# GE Digital Energy

# MultiLink™ Hardened Ethernet Switches

# Ethernet Communications for Industrial Automation, Power Utility & Traffic Control Markets

The MultiLink family is a superior line of Hardened Ethernet Switches that has the flexibility and features to fit all of your Industrial, Substation, and Transportation Networking needs. The MultiLink line of Managed and Unmanaged switches are designed for the unique needs of the protection and control industry and are unsurpassed in the areas of Network Security, Industrial Robustness and Network Reliability. The EnerVista Suite of Software products that support the MultiLink switches will simplify the configuration and diagnosing of your MultiLink switches and allow the data and alarms from your MultiLinks to be integrated into your monitoring and control systems.

## Key Benefits

- Physically hardened and environmentally ruggedized for reliability in harsh environments
- Harsh chemical environment option available for circumstances that are corrosive or otherwise damaging to electronic equipment
- Enables cyber protection and network integrity with advanced security features
- Forensic auditing of activities and changes using event logging
- Flexible options for Ethernet port and media types allow integration into any project requirement
- Supports intelligent traffic planning and integration with network management systems using a complete set of Ethernet switch management functions
- Support for high speed recovery of redundant LANs for mission-critical applications Simple, powerful, and easy configuration using web management software
- Fully supported and viewable using EnerVista™ Viewpoint Monitoring

## Applications

- Safely and reliably extends Ethernet networks to harsh production environments for utility and industrial applications
- Allows critical devices to be managed, analyzed, or controlled from a single location
- Enables high speed, redundant connections to GE Universal Relays

# (ge)

# Managed Networks

and a

- Supports SNMPv3, with full backwards compatibility for v1 & v2
- Traffic segregation and prioritization control via IEEE<sup>®</sup> 802.1p & IEEE 802.1Q
- Hardware and software alarm contacts for detection of critical network or switch events
- Fully integrates with Viewpoint Monitoring software

# Ease of Use

- Support for industrial protocols
- IP out-of-the-box for easy installation
- Simple but powerful web management interface for all configuration functions

# Secure

- Secure management via SSL
- Port security prevents unauthorized devices gaining access to the network
- Multi-level passwords with levels of privilege and command for different users or groups
- Complete event logging for forensic and regulatory auditing and reporting

# Industrially Hardened

- UL<sup>®</sup> listed/CE agency approved
- IEC<sup>®</sup> 61850 & IEEE 1613 for operation in electric substation environments
- Redundant and mixed power supply options for increased reliability
- Harsh chemical environment options ensures product function and viability
- RoHS (Reduction of Hazardous Substances)
   compliant

# Ethernet Switches Designed for the Unique Needs of Critical Infrastructures

#### Designed for the Needs of Protective Relaying

The MultiLink Ethernet Switches have been designed for the specific requirements of devices used in utility and industrial environments, such as protective relays. MultiLink Ethernet Switches support many unique features that allow for full redundancy under network fault conditions.

#### Link Loss Alert

The MultiLink Ethernet Switch family's Link Loss Alert feature allows for protective relays to recover from situations where only one of the fiber cables connected to the relay is damaged. The Link Loss Alert feature works with both 10Mbit and 100Mbit fiber ports of GE's Multilin™ Universal Relay, and allows for seamless switching to the relay's secondary port under all network fault conditions.

#### **Modbus Protocol Support**

Identifying network communication problems and retrieving network statistics from the MultiLink Ethernet Switches can now be achieved in SCADA or DCS systems through the use of the supported Modbus TCP/IP protocol. Modbus is a protocol supported by most Human Machine Interfaces and PLC's and can therefore be integrated into existing systems without having to invest in additional SNMP or other Network Management Software.

#### Enhanced High Speed Recovery of Redundant Ring Networks

The unique requirements of the Protection and Control Industry require Ethernet networks to be more reliable and to recover from network problems faster than is generally accepted in other commercially available equipment. The MultiLink Ethernet Switch's SMART RSTP feature allows for recovery from faults in ring network architectures in less than 5 milliseconds per switch in the network – 10 times faster than generally available in standard Ethernet switches.



Link Loss Alert allows recovery from a broken fiber connection in both 10Mbit and 100Mbit applications.

