

Communications Reference Guide

Volume 1



Digital Energy
MDS | Lentronics

GEDigitalEnergy.com

Digital Energy

An aerial photograph of a city at sunset. The sun is low on the horizon, casting a warm orange glow over the city lights and the silhouettes of mountains in the distance. The sky transitions from a deep blue at the top to a bright orange near the horizon.

we protect and connect the world's **critical** equipment
to ensure **safe, reliable** power

Solving unique customer challenges

Protection & Control | Multilin

The Multilin line of power system protection and management solutions continues the rich tradition of GE's 100 years in protection & control. From generators to transmission lines to motors and beyond, we are dedicated to ensuring dependable and safe power worldwide.



Communications | MDS, Lentrionics

Through our MDS and Lentrionics communication devices, we are developing new technologies to deliver complete networking solutions for customers worldwide. From secure wireless communications to rugged Ethernet switches and robust data multiplexers, our products are designed to withstand the harshest environments.



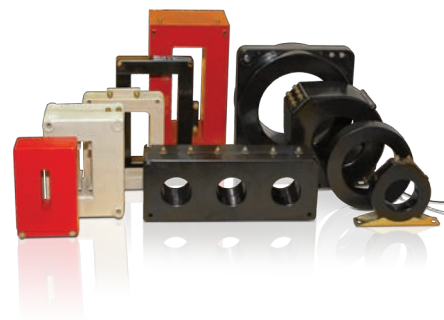
Power Quality | Zenith Controls

For mission critical processes that cannot be interrupted, customers worldwide rely on our industry-leading Zenith Controls line of power quality solutions. From Uninterruptible Power Supplies to Automatic Transfer Switches, Surge Suppression and Paralleling Switchgear, we ensure critical system reliability.



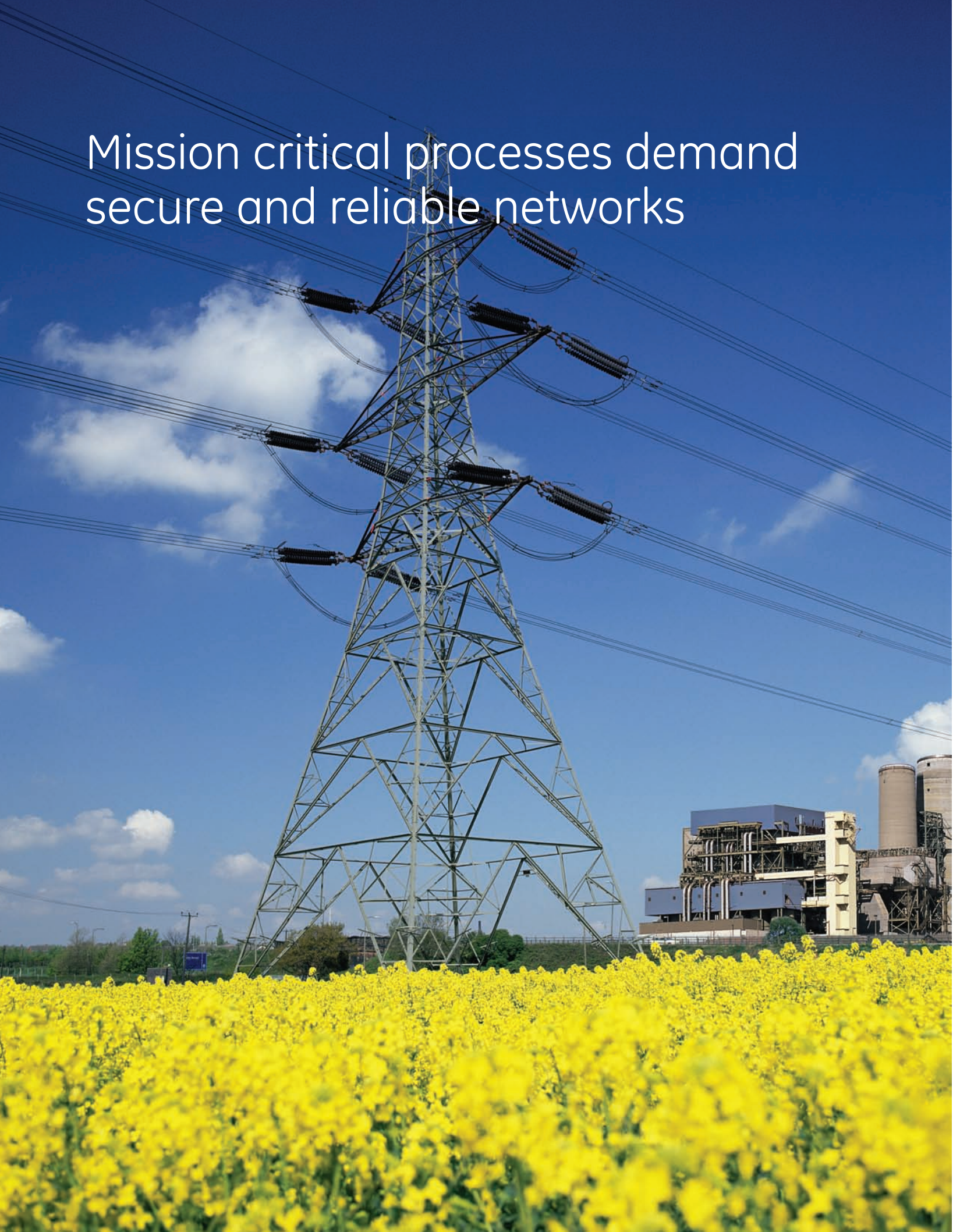
Power Sensing | ITI

To address their challenges, customers rely on our experience and deep portfolio of customizable ITI instrument transformers and control switches. Utilizing high quality materials and innovative designs. ITI products deliver accurate power sensing technology for reliable power systems.



imagination at work

Mission critical processes demand
secure and reliable networks



Industrial Strength Communications

Rugged Wireless | MDS

From the first meter to the last mile

GE Digital Energy - MDS is the world's leading single-source, end-to-end wireless solution provider. From wellhead monitoring to utility substation automation, our wireless devices are packaged for industrial environments and have been rated and tested to harsh industrial specifications. Our wireless networks carry serial and IP/Ethernet traffic, plus analog and digital I/O signals connected directly to field devices and sensors, accommodating an extensive array of industrial protocols.



Flexible Multiplexers | Lentronics

Critical communications solutions

GE Digital Energy - Lentronics is a leading global supplier of rugged telecommunications solutions for electric utility, pipeline, transportation and industrial applications. The Lentronics Multiplexer family offers T1, SONET and SDH standards based solutions for both short and long range applications over optical fiber and other media. This powerful family of multiplexers permits consolidation of all telecommunications requirements into a single, integrated network.



Ethernet Switches & Protocol Converters | MultiLink

Designed and tested for harsh environments

The MultiLink family is a line of industrial and substation hardened Ethernet switches that will provide you with secure, reliable communications for all of your critical infrastructure devices. Designed to meet the unique requirements of the protection and control Industry, the MultiLink Ethernet Switches will ensure your communications network is always available, fast, and secure.



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Fiber Optic Multiplexers | Lentronics

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Ethernet Switches & Converters | MultiLink

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Our products deliver application specific



Energy

Digital Energy communications products offers advanced connectivity solutions for a wide range of utility applications. Our rugged MDS products deliver reliable wireless solutions to monitor remote assets, facilitate field force automation, and enable AMI communications for the Smart Grid. Lentronics multiplexers support a variety of communications protocols, while providing reliable and secure network solutions for automation and control of the electric power grid. The MultiLink line of Ethernet networking products provide reliable communications in harsh environments.



Oil & Gas

Harsh environments demand communication solutions that have been designed to perform reliably in extreme conditions. For pipelines and offshore production fields, rugged Lentronics multiplexers offer optical network solutions for emergency voice, safety, SCADA, security and IT requirements. For monitoring and controlling wellheads and pipelines, MDS wireless communications equipment provides secure and reliable transmission of mission and revenue critical data. Industrially hardened MultiLink Ethernet switches enable management of all the network traffic at central control centers.



Public Safety

MDS solutions provide high speed mobile data access to dispatch systems, communications between voting-receiver and simulcast systems, city-wide high speed wireless rings and spurs, inter-agency connectivity, and streaming video for neighborhood surveillance. Lentronics optical backbone networks provide high capacity connectivity between city and regional public safety facilities, supporting the growing need for closer coordination and information exchange among staff.

solutions across multiple industries



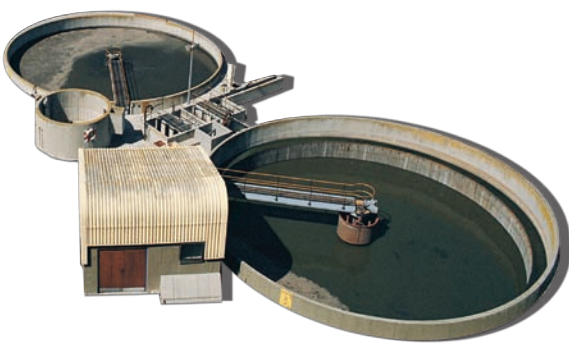
Heavy Industrial

Heavy process operations such as mining, pulp & paper, and cement rely on MultiLink switches to manage the fiber optic Ethernet LAN throughout facilities allowing high speed connection to IP video and IP sensors. Our MDS industrial wireless devices provide fast and secure remote monitoring capabilities for applications such as equipment status and mobile asset tracking. Lentronics multiplexers deliver the critical communications services to support the operation of mine slurry pipelines and industrial electrical grids.



Transportation

Helping to shape the mobility of tomorrow, customers rely on our innovative communications solutions to perform reliably in even the harshest environments for traffic and transport applications. Our Lentronics products provide connectivity for train platforms, traffic control systems, passenger information systems, intelligent highways, and physical security systems. MDS products provide a reliable wireless communications infrastructure for increased flexibility in handling data, voice, and control connectivity.



Water

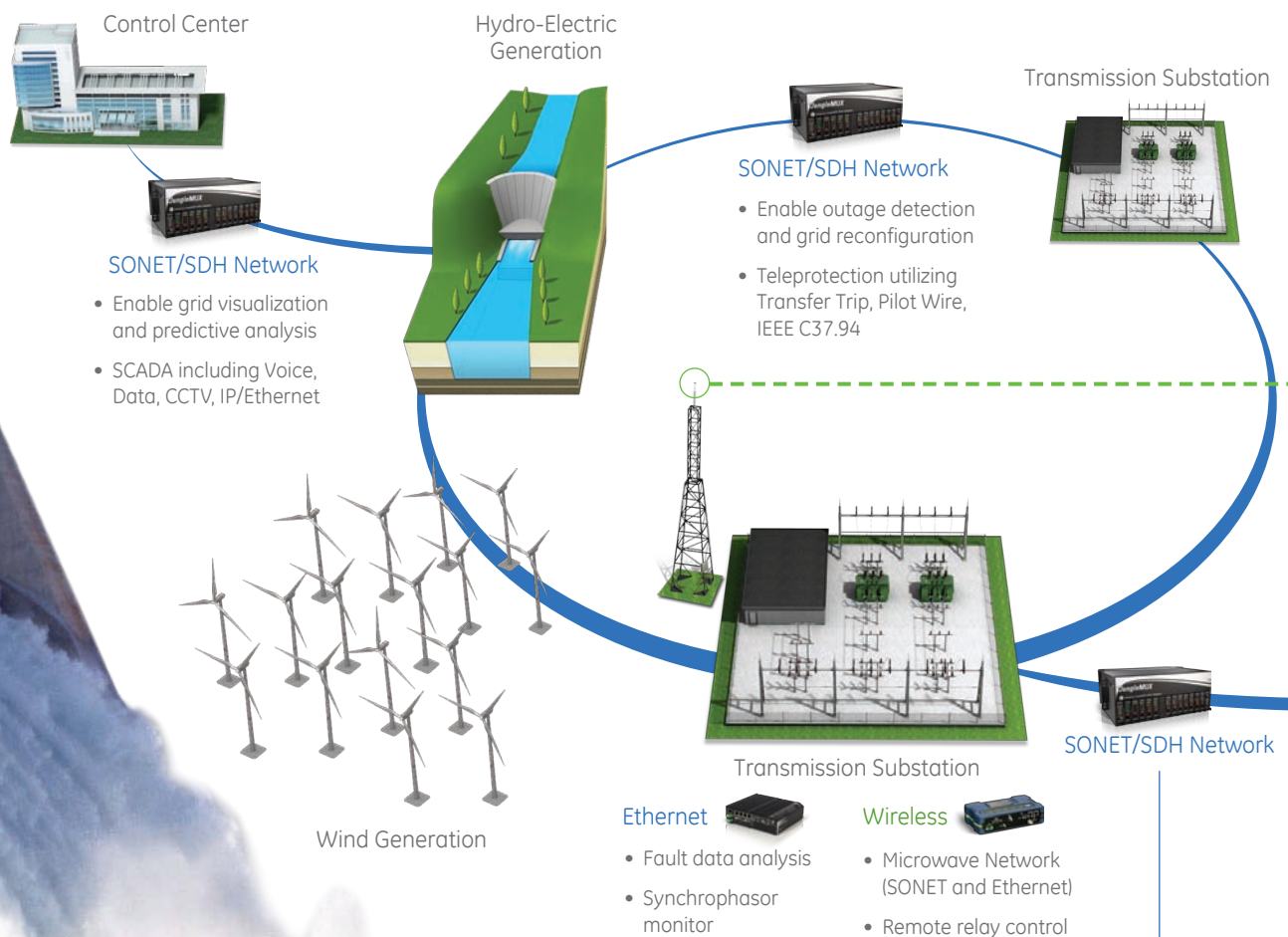
From industrial facilities to public water treatment and delivery centers, customers rely on our advanced products and services to meet water/wastewater process requirements. Our MDS wireless networking solutions deliver secure communications for SCADA and remote monitoring, and enable video surveillance in order to secure reservoirs and pumping stations. Lentronics optical network solutions provide a powerful platform to control and monitor water transmission systems extending over a large geographical area.

Smart Grid communications solutions

The Smart Grid

The Smart Grid is “a power system that serves millions of customers and has an intelligent communications infrastructure enabling the timely, secure and adaptable information flow needed to provide power to the evolving digital economy”. Defined by EPRI

Advanced communications are essential for enabling Smart Grid applications such as grid visualization, real-time load monitoring, automated demand response, advanced protection, asset monitoring, smart metering, and consumer load control.



Fiber Optic | High speed, high capacity

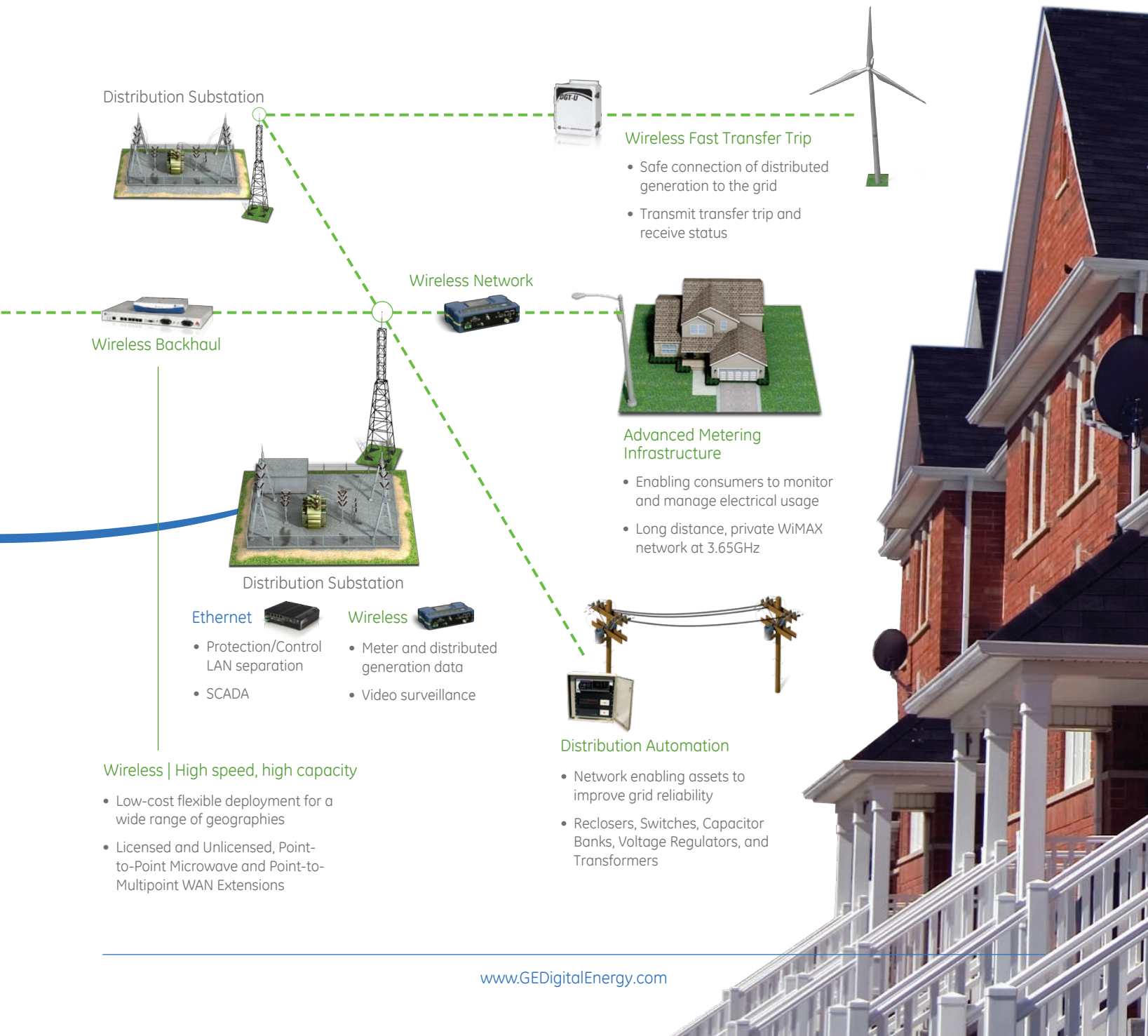
- Dedicated bandwidth for each application ensures performance
- Supports SCADA, Teleprotection, Corporate Voice, LAN/WAN, Full Motion Security Video, AMI Backhaul

from power generation to consumers

Digital Energy

As pioneers of the electrical grid, GE has ensured power system reliability for over 100 years. For the last 25 years, GE Digital Energy has developed and implemented technology that improves the resiliency and responsiveness of the grid, enabling greater connectivity and increased security.

Digital Energy delivers the foundations of Smart Grid communications with multi-service, fiber optic Lentrionics multiplexers, flexible MDS wireless devices that create reliable, long distance, wireless networks, and rugged MultiLink Ethernet management and data handling products.



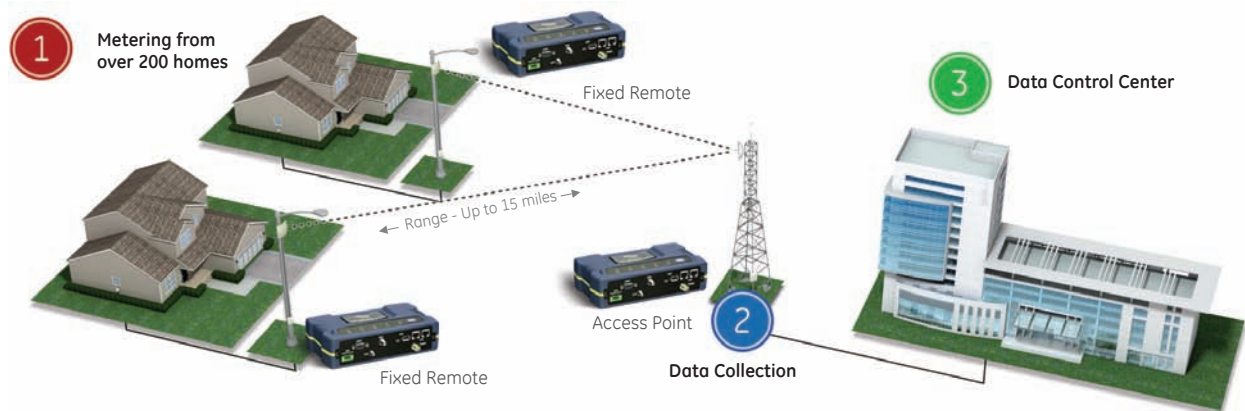
New product innovations designed and

Mercury 3650 - Enabling AMI for the Smart Grid

The MDS Mercury 3650, operating in the 3.650 GHz frequency band, is a highly secure, industrial-grade WiMAX solution for mission-critical, wireless wide area network communications, including Advanced Metering Infrastructure to enable the Smart Grid, SCADA, Distribution Automation, streaming video, and Voice over IP applications. With aggregate Ethernet throughput up to 9 Mbps and extreme operational temperature ranges enclosed in a rugged, aluminum chassis, MDS Mercury 3650 has the capability, durability, and deployment flexibility to facilitate the immediate and evolving requirements of industrial deployments.



[Learn More - Page 41](#)



ML1200 - Ethernet Switching for Medium-Sized Deployments

The ML1200 provides industrial and utility-hardened, managed Ethernet networks perfectly suited to medium-density deployments. With support for up to 12 ports, plus 2 Gigabit ports, in a single chassis, a high level of security features and logging to enable cyber security compliance, and support for both copper connections and a variety of fiber-optic connector choices, the ML1200 is an ideal solution for rugged, reliable industrial networking.



[Learn More - Page 109](#)

built to be reliable, secure and rugged

WiYZ - Rugged Outdoor Data Acquisition

The MDS WiYZ products combine technology and function to provide a comprehensive range of solutions for data acquisition and networking. Whether your application requires the collection of data from remote, unpowered sensors or deployment in areas with obstructed communication paths or a bridge for data using the cellular infrastructure to your enterprise network, the WiYZ products provide simple, reliable and cost-effective solutions.

[Learn More - Page 29](#)



MultiNet 1000 Router- Advanced, Secure Networking

The MultiNet 1000 Managed Router is an industrial-hardened, multipurpose networking device that combines a serial port server, managed switch, and full-featured router. With support for IP routing, a full suite of managed switch features, and rich cyber-security features, the MN1000 suits the needs of almost any network or application. Combined with the ability to interconnect multiple networks and a built-in serial port server, the MN1000 provides flexible, intelligent networking that's reliable even in industrial and utility environments.

[Learn More - Page 119](#)



SD Series - Long Distance IP/Ethernet & Serial

The MDS SD Series are industrial wireless solutions that provide long distance communications over licensed radio band, allowing users to interface to both IP/Ethernet and serial controllers such as PLCs, RTUs and SCADA systems. This software-defined digital radio is the latest generation of MDS licensed narrowband wireless devices and is compatible with previous generations, allowing for a smooth and controlled upgrade to existing systems.

[Learn More - Page 21](#)



OC-48/STM-16 – Secure and Robust Broadband

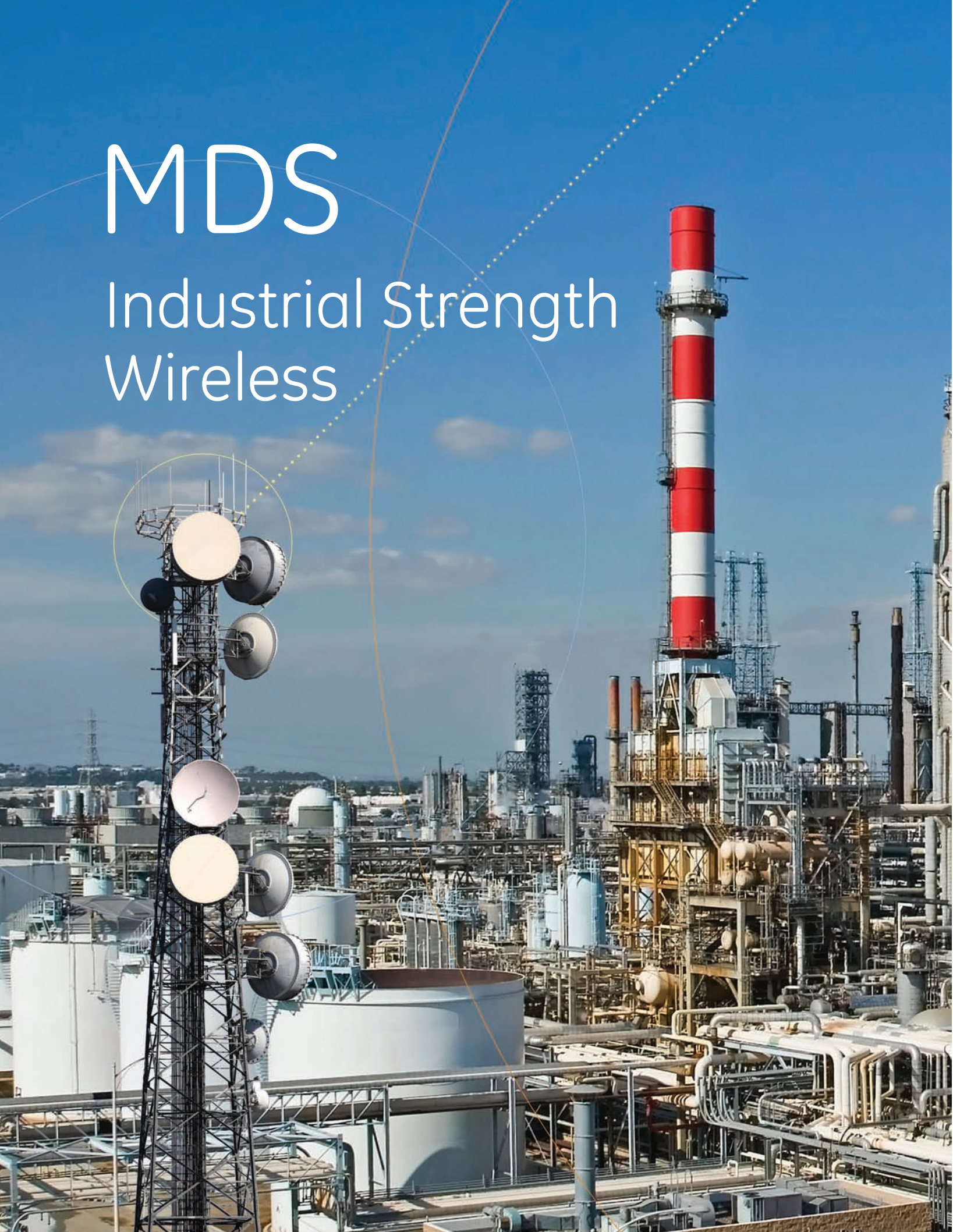
The GE Lentonics multiplexer product family now offers SONET OC-48 and SDH STM-16 broadband transmission capacity (2.488 Gb/s) supporting AMI backhaul, Smart Grid services, high definition video surveillance and the latest corporate WAN applications. Existing systems can be upgraded, by simple substitution of optical transceiver units.

[Learn More - Page 84](#)



MDS

Industrial Strength Wireless



Innovative Communications Solutions

Data Acquisition

Wireless asset monitoring 20

Our devices offer long range communications for asset monitoring that provide signal regeneration of discrete I/O, precise timing for controller data transmission, and support for multiple protocols.



LAN Extension

High speed point-to-multipoint 40

We have the wireless solutions to extend your network into the field, with full networking support for IP-based PLCs/RTUs, video surveillance, and field force automation.



Backhaul

High capacity point-to-point 52

When you require an alternative to fiber or copper, we have the high capacity wireless backhaul solutions to carry up to 800 Mbps of data, voice and video back to your operations center.



Commercial Services

Network design and engineering services 61

The MDS team of highly-qualified engineers offer Network Design and Engineering Services, Technical Training Services, and design and deliver custom Racks and Enclosures for projects across the globe.



Accessories

Complete wireless systems 66

To ensure maximum performance from our wireless devices, we provide a complete line of compatible and cost-effective accessories that are fully tested to perform at optimal levels.



Industry Specific Solutions

Wireless devices built for harsh environments 74

GE has a tradition of designing innovative solutions for the marketplace. Partnership with our customers allows us to develop solutions tailored to the unique challenges each of them are facing.



Industrial strength wireless from the

Ensuring mission critical communications

GE Digital Energy - MDS is the world's leading single-source, end-to-end wireless solution provider, with more than 20 years of experience and over 1.5 million devices installed. MDS solutions implement future-proof technologies that provide our customers with infrastructure savings, exceptional reliability, and the longest in-service life.

Our wireless devices are long range, secure, and rugged to survive extreme conditions, delivering the lowest possible cost of ownership, and extended warranties to give you peace of mind. With highly secure point-to-point and point-to-multipoint solutions supporting a wide range of frequencies, MDS can take you from the first meter to the last mile.



With over 1.5 million wireless devices installed worldwide, we bring industry-leading experience to your applications.

first meter to the last mile

Industrially Hardened

From wellhead monitoring to utility substation automation, our wireless devices are packaged for industrial environments and have been rated and tested to harsh industrial specifications, including extreme operating temperatures and Class 1/Div 2 hazardous location approvals.

Application Flexibility

We offer highly secure, rugged, fixed, and mobile wireless solutions ranging in frequencies from 150 MHz to 38 GHz with speeds up to 800 Mbps. Our point-to-multipoint solutions are optimized for industrial infrastructure applications, such as AMI communications for enabling the Smart Grid, SCADA, mobile data, streaming video, and Voice over Internet Protocol (VoIP). Our wireless networks carry IP/Ethernet and serial traffic, plus analog and digital I/O signals connected directly to field devices and sensors, accommodating an array of industrial protocols.

Reliable and Scalable

Our wireless devices provide reliable communications and are future-proof and long range (up to 60 miles), allowing customers to use their existing networks and expand when necessary. A single MDS infrastructure can support multiple applications simultaneously and independently.

Secure

Our private and trusted network infrastructures are a cornerstone strategy in eliminating cyber risks. Our devices offer standards-based encryption and advanced security features including authentication, verification, dynamic key rotation, data integrity verification, provisioning lists, redundancy, and anti-jamming technologies.

Complete Solutions

We offer a full range of accessories and engineering services for projects from custom environmental enclosures to complete wireless solutions. We provide a range of wireless services including network design, computer-generated path analyses, frequency coordination, licensing, network design, installation and support, and in-depth training.



Secure and reliable wireless designed for harsh environments

Data Acquisition

Our devices offer reliable long range communications for asset monitoring that provides signal regeneration of discrete I/O, precise timing for controller data transmission, and support for multiple protocols.



Input collection from sensors including breaker status, tank level and oil wellhead pressure



Output control to devices including pumps, valves, alarms, and trip relays



IP/serial communication to meters and RTUs

LAN Extension

We have the wireless solutions to extend your network into the field, with full networking support for IP-based PLCs/RTUs, video surveillance, and field force automation.



High speed, long range connectivity including data and live video feed



Mobile data access including work orders and field force automation

Backhaul

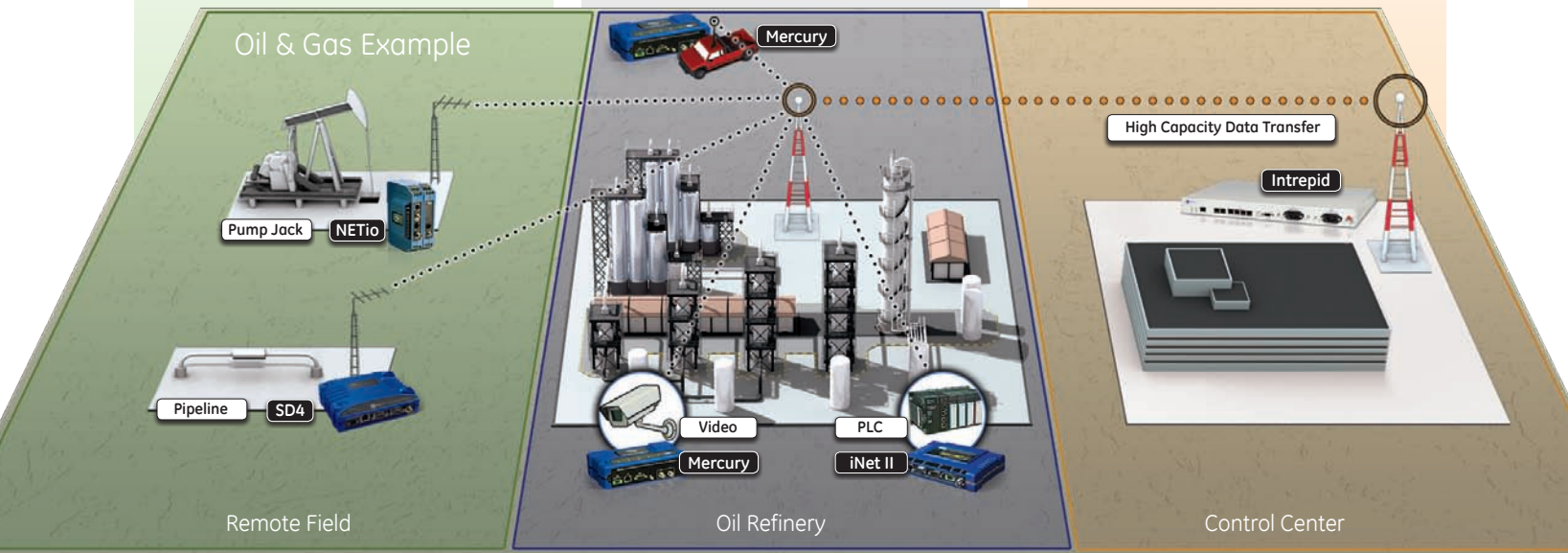
When you require an alternative to fiber or copper, we have the high capacity wireless backhaul solutions to carry up to 800 Mbps of data, voice and video back to your operations center.



High capacity, long distance network aggregation of field communications



High-security real-time network management and full-duplex connectivity



Data Acquisition

Wireless Asset Monitoring



Data Acquisition

SD Series



Secure, Long Range IP/Ethernet

The MDS SD Series is the next generation of licensed wireless devices featuring a software-defined modem and an optimized hardware platform supporting both IP/Ethernet and serial communications. SD products are ideal for customers using dedicated frequencies for long range communication to PLCs. These telemetry solutions are optimized with low power and sleep mode features for battery and solar applications.

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NETio



Analog and Digital I/O Signal Communications

The unlicensed MDS NETio family provides flexible I/O signal communication solutions on two levels. Protocol addressable I/O allows direct communication with remote I/O accommodating IP/Ethernet and serial protocols, without the need for a PLC or RTU. I/O extension allows regeneration signals between remote I/O points and monitoring/control devices, providing location-specific distance and point count requirements.

25

WiYZ



Intelligent Data Acquisition and Signal Communications

The MDS WiYZ implements standards-based mesh networking and allows both Ethernet and serial data collection for use in asset management, supply chain management, inventory control, and metering. With self-powered I/O and sensor data acquisition, the flexible WiYZ allows for cost effective deployment of both simple data acquisition and enterprise wide area networking.

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x710 Series



Narrowband Connectivity

The MDS Transceiver Series is a price and performance leader in licensed microwave radios in the 130-174 MHz, 220-240 MHz, 330-512 MHz, and 800-960 MHz frequency ranges. They provide increased throughput and longer range for multiple address systems.

33

x790 Series



Master Stations

The redundant, full-duplex MDS Master Station Series offers the ultimate in reliability and simplicity for ease of configuration and operation. The MDS Master Station Series is the price and performance leader of licensed microwave radios in the 330-512 MHz and 800-960 MHz frequency range.

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TransNET



Long Range, High Speed Serial Communications

Today's SCADA and Telemetry systems must transmit large amounts of data at ever increasing speeds. The MDS TransNET uses frequency hopping technology to provide a flexible wireless serial solution. Featuring a sleep mode that is well suited to solar-powered applications, store and forward capabilities, and unparalleled robustness, the TransNET sets new standards for reliable, long range wireless serial data transmission.

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Selector Guide

	SD	NETio	WiYZ	x710 / x790	TransNET
Frequency					
900 MHz Unlicensed		•	•		•
2.4 GHz Unlicensed		•			•
100 – 200 MHz Licensed				•	
400 MHz Licensed	•			•	
900 MHz Licensed	•			•	
Cell			•		
WiFi			•		
Range					
	50 miles	30 miles	1 mile, cell	50 miles	30 miles
Speed					
	19.2 kbps	115 kbps	9.6 kbps	19.2 kbps	115 kbps
Data Interfaces – Access Point					
Ethernet	•	•	•		
Serial	•	•	•	•	•
I/O		•			
Data Interfaces - Remote					
Ethernet	•	•			
Serial	•	•		•	•
I/O		•	•		
Network Type					
Point-to-Multipoint	•	•	•	•	•
Mesh			•		

SD Series

Secure, Long Range IP/Ethernet
MDS SD4™ & MDS SD9™



Data Acquisition | Ethernet and Serial

The MDS SD Series are industrial wireless solutions that provide long distance communications over licensed radio bands, allowing users to interface to both Ethernet and serial controllers such as PLCs, RTUs and SCADA systems.

This software-controlled digital radio is the latest generation of MDS licensed narrowband wireless devices and is compatible with previous generations, allowing for a smooth and controlled upgrade to existing systems.

Key Benefits

- Reliable connectivity to Ethernet devices
- Long range communication of IP/Ethernet and serial data over licensed band radio
- Secure communications with AES-128 encryption
- Compatible with multiple industry-standard SCADA protocols including Modbus TCP and DNP3
- Low power consumption with sleep mode allowing for solar powered operation
- Lower integration, configuration, and support costs than multi-box solutions
- RoHS/WEEE compliant (Lead-free construction)

Application Specific Wireless Solution



Oil & Gas

- Remote monitoring of pipeline flow and status signals
- Monitor and transmit wellhead pressure and tank levels collected by RTUs



Energy

- Remote control of IED and PLC at distribution substations
- Condition monitoring for pole-top circuit breakers and capacitor banks



Water & Wastewater

- Monitor lift stations across multiple sites from control room



Heavy Industrial

- Activation of perimeter gates based on detection of vehicle
- Monitor and control remote pumps and compressors

Industrially Hardened

- Operational temperature range from -40°C to 70°C
- CSA Class I, Div. 2 groups A,B,C,D for Hazardous Locations
- IEEE-1613 for electric substation environments

Application Flexibility

- Low power consumption for solar powered applications
- Long range wireless - up to 50 miles
- IP/Ethernet and serial functions operate simultaneously on the same network
- Compatible with previous generations of MDS x710 Series radios

Reliable & Scalable

- Exclusive-use, non-shared licensed band operation
- Point-to-Multipoint, 2-way communication
- High receive sensitivity for long distance communications
- Compatible with multiple industry protocols including Modbus, Modbus TCP, and DNP3

Secure

- AES 128-bit data encryption
- Password protected access and lockdown



Long Range Communications

The MDS SD Series of industrial-strength data communications products offer secure, reliable, long distance transmission of data for your mission critical applications. The higher transmit power used by the SD to operate in the licensed 400 MHz (SD4) and 900 MHz (SD9) frequencies, results in a wide area of coverage. The SD's exceptional receiver sensitivity allows for deployment in applications where obstructions, such as trees and buildings, would limit the effectiveness of other wireless devices. The combination of these features results in the ideal data acquisition product for error free, long distance communication.

IP/Ethernet and Serial Communications

SD Series are cost-effective solutions to wirelessly transport polled IP/Ethernet, and/or serial data from attached PLCs and RTUs, over long distances, to SCADA systems.

The SD optimizes the use of narrow radio channels and increases the throughput available for data traffic. This results in a higher usable data speed that benefits Ethernet SCADA applications.

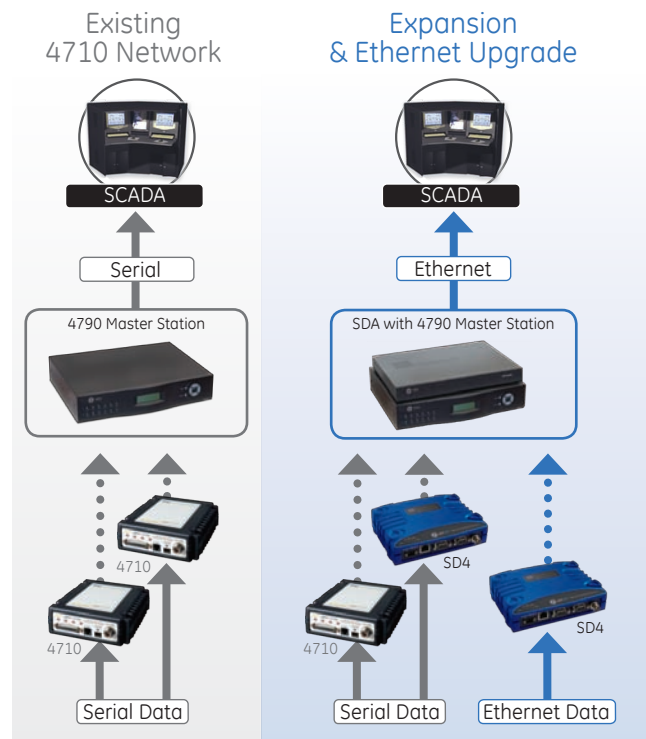
Low Power Consumption

The ability to power a remote wireless device using solar power not only makes the communication system more resistant to failure, but it also adds installation and application flexibility. SD4 is one of the lowest power consumption Ethernet radios available for long range SCADA applications allowing for solar powered operation.

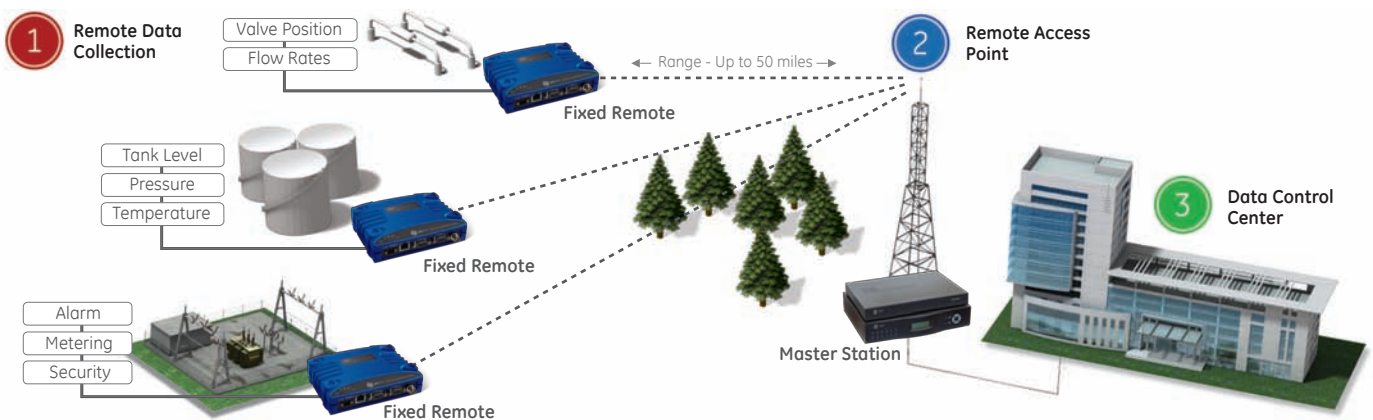
Additionally, sleep mode allows the SD4 to temporarily disable unused circuitry saving energy and reducing the size of the batteries needed to operate in a remote location, for longer periods of time, when direct sunlight is not available.

Backward Compatibility

MDS SD Series radios can be directly added to existing MDS x710 and x790 systems, providing both "drop-in" compatibility for expansions and replacements, and adding Ethernet support. Backward compatibility preserves your investment and allows a smooth transition from a serial based SCADA infrastructure to IP/Ethernet without disrupting day-to-day operations.



SD Series Application Advantages



Secure Communications

- Licensed 400 MHz and 900 MHz is free from the potential interference in unlicensed bands
- AES 128-bit encryption to secure data and achieve regulatory compliance

Long Range Coverage

- Operation in licensed band uses a higher transmit power for greater coverage
- Exceptional receiver sensitivity maximizes operation in difficult links where foliage limits other wireless devices

Protocol Communications

- Supports multiple protocols including Modbus, Modbus TCP, DNP3
- Provides IP/Ethernet and serial communication to SCADA hosts, UDP, TCP Client and TCP Server
- Accommodates multiple protocols for diverse devices on the same radio system

Increased Reliability

The SD Series software-defined architecture maximizes durability. A single-board design and extended temperature range maximizes reliability and performance in the field. A wireless system built with SD digital radios will provide greater longevity and less maintenance issues over the lifetime of the system.

Narrowbanding

The SD Series achieves optimal throughput with configuration options for 6.25 kHz, 12.5 kHz, or 25 kHz, all on a single hardware platform. The ability to operate in 6.25 kHz channels is important preparation for the FCC mandate to use radio frequency between 150 and 512 MHz more efficiently starting in 2013. This process is also referred to as refarming.

SD Series Remote

The SD4 radio operates in the 400 MHz frequency band and the SD9 operates in the 900 MHz frequency band. Choose between remote models that support both Ethernet and serial, or only serial interface.

The SD Series handles concurrent Ethernet and serial traffic from multiple sources. Directly communicate to multiple PLCs using the built-in serial device server and modem-sharing device using industry-standard TCP or UDP protocols.

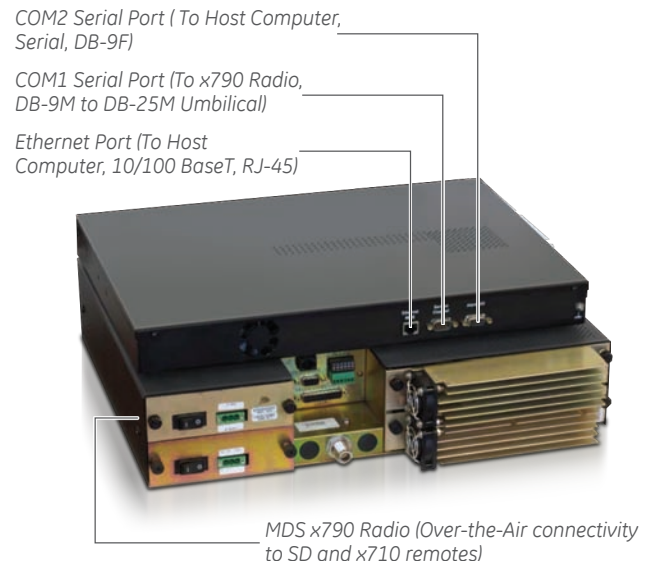
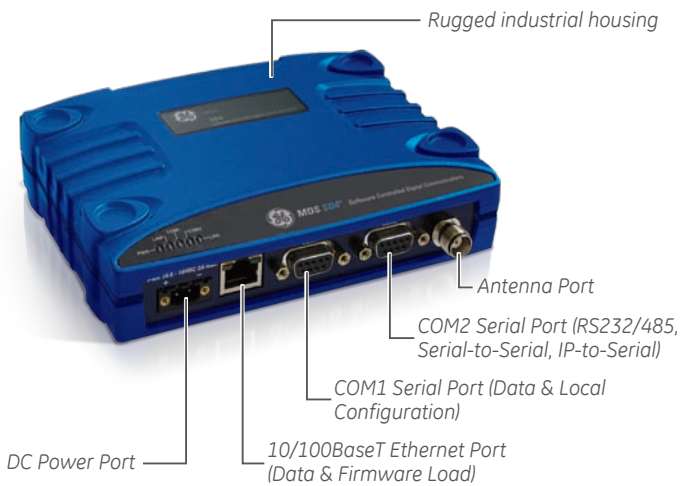
Every SD Series wireless device includes remote management capability and can be managed by MDS NETview or MDS InSite management systems.

An SD Series remote radio can be used as a master.

Master Station (Access Point) and Repeater Station

Mission-critical applications demand that no single point of failure can stop the communications system. In wireless applications the Master Station serves as the central hub to all remote radios. Installation of an SD adapter to an existing x790 Master Station adds direct Ethernet connectivity to an IP network, and adds advanced data encryption. The SDA Master Station with redundancy option increases the availability of a system with a warm-standby configuration. The standby radio activates automatically whenever a fault condition is detected by the active radio.

When used as a repeater station, the full-duplex capability of the x790 maximizes the speed of data traffic retransmissions, resulting in better system performance.



