

With our global brands of Multilin, MDS, Lentrionics and ITI, GE Digital Energy™ designs, manufactures, distributes and supports a full range of protection, control, metering, telecommunications and power sensing equipment, software and services for industrial, utility and transportation customers.

The Multilin line of protection and control products are based on industry leading technologies essential for the reliable operation of mission-critical applications including generation, transmission, distribution, metering, motors, and communications. Multilin protection relays and systems are complemented with a complete line of substation hardened multiplexers, Ethernet switch network devices, and wireless radios for utility teleprotection, industrial, transit, railways, and highway traffic management systems. Every aspect of device configuration and monitoring is made simple through the powerful EnerVista® suite of software tools. All relays are programmed and managed through EnerVista® Software.

GE Digital Energy™'s ITI brand of power sensing products include a full line of current, voltage and potential transformers, switches, indicating lights and other protection relay accessories.

Complimenting our products, we also offer a complete range of consulting services, customized panel solutions and fully integrated energy management systems for effective energy savings.

For more information on these products, please visit our website at [www.GEMultilin.com](http://www.GEMultilin.com) or contact your local sales representative. GE Digital Energy™ provides worldwide customer support 24/7 for its products and systems through its Customer Support Centers.

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### Protection & Control

#### Protection & Control Product Families .....18-3

UR Family Protection System .....	18-4
SR Enhanced Drawout Protection System .....	18-16
650 Mid-range Protection System .....	18-17
MII Modular Protection System .....	18-18

#### Generator Protection.....18-23

Generator Protection Selector Guide.....	18-24
G60 Medium to Large Generator Protection.....	18-25
G30 Combined Generator and Transformer Protection.....	18-27
489 Small to Medium Generator Protection.....	18-29
G650 Distributed Generator Protection.....	18-31
W650 Wind Turbine Generator Protection.....	18-33
MIIG II Small Generator Protection.....	18-35
MIW II Directional Power/Loss of Field Protection.....	18-36

#### Transformer Protection.....18-37

Transformer Protection Selector Guide .....	18-38
T60 Medium to Large Transformer Protection .....	18-39
T35 6 Winding Transformer Protection.....	18-41
745 Medium to Large Transformer Protection.....	18-43

#### Transmission Line Protection.....18-45

Transmission Protection Selector Guide .....	18-46
L90 Line Current Differential Protection .....	18-47
L60 Phase Comparison Protection .....	18-49
D90 <sup>Plus</sup> Sub-Cycle Distance Protection .....	18-51
D60 Distance Protection .....	18-53
D30 Backup Distance Protection .....	18-55

#### Bus Protection.....18-57

Bus Protection Selector Guide.....	18-58
B90 Multiple Section Busbar Protection .....	18-59
B30 Busbar Protection.....	18-61
MIB High Impedance Busbar Protection.....	18-63
HID High Impedance Auxiliary Protection Module.....	18-64

#### Distribution Feeder Protection .....18-65

Distribution Feeder Protection Selector Guide .....	18-66
F60 Feeder Protection with Hi-Z Detection.....	18-67
F35 Multiple Feeder Protection.....	18-69
750/760 Comprehensive, Draw Out Feeder Protection.....	18-71
F650 Feeder/Bay Protection .....	18-73
735/737 Three-Phase and Ground Feeder Protection .....	18-75
MIF II Economical Feeder Protection with Recloser .....	18-76
FM2 Low Voltage Feeder Protection .....	18-77
URC Feeder Recloser System.....	18-78

#### Motor Protection .....18-80

Motor Protection Selector Guide.....	18-81
M60 Medium to Large Motor Protection .....	18-82
469 Medium to Large Motor Protection .....	18-84
369 Small to Medium Motor Protection.....	18-85
269Plus Small to Medium Motor Protection .....	18-87
239 Small to Medium Motor Protection.....	18-88
MM300™ Low Voltage Motor Management.....	18-89
MM2 Low Voltage Motor Management.....	18-91
SPM Synchronous Motor Protection.....	18-93

#### Specialized Protection, Control and Recording .....18-94

C60 Breaker Monitoring and Control .....	18-95
C30 I/O Logic Controller .....	18-97
N60 Network Stability and Synchrophasor Measurement.....	18-99
C70 Capacitor Bank Protection.....	18-101
MIV II Voltage/Frequency Protection .....	18-103
MIN II Ground Protection .....	18-104
RRTD Remote RTD Metering Module for the 369.....	18-105
DDFR Distributed Digital Fault Recorder .....	18-106

#### Single Function Protection Relays.....18-108

#### Single Function Auxiliary Relays.....18-119

(Continued on page 18-2)



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

**Metering**

<b>Digital Metering.....</b>	<b>18-121</b>
Digital Metering Family Overview.....	18-122
EPM 9800 Socket Mounted Power Quality Meter.....	18-123
EPM 9000 Advanced Power Quality Meter.....	18-125
PQM II Power Quality Meter.....	18-127
EPM 6000 Revenue Class Power Meter.....	18-128
EPM 2000 Power Meter.....	18-129
EPM 4000 Multi-tenant Sub-Metering System.....	18-130
EPM 1000 Single-point Sub-Metering System.....	18-132

**Communications**

<b>Multiplexers.....</b>	<b>18-134</b>
Multiplexer Family Overview.....	18-135
JMUX SONET Multiplexer.....	18-138
JMUX T1 Multiplexer.....	18-138
TN1U SDH Multiplexer.....	18-139
TN1Ue SDH Enhanced Multiplexer.....	18-139
VistaNET® Network Management Software.....	18-140
MDS Wireless Solutions.....	18-142

**Ethernet Switches.....18-145**

Multilink Family Overview.....	18-145
ML2400 19" Rack-mounted Managed Switch.....	18-146
ML1600 9" Panel-mounted Managed Switch.....	18-147
ML600 Unmanaged Compact Switch.....	18-148

**Media & Protocol Converters.....18-149**

MultiNet® RS485 to Ethernet.....	18-150
Media & Protocol Converters.....	18-151

**Power Sensing**

**Instrument Transformers.....18-152**

Current Transformers.....	18-152
Low Voltage Potential Transformers.....	18-155
Bushing Current Transformers.....	18-156
Medium Voltage Instrument Transformers.....	18-156
Control Power Transformers.....	18-157
Current Transducers.....	18-157
IEC Rated Instrument Transformers.....	18-158

**Accessories.....18-159**

**Switches**

SB-1, SB-9, Series 95.....	18-159
SB-10, SBM, FT, RT Test Switch.....	18-160

**Test Equipment**

515, PK2, XCA, XLA.....	18-161
-------------------------	--------

**Terminal Blocks**

116B407, EB-25, EB-26, EB-27, IKU, EB-1, EB-2, EB-4.....	18-161
--	--------

**Indicator Lights**

ET-16, ET-16 LED, ET-17.....	18-161
------------------------------	--------

**Test Equipment**

RTT Desktop Test Set.....	18-162
---------------------------	--------

**Software**

**EnerVista® Suite.....18-164**

Launchpad Device Setup & Document Management.....	18-165
Viewpoint Engineer Control Logic Creator & Commissioning Toolset.....	18-168
Viewpoint Maintenance Device Health & Security Reporting.....	18-172
Viewpoint Monitoring & Data Recording.....	18-176
Integrator OPC/DDE Communications Server.....	18-186

**Value Added Services**

**Value Added Services.....18-189**

Energy Management Systems.....	18-189
Advanced Training Services.....	18-191
Consulting Services.....	18-193
Packaged Solutions.....	18-195

**Product Upgrades And Replacements**

**Product Upgrades and Replacements.....18-196**



# GE Multilin® Protection and Control Product Families

## Section 18

### UR Universal Relay Family

page 18-4

**Superior protection, control and communication for utility and industrial applications.**

The Universal Relay (UR) is a family of leading edge protection and control products built on a common modular platform. All UR products feature high performance protection, expandable I/O options, integrated monitoring and metering, high speed communications, and extensive programming and configuration capabilities.



### SR Relay Family

page 18-16

**Competitive industrial power management systems for motors, generators, transformers and feeders.**

The SR Family of protection relays represents a multi-functional line of products, with draw out capabilities. By providing protection, control, monitoring, metering, and both local and remote user interfaces in one assembly, the SR relays effectively eliminate the need for expensive discrete components.



### 650 Relay Family

page 18-17

**Advanced protection, control and monitoring system.**

The 650 family of relays incorporate a new generation of products that provides comprehensive protection, control monitoring and metering in a compact and cost effective package. The architecture is a complete solution for different applications, that complies with the most relevant international standards, including IEC61850 protocol.



### MII Modular Microprocessor Family

page 18-18

**An economical choice for digital relaying applications.**

The MII Family offers a competitive solution that combines advanced protection, monitoring, widely accepted communications standards, and flexible configuration tools for a range of protection applications.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE GE Multilin® Protection and Control UR Family

Flexibility in protection, control and communications

## Section 18

### Key Benefits

- Application flexibility - Multiple I/O options, programmable logic (FlexLogic™), modularity, customize to specific requirements
- Fewer external devices required - Multifunction device that integrates protection and control functions, programmable pushbuttons and status LEDs, and communication interfaces
- Modular construction - Common hardware, reduced stock of spare parts, plug & play modules for maintenance cost savings and simplification
- Common platform - Reduced training time and drafting costs
- Cost effective and flexible access to information - Multiple communication options and protocols
- Use high speed communications to reduce wiring and installation costs - Exchange inputs and outputs between relays to achieve relay-to-relay interaction
- Reduce system event analyzing time and cost - Sequence of event reports, oscillography, datalogging, IRIG-B time synchronization
- Long lasting life - When exposed to chemically corrosive and humid environments with optional conformal coating
- Enhanced CT/VT Diagnostics -Enhanced CT/VT module diagnostics verifying the integrity of the analog signals using an advanced algorithm ensuring reliable performance of the relay

### Applications

- Generation, transmission, distribution, motor protection, monitoring, metering & control
- Utility substation and industrial plant automation
- Digital Fault Recording and Sequence of Event Recording
- Predictive maintenance through data analysis and trending

### Features

#### Protection and Control

- Extensive protection and control capabilities
- Up to 96 digital input and 64 digital outputs
- Solid state outputs for fast tripping
- Transducer I/Os (RTD, dc mA)
- Dual power supply

#### Communications

- Networking interfaces - 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O - secure, high-speed exchange of data between URs for Direct Transfer Trip and I/O Extension applications

#### Monitoring and Metering

- Synchrophasors in select products
- Oscillography - up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5ms scan of digital inputs
- DataLogger - Up to 16 channels with user selectable sampling rate
- Fault Locator and User Programmable Fault Reports
- Breaker condition monitoring including breaker arcing current ( $I^2t$ )
- Metering - current, voltage, power, power factor, frequency, current harmonics



### Features (continued)

#### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the UR Family into new or existing monitoring and control systems





Features		ANSI	B30	B90	C30	C60	C70	D30	D60	F35	F60	G30	G60	L60	L90	M60	N60	T35	T60
Protection	Disturbance Detector						•		•		•			•	•	•	•		
	Mho Distance, Phase (No. of Zones)	21P						3	5				3	3	3				
	Mho distance, Ground or Neutral Phase (No. of Zones)	21G/N						3	5					3	3				
	Quadrilateral Distance, Phase (No. of Zones)	21P						3	5					3	3				
	Quadrilateral Distance, Ground or Neutral (No. of Zones)	21G/N						3	5					3	3				
	Permissive Pilot Logic									•					•				
	Overexcitation Protection (V/Hz)	24										•	•	•	•				•
	Synchronism Check or Synchronizing	25				•	•	•	•	•	•	•	•	•	•		•		
	Undervoltage, Phase	27P	•	•		•	•	•	•	•	•	•	•	•	•		•		•
	Undervoltage, Auxiliary	27X				•	•	•	•	•	•	•	•	•	•		•		•
	Stator Ground (3 <sup>rd</sup> Harmonic)	27TN										•	•	•	•		•		
	Sensitive Directional Power	32S				•						•	•	•	•		•		
	Loss of Excitation – Based on Reactive Power	40Q																	
	Loss of Excitation – Based on Impedance Element	40																	
	Current Unbalance	46										•	•	•	•		•		
	Broken Conductor Detection	46BC																	
	IOC, Negative Sequence	46/50					•	•	•					•	•				
	TOC, Negative Sequence	46/51					•	•	•					•	•				
	Current Directional, Negative Sequence	46/67					•	•	•			•	•	•	•				
	Reverse Phase Sequence Voltage	47																	
	Thermal Model	49														•			•
	Inadvertent/Accidental Energization	50/27										•	•						
	End of Fault Protection			•															
	Motor Mechanical Jam															•			
	Motor Start Supervision															•			
	Motor Acceleration Time															•			
	User Programmable Curves		•			•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Breaker Failure	50BF		•				Logic		Logic		•	•	•	•	•	•	Logic	Logic
	IOC, Phase	50P	•	•		•	•	•	•	•	•	•	•	•	•	•	•		
	IOC, Ground	50G	•			•	•	•	•	•	•	•	•	•	•	•	•		
	IOC, Neutral	50N	•			•	•	•	•	•	•	•	•	•	•	•	•		
	IOC, Sensitive Ground	50SG	•			•	•	•	•	•	•	•	•	•	•	•	•		
	High Impedance Fault Detection																		
	TOC, Phase	51P	•	•			•	•	•	•	•	•	•	•	•	•		•	•
	TOC, Ground	51G	•				•	•	•	•	•	•	•	•	•	•		•	•
	TOC, Neutral	51N	•				•	•	•	•	•	•	•	•	•	•		•	•
	TOC, Sensitive Ground	51SG	•				•	•	•	•	•	•	•	•	•	•		•	•
	TOC, Voltage Restrained	51V	•				•	•	•	•	•	•	•	•	•	•		•	•
	Overvoltage, Phase	59P					•	•	•	•	•	•	•	•	•	•			
	Overvoltage, Auxiliary	59A	•				•	•	•	•	•	•	•	•	•	•			
	Overvoltage, Neutral	59N					•	•	•	•	•	•	•	•	•	•			
	Negative Sequence Overvoltage	59-2					•	•	•	•	•	•	•	•	•	•			
	100% Stator Ground Protection	64TN											•						
	Current Directional, Phase	67P					•	•			•	•	•	•	•	•			•
	Current Directional, Neutral	67N					•	•			•	•	•	•	•	•			•
	Current Directional, Negative Sequence	46/67					•	•			•	•	•	•	•	•			
	Power Swing Blocking	68					•	•					•	•	•		•		
	Out-of-Step Tripping	78					•	•					•	•	•				
	AC Reclosing (No. of Shots)	79				4		4	4	4	4			4	4				
	Switch on to Fault (Line Pickup)	SOTF					•	•											
	Voltage Transformer Fuse Failure	VTFF				•	•	•	•		•	•	•	•	•	•	•		
	Current Transformer Supervision	50/74	•	•										•	•				
	Load Encroachment Logic							•	•		•			•	•				
	Underfrequency	81U								•	•	•	•				•		•
	Overfrequency	81O									•	•	•				•		•
	Anti-Islanding Protection / Frequency Rate of Change	81R									•	•	•				•		
	Lockout Functionality	86	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Bus Differential	87B	•	•															
	Line Current Differential	87L																	
	Ground Differential	87G																	
	Stator Differential	87S										•	•			•			•
	Group Differential	87T										•	•					•	•
	Line Phase Comparison	87PC												•					
	Voltage Differential						•												
	Capacitor Bank Overvoltage						•												
	Neutral Voltage Unbalance						•												
	Automatic Voltage Regulation						•												
	Time of Day Control						•												
	Instantaneous Differential	50/87	•	•														•	•
	Split Phase Protection											•	•						
	Line Current Differential Trip Logic														•				



### 100% Stator Ground

Operating quantity:	V_neutral_3rd/IV_neutral_3rd +V_zero_3rd
Pickup level:	0.000 to 0.250 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±2% of reading from 1 to 120 V
Pickup delay:	0 to 600.00 s in steps of 0.01
3rd harmonic supervision level:	0.0010 to 0.1000 pu in steps of 0.0001
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz

### Acceleration Time

Acceleration current:	1.00 to 10.00 × FLA in steps of 0.01
Acceleration time:	0.00 to 180.00 s in steps of 0.01
Operating mode:	Definite Time, Adaptive

### Accidental Energization

Operating condition:	Overcurrent
Arming condition:	Undervoltage and/or Machine Offline
Overcurrent:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading from 0.1 to 2.0 × CT rating
Undervoltage:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading 10 to 208 V
Operate Time:	< 30 ms at 1.10 × Pickup at 60 Hz

### Autoreclosure C60/D60/L90/L60

Two breakers applications  
 Single- and three-pole tripping schemes  
 Up to 4 reclose attempts before lockout  
 Selectable reclosing mode and breaker sequence

### Autoreclosure F60/F35/D30

Single breaker applications, 3-pole tripping schemes  
 Up to 4 reclose attempts before lockout  
 Independent dead time setting before each shot  
 Possibility of changing protection settings after each shot with FlexLogic.

### AMP Unbalance

Avg and Full Load amps:	RMS
I <sub>1</sub> and I <sub>2</sub> amps:	Phasor
Pickup level:	0.0 to 100.0% in steps of 0.1
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.1
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	< 20 ms at 1.10 × pickup at 60 Hz
Timing accuracy:	±3% or ±20 ms, whichever is greater

### Auxiliary Overvoltage

Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)
Operate time:	< 30 ms at 1.10 × pickup at 60 Hz

### Auxiliary Undervoltage

Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Curve shapes:	GE IAV Inverse, Definite Time
Curve multiplier:	Time Dial = 0 to 600.00 in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)

### Breaker Arcing Current

Principle:	Accumulates breaker duty (I <sup>2</sup> t) and measures fault duration
Initiation:	Programmable per phase from any Flex-Logic. operand

Compensation for auxiliary relays:	0 to 65.535 s in steps of 0.001
Alarm threshold:	0 to 50000 kA <sup>2</sup> -cycle in steps of 1
Fault duration accuracy:	0.25 of a power cycle
Availability:	1 per CT bank with a minimum of 2

### Breaker Failure

Mode:	1-pole, 3-pole
Current supervision:	phase, neutral current
Current supv. pickup:	0.001 to 30.000 pu in steps of 0.001
Current supv. dropout:	97 to 98% of pickup
Current supv. accuracy:	
0.1 to 2.0 × CT rating:	±0.75% of reading or ±2% of rated (whichever is greater)
above 2 × CT rating:	±2.5% of reading

### Breaker Flashover

Operating quantity:	Phase current, voltage and voltage difference
Pickup level voltage:	0 to 1.500 pu in steps of 0.001
Dropout level voltage:	97 to 98% of pickup
Pickup level current:	0 to 1.500 pu in steps of 0.001
Dropout level current:	97 to 98% of pickup
Level accuracy:	±0.5% of ±0.1% of rated, whichever is greater
Pickup delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±42 ms, whichever is greater
Operate time:	< 42 ms at 1.10 × pickup at 60 Hz

### Bus Differential (87B)

Pickup level:	0.050 to 2.000 pu in steps of 0.001
Low slope:	15 to 100% in steps of 1
High slope:	50 to 100% in steps of 1
Low breakpoint:	1.00 to 30.00 pu in steps of 0.01
High breakpoint:	1.00 to 30.00 pu in steps of 0.01
High set level:	0.10 to 99.99 pu in steps of 0.01
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 × CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.5% of reading
Operating time:	one power system cycle (typical)

### CT Trouble

Responding to:	Differential current
Pickup level:	0.020 to 2.000 pu in steps of 0.001
Pickup delay:	1.0 to 60.0 sec. in steps of 0.1
Time Accuracy:	±3% or ±40ms, whichever is greater
Availability:	1 per zone of protection (B90)

### Generator Unbalance

Gen. nominal current:	0.000 to 1.250 pu in steps of 0.001
Stages:	2 (I <sup>2</sup> t with linear reset and definite time)
Pickup level:	0.00 to 100.00% in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	
0.1 to 2 × CT rating:	±0.5% of reading or 1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.5% of reading
Time dial (K-value):	0.00 to 100.00 in steps of 0.01
Pickup delay:	0.0 to 1000.0 s in steps of 0.1
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 50 ms at 60 Hz

### Ground Distance

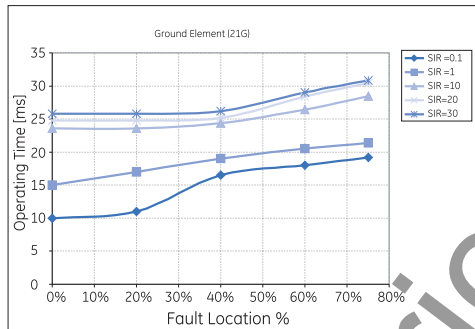
Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or nondirectional), selectable individually per zone
Reactance polarization:	negative-sequence or zero-sequence current
Non-homogeneity angle:	-40 to 40° in steps of 1
Number of zones:	5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance characteristic angle:	30 to 90° in steps of 1
Distance comparator limit angle:	30 to 90° in steps of 1



<b>Directional supervision</b>	
<b>characteristic angle:</b>	30 to 90° in steps of 1
<b>Limit angle:</b>	30 to 90° in steps of 1
<b>Zero-sequence compensation</b>	
Z0/Z1 magnitude:	0.00 to 10.00 in steps of 0.01
Z0/Z1 angle:	-90 to 90° in steps of 1
<b>Zero-sequence mutual compensation</b>	
Z0M/Z1 magnitude:	0.00 to 7.00 in steps of 0.01
Z0M/Z1 angle:	-90 to 90° in steps of 1
<b>Right blinder (Quad only):</b>	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
<b>Left blinder (Quad only):</b>	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
<b>Time delay:</b>	0.000 to 65.535 s in steps of 0.001
<b>Timing accuracy:</b>	±3% or 4 ms, whichever is greater
<b>Current supervision:</b>	
Level:	neutral current (3I <sub>0</sub> )
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
<b>Voltage supervision pickup</b>	
(series compensation applications):	0 to 5.000 pu in steps of 0.001
<b>Operation time:</b>	1 to 1.5 cycles (typical)
<b>Reset time:</b>	1 power cycle (typical)

### Ground Distance Operating Time Curves

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



### Line Current Differential (87L)

<b>Application:</b>	2 or 3 terminal line, series compensated line, tapped line, with charging current compensation
<b>Pickup current level:</b>	0.20 to 4.00 pu in steps of 0.01
<b>CT Tap (CT mismatch factor):</b>	0.20 to 5.00 in steps of 0.01
<b>Slope # 1:</b>	1 to 50%
<b>Slope # 2:</b>	1 to 70%
<b>Breakpoint between slopes:</b>	0.0 to 20.0 pu in steps of 0.1
<b>DTT:</b>	Direct Transfer Trip (1 and 3 pole) remote L90
<b>Operating Time:</b>	1.0 to 1.5 power cycles duration
<b>Asymmetrical channel delay compensation using GPS:</b>	asymmetry up to 10ms

### Line Current Differential Trip Logic

<b>87L trip:</b>	Adds security for trip decision; creates 1 and 3 pole trip logic
<b>DTT:</b>	Engaged Direct Transfer Trip (1 and 3 pole) from remote L90
<b>DD:</b>	Sensitive Disturbance Detector to detect fault occurrence
<b>Stub bus protection:</b>	Security for ring bus and 1 1/2 breaker configurations
<b>Open pole detector:</b>	Security for sequential and evolving faults

### Line Pickup

<b>Phase IOC:</b>	0.000 to 30.000 pu
<b>Undervoltage pickup:</b>	0.000 to 3.000 pu
<b>Overvoltage delay:</b>	0.000 to 65.535 s

### Load Encroachment

<b>Responds to:</b>	Positive-sequence quantities
<b>Minimum voltage:</b>	0.000 to 3.000 pu in steps of 0.001
<b>Reach (sec. W):</b>	0.02 to 250.00 in steps of 0.01
<b>Impedance accuracy:</b>	±5%
<b>Angle:</b>	5 to 50° in steps of 1
<b>Angle accuracy:</b>	±2°
<b>Pickup delay:</b>	0 to 65.535 s in steps of 0.001
<b>Reset delay:</b>	0 to 65.535 s in steps of 0.001
<b>Time accuracy:</b>	±3% or ±4 ms, whichever is greater
<b>Operate time:</b>	< 30 ms at 60 Hz

### Loss of Excitation

<b>Operating condition:</b>	Positive-sequence impedance
<b>Characteristic:</b>	2 independent offset mho circles
<b>Center:</b>	0.10 to 300.0 (sec.) in steps of 0.01
<b>Radius:</b>	0.10 to 300.0 (sec.) in steps of 0.01
<b>Reach accuracy:</b>	±3%
<b>Undervoltage supervision Level:</b>	0.000 to 1.250 pu in steps of 0.001
<b>Accuracy:</b>	± 0.5% of reading from 10 to 208V
<b>Pickup delay:</b>	0 to 65.535 s in steps of 0.001
<b>Timing accuracy:</b>	±3% or ±20 ms, whichever is greater
<b>Operate time:</b>	<50 ms

### Mechanical Jam

<b>Operating condition:</b>	Phase overcurrent
<b>Arming condition:</b>	Motor not starting
<b>Pickup level:</b>	1.00 to 10.00 * FLA in steps of 0.01
<b>Dropout level:</b>	97 to 98% of pickup
<b>Level accuracy:</b>	at 0.1 to 2.0 * CT: ±0.5% of reading at > 2.0 * CT rating: ±1.5% of reading
<b>Pickup delay:</b>	0.10 to 600.00 s in steps of 0.01
<b>Reset delay:</b>	0.00 to 600.00 s in steps of 0.01
<b>Time accuracy:</b>	±3% or ±20 ms, whichever is greater

### Motor Start Supervision

<b>Maximum no. of starts:</b>	1 to 16 in steps of 1
<b>Monitored time interval:</b>	1 to 300 minutes in steps of 1
<b>Time between starts:</b>	0 to 300 minutes in steps of 1
<b>Restart delay:</b>	0 to 50000 seconds in steps of 1

### Negative Sequence Directional OC

<b>Directionality:</b>	Co-existing forward and reverse
<b>Polarizing:</b>	Voltage
<b>Polarizing voltage:</b>	V <sub>2</sub>
<b>Operating current:</b>	I <sub>2</sub> or I <sub>0</sub>
<b>Level sensing:</b>	
<b>Zero-sequence:</b>	I <sub>0</sub>   - K *  I <sub>1</sub>
<b>Negative-sequence:</b>	I <sub>2</sub>   - K *  I <sub>1</sub>
<b>Restraint, K:</b>	0.000 to 0.500 in steps of 0.001
<b>Characteristic angle:</b>	0 to 90° in steps of 1
<b>Limit angle:</b>	40 to 90° in steps of 1, independent for forward and reverse
<b>Angle accuracy:</b>	±2°
<b>Offset impedance:</b>	0.00 to 250.00W in steps of 0.01
<b>Pickup level:</b>	0.05 to 30.00 pu in steps of 0.01
<b>Dropout level:</b>	97 to 98%
<b>Operation time:</b>	< 16 ms at 3 * Pickup at 60 Hz



### Negative Sequence IOC

Current:	Phasor
Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 * CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
> 2.0 * CT rating:	±1.5% of reading
Overreach:	< 2%
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	< 20 ms at 3 * Pickup at 60 Hz
Timing accuracy:	Operate at 1.5 * Pickup ±3% or ± 4 ms (whichever is greater)

### Negative Sequence Overvoltage

Pickup level:	0.000 to 1.250 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 * Pickup at 60 Hz

### Negative Sequence TOC

Current:	Phasor
Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97% to 98% of Pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater from 0.1 to 2.0 x CT rating ±1.5% of reading >2.0 x CT rating)
Curve shapes:	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/Extremely Inverse; I <sup>2</sup> t; FlexCurves. (programmable); Definite Time (0.01 s base curve)
Curve multiplier (Time dial):	0.00 to 600.00 in steps of 0.01
Reset type:	Instantaneous/Timed (per IEEE) and L ear
Timing accuracy:	Operate at > 1.03 * Actual Pickup ±3.5% of operate time or ± 1/2 cycle (whichever is greater)

### Neutral Directional Overcurrent

Directionality:	Co-existing forward and reverse
Polarizing:	Voltage, Current, Dual
Polarizing voltage:	V, 0 or VX
Polarizing current:	IG
Operating current:	I, 0
Level sensing:	$3 * ( I_{0L}  - K *  I_{1L} )$ , IG
Restraint, K:	0.000 to 0.500 in steps of 0.001
Characteristic angle:	-90 to 90° in steps of 1
Limit angle:	40 to 90° in steps of 1, independent for forward and reverse
Angle accuracy:	±2°
Offset impedance:	0.00 to 250.00W in steps of 0.01
Pickup level:	0.05 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98%
Operation time:	< 16 ms at 3 * Pickup at 60 Hz

### Neutral Overvoltage

Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Timing accuracy:	±3% or ±20 ms (whichever is greater)
Operate time:	< 30 ms at 1.10 * Pickup at 60 Hz

### Open Pole Detector

Detects an open pole condition, monitoring breaker auxiliary contacts, the current in each phase and optional voltages on the line

Current pickup level:	0.000 to 30.000 pu in steps of 0.001
Line capacitive reactances (XC1, XC0):	300.0 to 9999.9 sec. W in steps of 0.1
Remote current pickup level:	0.000 to 30.000 pu in steps of 0.001
Current dropout level:	Pickup + 3%, not less than 0.05 pu

### Overfrequency

Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup - 0.03 Hz
Level accuracy:	±0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	±3% or 4 ms, whichever is greater

### Phase Comparison Protection (87PC)

Signal Selection:	Mixed I, 2 - K x I, 1 (K=0.00 to 0.25 in steps of 0.01, or 3I, 0)
Angle Reference:	0 to 360° leading in steps of 1
Fault detector low:	
Instantaneous Overcurrent:	0.02 to 15.00 pu in steps of 0.01
I <sub>2</sub> x Z - V <sub>2</sub> :	0.005 to 15.00 pu in steps of 0.01
dI <sub>2</sub> / d <sub>t</sub> :	0.01 to 5.00 pu in steps of 0.01
dI <sub>1</sub> / d <sub>t</sub> :	0.01 to 5.00 pu in steps of 0.01
Fault detector High:	
Instantaneous Overcurrent:	0.10 to 15.00 pu in steps of 0.01
I <sub>2</sub> x Z - V <sub>2</sub> :	0.005 to 15.00 pu in steps of 0.01
dI <sub>2</sub> / d <sub>t</sub> :	0.01 to 5.00 pu in steps of 0.01
dI <sub>1</sub> / d <sub>t</sub> :	0.01 to 5.00 pu in steps of 0.01
Signal Symmetry Adjustment:	-0.5 to 0.0 ms in steps of 0.1
Channel Delay Adjustment:	0.000 to 30.00 ms in steps of 0.001
Channel Adjustments:	channel delay and signal symmetry compensation
Operate Time (Typical):	3/4 cycle for single phase comparison
Trip Security:	First coincidence or enhanced
Second Coincidence Timer:	10 to 200 ms in steps of 1
Enhanced Stability Angle:	40 to 180° in steps of 1

### Phase Directional Overcurrent

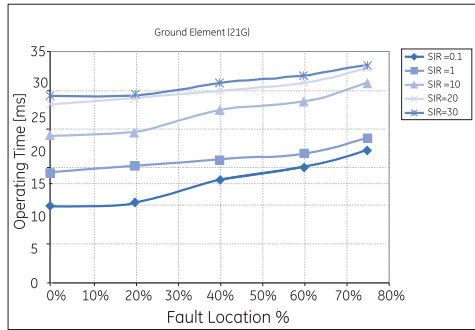
Relay connection:	90° (quadrature)
Quadrature voltage:	
ABC phase seq:	phase A (V <sub>BC</sub> ), phase B (V <sub>CA</sub> ), phase C (V <sub>AB</sub> )
ACB phase seq:	phase A (V <sub>CB</sub> ), phase B (V <sub>AC</sub> ), phase C (V <sub>BA</sub> )
Polarizing voltage threshold:	0.000 to 3.000 pu in steps of 0.001
Current sensitivity threshold:	0.05 pu
Characteristic angle:	0 to 359° in steps of 1
Angle accuracy:	±2°
Operation time (FlexLogic™ elements):	
Tripping (reverse load, forward fault):	< 12 ms, typically
Blocking (forward load, reverse fault):	< 8 ms, typically

### Phase Distance

Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or nondirectional), selectable individually per zone
Number of zones:	Up to 5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance:	
Characteristic angle:	30 to 90° in steps of 1
Comparator limit angle:	30 to 90° in steps of 1
Directional supervision:	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left Blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	line-to-line current
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
VT location:	all delta-wye and wye-delta transformers
CT location:	all delta-wye and wye-delta transformers
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001

### Phase Distance Operating Time Curves

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



### Phase/Neutral Ground IOC

<b>Pickup level:</b>	0.000 to 30.000 pu in steps of 0.001
<b>Dropout level:</b>	97 to 98% of pickup
<b>Level accuracy:</b>	
0.1 to 2.0 x CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
> 2.0 x CT rating:	±1.5% of reading
<b>Overreach:</b>	<2%
<b>Pickup delay:</b>	0.00 to 600.00 s in steps of 0.01
<b>Reset delay:</b>	0.00 to 600.00 s in steps of 0.01
<b>Operate time:</b>	<16ms at 3 * pickup at 60Hz (Phase/Ground IOC) <20ms at 3 x pickup at 60Hz (Neutral IOC)
<b>Timing accuracy:</b>	Operate at 1.5 x Pickup ±3% or ±4 ms (whichever is greater)