Network Fault Recovery Using	MultiLink Ethernet Switches



Fault Between Switches	Recovery Time Per Switch (Hop)
SW1-SW2	1.90 ms
SW2-SW3	2.12 ms
SW3-SW4	2.11 ms
SW4-SW5	2.29 ms
SW5-SW6	1.95 ms
SW6-SW7	2.06 ms
SW7-SW8	2.18 ms
SW8-SW9	1.82 ms
SW9-SW10	2.27 ms
SW10-SW1	0.00 ms

Network recovery times.

Example of network fault recovery testing using MultiLink SMART RSTP in a ring network architecture.

# Robust Ethernet Switches for Providing Secure and Reliable Networks

#### Ideal for Harsh Environments

GE's MultiLink Ethernet Switches have been tested and certified to meet the same rigorous environmental standards as all of our protection relays and meters.

- Operating temperature -40°C to +85°C without fans
- Type tested to IEC 61850-3, IEEE 1613 Class 2, NEBS level 3 substation requirements
- IP40 Rated
- Dual power supply option with the ability to mix the input sources used (i.e. 48 VDC and 125 VDC)

#### **Enhanced Security**

The MultiLink family of Ethernet Switches have implemented the most advanced techniques available for providing security in network communications including:

- SNMP v1/v2/v3 supplying secure access to network devices through authentication, and encryption
- Imbedded RADIUS and TACACS+ security for remote access and password verification
- SSL web encryption preventing eavesdropping, tampering or message forgery
- Port security through the disabling of packets from unauthorized MAC addresses
- Logging of events and sending email notification of unauthorized access attempts

#### **Full Network Management Capabilities**

The MultiLink Ethernet Switches support most 802.1 network management features and are configurable using the Command Line Interface (CLI) and through our web management interface. Management functionality includes:

- SNMPv3 for secure configuration of network switches
- Full support of the CLI commands
- Web management interface for user-friendly configuration and monitoring
- RSTP (802.1w) industry standard method for providing recovery of redundant networks
- SMART RSTP (ring only mode) for enhanced fast recovery (<5ms/hop) of ring architecture networks
- RMON for monitoring of network status and statistics
- VLAN (802.1Q) providing the ability of segregating the network into smaller virtual networks (up to 256)
- QoS- (802.1Q) for prioritization of network traffic
- Port mirroring, assisting network troubleshooting
- IGMP snooping, enabling reductions in multicast traffic
- SNTP for synchronizing the switch's internal clock
- SMTP providing email notification when problems in the network have occurred
- Event logs creating a historical record of events occurring on the network
- IPv6 support, allowing for more addressable devices in a network

# EnerVista Viewpoint Monitoring and Integrator Supported

The MultiLink Ethernet Switches are fully supported by the EnerVista Viewpoint Monitoring and Integrator software packages, allowing integration of LAN status, network alarm problems, and security alerts into your monitoring and control system.



EnerVista Viewpoint Monitoring provides monitoring of the status of all network ports, indication of network problems and alarming of unauthorized network access attempts.

# EnerVista Web Interface Provides User-Friendly Configuration and Network Monitoring

#### Easy-to-Use Web Configuration and Reporting Software

The EnerVista Web configuration software allows programming of all settings in the MultiLink Ethernet Switches using a simple web browser. Accessible by typing the pre-configured IP address of your switch into the address bar of a web browser, the user-friendly graphical interface allows for easy navigation, monitoring and configuration through simple point and click operations.

#### **Communication Status & Port Navigation**

- Instant graphical indication of the status of all communication ports
- Identify the configuration of all communication parameters
- The ability to click on any of the shown Ethernet terminals to jump immediately to the settings screen for that port



#### Intuitive Menu-Driven Configuration

- Navigate through configuration screens using an easy to understand categorized menu tree
- Configure all settings using menu-driven pull-down fields
- Program alarm triggers by selecting from a list of all possible conditions
- Eliminate the need to memorize any CLI commands

#### Powerful Troubleshooting Statistics

- Monitor traffic statistics using intuitive bar graph representations
- Identify the amount and type of traffic sent and received through each port of the switch
- Simplify troubleshooting by identifying the number of CRC errors, collisions, and dropped packets occurring on each port
- Clear and restart the capturing of port statistics to allow for the troubleshooting of specific network problems





# Managed Switches

The MultiLink ML3000 Series, ML2400, ML1600, ML1200, ML810 and ML800 Managed Ethernet Switches provide extremely reliable networks with very fast reconfiguration times for recovering from faults occurring in the network. The complete set of network management functions available provides the configurability and monitoring capability needed for most applications, while the high level of security features available ensures your network is protected from tampering or illegal access.