Specifications

GENERAL

Frequency	Configurable
Programmability	Configurable
Operational modes	Simplex, half-duplex
Modulation	Digital / CPFSK
Range	Up to 50 miles

SD4

RF data rate & bandwidth	4800 bps @ 6.25 kHz 9600 bps @ 12.5 kHz 19200 bps @ 25 kHz
Frequency bands	350 - 400 MHz 400 - 450 MHz 450 - 512 MHz

SD9

RF data rate & bandwidth	9600 bps @ 12.5 kHz 19200 bps @ 25 kHz
Frequency bands	928-960 MHz

TRANSMITTER

Frequency Stability	+/- 0.5 ppm
Carrier power	0.1 to 5 Watts Programmable
Carrier power Accuracy	Normal +/- 1.5 dB
Duty Cycle	Continuous
Output Impedance	50 Ohms

RECEIVER

Type	Double Conversion Superheterodyne
Bit Error Rate	1x10 ⁻⁶ @ -112 dBm typical
Selectivity	>70dB
Adjacent Channel Rejection	40 dB nominal

INTERFACES

Serial COM1	RS-232, DB-9
Serial COM2	RS-232, RS-485 DB-9
Ethernet	10/100 BaseT, RJ 45
Antenna	TNC Female

MANAGEMENT

MDS InSite software	
MDS NetView software	
MDS Radio Configuration software	

ENVIRONMENTAL

Temperature	-40°C to +70°C (-40°F to +158°F)
Humidity	95% at 40C (104°F) non-condensing

ELECTRICAL

Tx Current	2.2A Typical at 5 Watts
Rx Current	<125 mA
Sleep mode	9 mA nominal

SD4

Primary power	10.5 Vdc to 16 Vdc
---------------	--------------------

SD9

Primary power	10.5 Vdc to 30 Vdc
---------------	--------------------

MECHANICAL

Case	Rugged die-cast aluminum
Dimensions	5.08 H x 14.29 W x 18.4 D cm. (2.0 H x 5.625 W x 7.25 D in.)
Weight	1 kg (2.2 lb.)

AGENCY APPROVALS

CSA Class 1 Div 2 for hazardous locations
IEEE 1613 substation environment
FCC Part 90
Industry Canada & ENTELA
SD4: ETSI, EMC, CE MARK (ETSI: ETS 300 113, EMC: EN 300 279)
SD9: Pending FCC Approval

Ordering

SD4 Remote

SD04MD-	*	**	-NNSNN
Sub -band	A		350-400 MHz
	B		400-450 MHz
	C		450-512 MHz
Model		SS	Serial
		ES	Ethernet and Serial
		MS	4710 Emulation

Order Code Example

SD04MD-CSS-NNSNN

- Remote radio
- 450 - 512 MHz
- Serial only communication
- Standard mounting brackets
- No special assembly

SD9 Remote

SD09MD-	*	**	-NNSNN
Sub -band	C		928-960 MHz
Model		SS	Serial
		ES	Ethernet and Serial
		MS	9710 Emulation

Order Code Example

SD09MD-CES-NNSNN

- Remote radio
- Ethernet and Serial
- Standard mounting brackets
- No special assembly

SD Adapter for x790 Series Master Stations

SDA-	*	**	
Modem	A		Pre-configured for 4790A or 9790A Master Station
	C		Pre-configured for 4790C Master Station
	E		Pre-configured for 4790E or 9790E Master Station
	M		Pre-configured for 4790M Master Station
Network		S	SD-only radio system
		X	x710 compatible system

Order Code Example

SDA-AS

- Adaptor for master station
- Pre-configured for 9600 bps
- Pre-configured for 12.5 kHz
- Ethernet communications

Accessories for the SD Series

Fixed Remote Kits with Yagi

KFR-S04-C1 (406-430 MHz)
KFR-S04-C2 (430-450 MHz)
KFR-S04-C3 (450-470 MHz)
KFR-S09-D1 (900 MHz)

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/SDSeries to:



- Buy SD through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

NETio

Analog and Digital I/O



Data Acquisition | Flexible Wireless I/O

The MDS NETio is an integrated, scalable family of wireless solutions that provide long distance unlicensed communications, allowing users to interface both analog and digital I/O including sensors for pressure and flow as well as controls for pumps or alarms. NETio can wirelessly regenerate I/O signals or use standard IP/Ethernet and serial protocols to communicate with controllers such as PLCs, RTUs and SCADA systems.

Key Benefits

- Direct connectivity to analog and digital devices without the need for a controller
- Unlicensed long range communication of IP/Ethernet or serial data
- Supports multiple industry-standard protocols including Modbus TCP and DNP3
- Reduces the high cost of wiring and terminations
- Reduces integration, configuration, and support costs found with multi-box solutions
- Seamless connectivity to network access points

Application Specific Wireless Solution



Water & Wastewater

- Low-cost, low-power tank level monitoring for remote locations
- Control pumps across multiple sites from central PLC



Energy

- Real-time circuit trip control for distributed generation sites
- Condition monitoring for pole-top circuit breakers and capacitor banks



Oil & Gas

- Remote monitoring of pipeline flow and status signals
- Monitor and transmit wellhead pressure and tank levels to RTUs



Heavy Industrial

- Activation of perimeter gates based on detection of vehicle
- Monitor and control remote pumps and compressors

Industrially Hardened

- Operation in extreme temperatures from -40°C to 70°C
- Class I, Div 2 hazardous location approval
- Fully-isolated I/O

Application Flexibility

- Handles diverse I/O configurations including analog 4-20 mA, 0-5 V or 0-10 V and digital 5-36 VDC
- Long range wireless communication up to 30 miles (900 MHz) and 15 miles (2.4 GHz)
- Wirelessly expand I/O coverage 3,000 feet using the 802.15.4 wireless option
- IP/Ethernet, serial and I/O functions simultaneously on the same network
- Backwards compatible with entraNET and TransNET networks

Reliable & Scalable

- License-free spread spectrum technology in both 900 MHz and 2.4 GHz bands
- Point-to-Multipoint, 2-way communication
- High receive sensitivity for noisy environments and long distances
- Handles multiple industry protocols including Modbus, Modbus-TCP, and DNP3

Secure

- Authorized access point and remote lists prevent unauthorized access
- Password protected access and lockdown
- Built-in 128-bit encryption



Application Flexibility

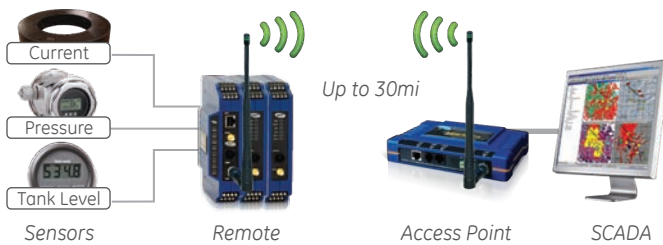
The MDS NETio family of industrial-strength data communications products from GE offer secure, reliable, long distance transmission of data for your mission critical applications. The NETio operates in license-free 900 MHz or 2.4GHz spread spectrum frequencies and has built-in I/O for a wide variety of market applications.

The NETio solution acquires, transports and delivers I/O signal data, and interfaces directly to a wide variety of I/O without the need for a controller. NETio offers a quickly deployed low cost alternative to wires. In many industrial applications, it is impossible or cost prohibitive to run hardwired circuits between inputs and outputs.

Protocol Addressability

NETio interfaces I/O from sensors and devices using multiple industrial protocols including Modbus RTU, Modbus TCP and DNP3. This allows a SCADA system or host controller to communicate directly with NETio using IP/Ethernet or serial protocols when PLCs and RTUs are not necessary. NETio allows serial communication using DNP3 or Modbus RTU without the need for an access point for simple point-to-multipoint applications between remotes or over WeXP.

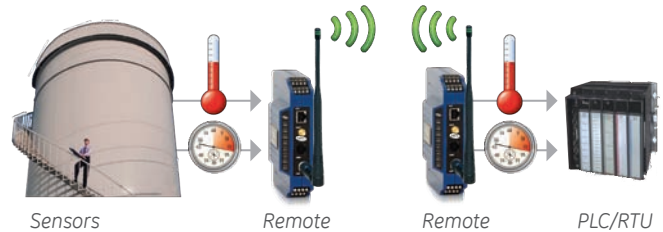
I/O from remote sensors to SCADA host



I/O Extension

Using I/O extension, NETio regenerates analog and digital signals between multiple field devices and controllers resulting in significant savings on wiring and termination costs. NETio supports cost-effective remote to remote communication for small point-to-point or point-to-multipoint requirements that do not require an access point.

Wirelessly extend I/O from the field to PLCs and RTUs



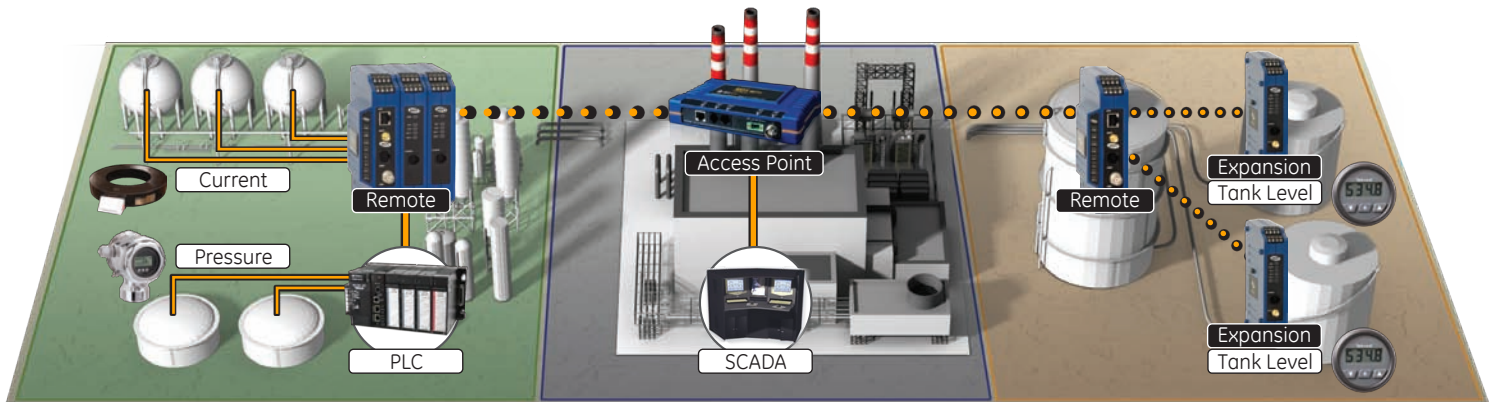
IP/Ethernet and Serial Communications

In addition to I/O extension and protocol addressability, NETio also supports IP/Ethernet and serial communication over long distance between SCADA systems and RTUs or PLCs. Use the NETio Access Point whenever IP/Ethernet communications are required.

Backwards Compatibility

NETio can serve as the wireless access point to a central control station for remote NETio units in the field. In applications where wireless network infrastructure already exists, NETio Remotes can still be deployed, as they are compatible and interoperable with MDS TransNET and MDS entraNET wireless access points.

NETio Application Advantages



I/O Extension

- NETio can be used to regenerate I/O signals between sensors and PLCs
- Input signals can be mapped to outputs anywhere in a NETio network
- NETio provides IP/Ethernet and serial data communications for attached PLC or RTU

Protocol Communications

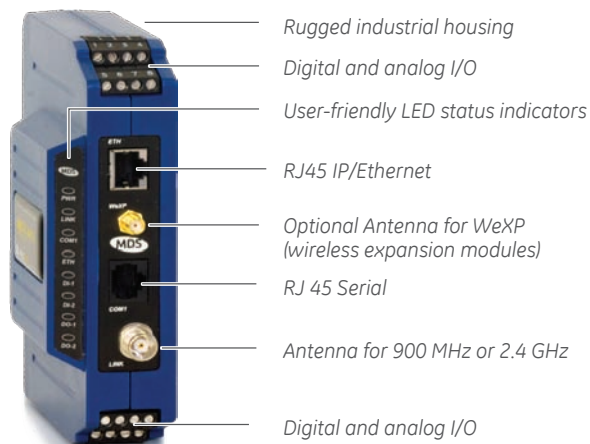
- NETio supports multiple protocols including Modbus RTU, Modbus TCP, and DNP3
- Provides IP/Ethernet and serial communication to SCADA hosts and HMIs
- Accommodates multiple protocols for diverse devices and I/O signals on the same IP/Ethernet network

Wireless Expansion

- Wirelessly expand I/O capacities of NETio Remotes to connect additional I/O signals
- Cover I/O signals within 3,000 feet with NETio expansion modules with 802.15.4 WeXP
- Combine protocol addressable I/O and I/O extension on the same network

Remote

NETio is available in the 900 MHz or 2.4 GHz frequency bands for IP/Ethernet and serial communication. Each NETio has built-in connections for one analog input, one analog output, two digital inputs and two digital outputs. Each NETio can be configured for multiple operating modes including I/O extension for regenerating I/O signals between devices, protocol addressability for interfacing I/O using industry-standard protocols (e.g., Modbus-TCP), and SCADA communications to remote RTUs and PLCs using IP/Ethernet and a NETio Access Point.



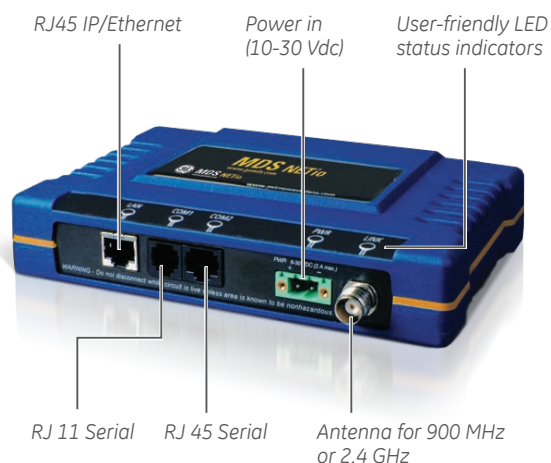
Expansion Module

Expansion Modules expand the number of I/O points to meet your requirements. Expansion Modules can be connected directly to the NETio via a fully integrated power/communication backplane connector or they can be located up to 3,000 feet away and wirelessly connect to NETio over WeXP. Expansion Modules are available in 6 different configurations and deliver connectivity for up to 128 I/O signals at any one location.



Access Point

When you require protocol addressability using Modbus TCP or DNP3 via TCP, or utilize IP/Ethernet on your SCADA network and other applications, NETio uses an access point for maximum performance. The NETio access point provides long range, peer-to-peer, secure wireless IP/Ethernet and serial communication plus network-wide configuration from a single location. The access point also allows you to mix modes of communication and multiple protocols on the same network.



Increase I/O capacity of remotes with expansion modules



Expansion modules connected via backplane

Wireless expansion modules connected via 802.15.4

Accessories & Custom Enclosures

GE MDS provides a complete line of reliable industrial-strength and cost effective accessories that are tested to perform at optimal levels and maintain product warranties. GE MDS offers both standard and custom packages for wireless applications in harsh industrial environments. We simplify your wireless systems design by providing a convenient single-source ordering process. From antennas for the NETio (900 MHz and 2.4 GHz) to field-rated power supplies for your mission critical application, GE MDS can help ensure your system is robust and future-proof.

Accessories for the NETio

	900 MHz	2.4 GHz
Fixed Remote Kit with Yagi	KFR-N09-D1	KFR-N24-E1
WeXP antenna	97-4278-A10	97-4278-A10
Power Supply (AC Input)	01-3682A02	01-3682A02

View Accessories catalog at www.gemds.com

Specifications

GENERAL	
Access Point Power	10-30 Vdc
Remote Power	6-30 Vdc
Current	<450 mA Transmit, < 180 mA receive (@13.8 Vdc)
Temperature	-40° C to +70° C
Housing (Remote)	High-impact plastic
Housing (Access Point)	Die-cast Aluminum
Mounting	35mm DIN rail (Remote), Flat Panel or DIN (Access Point)
Access Point Size	3.15H x 17.2W x 11.2D cm. (1.25H x 6.75W x 4.5D in.)
Remote Size	14.6H x 4.14W x 11.4D cm. (5.75 H x 1.63 W x 4.5 D in.)
Expansion Size	14.6H x 3.0W x 11.4D cm. (5.75H x 1.18W x 4.5D in.)
Access Point Weight	635g (1.4 lb.)
Remote Weight	226 g (0.5 lb.)
NETIO B MODEL	
Compatibility	MDS entraNET networks & AP
I/O Capacity	1 analog input, 1 analog output, 2 digital inputs, 2 digital outputs
Ethernet Port	One RJ45 10baseT, 10 Mbps, requires NETio Access Point
Serial Port	One RJ-45, RS232, 1.2 to 115.2 kbps
I/O extension	Network-wide (Access points, remotes, expansion modules)

Protocols	Serial (Modbus RTU and DNP3); Ethernet (DNP3, Modbus-TCP) requires NETio Access Point
NETIO T MODEL	
Compatibility	MDS TransNET & Master
I/O Capacity	1 analog input, 1 analog output, 2 digital inputs, 2 digital outputs
Serial Ports	Two RJ45, RS-232, 1.2 to 115.2 kbps
I/O Extension	Over WeXP option only
Protocols	Modbus RTU
900 MHZ OPTION	
Data Rate	106 kbps (EB); 115 kbps (TB)
Frequency	902-928 MHz ISM band
Mode	Frequency Hopping Spread Spectrum
Range	Up to 30 miles
Antenna	TNC female
System Gain	136 dB
Carrier Power	0.1 to 1.0 watts (20 to 30 dBm)
Receiver Sensitivity	-106 dBm (1 x 10 ⁻⁶ BER)
2.4 GHZ OPTION	
Data Rate	106 kbps
Frequency	2.4016 - 2.4778 GHz ISM band
Mode	Frequency Hopping Spread Spectrum
Range	Up to 15 miles
Antenna	TNC female
System Gain	131 dB
Carrier Power	.05 to .5 watts (17 to 27 dBm)
Receiver Sensitivity	-104 dBm (1 x 10 ⁻⁶ BER)

WeXP OPTION (BASED ON 802.15.4)	
Frequency	2.4 to 2.4835 GHz
Range	Up to 3,000 ft.
Antenna	SMA female
Carrier Power	10-60 mW (10 to 18 dBm)
TX Power	27 dBm
Receiver Sensitivity	-100 dBm (1% packet error)
ANALOG INPUTS	
Types	4-20 mA, 0-5 vDC, 0-10 vDC, .1-5 vDC
Accuracy	0.1% (full scale V or I)
A/D Resolution	22 bit
Isolation	1400 V input to power (not isolated on NIOXM-6)
ANALOG OUTPUTS	
Types	4-20 mA, 0-5 V, 0-10 V
Accuracy	0.2% (full scale V or I)
Isolation	1400 V output to power
D/A resolution	16 bits
DIGITAL INPUTS	
Type	5-36 VDC
Isolation	3000 V to chassis ground
DIGITAL OUTPUTS	
Type	FET relay
Hold Off Voltage	36 vDC
Load	2A continuous (per output)
Isolation	3,700 V to chassis ground
AGENCY APPROVALS	
FCC	Part 15.247
Industry Canada	RSS210
CSA	Class 1, Div. 2 groups A,B,C,D for hazardous locations (ANSI/UL equivalent)

Ordering

NETio Remote

NETIO Model	* -MD	* 11	* BFC10N	
Model	B			Serial and Ethernet Remote (NETio and entraNET Access Point compatible)
	T			Serial Remote (TransNET Access Point compatible)
Frequency	9			MDS 900 MHz long range, up to 30 miles
	2			MDS 2.4 GHz long range, up to 15 miles (Only with B model)
Wireless Expansion		W		WeXP short-range wireless option (up to 3,000 ft.)
		N		No WeXP short-range wireless

Order Code Example

NETIOB-MD911WBFC10N

- Remote
- Serial and Ethernet
- entraNET-based 900 MHz
- Wireless expansion

NETio Expansion Module

NETIOE-MDN1 I/O config	* 1	* 2	* 3	* 4	* 6	* 7	NFC00N	
1								1 Analog input (V or I) , 1 Analog output (I) , 2 Digital inputs, 2 Digital outputs
2								6 Digital inputs
3								6 Digital outputs
4								2 Analog inputs (V or I), 4 Digital inputs
6								2 Analog inputs (V, non-isolated), 2 Analog outputs (V, non-isolated), 2 Digital inputs, 2 Digital outputs
7								2 Analog inputs (I), 1 Digital input, 3 Digital outputs
Wireless Expansion		W						WeXP short-range wireless option (up to 3,000 ft.)
		N						No WeXP short-range wireless

Order Code Example

NETIOE-MDN16WNFC00N

- Expansion module
- 4 Analog I/O
- 4 Digital I/O
- Wireless expansion

NETio Access Point

NETIOA-MD Frequency	* 9	* 2	F	* S	* A	
NETIOA-MD						NETio Serial/Ethernet Access Point - entraNET model
Frequency	9					MDS 900 MHz long range, up to 30 miles
	2					MDS 2.4 GHz long range, up to 15 miles
Mounting				S		Standard Brackets
				A		DIN Rail
Network Management					1	Enable
					0	Disable

Order Code Example

NETIOA-MD9A1

- Access Point (Serial/Ethernet)
- entraNET-based 900 MHz
- DIN rail mounting
- Network management

Visit www.GEMDS.com/NETio to download NETio resources

WiYZ

Intelligent Data Acquisition and Signal Communications

Data Acquisition | MDS Mesh, WiFi, Cellular

The MDS WiYZ™ products combine technology and function to provide a comprehensive range of solutions for data acquisition and networking requirements. Whether your application requires the collection of data from remote, unpowered sensors or deployment in areas with obstructed communication paths or a bridge for data using the cellular infrastructure to your enterprise network, the WiYZ products provide simple, reliable and cost-effective solutions.

Key Benefits

- Self-powered remotes connect off-the-shelf sensors, instruments and switches
- Reduced deployment costs with standard based mesh networking
- Eliminate added cabling, power and infrastructure costs at remote locations
- Seamless connection to multiple public and private wireless solutions
- Ethernet and serial data collection with Modbus and Modbus TCP
- Automatic mesh network creation insures wireless reliability and performance
- Automatic re-routing of communication in the event of a device failure or path obstruction
- Global unlicensed use in 2.4 GHz band and public GSM and CDMA cellular technology

Application Specific Wireless Solution



Water & Wastewater

- Battery powered remotes monitor storage tank levels
- Collect pollution discharge flow rates for regulatory compliance



Energy

- Monitor pole top circuit breakers and report status
- Collect inventory data from gas storage facilities



Oil & Gas

- Monitor gas well head tubing and casing pressure
- Collect compressor inlet and discharge pressure values



Heavy Industrial

- Track remote liquid storage inventories and monitor remote assets
- Monitor holding pond levels and discharge flow for regulatory reporting



Industrially Hardened

- Operation in extreme temperatures from -40°C to 70°C
- Class 1 Div. 2 approved for hazardous locations
- Rugged NEMA 4X, IP 65 outdoor housing

Application Flexibility

- Battery powered options for exceptional versatility in deployment and use
- Configurable data sampling and transmission rates
- Single sensor or multiple analog, digital I/O signals
- Connect mV, V, mA, 5-36 VDC, and RS232/485
- Depot data storage and time-stamping at remotes and gateway
- Optional cellular, WiFi and MDS wireless
- Wired options for IP/Ethernet and serial connections to host systems or devices
- Bridge data to cellular WiFi and MDS wireless

Reliable & Scalable

- MDS mesh communications
- Global unlicensed 2.4 GHz
- Capacity for up to 250 remotes with additional expansion options
- Consolidate multiple wireless connections in a single gateway
- Use Modbus, Modbus TCP protocols or ftp for data file transmission

Secure

- 128-bit encryption
- Password protected access and lockdown
- Mac Address block list



Flexible Data Acquisition

Process optimization, quality control, regulatory compliance, improved productivity, preventive maintenance, safety and security are just a few of the requirements that drive the need for data acquisition and monitoring solutions.

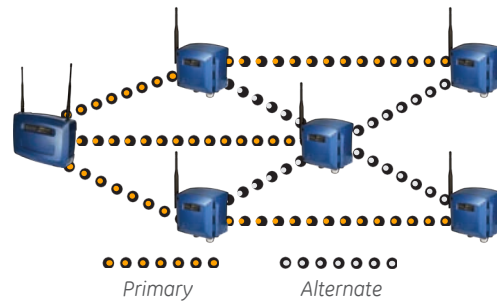
Delivering remotely collected data cost effectively to local devices and systems or to Enterprise networks on a regional, national, even international scale requires new solutions that bridge multiple communication methods and technologies. The MDS WiYZ products deliver these solutions for both data acquisition and networking.

Direct sensor to wireless connectivity



MDS Mesh Networking

WiYZ implements the ISA 100 standard for mesh network communication between remotes and the gateway. Mesh networking provides significant benefits in network design, deployment and reliability. WiYZ automatically creates the wireless network eliminating the cost and effort associated with path planning and analysis. Moreover, the mesh network automatically establishes alternate communication paths to the Gateway and between remotes re-routing communication around obstructions or device failures. The ISA 100 standard is extremely robust, operates in the 2.4 GHz band and is designed to coexist with other wireless solutions.



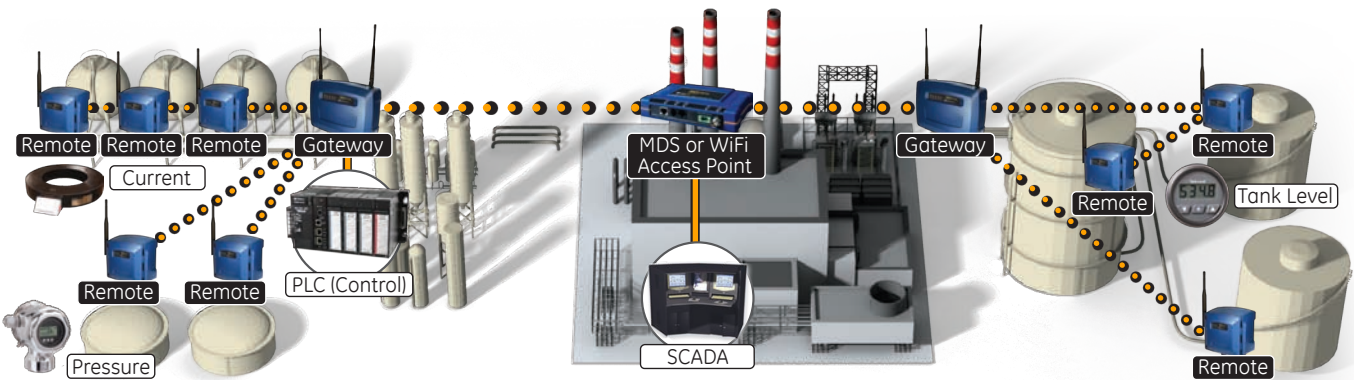
Connect Sensors and I/O - Battery or Line Powered

WiYZ provides true connection flexibility supporting the direct connection of a single sensor, or multiple I/O signals from external devices. WiYZ's battery power option allows you to install it even when local power is unavailable and lasts up to 5 years. WiYZ constantly monitors and reports battery power levels so depletion is predictable.

Enterprise, System and Device Connectivity

The WiYZ Gateway provides unparalleled performance and flexibility. Interface to local host controllers, systems or networks using IP/Ethernet or serial connections. Select up to two additional options for wireless connectivity to far-away Enterprise networks using cellular, local plant infrastructure using WiFi and long range MDS wireless for SCADA networks. Interface sensor and I/O data using Modbus and Modbus TCP or move data files via ftp.

WiYZ Application Advantages



Sensors and I/O Signals

- Use WiYZ Remotes with level, pressure, flow and temperature sensors to remotely monitor important parameters
- Connect digital signals for status monitoring and control
- Regenerate signals from sensors and I/O to RTUs and controllers

System Communication

- Interface data to host systems using Modbus or Modbus TCP
- Transfer data files to Enterprise systems using ftp
- Bridge IP/Ethernet and serial communication to remote controllers and multi-variable transmitters

Gateway Connectivity

- Global Enterprise connectivity using public cellular communication
- Connect multiple WiYZ networks to SCADA systems using MDS point-to-multipoint wireless
- Utilize your open plant infrastructure using WiFi for networking and maintenance

WiYZ Remote

WiYZ Remotes are packed with features and functionality to match up with a diverse range of remote monitoring and control requirements.

- Configurable sample periods and transmit intervals allow remotes to periodically sample sensor and I/O data, and transmit back to the gateway at specified intervals, conserving battery power and reducing network traffic. Time stamped readings are stored in the remote until transmission to the gateway.
- Use built-in I/O extension function to regenerate sensor and I/O signals at other between remotes

Each WiYZ Remote accommodates 2 Digital Inputs, 2 Digital Outputs, and 2 Analog Inputs or Outputs. Remotes are also equipped with a built in RS232/485 serial port to connect intelligent instruments and devices.

The WiYZ Remote is designed for harsh outdoor environments and includes convenient mechanical and electrical connection options. The remote also includes an integral antenna plus options for remote antennas. Surface mount, pole mount and conduit mount options simplify installation. The WiYZ Remote is Class 1 Division 2 approved for use in hazardous locations.

No power? No problem. The WiYZ Remote can be battery powered so users can implement monitoring solutions at important locations that have been impractical before.



WiYZ Gateway

The WiYZ Gateway is a powerful and flexible device facilitating wired and wireless connectivity to host systems and Enterprise networks. The WiYZ Gateway supports up to 3 wireless connectivity options for bridging communication between Mesh, Cellular, WiFi and MDS wireless and serial or IP/Ethernet networks.

The WiYZ Gateway establishes and maintains the ISA 100 mesh network. It also collects data from WiYZ Remotes. Data can be locally stored on the gateway in between transmissions to Enterprise networks resulting in significant savings in cellular communication costs. Alternatively, the gateway supports Modbus and Modbus TCP for direct polling of sensor and I/O data in real time.

The WiYZ Gateway operates as a multi-device hub and bridges IP/Ethernet and serial communication (either wired or wireless) anywhere, between remotes, controllers and PLCs and host systems.

- Configurable data transmission periods
- Storage of time stamped data in between data transmissions to host systems
- Protocol support for Modbus, Modbus TCP and FTP
- I/O extension of sensor and I/O signals between TDR remotes
- Security implementation including encryption and password access
- Networking support for VLAN, DHCP, Port Forwarding and NAT

The WiYZ Gateway manages the ISA 100 mesh network and implements the local user interface. It has a capacity for up to 250 TDR remotes. It also implements the cyber security layer for the entire network. WiYZ is designed for harsh outdoor environments and includes convenient connections for power and system connections.



Specifications

GENERAL

Gateway Power	10-30 vDC
Remote Power	7-30 vDC
Temperature	-40° to +60°C
Housing	Die-cast Aluminum
Area Approval	Class 1, Division 2, Groups A, B, C, D for hazardous locations

WIYZ GATEWAY

Size	14.6 H x 4.14 W x 11.4 D cm. 5.75 H x 1.63 W x 4.5 D in.
Weight	5 Lbs
Ethernet Port	One RJ45 10/100
Serial Port	Two RJ-45, RS232, 1.2 to 115.2 kbps
LAN Protocols	802.3 (Ethernet), 802.1D (Spanning Tree), 802.1Q (VLAN), TCP/IP, DHCP, ICMP, TFTP, IGMP, FTP, UDP, SNMP v1/v2/v3
Networking	VLAN, DHCP, Port Forwarding, NAT
Configuration	Serial console, Telnet/SSH, Web. Config files
Security	Encryption, Password Access, MAC Address block list

MESH SPECIFICATIONS

Frequency	2.4 to 2.4835 GHz
Range	Up to 3,000 ft.
Carrier Power	100 mW (18 dBm)
Receiver Sensitivity	-100 dBm

CELLULAR OPTIONS

Types	CDMA, GSM/GPRS, EDGE
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WIFI OPTIONS

WiFi Remote	802.11b/g
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900 MHZ OPTION

Data Rate	106 kbps (EB); 115 kbps (TB)
Frequency	902-928 MHz ISM band
Mode	Frequency Hopping Spread Spectrum
Range	Up to 25 miles
Antenna	N-female
System Gain	136 dB
Carrier Power	01. To 1.0 watts (20 to 30 dBm)
Receiver Sensitivity	-106 dBm (1 x 10 ⁻⁶ BER) typical

2.4 GHZ OPTION

Data Rate	106 kbps
Frequency	2.4016 – 2.4778 GHz ISM
Mode	Frequency Hopping
Channels	Selectable 80 to 128
Range FCC/IC	Up to 15 miles
Range ETSI	2500 Ft, 750 Meters
Antenna	N-female
System Gain	131 dB
Carrier Power	01. To 0.5 watts (20 to 27 dBm)
Receiver Sensitivity	-104 dBm (1 x 10 ⁻⁶ BER) typical

TDR REMOTE

I/O Capacity	2 AI, 2 AO, 2 DI, 2 DO
Size	5.0 x 5.3 x 3.5 (HWD)
Weight	1 lb
Housing	Die-cast Aluminum
Receiver Sensitivity	-100 dBm

I/O SPECIFICATIONS

ANALOG INPUTS

Types	0-100 mV, 0-20 mA, 0-5 V
Accuracy	.1% of Span
A/D Resolution	12 bit
Isolation	1,400 V input to power (not isolated on NIOXM-6)

ANALOG OUTPUTS

Types	0-20 mA, 0-5 VDC
Accuracy	.1% of Span
Isolation	1400 V output to power
D/A resolution	12 bits

DIGITAL INPUTS

Type	5-36 vDC
Isolation	3,000 V to chassis ground

DIGITAL OUTPUTS

Type	FET relay
Capacity	36 vDC
Load	2A continuous (per output)
Isolation	3,700 V to chassis ground

APPROVALS

FCC	Pending
IC - Industry Canada	Pending
ETSI	Pending
CSA/US and CE	Pending

Gateway Ordering

WiYZG-	*	*	*	*	WiYZ Gateway: Mesh, IP/Ethernet, Serial
	N				No Cell Modem
	C				CDMA Cellular
	G				GSM/GPRS Cellular
		N			No MDS Point-to-Multipoint
		9			MDS 900 MHz Point-to-Multipoint
		2			MDS 2.4 GHz Point-to-Multipoint
			N		No WiFi
			W		802.11b/g WiFi Remote
				D	10-30 VDC Power
				A	110-220 VAC Power
					S Surface Mounting Brackets
					P Pole Mounting Brackets

Order Code Example
WiYZG-CNWDS

- CDMA cellular
- No MDS point-to-multipoint
- 802.11b/g WiFi remote
- DC power
- Surface mounting

Remote Ordering

WiYZR-	*	*	*	*	WiYZ Remote: Mesh, Serial, Antenna
	B				Battery Power
	D				DC Power
	A				AC Power
		1			2 0-100mV-AI, 2 0-5-VDC AO, 2 DI, 2 DO
		2			2 0-5 VDC-AI, 2 0-5 VDC-AO, 2 DI, 2 DO
		3			2 0-20mA-AI, 2 DI, 2 DO
		4			2 0-20mA-AO, 2 DI, 2 DO
			C		½" NPT Male Fitting
			M		M20 Metric Fitting
			N		No Fitting - Plugged
				G	Cable Gland Hub
				N	No Cable Gland - Plugged
					S Surface Mounting Brackets
					P Pole Mounting Brackets

Order Code Example
WiYZR-B1CNS

- Battery power
- Two 0-100 mV analog inputs
- Two 0-5-VDC analog outputs
- Two digital inputs
- Two digital outputs
- ½" NPT conduit fitting
- No cable gland
- Surface mounting

Visit www.GEMDS.com/WiYZ to:



- Buy WiYZ through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

x710 Series

Narrowband Connectivity
1710, 2710, 4710, 9710



Data Acquisition | Serial Transceiver

The MDS x710 Series is a price and performance leader in licensed microwave radios in the 130-174 MHz, 220-235 MHz, 330-512 MHz, and 800-960 MHz frequency ranges. They provide increased throughput and longer range for multiple address systems. Transparent and direct asynchronous communication offers real-time communication. No extra software or programming is needed to implement communications using standard asynchronous protocols. A general purpose (unconditioned) digital output is available.

The MDS x710 Series is field configurable as a master station or remote radio. The MDS x710 can operate as a half-duplex or simplex radio, and supports all splits in duplex frequencies. When operating as a master station, full network diagnostics are available. Simplex mode permits peer-to-peer radio communications. This product is available for use in Class I, Division 2, Groups A, B, C & D hazardous locations.

Key Benefits

- High system performance and data integrity with robust construction and digital signal processing technology (DSP) providing up to 19.2 Kbps data throughput
- Quick return on investment due to ease of wireless installation. This licensed radio offers the ability to communicate with any asynchronous protocol without extra software or programming.
- Exceptional design provides excellent performance in the face of interference or difficult signal paths
- Network management software simplifies maintenance tasks, reduces the cost of managing the network infrastructure, and provides a non-intrusive means of maintenance and link monitoring

Application Specific Wireless Solution



Oil & Gas

- Monitor and transmit wellhead pressure and tank levels collected by RTUs



Water & Wastewater

- Monitor lift stations across multiple sites from control room



Energy

- Condition monitoring for pole-top circuit breakers and capacitor banks



Heavy Industrial

- Monitor and control remote pumps and compressors

Industrially Hardened

- Operational temperature range from -30°C to 60°C
- CSA Class I, Div. 2 groups A, B, C, D for hazardous locations

Application Flexibility

- Low power consumption for solar powered applications
- Long range wireless communication, up to 50 miles
- Fully compatible with first generation MDS radios

Reliable & Scalable

- Exclusive-use, non-shared licensed band operation in 400 MHz
- Point-to-multipoint 2-way communication
- High receive sensitivity for long distances
- Compatible with multiple industry protocols including Modbus and DNP3

High Performance

- Digital signal processing (DSP) engine
- Single unit configurable as master or remote radio
- Inter-operable "B" versions available for use with existing MDS 2000, MDS 4000 series radios

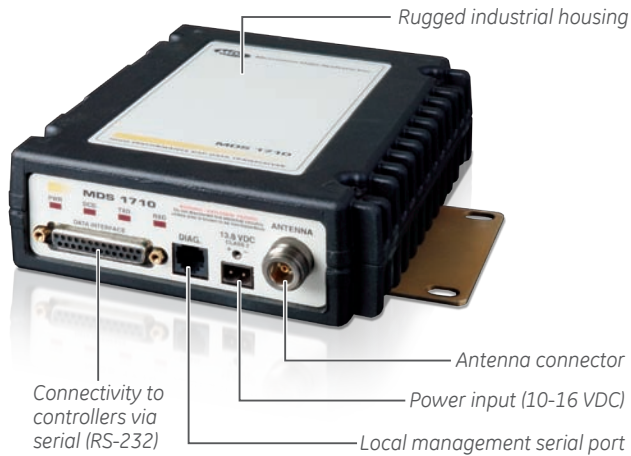


Remote & Master Station

The x710 radio operates in the 200, 400 or 900 MHz licensed frequency bands.

A radio system is built with a master station and remote radios. Additionally, the use of repeater stations helps to overcome obstructions and extend coverage.

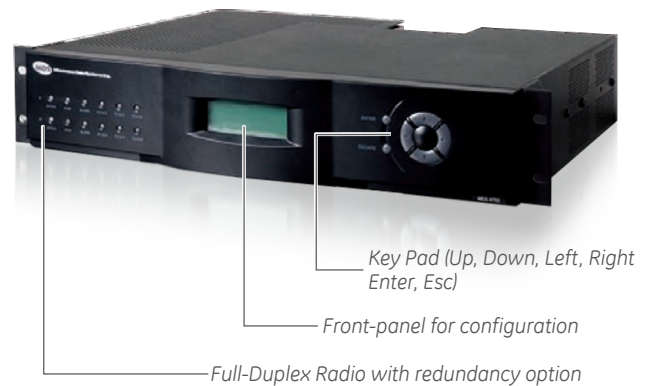
x710 radios operate on a specific frequency band, and are tuned at the factory to the ordered operational range. No field adjustments are necessary for normal operation.



Protected Master and Repeater Station

Mission critical applications demand that no single point of failure can stop the communications system. In wireless applications the master station serves as the central hub to all remote radios. The x790 Master Station with redundancy option increases the availability of a system with a hot-standby configuration. The standby radio activates automatically whenever a fault condition is detected by the active radio.

For repeater locations, the full-duplex capability of the x790 maximizes the speed of data traffic relays, for a system with better overall performance.



Specifications

GENERAL		TRANSMITTER		ENVIRONMENTAL	
Operational modes	Simplex, half-duplex	Frequency Stability	+/- 1.5 ppm	Temperature	-30°C to +60°C (-22°F to +140°F)
Modulation	Digital / CPFSK	Carrier power	0.1 to 5 Watts Programmable	Humidity	95% at 40°C (104°F) non-condensing
Range	Up to 50 miles	Accuracy	Normal +/- 1.5 dB	ELECTRICAL	
1710		Duty Cycle	Continuous	Primary power	(10.5 to 16 Vdc) 13.8 Vdc nominal
RF Data Rate & bandwidth	3200 @ 6.25 kHz 9600 @ 12.5 kHz 19200 @ 25 kHz	Output Impedance	50 Ohms	Tx Current	2A Typical at 5 Watts
Frequency band	130 - 174 MHz	RECEIVER		Rx Current	<125 mA
2710		Type	Double Conversion Superheterodyne	Sleep mode	15 mA nominal
RF Data Rate & bandwidth	3200 @ 6.25 kHz 9600 @ 12.5 kHz 19200 @ 25 kHz	Selectivity	>70dB	MECHANICAL	
Frequency band	216-235 MHz	Bit Error Rate	1x10 ⁻⁶ @ -110 dBm typical	Case	Rugged die-cast aluminum
4710		INTERFACES		Dimensions	5.08 H x 14.29 W x 18.4 D cm. (2.0 H x 5.625 W x 7.25 D in.)
RF Data Rate & bandwidth	4800 @ 12.5 kHz 9600 @ 12.5 kHz 19200 @ 25 kHz	Serial	RS232, DCE, DB25 Female	Weight	1 kg (2.2 lb.)
Frequency band	330-512 MHz	Diagnostic	RS232, DCE, RJ11 Female	AGENCY APPROVALS	
9710		Antenna	N-Type Female	CSA Class 1 Div 2 for hazardous locations	
RF Data Rate & bandwidth	9600 @ 12.5 kHz 19200 @ 25 kHz	MANAGEMENT		FCC Part 90	
Frequency band	800-960 MHz	MDS InSite software		Industry Canada & ENTELA	
		MDS NetView software		ETSI, EMC, CE MARK (ETSI: ETS 300 113, EMC: EN 300 279)	
		MDS Radio Configuration software			

Accessories for the x710

Fixed Remote Kits with Yagi

- KFR-L04-C1 (406-430 MHz)
- KFR-L04-C2 (430-450 MHz)
- KFR-L04-C3 (450-470 MHz)
- KFR-L09-D1 (900 MHz)

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/x710 to:



- Buy x710 through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

x790 Series

Master Stations
4790, 9790 & SDA



Data Acquisition | Serial Transceiver

The redundant, full-duplex MDS x790 Series Master Stations are the price and performance leader of licensed microwave radios in the 330-512 MHz and 800-960 MHz frequency range. It gives increased throughput and longer range alternatives for our customers' Multiple Address Systems needs. Transparent and direct asynchronous communications offer real-time communication. No extra software or programming is needed to implement communications that use standard asynchronous protocols. The addition of the SD Adapter enables IP/Ethernet communications and AES 128-bit encryption to a system based on the MDS SD Series radio.

The MDS x790 Series Master Station may operate as a full-duplex, half-duplex or simplex radio and is configurable as a redundant master station, a redundant repeater or a remote radio. The MDS 4790 and MDS 4710 or the MDS 9790 and MDS 9710 remote transceivers together offer a new level of ease of integration, reliability and performance for our customers' data network systems.

Key Benefits

- High system performance and data integrity with robust construction and digital signal processing technology (DSP) providing up to 19.2 Kbps data throughput
- Quick return on investment due to ease of wireless installation, coupled with the ability to communicate with any asynchronous protocol without extra software or programming
- Excellent performance in the face of interference or difficult signal paths
- Network management software simplifies maintenance tasks, reduces network infrastructure management costs, and provides a non-intrusive means of maintenance and link monitoring

Application Specific Wireless Solution



Oil & Gas

- Monitor and transmit wellhead pressure and tank levels collected by RTUs



Water & Wastewater

- Monitor lift stations across multiple sites from control room



Energy

- Condition monitoring for pole-top circuit breakers and capacitor banks



Heavy Industrial

- Monitor and control remote pumps and compressors

Industrially Hardened

- Operational temperature range from -30°C to 60°C
- CSA Class I, Div. 2 groups A, B, C, D for Hazardous Locations

Application Flexibility

- Long range wireless communications up to 50 miles
- Fully compatible with first generation MDS radios

Reliable & Scalable

- Exclusive-use, non-shared licensed band operation
- Point-to-multipoint 2-way communication
- High receive sensitivity for noisy environments and long distances
- Compatible with multiple industry protocols including Modbus and DNP3

High Performance

- Digital signal processing (DSP) engine
- Single unit configurable as master or remote radio
- Inter-operable "B" versions available for use with existing MDS 2000, MDS 4000 series radios



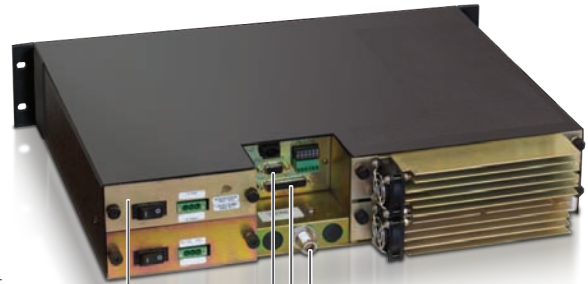
x790



Full-Duplex Radio with redundancy option

Detachable front-panel LCD Display for configuration

Key Pad (Up, Down, Left, Right Enter, Esc)



Dual DC or AC Power
Local management diagnostics serial port

Antenna (Over-the-Air connectivity to SDx and x710 remotes)

COM1 serial port

SD Adapter

COM2 Serial Port (To Host Computer, Serial, DB-9F)

COM1 Serial Port (To x790 Radio, DB-9M to DB-25M Umbilical)

Ethernet Port (To Host Computer, 10/100 BaseT, RJ-45)



Rear view

Specifications

GENERAL

Data Rate (data)	110 bps - 38.4 Kbps
Frequency programmability	6.25 kHz increments to any MAS channel pair
Operational modes	asynchronous - simplex, half-duplex, full-duplex (synchronous available in 4790B, and 9790B), protected, non-protected digital / CPFSK
Modulation	digital / CPFSK
Latency (Rx-Tx-Rx)	10 ms including RTS/ CTS delay
CTS Delay	0-255 msec programmable in 1 msec increments
PTT Delay	0-255 msec programmable in 1 msec increments
Range	Up to 50 miles

4790

RF Data Rate	4790E: 4800 bps 4790P: 9600 bps 4790A: 9600 bps 4790C: 19,200 bps
Frequency Bands	330 - 512 MHz
Tx / Rx split:	4790: simplex to 132 MHz

9790

RF Data Rate	9790E: 4800 bps 9790A: 9600 bps
Frequency bands	800 - 960 MHz
Tx / Rx split:	simplex to 160 MHz

TRANSMITTER

Frequency Stability	+/- 1.5 ppm
Carrier power	0.1 to 5 Watts Programmable
Carrier power Accuracy	Normal +/- 1.5 dB
Duty Cycle	Continuous
Output Impedance	50 Ohms

RECEIVER

Type	Double Conversion Superheterodyne
Adjacent channel (EIA):	60 dB nominal

BIT ERROR RATE

4790	4790E: 4800 bps: BER 1x10 ⁻⁶ @ -114 dBm typical 4790M: 9600 bps: BER 1x10 ⁻⁶ @ -100 dBm typical 4790A: 9600 bps: BER 1x10 ⁻⁶ @ -110 dBm typical 4790C: 19.2 Kbps BER 1x10 ⁻⁶ @ -105 dBm typical
9790	9790E: 4800 bps: BER 1x10 ⁻⁶ @ -114 dBm typical 9790A: 9600 bps: BER 1x10 ⁻⁶ @ -110 dBm typical

INTERFACES

4790 & 9790	Data interface RS232, DB25 Female
	Supports TXD, RXD, RTS, CTS, DCD, RUS, AUX POWER, DSR, and GND

SDA

Serial COM1	RS-232, DB9
Serial COM2	RS-232, DB9
Ethernet	10/100BaseT, RJ45

DIAGNOSTICS

Local diagnostics	included in all models
Network-wide diagnostics	InSite™ Radio System Management software (optional)

ENVIRONMENTAL

Temperature	-30°C to +60°C (-22°F to +140°F)
Humidity	95% at 40C (104°F) non-condensing

ELECTRICAL

Primary power	100-240 Vac (50/60 Hz), 24/48 Vdc (21 to 60 Vdc), 125 Vdc external, 12 Vdc external
Power required	< 60 Watts nominal

MECHANICAL

4790 & 9790	Dimensions 8.8 H(2U) x 43.7 W x 36.3 D cm. 3.5 H x 14.3 W x 14.3 D in.
Weight	9 kg (19.8 lbs)

SDA

Dimensions	4.4 H(1U) x 43.7 W x 30 D cm. 1.7 H x 14.3 W x 12 D in.
Weight	1.5 kg (3.3 lbs)

AGENCY APPROVALS

4790A:	FCC part 90, industry Canada & ENTELA (safety)
4790E and 4790M:	ETS: ETS 300 113, EMC: EN 300 279, CE Mark & ENTELA (safety)
9790A:	FCC Part 101, Industry Canada & ENTELA (safety)

Accessories for the x790

Fixed Remote Kits with Yagi	400 MHz	900 MHz
	KAP-L04-C1 (406-430 MHz)	KAP-L09-D1
	KAP-L04-C2 (430-450 MHz)	
	KAP-L04-C3 (450-470 MHz)	

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/x790 to:



- Buy the x790 through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

TransNET

Long Range, High Speed
Serial Communications



Data Acquisition | Compact and Unlicensed

Today's SCADA and Telemetry systems transport large amounts of data at ever-increasing speeds. Additionally, the need for greater packaging flexibility has redefined the "ideal" wireless platform. The MDS TransNET™ utilizes FHSS (Frequency Hopping Spread Spectrum) to provide reliable long range data transportation at up to 115.2 kbps. The TransNET provides transparent data communications for nearly all SCADA, Telemetry, and EFM protocols including Modbus.

