Complete Protection, Control, Metering and Communication Solutions

From the lighting of the first commercial light bulb on Pearl Street in New York City in 1882, GE people worldwide have been dedicated to turning imaginative ideas into leading products and services that help solve the world's toughest problems including those associated with protection, control, metering and communications. In the ensuing years, GE has been admired for its performance and imaginative spirit. The businesses and products that we invent and build fuel the global economy and improve people's lives.

Over the years, GE has pioneered the development of numerous protection, control and communications technologies. From the introduction of the Induction Disk Time Overcurrent Protection Relay at the turn of the century, to the more recent introduction of the first complete family of protection relays with the IEC61850 communications standard implemented across all applications . . . GE has lead the way in technical innovation for the protection and communications industry.

The GE Multilin Family

The protection and control of the power system has evolved into a complex system with interactions among its many components. In order to meet customer needs in this arena, GE Multilin has evolved into a one-stop location for all your Protection, Control, Monitoring, Measurement, Communication, and Engineering needs, covering applications for generation, transmission, distribution, motors and communications.

As part of the GE Consumer & Industrial business, GE Multilin provides a broad range of products and solutions as summarized:

- Protection & Control - provide multi-function digital and electromechanical protection and control relays with associated "single package" EnerVista management software.
- Lentronics Multiplexers - providing utility hardened SONET and SDH multiplexers, associated interfaces and "single package" VistaNET management software.
- Instrument Transformers Incorporated (ITI) - CT's, VT's, control transformers, and auxiliary transformers.
- EPM/PQM Meters - providing a family of digital meters for industrial, utility and commercial sectors that cover the spectrum of applications from simple power metering, to individual tenant metering, to power quality analysis.

More recently GE Multilin expanded its product offering even further with the addition of a number of product lines for Power Quality applications including GE Zenith transfer switches, UPS products and services, transient and surge supression devices, and Instrumentation Services. In addition, GE Multilin offers a number of other complimentary services and products including a range of Accessory Products (Ethernet switches, E/M switches, terminal blocks, indicator lights, etc), Automation Solutions, Packaged Solutions, Real Time Digital Simulator Services, Protection & Communications Consulting, Training, and 24/7 Product Support - all the pieces needed to address your protection, control, metering and communications needs.

Universal Relay Product Family

The most versatile and unique of the Multilin protection families is the Universal Relay or the UR. The UR is a family of products that uses a single high technology platform for applications in Generation, Bus, Line Distance, Line Differential, Line Phase Comparison, Transformer, Feeder, Motor, Breaker, Controller and Network protection. The UR's modular design enables the platform to be kept technologically up to date through its ability to address parts obsolescence by module re-design, and to extend the UR's capabilities through the addition of new modules and functions as required. The modular software enables rapid, stable deployment of new features and the common faceplate and interface software facilitates user familiarity and minimizes user training.

The UR design has enabled several "unique" features and applications in protection, control, monitoring, and communications such as:

- Patented Dynamic Current Differential (L90)
- "Best in Class" Distance protection on high SIR lines (D60)
- Complete Generator protection down to 3Hz (G60)
- Comprehensive Bus protection w/ saturation detection (B90)
- First embedded Ethernet based UCA Communication implementation
  - Relay to Relay communication through GOOSE* communication
  - Numerous applications in service
  - First "Wide Area" GOOSE* - operating over 150 km or 100 miles in 8ms
- First "complete family" of IEC61850 communication enabled devices
- Reliable relay-to-multiple-relay serial communication through a ring architecture
  - High-speed (as little as 1.25 ms device to device)
  - In service on numerous remedial action schemes
- High-impedance (HiZ) fault detection (F60)
  - Provides additional property and personnel safety
- Enhanced Transformer protection dependability and security
  - Exact CT ratio/configuration matching
  - Improved restraint through 2nd and 5th harmonic angle analysis

The UR's modular design has allowed functions to be developed for special applications. These are generally available across the entire range of applications. Several of these special functions include:

- High-speed/Universal Voltage Digital Inputs (Dt = 0.5msec)
- Solid-State MOSFET based Control Output module
  - Make 30 A DC / Break 10A DC
- Analog I/O modules
  - Process monitoring & alarming
  - SCADA interface
  - Closed loop control
- Redundant power supply option

The UR's setup software is a best in class application that includes:

- First setup program that is used for all relays across the entire platform
- Allows you to view the status of control logic in real time

MODULAR DESIGN
Facilitates upgrades and replacement of units

* Generic Object Oriented Substation Event

SR Product Family

The SR Family is a multi-functional line of protection relays covering motor, feeder, transformer, and generator protection applications. The SR line evolved from one of Multilin's core competencies - motor protection. With over 100,000 SR protection devices in service, the name Multilin has become synonymous with motor protection and continued innovation.