ML810

#### ML3000 Series

ML3000 Series supports (model dependent): Up to 32 ports 10/100 Mbit copper RJ45 Up to 16 ports 10 or 100 Mbit fiber Up to 8 ports GigE fiber or copper Up to 18 fiber ports depending on configuration 1588v2 timing Redundant power supplies Field replaceable power supply models available



ML810 supports: 8 ports 10/100 Mbit copper RJ45 4 ports LC, ST, SC or MTRJ fiber 2 ports 1 Gbit fiber or copper RJ45

# Unmanaged Compact Switch

The ML600 Unmanaged Ethernet Switch provides the ability to connect remote sites or stations that contain few Ethernet devices to your local network in a cost effective manner. The ML600 can be configured with several different port configurations allowing for use with many different device types and can be connected to other Ethernet switches, forming a ring architecture that provides redundancy throughout your critical networks.

#### ML600





ML600 supports: 6 ports 10/100 Mbit copper RJ45 2 ports 100 Mbit ST, or SC fiber High voltage AC power supply

PORT TYPE	TYPICAL DISTANCE	POWER BUDGET
10/100 Mbit RJ45 Copper	100 m	N/A
10 Mbit Multimode ST Fiber Optic	2 km	17 dB
100 Mbit Multimode ST Fiber Optic	2 km	14 dB
100 Mbit Multimode SC Fiber Optic	2 km	14 dB
100 Mbit Singlemode SC Fiber Optic	20 km	17.5 dB
100 Mbit Singlemode SC Fiber Optic	40 km	17.5 dB
100 Mbit Multimode LC Fiber Optic	2 km	14 dB
100 Mbit Singlemode LC Fiber Optic	15 km	17.5 dB
100 Mbit Multimode MTRJ Fiber Optic	2 km	14 dB

#### Port Selector Guide

1 Gbit RJ45 Copper	100 m	N/A
1 Gbit Multimode SC Fiber Optic	2 km	12.5 dB
1 Gbit Singlemode 1310nm SC Fiber Optic	10 km	10.5 dB
1 Gbit Singlemode 1310nm SC Fiber Optic	25 km	17.5 dB
1 Gbit Singlemode 1550nm SC Fiber Optic	40 km	17.5 dB
1 Gbit Singlemode 1550nm SC Fiber Optic	70 km	20.5 dB
100 Mbit Multimode MTRJ Fiber Optic	2 km	15.8 dB