Any MDS TransNET may be configured as a repeater to extend the operating range of the network. Multiple repeaters may exist at any level of the network preventing a single radio failure from disabling the entire network.

Key Benefits

- Digital signal processing (DSP) technology with self-equalization, automatic CRC/ARQ and powerful forward error correction
- Quick return on investment with plug-and-play installation
- Unlicensed radio design
- Communicate with any asynchronous protocol without extra software or additional programming
- Excellent performance in the face of interference or difficult signal paths
- Network-wide diagnostics software simplifies tasks and reduces costs

Application Specific Wireless Solution



Oil & Gas

- Remote monitoring of pipeline flow and status signals
- Monitor and transmit wellhead pressure and tank levels collected by RTUs



Energy

- Remote control of IED and PLC at distribution substations
- Condition monitoring for pole-top circuit breakers and capacitor banks



Water & Wastewater

- Monitor lift stations across multiple sites from control room



Heavy Industrial

- Activation of perimeter gates based on detection of vehicle
- Monitor and control remote pumps and compressors

Industrially Hardened

- Operational temperature range from -40°C to 70°C
- CSA Class I, Div. 2 groups A, B, C, D for hazardous locations

Application Flexibility

- Low power consumption sleep mode for solar powered applications
- Long range wireless communication, up to 30 miles
- High speed throughput to 115.2 Kbps

Reliable & Scalable

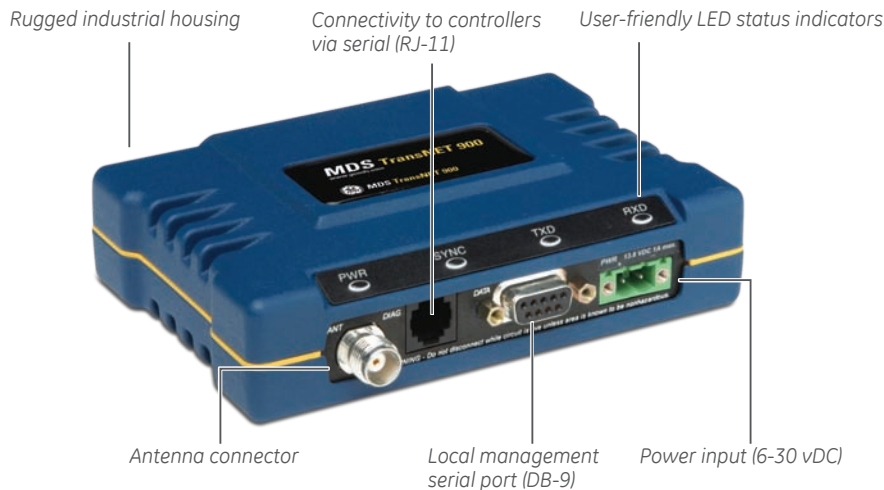
- Point-to-Multipoint, 2-way communication
- High receive sensitivity for noisy environments and long distances
- Compatible with multiple industry protocols including Modbus and DNP3
- Unparalleled robustness with forward error correction and CRC/ARQ multiple re-sends
- Store and forward to extend network range cost-effectively

Secure

- Proprietary hopping algorithm among 128 channels



Remote & Access Point



Specifications

GENERAL

Frequency Band 902-928 MHz ISM band
 Dimensions 8.9 D x 12.7 W x 2.5 H cm.
 (3.5 D x 5 W x 1 H in.)

Input Power 6 to 30 Vdc
 Current Drain for AP and Remote

Mode	30 Vdc	13.8 Vdc	6 Vdc
Transmit	236 mA	510 mA	1.18 A
Receive	51 mA	100 mA	155 mA

Sleep Mode 4 mA typical
 Temperature -40° C to +70° C
 Range Up to 30 miles
 Humidity < 95% RH (Non-Condensing)

TRANSMITTER

Power Output 1 Watt (30 dBm) at 6 Vdc to 30 Vdc, user selectable down to 100 mw (+20 dBm)
 Modulation CPFSK

RECEIVER

Sensitivity -105 dBm (1 x 10⁻⁶ BER) typical
 Error Detection CRC16; Resend on Error
 Interference Avoidance
 64,000 hop patterns selected automatically via network address
 FEC, CRC/ARQ and/or Multiple Packet Transmits
 Excellent Strong Signal (interference) Characteristics
 Band Segmentation for Friendly Coexistence with other services such as LMS

DATA

Interface RS-232/RS-485 (User Selectable)
 Usable Throughput 115.2 kbps
 Port Speeds 1.2 to 115.2 kbps

CONNECTORS

Power, User, NMS 2 Pin Phoenix, DB-9, RJ11
 RF TNC

OPERATING MODES

Point-to-Multipoint
 Master
 Remote
 Repeater Extension (store and forward) - Unlimited repeaters, self healing networks

NETWORK MANAGEMENT

Diagnostics
 Centralized network control eliminates site visits
 Create store and forward configurations
 Compatible with other MDS Products
 MDS InSite

AGENCY APPROVALS

FCC Part 15 Approved
 UL/CSA Class 1 Div. 2 approved (UL 508, UL 1604)
 IC Approved

Ordering

TransNET Remote and Access Point

EL805-MD	* X * A * C * * * N	
Frequency	9	MDS 900-928 MHz long range (up to 30 miles), FCC and IC approved
	2	MDS 2.4 GHz long range (up to 15 miles), not FCC/IC/ETSI approved
Interface	0	RS-232
	1	RS-485
Diagnostics	N	None
	W	Network-wide

Order Code Example

EL805-MD9X1AFCS0WN

- Chassis-enclosed radio
- 902-928 MHz band
- RS-232 interface
- Include network diagnostics

Accessories for the TransNET

Fixed Remote Kit with Yagi KFR-N09-D1
 Power Supply (AC Input) 01-3682A02

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/TransNET to:



- Buy TransNET through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

A tall metal lattice tower, likely a power line tower, stands against a sunset sky. The sky transitions from a bright orange glow near the horizon to a deep blue at the top. Several power lines stretch across the frame. Abstract geometric overlays, including a large white circle and a smaller white circle, are present. A dotted line also curves across the right side of the image.

LAN Extension

High Speed Point-to-Multipoint

LAN Extension

Mercury Series



Industrial WiMAX Networking

Multi-megabit speed and long range facilitates fixed and mobile data applications with quick, seamless hand-offs. The MDS Mercury Series of devices are industrial wireless Ethernet-based solutions with advanced cyber-security. The Mercury can be optimized for specific throughput and coverage requirements.

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iNET-II



Secure IP/Ethernet

The MDS iNET-II is the industry leader for unlicensed industrial networking with its combined megabit speed, exceptional range and industry-leading cyber security. The iNET-II supports IP/Ethernet and serial communication to permit the smooth migration of legacy serial devices to IP networks. The iNET-II meets the needs of SCADA system designers and IT professionals, with a cyber-security suite including VLAN tagging, Radius Authentication, and AES 128-bit encryption, all at the lowest cost of ownership.

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entraNET



Extended Range IP/Ethernet and Serial Networking

The MDS entraNET is an exceptionally long range, unlicensed device offering robust performance in extreme environmental conditions. Sleep modes keep power consumption low for battery and solar applications. Both Ethernet and serial devices can communicate in peer-to-peer mode and connect to an IP network—all with multiple layers of cyber-security. The end result is reduced cost of deployment and a low cost of ownership for systems that bring mission-critical, revenue-generating data from assets dispersed over great distances.

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Selector Guide

Features	Mercury	iNET-II	entraNET
Frequency			
900 MHz Unlicensed	•	•	•
2.4 GHz Unlicensed			•
3650 MHz Non-Exclusive Licensed	•		
Range			
	15 miles	20 miles	30 miles
Speed			
	9 Mbps	1 Mbps	106 kbps
Data Interfaces – Access Point			
Ethernet	•	•	•
Serial	•	•	•
Data Interfaces - Remote			
Ethernet	•	•	•
Serial	•	•	•
Network Type			
Point-to-Multipoint	•	•	•

Mercury Series

Industrial WiMAX Networking Mercury 900 & Mercury 3650



LAN Extension | Mobile and Fixed Long Range

MDS Mercury is a highly secure, industrial-grade WiMAX platform for mission critical, industrial and public safety applications, including AMI, SCADA, Distributed Automation devices, video, Voice over Internet Protocol, mobile data, and Intranet applications. With aggregate Ethernet throughput up to 9 Mbps (or 800 kbps for nomadic mobile deployments), Quality of Service (QoS), service flows, and a choice of frequencies, MDS Mercury has the capacity, service prioritization, and deployment flexibility to facilitate your immediate and long-term requirements.

Key Benefits

- WiMAX technology for high speed, long range point-to-multipoint communications
- Prevents unauthorized network access and secures data as it's transmitted over the air
- Rugged solution for operation in extreme temperature ranges and hazardous locations
- Reduces required infrastructure and simplifies deployment and maintenance
- Supports existing PLCs and RTUs with comprehensive serial protocol support

Application Specific Wireless Solution



Energy

- High capacity wireless network for AMI collectors, aggregation locations, RTUs, voltage regulators, reclosures, cap banks, and switches



Oil & Gas

- High capacity wireless network for SCADA and aggregation locations
- Monitor well-heads, video surveillance, and transmit Voice Over IP (VoIP)



Water & Wastewater

- Monitor vital water flow
- Transmit real-time, fast scan rate video surveillance



Public Safety

- Mobile data access to dispatch system, agency Intranet for Amber Alerts, shift logs, and policies

WiMAX Technology

- Up to 9 Mbps, (800 kbps for mobile parked)
- Quality of Service (QoS) and service flow for dedicated & prioritized bandwidth assignments
- Time-Division Duplexing (TDD) synchronization for deterministic deployments
- Seamless, automatic adaptive modulation for optimized throughput

Industrially Hardened

- Operation in extreme temperatures from -30°C to +70°C
- Class I, Div 2 hazardous location approved
- IEEE-1613 approval for operation in electric substation environments
- Rugged aluminum chassis tested to military shock and vibration standards

Application Flexibility

- Multi-Megabit speed accommodates multiple services on one infrastructure
- Long range wireless communications, up to 15 miles (Fixed) and 4 miles (Mobile)
- IP/Ethernet and serial operate simultaneously on the same network
- Handles multiple industry protocols including DNP3, Modbus, Modbus TCP, and Multicast/Unicast Ethernet

Secure

- Built-in AES 128-bit encryption
- VLAN traffic data segregation
- Radius authentication and MAC address filtering for robust authentication

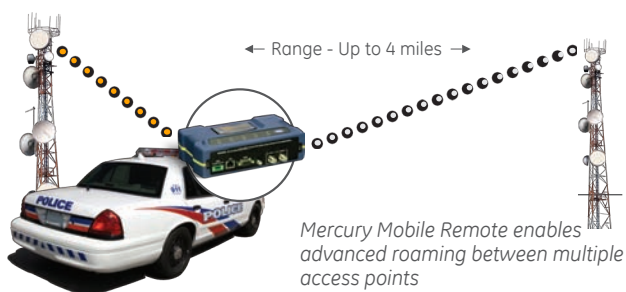


Multi-use, Industrial Infrastructure

With high WiMAX throughput, an organization may deploy an MDS Mercury solution to provide communications to mission critical polling and monitoring devices with enough capacity remaining to provide additional services such as video surveillance, Voice over IP (VoIP), and with Mercury 900, mobile data.

Service flows dedicate bandwidth for specific applications, and Quality of Service (QoS) further prioritizes data within service flows based on a number of configurable criteria.¹ Finally, VLAN tagging facilitates segregating sensitive operational data from administrative and overhead communications.

Advanced roaming algorithms make Mercury 900 the choice for mobile applications. The Mercury remote switches access points based on several criteria, such as signal strength, distance, and a combination of signal strength, distance, and bearing.



All MDS Mercury radios provide extreme operational temperature ranges, -30C to +70C, are housed in a rugged, aluminum chassis, and are tested for shock and vibration according to military standards. These radios are built for mission critical, industrial deployments.

More Deterministic Deployments

The MDS Mercury platform provides channel selection options to permit using the clearest channels in a given area, which facilitates optimized and more consistent throughput and latencies. Single channels may be selected, or for Mercury 900, multiple channels may be selected in the frequency hopping pattern.

Additionally, Time-Division Duplexing synchronizes access points (APs) to facilitate co-location of APs and overlap of coverage without introducing self-inflicted interference.

Networking Flexibility

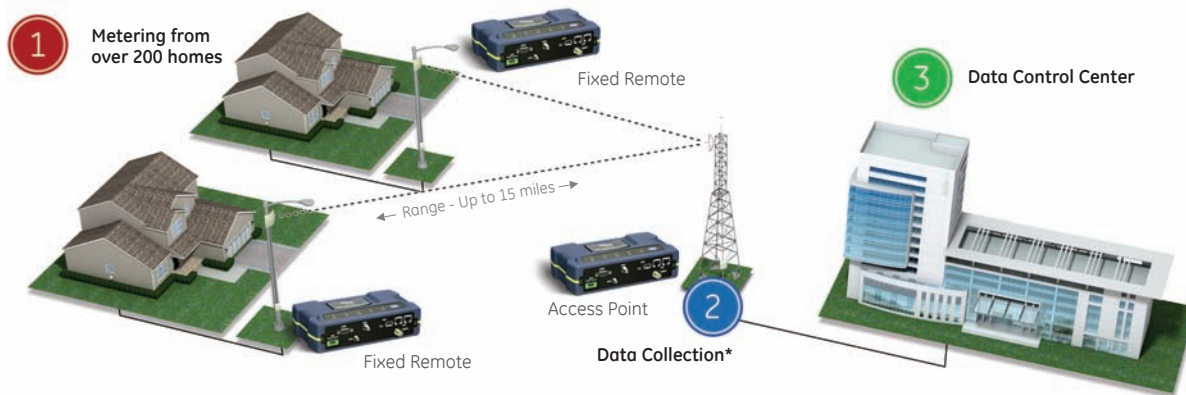
Serial protocol support, both active and transparent, provides communications to legacy and proprietary solutions as easily as Ethernet communications. Whether active Modbus TCP or transparently passing through TCP server, TCP client, Modbus TCP, Modbus RTU, and more, the MDS Mercury platform seamlessly provides a wide array of protocol support.

Additionally, frequency options available with the Mercury platform provide organizations the ability to select the most appropriate frequency for their applications.

Secure Communications

Sensitive communications must be protected from over-the-air capture and deciphering, and networks must be protected from unauthorized access. The MDS Mercury platform provides AES 128-bit encryption to protect data as it travels the air waves. Secure network authentication is provided by Radius authentication and MAC address filtering. Finally, sensitive data may be segregated using VLAN tagging.

Mercury Application Advantages



Multi-use, Secure Infrastructure

- High throughput to support multiple applications, to include high speed mobile data, video surveillance, collection point data aggregation, and VoIP
- Transmission security, network authentication security, and segregation of sensitive data

Flexible and More Deterministic

- Frequency options for best-band performance selection
- Full Ethernet and serial protocol support—in the same chassis
- Ability to block “noisy” channels

Single-box Solution

- Reduces points-of-failure
- Reduces infrastructure up to 67%
- Eases maintenance, support, and sparring

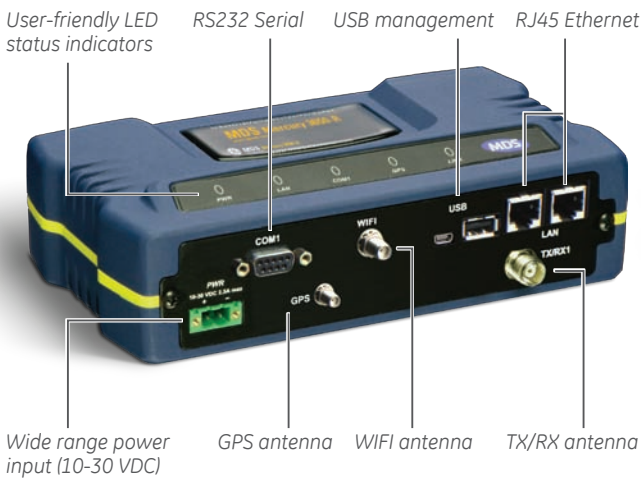
* Communication between the Access Point and the Data Control Center is achieved via a Backhaul device, such as the MDS Intrepid series

Mercury 3650

Superior throughput and protection

Mercury 3650 provides up to 9 Mbps aggregate Ethernet throughput for fixed, point-to-point or point-to-multipoint deployments. Operating under Part 90 of FCC rules, the Mercury 3650 includes both restricted and unrestricted, contention-based protocol support.²

Mercury 3650 is highly secure with AES 128-bit encryption, Radius and MAC address filtering authentication, and VLAN tagging included as standard features. This industrial-grade, single-box solution delivers extreme temperature specs for all equipment, Class 1, Div 2 approval, and IEEE-1613-compliance, this solution is built to be deployed in harsh environments. As a single-box solution, infrastructure costs are reduced and significantly fewer points of failure exist.

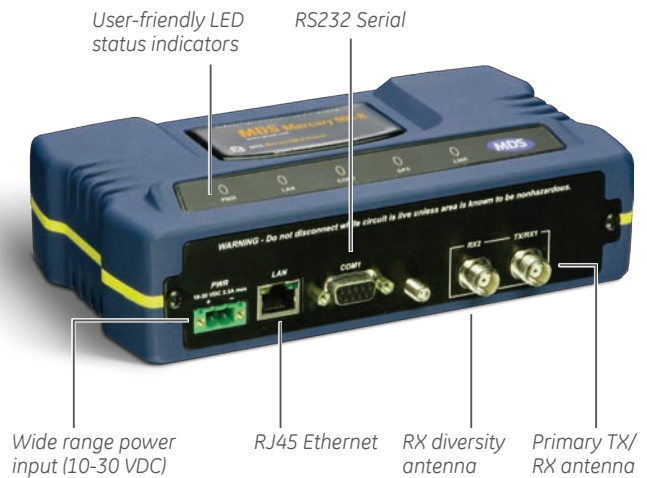


Mercury 900

High speed, secure mobility

Mercury 900 is a premier mobile data solution for public safety and field force automation deployments where security, channel availability, and high throughput are required. While Mercury 900 may be deployed as fixed infrastructure, its feature set is optimized for mobility, to include advanced roaming capabilities and seamless adaptation to specific access point configuration settings.

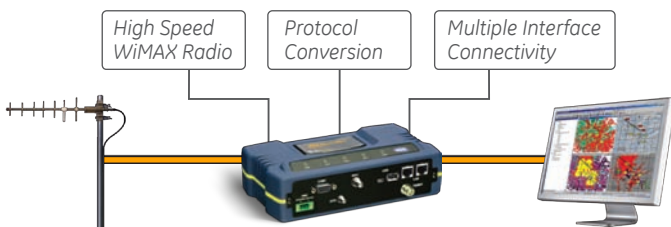
Officers or field workers benefit from up to 800 kbps aggregate Ethernet throughput while parked. This throughput is required for today's feature-rich dispatch applications and accessing agency Intranet and e-mail systems.



Single-Box Solution

All required components, except an external antenna, are housed within a single MDS Mercury chassis. The radio, modem, interface connections, and TDD synchronization features are all part of one box. When deploying access points (i.e., base stations), no additional equipment is required for synchronizing co-located access points. For remote radios (i.e., subscriber units), no additional equipment is required for supporting Ethernet and serial connections simultaneously.

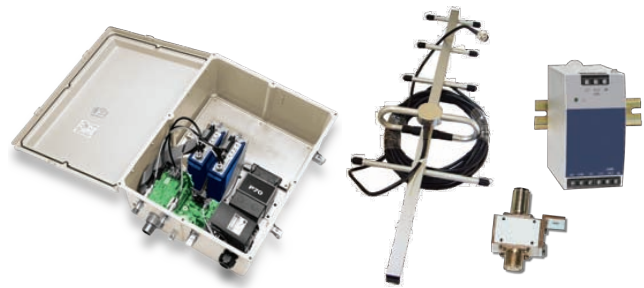
Additionally, there are no hidden fees for the full security suite and prioritization services, they are all included as standard features.



All required components are included in the Mercury single-box solution

Accessories & Custom Enclosures

GE MDS provides a complete line of reliable industrial-strength and cost-effective accessories that are tested to perform at optimal levels. GE MDS offers both standard and custom packages for wireless applications in harsh industrial environments. We simplify your wireless systems design by providing a convenient single-source ordering process. From antennas for the Mercury to field-rated power supplies for your mission-critical application, GE MDS can help ensure your system is robust and future-proof.



¹ QoS and service flow support via no-charge upgrade Q2 2009

² Unrestricted protocol support (allowing use of spectrum's upper 25 MHz) available Q4 2009

Specifications

GENERAL	
Technology	802.16d-2004, WiMAX
Modulation	OFDM with FEC and configurable ARQ
Frame Duration	5 ms, 8 ms, 10 ms, 20 ms
Duplex Method	TDD with GPS synchronization, fixed or dynamic duty cycle
Output Impedance	50 Ohms
Available Configurations	Single box Access Point, single box Remote
MERCURY 900	
Frequency	902-928 MHz
Channel Size	1.75, 3.5 MHz
Carrier Power	100 mW – 1 W
Range	Up to 4 miles (mobile)
MERCURY 3650	
Frequency	3.65 – 3.70 GHz
Channel Size	1.75, 3.5, 5, and 7 MHz
Carrier Power	100 mW – 200 mW
Range	Up to 15 miles
Ethernet	10/100BaseT, RJ-45
PHYSICAL INTERFACES	
Ethernet	10/100BaseT, RJ-45
Serial	1,200 – 115,200 bps, COM1 RS-232, DB-9F

Antennas	TX/RX - TNC connectors, GPS - Female SMA connector
LEDs	PWR, LAN, COM1, GPS, LINK
OPTIONAL FEATURE SET (REMOTES ONLY)	
	Built-in 2.4 GHz 802.11 b/g WiFi
	Second 10/100BaseT, RJ-45 Ethernet port with integrated switch
	USB 2.0 management port.
PROTOCOLS	
Ethernet	IEEE 802.3, Spanning Tree (Bridging), VLAN, IGMP
TCP/IP	DHCP, ICMP, UDP, TCP, ARP, Multicast, SNMP, TFTP
Serial	Active Modbus TCP and transparent TCP server, TCP client, Modbus TCP, Modbus RTU, UDP Unicast, UDP Multicast, BSAP and DNP3
MDS CYBER SECURITY SUITE, LEVEL 1	
Encryption	AES-128 w. auto key rotation
Authentication	802.1x, RADIUS, EAP/TLS, PKI, PAP, CHAP
Management	SSL, SSH, HTTPS
MANAGEMENT	
	HTTP, HTTPS, TELNET, SSH, SSL, local console
	SNMPv1/v2/v3, MIB-II, Enterprise MIB
	MDS NETview MST™ compatible

ENVIRONMENTAL				
Temperature	-30°C to 70°C (-22°F to 158°F)			
Humidity	95% at 60°C (104°F) non-condensing			
MECHANICAL				
Case	Die Cast Aluminum			
Dimensions	5.715 H x 20 W x 12.382 D cm. (2.25 H x 7.875 W x 4.875 D in.)			
Weight	1kg (2.2 lb.)			
Mounting options	Flat surface mount brackets, DIN rail, 19" rack tray			
AGENCY APPROVALS				
	FCC Part 15.247 (Mercury 900)			
	FCC Part 90 (Mercury 3650)			
	CSA Class 1 Div. 2 (UL 508, UL 1604)			
	IC pending			
ELECTRICAL				
Input Voltage	10-30 Vdc			
Current Consumption (nominal)				
	Mode Power 13.8 Vdc 24 Vdc			
AP	Operational (50% TX)	12W	0.87A	0.5A
RM	Operational & Associated	8W	0.58A	0.33A

Radio Sensitivity in dBm

Channel BW	1.75 MHz	3.5 MHz	5 MHz	7 MHz
MERCURY 3650				
BPSK	-99	-96	-95	-94
QPSK FEC 1/2	-96	-93	-91	-90
QPSK FEC 3/4	-93	-90	-88	-87
16QAM FEC 1/2	-90	-87	-85	-84
16QAM FEC 3/4	-87	-84	-82	-81
64QAM FEC 2/3	-84	-81	-79	-78
MERCURY 900				
BPSK FEC 1/2	-98	-95	-	-
QPSK FEC 1/2	-95	-92	-	-
QPSK FEC 3/4	-92	-89	-	-
16QAM FEC 1/2	-89	-86	-	-
16-QAM FEC 3/4	-86	-83	-	-
64-QAM FEC 2/3	-83	-80	-	-

Signal Rate (SR) & Aggregate Ethernet Throughput (AET) in Mbps

Channel BW	1.75 MHz		3.5 MHz		5 MHz		7 MHz	
	SR	AET	SR	AET	SR	AET	SR	AET
MERCURY 3650								
BPSK	0.71	0.30	1.41	0.97	2.02	1.30	2.82	1.78
QPSK FEC 1/2	1.41	0.95	2.82	2.09	4.03	2.76	5.65	3.58
QPSK FEC 3/4	2.12	1.51	4.24	3.19	6.05	4.10	8.47	6.01
16QAM FEC 1/2	2.82	2.01	5.65	3.61	8.06	5.72	11.29	7.52
16QAM FEC 3/4	4.24	2.99	8.47	5.52	12.10	7.46	16.94	8.11
64QAM FEC 2/3	5.60	3.84	11.18	6.36	15.97	8.67	22.36	8.86
MERCURY 900*								
BPSK FEC 1/2	0.71	0.30	1.41	0.96	-	-	-	-
QPSK FEC 1/2	1.41	0.96	2.82	2.09	-	-	-	-
QPSK FEC 3/4	2.12	1.51	4.24	3.20	-	-	-	-
16QAM FEC 1/2	2.82	2.01	5.85	3.60	-	-	-	-
16-QAM FEC 3/4	4.24	2.99	8.47	5.52	-	-	-	-
64-QAM FEC 2/3	5.60	3.84	11.18	6.36	-	-	-	-

Ordering

Mercury	HG- **** -0F- * - ** - * - * - *	
Frequency Range	A090 A365 R090 R365	Access Point - 902-928 MHz ISM (FCC Part 15) Access Point - 3.65-3.70 GHz (FCC Part 90) Remote - 902-928 MHz ISM (FCC Part 15) Remote - 3.65-3.70 GHz (FCC Part 90) Software configurable (not available for Mercury 900)
Channel size	0 1 2	1.75 MHz (use only for Mercury 900) 3.5 MHz (use only for Mercury 900)
Interface package	00 01	Standard (one Eth, one serial) Remote Option Set 1 (Two Eth, WiFi, one serial, USB)
Security suite	1	AES 128 encryption, Radius authentication, VLAN
Serial support	1	Modbus TCP, Multicast, DNP3
RF Essentials Kit		0 No kit 1 AP kit with omni 2 RM kit with panel 3 RM kit for Option Set 1 with panel and WiFi antenna

Order Code Example

HG-R365-0F-0-01-1-1-3

- 3.65 GHz FCC remote radio
- Software configurable channel size
- Two ethernet, WiFi, one serial, USB
- AES 128-bit encryption
- VLAN
- Radius authentication
- Full serial support
- RM kit with panel and WiFi antenna

Accessories for the Mercury

	900 MHz	3.65 GHz
Fixed Remote Kit with Panel	KFR-M09-F1	KFR-M36-F1
Fixed Remote Kit for Option Set 1 with Panel and WiFi Antenna	KFR-M09-F2	KFR-M36-F2

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/Mercury to:



- Buy Mercury through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

iNET-II

Secure IP/Ethernet



LAN Extension | Ethernet and Serial

The MDS iNET-II is an industrial wireless solution that provides long distance, unlicensed communications, up to 1 Mbps, allowing users to interface both Ethernet and serial controllers such as PLCs, RTUs and SCADA systems. The MDS iNET-II offers the right balance of speed and range to enable a wide variety of applications that require higher data capability than typical SCADA communication systems can provide. It combines the higher speed of Digital Transmission Systems (DTS) with the robustness of Frequency Hopping technology.

The MDS iNET-II combines the interfaces, functionality and security features that are standard across the Information Technology (IT) industry with a hardened radio platform necessary for the harsh environment of mission-critical applications in SCADA applications.

Key Benefits

- Provides wireless megabit-speed connectivity to Ethernet devices
- Unlicensed long range communication of IP/Ethernet and serial data
- Multiple layers of cyber-security, including AES 128-bit encryption, 802.1x device authentication and frequency hopping
- Supports multiple industry-standard protocols including Modbus TCP, DF1 and IEC 61850
- Reduces integration, configuration, and support costs found with multi-box solutions

Application Specific Wireless Solution



Energy

- Remote control of EID at distribution substations
- Condition monitoring for pole-top circuit breakers and capacitor banks



Oil & Gas

- Remote monitoring of pipeline flow and status signals
- Monitor and transmit wellhead pressure and tank levels collected by RTUs



Water & Wastewater

- Monitor lift stations across multiple sites from control room
- Slow scan video surveillance of reservoirs



Heavy Industrial

- Activation of perimeter gates based on detection of vehicle
- Monitor and control remote pumps and compressors

Industrially Hardened

- Operation in extreme temperatures from -30°C to 60°C
- CSA-approved for class I, Div. 2 groups
- IEEE-1613 approval for operation in electric substation environments

Application Flexibility

- Industry standard software compatibility in industrial grade hardware platform
- Megabit speed accommodates multiple services on one infrastructure
- Long range wireless communication, up to 20 miles
- IP/Ethernet and serial functions can operate simultaneously on the same network

Reliable & Scalable

- Unlicensed spread spectrum technology
- Point-to-Multipoint, 2-way communication
- High receive sensitivity for noisy environments and long distances
- Handles multiple industry protocols including Modbus, Modbus TCP, and DF1

Secure

- 802.1x centralized authentication prevents unauthorized access
- Built-in AES 128-bit encryption
- Dynamic key rotation
- VLAN traffic segregation
- Password protected access and lockdown



Application Flexibility

The MDS iNET-II family of industrial-strength data communications products offer secure, reliable, long distance transmission of data for your mission-critical applications. The iNET-II operates in the unlicensed 900 MHz spread spectrum frequencies.

The iNET-II solution interfaces directly to a wide variety of controllers and offers a quickly developed, low cost alternative to wires.

Secure Wireless Connectivity

iNET-II is the most secure wireless device available for industrial applications. Standard WiFi equipment operates on a different frequency than iNET-II. This is another layer of protection because common hacking tools do not even detect iNET-II signals. Additionally the iNET-II encrypts wireless data with the AES 128 cipher and automatically rotates the encryption keys.

iNET-II is compatible with industry-standard software such as RADIUS servers used for centralized authentication of users and devices. iNET-II is also VLAN aware and can act as a trunk or access port, allowing for segregation of operational data from management traffic.

Mobile Network Access

iNET-II has the power to operate in mobile applications, allowing vehicles to communicate with control centers. An iNET-II radio can roam between multiple access point locations, while providing near-seamless data handling.

IP/Ethernet and Serial Communications

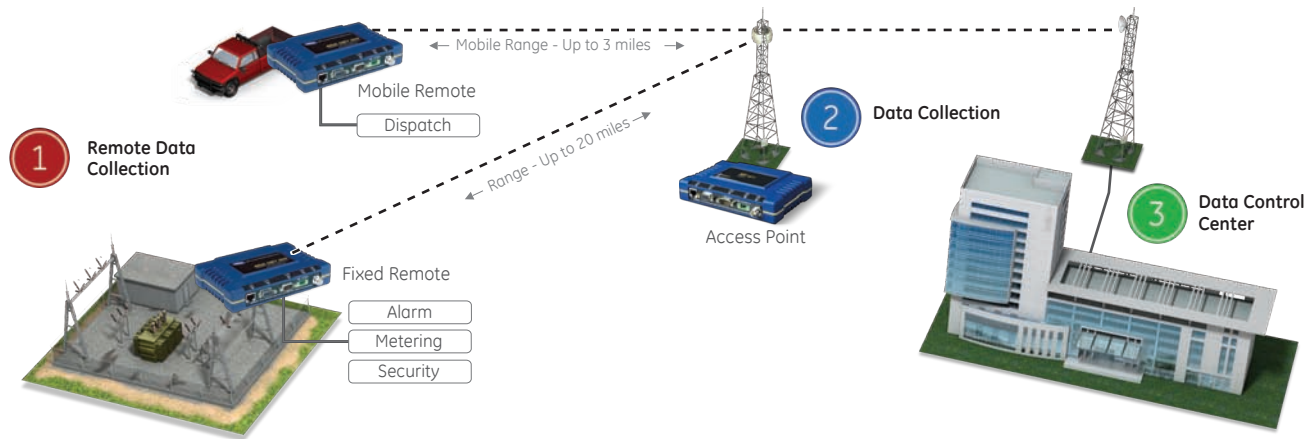
iNET-II is a cost-effective solution to transport IP/Ethernet and serial data from attached PLCs and RTUs over long distances to SCADA systems.

For IP/Ethernet communications, the iNET-II Access Point is necessary to communicate with remote radios.

A Simple Path to Technology Upgrade

In applications where serial RTUs or PLCs already exist, iNET-II remotes can be deployed to replace existing communication devices, wired or wireless, as it will accept connection of both Ethernet and serial controllers. This capability allows a smooth transition from a serial based SCADA infrastructure to IP/Ethernet without disrupting day-to-day operations.

iNET-II Application Advantages



Mobile Applications

- iNET-II can be used to communicate with vehicles over a service area
- Remote radios handoff between multiple access point locations
- iNET-II provides IP/Ethernet and serial data communications

Protocol Communications

- iNET-II supports multiple protocols including Modbus, Modbus TCP, DF1
- Provides IP/Ethernet and serial communication to SCADA hosts and HMIs
- Accommodates multiple protocols for diverse devices on the same IP/Ethernet network

Speed and Range

- One megabit is adequate for most data applications, and in some cases for video transmissions
- The 15-mile fixed typical transmission range of iNET-II covers the most common distances without sacrificing usable speed

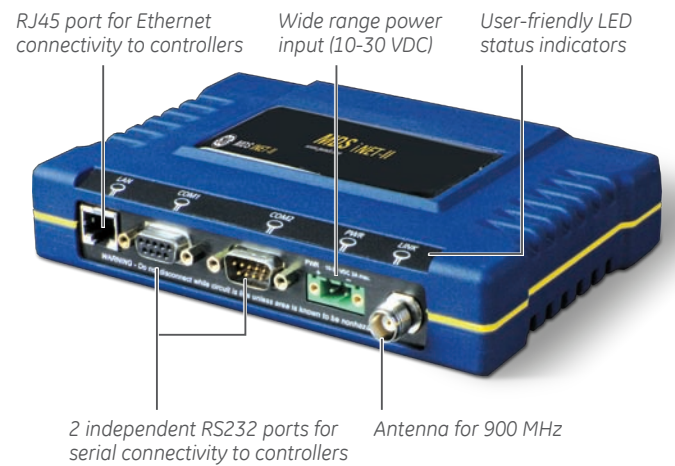
Remote & Access Point

The iNET-II radio operates in the 900 MHz frequency band under the FCC rules for Industrial, Scientific, and Medical (ISM) equipment. Every system must have at least one access point model. You can choose between remote models that support serial only, Ethernet only or both types of interfaces (DG Model).

The iNET-II handles concurrent Ethernet from multiple sources. Directly address the integrated serial device server using industry-standard protocols (e.g., Telnet, TCP, UDP), and serve as backhaul to MDS TransNET, SD, 4710 and 9710 radios.

Every iNET-II radio includes an SNMP agent and can be managed by MDS NETview or any other SNMP-based management system.

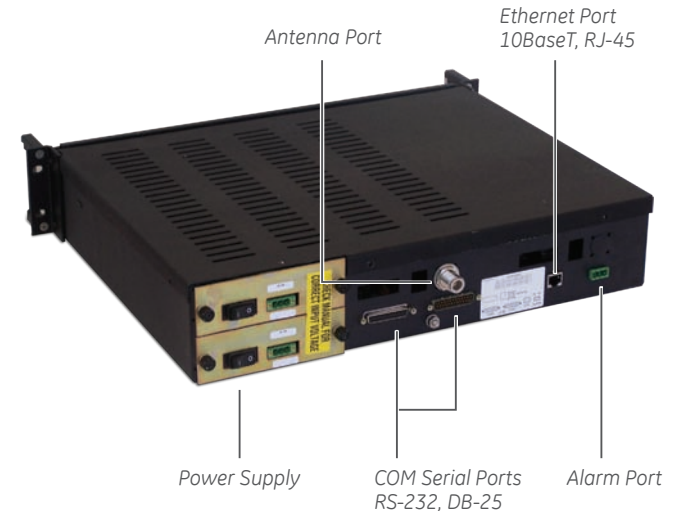
An access point radio can be configured to operate as a remote, serving as a common replacement for any access point or remote locations and simplifying maintenance tasks in the field.



Protected Station

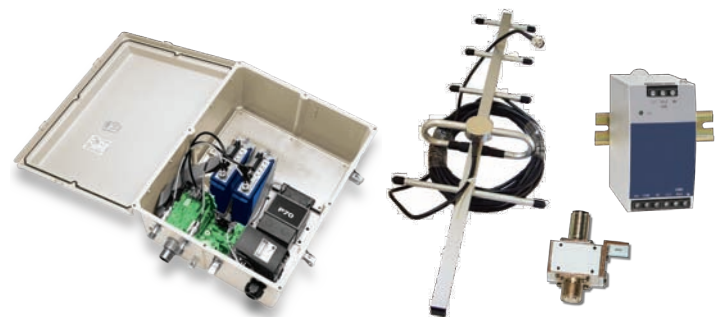
Mission-critical applications demand that no single point of failure can stop the communications system. In wireless applications the access point serves as the central hub to all remote radios. The P21 Protected Station increases the availability of a system by housing two radios in a cold standby configuration. The standby radio activates automatically whenever a fault condition is detected by the active radio.

The MDS P21 Protected Station houses two iNET-II radios inside, and a standard iNET-II unit can be used as a spare during field maintenance. A Protected Station can also operate with Remote iNET-II radios, allowing for deployment of redundant point-to-point link configurations, and providing a cost-effective replacement for analog microwave links.



Accessories & Custom Enclosures

GE MDS provides a complete line of reliable industrial-strength and cost-effective accessories that are tested to perform at optimal levels and maintain product warranties. GE MDS offers both standard and custom packages for wireless applications in harsh industrial environments. We simplify your wireless systems design by providing a convenient single-source ordering process. From antennas for the iNET-II (900 MHz) to field-rated power supplies for your mission-critical application, GE MDS can help ensure your system is robust and future-proof.



Specifications

GENERAL

Data Rate	1 Mbps/512 Kbps user configured air link
Frequency band	902-928 MHz ISM band
Spreading mode	DTS/FHSS
Range (512 Kbps)	Up to 20 miles (fixed) Up to 3 miles (mobile)
Range (1 Mbps)	Up to 15 miles

AVAILABLE CONFIGURATIONS

Remote Serial Gateway	
Remote Ethernet Bridge	
Access Point/Remote Dual Gateway (Both Serial and Ethernet)	

RADIO

System gain	139 dB @ 512 Kbps; 134 dB @ 1 Mbps
Carrier power	100mW to 1W (20 to 30 dBm)
Output impedance	50 Ohms
Occupied bandwidth	600 kHz
Modulation	CPFSK (continuous phase FSK)

RECEIVER SENSITIVITY (WITH 10-6 BER):

512 Kbps	-97 dBm
1 Mbps	-92 dBm

PHYSICAL INTERFACE

Ethernet	10baseT, RJ-45
Serial	
COM1	RS-232/V.24, DB-9F, DCE
COM2	RS-232/V.24, DB-9M, DTE, 1,200-115,200 bps serial ports
Antenna	TNC connector (female)
LEDs	Lan, Com1, Com2, Power, Link

PROTOCOLS

Wireless	CSMA/CA (collision avoidance)
Ethernet	IEEE 802.3, ethernet II, IEEE 802.1Q (trunk, access, and native), STP, IGMP
TCP/IP	DHCP, ICMP, UDP, TCP, ARP, Multicast, SNMP, TFTP
Serial	PPP, encapsulation over IP (tunneling) for serial async multidrop protocols including Modbus, DNP.3, DF1, BSAP
Optional	Modbus TCP

MDS CYBER SECURITY SUITE, LEVEL 4

Encryption	AES-128 with automatic key rotation. (optional)
Authentication	802.1x, RADIUS, EAP/TLS, PKI, PAP, CHAP
Traffic segregation Management	802.1Q VLAN SNMPv1/v2/v3, MIB II, enterprise MIB

MANAGEMENT

HTTP, HTTPS, SSH, TELNET, local console	
SNMPv1/v2/v3, MIB II, enterprise MIB	
SYSLOG	
MDS NETview MSTM	

ENVIRONMENTAL

Temperature	-30°C to +60°C (-22°F to +140°F)
Humidity	95% at 40°C (104°F) non-condensing

ELECTRICAL

Input power	10.5-30 Vdc
Current consumption (nominal)	

Mode	Power	13.8 Vdc	24 Vdc
Transmit	7 W	510 mA	290 mA
Receive	2.8 W	200 mA	120 mA

MECHANICAL

Case	die cast aluminum
Dimensions	3.15 H x 17.2 W x 11.2 D cm. (1.25 H x 6.75 W x 4.5 D in.)
Weight	908 g (2 lb.)
Mounting options	flat surface mount brackets, DIN rail, 19" rack tray

P21 OPTION:

Case	steel (rack mountable 2U)
Dimensions	8.9 H x 48.3 W x 35.6 D cm. (3.5 H x 19 W x 14 D in.)
Weight	7.6 kg, (14.7 lbs) with transceivers

AGENCY APPROVALS

FCC part 15.247 (DTS)	
UL/CSA class 1 Div. 21	
IC	

Ordering

iNET-II Remote and Access Point

iNETII-	**	*	*
Features	AP		
	DG		
	EB		
	SG		
Mounting		S	
		N	
		D	
Special Assembly			N
			A

Access Point
Dual Gateway. Ethernet and Serial remote
Ethernet Bridge. Ethernet only remote
Serial Gateway. Serial only remote.
Standard brackets for mounting on flat surfaces
No brackets
Din-rail brackets
None
Mounted in a P21 Protected Station

Order Code Example

iNETII-APNN

- Access point
- Ethernet and Serial
- No mounting brackets
- No special assembly

P21 Protected Station

P21-	*	*
Input Power	1	12 VDC
	2	24 VDC
	3	48 VDC
	A	115/220 VAC with battery backup
	B	115/220 VAC without battery backup
Antenna Ports	1	One port
	2	Two ports

Order Code Example

P21-21

- Protected station for iNET-II
- Radios ordered separately
- 24 VDC power input
- Single antenna port (switched)

Accessories for the iNET-II

Fixed Remote Kit with Yagi	KFR-N09-D1
Power Supply (AC Input)	01-3682A02

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/iNET-II to:



- Buy iNET-II through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

entraNET

Extended Range IP/Ethernet and Serial Networking



LAN Extension | Ethernet and Serial

The MDS entraNET™ is an ultra long range, industrial, wireless IP/Ethernet solution, with a high level of cyber-security. It allows the connection of Ethernet and/or serial devices to an IP network. This includes mission-critical, revenue-generating remote devices monitoring and controlling fixed assets such as oil and gas wells, compressor stations, pipelines, fluid storage tanks and utility meters. The entraNET has also been optimized for mobility allowing it to be used in vehicles when applications require mobile network access.

