Used by network management tools to read and write the LONMARK configuration files and for reading the error log. See the LONMARK Application Layer Interoperability Guidelines and the section <i>Error Log</i> later in this chapter for details on how to use this variable.
nvoHealthy (Healthy)	SNVT_switch	If the state field of this variable is True, there are no reportable errors on any of the five routers. If the state field is False, one or more errors have been logged. The Monitor Status LED reflects the state of this variable.
nvoErrorMap (Error Map)	SNVT_state	If an error has been logged for a particular channel, the corresponding bit in this variable is set. The corresponding Router Status LED will also reflect the state of the bit, if an error has been logged for that router and attached channel.

nviClearStat (Clear Statistics)	SNVT_switch	<p>When diagnosing a network problem, it may be useful to use this network variable to clear all of the router statistics and error log after corrective actions have been taken, so that one can verify whether or not the actions were effective. The Status LEDs on the front panel, if they indicated error conditions, will also revert to their normal status indications, until another error occurs.</p> <p>It is not necessary to set the network variable to OFF. It automatically sets itself to OFF once the ON state is detected. The value field of this network variable is ignored by the Node Object; however, the network tool should send valid values.</p> <p>The default state is OFF.</p> <p>The Status LED behavior is described in Chapter 2, <i>MPR-50 Multi-Port Router Hardware and Software</i>. The error log is described in the <i>Error Log</i> section, later in this chapter.</p>
nvoElapsedTime (Elapsed Time)	SNVT_elapsed_time	<p>Elapsed time since power-up or last reset. Normally used to compute at what time in the past events logged in the error log occurred. The MPR-50 does not have a real-time clock, which means this variable is subject to accuracy errors particularly over long periods of time.</p>
nvoAlarm2 (Alarm)	SNVT_alarm_2	<p>Used to transmit alarm data for each functional block on the device whenever an alarm occurs or is cleared, and upon request. For more information, see the <i>Alarms</i> section, later in this chapter.</p>

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## Configuration Properties

The Node Object implements the following configuration properties:

Configuration Property	Description
SCPTmajDevVer	Defines the major version of the device, and can be useful for integrators when upgrading or verifying installations. This property is read-only.
SCPTminDevVer	Defines the minor version of the device, and can be useful for integrators when upgrading or verifying installations. This property is read-only.
UCPTfactoryDefaultsEnable	If set to True (the default), an end-user can use the Monitor Service button to reset the MPR-50 to factory defaults. To prevent tampering with the configuration of the MPR-50 from the front panel, disable this feature by setting the configuration property to False.
UCPTrepeaterModeEnable	If set to True (the default), an end-user can use the Monitor Service button to put the MPR-50 into repeater mode. To prevent tampering with the configuration of the MPR-50 from the front panel, disable this feature by setting the configuration property to False.

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## Error Log

Certain network variables that are part of the Channel Monitor functional blocks are alarmed, and the Monitor maintains an error log of any alarm conditions. The log is circular, the entries are in the SNVT\_alarm\_2 format, and it contains up to 50 of the latest alarms. Think of this error log as the latest 50 values that have been output on the Node Object's nvoAlarm2 output. The error log is not retained across power cycles or resets.

A network management tool can read this error log using standard LONMARK direct memory read/write commands, and use the error log contents to aid in debugging network problems. The network management tool uses the nvoFileDirectory network variable to find the location of the error log. LNS based tools can use the available LNS FileTransfer method to transfer the log file. For instance, when using LonMaker Turbo Edition, choose *LonWorks FTP...* from the LonMaker menu. When not using an LNS based tool, see the Node Object Functional Profile and the LONMARK Application Layer Interoperability Guidelines on the LONMARK Web site for details about how to read the log file.

