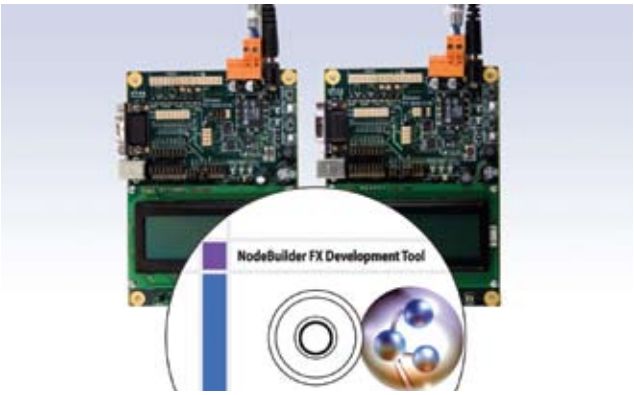
NodeBuilder® FX Development Tool
Model 10020R-40-24, 10020R-40-27, 10020R-40-34, and 10050-40



- ▼ Available in free topology (FT), power line (PL), classroom, and software-only versions
- ▼ FT and PL versions include a hardware platform (PL) or platforms (FT) for initial application development and testing
- ▼ FT and PL versions include sample I/O hardware with a 4x20 character LCD display for easy I/O prototyping and testing
- ▼ CD version available for use with your custom hardware
- ▼ Neuron® C Version 2.2 compiler supports up to 254 network variables for Series 5000 and 3100 chips, and supports interrupts for Series 5000 chips
- ▼ Resource editor displays available functional profiles, network variable types, and configuration property types, and can be used to create new functional profiles and types
- ▼ Code wizard automatically generates Neuron C code to implement an easy-to-integrate device interface
- ▼ Code editor provides easy editing of device application source code
- ▼ Project manager manages device definitions and builds applications
- ▼ ISI library lets you create devices that install themselves without the use of an installation tool
- ▼ LonMaker® Turbo Integration Tool installs development and production devices into networks, simplifying network integration and testing
- ▼ LonScanner® Protocol Analyzer LNS Turbo Edition captures, analyzes, characterizes, and displays network packets so you can pinpoint network or device faults and identify potential solutions
- ▼ LNS® Device Plug-in Framework Developer's Kit lets you develop and redistribute LNS plug-ins written in a Microsoft .NET programming language such as C# or Visual Basic.NET that make your devices much easier to install and configure

Description

The NodeBuilder FX Development Tool is a complete platform for developing, debugging, testing, and maintaining LonWorks devices based on the Series 5000 and 3100 Neuron® Processors and the Series 5000 and 3100 Smart Transceivers. You can use the NodeBuilder tool to create many types of devices, including VAV controllers, thermostats, washing machines, card-access readers, refrigerators, lighting ballasts, blinds, and pumps. You can use these devices in a variety of systems including building and lighting controls, factory automation, energy management, and transportation systems.

There are four NodeBuilder FX products: the NodeBuilder FX/FT Development Tool, the NodeBuilder FX/PL Development Tool, the NodeBuilder FX/FT Classroom Edition, and the NodeBuilder FX CD. The NodeBuilder FX/FT Classroom Edition is for educational-use only. The NodeBuilder FX CD is for developers who do not require development hardware such as NodeBuilder 3.1 users or Mini FX users who want to upgrade from an evaluation kit to a development kit (the NodeBuilder FX/FT tool and Mini FX/FT kit both include FT 5000 Evaluation Boards).

All four products include a complete suite of device development software for Windows Vista or Windows XP. The following table summarizes the components in the four NodeBuilder FX products:

Component	FX/FT and FX/PL Development Tools	FX/FT Classroom Edition	FX CD
NodeBuilder Development Tool CD	☑	☑	☑
Development Platforms*	☑	☑	
LonMaker Integration Tool Professional Edition CD (includes Microsoft Visio 2003 Professional)	☑		☑
LonMaker Integration Tool Standard Edition CD (includes Microsoft Visio 2003 Standard)		☑	
LonScanner Protocol Analyzer LNS Turbo Edition CD	☑	☑	☑
U10/U20 USB Network Interface	☑	☑	

* The NodeBuilder FX/FT Development Tool and Classroom Edition include two FT 5000 EVBs. The NodeBuilder FX/PL Development Tool Full Edition includes one LTM10A Hardware Platform, one NodeBuilder Gizmo 4 I/O Board, and one LonWorks Module Application Interface (for development of PL devices).