Key Benefits

- Exceptional range of distances up to 30 miles in 900 MHz band and 15 miles in 2.4 GHz band
- Combine IP/Ethernet and transparent serial communication on the same network
- Operate multiple users, multiple applications and multiple protocols on the same network simultaneously
- Sleep and shutdown modes reduce power load for solar and battery powered applications

Application Specific Wireless Solution



Energy

- IP/Ethernet and serial communication between host systems and remote IEDs or controllers
- Intelligent peer-to-peer routing of DNP3 messaging between remote devices



Oil & Gas

- Connect battery or solar powered remote flow meters and RTU devices to host SCADA networks
- Migrate legacy serial devices onto IP networks to consolidate monitoring and enhance visibility of remote assets



Water & Wastewater

- Extend HMI and PLC network communication to remote equipment at lift stations, storage tanks and reservoirs
- Implement field force automation functions and remote dispatch on common network



Heavy Industrial

- Deploy facility wide monitoring and control system networks in process manufacturing, mining, and irrigation applications
- Connect remote I/O and measurement devices to HMIs, and monitoring and alarm systems

Industrially Hardened

- Operation between -40°C to 70°C
- CSA Class 1 Division 2 Groups A,B,C,D approved – ANSI/UL equivalent
- Die-cast aluminum housing

Application Flexibility

- Robust long range communication for coverage up to 30 miles
- Low power modes reduce collateral costs for solar panel and battery equipment
- IP/Ethernet and serial interfaces allow migration of serial devices to IP networks
- Fast – Up to 106 Kbps data rate over the air
- Recognizes DNP3 addressing allowing serial and Ethernet devices to communicate in peer-to-peer mode
- Global unlicensed operation in 900 MHz, 2.4 GHz and 2.4 GHz-ETSI ISM bands

Reliable & Scalable

- Designed and built for low failure rates and reduced maintenance costs
- Protected access point option enhances network availability with redundant radios in a warm-standby configuration

Secure

- AES 128-Bit Encryption with dynamic key rotation
- Approved access point and remote lists
- Password protected access and lockdown
- Compatible with off-the-shelf SNMP network management systems



Specifications

GENERAL

Power	6-30 VDC
Temperature	-40°C to +70°C
Humidity	95% at 60°C (104°F) non-condensing
Housing	Die-cast Aluminum
Area Approval	Class 1, Division 2, Groups A, B, C, D for hazardous locations - CSA
Spreading Mode	Frequency Hopping Spread Spectrum
Access Point Size	3.15 H x 17.2 W x 11.2 D cm. (1.25 H x 6.75 W x 4.5 D in.)
Remote Size	2.5 H x 12.7 W x 8.9 D cm. (1 H x 5 W x 3.5 D in.)
P22 Option Size	8.9 H x 48.3 W x 35.6 D cm. (3.5 H x 19 W x 14 D in.)
Access Point Weight	635 g (1.4 lb.)
Remote Weight	472 g (1.04 lb.)
P22 Option Weight	7.6 kg (14.7 lbs.) with Transceivers
Power	6-30 VDC
Ethernet Interface	10BaseT, RJ-45
Serial COM 1	RS-232/V.24, RJ-11, DCE, 1200-115,200 bps
Serial COM 2	RS-232/V.24, RJ-45, DCE, 1200- 115,200 bps
Antenna	TNC connector (female)
Mounting	Flat surface mount brackets DIN Rail
LED Indications	ETH, COM1, COM2, Power, Link

900 MHZ MODELS

Data Rate	106 kbps
Frequency	902-928 MHz ISM band
Range (Fixed)	Up to 30 miles
Range (Mobile)	Up to 10 miles
Gain	136 dB

Carrier Power	0.1 To 1.0 watts (20 to 30 dBm)
Receiver Sensitivity	-106 dBm (1 x 10-6 BER) typical
Output Impedance	50 Ohms
Occupied Bandwidth	200 kHz
Modulation	CPFSK (Continuous Phase FSK)

2.4 GHZ MODELS

Data Rate	106 kbps
Frequency	2.4016-2.4778 GHz ISM band
Range	Up to 15 miles
Range - ETSI	Up to 1 mile
Mobile Range	Up to 2.5 miles
Gain	131 dB
Carrier Power	0.05 To 0.5 watts (17 to 27 dBm)
Carrier Power-ETSI	0.01 to 0.1 watts (10 to 20 dBm)
Receiver Sensitivity	-104 dBm (1 x 10-6 BER) typical
Output Impedance	50 Ohms
Occupied Bandwidth	200 kHz
Modulation	CPFSK (Continuous Phase FSK)

PROTOCOLS

Wireless	CSMA/CA (Collision Avoidance)
Ethernet	IEEE 802.3, Ethernet IITCP/IP (DHCP, ICMP, UDP, TCP, ARP)
Serial	Encapsulation over IP (tunneling) for serial async multidrop protocols
Management	HTTP (embedded web server), TELNET, Local Console, SNMPv1/2/3, MIB II, Enterprise MIB, SYSLOG, MDS NETview MS®

APPROVALS

FCC	Part 15.247
IC - Industry Canada	RSS210
EU	ETSI Approved, CE Mark

POWER CONSUMPTION

900 MHZ ACCESS POINT

Mode	30 Vdc	13.8 Vdc	6 Vdc
Transmit	270 mA	525 mA	1175 mA
Receive	115 mA	220 mA	510 mA

900 MHZ REMOTE

Mode	30 Vdc	13.8 Vdc	6 Vdc
Transmit	240 mA	470 mA	1025 mA
Receive	65 mA	120 mA	260 mA
Sleep	8 mA	15 mA*	130 mA
Shutdown	0.78 mA	0.55 mA*	0.37 mA

2.4 GHZ ACCESS POINT

Mode	30 Vdc	13.8 Vdc	6 Vdc
Transmit	253.3 mA	488.5 mA	1091.7 mA
Receive	119.7 mA	230.1 mA	533.3 mA

2.4 GHZ REMOTE

Mode	30 Vdc	13.8 Vdc	6 Vdc
Transmit	223.3 mA	433.8 mA	941.7 mA
Receive	69.7 mA	130.1 mA	283.3 mA
Sleep	8 mA	15 mA*	130 mA
Shutdown	0.78 mA	0.55 mA*	0.37 mA

* Sleep/shutdown measurements @ 12 Vdc

Ordering

entraNET

eNETN-MD	*	*	11	*	S	*
9						900 MHz Band
2						2.4 GHz
	A					Access Point
	R					Remote IP/Ethernet and Serial Connections
		F				FCC/Industry Canada Certification
		E				EU/ETSI Certification - Limit 0.1 Watt Transmit Power
						Only available for 2.4 GHz models
				1		Enable Network Management - Diagnostics
				0		Disable Network Management - Diagnostics

Order Code Example

eNETN-MD9A11FS1

- Access point
- 900 MHz
- FCC/IC certification
- Network management enabled

Accessories for the entraNET

	900 MHz	2.4 MHz
Fixed Remote Kit with Yagi	KRF-N09-D1	KFR-N24-E1
Power Supply (AC Input)	01-3682A02	01-3682A02

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/entraNET to:



- Buy entraNET through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

Backhaul

High Speed, High Capacity Point-to-Point



Backhaul

Intrepid Series



High Capacity Point-to-Point Solutions

The MDS Intrepid™ family of products is offered in a variety of protected and non-protected configurations, and supports a variety of frequencies with speeds up to 800 Mbps (two carrier offering). The Intrepid family is differentiated by its wide array of interfaces, including SONET/OC3, multiple E1s/T1s, Ethernet, Gigabit Ethernet, and Fast Ethernet. The Intrepid is available in MDS's traditional industrial class, and for some models, has expanded to include Enterprise class solutions for projects where environmental specifications are less stringent.

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LEDR Series



Scalable, Long Range Licensed Point-to-Point Solutions

The MDS LEDR Series provides full duplex and scalable bandwidth in both subrate and fullrate models. Designed to connect to industry-standard sources, the LEDR Series is available in protected configurations with console displays, integrated web servers, and management systems.

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FIVE Series



High Capacity Unlicensed Point-to-Point Solutions

The MDS FIVE Series balances exceptional system gain with outstanding spectral efficiency and channel availability to provide the best overall network connectivity in the industry. Self-healing redundancy makes the MDS FIVE Series more reliable than traditional point-to-point networks, and automatically adjusts transmit power in response to interference, simplifying deployment and network management. The MDS FIVE Series can be used for network aggregation, backhaul or to extend an existing network.

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Selector Guide

Features	Intrepid	LEDR	FIVE
Frequency			
400 MHz Licensed		•	
900 MHz Licensed		•	
1400 MHz Licensed		•	
2.4 GHz Unlicensed	•		
5.8 GHz Unlicensed	•		•
6 – 38 GHz Unlicensed	•		
Range			
	50 miles	60 miles	20 miles
Speed			
	48-800 Mbps	64 – 768 kbps (FCC, IC) 64 kbps – 8.192 Mbps (ETSI)	100 Mbps
Data Interfaces			
Ethernet	•		•
E1/T1 (Partial or multiple)	•	•	•
SONET/OC-3	•		
Network Type			
Point-to-Point	•	•	•

Intrepid Series

High Capacity
Point-to-Point Solutions



Backhaul | Licensed or Unlicensed

The MDS Intrepid™ Series of point-to-point wireless devices provide flexibility in frequency selection, including multiple unlicensed and licensed options from 2.4 GHz to 38 GHz. T1/E1, Ethernet interfaces are supported along with OC3. The MDS Intrepid Series can be configured with hot standby or space diversity deployment. Channel size can also be configured to optimize the required throughput with the desired range, from 5 MHz to 80 MHz, all depending on the model selected. The rich feature set and native Ethernet and TDM interface support provide maximum throughput with minimal latency. Additionally, the Intrepid Series features a modular design that facilitates less expensive sparring and easier maintenance.

Key Benefits

- Throughput options from 18 Mbps full duplex to 800 Mbps full-duplex
- Range from 20 to 50 miles, depending on frequency and modulation selected
- Multiple deployment configurations maximize equipment and RF redundancy or minimize infrastructure cost
- Lowest latency facilitates ring-base deployments for efficient data pass-through
- Native Ethernet and TDM implementation provides highest throughput possible with selected channel size

Application Specific Wireless Solution



Water & Wastewater

- Water monitoring SCADA and LAN/WAN
- Fiber extensions, video surveillance, building connectivity



Energy

- Substation SCADA, LAN/WAN and cellular/carrier
- Fiber extensions, voice/PBX, video surveillance



Oil & Gas

- Pump on/pump off SCADA control, WAN networks for remote offices
- Disaster recovery, video surveillance, voice/PBX



Heavy Industrial

- Two-way radio repeater control, mobile command vehicles
- T1/E1 leased line replacement, disaster recovery, video surveillance

Industrially Hardened

- Operation in extreme temperatures from -35°C to 60°C

Application Flexibility

- One time investment; no recurring leased fees
- Single, cost-effective solution for voice and data (E1/T1 and Ethernet)
- Dedicated bandwidth—not shared with outside users
- Network Operations Center (NOC) “chain of custody” control
- No mapping of Ethernet over TDM circuits
- Highest possible throughput with lowest possible latencies
- Maximize spectral efficiency to assist in reducing required channel sizes
- Dedicated throughput in both directions for deterministic application planning
- Fast or Gigabit Ethernet
- Multiple E1/T1 circuits
- SONET/OC-3

Reliable & Scalable

- Specific license-key upgrades allowing additional capacity as required
- Commonality of components reduces sparring costs and eases maintenance

Secure

- Definable authorization lists to prevent unauthorized access
- Password protected access and lockdown
- Built-in AES 128-bit encryption



Intrepid Series

Robust, Optimized RF Communications

The MDS Intrepid Series seamlessly change modulation and throttle throughput based on changes in signal strength, whereas other solutions just “drop the link.” Dropping the link is the last resort for the MDS Intrepid Series.

Additionally, when link quality falls below a pre-set standard, MDS Intrepid Series automatically searches for a more clear channel based on a pre-set list of available channels. Finally, MDS Intrepid Series offer bandwidth options that may be implemented to improve immunity to disturbances.

MDS Intrepid Series is available in the unlicensed 2.4, 5.4, and 5.8 GHz bands and the U.S. public safety 4.9 GHz band. Various agency approvals for these frequencies have been granted from FCC, IC, and ETSI. Interface options include Fast Ethernet plus 0, 1, or 2 E1s/T1s (standard IDU) or two Fast Ethernet ports plus 4 E1s/T1s (industrial-grade IDU).

Link information is readily available for analysis with a few simple actions and external events trigger alarms via dry contact alarm inputs. At any time, factory settings can be restored for each outdoor unit (ODU).

Highly Reliable

With a bit error rate (BER) of $10E^{-11}$ for all communications (Ethernet or T1/E1), a patented fast Automatic Retransmit reQuest (ARQ) algorithm, and a TDM clocking accuracy of five parts per billion (PPB) for T1/E1 circuits, support for time-sensitive links and success statistics for channel availability and reliability are some of the highest in the industry.

Indoor Unit/Outdoor Unit Configuration

The MDS Intrepid Series is offered as a split mount system consisting of an Indoor Unit (IDU), which contains interfaces and protocol firmware support, and an Outdoor Unit (ODU), which contains the RF and frequency-specific firmware. The ODU may be purchased with an integrated antenna or with an external antenna connection when it is desirable to have the ODU readily accessible or more environmentally controlled.

The IDU is offered in an industrial-grade enclosure or a more cost-effective standard enclosure. Alternatively, a power over Ethernet (PoE) IEEE 802.3AF option is available.

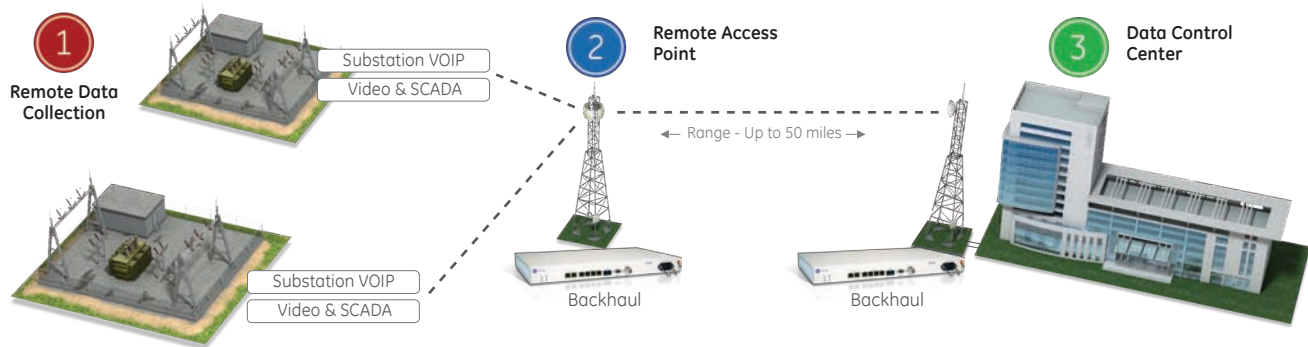
Radio Regulatory Compliance and Maximum Transmit Power

Frequency [GHz]	USA and Canada Regulation	Max. Tx Power [dBm]	Europe (ETSI) Regulation	Max. Tx Power [dBm]
5.725 – 5.850	47CFR Part 15 Subpart C, RSS-210	17/23	N/A	N/A
4.940 – 4.990	47CFR Part 15 Subpart B	15	N/A	N/A
2.400 – 2.4835	47CFR Part 15 Subpart C RSS-210	11	EN 300 328	-4 EIRP ≤ 20

Throughput Chart

Modulation (Mbps)	Sensitivity (dBm)	Air Interface Rate (Mbps)	Aggregate Throughput (Mbps)	TDM Service Throughput				Maximum Range	
				1 x E1	2 x E1	1 x T1	2 x T1	(km)	(miles)
BPSK	-84	12	4.2	2.0	N/A	2.5	0.9	41.0	25.5
QPSK	-81	18	6.5	4.4	2.3	4.8	3.2	25.0	15.5
QAM	-74	36	13.6	11.5	9.3	11.9	10.2	10.0	6.0
QAM	-68	48	18.3	16.2	14.0	16.6	14.9	4.0	2.5

Intrepid Series Application Advantages



Reliable Communications

- BER of $10E^{-11}$ with patented fast ARQ algorithm
- Native, low latency Ethernet and TDM interfaces
- Adaptive modulation and automatic channel selection for changing unlicensed RF environment

Flexible Deployment

- Multiple unlicensed frequencies
- Co-location of radios to optimize tower use via hub site synchronization
- Various channel size options facilitate best combination of range and speed

Prioritized and Secure

- AES 128-bit encryption for secure data transmission
- Quality of Service (QoS) ensures most critical communications receive highest priority

Intrepid (Unlicensed)

Easy to Deploy & Manage

The MDS Intrepid facilitates rapid deployment by virtue of unlicensed frequency options, antenna alignment features, and simplified GUI-based configuration and management.

Secure, Prioritized Communications

The MDS Intrepid transmits data using secure AES 128-bit encryption. Quality of Service (QoS) facilitates prioritization of data so that the most mission-critical communications receive required bandwidth.

Co-location for Optimized Tower Use

MDS Intrepid provides hub site synchronization that permits up to eight radios to be located at a single hub site without causing self-induced interference.

Intrepid (Unlicensed) is optimized for:

- Quick deployment in unlicensed frequencies
- Aggregate throughput up to 36 Mbps
- Low infrastructure cost

Intrepid-HC (High Capacity Licensed)

Application and Deployment Flexibility

Modulation options from QPSK to 256 QAM over 10, 28, 30, or 40 MHz channel sizes are available to optimize range and throughput and to comply with regulatory restrictions that may exist for certain license pairs. Frequency band support from 6 to 38 GHz is one of the highest in the industry, and optional high power options facilitate long distance communications.

Fast Ethernet, Gigabit Ethernet, SONET/OC-3, and multiple T1/E1s interface options facilitate a wide range of applications. Support for N+1, space diversity, and protected configurations make MDS Intrepid-HC ideally suited for any deployment architecture.

Scalable & Fast

The MDS Intrepid-HC facilitates economical growth as throughput requirements evolve. Indoor Modules (IDMs) are upgradable from 50 Mbps to 400 Mbps using a single carrier or up to 800 Mbps using two carriers in a single receiver unit. This high capacity is provided as full duplex at layer two of the protocol stack for Fast Ethernet.

Modular Architecture

The modular architecture of the MDS Intrepid-HC reduces capital and operational expenditures and facilitates commonality of sparing and

reduced maintenance costs. Ethernet and TDM traffic is facilitated simultaneously, each with native interfaces for an optimized shared backhaul for networks with multiple applications.

Native Ethernet & TDM Interfaces

The MDS Intrepid-HC native Ethernet platform provides a more efficient solution than those requiring extensive mapping over TDM circuits. This efficiency results in higher throughput and lower latency—less than ½ millisecond, which is paramount for VoIP applications.

Intrepid-HC (High Capacity Licensed) is optimized for:

- Highest capacity (up to 800 Mbps)
- Fast or Gigabit Ethernet and up to 8 T1s/E1s
- Split mount deployment

High power option:

- Longest range for licensed deployment (up to 20 miles)

High power trunked option:

- Up to 9+1

64T option:

- Up to 64 T1/E1 circuits

Intrepid-HC and Intrepid-HC HP Selector Guide

	Intrepid-HC (High Capacity Licensed)	Intrepid-HC HP (High Capacity High-Power Licensed)
Frequency	6 – 38 GHz	6 – 11 GHz
Capacities (per carrier)	45 Mbps to 400 Mbps	45 Mbps to 200 Mbps
Interfaces	1 or 2 Fast Ethernet plus 8 E1/T1 Gigabit Ethernet plus 8 E1/T1, OC-3, 2xOC-3, DS-3, 3xDS-3	1 or 2 Fast Ethernet plus 8 E1/T1 Gigabit Ethernet plus 8 E1/T1, OC-3, 2xOC-3, DS-3, 3xDS-3
Configurations	East/West, 1+1, 2+0 Space Diversity Frequency Diversity Cross Polarization Interference Cancellation (XPIC)	East/West, 1+1, 2+0, 1+0 and 1+1 Space Diversity Frequency Diversity Cross Polarization Interference Cancellation (XPIC) N+1 ready

Intrepid Antenna Options

Freq.	Antenna Type	Gain (dBi)	Typical Range		Beam (degrees)	Dimensions		Weight		Connector	Lightning Protection
			(km)	(mi)		(mm)	(in)	(kg)	(lb)		
5.8 GHz	Integrated - Flat panel	22	40	25	9.0	305 x 305 x 58	12 x 12 x 2.3	0.5	1.1	NR	Yes
5.8 GHz	External - Flat panel	28	80	50	4.5	600 x 600 x 51	23.6 x 23.6 x 2	5.0	11.0	N-type	No
5.8 GHz	External - Dish	32.5	80	50	4.5	Dia. 900	Dia. 35.4	10	22	N-type	No
4.9 GHz	External - Flat panel	21	24	15	9.0	305 x 305 x 58	12 x 12 x 2.3	0.5	1.1	N-type	Yes
4.9 GHz	External - Dish	27	80	50	5	Dia. 600	Dia. 23.6	5.0	11.0	N-type	Yes
2.4 GHz	Integrated - Flat panel	16	40	25	20	305 x 305 x 58	12 x 12 x 2.3	0.5	1.1	NR	Yes
2.4 GHz	External - Grid	24	80	50	7.5	600 x 997 x 380	23.5 x 39.2 x 15	2.0	4.6	N-type	No

Specifications Intrepid (Unlicensed)

RADIO

Frequency Bands	5.8 GHz (5.725–5.850 GHz) 4.9 GHz (4.940–4.990 GHz) 2.4 GHz (2.400–2.4835 GHz)
Data Rate	Up to 48 Mbps, user-configurable
Channel Bandwidth	5, 10, or 20 MHz
Duplex Technique	TDD
Modulation	OFDM - BPSK, QPSK, 16 QAM, 64 QAM
Transmit Power	See Table 2
RF Dynamic Range	More than 50 dB

LAN INTERFACE

Number of Ports	IDU: 1 IDU-C: 2
Type	10/100BaseT, auto negotiation
Framing/Coding	IEEE 802.3u
Bridging	Up to 2048 MAC addresses self-learning
Traffic Handling	MAC layer bridging, self-learning
Latency	3 msec (typical)
Line Impedance	100Ω
VLAN Support	Transparent
Connector	RJ-45

T1 INTERFACE

Number of Ports	IDU: 1 or 2, IDU-C: 4
Framing	Unframed
Timing	Plesiochronous (independent, Tx and Rx timing)
Line Code	T1: B8ZS, AMI
Latency	8 msec
Line Impedance	T1: 100Ω, balanced
Connector	RJ-45
Jitter and Wander	As per G.823, G.824

MANAGEMENT

Network Management and Protocol
SNMPC-based

Interface	10/100BaseT
Connector	RJ-45
Upgrade Capabilities	Local and over-the-air software download

MISCELLANEOUS

Diagnostics	Local and remote loopbacks
IDU-to-ODU Connection	Outdoor Cat.5e cable, 100m (328 ft) max. length

ENVIRONMENTAL

OUTDOOR UNIT AND EXTERNAL ANTENNA

Enclosure	IP67 all-weather case
Temperature	-35° to 60°C (-31° to 140°F)

INDOOR UNIT

Temperature	0° to 50°C (32° to 122°F)
Humidity	Up to 90%, non-condensing

ELECTRICAL

Power	-48, 24 VDC, 100–240 VAC
Power Consumption	10W max (ODU with IDU), 14W max (ODU with IDU-C)

MECHANICAL

ODU (WITH INTEGRATED ANTENNA)

Dimensions	H 305 mm (12.0 in), W 305 mm (12.0 in), D 58 mm (2.3 in)
Weight	1.5 kg (3.3 lb)

IDU

Dimensions	H 44 mm (1.7 in), W 237 mm (9.3 in), D 165 mm (6.5 in)
Weight	0.5 kg (1.1 lb)

IDU-C

Dimensions	H 44 mm (1.7 in), W 430 mm (17.0 in), D 290mm (11.4 in)
Weight	1.5 kg (3.3 lb)

AGENCY APPROVALS

SAFETY

TUV according to UL 60950
EN 60950-1, EN 60529

EMC

FCC 47CFR Parts 15, 15.247, and subpart B
CAN/CSA-CEI/IEC CISPR 22-02

ENVIRONMENTAL

IEC 60721-3-4 Class 4M5
IP 67

Specifications Intrepid-HC (High Capacity Licensed)

SYSTEM SPECIFICATIONS

Auxiliary channels, Wayside channel, per carrier	2 Mbps or 64 Kbps, Ethernet 10BaseT (wayside channel uses 2 Mbps capacity)
Engineering order wire	audio channel (64 Kbps) G.711
User channels	V.11 and RS-232 up to 64 Kbps

ENVIRONMENTAL

Altitude	up to 4,500 m (15,000 ft)
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OPERATING TEMPERATURE

ODU/RFU	-35°C to 55°C (31°F to 131°F)
IDU	-5°C to 45°C (23°F to 113°F)

RELATIVE HUMIDITY

ODU/RFU	up to 100% (all weather operation)
IDU	up to 95% (non-condensing)

POWER INPUT

Standard input	-48 VDC
DC Input range	-40.5 to -72 VDC (up to -57 VDC for USA market)
Optional input	110-220 VAC

POWER CONSUMPTION

Max System (ODU+IDU) power consumption
(11-38 GHz) 1+0= 65W, 1+1= 105W

Max System (ODU+IDU) power consumption
(6-8 GHz) 1+0= 80W, 1+1= 130W

Max System (RFU+IDU) power consumption
(HP 6-11 GHz) 1+0=105W, 1+1= 150W

MECHANICAL

ODU (11-38 GHZ)

Dimensions	27 cm diameter x 14 cm D (10.8" diameter x 4.5" D)
Weight	8 kg/18 lbs

ODU (6-8 GHZ)

Dimensions	40.9 cm H x 28.6 W x 86 D
Weight	8 kg/18 lbs

RFU (HP 6-11 GHZ)

Dimensions	49 cm H x 14.4 cm W x 28 cm D (19" x 6" x 11")
Weight	7 kg/16 lbs

IDU (1U)

Dimensions	4.4 cm H x 43.2 cm W x 24 cm D (1.7" x 17" x 9.4")
Weight	5 kg/11 lbs

IDU-ODU/RFU COAXIAL CABLE

RG-223 (100 m/300 ft), Belden 9914/RG-8 (300 m/1000 ft) or equivalent, N-type connectors (male)

NETWORK MANAGEMENT

Type	SNMP, in compliance with RFC 1213, RFC 1595 (SONET MIB)
Local or remote	Advanced GUI for Windows 2000/2003/XP and Sun Solaris, integrated with HP OpenView
NMS interface	Ethernet 10Base-T, RS-232 (PPP, SLIP), built-in Ethernet
Local configuration & monitoring	Standard ASCII terminal, serial RS-232
In-Band Management	Uses standard embedded communications channel, dual port built-in Ethernet hub
TMN	NMS functions are in accordance with ITU-T recommendations for TMN
External alarms	5 inputs: TTL-level or contact closure to ground. 3 outputs: form C contacts, software configurable
Performance Monitoring	Integral with onboard memory according to ITU-T G.828

To order the Intrepid visit www.GEMDS.com/Intrepid

LEDR Series

Scalable, Long Range
Licensed Point-to-Point



Backhaul | Subrate and Fullrate

The MDS LEDR Series provides full duplex and scalable bandwidth in both subrate and fullrate models. Designed to connect to industry-standard sources, the LEDR Series is available in protected configurations with displays, integrated web servers, and management systems.

Key Benefits

- Deployment flexibility gained with multiple frequency options
- Scalable throughput based on channel size desired and selectable modulation (64 – 768 kbps subrate and up to 8.192 Mbps fullrate)
- Long range resulting from excellent sensitivity (-102 dBm subrate and -89 dBm fullrate) and licensed support in propagation-friendly frequencies
- Highly robust communications with forward error correction (FEC), interleaver, and adaptive equalizer

Application Specific Wireless Solution



Energy & Utilities

- SCADA and substation backhaul, fiber extensions, voice/PBX, video surveillance, and LAN/WAN backhaul, building connectivity, and cellular/carrier backhaul



Water & Wastewater

- SCADA and water monitoring facility backhaul, fiber extensions, video surveillance and LAN/WAN backhaul, building connectivity



Oil & Gas

- Pump on and pump off SCADA control backhaul, WAN networks for Oil company remote offices, backhaul for oil field, backhaul for disaster recovery, video surveillance, and voice/PBX connectivity



Public Safety

- Trunked radio repeater control, leased line replacement, voice/PBX connectivity

Private Network

- One time investment; no recurring leased fees
- Single, cost-effective solution for voice and data (E1/T1)
- Dedicated bandwidth—not sharing with other outside users
- Network Operations Center (NOC) “chain of custody” control—not dependent on external NOC

Flexible Configuration

- Optional interfaces for direct connection to fractional E1/T1 or full E1s
- Optional 1+1 hot standby protected configuration
- Optional space diversity
- Configurable for multiple frequency ranges including 330 MHz to 512 MHz, 800 MHz to 960 MHz, and 1350 MHz to 1535 MHz

Advanced Management

- Front panel displays for easy maintenance and link monitoring
- Built-in NMS element manager
- SNMP network management for Fault, configuration, performance and security management
- Integrated HTML web server allows network wide management via the Internet
- Built-in 9600 bps data service channel
- Local loopback and remote loopback
- 8 Relay alarm contacts per radio
- DTMF compatible orderwire



Specifications

GENERAL	
Frequency Bands (Subrate)	
Non-ETSI	400S: 330-512 MHz 900S: 800-960 MHz 1400S: 1350-1535 MHz
ETSI	1400S: 1350-1535 MHz
Frequency Bands (Fullrate)	
Non-ETSI	400F: 330-512 MHz 900F: 800-960 MHz 1400F: 1350-1535 MHz
ETSI	1400F: 1350-1535 MHz
Channel size (Subrate)	
Non-ETSI	25, 50, 100, 200 kHz
ETSI	25, 75, 250 kHz
Channel size (Fullrate)	
Non-ETSI	500 kHz, 1 MHz, 2 MHz
ETSI	500 kHz, 2 MHz
Data rates (Subrate)	
Non-ETSI	64, 128, 256, 384, 512, 768 kbps
ETSI	64, 128, 768 kbps (fractional E1/T1 available at 768 Kbps)
Data rates (Fullrate)	
Non-ETSI	1-E1 up to 4-E1
ETSI	1xE1, 3xE1
Modulation (Subrate)	
Non-ETSI	32-QAM, 16-QAM, QPSK
ETSI	16-QAM
Modulation (Fullrate)	
Non-ETSI	32-QAM, 16-QAM, QPSK
ETSI	32-QAM
Voltage range	
Non-ETSI	±12 Vdc (w/external power supply), ±24 Vdc or ±48 Vdc (±20%)
ETSI	±24 Vdc or ±48 Vdc (±20%)
Voltage range (Fullrate)	
Non-ETSI	±12 Vdc (w/external power supply), ±24 Vdc or ±48 Vdc (±20%)
ETSI	±24 Vdc or ±48 Vdc (±20%)

TRANSMITTER	
Output control range	10 steps of up to 10 dB
Frequency stability	1.5 ppm
Output power	+30dBm
TRANSMITTER	
Residual BER	<1x10 ⁻⁶
Dynamic range	>65 dB
INTERFACES	
Data	EIA-530 / G.703 (option available)
Orderwire	DTFM capable
Data Service Channel	RS-232, 300 – 9600 bps
Ethernet NMS	10 Base-T
Console Port	RS-232, 300 bps – 115.2 Kbps
Alarms	4 programmable outputs, 4 programmable inputs
Antenna	50 Ohms impedance
NETWORK MANAGEMENT	
Local LED Indicators	Front panel LED status indicate: Power, Active, General Alarm, Rx Alarm, Tx Alarm, I/O Alarm
Front Panel LCD	Display & keypad for management of local & remote radio
Element Management	Full management of LEDR network via command line interface
SNMP Management	Full IP- based management of LEDR network and SNMP-enabled peripherals via customer enterprise MIB
HTML Webserver	Full IP-based management of LEDR network and web-enabled peripherals via web browser
ENVIRONMENTAL	
Temperature	-10C to +50C
Humidity	< 95% non-condensing

ELECTRICAL	
Power Consumption	< 60W (non protected), < 135W (protected)
MECHANICAL	
Dimensions	4.5 H (1U) x 48 W x 30 D cm (1.75 H x 19 W x 12 D in)
AGENCY APPROVALS	
LEDR 400S & 400F	
Transmission	FCC Part 90, IC RSS-119
EMC	ETS 300 385 (LEDR 400S), FCC Part 15
LEDR 900S & 900F	
Transmission	FCC Part 101, IC RSS-119
EMC	FCC Part 15
LEDR 1400S & 1400F	
Transmission	ETS 300 630, MPT 1717 Class 3
Environmental	ETS 300 019, Class 3.2
EMS	ETS 300 385
Safety	CE Mark
MISCELLANEOUS	
Options	Space Diversity Hot-standby Protected Bandwidth Upgrade Kits (consult factory) Bandpass Duplexers
Accessories	110/240 Vac, 50/60 Hz Power Supply Orderwire Handset G.703 120 Ohms to 75 Ohms balun
Protected	Configuration: 2 x LEDR radios, connected via protected switch box Total size: 2 x 1 RU high + 1 x 2 RU high Transmit/Receive Branching Loss: 2 dB/5 dB Receive Switching: Hitless

System Performance Fullrate, Non-ETSI

Channel Spacing	500 kHz	1.0 MHz	2.0 MHz
Capacity	1 x E1	2 x E1	4 x E1
Receiver Sensitivity (10 ⁻⁶ BER) ¹ (32 QAM)	-89 dBm	-86 dBm	-83 dBm
System Gain (10 ⁻⁶ BER) (32 QAM)	119 dB	116 dB	113 dB

Modulation Type	Threshold Differential	Norm. System Gain Differential
QPSK	-4.5 dB	-5.5 dB
16 QAM	-1.5 dB	-2.5 dB
32 QAM	0 dB	0 dB

1. Receiver sensitivity for 10-3 BER are typically 3 dB better
2. Additional overhead channels over and above capacity shown

System Performance Fullrate, ETSI

Channel Spacing	500 kHz	2.0 MHz
Capacity	1 x E1	3 x E1
Receiver Sensitivity (10 ⁻⁶ BER) ¹ (32 QAM)	-89 dBm	-83 dBm
System Gain (10 ⁻⁶ BER) (32 QAM)	119 dB	113 dB

System Performance Subrate, Non-ETSI

Channel Spacing	25 kHz	50 kHz	100 kHz	200 kHz
Capacity*	64 kbps	128 kbps	256 kbps	768 kbps
Receiver Sensitivity (10 ⁻⁶ BER) ¹ (32 QAM)	-101 dBm	-99 dBm	-96 dBm	-91 dBm
System Gain (10 ⁻⁶ BER) (32 QAM)	131 dB	127 dB	126 dB	121 dB

Modulation Type	Threshold Differential	Norm. System Gain Differential
QPSK	-4.5 dB	-5.5 dB
16 QAM	-1.5 dB	-2.5 dB
32 QAM	0 dB	0 dB

1. Receiver sensitivity for 10-3 BER are typically 3 dB better

System Performance Subrate, ETSI

Channel Spacing	25 kHz	75 MHz	250 kHz
Capacity plus overhead	72 kbps	152 kbps	800 kbps
Capacity w/o overhead	64 kbps	128 kbps	768 kbps
Receiver Sensitivity (10 ⁻⁶ BER) ¹ (32 QAM)	-101 dBm	-99 dBm	-91 dBm
System Gain (10 ⁻⁶ BER) (32 QAM)	131 dB	127 dB	121 dB

Fractional T1/E1 Interface Card

General Specifications	
Line rate	T1 (1.544 Mbps); E1 (2.048 Mbps)
Channel size	200 kHz
Data rate	768 kbps (12 x 64 kbps)
Framing	SF, ESF (T1), FAS, CAS, CRC (E1)
Signaling	RBS (T1); Time Slot 16 CAS (E1)
Line codes	AMI, B8ZS, B7ZS (T1), AMI, HDB3 (E1)
Interface	RJ48C Balanced Interface, 100 Ohms (T1), 120 Ohms (E1)
Physical	
Size	15.24 cm x 12.7 cm (6 in x 5 in)
Configuration	Option card, fitted internal to LEDR chassis
Availability ETSI	Fractional and full E1 (1400S)
Availability Non-ETSI	Fractional T1 (400S, 900S, 1400S) Fractional E1 (400S, 900S, 1400S) Full E1 (400F, 900F, 1400F)

To order the LEDR visit www.GEMDS.com/LEDR

FIVE Series

High Capacity Unlicensed Point-to-Point Solution



Backhaul | Indoor and Outdoor

The MDS FIVE Series consists of an open front/rear Software Defined Indoor Unit (IDU) and Outdoor Unit (ODU). MDS FIVE Series devices are spectrum and data rate scalable, enabling utilities and other industrial organizations to trade-off system gain with spectral efficiency (range versus speed) and channel availability for optimal network connectivity. The MDS FIVE Series delivers aggregate data rates up to 200 Mbps in the 5.8 GHz ISM band. A common platform supports plug-in 100 Mbps Ethernet.

Key Benefits

- Throughput options from 50 Mbps to 100 Mbps full duplex, depending on signal strength
- Range up to 20 miles
- Multiple deployment configuration options to maximize equipment and RF redundancy or minimize infrastructure cost
- Ring architecture with self-healing rerouting/redundancy
- Quick return on investment
- Easily deployed and activated

Application Specific Wireless Solution



Energy & Utilities

- SCADA and substation backhaul, fiber extensions, voice/PBX, video surveillance, and LAN/WAN backhaul, building connectivity, and cellular/carrier backhaul



Water & Wastewater

- SCADA and water monitoring facility backhaul, fiber extensions, video surveillance and LAN/WAN backhaul, building connectivity



Oil & Gas

- Pump on and pump off SCADA control backhaul, WAN networks for Oil company remote offices, backhaul for oil field, backhaul for disaster recovery, video surveillance, and voice/PBX connectivity

Private Network

- One time investment; no recurring leased fees
- Single, cost-effective solution for voice and data (E1/T1 and Ethernet)
- Dedicated bandwidth—not sharing with other outside users
- Network Operations Center (NOC) “chain of custody” control—not dependent on external NOC

Native Interface Implementation

- No mapping of Ethernet over TDM circuits is required
- Both Ethernet and TDM interfaces provide highest possible throughput and lowest possible latencies
- Both interfaces maximize spectral efficiency to assist in reducing required channel sizes

Full Duplex

- Dedicated throughput in both directions for deterministic application planning
- Fast Ethernet - scalable from 25 to 100 Mbps

Choice of Interfaces

- Fast Ethernet
- Multiple E1/T1 circuits



FIVE Series Indoor Unit



FIVE Series Outdoor Unit



Specifications

GENERAL		ENVIRONMENTAL	
Frequency bands	5,725 – 5,850 MHz	Temperature	IDU -5° to 55°C ODU -30° to 55°C
Average Output Power	-8 to 23 dBm RMS	Humidity	IDU: 0 to 95%, non-condensing ODU: Up to 100% at 45°C
Max EIRP	+46 dBm RMS (with integrated antenna)	Altitude	IDU/ODU: 4500 m (14,100 ft.)
Capacity Options	Ethernet: Spectrum scalable from 25 Mbps to 100 Mbps full duplex +2 T1/E1 Wayside Channels	ELECTRICAL	
Modulation	QPSK, 16-QAM, 32-QAM, 64-QAM	Primary power	-48 volts +/- 10%, <70 watts; Optional 100-240 Volts AC, 47-63 Hz power supply
FEC	Trellis Coded Modulation concatenated with Reed-Solomon Coding	MECHANICAL	
Receive Sensitivity	100 Mbps 25 MHz: 67 dBm 50 Mbps 25 MHz (50FE2): 73 dBm 25 Mbps 25 MHz (25FE2): 79 dBm 16 T1 25 MHz: 79 dBm 16 E1 25 MHz: 77 dBm	Case	Rugged die cast aluminum
Antenna Gain	23 dBi (integrated antenna)	Dimensions	IDU: 1RU, ETSI Compliant 17.5 x 9.4 x 1.75 inches (445x238.5x44.5mm) rack mount 19 inches, (48.2 cm) ODU: 15.7 x 14.5 x 2.1 inches (39.9x36.8x5.33cm)
Antenna Connector	N-Type Female for optional external antenna	Weight	IDU: 7 lbs. (3.17 kg) ODU: 15 lbs. (6.8 kg)
Distance	Up to 20 miles (or greater, depending on antenna)	AGENCY APPROVALS	
Protected Option	Configurable for 1+1, hot standby, hitless switching, spacial diversity (not for diversity combining)	FCC approved	IC approved
DATA INTERFACES			
Physical Connector	100BaseTX, Full duplex E1/T1 Ethernet: RJ-45 Nx E1/T1: 2xRJ-48C, HD60		
Compliance	Ethernet: IEEE 802.3 Nx E1/T1: ITU-T		
AUX Connections	Wayside Channels T1/E1 - Interface DSX-1 - Connector RJ-48C Alarm Port - 2 Form C relay alarm outputs, 2 TTL outputs Voice Service Channel - 6 wire, PTT handset		
MANAGEMENT			
Support	Network management config. tool SNMP v1, 2, 3, and web-based config. Built-in Web browser		
Connector	RJ-45, 10/100BaseTX		

MODEL	THROUGHPUT DATA	INTERFACE	WAYSIDE
MDS FIVE Series - 050	100 Mbps Aggregate (50 Mbps full-duplex)	100 Base TX	Two T1/E1s
MDS FIVE Series - 100	200 Mbps Aggregate (100 Mbps full-duplex)	100 Base TX	Two T1/E1s
MDS FIVE Series - 160	70-200 Mbps Aggregate (35 - 100 Mbps full duplex)	1-16 x T1/E1	Scalable Ethernet

Ordering

FIVE Series Indoor Unit

SDIDU-MD-000	*	
Setup	3	1+0, 50 Mbps
	4	1+0, 100 Mbps
	7	1+1 2+0, 50 Mbps
	8	1+1 2+0, 100 Mbps

FIVE Series Outdoor Unit

ODU5800M	*	DPP
Antenna	I	Internal
	E	External

Accessories for the FIVE Series

Antenna Kit	KFR-L04-C2
RTU Simulator Assembly	02-2094A01

View Accessories catalog at www.gemds.com

Visit www.GEMDS.com/FIVESeries to:



- Buy FIVE Series through the online store
- Download guideform specifications
- Download user documentation
- Read application notes and white papers

Commercial Services

Engineering, Training, Custom Racks
and Enclosures

Industry-Leading Experience

GE MDS Commercial Services are custom-tailored to each customer's requirements. The suite of offerings from Commercial Services includes engineering services from our Wireless Systems Group (WSG), a robust curriculum of on-site and in-house technical training and certification, and a wide array of custom racks and enclosures for industrial-strength wireless solutions.

GE offers a unique combination of wireless communications and IT expertise. Our team of highly qualified engineers manage the design, installation, integration, commissioning, and training for complete end-to-end projects around the world in diverse environments for greenfield, upgrade, and retrofit installations.

Our world-class expertise assures optimum system performance with today's most advanced technology. From thorough requirements definitions and exacting path analyses to detailed CAD drawings and documentation, our Commercial Services group transforms even the most challenging possibilities into precise network performance.

With more than 200 years of combined domestic and international experience, the MDS Commercial Services team provides the expertise to deploy wireless projects correctly. Our Commercial Services and Engineering teams have installed projects in more than 30 countries, ranging from individual services to complete solutions in remote locations. Our engineers hold MSEE degrees and certifications including MDS, CCNP, CCDP, and PM.

Markets and Applications

More than 75 Fortune 500 companies rely on GE MDS products and services for their wireless system requirements. Our wireless solutions solve customer mission-critical applications including:

- Oil and Gas production, transportation, refinery and storage automation
- Electric generation and distribution
- Water and wastewater SCADA
- Mobile data
- Lottery and gaming communications
- Public safety and first responders
- Workforce automation
- Railroad signal and control
- Mission-critical microwave communications
- Traffic system monitoring
- Telecom last-mile links



Engineering Services

- Network design
- Network installation
- Project pre-planning
- Site surveys
- RF path analyses
- RF propagation studies

Racks & Enclosures

- Project management
- Material procurement & sourcing
- Panel design and construction
- Testing
- Industry safety certification

Training & Certification

- Scheduled classes at MDS Training Center
- Pre-scheduled Regional Training Classes
- On-site training at customer facilities
- Virtual classroom teaching



MDS Wireless Systems Group



Planning

The MDS Wireless Systems Group offers services to support projects from the initial planning stage, including requirements gathering, to define the scope and desired performance requirements.

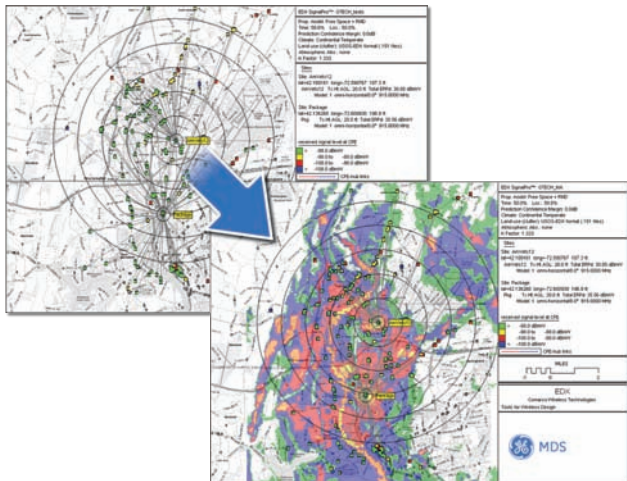
Project evaluation services are also offered, where GE engineers review and advise on project plans and feasibility.

Frequency planning and licensing coordination includes the evaluation of what regulatory licensing is required (such as FCC), and the complete hands-on coordination of filing all regulatory and wireless licenses with the appropriate agencies for the location and application.

Vendor selection services are also coordinated through GE to manage this critical planning phase.

Design

The extensive design services offered by the MDS Wireless Systems Group brings together our experienced RF engineers, IT and networking teams. We perform wireless propagation studies using carrier-class EDX software and verify our results with field testing and site surveys. Our tools cover the VHF, UHF, and microwave frequency bands.



Additionally, our design services include site validation, tower analysis, and RF analyses, including more complex RF interference studies. These services are fully documented with network drawings and topographic aerial studies.

Site surveys are performed by highly qualified engineers to verify the results of computer-generated predictions and propagation studies.

Complete network design capabilities cover IP/Ethernet, routing and bridging, firewalls and security, VLANs, PABX's, trunking, mobile data, SCADA, and backhaul applications.

Deployment

The Wireless Systems Group oversees project deployments with a highly skilled project management team. Our services cover Equipment and Vendor Selection, Budgeting and Scheduling, Bill of Materials Preparation, and Quotations Management.

Acceptance Test Planning is a key final component that must be defined for projects. Identifying and documenting the acceptance test requirements is critical to ensuring final system performance.

Using advanced MDS software packages, project deployments are organized, analysis is rapid, and documentation is fully transparent, a must for large deployments.

MDS Installation Tracker software allows for easy tracking of device installations for large projects. This information is accessible on a secure network, allowing customers to visualize and monitor complete project critical path progress.

MDS Transfer Zone software allows tracking of all project information managing both the data and access to the data. This proprietary tool enables the sharing of schedules, documents, and graphics.

Project deployment services also cover:

- Site Preparation
- Installation and Project Supervision
- Acceptance Testing
- Final Commissioning
- Documentation (system level, rack level and site level)

Support

Wireless communications projects are fully supported by GE MDS. This includes Technical Support for the wireless product installations, Maintenance, Troubleshooting, and Lifecycle Planning.

Racks & Custom Enclosures

Our equipment integration designs are developed with detailed attention to equipment placement and accessibility. Offerings include both standard and custom packages for wireless device integration and networking accessories. Standards-based procedures for equipment integration and testing ensure that wireless systems are robust and future-proof.

Custom Enclosures & Integration Services

- Standardized offerings or custom designs
- Integration of radios, multiplexers, switches and routers with power supplies, antennas and cables
- Offering open frame racks, NEMA enclosures, or custom enclosures
- Ability to pursue industry safety certifications
- Complete documentation provided
 - System level documentation
 - Rack level documentation
 - Site level documentation



Technical Training & Certification Services

GE MDS Technical Training and Certification Services provide customers with the high-quality training and certifications required to be safe, efficient and successful in all aspects of industrial wireless communications. GE MDS Technical Training Services offer a complete suite of training and certification courses that includes topics such as Fundamentals of Industrial Wireless Communications, product-specific technical training, wireless RF network planning, and MDS product certification classes.

This training is ideal for End Users, Application Engineers, System Engineers or anyone who is responsible for the design and maintenance of a wireless data network. Additionally, any management personnel who supervise and delegate the design and maintenance assignments for a wireless network will benefit from these courses.



Professional Education (CEU)

GE is authorized to offer professional credits to participants who successfully complete our training courses. Most of the GE MDS courses take between 2 and 5 days to complete. These Continuing Education Unit (CEU) professional credits allow engineers and technicians to maintain their professional accreditation. The online agendas at www.GEMDS.com contain information about the number of CEU credits awarded for each class completed.

Technical Training Center

Scheduled training classes are offered at regular intervals throughout the year at the GE MDS Technical Training facility located in Rochester New York, U.S.A. The Technical Training Center contains equipment for hands-on interaction with wireless communications products, test tools, and computers.

Training class sizes are kept small so instructors can interact with each student. Students receive comprehensive course manuals, with course notes that include lab exercises.

Regional Training

Regularly scheduled Regional Training courses are offered at selected locations around North America. Visit www.GEMDS.com to view training calendars and stay updated with the latest news on locations, dates, and course topics.

On-Site Training Courses

To increase the number of employees who can benefit from our training, GE MDS Technical Training offers the option of conducting training courses in person at customer facilities. These on-site courses can be customized to a specific range of topics. All the necessary equipment is provided to recreate the environment of our Training Center.

Fundamentals of Industrial Wireless

Instructors will remove the mysteries of RF communications by showing students the fundamentals of RF wireless theory, design, and installation. We will also discuss best practices for industry standard applications including Point-to-Point and Point-to-Multipoint radio systems. Students will also learn about the various types of radio interfaces including protocols and network fundamentals.

Contact Us

Visit www.GEMDS.com, "Training and Certifications" for updated training calendars and registration forms. You can also contact GE MDS Technical Services at 585-242-9600 and ask for the Technical Training Department.

Accessories



Accessories

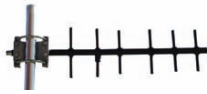
GE MDS Accessories are hand-picked and tested to ensure optimal performance under even the most extreme conditions. We provide a complete line of reliable and cost-effective accessories that are fully tested to perform at optimal levels. We simplify wireless system design by providing a convenient single source for ordering.

RF Essentials Kits



The GE MDS RF Essentials Kits provide an easy-to-order wireless package. These kits include everything needed in typical applications, including wireless devices, antennas, cables, connectors, grounding and lightning arrestors.

Antennas



GE MDS ClearWave™ Omni antennas are smaller than equivalent gain antennas which means less wind loading, and higher wind and ice survival ratings. ClearWave antennas support masts up to 2.5 inches, have increased gain, and extended warranties.

GE MDS ClearWave™ Yagi antennas are simple to install and optimize, allowing for quick return on investment. The all-welded design utilizes high strength aluminum to withstand heavy ice, high wind, and other extreme weather conditions.

Surge Protection



Preparation is the best course of action when protecting wireless devices against lightning strikes. Lightning arrestors provide ideal protection for general radio use and single transmitter applications. Our lightning arrestors have multi-strike capability with low strike throughput energy and can handle the immense amount of current released during lightning strikes, drawing the current away to protect valuable wireless assets.