The index of the log file in the Monitor is 3. The format of the error log is as follows:

Item	Offset (Bytes)	Length (Bytes)	Description
Version	0	1	Error log version number. Currently 1.
Entry size	1	1	Size of each error log entry
Entry count	2	1	Current number of error log entries
Latest entry	3	1	Index of latest error log entry
Sequence	4	2	Incremented for each additional error log entry
Error log entries	6	Entry size * Entry count	(Entry count) SNVT_alarm_2 records

To compute the time at which an alarm in the error log occurred, first compute the alarm time by using the alarm\_time and milliseconds fields from a particular error log record. The record format is SNVT\_alarm\_2. Then read the nvoElapsedTime network variable. Using the difference, subtract that time from the local time of day. Don't forget to factor in daylight savings time, if applicable.

Since direct memory commands are used to read the log, it is possible that the Monitor will be updating the log while a network management tool is reading it. In order to ensure that reads are consistent, read the error log only after all of the Channel Monitor functional blocks are temporarily disabled.

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## Channel Monitor Functional Blocks

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### Network Variables

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Each of the five Channel Monitor functional blocks collects information about the number of errors and number of messages on the associated externally-connected channel. This information is used to update the Status LEDs described in *LED Legends* in Chapter 2, and this information is also available on the network through the following network variables:

**Note:** *The programmatic Network Variable name appears first. The LonMaker Channel Monitor's Network Variable shape name is located under it, in parentheses.*

Network Variable	Type	Description
nvoIvalBandUtl (Last Bandwidth Use)	SNVT_lev_cont	Percentage of bandwidth being used in the last interval. This variable is alarmed. See the section <i>Alarms</i> below for details.
nvoIvalPackets (Last Packets)	SNVT_count_32	Number of messages received in the last interval.

nvoIvalCrcErr (Last CRC Errors)	SNVT_lev_cont	Percentage of messages with CRC errors in the last interval. This variable is alarmed. See the section <i>Alarms</i> below for details.
nvoIvalMissed (Last Missed Packets)	SNVT_lev_cont	Percentage of missed messages in the last interval. This variable is alarmed. See the section <i>Alarms</i> below for details.
TotalPkts (Total Packets)	SNVT_count_32	Total messages received since last reset or clearance of statistics.
nvoTotalCRCErr (Total CRC Errors)	SNVT_count_32	Total number of messages with CRC errors since last reset or clearance of statistics.
nvoTotalMissed (Total Missed Packets)	SNVT_count_32	Total number of missed messages since last reset or clearance of statistics.
nvoMaxBandUtil (Max Bandwidth Use)	SNVT_lev_cont	Maximum bandwidth percentage utilization in any interval since last reset or clearance of statistics.
nvoMaxPackets (Max Packets)	SNVT_count_32	Maximum number of messages in any interval since last reset or clearance of statistics.
nvoAvgPackets (Average Packets)	SNVT_count_32	Average number of packets per interval since last reset or clearance of statistics.

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## Configuration Properties

Each of the five Channel Monitor functional blocks implements the following configuration properties. The alarm configuration properties are described separately in the next section, Alarms.

Configuration Property	Description
SCPTholdTime	The amount of time (in tenths of seconds) that a router's Status LED flashes green after detecting activity on its external channel.
SCPTneuronId	An array that contains the two Neuron IDs of the router, with the first Neuron ID in the array being on the internal channel of the MPR-50, and the second Neuron ID in the array being on the external channel. This configuration property is useful for network management tools and plug-ins to be able to automatically install all of the routers in the MPR-50 by reading this configuration property and then being able to know which router is connected to which external channel.

UCPTinterval	This configuration property defines the interval over which statistics are collected. Its type is SNVT_elapsed_tm, with the default being one minute. The maximum interval supported is 65,535 seconds (over 18 hours). A minimum interval of 5 seconds is enforced, which means that if this configuration property is set to a value below 5 seconds, the statistics interval will be 5 seconds. This is a shared configuration property that applies to all of the Channel Monitor functional blocks.
UCPTpacketBytesAverage	To calculate bandwidth utilization, the Monitor uses an approximate value for the average packet size. The average packet size defaults to 15 bytes, but can be configured to whatever your average message size is.
UCPTpacketsPerSecondMax	The bandwidth utilization calculation is made relative to a fixed model of the maximum channel capacity of the TP/FT-10 and TP/XF-1250 channels. The default is 0 for all channels and should not be changed.