The unique drawout construction of the SR relay family was a major innovation in relay design when introduced, and it continues to be a highly specified feature. The drawout construction allows the electronics package to be easily removed from the front of the relay without disturbing the termination wiring. When removed, the CT secondaries are automatically connected to prevent dangerous high voltages from open CTs.

The SR relays were also the earliest relay devices to standardize on Modbus communication. This strategy facilitated the integration of Multilin devices not only into GE systems, but into any Modbus-based Digital Control System. Improvements in the SR product line continue today with the recent release of built-in Modbus/Ethernet communications - the only industrial product family in the world to have this feature. By providing an economical system for protection, control, monitoring and metering, and both local and remote user interfaces in one assembly, the SR relays effectively eliminate the need for expensive discrete components.

650 Product Family

In the world of the double-bus, switched feeder arrangements, the protection and control of each bay as well as the inter-locking of the overall control of the station must be addressed. The need is met with the F650 Bay Controller. The F650 Bay Controller provides cost effective high speed protection, control and monitoring for bay applications, including overcurrent protection, directional elements, voltage, frequency, breaker failure, autoreclosure, synchrocheck, and more. In addition, a front panel LCD display is available that is user-configurable as a mimic of the bay, and can facilitate user interaction. The flexibility of the architecture enables its use in a wide array of application domains. The environmental design that complies with the most relevant international standards gives the F650 the status of a "World" class relay. All the elements required for each application have been highly integrated resulting in a low parts count and subsequently, a high degree of reliability. The F650 is also an early implementer of the new IEC61850 communication protocol.

More recently, the 650 family has been further expanded with the introduction of the W650 for wind generation applications and the G650 for other distributed generation and control applications. The recently introduced CANBus I/O option also provides the product with a unique remote I/O capability.

M Product Family

The M Family offers an economical, small package solution for basic protection functions. Family members include feeder, small generator, voltage, frequency, power flow, and sync check. All family members include basic functionality such as programmable I/O, programmable logic, events, oscillography, keypad, display, and communications. Each product within the M Family may be used as a stand-alone unit or as a component of an automated substation or industrial protection and control system.

Metering Family

From basic metering to high end transient capture and flicker detection, GE Multilin offers a full range of commercial, industrial and utility grade meters that compliments the line of protective relays. Building on the success of the PQM and PQMII meters, the EPM family of meters is offered in four basic categories to meet the specific application needs -Submetering, Power Metering, Power Quality Metering and Advanced Power Quality Metering Systems.

EnerVista™ Software

The EnerVista Software suite simplifies the task of working with GE Mutlilin devices including protection relays. This impacts on the productivity and efficiency of the maintenance personnel right through to the facility manager. These tools include:

- EnerVista Launchpad - a program that provides a full set of powerful device setup and support tools for GE Multilin devices. The package automatically downloads any new software, firmware, brochures, and instructions manuals so the latest information is always right at your fingertips.
- EnerVista Viewpoint - Consisting of Viewpoint Engineer, Viewpoint Maintenance and Viewpoint Monitoring, it provides a family of software packages that simplify each step of using GE Mutlilin devices including protection and control logic, commissioning of relays, real time monitoring, data collection, and trouble-shooting of your relays or system. Viewpoint Engineer in particular is a very powerful logic configuration and monitoring tool. With the package, the user can drag and drop logic symbols onto the design page and generate logic functions as needed. Once created, the EnerVista Engineer can be used to monitor the instantaneous state of the logic sequence - enabling the design engineer to easily analyze and debug logic.
- EnerVista Integrator - is a client/server software package that communicates to relays in a facility and serves up the collected information via the standard interfaces of Dynamic Data Exchange (DDE) or OLE for Process Control (OPC). The interfaces allow for seamless integration into other plant applications, Digital Control Systems (DCS), Databases, and viewers.
- EnerVista Aggregator - a software package that works in conjunction with EPM/PQM meters to monitor, log and profile the energy consumption for multiple locations in an industrial, commercial or apartment complex. It in turn calculates and allocates the cost of energy to the tenants.