Filters



GE MDS provides many types of bandpass, band reject, and notch filters with adjustable selectivity characteristics to allow a trade-off between insertion loss and selectivity.

Power Supplies



Power supplies not only allow customers to increase the efficiency of their wireless system, but they can also help protect against power system overloads. MDS power supplies come with universal adapters and are available in a wide range of voltages to fit all GE MDS wireless devices.

Installation Tools



From stripping and deburring tools, to grounding and hanger kits, GE MDS offers a full compliment of professional installation tools to provide fast and easy installation of your communication system. Professional installation tools consistently provide your telecommunications system a professional appearance while reducing installation time, providing you a faster return on investment.

Cables & Connectors



GE MDS offers cost-effective, high-performance cables. Our foam cable offering ranges from ½" to 1-5/8" in diameter. Our standard connectors offer pre-set pin depths and self flaring mechanisms to ensure fast, accurate installation along with low inter-modulation and low VSWR. Premium connectors can be easily attached in the field and drastically reduce the time required for connector attachment while providing superior electrical and mechanical performance.

RF Essentials Kits

Access Point Kit



The Access Point site is the location where data is aggregated from multiple remote sites. Many times the SCADA host computers are located here. The site usually has a tower to maximize antenna elevation and coverage. Access Point Kits include the following:

- Omni Antenna
- 150 ft of 7/8" Cable
- Matched Connectors
- Lightning Protection
- Jumpers
- Grounding Kits
- Hoisting Grip
- Hangers
- Weatherproofing Kits

KAP-	xxx-	xx	Description
MDS radio compatibility	N09 L01 L04 L09 S04 M09		iNET, iNET-II, TransNET, entraNET, NETio; 900 MHz 1710; 150-174 MHz 4710; 400 MHz 9710; 900 MHz SD4; 400 MHz Mercury; 900 MHz
Omni Antenna		A1 A2 A3 A4 C1 C2 C3 D1 D2	156-162 MHz 163-168 MHz 188-174 MHz 150-156 MHz 406-430 MHz 430-450 MHz 450-470 MHz 902-960 MHz 902-960 MHz (9810 only)
Cable			150 ft., 7/8 Coaxial
Connector			N-Type
Hanger			5 Kits (10 per Kit)
Grounding			Clamp with Pigtail
Lightning Arrestor			Flange
Jumper Cable			6 ft. with Connectors

Fixed Remote Kit

Remote sites typically contain a PLC, RTU or similar equipment that collects data used by the central computer. Typical remote sites are wellheads, transformers and capacitor banks. Fixed Remote Kits include the following:

- Yagi Antenna
- Lightning Protection
- Jumpers
- Grounding Kit
- 25 ft pigtail with N male connector
- UV Cable Ties

KFR-	xxx-	xx	Description
MDS radio compatibility	N09 N24 L01 L04 L09 S04 M09		iNET, iNET-II, TransNET, entraNET, NETio; 900 MHz entraNET, NETio; 2.4 GHz 1710; 150-174 MHz 4710; 400 MHz 9710; 900 MHz SD4; 400 MHz Mercury; 900 MHz
Yagi Antenna		A1 C1 C2 C3 D1 D2 E1	150-174 MHz 406-430 MHz 430-450 MHz 450-470 MHz 902-960 MHz 902-960 MHz (9810 only) 2400-2535 MHz
Cable			Included 25 ft Pigtail
Connector			N-Type
Hanger			UV Ties
Grounding			Clamp with Pigtail
Lightning Arrestor			Flange
Jumper Cable			3 ft. with Connectors

Custom designed Fixed Solar Kits are now available. Contact GE MDS for additional details.

Backhaul Kit

Backhaul links are high capacity, point to-point links with data rates up to 4xE1. Typical applications are data, video and/or voice. Backhaul Kits include the following:

- High Gain Paraflector
- 150 ft of 7/8" Cable
- Matched Connectors
- Lightning Protection
- Jumpers
- Grounding Kits
- Hoisting Grip
- Hangers
- Weatherproofing Kits

KBL-	xxx-	xx	Description
MDS radio compatibility	B01		LEDR
Parabolic Antenna		A1	406-420 MHz (LEDR 400 Only)
		A2	450-470 MHz (LEDR 400 Only)
		B1	890-960 MHz (LEDR 900 Only)
		C1	1400-1500 MHz (LEDR 1400 Only)
Cable			150 ft., 7/8 Coaxial
Connector			N-Type
Hanger			5 Kits (10 per Kit)
Grounding			Clamp with Pigtail
Lightning Arrestor			Flange
Jumper Cable			6 ft. with Connectors

Mobile Kit

A mobile remote is typically installed in a service vehicle such as maintenance trucks, police vehicles, ambulances, fire trucks, or cranes. The Mobile Kits include the following:

- 5 dB NGP Antenna
- Cables
- Matched Connectors
- Chargeguard
- Through-hole Antenna Mount (with Integrated GPS Antenna for Mercury)

KMU-	xxx-	xx	Description
MDS radio compatibility	M09		Mercury: 900 MHz
	N09		iNET-II, iNET, EntraNet
Omni Antenna		D1	902-960 MHz
Antenna Mount (GPS +)			Through-hole
Cable			Coaxial
Connector			TNC Type/SMA Type (GPS)
Power Switch			ChargeGuard

Repeater Kit

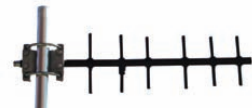
The repeater is used to provide coverage to remote sites that are separated by large distances or obscured by physical obstructions such as hills and buildings. The Repeater Kit includes the following:

- 9 dBd Omni & 10 dBd Yagi
- 300 ft of 7/8" Cable
- Matched Connectors
- Lightning Protection
- Jumpers
- Grounding Kits
- Hoisting Grip
- Hangers
- Weatherproofing Kits

KRR-	xxx-	xx	Description
MDS radio compatibility	N09		iNET, iNET-II, TransNET, entraNET; 900 MHz
Omni and Yagi Antenna		D1	902-960 MHz
Cable			300 ft., 7/8 Coaxial
Connector			N-Type
Hanger			10 Kits (10 per Kit)
Grounding			Clamp with Pigtail
Lightning Arrestor			Flange
Jumper Cable			6 ft. with Connectors

Antennas

Yagi



Clearwave MHz Yagi

These antennas have been optimized using a genetic algorithm to achieve superior performance. They feature solid 3/8" elements attached to a seamless aluminum boom with 360° welds, and are finished with a black powder coating. Their sturdy construction and advanced design provides outstanding durability and superior performance in all weather conditions.

Frequencies	Gain	Power Rating	Termination	Weight	Mounting	Vertical Beamwidth	Horizontal Beamwidth
406-430 MHz, 430-450 MHz, 450-470 MHz, 902-960 MHz	10 dBd	150 W	N-Female Pigtail optional	1.1-2 lbs	1 5/8" Diameter Bracket incl.	45 degrees	50 degrees

Scala 900 MHz Yagi

These rugged antennas are fabricated of 6061/T6 aluminum rod and seamless drawn pipe, and anodized for maximum reliability and corrosion resistance. The internal balun, coax feed and connector are sealed in a foam potting system to prevent moisture penetration and assure long service life in severe environmental conditions. They are specifically designed for professional fixed-station applications.

Frequency	Gain	Power Rating	Termination	Weight	Mounting	E-Plane Beamwidth	H-Plane Beamwidth	Dimensions
890-960 MHz	10 dBd	100 W	N-Female	3 lbs	Fits 1.25-2.375" Masts Bracket incl.	40 degrees	48 degrees	23" x 7"

GPS

GPS Timing



The timing reference antenna is designed for long-lasting, trouble-free deployment. The 16 dBd high gain amplifier addresses attenuation issues associated with longer cable runs. The proprietary design, coupled with multistage filtering provides a superior out-of-band rejection and improved elevation pattern performance than traditional patch antennas. Their unique radome shape sheds water and ice.

Frequency	Gain	Voltage	Termination	Weight	Mounting	Vertical Beamwidth	Dimensions
L1 1575.42 +/- 10 MHz	16 dBd	3.3-6 Vdc	N-Female	0.6 lbs	Fits 1-1.45" Masts Bracket incl.	9 degrees	5" H x 3.2" D

Mobile/GPS

These GPS antennas provide maximum performance and versatility for telematics applications, including fleet monitoring and asset tracking. Their precise performance and ease of installation provide outstanding value and flexibility for the most demanding wireless mobile applications. The combination GPS/mobile antenna provides GPS tracking coverage and voice/data wireless coverage capabilities.

Frequency	Gain	Voltage	Termination	Mounting	Vertical Beamwidth	Dimensions	Cable
L1 1575.42 +/- 10 MHz	16 dBd (GPS)	3-5 Vdc	SMA-Male (GPS) TNC-Male (mobile)	1-1/8", 18 thread mount	9 degrees	2.25" W x 4.25" L x 1.25" H	17' RG-174 (GPS) 17' RG-58/U (mobile)

Antennas

Omni

Clearwave 900 MHz Omni

Through robust design and construction, GE MDS ClearWave Antennas are optimized for MDS wireless systems, providing high system performance and data integrity. These antennas provide optimum installation efficiency, flexibility and rapid installation.



Frequency	Gain	Power Rating	Termination	Weight	Mounting	Vertical Beamwidth
902-928 MHz	7 dBd	250 W	N-Male on 16" pigtail	4 lbs	up to 2.5" Mast Bracket incl.	17 degrees

Clearwave 400 MHz Omni

These antennas consist of base matched half wave antennas in heavy duty fiberglass with thick walled aluminum mounting bases for reliable long term use. Sturdy construction and advanced design provides durability and superior performance in all weather conditions.

Frequencies	Gain	Power Rating	Termination	Weight	Mounting	Vertical Beamwidth
406-430 MHz, 430-450 MHz, 450-470 MHz	5 dBd	250 W	N-Male on 16" pigtail	4 lbs	1-5/16" Base Diameter Bracket incl.	27 degrees

Scala Omni

This omnidirectional antenna is extremely robust and is constructed with the finest fiberglass, brass, and aluminum providing the highest performance and reliability in the toughest weather conditions. Mounting hardware is fabricated from stainless steel.

Frequency	Gain	Power Rating	Termination	Weight	Mounting	E-Plane Beamwidth	Height
870-960 MHz	9 dBd	500 W	N-Female	17.6 lbs	2-3.75" mast Bracket incl.	7 degrees	119.4"

2.4 GHz Omni

These omnidirectional antennas are designed to provide maximum performance and reliability under the toughest weather conditions. They feature a UV stable, vented radome that provides ultimate protection against weather elements. They can be mast or wall mounted and provide reliable performance by protecting the electrical design against extreme moisture and/or temperatures.

Frequencies	Gain	Power Rating	Termination	Weight	Mounting	Vertical Beamwidth	Height
2400-2483.5 MHz	8 dBi	25W	N-Female	0.50 lbs	not included	13 degrees	20.2"
2400-2483.5 MHz	10 dBi	25W	N-Female	0.65 lbs	not included	9 degrees	36.0"
2400 - 2500 MHz	12 dBi	25W	N-Female on 16" pigtail	3.00 lbs	not included	7 degrees	44.0"

Surge Protectors

Lightning Arrestors

Lightning arrestors provide ideal protection for general radio use and single transmitter applications. These devices have multi-strike capability with low strike throughput energy.



Frequency	Throughput	RF Power	Turn on	Mounting	Termination
125-1000 MHz	< 220 uJ	375 W	600 V	Flange and Bulkhead	N-Female

Frequency	Throughput	RF Power	Turn on	Mounting	Termination
800-2500 MHz	< 175 uJ	300 W	600 V	Flange and Bulkhead	N-Female

Filters

Filtering unwanted signals is common in any wireless RF system. An RF filter simply attenuates a portion of the frequency spectrum, so it can not get through to the radio's receiver. GE MDS provides many types of notch, bandpass and band reject filters.



Frequency	Insertion Loss	RF Power	Mounting	Termination
902 - 928 MHz	1.5 dB (typical)	90W	Flange	N-Female

Power Supplies

Power supplies not only allow customers to increase the efficiency of their wireless system, but they can also help protect against power system overloads. MDS power supplies come with universal adapters and are available in a wide range of voltages to fit all GE MDS wireless devices. Experience never ending power with GE MDS.



Available Options

- AC to DC
- DC to DC

Installation Tools



Grounding Kits

These grounding kits provide the ultimate in ease of installation and provide reliable protection of your coaxial cable system. They greatly reduce installation time. All hardware is included, along with required mastic and electrical tape for weatherproofing. Each kit also includes copper ground and a 2-hole lug.

Specifications

- Cable Diameter 7/8" 1/2"
- Ground Wire Length 24"
- Used With LDF5-50A and LDF4

Weatherproofing Kits

Weatherproofing kits flawlessly seal the junction between two connectors. This not only protects the connection from water damage, it also prevents vibrations from loosening the interface.

Each kit contains

- (6) rolls of 2-1/2" x 24" butyl tape
- (2) rolls of 3/4" x 66' black electrical tape
- (1) roll of 2" x 20' black electrical tape

Covers one of the following groups of connections

- (6) 7/8" to 1/2"
- (4) 1-5/8" to 1/2"
- (5) 1-1/4" to 1/2"
- (8) 1/2" to 1/2"

Hanger Kits

Hangers provide a reliable solution for supporting single runs of coaxial cable in wireless systems. Cable grippers bite into the coax jacketing to provide additional support. Recommended spacing is one hanger for every 3 feet of cable.

Specifications

- For 1/2" or 7/8" cable
- 10 per pack

Not Included

- Mounting hardware (3/8" dia. x 1" long bolts, nuts and lockwashers)

Cables

LMR Series



LMR-400

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
0.405" Black PE Jacket	Aluminum tape	Solid BCCAI	Foam	0.068 lb/ft	3.9 dB @ 900 MHz/100 ft

LMR-600

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
0.590" Black PE Jacket	Aluminum tape	Solid BCCAI	Foam	0.131 lb/ft	2.5 dB @ 900 MHz/100 ft

LDF/AVA Series

LDF4-50A Coaxial Cable

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
1/2" Black PE Jacket	Corrugated Copper	Copper-clad aluminum	Foam	0.15 lb/ft	2.21 dB @ 900 MHz/100 ft

AVA5-50A Coaxial Cable

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
7/8" Black PE Jacket	Corrugated Copper	Copper tube	Foam	0.30 lb/ft	1.12dB @ 900 MHz/100 ft

LDF6-50A Coaxial Cable

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
1 1/4" Black PE Jacket	Corrugated Copper	Copper	Foam	0.66 lb/ft	0.91 dB @ 900 MHz/100 ft

LDF7-50 Coaxial Cable

Insulation	Outer Conductor	Inner Conductor	Dielectric	Weight	Attenuation
1 5/8" Black PE Jacket	Corrugated Copper	Copper	Foam	0.92 lb/ft	0.77 dB @ 900 MHz/100 ft

Connectors

LMR Series



A wide variety of connectors are available for LMR cable, including most interface types and a choice of solder or non-solder center pins.

Type	Description	Compatibility	Inner Contact Attach	Outer Contact Attach
TC-400-NFC	Straight Jack	LMR-400	Solder	Clamp
TC-400-NM	Straight Plug	LMR-400	Solder	Crimp
TC-400-NMC	Straight Plug	LMR-400	Solder	Clamp
EZ-400-NF	Straight Jack	LMR-400	Spring Finger	Crimp
EZ-400-NMH-D	Straight Plug	LMR-400	Spring Finger	Crimp

LDF/AVA Series

A wide variety of connectors are available for LDF cable, including most interface types and a choice of solder or non-solder center pins.

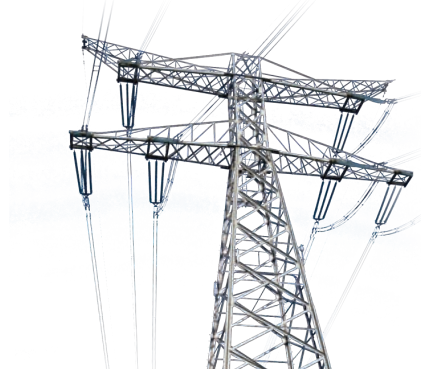
Type	Description	Compatibility	Inner Contact Attach	Outer Contact Attach
L4TNF-PS	Straight Jack	LDF4-50	Captivated	RingFlare
L4TNM-PS	Straight Plug	LDF4-50	Captivated	RingFlare
AL5NM-PS	Straight Plug	AVA5-50	Captivated	RingFlare
AL5NF-PS	Straight Jack	AVA5-50	Captivated	RingFlare
L6TNM-PS	Straight Jack	LDF6-50	Captivated	RingFlare
L6TNF-PS	Straight Plug	LDF6-50	Captivated	RingFlare
AL7NM-PS	Straight Plug	LDF7-50	Captivated	RingFlare
AL7NF-PS	Straight Jack	LDF7-50	Captivated	RingFlare

Application Specific Solutions



Critical processes and essential services

Energy



Solutions for the Smart Grid

Electric utilities depend on our industrial solutions to securely, reliably, and cost-effectively communicate to and control their vital generation, transmission and distribution assets. Our MDS wireless devices and networking multiplexers reduce infrastructure costs, provide the highest levels of security, and are used for Smart Grid and Distribution Automation communication infrastructures including AMI, collection point data aggregation, load balancing, pole-top switching, and Recloser control.

Fast Wireless Transfer Trip

Designed for electric utilities, the DGT Distributed Generation Trip Control enables the fast and secure disconnect of renewable energy generators from the electrical power grid, which protects both citizens and critical assets.



Oil & Gas



Improving Productivity, Contributing to Safety

The most recognized Oil & Gas companies in the world trust our wireless communications and multiplexing solutions to monitor and control vital assets and processes for the production and pipeline transmission of oil and gas resources. Our communications products allow customers to respond to system demands, and quickly deal with emergency situations.

Remote Gas Pipeline Monitoring

Our low power devices allow remote control and monitoring of compressor stations and pipelines. Flow measurement and device data is wirelessly transmitted from PLCs and RTUs located along pipelines. A single MDS wireless hub can communicate to hundreds of different remote pipeline locations. By using multiple hubs, pipeline customers transmit data from thousands of locations to a central control station.



Water & Wastewater



Wide Area Asset & Security Monitoring

We provide a full range of wireless and multiplexing solutions for Water and Wastewater applications including monitoring vital water flow, video surveillance, and sending control commands to valves, pumps and motors. Customers rely on our industrial hardened wireless devices to withstand their harsh process environments.

Ultra-Low Power Tank Level Monitoring

The MDS WiYZ data acquisition solution monitors dozens of remote water treatment tank levels. The system uses ultra-low power mesh radios that can operate on internal power for up to 5 years. Tank level data is collected at the wireless gateway and transmitted to a remote data center using private wireless infrastructure and a public carrier.



demand application specific solutions

Transportation



Reliable Communications for Monitoring and Control

The robust, long range wireless communications solutions we offer provides secure, reliable wireless communications across thousands of miles of highway and track worldwide for condition monitoring, signaling, switch control, and linking of infrastructure control locations. This includes remote locomotive control, computer-aided dispatch systems and traffic monitoring that increases productivity, safety and fuel efficiency.

Remote Control Locomotive

The RCL220 radio family sets the standard for locomotive remote control, enabling simultaneous coordinated control of 30 locomotives with 60 control units in only 50 kHz bandwidth. With repeaters, locomotive radios, and embedded portable radios, RCL220 offers a complete communications solution.



Public Safety



Mission-Critical Data to First Responders

Forewarned is forearmed. We provide highly secure wireless communications required for mobile data access to computer-aided dispatch systems, remote mug shot lineups, intra-agency operating procedures, and Amber Alerts. Our wireless communications systems link voting receivers and simulcast systems, backhaul voice communications, and provide high-capacity connection between control centers and access points.

Mobile Data Networks for First Responders

The MDS mobile data solution uses Mercury LAN extension devices to provide high-speed connectivity to essential information for thousands of vehicles in consortia and municipalities across the country. Law enforcement, fire, and ambulances have a reliable, secure, network to access criminal databases, video, and geographic data.



Heavy Industrial



Rugged Solutions for Harsh Environments

Industries from Petrochemical to Mining deploy MDS wireless solutions to extend monitoring and control networks for process optimization, alarming, regulatory compliance, and cost-effectively implementing safety and security systems.

Surface Mine Condition Monitoring

I/O signals from remote sensors and serial data from PLCs are processed simultaneously on a MDS NETio system at one of North America's largest surface mines. PLCs collect signals wirelessly from seismic sensors connected at 25 remote radios to control mining vehicle traffic and facility access during unsafe conditions.



Application Spotlight



DGT

Distributed Generation Trip Control



Fast & Wireless trip of Distributed Generators

Distributed Generation Trip Controls (DGT) are wireless communication devices used in applications that require transferring of trip signals from Power Distribution Utility Substations or Recloser Sites to multiple (1-7) Distributed Generators interconnected to the distribution grid.

Key Benefits

- Cost-effective, wireless and fast transfer trip solution
- Transfers trip and status confirmation faster than standard breaker reclose time
- Reliable and secure long distance transfer trip to multiple Distributed Generators
- Extremely resistant to interference due to frequency hopping spread spectrum technology
- Packaged and engineered system tested to industry standards
- Suitable for direct outdoor application

Application Specific Solution

The DGT provides the performance and security essential across the Power Distribution industry with a fast radio platform necessary for mission-critical applications such as DG interconnection. It is a wireless solution that enables long range, unlicensed transfer trip signals in 30 msec or less, allowing fast disconnect of remote distributed generators from the utility power network.

The DGT offers a right balance of speed and range to transfer trip signals and status confirmation, faster than typical radio communications systems. Combining high data-rate digital transmissions, with robust frequency hopping technology, the helps ensure.

- Safe Distributed Generation Interconnection to the power grid
- Ensure Line personnel safety
- Prevent customer equipment damage
- Prevent system damage

Control

- Transfer trip issued from up to 2 locations on the feeder - substation and recloser site
- Point-to-multipoint transfer trip issued to maximum 7 Distributed Generation sites
- Trip status of DG sites transferred back to utility substation and recloser site

Communication

- Secure communication: frequency hopping spread spectrum technology
- High speed: transfer trip in 30 msec
- Long distance: 30 mile range with repeater
- Reliable communication: 32 bit CRC
- Unlicensed operation in the 902-928 ISM band (N. America)
- 100% tested for RF performance -40° C to +60° C
- High sensitivity: -10⁶dBm @ 1x10⁻⁶ bit error rate

EnerVista

- Separate setup software based on user application -Utility & Distributed Generator Owner.
- Single click option for quick connect to devices provides real-time feedback on device status
- Single step configuration for DG owner



Overview

The desire for green power and rapid developments in renewable energy sources are driving the growth of distributed generation. Many Power Distribution Companies are now encouraging small power producers to interconnect to the Utility grid. Independent power producers are typically customers who install small scale generating units up to 10 MW in size to offset their load and sell excess power to the local distribution Utility for grid support and reliable supply.

As Distributed Generation (DG) becomes more prevalent, DG interconnection to the Utility network requires an affordable, reliable, and high speed solution that can prevent power from being fed back to the grid during undesirable situations, such as power line maintenance, electrical faults, etc. In the event of a fault, the Distributed Generator needs to disconnect from the grid prior to the reclosing operation of the Utility Substation breaker.

The following factors determine the need for automatic Distributed Generation disconnect from the power grid when the substation breaker trips open:

- Safety Hazard: A power line assumed to be disconnected remains energized. This can be unsafe for the public, line personnel working on the feeder, etc.
- Distributed Generation Damage: If a main Utility breaker closes out of sync, the Distributed Generator can be damaged
- Customer equipment damage: Frequency and voltage provided to customers can vary significantly and damage apparatus

GE Digital Energy is the industry leader in introducing a revolutionary and innovative Distributed Generation disconnect solution that is high speed, cost effective, wireless, long range, reliable and secure.

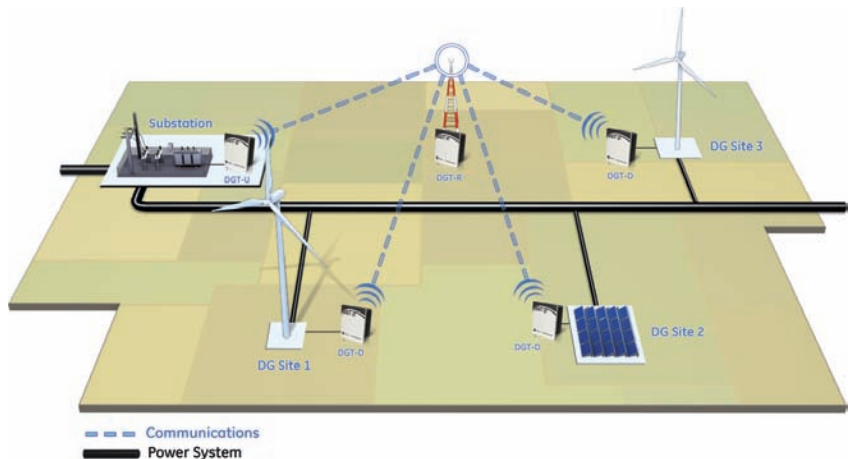


Figure 2. Wireless network that allows transfer trip from point to multi-point.

Transfer Trip Control System

There are three types of Distributed Generation Trip Control (DGT) devices available for a wireless transfer trip system.

In a point-to-multipoint system, a first control device is required at the Utility Substation, a second control device between the substation and the generation site, and a third control device at each Distributed Generation site. A point-to-multipoint system can support up to 7 distributed generation sites.

However, in a point-to-point system, one control is installed at the Utility Substation and a second control at the Distributed Generation site. A point-to-point system supports one remote generation site.

Each DGT control device location is based on its respective function. The substation unit is required to transfer trip signals from the Utility Substation, the downstream control unit is needed to repeat the Substation trip signal to each DG site, and the DG site control device is needed to receive the trip signal from the substation and initiate the disconnect of the local breaker.

DGT-U

A DGT-U is a trip control device implemented at the Utility Substation for transferring wireless trip signals to remote DG sites (up to 7 sites) and receiving status notification back from each DG site after a trip operation has been completed. The transfer trip timing is 30 milliseconds.

There is an option to locate a second DGT-U control at a recloser site on the distribution feeder. In this instance, the recloser sends a trip command to the remote DGT-D unit(s). The DGT-D then responds by initiating a trip and sending status confirmation back to the DGT-U at the recloser site and the DGT-U at the Substation.

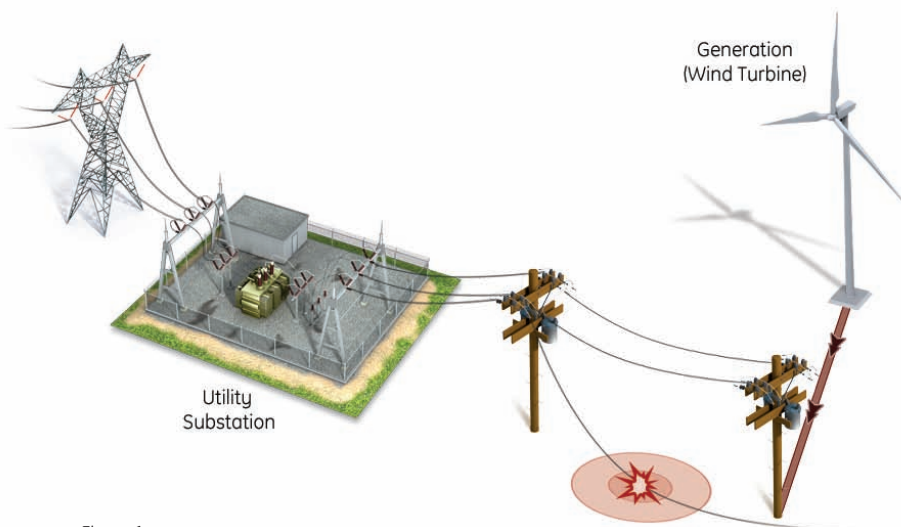


Figure 1. Distributed Generator feeds a faulted grid in the absence of a transfer trip solution.

DGT-R

A DGT-R is a Repeater device installed at or near the Utility Substation for coordinating wireless communication among the Utility and its various generation sites). In a point-to-multipoint system, all communication is coordinated through the DGT-R unit in order to achieve a maximum distance of 30 miles and communicate with multiple generation sites.

DGT-D

A DGT-D is a trip control needed at the Distributed Generation site for receiving trip signals from the Utility Substation and sending a wireless status notification back to the Substation after a trip operation has been performed. The disconnect status transmit timing is less than 150 milliseconds.

The control devices in a DGT network continuously map data. The DGT-U and the DGT-D control units constantly transmit and receive an event (trip status =1) or a no event (no activity = 0) data between themselves via the DGT-R.

DGT System

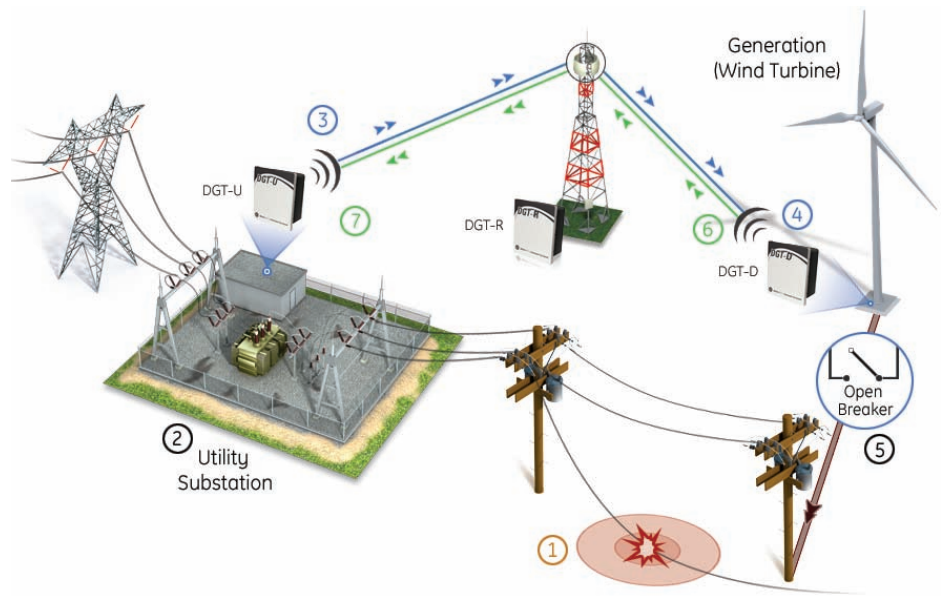
The DGT-U, DGT-R and DGT-D control devices are completely packaged units that include the appropriate DGT transceivers, power supply, necessary input and output terminations, antenna jumper cable and lightning protection in a weather resistant and lockable NEMA 4 enclosure.

The only connections required are for primary power, wiring to external devices (where necessary) and external antenna cable. All wiring connections are made within the enclosure leaving no connections exposed to environmental factors. DGT units are designed to be installed in a wall mount or pole mount configuration.

Distributed Generation Disconnect Sequence and Timing

The following steps describe how the application of DGT Controls enable safe and timely Distributed Generator disconnect from the Utility grid:

- Fault at power distribution line [1]
- Substation relay detects the fault [2]
- Relay triggers DGT-U Control device at the substation to transfer a trip signal via Repeater control device (DGT-R) to remote distributed generation site [3]



- 1 Fault Occurs
- 2 Fault detected
- 3 DGT-U Transfers Trip Signal
- 4 DGT-D Receives Trip Signal
- 5 Breaker Trips at DG Site
- 6 Status Confirmation Sent to Substation
- 7 Status info received in Substation

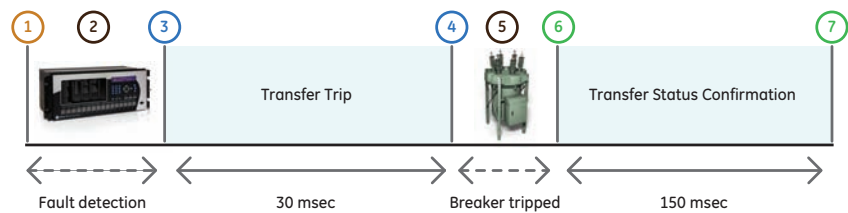


Figure 3. Sequence and timing for isolating a Distributed Generator from a faulted grid.

- Trip signal transferred in 30 milliseconds from DGT-U to the remote site
- DGT-D Control unit at Distributed Generation site receives trip signal [4]
- DGT-D triggers on site disconnect device to trip
- Disconnect device (breaker, switch, etc) at DG site disconnects generator from the Utility grid [5]
- DGT-D Control at DG site transmits status confirmation back to Utility Substation via Repeater device DGT-R [6]
- Status confirmation transferred in 150 milliseconds from DGT-D to substation
- DGT-U unit at substation receives status confirmation info [7]

Wireless Technology

The DGT control provides highly reliable long range communication over up to 30 miles. The DGT uses frequency hopping spread spectrum radios that operate in the license free spectrum between 902 and 928 MHz. The radios hop between 128 channels with a bandwidth of 130 kHz. The frequency hopping technique makes the radios extremely resistant to interference. Frequency hopping also establishes a high level of security because data transmission occurs on a variety of frequencies in a random pattern. In addition, the DGT uses a 32-bit CRC algorithm to further insure security and reliability of data.

The DGT's are able to operate in a point to multipoint configuration and transmit digital status among themselves at extremely high speeds. GE Digital Energy's unique wireless data transmission technology allows transfer trip signals to be sent and received by the end sites in 30 milliseconds.

While the DGT radios provide very robust wireless communication, radio line of site is needed to insure maximum range and performance. This path is achieved by mounting the DGT antenna at a suitable height above surrounding terrain and obstructions.

LED Indicators

Each transceiver in any DGT Control has a set of LED indicators to enable users to observe status of each device and its performance.

DGT-U: There are 11 indicators in the DGT-U transceiver

DGT-R: The DGT-R transceiver consists of 3 indicators

DGT-D: The DGT-D transceiver contains 6 indicators

Below are some of the common LED's:

- The Power LED illuminates when power is applied to the radio

- The Service LED flashes when a radio alarm condition is detected
- The IN LED is lit only when energized in the event of a trip
- The Link LED illuminates when the radio has established a connection

EnerVista™ Software

The EnerVista™ is an industry leading software program that simplifies every aspect of using the DGT Control. The EnerVista™ software not only provides all the essential tools to configure the DGT devices, it also provides exceptional levels of security in creating the Distributed Generation Trip network and encrypting configuration files for download.

For ease of use, there are two versions of the DGT software dependant upon user application. The DGT-Utility software is for the Power Utility Company and the DGT-DG software is for the independent power producer.

DGT-Utility Software

Using the DGT-Utility software a Utility user builds a DGT network. The software then creates encrypted data files that contain all necessary information and settings for the DGT-R and DGT-U devices. The DGT-Utility software also creates a DGT-D setting file to be sent to the distributed generation owner to authorize their DGT-D device to join the network. Only the utility can add DGT-D devices to a DGT Network. The configuration set up is simple with an online and offline menu available for ease of use. Configuration files are unique to each DGT network. A quick connect button allows the user to easily connect to the selected device.

DGT-DG Software

The Distributed Generation software allows User to upload a settings file or get diagnostics from a DGT-D control by simply clicking on the menu option. A quick connect button also allows the User to easily connect to the DGT-D device.

Energista Launchpad

Energista Launchpad is a powerful software package that provides Users with all the set up and support tools needed for configuring and maintaining GE Digital Energy DGT Controls. The set up software within Launchpad allows configuring devices in real time by communicating using serial connection or offline by creating setting files to be sent to devices at a later time.

Included in Launchpad is a document archiving and management system that ensures critical documentation is up to date and available when needed. Documents made available include:

- Manuals
- Brochures
- Wiring Diagrams
- FAQ's
- Help File

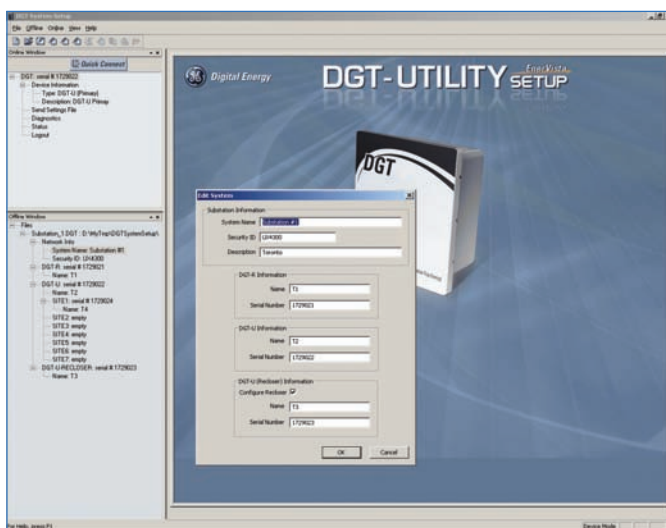


Figure 4.
DGT-Utility creates the setting files for all the devices.

Specifications

ENCLOSURE

Enclosure Dimensions: 13.75" H x 11.85" W x 6.5" D (35 x 30.1 x 16.5 cm)

Approximate Weight: 21 lb. (9.53 kg)

Humidity: 95% at + 60°C Non-Condensing

Testing: IEEE 1613

INPUT

Type: Wetted contact

Coil resistance: 1400 ohms maximum

Power draw: 400 mW

OUTPUT

Type: Dry contact Form A-relay (service output is Form B)

Contact material: Silver alloy

Operate time: < 10ms

Continuous carry: 5 A

Make & Carry for 0.2s: 30A per ANSI C37.90

COMMUNICATION

Frequency: 902-928 MHz Unlicensed ISM Band

Data transfer rate: 106 Kbps

Format: 8 data bits, no parity bit, 1 stop bit

Latency: <150 msec (round trip)

Trip Latency: <30 msec

Range: 30 miles

Security: 32 bit CRC

Frequency: License free 902-928 MHz

Sensitivity: -106 dBm at 1×10^{-6} Bit error rate

POWER SUPPLY

Nominal DC: 125 to 250 VDC

Min/Max DC: 100/350 VDC

Nominal AC: 120 to 240 VAC at 50/60 Hz

Min/Max AC: 88/260 VAC at 50/60 Hz

Voltage loss hold up: >25 ms

Voltage withstand: 30 V above maximum rating

Power consumption: 20 to 30 W typical, 60 W maximum

Internal fusing: Ratings: 2 A/600V

Interrupt rating: AC = 200,000 A
DC = 100,000 A

ENVIRONMENT

Ambient operating temperature: -40 °C to + 60 °C

Ambient storage temperature: -40 °C to + 85 °C

Humidity: < 90% at 40 °C, non-condensing

CERTIFICATION

ISO: Manufactured under an ISO 9001 registered program

CSA: DGT transceivers are approved for Class1, Division 2

FCC ID: E5MDS-EL806

IC ID: 3738A-MDSEL806

IEEE 1547: Enables Compliance

Figure 5.
Distributed Generation Trip Controls
packaged for direct outdoor application



Ordering

To order select the basic model and the desired features from the Selection Guide below:

DGT U and D Models

	DGT	*	*	*	
Basic Unit	DGT	U			DGT Utility Substation Control
	DGT	D			DGT Distributed Generation Site Control
Power Supply		H			125 V DC / V AC (no internal battery or charger) ; 90-375 V DC
		L			24-48 V DC (no internal battery or charger)
Antenna & Cable				1	6.4 dB Yagi Antenna, 50 feet cable, with connectors
				2	6.4 dB Yagi Antenna, 100 feet cable, with connectors
				3	6.4 dB Yagi Antenna, 150 feet cable, with connectors
				4	6.4 dB Yagi Antenna, 200 feet cable, with connectors
				5	6.4 dB Yagi Antenna, 250 feet cable, with connectors
				0	None

DGT R Model

	DGT	*	*	*	
Basic Unit	DGT	R			DGT Repeater Control
Power Supply		H			125 V DC / V AC (no internal battery or charger) ; 90-375 V DC
		L			24-48 V DC (no internal battery or charger)
Antenna & Cable				1	7.0 dB Omni Antenna, 50 feet cable, with connectors
				2	7.0 dB Omni Antenna, 100 feet cable, with connectors
				3	7.0 dB Omni Antenna, 150 feet cable, with connectors
				4	7.0 dB Omni Antenna, 200 feet cable, with connectors
				5	7.0 dB Omni Antenna, 250 feet cable, with connectors
				0	None

Visit www.GEDigitalEnergy.com/DGT to:



- View Guideform specifications
- Download the instruction manual
- View applications notes and support documents
- Buy a DGT online
- View the DGT brochure

Lentronics Multiplexers

Critical Communications Solutions



Our Multiplexers balance flexibility

Driving Security and Dependability to the Network Edge

Today's complex, converged services networks need powerful, flexible and reliable multiplexing solutions. GE Lentronics is a leading supplier of hardened multi-service telecommunications platforms, providing secure application performance over optical cable and other media from the network core to the edge.

Lentronics Multiplexers are designed for reliable operation in extremely harsh environments, making them perfectly suited for critical communications and asset protection. Their compliance to North American NERC CIP electric utility security standards, mitigates the risks facing all types of organizations. Lentronics Multiplexers protect critical assets, people, equipment and data through sound security profiles.

With support for almost any protocol, interface or application, Lentronics Multiplexers provide a secure, rugged network platform, that can handle multiple signals of both low and high speed data streams, as well as integrating voice, video, and Ethernet. Because of this flexibility, Lentronics Multiplexers have the ability to meet tomorrow's needs, while also providing effective, economical network access today.

Our long history of helping companies meet the increasing complexity of their telecommunications requirements, means that customers can rely on GE Lentronics to deliver cost-effective, flexible, and reliable solutions for managing both their mission critical applications and basic network requirements.



Expertise based on tens of thousands of installations with hundreds of customers worldwide.

with security and dependability

Utility Hardened

Designed and built for use in electric utility, pipeline, heavy industrial and transportation applications, the Lentronics family of multiplexers is tested to harsh specifications. These include tolerance to extreme temperatures and electrical surges, as well as radio frequency and electromagnetic interference.

Flexible

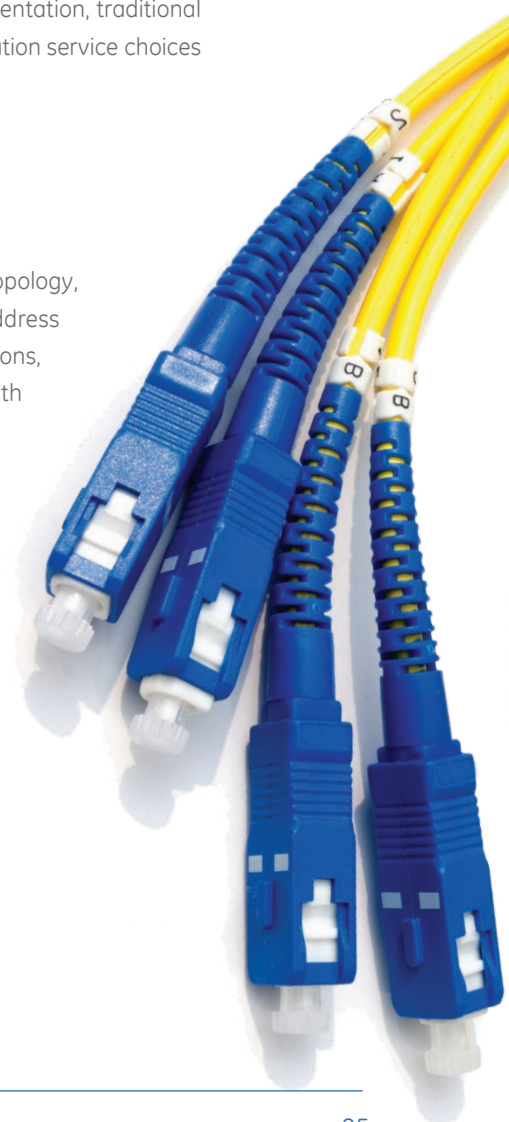
Because of their unique modular architecture, Lentronics Multiplexers integrate easily into existing networks, providing support for legacy requirements, as well as the latest telecommunication innovations. Lentronics Multiplexers create a secure, segregated transport environment for mission critical applications and traditional business requirements. From Ethernet interfaces to modules for video, telemetry, instrumentation, traditional telephony and teleprotection, Lentronics Multiplexers offer a wide variety of telecommunication service choices to optimize the usefulness of your network.

Reliable & Scalable

With their add/drop capability for new application connections and changes in network topology, coupled with the ability to provide 5x9 availability, Lentronics Multiplexers seamlessly address network modifications with a minimum of downtime. Combined with a full suite of operations, management and administration tools, Lentronics Multiplexers can easily integrate with existing network management systems, providing real-time visibility and control.

Secure

With robust, multi-level division of traffic, Lentronics Multiplexers provide simple, dependable security across network applications. In addition to separating traffic types into distinct transport "pipes", they can also ensure segregation of critical data and applications from other network traffic using traffic classification and LAN division techniques. Combined with the ability to handle the latest in encrypted traffic types and event logging for security forensics, Lentronics Multiplexers offer a complete suite of security options to ensure the safety of your data and applications.



Multiplexers



JungleMUX™ Sonet Multiplexer oc-1/oc-3/oc-12/oc-48

87

The JungleMUX SONET Multiplexer delivers robust, secure wide area telecommunications over an optical cable infrastructure adhering to Telcordia SONET standards, supporting a wide array of applications in a reliable, secure manner.



TN1U SDH Multiplexer STM-1/STM-4/STM-16

91

The TN1U SDH Multiplexer delivers robust, secure wide area telecommunications over an optical cable infrastructure adhering to ITU-T SDH standards, supporting a wide array of applications in a reliable, secure manner.



TN1Ue SDH Multiplexer STM-1/STM-4/STM-16

95

The TN1Ue SDH Multiplexer delivers robust, secure wide area telecommunications over an optical cable infrastructure adhering to ITU-T SDH standards, supporting a wide array of applications in a reliable, secure manner. The enclosed shelf design provides additional security in sensitive electromagnetic interference (EMI) environments.



JungleMUX™ T1 Multiplexer

99

The JungleMUX T1 Multiplexer provides voice, data, telemetry, ethernet and teleprotection transport services over T1 leased line, microwave radio, as well as dedicated copper or optical cable media. An integrated digital cross connect offers powerful traffic grooming options.



VistaNET Network Management System (NMS)

103

As a flexible NMS for all Lentronics Multiplexers, VistaNET can be provisioned as a standalone or a client-server LAN/WAN solution, permitting centralized or distributed network management.

JungleMUX SONET Multiplexer



Powerful and Flexible Multiplexing Solutions

The Lentronics JungleMUX SONET Multiplexer delivers powerful optical networking solutions for critical communications applications. With a wide range of tributary interface units, the JungleMUX provides both transport and access capabilities for voice, data, IP/Ethernet WAN, video and utility teleprotection traffic in a single package. Harsh environment ready, the modular JungleMUX delivers flexible, secure and reliable communications.

Key Benefits

- Eliminate complex multi-device equipment solutions with a single integrated package
- Protect capital investment with seamless capacity upgrade from OC-1 to OC-48
- 5x9 system availability with redundant common equipment for path switched ring networks
- Fast path protection switching (<3 ms)
- Reduce connectivity, expansion, and configuration costs with modular solution
- Advanced network visibility from SONET level down to individual DS-0 signals
- Comprehensive network management capabilities using VistaNET
- Secure and dependable transport of critical services

Application Specific Optical Solutions



Energy

- Connecting substations, generation plants, control centers, and administration offices
- Highly secure traffic segmentation
- Teleprotection, SCADA, video surveillance, voice, IP Ethernet WAN



Oil & Gas

- Connecting production platforms, FPSO vessels, and on-shore facilities
- Voice, data, CCTV, IP/Ethernet for SCADA and security sub-systems



Pipelines

- Connecting block valves, metering, pumping / compressor stations and control centers
- Operational communications for voice, data, CCTV, IP/Ethernet WAN, security, safety and SCADA sub-systems



Transportation

- Connecting train platforms, traction power substations, wayside cabinets, maintenance facilities and control centers
- Emergency voice, passenger information and ticketing systems, train control, traction power and security sub-systems

Utility Hardened

- Meets IEEE 1613 specification for communications networking devices in electric power substations
- Reliable operation in extreme temperatures from -4°F to +140°F (-20°C to +60°C)
- Meets Earthquake Risk Zone 4 shock and vibration specification

Scalable Design

- Add/Drop Multiplexer supporting industry standard network topologies
- Optional site specific tributary interfaces for video, voice, IP/Ethernet and utility teleprotection applications
- High-bandwidth optical interfaces from OC-1 to OC-48

Robust & Reliable

- 5x9 System availability with Telcordia standards
- Fast path protection switching (<3 ms)
- Built-in test capabilities
- Designed with redundant common equipment for ring architectures
- VistaNET network management software provides complete system monitoring and diagnostics

Secure & Dependable

- Segregated and dedicated SONET payload assignments for each application optimize QoS and security
- Port and VLAN partitioning isolates and protects critical communications applications



SONET Network Access

Facing increasingly complex demands for communications and security, organizations are looking for cost effective, reliable solutions for managing mission critical operations. The robust design of the GE Lentronics JungleMUX SONET Multiplexer makes it the ideal optical networking solution for electric power utility, transportation, pipeline and many industrial requirements.

