MULTILINK ML2400

Guideform Specification

19" Rack Mounted Substation/Industrial Hardened Managed Ethernet Switch

The MultiLink ML2400 is a Substation/Industrial hardened Ethernet switch that is ideally suited for providing reliable network communications in harsh electrical and environmental conditions that are often found in Utility Substations or Industrial Facilities. Designed for the unique needs and requirements of the protection and control industry, the ML2400 has many unique features such as Link-Loss-Alert and SMART RSTP that allow for optimum and fast recovery of faults that can occur on a network.

The ML2400 has implemented the highest levels of Network Security available therein protecting your network by limiting access to the network and network management functions to only personnel and computers that have been authenticated through appropriate security measures.

The ML2400 is designed with a modular platform that provides for flexible configurations and multiple Ethernet media types on each Switch. This modularity allows for connections in many different applications and to many different devices that may be found in these substation or industrial locations. The ML2400 can have all communication ports mounted on the Front or Rear of the unit and supports all common copper and fiber optic Ethernet ports including ST, SC, LC, MTRJ, RJ45 with speeds of 10Mbit, 100Mbit and 1000Mbit per second.

Ethernet Ports Supported

Port Type	Quantity Available	Typical Distance	Wavelength	Transmit Power	Receive Sensitivity
10/100 Mbps RJ45 Copper	32	100 m	N/A	N/A	N/A
10 Mbps Multimode ST Fiber Optic	16	2 km	850 nm	-15 dB	-31 dB
100 Mbps Multimode ST Fiber Optic	16	2 km	1310 nm	-20 dB	-31 dB
100 Mbps Multimode SC Fiber Optic	16	2 km	1310 nm	-20 dB	-31 dB
100 Mbps Singlemode SC Fiber Optic	16	20 km	1310 nm	-20 dB	-31 dB
100 Mbps Singlemode SC Fiber Optic	16	40 km	1310 nm	-5 dB	-34 dB
100 Mbps Multimode LC Fiber Optic	12	2 km	1310 nm	-19 dB	-31 dB
100 Mbps Singlemode LC Fiber Optic	12	15 km	1310 nm	-15 dB	-28 dB
100 Mbps Multimode MTRJ Fiber Optic	12	2 km	1310 nm	-19 dB	-31 dB
1 Gbps RJ45 Copper	8	100 m	N/A	N/A	N/A
1 Gbps Multimode SC Fiber Optic	8	2 km	850 nm	-9.5 dB	-17 dB
1 Gbps Singlemode 1310nm SC Fiber Optic	8	10 km	1310 nm	-9.5 dB	-20 dB
1 Gbps Singlemode 1310nm SC Fiber Optic	8	25 km	1310 nm	-4.0 dB	-21 dB
1 Gbps Singlemode 1550nm SC Fiber Optic	8	40 km	1550 nm	-4.0 dB	-21 dB
1 Gbps Singlemode 1550nm SC Fiber Optic	8	70 km	1550 nm	-3.0 dB	-23 dB

Product Features

Security

SNMPv3 - SNMPv3 implies compliance to both SNMPv1 and SNMPv2 and includes additional functionality in the areas of Security and the ability to configure Switches remotely. SMNPv3 brings a high level of security not found in the previous versions that utilize both encryption and authentication of all management functions.

SSL - Secure Socket Layer ensures that secure access is made with the switch whenever any management functions are performed over a Web Interface connection. SSL is the same technology used by financial institutions to ensure all transactions are secure and free from eavesdropping.

Remote Access Security – Remote Access Security ensures that only specified users have access to the Switch's management functions. Once configured, SNMP commands sent to the Switch through the Web or through Telnet will only be accepted from specified MAC addresses.

CLI Password Security – Multi-Level CLI login access enhances security by defining the set of CLI commands that are accessible to the different users.

Port Security – Port Security prevents unauthorized access to the network by validating network traffic entering each port to a list of acceptable MAC addresses. The list of accepted MAC addresses can be entered by a system manager, or learned and controlled by the MultiLink Switch itself.

RADIUS (802.1x) – Remote Authentication Dial-In User Service is used to provide authentication and authorization to the network by comparing all network access attempts with a centralized RADIUS server. Using this feature enhances security of your network by protecting against access through point-to-point connections such as Wireless Access.