### Phase/Neutral Ground TOC

<b>Current:</b>	Phasor or RMS
<b>Pickup level:</b>	0.000 to 30.000 pu in steps of 0.001
<b>Dropout level:</b>	97% to 98% of Pickup
<b>Level accuracy:</b>	for 0.1 to 2.0 x CT: ±0.5% of reading or ±1% of rated (whichever is greater) for > 2.0 x CT: ±1.5% of reading > 2.0 x CT rating
<b>Curve shapes:</b>	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/Extremely Inverse; I <sup>2</sup> t; FlexCurves (programmable); Definite Time (0.01 s base curve)
<b>Curve multiplier:</b>	Time Dial = 0.00 to 600.00 in steps of 0.01
<b>Reset type:</b>	Instantaneous/Timed (per IEEE)
<b>Timing accuracy:</b>	Operate at > 1.03 x actual Pickup ±3.5% of operate time or ± 1/2 cycle (whichever is greater)

### Phase Overvoltage

<b>Voltage:</b>	Phasor only
<b>Pickup level:</b>	0.000 to 3.000 pu in steps of 0.001
<b>Dropout level:</b>	97 to 98% of Pickup
<b>Level accuracy:</b>	±0.5% of reading from 10 to 208V
<b>Pickup delay:</b>	0.00 to 600.00 in steps of 0.01 s
<b>Operate time:</b>	<30 ms at 1.10 x Pickup at 60 Hz
<b>Timing accuracy:</b>	±3% or ±4 ms (whichever is greater)

### Phase Undervoltage

<b>Voltage:</b>	Phasor only
<b>Pickup level:</b>	0.000 to 3.000 pu in steps of 0.001
<b>Dropout level:</b>	102 to 103% of Pickup
<b>Level accuracy:</b>	±0.5% of reading from 10 to 208V
<b>Curve shapes:</b>	GE IAV Inverse; Definite Time (0.1s base curve)
<b>Curve multiplier:</b>	Time Dial = 0.00 to 600.00 in steps of 0.01
<b>Timing accuracy:</b>	Operate at < 0.90 * Pickup ±3.5% of operate time or ±4 ms (whichever is greater)

### Pilot-aided Schemes

<b>Direct Underreaching Transfer Trip (DUT)</b>
<b>Permissive Underreaching Transfer Trip (PUT)</b>
<b>Permissive Overreaching Transfer Trip (POT)</b>
<b>Hybrid POT Scheme</b>
<b>Directional Comparison Blocking Scheme</b>

### Power Swing Detect

<b>Functions:</b>	Power swing block, Out-of-step trip
<b>Characteristic:</b>	Mho or Quad
<b>Measured impedance:</b>	Positive-sequence
<b>Blocking / tripping mozes:</b>	2-step or 3-Step
<b>Tripping mode:</b>	Early or Delayed
<b>Current supervision:</b>	
Pickup level:	0.050 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
<b>Fwd / reverse reach (sec. W):</b>	0.10 to 500.00W in steps of 0.01
<b>Left and right blinders (sec. W):</b>	0.10 to 500.00W in steps of 0.01
<b>Impedance accuracy:</b>	±5%
<b>Fwd / reverse angle impedances:</b>	40 to 90° in steps of 1
<b>Angle accuracy:</b>	±2°
<b>Characteristic limit angles:</b>	40 to 140° in steps of 1
<b>Timers:</b>	0.000 to 65.535 s in steps of 0.001
<b>Timing accuracy:</b>	±3% or 4 ms, whichever is greater

### Rate of Change of Frequency

<b>df/dt trend:</b>	increasing, decreasing, bi-directional
<b>df/dt pickup level:</b>	0.10 to 15.00 Hz/s in steps of 0.01
<b>df/dt dropout level:</b>	96% of pickup
<b>df/dt level accuracy:</b>	80 mHz/s or 3.5%, whichever is greater
<b>Overvoltage supv.:</b>	0.100 to 3.000 pu in steps of 0.001
<b>Overcurrent supv.:</b>	0.000 to 30.000 pu in steps of 0.001
<b>Pickup delay:</b>	0 to 65.535 s in steps of 0.001
<b>Reset delay:</b>	0 to 65.535 s in steps of 0.001
<b>Time accuracy:</b>	±3% or ±4 ms, whichever is greater
<b>95% settling time for df/dt:</b>	< 24 cycles
<b>Operate time:</b>	
at 2 x pickup:	12 cycles
at 3 x pickup:	8 cycles
at 5 x pickup:	6 cycles

### Restricted Ground Fault

<b>Pickup:</b>	0.000 to 30.000 pu in steps of 0.001
<b>Dropout:</b>	97 to 98% of Pickup
<b>Slope:</b>	0 to 100% in steps of 1%
<b>Pickup delay:</b>	0 to 600.00 s in steps of 0.01
<b>Dropout delay:</b>	0 to 600.00 s in steps of 0.01
<b>Operate time:</b>	< 1power system cycle

### Sensitive Directional Power

<b>Measured power:</b>	3-phase, true RMS
<b>Number of stages:</b>	2
<b>Characteristic angle:</b>	0 to 359° in steps of 1
<b>Calibration angle:</b>	0.00 to 0.95° in steps of 0.05
<b>Minimum power:</b>	-1.200 to 1.200 pu in steps of 0.001
<b>Pickup level accuracy:</b>	±1% or ±0.001 pu, whichever is greater
<b>Hysteresis:</b>	2% or 0.001 pu, whichever is greater
<b>Pickup delay:</b>	0 to 600.00 s in steps of 0.01
<b>Time accuracy:</b>	±3% or ±4 ms, whichever is greater
<b>Operate time:</b>	50 ms

### Split Phase Protection

<b>Operating quantity:</b>	split phase CT current biased by generator load current
<b>Pickup level:</b>	0.000 to 1.500 pu in steps of 0.001
<b>Dropout level:</b>	97 to 98% of pickup
<b>Level accuracy:</b>	±0.5% of reading or ±1% of rated
<b>Pickup delay:</b>	0.000 to 65.535 s in steps of 0.001
<b>Time accuracy:</b>	±3% of ± cycles, whichever is greater
<b>Operate time:</b>	< 5 cycles at 1.10 x pickup at 60Hz





### Stator Differential

Pickup:	0.050 to 1.00 pu in steps of 0.01
Slope 1/2:	1 to 100% in steps of 1
Break 1:	1.00 to 1.50 pu in steps of 0.01
Break 2:	1.50 to 30.00 pu in steps of 0.01
Level accuracy:	±2%

### Synchrocheck

Max voltage difference:	0 to 400000 V in steps of 1
Max angle difference:	0 to 100° in steps of 1
Max freq. difference:	0.00 to 2.00 Hz in steps of 0.01
Hysteresis for max. freq. diff.:	0.00 to 0.10 Hz in steps of 0.01
Dead source function:	None, LV1 & DV2, DV1 & LV2, DV1 or DV2, DV1 x or DV2, DV1 & DV2 (L = Live, D = Dead)

### Thermal Model

Thermal overload curves:	Standard curve, FlexCurve™, voltage dependent curve
Standard Curve Time Multiplier:	0.00 to 600.00 in steps of 0.01
Thermal Overload Pickup:	pu = overload factor x FLA
Overload (OF):	1.00 to 1.50 in steps of 0.001
Standard Overload Curve:	

trip time =

$$TD \times 2.2116623 \times \left( \frac{I_{\text{motor}}}{OF \times FLA} \right)^2 + 0.0505054758 \times \frac{I_{\text{motor}}}{OF \times FLA}$$

Motor Rated Voltage:	1 to 50000 V in steps of 1
Thermal Motor Biasing:	Current unbalance, RTDs
Thermal Model Update Rate:	1 power cycle
Stopped/Running	1 to 65000 min. in steps of 1
Time Cool Constants:	
Stopped/Running	Exponential
Time Cool Constants Decay:	
Hot/Cold Safe Stall Ratio:	0.01 to 1.00 in steps of 0.01
Current Accuracy:	Per phase current inputs
Current Source:	True RMS
Timing Accuracy	± 100 ms or ± 2% whichever is greater
Timing Accuracy for	± 100 ms or ± 4%, whichever is greater
Voltage Dependent Overload:	

### Third Harmonic Neutral Undervoltage

Operating quantity:	3rd harmonic of auxiliary undervoltage
Undervoltage:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Accuracy:	±2% of reading from 1 to 120V
Power:	
Pickup level:	0.000 to 1.200 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Accuracy:	±5% or ±0.01 pu, whichever is greater
Undervoltage Inhibit Level:	0.000 to 3.000 pu in steps of 0.001 pu
Accuracy:	±0.5% of reading from 10 to 208V
Pickup delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 110 x pickup at 60 Hz

### Transformer Aging Factor

Operating quantity:	computed aging acceleration factor (pu)
Pickup level:	1 to 10 pu in steps of 0.1
Pickup delay:	0 to 30000 min. in steps of 1

### Transformer Instantaneous Differential

Pickup level:	2.00 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)
Operate time:	< 20 ms at 3 x pickup at 60 Hz

### Transformer Hottest-Spot Temperature

Operating quantity:	computed temperature in °C
Pickup level:	50 to 300°C in steps of 1
Dropout level:	1°C below pickup
Pickup delay:	0 to 30000 min. in steps of 1

### Transformer Loss of Life

Operating quantity:	computed accumulated transformer loss of life, in hours
Pickup level:	0 to 500000 hours in steps of 1

### Transformer Percent Differential

Characteristic:	Differential Restraint pre-set
Number of zones:	2
Minimum pickup:	0.05 to 1.00 pu in steps of 0.001
Slope 1 range:	15 to 100% in steps of 1%
Slope 2 range:	50 to 100% in steps of 1%
Kneepoint 1:	1.0 to 2.0 pu in steps of 0.0001
Kneepoint 2:	2.0 to 30.0 pu in steps of 0.0001
2nd harmonic inhibit level:	1.0 to 40.0% in steps of 0.1
2nd harmonic inhibit function:	Adaptive, Traditional, Disabled
2nd harmonic inhibit mode:	Per-phase, 2-out-of-3, Average
5th harmonic inhibit range:	1.0 to 40.0% in steps of 0.1
Operate times:	
Harmonic inhibits selected:	20 to 30 ms
No harmonic inhibits selected:	5 to 20 ms
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)

### Trip Output

Collects trip and reclose input requests and issues outputs to control tripping and reclosing.

Communications timer delay:	0 to 65.535 s in steps of 0.001
Evolving fault timer:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater

### Underfrequency

Minimum signal:	0.10 to 1.25 pu in steps of 0.01
Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup + 0.03 Hz
Level accuracy:	±0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	±3% or 4 ms, whichever is greater

### Volts Per Hertz

Voltage:	Phasor only
Pickup level:	0.80 to 4.00 in steps of 0.01 pu V/Hz
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.02 pu
Timing curves:	Definite Time; Inverse A, B, and C, FlexCurves A, B, C, and D
TD Multiplier:	0.05 to 600.00 s in steps of 0.01
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Timing accuracy:	±3% or ± 4 ms (whichever is greater)

### VT Fuse Fail

Monitored parameters:	V_2, V_1, I_1
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### Wattmetric Zero-Sequence Directional

Measured Power:	Zero-Sequence
Number of Elements:	2
Characteristic Angle:	0 to 360° in steps of 1
Minimum Power:	0.001 to 1.20pu in steps of 0.001
Pickup Level Accuracy:	±1% or ± 0.0025 pu, whichever is greater
Pickup Delay:	Definite time (0 to 600.00 s in steps of 0.01), inverse time, or FlexCurve™
Inverse Time Multiplier:	0.01 to 2.00 s in steps of 0.01
Time Accuracy:	±3% or ±8 ms, whichever is greater
Operate Time:	<30 ms at 60 Hz



# GE Multilin®

## Protection and Control

### UR Family

Technical Specifications – Monitoring, Metering

## Section 18

### Monitoring

#### Data Logger

Number of channels:	1 to 16
Parameters:	Any available analog actual value
Sampling rate:	15 to 3600000 ms in steps of 1
Trigger:	Any FlexLogic™ operand
Mode:	Continuous or Triggered
Storage capacity:	(NN is dependent on memory)
1-second rate:	01 channel for NN days 16 channels for NN days
60-minute rate:	01 channel for NN days 16 channels for NN days

#### Event Recorder

Capacity:	1024 events
Time-tag:	to 1 microsecond
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Self-test events
Data storage:	In non-volatile memory

#### Fault Locator

Method:	Single-ended
Maximum accuracy if:	Fault resistance is zero or fault currents from all line terminals are in phase
Relay accuracy:	±1.5% (V > 10 V, I > 0.1 pu)
Worst-case accuracy:	VT%error + (user data) CT%error + (user data) ZLine%error + (user data) METHOD%error + (Chapter 6) RELAY ACCURACY%error + (1.5%)

#### High-Impedance Fault Detection (HiZ)

Detections:	Arc Suspected, Arc Detected, Downed Conductor, Phase Identification
-------------	---

#### Oscillography

Maximum records:	64
Sampling rate:	64 samples per power cycle
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Any FlexLogic Operand FlexLogic Equation
Data:	AC input channels Element state Digital input state Digital output state Data storage: In non-volatile memory

#### User-Programmable Fault Report

Number of elements:	2
Pre-fault trigger:	any FlexLogic operand
Fault trigger:	any FlexLogic operand
Recorder quantities:	32 (any FlexAnalog value)

### Metering

#### RMS Current: Phase, Neutral, and Ground

Accuracy at:	
0.1 to 2.0 × CT rating:	±0.25% of reading or ±0.1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.0% of reading

#### RMS Voltage

Accuracy:	±0.5% of reading from 10 to 208 V
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#### Real Power (Watts)

Accuracy:	±1.0% of reading at -0.8 < PF < -1.0 and 0.8 < PF < 1.0
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#### Reactive Power (VARs)

Accuracy:	±1.0% of reading at -0.2 < PF < 0.2
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#### Apparent Power (VA)

Accuracy:	±1.0% of reading
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#### Watt-Hours (Positive and Negative)

Accuracy:	±2.0% of reading
Range:	±0 to 2 × 109 MWh
Parameters:	3-phase only
Update rate:	50 ms

#### VAR-Hours (Positive and Negative)

Accuracy:	±2.0% of reading
Range:	±0 to 2 × 109 Mvarh
Parameters:	3-phase only
Update rate:	50 ms

#### Current Harmonics

Harmonics:	2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1

#### Demand

Measurements:	Phases A, B, and C present and maximum measured currents 3-Phase Power (P, Q, and S) present and maximum measured currents
Accuracy:	±2.0%

#### Frequency

Accuracy at V = 0.8 to 1.2 pu:	±0.01 Hz (when voltage signal is used for frequency measurement)
I = 0.1 to 0.25 pu:	±0.05 Hz
I > 0.25 pu:	±0.02 Hz (when current signal is used for frequency measurement)

#### Voltage Harmonics

Harmonics:	2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## User Programmable Elements

### Control Pushbuttons

Number of pushbuttons:	3 (standard) or 16 (optional)
Operation:	drive FlexLogic operands

### FlexCurves™

Number:	4 (A through D)
Reset points:	40 (0 through 1 of pickup)
Operate points:	80 (1 through 20 of pickup)
Time delay:	0 to 65535 ms in steps of 1

### FlexLogic™

Programming language:	Reverse Polish Notation with graphical visualization (keypad programmable)
Lines of code:	512
Internal variables:	64
Supported operations:	NOT, XOR, OR (2 to 16 inputs), AND (2 to 16 inputs), NOR (2 to 16 inputs), NAND (2 to 16 inputs), Latch (Reset Dominant), Edge Detectors, Timers
Inputs:	any logical variable, contact, or virtual input
Number of timers:	32
Pickup delay:	0 to 60000 (ms, sec., min.) in steps of 1
Dropout delay:	0 to 60000 (ms, sec., min.) in steps of 1

### Flex Elements™

Number of elements:	8 or 16
Operating signal:	any analog actual value, or two values in Differential mode
Operating signal mode:	Signed or Absolute Value
Operating mode:	Level, Delta
Comparator direction:	Over, Under
Pickup Level:	-30.000 to 30.000 pu in steps of 0.001
Hysteresis:	0.1 to 50.0% in steps of 0.1
Delta dt:	20 ms to 60 days
Pickup & dropout delay:	0.000 to 65.535 s in steps of 0.001

### Flex States™

Number:	up to 256 logical variables grouped under 16 Modbus addresses
Programmability:	any logical variable, contact, or virtual input

### LED Test

Initiation:	from any digital input or user programmable condition
Number of tests:	3, interruptible at any time
Duration of full test:	approximately 3 minutes
Test sequence 1:	all LEDs on
Test sequence 2:	all LEDs off, one LED at a time on for 1 s
Test sequence 3:	all LEDs on, one LED at a time off for 1 s

### Non-Volatile Latches

Type:	Set-dominant or Reset-dominant
Number:	16 (individually programmed)
Output:	Stored in non-volatile memory
Execution sequence:	As input prior to protection, control, and FlexLogic.

### Selector Switch

Number of elements:	2
Upper position limit:	1 to 7 in steps of 1
Selecting mode:	Time-out or Acknowledge
Time-out timer:	3.0 to 60.0 s in steps of 0.1
Control inputs:	step-up and 3-bit
Power-up mode:	restore from non-volatile memory or synchronize to a 3-bit control input

### User-Definable Displays

Number of displays:	16
Lines of display:	2 x 20 alphanumeric characters
Parameters:	up to 5, any Modbus register addresses
Invoking and scrolling:	keypad, or any userprogrammable condition, including pushbuttons

### User-Programmable LEDs

Number:	48 plus Trip and Alarm
Programmability:	from any logical variable, contact, or virtual input
Reset mode:	Self-reset or Latched

### User-Programmable Pushbuttons (optional)

Number of pushbuttons:	12
Mode:	Self-Reset, Latched
Display message:	2 lines of 20 characters each

### 8-Bit Switch

Number of elements:	6
Input signals:	two 8-bit integers via FlexLogic™ operands
Control:	any FlexLogic™ operand
Response time:	< 8 ms at 60 Hz, < 10 ms at 50 Hz

## Inputs

### AC Current

CT rated primary:	1 to 50000 A
CT rated secondary:	1 A or 5 A by connection
Nominal frequency:	20 to 65 Hz
Relay burden:	< 0.2 VA at rated secondary
Conversion range:	
Standard CT:	0.02 to 46 x CT rating RMS symmetrical
Sensitive Ground/HI-Z CT module:	0.002 to 4.6 x CT rating RMS symmetrical
Current withstand:	20 ms at 250 times rated 1 sec. at 100 times rated continuous at 3 times rated

### AC Voltage

VT rated secondary:	50.0 to 240.0 V
VT ratio:	1.00 to 24000.00
Nominal frequency:	20 to 65 Hz For the L90, the nominal system frequency should be chosen as 50 Hz or 60 Hz only.
Relay burden:	< 0.25 VA at 120 V
Conversion range:	1 to 275 V
Voltage withstand:	continuous at 260 V to neutral 1 min/hr at 420 V to neutral

### Contact Inputs

Dry contacts:	1000 $\Omega$ maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	±10%
Contacts Per Common Return:	4
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)

### Contact Inputs with Auto-Burnishing

Dry contacts:	1000 $\Omega$ maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	±10%
Contacts Per Common Return:	2
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)
Auto-Burnish Impulse Current:	50 to 70 mA
Duration of Auto-Burnish Impulse:	25 to 50 ms



# GE Multilin®

## Protection and Control

### UR Family

Technical Specifications – User Programmable Elements, Inputs

Section 18

#### Inputs (continued)

##### DCMA Inputs

Current input (mA DC):	0 to -1, 0 to +1, -1 to +1, 0 to 5, 0 to 10, 0 to 20, 4 to 20 (programmable)
Input impedance:	379 ±10%
Conversion range:	-1 to +20 mA DC
Accuracy:	±0.2% of full scale
Type:	Passive

##### Direct Inputs

Number of input points:	32
No. of remote devices:	16
Default states on loss of comms.:	On, Off, Latest/Off, Latest/On
Ring configuration:	Yes, No
Data rate:	64 or 128 kbps
CRC:	32-bit

##### CRC alarm:

Responding to:	Rate of messages failing the CRC
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1

##### Unreturned message alarm:

Responding to:	Rate of unreturned messages in the ring configuration
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1

##### IRIG-B Input

Amplitude modulation:	1 to 10 V pk-pk
DC shift:	TTL
Input impedance:	22 kW
Isolation:	2 kV

##### Remote Inputs (IEC61850 GSSE)

Number of input points:	32, configured from 64 incoming bit pairs
Number of remote devices:	16
Default states on loss of comms.:	On, Off, Latest/Off, Latest/On

##### RTD Inputs

Types (3-wire):	100 W Platinum, 100 W & 120 W Nickel, 10 W Copper
Sensing current:	5 mA
Range:	-50 to +250°C
Accuracy:	±2°C
Isolation:	36 V pk-pk



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## Outputs

### Control Power External Output (for Dry Contact Input)

Capacity:	100 mA DC at 48 V DC
Isolation:	±300 Vpk

### DCMA Outputs

Range:	-1 to 1 mA, 0 to 1 mA, 4 to 20 mA
Max. load resistance:	12 k for -1 to 1 mA range 12 k for 0 to 1 mA range 600 for 4 to 20 mA range
Accuracy:	±0.75% of full-scale for 0 to 1 mA range ±0.5% of full-scale for -1 to 1 mA range ±0.75% of full-scale for 0 to 20 mA range
99% Settling time to a step change:	100 ms
Isolation:	1.5 kV
Driving signal:	any FlexAnalog quantity
Upper and lower limit for the driving signal:	-90 to 90 pu in steps of 0.001

### Direct Outputs

Output points:	32
----------------	----

### Form-A Current Monitor

Threshold current:	approx. 80 to 100 mA
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### Form-A Relay

Make and carry for 0.2s:	30 A as per ANSI C37.90
Carry continuous:	6 A
Break at L/R of 40 ms:	1 A DC max. at 24 V 0.5 A DC max. at 48 V 0.3 A DC max. at 125 V 0.2 A DC max. at 250 V
Operate time:	< 4 ms
Contact material:	Silver alloy

### Form-A-Voltage Monitor

Applicable voltage:	approx. 15 to 250 V DC
Trickle current:	approx. 1 to 2.5 mA

Input Voltage	Impedance	
	2W Resistor	1W Resistor
250 V DC	20 K	50K
120 V DC	5 K	2 K
48 V DC	2 K	2 K
24 V DC	2 K	2 K

### Form-C and Critical Failure Relay

Make and carry for 0.2 s:	30 A
Carry continuous:	8 A
Break at L/R of 40 ms:	0.25 A DC max. at 48 V 0.10 A DC max. at 125 V
Operate time:	< 8 ms
Contact material:	Silver alloy

### Fast Form-C Relay

Make and carry:	0.1 A max. (resistive load)
Minimum load impedance:	
Operate time:	< 0.6 ms
Internal Limiting Resistor:	100, 2

### IRIG-B Output

Amplitude:	10 V peak-peak RS485 level
Maximum load:	100 ohms
Time delay:	1 µs for AM input 40 µs for DC-shift input
Isolation:	2 kV

### Latching Relay

Make and carry for 0.2 s:	30 A as per ANSI C37.90
Carry continuous:	6 A
Break at L/R of 40 ms:	0.25 A DC max.
Operate time:	< 4 ms
Contact material:	Silver alloy
Control:	separate operate and reset inputs
Control mode:	operate-dominant or reset dominant

### Remote Outputs (IEC61850 GSSE)

Standard output points:	32
User output points:	32

### Solid State Output Relay

Operate and release time:	<100 µs
Maximum voltage:	265 V DC
Maximum continuous current:	5 A at 45°C; 4 A at 65°C
Make and carry for 0.2 s:	as per ANSI C37.90
For 0.3s:	300 A

Breaking capacity:

	IEC 647-5/UL508	Utility Application (Autoreclose Scheme)	Industrial Application
Operations/ Interval	5000 ops 1 s-On, 9 s-Off 1000 ops 0.5 s-On, 0.5 s-Off	5 ops/ 0.2 s-Off within 1 minute	10000 ops/ 0.2 s-On, 30 s-Off
Break capability (0 to 250 VDC)	3.2 A L/R = 10 ms 1.6 A L/R = 20 ms 0.8 A L/R = 40 ms	10 A L/R = 40 ms	10 A L/R = 40 ms

## Communications

### RS232

Front port:	19.2 kbps, Modbus® RTU, DNP 3.0
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### RS485

1 or 2 rear ports:	Up to 115 kbps, Modbus® RTU, DNP 3.0 isolated together at 36 Vpk
Typical distance:	1200 m
Isolation:	2 kV

### Ethernet Port

10Base-F:	820 nm, multi-mode, supports half-duplex/full-duplex fiber optic with ST connector
Redundant 10Base-F:	820 nm, multi-mode, halfduplex/full-duplex fiber optic with ST connector
10Base-T:	RJ45 connector
Power budget:	10 db
Max optical input power:	-7.6 dBm
Max optical output power:	-20 dBm
Receiver sensitivity:	-30 dBm
Typical distance:	1.65 km
SNTP clock Synchronization error:	<10 ms (typical)

### Protocols

	RS232	RS485	10BaseF	10BaseT	100BaseT
IEC61850			•	•	•
DNP 3.0	•	•	•	•	•
Modbus	•	•	•	•	•
IEC104			•	•	•
EGD			•	•	•





# GE Multilin®

## Protection and Control

### UR Family

#### Technical Specifications – Outputs, Communications

#### Inter-Relay Communications

## Section 18

### Shielded Twisted-Pair Options

Interface Type	Typical Distance
RS422	1200m
G.703	100m

\* NOTE: RS422 distance is based on transmitter power and does not take into consideration the clock source provided by the user.

### Link Power Budget

Emitter, Fiber Type	Transmit Power	Received Sensitivity	Power Budget
820nm LED Multimode	-20dBm	-30dBm	10dB
1300 nm LED Multimode	-21dBm	-30dBm	9dB
1300 nm ELED Multimode	-21dBm	-30dBm	9dB
1300 nm Laser Singlemode	-1dBm	-30dBm	29dB
1550 nm Laser Singlemode	+5dBm	-30dBm	35dB

\* NOTE: These Power Budgets are calculated from the manufacturers worst-case transmitter power and worst case receiver sensitivity.

### Maximum Optical Input Power

#### Maximum Optical Input Power

Emitted, Fiber Type	Max. Optical Input Power
820 nm LED, Multimode	-7.6 dBm
1300 nm LED, Multimode	-11 dBm
1300 nm ELED, Singlemode	-14 dBm
1300 nm Laser, Singlemode	-14 dBm
1500 nm Laser, Singlemode	-14 dBm

### Typical Link Distance

Emitted Type	Fiber Type	Connector Type	Typical Distance
820 nm LED	Multimode	-7.6 dBm	1.65 km
1300 nm LED	Multimode	-11 dBm	3.8 km
1300 nm ELED	Singlemode	-14 dBm	11.4 km
1300 nm Laser	Singlemode	-14 dBm	64 km
1500 nm Laser	Singlemode	-14 dBm	105 km

\* NOTE: Typical distances listed are based on the following assumptions for system loss. Actual losses will vary from one installation to another, the distance covered by your system may vary.

### Connector Losses (Total of Both Ends)

ST connector	2dB
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### Fiber Losses

820 nm multimode	3 dB/km
1300 nm multimode	1 dB/km
1300 nm singlemode	0.35 dB/km
1550 nm singlemode	0.25 dB/km
Splice losses:	One splice every 2 km, at 0.05 dB loss per splice

### System Margin

3 dB additional loss added to calculations to compensate for all other losses.  
Compensate difference in transmitting and receiving (channel asymmetry) channel delays using GPS satellite clock: 10 ms

### Power Supply

#### Low Range

Nominal DC voltage:	24 to 48 V at 3 A
Min/max DC voltage:	20 / 60 V
* NOTE:	Low range is DC only.

### High Range

Nominal DC voltage:	125 to 250 V at 0.7 A
Min/max DC voltage:	88 / 300 V
Nominal AC voltage:	100 to 240 V at 50/60 Hz, 0.7 A
Min/max AC voltage:	88 / 265 V at 48 to 62 Hz

### All Ranges

Volt withstand:	2 * Highest Nominal Voltage for 10 ms
Voltage loss hold-up:	50 ms duration at nominal
Power consumption:	Typical = 15 VA; Max. = 30 VA

### Internal Fuse Ratings

Low range power supply:	8 A / 250 V
High range power supply:	4 A / 250 V

#### Interrupting Capacity

AC:	100 000 A RMS symmetrical
DC:	10 000 A
Hold up time:	200 ms

### Type Tests

Electrical fast transient:	ANSI/IEEE C37.90.1 IEC 61000-4-4 IEC 60255-22-4
Oscillatory transient:	ANSI/IEEE C37.90.1 IEC 61000-4-12
Insulation resistance:	IEC 60255-5
Dielectric strength:	IEC 60255-6 ANSI/IEEE C37.90
Electrostatic discharge:	EN 61000-4-2
Surge immunity:	EN 61000-4-5
RFI susceptibility:	ANSI/IEEE C37.90.2 IEC 61000-4-3 IEC 60255-22-3 Ontario Hydro C-5047-77
Conducted RFI:	IEC 61000-4-6
Voltage dips/interruptions/variatio	IEC 61000-4-11 IEC 60255-11
Power frequency magnetic field immunity:	IEC 61000-4-8
Vibration test (sinusoidal):	IEC 60255-21-1
Shock and bump:	IEC 60255-21-2
* NOTE:	Type test report available upon request.

### Production Tests

#### Thermal

Products go through an environmental test based upon an accepted quality level (AQL) sampling process

### Environmental

### Operating Temperatures

Cold:	IEC 60028-2-1, 16 h at -40°C
Dry Heat:	IEC 60028-2-2, 16 h at +85°C

### Other

Humidity(noncondensing):	IEC 60068-2-30, 95%, Variant 1,6days.
Altitude:	Up to 2000 m
Installation Category:	II

### Approvals

UL Listed for the USA and Canada

Manufactured under an ISO9000 registered system.