System Technology

This powerful SONET multiplexer has a modular design for ease of maintenance, configuration flexibility, and expandability.

The JungleMUX delivers the benefits of the Telcordia SONET telecommunications standards to applications previously serviced by a mix of proprietary and legacy standards based equipment.

The multiplexer provides redundancy for critical modules, with guaranteed performance over an extended ambient



temperature range of -4°F to +140°F (-20°C to +60°C). It meets ANSI/IEEE Surge Withstand Capability (SWC), Radio Frequency Interference (RFI) as well as Earthquake Risk Zone 4 specifications providing secure performance in harsh environments.

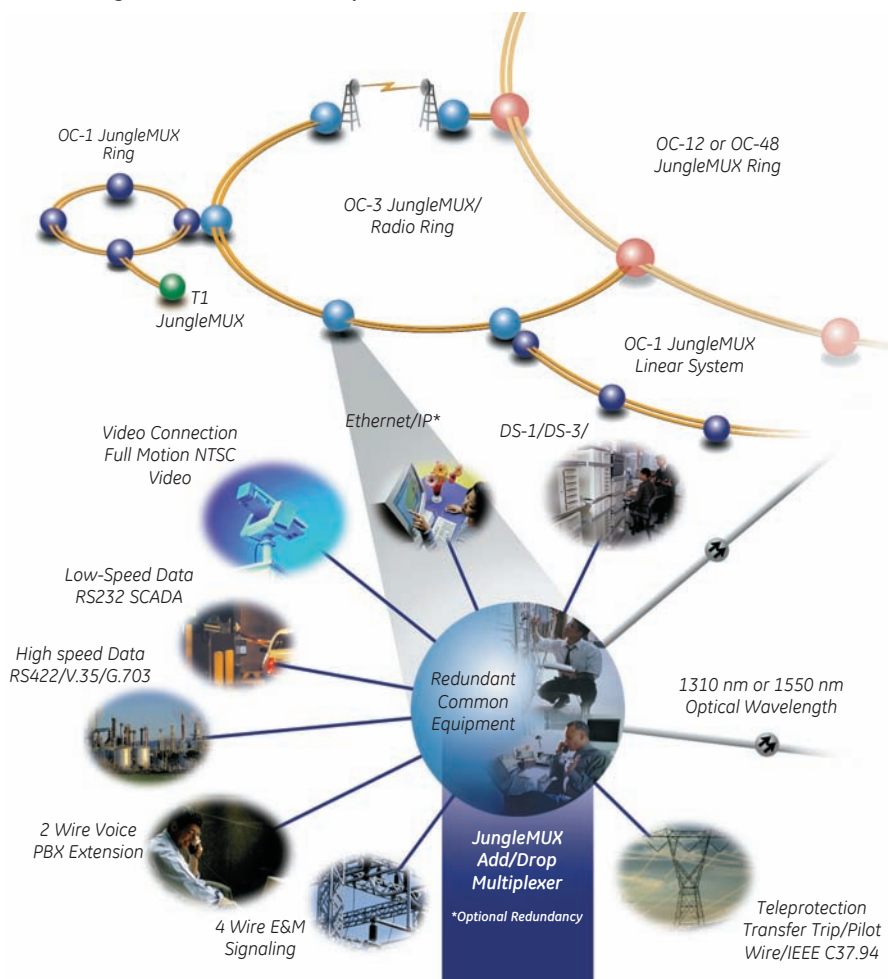
The JungleMUX is powered by 115 VAC or 24, 48, 130 VDC sources. Its built-in test capabilities can save the cost of purchasing SONET test equipment.

The JungleMUX can be customized to the user's requirements by equipping each site with specific modules as needed. New modules are added to the product line, as market needs dictate.

SONET Network Flexibility

Simply replacing optical transceiver modules allows users to expand an existing JungleMUX system to a higher capacity, while maintaining their capital investment.

JungleMUX SONET Multiplexers



Mixed access networks of T1, and OC-1/OC-3, combined with JungleMUX backbone rings of OC-3, OC-12 or OC-48 cost effectively distribute telecommunications services, allocating bandwidth only where it is needed.

The product also has the flexibility to operate with GE MDS and third party SONET microwave radios and higher capacity OC-n multiplexers.

Operations, Administration, Maintenance and Provisioning (OAM&P)

The JungleMUX takes advantage of the inherent network management capabilities provided by the SONET telecommunications standards.

VistaNET NMS software provides network visibility down to the individual circuit level at all nodes. This facilitates remote provisioning, monitoring, and alarm logging of the network from any node. Vistanet software operates on a Windows® based personal computer. An optional SNMP Network Management System (NMS) interface is available. Vistanet is also used for system diagnostics and troubleshooting.

Visibility of all JungleMUX equipment, including the DS-0 tributary units, improves maintenance response time and saves the operator money.

Applications

Electric Power Utilities

Originally designed for the unique needs of utilities, the JungleMUX system supports a wide range of specialty traffic, including teleprotection (direct transfer trip, pilot wire, and IEEE C37.94 optical interface to protection relays), surveillance video, substation automation, Ethernet WAN/IP and telephony.

High system availability is provided through redundant common equipment and compliance with Telcordia SONET standards for path switched ring protection architecture.

But the JungleMUX goes beyond SONET standards, offering the industry's fastest path protection switching (<3 ms), and incorporating special design characteristics that allow it to meet ANSI/IEEE RFI and SWC standards for operation in harsh utility environments.

Transportation Corridors

For highway, roads, bridges, tunnels, rail transit, freight railway, and airport applications the JungleMUX system cost-effectively integrates services previously provided by proprietary and legacy standards based equipment. Now these services can be combined to receive the full benefits of a SONET network.

For applications such as video surveillance, fare collection, passenger information systems, train control, emergency voice and signalling, the JungleMUX is the optical communications product of choice.

JungleMUX networks support both 48 Mb/s and 12 Mb/s video wide area networks (WANs). Each analog video source (camera, VCR, DVD, etc.) is digitized with a user configurable compression algorithm for bit-rate bandwidth management and then integrated into a shared video WAN.

For incident detection in surveillance applications, intelligent bandwidth allocation allows more bandwidth to be instantly assigned to specific cameras, permitting a higher resolution and more frames per second. When required, audio and data channels may be transported with the video.

The JungleMUX video interface addresses the issues of quality versus bandwidth by efficiently transporting video signals.

An optional remote video interface accessory is also available, which cost

effectively extends video capability up to 24.8 miles from a JungleMUX node via fibre optic cable.

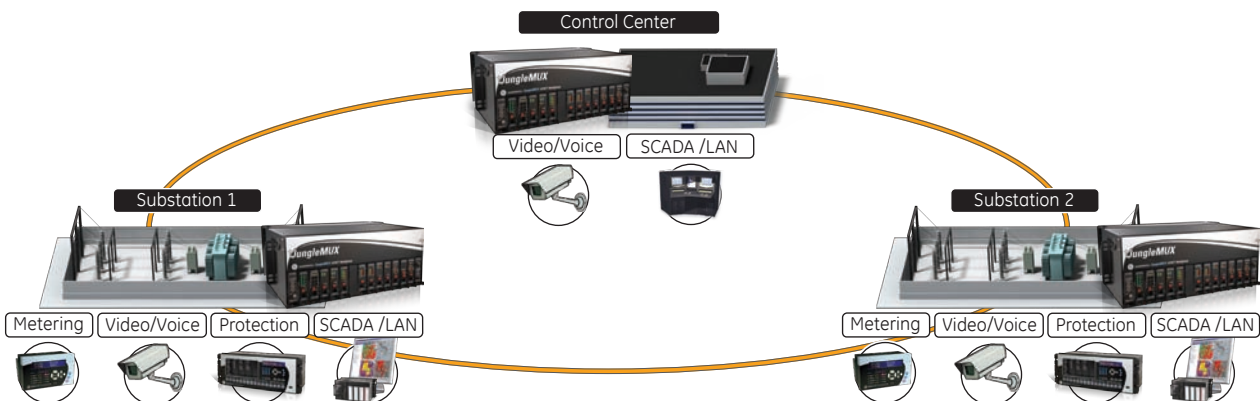
Pipelines and Industrial Facilities

The rugged design, compact size and low power consumption of the JungleMUX also make it the ideal optical communications solution for oil, gas, refined products, water and slurry pipelines. Field proven industrial applications include electrical distribution protection and control in mines, as well as SCADA for onshore or offshore oil and gas production fields.

The JungleMUX SONET Multiplexer creates greater value for its user by carrying a multitude of services such as low speed polling data, SCADA, power measurement data, video surveillance, Ethernet WAN/IP and PBX phone drop extensions over a single network.



JungleMUX SONET Multiplexer Electric Utility Application



Specifications

SIGNALING RATES AND OPTICAL INTERFACES

OC-1 SIGNAL

Speed	51.84 Mb/s
Channels	672 DS-0
System Gain (singlemode fiber)	
@ 1310 nm	28 dB
@ 1550 nm	40 dB
Optical Connector	FCPC

OC-3 SIGNAL

Speed	155.52 Mb/s
Channels	2016 DS-0
System Gain (singlemode fiber)	
@ 1310 nm	20 dB (IR)
@ 1310 nm	29 dB (LR)
@ 1550 nm	34 dB (ELR)
System Gain (multimode fiber)	
@ 1310 nm	11 dB (SR)
Optical Connector	LC

OC-12 SIGNAL

Speed	622.08 Mb/s
Channels	8064 DS-0
System Gain (singlemode fiber)	
@ 1310 nm	13 dB (IR)
@ 1310 nm	25 dB (LR)
@ 1550 nm	25 dB (ELR)
Optical Connector	LC

Speed	622.08 Mb/s
Channels	8064 DS-0
System Gain (singlemode fiber)	
@ 1310 nm	13 dB (IR)
@ 1310 nm	25 dB (LR)
@ 1550 nm	25 dB (ELR)
Optical Connector	LC

OC-48 SIGNAL

Speed	2,488 Gb/s
Channels	32,256 DS-0
System Gain (singlemode fiber)	
@ 1310 nm	13 dB (IR)
@ 1310 nm	26 dB (LR)
@ 1550 nm	26 dB (ELR)
@ 1550 nm	31 dB (ELR)
Optical Connector	LC

NETWORK MANAGEMENT CAPABILITIES

Windows based PC NMS allowing network access from any node for full system monitoring and diagnostics

Network visibility of every node, remote provisioning (monitoring and configuration of the network)

Alarm logging and time stamping

Simple troubleshooting and network maintenance

Optional redundant NMS platforms

Optional interface for SNMP Manager, allowing common NMS integration using IP

EMI/RFI

Meets ANSI/IEEE C37.90.2 RFI

ISOLATION

Meets ANSI/IEEE C37.90.1 SWC

RELIABILITY

Per Telcordia TR-NWT-000332

Ring system common equipment MTBF of 130,000 hours

Linear system common equipment MTBF of 50,000 hours

Refer to Technical Data Sheets for unit MTBFs

POWER REQUIREMENTS

24, 48, 130 VDC or 115 VAC

POWER CONSUMPTION

10 W for common equipment plus individual tributary unit power

ENVIRONMENTAL

Operating Temperature	-20° to +60° C (-4° to +140° F)
Storage Temperature	-40° to +70° C (-40° to +158° F)
Humidity	5 - 95% non-condensing
Power Substation	IEEE 1613

PHYSICAL SIZE

COMMON EQUIPMENT SHELF

Height	178 mm (7 inches)
Width	483 mm (19 inches)
Depth	423 mm (16.67 inches)
Weight	3.6 kg (8 lbs)

CHANNEL (EXPANSION) SHELF

Height	134 mm (5.25 inches)
Width	483 mm (19 inches)
Depth	423 mm (16.67 inches)
Weight	2.3 kg (5 lbs)

Tributary Functionality

DATA UNITS

LOW SPEED DATA

RS232 interface

Sub-rate multiplexing

Point-to-point and multi-point

HIGH SPEED DATA

64 (56) kb/s rates

RS422, V.35, G.703 and OCUDP

N X 64 KB/S DATA ELECTRICAL INTERFACE

N = 1 to 12 64 kb/s channels

V.35 and 10/100 Mb/s Ethernet interfaces

DS-1

1.544 Mb/s Data

DS-3

44.736 Mb/s Data

ETHERNET

IP connectivity

LAN/WAN interconnect

10/100/1000 Mb/s learning bridge

IEEE 802.3

VOICE UNITS

4W VF

Optional E&M signaling

Point-to-point and multi-point

2W VF

Optional E&M signaling

2W FOREIGN EXCHANGE

Loop start, ground start or PLAR signalling

VIDEO

NTSC/PAL analog video signal transport

Dynamically assigned compression scheme

56 kb/s to 10 Mb/s bandwidth

1-30 frames/second update rate

PTZ camera control capable

Optional multi-service data and contact I/O circuits

Remote video I/O assembly for fiber optic extension of video capability

TELEPROTECTION UNITS

TRANSFER TRIP

Separate Transmit and Receive units, optional test panel

CURRENT DIFFERENTIAL

HCB, CPD, SPD, RADHL pilot wire relay interfaces

CONTACT INPUT/OUTPUT

Transport of contact closure

N X 64 KB/S DATA OPTICAL INTERFACE

N = 1 to 12 64 kb/s channels

IEEE C37.94 fiber optic connection to protection relays

ORDERWIRE

Party line voice circuit carried on 64 kb/s channel of either SONET Transport or Path Overhead

DTMF signalling

Find your local sales representative at www.GEDigitalEnergy.com

TN1U SDH Multiplexer



Powerful and Flexible Multiplexing Solutions

The Lentronics TN1U SDH Multiplexer delivers powerful optical networking solutions for critical communications applications. With a wide range of tributary interface units, the TN1U has the ability to provide both transport and access capabilities for voice, data, IP/Ethernet WAN, video and utility teleprotection traffic in a single package. Harsh environment ready, the modular TN1U delivers flexible, secure, and reliable communications.

Key Benefits

- Eliminate complex multi-device equipment solutions with a single integrated package
- High speed fibre optic communications (STM-1, STM-4, STM-16)
- 5x9 system availability with redundant common equipment for path switched ring networks
- Fast path protection switching (<3 ms)
- Reduce connectivity, expansion, and configuration costs with modular solution
- Advanced network visibility from the SDH level down to individual 64 kb/s signals
- Comprehensive network management capabilities using VistaNET
- Secure and dependable transport of critical services

Application Specific Optical Solutions



Energy

- Connecting substations, generation plants, control centres, administration offices
- Highly secure traffic segmentation
- Teleprotection, SCADA, video surveillance, voice, IP/Ethernet WAN



Oil & Gas

- Connecting production platforms, FPSO vessels, and on-shore facilities
- Voice, data, CCTV, IP/Ethernet for SCADA and security sub-systems



Pipelines

- Connecting block valves, metering, pumping / compressor stations and control centres
- Operational communications for voice, data, CCTV, IP/Ethernet WAN, security, safety and SCADA sub-systems



Transportation

- Connecting train platforms, traction power substations, wayside cabinets, maintenance facilities and control centres
- Emergency voice, passenger information and ticketing systems, train control, traction power and security sub-systems

Utility Hardened

- Meets IEEE 1613 specification for communications networking devices in electric power substations
- Reliable operation in extreme temperatures from -20°C to +60°C (-4°F to +140°F)
- Meets Earthquake Risk Zone 4 shock and vibration specification

Scalable Design

- Add/Drop Multiplexer supporting industry standard network topologies
- Optional site specific tributary interfaces for video, voice, IP/Ethernet and utility teleprotection applications
- High-bandwidth optical interfaces from STM-1 to STM-16

Robust & Reliable

- 5x9 System availability with ITU-T standards
- Fast path protection switching (<3 ms)
- Built-in test capabilities
- Designed with redundant common equipment for ring architectures
- VistaNET network management software provides complete system monitoring and diagnostics

Secure & Dependable

- Segregated and dedicated SDH payload assignments for each application optimize QoS and security
- Port and VLAN partitioning isolates and protects critical communications applications



SDH Network Access

Facing increasingly complex demands for communications and security, organizations are looking for cost effective, reliable solutions for managing mission critical operations. The robust design of the GE Lentronics TN1U SDH Multiplexer makes it the ideal optical networking solution for electric power utility, transportation, pipeline and many industrial requirements.

System Technology

This powerful SDH multiplexer has a modular design for ease of maintenance, configuration flexibility, and expandability.

The TN1U delivers the benefits of the ITU-T SDH telecommunications standards to applications previously serviced by a mix of proprietary and legacy standards based equipment.

The multiplexer provides redundancy for critical modules, with guaranteed performance over an extended ambient temperature range of -20°C to +60°C (-4°F to



+140°F). It meets ANSI/IEEE Surge Withstand Capability (SWC), Radio Frequency Interference (RFI) as well as Zone 4 Earthquake specifications providing secure performance in harsh environments.

The TN1U is powered by 115 VAC or 24, 48, 130 VDC sources. Its built-in test capabilities can save the cost of purchasing SDH test equipment.

The TN1U can be customized to the user's requirements by equipping each site with specific modules as needed. New modules are added to the product line, as market needs dictate.

SDH Network Flexibility

Simply replacing optical transceiver modules allows users to expand an existing TN1U system to a higher capacity, while maintaining their capital investment.

Mixed TN1U access networks of STM-1/STM-4, combined with TN1U backbone rings of STM-4 or STM-16 cost effectively distribute telecommunications services, allocating bandwidth only where it is needed.

The product also has the flexibility to operate with GE MDS or third party microwave radios and higher capacity STM-n multiplexers.

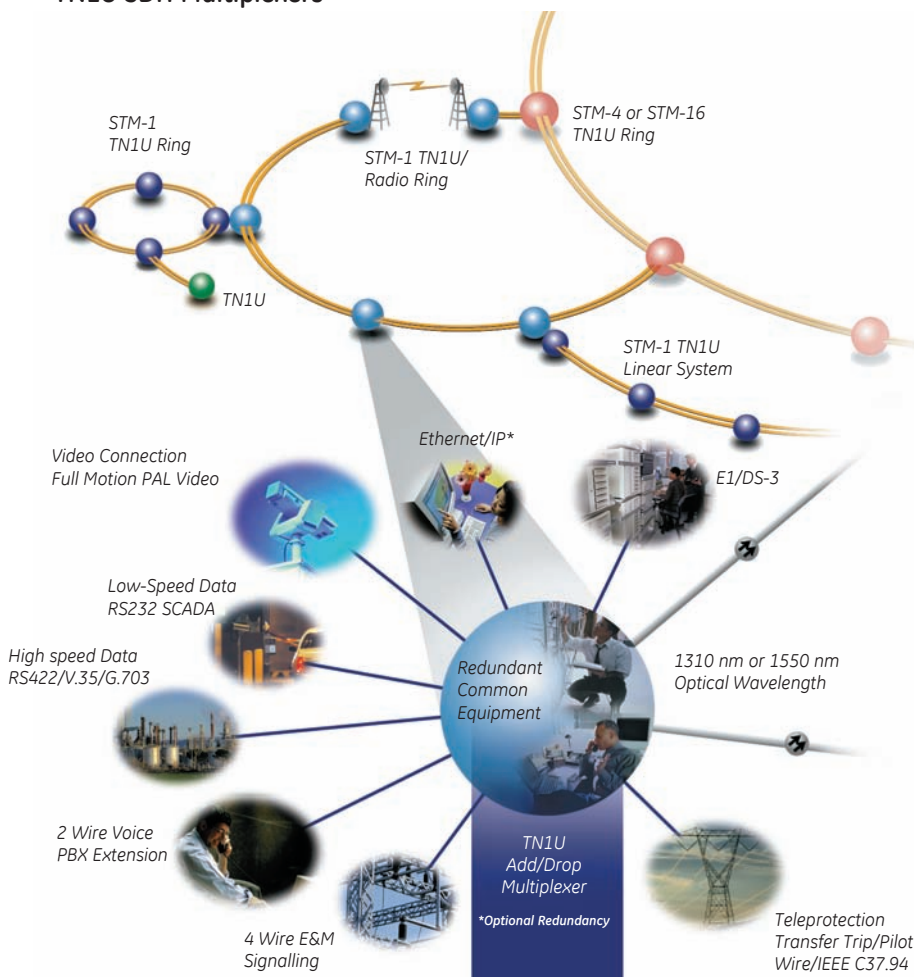
Operations, Administration, Maintenance and Provisioning (OAM&P)

The TN1U takes advantage of the inherent network management capabilities provided by the SDH telecommunications standards.

VistaNET NMS software provides network visibility down to the individual circuit level at all nodes. This facilitates remote provisioning, monitoring, and alarm logging of the network from any node. Vistanet software operates on a Windows® based personal computer. An optional SNMP Network Management System (NMS) interface is available. Vistanet is also used for system diagnostics and troubleshooting.

Visibility of all TN1U equipment, including the 64 kb/s tributary units, improves maintenance response time and saves the operator money.

TN1U SDH Multiplexers



Applications

Electric Power Utilities

Originally designed for the unique needs of utilities, the TN1U system supports a wide range of specialty traffic, including teleprotection (direct transfer trip, pilot wire, and IEEE C37.94 optical interface to protection relays), surveillance video, substation automation, Ethernet WAN/IP and telephony.

High system availability is provided through redundant common equipment and compliance with ITU-T SDH standards for path switched ring protection architecture.

But the TN1U goes beyond SDH standards, offering the industry's fastest path protection switching (<3 ms), and incorporating special design characteristics that allow it to meet IEC RFI and SWC standards for operation in harsh utility environments.

Transportation Corridors

For highway, roads, bridges, tunnels, rail transit, freight railway, and airport applications the TN1U system cost-effectively integrates services previously provided by proprietary and legacy standards based equipment. Now these services can be combined to receive the full benefits of a SDH network.

For applications such as video surveillance, fare collection, passenger information

systems, train control, emergency voice and signalling, the TN1U is the optical communications product of choice.

TN1U networks support both 48 Mb/s and 12 Mb/s video wide area networks (WANs). Each analog video source (camera, VCR, DVD, etc.) is digitized with a user configurable compression algorithm for bit-rate bandwidth management and then integrated into a shared video WAN.

For incident detection in surveillance applications, intelligent bandwidth allocation allows more bandwidth to be instantly assigned to specific cameras, permitting a higher resolution and more frames per second. When required, audio and data channels may be transported with the video.

The TN1U video interface addresses the issues of quality versus bandwidth by efficiently transporting video signals.

An optional remote video interface accessory is also available, which cost effectively extends video capability up to 30 km from a TN1U node via fibre optic cable.

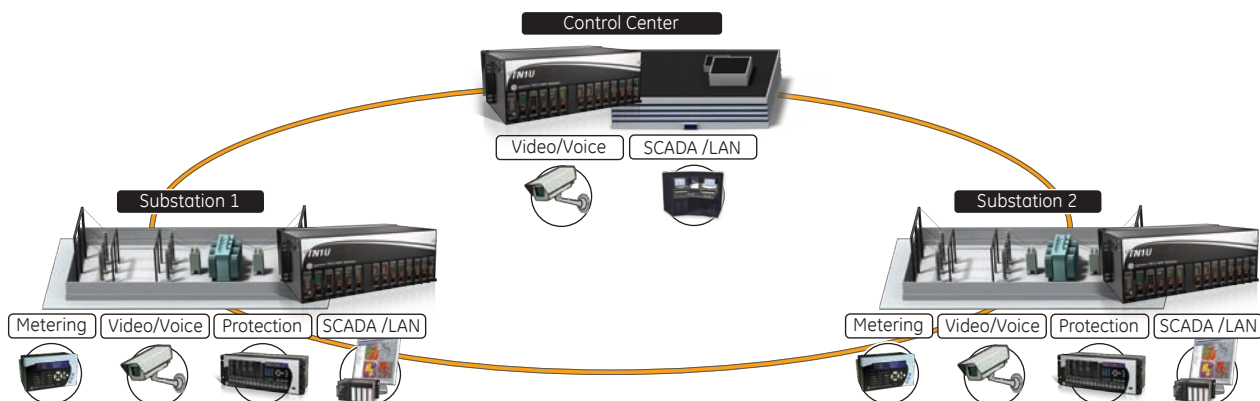
Pipelines and Industrial Facilities

The rugged design, compact size and low power consumption of the TN1U also make it the ideal optical communications solution for oil, gas, refined products, water and slurry pipelines. Field proven industrial applications include electrical distribution protection and control in mines, as well as SCADA for onshore or offshore oil and gas production fields.

The TN1U SDH Multiplexer creates greater value for its user by carrying a multitude of services such as low speed polling data, SCADA, power measurement data, video surveillance, Ethernet WAN/IP and PBX phone drop extensions over a single network.



TN1U SDH Multiplexer Electric Utility Application



Specifications

SIGNALLING RATES AND OPTICAL INTERFACES

STM-1 SIGNAL

Speed	155.52 Mb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	20 dB
Intermediate Reach up to 30 km (19 miles)	
@ 1310 nm	29 dB
Long Reach up to 50 km (31 miles)	
@ 1550 nm	34 dB
Extra Long Reach up to 120 km (75 miles)	
@ 1550 nm	38 dB
Extra Long Reach-2 up to 200 km (125 miles)	
System Gain (multimode fibre)	
@ 1310 nm	12 dB
Intra-office	up to 2 km (1¼ miles)

STM-4 SIGNAL

Speed	622.08 Mb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	14 dB
Intermediate Reach up to 20 km (12.4 miles)	
@ 1310 nm	25 dB
Long Reach up to 40 km (25 miles)	
@ 1550 nm	34 dB
Extra Long Reach up to 120 km (100 miles)	
@ 1550 nm	38 dB
Extra Long Reach-2 up to 160 km (100 miles)	
System Gain (multimode fibre)	
@ 1310 nm	7 dB
Intra-office	up to 1 km (½ mile)

STM-16 SIGNAL

Speed	2.488 Gb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	13 dB
Intermediate reach up to 15 km, 9 miles	
@ 1310 nm	26 dB
Long reach up to 40 km, 25 miles	
@ 1550 nm	26 dB
Extra long reach up to 80 km, 50 miles	
@ 1550 nm	31 dB
Extra long reach up to 120 kms, 75 miles	

CONFIGURATIONS SUPPORTED

Self healing D-P Rings
 Two fibre linear systems
 Multiple rings plus spurs
 Multiple STM-1/STM-4/STM-16 rings interconnected through synchronous TIE links

NETWORK MANAGEMENT CAPABILITIES

- Windows based PC NMS allowing network access from any node for full system monitoring and diagnostics
- Network visibility of every node, remote-provisioning (monitoring and-configuration) of the network
- Alarm logging and time stamping
- Simple troubleshooting and network maintenance
- Optional redundant NMS platforms
- Optional interface for SNMP Manager, allowing common NMS integration using IP

SYSTEM ALARMS

Major	Form C alarm relays and LED-indicators
Minor	Form C alarm relays and LED-indicators

ORDERWIRE

64 kb/s voice channel carried in SDH overhead

CHANNEL INTERFACE UNITS

LED status indicators
 Teleprotection units have Form C alarm-relays

NODE THROUGH-DELAY

20 µs (STM-1)

D-PR PATH PROTECTION SWITCHING TIME

<3 ms

POWER REQUIREMENTS

24, 48, 130 VDC or 115, 230 VAC

LOW POWER CONSUMPTION:

10 W for add/drop node common equipment
 (For individual channel unit power consumption, refer to the technical data sheet for that unit)

RFI

Meets ANSI/IEEE C37.90.2 RFI

ISOLATION

Meets ANSI/IEEE C37.90.1 SWC

AVAILABILITY

99.9999% for redundant 1+1 protected common equipment (For individual interface unit MTBF figures, refer to the unit interface technical data sheet)

ENVIRONMENTAL

Operating Temperature	-20° to +60°C (+14° to +140°F)
Storage Temperature	-40° to +70°C (-40° to +158°F)
Humidity	5-95% non-condensing

PHYSICAL DATA

COMMON EQUIPMENT SHELF

Height	178 mm (7 inches)
Width	483 mm (19 inches)
Depth	423 mm (16.67 inches)
Weight	3.6 kg (8 lbs)

CHANNEL (EXPANSION) SHELF

Height	134 mm (5.25 inches)
Width	483 mm (19 inches)
Depth	423 mm (16.67 inches)
Weight	2.3 kg (5 lbs)

VOICE UNITS

4W VF

Standard 600/900 Ω 4W interface with optional E&M signalling operating at standard TX/RX levels

2W VF

Standard 600/900 Ω 2W interface with optional E&M signalling operating at standard TX/RX levels

2W FOREIGN EXCHANGE

Loop start, ground start or PLAR signalling

DATA UNITS

LOW SPEED DATA

Asynchronous V.24/V.28 (RS232) interface, sub-rate multiplexing of four 9.6 kb/s or two 19.2-kb/s or one 38.4 kb/s signal

HIGH SPEED DATA

V.11/RS422, V.35, G.703 interfaces, 56 kb/s or 64 kb/s (Synchronous/Asynchronous)

NX64 KB/S DATA ELECTRICAL INTERFACE

N = 1 to 12 64 kb/s channels
 V.35 interface

E1

G.703 2.048 Mb/s E1 interface (75Ω and 120Ω)

ETHERNET

10/100/1000 Mb/s Ethernet Learning Bridges per IEEE 802.3 standard

VIDEO

User adjustable video signal bandwidth and frame refresh rates. Supports transport of:

- PAL or NTSC video signal
- Full duplex audio
- V.10/V.11/V.24/V.28 data
- Contact I/O
- PTZ camera control and remote alarms

TELEPROTECTION UNITS

TRANSFER TRIP

Separate Transmit and Receive units, optional test panel

CURRENT DIFFERENTIAL

HCB, CPD, SPD, RADHL pilot wire relay interfaces

CONTACT INPUT/OUTPUT

Transport of contact closure

N X 64 KB/S DATA OPTICAL INTERFACE

N = 1 to 12 64 kb/s channels
 IEEE C37.94 fibre optic connection to protection relays

Find your local sales representative at www.GEDigitalEnergy.com

TN1Ue SDH Multiplexer



Powerful and Flexible Multiplexing Solutions

The Lentronics TN1Ue SDH Multiplexer delivers powerful optical networking solutions for critical communications applications. With a wide range of tributary interface units, the TN1Ue provides both transport and access capabilities for voice, data, IP/Ethernet WAN, video and utility teleprotection traffic in a single package. Harsh environment ready, including a special metal cage enclosure to satisfy ETSI EMC requirements, the modular TN1Ue delivers flexible, secure, and reliable communications.

Key Benefits

- Eliminate complex multi-device equipment solutions with a single integrated package
- High speed fibre optic communications (STM-1, STM-4, STM-16)
- 5x9 system availability with redundant common equipment for path switched ring networks
- Fast path protection switching (<3 ms)
- Reduce connectivity, expansion, and configuration costs with modular solution
- Advanced network visibility from the SDH level down to individual 64 kb/s signals
- Comprehensive network management capabilities using VistaNET
- Secure and dependable transport of critical services

Application Specific Optical Solutions



Energy

- Connecting substations, generation plants, control centres, administration offices
- Highly secure traffic segmentation
- Teleprotection, SCADA, video surveillance, voice, IP/Ethernet WAN



Oil & Gas

- Connecting production platforms, FPSO vessels, and on-shore facilities
- Voice, data, CCTV, IP/Ethernet for SCADA and security sub-systems



Pipelines

- Connecting block valves, metering, pumping / compressor stations and control centres
- Operational communications for voice, data, CCTV, IP/Ethernet WAN, security, safety and SCADA sub-systems



Transportation

- Connecting train platforms, traction power substations, wayside cabinets, maintenance facilities and control centres
- Emergency voice, passenger information and ticketing systems, train control, traction power and security sub-systems



Utility Hardened

- Meets IEEE 1613 specification for communications networking devices in electric power substations
- Reliable operation in extreme temperatures from -20°C to +60°C (-4°F to +140°F)
- Meets Earthquake Risk Zone 4 shock and vibration specification

Scalable Design

- Add/Drop Multiplexer supporting industry standard network topologies
- Optional site specific tributary interfaces for video, voice, IP/Ethernet and utility teleprotection applications
- High-bandwidth optical interfaces from STM-1 to STM-16

Robust & Reliable

- 5x9 System availability with ITU-T standards
- Fast path protection switching (<3 ms)
- Built-in test capabilities
- Designed with redundant common equipment for ring architectures
- VistaNET network management software provides complete system monitoring and diagnostics

Secure & Dependable

- Segregated and dedicated SDH payload assignments for each application optimize QoS and security
- Port and VLAN partitioning isolates and protects critical communications applications

SDH Network Access

Facing increasingly complex demands for communications and security, organizations are looking for cost effective, reliable solutions for managing mission critical operations. The robust design of the GE Lentronics TN1Ue SDH Multiplexer makes it the ideal optical networking solution for electric power utility, transportation, pipeline and many industrial requirements.

System Technology

This powerful SDH multiplexer has a modular design for ease of maintenance, configuration flexibility, and expandability.

The TN1Ue delivers the benefits of the ITU-T SDH telecommunications standards to applications previously serviced by a mix of proprietary and legacy standards based equipment.

The multiplexer provides redundancy for critical modules, with guaranteed performance over an extended ambient temperature range of -20°C to +60°C (-4°F to



+140°F). It meets ANSI/IEEE Surge Withstand Capability (SWC), Radio Frequency Interference (RFI) as well as Zone 4 Earthquake specifications providing secure performance in harsh environments.

The TN1Ue is powered by optionally redundant 48 VDC power supplies. Its built-in test capabilities can save the cost of purchasing SDH test equipment.

The TN1Ue can be customized to the user's requirements by equipping each site with specific modules as needed. New modules are added to the product line, as market needs dictate.

SDH Network Flexibility

Simply replacing optical transceiver modules allows users to expand an existing TN1Ue system to a higher capacity, while maintaining their capital investment.

Mixed TN1Ue access networks of STM-1/STM-4, combined with TN1Ue backbone rings of STM-4 or STM-16 cost effectively distribute telecommunications services, allocating bandwidth only where it is needed.

The product also has the flexibility to operate with GE MDS or third party microwave radios and higher capacity STM-n multiplexers.

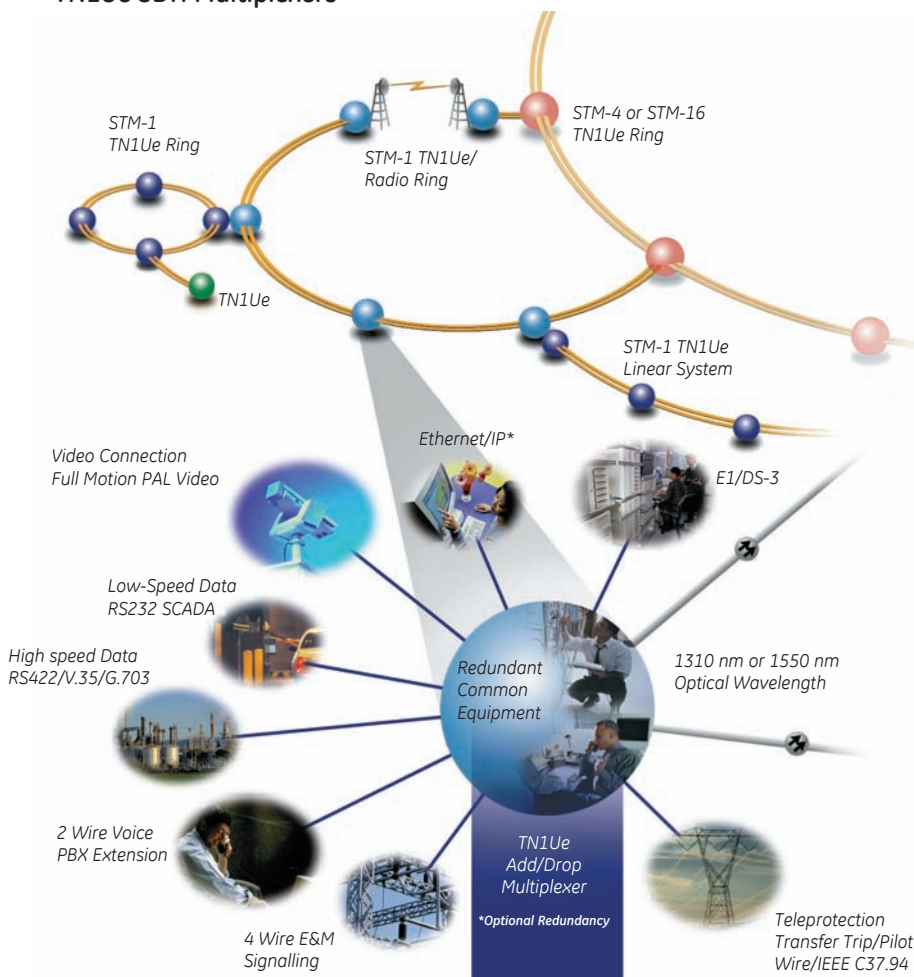
Operations, Administration, Maintenance and Provisioning (OAM&P)

The TN1Ue takes advantage of the inherent network management capabilities provided by the SDH telecommunications standards.

VistaNET NMS software provides network visibility down to the individual circuit level at all nodes. This facilitates remote provisioning, monitoring, and alarm logging of the network from any node. Vistanet software operates on a Windows® based personal computer. An optional SNMP Network Management System (NMS) interface is available. Vistanet is also used for system diagnostics and troubleshooting.

Visibility of all TN1Ue equipment, including the 64 kb/s tributary units, improves maintenance response time and saves the operator money.

TN1Ue SDH Multiplexers



Applications

Electric Power Utilities

Originally designed for the unique needs of utilities, the TN1Ue system supports a wide range of specialty traffic, including teleprotection (direct transfer trip, pilot wire, and IEEE C37.94 optical interface to protection relays), surveillance video, substation automation, Ethernet WAN/IP and telephony.

High system availability is provided through redundant common equipment and compliance with ITU-T SDH standards for path switched ring protection architecture.

But the TN1Ue goes beyond SDH standards, offering the industry's fastest path protection switching (<3 ms), and incorporating special design characteristics that allow it to meet IEC RFI and SWC standards for operation in harsh utility environments.

Transportation Corridors

For highway, roads, bridges, tunnels, rail transit, freight railway, and airport applications the TN1Ue system cost-effectively integrates services previously provided by proprietary and legacy standards based equipment. Now these services can be combined to receive the full benefits of a SDH network.

For applications such as video surveillance, fare collection, passenger information systems, train control, emergency voice

and signalling, the TN1Ue is the optical communications product of choice.

TN1Ue networks support both 48 Mb/s and 12 Mb/s video wide area networks (WANs). Each analog video source (camera, VCR, DVD, etc.) is digitized with a user configurable compression algorithm for bit-rate bandwidth management and then integrated into a shared video WAN.

For incident detection in surveillance applications, intelligent bandwidth allocation allows more bandwidth to be instantly assigned to specific cameras, permitting a higher resolution and more frames per second. When required, audio and data channels may be transported with the video.

The TN1Ue video interface addresses the issues of quality versus bandwidth by efficiently transporting video signals.

An optional remote video interface accessory is also available, which cost effectively extends video capability up to 30 km from a TN1Ue node via fibre optic cable.

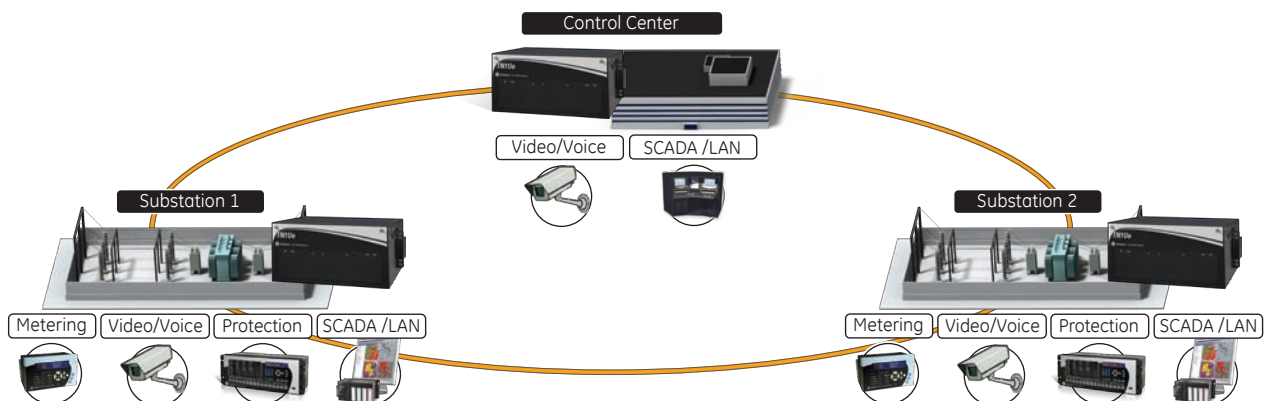
Pipelines and Industrial Facilities

The rugged design, compact size and low power consumption of the TN1Ue also make it the ideal optical communications solution for oil, gas, refined products, water and slurry pipelines. Field proven industrial applications include electrical distribution protection and control in mines, as well as SCADA for onshore or offshore oil and gas production fields.

The TN1Ue SDH Multiplexer creates greater value for its user by carrying a multitude of services such as low speed polling data, SCADA, power measurement data, video surveillance, Ethernet WAN/IP and PBX phone drop extensions over a single network.



TN1Ue SDH Multiplexer Electric Utility Application



Specifications

SIGNALLING RATES AND OPTICAL INTERFACES

STM-1 SIGNAL

Speed	155.52 Mb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	20 dB
Intermediate Reach up to 30 km (19 miles)	
@ 1310 nm	29 dB
Long Reach up to 50 km (31 miles)	
@ 1550 nm	34 dB
Extra Long Reach up to 120 km (75 miles)	
@ 1550 nm	38 dB
Extra Long Reach-2 up to 200 km (125 miles)	
System Gain (multimode fibre)	
@ 1310 nm	12 dB
Intra-office	up to 2 km (1¼ miles)

STM-4 SIGNAL

Speed	622.08 Mb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	14 dB
Intermediate Reach up to 20 km (12.4 miles)	
@ 1310 nm	25 dB
Long Reach up to 40 km (25 miles)	
@ 1550 nm	34 dB
Extra Long Reach up to 120 km (100 miles)	
@ 1550 nm	38 dB
Extra Long Reach-2 up to 160 km (100 miles)	
System Gain (multimode fibre)	
@ 1310 nm	7 dB
Intra-office	up to 1 km (½ mile)

STM-16 SIGNAL

Speed	2.488 Gb/s
Line Code	NRZ
Optical Connector	LC
System Gain (singlemode fibre)	
@ 1310 nm	13 dB
Intermediate reach up to 15 km, 9 miles	
@ 1310 nm	26 dB
Long reach up to 40 km, 25 miles	
@ 1550 nm	26 dB
Extra long reach up to 80 km, 50 miles	
@ 1550 nm	31 dB
Extra long reach up to 120 kms, 75 miles	

CONFIGURATIONS SUPPORTED

Self healing D-P Rings
 Two fibre linear systems
 Multiple rings plus spurs
 Multiple STM-1/STM-4/STM-16 rings interconnected through synchronous TIE links

NETWORK MANAGEMENT CAPABILITIES

- Windows based PC NMS allowing network access from any node for full system monitoring and diagnostics
- Network visibility of every node, remote-provisioning (monitoring and-configuration) of the network
- Alarm logging and time stamping
- Simple troubleshooting and network maintenance
- Optional redundant NMS platforms
- Optional interface for SNMP Manager, allowing common NMS integration using IP

SYSTEM ALARMS

Major	Form C alarm relays and LED-indicators
Minor	Form C alarm relays and LED-indicators

ORDERWIRE

64 kb/s voice channel carried in SDH overhead

CHANNEL INTERFACE UNITS

LED status indicators

Teleprotection units have Form C alarm-relays

NODE THROUGH-DELAY

STM-1, STM-4: 20 µs
 STM-16: 25 µs

D-PR PATH PROTECTION SWITCHING TIME

<3 ms

POWER REQUIREMENTS

24, 48, 130 VDC or 115, 230 VAC

LOW POWER CONSUMPTION:

10 W for add/drop node common equipment (For individual channel unit power consumption, refer to the technical data sheet for that unit)

RFI

Meets ANSI/IEEE C37.90.2 RFI

ISOLATION

Meets ANSI/IEEE C37.90.1 SWC

AVAILABILITY

99.9999% for redundant 1+1 protected common equipment (For individual interface unit MTBF figures, refer to the unit interface technical data sheet)

ENVIRONMENTAL

Operating Temperature	-20° to +60°C (+14° to +140°F)
Storage Temperature	-40° to +70°C (-40° to +158°F)
Humidity	5-95% non-condensing

PHYSICAL DATA

COMMON EQUIPMENT SHELF

Height	222 mm (8.75 inches)
Width	483 mm (19 inches)
Depth	413 mm (16.26 inches)
Weight	5.9 kg (13 lbs)

CHANNEL (EXPANSION) SHELF

Height	178 mm (7 inches)
Width	483 mm (19 inches)
Depth	409 mm (16.1 inches)
Weight	5.7 kg (12.9 lbs)

VOICE UNITS

4W VF

Standard 600/900 Ω 4W interface with optional E&M signalling operating at standard TX/RX levels

2W VF

Standard 600/900 Ω 2W interface with optional E&M signalling operating at standard TX/RX levels

2W FOREIGN EXCHANGE

Loop start, ground start or PLAR signalling

DATA UNITS

LOW SPEED DATA

Asynchronous V.24/V.28 (RS232) interface, sub-rate multiplexing of four 9.6 kb/s or two 19.2-kb/s or one 38.4 kb/s signal

HIGH SPEED DATA

V.11/RS422, V.35, G.703 interfaces, 56 kb/s or 64 kb/s (Synchronous/Asynchronous)

NX64 KB/S DATA ELECTRICAL INTERFACE

N = 1 to 12 64 kb/s channels
 V.35 interface

E1

G.703 2.048 Mb/s E1 interface (75Ω and 120Ω)

ETHERNET

10/100/1000 Mb/s Ethernet Learning Bridges per IEEE 802.3 standard

VIDEO

User adjustable video signal bandwidth and frame refresh rates. Supports transport of:

- PAL or NTSC video signal
- Full duplex audio
- V.10/V.11/V.24/V.28 data
- Contact I/O
- PTZ camera control and remote alarms

TELEPROTECTION UNITS

TRANSFER TRIP

Separate Transmit and Receive units, optional test panel

CURRENT DIFFERENTIAL

HCB, CPD, SPD, RADHL pilot wire relay interfaces

CONTACT INPUT/OUTPUT

Transport of contact closure

N X 64 KB/S DATA OPTICAL INTERFACE

N = 1 to 12 64 kb/s channels
 IEEE C37.94 fibre optic connection to protection relays

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JungleMUX T1 Multiplexer



Multiplexing Solutions for Critical Communications

The JungleMUX T1 Multiplexer (T1MX) is a powerful, flexible and reliable solution for converged service networks. The JungleMUX T1MX extends critical channel access into harsh utility environments over microwave radio, leased line and dedicated fiber optic or copper cable networks.