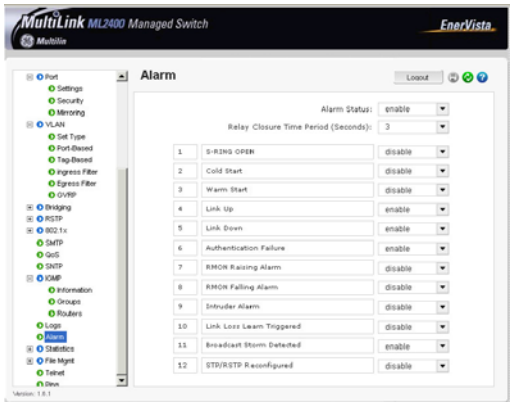
TACACS+ - Terminal Access Controller Access Control System provides authentication and authorization for routers and network access servers that are attempting to access the network and it's configuration.

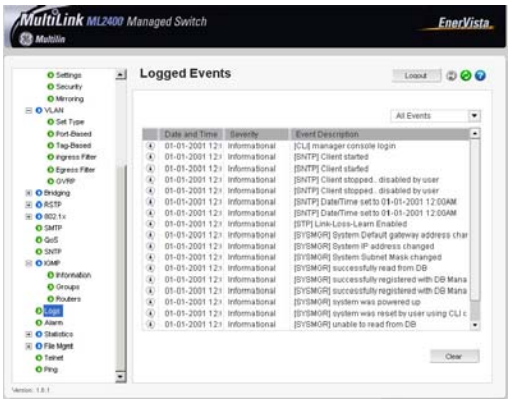
SMTP Email Alerts – The MultiLink ML2400 can be configured to send Email notification that will provide warnings of unauthorized network access attempts to System Administration personnel. Utilizing this functionality will provide greater visibility of any attempts to breach the security of your Ethernet Network.

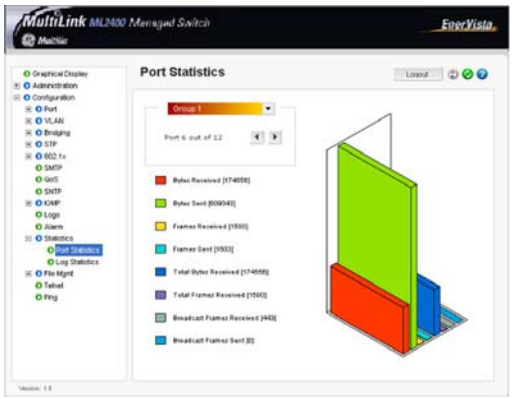
Network Management

SNMPv3 – Simple Network Management Protocol is an industry standard method for programming and managing Ethernet Switches. This protocol allows for configuring of switches made by different manufacturers by using standard network management system software (NMS). SNMPv1 and SNMPv2 define a set of instructions that can be used to configure settings, interrogate information from the switches, and send alerts upon detection of network problems. SNMPv3 defines the security required to prevent the switches from being accessed or altered by unauthorized users.

Web Management – The Multilink family of switches provide a simple, easy to use, graphical Web Management interface for all configuration and monitoring functions. The Web Manager allows for configuring and monitoring your Multilink switches from anywhere in your network using any standard Internet browser.







VLAN – Virtual Local Area Networks allow separation of a larger physical network in smaller Virtual networks in order to improve bandwidth allocation and optimize network efficiency. Virtual Local Area Networks will restrict broadcast, multicast and unicast traffic to only VLAN on which they reside thus preventing large amounts of broadcast traffic from degrading the entire network.

Quality of Service (802.1p) – Quality of Service (QoS) allows for prioritizing of network traffic so that critical traffic is allowed to jump ahead of normal network traffic that is buffered and transmitted on a First-Come-First-Serve basis. Network traffic priority classification can be made by Port, by Tag and by IP Type of Service (TOS).

Port Mirroring – Port Mirroring allows all of the traffic on any given port to be duplicated on a selected second port. Monitoring the traffic on this second port will help facilitate analysis or troubleshooting of selected network paths.

IGMP Snooping - Internet Group Management Protocol Snooping reduces the amount of multicast traffic passing through your switch by restricting these messages only to those ports that need to receive this traffic.

IPv6 - The ML2400 supports IPv6 that allows for addressing of a large number of devices in a single network.