The following sections describe each of the components.

NodeBuilder Software

The NodeBuilder software lets you create, debug, test, and maintain applications for LonWorks devices based on an Echelon Series 5000 or 3100 Neuron Processor or an Echelon Series 5000 or 3100 Smart Transceiver. Using the NodeBuilder FX software, you write your device applications using the Neuron C Version 2.2 programming language, a high-level language based on ANSI C with extensions to simplify network communication, hardware I/O, and event-driven processing. Version 2.2 of the Neuron C language introduces support for up to 254 static network variables and 127 network variable aliases per device for devices based on a Series 5000 or 3100 chip with Neuron Firmware version 16 or newer, subject to available memory.

For Series 5000 applications, Neuron C Version 2.2 also introduces support for application-specific interrupt handlers and a hardware semaphore that can be used for interrupt task synchronization. Interrupt sources include signals on any of the twelve I/O pins (rising edge, falling edge, either edge, positive or negative level), the high-performance on-chip timer and counter units, and a dedicated, configurable, high-performance, periodic system timer.

The NodeBuilder FX software includes the following tools:

- **NodeBuilder Resource Editor**—View standard types and functional profiles, and create user-defined types and profiles if the standard resource files do not include the resources you need.
- **NodeBuilder Code Wizard**—Use a drag-and-drop interface to create your device's interface and then automatically generate Neuron C source code that implements the device interface and creates the framework for your device application. The code wizard saves days of development for every new device.
- **NodeBuilder Editor**—Edit the Neuron C source code generated by the Code Wizard to create your device's application.
- **NodeBuilder Debugger**—Debug your application with a source-level view of your application code as it executes.
- **NodeBuilder Project Manager**—Build and download your application image to your development platform or to your own device hardware.
- **ISI Developer's Kit**—Develop ISI devices that use the Interoperable Self-Installation (ISI) protocol to install and organize themselves into networks automatically or at the push of a button, all without the use of a separate installation tool.
- **LNS Device Plug-in Framework Developer's Kit**—Develop and redistribute LNS plug-ins written in a Microsoft .NET programming language such as C# or Visual Basic .NET. Plug-ins make your devices much easier to install and configure. LNS is the standard network operating system for managed LonWorks networks.

LonMaker Integration Tool Turbo Edition

The LonMaker tool is an integral part of the NodeBuilder FX Development Tool that you can use to load, install, connect, configure, test, and update the devices in your project. It is a software package for designing, installing, and maintaining 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 LonMaker tool is compatible with a number of LNS plug-ins, including the NodeBuilder Project Manager.

You can use the LonMaker tool to manage all phases of a network's life cycle, from the initial design and commissioning to the ongoing operation. You can use the same LonMaker tool during development and to install, maintain, and operate devices in the field, simplifying the transition from development to production.

LonScanner Protocol Analyzer LNS Turbo Edition

The LonScanner Protocol Analyzer is a software package that provides network diagnostic tools that you can use to observe, analyze, and diagnose the behavior of installed LonWorks networks, including networks with devices that you have built with the NodeBuilder tool. You can use the LonScanner tool with the U10 or U20 USB network interface included with the NodeBuilder FX/FT and FX/PL Tools, and you also use it with other network interfaces including all layer-2 OpenLDV compatible network interfaces or an IP-852 (ISO/IEC 14908-4) network interface.