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## Alarms

The Monitor implements LONMARK alarms for several network variables in the Channel Monitor functional blocks. The alarmed network variables and their default alarm limits are listed below. These alarm limits may be modified with a network management tool.

***Note:** The programmatic Network Variable name appears first. The LonMaker Channel Monitor's Network Variable shape name is located under it, in parentheses.*

Network Variable	Low Limit	Low Hysteresis	High Limit	High Hysteresis
nvoIvalCrcErr (Last CRC Errors)	N/A	N/A	5%	2%
nvoIvalMissed (Last Missed Packets)	N/A	N/A	1%	0%
nvoIvalBandUtl (Last Bandwidth Use)	0%	0%	70%	5%

Alarm conditions are reported on the nvoAlarm2 output on the Node Object. This output is of type SNVT\_alarm\_2 and contains a string with the current alarm source, the error type, and the percentage value. The following alarm source strings are used (where <n> is for router (and channel) and xx is either a whole number like 57 or a real number like 49.5.):

- Ch<n>: CRC errors (xx%)
- Ch<n>: Missed (xx%)

- Ch<n>: Bandwidth (xx%)

In the LONMARK guidelines, the possibility exists for two limit levels (levels 1 and 2) for each of the low and high limits. The MPR-50 implements a single limit according to the following rules:

1. If the alarm type was not `AL_HIGH_LMT_ALM_1` and the value is now greater than `SCPThighLimit1`, then the alarm type becomes `AL_HIGH_LMT_ALM_1`.
2. If the alarm type was `AL_HIGH_LMT_ALM_1` and the value drops below `SCPThighLimit1` minus `SCPThystHigh1`, then the alarm type becomes `AL_HIGH_LMT_CLR_1`. For high limit alarms, the hysteresis value is used only to subtract from the limit value.
3. If the alarm type was not `AL_LOW_LMT_ALM_1` and the value is now less than `SCPTlowLimit1`, then the alarm type becomes `AL_LOW_LMT_ALM_1`.
4. If the alarm type was `AL_LOW_LMT_ALM_1` and the value rises above `SCPTlowLimit1` plus `SCPThystLow1`, then the alarm type becomes `AL_LOW_LMT_CLR_1`. For low limit alarms, the hysteresis value is used only to add to the limit value.

The `nvoIvalCrcErr` and `nvoIvalMissed` variables have a high alarm limit (`SCPThighLimit1`) and do not have a low alarm limit. A hysteresis value (`SCPThystHigh1`) is used to prevent oscillation of the alarm condition when it is near the high alarm limit value. The high alarm is enabled by default via the `SCPThighLimit1Enable` property.

The `nvoIvalBandUt1` variable has both a high alarm limit (`SCPThighLimit1`) and a low alarm limit (`SCPTlowLimit1`). The high alarm is enabled by default via the `SCPThighLimit1Enable` property, and the low alarm limit is *disabled* by default via the `SCPTlowLimit1Enable` property. The low alarm limit can be useful to detect that, for instance, a certain level of background heartbeat traffic expected on a channel has slowed or stopped—which indicates a power, channel wiring, or other problem. If the low alarm limit is enabled, also set the `SCPTlowLimit1` property to a non-zero value that is slightly below the expected level of background heartbeat traffic. Hysteresis values (`SCPThystHigh1` and `SCPThystLow1` as appropriate) are used to prevent oscillation of the alarm condition when it is near the alarm limit value.

# 5

## Troubleshooting

The MPR-50 is designed to offers years of reliable service without maintenance. In the unlikely event that a problem arises, this chapter describes how to diagnose and correct the problem. If the problem cannot be readily corrected, please contact Echelon Support at [www.echelon.com/support](http://www.echelon.com/support).

## Troubleshooting Table

This troubleshooting table is intended to address abnormal operation only and does not include errors reported on the Status LEDs. Refer to the *LED Legends* section in Chapter 2 for a description of the Status LED messages.