RMON – Remote Monitoring is a standard monitoring specification that provides statistics and data exchange to remote sites for the purpose of network planning and network fault diagnosis.

SNTP - Simple Network Time Protocol provides a method for synchronizing the internal clocks of devices on an Ethernet LAN. Using this protocol, all MultiLink switches can have the time-tagging of events in their Event Log synchronized to allow for more accurate and precise troubleshooting of the entire network.

SMTP – Simple Mail Transfer Protocol supplies a means of instantly notifying network managers when events have occurred on the network that require immediate attention. Email alerts can be automatically sent by the MultiLink switches, indicating that part of the network may be down, an unauthorized network access attempt was made, along with many other user definable network events.

Event Log – The Event Log will store and timestamp all configuration changes and network problems that are detected by the Switch. The Multilink Switch can store up to 1000 events that can be used to analyze network problems and provide traceability to network configuration changes.

Alarm Contact – The MultiLink switches provide 2 Alarm contacts that can be used for identifying problems with the network or networking devices. The hardware alarm contact will change state upon the loss of control power or upon detecting of a critical problem with hardware within the switch. The software alarm contact can be configured to change state upon the detection of several user configurable events including, loss of one or more communication ports, detection of a broadcast storm, or illegal network access attempts.

IP Out-of-the-Box- The ML2400 is programmed to automatically have an IP address programmed when the switch is being used for the first time. The ML2400 will first detect if there is a DHCP severer is available on the network, and if so, it will receive its IP address from this server. If there is no DHCP server available, the ML2400 will assign itself the IP address 192.168.1.2.

Modbus – The Modbus protocol provides a means of integrating the data stored in the ML2400 such as the status of all ports, network data statistics, and alarm conditions, into existing HMI, SCADA, or DCS monitoring systems. Communicating to the switches using the Modbus protocol allows for retrieval of network data using the existing HMI Modbus drivers and without having to use additional SNMP or other servers.

Viewpoint Monitoring – The ML2400 is integrated into the Viewpoint Monitoring software that allows for monitoring of all network and switch data in your local HMI. Using this software, engineering staff will be able to monitor the status of all network ports, generate alarms of network problems, and identify the overall health of their entire communications network.

CLI – Command Line Interface provides a set commands that can be used for configuration and interrogation of switches. The MultiLink family of managed switches support the full set of CLI commands and also provides a help function for assisting CLI users.

Network Reliability

Link Loss Alert – The GE Multilin Universal Relay (UR) family and the F650 family of relays have redundant Ethernet ports that allow for automatic switching to their secondary ports when they detect that their primary path is broken. The MultiLink switches can compensate for situations where only the relay's Transmitter fiber cable is broken. Upon detection of the broken Transmit fiber, the ML2400 will cease sending a link pulse to the relay's Receive fiber cable, thereby allowing the relay to switch to its secondary port. The Link Loss Alert feature is available on both the **10Mbit and 100Mbit** fiber optic ports, thus allowing for recovery of a single broken fiber connected to any GE Multilin relay.

RSTP (IEEE 802.1w) – The MultiLink family of Ethernet Switches use the industry standard Rapid Spanning Tree Protocol for providing fast fault recovery of redundant ring or mesh Ethernet Networks. Using RSTP, the MultiLink switches will eliminate loops or redundant paths in network architectures and quickly reconfigure the network to these redundant paths in the event of a fault occurring in the primary path. Implementing the standards based RSTP allows the MultiLink Switches to seamlessly be used with other third party switches found in your network.

SMART RSTP – The MultiLink family of Ethernet Switches uses our SMART Rapid Spanning Tree mode for providing fault recovery of ring architecture networks with recovery times of less than 5ms per MultiLink Switch (hop). When other third party switches are found in the network or the architecture is modified into a configuration that is not a ring (i.e. mesh), the ML2400 will automatically revert to RSTP mode thus allowing interoperability with other switches on the network.

Power Supply - Redundant

The ML2400 has the option to be ordered with **Redundant Power Supplies** that allow for full redundancy of the power being supplied to the switches. The two power supplies ordered on the ML2400 can be of the same type (High-High) or can be a mix of the two options available (High-Low). This redundancy of power supplies allows for supplying of input power from two different sources, thus ensuring that the network will stay available even the case where one of the input sources is lost.