FT 5000 EVB Evaluation Board

Two FT 5000 EVB Evaluation Boards are included with the Model 10020R-40-24 NodeBuilder FX/FT Development Tool and the Model 10020R-40-34 NodeBuilder FX/FT Classroom Edition. The FT 5000 EVB is a complete Series 5000 LonWorks device that you can use to evaluate the LonWorks 2.0 platform and create LonWorks 2.0 devices. The FT 5000 EVB includes an FT 5000 Smart Transceiver with an external 10 MHz crystal (you can adjust the internal system clock speed from 5MHz to 80MHz), an FT-X3 communication transformer, 64 KB external serial EEPROM and flash memory devices, and a 3.3V power source. The FT 5000 EVB features a compact design that includes the following I/O devices that you can use to develop prototype and production devices and test the FT 5000 EVB example applications:

- 4-line x 20-character LCD display
- 4-way joystick with center push button
- 2 push-button inputs
- 2 LED outputs
- Light-level sensor
- Temperature sensor

An FT 5000 EVB I/O library is included with the NodeBuilder software that provides easy-to-use high-level functions for accessing the display, light-level sensor, and temperature sensor.

The FT 5000 EVB Evaluation Board also includes an EIA-232/TIA-232/RS-232 interface and a USB interface that you can use to connect the board to your development computer and perform application-level debugging (only one of the two serial interfaces can be used at a time).

Each FT 5000 EVB also features a connector for optional in-circuit programming of the external non-volatile memory of the FT 5000 Smart Transceiver on the board. This allows fast application downloads to the external non-volatile memory.

LTM-10A Platform

The LTM-10A Platform is included with the Model 10020R-40-27 NodeBuilder FX/PL Development Tool. It is a complete LonWorks device with downloadable flash memory and RAM that you can use for application and prototype I/O hardware testing.

The LTM-10A Platform includes an LTM-10A Flash Control Module that you can design into your prototypes and products. The LTM-10A module includes a Neuron 3150 Chip, 64 KB flash memory, 32 KB static RAM, 10 MHz crystal oscillator (providing a 5MHz internal system clock), and custom Neuron firmware. The custom firmware allocates the memory to the Neuron Chip 64 KB address space and automatically initializes the transceiver interface for standard transceivers. The NodeBuilder tool can load your application image into the RAM or flash memory of the LTM-10A module. An application image loaded into the flash memory is preserved when the module is powered down. An application image loaded into the RAM is preserved when the module is reset, but not when it is powered down. You can use the Neuron C Debugger to debug applications running in the RAM or flash memory; however, you should debug your application running in RAM because extensive debugging in the flash memory can cause the flash memory to fail.

The LTM-10A Platform also includes a PLM-22 power line transceiver with external power line coupler for attaching the platform to a LonWorks network. Two power line couplers are included, one for line-to-earth coupling and one for line-to-neutral coupling.

NodeBuilder Gizmo 4 I/O Board

The NodeBuilder Gizmo 4 I/O Board is included with the Model 10020R-40-27 NodeBuilder FX/PL Development Tool. It is a collection of I/O devices that you can use with the LTM-10A Platform for developing prototype devices and I/O circuits, developing special-purpose devices for testing, or running the NodeBuilder examples. The following picture shows the Gizmo 4 plugged into the LTM-10A Platform:

You can also plug a TP/FT-10 or TP/FT-10F Control Module into the Gizmo 4 to create a self-contained LonWorks device. This requires separate purchase of the TP/FT-10 or TP/FT-10F Control Module.

The Gizmo 4 includes the following I/O devices:

- 4-line x 20-character LCD display
- Two 10-bit resolution analog inputs with screw terminal connector
- Two 8-bit resolution analog outputs with screw terminal connector
- Two digital inputs with screw terminal connector and pushbutton inputs
- Two digital outputs with screw terminal connector and LED outputs
- Digital shaft encoder
- Piezoelectric transducer
- Real-time clock
- Temperature sensor

A Gizmo 4 I/O library is included with the NodeBuilder software that provides easy-to-use high-level functions for accessing the display, analog I/O, piezo transducer, real-time clock, and temperature sensor.