Key Benefits

- Secure and dependable transport of critical utility information over public or private communication infrastructures
- Supports standalone T1 networks, T1 spurs and T1 access applications for higher order systems
- Upgradable to a JungleMUX SONET Multiplexer to satisfy increasing bandwidth requirements
- Network managed providing complete system monitoring and diagnostics for each individual DS0 channel

Application Specific Solutions



Energy

- Communication between substations, generation plants, control centers and administration offices
- Supporting teleprotection, video surveillance, SCADA, substation automation, voice and data



Oil & Gas

- Communication between well clusters, production platforms, tank storage and control centers
- Voice, data, CCTV, IP/Ethernet telecom services for SCADA, safety/fire and security sub-systems



Water & Wastewater

- Communication between remote wells, dams, metering, treatment facilities, pumping / compressor stations and control centers
- Voice, data, CCTV, IP/Ethernet, security and safety sub-systems



Transportation

- Communication for train platforms, traction power substations, wayside cabinets, maintenance facilities and control centers
- Data, voice, transducers and contacts, IP/Ethernet

Utility Hardened

- Meets IEEE 1613 specification for communications networking devices in electric power substations
- Reliable operation in extreme temperatures from -4°F to +140°F (-20°C to +60°C)
- Meets Earthquake Risk Zone 4 shock and vibration specification

Scalable Design

- T1 multiplexer with integrated Compact Digital Access X-Connect (CDAX)
- Supports a wide range of JungleMUX SONET compatible DS0 interface units including voice, data, teleprotection and Ethernet applications

Robust & Reliable

- Built-in test capabilities
- No external power converter required and no internal fans
- Hot swappable units eliminate the need to power down the multiplexer, minimizing traffic disruptions
- Optional 1:1 protected CDAX units improve reliability and circuit availability

Network Managed

- End-to-end circuit monitoring
- Integrated NMS solution with JungleMUX SONET Multiplexer networks

Application Flexibility

The JungleMUX T1 Multiplexer (T1MX), a part of the field proven JungleMUX digital transport and access system, supports a wide range of DS0 applications.

The T1MX can be deployed in several network configurations such as:

- Terminal multiplexer
- Add/Drop multiplexer
- Cross connect configuration

The T1MX's Compact Digital Access and X-connect (CDAX) unit provides integrated multiplexer control including network management, T1 line interfaces and DS0 cross connect. The 96 x 96 cross connect permits the grooming and consolidation of DS0 channels between multiple T1s, or from multiple T1s to a T1 drop port on the CDAX unit paddleboard.

The T1MX can be used in T1 leased line, microwave radio, or SONET networks, as well as dedicated copper and fiber optic cable applications. Standalone T1 networks connecting multiple facilities, or multiple sites within a single large facility, provide an efficient and cost effective telecommunication solution.

The T1MX is a powerful solution to extend the reach of JungleMUX SONET Multiplexer networks.

The T1MX provides best of class solutions for electric power grid protection and control, pipeline control, as well as water, rail and highway mission critical applications.

Interface Units

Supporting a wide range of DS0 interface units, the JungleMUX T1MX has voice, data, teleprotection and Ethernet options. For high circuit count applications, the T1MX offers expansion shelves to grow with the network's requirements.

Reliability

Designed for critical infrastructure applications, the JungleMUX T1MX supports full duplex T1.102 (ITU-T G.703) 1.544 Mb/s channelized circuits ensuring low latency for DS0 applications.

With hot swappable units, the T1MX eliminates the need to power down the multiplexer for unit additions, minimizing traffic disruptions. In addition, the T1MX offers an optional redundant multiplexer control and T1 line unit (CDAX unit). This protects against CDAX unit failure and ensures rapid, automatic cutover to a hot standby CDAX unit, maximizing system uptime and reliability.

Local or Remote Configuration

Allowing simple installation, ongoing management and maintenance of the multiplexer, without expensive workstations, the JungleMUX T1MX offers local or remote configuration, performance monitoring and diagnostics. With settings and configuration parameters maintained in non-volatile flash memory, configuration is maintained after loss of power.

Network Management System

VistaNET provides remote configuration, monitoring and testing of all common equipment and telecommunication service interface units at any node in the system, minimizing disruption and maintenance costs. More than one user is able to simultaneously configure and monitor the system. Time stamped logging of alarms and intelligent processing of alarm lists, assists in identifying hard-to-find problems, facilitates alarm acknowledgement and provides immediate update on current system status.

Recording of network configuration changes provides an audit trail for future reference. A single integrated system view for interconnected and discrete network segments simplifies management. Security is enhanced through a multi-level password and privilege system with automatic expiration interval, controlled by a system administrator. Optical status information and BER statistics provide preliminary indications of system level problems, such as fiber cable and equipment component degradation

Applications

Electric Power Utilities

Originally designed for the unique needs of electric power utilities, the JungleMUX T1MX system supports a wide range of speciality traffic including teleprotection (direct transfer trip and IEEE C37.94 optical interface to protection relays), surveillance video, substation automation, Ethernet WAN/IP and telephony.

High system availability is provided through redundant common equipment and compliance with industry standards.

The JungleMUX T1MX goes beyond industry standards for T1 communications by incorporating design characteristics that allow it to meet IEC/IEEE RFI, SWC and EMC standards for operation in harsh utility environments.

Industrial Facilities

The rugged design, compact size and low power consumption of the JungleMUX T1 Multiplexer makes it the ideal solution for oil and gas, water, as well as mining related applications.

The JungleMUX T1MX creates greater value by carrying a multitude of services such as low speed polling data, SCADA, power measurement data, video surveillance, Ethernet WAN/IP and PBX phone drop extensions over a single T1 link.

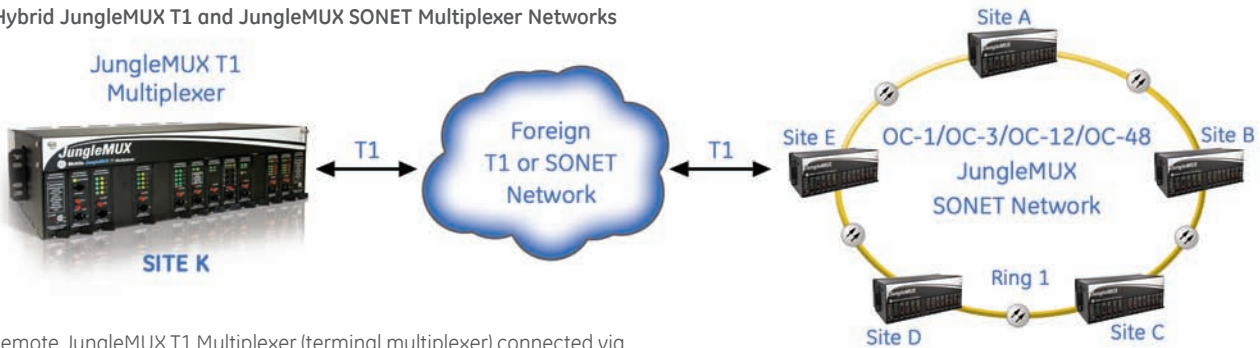
Transportation Corridors

For highway, roadway, bridge, tunnel, rail transit, freight railway, and airport applications, the JungleMUX T1MX system cost effectively integrates services previously provided by proprietary and legacy standards based equipment. For applications such as video surveillance, toll collection, traffic monitoring and control, VMS, emergency voice, SCADA, signaling and loop detection the JungleMUX T1MX is the multiplexer of choice.

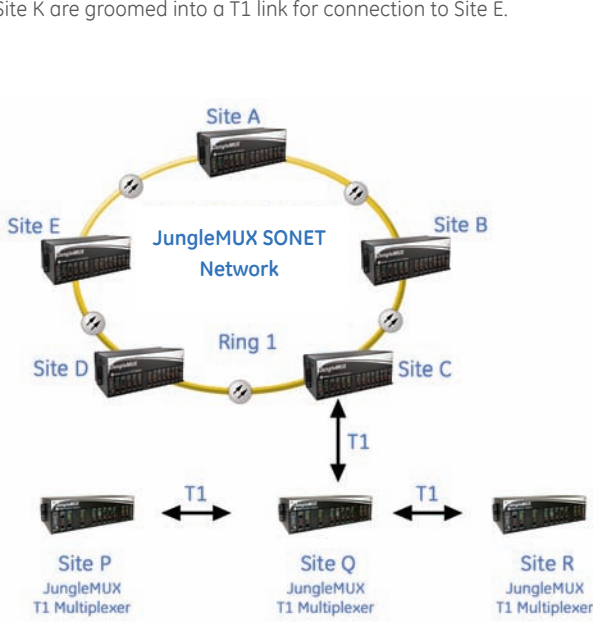
Network Applications

The JungleMUX T1 Multiplexer can be deployed in a variety of applications, from T1 circuit extensions through leased lines, T1 microwave radio links and spurs, as well as in standalone T1 networks connecting multiple facilities or multiple sites within a single large facility.

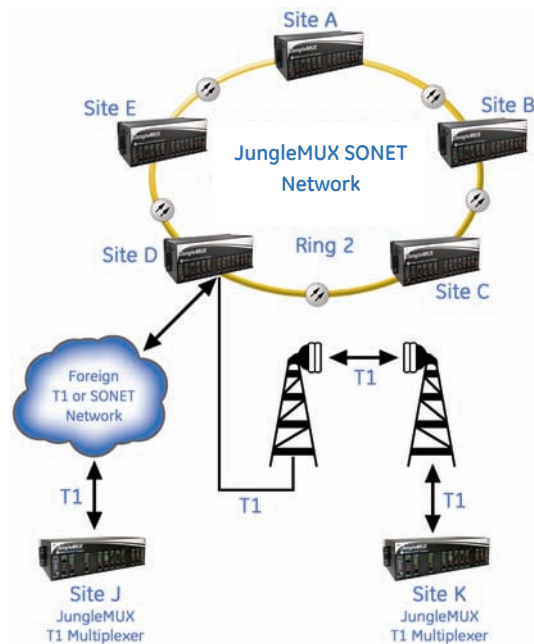
Hybrid JungleMUX T1 and JungleMUX SONET Multiplexer Networks



Remote JungleMUX T1 Multiplexer (terminal multiplexer) connected via a T1 link to a JungleMUX SONET network. DS0 circuits from remote Site K are groomed into a T1 link for connection to Site E.



Remote JungleMUX T1 Multiplexers (Add/Drop) are connected to a JungleMUX SONET network over a T1 link. DS0 channels from Sites P and R are consolidated at Site Q and groomed for T1 connection to Site C.



Remote JungleMUX T1 Multiplexers are installed at Site J and Site K. DS0 channels from Site J and Site K are groomed and consolidated at Site D along with other DS0 channels and transported in a SONET shared VT to another site, such as Site A.

JungleMUX T1 Multiplexer



- 19" rack mount
- 3 rack units (RU) high
- 15 shelf slot positions
- Optional redundant power supply and CDAX units
- Software configurable, no hardware dip switch settings

Specifications

T1 INTERFACES

Line Rate	1.544 Mb/s ± 50 ppm
Line Code Options	B8ZS, AMI
Framing Format	SF, ESF
PRBS Generator	2 ¹¹ -1, 2 ¹⁵ -1, 2 ²⁰ -1
Pulse Shape	T1.102 Compliant
	ITU G.703 Compliant
Nominal Line Impedance	100Ω balanced pair ± 5% resistive
Connectors	RJ-48C for 100Ω T1 LC for SFP optical T1
	3 pin header for both major and minor shelf alarm contact outputs
	3 pin header for shelf power supply(s) alarm contact input

TELEPROTECTION INTERFACES

Transfer Trip	Separate Transmit and Receive units
Nx64 kb/s Data Optical	N = 1 to 12 64 kb/s channels
	IEEE C37.94 standard for fiber optic connection to protection relays

DATA INTERFACES

Low Speed Data	RS232 interface Sub-rate multiplexing
High Speed Data	Point-to-point and multi-point 64 (56) kb/s rates RS422, V.35, G.703 and OCUDP interfaces
Nx64 kb/s Data Electrical	N = 1 to 12 64 kb/s channels V.35 and Ethernet bridge interfaces

TELEMETRY INTERFACES

Contact Input/Output	Transport of contact closure
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VOICE INTERFACES

4W VF	Optional E&M signaling Point-to-point and multi-point
2W VF	Optional E&M signaling
2W Foreign Exchange	Loop or groundstart signaling

POWER

24 VDC, 48 VDC, 130 VDC or 115 VAC choices	Optional redundant power supply units
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NETWORK MANAGEMENT

VistaNET, operating on MS-Windows based PCs, allows network access via JungleMUX T1 or SONET Multiplexer nodes for system monitoring and diagnostics

Alarm logging and time stamping

Simple troubleshooting and network maintenance

RS-232 serial and IP LAN access, as well as SNMP software license choices

ENVIRONMENTAL

Operating Temperature	-4° F to +140° F (-20° C to +60° C)
Storage Temperature	-40° F to +158° F (-40° C to +70° C)
Humidity	5-95% non-condensing
Earthquake	Earthquake Risk Zone 4 shock and vibration

ENVIRONMENTAL – ELECTRIC POWER SUBSTATION

Meets IEEE 1613, which includes the following:
EMI/RFI – IEEE C37.90.2
Isolation/SWC – IEEE C37.90.1

PHYSICAL DATA ON SHELF

Height	5.25 inches (133 mm)
Width	19 inches (483 mm)
Depth	16.25 inches (413 mm)
Weight	Dependent upon configuration

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VistaNET

Network Management System (NMS)

VistaNET is a complete suite of software tools to manage the GE Lentronics family of telecommunications products, consisting of JungleMUX SONET and T1 Multiplexers, TN1U and TN1Ue SDH Multiplexers.

Key Benefits

- Remote configuration, monitoring and testing of all common equipment and telecommunication service interface units at any node in the system, minimizes disruption and maintenance costs
- Simultaneous configuration and monitoring by more than one user, distributes network administration and maintenance responsibilities
- Time stamped logging of alarms and intelligent processing of alarm lists, assists in identifying hard-to-find problems, facilitates alarm acknowledgement and provides immediate update on current system status
- Recording of network configuration changes provides an audit trail for future reference
- Single integrated system view for interconnected and discrete network segments
- Security is enhanced through a multi-level password and privilege system with automatic expiration interval, controlled by a system administrator
- Optical status information and BER statistics provide preliminary indications of system level problems, such as fiber cable and equipment component degradation

VistaNET Components

- **VistaNET Local Access (VLA)** is a thrifty, rudimentary NMS solution ideal for small networks
- **VistaNET Network Interface (VNI)** is the standard NMS offering, providing remote configuration and monitoring of Lentronics Multiplexer networks
- **VistaNET Serial Communication Port Expansion** is a Right to Use (RTU) license offered for each additional VNI serial communication port connection privilege. This license is required when further redundancy is needed, or a new network segment is added to the system
- **VistaNET Server Application (VSA)** provides a single instance RTU license for the VistaNET server gateway to run on a Windows 2008, 2000, NT or XP PC or LAN server computer
- **VistaNET Server Package (VSP)** is a server gateway application supporting TCP/IP Ethernet NMS access, running on an embedded computer in the IP version of the Lentronics service unit (IPSU)
- **VistaNET SNMP Agent (VSNMP)** enhances any VistaNET service with SNMP functionality. When enabled, the VistaNET session converts VistaNET alarms into SNMP traps (ver1.0 and/or 2.0) and forwards them to a user-defined list of SNMP managers (via UDP/IP). The agent supports Get commands of active and cleared alarms
- **Alternate Traffic Routing (ATR)** provides a RTU license, enabling creation and activation of primary and backup traffic routing schemes in certain Lentronics optical transceiver units



Network Visibility

- Complete peer-to-peer NMS solution for Lentronics Multiplexer networks
- Easily accessible through high speed corporate LAN/WANs and traditional dial-up systems

Centralized Management

- Centralized management of both contiguous and non-contiguous networks
- Supports hundreds of nodes

Easy Accessibility

- Intuitive menu driven, industry standard screens
- Operates on standard Microsoft (R) Windows platforms (Windows 2008 Server, 2000, XP or NT)
- Delivers complete monitoring information and configuration control for a Lentronics Multiplexer system



Specifications

VISTANET NETWORK INTERFACE (VNI) 86456-01

- Standard NMS offering
- Remote configuration and monitoring of rings, nodes and units
- Provides two serial communication port connection privileges from a PC or laptop to network segments
- VistaNET Local Access (VLA) RTU license included
- Provides for VNI client functionality in client-server TCP/IP Ethernet NMS implementation

VISTANET LOCAL ACCESS (VLA) 86456-02

- Thrifty, rudimentary NMS offering for small networks
- Local configuration and troubleshooting of units
- Remote monitoring of rings, nodes and units
- RTU license per node
- Provides two serial communication port connections privileges from a PC or laptop to network segments and local units
- Included with VNI RTU license

VISTANET UPGRADE FROM JNCI/TNCI 86456-03

- License for upgrading from legacy JNCI/TNCI to VistaNET

VISTANET SERVER APPLICATION (VSA) 86456-04

- Creates client-server TCP/IP Ethernet NMS environment for a network segment
- Provides server gateway functionality from a PC or LAN server computer, when a NMS serial communications port connection to a network segment is required
- Provides one serial communication port connection privilege to the network segment and up to three TCP/IP Ethernet connection privileges for VNI clients
- Single instance of VSA required for each serial communications port connection to a network segment
- RTU license per instance of VSA
- Each VSA instance supports up to 50 nodes

VNI SERIAL COMMUNICATION PORT EXPANSION 86456-05

- RTU license for one additional VNI serial communication port connection privilege to a network segment

VISTANET CLIENT SEAT (VCS) EXPANSION 86456-06

- System wide RTU license
- TCP/IP Ethernet connection privileges to server gateways for additional 3 VNI clients

ALTERNATE TRAFFIC ROUTING 86456-07

- License to allow second configuration image in certain optical units
- Allows for emergency re-routing of traffic

SNMP SUPPORT PACKAGE FOR IPSU 86434-51 (Downloadable)

- Provides UDP/IP Ethernet NMS connection from a network (downloadable) segment to a third-party SNMP Manager
- VSP server gateway functionality embedded within IPSU
- Provides up to three TCP/IP connection privileges for VNI clients
- IPSU Package
- IPSU software module for SNMP Functionality
- Converts VistaNET alarms into SNMP traps for forwarding to user-defined list of SNMP managers

VSP (VISTANET SERVER PACKAGE) FOR IPSU 86434-61 (Downloadable)

- Creates client-server TCP/IP Ethernet NMS environment (downloadable) for a network segment
- IPSU software module for VistaNET functionality
- VSP server gateway functionality imbedded within IPSU
- Provides up to 3 TCP/IP connection privileges for VNI clients

VISTANET SNMP AGENT (VSNMP) 86456-51

- Software module adds SNMP functionality
- Converts VistaNET alarms into SNMP traps
- Forwards traps to user-defined list of SNMP managers
- Supports Get commands of active and cleared alarms

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Ethernet Switches & Protocol Converters



Ethernet Switches

ML2400



Managed 32 port Switch

The MultiLink ML2400 is a 19" Rack Mountable hardened Managed Ethernet Switch that is designed specifically for use in Industrial Facilities, Substations and Transportation environments. It will supply you with reliable, high speed networking of all your mission critical applications and provide flexibility and security with easy to use management functions that are unsurpassed in the industry.

109

ML1600



Managed 16 Port Switch

The MultiLink ML1600 is a 9" Panel Mounted hardened Managed Ethernet Switch that is designed specifically for use in Industrial Facilities, Substations, and Transportation environments. With support for a variety of power supply types and port options for copper, fibre or gigabit connectors, the ML1600 is ideally suited for almost any type of application, infrastructure or location.

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ML1200



Managed 12 Port Switch

The MultiLink ML1200 combines all the reliability and flexibility of the MultiLink family with a compact, rugged package that is suited for small to medium-sized deployments. With configurations up to 12 ports, the ability to mix Fiber, Copper, and Gigabit connector types, and support for Power-over-Ethernet, the ML1200 provides powerful, reliable networking for almost any environment.

109

ML800



Managed 8 Port Switch

The MultiLink ML800 is 9" Panel Mounted switch that is ideally suited to low-density industrial networking. With a full set of management and security features, in addition to support for up to 2 gigabit ports in addition to 8 ports that can be configured for either copper or fiber connectors, the ML800 combines big switch brains with a compact rugged casing suited to almost any application.

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ML600











6 Port Unmanaged Compact Switch

The MultiLink ML600 is a Compact Unmanaged Ethernet Switch that is ideal for Industrial Facilities, Substations, and Transportation environments that have few Ethernet devices in one location. As a very cost effective solution, the ML600 will supply you with high speed networking in your harsh environments and is equipped with Link Loss Learn (LLL) that allows for use in redundant architectures thus ensuring you will always have access to your devices.

109

Protocol Converters & Routers

MultiNet1000 	Managed Redundant WAN Router with Integrated 12-port Serial Port Server The MultiNet 1000 Managed Router is an industrial-hardened, multipurpose networking appliance that combines a serial port server, a managed switch, and a full-featured WAN & Ethernet Router into a single device. With support for IP routing, a full suite of managed switch features, and support for up to hundreds of serial devices, the MN1000 provides the flexibility to interconnect almost any network or device type, while offering reliability and rich cyber-security features in an easy-to-use appliance.	119
MultiNet4 	Multi-Port Serial Server & Managed Switch The newest addition to the Multilin family of Serial-to-Ethernet media converters, the MultiNet4 supports large advanced networks and provides an economical option for Serial to Ethernet protocol conversion for Intelligent Electronic Devices (IEDs) and other serial devices.	121
MultiNet 	Serial to Ethernet Converter The MultiNet is a communications module that provides serial devices with ModBus TCP/IP communications over Ethernet, allowing connection to fiber optic LAN and WAN network systems.	125
MC-E1000 	Copper to 1000 Mbps Fiber The MultiLink Media Converter MC-E1000 is a 2-port Copper to 1000Mbps Fiber uplink Ethernet media converter. Conversion from copper to fiber is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.	128
MC-E100 	Copper to 100 Mbps Fiber The MultiLink Media Converter MC-E100 is a 2-port Copper to 100Mbps Fiber uplink Ethernet media converter. Conversion from copper to fiber is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.	128
MC-E10 	Copper to 10 Mbps Fiber The MultiLink Media Converter MC-E10 is a 2-port Copper to 10Mbps Fiber uplink Ethernet media converter. Conversion from copper to fiber is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.	128
F485 	Multi-Port Serial Server & Managed Switch The F485 is a self-contained device for converting between RS232, RS485 and fiber optic signals. The F485 is electrically isolated to improve communications in noisy environments.	128
USB2Serial Converter 	USB to Serial Cable Converter This cable is the solution for users who want to communicate with serial devices via PCs that have USB communication ports. Using this cable is quick and easy. Simply install the cable driver on your PC, plug in the cable and you are ready to communicate.	128

Selector Guides

Ethernet Switches

Features	ML2400	ML1600	ML1200	ML800	ML600
Hardware					
Gigabit Ports	8	4	2	2	
10/100 Mbps Copper RJ45 ports	32	16	12	8	6
10 or 100 Mbps fiber ports	16	12	8	3	2
Maximum Number of ports	32	16	14	10	6
Maximum Fibre Distance (km)	70	70	40	40	2
Hardware & Software Alarm Contacts	•	•	•	•	•
Low (48V) Power Supply Option	•	•	•	•	•
Redundant Power Supplies	•				
AC/DC Power Supply Option	•	•		•	
Security					
SSL	•	•	•	•	
Port Security + 802.1x	•	•	•	•	
RADIUS/TACACS+	•	•	•	•	
Usability					
Modbus Protocol Support	•	•	•	•	•
Viewpoint Monitoring Integrated	•	•	•	•	
Configurable Alarms	•	•	•	•	
Network Management					
SMTP Email Alerts	•	•	•	•	
IPv6	•	•	•	•	
VLAN & QoS	•	•	•	•	
Port Mirroring	•	•	•	•	
Event Logs	•	•	•	•	
Reliability					
RSTP & Smart (Ring-Only) RSTP	•	•	•	•	
Link-Loss-Alert 10/100 Mbit Fiber	•	•	•	•	
Robustness					
NEBS level 3	•	•	•	•	•
UL certified	•	•	•	•	•
ETSI Certified	•	•	•	•	•
NEMA TS2	•	•	•	•	•
IEC 61850-3 Compliant	•	•	•	•	•
IEE 1613	•	•	•	•	•
-40° + 85° operating temp. w/ no fans	•	•	•	•	•
Harsh Chemical Environment Option	•	•	•	•	•
RoHS Option	•	•	•	•	•

Protocol Converters

Features	MultiNet	MultiNet4	MultiNet1000	MCE-10	MCE-100	MCE-1000
Hardware						
IP Routing		•	•			
Managed Switch		•	•			
Serial to Ethernet Conversion	•	•	•			
RS-422/RS-485 serial ports	1	4	12			
Serial Port Speed (kbps)	0.3 - 115	0.6 - 115	0.6 - 115			
Modbus RTU to Modbus TCP conversion	•	•	•			
Copper Ethernet Ports	1	4	5	2	2	2
10Mbps Fiber Ethernet Ports		2	2	1		
100Mbps Fiber Ethernet Ports	1	2	2		1	
Gigabit Ethernet Ports						3
Maximum usable Ethernet Ports	1	4	5	3	3	3
-40° + 85° operating temp. w/ no fans	•	•	•	•	•	•
AC Power Supply	•	•	•	•	•	•
Low Voltage Power Supply (24-48V)	•	•	•	•	•	•
AC/DC Power Supply						
UL Listed	•	•	•	•	•	•
Meets IEEE 1613	•	•	•	•	•	•
Meets IEC 61850-3	•	•	•	•	•	•

MultiLink

Hardened Ethernet Switches



Industrial and Substation Hardened

MultiLink Managed Ethernet Switches provide extremely reliable networking with very fast reconfiguration times for recovering from faults occurring in the network. The complete set of network management functions available will provide the configurability and monitoring capability needed for most applications, while the high level of Security features available will ensure your network is always protected from tampering or illegal access. In addition, MultiLink switches offer industry-leading port density, with support for up to 32 ports in a single chassis. Combined with support for both copper connections and a variety of fibre-optic connector choices, MultiLink switches are flexible enough to work with a variety of network media types and applications.

Key Benefits

- Physically hardened and environmentally ruggedized for reliability in harsh environments
- Harsh chemical environment option available for environments 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
- Supports intelligent traffic planning and integration with network management systems using a complete set of Ethernet switch management functions
- Flexible options for Ethernet port and media types allow integration into any project requirement
- 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 Viewpoint Monitoring software

Applications

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

Industrially Hardened

- UL listed/CE agency approved
- IEC 61850 and IEE 1613 approval for operation in electric substation environments
- Redundant and mixed power supply options for increased reliability
- Harsh chemical environment options ensures product function and viability
- Reduction of hazardous substances (RoHS)

Ease-of-use

- Support for industrial protocols (e.g. Modbus)
- IP out-of-the-box for easy installation and initial setup
- Simple but powerful web management interface for all configuration functions

Managed Networks

- Supports SNMPv3, with full backwards compatibility for v1 and v2
- Traffic segregation and prioritization control via IEE 802.1p and IEE 802.1q
- Hardware and software alarm contacts for detection of critical network or switch events
- Fully Integrates with Viewpoint Monitoring software

Secure

- Secure management via SSL
- Port security prevents unauthorized devices from 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



Ideal for Harsh Environments

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

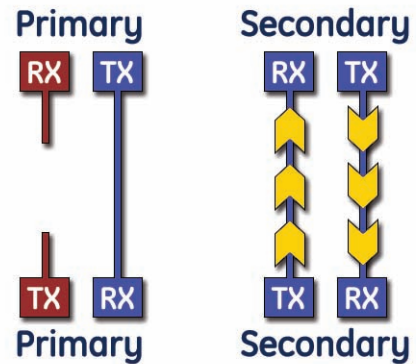
- Operating Temperature -40°C to +85°C without fans
- Type tested to IEC61850-3, IEEE1613 Class2, NEBS level 3 substation requirements
- IP40 Rated
- Dual power supply option with the ability to mix the input sources used (i.e. 48VDC and 125VDC)
- Harsh Chemical Environment option provides reliable and rugged Ethernet connectivity

Designed for the Needs of Protection Relaying

The MultiLink Ethernet Switches have been designed for the specific requirements of devices used in Utility and Industrial environments such as Protection Relays. MultiLink Switches support many unique features that allow for full redundancy under network fault conditions.

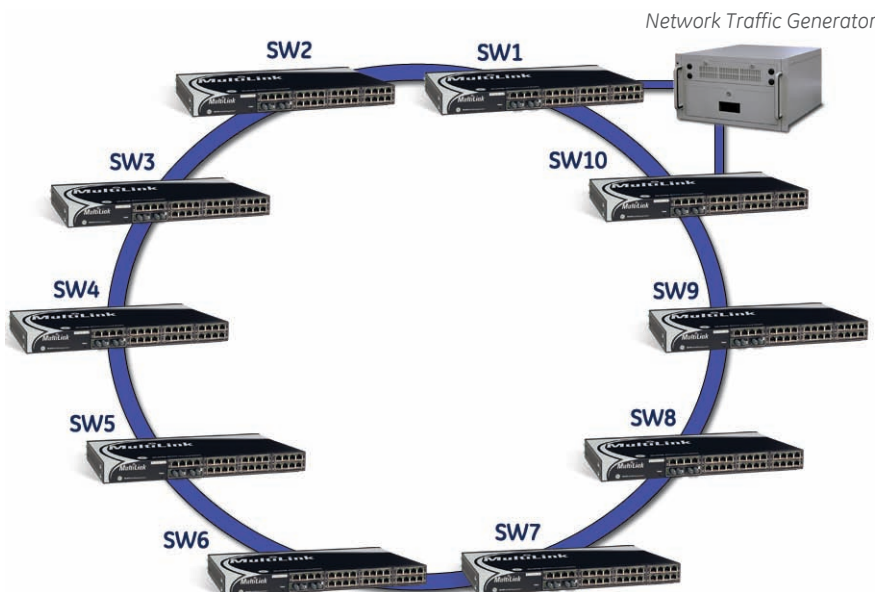
Link Loss Alert

The MultiLink Switch'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 Multilin's Universal Relay, and allows for seamless switching to the relay's secondary port under all network fault conditions.



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	1.61 ms
SW2-SW3	3.78 ms
SW3-SW4	4.63 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

Typical Recovery Time Test Results

Example of Network Fault recovery testing using MultiLink SMART RSTP in a Ring Network Architecture.

Port Mirroring

To help analyze and optimize network links and traffic, MultiLink users can enable the Port Mirroring feature. This feature allows all of the traffic on any given port to be duplicated on a selected second port, so it can be monitored and analyzed to help troubleshooting the network and ensure the whole system behaves as required.

QoS

MultiLink switches offer Quality of Service (QoS) in compliance to IEEE 802.1p. By defining certain switch ports, or certain traffic types, with different priority levels, 802.1p prioritizes network flows so that critical data is allowed to jump ahead of normal network traffic passing through the switch at the same time. Network traffic priority classification can be made by Port, by Tag or by IP Type of Service (ToS).

Port Security

Port Security prevents unauthorized access to the network by validating network traffic entering each port to a list of acceptable MAC addresses. If an unauthorized device is connected to any port on the switch, the device will be refused connection by the Port Security feature. The list of accepted devices can be entered by a system manager, or learned and controlled by the MultiLink Switch itself.

Event Logging for All Switch Changes

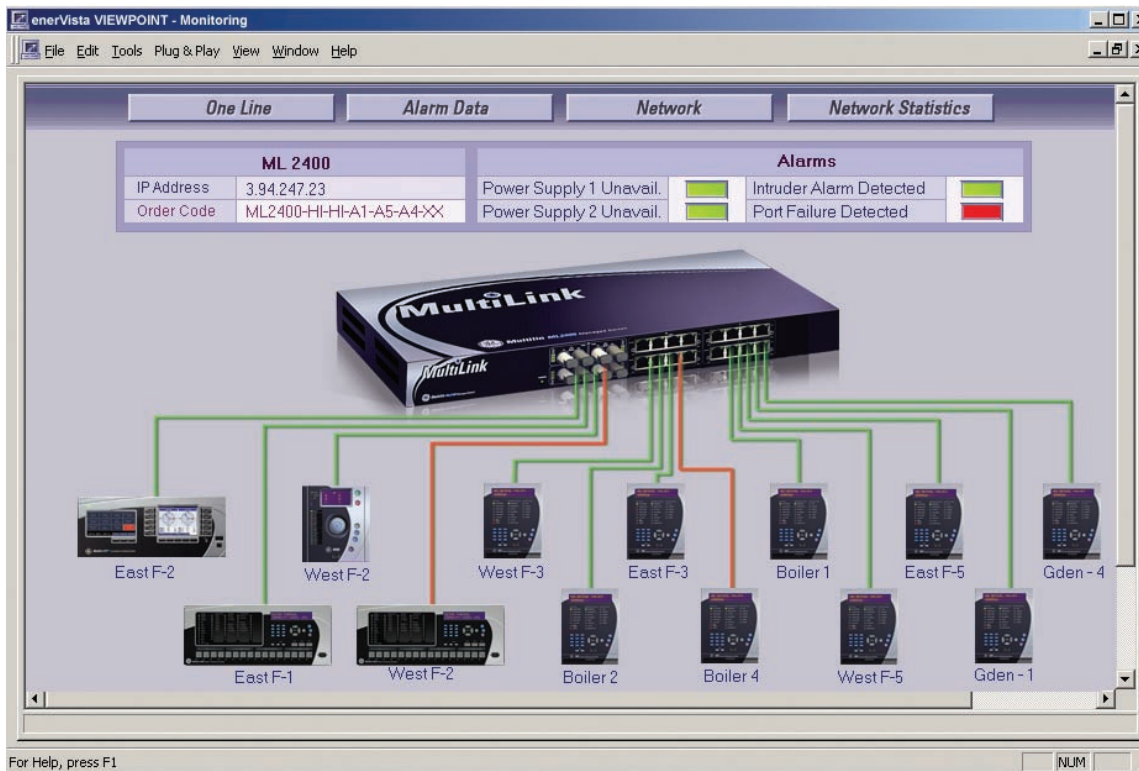
To help enable forensic and regulatory auditing and reporting, MultiLink's Event Log will store and timestamp all configuration changes and network problems detected by the switch. This data can be used to analyze network problems and provide traceability to network configuration changes.

Traffic Separation and Security (802.1q VLANs)

In order to help keep network traffic between devices and applications that do not need to know about each other minimized and optimize network performance and security, MultiLink switches provide support for Virtual Local Area Networks (VLANs) with compliance to IEEE 802.1q. VLANs allow separation of a larger physical network into smaller Virtual networks restrict network traffic to only VLAN on which it resides, preventing excess traffic from crowding the network, improving bandwidth allocation and optimizing network efficiency.

Viewpoint Monitoring Supported

The MultiLink Ethernet Switches are fully supported by the Viewpoint Monitoring and EnerVista Integrator software packages allowing integration of the status of the Local Area Networks and Alarming of Network problems and Security Alerts into your Monitoring and Control Systems.



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

Modbus Protocol Support

Identifying network communication problems and retrieving network statistics from the MultiLink 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.

High Speed Ring Recovery with Smart RSTP

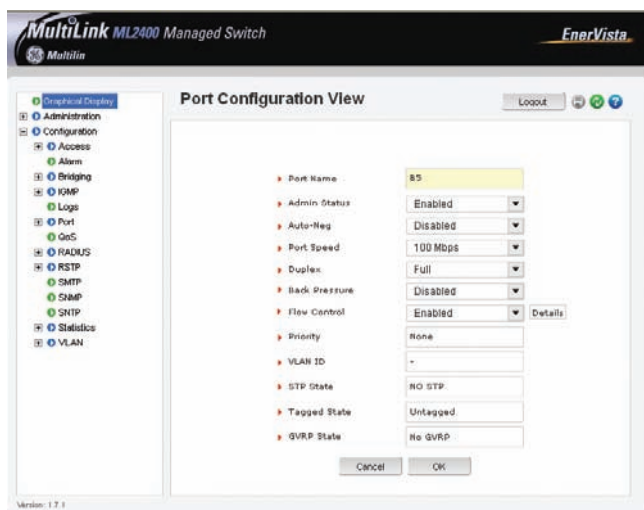
The unique requirements of the Protection and Control Industry require Ethernet networks to be more reliable and to recover from network problems faster than is generally accepted in other commercially available equipment. The MultiLink Ethernet Switch's SMART RSTP feature allows for recovery from faults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

Easy to Use Web Configuration and Reporting

EnerVista Web Interface provides user-friendly configuration and network monitoring. Easily program 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.

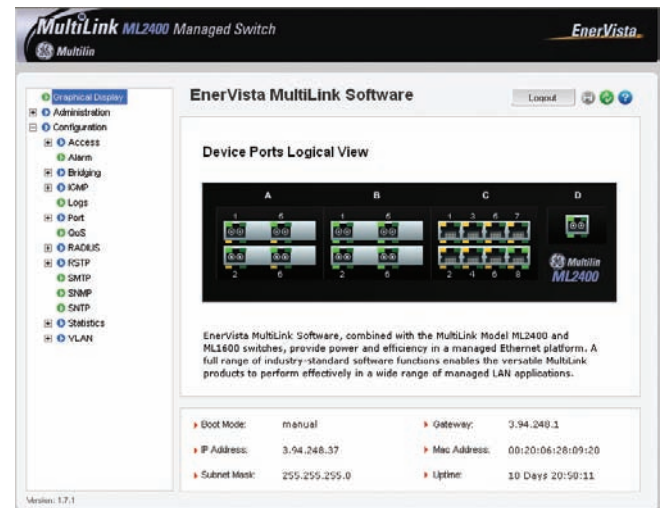
Intuitive Menu Driven Configuration

- 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 Command-line interface (CLI) commands



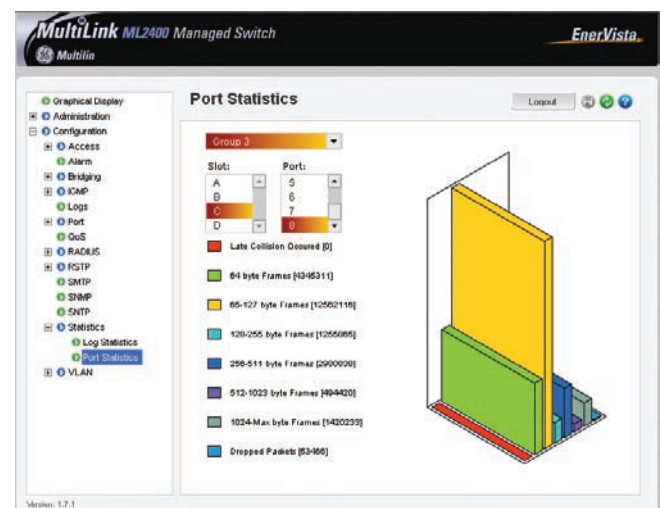
Communication Status & Port Navigation

- 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



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 troubleshooting of specific network problems



Managed Switches

The MultiLink ML2400, ML1600, ML1200 and the 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 will provide the configurability and monitoring capability needed for most applications, while the high level of Security features available will ensure your network is protected from tampering or illegal access.

ML2400



ML2400 supports:

- 32 - 10/100 Mbit Copper RJ45 Ports
- 16 - 10 or 100 Mbit ST or SC Fiber Ports
- 12 - 100 Mbit LC or MTRJ Fiber Ports
- 8 - 1 Gbit Fiber or Copper RJ45 Ports
- Redundant High Voltage AC/DC Power Supplies

ML1600



ML1600 supports:

- 16 - 10/100 Mbit Copper RJ45 Ports
- 8 - 10 or 100 Mbit ST or SC Fiber Ports
- 12 - 100 Mbit LC or MTRJ Fiber Ports
- 4 - 1 Gbit Fiber or Copper RJ45 Ports
- High Voltage AC/DC Power Supplies

ML1200



ML1200 supports:

- 12 - 10/100 Mbit Copper RJ45 Ports
- 4 - 10 or 100 Mbit ST or SC Fiber Ports
- 8 - 100Mbit LC or MTRJ Fiber Ports
- 2 - 1 Gbit Fiber or Copper RJ45 Ports
- Low, Medium, and High Voltage DC Power Supply

ML800



ML800 supports:

- 8 - 10/100Mbit Copper RJ45 Ports
- 3 - LC or MTRJ Fiber Ports
- 2 - 1 Gbit Fiber or Copper RJ45 Ports

Unmanaged Compact Switch

The ML600 Unmanaged Ethernet Switch will provide 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 providing redundancy throughout your critical networks.

ML600



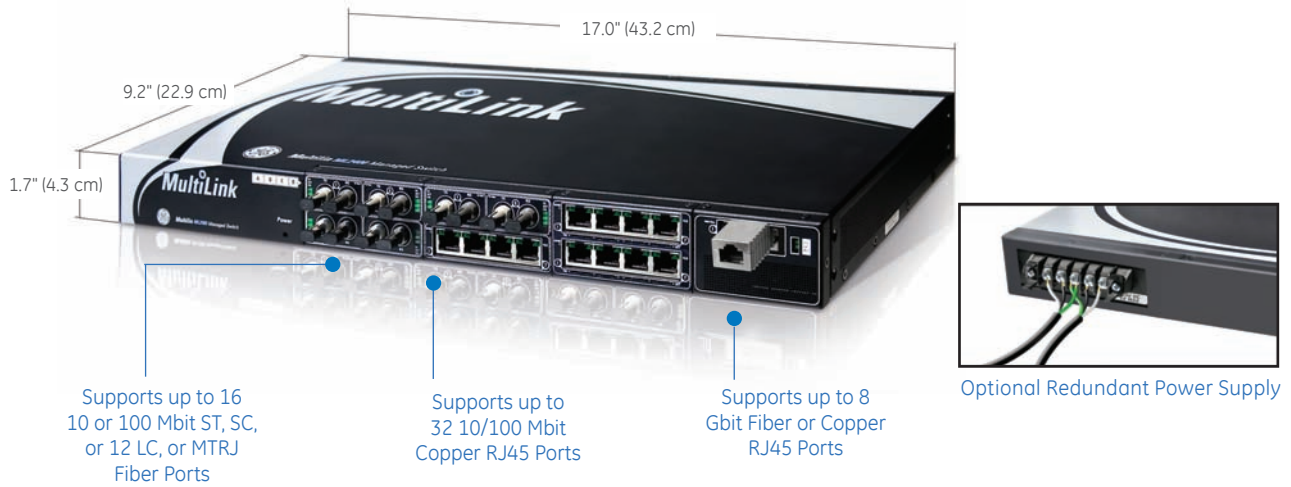
ML600 supports:

- 6 - 10/100 Mbit Copper RJ45 Ports
- 2 - 100 Mbit ST, or SC Fiber Ports
- High Voltage AC Power Supply

Port Selector Guide

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
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

ML2400

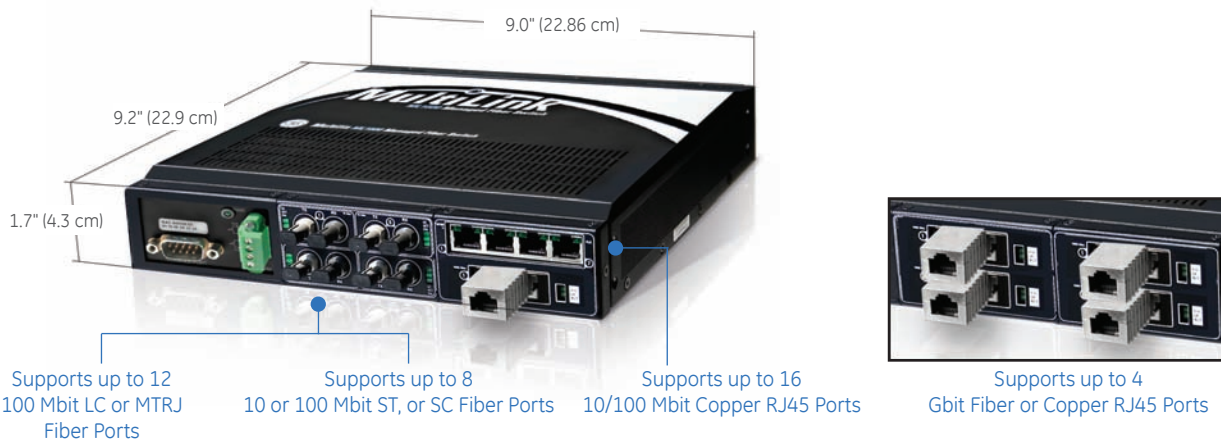


Ordering

ML2400	-	*	-	**	-	**	-	**	**	**	**	-	*	Base Unit
Module								A	B	C	D			Front Mounted Ports
Port Mounting		F												Rear Mounted Ports
Power Supply		B		AC HI LO										100-240 VAC Power Supply 110-250 VDC/100-240 VAC Power Supply 48 VDC Power Supply
Redundant Power Supply						XX HI LO								No Redundant Power Supply 110-250 VDC/100-240 VAC Power Supply 48 VDC Power Supply
Modules								A1	A1	A1	A1			4 x 10 Mbit - ST mm Fiber 4 x 100 Mbit - ST mm Fiber 4 x 100 Mbit - SC mm Fiber 8 x 10/100 Mbit - RJ45 Copper 2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper 2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper 2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper 2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper 4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper 8 x 100 Mbit - LC mm Fiber 4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper 8 x 100 Mbit - LC sm Fiber 2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper 2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber 8 x 100 Mbit - MTRJ mm Fiber 4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper 2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper 1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber 1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper 2 x 1000 Mbit - SC mm Fiber 2km 1 x 1000 Mbit - RJ45 Copper 1 x 1000 Mbit - SC mm Fiber 2km 1 x 1000 Mbit - SC sm Fiber 10 km 1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber 1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper 2 x 1000 Mbit - RJ45 Copper 1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber 1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper 2 x 1000 Mbit - SC sm Fiber 10km
Harsh Environment								GJ	GJ	GJ	GJ		X H	Standard Environment Harsh Chemical Environment Option

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

ML1600

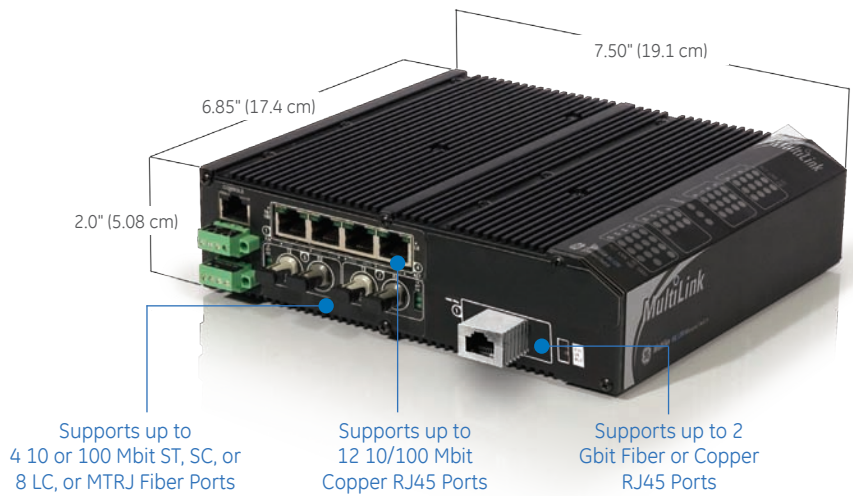


Ordering

ML1600	-	**	-	**	**	-	*	Base Unit
Module				A	B			100-240 VAC Power Supply
Power Supply	AC	HI	LO					110-250 VDC/100-240 VAC Power Supply
Modules				A1	A1			48 VDC Power Supply
				A2	A2			4 x 10 Mbit - ST mm Fiber
				A3	A3			4 x 100 Mbit - ST mm Fiber
				A4	A4			4 x 100 Mbit - SC mm Fiber
				A5	A5			8 x 10/100 Mbit - RJ45 Copper
				A6	A6			2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A7	A7			2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A8	A8			2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AA	AA			2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper
				AB	AB			4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AC	AC			8 x 100 Mbit - LC mm Fiber
				AD	AD			4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AE	AE			8 x 100 Mbit - LC sm Fiber
				AF	AF			2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper
				AH	AH			2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber
				AJ	AJ			8 x 100 Mbit - MTRJ mm Fiber
				AK	AK			4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				G3	G3			2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper
				G4	G4			1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber
				G5	G5			1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper
				G6	G6			2 x 1000 Mbit - SC mm Fiber 2km
				G7	G7			1 x 1000 Mbit - RJ45 Copper
				G8	G8			1 x 1000 Mbit - SC mm Fiber 2km
				GC	GC			1 x 1000 Mbit - SC sm Fiber 10 km
				GD	GD			1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber
				GE	GE			1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper
				GF	GF			2 x 1000 Mbit - RJ45 Copper
				GH	GH			1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber
				GJ	GJ			1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper
Harsh Environment						X		2 x 1000 Mbit - SC sm Fiber 10km
						H		Standard Environment
								Harsh Chemical Environment Option