Symptom	Troubleshooting Solutions
The Power LED is not on continuously.	<ul style="list-style-type: none"> <li>• Verify that the input voltage measured at the MPR-50 power input connector is within limits.</li> <li>• Verify that the input power is connected to terminals 1 and 2.</li> <li>• Remove the earth ground connection temporarily if it is connected.</li> </ul>
A network tool does not receive a service pin message when the Monitor's Service button is pressed.	<ul style="list-style-type: none"> <li>• Verify that Service pin messages from other devices can be received.</li> <li>• Verify that the router inside the MPR-50, in between the Monitor and the network tool, has been commissioned properly by the network tool or is in repeater mode.</li> <li>• Verify that the network wiring is functional by pressing the Service button on any intervening routers, and on the router inside the MPR-50, in between the Monitor and the network tool.</li> <li>• Verify that the proper transceiver types are connected to a particular channel. For instance, verify that a TP/FT-10 channel is <u>not</u> connected to the Router 1 – TP/XF-1250 port of the MPR-50, and that a TP/XF-1250 channel is <u>not</u> connected to Routers 2-5.</li> <li>• Verify that the network channels are properly terminated with either a single or double termination, as required.</li> <li>• If the configuration of Routers 1–5 is in doubt, put it into repeater mode. Then press the Service button on the Monitor.</li> </ul>
The network tool returns error messages when attempting to install Routers 1–5 and the Monitor in a single operation.	<ul style="list-style-type: none"> <li>• First commission only the router nearest to the network tool. Then commission the other routers and the Monitor at the same time.</li> </ul>

Symptom	Troubleshooting Solutions
When using multiple MPR-50s, network topology errors occur.	<ul style="list-style-type: none"> <li>• Ensure that the internal channel of each of the MPR-50s in the network is defined within the network tool as a separate channel.</li> </ul>
The MPR-50 does not pass messages larger than 114 bytes.	<ul style="list-style-type: none"> <li>• The MPR-50 can support messages up to 256 bytes. Configure the router buffers using the application described in Appendix A, Buffer Configuration Utility.</li> </ul>



# Appendix A

## Buffer Management Utility

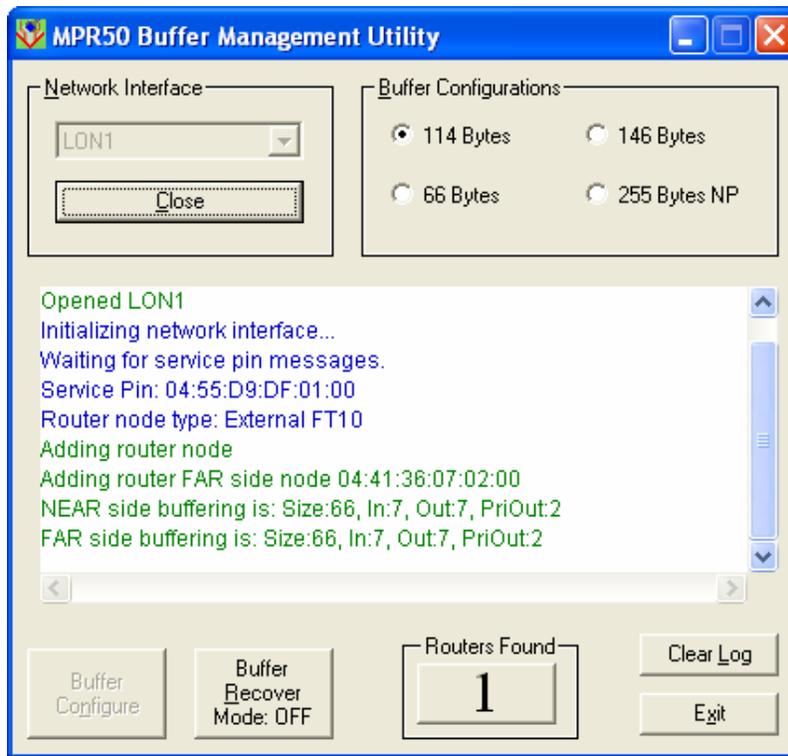
This appendix explains how to use the buffer management utility for the MPR-50 Multi-Port Router.