CE	LVD 73/23/EEC; IEC 1010-1 EMC 81/336/EEC; EN 50081-2, EN 50082-2
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Publications and Reference: See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control SR Family

Comprehensive industrial and utility protective relay systems  
for motors, generators, transformers, and feeders

## Section 18

### Key Benefits

- Large backlit display with 40 characters to view relay information and settings in direct sunlight, full numerical keypad, and setpoint navigation keys. (Except 735/737)
- Accurate metering under severe system disturbances (750, 745 & 489) - Power system frequency tracking and adjusting sampling rate accordingly
- Minimize replacement time - Draw-out construction
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Ease of use and installation - same front panel programming, common cutout (Except 735/737)
- Reduce troubleshooting time and maintenance costs -IRIG-B time synchronization, event reports, waveform capture, data logger (Except 735/737)
- Simplify testing - Built in simulation features and unique waveform play back functionality in the 745
- Cost Effective Access information - Via Modbus RTU and DNP 3.0 Level 2 protocols, through standard RS232, RS485 & RS422 serial ports, and optional Modbus RTU over TCP/IP through embedded Ethernet Port to connect to 10MB Ethernet local or wide area networks.
- Complete asset monitoring - Analog I/O, metering including demand & energy (Except 735/737)
- Follow technology evolution - Flash memory for product field upgrade (Except 735/737 that requires an EEPROM replacement)
- Long lasting life - When exposed to chemically corrosive and humid environments with optional conformal coating (Except 735/737)

### Applications

- 735/737 - Feeder Protection
- 750/760 - Feeder Protection (comprehensive)
- 469 - Motor Protection
- 745 - Transformer Protection
- 489 - Generator Protection

### Features

#### —Monitoring and Metering

- Event recorder
- Oscillography and Data Logger
- Self diagnostic
- Metering
- Demand

#### User Interface and Programming

- Front Panel LEDs, full key pad, and backlit LCD display
- RS232, RS485 and RS422 ports - up to 19,200 bps
- Ethernet port - 10 Mbps
- Multiple protocols - ModBus™ RTU, ModBus™ RTU over TCP/IP, DNP 3.0 Level 2, Optional Device Net on 469



### Features (continued)

#### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the SR relays into new or existing monitoring and control systems



# GE Multilin®

## Protection and Control

### 650 Family

Advanced Protection Control and Monitoring System

Section 18

#### Key Benefits

- Unique built-in control features - Comprehensive protection plus programmable logic
- Flexible and cost effective control for complex systems - Use IEC compatible programmable logic to customize the functionality of your protection & control system to address unique, site specific applications
- Human machine interface (HMI) - Standard backlit LCD display with 4 x 20, optional 16 x 40 (240 x 128 pixels) graphical LCD, programmable buttons, and rotary knob for selecting setting menus, and submenus.
- Minimize replacement time - Modular with card draw-out construction
- Reduce troubleshooting time and maintenance costs - IRIG-B time synchronization, event reports, waveform capture, data logger
- Cost Effective Access information - Via multiple protocols, through standard RS232, & RS485, Ethernet Ports.
- Optimal integration flexibility via open standard protocols - Modbus RTU, DNP 3.0 Level 2, IEC60870-5-104, IEC61850
- Minimize communication down time - Reliable redundant Ethernet Communication ports with 10/100BaseTX, 100BaseFX with ST connectors, and optional double 100BaseFX, with ST connectors
- Complete asset monitoring - Full metering including demand & energy
- Follow technology evolution - Flash memory for product field upgrade

#### Applications

- F650: Management and primary protection of distribution feeders and bus couplers
- F650: Backup protection of busses, transformers and power lines
- G650: Packaged generator mains failure detection
- G650: Distributed generation management device
- G650: Reliable Distributed Generation interconnection protection system
- W650: Wind turbine protection, control and monitoring
- W650: Distributed generation grid interconnection device

#### Features

##### Protection and Control

- Up to 32 Programmable digital inputs
- Up to 16 digital outputs
- Trip Circuit Supervision
- Redundant power supply option
- Configurable PLC logic according to IEC 61131-3
- Fully configurable graphic display HMI interface
- Alarms panel



#### Features (continued)

##### Monitoring and Metering

- Energy metering
- Demand metering
- Trip circuit monitoring
- Oscillography
- Data logger
- Sequence of event
- Self diagnostic

##### User Interface

- Large graphic (16x40) or regular (4x20) character display
- Easy to use control via Shuttle key
- Front RS232
- Rear wire 10/100BaseTX Ethernet for LAN connection.
- Rear wire CAN bus port (OPEN CAN protocol - W650)
- Optional fibre optic 100BaseFX Ethernet, single or redundant.
- Optional rear RS485 port
- 1 ready LED and 15 programmable LED indicators
- EnerVista® Integrator providing easy integration of data in the 650 relay into new or existing monitoring and control systems
- Energy metering
- Demand metering
- Trip circuit monitoring
- Oscillography
- Data logger
- Sequence of event
- Self diagnostic



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin®

## Protection and Control

### MII Family

#### Modular Microprocessor Family

An economical choice for standard digital relaying applications

## Section 18

#### Key Benefits

- Ease of use and installation - same front panel programming, common cutout
- Follow technology evolution - Flash memory for product field upgrades
- Low priced scalable options - event reports, waveform capture, recloser, breaker fail
- Reduce troubleshooting and maintenance cost - Event reports, waveform capture
- Design flexibility - Easy to use programming logic
- Asset monitoring - Breaker health, and breaker failure protection
- Access to information - Modbus RTU™ communications
- AC/DC power supply
- Easy access via front panel keypad or communication links

#### Applications

- Feeder protection
- Main protection for small generators and motors
- Backup/Auxiliary protection for transformers, motors, generators and busbars
- Overload protection
- Automatic transfer equipment
- Load shedding and restoration schemes
- Backup directional overcurrent protection
- Reverse power protection
- Synchrocheck

#### Features

##### Features and Benefits

- Digital relay
- Incorporates protection, and control
- Local and remote user interfaces
- Internal memory
- Diagnostic features - event recording, and oscillography

##### User Interface and Programming

- Front Panel LEDs, key pad, and 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps

##### Monitoring and Metering

- Current, voltage, frequency, thermal image
- Analog/digital oscillography (optional)
- Event recording up to 32 events
- Self-diagnostics

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in MII relays into new or existing monitoring and control systems



MII Family Feature Comparison

Features		Device	MIF II	MIG II	MIN II	MIV II	MIW II	MIB
Protection	Phase Undervoltage	27P				■		
	Directional Low Forward Power	32L					■	
	Directional Reverse Power	32R					■	
	Loss of Excitation	40					■	
	Current Unbalance	46		■				
	Voltage Unbalance	47				■		
	Thermal Image Unit	49	■	■				
	Ground Overvoltage	59N				■		
	Ground IOC	50G	■	■	■			
	Phase IOC	50P	■	■				
	Ground TOC	51G	■	■	■			
	Phase TOC	51P	■	■				
	Phase Overvoltage	59P				■		
	Fuse Failure	VTFF					■	
	Ground Directional	67G			■			
	Isolated Ground Directional	67N			■			
	Petersen Coil Ground Directional	67PC			■			
	Loss of Mains	78						
	Overfrequency	81O				■		
	Underfrequency	81U				■		
	Starts per Hour and Locked Rotor			■				
	Undercurrent	37		■				
	Differential Unit	87						■
	Restricted Earth Fault	87RGF		■				■
	Breaker Failure Protection	50BF	O					
	Programmable I/O and LEDs		O	■	■	■	■	■
	Breaker Arcing Current		O					
	Programmable Logic		O	■	■	■	■	■
	Multiple Settings Groups		■	■	■	■	■	■
Monitoring and Metering	Event Recorder		O	■	■	■	■	■
	Oscillography		O	■	■	■	■	■
	Thermal Capacity		■	■				
Communications	Alphanumeric Display		■	■	■	■	■	■
	Three-Button Keypad		■	■	■	■	■	■
	ModBus® Communications		■	■	■	■	■	■
	RS232 Serial Port		■	■	■	■	■	■
	RS485 Serial Port		■	■	■	■	■	■





## Protection

### Phase Time Overcurrent

Pickup level:	10 – 240% of CT rating
Curve shapes:	Definite time, inverse, very inverse, extremely inverse, custom
Time multiplier:	0.05 – 2.00 in steps of 0.01
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Ground Time Overcurrent

Pickup level:	10 – 240% of CT rating
Curve shapes:	Definite time, inverse, very inverse, extremely inverse, custom
Time multiplier:	0.05 – 2.00 in steps of 0.01
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Phase Instantaneous

Pickup level:	10 – 3000% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Ground Instantaneous

Pickup level:	10 – 3000% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Ground Directional

Torque angle:	-90°, +90° (1° steps)
Direction:	Forward/back (rew)
Loss of voltage polarization logic:	Enable/disable

### Isolated Ground Directional (MIN Option S)

Voltage pickup levels:	Vh 2 – 70 V in steps of 0.01 V Vi 2 – 70 V in steps of 0.01 V
Current pickup levels:	I low 5 – 400 mA in steps of 1 mA I hi 5 – 400 mA in steps of 1 mA
Definite time:	0 – 99.99 sec in steps of 10 msec
Instantaneous trip deviation time:	0 – 99.99 sec in steps of 100 msec
Torque angle:	-90°, +90° (1° steps)

### Petersen Coil Ground Directional

Voltage pickup levels:	Vh 2 – 45 V in steps of 0.1 V
Current pickup levels:	I low 5 – 100 mA in steps of 1 mA
Real power pickup levels:	10 – 4500 mW in steps of 0.1 mW
Definite time:	0.03 – 3 sec in steps of 10 msec
Instantaneous trip deviation time:	1 – 10 sec in steps of 100 msec
Torque angle:	-90, +90 (0.01 steps)

### Directional Reverse Power

Power pickup level:	0.01 – 0.99 x Rated MW
Time delay:	0.2 – 120 seconds in steps of 0.1
Block from online:	0 – 5,000 sec.

### Directional Low Forward Power

Power pickup level:	0.01 – 0.99 x Rated MW
Time delay:	0.2 – 120 seconds in steps of 0.1
Block from online:	0 – 15,000 sec.

### Loss of Excitation

Circle 1 diameter:	2.5 – 300 ohm
Circle 1 offset:	2.5 – 150 ohm
Circle 1 trip delay:	0.1 – 10 sec
Circle 2 diameter:	2.5 – 300 ohm
Circle 2 offset:	2.5 – 150 ohm
Circle 2 trip delay:	0.1 – 10 sec

### Thermal Image Unit

Tap current:	10 – 240% of CT rating
Cool rate:	
T1	3 – 600 min
T2	1 – 6 x T1
K	1 – 1.2
Alarm level:	70 – 100%

### Phase Undervoltage

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

### Phase Overvoltage

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

### Ground Overvoltage

Pickup level:	2.0 – 60 V or 10 – 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

### High Impedance

### Differential Unit

Pickup Level:	10mA to 400mA
Definite Time:	Up to 600 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Alarm Unit

Pickup Level:	10mA to 400mA
Definite Time:	Up to 600 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25ms

### Voltage Unbalance

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms



# GE Multilin®

## Protection and Control

### MII Modular Microprocessor Family

#### Common Technical Specifications

## Section 18

### Overfrequency

Source:	Voltage (Phase B)
Pickup level:	42.0 to 67.5 Hz in steps of 0.01 Hz
Time delay:	0.0 to 600 sec in steps of 0.01
Voltage inhibit setting:	30 to 250 V/10 to 60 V in steps of 0.01

### Underfrequency

Source:	Voltage (phase B)
Pickup level:	42.0 to 67.5 Hz in steps of 0.01 Hz
Time delay:	0.0 to 600 sec in steps of 0.01
Voltage inhibit setting:	30 to 250 V/10 to 60 V in steps of 0.01

### Current Unbalance

Pickup level:	5 – 99% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Curve shapes:	I <sup>2</sup> t = K
Time multiplier:	K: 1 – 100
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

### Starts/Hour and Locked Rotor

Pickup level:	101 – 1000% of CT rating
Definite time:	0.1 – 99.9 sec
Time window:	10 – 100 min
Number of starts:	1 – 10
Restart block time:	10 – 100 min

### Undercurrent

Pickup level:	10 – 99% of CT rating
Definite time:	0 – 99.99 sec

### Metering

Frequency:	±5m Hz
Voltage/current:	±3% over the complete range

### Thermal Capacity

Current circuits:	
Continuously:	4 x I <sub>n</sub>
During 3 sec:	50 x I <sub>n</sub>
During 1 sec:	100 x I <sub>n</sub> monitoring (optional)

### Monitoring (Optional)

### Oscillography

Records:	1 x 24 cycles
Sampling rate:	8 samples per power frequency cycle
Triggers:	Any element pickup/operate Digital input change of state Digital output change of state Communication command
Data:	AC input channels Digital input/output channels Self-test events

### Event Recorder

Capacity:	24 events (32 in MIF)
Time-tag:	To 1 millisecond
Triggers:	Any element pickup, operate or reset Digital input/output change of state Self-test events

### Ranges

Current:	0.2 – 30 x I <sub>n</sub>
Voltage:	Pickup level

### Outputs

### Tripping Contacts

Contact capacity:	
Max. operating voltage:	400 VAC
Continuous current:	16 A
Make and carry:	30 A
Breaking:	4000 VA

### Output Relays

Configuration:	6 electromechanical Form C
Contact material:	silver alloy suited for inductive loads
Operate time:	8 ms

#### Max ratings for 100000 operations:

	Voltage	M/C cont.	M/C 0.2 sec	Break	Max Load
DC Resistive	24 VDC	16 A	48 A	16 A	384 W
	48 VDC	16 A	48 A	2.6 A	125 W
	125 VDC	16 A	48 A	0.6 A	75 W
	250 VDC	16 A	48 A	0.5 A	125 W
DC Inductive	24 VDC	16 A	48 A	8 A	192 W
	48 VDC	16 A	48 A	1.3 A	62 W
	125 VDC	16 A	48 A	0.3 A	37.5 W
	250 VDC	16 A	48 A	0.25 A	62.5 W
(L/R = 40 ms)					
AC Resistive	120 VAC	16 A	48 A	16 A	1920 VA
	250 VAC	16 A	48 A	16 A	4000 VA
AC Inductive	120 VAC	16 A	48 A	6 A	720 VA
PF=0.4	250 VAC	16 A	48 A	5 A	1250 VA

### Inputs

### AC Current

Secondary Rated Current:	1m 5 A depending on the selected model, or 50 mA for sensitive ground models
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ I <sub>n</sub> = 5A secondary < 0.08 VA @ I <sub>n</sub> = 1A secondary < 0.08 VA @ I <sub>n</sub> = 1A sensitive ground, secondary
Current Withstand:	4 x I <sub>n</sub> continuously 100 x I <sub>n</sub> for 1 sec.

### AC Voltage

High Range	
Secondary Rated Voltage:	50-240 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	440 Vac continuously
Low Range	
Secondary Rated Voltage:	20-60 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	250 Vac continuously

### Digital Inputs

High Range	
Voltage Threshold:	75 Vdc
Maximum Voltage:	300 Vdc
Relay Burden:	5 mA @ 300 Vdc
Low Range	
Voltage Threshold:	12 Vdc
Maximum Voltage:	57 Vdc
Relay Burden:	2 mA @ 57 Vdc



# GE Multilin®

## Protection and Control

### MII Modular Microprocessor Family

#### Common Technical Specifications

## Section 18

### Communications

Local communication:	Alphanumeric display; 3 button frontal keypad
Remote communication(local or remote PC and communications net):	
Mode:	ModBus® RTU
Speed:	300 to 19,200 bps

### Power Supply

#### Low Range

Rated DC Voltage:	24 to 48 Vdc
Min./Max. DC Voltage:	19 / 58 Vdc

#### High Range

Rated DC Voltage:	110 to 250 Vdc
Min./Max. DC Voltage:	88 / 300 Vdc
Rated AC Voltage:	110 to 230 Vac @ 50 – 60 Hz
Min./Max. AV Voltage:	88 / 264 Vac @ 50 – 60 Hz
Power Consumption:	Max. = 10 W
Backup time:	(date, time and log memory) without power supply voltage >1 week

### Mechanical Characteristics

—Metallic package in quarter 19" rack and four units high
—Frontal MMI with display and keypad
—DB9 connector for RS232 ports on the front (1) and RS485 on the rear
—Protection class IP52 (according to IEC 529)

### Environmental

Temperature	
Storage:	-40° C to +80° C
Operation:	-20° C to +60° C
Humidity:	Up to 95% without condensing

### Type Tests

Test	Standard	Class
Insulation Test Voltage:	IEC 60255-5	2kV, 50/60 Hz 1 min
Surge Test Voltage:	IEC 60255-5	5 kV, 0.5 J. (3 positive pulses and 3 negative.)
1 MHz Interference:	IEC 60255-22-1	III
Electrostatic Discharge:	IEC 60255-22-2 EN 61000-4-2	IV 8 kV in contact, 15 kV through air
Radio interference:	IEC 60255-22-3: 40 MHz, 151 MHz, 450 MHz and cellular phone	III
Radiated Electromagnetic fields with amplitude modulation.	ENV 50140	10 V/m
Radiated Electromagnetic fields with amplitude modulation Common mode	ENV 50141	10 V/m
Radiated Electromagnetic fields with frequency modulation.	ENV 50204	10 V/m
Fast Transients:	ANSI/IEEE C37.90.1 IEC 60255-22-4 BS EN 61000-4-4	IV IV IV
Magnetic fields at industrial frequency:	EN 61000-4-8	30 A/V/m
Power Supply interruptions:	IEC 60255-11	
Temperature:	IEC 57 (CO) 22	
RF Emission:	EN 55011	B
Sinusoidal Vibration:	IEC 60255-21-1	II
Shock:	IEC 60255-21-2	I
Insulation Test:	IEC255-5 (Tested on CTs, Power Supply terminals, Contact Inputs and Contact Outputs)	

### Packaging

Approximate weight:	Two 4-rack	One 8-rack
Net:	8.8 lbs (4 kgs)	3.9 lbs (2.7 kg)
Ship:	9.9 lbs (4.5 kgs)	7 lbs (3.2 kg)

### Approvals

ISO:	Manufactured under an ISO9001 registered system.
CE:	Conforms to 89/336/CEE and 73/23/CEE

\*Specifications subject to change without notice.



# GE Multilin® Protection and Control Generator Protection

## Section 18

### Generator Protection Selector Guide

page 18-24

#### Complete generator protection comparison

A reference table highlighting the feature set for each protection system

### G60

page 18-25

#### Comprehensive protection for generators

The G60 Generator Protection System provides comprehensive protection for medium and large generators, including large steam and combustion turbines, combined-cycle generators and multi-circuit hydro units. The G60 may also be used on pumped storage generators without the need of switching the CT secondary circuitry.



### G30

page 18-27

#### Protection of small to medium sized generators and unit transformers

The G30 Generator Protection System provides economical protection for small to medium sized steam, hydraulic and combustion-turbine generators as well as for applications that have both the generator and transformer in the same zone of protection. The G30 is ideal for protecting single and multi-pole generators with single or split phase windings configurations.



### 489

page 18-29

#### Protection, monitoring and metering for industrial generators

The 489 Generator Protection System provides complete protection of small to medium sized synchronous or induction generators operating at 25, 50 or 60 Hz. The 489 has specific features required for industrial environments including a drawout case to limit downtime during maintenance as well as conformal coating for protection from harsh chemical environments.



### G650

page 18-31

#### Protection for distributed generation applications

The G650 is a distributed generation protection and control system designed to protect and control small to medium size generators, as well as to operate as a distributed generation interconnection protection system.



### W650

page 18-33

#### Advanced wind turbine protection and control system

The W650 Wind Generator Protection System provides economical protection and control of medium to large sized wind turbine generators. The W650 has unique communication and control functionality that drastically reduce the installation costs associated with the coordination of wind turbine protections and system control.



### MIG II

page 18-35

#### Protection for small generators

The MIG II provides a cost effective solution for providing basic protection for rotating electrical machines. The primary application is for the protection of small generators, however the MIG II contains protection elements such as thermal image protection that can be used for protection of small induction motors.



### MIW II

page 18-36

#### Directional power and loss of excitation protection

The MIW II provides directional power and loss of field protection to prevent motoring and detection of loss of excitation on synchronous generators.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control Generator Protection Selection Guide

## Section 18

Features		ANSI	MIG II	W650	G650	489	G30	G60
Protection & Control	Overspeed	12				•		•
	Distance Backup	21P				•		•
	Volts/Hz	24			•	•	•	•
	Synchronism check	25		•	•	•	•	•
	Phase/Ground/Auxiliary Undervoltage	27P/G/A		P/A	P/A	P	P/A	P/A
	Third Harmonic Neutral Undervoltage	27TN				•	•	•
	Directional Power	32		•	•	•	•	•
	Undercurrent	37	•					
	Bearing RTD	38				•		•
	Loss of Field	40			•	•	•	•
	Generator Unbalance	46	•		•	•	•	•
	Voltage phase reversal	47		•	•	•		
	Thermal Overload	49	•		•	•	•	•
	Accidental Energization	50/27			•	•	•	•
	Negative Sequence Overcurrent	50 2/51 2		•				
	Instantaneous Overcurrent Phase/Ground/Neutral	50P/G/N	P/G	P/G/N	P/G/N	P/G	P/G/N	P/G/N
	Timed Overcurrent Phase/Ground/Neutral	51P/G/N	P/G	P/G/N	P/G/N	P/G	P/G/N	P/G/N
	Split Phase	50SP					•	•
	Voltage Restraint Overcurrent	51V		•	•	•	•	•
	Breaker Failure	50BF		•	•	•		
	Power Factor Limiting	55			•			
	Overvoltage Phase/Ground/Neutral/Auxiliary	59 P/G/N/A		P/N/A	P/G/N/A	P/N		P/N/A
	100% Stator Earth Fault	27TN/59N				•		•
	Voltage Unbalance	60V		•				
	Directional Overcurrent Phase/Ground/Neutral/Neg. Seq.	67P/G/N/Q		P/G/N	G/N	G	P/N/Q	P/N/Q
	Power Swing Blocking	68						•
	Out of Step Tripping	78						
	Voltage Surge/Loss of Mains	78V			•			
	Autoreclose	79		•				
	Under/Overfrequency	81U/O		•		•	•	•
	Rate of Change of Frequency	81R			•		•	•
	Lockout	86			•		•	•
	Generator Differential	87G				•		•
	Generator & Transformer Differential	87GT					•	
	Restricted Ground Fault	87RGF	•		•		•	•
	VT Fuse Failure	VTFF		•	•	•	•	•
Automation	Contact Inputs (max)	2	•	64	64	7	96	96
	Contact Outputs (max)	5		16	16	6	64	64
	Analog Inputs			16	16	4	24	24
	Analog Outputs					4	4	4
	RTD Inputs					12	24	24
	Virtual Inputs			32	32		64	64
	Direct Inputs						32	32
	Programmable Logic		•	•	•		•	•
	FlexElements						•	•
	Trip-Coil Supervision			•	•	•	•	•
	User-Programmable LED's			•	•		•	•
	User-Programmable Pushbuttons			•	•		•	•
	Selector Switch						•	•
	Digital Counters						•	•
	Digital Elements						•	•
Monitoring & Metering	Redundant Power Supply			•	•		•	•
	Current		•	•	•	•	•	•
	Voltage			•	•	•	•	•
	Frequency			•	•	•	•	•
	Power Factor			•	•	•	•	•
	Power - Real, Reactive, Apparent			•	•	•	•	•
	Energy			•	•	•	•	•
	Demand - Current, MW, MVA, Mvar			•	•	•	•	•
	Temperature						•	•
	Event Recorder (number of events)		24	479	479	256	1024	1024
COMMS	Oscillography (max samples per cycle)		8	72	72	12	64	64
	Fault Reports			•	•		•	•
	Data Logger (max sample rate)			1s	1s	5s	15ms	15ms
	RS232/RS485 serial communications		•	•	•	•	•	•
	Ethernet Communications			•	•	•	•	•
Protocols	Fiber Optic Ethernet			•	•		•	•
	Modbus Protocol		•	•	•	•	•	•
	DNP 3.0 Protocol			•	•		•	•
	EGD Protocol						•	•
	IEC 61870-5-105 protocol						•	•
	IEC61850 protocol			•			•	•
	Peer-to-Peer Communications (GSSE/GOOSE)			•			•	•
	Simple Network Timesync Protocol			•	•		•	•
	IRIG-B Input			•	•	•	•	•

\* For the most current comparison list see: [www.GEMultilin.com/selector/generator.pdf](http://www.GEMultilin.com/selector/generator.pdf)





# GE Multilin®

## Protection and Control

### G60 Generator Protection System

Comprehensive protection for generators

Section 18

#### Key Benefits

- Secure, high-speed protection elements for complete generator protection, compliant with IEEE C37.102
- Modular hardware architecture allows for flexibility in relay configurations to cover most generator applications
- Advanced automation capabilities for providing customized protection and control solutions
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push buttons, status LEDs, and communication interfaces
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for external recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Available Ethernet Global Data (EGD) eases integration with new and existing GE Energy control systems
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Medium to large generators typically driven by steam, gas or hydraulic turbines
- Pumped Storage generators used as pumping motors for reservoir storage
- Stand-alone protection or component in automated substation control system
- Standard protection product offering on new General Electric generator installations.

#### Features

##### Protection and Control Monitoring and Metering

- Generator stator differential
- 100% stator ground protection
- Loss of excitation
- Power swing blocking and out-of-step tripping
- Backup distance
- Reverse / low forward power
- Restricted ground fault
- Overexcitation
- Generator unbalance
- Split phase protection
- Phase sequence reversal for pumped storage

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip and I/O Extension applications



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder – 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger – 16 channels with sampling rate up to 1 sample/cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to G60 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the G60 into new or existing monitoring and control systems



# GE Multilin® Protection and Control G60 Generator Protection System

## Section 18

### Ordering

G60 - * 00 - H * * - F ** - H ** - M ** - P ** - U ** - W/X **											For full size		
Base Unit	G60	E		H	*	F **	H **	M **	P **	U **	W/X	**	Base Unit
CPU		G											RS485 + RS485 (IEC61850 option not available)
		H											RS485 + multi-mode ST 10BaseF
		J											RS485 + multi-mode ST Redundant 10BaseF
		K											RS485 + multi-mode ST 100BaseFX
		N											RS485 + multi-mode ST Redundant 100BaseFX
													RS485 + 10/100 BaseT
Software Options			00										No Software Options
			01										Ethernet Global Data (EGD)
			03										IEC61850
			04										Ethernet Global Data (EGD) + IEC61850
Mount / Coating				H									Horizontal (19" rack) - Standard
				A									Horizontal (19" rack) - Harsh Environment Coating
				V									Vertical (3/4 size) - Standard
				B									Vertical (3/4 size) - Harsh Environment Coating
User Interface					K								Enhanced English Front Panel
					L								Enhanced English Front Panel with User-Programmable Pushbuttons
					M								Enhanced French Front Panel
					N								Enhanced French Front Panel with User-Programmable Pushbuttons
					O								Enhanced Russian Front Panel
					T								Enhanced Russian Front Panel with User-Programmable Pushbuttons
					U								Enhanced Chinese Front Panel
					V								Enhanced Chinese Front Panel with User-Programmable Pushbuttons
					F								Vertical Front Panel with English display
Power Supply					H							RH	125 / 250 V AC/DC
					L								125/250 V AC/DC with redundant 125/250 V AC/DC
													24 - 48 V (DC only)
CT/VT DSP						8L		8L					Standard 4CT/4VT w/ enhanced diagnostics
						8M		8M					Sensitive Ground 4CT/4VT w/ enhanced diagnostics
						8N		8N					Standard 8CT w/ enhanced diagnostics
						8R		8R					Sensitive Ground 8CT w/ enhanced diagnostics
Digital I/O							XX	XX	XX	XX		XX	No module
							4A	4A	4A	4A		4A	4 Solid State (No Monitoring) MOSFET Outputs
							4C	4C	4C	4C		4C	4 Solid State (Current w/opt Voltage) MOSFET Outputs
							4D	4D	4D	4D		4D	16 Digital Inputs with Auto-Burnish
							4L	4L	4L	4L		4L	14 Form-A (No Monitoring) Latchable Outputs
							67	67	67	67		67	8 Form-A (No Monitoring) Outputs
							6C	6C	6C	6C		6C	8 Form-C Outputs
							6D	6D	6D	6D		6D	16 Digital Inputs
							6E	6E	6E	6E		6E	4 Form-C Outputs, 8 Digital Inputs
							6F	6F	6F	6F		6F	8 Fast Form-C Outputs
							6K	6K	6K	6K		6K	4 Form-C & 4 Fast Form-C Outputs
							6L	6L	6L	6L		6L	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
							6M	6M	6M	6M		6M	2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
							6N	6N	6N	6N		6N	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
							6P	6P	6P	6P		6P	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
							6R	6R	6R	6R		6R	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
							6S	6S	6S	6S		6S	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
							6T	6T	6T	6T		6T	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
							6U	6U	6U	6U		6U	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O						5A	5A	5A	5A	5A		5A	4 dcmA Inputs, 4 dcmA Outputs
						5C	5C	5C	5C	5C		5C	8 RTD Inputs
						5D	5D	5D	5D	5D		5D	4 RTD Inputs, 4 dcmA Outputs
						5E	5E	5E	5E	5E		5E	4 dcmA Inputs, 4 RTD Inputs
						5F	5F	5F	5F	5F		5F	8 dcmA Inputs
Inter-Relay Communications												7A	820 nm, multi-mode, LED, 1 Channel
												7B	1300 nm, multi-mode, LED, 1 Channel
												7C	1300 nm, single-mode, ELED, 1 Channel
												7H	820 nm, multi-mode, LED, 2 Channels
												7I	1300 nm, multi-mode, LED, 2 Channels
												7J	1300 nm, single-mode, ELED, 2 Channels
												7S	G.703, 2 Channels
												7W	RS422, 2 Channels
												76	IEEE C37.94, 820 nm, multi-mode, LED, 1 Channel
												77	IEEE C37.94, 820 nm, multi-mode, LED, 2 Channel

### Accessories for the G60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the G60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/G60](http://www.GEMultilin.com/G60) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a G60 online
- View the UR Family brochure



# GE Multilin® Protection and Control G30 Generator Protection System

Small to medium generators and combined generators and transformer protection

## Section 18

### Key Benefits

- Complete generator protection for small to medium sized generators
- Combined generator and transformer protection in one protection device
- Advanced automation capabilities for providing customized protection and control solutions
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push buttons, status LEDs, and communication interfaces
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- High-end fault and disturbance recording eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocol supports
- High-speed peer-to-peer communications allowing reduction of relay to relay wiring and associated installation costs
- Embedded IEC61850 Protocol with no external protocol converters required

### Applications

- Small to medium sized generators typically driven by steam, gas or hydraulic turbines
- Pumped Storage Generators
- Combined Generator and Transformer in the zone of protection
- Distributed Generator (DG) interconnect protection per IEEE 1547

### Features

#### Protection and Control

- Overall unit differential including transformer
- Restricted ground fault
- Split phase protection
- Loss of excitation, overexcitation
- Generator unbalance
- Reverse and low forward power
- Accidental energization
- Synchronism check
- Phase sequence reversal for pumped storage

#### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for transformer tripping applications



### Features (continued)

#### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder – 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger – 16 channels with sampling rate up to 1 sample/cycle
- Advanced device health diagnostics
- Setting Security Audit Trail for tracking changes to G30 configuration

#### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- EnerVista® Integrator providing easy integration of data in the G30 into new or existing monitoring and control systems



# GE Multilin® Protection and Control G30 Generator Protection System

## Section 18

### Ordering

G30 - * 00 - H * - F ** - H ** - M ** - P ** - U ** - W / X **										For Full Sized Horizontal Mount
Base Unit	G30	E	G	H	J	K	N			Base Unit RS485 + RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
CPU										No Software Options Ethernet Global Data (EGD) IEC61850
Software Options		00	01	03	04					Ethernet Global Data (EGD) IEC61850
Mount / Coating			H	A	V	B				Ethernet Global Data (EGD) + IEC61850 Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Environment Coating Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Environment Coating
User Interface				K	L	M	N	O	Q	Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
Power Supply				H	L					125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)
CT/VT DSP						8L	8M	8N	8R	Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 2CT/6VT w/ enhanced diagnostics
Digital I/O						XX	XX	XX	XX	No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/ opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O						5C	5E	5F	5F	5C 8 RTD Inputs 4 dcma Inputs, 4 RTD Inputs 8 dcma Inputs
Inter-Relay Communications						7A	7B	7C	7H	820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels G.703, 1 Channels G.703, 2 Channels RS422, 1 Channels RS422, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 1 Channel IEEE C37.94, 820 nm, multimode, LED, 2 Channel C37.94SM, 1300nm Singlemode, ELED, 1 Channel Single mode C37.94SM, 1300nm Singlemode, ELED, 2 Channel Single mode

### Accessories for the G30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the G30, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/G30](http://www.GEMultilin.com/G30) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a G30 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### 489 Generator Protection System

Economical protection, monitoring and metering for generators

Section 18

#### Key Benefits

- Complete, secure protection of small to medium sized generators
- Easy to use generator protection system supported by an industry leading suite of software tools.
- Advanced protection and monitoring features including the use of RTDs for stator and bearing thermal protection and Analog Inputs for vibration monitoring
- Global acceptance as a member of the most renowned protection relay product family in the market.
- Draw-out construction allowing for minimized downtime and easy removal/installation of the 489 during maintenance routines
- Large, user-friendly front panel interface allowing for realtime power monitoring and setpoint access with a display that is easily readable in direct sunlight
- Enhanced generator troubleshooting through the use of IIRGB time synchronized event records, waveform capturing, and data loggers
- Simplified setpoint verification testing using built in waveform simulation functionality
- Cost effective access to information through industry standard communication hardware (RS232, RS485, 10BaseT Ethernet) and protocols (Modbus RTU, Modbus TCP/IP, DNP 3.0)
- Available for use in most extreme harsh locations with the available Harsh Chemical Environment Option

#### Applications

- Synchronous or induction generators operating at 25Hz, 50Hz or 60Hz
- Primary or backup protection in cogeneration applications

#### Features

##### Protection and Control

- Generator stator differential
- 100% stator ground
- Loss of excitation
- Distance backup
- Reverse power (anti-motoring)
- Overexcitation
- Ground directional overcurrent
- Inadvertent energization
- Breaker failure
- Stator and bearing thermal monitoring
- Stator and bearing vibration monitoring
- Negative sequence overcurrent

##### Communications

- Networking interfaces - RS232, RS485, 10Mbps copper Ethernet
- Multiple protocols - ModBus™ RTU, ModBus™ TCP/IP, DNP 3.0 Level 2



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, Energy, frequency, power factor
- Demand – current, watts, vars, VA
- Temperature – 12 RTD inputs
- Vibration and Speed – 4 analog transducer inputs
- Event Recorder – 256 time tagged events
- Oscillography – 12 samples/ cycle up to 128 cycles in length
- Trending – 8 parameters with up to a 5 second sample rate

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- Ease to use real time monitoring, control, and data archiving software available
- EnerVista® Integrator providing easy integration of data in the 489 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



GE Multilin®  
Protection and Control  
489 Generator Protection System

Ordering

489	*	*	*	*	*	
I						Current Input Relays
P1						1 A phase CT secondaries
P5						5 A phase CT secondaries
	LO					Power Supply Options
	HI					DC: 24 – 60 V; AC: 20 – 48 V @ 48 – 62 Hz
						DC: 90 – 300 V; AC: 70 – 265 V @ 48 – 62 Hz
		A1				Analogue Outputs
		A20				0 – 1 mA analog outputs
						4 – 20 mA analog outputs
				E		Enhancements
				T		Enhanced display, larger LCD, improved keypad
						Enhanced display, larger LCD, improved keypad plus
						10BaseT Ethernet Port
					H	Environmental Protection
						Harsh (Chemical) Environment Conformal Coating

Accessories for the 489

489 Generator Protection Learning CD	TRCD-SR489-C-S-1
Multilink Ethernet Switch	ML1600-HI-A1-A1
Multinet®	Multinet-FE
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1

Visit [www.GEMultilin.com/489](http://www.GEMultilin.com/489) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 489 online
- View the 489 brochure



# GE Multilin®

## Protection and Control

### G650 Generator Protection System

Protection, control and monitoring for generator interconnection

Section 18

#### Key Benefits

- Complete distributed generator interconnection protection with two protection options, Basic Protection and Enhanced Protection, to fit your generator protection requirements.
- Preconfigured with Logic for standard Tripping and Closing operation.
- Reduce installation space requirements with a compact design incorporating protection, control, programmable pushbuttons, programmable LEDs, and communication interfaces
- Reduced system event analyzing time and cost through integrated Sequence of Event reports, Oscillography recording, and Trending files.
- Flexible and cost effective control for complex systems through the use of IEC61131 compatible programmable logic to customize the relay's operation
- Minimized communication down time through reliable redundant Ethernet Communication ports

#### Applications

- Protection of small to medium sized Induction or Synchronous Generators
- Stand-alone or component in automated substation control system
- Distributed generation and interconnection protection, management, and control where programmable logic is a requirement to interact with prime mover control system

#### Features

##### Basic Protection Option

- Phase, Neutral, Ground and Negative Sequence TOC and IOC
- Neutral and Ground Directional Overcurrent
- Voltage Restraint Overcurrent
- Phase Under and Overvoltage, Neutral and Ground Overvoltage
- Directional Power
- Under and Overfrequency, and Frequency Rate of Change
- Generator Thermal Model
- Generator Current unbalance
- Loss of Excitation
- Inadvertent Generator Energization

##### Enhanced Protection Option (Includes all Basic functions)

- Sensitive Ground Overcurrent
- Volts/Hz
- Power Factor limiting
- Vector surge loss of mains detection
- Breaker Failure
- VT Fuse failure
- Restricted Ground Fault



#### Features (continued)

##### Monitoring and Metering

- Current, voltage, power, power factor, frequency metering, demand
- Breaker condition monitoring including breaker arcing current (I<sub>2t</sub>) trip counters, and trip circuit monitoring
- Event Recorder - 479 time tagged events, with 1ms time resolution
- High resolution oscillography and Data Logger, with programmable sampling rate
- Fault locator, record of last 10 faults

##### Communications

- Standard serial interface with RS232 - up to 115,200 bps
- Optional second rear RS485 or serial fiber plastic or glass fiber optic port
- Ethernet Ports - 10/100 Base TX, 100 Base FX with ST connectors, options for redundancy available
- Multiple protocols - ModBus™ RTU and over TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104, Http, and tftp.