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

ML1200

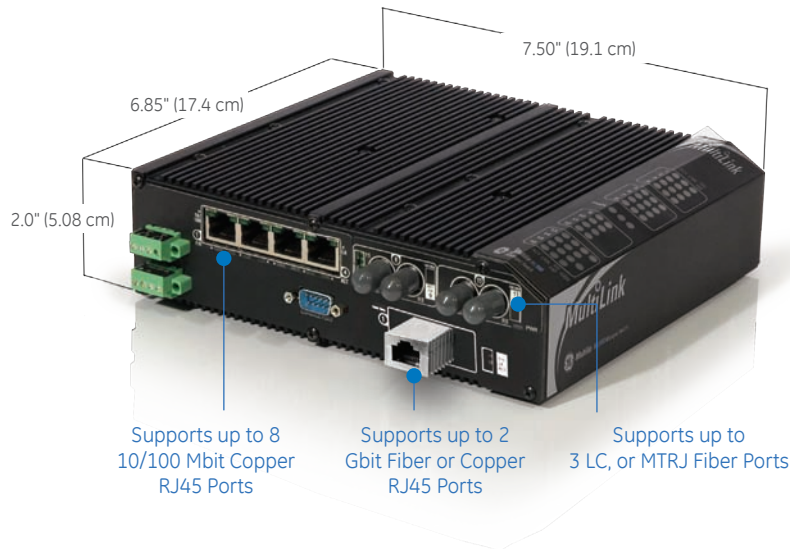


Ordering

ML1200	-	**	-	**	-	**	-	**	-	**	-	**	Base Unit
Power Supply	250S												ML1200 250VDC Chassis
	125S												ML1200 125VDC Chassis
	48VS												ML1200 48VDC Chassis
	24VS												ML1200 24VDC Chassis
	12VS												ML1200 12VDC Chassis
	125D												ML1200 125VDC Chassis - Dual Input PSU
	48VD												ML1200 48VDC Chassis - Dual Input PSU
	24VD												ML1200 24VDC Chassis - Dual Input PSU
	48PS												ML1200 48VDC Chassis - PoE enabled
	48PD												ML1200 48VDC Chassis - PoE enabled with Dual Input PSU
Modules		C1		XX		XX		XX					None
		C2		C1		C1							4 x 10/100 RJ-45
				C2									4 x 10/100 RJ-45 PoE-enabled ports (only with ML1200-48 model)
				C3		C3							2 x 10/100 RJ-45 + 2x 100Mbit MTRJ mm Fiber
				C4		C4							2x 10/100 RJ-45 + 2x 100Mbit LC mm Fiber
				C5		C5							2x 10/100 RJ-45 + 2x 100Mbit LC sm Fiber 15km
				C6		C6							2x 10/100 RJ-45 + 1x 100Mbit SC mm Fiber
				C7		C7							2x 10Mbit ST mm Fiber
				C8		C8		C8					2x 100Mbit ST mm Fiber
				C9		C9		C9					2x 100Mbit SC mm Fiber
				CA		CA		CA					2x 100Mbit SC sm Fiber 20km
				CB		CB		CB					2x 100Mbit SC sm Fiber 40km
				CC		CC		CC					4x 100Mbit MTRJ mm Fiber
				CD		CD		CD					4x 100Mbit LC mm Fiber
				CE		CE		CE					4x 100Mbit LC sm Fiber 15km
								CF					1x 100Mbit ST mm Fiber
								CG					1x 100Mbit SC mm Fiber
								CH					1x 100Mbit SC sm Fiber 20km
								CI					1x 100Mbit SC sm Fiber 40km
								CJ					2x 100Mbit MTRJ mm Fiber
								CK					2x 100Mbit LC mm Fiber
								CL					2x 100Mbit LC sm Fiber 15km
						H3							2x 1000Mbit LC sm Fiber 10km
						H4							2x 1000Mbit LC sm Fiber 25km
						H5							2x 1000Mbit LC sm Fiber 40km
						H6							2x 1000Mbit LC sm Fiber 70km
						H7							2x 1000Mbit RJ-45 Copper
						HA							1x 1000Mbit RJ-45 Copper + 1x 1000Mbit LC sm Fiber 10km
						HB							1x 1000Mbit RJ-45 Copper + 1x 1000Mbit LC sm Fiber 25km
						HC							1x 1000Mbit RJ-45 Copper + 1x 1000Mbit LC sm Fiber 40km
						HD							1x 1000Mbit RJ-45 Copper + 1x 1000Mbit LC sm Fiber 70km
						HG							1x 1000Mbit LC sm Fiber 10km
						HH							1x 1000Mbit LC sm Fiber 25km
						HI							1x 1000Mbit LC sm Fiber 40km
						HJ							1x 1000Mbit LC sm Fiber 70km
						HK							1x 1000Mbit RJ-45 Copper
Conformal Coating Option								X					None
								H					Harsh Chemical Environment Conformal Coating
								Z					RoHS-compliant
								Y					RoHS-compliant with Harsh Chemical Environment Coating

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

ML800

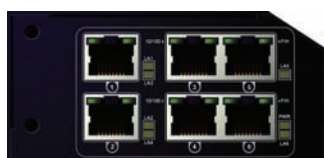
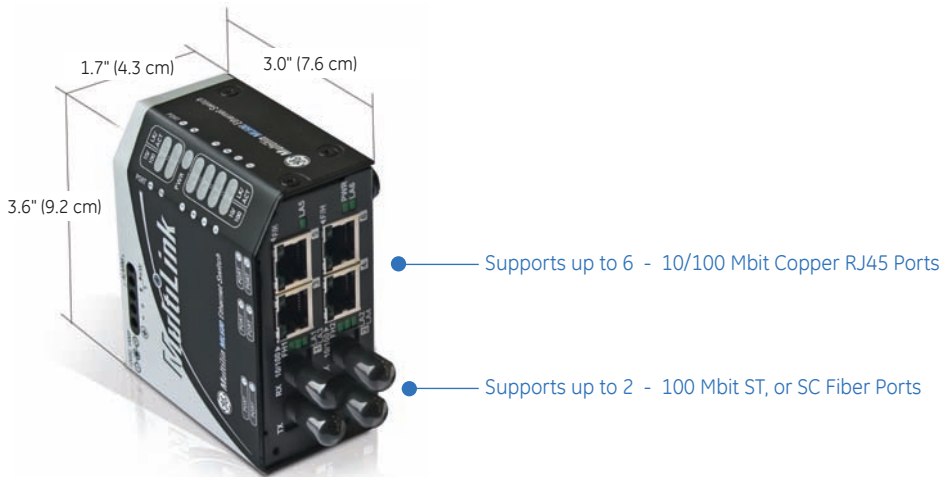


Ordering

ML800	-	**	-	**	-	**	-	**	-	**	Base Unit
Power Supply	250S										ML800 250VDC Chassis
	125S										ML800 125VDC Chassis
	48VS										ML800 48VDC Chassis
	24VS										ML800 24VDC Chassis
	12VS										ML800 12VDC Chassis
	125D										ML800 125VDC Chassis - Dual Input PSU
	48VD										ML800 48VDC Chassis - Dual Input PSU
	24VD										ML800 24VDC Chassis - Dual Input PSU
	12VD										ML800 12VDC Chassis - Dual Input PSU
	48PS										ML800 48VDC Chassis - PoE enabled
	48PD										ML800 48VDC Chassis - PoE enabled with Dual Input PSU
	HIAC										ML800 100-240V AC Chassis
Modules											None
		C1		XX							4 x 10/100 RJ-45
		C2		C1							4 x 10/100 RJ-45 PoE-enabled ports (only with ML800-48P models)
				C3							2 x 10/100 RJ-45 + 2 x 100Mbit MTRJ mm Fiber
				C4							2 x 10/100 RJ-45 + 2 x 100Mbit LC mm Fiber
				C5							2 x 10/100 RJ-45 + 2 x 100Mbit LC sm Fiber 15km
				CB							3 x 10/100 RJ-45 Copper + 1 x mm MTRJ Fiber
				CC							1 x 10/100 RJ-45 Copper + 3 x mm MTRJ Fiber
				CD							3 x 10/100 RJ-45 Copper + 1 x mm LC Fiber
				CE							1 x 10/100 RJ-45 Copper + 3 x mm LC Fiber
				CF							3 x 10/100 RJ-45 Copper + 1 x sm LC 15km Fiber
				CG							1 x 10/100 RJ-45 Copper + 3 x sm LC 15km Fiber
				CH							3 x 10/100 RJ-45 Copper + 1 x sm LC 40km Fiber
				CI							2 x 10/100 RJ-45 Copper + 2 x sm LC 40km Fiber
				CJ							1 x 10/100 RJ-45 Copper + 3 x sm LC 40km Fiber
						H3					2 x 1000Mbit LC sm Fiber 10km
						H4					2 x 1000Mbit LC sm Fiber 25km
						H5					2 x 1000Mbit LC sm Fiber 40km
						H6					2 x 1000Mbit LC sm Fiber 70km
						H7					2 x 1000Mbit RJ-45 Copper
						HG					1 x 1000Mbit LC sm Fiber 10km
						HH					1 x 1000Mbit LC sm Fiber 25km
						HI					1 x 1000Mbit LC sm Fiber 40km
						HJ					1 x 1000Mbit LC sm Fiber 70km
						HK					1 x 1000Mbit RJ-45 Copper
Conformal Coating Option										X	None
										H	Harsh Chemical Environment Conformal Coating
										Z	RoHS-compliant
										Y	RoHS-compliant with Harsh Chemical Environment Coating

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

ML600



6 - 10/100 Mbit Copper RJ45 Ports



4 - 10/100 Mbit Copper RJ45 Ports
2 - 100 Mbit ST, or SC Fiber Ports

Ordering

ML600	- **	- **	-	Base Unit
Power Supply	AC HI LO			External 100 - 240 VAC Adaptor 30 - 60 VDC Power Supply 10 - 36 VDC Power Supply
Modules		XX B1 B2 B3 B4		None 6 x 10/100 Mbit - RJ45 Copper 2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit - RJ45 Copper 2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit - RJ45 Copper 2 x 100 Mbit - SC sm Fiber + 4 x 10/100 Mbit - RJ45 Copper

Accessories for MultiLink Switches

- Industrial Power System Communications Learning CD TRCD-ICOM-C-S-1
- MultiNet MultiNet-FE
- EnerVista Integrator EVI-1000

Visit www.GEMultilin.com to:



- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MultiLink Switch online
- View the MultiLink Family brochure

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

MultiNet1000

Router and Multi-Port Serial Server



Easy, Advanced and Secure Networking

The MultiNet1000 Router and Multi-Port Serial Server is an industrial-hardened, multipurpose networking appliance that combines a serial port server, a managed switch, and a full-featured WAN & Ethernet Router into a single device. With support for IP routing by physical interface, virtual interface, or VLAN, the MultiNet1000 can create controlled interconnections between almost any set of networks, while also ensuring reliable and secure control of network applications and devices at all times.

The MultiNet1000's integrated switch includes 5 Ethernet ports that can be configured for copper or fiber interfaces, and also provides a full suite of managed switch features. Finally, with 12 serial ports, support for Modbus RTU to Modbus TCP conversion, and support encapsulation for all other serial protocols, the MultiNet1000 provides the flexibility to support almost any network or device type, while offering reliability and rich cyber-security features in an easy-to-use appliance.

Key Benefits

- Physically hardened for use in industrial, utility, substation, and other harsh environments
- Support for many routing protocols, including Static, RIP I, RIP II, OSPF and BGP
- Can support redundant and backup routing strategies using VRRP
- Enables routing between physical networks, virtual networks, and other interfaces
- Supports Cyber Protection and regulatory compliance with Advanced Security Features and Event Logging
- Integrated Stateful IP Firewall for protection from network intrusions
- Compatible with RADIUS and TACACS+ user authentication systems using 802.1x
- Supports encrypted traffic for protection of outgoing data, as well as for authorized remote users connecting by VPN
- Flexible options for Ethernet media and port types allow integration into any project requirement
- Integrates with managed switch networks and Network Management Systems using SNMP
- Support for many serial devices using serial port server enables extension of the routed network to serial end-devices
- Collection of Modbus and other SCADA data across the routed network using SCADA Frame Forwarding

Applications

- User-defined interconnection of multiple networks and LANs using routing and firewall functions
- Interconnecting networks with service providers or with business partner networks
- Creating a connection and routing point between VLANs
- Create high-availability remote networks using VRRP for redundant routing

Industrial Hardened

- -40°C to +85°C Operating temperature
- Meets IEC 61850 and IEE 1613 standards for operation in electrical substation environments
- Redundant and Mixed Power Supply options for increased reliability

Flexible, Simple Solution

- Provides managed switch, industrial router, and serial port server, all in one device
- Supports both copper and fiber-based Ethernet connections
- T1/E1 wide-area and remote access
- Setup in just a few clicks with configuration software or web-based interface

Managed Networks

- Full switch management for integration with Network Management Systems
- Traffic segregation and priority control using IEE 802.1q and IEE 802.1p
- Fast network recovery with support for RSTP

Secure

- Integrated stateful firewall for protection from network intruders
- Multi-level passwords with levels of privilege and command for different users or groups
- Port Security prevents unauthorized devices from gaining access to the network
- Complete Event Logging for forensic and regulatory auditing and reporting



Hardened for Reliability in Harsh Environments

The MultiNet1000 is purpose-built for extremely harsh environments such as power utility substations, and meets IEEE1613 and IEC 61850-3 specifications for EMI/ ESD protection. With the ability to operate at -40°C to +85°C without open vent holes or fans, and support for both single and dual wide-ranging power supply options, the MultiNet1000 is ready for almost any location challenge.

Advanced Routing & Wide Area Networking

With support for IP routing services in both LAN and WAN applications, each of the MultiNet1000 Ethernet ports can be configured to operate as part of the integrated managed switch, or in routed mode as a discrete interface. IP routing is provided on any combination of physical and virtual interfaces, including per VLAN. WAN interfaces include dual T1/E1 or dual DDS ports using the MultiNet1000's integral CSU/DSU for access to IP-based, TDM, frame relay or MPLS-based services. IP/PPP/a sync is also supported on the WAN interfaces, which provides a dial-up WAN option when combined with external AT-compatible modems.

In addition, the MultiNet1000 can support static routing, as well as dynamic routing via RIP, OSPF, and/or BGP, ensuring easy inter-operation with existing networks and routing schemes.

Powerful Cyber Security

The MultiNet1000's cyber security capabilities cover both security and protection of the router itself as well as electronic perimeter protection for remote sites. With support for stateful IP firewall, IP address translation (NAT/PAT) and encryption options via IPsec, SSH port forwarding and serial port SSL VPNs, the MultiNet1000 provides for authentication, authorization, logging and compliance reporting for remote user access to local devices. Management security includes encrypted interfaces (HTTPS, SSH, SFTP and SNMPv3), multi-level user IDs with support for strong form passwords, authentication via RADIUS, and extensive local and/or remote logging and alerting. A flexible integrated protocol analyzer provides remote trouble shooting and detailed traffic analysis.

Integrated Serial Port Server

In addition to interconnecting Ethernet and WAN networks, MultiNet1000's built in 12-serial port server allows extension of the routed network all the way to end serial devices. MultiNet1000's serial port server provides devices with serial ModBus to ModBus TCP/IP communications capability on an Ethernet network, allowing connection to LAN and WAN network systems via fiber or wire media, which eliminates complex wiring and additional communications converters.

Quick and Easy Setup

MultiNet1000 is supported by GE Multilin's PC Setup Application, a Windows-based software program for installing and configuring the communication drivers that allows complete configuration and setup with a few mouse-clicks.

Full Managed Switch Functions

MultiNet1000's built-in Ethernet switch is fully-managed and configurable and provides users with the ability to finely control, view, and manage MultiNet1000 as part of the switch network. The MultiNet1000's integrated switch supports most 802.1 network management features and are configurable using either Command Line Interface (CLI) or our Web Management Interface. Management functionality includes:

- SNMPv3 for secure switch management
- Web Management Interface for easy administration
- RSTP (802.1w), VLAN (802.1q) and QoS (802.1p) for network traffic optimization

Ordering

MN1000	- **	- **	- **	- **	- X	Base Unit
Power Supply	W2	250 48	250 48 XX			Dual T1/E1/DDS WAN Port MultiNet1000 90-250VAC/VDC MultiNet1000 24-48VDC None
Modules				E1		5 x 10/100 RJ-45
				E2		3x 10/100 RJ-45 + 2x 10Mbit ST mm Fiber
				E3		3x 10/100 RJ-45 + 2x 100Mbit ST mm Fiber
				E4		3x 10/100 RJ-45 + 2x 100Mbit SC mm Fiber
				E5		3 x10/100 RJ-45 + 2x 100Mbit MTRJ mm Fiber
				E6		3x 10/100 RJ-45 + 2x 100Mbit SC sm Fiber 20km
				E7		3x 10/100 RJ-45 + 2x 100Mbit SC sm Fiber 40km
				E8		3x 10/100 RJ-45 + 2x 100Mbit LC mm Fiber
				E9		3x 10/100 RJ-45 + 2x 100Mbit LC sm Fiber 15km

Visit www.GEMultilin.com/MultiNet1000 to:



- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a MN1000 online
- View the MultiLink Family brochure

MultiNet4

Multi-Port Serial Server & Managed Switch



Network Enable Many Serial Devices

MultiNet4 provides devices with serial ModBus to ModBus TCP/IP communications capability on an Ethernet network, allowing connection to LAN and WAN network systems via fiber or wire media. MultiNet4's four serial ports have the capability to connect up to 128 serial ModBus devices, which eliminates complex wiring and additional communications converters.

Key Benefits

- Converts Modbus RTU into Modbus TCP over Ethernet
- Raw Socket serial encapsulation for other serial protocols
- Substation hardened to meet the requirements for harsh utility and industrial applications
- Simple plug & play device setup and configuration using Multilin EnerVista (TM) Software
- Connects a large number of serial devices to a Ethernet network
- Rich Network Management and Security functions
- Fast collection of data via individually-configurable Modbus TCP settings for each serial port
- Enhanced Reliability with Fast Fault Recovery via Link-Loss Alert (LLA)
- Flexible mounting options allows for easy installation

Application specific wireless solution

- Provides Modbus TCP connectivity to relays, meters, and other serial devices
- Connection point to network for both serial and Ethernet devices
- Connect serial devices to SCADA network and HMI applications
- Provides visibility to serial devices through EnerVista(TM) management software
- Connect remote sites to Ethernet network using integrated managed switch and long distance fiber port option
- Provides managed network visibility into the serial network

Industrially Hardened

- Temperature range of -40°C to 85°C
- Internal DC and AC Power supply
- Transients Protection (IEC and IEEE standards)

Application Flexibility

- High density solution provides 4 serial ports
- Connect up to 128 devices
- Integrated 4-port fully managed Ethernet switch
- Supports both 10/100BaseT and 100BaseF fiber optic connections
- Multiple Modbus TCP masters for serial devices

Easy to Use

- Integrated fully-managed switch with a serial port server
- Implementation in just a few clicks using MultiNet4 setup software
- Web-based and command-line interfaces for advanced users and configurations

Secure

- SNMP v1/v2/v3 for secure access to network devices via authentication and encryption
- Embedded RADIUS and TACACS+ support for remote access and password control
- SSL Web encryption to secure and ensure integrity of users and data
- Port Security to block unauthorized MAC addresses
- Event Logging and email (SMTP) notification of unauthorized access attempts



Fast, Secure and Reliable

The MultiNet Family is a line of industrially-hardened serial port servers that provide access for serial devices onto a TCP/IP Ethernet network. Designed to meet the unique networking and environmental requirements of the Protection & Control industry, MultiNet devices ensure continuous connection with and control of serial devices through your communications network. The MultiNet family of devices are designed and built to meet the needs of the utility industry, and are tested to the same environment and conditions as all GE Multilin devices to deliver a solution that maximizes the availability of your critical infrastructure.

High Density Solution for Any Serial Devices

MultiNet4 provides devices with serial ModBus to ModBus TCP/IP communications capability on an Ethernet network, allowing connection to LAN and WAN network systems via fiber or wire media. MultiNet4's four serial ports have the capability to connect up to 128 serial devices, which eliminates complex wiring and additional communications converters.

In order to ensure fast access to serial device data, MultiNet4 features individually-configurable serial ports that can be set to work at different speeds and even with different Modbus TCP port settings, enabling optimization of serial data collection. MultiNet4 has been environmentally hardened to withstand severe utility and industrial conditions, and with a variety of mounting options, the device can be placed anywhere it is required to work.

Add Ethernet to ModBus Devices

In addition to connecting serial devices to the network, MultiNet4's built-in 4-port Ethernet switch provides highly reliable network connectivity, both upstream to SCADA and management applications, as well as downstream to other Ethernet devices. With options for 100Base-FL fiber optic interfaces MultiNet4 is designed for applications where long cable runs, EMI/RFI immunity, and the inherent electrical isolation that optical fiber offers is required. With multiple options for connection port types, MultiNet4 can connect to almost any Ethernet device and ensures connectivity through fast recovery from broken links using Link Loss Alert (LLA). In addition, the built-in 4-port Ethernet switch is fully-managed and configurable and provides users with the ability to finely control, view, and manage MultiNet4 as part of the network. The MultiNet switches support most 802.1 network management features and are configurable using either Command Line Interface (CLI) or our Web Management Interface. Management functionality includes :

- SNMPv3 for secure switch management
- Web Management Interface for easy administration

- RSTP (802.1w), VLAN (802.1q) and QoS (802.1p) for network traffic optimization
- Port Mirroring to assist network troubleshooting

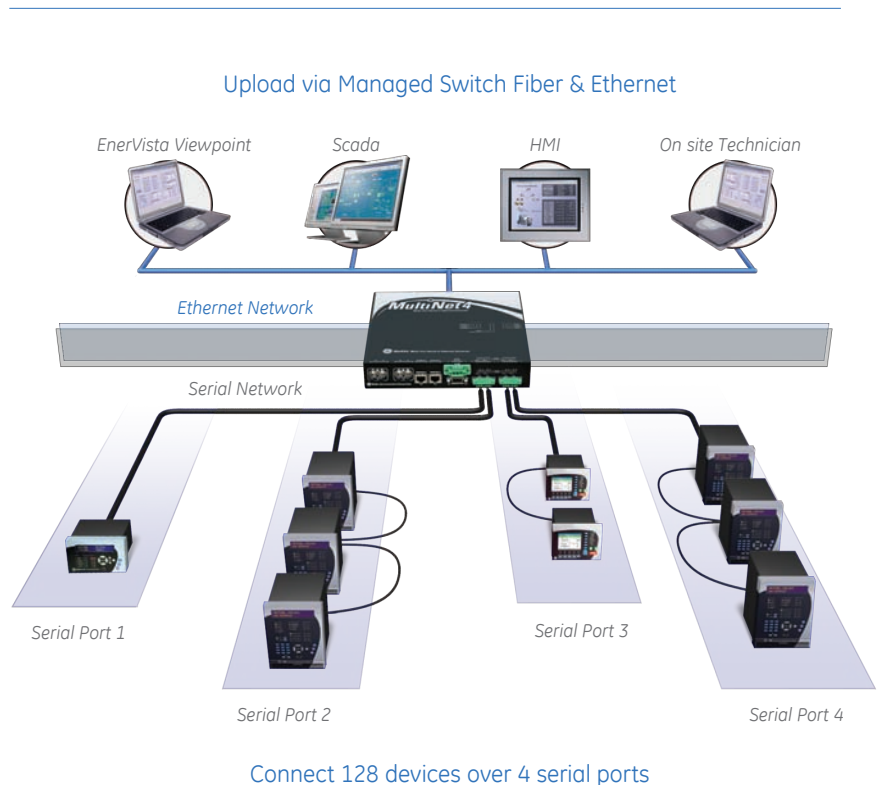
4-Port Serial Port Server

- Converts Modbus RTU over RS485/RS232 into Modbus TCP/IP over Ethernet
- Raw Socket serial encapsulation for other serial protocols
- Connect up to 128 serial devices to an Ethernet network.
- Fast collection of serial device data via individually-configurable Modbus TCP settings for each serial port
- Simple "plug & play" device setup with EnerVista software

Enhanced Network Security

MultiNet4 includes advanced techniques for providing security in network communications including:

- SNMP v1/v2/v3 for secure access to network devices via authentication and encryption
- Embedded RADIUS support for remote access and password control
- SSL Web encryption to secure and ensure integrity of users and data
- Port Security to block unauthorized MAC addresses
- Event Logging



Industrial Networking

Like all Multilin products, MultiNet4 is designed and built by the same people who build GE Multilin IEDs and relays, and are designed as part of complete solution for utility and industrial applications. Because of this, MultiNet4 is designed not only to work with any standard serial device, but is fully supported by the Viewpoint Monitoring and EnerVista Integrator software packages, allowing integration of the status of the Local Area Networks and Alarming of Network problems and Security Alerts into your Monitoring and Control Systems.

- SNTP for synchronizing the switch's internal clock
- Event Logs for a historical record of events occurring on the network

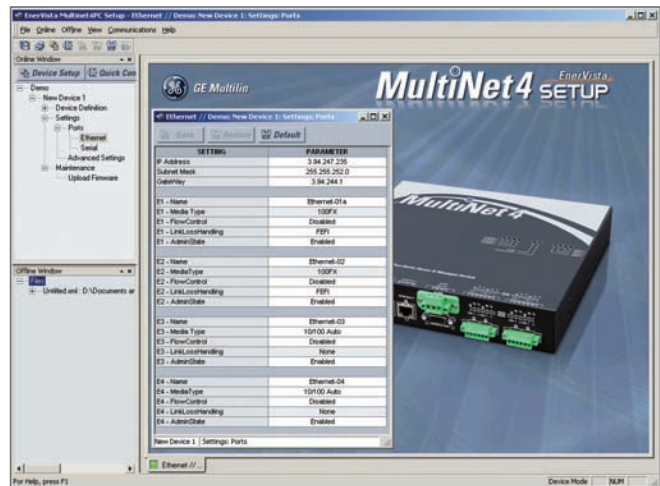
Quick and Easy Setup

MultiNet4 is supported by GE Multilin's PC Setup Application, a Windows-based software program for installing and configuring the communication drivers that allows complete configuration and setup with a few mouse-clicks. MultiNet4 uses non-volatile flash memory for firmware storage. This allows future product upgrades to be loaded with ease.

Made for Industrial and Utility Environments

MultiNet4 was designed for industrial and utility applications. Unlike traditional communication devices, MultiNet4 is industrially hardened to withstand the harshest environmental conditions.

- Internal DC and AC Power supply
- DIN rail Mounting
- Transients Protection (IEC and IEEE standards)

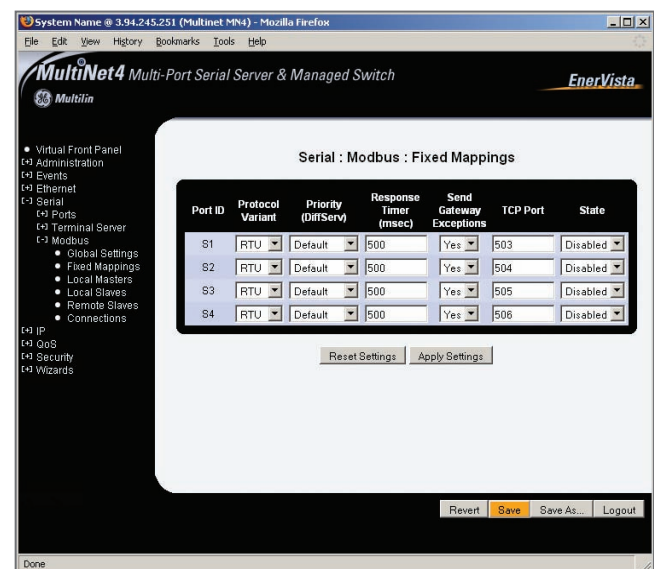
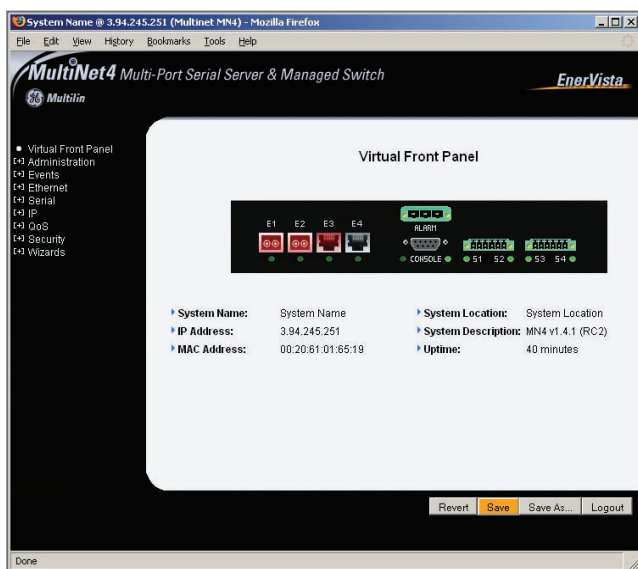


Quick and Easy Setup with EnerVista

Compatible with All GE Multilin IEDs

MultiNet4 provides a simple way to add Ethernet communications to your existing devices, and its convenient size can be accommodated easily in any panel. MultiNet4 can be used with any GE Multilin or any other standard ModBus device, including:

- PQM Meters/PQMII – Meters
- M Series
- SR Series
- DDS



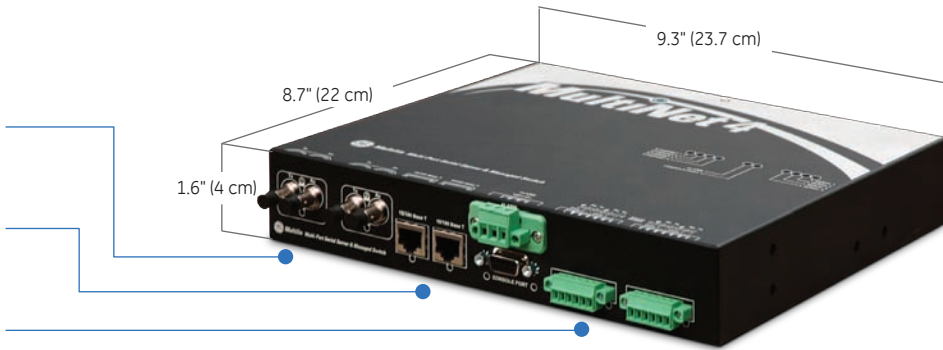
EnerVista Provides User-Friendly Configuration and Network Monitoring

Port Configuration

Supports up to 2x 100 Mbit LC/SC/ST Fiber Ports

Supports up to 4x 10/100 Mbit Copper Ethernet Ports

4 independently configurable and discrete RS-485/RS-232 Serial Ports



Specifications

USER INTERFACES

Ethernet
Version 2.0/IEEE 802.3
10/100BaseT: RJ45 connection
10/100BaseF: multi-mode or single-mode, fiber optic with ST, SC, or LC connectors
ModBus® TCP/IP

RS485 ports
RS485/RS232 2-wire, half duplex, isolated
Baud Rate: 600 bps to 115 Kbps
Protocol: ModBus® RTU

Installation
Configuration screen through Telnet Interface
Configuration through enerVista setup software
Configuration via Web Management Interface

MECHANICAL

Mounting: DIN-rail (35 mm) Flush mount brackets
Material: Metal enclosure

Dimensions:
Shipping box:
Ship weight:

ENVIRONMENTAL

Humidity: 95% non-condensing
Operating Temp.: -40°C, 16 hours (60068-2-1)
85°C, 16 hours (60068-2-2)
-40 to 85°C

POWER SUPPLY

DC power: 90 to 250 VDC (HI) or 24 to 48 VDC (LO)
AC power: 90 to 250 VAC 50/60 Hz

APPROVALS

ISO: Manufactured to an ISO9001 registered program
UL: Listed for US and Canada under E83849 - Vol. 1 Sec.10.
CE: EMC/EN 50082-2
Safety: IEC 1010-1

TYPE TESTS

Conditions: IEC60255-6
ESD: IEC60255-22-2
IEEE C37.90.3
Surge Immunity: IEC 60255-22-5
Fast Transient: IEC 60255-22-4
IEEE C37.90.1
IEC 61850-3
Oscillatory: IEIE C37.90.1
IEC 60255-22-1
IEC 60255-5

Dielectric Strength:

TYPE TESTS (CONTINUED)

Insulation Resistance: IEC 60255-5
Impulse Voltage: IEC 60255-5
Power Fr. Magnetic Field: IEC 61000-4-8
Pulse Magnetic Field: IEC 61000-4-9
Voltage Dip/ Interruption: IEC 61000-4-11
IEC 61850-3
RF cond. & radiated emission: IEC 60255-25
IEC 61850-3
RF Conducted Immunity: IEC 60255-22-6
IEC 61000-4-6
IEC 61850-3
RF Radiated Immunity: IEC 60255-22-3
IEC 61000-4-3
IEC 61850-3
IEEE C37.90.2

TYPE TESTS (CONTINUED)

Digital Port. Tel. IEC 50204
Immunity:
Temperature:
Cold: IEC 60068-2-1
Hot: IEC 60068-2-2
Relative humidity: IEC 60068-2-30
Sinusoidal Vibration: IEC 255-21-1
Ingress Protection: IEC 60529
Electrostatic Discharge IEC61000-4-3
Surge Immunity IEC61850-3
IEC61000-4-5
IEC61850-3
Damped Magnetic Immunity IEC61000-4-10
Damped Oscillatory Burst IEC61850-3
IEC61000-4-12
Power Supply Ripple IEC61850-3
IEC61000-4-17
IEC61850-3
Voltage Dips & Interrupts IEC61000-4-29
Non-destructive transient IEC61850-3
Power Transients: NEMA TS2
Low Repetition High Repetition NEMA TS2 2.1.6.1
Transient I/O NEMA TS2 2.1.7.1
Terminals
Humidity NEMA TS2 2.1.5
Shock NEMA TS2 2.2.9
Operating Voltage NEMA TS2 2.1.2
Operating Frequency NEMA TS2 2.1.3
Vibration MIL-STD-167-1

Ordering

MultiNet4		-	**	-	XX	-	**	-	X
Base Unit			HI						MultiNet4 Chassis with Universal 90-250VDC / 90-250 VAC Power Supply
			LO						MultiNet4 Chassis with 24-48 VDC Power Supply
Ethernet Module							A1		2x 100 Mb ST mm Fiber
							A2		2x 100 Mb ST sm Fiber 15km
							A3		2x 100 Mb ST sm Fiber 30km
							A4		2 x 100 Mb ST sm Fiber 60km
							A5		2x 100MB SC mm Fiber
							A6		2x 100MB SC sm Fiber 15km
							A7		2x 100MB SC sm Fiber 30km
							A8		2x 100MB SC sm Fiber 60km
							A9		2x 100MB LC mm Fiber
							AA		2x 100MB LC sm Fiber 15km
							AB		2x 100MB LC sm Fiber 40km
							AD		2x 10/100 RJ45 Copper

Accessories for the MultiNet4

- DIN Rail Mounting Accessories
- 19" Rack & Panel Mount Bracket Accessories
- Reverse 19" Rack Mount Bracket Accessories

View Accessories catalog at www.gemds.com

Visit www.GEMultilin.com/MultiNet4 to:



- Download the instruction manual
- Review applications notes and support documents
- Buy a MultiNet4™ online

MultiNet™

Serial To Ethernet Converter



Ethernet communications made simple for serial devices

The MultiNet™ is an industrially-hardened protocol converter that provides access for ModBus RTU devices onto a TCP/IP Ethernet network. Designed to meet the unique networking and environmental requirements of the Protection & Control industry, MultiNet devices ensure continuous connection with and control of serial devices through your communications network. The MultiNet family of devices are designed and built to meet the needs of the utility industry, and are tested to the same environment and conditions as all GE Multilin devices to deliver a solution that maximizes the availability of your critical infrastructure.

Key Benefits

- Converts Modbus RTU over RS485 into Modbus TCP/IP over Ethernet
- Raw Socket serial encapsulation for other serial protocols
- Supports both 10BaseT and 10BaseF fiber connections
- Connect up to 32 RS485 serial devices to an Ethernet network
- Modbus TCP/IP provides multiple SCADA masters allowing simultaneous communications to the same IED
- Flexible mounting options allow retrofit to existing devices
- Industrial hardened for utility and industrial applications
- Simple "plug & play" device setup with EnerVista™ software

Application

- PQM / PQM II - Power Quality Meter
- SR Family IEDs
- M Family IEDs
- ALPS - Advanced Line Protection System
- DDS Family IEDs
- Other Modbus RTU compatible devices
- Includes EnerVista™ software - an industry-leading suite of software tools

Industrially Hardened

- Temperature range of -20C to 70C
- Internal DC and AC Power supply
- DIN rail Mounting
- Transients Protection (IEC and IEEE standards)

Application Flexibility

- Plug-and-play operation in many cases
- Simple and fast configuration with a few clicks using MultiNet setup software
- Supports both copper and fiber Ethernet connectivity
- Flexible mounting options allow retrofit to existing devices

Network Extension

- Support for multiple SCADA masters allows simultaneous communications to the same device
- Includes EnerVista™ software's industry-leading suite of software tools to simplify working with GE Multilin devices



One Simple Communications Solution

MultiNet is a communications module that provides serial devices with communications over Ethernet, allowing connection to fiber optic LAN and WAN network systems. MultiNet has the capability to connect up to 32 serial devices eliminating complex wiring and additional communications converters, and providing a streamlined and economical Ethernet hub. Unlike most communications converters that are designed for commercial use, MultiNet is environmentally hardened to withstand severe utility and industrial conditions.

- Converts Modbus RTU over RS485 into Modbus TCP/IP over Ethernet
- Raw Socket serial encapsulation for other serial protocols
- Supports both 10BaseT and 10BaseF fiber connections
- Connect up to 32 RS485 serial devices
- Modbus TCP/IP provides multiple SCADA masters allowing simultaneous communications to the same IED
- Flexible mounting options allow retrofit to existing devices
- Simple “plug & play” device setup with EnerVista™ software

Easily Add Ethernet to ModBus Devices

MultiNet gives you the ability to connect ModBus serial devices to new or existing Ethernet networks. It has a 10BaseF fiber optic interface that provides high EMI/RFI immunity and inherent electrical isolation

over long cable runs. MultiNet setup is simple, with a Windows-based software program for installing and configuring the communication drivers.

MultiNet is Compatible with GE Multilin IEDs

MultiNet provides a simple way to add Ethernet communications to your existing devices, and its convenient size can be accommodated easily in any panel. MultiNet can be used with any GE Multilin ModBus IED including:

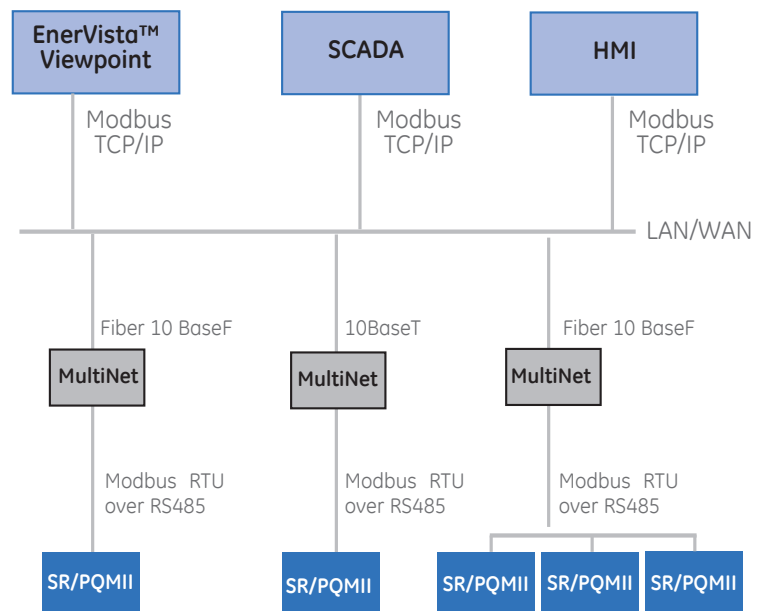
- PQM/PQMII - Power Quality Meter
- SR Family IEDs
- M Family IEDs
- ALPS - Advanced Line Protection System
- DDS Family IEDs

Industrial and Utility Environments

MultiNet is designed for industrial and utility applications. Unlike traditional communication devices, MultiNet is industrial hardened to withstand the harshest environmental conditions.

- Temperature range of -20°C to 70°C
- Internal DC and AC Power supply
- DIN rail Mounting
- Transients Protection (IEC and IEEE)

Typical Configurations



MultiNet can connect GE Multilin RS485 devices to Modbus TCP/IP masters over a LAN/WAN

Mounting



Rail Mounted



Example of MultiNet rail mounted in Switch Gear

Specifications

APPLICATIONS

Converts Modbus® RTU in Modbus® TCP/IP over Ethernet for up to 32 devices on a RS485 network. Provides a 10BaseT or 10BaseF Modbus® TCP/IP connection

USER INTERFACES

Ethernet: Version 2.0/IEEE 802.3
10BaseT: RJ45 connection
10BaseF: 820 nm, multi-mode, fiber-optic with ST connector
Protocol: ModBus® TCP/IP

RS485 ports: RS485 2-wire, half duplex, isolated
Baud Rate: 300 bps to 115.2 Kbps
Protocol: ModBus® RTU

Installation: Configuration through EnerVista setup software

MECHANICAL

Mounting: DIN-rail (35 mm) Flush mount brackets
Material: Metal enclosure
Dimensions: 6.6" x 3.98" x 1.46"
Shipping box: 12.9" x 9" x 3.25"
Ship weight: 2 lbs.

APPROVALS

ISO: Manufactured to an ISO9001 registered program
UL: Listed for US and Canada under E83849 - Vol. 1 Sec.10.
FCC: PART 15

POWER SUPPLY

DC power: 90 to 300 VDC
AC power: 90 to 264 VAC 50/60 Hz

ENVIRONMENTAL

Humidity: 95% non-condensing
Operating Temperature: -20°C to 70°C
Storage Temperature: -40 to 85°C (-40 to 185°F)
IP rating: IP 40

TYPE TESTS

EMC Test Levels: EN 50263
Test Conditions: IEC60255-6
ESD: IEC60255-22-2 (IEC 61000-4-2)
IEEE/ANSI C37.90.3

Surge Immunity: *IEC 60255-22-5(IEC 61000-4-5)
IEC 60255-22-4(IEC 61000-4-4)
IEEE/ANSI C37.90.1

Fast Transient: IEC 60255-22-1
IEEE/ANSI C37.90.1
*IEC 60255-22-1

Oscillatory: *IEC 60255-22-1

Dielectric Strength: IEC 60255-5

Insulation Resistance: EC 60255-5

Impulse Voltage: EC 60255-5

Power Fr. Magnetic Field: IEC 61000-4-8

TYPE TESTS

Pulse Magnetic Field: IEC 61000-4-9

Voltage Dip/ Interruption: IEC 61000-4-11

RF cond. & radiated emission: IEC 60255-25

RF Conducted Immunity: IEC 60255-22-6
(IEC 61000-4-6)

RF Radiated Immunity: *IEC 60255-22-3 (IEC 61000-4-3)
IEEE/ANSI C37.90.2

Digital Port. Tel. Immunity: IEC 50204

Temperature: (Cold) IEC 60068-2-1,
(Hot) IEC 60068-2-2

Relative humidity: IEC 60068-2-30

Ingress Protection: IEC 60529

Mechanical Stress: 2 G
*RJ-45 not supported

Ordering

MultiNet	*	Description
MultiNet	*	Modbus RTU to Modbus TCP/IP converter with RS485 Comm.RS232 comm port
	FE	10BaseT ethernet port and 10BaseF fiber port

Visit www.GEMultilin.com/MultiNet to:



- Watch MultiNet installation video
- Download the instruction manual
- Review applications notes and support documents
- Buy a MultiNet online

Media & Protocol Converters

MC-E Series MC-E10, MC-E100, MC-E1000 Ethernet Copper-to-Fiber Converters



The MultiLink MC-E10, MC-E100, and MC-E1000 are a family of environmentally-hardened Ethernet Fiber media converters that include an integrated 2-port copper switch for device access. With options for a wide variety of AC and DC power supplies, as well as the ability to configure the fibre port type and speed, MultiLink Converters provide a flexible, robust, plug-and-play solution for extending your Ethernet network.

Features

- Built-in two copper port unmanaged switch: uplink 2 devices using one link
- Options for 10Mbps, 100Mbps, and 1000Mbps to meet any networking requirement
- RoHS-compliant options available
- Conformal Coating option for Harsh Chemical Environments
- Long-distance fiber options for extension to remote sites

Models

- MC-E10 - 10/100 Mbps Copper to 10Mbps Fiber
- MC-E100 - 10/100 Mbps Copper to 100Mbps Fiber
- MC-E1000 - 10/100/1000 Mbps Copper to 1000Mbps Fiber

Specifications

- -40°C to +75°C operating temperature
- UL/CE Listed
- Meets IEC 61850 specifications

F485 Isolated RS232 to RS485 to Fiber Optic Converter



- Versatile, simple design in a self-contained unit
- Simplifies communications between IEDs, computers and other equipment
- Direct or modem communications
- Electrically isolated for reliable communications in noisy environments
- Up to 57,600 bps communication rate
- Operates with multimode fiber optic cables
- 120 or 220 VAC adapter included
- Additional power supply terminals accept external 9 VAC/VDC source
- Two mounting configurations
- Internal switches for selecting signal conversion type

USB2Serial USB to Serial Cable Converter



- RS-232C standard compliant
- Powered by your computer's USB bus
- DB 9 male connector

Contact Us

Worldwide Sales, Service & Support



Digital Energy Online Store

GE Digital Energy Online Store

we protect and connect critical equipment ensuring safe reliable power

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About Us
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Configure, quote and order with ease

Flexible Product Configuration

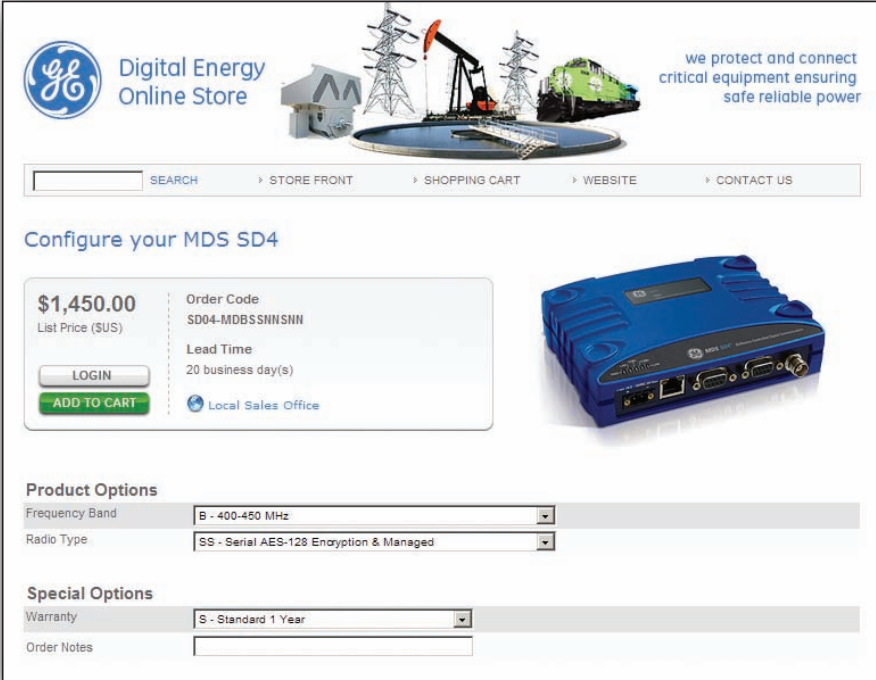
The Digital Energy Online Store allows you to choose from over 300 Digital Energy products, available for order 24 hours a day, 7 days a week. Easy to use configurators provide visibility to all product options, allowing you to configure products for your specific application requirements.

Quotes and Orders based on Preferred Pricing

Visit the Digital Energy online store to set up an account and take advantage of preferred pricing. With an account, create accurate quotes with your actual pricing and product lead times. Conveniently select from a list of pre-qualified product accessories, recommended for use with our products.

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Save partially completed orders before submitting, so you can start an order one day, and submit it the next. Track the status of your purchase from the date you place the order, to the time it arrives at your door, and view your past online purchases in the order history.



GE Digital Energy Online Store we protect and connect critical equipment ensuring safe reliable power

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Configure your MDS SD4

\$1,450.00
List Price (SUS)

Order Code: SD04-MDBS SNNNSNN

Lead Time: 20 business day(s)

Local Sales Office

Product Options

Frequency Band	B - 400-450 MHz
Radio Type	SS - Serial AES-128 Encryption & Managed

Special Options

Warranty	S - Standard 1 Year
Order Notes	


www.GEDigitalEnergy.com/OnlineStore

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