# Buffer Management Utility

The MPR-50 Buffer Management utility is a stand-alone Windows program that allows you to:

- Change the MPR-50 Network buffer sizes.
- Fix the buffer settings if they become corrupted (for example, if they are set to an invalid number).

Figure 1 shows the main window for the utility. This program provides four common buffer sizes for the MPR routers. If you need to use a different buffer size than what is provided, see *Changing the Utility's Buffer Sizes*.



**Figure 1.** MPR-50 Buffer Management Utility Main Window

Button	Action
Open, Close	Opens/Closes a Network Interface
Buffer Configure	Changes the Buffer size to the selected Buffer Configuration. The service pins from all five routers must be recorded before it works – you must see *5 before you can use it.
Buffer Recovery Mode	Sets the Buffers to default. Use to fix corrupted buffer settings.
Routers Found	Indicates the number of router service pins received. Click to clear the Routers Found number.
Clear Log	Clears the Log box.
Exit	Exits the program.

---

## Installing and Running the MPR Buffer Management Utility

To install the MPR-50 Buffer Management utility, unzip the files from the supplied ZIP file into the LONWORKS bin directory (usually, C:\LonWorks\bin). This step creates a new directory with four files.

To run the MPR-50 Buffer Management utility, double click the icon for the “MPR-50Tool.exe” file.

This program requires the following Windows dynamic link library (DLL) files to be present on the Windows system:

- LDV32.DLL – for the LDV32 interface
- MFC42.DLL – for the Microsoft Foundation Classes

This program supports the following Network Interfaces:

- Supported: USB U10 and RNI (e.g., *i*.LON® 10 and *i*.LON 100).
- Not Supported: IP-852 Network Interfaces.

### Using the MPR Program

To check the MPR-50 buffer sizes:

1. Connect the network interface to any of the MPR routers (e.g., Router 2).
  - a. Router 1 is for a TP/XF-1250 channel and Routers 2 – 5 are for TP/FT-10 channels.
2. Select the Network Interface and click **Open**.
  - a. Click **Close** to close the Network Interface.

### Checking the Current Buffer Sizes

To check the MPR-50 buffer sizes:

1. Make sure the Buffer Recover Mode button is off (i.e., grey background).
2. Click the Routers Found Button to clear the list of registered routers.
3. Press each MPR router service pin. The buffers sizes will be displayed in the Log Box.

### Using Buffer Configure

To configure the MPR-50 buffers, you first need to configure the MPR-50 for repeater mode. If you are unable to configure the MPR-50, or it is not working, then the router buffer settings might be corrupted. To fix them, use the Buffer Recover Mode on the routers before changing the buffer sizes to the desired values; see *Using Buffer Recover Mode* on page 39 for more information.

**Note:** *While the Buffer Recover Mode is enabled (the button is orange), when you press a Service Pin on the MPR-50, the utility tries to recover the buffers for that router and sets the buffer size to 114 bytes.*

To change the MPR-50 buffer sizes:

1. Decommission all the routers in the MPR-50 if they have been commissioned before. If the MPR-50 has not been commissioned or if all the MPR-50's status

LEDs are flashing green, proceed to step 2.

To decommission the routers, perform either of the following steps:

- a. Use your Network Integration Tool (such as the LonMaker® tool). For the LonMaker tool, right-click the router shape and select decommission.
- b. Press the Service Pin button on each router for at least 20 seconds until the Status LED flashes orange.

2. Connect your Network Interface to any of the MPR-50's routers.
3. Place the MPR-50 in Repeater mode by pressing the Monitor Service Pin button for 30-40 seconds. The MPR is in repeater mode when all the LEDs flash green.
4. Start the MPR-50 Buffer Management utility.
5. Select the Network Interface device from dropdown list in the Network Interface area of the MPR-50 Buffer Management utility main window, and click **Open**.
6. Select the buffer size that you want from the Buffer Configurations area of the MPR-50 Buffer Management utility main window.
7. Ensure that the **Buffer Recovery Mode** is off and that the button's background is grey and not orange (or yellow). When the button is grey, you are in buffer configuration mode.
8. Press the Service Pin button on all of the MPR-50's routers.