Instrument Transformers

GE Multilin offers a complete range of both low and medium voltage instrument transformers up to 34.5KV. GE Multilin can work with you to match your instrument transformer needs with your specific relay application. In addition to instrument transformers, GE Multilin - also offers a complete set of switchboard auxiliary devices, including ground fault relays, voltage relays, power monitors, control switches, switchgear, and motor control equipment. All CTs use the best quality materials and the most advanced designs to achieve the highest accuracy and are tested in accordance with industry standards such as IEEE, IEC, BS, CSA and JIS.

SONET and SDH Communications

The Lentronics JungleMux and TN1U/TN1Ue products are the industry leaders in high-speed, robust, utility hardened communications. Lentronics multiplexers are designed to be used in power utilities, transportation, oil & gas, water and general industrial applications. This powerful family of fiber optic multiplexers has a modular design for ease of maintenance, configuration flexibility and expandibility.

The JungleMux is a SONET based multiplexer that provides redundant communications through its ring architecture and is able to "heal" itself in a world-class time of less than 3ms. The JungleMux can operate a base speed of OC-1 (carrying 672 voice channels) and be field-upgraded to OC-12 which is capable of carrying 8064 simultaneous voice conversations. Although other SONET multiplexers exist in the market, what is unique about the JungleMux is its ability to tightly integrate its local communications interfaces through plug-in modules. Plug-in modules are available to provide publisher/ subscriber full motion/full color video with motion detection, voice, data (RS-232, G.703, RS-422, IEEE C37.94), 10/100MB Ethernet, T1/E1, end-to-end I/O, FDM channel interface, teleprotection interfaces, and DS3. Monitoring a complete JungleMux SONET system can be accomplished through the Lentronics VistaNET software. VistaNET operates client-server and manages the complete solution from optical transmission to an individual serial channel interface. This degree of monitoring is possible due to the tight integration of the SONET communications and the individual channel cards.

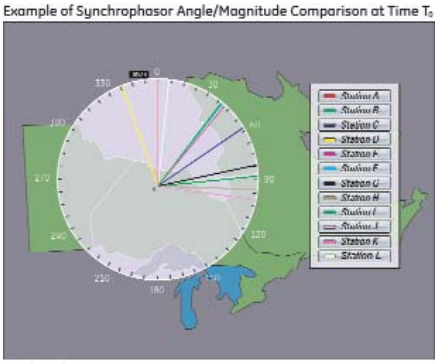
The TN1U and TN1Ue products respectively follow the SDH and Enhanced SDH multiplexer standards. These products likewise leverage many of the same unique features as the JungleMux, such as modularity, allowing easy expansion and upgrade in the field.

The JungleMux, TN1U and TN1Ue can also be ideally matched with the L90 Universal Relay to provide a high speed and reliable communication system for direct transfer trips and as a pilot communications channel.

Synchrophasors

A new feature coming to the UR in 2005 will be the ability to calculate Synchronized Phasors or Synchrophasors. A synchrophasor is a phasor that has been time tagged to UTC time as provided by a GPS clock. Synchrophasors, measured at different locations around the electric power grid, provide a "snapshot" of the instantaneous state of the power system. What is different about synchrophasors compared with existing SCADA measurements is the degree of accuracy and performance in the measurement. Whereas SCADA typically responds on the order of 1 to 2 seconds, a synchrophasor responds on the order of 1/60 of a second - over 120 time faster than existing SCADA systems. This faster response time enables synchrophasors to be used to view and eventually control the dynamics of the electric power grid.

Example of Synchrophasor Angle/Magnitude Comparison at Time T_0



Angle Reference is Station A

In order to meet the stringent requirements specified in the IEEE Synchrophasor standard (IEEE C37.118), GE Multilin is introducing a new computational algorithm (patent pending). This new algorithm minimizes the effects of harmonics and sub 60 Hz interfering signals and provides a more accurate phasor measurement over a wide range of system operating frequencies using either fixed or frequency tracked data sampling.