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the G650 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control G650 Generator Protection System

## Section 18

### Ordering

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

G650	*	*	*	F	*	G	*	*	*	Description
B										<b>Display and Functionality Options</b>
M										Basic Display and Basic Protection Functionality.
N										Graphical Display with Standard Symbols and Basic Protection Functionality.
E										Graphical Display with IEC Symbols and Basic Protection Functionality.
C										Basic Display and Enhanced Protection Functionality.
D										Graphical Display with Standard Symbols and Enhanced Protection Functionality.
										Graphical Display with IEC Symbols and Enhanced Protection Functionality.
										<b>Rear Serial Communications Board 1</b>
										None
										Redundant RS485
										Redundant plastic F.O.
										Redundant glass F.O.
										Redundant RS485 + remote fiber CAN bus I/O
										Redundant plastic F.O. + remote fiber CAN bus I/O
										Redundant glass F.O. + remote fiber CAN bus I/O
										Remote cable CAN bus I/O
										RS485 + Remote cable CAN bus I/O
										<b>Rear Ethernet Communications board 2</b>
										10/100 BaseT
										10/100 BaseT + 10/100 Base FX
										10/100 BaseT + redundant 10/100 Base FX
										Redundant 10/100 Base TX
										<b>I/O board 1</b>
										16 digital inputs + 8 outputs
										8 digital inputs, 4 circuits for circuit supervision, 6 Outputs + 2 outputs with circuits for trip current supervision (latching)
										32 Digital Inputs
										16 Digital Inputs + 8 Analog Inputs
										<b>I/O board 2</b>
										None
										16 Digital Inputs + 8 Outputs
										32 Digital Inputs
										16 Digital Inputs + 8 Analog Inputs
										<b>Auxiliary Voltage</b>
										24-48 Vdc (range 19.2 - 57.6)
										110-250 Vdc (range 88-300)
										120-230 Vac (range 88-264)
										Redundant LO
										Redundant HI
										<b>ENVIRONMENTAL PROTECTION</b>
										Without Harsh (Chemical) Environment
										Conformal Coating
										Harsh (Chemical) Environment Conformal Coating

### Accessories for the G650

Multilink Ethernet Switch	ML1600-HI-A2-A2
Multinet®	Multinet-FE
Viewpoint Monitoring	VP-1

Visit [www.GEMultilin.com/G650](http://www.GEMultilin.com/G650) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a G650 online
- View the G650 brochure



### Key Benefits

- [illegible]

- Protection of single wind turbine generators
- Transfer trip application for wind farm controls

## Features (continued)

**EnerVista® Software**

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- Ease to use real time monitoring, control, and data archiving software available
- EnerVista® Integrator providing easy integration of data in the W650 into new or existing monitoring and control systems

- 100Mbit Fiber Optic Ethernet
- RS485, RS232, and Canbus serial interfaces
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, CANopen

- Metering - current, voltage, power, power factor, frequency, energy, demand
- Oscillography - analog and digital parameters at 64 samples/cycle
- Event Recorder - 128 time tagged events
- Data Logger - 16 channels with sampling rate up to 1 sample/second
- Fault Locator - 10 configurable Fault Reports



Rev. 1/08  
Prices and data subject  
to change without notice

# GE Multilin® Protection and Control W650 Wind Generator Protection System

## Section 18

### Ordering

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

W650	*	*	*	F	*	G	*	*	*	*
B										
M										
	F									Basic display (4 x 20 characters)
	A									Graphic display (240 x 128 pixels)
	P									<b>Rear serial communications board 1</b>
	G									None
	X									Redundant RS485
	Y									Redundant plastic fiber optic
	Z									Redundant glass fiber optic
	C									Redundant RS485 + fiber CAN port (CANopen)
	M									Redundant plastic fiber optic + fiber CAN port (CANopen)
										Redundant glass fiber optic + fiber CAN port (CANopen)
										Cable CAN port (CANopen)
										RS485 + cable CAN port (CANopen)
										<b>Rear ethernet communications board 2</b>
										10/100 Base TX
										10/100 Base TX + 100 Base FX
										10/100 Base TX + Redundant 100 Base FX
										Redundant 10/100 Base TX
										<b>I/O Board 1 in Slot F</b>
										16 Digital Inputs + 8 Outputs
										8 Digital Inputs + 8 Outputs + 2 Trip / Close circuit supervision circuits
										32 Digital Inputs
										16 Digital Inputs + 8 Analog Inputs
										<b>I/O Board In Slot G</b>
										None
										16 Inputs + 8 Outputs
										32 Digital Inputs (See Note 1)
										16 Digital Inputs + 8 Analog Inputs (See Note 1)
										<b>Auxiliary Voltage</b>
										24-48 Vdc (range 19.2 - 57.6)
										110-250 Vdc (range 88 - 300)
										120-230 Vac (range 96 - 250)
										Redundant LO
										Redundant HI
										<b>Protocol</b>
										without IEC 61850
										IEC61850
										<b>Environmental Protection</b>
										Without Harsh (Chemical) Environment Conformal Coating
										Harsh (Chemical) Environment Conformal Coating

Note 1: The number selected for option G must be equal or higher than the number selected for option F.

### Accessories for the W650

Multilink Ethernet Switch	ML1600-HI-A2-A2
Multinet®	Multinet-FE
Viewpoint Monitoring	VP-1

Visit [www.GEMultilin.com/W650](http://www.GEMultilin.com/W650) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a W650 online
- View the W650 brochure





# GE Multilin®

## Protection and Control

### MIG II Generator Protection System

Three-phase and ground protection for small generators

Section 18

#### Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Follow technology evolution - Flash memory for product field upgrade
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista® compatible
- Isolated RS232 port

#### Applications

- Small generators and motors
- Component for bigger generator packages
- Standby/critical power protection main unit
- Small motor protection
- Transformer protection

#### Features

##### Protection and Control

- Phase, ground TOC
- Phase, ground IOC
- Thermal image protection
- Circuit breaker control (open and close)
- Negative Sequence Element
- Restricted Ground Differential Element
- Undercurrent
- Maximum number of starts
- Locked rotor
- Configurable I/O
- Six outputs: trip, service, 4 auxiliary
- 4 pre-configured overcurrent curves (ANSI, IEC)



#### Features (continued)

##### Monitoring and Metering

- 24-event record
- Analog/digital oscillography
- Per phase current metering
- Monitoring of the last 5 trips information from the display

##### User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps
- EnerVista® Software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices

#### Ordering

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

MIG II *	*	*	*	E	0	0	*	0	0	Description
P										<b>Application</b>
Q										Generator protection elements
										Motor protection elements
										<b>Curves</b>
										ANSI
										IEC
										<b>PHASE CT</b>
										CT In = 5 A (0.5 - 12 A)
										CT In = 1 A (0.1 - 2.4 A)
										<b>GROUND CT</b>
										CT In = 5 A (0.5 - 12 A)
										CT In = 1 A (0.1 - 2.4 A)
										CT In = 1 A (0.005 - 0.12 A) *
										<b>POWER SUPPLY</b>
										24 - 48 Vdc ( 19.2 - 57.6 Vdc)
										110 - 250 Vdc ( 88 - 300 Vdc )
										110 - 230 Vac ( 88 - 264 Vac )

Visit [www.GEMultilin.com/MIGII](http://www.GEMultilin.com/MIGII) to:

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



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

GE Multilin®  
Protection and Control  
MIW II Directional Power Protection System

Numerical reverse, forward and low forward directional power and loss of field protection relay

Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analogy/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista® compatible
- Isolated RS232 port

Applications

- Controlling power flow in AC generator applications

Features

Protection and Control

- Three power elements for MIW II 1000 and four power elements for MIW II 2000 (32\_x)
- Loss of field/excitation (40)
- Fuse failure (60)
- Configurable I/O
- 6 outputs, 4 configurable, plus trip and alarm

Monitoring and Metering

- Metering values for Ia, voltage values, P, Q, S, V<sub>1</sub>, V<sub>2</sub> and angle.
- 24-event record
- Analog/digital oscillography - 24 cycles at 8 samples per cycle
- Information displayed on last 5 relay trips

User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus RTU protocol up to 19,200 bps
- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices



Visit [www.GEMultilin.com/MIWII](http://www.GEMultilin.com/MIWII) to:

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

Ordering

MIW II*	0	0	0	E	0	0	*	0	0	DESCRIPTION
1										<b>Protection Elements:</b> 3 x Directional Power, 1 x Loss of field, 1 x Fuse Failure
2										4 x Directional Power
							LO HI			<b>Power Supply</b> 24-48 VDC (Range: 19~58 VDC) 110-250 VDC (Range: 88~300 VDC) 110-230 VAC (Range: 88~264 VAC)



Selector Guide

page 18-38

**Complete transformer protection comparison**

A reference table highlighting the feature set for each protection system

**T60**

page 18-39

**Comprehensive multi-winding transformer protection system**

The T60 Transformer Protection System is designed for various power transformer applications, including auto-transformers, generator step up transformers, split-phase, angle regulating transformers and reactors. Uses multiple current and voltage inputs to provide primary protection and back-up protection of transformers, including differential, ground differential, phase, neutral, and ground overcurrent, under- and over-voltage, under- and over-frequency, over-fluxing, and breaker failure protection. Also provides protection of transformer based on winding temperature and loss-of-life calculations.



**T35**

page 18-41

**Cost effective protection for transformers with up to 6 restraints**

The T35 Transformer Protection System is designed to provide basic transformer protection functions for variety of transformer applications. Uses multiple current inputs to provide primary protection and backup protection of transformers, including differential, phase and ground overcurrent, protection. The relay can be configured to accept up to 6 sets of current inputs to provide proper differential restraint for applications with three winding transformers with windings configured in dual breaker arrangements.



**745**

page 18-43

**Draw-out transformer protection system**

The 745 Transformer Protection System is a full featured transformer protection relay, suitable for application on small, medium, and large power transformers. The 745 can be applied on two-winding and three-winding transformers. Uses multiple current and voltage inputs to provide primary protection and back-up protection of transformers, including differential, ground differential phase, neutral, and ground overcurrent, over-fluxing, and on-load tap changer. The 745 also has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments. 745 also includes analog inputs and outputs, while incorporating advanced features such as transformer loss of life calculations.



Features		ANSI	745	T35	T60
Protection/Control	Transformer Differential	87T	•	•	•
	Maximum Number of Windings		3	4	6
	Harmonic Restraint		•	•	•
	Internal Winding Phase Shift Compensation		•	•	•
	Dynamic CT Ratio-Matching		•	•	•
	CT Mismatch Range		16/1	32/1	32/1
	Restricted Ground Fault	87RGF	•	•	•
	Over-Fluxing (Voltz Per Hertz)	24	•	•	•
	Phase Undervoltage	27P	•	•	•
	IOC, Ground/Neutral/Phase	50G/N/P	G/N/P	•	G/N/P
	TOC, Ground/Neutral/Phase	51G/N/P	G/N/P	G/P	G/N/P
	Custom programmable overcurrent curves		•	•	•
	Overvoltage, Neutral/Phase/Auxiliary	59N/P/X	•	•	N/P/X
	Overvoltage, Symmetrical Component	59N	•	•	•
	Current Directional, Neutral/Phase	67 N/P	•	•	P/N
	Voltage Transformer Fuse Failure	VTEF	•	•	•
	Under/Overfrequency	81U/O	•	•	•
	Synchrocheck	25	•	•	•
Automation	Transformer Overload	49	•	•	•
	Lockout	86	•	•	•
	Settings Groups		4	6	6
	Contact Inputs (Up to)		16	96	96
	Contact Outputs (Up to)		8	64	64
	Non-volatile latches		•	•	•
	Programmable Logic		•	•	•
	FlexElements™		•	•	•
	Virtual Inputs/Outputs		16/16	64/96	64/96
	Direct Inputs/Outputs			32/32	32/32
	Programmable Pushbuttons			12	12
	Trip/Close Coil Supervision		Trip	Trip/Close	Trip/Close
	User-Programmable LEDs			48	48
	User-Programmable Self Test		•	•	•
	Selector Switch		•	•	•
	Digital Counters		•	•	•
	Digital Elements		•	•	•
Monitoring/Metering	Analog Inputs/Outputs (Up to)		1	24/12	24/12
	RTD Inputs (Up to)		1	24	24
	Power Factor		•	•	•
	Current – RMS		•	•	•
	Current – Phasor		•	•	•
	Current – Demand		•	•	•
	Current – Unbalance		•	•	•
	Voltage		•	•	•
	Power – Apparent, Real, Reactive		•	•	•
	MW, MVA, Mvar Demand		•	•	•
	Breaker Arc Current		•	•	•
	Energy		•	•	•
	Frequency		•	•	•
	Temperature		•	•	•
	Current Harmonics (Up to)		21	•	25
	Loss of Life Calculations		•	•	•
	Fault Report		•	•	•
	User Programmable Trip Reports		•	•	•
Comms	Event Recorder - Number of Events		40	1024	1024
	Oscillography - Sampling Rate		12	64	64
	Trip Counters		•	•	•
	Data Logger		•	•	•
	Simulation Mode		•	•	•
	RS232 Port		•	•	•
	RS485 Port		•	•	•
	RS422, G.703, C37.94		•	•	•
	Ethernet		•	•	•
	Fiber (800nm, 1300nm, 1550nm)		•	•	•
Protocols	ModBus (RTU & TCP/IP)		•	•	•
	DNP3		•	•	•
	EGD Protocol		•	•	•
	IEC61850		•	•	•
	IEC 60870-5-104		•	•	•
	Simple Network Time Protocol		•	•	•
	TCP/IP		•	•	•
	HTTP		•	•	•
	IRIG-B Input		•	•	•

\* For the most current comparison list, see [www.GEMultilin.com/selector/transformer.pdf](http://www.GEMultilin.com/selector/transformer.pdf)

# GE Multilin®

## Protection and Control

### T60 Transformer Protection System

Fully featured, multiple winding transformer protection

Section 18

#### Key Benefits

- Secure high-speed protection for transformers, compliant with IEEE C37.91
- Improved security for transformer energization and inrush provided through a superior Adaptive 2nd Harmonic Restraint algorithm
- Sensitive ground fault protection provides low impedance differential protection down to 5% of the winding to limit transformer damage
- Integrated transformer thermal monitoring for asset management maintenance optimization
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs, and communication interfaces
- Advanced automation capabilities for providing customized protection and control solutions
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Reliable and secure protection for three-phase transformers, autotransformers, reactors, split phase and phase angle regulating transformers
- Transformer asset monitoring using Hottest Spot, Loss-of-Life and Aging Factor
- Applicable for transformers with windings in a ring bus or breaker-and-a-half configuration
- Stand-alone or component in automated substation control system

#### Features

##### Protection and Control

- Dual slope, dual breakpoint differential restraint characteristic restrained and unrestrained differential
- 2nd harmonic inrush and overexcitation inhibit
- Transformer overexcitation protection
- Restricted ground fault
- Loss-of-Life, Aging Factor, Hottest Spot
- Phase & Neutral overvoltage
- Synchrocheck

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip applications



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency, temperature, transformer monitoring
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder – 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger – 16 channels with sampling rate up to 1 sample /cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to T60 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the T60 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin® Protection and Control T60 Transformer Protection System Ordering

## Section 18

T60 - * 00 - H * * - F ** - H ** - M ** - P ** - U ** - W/X **										For Full Sized Horizontal Mount
Base Unit	T60	E G H J K N								Base Unit RS485 + RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
CPU										No Software Options Ethernet Global Data (EGD) IEC61850 Ethernet Global Data (EGD) + IEC61850 Synchrocheck Synchrocheck + IEC61850
Software Options	00 01 03 04 10 11									Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
Mount / Coating		H A V B								Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
User Interface			K L M N O T U V F							125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)
Power Supply			H L						RH	Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 8CT/6VT w/ enhanced diagnostics
CT/VT DSP				8L 8M 8N 8R		8L 8M 8N 8R				No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 2 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 4 dcma Inputs, 4 dcma Outputs 8 RTD Inputs 4 dcma Inputs, 4 RTD Inputs 8 dcma Inputs
Digital I/O				XX 4A 4C 4D 4L 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	5A 5C 5E 5F	
Transducer I/O				5A 5C 5E 5F	5A 5C 5E 5F	5A 5C 5E 5F	5A 5C 5E 5F	5A 5C 5E 5F	5A 5C 5E 5F	7A 7B 7C 7H 7I 7J 7S 7W 77 2B
Inter-Relay Communications										820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels G.703, 2 Channels RS422, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 2 Channel C37.94SM, 1300nm Singlemode, ELED, 2 Channel Single mode

Accessories for the T60

### Accessories for the T60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the T60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/T60](http://www.GEMultilin.com/T60) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a T60 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### T35 Transformer Protection System

Section 18

Cost effective differential protection for transformers with up to 6 sets of CTs

#### Key Benefits

- Secure high-speed transformer differential protection with advanced features in a cost-effective package
- Improved security for transformer energization and inrush provided through a superior Adaptive 2nd Harmonic Restraint algorithm
- Application flexibility for transformers with up to 6 sets of CTs, with independent magnitude/phase angle compensation and grounding settings
- Advanced automation capabilities for providing customized protection and control solutions
- Embedded IEC61850 Protocol
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs, and communication interfaces
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Primary and backup protection of power transformers autotransformer, reactors, split-phase and angle regulating transformer
- Combined protection for transformer and small bus zone, including breaker-and-a-half and ring bus diameters
- Stand-alone or component in automated substation control system
- Advanced data logging for asset management and maintenance optimization

#### Features

##### Protection and Control

- Percent restrained and unrestrained differential protection
- 2nd harmonic inrush inhibit and overexcitation inhibit
- TOC elements for backup protection
- Transducer I/Os (RTD & dcMA)
- Flex Elements™
- FlexCurves™

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip applications

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency, temperature
- Oscillography – analog and digital parameters at 64 samples/cycle



#### Features (continued)

- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to T35 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the T35 into new or existing monitoring and control systems



# GE Multilin® Protection and Control T35 Transformer Protection System Ordering

## Section 18

	T35 - * - ** - H * - * - F** - H** - M** - P** - U** - W**												For full sized horizontal mount
Base Unit	T35	E	G	H	J	K	N						Base Unit RS485 & RS485 (IEC61850 option not available) RS485 + 10BaseF RS485 + Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 100BaseT
CPU													IEC61850
Software Options		00	03										No Software Options
Mount				H	A	V	B						Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface					K	L	M	N	O	T	U	V	Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
Power Supply					H	L						RH	125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC power supply 24 - 48 V (DC only)
CT/VT DSP							8L	8M	8N	8R			Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 2CT/6VT w/ enhanced diagnostics
Digital I/O							XX	XX	XX	XX	XX		No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O							5C	5D	5E	5F			8 RTD Inputs 4 dcma inputs, 4 RTD Inputs 8 dcma inputs
Inter-Relay Communications							7A	7B	7C	7D	7E	7F	820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels G, 703, 2 Channels RS422, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 2 Channel

### Accessories for the T35

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the T35, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/T35](http://www.GEMultilin.com/T35) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a T35 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### 745 Transformer Protection System

High-speed, draw-out transformer protection and management

Section 18

#### Key Benefits

- Easy to use Transformer Protection System supported by industry leading suite of software tools to optimize transformer performance and to extend life expectancy
- Improved security for transformer energization using superior Adaptive 2nd Harmonic Restraint algorithm
- Accurate built-in metering functions - Eliminates auxiliary metering devices and reduces cost
- Advanced automation capabilities using FlexLogic to provide customized protection and control solutions
- Fast, flexible and reliable communications - Embedded 10BaseT Ethernet capability provides faster data transfer for improved system performance
- Minimize replacement time - Draw-out construction ideal in industrial environments
- Reduce troubleshooting time and maintenance costs - IIRIG-B time synchronization, event reports, waveform capture, data logger
- Simplified testing - Built in simulation features for setpoint verification including waveform playback for relay setting verification
- Cost effective access to information - Modbus and DNP 3.0 Level 2 protocols through embedded Ethernet, standard RS232, RS485 & RS422 serial ports.
- Globally accepted - Member of the most renowned product family in the market.
- Extended life - Optional conformal coating for chemically corrosive and humid environments
- Fast and easy troubleshooting, improved maintenance procedures and increased device security - Security Audit Trail provides detailed traceability for system configuration changes

#### Applications

- Primary and back-up protection and management of small, medium and larger power transformers, autotransformers and reactors
- Transformer asset monitoring using Hottest Spot, Loss-of- Life and Aging Factor
- Stand-alone or component in automated substation control system

#### Features

##### Protection and Control

- Variable dual-slope percent differential protection
- Magnetizing inrush and overexcitation blocking
- Phase & ground overcurrent elements
- Adaptive time overcurrent using FlexCurves elements
- Underfrequency/Overfrequency Protection
- Frequency rate-of-change Detection
- Overexcitation (V/Hz) Protection
- Restricted Ground Fault Protection
- Transformer overload protection



#### Features (continued)

##### Communications

- Networking interfaces - 10Mbps Ethernet, RS232, RS485 and RS422 ports
- Ethernet port, 10Mbps
- Multiple protocols - ModBus™ RTU, ModBus™ RTU TCP/IP, DNP 3.0 Level 2

##### Monitoring and Metering

- Metering - current, voltage, sequence components per winding, power, energy, voltage
- THD and harmonics up to the 21st
- Event recording - 128 time tagged events
- Tap position up to 50 tap positions
- Ambient temperature /analog transducer input
- Analog transducer input
- Oscillography & Data Logger - 10 records up to 32 power cycles
- Simulation mode and playback capability.

##### EnerVista® Software

- Sophisticated software for configuration and commissioning
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset
- EnerVista® Integrator providing easy integration of data in the 745 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## 745 Transformer Protection System

### Ordering

<b>745</b>	*	*	*	*	*	*	*	*	*	*
745										
W2										
W3										
P1										
P5										
P15										
P51										
P115										
P151										
P155										
P511										
P515										
P551										
G1										
G5										
G15										
G51										
LO										
HI										
A										
L										
R										
E										
T										
H										

Base unit Transformer Protection System

#### Phase Current Input Rating

2 windings per phase

3 windings per phase

#### Phase Current Input Rating

1 A for all windings

5 A for all windings

1 A for winding 1, 5 A for winding 2

5 A for winding 1, 1 A for winding 2

1 A for winding 1, 1 A for winding 2, 5 A for winding 3

1 A for winding 1, 5 A for winding 2, 1 A for winding 3

1 A for winding 1, 5 A for winding 2, 5 A for winding 3

5 A for winding 1, 1 A for winding 2, 1 A for winding 3

5 A for winding 1, 1 A for winding 2, 5 A for winding 3

5 A for winding 1, 5 A for winding 2, 1 A for winding 3

#### Ground Current Input Rating

1 A for windings 1 and 2, 1 A for windings 2 and 3

5 A for windings 1 and 2, 5 A for windings 2 and 3

1 A for windings 1 and 2, 5 A for windings 2 and 3

5 A for windings 1 and 2, 1 A for windings 2 and 3

#### Power Supply Options

24 – 60 VDC, 20 – 48 VAC @ 48 – 62 Hz

90 – 300 VDC, 70 – 265 VAC @ 48 – 62 Hz

#### Enhancements

Analog input/outputs option

Loss of Life

Restricted ground fault option

Enhanced display, larger LCD, improved keypad

Enhanced display, larger LCD, improved keypad plus

10BaseT Ethernet Port

#### Environmental Protection

Harsh (Chemical) Environment Conformal Coating

### Accessories

Dual mounting available with the 19-2 Panel

**NOTE:** For dimensions see SR Family brochure.

### Accessories for the 745

745 Applications Learning CD	TRCD-SR745-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

Visit [www.GEMultilin.com/745](http://www.GEMultilin.com/745) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 745 online
- View the SR Family brochure





### Selector Guide

page 18-46

#### Complete transmission line protection product comparison

A reference table highlighting the feature set for each protection system

### L90

page 18-47

#### Phase segregated line current differential protection

The L90 provides high-speed current differential protection suitable for transmission lines and cables of various voltage levels. The L90 supports dual breaker applications suitable for single and three-pole tripping applications. The L90 uses synchronized sampling at each relay to limit the impact of communications channel issues. The differential element employs an adaptive restraint to balance sensitivity for internal faults and security during external faults. The L90 supports inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94. The L90 also provides Synchrophasor measurement over Ethernet as per IEEE C37.118.

### L60

page 18-49

#### Sub-cycle phase comparison protection

The L60 provides fast and secure sub-cycle phase comparison protection, for both two-terminal and threeterminal lines, lines with series compensation and for single-pole and three-pole tripping applications. The L60 can operate using existing Power Line Carrier or fiber optic communications, and compensates for channel asymmetry and charging currents. The L60 can provide complete support of dual-breaker line terminals by using multiple current inputs. Supports both dual and single phase comparison, and can be configured for tripping or blocking applications.

### D90<sup>Plus</sup>

page 18-51

#### Sub-cycle line distance protection & advanced automation controller

The D90<sup>Plus</sup> is a sub-cycle line distance protection system and bay controller suitable for protecting transmission lines and cables including lines equipped with series compensation. The D90<sup>Plus</sup> supports dual-breaker applications and can be used for single or three-pole tripping. The D90<sup>Plus</sup> supports different teleprotection schemes, including DCB, DCU, POTT, Hybrid POTT, and PUTT. The D90<sup>Plus</sup> also provides Synchrophasor measurement over Ethernet per IEEE C37.118. The automation controller, dedicated programmable logic separate from programmable logic for protection applications, color annunciator and HMI panels make D90<sup>Plus</sup> a stand-alone substation controller.

### D60

page 18-53

#### Transmission line protection with three/single pole tripping

The D60 is suitable for protecting transmission lines and cables including lines equipped with series compensation. The D60 supports dual-breaker applications and can be applied in single-pole or three-pole tripping applications. The D60 is applicable to different teleprotection schemes, including DCB, DCU, POTT, Hybrid POTT, and PUTT, and includes inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94. The D60 also provides Synchrophasor measurement over Ethernet per IEEE C37.118.

### D30

page 18-55

#### Cost-effective, three pole, primary and backup distance protection

The D30 is a cost-effective distance protection system suitable for primary protection of sub-transmission lines and as a backup protection for HV, EHV lines, reactors and generators. The D30 provides three zones of phase and ground distance protection along with complete overcurrent and voltage protection functions intended for three-pole tripping applications. The D30 comes with versatile automation features using which custom pilot schemes can be built. The D30 also includes inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

Features		ANSI	L90	L60	D90 <sup>Plus</sup>	D60	D30
Applications	Distance	21	•	•	•	•	•
	Line Differential - Current Comparison	87L	•				
	Line Differential - Phase Comparison	87PC		•			
	Breaker-and-Half configurations		•	•	•	•	•
	Series Compensation		•	•	•	•	•
	Three terminal lines		•	•	•	•	•
	Lines with In-zone transformers		•	•	•	•	•
Protection & Control	Synchrophasors						
	Typical Operating Time (cycles)		<1	<1	<1	<2	<2
	Mho Phase & Ground Distance (No. of Zones)	21P/G	3	3	5	5	3
	Quad Phase & Ground Distance (No. of Zones)	21P/G	3	3	5	5	3
	IOC, Ground/Neutral/Phase/Negative Sequence	50G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2
	TOC, Ground/Neutral/Phase/Negative Sequence	51G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2	G/N/P/_2
	Directional overcurrent, Neutral/Phase/Neg. Seq.	67G/N/P/_2	N/P/_2	N/P/_2	N/P/_2	N/P/_2	N/P/_2
	Wattmetric Ground Directional		•	•	•	•	•
	Overvoltage Phase/Auxiliary/Neutral	59P/X/N	P/X/N	P/X/N	P/X/N	P/X/N	P/X/N
	Undervoltage Phase/Auxiliary	27P/X	P/X	P/X	P/X	P/X	P/X
	Negative Sequence Overvoltage	59_2	•	•	•	•	•
	Under/Over frequency	81U/O	•	•	•	•	•
	Out-of-Step Blocking/Tripping	68B	•	•	•	•	•
	Switch on to Fault (Line Pickup)	SOTF	•	•	•	•	•
	Voltage Transformer Fuse Failure	VTFF	•	•	•	•	•
	Current Transformer Supervision		•	•	•	•	•
	Open Pole Detector		•	•	•	•	•
	Load Encroachment Logic		•	•	•	•	•
	Breaker Failure	50BF	•	•	•	•	•
	Breaker Flashover		•	•	•	•	•
	Lockout Functionality	86	•	•	•	•	•
	Synchronism Check or Synchronizing	25	•	•	•	•	•
	AC Reclosing (No. of Shots)	79	4	4	4	4	4
	Trip Modes: Three-Pole/Single-Pole		1&3	1&3	1&3	1&3	3
	Pilot Protection Logic		POTT	POTT	•	•	•
	Fault Location		•	•	•	•	•
Automation	Programmable Protection Logic (no of lines)		512	512	512	512	512
	Programmable Automation Logic (no of lines)				1024		
	FlexElements™		•	•	•	•	•
	User Programmable Self-Test Contact		•	•	•	•	•
	Settings Groups		6	6	6	6	6
	Non-volatile latches (up to)		16	16	16	16	16
	Contact Inputs Programmable - (up to)		80	80	60	80	80
	Contact Outputs Programmable - (up to)		64	64	60	64	64
	Virtual Inputs - (up to)		32	32	32	32	32
	Virtual Outputs - (up to)		64	64	64	64	64
	Direct Inputs/Outputs		•	•	•	•	•
	Breaker Control (up to)		2	2	2	2	2
	User-Programmable LEDs (up to)		48	48		48	48
	User - Programmable Annunciator Alarms (up to)				96		
	User-Programmable Push Buttons (up to)		12	12	12	12	12
	User-Programmable Self Test		•	•	•	•	•
	User Definable Displays		•	•	•	•	•
	Large HMI				•		
	Timers		•	•	•	•	•
	Selector Switch		•	•	•	•	•
	Digital Counters		•	•	•	•	•
	Digital Elements		•	•	•	•	•
	IRIG-B Input		•	•	•	•	•
Monitoring & Metering	Analog Inputs/Outputs (up to)		24	24		24	24
	RTD Inputs (up to)		24	24		24	24
	Current, voltage		•	•	•	•	•
	Symmetrical Components		•	•	•	•	•
	Power - Apparent, Real, Reactive		•	•	•	•	•
	Energy		•	•	•	•	•
	Power Factor		•	•	•	•	•
	Frequency		•	•	•	•	•
	Fault Location		•	•	•	•	•
	Event Recorder - Number of Events		1024	1024	8000	1024	1024
	Oscillography - Sampling Rate		64/5	64/5	128/30	64/5	64/5
	Disturbance Recorder - Sampling Rate/Duration in seconds				1/300		
	Breaker Arcing Current		•	•	•	•	•
Comm Interfaces	Trip/Close Coil Supervision		•	•	•	•	•
	Data Logger		•	•	•	•	•
	RS232 Port		•	•	•	•	•
	USB Port		•	•	•	•	•
	RS485 Port		•	•	•	•	•
	Ethernet Port (Fiber and Copper, up to)		1	1	3	1	1
	Direct Fiber Communications (800nm, 1330nm, 1550nm)		•	•	•	•	•
Protocols	Communication Interface (RS422, G.703, C37.94)		•	•	•	•	•
	ModBus (RTU and TCP/IP)		•	•	•	•	•
	DNP3		•	•	•	•	•
	IEC60870-5-104		•	•	•	•	•
	UCA2/MMS		•	•	•	•	•
	IEC61850		•	•	•	•	•
	Simple Network Time Protocol (SNTP)		•	•	•	•	•
	HTTP		•	•	•	•	•
	TFTP		•	•	•	•	•

\* For the most current comparison list, see [www.GEMultilin.com/selector/transmission.pdf](http://www.GEMultilin.com/selector/transmission.pdf)