As you press each of the Service Pins, notice that the number displayed on the **Routers Found** button of the MPR-50 Buffer Management utility main window is incremented. When you see “\*5\*” on the **Routers Found** button, the utility has received all five of the MPR-50 routers' Service Pin messages. You must press the Service Pin for all of the MPR-50's routers before the utility can configure their buffers.

If the utility does not recognize all of the routers' Service Pin messages, then the MPR-50 is likely not in Repeater Mode (see step 3).

You can click the **Routers Found** button to clear the list of registered routers.

9. Click the **Buffer Configure** button on the MPR-50 Buffer Management utility main window to change the buffer sizes.
10. The log area of the MPR-50 Buffer Management utility main window shows “Buffer configuration complete” when the buffers have been successfully modified.
11. Click the **Routers Found** Button to clear the list of registered routers.
12. Press each MPR router service pin. The buffers sizes are displayed in the Log Box.
13. When the buffer configuration is complete, click **Exit** to close the MPR-50 Buffer Management utility.

### Using Buffer Recover Mode

You can use the MPR-50 Buffer Management utility's buffer recovery mode to recover router nodes that have had invalid buffer configurations programmed into them. Without the MPR-50 Buffer Management utility, buffer recovery can be difficult. For example, some configurations result in a router that is only capable of receiving a few network packets before it enters a state in which it can no longer receive messages. In these cases, it might be necessary to reset (power cycle) the router before attempting recovery. As a further complication, the Monitor Node periodically tries to communicate with these router nodes, which uses packet buffers if the router node is configured incorrectly.

When you click the **Buffer Recover Mode** button, the MPR-50 Buffer Management utility enters the buffer recovery mode; if you click this button again, the utility returns to buffer configuration mode. While the utility is in buffer recovery mode, any Service Pin message captured by the utility causes it to perform the following steps:

1. It checks the Program ID to ensure that the message came from a router.
2. It uses the Neuron<sup>®</sup> ID to address a buffer configuration message to the *near* router node using the un-ack'd service. The utility uses this service because the node might not be able to generate a response. The router is also reset as a result of the buffer configuration message.
3. After a small delay, the utility uses the same Neuron ID to send a buffer configuration message to the *far* router node using the un-ack'd service. The router is reset as a result.
4. After another small delay, the utility reads the router's *far* side buffer configuration and confirms it.

If this process is successful, you should proceed with the next router using the connectivity that you now have with the recovered router. If it is impossible to recover the other routers using the internal channel path, you may have to approach the routers from each of their external channel interfaces.

**Note:** *A single "safe" default buffer configuration is used for all recovery operations (the same one used for the default configuration of the FT10 nodes). Normally, the internal node configuration is different from the external node configuration, and the TP1250 configuration is quite large. To correct for this difference, after the recovery process is complete, you should re-configure all five routers using the normal buffer configuration mode.*

Fixing the MPR-50 buffers because of a corrupted buffer can take several attempts to fix all five routers.

To fix the MPR-50 buffer sizes:

1. Decommission all the routers in the MPR-50 if they have been commissioned before. If the MPR-50 has not been commissioned, proceed to step 2. To decommission the routers, perform either of the following steps:
  - a. Use your Integration Tool (for example, the LonMaker tool).
  - b. Press the Service Pin button on each router for at least 20 seconds until the Status LED flashes orange.
2. Connect your Network Interface to any of the MPR-50 routers.