### ML3000 Series

Supports up to 16, 10 or 100Mbit, ST, SC, LC or MTRJ Fiber Ports

Supports up to 8 Ports Gigabit Copper or Fiber and 1588v2 Timing



# Ordering

					210				100	ואר	bps		
			4		Gig				 -				
MI 7100 *	<b>.</b> .	**	1	4	2	3	4	5	6	7	8		NI 7100 Character with Independent Development in a
ML3100 * Mounting F				_	_	Î	Î		-				ML3100 Chassis with Integrated Power Supplies Front Mounted Ports
B	3												Rear Mounted Ports
Power Supply	ł	HX HH LX P1 P2 HL											Single Integrated 90 to 250V AC/DC Power Supply Dual Integrated 90 to 250V AC/DC Power Supplies Single Integrated 22 to 60 VDC Power Supply Dual Integrated 22 to 60 VDC Power Supplies Single Integrated 22 to 60 VDC Power Supply with PoE Support Dual Integrated 22 to 60 VDC Power Supply with PoE Support Dual Integrated 22 to 60 VDC Power Supply with PoE Support Dual Integrated 22 to 60 VDC Power Supply with PoE Support
Gigabit			A B C D E F G X		8000000	ABCDEFGX	ABCDEFGX						2 x 1000 RJ45 or SFP Combo Ports, Ports are Auto-Detect, No SFT Transceivers, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Multimode Fiber, 550m, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 2km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 2km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 2km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 2km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 40km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 70km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 70km, with 1588 Timing 2 x 1000 RJ45 or SFP Combo Ports, Populated with 2 x SFP Singlemode Fiber, 70km, with 1588 Timing
100Mbps								A O D B F O H J K L M N F Q F S T U V Y Z X	ACDEFGHJKLMNPORSTUWYZX	ACDEFGHJKLMNPQRSTUSYZX	O D E F G H J K L M N F Q F S T U V Y		4 x 10/100Mbit - RJ45 Copper         4 x 10/100Mbit - SL45 Copper with P0E+*         2 x 100Mbit - ST Multimode Fiber         2 x 100Mbit - ST Multimode Fiber         4 x 10/100Mbit - ST Multimode Fiber         4 x 100Mbit - SC Multimode Fiber         4 x 100Mbit - MTRJ Multimode Fiber         4 x 100Mbit - MTRJ Multimode Fiber         2 x 100Mbit - MTRJ Multimode Fiber         2 x 100Mbit - MTRJ Multimode Fiber         2 x 100Mbit - LC Singlemode Fiber 20km         4 x 100Mbit - LC Singlemode Fiber 20km         4 x 100Mbit - LC Singlemode Fiber 40km         4 x 100Mbit - LC Singlemode Fiber 40km         4 x 100Mbit - LC Singlemode Fiber 40km         5 X 100Mbit - LC Singlemode Fiber 40km         5 X 100Mbit - LC Singlemode Fiber 40km         5 X 100Mbit - LC Singlemode Fiber with 1588 Timing         2 x 100Mbit - LC Multimode Fiber with 1588 Timing         2 x 100Mbit - LC Multimode Fiber with 1588 Timing         2 x 100Mbit - LC Multimode Fiber with 1588 Timing         2 x 100Mbit - LC Multimode Fiber with 1588 Timing         2 x 100Mbit - LC Singlemode Fiber 20km with 1588 Timing         2 x 100Mbit - LC Singlemode Fiber 20km with 1588 Timing         2 x 100Mbit - LC Singlemode Fiber 20km with 1588 Timing         2 x 100Mbit - LC Singlemode Fiber 20km with 1588 Timing         2 x 100Mbit - SC Singlemode Fiber 20km
Environment												×	None Harsh Chemical Environment Conformal Coating