# GE Multilin®

## Protection and Control

### L90 Line Current Differential System

Phase segregated line current differential and distance protection

Section 18

#### Key Benefits

- Phase segregated differential protection ensures secure high-speed single pole tripping
- Adaptive restraint characteristic provides excellent security against measurement errors including CT saturation.
- Increased sensitivity through dynamic charging current compensation and communication channel asymmetry compensation
- Reliable and secure protection on lines equipped with series compensation
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for external recording devices
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push buttons, status LEDs, and communication interfaces
- Phasor Measurement Unit - Synchronized phasor information according to IEEE C37.118 standard
- Embedded IEC61850 Protocol

#### Applications

- Overhead lines including series compensated lines and underground cables of different voltage levels
- Suitable for three terminal line configurations, with channel redundancy and direct transfer tripping (DTT)
- Circuits with tapped transformer feeders.
- Wide area system monitoring and control and using integrated protection and synchrophasor measurement
- Distributed busbar protection

#### Features

##### Protection and Control

- Phase segregated line current differential with adaptive restraint
- Stub bus protection
- Phase Distance (three Zones) with independent compensation settings for in-zone power transformers
- Ground distance (three zones) with independent self and mutual zero sequence compensation
- Out-of-step tripping and power swing blocking
- Directional overcurrent: Phase, neutral and negative sequence
- Wattmetric zero sequence directional function
- Synchronism check for dual breaker applications
- Four-shot dual breaker auto-recloser

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between L90s for Direct Transfer Trip applications



#### Features (continued)

##### Monitoring and Metering

- Real time monitoring of remote, local and differential per phase currents
- Breaker condition monitoring including breaker arcing current ( $I^2t$ ) and trip counters
- Oscillography - 64 samples/cycle, up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5ms scan of digital inputs
- DataLogger - Up to 16 channels with user selectable sampling rate
- Synchronised measurement of voltage & current and sequence component phasors - 1 to 60 phasors/sec
- Fault Locator

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the L90 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

L90 - * 00 - H * * - F ** - H ** - L ** - N ** - S ** - U ** - W / X **										For Horizontal Mount
Base Unit	L90	E	G	H	J	K	N			Base Unit RS485 + RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
CPU										No Software Options Breaker and Half software IEC61850 Breaker and Half + IEC61850 Phasor Measurement Unit (PMU) IEC61850 + Phasor Measurement Unit (PMU) Breaker & Half + Phasor Measurement Unit (PMU) Breaker & Half + IEC61850 + Phasor Measurement Unit (PMU)
Software		00	02	03	05	06	07	08	09	Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
Mount / Coating				H	A	V	B			Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
User Interface										125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)
Power Supply										Standard 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics
CT/VT DSP										No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 dcmA Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 dcmA Inputs
Digital I/O										7A 820 nm, multi-mode, LED, 1 Channel 7B 1300 nm, multi-mode, LED, 1 Channel 7C 1300 nm, single-mode, ELED, 1 Channel 7H 820 nm, multi-mode, LED, 2 Channels 7I 1300 nm, multi-mode, LED, 2 Channels 7J 1300 nm, single-mode, ELED, 2 Channels 7S G.703, 2 Channels 7W RS422, 2 Channels 73 1550 nm, single-mode, LASER, 2 Channel 76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel 2B C37.94SM, 1300nm Singlemode, ELED, 2 Channel Single mode
Transducer I/O										
Inter-Relay Communications										

### Accessories for the L90

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the L90, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/L90](http://www.GEMultilin.com/L90) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a L90 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### L60 Line Phase Comparison System

Sub-cycle phase comparison and distance protection

Section 18

#### Key Benefits

- Extremely fast and secure phase comparison protection with a typical tripping time of 3/4 power cycle.
- End to end communication over power line carrier provides cost effective solution
- Advanced algorithms for channel noise immunity, accurate per-channel signal asymmetry, charging current compensation and channel delay compensation
- Three zone high speed back-up phase and ground distance function
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push buttons, status LEDs, and communication interfaces
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for external recording devices
- Application flexibility - Multiple I/O options, programmable logic (FlexLogic™), modularity, customize to specific requirements
- Embedded IEC61850 Protocol

#### Applications

- Short and long overhead lines and cables of different voltage levels
- Suitable for two- and three-terminal lines
- Circuits with tapped transformer feeders.
- Implicit Direct Transfer Trip for breaker failure applications

#### Features

##### Protection and Control

- Single or dual phase comparison with permissive and blocking schemes for 2 and 3 terminal applications
- Multiple instantaneously and timed directional overcurrent elements
- 3 zone phase and ground distance elements
- Phase, neutral and negative sequence overcurrent
- Overvoltage and undervoltage
- Single-pole, dual-breaker autoreclose with synchronism check
- CT failure, VT fuse failure
- Wattmetric zero-sequence directional function

##### Communications

- Networking options - Ethernet-fiber (optional redundancy), RS485
- Multiple protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104
- Direct I/O - secure high-speed exchange of data between URs for Direct Transfer Trip and Pilot-aided distance schemes



#### Features (continued)

##### Monitoring and Metering

- Breaker condition monitoring including breaker arcing current ( $I^2t$ ) and trip counter
- Metering - Current, voltage, power, energy and frequency
- Oscillography - 64 samples/cycle, up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5ms scan of digital inputs
- Datalogger- Up to 16 channels with user selectable sampling rate
- Fault Locator

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the L60 into new or existing monitoring and control systems





L60 - *00 - H * * - F ** - H ** - L ** - N ** - S ** - U ** - W/X** For Full Sized Horizontal Mount										
Base Unit	L60	E G H J K N								Base Unit RS485 + RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
CPU										No Software Options IEC61850
Software		00 03								Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
Mount / Coating			H A V B							Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
User Interface				K L M N O T U V F						
Power Supply			H L							125 / 250 V AC/DC RH 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)
CT/VT DSP					8P			8F		L60 DSP 4CT & 2 Comms Channels + Standard 4CT/4VT (Breaker and Half) Standard 4CT/4VT w/ enhanced diagnostics
Digital I/O						XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U		XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 dcmA Inputs
Transducer I/O						5A 5F		5A 5F	5A 5F	7A 820 nm, multi-mode, LED, 1 Channel 7B 1300 nm, multi-mode, LED, 1 Channel 7C 1300 nm, single-mode, ELED, 1 Channel 7H 820 nm, multi-mode, LED, 2 Channels 7I 1300 nm, multi-mode, LED, 2 Channels 7J 1300 nm, single-mode, ELED, 2 Channels 7S G.703, 2 Channels 7W RS422, 2 Channels 73 1550 nm, single-mode, LASER, 2 Channels 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel 2B C37.94SM, 1300nm Singlemode, ELED, 2 Channel Single mode
Inter-Relay Communications										

#### Accessories for the L60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the L60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/L60](http://www.GEMultilin.com/L60) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a L60 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### D90<sup>PLUS</sup> Line Distance Protection System

Sub-cycle distance protection and advanced automation controller

#### Key Benefits

- Secure subcycle protection ensures trip times less than a cycle
- Reliable and secure protection on lines equipped with series compensation
- Superior phase selection algorithm ensures secure high speed single pole tripping
- Simplified powerful programmable automation controller eliminates the need for substation programmable logic controller
- Configurable alarm annunciator eliminates the need for separate annunciator panel
- Intuitive and easy to use large color HMI with preconfigured comprehensive information on metering, fault records, event records and separate control screen for bay control.
- High-end fault and disturbance recording, including internal relay operating signals thus eliminating the need for redundant recording devices
- Reduced installation space requirements through compact design - True convergence of protection, metering, automation, bay control functions, multiple I/O options and extensive communications capability.
- Built-in phasor measurement unit streaming synchrophasors as per IEEE C7.118

#### Applications

- Overhead lines including series compensated lines and underground cables of various voltage levels
- Single and dual-breaker circuits requiring single pole/ three-pole autoreclosing and independent synchrocheck supervision
- Backup protection for generators, transformers and reactors
- Secure application with Capacitively-Coupled Voltage Transformers (CCVTs)
- Circuits with in-zone power transformers and tapped transformer feeders
- Wide area system monitoring and control using integrated protection and synchrophasor measurement

#### Features

##### Protection and Control

- Dual algorithm with the accelerated algorithm providing subcycle distance protection.
- Phase Distance (five zones) with independent compensation settings for in-zone power transformers
- Ground distance (five zones) with independent self and mutual zero sequence compensation
- Out-of-step tripping and power swing blocking
- Directional overcurrent: Phase, neutral and negative sequence
- Wattmetric zero-sequence directional power
- Under/Over frequency
- Synchronism check for dual breaker applications
- Single/three-pole Four-shot dual breaker auto-recloser
- Customization of protection and control functions with independent protection FlexLogic™, FlexCurves™, and FlexElements®



#### Features (continued)

- Advanced automation controller with independent automation programmable logic.
- 12 Bay single line diagrams for different applications and associated controls through front panel HMI

##### Monitoring and Metering

- CT and VT monitoring
- Metering - current, voltage, frequency, power, energy and phasors as per IEEE C37.118
- Transient recorder - 128 samples/cycle, 1 min of storage capacity
- Disturbance recorder - 1 sample/cycle, 5 min of storage capacity
- Event recorder - 8000 time tagged events, with 0.5 ms scan of digital inputs
- Comprehensive display of metering, phasors, maintenance and fault information in the front panel.

##### EnerVista® Software

- Sophisticated software for configuration and commissioning that is second-to-none
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date

##### Communications

- Multiple protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104
- Three independently configurable IP addresses
- Front USB port for high speed communications



Order Code Example:

D90P	-	H	E	-	A	E	04	U	D	S	-	C	H	X	A	B	C	X	D	01	X
------	---	---	---	---	---	---	----	---	---	---	---	---	---	---	---	---	---	---	---	----	---

## Accessories for the D90<sup>Plus</sup>

Visit [www.GEMultilin.com/D90Plus](http://www.GEMultilin.com/D90Plus) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a D90<sup>plus</sup> online

# GE Multilin®

## Protection and Control

### D60 Line Distance Protection System

High-speed transmission line protection with three/single pole tripping

Section 18

#### Key Benefits

- High-speed cost effective five zone quad or mho, phase and ground distance protection
- Reliable and secure protection on series compensated lines
- Superior phase selection algorithm ensures secure high speed single pole tripping
- Supports multiple standard pilot schemes for fast fault clearance within the protected zone
- Flexible programmable logic for building customized schemes
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Simplified teleprotection interfaces with Direct I/O communications hardware for Transfer Trip and Pilot-Aided distance schemes
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push-buttons, status LEDs, and communication interfaces
- Phasor Measurement Unit - Synchronised phasor information according to IEEE C37.118 standard
- Embedded IEC61850 Protocol

#### Applications

- Overhead lines including series compensated lines and underground cables of different voltage levels
- Single and dual-breaker circuits requiring single pole/three-pole autoreclosing and independent synchrocheck supervision
- Circuits with in-zone power transformers and tapped transformer feeders
- Secure application with Capacitively-Coupled Voltage Transformers (CCVTs)
- Backup protection for generators, transformers and reactors

#### Features

##### Protection and Control

- Phase Distance (five zones) with independent compensation settings for in-zone power transformers
- Ground distance (five zones) with independent self and mutual zero sequence compensation
- Out-of-step tripping and power swing blocking
- Line pickup
- Directional overcurrent: Phase, neutral and negative sequence
- Synchronism check for dual breaker applications
- Four-shot dual breaker auto-recloser
- VT fuse failure detector
- Customize protection and control functions with FlexLogic™, FlexCurves™, and FlexElements®

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)



#### Features (continued)

- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip and pilot-Aided schemes

##### Monitoring and Metering

- Synchronised measurement of voltage & current and sequence component phasors - 1 to 60 phasors/sec
- Metering - current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample /cycle
- Advanced device health diagnostics
- Setting Security Audit Trail for tracking changes to D60 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the D60 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin®

## Protection and Control

### D60 Line Distance Protection System

#### Ordering

## Section 18

D60 - * ** - H * * - F ** - H ** - M ** - P ** - U ** - W **										For Full Sized Horizontal Mount
Base Unit	D60									Base Unit
CPU	E G H J K N									RS485 & RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
Software Options	00 02 03 05 06 07 08 09									No Software Options Breaker & Half IEC61850 Breaker and Half + IEC61850 Phasor Measurement Unit (PMU) IEC61850 + Phasor Measurement Unit (PMU) Breaker and Half + Phasor Measurement Unit (PMU) Breaker and Half + IEC61850 + Phasor Measurement Unit (PMU)
Mount	H A V B									Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface	K L M N O T U V F									Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons
Power Supply	H								RH	Vertical Front Panel with English display 125/250 V AC/DC w/ redundant 125/250 V AC/DC power supply 125/250 V AC/DC
CT/VT DSP		8L 8M			8L 8M					Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics
Digital I/O			XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 dcmA Inputs		
Transducer I/O		5A 5F	5A 5F	5A 5F	5A 5F	5A 5F	5A 5F	5A 5F	5A 5F	7A 7B 7C 7H 7I 7J 7S 7W 73 77 2B
Inter-Relay Communications										820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels G.703, 2 Channels RS422, 2 Channels 1550 nm, single-mode, LASER, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 2 Channel C37.94SM, 1300nm Singlemode, ELED, 2 Channel Single mode

#### Accessories for the D60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the D60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/D60](http://www.GEMultilin.com/D60) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a D60 online
- View the UR Family brochure





# GE Multilin®

## Protection and Control

### D30 Line Distance Protection System

Cost effective high-speed, primary and backup distance protection

#### Key Benefits

- Cost effective, three zone quad or mho, phase and ground distance protection
- Programmable logic for building customized pilot schemes
- Simplified teleprotection interfaces with Direct I/O communications hardware for Transfer Trip and custom built Pilot-Aided distance schemes
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push-buttons, status LEDs, and communication interfaces
- Application flexibility - Multiple I/O options, programmable logic (FlexLogic™)
- Embedded IEC61850 Protocol

#### Applications

- Overhead sub-transmission lines and underground cables including series compensated lines.
- Circuits requiring three-pole autoreclosing and independent synchrocheck supervision
- Circuits with in-zone power transformers
- Secure application with Capacitively-Coupled Voltage Transformers (CCVTs)
- Backup protection for generators, transformers and reactors

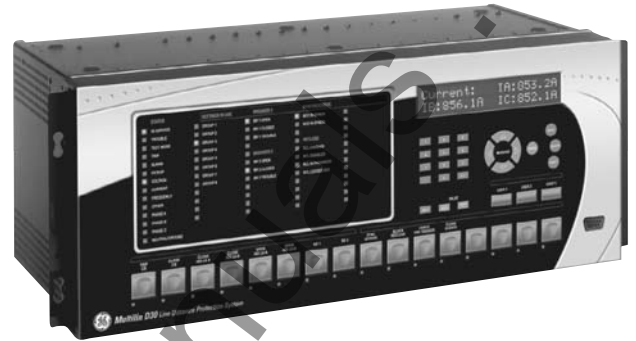
#### Features

##### Protection and Control

- Phase distance (three zones) with independent compensation settings for in-zone power transformers
- Ground distance (three zones) with independent self and mutual zero sequence compensation
- Out-of-step tripping and power swing blocking
- Line pickup
- Directional overcurrent: Phase, neutral and negative sequence
- Synchronism check
- Four-shot auto-recloser
- VT fuse failure detector
- Customize protection and control functions with FlexLogic™, FlexCurves™, and FlexElements™

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure high-speed exchange of data between URs for Direct Transfer Trip and Pilot-aided distance schemes



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Advanced device health diagnostics
- Setting Security Audit Trail for tracking changes to D30 configuration
- Breaker condition monitoring including breaker arcing current (I<sup>2</sup>t) and trip counter

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the D30 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin®

## Protection and Control

### D30 Line Distance Protection System

#### Ordering

## Section 18

	D30	-	*	**	-	H	*	*	-	F**	-	H**	-	M**	-	P**	-	U**	-	W**		For Full Sized Horizontal Mount
Base Unit	D30																					Base Unit
CPU		E	G	H	J	K	N															RS485 + RS485 (IEC61850 option not available)
																						RS485 + Multi-mode ST 10BaseF
																						RS485 + Multi-mode ST Redundant 10BaseF
																						RS485 + Multi-mode ST 100BaseFX
																						RS485 + Multi-mode ST Redundant 100BaseFX
																						RS485 + 10/100 BaseT
Software Options																						No Software Options
Mount																						IEC61850
																						Horizontal (19" rack) - Standard
																						Horizontal (19" rack) - Harsh Chemical Environment Option
																						Vertical (3/4 size) - Standard
																						Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface																						Enhanced English Front Panel
																						Enhanced English Front Panel with User-Programmable Pushbuttons
																						Enhanced French Front Panel
																						Enhanced French Front Panel with User-Programmable Pushbuttons
																						Enhanced Russian Front Panel
																						Enhanced Russian Front Panel with User-Programmable Pushbuttons
																						Enhanced Chinese Front Panel
																						Enhanced Chinese Front Panel with User-Programmable Pushbuttons
Power Supply																						Vertical Front Panel with English display
																						125 / 250 V AC/DC
																						125/250 V AC/DC with redundant 125/250 V AC/DC power supply
																						24 - 48 V (DC only)
CT/VT DSP																						Standard 4CT/4VT w/ enhanced diagnostics
Digital I/O																						Sensitive Ground 4CT/4VT w/ enhanced diagnostics
																						No module
																						4 Solid State (No Monitoring) MOSFET Outputs
																						4 Solid State (Current w/opt Voltage) MOSFET Outputs
																						16 Digital Inputs with Auto-Burnish
																						14 Form-A (No Monitoring) Latchable Outputs
																						8 Form-A (No Monitoring) Outputs
																						8 Form-C Outputs
																						16 Digital Inputs
																						4 Form-C Outputs, 8 Digital Inputs
																						8 Fast Form-C Outputs
																						4 Form-C & 4 Fast Form-C Outputs
																						2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
																						2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
																						4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
																						6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
																						2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
																						2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
																						4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
																						6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O																						4 dcmA Inputs, 4 dcmA Outputs
																						8 dcmA Inputs
Inter-Relay Communications																						7A 820 nm, multi-mode, LED, 1 Channel
																						7B 1300 nm, multi-mode, LED, 1 Channel
																						7C 1300 nm, single-mode, ELED, 1 Channel
																						7H 820 nm, multi-mode, LED, 2 Channels
																						7I 1300 nm, multi-mode, LED, 2 Channels
																						7J 1300 nm, single-mode, ELED, 2 Channels
																						7S G.703, 2 Channels
																						7W RS422, 2 Channels
																						73 1550 nm, single-mode, LASER, 2 Channels
																						77 IEEE C37.94, 820 nm, multi-mode, LED, 2 Channel
																						2B IEEE C37.94SM, 1300nm Single mode, ELED, 2 Channel Single mode

### Accessories for the D30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the D30, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/D30](http://www.GEMultilin.com/D30) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a D30 online
- View the UR Family brochure



[Selector Guide](#)

[page 18-58](#)

**Complete bus protection comparison.**

A reference table highlighting the feature set for each protection system

[B90](#)

[page 18-59](#)

**Low impedance numerical bus differential system**

The B90, a member of the UR Family, features integrated protection and breaker failure for re-configurable LV, HV, EHV multi-section busbars with up to 24 feeders. Use one or more B90s together to build a sophisticated protection system that can be engineered to meet specific application requirements. The B90 performs fast and secure low impedance bus protection with a sub-cycle tripping time of 0.75 cycles.



[B30](#)

[page 18-61](#)

**Cost effective bus protection and metering for up to six feeders**

The B30, a member of the UR Family, features integrated protection, control and metering for HV and EHV busbars, providing cost effective, feature-focused busbar protection. Use the B30 to protect busbars with up to 6 feeders in a single three phase zone. The B30 is a cost effective alternative to high impedance schemes, ideal for breaker-and-half bus schemes, with integrated feeder backup protection and metering. The B30 performs fast and secure low impedance bus protection with a sub-cycle tripping time of 0.75 cycles.



[MIB](#)

[page 18-63](#)

**High impedance numerical differential protection system**

The MIB is a high impedance numerical bus protection relay designed for fast and selective differential protection based on the high-impedance circulating current principle. The MIB is used for the protection of busbars, generators, transformers, reactor against phase-to-phase and phase-to-earth faults. It can be applied for protection of bus bars of different voltage levels.



[HID](#)

[page 18-64](#)

**High impedance differential module**

Auxiliary resistors and varistors for high impedance differential schemes. The HID module provides resistors together with voltage limiters (MOVs) normally used in conjunction with a high-speed overcurrent relay to achieve high impedance differential protection. Use the HID in applications that include high impedance differential protection for busbars and electrical machines, such as transformers, generators or motors, as well as restricted earth fault protection.



Features		ANSI	MIB	B30	B90
Apps	Low impedance Bus differential	87B	•	•	•
	High impedance Bus differential	87B	•		
	High impedance Restricted Ground Fault	87RGF	•		
	Typical Operating Time (cycles)		<2	<1	<1
Protection & Control	Bus differential	87B	•	•	•
	IOC, Ground/Neutral/Phase	50G/N/P		G/N/P	G/N/P
	TOC, Ground/Neutral/Phase	51G/N/P		G/N/P	G/N/P
	Overvoltage Auxiliary/Neutral	59X/N		X/N	
	Phase Undervoltage	27P		•	•
	Current Transformer Supervision		•	•	•
	Breaker Failure	50BF		•	•
	Breaker Flashover			•	•
	Lockout Functionality	86		•	•
	Dynamic Bus Replica			•	•
Automation	Programmable Logic		•	•	•
	FlexElements™			•	•
	Settings Groups		2	6	6
	Non-volatile latches (up to)			16	16/box
	Contact Inputs Programmable - (up to)		4	80	96/box
	Contact Outputs Programmable - (up to)		4	64	64/box
	Virtual Inputs - (up to)			32	32
	Virtual Outputs - (up to)			64	64
	Direct Inputs/Outputs			•	•
	User-Programmable LEDs (up to)		4	48	48/box
	User-Programmable Push Buttons (up to)			12	12/box
	User-Programmable Self Test			•	•
	User Definable Displays			•	•
	User Programmable Self-Test Contact			•	•
	Timers		•	•	•
	Selector Switch			•	•
	Digital Counters			•	•
	Digital Elements			•	•
	IRIG-B Input			•	•
Monitoring & Metering	Current		•	•	•
	Voltage			•	•
	Symmetrical Components			•	•
	Power - Apparent, Real, Reactive			•	•
	Energy			•	•
	Power Factor			•	•
	Frequency			•	•
	Event Recorder - Number of Events		24	1024	1024
	Oscillography		•	•	•
	Trip/Close Coil Supervision		•	•	•
Comms	RS232 Port		•	•	•
	RS485 Port		•	•	•
	Ethernet Port (Fiber and Copper, up to)			1	1
	Direct Fiber Communications (800nm, 1330nm, 1550nm)			•	•
	ModBus (RTU and TCP/IP)		•	•	•
Protocols	DNP 3.0			•	•
	IEC60870-5-104			•	•
	UCA2/MMS			•	•
	IEC61850			•	•
	Simple Network Time Protocol (SNTP)			•	•
	HTTP			•	•
	TFTP			•	•

\* For the most current comparison list see: [www.GEMultilin.com/selector/bus.pdf](http://www.GEMultilin.com/selector/bus.pdf)

# GE Multilin®

## Protection and Control

### B90 Low Impedance Bus Differential System

Section 18

Secure, dependable and scalable bus differential protection system for LV, HV and EHV busbars

#### Key Benefits

- High speed protection algorithm for enhanced stability with trip times of 0.75 power cycle
- Superior CT saturation detector capable of detecting CT saturation even with only 2 msec of saturation free current for enhanced through fault stability
- Enhanced security and dependability through CT saturation detector and additional directional element
- Suitable for different bus configurations, scalable architecture to protect up to 24 feeders.
- Pre Engineered Bus protection system - Use experienced GE Multilin® application engineers to develop busbar protection system for your specific configurations
- Use high speed communications to reduce wiring and installation costs - Exchange inputs and outputs between relays to achieve relay-to-relay interaction
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs, and communication interfaces
- Integrated isolator position monitoring & alarming

#### Applications

- Re-configurable multi-section busbar with up to 24 feeders
- Single Bus, Breaker and half bus bar configurations, Double Bus and Triple Bus with and without bus couplers

#### Features

##### Protection and Control

- Multi-zone bus differential protection with restrained and unrestrained function
- Fast and reliable CT saturation detection
- Breaker failure protection
- End fault (dead zone) protection
- Check-zone functionality
- CT ratio mismatch compensation
- Dynamic Bus Replica
- Back-up time and instantaneous overcurrent elements
- Undervoltage function for supervision purposes

##### Communications

- Networking options - Ethernet-fiber (optional redundancy), RS422, RS485, G.703, C37.94
- Multiple protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104
- Direct I/O - secure, high-speed exchange of data between URs



#### Features (continued)

##### Monitoring and Metering

- Isolator monitoring (up to 48) and alarming
- CT trouble monitoring
- VT supervision
- Metering - current, voltage, frequency
- Oscillography - 64 samples/cycle, up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5 ms scan of digital inputs

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the B90 into new or existing monitoring and control systems



# GE Multilin® Protection and Control B90 Low Impedance Bus Differential System Ordering

## Section 18

(Please contact GE Multilin® for Engineered Bus Protection Solutions)

	B90	*	*	-H	*	-F**	H**	L**	N**	S**	U**	-W/X**	For full sized horizontal mount
Base Unit	B90	E	G	H	J	K	N						Base Unit RS485 + RS485 (IEC61850 option not available) RS485 + 10BaseF RS485 + Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT Without Breaker Failure With Breaker Failure (With Engineered Solution Only)
CPU													8-feeders, 4 zones 16-feeders, 4 zones 24-feeders, 4 zones 8-feeders, 4 zones, IEC61850 16-feeders, 4 zones, IEC61850 24-feeders, 4 zones, IEC61850
Software Options		0	1										Horizontal (19" rack) Horizontal (19" rack) - Harsh Chemical Environment Option
Mount/ Coating				H	A								Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons
User Interface					K	L	M	N	O	T	U	V	
Power Supply						H	L						125 / 250 V AC/DC 125 / 250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)
CT/VT DSP							8F	8H	8K	8F	8H	8K	Standard 4CT/4VT Standard 8CT Standard 7CT/1VT
Digital I/O							XX	XX	XX	XX	XX	XX	No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/ opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Inter-Relay Communications							6U	6U	6U	6U	6U	6U	7A 820 nm, multi-mode, LED, 1 Channel 7B 1300 nm, multi-mode, LED, 1 Channel 7H 820 nm, multi-mode, LED, 2 Channels 7I 1300 nm, multi-mode, LED, 2 Channels 7S G.703, 2 Channels 7W RS422, 2 Channels 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel

### Accessories for the B90

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the B90, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/B90](http://www.GEMultilin.com/B90) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a B90 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### B30 Bus Differential System

Cost effective low impedance biased bus differential protection for up to six feeders

Section 18

#### Key Benefits

- High speed differential protection algorithm for enhanced with Subcycle trip times of 0.75 power cycle
- Superior CT saturation detector capable of detecting CT saturation even with only 2 msec of saturation free current for enhanced through fault stability.
- Enhanced security and dependability through CT saturation detector and additional directional element
- Cost effective alternative to high impedance schemes
- Advanced automation capabilities for providing customized protection and control solutions
- High-end fault and disturbance recording, including internal relay operating signals provided thus eliminating the need for redundant recording devices
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Reduced installation space requirements through compact design - True convergence of protection, metering and control functions, multiple I/O options programmable pushbuttons and status LEDs, and communication interfaces.
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Embedded IEC61850 Protocol with no external communications hardware required

#### Applications

- Re-configurable simple bus applications, up to 6 feeders with breaker failure
- Integrated bus protection and metering for HV and EHV substations

#### Features

##### Protection and Control

- Differential protection with restrained and unrestrained function
- Fast and reliable CT saturation detection
- Breaker failure protection
- External Check-zone
- CT ratio mismatch compensation
- Dynamic Bus Replica
- Back-up time and instantaneous overcurrent elements
- Undervoltage function for supervision purposes

##### Communications

- Networking options - Ethernet-fiber (optional redundancy), RS422, RS485, G.703, C37.94
- Multiple protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104
- Direct I/O - secure high-speed exchange of binary data between URs



#### Features (continued)

##### Monitoring and Metering

- Isolator monitoring
- CT trouble monitoring
- VT supervision
- Metering - current, voltage, frequency
- Oscillography - 64 samples/cycle, up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5 ms scan of digital inputs

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the B30 into new or existing monitoring and control systems





# GE Multilin® Protection and Control B30 Bus Differential System Ordering

## Section 18

B30- *** - H ** - F** - H** - L** - N** - S** - U** - W**										For Full Sized Horizontal Mount	
Base Unit	B30									Base Unit	
CPU	E G H J K N									RS485 + RS485 (IEC61850 option not available)	
Software Options	00 03									RS485 + 10BaseF	
Mount/Coating	H A									RS485 + Redundant 10BaseF	
User Interface	K L M N O Q T U V F									RS485 + Multi-mode ST 100BaseFX	
Power Supply	H H L									RS485 + Multi-mode ST Redundant 100BaseFX	
CT/VT DSP	8L 8M 8N 8R									RS485 + 10/100 BaseT	
Digital I/O	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U									No Software Options	
Transducer I/O	5A 5F									IEC61850	
Inter-Relay Communications										Horizontal (19" rack)	
										Horizontal (19" rack) - Harsh Chemical Environment Option	
										Enhanced English Front Panel	
										Enhanced English Front Panel with User-Programmable Pushbuttons	
										Enhanced French Front Panel	
										Enhanced French Front Panel with User-Programmable Pushbuttons	
										Enhanced Russian Front Panel	
										Enhanced Russian Front Panel with User-Programmable Pushbuttons	
										Enhanced Chinese Front Panel	
										Enhanced Chinese Front Panel with User-Programmable Pushbuttons	
										Vertical Front Panel with English display	
										125 / 250 V AC/DC	
										125/250 V AC/DC with redundant 125/250 V AC/DC power supply	
										24 - 48 V (DC only)	
										Standard 4CT/4VT w/ enhanced diagnostics	
										Sensitive Ground 4CT/4VT w/ enhanced diagnostics	
										Standard 8CT w/ enhanced diagnostics	
										Sensitive Ground 8CT w/ enhanced diagnostics	
										No module	
										4 Solid State (No Monitoring) MOSFET Outputs	
										4 Solid State (Current w/ opt Voltage) MOSFET Outputs	
										16 Digital Inputs with Auto-Burnish	
										14 Form-A (No Monitoring) Latchable Outputs	
										8 Form-A (No Monitoring) Outputs	
										8 Form-C Outputs	
										16 Digital Inputs	
										4 Form-C Outputs, 8 Digital Inputs	
										8 Fast Form-C Outputs	
										4 Form-C & 4 Fast Form-C Outputs	
										2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs	
										2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs	
										4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs	
										6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs	
										2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs	
										2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs	
										4 Form-A (No Monitoring) Outputs, 8 Digital Inputs	
										6 Form-A (No Monitoring) Outputs, 4 Digital	
										4 dcmA Inputs, 4 dcmA Outputs	
										8 dcmA Inputs	
										C37.94SM, 1300nm single-mode, ELED, 2 channel single-mode	
										820 nm, multi-mode, LED, 1 Channel	
										1300 nm, multi-mode, LED, 1 Channel	
										1300 nm, single-mode, ELED, 1 Channel	
										820 nm, multi-mode, LED, 2 Channels	
										1300 nm, multi-mode, LED, 2 Channels	
										1300 nm, single-mode, ELED, 2 Channels	
										G.703, 2 Channels	
										RS422, 2 Channels	
										IEEE C37.94, 820 nm, multimode, LED, 2 Channel	

### Accessories for the B30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the B30, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/B30](http://www.GEMultilin.com/B30) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a B30 online
- View the UR Family brochure



## Key Benefits

- Robust numerical high impedance differential protection relay suitable for all high-impedance circulating current differential protection applications
- Alternate setting groups for sensitive setting of the differential element for changing system conditions
- Reduced troubleshooting and maintenance cost through built-in event recording, and oscillography functions
- Easy to use programming logic for scheme customization
- Application flexibility through digital I/Os and LEDs
- Wide range of auxiliary power supply supported
- Easy access to relay information through front panel keypad or through communication links
- Isolated RS232 port for easy front port communications.
- Drawout construction in a 19" rack case and can be flush or 19" rack mounted



### Features (continued)

- Differential protection of single and split busbar arrangements.
- High impedance differential (restricted ground fault) protection for reactors, transformers, generators and large motors

## Features

## Communications

- High impedance differential protection
- Two 87 elements easily configurable for trip or alarm
- Open CT detection can be achieved using the second 87 element
- Lockout logic
- 6 outputs - four configurable, plus trip and alarm
- Two setting groups

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps

**EnerVista® Software**

- 24-event record
- Analog/digital oscillography
- Per phase differential current metering
- Monitoring of the last 5 trips information from the display

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the MIB into new or existing monitoring and control systems

## Ordering

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

MIB \* 0 \* \* C E 000 00

			<b>Application</b>
1			1 winding Transf. REF App. 1 High Imp. Differential Element
2			2 winding Transf. REF App. 2 High Imp. Differential Elements
3			Busbar App. 3 High Imp. Differential Elements
			<b>Auxiliary Voltage</b>
	L	O	LO Power Supply: 24-28 Vdc (range: 19~58Vdc)
	H	I	HI Power Supply: 110-250Vdc (range: 88~300Vdc)

## Accessories for the MIB

Multinet Ethernet Converter	Multinet-FE
Viewpoint Monitoring	VP-1



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## HID High Impedance Differential Module

Auxiliary resistors and varistors for high impedance differential schemes

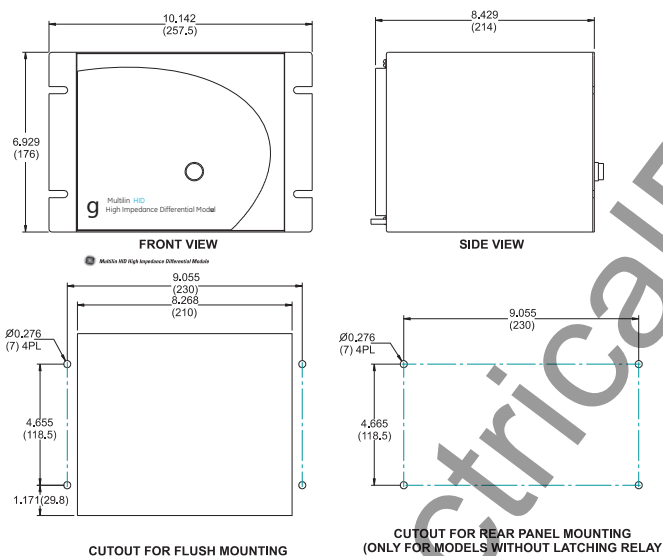
### Key Benefits

- Includes 2000-ohm resistors to provide security against the effects of CT saturation for through faults
- Provides metal oxide varistors (MOV) to clamp secondary peak voltage to less than 2 kV
- Use the HID in conjunction with an overcurrent relay for a separate phase, neutral, and negative-sequence overcurrent elements, including instantaneous, definite-time, and inverse time-overcurrent elements for backup overcurrent protection.