LonWorks Module Application Interface

The LonWorks Module Application Interface (MAI) is included with the Model 10020R-40-27 NodeBuilder FX/PL Development Tool. It is an interface board that is plug compatible with the LonWorks TP/FT-10, TP/FT-10F, TP/XF-78, TP/XF-78F, TP/XF-1250, and LTM-10A Control Modules. The MAI replaces the control module in a custom device so that the LTM-10A Platform can be used to debug the custom hardware. This simplifies testing since the application can be easily downloaded to the LTM-10A Platform during development and testing. Once the application has been debugged, the MAI can be replaced by the control module with the application programmed into the control module's PROM or flash memory.

U10/U20 USB Network Interface

The U10 USB Network Interface is included with the Model 10020R-40-24 NodeBuilder FX/FT Development Tool and the Model 10020R-40-34 NodeBuilder FX/FT Classroom Edition. The U20 USB Network Interface is included with the Model 10020R-40-27 NodeBuilder FX/PL Development Tool. The U10 and U20 USB Network Interfaces are low-cost, high-performance LonWorks interfaces for USB-enabled computers and controllers.

The U10 USB Network Interface connects directly to a TP/FT-10 Free Topology Twisted Pair (ISO/IEC 14908-2)

LonWorks channel through a compact removable connector. The U20 USB Network Interface connects to a PL-20 C-Band Power Line (ISO/IEC 14908-3) LonWorks channel through an included power supply with integrated power line coupler. The U20 USB Network Interface can also be connected directly to 10.8-18VDC power systems (such as those in automobiles, trucks and buses) without a coupling circuit, or to virtually any powered line through a customer-supplied coupler/power supply.

The USB Network Interfaces can be used with virtually any computer-based LonWorks application, including all LNS and OpenLDV based applications such as the NodeBuilder tool, LonMaker tool, and LonScanner Protocol Analyzer.

Software Specifications

PC requirements	Description
Operating System	Microsoft Windows Vista or Windows XP
Minimum Hardware	Intel® Pentium® III 600MHz processor or faster, and meeting the minimum Windows requirements for the selected version of Windows; 2GB RAM for Windows Vista, 512MB RAM for Windows XP; CD-ROM drive; 1024x768 or higher-resolution display with at least 256 colors; mouse or other Windows-compatible pointing device; 300 to 550 megabytes (MB) free hard-disk space, plus the minimum Windows requirements for the selected version of Windows
Compatible LNS Network Interfaces and IP-852 Routers	OpenLDV compatible local and remote network interface or IP-852 router. Compatible local network interfaces include the U10/U20 USB network interface (included with the NodeBuilder FX/FT and FX/PL Development Kits and the NodeBuilder FX/FT Classroom Edition); PCC-10, PCLTA-20, or PCLTA-21 network interfaces; and the SLTA-10 Serial LonTalk Adapter. Compatible remote network interfaces include the *i*.LON® SmartServer, *i*.LON 100 e3 plus Internet Server, *i*.LON 600 LonWorks IP Server, or *i*.LON 10 Ethernet Adapter. Compatible IP-852 routers include the *i*.LON SmartServer with IP-852 routing, *i*.LON 100 e3 plus Internet Server with IP-852 routing, or an *i*.LON 600 LonWorks IP Server. If you are using an IP-852 router, your computer must have an IP network interface such as an Ethernet card or modem with PPP software. In addition, the *i*.LON software must be installed on your computer, and the IP-852 channel must be configured using the LonWorks-IP Configuration Server application software.
Neuron C I/O Objects	Bit, byte, nibble input/output Bitshift input/output Dallas Touch input/output Dual slope input (for low-cost A/D) Edge divide output Edgelog input Frequency output Infrared input Infrared pattern output I^2C input/output Level detect input Magcard bitstream input Magcard track 1 and 2 input (for ISO 7811 input) Muxbus input/output (multiplexed address/data) Neurowire input/output (National Semiconductor Microwire and Motorola SPI compatible) Oneshot output, ontime input, period input, pulsewidth output Parallel input/output Pulsecount input/output Quadrature input SCI (UART) Serial input/output* SPI serial input/output* Serial input/output Totalcount input Touch input/output (Maxim/Dallas 1-Wire® protocol compatible) Triac and stretched triac** output Triggeredcount output Wiegand input

Neuron C Network Communication Extensions	Functional Blocks Network Variables Configuration Properties Application and Foreign-Frame Messages

* For Series 5000 and 3100 Smart Transceivers and Neuron Chips with hardware SCI and SPI support only.