3. Place the MPR in Repeater mode by pressing the Monitor Service Pin button for 30-40 seconds. The MPR is in repeater mode when all the LEDs flash green.
4. Start the MPR-50 Buffer Management utility.
5. Select the Network Interface device from dropdown list in the Network Interface area of the MPR-50 Buffer Management utility main window, and click **Open**.
6. Click the **Buffer Recover Mode** button to ON to enter buffer recovery mode. The button turns orange (or yellow) while you are in this mode.
7. Press the Service Pin button on the router that the network interface is connected to.
8. The log area of the MPR-50 Buffer Management utility main window shows “Buffer configuration complete” when the buffers have been successfully modified.
9. Press the Service Pin button on another of the MPR-50’s routers. If you don’t see that this Service Pin message is received, make sure that the router is in Repeater Mode (see step 3).
10. The log area of the MPR-50 Buffer Management utility main window shows “Buffer configuration complete” when the buffers have been successfully modified.
11. Repeat steps 9 and 10 until you have fixed the buffers for all five routers.
12. If you want to use the default buffer size of 114 bytes, proceed to step 18. Otherwise, proceed to the next step.
13. Click the **Buffer Recover Mode** button to OFF to leave buffer recovery mode. The button turns grey.
14. Select the buffer size that you want from the Buffer Configurations area of the MPR-50 Buffer Management utility main window.
15. Press the Service Pin button on all of the routers.

As you press each of the Service Pins, notice that the number displayed on the **Routers Found** button of the MPR-50 Buffer Management utility main window is incremented. When you see “\*5\*” on the **Routers Found** button, the utility has received all five of the MPR-50 routers’ Service Pin messages.

You must press the Service Pin for all of the MPR-50’s routers before the utility can configure their buffers.

If the utility does not recognize all of the routers’ Service Pin messages, then the MPR-50 is likely not in Repeater Mode (see step 3).

You can click the **Routers Found** button to clear the list of registered routers.

16. Click the **Buffer Configure** button on the MPR-50 Buffer Management utility main window to change the buffer sizes.

17. The log area of the MPR-50 Buffer Management utility main window shows “Buffer configuration complete” when the buffers have been successfully modified.
18. Click the **Routers Found** Button to clear the list of registered routers.
19. Press each MPR router service pin. The buffers sizes are displayed in the Log Box.
20. When the buffer configuration is complete, click **Exit** to close the MPR-50 Buffer Management utility.

### Changing the Utility’s Buffer Sizes

The utility uses a text file that presents up to four separate “Buffer Configurations”. This is a comma-separated value (CSV) file that contains an informational header plus various buffer configuration fields. The file name is “buffconfig.csv”, and you can edit it with a text editor or a spreadsheet application (such as Microsoft Excel). This file must exist in the same folder as the utility’s executable file. Also provided is an alternative CSV file that shows how to support 255 byte buffers (see the “Alternate CSV” sub-directory). Table 1 shows an example of the file layout.

**Table 1. Buffer Configuration File**

# This is a comment.									
NodeID	Name	NetBuff Size	AppBuff Size	NetBuffIn Count	NetBuffOut Count	NetBuffOut PriCount	AppBuffInCount	AppBuffOut Count	AppBuffOut PriCount
EXTFT10	66 Bytes	66	42	7	7	2	2	2	1
INTDIFF	66 Bytes	66	42	5	11	0	2	2	0
EXTTP12	66 Bytes	66	42	127	191	63	2	2	1
EXTFT10	114 Bytes	114	42	5	3	1	2	2	1
INTDIFF	114 Bytes	114	42	3	5	0	2	2	0
EXTTP12	114 Bytes	114	42	47	127	31	2	2	1

The “NodeID” field must contain one of the following values:

- EXTFT10
- INTDIFF
- EXTTP12

The “Name” field is used to create one of the four unique buffer configurations that appear in the “Buffer Configurations” area of the utility.

The rest of the fields refer to standard Neuron buffer configurations values. The order of the rows in the file are only important in that the first three entries are used to set the default values. However, the order of the columns are important because they are always assigned in the order that matches the descriptors listed in the table (the program doesn’t use these descriptors; they are purely informative for the CSV file).

For each unique configuration “Name” value, there should be 3 entries, one for each NodeID. The utility checks all values against the acceptable buffer configuration

values, and rejects any that are out of range, including Network buffer sizes that aren't consistent within a specific configuration. If you attempt to use a buffer configuration that exceeds the available RAM for the particular NodeID type, the utility displays an error and the configuration will not proceed.

The utility communicates with the router nodes using Neuron ID addressing on the zero-length domain. As each router is configured, the utility resets it before proceeding to the next router.



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