### Applications

- Single-zone bus protection, reactor protection, or sensitive restricted earth fault protection on grounded, wye-connected power transformer windings
- High impedance differential protection for electrical machines such as generators or motors, including lockout logic.

### Dimensions



Visit [www.GEMultilin.com/HID](http://www.GEMultilin.com/HID) to:

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

### Ordering

HID	*	*	Application
1			1 winding transformer REF - 1 resistor + 1 MOV
2			2 winding transformer REF - 2 resistors + 2 MOV
3			Busbar Applications 3 High impedance differential elements
			<b>Latching relay / Power supply</b>
0			Without latching relay
1			48 Vdc latching relay
2			125 Vdc latching relay
3			220 Vdc latching relay



# GE Multilin®

## Protection and Control

### Distribution Feeder Protection

## Section 18

#### [Selector Guide](#)

[page 18-66](#)

#### **Complete distribution feeder protection product comparison**

A reference table highlighting the feature set for each system

#### [F60](#)

[page 18-67](#)

#### **Advanced protection, control and automation solutions for distribution feeders**

The F60, a member of the UR Family of protection relays, provides high performance feeder protection, control, monitoring and metering in an integrated, economical, and compact package. The F60 includes GE Multilin®'s unique high impedance fault detection for fast and reliable detection of downed conductors.

#### [F35](#)

[page 18-69](#)

#### **Cost-effective protection and control for single/multiple distribution feeders**

The F35, a member of the UR Family of protection relays, provides cost-effective feeder protection, control and metering for up to five feeders with busbar voltage measurement, or six feeders without busbar voltage in one integrated package. Use the F35 as a stand-alone device or as a component of an automated substation control system.

#### [750/760](#)

[page 18-71](#)

#### **Draw-out feeder protection and control for industrial and utility feeders**

The 750/760 Feeder Protection System, a member of the SR Family of protection relays, with draw out capability intended for primary protection and management of distribution feeders. The 750/760 has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments.

#### [F650](#)

[page 18-73](#)

#### **Comprehensive feeder protection with bay controller**

The F650, a member of the 650 Family of protection relays, incorporates protection, control, automation and metering in a economical package. F650 comes with a large LCD and single line diagrams can be built for bay monitoring and control for various feeder arrangements including ring-bus, double breaker or for breaker and half.

#### [735/737](#)

[page 18-75](#)

#### **Three-phase and ground feeder protection for medium and low voltage**

The 735/737, a member of the SR Family of protection relays, provides primary protection for distribution feeders. The 735/737 has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments.

#### [MIF II](#)

[page 18-76](#)

#### **Economical feeder protection with recloser**

The MIF II is a member of the MII Family of protection relays. MIF II provides comprehensive overcurrent protection with multi-shot recloser. Also, MIF II can be utilized to provide backup/auxiliary protection for transformers, generators and motors.

#### [FM2](#)

[page 18-77](#)

#### **Economical and compact feeder protection for low voltage feeders**

Typically designed for power control center (PCC) applications. FM2 can be used for fuse contactors feeders or feeders with breakers having built in trip units.

#### [URC](#)

[page 18-78](#)

#### **Reliable recloser control system for distribution feeders**

The URC is designed to provide distribution feeder recloser control, protection, monitoring and metering in one integrated package. Advanced applications such as dynamic network restoration, automatic source transfer and various reclosing arrangements can be easily implemented.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

Features		ANSI	FM2	MIF II	735/737	F650	750/760	F35	F60
Protection & Control	Current Disturbance Detector	50DD				•	•	•	•
	Synchronism Check	25				•	•	•	•
	Undervoltage, Phase/Auxiliary	27 P/X				P/X	P/X	P/X	P/X
	Directional Power	32				•	•	•	•
	Directional, Phase/Neutral/ Ground/ Negative Seq.	67P/N/G/_2				•	•	•	•
	Wattmetric Zero Seq. Directional					•	•	•	•
	Breaker Failure	50BF		•		•	•	Logic	•
	IOC, Phase/Neutral/Ground/Negative Seq.	50 P/N/G/_2	G	P/G	P/G	P/N/G/_2	P/N/G/_2	P/N/G	P/N/G/_2
	IOC, Sensitive Ground			•		•	•	•	•
	TOC, Phase/Neutral/Ground/ Negative Seq.	51 P/N/G		P/G	P/G	P/N/G/_2	P/N/G/_2	P/N/G	P/N/G/_2
	TOC, Sensitive Ground			•		•	•	•	•
	Custom programmable overcurrent curve					•	•	•	•
	High Impedance Fault Detection (Hi-Z)					•	•	•	•
	Load Encroachment Logic					•	•	•	•
	Overvoltage, Phase/Auxiliary/Neutral/ Negative Seq.	59P/X/N				P/N/G	P/N	X/N	P/X/N/_2
	AC Reclosing (Shots)	79		4		4	4	4	4
	Underfrequency	81U				•	•	•	•
	Overfrequency	81O				•	•	•	•
	Lockout Protection				•	•	•	•	•
	Broken Conductor Detection					•	•	•	•
Automation	Programmable Elements					•	•	•	•
	Voltage Transformer Fuse Failure					•	•	•	•
	Cold Load Pickup			•		•	•	•	•
	FlexElements™					•	•	•	•
	Settings Groups			2		3	4	6	4
	Contact Inputs (Up to)		16	2		32	14	96	96
	Contact Outputs (Up to)		6	5	19	16	8	64	64
	Non-volatile latches					•	•	•	•
	User-Programmable Push Buttons (Up to)					•	•	•	•
	Graphical Display					•	•	•	•
	Trip/Close Coil Supervision					•	•	•	•
	Breaker Control		•	•		•	•	•	•
	Programmable Logic		•	•		•	•	•	•
	User-Programmable LEDs		•	•		•	•	•	•
	Timers		•	•		•	•	•	•
Monitoring & Metering	Digital Counters					•	•	•	•
	Digital Elements					•	•	•	•
	Selector Switch					•	•	•	•
	Analog Inputs/Outputs (Up to)					1	1	24/12	24/12
	RTD Inputs					•	•	24	24
	Automatic Transfer Scheme					•	•	•	•
	Undervoltage Restoration		•			•	•	•	•
	Underfrequency Restoration		•			•	•	•	•
	Current		•	•		•	•	•	•
	Voltage		•			•	•	•	•
	Power Factor		•			•	•	•	•
	Real, Reactive & Apparent Power		•			•	•	•	•
	Current, MW, MVAR, MVA Demand		•			•	•	•	•
	Energy		•			•	•	•	•
	Frequency		•			•	•	•	•
Communications	Frequency Decay					•	•	•	•
	Analog Inputs					•	•	•	•
	Fault Location					•	•	•	•
	Event Recorder - Number of Events		1	32		479	512	1024	1024
	Oscillography - Sampling Rate			8		16	16	64	64
	Breaker Arcing Current		•	•		•	•	•	•
	Data Logger		•			•	•	•	•
	THD & Harmonics Meter					•	•	•	•
	RS232 Port		•	•		•	•	•	•
	RS485 Port		•	•	•	•	•	•	•
	RS422 Port, G.703, C73.94					•	•	•	•
	Ethernet					•	•	•	•
	Fiber (800nm, 1300nm, 1550nm)					•	•	•	•
	ModBus (RTU/TCP/IP)		•	•	•	•	•	•	•
	DNP3 Protocol					•	•	•	•
	IRIG-B Input					•	•	•	•
	EGD Protocol					•	•	•	•
	TCP/IP					•	•	•	•
	Simple Network Time Protocol					•	•	•	•
	IEC 60870-5-104					•	•	•	•
	IEC61850 Protocol					•	•	•	•

\* For the most current comparison list, access us online at: [www.GEMultilin.com/selector/distfeed.pdf](http://www.GEMultilin.com/selector/distfeed.pdf)



# GE Multilin®

## Protection and Control

### F60 Feeder Protection System

Advanced Protection, Control and Automation Solutions for Distribution Feeders

Section 18

#### Key Benefits

- The most flexible protection and control device for distribution feeder applications
- Unique and secure downed conductor detection, backed up by many years of field experience
- Flexible load encroachment allows secure operation during heavy load conditions
- Voltage and frequency elements to provide load shedding and transfer schemes for increased system uptime and improve system stability
- Advanced automation capabilities for providing customized protection and control solutions
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Integrated functionalities of multiple devices including protection, control functions, pushbuttons, status LEDs, and communication interfaces
- Advanced fault and disturbance recording, including internal relay operating signals provided thus eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Primary protection and control for feeders on solidly grounded, impedance grounded or resonant (Peterson Coil) grounded systems
- Bus blocking/Interlocking schemes
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Distribution load shedding schemes based on voltage and frequency elements
- Back-up protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

#### Features

##### Protection and Control

- High impedance fault detection (Downed Conductor Detection)
- Directional time, instantaneous phase & ground overcurrent protection
- Load encroachment supervision
- Wattmetric ground fault detection
- Four-shot autorecloser with synchronism check
- Breaker control and breaker failure
- Abnormal frequency protection (Rate of change, under and over frequency)

##### Communications

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, IEEE C37.94



#### Features (continued)

- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus TCP/IP, IEC60870-5-104
- Direct I/O – secure, high-speed data exchange between URs, for DG, distribution automation applications

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency and harmonics
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample /cycle
- Breaker monitoring: contact wear, continuous trip coil monitoring
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to F60 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the F60 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin®

## Protection and Control

### F60 Feeder Protection System

#### Ordering

## Section 18

F60 - * - ** - H * - F** - H** - M** - P** - U** - W**												For Full Sized Horizontal Mount
Base Unit	F60	I										Base Unit
CPU		E										RS485 + RS485 (IEC61850 option not available)
		G										RS485 + Multi-mode ST 10BaseF
		H										RS485 + Multi-mode ST Redundant 10BaseF
		J										RS485 + Multi-mode ST 100BaseFX
		K										RS485 + Multi-mode ST Redundant 100BaseFX
		N										RS485 + 10/100 BaseT
Software Options			00									No Software Options
			03									IEC61850
Mount / Coating				H								Horizontal (19" rack) - Standard
				A								Horizontal (19" rack) - Harsh Chemical Environment Option
				V								Vertical (3/4 size) - Standard
				B								Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface					K							Enhanced English Front Panel
					L							Enhanced English Front Panel with User-Programmable Pushbuttons
					M							Enhanced French Front Panel
					N							Enhanced French Front Panel with User-Programmable Pushbuttons
					O							Enhanced Russian Front Panel
					Q							Enhanced Russian Front Panel with User-Programmable Pushbuttons
					T							Enhanced Chinese Front Panel
					U							Enhanced Chinese Front Panel with User-Programmable Pushbuttons
					V							Vertical Front Panel with English display
Power Supply					H							125 / 250 V AC/DC
					L							125/250 V AC/DC with redundant 125/250 V AC/DC power supply
												24 - 48 V (DC only)
CT/VT DSP						8F						Standard 4CT/4VT
						8G						Sensitive Ground 4CT/4VT
						8H						Standard 8CT
						8J						Sensitive Ground 8CT
						8L						Standard 4CT/4VT w/ enhanced diagnostics
						8M						Sensitive Ground 4CT/4VT w/ enhanced diagnostics
						8N						Standard 8CT w/ enhanced diagnostics
						8R						Sensitive Ground 8CT w/ enhanced diagnostics
Digital I/O							8Z					HI-Z 4CT (high impedance fault detection)
						XX	XX	XX	XX	XX		No module
						4A	4A	4A	4A	4A		4 Solid State (No Monitoring) MOSFET Outputs
						4C	4C	4C	4C	4C		4 Solid State (Current w/ opt Voltage) MOSFET Outputs
						4D	4D	4D	4D	4D		16 Digital Inputs with Auto-Burnish
						4L	4L	4L	4L	4L		14 Form-A (No Monitoring) Latchable Outputs
						67	67	67	67	67		8 Form-A (No Monitoring) Outputs
						6C	6C	6C	6C	6C		8 Form-C Outputs
						6D	6D	6D	6D	6D		16 Digital Inputs
						6E	6E	6E	6E	6E		4 Form-C Outputs, 8 Digital Inputs
						6F	6F	6F	6F	6F		8 Fast Form-C Outputs
						6K	6K	6K	6K	6K		4 Form-C & 4 Fast Form-C Outputs
						6L	6L	6L	6L	6L		2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
						6M	6M	6M	6M	6M		2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
						6N	6N	6N	6N	6N		4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
						6P	6P	6P	6P	6P		6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
						6R	6R	6R	6R	6R		2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
						6S	6S	6S	6S	6S		2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
						6T	6T	6T	6T	6T		4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
						6U	6U	6U	6U	6U		6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O						5C	5C	5C	5C	5C		8 RTD Inputs
						5E	5E	5E	5E	5E		4 dcmA Inputs, 4 RTD Inputs
						5F	5F	5F	5F	5F		8 dcmA Inputs
Inter-Relay Communications												820 nm, multi-mode, LED, 1 Channel
												1300 nm, multi-mode, LED, 1 Channel
												1300 nm, single-mode, ELED, 1 Channel
												820 nm, multi-mode, LED, 2 Channels
												1300 nm, multi-mode, LED, 2 Channels
												1300 nm, single-mode, ELED, 2 Channels
												G.703, 2 Channels
												RS422, 2 Channels
												IEEE C37.94, 820 nm, multimode, LED, 1 Channel
												IEEE C37.94, 820 nm, multimode, LED, 2 Channel

### Accessories for the F60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the F60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/F60](http://www.GEMultilin.com/F60) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a F60 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### F35 Feeder Protection System

Cost-effective protection and control for single/multiple distribution feeders

Section 18

#### Key Benefits

- Cost effective and flexible protection and control device for distribution feeder applications
- Dependable and secure performance backed up by many years of field experience
- Improved system stability at reduced cost - Control schemes using hi-speed communications
- Accurate built-in metering functions - Eliminates auxiliary metering devices and reduces cost
- Advanced automation capabilities for providing customized protection and control solutions
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs, and communication interfaces
- High-end fault and disturbance recording, including internal relay operating signals thus eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol with no external communications hardware required

#### Applications

- Primary protection and control for multiple distribution feeders
- Busblocking/ interlocking schemes
- Throw over schemes (bus transfer scheme applications)
- Distribution load shedding schemes based on voltage and frequency elements
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

#### Features

##### Protection and Control

- Instantaneous and time phase overcurrent protection
- Instantaneous and time ground/neutral overcurrent protection
- Neutral and auxiliary overvoltage
- Phase and auxiliary undervoltage
- Under frequency
- Four-shot automatic reclosers for up to six breakers
- Built-in selector switch

##### Communications

- Networking interfaces - 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, IEEE C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O - secure, high-speed exchange of data between URs for Direct Transfer Trip applications



#### Features (continued)

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency
- Oscillography - analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Breaker monitoring - contact wear, continuous trip coil monitoring for up to 6 breakers
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to F35 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the F35 into new or existing monitoring and control systems



# GE Multilin® Protection and Control F35 Feeder Protection System Ordering

## Section 18

F35 - * - H * - F** - H** - M** - P** - U** - W**											For Full Sized Horizontal Mount
Base Unit	F35										Base Unit
CPU	E G H J K N										RS485 + RS485 (IEC61850 option not available) RS485 + Multi-mode ST 10BaseF RS485 + Multi-mode ST Redundant 10BaseF RS485 + Multi-mode ST 100BaseFX RS485 + Multi-mode ST Redundant 100BaseFX RS485 + 10/100 BaseT
Software Options	00 03										No Software Options IEC61850
Mount / Coating		H A V B									Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface			K L M N O T U V F								Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display
Power Supply			H H L							RH	125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC power supply 24 - 48 V (DC only)
CT/VT DSP				8F 8G 8H 8J 8L 8M 8N 8R							Standard 4CT/4VT Sensitive Ground 4CT/4VT Standard 8CT Sensitive Ground 8CT Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 8CT w/ enhanced diagnostics
Digital I/O					XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U	No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/ opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs	
Transducer I/O				5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	5A 5C 5D 5E 5F	4 dcmA Inputs, 4 dcmA Outputs 8 RTD Inputs 4 RTD Inputs, 4 dcmA Outputs 4 dcmA Inputs, 4 RTD Inputs 8 dcmA Inputs
Inter-Relay Communications										7A 7B 7C 7H 7I 7J 7S 7T 7W 76 77	820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels G.703, 2 Channels RS422, 1 Channel RS422, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 1 Channel IEEE C37.94, 820 nm, multimode, LED, 2 Channel

### Accessories for the F35

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the F35, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/F35](http://www.GEMultilin.com/F35) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a F35 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### 750/760 Feeder Protection System

Comprehensive, draw out distribution feeder protection and management

Section 18

#### Key Benefits

- Easy to use Feeder Protection System supported by industry leading suite of software tools
- Accurate built-in metering functions - Eliminates auxiliary metering devices and reduces cost
- Improve uptime of auxiliary equipment - I/O monitoring
- Reduce troubleshooting time and maintenance costs - IRIG-B time synchronization, event reports, waveform capture, data logger
- Minimize replacement time - Draw-out construction
- Simplify testing - Built in simulation features
- Cost effective access information - Embedded 10MB Ethernet port for system integration. Supports industry protocols such as DNP 3.0 & Modbus
- Complete asset monitoring - Analog I/O, Full metering including demand & energy
- Leading edge technology - Flash memory for product field upgrade
- Extended life - Optional conformal coating for chemically corrosive and humid environments
- Globally accepted - Member of the most renowned product family in the market.

#### Applications

- Primary protection and control for distribution feeders on solidly grounded, high impedance grounded or resonant (Peterson Coil) grounded systems
- Bus blocking/Interlocking schemes
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Load shedding schemes based on voltage and frequency elements
- Back-up protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

#### Features

##### Protection and Control

- Directional time, instantaneous phase overcurrent protection
- Directional time, instantaneous ground overcurrent protection
- Directional sensitive ground and Restricted Earth Fault protection
- Negative sequence overcurrent protection
- Bus and line undervoltage
- Overvoltage
- Neutral overvoltage
- Underfrequency/Frequency decay
- Reverse power protection
- Synchro Check
- Automatic bus transfer
- Manual control
- Cold load pickup control
- Power factor control



#### Features (continued)

- 4 shot recloser (760 only)
- Power factor control
- Synchrocheck - V, f, Hz, & dead-source

##### Communications

- Networking interfaces - 10Mbps Ethernet, RS232, RS485 and RS422 ports
- Ethernet port, 10Mbps — Multiple protocols - ModBus™ RTU, ModBus™ RTU, TCP/IP, DNP 3.0 Level 2

##### Monitoring and Metering

- Metering - current, voltage, sequence components per, power, energy, voltage
- Breaker operation & trip failure
- Event recording - 128 time tagged events
- Total breaker arcing current
- Ambient temperature /analog transducer input
- Analog transducer input
- Oscillography & Data Logger - 10 records up to 32 power cycles
- Simulation mode and playback capability.

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the 750/760 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

GE Multilin®  
Protection and Control  
750/760 Feeder Protection System  
Ordering

750/760	*	*	*	*	*	*	*	Description
Phase Current Inputs	P1							1 A phase current inputs
	P5							5 A phase current inputs
Ground Current Inputs		G1						1 A zero sequence current inputs
		G5						5 A zero sequence current inputs
Sensitive Ground Current Inputs			S1					1 A sensitive ground current input
			S5					5 A sensitive ground current input
Power Supply Options				LO				20 – 60 VDC, 20 – 48 VAC @ 48 – 62 Hz
				HI				88 – 300 VDC, 70 – 265 VAC @ 48 – 62 Hz
Analog Outputs					A1			Eight 0 – 1 mA analog outputs
					A5			Eight 0 – 5 mA analog outputs
					A10			Eight 0 – 10 mA analog outputs
					A20			Eight 4 – 20 mA analog outputs
Breaker Status LED						R		Red breaker closed LED
						G		Green breaker closed LED
Enhancements							E	Enhanced display, larger LCD, improved keypad
							T	Enhanced display with Ethernet 10BaseT option
Environmental Protection								Harsh Chemical Environment Option

Accessories for the 750/760

Feeder Protection with the SR750/760	TRCD-SR750-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1

Ordering Note: This order code is valid for the latest version of SR hardware and firmware version. The older hardware and previous firmware versions are still available and may be ordered through the usual channels.

Visit [www.GEMultilin.com/750](http://www.GEMultilin.com/750) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 750/760 online
- View the SR Family brochure





# GE Multilin®

## Protection and Control

### F650 Feeder Protection and Bay Controller System

Cost effective solution for protection, automation and control of distribution feeders

Section 18

#### Key Benefits

- Flexible protection and control device for distribution feeder applications
- Advanced automation capabilities for providing customized protection and control solutions
- Human machine interface (HMI) - graphical LCD, programmable buttons, and rotary knob for selecting setting menus, and submenus.
- Minimize replacement time - Modular with card draw-out construction
- Reduce troubleshooting time and maintenance costs - IRIG-B and SNTP time synchronization, event reports, waveform capture, data logger
- Voltage and frequency based load shedding and transfer schemes to increase system uptime and improve system stability
- Advanced automation capabilities for providing customized protection and control solutions
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Primary protection and control for distribution feeders on solidly grounded, high impedance grounded or resonant (Peterson Coil) grounded systems —Bus blocking/Interlocking schemes
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Load shedding schemes based on voltage and frequency elements
- Back-up protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

#### Features

##### Protection and Control

- Time, instantaneous & directional phase, neutral, ground and sensitive ground overcurrent
- Manual close with cold load pickup control via PLC, Forward Power and Directional Power Units
- Load encroachment supervision
- Wattmetric ground fault detection
- Positive and negative sequence based over/under voltage elements
- Four-shot autorecloser with synchronism check
- Breaker control and breaker failure
- Abnormal frequency protection (Rate of change, under and over frequency)



#### Features (continued)

##### Monitoring and Metering

- Fault locator, record of last 10 faults -metering - current, voltage, power, energy, frequency and harmonics
- Breaker operation & trip failure
- Total breaker arcing current
- Event recorder - 479 Events
- High resolution oscillography and Data Logger, with programmable sampling rate
- Metering: V I Hz W VA PF
- Demand: Ia , Ib , Ic , Ig, Isg, I2, MW, MVA
- Configurable graphical HMI interface
- Alarm Panel

##### EnerVista® Software

- Sophisticated software for configuration and commissioning
- Document and software archiving
- EnerVista® Integrator providing easy integration of data in the F650 into new or existing monitoring and control systems



# GE Multilin®

## Protection and Control

### F650 Feeder/Bay Protection System

Ordering

## Section 18

F650	*	*	*	F	*	G	*	*	*	*	DESCRIPTION
F650	B	M	N								<b>DIGITAL BAY MANAGEMENT DEVICE</b>
											Basic display (4 x 20 characters)
											Graphical display with standard symbols (240x128 pixels)
											Graphic display with IEC Symbols (240x128 pixels)
											<b>REAR SERIAL COMMUNICATIONS BOARD 1</b>
											None
											Redundant RS485
											Redundant plastic fiber optic
											Redundant glass fiber optic
											Redundant RS485 + fiber remote CAN bus I/O
											Redundant plastic fiber optic + fiber remote CAN bus I/O
											Redundant glass fiber optic + fiber remote CAN bus I/O
											Cable Remote CAN Bus I/O
											RS485 + cable Remote CAN Bus I/O
											<b>REAR ETHERNET COMMUNICATIONS BOARD 2</b>
											10/100 Base TX
											10/100 Base TX + 100 Base FX
											10/100 Base TX + Redundant 100 Base FX
											Redundant 10/100 Base TX
											<b>I/O BOARD IN SLOT F</b>
											16 Digital Inputs + 8 Outputs
											8 Digital Inputs + 8 Outputs + 2 trip/close circuit supervision circuits
											32 Digital Inputs
											16 Digital Inputs + 8 Analog Inputs
											<b>I/O BOARD IN SLOT G</b>
											None
											16 Digital Inputs + 8 Outputs
											32 Digital Inputs (See Note 1)
											16 Digital Inputs + 8 Analog Inputs (See Note 1)
											<b>AUXILIARY VOLTAGE</b>
											24-48 Vdc (range 19.2 - 57.6)
											110-250 Vdc (range 88 - 300)
											120-230 Vac (range 96 - 250)
											Redundant LO
											Redundant HI
											<b>LANGUAGE</b>
											English/English
											Chinese/English (See Note 2)
											French/English
											Russian/English (See Note 2)
											Spanish/English
											<b>COMMUNICATION PROTOCOL</b>
											Modbus ® RTU, TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104
											Procome, Modbus ® RTU, TCP/IP
											IEC61850, Modbus ® RTU and TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104
											<b>ENVIRONMENTAL PROTECTION</b>
											- Without Harsh (Chemical) Environment Conformal Coating
											H Harsh (Chemical) Environment Conformal Coating

**SPECIAL MODELS:**  
MOD001: 6A output contacts instead of 16A..

#### (\*) Notes:

(1) The number selected for option G must be equal or higher than the number selected for option F for models including boards 4 and 5.

(2) Russian and Chinese languages available only for basic display models.  
Chinese Basic Display: 2x20 characters for English characters, 2x10 characters for Chinese characters.

#### Accessories for the F650

Feeder Protection with the F650	TRCD-F650-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** This order code is valid for the latest version of F650 hardware and firmware version.  
The older hardware and previous firmware versions are still available and may be ordered through the usual channels.

Visit [www.GEMultilin.com/F650](http://www.GEMultilin.com/F650) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a F650 online
- View the 650 Family brochure



# GE Multilin® Protection and Control 735/737 Feeder Protection System

Three-phase and ground feeder protection

Section 18

## Key Benefits

- Minimize replacement time - Draw-out construction
- Simplify testing - Built in simulation features
- Access information - via Modbus RTU

## Applications

- Primary circuit protection on distribution networks at any voltage level
- Backup protection for transformers and transmission lines

## Features

### Protection and Control

- 3 phase time overcurrent
- Ground time overcurrent
- 5 curve shapes
- 4 curve shift multipliers per curve
- 10 time multipliers per curve
- ANSI, IAC, or IEC/BS142 curves
- Phase instantaneous overcurrent
- Ground instantaneous overcurrent
- Pickup level for each overcurrent
- Outputs: trip, aux trip, service
- Aux trip: 86 lockout, ground trip
- SR737 has 8 additional output relays

## Features (continued)

### Communications

- 8 LED trip indicators
- 4 LED status indicators
- Current bar graph, % of CT
- RS485 or RS422 communications
- ModBus™ RTU protocol
- Baud rate up to 19,200 bps

### Monitoring and Metering

- Trip record of last 5 trips
- Pre-trip data includes currents
- True RMS sensing

### EnerVista® Software

- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices
- EnerVista® Integrator providing easy integration of data in the 735/737 into new or existing monitoring and control systems



## Ordering

*	*	*	*	*
735				
737				
1				
5				
	1			
	5			
		LO		
		HI		
			485	
			422	
Standard relay with 50/51, 50G/51G protection				
Relay with 8 additional outputs				
1 A phase CT secondaries				
5 A phase CT secondaries				
1 A ground CT secondaries				
5 A ground CT secondaries				
20 - 60 VDC; 20 - 48 VAC @ 50, 60 Hz control power				
90 - 300 VDC; 70 - 265 VAC @ 50, 60 Hz control power				
RS485 2-wire communications (standard)				
RS422 4-wire communications (optional)				

## Accessories

19-1 PANEL	Single cutout panel
19-2 PANEL	Dual cutout panel
SCI	RS232 to RS485 convertor
735/737-DEMO	737 demo/test case
1 3/8" Collar:	For shallow switchgear, reduces the depth of the relay by 1 3/8".
3" Collar:	For shallow switchgear, reduces the depth of the relay by 3".

Consider upgrading the 735/737 to the 750/760 for increased functionality and optional ethernet communication interface.

Visit [www.GEMultilin.com/735](http://www.GEMultilin.com/735) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a 735/737 online



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control MIF II Feeder Protection System

Economical feeder protection with recloser

## Section 18

### Key Benefits

- Low priced scalable options – event reports, waveform capture, reclosure
- Reduce troubleshooting and maintenance cost – Event reports, waveform capture
- Design flexibility – Easy to use programming logic
- Asset monitoring – Breaker health, and breaker failure
- Access to information – Modbus RTU communications
- Configurable logic, curves, I/Os and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Improved user interface
- Access via front panel keypad or communication links
- EnerVista® compatible
- Isolated front RS232 serial port

### Applications

- Primary feeder protection on distribution networks
- Backup/auxiliary protection for transformers, generators and motors

### Features

#### Protection and Control

- Phase and ground TOC and IOC
- Thermal image protection
- IAC time-current curves
- EPTAR-C time-current curves
- Circuit breaker control (open and close)
- Four shot autorecloser
- Cold load pickup element
- Configurable breaker failure to open
- Configurable I/O
- 6 outputs: trip, service required, 4 auxiliary

Visit [www.GEMultilin.com/MIFI](http://www.GEMultilin.com/MIFI) to:

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



### Features (continued)

#### Monitoring and Metering

- 32-event record
- Analog/digital oscillography
- KI<sup>2</sup> counter for breaker maintenance
- Per phase current metering
- Monitoring of the last 5 trips information from the display

#### User Interfaces

- EnerVista® for setting and monitoring
- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and colour.
- Independent front RS232 and rear RS485
- Multiple Protocols - ModBus RTU, IEC60870-5-103

#### EnerVista® Software

- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices
- EnerVista® Integrator providing easy integration of data in the MIFI into new or existing monitoring and control systems

### Ordering

MIF II	*	*	*	*	*	*	*	00	
P	N								3 phase + ground relay
A									Single phase or ground relay
I									ANSI curves
U									IEC curves
C									IAC curves
	0								EPTAR-C curves (only for single phase model)
	1								MIF II N models
	5								MIF II P models: Phase CT in = 1 A
		1							MIF II P models: Phase CT in = 5 A
		5							Ground CT In = 1 A
		N							Ground CT In = 5 A
		L							Sensitive ground: CT In = 1 A
			E						Very sensitive ground: CT In = 1 A
			F						English language
				0					French language
				1					MIF II Basic Model
				2					MIF II Option 1 *
					0				MIF II Option 2 **
					R				Without recloser
						LO			With recloser (not available in the Basic Model)
						HI			24-48 VDC (Range: 19~58 Vdc) Power Supply
									110-250 VDC (Range: 88~300 Vdc) Power Supply
									110-230 VAC (Range: 88~264 Vac) Power Supply

\* Configurable I/O/LEDs, event recording, oscillography

\*\* Option 1 + cold load pickup, breaker failure to open, breaker health, configurable logic



# GE Multilin®

## Protection and Control

### FM2 Feeder Protection System

Economical and compact feeder protection for low voltage feeders

Section 18

#### Key Benefits

- Comprehensive low voltage feeder management system - Integrated feeder protection and process control in a small package
- Cost effective solution - Low cost modular design
- Small footprint and compact design - With or without display, fits into standard Power Control Center buckets
- Ease of use - EnerVista® compatible
- Remote monitoring - via serial communications, Modbus RTU
- Easy installation and integration - Door mount option
- Reduced number of devices - Replaces of bi-metal overload elements, integrates timers, relays, meters, switches, indicators
- Integrated trip pushbutton
- Easy to read two line display

#### Applications

- Feeder protection and management system for low voltage distribution feeders
- Integrated process and electrical control
- Specifically designed for Power Control Center applications

#### Features

##### Protection and Control

- Thermal overload protection
- Current unbalance
- Ground fault protection
- Open contactor/Welded contactor
- Under voltage autoreclose
- Outputs: 2 fixed, 1 programmable and 1 emergency shutdown
- Inputs: 6 fixed, 10 programmable

##### Monitoring and Metering

- Display phase current, ground current, current unbalance, voltage, power, energy, etc.
- Trip record and pre-trip values
- Maintenance information

##### Communications

- RS485 ModBus™, 1200 - 19,200 bps
- Front Panel 11 LEDs, key pad, and 2x20 LCD display
- Front Panel control push buttons
- Includes EnerVista® software

##### EnerVista® Software

- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices
- EnerVista® Integrator providing easy integration of data in the FM2 into new or existing monitoring and control systems



#### Ordering

FM2 * - * - * - *				
Base Unit	FM2			Product Family
Model	712			120V AC VT and Switch input voltage
	722			240V AC VT and Switch input voltage
		PD		Panel mount with Display
		C		Chassis mount (Black box)

Visit [www.GEMultilin.com/FM2](http://www.GEMultilin.com/FM2) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a FM2 online
- View the FM2 brochure



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin®

## Protection and Control

### URC Universal Recloser Control

Reliable reclosing for distribution system

## Section 18

#### Key Benefits

- Rugged weatherproof enclosure (NEMA4)
- Unique and secure downed conductor detection
- Reliable and secure performance backed up by many years of field experience
- High-end fault and disturbance recording, including internal relay operating signals provided without requiring external recording devices
- Voltage and frequency based load shedding and transfer schemes to increase system uptime and improve system stability
- High-accuracy metering, oscillography and digital fault recording
- Advanced automation capabilities for providing customized protection and control solutions
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Single to multiple recloser applications

#### Applications

- Single and three phase autorecloser applications
- Primary protection and control for feeders on solidly grounded, impedance grounded or resonant (Peterson Coil) grounded systems
- Dynamic network restoration
- Bus blocking/Interlocking schemes
- Distribution load shedding schemes based on voltage and frequency elements

#### Features

##### Protection and Control

- Single / three phase autorecloser with synchronism check
- Directional time, instantaneous phase & ground overcurrent protection
- Load encroachment supervision
- Wattmetric ground fault detection
- High impedance fault detection (Downed Conductor Detection)
- Breaker control and breaker failure
- Abnormal frequency protection (Rate of change, under and over frequency)
- Display phase current, ground current, current unbalance, voltage, power, energy, etc.
- Trip record and pre-trip values
- Maintenance information

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency and harmonics
- Oscillography - analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Breaker monitoring, contact wear, continuous trip coil monitoring
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to relay configuration



#### Features (continued)

##### Communications

- Networking interfaces - 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G 703, IEEE C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus TCP/IP, IEC60870-5-104
- Direct I/O - secure, high-speed data exchange between URs, for DG, distribution automation applications

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date





GE Multilin®  
Protection and Control  
URC Universal Recloser Control  
Ordering

Section 18

	N *	N *	N *	R *	N *	N *	N *	1 *	B *	
F650R										Single recloser control with F650
F60R										Single recloser control with F60
F35R1										Single recloser control with F35
F35R2										Double recloser control with F35
F35R3										Triple recloser control with F35
F35R4										Quadruple recloser control with F35
	N V									No voltage function
		N T								Voltage functions
			N H							No test switches
				R						Test switch GE 515
					N 1 2					No climate control
						N Z				Heater with thermostat
							N A			Steel enclosure
								1 5		No ethernet port
									L	Ethernet port
									M	Redundant Ethernet port
									B	No Hi-Z
										Hi-Z (F60 only)
										No Amphenol Plug
										Amphenol Plug
										1A Current Input
										5A Current Input
										24-48 Vdc OC Input (no internal battery or charger)
										125-250 Vdc Input (no internal battery or charger)
										24 VDC Battery and charger



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin®

## Protection and Control

### Motor Protection

## Section 18

#### Selector Guide

[page 18-81](#)

#### Complete motor protection comparison

A reference table highlighting the feature set for each protection system

#### M60

[page 18-82](#)

#### High performance motor protection relay

The M60 Motor Protection System, a member of UR family of relays, is designed for three phase motor applications, including induction motors with squirrel cage rotors, slip-ring induction motors and synchronous motors. The M60 relay uses current and voltage inputs to prevent overheating during all operating conditions where no faults are present. The M60 relay also provides short circuit protection, differential protection, and a number of others functions required for protection of motors as well as the driven equipment. It may be used as part of the automated control system with peer-to-peer communication or as a stand-alone protection device.