#### ML810



# Ordering

ML810	- ** - ** -	** -	** -	** - **	Base Unit
Power Supply	250S 125S 48VS 48PS 24VS 12VS 125D 48VD 48PD 24VD 24VD 12VD HIAC				ML810 250VDC Chassis ML810 125VDC Chassis ML810 48VDC Chassis ML810 48VDC Chassis with PoE enabled ML810 24VDC Chassis ML810 12VDC Chassis - Dual Input PSU ML810 48VDC Chassis - Dual Input PSU ML810 48VDC Chassis - Dual Input PSU ML810 48VDC Chassis - Dual Input PSU ML810 24VDC Chassis - Dual Input PSU ML810 12VDC Chassis - Dual Input PSU ML810 120VDC Chassis - Dual Input PSU ML810 100 - 240 VAC
Mount	P				Panel Mount Kit DIN Mount Kit
SlotA	U	C1			4x 10/100 RJ45
SlotB			H1 H2 H3 H4 H5 H6 H7 XX		4x 10/100 RJ45 PoE-enabled ports (only with ML810-48PD models) 2x 1000Mb LC mm Fiber, SFP connector type 2x 1000Mb LC mm Fiber 2km, SFP connector type 2x 1000Mb LC sm Fiber 25km, SFP connector type 2x 1000Mb LC sm Fiber 40km, SFP connector type 2x 1000Mb LC sm Fiber 40km, SFP connector type 2x 1000Mb LC sm Fiber 70km, SFP connector type 2x 1000Mb LC sm Fiber 70km, SFP connector type 2x 1001Mb LC sm Fiber 70km, SFP connector type 2x 1001Mb LC sm Fiber 70km, SFP connector type 2x 1001Mb LC sm Fiber 70km, SFP connector type 2x 10/100/1000TK RJ45, fixed copper None
SlotC				C1 C2 C3 C4 C5 C6 C7 C8 CD CF CH C1 CK E1 E2 E4 E5 E6 E7 E8 E4 E5 E6 E7 E8 E8 E0 E1 E1 E2 E4 E5 E6 E7 E8 E8 E8 E8 E8 E8 E8 E8 E8 E8 E8 E8 E8	4x 10/100 RJ45 4x 10/100 RJ45 PCE-enabled ports (only with ML810-48PD models) 2x 10/100 RJ45 + 2x 100Mbit LC mm Fiber 2x 10/100 RJ45 + 2x 100Mbit LC sm Fiber 20km 2x 10/100 RJ45 + 2x 100Mbit SC mm Fiber 2x 10/100 RJ45 + 2x 100Mbit SC mm Fiber 2x 10/100 RJ45 + 2x 100Mbit SC mm Fiber 2x 10/100 RJ45 + 1x 100Mbit LC mm Fiber 3x 10/100 RJ45 + 1x 100Mbit LC sm 20km Fiber 3x 10/100 RJ45 + 1x 100Mbit LC sm 20km Fiber 2x 10/100 RJ45 + 1x 100Mbit LC sm 40km Fiber 2x 10/100 RJ45 + 1x 100Mbit LC sm 70km Fiber 2x 10/100 RJ45 + 1x 100Mbit LC sm 70km Fiber 2x 10/100 RJ45 + 1x 100Mbit LC sm 70km Fiber 2x 10/100 RJ45 + 2x 100Mbit LC sm 70km Fiber 2x 10/100 RJ45 + 2x 100Mbit LC sm 70km Fiber 2x 10/100 RJ45 + 2x 100Mbit SC sm Fiber 40km 2x 10/100 RJ45 + 2x 100Mbit SC sm Fiber 40km 4x 100Mbit ST mm Fiber 4x 100Mbit ST mm Fiber 4x 100Mbit SC sm 20km Fiber 4x 100Mbit LC sm 20km Fiber 4x 100Mbit LC sm 20km Fiber 4x 100Mbit LC sm 20km Fiber 1x 100Mbit LC sm 20km Fiber 2x 100Kbit LC sm 2
Coating				X H	none Harsh Chemical Environmental Option

Additional modules and configurations available. Please see the Online Store for the latest module availability.



6 - 10/100 Mbit Copper RJ45 Ports



4 - 10/100 Mbit Copper RJ45 Ports2 - 100 Mbit ST, or SC Fiber Ports

Additional modules and configurations available. Please see the Online Store for the latest module availability.

# Ordering

ML600	- **	- ** -	**	Base Unit
Power Supply	AC 48			External 100 - 240 VAC Adaptor 30 - 60 VDC Power Supply
	24			10 - 36 VDC Power Supply
Modules		XX B1 B2 B3 B4		None 6 × 10/100 Mbit - RJ45 Copper 2 × 100 Mbit - ST mm Fiber + 4 × 10/100 Mbit - RJ45 Copper 2 × 100 Mbit - SC mm Fiber + 4 × 10/100 Mbit - RJ45 Copper 2 × 100 Mbit - SC sm Fiber + 4 × 10/100 Mbit - RJ45 Copper
Conformal Coating Option			X H Z Y	Standard Environment Harsh Chemical Environment Conformal Coating ROHS Compliant ROHS Compliant with Harsh Chemical Environment Conformal Coating

### - Accessories for MultiLink Switches

•	Industrial Power System Communications Learning CD	TRCD-ICOM-C-S-1
٠	MultiNet Serial to Ethernet Converter	MultiNet-FE
•	EnerVista Integrator	EVI-1000

# GEDigitalEnergy.com

IEC is a registered trademark of Commission Electrotechnique Internationale. IEEE is a registered trademark of the Institute of Electrical Electronics Engineers, Inc. Modbus is a registered trademark of Schneider Automation. NERC is a registered trademark of North American Electric Reliability Council. NIST is a registered trademark of the National Institute of Standards and Technology.

GE, the GE monogram, Multilin, FlexLogic, EnerVista and CyberSentry are trademarks of General Electric Company.

GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

imagination at work

Copyright 2015, General Electric Company. All Rights Reserved.