Substation Automation Integration

Substation Automation is the ability of various devices in a substation to communicate with one another and share information, enabling functions such as distributed SCADA, integrated Sequence Of Events, dynamic 1-line view, alarm monitoring/display, file transfer/automatic oscillography collection, remote relay settings, relay firmware upgrades, high-speed relay-to-relay communication, and any other function enabled through communications. These functions can be implemented both locally (in the substation) and/or to a remote workstation through a Human Machine Interface or HMI. The HMI software enables the user to implement and execute the functions outlined above in an easy-to-use format.

The implementation of Substation Automation is optimized when the communicating devices can all speak the same language or protocol over a communication network. The protocol clarifies issues such as definition of the information to be exchanged, the services to exchange the defined information, end-to-end delivery guarantee, data networking, and the physical interface into the real world. There are several popular protocols in use in the utility substation today, namely, Modbus, DNP, IEC870-5, and IEC61850. The Universal Relay is unique in the relay world as it incorporates all the protocols into one platform with embedded serial and Ethernet communications, facilitating a very simplified and flat communications architecture. At any point in time, any of the above protocols can be actively communicating in the Universal Relay.

The New IEC 61850 Protocol

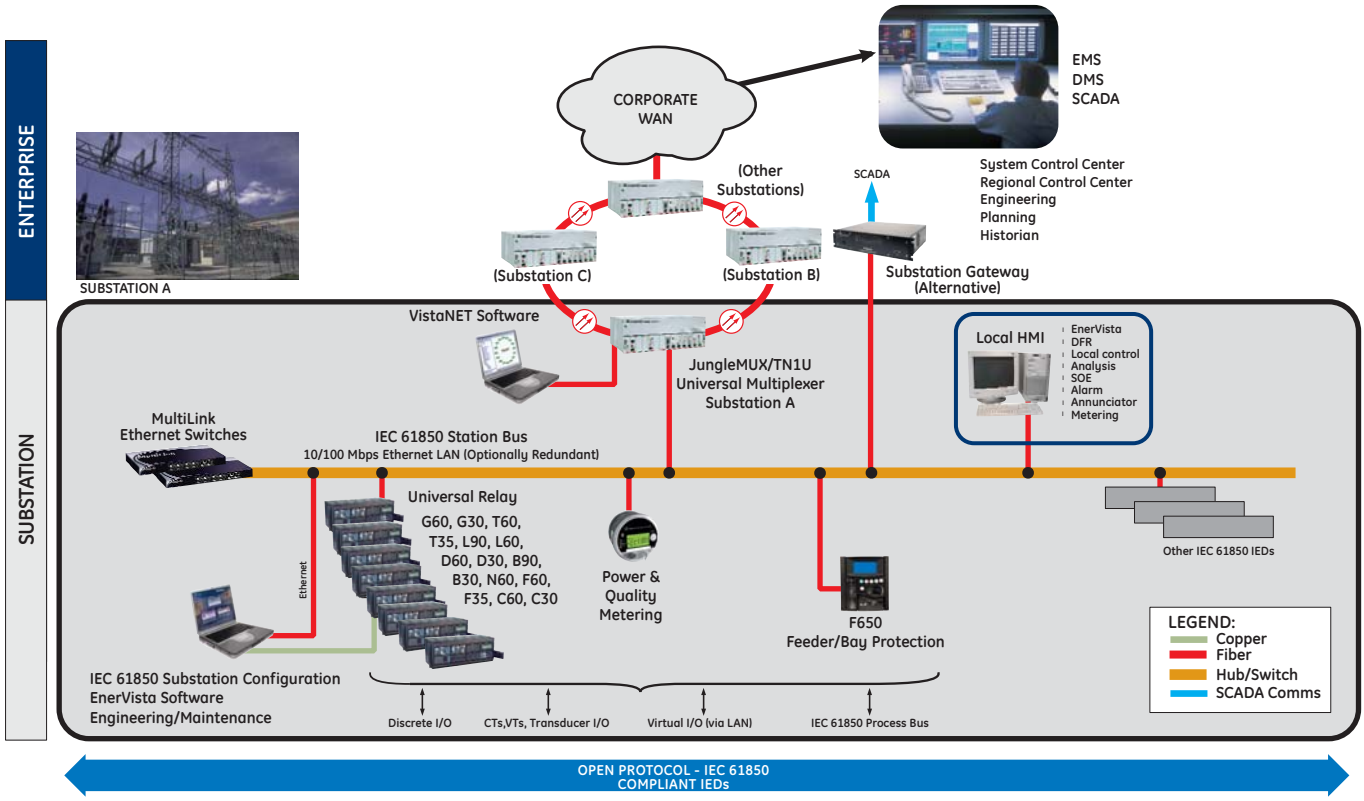
The next generation of substation automation systems are being based on the IEC61850 standard on "Communication Networks and Systems in Substations". In this standard, the physical communication interface is specified as Ethernet. Ethernet can be operated today at either 10 or 100MB rates over copper wires or fiber optic cable with fiber being highly recommended. For the Network and Transport functions of the IEC61850 protocol, the Internet protocols of Transmission Control Protocol (TCP) and the Internet Protocol (IP) are required. The application layer functions are implemented in the Manufacturing Messaging Specification (MMS) Protocol, and the information to be communicated is defined in standardized object models. A special feature in IEC61850 is the ability to implement high-speed (<4ms) relay-to-relay communication. This communication function is implemented via the Generic Object Oriented Substation Event or GOOSE*. The IEC GOOSE* is a user-configurable dataset that can transport any data object that is implemented in the relay to multiple other devices through an Ethernet Multicast format. Given that data is received, the relay must now be able to implement user-programmable logic to apply the communicated information.