The High Voltage power supply on the ML2400 is dual AC and DC meaning the same power supply and power supply input terminals can be used for either AC or DC input power.

Power Supply Rating

AC Voltage	100 – 240 VAC
HI Voltage:	110 – 250VDC / 100 – 240VAC
LO Voltage:	36VDC – 60VDC

Substation/Industrial Robustness

GE Multilin brings the same degree of robustness and immunity to harsh electrical environments that we use for our protective relays to the MultiLink line of Substation and Industrial Ethernet Switches. All of the standard rigorous testing used to verify proper operation of our relays also are performed on our MultiLink Ethernet Switches while ensuring error free communications throughout the entire tests.

The MultiLink Ethernet Switches are compliant with all major International Standards for Networking Communications devices including:

IEC 61850-3	- Standards for reliability of communication networks and systems in Substations
IEEE 1613 CLASS 2	- Standards for the design of communication network equipment to be used in Substations and Industrial sites
NEBS Level 3	- Stringent test level required for high reliability in harsh environments and mission critical applications (Competitive Local Exchange Carriers)
ETSI Certified	- European Telecommunications Standards Institute that establishes requirements for operation of telecommunication equipment throughout Europe
NEMA TS2	- Stipulates the environmental requirements for traffic control equipment subjected to unregulated environmental conditions
MIL-STD-167	- Requirements for vibration for use of equipment on military equipment and environments

The MultiLink Ethernet Switches have approval from the following organizations:

UL Listed E156407	- UL Listed
CUL 60950-1	- Canadian UL Listed
CSA C22.2 No 60950	- CSA us Agency Approval
EN 60950	- CE Agency Approval
21 CFR Chapter 1	- FDA Agency Approval

Environmental Type Test Standards

STANDARD COMPLIANCE	TYPE TEST	DESCRIPTION	SEVERITY LEVEL
IEC 61850-3	CISPR22	Conducted and Radiated Emissions	Class A
	FCC 15	Conducted and Radiated Emissions	Class A
	EN55022A	Conducted and Radiated Emissions	Class A
	IEC 61000-4-2	Electrostatic Discharge	Level 4 - 8kV Contact/15kV Air
	IEC 61000-4-3	Radiated RFI	Level 3 – 10V/m
	IEC 61000-4-4	Fast Transient / Burst Immunity	Level 4 – 4kV @ 2.5 kHz
	IEC 61000-4-5	Surge Immunity	Class 4 – 2kV Line to Earth/1kV Line to Line
	IEC 61000-4-6	Conducted RF Immunity	Level 3 – 10Vrms
	IEC 61000-4-8	Magnetic Field Immunity	Level 5 – 100/200 A/m continuous
	IEC 61000-4-10	Damped Magnetic Immunity	Level 3 – 10 A/m
	IEC 61000-4-11	Voltage Dip/Voltage Interruption	0% 5000msec, 40% 120ms, 70% 10ms.
	IEC 61000-4-12	Damped Oscillatory Burst	Level 2 – 1kV common/1kV differential
	IEC 61000-4-16	Conducted RF Immunity	Level 3 – 15Hz-150KHz 1-10V
	IEC 61000-4-17	Power Supply Ripple	Level 3 – 10% Rated Voltage
	IEC 61000-4-29	Voltage Dips & Interrupts	All levels and durations passed Criteria B
IEEE 1613	IEEE C37.90.1	Fast Transient / Burst Immunity	Class 4 – 4KV all ports
	IEEE C37.90.1	Damped Oscillatory	2.5 KV common mode
	IEEE C37.90.2	Radiated RFI	35 v/m
	IEEE C37.90.3	Electro Static Discharge	8kV Contact/15kV Air
	IEEE C37.90	Dielectric Strength	5KV
	IEEE C37.90	H.V. Impulse	2000VAC
	IEEE C37.90	Rated Input Power	85% to 110% of rated
	IEC 60870-2-1	AC Voltage Ranges	+/- 10%
	IEC 60870-2-1	DC Voltage Ranges	+/- 15%
NEMA TS2	NEMA TS2	Non-destructive transient	1000V, 1 Ohm impedance
	NEMA TS2	Non-destructive transient	1000V, 1 Ohm impedance
	NEMA TS2	Power Transients –low repetition	600V, 1 Ohm impedance
	NEMA TS2 2.1.6.1	Power Transients – high repetition	300V, 2500W
	NEMA TS2 2.1.7.1	Transient I/O Terminals	300V, 100 Ohms impedance
	NEMA TS2 2.1.5	Humidity	-34 C to 74C, 10-95%
	NEMA TS2 2.2.9	Shock	10G, x, y, z axis
	NEMA TS2 2.1.2	Operating Voltage	Max nominal rating
	NEMA TS2 2.1.3	Operating Frequency	Nominal +/- 3 Hz
Environmental	IEC 60068-2-1	Cold Temperature	-40 deg startup for 16 hours
	IEC 60068-2-2	Dry Heat Temperature	+85 deg startup for 16 hours
	IEC 60068-2-30	Humidity Cyclic	Variant 2 - 6 day @ 93%
	IEC 60255-21-1	Sinusoidal Vibration	Class 1 - 10-150 Hz @ 1G
	IEC 60255-21-2	Shock	Class 2 – 30G bump, 20 G shock
MIL- STD	MIL-STD-167-1	Vibration	0.5G, 5-30 Hz