#### 469

[page 18-84](#)

#### Comprehensive protection and control of medium and large AC motors

The SR469 Motor Protection System, a member of the SR family of relays provide protection for three phase motors. It is a cost effective draw-out unit for protection, fault diagnostics, metering, and communication applications ideally suited for industrial installations. It may be used for applications for two speed motors as well as for applications where single CT differential protection is required.



#### 369

[page 18-85](#)

#### Comprehensive protection and monitoring for three-phase motors and their driven equipment

The 369 Motor Management Relay® may be applied on three-phase motors. It can be adapted to each application by learning motor parameters. It is available with optional RRTD module (monitors twelve RTD's) for applications where the relay is distant from the motor. The 369 is also available with an optional Back-spin detection element for down-hole pump motor applications where this function is used to detect flow.



#### 269Plus

[page 18-87](#)

#### Protection for three-phase industrial motors and driven equipment

The 269Plus Motor Management Relay® detects damaging conditions of the motor. This relay learns motor parameters and may be adapted to any application and initial protection may be improved. Relay is available in draw-out and standard version. This relay monitors ten RTD's.



#### 239

[page 18-88](#)

#### Protection for three-phase industrial motors and driven equipment

The 239 Motor Protection relay is designed to provide protection and control for small to medium size motors and the associated mechanical equipment. Optional switches allow for protection of multi-speed motors.



#### MM300™

[page 18-89](#)

#### Comprehensive low voltage motor management including automation and diagnostics

The MM300™ integrates advanced motor protection, control automation, communication and diagnostics into a single rugged, flexible device for low voltage motors. Designed to be mounted in MCCs in harsh plant environments, the MM300™ combines protection and PLC functionality in a small, modular hardware platform.



#### MM2

[page 18-91](#)

#### Integrated process and electrical control with protection for low voltage motors

The MM2 controller can be used in applications where integrated process control with protection for low voltage motors is required. This controller replaces relays, meters, panel indicators and reduces field wiring.



#### SPM

[page 18-93](#)

#### Starting protection, synchronization and control for synchronous motors

The SPM motor system is used for control, synchronization and specific protection (stator protection have to be done by one an induction motor protection relay) of collector-ring or brushless synchronous motors.



	Features	Device	Low Voltage		Medium Voltage						
			MMII	MM300	239	269Plus	369	369 + RRTD	469	469 + SPM	M60
Protection & Control	Thermal Model	49	•	•	•	•	•	•	•	•	•
	RTD Biasing	49RTD		•		•	•	•	•	•	•
	Current Unbalance Biasing			•		•	•	•	•	•	•
	Custom Overload Curves					•	•	•	•	•	•
	Voltage Dependend Overload Curves							•	•	•	•
	Start Inhibit, Thermal		•	•	•	•	•	•	•	•	•
	Jogging Start / Starts-Per-Hour	66	•	•	•	•	•	•	•	•	•
	Incomplete Sequence	48		•	•	•	•	•	•	•	•
	Reduced Voltage Starting	19		•	•	•	•	•	•	•	•
	Backspin Detection			•	•	•	•	•	•	•	•
	Two Speed Motor		•	•	•	•	•	•	•	•	•
	Emergency Restart		•	•	•	•	•	•	•	•	•
	Jam / Stall	51R	•	•	•	•	•	•	•	•	•
	IOC, Phase, Ground, Sensitive Grnd, Neutral	50P/G/SG/N	G	G	P/G/SG	P/G/SG	P/G/SG	P/G/SG	P/G/SG	P/G/SG	P/G/SG/N
	TOC, Phase, Ground, Sensitive Grnd	51P/G/SG/		G							G/SG
	Differential	87M							•	•	•
	Current Directional, Phase, Ground, Neutral	67P/G/N			G						P/N
	Current Unbalance	46	•	•	•	•	•	•	•	•	•
	Undercurrent / Underpower	37	•	•	•	•	•	•	•	•	•
	Phase, Auxiliary, Neutral Overvoltage	59P/N/X	P	P		P	P	P	P	P	P/N/X
	Phase, Auxiliary Undervoltage	27P/X	P	P/X		P	P	P	P	P	P/X
	Negative Sequence Overvoltage	59_2									
	Voltage Transformer Fuse Failure	VTFF		•				•	•	•	•
	Phase Reversal	47		•				•	•	•	•
	Under / Overfrequency	81U/O			•	•	•	•	•	•	•
	Reverse Power	32R						•	•	•	•
	Reactive Overpower							•	•	•	•
	Power Factor	55				•	•	•	•	•	•
	Power Factor Control							•	•	•	•
	RTD Overtemperature	49	•	•	•	•	•	•	•	•	•
	Remote RTD (RRTD)	49					•	•			
	Thermistor Overtemperature		•	•	•	•	•	•	•	•	•
	Breaker Failure	50BF		•	•	•	•	•	•	•	•
Automation	Multiple Starter Configurations		•	•							
	Contact Inputs (max)		16	30	4	5	5	11	7	9	80
	Contact Outputs (max)		4	18	4	4	4	8	6	9	64
	Analog Inputs (max)		1						4	4	24
	Analog Outputs (max)				1	1	4	8	4	4	4
	RTD Inputs (max)			6	3	10	12	24	12	12	24
	Thermistor Input		•	•	•	•	•	•	•	•	•
	Virtual Inputs										64
	Programmable Logic			•							•
	FlexElements			•							•
	Trip / Close Coil Supervision			•					•	•	•
	User-Programmable LED's			•							•
	User-Programmable Push Buttons			•							•
	IRIG-B-Input			•	•						•
	Self Tests			•	•	•	•	•	•	•	•
	Digital Counters			•							•
	Digital elements			•							•
	Timers			•							•
Monitoring & Metering	Remote Display			•		•		•			•
	Redundant Power Supply			•							•
	Synchronous Motor - Field Breaker Control									•	
	Remote Start / Stop Via Communications		•	•			•	•	•	•	•
	Undervoltage Auto-restart		•	•			•	•	•	•	•
	Current		•	•	•	•	•	•	•	•	•
	Voltage		•	•	•	•	•	•	•	•	•
	Frequency		•	•	•	•	•	•	•	•	•
	Power - Real		•	•	•	•	•	•	•	•	•
	Power - Apparent / Reactive		•	•	•	•	•	•	•	•	•
	Power Factor		•	•	•	•	•	•	•	•	•
	Demand - Current, MW, MVA, Mvar		•	•	•	•	•	•	•	•	•
	Energy		•	•	•	•	•	•	•	•	•
	Torque		•	•	•	•	•	•	•	•	•
	Temperature			•	•	•	•	•	•	•	•
	Event Recorder (number of events)			256			512	512	256	256	1024
	Oscillography (max samples per cycle)			32			16	16	12	12	16
	User Programmable Fault reports			•			•	•	•	•	•
Communications	Data logger			•			•	•	•	•	•
	Motor Learned Information		•	•	•	•	•	•	•	•	•
	Thermal Capacity Used		•	•	•	•	•	•	•	•	•
	Trip Counters		•	•			•	•	•	•	•
	Motor Start Data Logger						•	•			•
	Motor Start / Stop Health Report						•	•			•
	RS232 Serial Communications			•			•	•	•	•	•
	RS485 Serial Communications		•	•	•	•	•	•	•	•	•
	Ethernet Communications			•			•	•	•	•	•
	Fiber Optic Ethernet			•			•	•	•	•	•
	Modbus protocol		•	•	•	•	•	•	•	•	•
	DeviceNet protocol			•			•	•			•
	Profibus protocol			•			•	•			•
	DNP 3.0 protocol										•
	IEC61870-5-105 protocol										•
	IEC61850 protocol										•
	Peer-to-Peer Communications (GSSE/GOOSE)										•
	Simple network Timesync protocol			•							•
	IRIG-B input										•
	Motor Settings Auto-Configurator			•			•	•			•

\* For the most current comparison list see: [www.GEMultilin.com/selector/motor.pdf](http://www.GEMultilin.com/selector/motor.pdf)



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin®

## Protection and Control

### M60 Motor Protection System

Comprehensive protection for medium to large motors

## Section 18

#### Key Benefits

- Improved protection sensitivity through a flexible and powerful thermal model including Standard, Custom, and Voltage Dependant Overload curves
- Improved maintenance planning via enhanced monitoring of motor operating characteristics
- Integrated automation and process control functions reduce the number additional control devices required in the system
- Reduced installation space requirements through integration of protection, control automation functions, communication and operator interfaces
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- High-end fault and disturbance recording, including internal relay operating signals provided thus eliminating the need for redundant recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

#### Applications

- Protection and control of medium to large three phase induction motors of most popular construction types
- Protection of medium to large synchronous motors when paired with the SPM Synchronous Motor Protection System
- Stand-alone protection or component in automated substation control system
- Applications requiring Automation or Process Control functionality

#### Features

##### Protection and Control

- Enhanced Thermal Model with RTD and current unbalance compensation
- Stator Differential
- Mechanical Jam / Stall
- Short Circuit Tripping
- Under Current / Under Power
- Ground / Neutral Timed Overcurrent
- Phase Reversal
- Undervoltage / Overvoltage
- Reverse/Low Forward Power protection
- Analog Transducer Inputs provide Tripping and Alarming for multiple sensor applications



#### Features (continued)

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency
- Oscillography - analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to M60 configuration
- Motor Starting characteristics for the last five successful starts

##### Communications

- Networking interfaces - 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104
- DeviceNet and Profibus protocols options available using the D485 and P485 protocol converters
- Direct I/O - secure, high-speed exchange of data between URs for Direct Transfer Trip applications

##### EnerVista® Software

- Sophisticated software for configuration and commissioning that is second-to-none
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Maintenance software to reduce troubleshooting and system maintenance
- EnerVista® Integrator providing easy integration of data in the M60 into new or existing monitoring and control systems



# GE Multilin®

## Protection and Control

### M60 Motor Protection System

#### Ordering

## Section 18

M60 - * 00 - H * - F ** - H ** - M ** - P ** - U ** - W/X**										For full sized horizontal mount
Base Unit	M60	E	G	H	J	K	N			Base Unit
CPU										RS485 + RS485 (IEC61850 option not available)
										RS485 + Multi-mode ST 10BaseF
										RS485 + Multi-mode ST Redundant 10BaseF
										RS485 + Multi-mode ST 100BaseFX
										RS485 + Multi-mode ST Redundant 100BaseFX
										RS485 + 10/100 BaseT
Software Options	00									No Software Options
	03									IEC61850
Mount / Coating										Horizontal (19" rack) - Standard
										Horizontal (19" rack) - Harsh Chemical Environment Option
										Vertical (3/4 size) - Standard
										Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface										Enhanced English Front Panel
										Enhanced English Front Panel with User-Programmable Pushbuttons
										Enhanced French Front Panel
										Enhanced French Front Panel with User-Programmable Pushbuttons
										Enhanced Russian Front Panel
										Enhanced Russian Front Panel with User-Programmable Pushbuttons
										Enhanced Chinese Front Panel
										Enhanced Chinese Front Panel with User-Programmable Pushbuttons
Power Supply										Vertical Front Panel with English display
										125 / 250 V AC/DC
										125/250 V AC/DC with redundant 125/250 V AC/DC
										24 - 48 V (DC only)
										24 - 48 V (DC only) with redundant 24 - 48 V (DC only)
CT/VT DSP										Standard 4CT/4VT w/ enhanced diagnostics
										Sensitive Ground 4CT/4VT w/ enhanced diagnostics
										Standard 8CT w/ enhanced diagnostics
										Sensitive Ground 8CT w/ enhanced diagnostics
Digital I/O										No module
										4 Solid State (No Monitoring) MOSFET Outputs
										4 Solid State (Current w/opt Voltage) MOSFET Outputs
										16 Digital Inputs with Auto-Burnish
										16 Form-A (No Monitoring) Latchable Outputs
										8 Form-A (No Monitoring) Outputs
										8 Form-C Outputs
										16 Digital Inputs
										4 Form-C Outputs, 8 Digital Inputs
										8 Fast Form-C Outputs
										4 Form-C & 4 Fast Form-C Outputs
										2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
										6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
										2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
										6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O										8 RTD Inputs
										4 dcma Inputs, 4 RTD Inputs
										8 dcma Inputs
Inter-Relay Communications										820 nm, multi-mode, LED, 1 Channel
										1300 nm, multi-mode, LED, 1 Channel
										820 nm, multi-mode, LED, 2 Channels
										1300 nm, multi-mode, LED, 2 Channels

### Accessories for the M60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850
D485 DeviceNet Converter	D485-C
P485 Profibus Converter	P485-C

**Ordering Note:** To view the latest options available for the M60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/M60](http://www.GEMultilin.com/M60) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a M60 online
- View the UR Family brochure



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin®

## Protection and Control

### 469 Motor Protection System

Complete integrated protection and management of medium and large motors

## Section 18

### Key Benefits

- Comprehensive motor protection plus voltage dependant overload curves, torque metering and protection, broken rotor bar protection
- Most advanced thermal model - Including multiple RTD inputs for stator thermal protection
- Minimize replacement time - Draw-out construction
- Complete asset monitoring - Temperature, Analog I/O, full metering including demand & energy
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Reduce troubleshooting time and maintenance costs - Event reports, waveform capture, data logger
- Built in simulation functions simplify testing and commissioning
- Cost Effective Access to information - Through standard RS232 & RS485 serial ports, and optional Ethernet and DeviceNet Ports
- Field upgradable firmware and settings
- Optional Conformal coating for exposure to chemically corrosive or humid environments



### Applications

- Protection and Management of three phase medium and large horsepower motors and driven equipment, including high inertia, two speed and reduced-voltage start motors.

### Features

#### Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Start supervision and inhibit
- Mechanical jam
- Voltage compensated acceleration
- Undervoltage, overvoltage
- Underfrequency
- Stator differential protection
- Thermal overload
- Overtemperature protection
- Phase and ground overcurrent
- Current unbalance
- Power elements
- Torque protection
- Dual overload curves for 2 speed motors
- Reduced voltage starting control

### Features (continued)

#### Communications

- Multiple Ports - 10baseT Ethernet, RS485, RS232, RS422, DeviceNet
- Multiple Protocols - Modbus RTU, Modbus TCP/IP, DeviceNet

#### Monitoring and Metering

- A, V, W, var, VA, PF, Hz, Wh, varh, demand
- Torque, temperature (12 RTDs)
- Event recorder
- Oscillography & Data Logger (trending)
- Statistical information & learned motor data

#### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the 469 into new or existing monitoring and control systems

### Ordering

469	*	*	*	*	*	
469	P1	LO	A1	D	H	Basic Unit
	P5	HI	A20	E		1 A phase CT secondaries
				T		5 A phase CT secondaries
						DC: 24 - 60 V; AC: 20 - 48 V @ 48 -62 Hz control power
						DC: 90 - 300 V; AC: 70 - 265 V @ 48 -62 Hz control power
						0 - 1 mA analog outputs
						4 - 20 mA analog outputs
						DeviceNet
						Enhanced front panel
						Enhanced front panel with Ethernet 10BaseT option
						Harsh (Chemical) Environment Conformal Coating

Visit [www.GEMultilin.com/469](http://www.GEMultilin.com/469) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 469 online

### Accessories for the 469

469 Motor Protection Learning CD	TRCD-469-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Product Maintenance Learning CD	TRCD-MAINT-C-S-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1





# GE Multilin®

## Protection and Control

### 369 Motor Protection System

Integrated protection and control for medium sized AC motors

#### Key Benefits

- Enhanced Thermal Model including RTD and Current Unbalance Biasing
- Complete Asset monitoring with programmable RTD inputs for Stator, Bearing and Ambient temperature protection
- Enhanced reporting - Motor Health Reports provide critical information for preventative maintenance
- Reduce troubleshooting time and maintenance costs -Event reports, waveform capture, motor start, data logger
- Simplify testing - Built in simulation features
- Multiple communication protocols - Modbus RTU, Profibus, DeviceNet, Modbus TCP/IP
- Cost Effective Access to information - Through standard RS232 & RS485 serial ports, and optional Ethernet, DeviceNet, and Profibus Ports
- Simplified programming with the EnerVista® 369 Motor Settings Auto-Configurator
- Field upgradable settings and firmware
- Optional Conformal coating for exposure to chemically corrosive or humid environments
- Suitable for hazardous locations - Underwriters Laboratory certification for Class 1 Division 2 applications
- Installation flexibility - Remote display and remote RTD options
- Safe and reliable motor re-start on "Down Hole" pump applications - Unique back spin detection feature detects flow reversal on a pump motor, enabling timely and safe motor restarting

#### Applications

- Protection and control for medium sized AC motors
- "Down Hole" pump applications
- Suitable for applications involving Variable Frequency Drives

#### Features

##### Protection and Control

- Enhanced thermal model
- Stall / Jam protection
- Undervoltage, overvoltage
- Underfrequency
- Thermal overload
- Undercurrent/current unbalance
- Variable lockout time
- Ground fault O/C
- Overtemperature 12 RTDs (R option)
- Starts/hour, time between starts
- Phase Reversal (M option)
- Undervoltage Auto-restart
- Two Speed Motor Protection

##### User Interface

- 40 Character Backlit LCD Display
- 10 System and Motor Status LED's
- Keypad for configuration and viewing metered values
- 4 programmable analog outputs
- 369 Motor Settings Wizard



#### Features (continued)

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency, RTD Temperature, Remote RTD
- Fault diagnosis, - Event Record, Oscillography, Motor Starting Data Logger
- Motor Start / Stop Health Report
- Statistical information & learned motor data
- Voltage/frequency/power display (M option)
- 4 analog outputs (M option)

##### Communications

- Front Panel RS232 port for programming and troubleshooting
- Optional embedded Ethernet port
- Optional Profibus DP/DPV1 or DeviceNet via dedicated port
- ModBus™ RTU
- ModBus™ over TCP/IP

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the 369 into new or existing monitoring and control systems



## Accessories for the 369

Visit [www.GEMultilin.com/369](http://www.GEMultilin.com/369) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 369 online

# GE Multilin®

## Protection and Control

### 269Plus Motor Protection System

Integrated protection and control for medium sized AC motors

## Section 18

#### Key Benefits

- Enhanced Thermal Model including current unbalance and RTD biasing
- Temperature monitoring with programmable RTD inputs for Stator, Bearing and Ambient temperature protection
- Reduce troubleshooting time and maintenance costs – motor running and learned data, last trip data
- Simplify testing - Built in simulation features
- Cost Effective Access to information through standard RS485 serial ports using Modbus RTU
- Field upgradable settings and firmware
- Installation flexibility - Remote display and drawout case options

#### Applications

- Medium size motors

#### Features

##### Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Stator winding & bearing overtemperature
- Motor multiple starts
- 8 standard overload curves
- User defined overload FlexCurve™
- Undercurrent for load loss
- Locked rotor
- Rapid trip/mechanical jam
- Unbalance/single phasing
- Short circuit
- Ground fault
- Phase reversal (meter option)
- Variable lock-out time
- Latched main trip relay, alarm relay
- 2 auxiliary relays
- Emergency restart capability
- Pre-trip alarm warnings

##### Monitoring and Metering

- Current & Thermal Capacity metering
- Data Logger
- Learned & Statistical Data
- Optional voltage, power metering

#### Accessories for the 269Plus

Multinet® Serial to Ethernet converter	Multinet-FE
Viewpoint Monitoring	VP-1
D485 Devicenet converter	D485-C
P485 Profibus converter	P485-C

Visit [www.GEMultilin.com/269Plus](http://www.GEMultilin.com/269Plus) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 269Plus online



#### Inputs and Outputs

- 12 RTDs, programmable
- 5 factory programmed digital inputs
- 4 output relays
- 1 programmable analog output

#### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the 269 Plus into new or existing monitoring and control systems

#### Ordering

269PLUS	*	*	*	*	*	*	269 Plus motor management relay*
269PLUS	SV						Standard version
	D/O						Drawout version
		1					Phase CT <sup>1</sup>
		2					Ground CT (required for D/O only)
		3					:5 2000:1
		4					:5 -5
							:1 2000:1
							:1 -5
							Relay fail safe code <sup>2</sup> (required for D/O only)
		1					Trip Alarm Aux1 Aux2
		2					FS NFS NFS FS
		3					NFS FS NFS FS
		4					FS FS NFS FS
		5					NFS NFS FS FS
		6					FS NFS FS FS
		7					NFS FS FS FS
		8					FS NFS NFS FS
							Relay contact arrangement <sup>3</sup> (required for D/O only)
		1					Alarm Aux1 Aux2
		2					N.O. N.O. N.O.
		3					N.O. N.O. N.C.
		4					N.O. N.C. N.O.
		5					N.O. N.C. N.C.
		6					N.C. N.O. N.O.
		7					N.C. N.O. N.C.
		8					N.C. N.C. N.O.
							N.C. N.C. N.C.
							100P 100 Ohm platinum RTD
							10C 10 Ohm copper RTD
							100N 100 Ohm nickel RTD
							120N 120 Ohm nickel RTD
							HI 80 - 300 VDC/65 - 265 VAC control power
							LO 20 - 60 VDC/20 - 48 VAC control power



Publications and Reference: See Section 22 for a complete list of additional product-related publications

- Enhanced Motor Overload Protection with Thermal Modeling
- Simple configuration and system monitoring using EnerVista® 239 Setup software
- Reduced cost and commissioning time with Protection, Monitoring, and Control in a single device
- Scalable protection with optional RTD inputs and advanced Motor Protection elements
- Simplified testing and commissioning with built in simulation features
- Field upgradable firmware and relay options
- Easy access to system and relay information using Modbus RTU



- Multiple groups of protection settings allows flexible protection for flexible systems
- Small to Medium sized three phase AC induction and synchronous motors
- Pumps, conveyors, compressors, fans, etc.

- Thermal Overload (15 selectable curves) - Trip and alarm, immediate current overload alarm
- Phase short circuit
- Mechanical jam
- Thermal memory lockout
- Single-Phasing /Current unbalance
- Ground fault - trip and alarm
- Overtemperature: via thermistor or optional RTD inputs
- Undercurrent
- Breaker Failure
- Trip/alarm/auxiliary/service outputs
- Multi-speed motor protection
- Motor start supervision

- RS485 Serial Communications
- Modbus RTU protocol

- Status/current/temperature display
- Fault diagnosis
- Trending
- Trip record, last 5
- Process control
- Optional analog output

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an 239 online

- 40 Character backlit display for easy viewing of settings and actual values
- 6 Motor and relay status LED's
- Multiple programming keys to allow easy access to system values and relay settings

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the 239 into new or existing monitoring and control systems

239	*	*	*	
239				Basic unit
	RTD			3 RTDs: stator/bearing; programmable type: platinum, nickel, copper
		AN		Single isolated, analog output: 0 - 1, 0 - 20, 4 - 20 mA
				Programmable output parameters: thermal capacity, % full load, phase current, RTD1, RTD2, RTD3 temperature
			H	Harsh environment conformal coating

MOD601:	240 VAC switch inputs – allows the use of external 240 VAC supply to power switch inputs
MOD602:	24 – 48 VDC switch inputs – allows the use of external 24 – 48 VDC supply to power switch inputs
MOD603:	ESD relay – converts AUX 2 relay into an emergency shutdown relay
MOD605:	Removable rear terminals – allows terminals 13 – 58 to be unplugged from the 239
MOD613:	240 VAC VT input
MOD614:	VT primary setpoint up to 7200 V and variable overload curve setting
MOD615:	VT primary setpoint up to 7200 V and backspin timer
MOD616:	239 with remote display

Viewpoint Monitoring	VP-1
50:0.025 Ground CT	HGF3
Multinet® Serial to Ethernet converter	Multinet-FE
2.25" Shallow Mount Collar	1009-0068

# GE Multilin®

## Protection and Control

### MM300™ Motor Management System

Integrated automation and protection for low voltage motors

## Section 18

#### Key Benefits

- Full-featured protection for low voltage AC motors
- Advanced automation capabilities for providing customized protection and integrated process control
- Advanced FlexLogic™ reduces requirement for local PLC's
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs and communication interfaces
- Application flexibility with multiple I/O options and programmable logic options (FlexLogic™)
- Enhanced troubleshooting tools including sequence of event records and waveform capture
- Powerful communications including Serial, Ethernet, Profibus, and DeviceNet protocols
- Small form factor and remote display options designed to fit in MCC buckets

#### Applications

- Low Voltage three phase AC motors
- MCC or stand alone panel mount applications
- Reversing and Reduced Voltage applications
- Motor applications requiring advanced Automation or Control such as conveyor systems or well recovery pumps
- IEC or NEMA class motors

#### Features

##### Protection and Control

- Enhanced Thermal Modeling
- Mechanical Jam / Stalled Rotor
- Undercurrent
- Underpower
- Acceleration Time
- Current Unbalance
- Ground Fault
- Sensitive Ground Fault
- Phase Overvoltage / Undervoltage
- Auxiliary Undervoltage
- Phase Reversal
- VT Fuse Failure
- Thermistor
- RTD Overtemperature

##### Automation

- Programmable FlexLogic™ option
- Starter Control
- Process Interlocks
- Programmable inputs and outputs
- Undervoltage Auto-restart

##### Monitoring and Metering

- Metering - current, voltage, power, energy, frequency, RTD, Thermistor
- Oscillography - analog values at 32 samples/cycle and digital states



#### Features (continued)

- Event Recorder - Up to 256 time tagged events with 1ms resolution
- Advanced device health diagnostics

##### Communications

- Networking Interfaces - Two Wire RS485, RJ45 Ethernet
- Multiple Protocols (Modbus RTU, Modbus TCP/IP, Profibus, Devicenet)
- Programming Ports - USB, RS485
- Network Time Protocol (when ordered with Ethernet)

##### User Interface

- Control panel with 12 status LED's, Motor Control and function keys
- Color HMI Display featuring a full color graphical display, Motor and system status LED's, USB programming port and motor control keys.

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date



## Accessories for the MM300

Visit [www.GEMultilin.com/MM300™](http://www.GEMultilin.com/MM300™) to:

- 



# GE Multilin®

## Protection and Control

### MM2 Motor Protection System

Integrated process, control, and protection for low voltage motors

#### Key Benefits

- Full featured protection for low voltage AC motors
- Advanced automation capabilities providing customized protection and integrated automation control
- Cost effective solution - Low cost modular design
- Small footprint and compact design - With or without display, fits into standard MCC buckets
- Preconfigured logic for all standard motor starter types, EnerVista® compatible
- Integrated motor control pushbuttons
- Remote monitoring via serial communications, Modbus RTU
- Easy installation and integration - Panel mount option
- Reduced number of devices - Replaces bi-metal overload elements, integrates timers, relays, meters, switches, indicators

#### Applications

- Motor protection and management system for low voltage AC motors
- Specifically designed for Motor Control Center applications

#### Features

##### Protection and Control

- Motor Thermal Model
- Single phase / Current unbalance
- Contactor failure
- Locked/stalled rotor
- Ground fault
- Undervoltage, Overvoltage
- Overtemperature
- Acceleration Trip
- Thermistor Protection
- Starts per Hour / Time Between Starts
- Undercurrent and underpower
- Configurable motor start controller
- Undervoltage auto restart

##### Monitoring and Metering

- Motor operational parameters and historical data
- Process data
- Phase and ground current, power, energy, voltage
- Status of relay inputs
- Trip record and pre-trip values
- Motor statistical information

##### User Interface

- 40 Character LCD display
- Front Panel control push buttons and programming keypad
- 11 Motor and Relay Status LED's
- RS485 ModBus™, 1200 - 19,200 bps

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the MM2 into new or existing monitoring and control systems



## Motor Protection

	Standard	Option 1 Adds	Option 2 Adds
<b>Protection and Control</b>	Overload (49/51) phase unbalance (46) welded/open contactor	Undervoltage auto restart diagnostics	Ground fault (50G/51G), rapid trip locked/stalled rotor (48) overtemperature thermistor (49) undercurrent/underpower (37) overvoltage (59)/undervoltage (27)
<b>Inputs</b>	4 Control 2 Programmable	8 Programmable 1 Analog	2 Control Thermistor input Single-phase voltage input for kW and kWh
<b>Relays</b>	Contactor control (A)	Auxiliary 1 and 2	Contactor control (B)
<b>Mounting Configurations</b>	Chassis mount	Chassis mount panel mount with display available when both options are ordered	Chassis mount

## Ordering

<b>MM2</b>	*	*	*	*	
MM2	PD				Basic unit
	C				Panel mount with display *
		1			Chassis mount (black box)
			2		<b>Option 1</b> Process control, 10 process inputs, undervoltage auto restart, diagnostics
					<b>Option 2</b> Enhanced protection, power (kW), thermistor, 2nd contactor control, and 2 process inputs
				120	Control voltage 120 VAC
				240	Control voltage 240 VAC

Note:\*Only Available when both options are ordered.