The Universal Relay is uniquely positioned to take advantage of the IEC61850 standard for simplified substation automation and integration. The common platform design and embedded high speed Ethernet communications capability allowed the Universal Relay to be the first product on the market to offer IEC61850 across all applications.

IEC

* Generic Object Oriented Substation Event

IEC 61850 Substation Architecture



Integration, Consulting, and Test Services

In today's fast paced world, there is often not enough time to do it yourself. To meet customer's "need for speed", GE offers a complete range of consulting services in system studies, fault analysis, relay scheme design, etc. After the system studies, GE will engineer, design, build, install, test, and commission your protection, control and communication system. Rack solutions can be fabricated in Markham and complete packaged turnkey solutions, including "drop-in" control rooms, are available.

Training

At GE Multilin's Advanced Training Centers, we offer a broad selection of courses from power system fundamentals to in-depth advanced applications to courses on every product sold by GE Multilin, including electromechanical relays. Courses are typically offered at GE Multilin's training facilities in Toronto, Canada, and Bilbao, Spain. In addition to the above locations, on-site courses can be arranged that are tailored to a customer's specific needs.

In addition to instructor-taught classes, GE Multilin offers interactive learning CDs that guide the student through fundamentals such as symmetrical components, zones of protection, back-up protection, as well as relay-specific education. The interactive CD is a cost effective alternative for basic training. GE Multilin courses are accredited by the International Association for Continuing Education and Training (IACET) and offer Continuing Education Units (CEU) to participants who successfully complete the attended course. With the most knowledgeable teachers in the field, GE Multilin training centers are sure to offer the most comprehensive understanding of our products and applications to meet your solution needs.

The GE Multilin Advantage

24/7 Customer Support

When you have a problem that's preventing a startup or keeping the lights off, you need an answer NOW! To meet this need, GE Multilin has established a multi-phased approach to customer service. The first line of information is the GE Multilin web site. Going to www.GEMultilin.com takes you to the home page where you can search the support tab for instruction manuals, drawings, FAQs, software upgrades, etc. GE Multilin also provides support through our ISO9000 registered service center where your call is routed to the right person with the requested knowledge. When you absolutely-positively have to have an answer right now, you can call our 24/7 support line at: 1-800-547-8629 and speak to a live person when you need it. GE Multilin is devoted to continuously providing the most comprehensive support possible to our valued customer.

Customer Focused!

Today, GE Multilin stands as the pre-eminent leader in protection, control, metering, and communication technology solutions. GE has lead in the past, is leading today's developments, and is committed to continued innovation in the industry through the 21st century and beyond.

" What we can Imagine, we can make Happen"