Physical Dimensions

	Imperial	Metric
Length:	17.0 inches	43.2 cm
Height:	1.7 inches	4.3 cm
Depth:	9.2 inches	2.9 cm

Ordering

ML2400	-	*	-	**	-	**	-	**	**	**	**	-	*	Base Unit
Module								A	B	C	D			
Port Mounting		F												Front Mounted Ports
		B												Rear Mounted Ports
Power Supply				AC										100-240 VAC Power Supply
				HI										110-250 VDC/100-240 VAC Power Supply
				LO										48 VDC Power Supply
Redundant Power Supply						XX								No Redundant Power Supply
						HI								110-250 VDC/100-240 VAC Power Supply
						LO								48 VDC Power Supply
Modules								A1	A1	A1	A1			4 x 10 Mbit - ST mm Fiber
								A2	A2	A2	A2			4 x 100 Mbit - ST mm Fiber
								A3	A3	A3	A3			4 x 100 Mbit - SC mm Fiber
								A4	A4	A4	A4			8 x 10/100 Mbit - RJ45 Copper
								A5	A5	A5	A5			2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A6	A6	A6	A6			2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A7	A7	A7	A7			2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A8	A8	A8	A8			2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper
								AA	AA	AA	AA			4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AB	AB	AB	AB			8 x 100 Mbit - LC mm Fiber
								AC	AC	AC	AC			4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AD	AD	AD	AD			8 x 100 Mbit - LC sm Fiber
								AE	AE	AE	AE			2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper
								AF	AF	AF	AF			2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber
								AH	AH	AH	AH			8 x 100 Mbit - MTRJ mm Fiber
								AJ	AJ	AJ	AJ			4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AK	AK	AK	AK			2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper
								G3	G3	G3	G3			1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber
								G4	G4	G4	G4			1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper
								G5	G5	G5	G5			2 x 1000 Mbit - SC mm Fiber
								G6	G6	G6	G6			1 x 1000 Mbit - RJ45 Copper
								G7	G7	G7	G7			1 x 1000 Mbit - SC mm Fiber 2km
								G8	G8	G8	G8			1 x 1000 Mbit - SC sm Fiber 10 km
								G9	G9	G9	G9			1 x 1000 SC sm Fiber 25km
								GA	GA	GA	GA			1 x 1000Mb SC sm Fiber 40km
								GB	GB	GB	GB			1 x 1000Mb SC sm Fiber 70km
								GC	GC	GC	GC			1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber
								GD	GD	GD	GD			1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper
								GE	GE	GE	GE			2 x 1000 Mbit - RJ45 Copper
								GF	GF	GF	GF			1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber
								GH	GH	GH	GH			1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper
								GJ	GJ	GJ	GJ			2 x 1000 Mbit - SC sm Fiber 10km
								GK	GK	GK	GK			1 x 1000Mb SC sm Fiber 25km + 2 x 100Mb - SC mm Fiber
								GL	GL	GL	GL			1 x 1000Mb SC sm Fiber 25km + 4 x 10/100Mb Copper
								GM	GM	GM	GM			2 x 1000Mb SC sm Fiber 25km
Harsh Environment													X	Standard Environment
													H	Harsh Chemical Environment Option