** For Series 5000 SmartTransceivers and Neuron Chips with stretched triac support only.

FT 5000 EVB Specifications

Function	Description
Processor	FT 5000 Smart Transceiver
Processor Input Clock	10MHz (5MHz to 80MHz system clock)
Processor Memory	64 KB on-chip RAM, 16 KB on-chip ROM, 64 KB external serial flash memory, and 64 KB external serial EEPROM mapped to 64 KB Neuron memory space based on NodeBuilder hardware template definition
Operating Input Voltage	+9 to 12VDC unregulated
External I/O Power	Combined +5V and +3.3V current not to exceed 100mA
External Power Supply	100 to 240VAC; 50 or 60Hz
Operating Temperature	0 to +45°C
Non-operating Temperature	-20 to +70°C
Dimensions	140mm x 105mm x 30mm
EMC Compliance	EN 55022 Class A

LTM-10A Platform Specifications

Function	Description
Processor	Neuron 3150 Chip
Processor Input Clock	10MHz (5MHz system clock)
Processor Memory	64 KB flash memory and 32 KB RAM mapped to 64 KB Neuron memory space in 3 memory configurations
Power Input	+5VDC ±5% regulated 3A minimum (power supply not included)
External I/O Power	+5VDC @ 100mA typical
Operating Temperature	0 to +55ºC with enclosure 0 to +70ºC in free air
Non-operating Temperature	-20 to +70ºC
Dimensions	198mm x 145mm x 53mm
EMC Compliance	EN 55022 Class A

Documentation

The following on-line documentation is included with the NodeBuilder tool. The documentation provides an overview of the development of LonWorks applications for the Neuron Chip and Echelon Smart Transceiver and of the development of LNS device plug-ins for configuring applications.

Document	Echelon Part Number
FT 5000 EVB Examples Guide	078-0389-01
FT 5000 EVB Hardware Guide	078-0390-01
Gizmo 4 User's Guide	078-0191-01
I/O Model Reference for Smart Transceivers and Neuron Chips	078-0392-01
Introduction to the LonWorks Platform	078-0183-01
LNS Plug-in Programmer's Guide	078-0393-01
LTM-10A User's Guide	078-0132-01
LonMaker User's Guide	078-0168-02

Neuron Assembly Language Reference	078-0399-01
Neuron C Programmer's Guide	078-0002-02 (printed copy shipped upon receipt of product registration)
Neuron C Reference Guide	078-0140-02 (printed copy shipped upon receipt of product registration)
Neuron Tools Errors Guide	078-0402-01
NodeBuilder FX User's Guide	078-0405-01
NodeBuilder FX/PL Examples Guide	078-0403-01
NodeBuilder Resource Editor User's Guide	078-0194-01
Series 5000 Chip Data Book	005-0199-01

Ordering Information

Four NodeBuilder FX products are available. Hardware development platforms are included with three of the products, and the hardware platforms are also available separately. Free e-mail technical support and on-line training is available. Additional support and training options are available. See www.echelon.com/support and www.echelon.com/training for support and training details or contact your local Echelon representative or distributor.

Product	**Echelon Model Number**
NodeBuilder FX/FT Development Tool	10020R-40-24
NodeBuilder FX/PL Development Tool	10020R-40-27
NodeBuilder FX/FT Classroom Edition	10020R-40-34
NodeBuilder FX CD	10050-40
FT 5000 EVB Evaluation Board	28022R
LTM-10A/PL-20 Platform	65150R-270
Gizmo 4 I/O Board	28004R