### Modifications

MOD601:	240 VAC switch inputs – allows the use of external 240 VAC supply to power switch inputs
MOD602:	24 – 48 VDC switch inputs – allows the use of external 24 – 48 VDC supply to power switch inputs
MOD603:	ESD relay – converts AUX 2 relay into an emergency shutdown relay
MOD605:	Removable rear terminals – allows terminals 13 – 58 to be unplugged from the MM2
MOD610:	Conformal coating
MOD613:	240 VAC VT input
MOD614:	VT primary setpoint up to 7200 V and variable overload curve setting
MOD615:	VT primary setpoint up to 7200 V and backspin timer
MOD616:	MM2 with remote display

## Accessories for the MM2

Viewpoint Monitoring	VP-1
50:0.025 Ground CT	HGF3
5 A Phase CT	
1 A Phase CT	

Visit [www.GEMultilin.com/MM2](http://www.GEMultilin.com/MM2) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an MM2 online



# GE Multilin®

## Protection and Control

### SPM Synchronous Motor Protection System

Starting protection, synchronization and control for synchronous motors

Section 18

#### Key Benefits

- Complete asset monitoring - Field Winding temperature and statistical data
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Access to information - RS485 Communications port and Modbus RTU Protocol

#### Applications

- Starting, synchronizing and protection of collector-ring or brushless-type synchronous motors

#### Features

##### Protection and Control

- Field application
- DC field current loss, exciter current loss, DC field voltage check
- PF regulation, reluctance torque synchronizing
- Protects motor during start up and in the event of asynchronous operation
- Squirrel cage winding overheating protection
- Automatic phase rotation correction
- Auto-loading and incomplete sequence
- Regulator tuning mode
- True RMS metering with DFT filtering
- Optional power factor regulator with adjustable settings
- Power factor & pull out protection (Optional)
- Speed dependent squirrel cage overload protection
- Motor restart protection

##### Monitoring and Metering

- Motor power factor
- DC excitor amps and voltage
- AC Current
- Exciter field resistance
- Motor run time
- Record of trips



#### Features (continued)

##### User Interface

- 40 Character backlit display for easy viewing of settings and actual values
- Function keys allow programming of settings and viewing of measured values

##### Communications

- RS485 Serial Communications
- Modbus RTU protocol
- Optional Ethernet communications using Multinet® Serial to Ethernet converter

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the SPM into new or existing monitoring and control systems

#### Ordering

SPM	*	*
SPM	PF	H

SPM: standard starting and protection relay with VDN board  
 PF: power factor regulation option used on motors with proportional SCR exciter. (not recommended for brushless applications)  
 H: Harsh environment conformal coating

#### Accessories for the SPM

200A DCCT & Calibration Module	PG2SPM
400A DCCT & Calibration Module	PG4SPM
µSPM Retrofit Package	MPSPM
Viewpoint Monitoring	VP-1

#### Visit [www.GEMultilin.com/SPM](http://www.GEMultilin.com/SPM) to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an SPM online



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

**C60**

[page 18-95](#)

**Breaker Monitoring and Control for Substation Automation**

The C60 Breaker Protection System provides a complete integrated package for the protection, control, and monitoring of circuit breakers. The C60 supports multi-breaker busbar configurations including breaker-and-a-half and ring bus arrangements.

**C30**

[page 18-97](#)

**Substation hardened programmable logic controller**

The C30 Controller System is a programmable logic controller for performing substation or bay automation that can also be used for expanding the I/O capability of protection devices and replacing Sequence of Event (SOE) recorders. The C30 provides fast deterministic execution of programmable logic with I/O capabilities far above an average protection relay.

**N60**

[page 18-99](#)

**Load shedding, remedial action and special protection schemes**

The N60 Network Stability and Synchrophasor Measurement System is a flexible device intended for the development of load shedding, remedial action, special protection schemes and wide area monitoring and control.

**C70**

[page 18-101](#)

**Capacitor bank protection and control system**

The C70 is an integrated protection, control, and monitoring device for shunt capacitor banks. The C70 provides both the bank and system protection schemes for shunt capacitor bank protection.

**MIV II**

[page 18-103](#)

**Three-phase and ground voltage protection relay**

The MIV II, a member of the M II Family of protection relays provides voltage and frequency protection for a wide range of applications.

**MIN II**

[page 18-104](#)

**Complete numerical ground directional protection**

The MIN II, a member of the M II Family of protection relays provides directional protection on distributed networks.

**RRTD**

[page 18-105](#)

**Remote temperature monitoring of RTD's**

The remote RTD Module provides additional RTD temperature metering capabilities for the 369 Motor Protection System.

**DDFR**

[page 18-106](#)

**Distributed Digital Fault Recorder**

The DDFR™ is a Power System Fault Recorder that collects, archives and manages Disturbance and Fault information that is recorded by microprocessor based protective relays distributed throughout your local power system.



# GE Multilin®

## Protection and Control

### C60 Breaker Protection System

Breaker monitoring and control for substation and industrial automation

Section 18

#### Key Benefits

- Complete breaker control, monitoring and integration in a single platform
- Reduced wiring through the use of high-speed peer-to-peer communication for accepting Trip and Close commands from other relays
- Advanced automation capabilities for providing customized protection and control solutions
- Reduced installation space requirements through integration of multiple devices including protection, control functions, push-buttons, status LEDs, and communication interfaces
- Modular hardware architecture allows for flexibility in device configurations to cover most breaker applications
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for external recording devices
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Embedded IEC61850 Protocol

#### Applications

- Stand-alone breaker monitoring and control
- Multiple breaker configuration control including Breaker-and-a-Half and Ring Bus
- Automatic Bus Transfer scheme using a single device
- As part of a distributed bay controller

#### Features

##### Protection and Control

- Breaker failure
- Synchronism check
- Autorecloser
- Phase and Auxiliary undervoltage
- Neutral and Auxiliary overvoltage
- Phase, ground and neutral overcurrent
- Sensitive directional power
- Dual breaker control

##### Communication

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols – IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip and I/O Extension applications



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Breaker monitoring – accumulated wear and operation time, number of operations, breaker flashover and trip coil monitoring
- Event Recorder – 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger – 16 channels with sampling rate up to 1 sample/cycle
- Fault Locator
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to C60 configuration

##### User Interfaces and Programming

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date



## Accessories for the C60

**Ordering Note:** To view the latest options available for the C60, or to order the UR Classic Front Panel, please visit our online store for more details.

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a C60 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### C30 Controller System

Substation hardened programmable logic controller

Section 18

#### Key Benefits

- Powerful and deterministic programmable logic suitable for creating most customized automated substation control solutions
- Reduced bay or station wiring through the use of high-speed peer-to-peer communication for sending and accepting control commands from other relays
- Modular hardware architecture allowing for flexibility in the I/O configuration to support most bay management applications
- Advanced Sequence of Events and disturbance recording providing accurate logging of station events thus eliminating the need for external recording devices
- Simplified system integration and access to information through the use of multiple communication options and protocols not found in industrial grade PLCs
- Embedded IEC61850 Protocol

#### Applications

- Bay control and substation automation
- Programmable Logic Control
- UR I/O expansion
- Sequence of Events (SOE) recorder replacement

#### Features

##### Protection and Control

- Programmable logic, timers, counters
- Distributed logic, remote I/O expansion
- User-definable protection elements
- Up to 96 digital input and 64 digital outputs
- Transducer I/Os (RTD, dcmA)

##### Communication

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URs for Direct Transfer Trip and I/O Extension applications

##### Monitoring and Metering

- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to C30 configuration



#### Features (continued)

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the C30 into new or existing monitoring and control systems



C30 -	*	**	-H	*	*	-F**	-H**	-M**	-P**	-U**	-W**	
CPU	I	E	G	H	J	K	L	M	N			
Software Options		00	01	03	04							
Mount/Coating			H	A	V	B						
User Interface				K	L	M	N	O	P	Q	R	
Power Supply				H	L						RH	
Digital I/O						XX	XX	XX	XX	XX	XX	
Transducer I/O						4A	4A	4A	4A	4A	4A	
Inter-Relay Communications						4B	4B	4B	4B	4B	4B	

**For Full Sized Horizontal Mount**  
 Base Unit  
 RS485 + RS485  
 RS485 + Multi-mode ST 10BaseF  
 RS485 + Multi-mode ST Redundant 10BaseF  
 RS485 + Multi-mode ST 100BaseFX  
 RS485 + Multi-mode ST Redundant 100BaseFX  
 RS485 + Single-mode SC 100BaseFX  
 RS485 + Single-mode SC Redundant 100BaseFX  
 RS485 + 10/100 BaseT  
 No Software Options  
 Ethernet Global Data  
 IEC61850  
 Ethernet Global Data (EGD) + IEC61850  
 Horizontal (19" rack) - Standard  
 Horizontal (19" rack) - Harsh Chemical Environment Option  
 Vertical (3/4 size) - Standard  
 Vertical (3/4 size) - Harsh Chemical Environment Option  
 Enhanced English Front Panel  
 Enhanced English Front Panel with User-Programmable Pushbuttons  
 Enhanced French Front Panel  
 Enhanced French Front Panel with User-Programmable Pushbuttons  
 Enhanced Russian Front Panel  
 Enhanced Russian Front Panel with User-Programmable Pushbuttons  
 Enhanced Chinese Front Panel  
 Enhanced Chinese Front Panel with User-Programmable Pushbuttons  
 Vertical Front Panel with English display  
 125 / 250 V AC/DC  
 125/250 V AC/DC with redundant 125/250 V AC/DC power supply  
 24 - 48 V (DC only)  
 No module  
 4 Solid State (No Monitoring) MOSFET Outputs  
 4 Solid State (Voltage w/ opt Current) MOSFET Outputs  
 4 Solid State (Current w/ opt Voltage) MOSFET Outputs  
 16 Digital Inputs with Auto-Burnish  
 14 Form-A (No Monitoring) Latchable Outputs  
 8 Form-A (No Monitoring) Outputs  
 2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs  
 2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs  
 8 Form-C Outputs  
 16 Digital Inputs  
 4 Form-C Outputs, 8 Digital Inputs  
 8 Fast Form-C Outputs  
 4 Form-A (Voltage w/ opt Current) Outputs, 8 Digital Inputs  
 6 Form-A (Voltage w/ opt Current) Outputs, 4 Digital Inputs  
 4 Form-C & 4 Fast Form-C Outputs  
 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs  
 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs  
 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs  
 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs  
 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs  
 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs  
 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs  
 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs  
 4 dcma Inputs, 4 dcma Outputs  
 8 RTD Inputs  
 4 RTD Inputs, 4 dcma Outputs  
 4 dcma Inputs, 4 RTD Inputs  
 8 dcma Inputs  
 C37.94SM, 1300nm single-mode, ELED, 1 channel single-mode  
 C37.94SM, 1300nm single-mode, ELED, 2 channel single-mode  
 820 nm, multi-mode, LED, 1 Channel  
 1300 nm, multi-mode, LED, 1 Channel  
 1300 nm, single-mode, ELED, 1 Channel  
 820 nm, multi-mode, LED, 2 Channels  
 1300 nm, multi-mode, LED, 2 Channels  
 1300 nm, single-mode, ELED, 2 Channels  
 G.703, 1 Channel  
 G.703, 2 Channels  
 RS422, 1 Channel  
 RS422, 2 Channels  
 IEEE C37.94, 820 nm, multimode, LED, 1 Channel  
 IEEE C37.94, 820 nm, multimode, LED, 2 Channels

### Accessories for the C30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

Visit [www.GEMultilin.com/C30](http://www.GEMultilin.com/C30) to:

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- Download the instruction manual
- Review applications notes and support documents
- Buy a C30 online
- View the UR Family brochure

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## Protection and Control

## N60 Network Stability and Synchrophasor Measurement System

Load shedding, remedial action, special protection schemes and synchrophasors

## Key Differentiators

- Scalable Synchrophasor measurements with up to 4 PMUs per IED reducing Synchrophasor cost by up to 75%
- PMU and network protection combined in one platform simplifying installation and application implementation
- Exceeds the latest IEEE C37.118 standard for Synchrophasor measurement devices with a Total Vector Error less than 1 %
- Uninterrupted Synchrophasor measurements during fault and disturbances providing highly reliable capture of data for critical control functions and post-mortem analysis
- Real time access to remote analog data providing for advanced wide area applications and enhanced system security
- Extended on-board Phasor data storage (25 MB) for historical recorded
- Simplified system integration with direct connection to JungleMUX SONET, TN1U SDH and TN1Ue SDH networks
- Hi-speed digital and analog peer-to-peer communications providing early detection & fast automated response to power system events
- Integrated control functions, latching outputs, and programmable pushbuttons allow for replacing mechanical switches and external device, and reducing wiring and commissioning costs
- Built on protection hardened and industry accepted Universal Relay platform

## Applications

- Decrease blackouts by identifying network instabilities and taking fast preventative action
- Increase utilization of existing investments by identifying power transfer capability on existing lines
- Compliments existing protection and control by sharing power and utilization information with existing systems to enhance system security
- Facilitate contingency planning through continuous Synchrophasor data collection and post mortem analysis
- Provides enhanced state estimation for SCADA to optimize system wide load shedding and remedial action schemes
- Mitigate system critical conditions such as power system dampening and loss of synchronism through the use of enhanced automated control to reduce outages

## Features

## Protection and Control

- Underfrequency, overfrequency, and rate of change of frequency (df/dt)
- Out-of-step tripping and power swing blocking
- Synchrocheck
- Overvoltage, undervoltage
- FlexMath for performing automated network control for applications such as automatic load shedding, power balancing and remedial action schemes



## Features (continued)

## Communication

- Synchrophasor streaming over Ethernet – rates from 1 to 60 Phasors/sec
- Direct I/O for exchange of binary and analog data with N60 located locally or wide areas apart
- IEC61850 enabled including Analog GOOSE
- N60 to N60 communications using direct fiber or through multiplexers using G.703, RS422, or C37.94 interfaces

## Monitoring and Metering

- Synchrophasor Recording – 25MB memory with multiple recording and triggering options
- Metering – current, voltage, power, energy frequency
- Data Logger – Up to 16 channels with sampling rate up to 1 sample/cycle
- Setting Security Audit Trail for tracking changes to N60 configuration

## EnerVista® Software

- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- Easy to use setup software to streamline the configuration process
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control N60 Network Stability and Synchrophasor Measurement System Ordering

## Section 18

	N60-	*	**	H	*	*	F**	H**	M**	P**	U**	W/X**	For Full Sized Horizontal Mount
Base Unit	N60												Base Unit
CPU		E	G	H	J	K	N						RS485 & RS485 (IEC61850 option not available)
													RS485 + Multi-mode ST 10BaseF
													RS485 + Multi-mode ST Redundant 10BaseF
													RS485 + Multi-mode ST 100BaseFX
													RS485 + Multi-mode ST Redundant 100BaseFX
													RS485 + 10/100 BaseT
Software Options		00	03	06	07	14	15	16	17				No Software Options
													IEC61850
													1 Phasor Measurement Units (PMU)
													1 Phasor Measurement Units (PMU) + IEC61850
													2 Phasor Measurement Units (PMU)
													2 Phasor Measurement Units (PMU) + IEC61850
													4 Phasor Measurement Units (PMU)
													4 Phasor Measurement Units (PMU) + IEC61850
Mount				H	A								Horizontal (19" rack) - Standard
User Interface					C	P	D	G	A	B	R	S	Horizontal (19" rack) - Harsh Chemical Environment Option
													English
													English with additional 4 small and 12 large programmable pushbuttons
													French
													French with additional 4 small and 12 large programmable pushbuttons
													Chinese
													Chinese with additional 4 small and 12 large programmable pushbuttons
													Russian
													Russian with additional 4 small and 12 large programmable pushbuttons
Power Supply													125/250 V AC/DC
CT/VT DSP	Required for PMU Option												24 - 48 V (DC only)
Digital I/O	Required for PMU Option												Standard 4CT/4VT w/ enhanced diagnostics
													Standard 8CT w/ enhanced diagnostics
													No Module
													8 Form-A (No Monitoring) Outputs
													2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs
													2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs
													8 Form-C Outputs
													16 Digital Inputs
													4 Form-C Outputs, 8 Digital Inputs
													8 Fast Form-C Outputs
													2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
													4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
													6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
													2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
													2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
													4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
													6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
													16 Digital Inputs with Auto-Burnish
													14 Form-A (No Monitoring) Latchable Outputs
Transducer I/O													4 dcma Inputs, 4 dcma Outputs
													8 RTD Inputs
													8 RTD Inputs
Inter-Relay Communications													7C 7C 1300 nm, single-mode, ELED, 1 channel
													7H 7H 820 nm, multi-mode, LED, 2 Channels
													7I 7I 1300 nm, multi-mode, LED, 2 Channels
													7J 7J 1300 nm, single-mode, ELED, 2 Channels
													7M 7M Channel 1 - RS422; Channel 2 - 1300 nm, multi-mode, LED
													7R 7R G.703, 1 Channel
													7S 7S G.703, 2 Channels
													7T 7T RS422, 1 Channel
													7W 7W RS422, 2 Channels, Single Clock
													73 73 1550 nm, single-mode, LASER, 2 Channels
													76 76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel
													77 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel
													2A 2A C37.94SM, 1300 nm Singlemode, ELED, 1 Channel Single mode
													2B 2B C37.94SM, 1300 nm Singlemode, ELED, 2 Channel Single mode
													7V 7V RS422, 2 Channels, Dual ClockV

### Accessories for the N60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the N60, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/N60](http://www.GEMultilin.com/N60) to:

- View guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a N60 online
- View the UR Family brochure



# GE Multilin®

## Protection and Control

### C70 Capacitor Bank Protection & Control System

Section 18

#### Key Benefits

- Protect capacitor banks of a variety of configurations with sensitive current and voltage balance protection functions
- Adaptive compensation techniques truly compensation for the inherent bank unbalance providing sensitive protection
- Flexible Automatic voltage regulation of shunt capacitor banks along with control supervision
- Custom programmable logics for advanced shunt capacitor bank controls
- Embedded IEC61850 Protocol - No external protocol converter required
- Reduced installation space requirements through compact design - True convergence of protection, metering and control functions, multiple I/O options programmable pushbuttons and status LEDs, and communication interfaces
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications

#### Applications

- Sensitive protection for grounded, ungrounded single and parallel capacitor banks and banks with taps, for a variety of capacitor bank configurations
- Protection, Control, Monitoring and Automation of shunt capacitor banks of different voltage levels
- Shunt capacitor banks based AVR and Capacitor control supervision
- Suitable for protecting multiple capacitor banks

#### Features

##### Protection and Control

- Voltage differential protection
- Compensated Bank Neutral Voltage Unbalance
- Phase Current Unbalance and Neutral Current Unbalance protection
- Bank phase overvoltage
- Negative sequence over voltage
- User programmable logics for custom schemes
- Automatic Voltage Regulator (AVR) for switching capacitor banks based on voltage, power factor and reactive power
- Time and Date function allowing capacitor bank switching based on time of day, week and seasons.
- Capacitor control supervision block for processing commands from SCADA, remote communication and local control through front panel HMI

##### Communication

- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – secure, high-speed exchange of data between URS for Direct Transfer Trip and I/O Extension applications



#### Features (continued)

##### Monitoring and Metering

- Metering – current, voltage, power, energy, frequency
- Oscillography – analog and digital parameters at 64 samples/cycle
- Event Recorder - 1024 time tagged events with 0.5ms scan of digital inputs
- Data Logger - 16 channels with sampling rate up to 1 sample/cycle
- Advanced relay health diagnostics
- Setting Security Audit Trail for tracking changes to C70 configuration

##### EnerVista® Software

- State of the art software for configuration and commissioning GE Multilin® products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the C70 into new or existing monitoring and control systems



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin®

## Protection and Control

### C70 Capacitor Bank Protection & Control System

Ordering

## Section 18

C70 - * 00 - * * * - F ** - H ** - M ** - P ** - U ** - W/X **										For full sized horizontal mount
Base Unit	E									Base Unit
CPU	G									RS485 + RS485 (IEC61850 option not available)
	H									RS485 + Multi-mode ST 10BaseF
	J									RS485 + Multi-mode ST Redundant 10BaseF
	N									RS485 + Multi-mode ST 100BaseFX
Software Options	00									RS485 + 10/100 BaseT
	03									None
	12									IEC61850
	13									Enhanced Capacitor Bank Control (AVR, Capacitor Control Supervision, Time & Date)
Mounting / Conformal Coating	H									Enhanced Capacitor Bank Control (AVR, Capacitor Control Supervision, Time & Date) + IEC61850
	A									Horizontal (19" rack) - Standard
User Interface	C									Harsh Chemical Environment Option
	P									English
Power Supply	L									English + 4 small and 12 large programmable pushbuttons
CT/VT DSP										125/250 V AC/DC
										24 - 48 V (DC only)
										Standard 4CT/4VT w/ enhanced diagnostics
										Standard 8CT w/ enhanced diagnostics
										Standard 8VT w/ enhanced diagnostics
Digital I/O										No Module
										2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs
										8 Form-C Outputs
										16 Digital Inputs
										4 Form-C Outputs, 8 Digital Inputs
										8 Fast Form-C Outputs
										4 Form-A (Voltage w/ opt Current) Outputs, 8 Digital Inputs
										6 Form-A (Voltage w/ opt Current) Outputs, 4 Digital Inputs
										4 Form-C & 4 Fast Form-C Outputs
										2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
										6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
										2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
										6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O										4 dcmA Inputs, 4 dcmA Outputs
Inter-Relay Communications										7H 820 nm, multi-mode, LED, 2 Channels
										7I 1300 nm, multi-mode, LED, 2 Channels
										7S G.703, 2 Channels
										7W RS422, 2 Channels
										77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel

### Accessories for the C70

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

**Ordering Note:** To view the latest options available for the C70, or to order the UR Classic Front Panel, please visit our online store for more details.

Visit [www.GEMultilin.com/C70](http://www.GEMultilin.com/C70) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a C70 online
- View the UR Family brochure





**MIV II Directional Power Protection System**

Numerical reverse, forward and low forward directional power and loss of field protection relay.

**Key Benefits**

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design Flexibility - easy to use programming logic
- Access to information - Modbus™ RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- Three models available for voltage, frequency and combined protection
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista® compatible
- Isolated RS232 port



**Applications**

- Voltage and/or frequency protection at any voltage in automatic transfer systems, generators, motors, lines and busbars

**Features**

**Protection and Control**

- Three-phase over and undervoltage, ground overvoltage
- Voltage unbalance, over and underfrequency, with the following options:
- Four independent time delay phase under/overvoltage elements complete with two independent fixed time ground overvoltage elements
- Four units of frequency protection
- Both voltage protection and two elements of frequency protection
- Circuit Breaker control (open/close)
- Configurable I/O
- 6 outputs, four configurable, plus trip and alarm

**Monitoring and Metering**

- 24-event record
- Analog/digital oscillography - 24 cycles at 8 samples per cycle
- Frequency and per-phase voltage
- Monitoring of the last 5 trips information from the display

**User Interfaces**

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps
- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices

**Ordering**

MIVII	*	0	*	0	*	00	*	00	
MIVII									Functions
1									Voltage functions
2									Frequency functions
3									Voltage and frequency functions
		0							Voltage range: 10-250 V (all models)
		1							Voltage range: 2-60 V (only for MIVII 1000)
				E					Relay language: English
				F					Relay language: French
						LO			Power Supply: 24-48 Vdc (Range: 19~58Vdc)
						HI			Power Supply: 110-250 Vdc (Range: 88~300Vdc)
									Power Supply: 100-230 Vdc (Range: 88~264Vac)

**Visit [www.GEMultilin.com/MIVII](http://www.GEMultilin.com/MIVII) to:**

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



# GE Multilin®

## Protection and Control

### MIN II Ground Protection System

Complete numerical ground directional protection

## Section 18

#### Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Follow technology evolution - Flash memory for product field upgrade
- Asset monitoring - Breaker health, and breaker failure protection
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista® compatible
- Isolated RS232 port

#### Applications

- Directional ground protection at any voltage level
- Backup/auxiliary protection for line schemes
- Component relay for transformers, generators and motors

#### Features

##### Protection and Control

- 2 ground IOC (high and low) units for grounded systems
- 2 ground TOC (high and low) units for grounded systems
- 2 directional units for grounded systems
- 2 directional overcurrent units for Petersen Coil
- 2 directional overcurrent units for isolated ground
- Directional comparison: scheme logic
- 4 preconfigured overcurrent curves (ANSI or IEC)
- Configurable breaker failure protection
- Configurable I/O
- 6 outputs: trip, service, 4 auxiliary

##### Monitoring and Metering

- 32-event record, analog/digital oscillography
- Ground current metering
- Monitoring of the last 5 trips information from the display

##### User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus™ RTU protocol up to 19,200 bps
- EnerVista® software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin® devices



#### Ordering

MINII	*	0	*	E	0	0	*	0	0	Description
	N									Basic Model
	L									With logic for teleprotection schemes (see Note 1)
	A									ANSI Curves
	I									IEC Curves (see Note 2)
				E						<b>Application</b>
				S						Grounded system (In = 1 or 5 A)
										Isolated ground / Petersen Coil
							LO			<b>Power Supply:</b>
							HI			24-48 Vdc (Range: 19~58 Vdc)
										110-250 Vdc (Range: 88~300 Vdc)
										110-240 Vac (Range: 88~264 Vac)

#### Visit [www.GEMultilin.com/MINII](http://www.GEMultilin.com/MINII) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIN II online
- View the MIN II brochure



## Key Benefits

- ## Applications

- ## Features

- RTD Overtemperature

## Automation

- Programmable Inputs and Outputs
- Analog Outputs

## Monitoring and Metering

- RTD Temperature

## Communications

- Networking via RS485 Serial Ports
- Optional Fiber Optic Port
- Modbus RTU Protocol
- Optional Profibus

**EnerVista® Software**

- State of the art software for configuration and commissioning GE Multilin® products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista® Integrator providing easy integration of data in the RRTD into new or existing monitoring and control systems



## Ordering

RRTD	*	*	*	*	
RRTD	HI	LO	IO	0	50 – 300 VDC/40 – 265 VAC 20 – 60 VDC/20 – 48 VAC
					Optional input and output
					No optional input and output
			F	0	Optional fiber optic port
					No optional fiber optic port

Note: The control power (HI or LO) must be specified with all orders.

## Accessories for the RRTD

Viewpoint Monitoring	VP-1
Multinet® Serial to Ethernet converter	MULTINET-FE

Visit [www.GEMultilin.com/RRTD](http://www.GEMultilin.com/RRTD) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an RRTD online



# GE Multilin®

## Protection and Control

### DDFR™ Distributed Digital Fault Recorder

Utilizing the fault recording power you already possess

## Section 18

The GE Multilin® DDFR™ is a Power System Fault Recorder that collects, archives and manages Disturbance and Fault information that is recorded by microprocessor based protective relays distributed throughout your local power system.

#### Key Benefits

- Provides a permanent detailed record of all substation activity at a fraction of the cost of installing traditional Digital Fault Recorders (DFR)
- Eliminates up to one-third of substation wiring needed for protection, metering and disturbance recording
- Allows for recording of Transfer Trip Signals, Block Signals and other inter-substation messages that are sent via IEC61850 peer-to-peer messages and not recordable by traditional DFR's
- Permits recording of internal protection relay operands and calculations in Sequence of Events (SOE) and Fault records
- Meets requirements of international Fault Recording standards when used with GE Multilin®'s Universal Relay family including NERC, IEEE, ECAR, & NPCC

#### Applications

- Substation Distributed Digital Fault Recording
- Component in a larger enterprise wide fault and disturbance recording system

#### Features

- Retrieves and Archives Transient Fault Records, Sequence of Event Records, and Disturbance Records recorded in protection relays distributed across the substation
- Automatically merges Events recorded in protection relays distributed across the network into a single substation wide Sequence of Event Record
- Stores months of fault and disturbance records internally, facilitating local substation analysis
- Effortlessly archives recorded data to a permanent enterprise network location or server for remote investigation and analysis



# GE Multilin®

## Protection and Control

### DDFR Distributed Digital Fault Recorder

#### Specifications/Ordering

## Section 18

#### Meets Standard DFR Requirements

When used with advanced microprocessor based relays such as the UR family, the DDFR System meets or exceeds requirements of International Standards for Digital Fault Recording.

#### DDFR Recording Specifications when used with the UR Family

Sequence of Event Records (SOE)	0.5 ms Digital Inputs, 2.0 ms Protection Elements
Timestamp Resolution	IRIG-B, SNTP
Time Synchronization	96 x number of UR's
Digital Input Quantity	Digital Input Status Changes, Protection Element Status Changes, Automation Logic Status Changes, Peer-to-Peer Communication Messaging (IEC61850)
Data Available	
Transient Fault Recording	
Sample Rate	Up to 64 samples/cycle
Length of Record	Up to 2 sec. @ 64samples/cycle
Number of Analog Channels	24 x number of UR's
Number of Digital Channels	64 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.) Digital Status - Contact I/O, Remote I/O, Virtual I/O, Protection Element Status
File Format	COMTRADE
Trigger	Configurable
Disturbance Record	
Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 120 seconds @ 1 samples/cycle with 8 Analog Channels
Number of Analog Channels	16 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.)
File Format	COMTRADE

#### DDFR Recording Specifications when used with the SR Family

Sequence of Event Record (SOE)	14 ms Digital Inputs and Protection Elements
Timestamp Resolution	IRIG-B
Time Synchronization	16 x # of SR750's & SR745's
Digital Input Quantity	9 x # of SR469's & SR489's
Data Available	Digital Input Status Changes Protection Element Status Changes
Transient Fault Recording	
Sample Rate	16 samples/cycle SR750, SR469, SR 489, 64 samples/cycle SR745
Length of Record	2 sec. - SR750 1 sec. - SR469, SR489 250 ms - SR745
Number of Analog Channels	8 x number of SR relays
Data Available	Voltage Phasors Current Phasors
File Format	COMTRADE
Trigger	Configurable
Disturbance Record (750 Only)	
Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 34 sec. @ 1 samples/cycle
Number of Analog Channels	8 x number of SR750's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF,
File Format	COMTRADE
Trigger	Configurable

#### Ordering

DDFR	**	**	Description
	HI	LO	120-230 VAC / 110-250 VDC
	LO	HI	24-48 VDC
		LO	Redundant 120-230 VAC / 110-250 VDC
		LO	Redundant 24-48 VDC

Visit [www.GEMultilin.com/DDFR](http://www.GEMultilin.com/DDFR) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a DDFR online



**IFC Time Overcurrent Relay**



**Applications**

- Feeder, AC machines and transformers
- Inverse time/current applications

**Protection and Control**

- Ground and phase time over and undercurrent
- Overload motor protection
- IOC (optional)

**Features**

- Six inverse time/current operating curves
- Instantaneous current ranges
- Extended time current ranges
- Target seal-in units available
- Instantaneous units available
- High seismic capability
- Molded drawout case with clear cover

**IAC Time Overcurrent Relay**



**Applications**

- Feeder, AC machines and transformers
- Applications where operating time is inverse to operating current

**Protection and Control**

- Ground and phase time over and undercurrent
- Overload motor protection
- IOC (optional)

**Features**

- Six inverse time/current operating curves
- Target seal-in units available
- Instantaneous units available
- Drawout case

**PJC Instantaneous Overcurrent Relay**



**Applications**

- Feeder circuit overcurrent protection
- High-speed, non-directional AC/DC current

**Protection and Control**

- Instantaneous over and undercurrent

**Features**

- Self-reset or manual-reset relays
- Mechanical target available
- Up to three independent units per case
- Molded or drawout case available

**DIAC/DIFC/DSFC Single-Phase Digital Overcurrent Protection**



**Applications**

- Industrial and utility power systems
- Feeders, transmission lines, AC-machines, transformers
- Facilities with medium voltage switchgear
- 50 or 60 Hz

**Protection and Control**

- Phase or ground overcurrent
- Separate TOC and IOC protection
- Wide pickup setting ranges
- 16 TOC curve characteristics
- RMS sensing
- Reset characteristic selection
- Manual trip levers

**User Interfaces**

- Pickup status LED
- TOC and IOC latched indicators
- Target reset

**Features**

- Three models: DIAC, DIFC, DSFC
- Direct/functional replacement of IAC, IFC, SFC
- Self-powered
- Reduced maintenance costs
- Low burden
- Drawout case



#### CHC Instantaneous Overcurrent Relay



##### Application

- Three-phase and ground fault in circuit breaker failure schemes

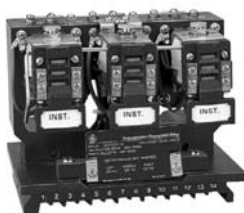
##### Protection and Control

- Three-phase and ground IOC
- Time delay operation

##### Features

- Electrically separate contacts available
- Drawout case

#### HFC Instantaneous Overcurrent Relay



##### Application

- Direct trip IOC

##### Protection and Control

- IOC
- Detection of severe close-in faults on transmission lines
- Differential motor protection
- Sensitive ground fault protection

##### Features

- Two electrically separated contacts per unit
- High seismic rating
- Molded drawout case

#### IFCV Relay with Voltage Restraint



##### Applications

- System fault backup protection
- Generator fault backup protection

##### Protection and Control

- TOC unit with voltage restraint
- IOC unit available

##### Features

- Inverse time-current operating curve
- Two electrically separate contacts
- Target seal-in unit
- Induction unit design
- Drawout case

#### SGC Negative Sequence Overcurrent



##### Application

- Generator negative sequence heating protection

##### Protection and Control

- Negative sequence TOC

##### Features

- K setting selection from K = 2 to 40
- Reset function approximates machine cooling
- Remote I<sub>2</sub> readout meter available
- Alarm function available
- Electrically operated target seal-in
- Alarm level LED available
- Drawout case

#### Ground Fault Relay



##### Application

- Protects electrical equipment from ground faults when used with a matching Sensor

##### Protection and Control

- Panel or door mount
- Adjustable time delay
- LED power or indicator
- Visual trip indicator
- Trip Currents 5 - 60 , 30 - 360 or 100 -1200 - A
- UL listed and CSA Approved



**MLJ MID Digital Synchronism Check Relay**



**Applications**

- Generator and network synchronism
- Bus or line synchronism check
- Manual closing of breakers

**Protection and Control**

- Synchronism check
- Undervoltage supervision
- DLDB, DLLB and LLDB indication

**Features**

- RS485, RS232 or fiber communications available
- Configurable auxiliary outputs
- V f Hz line and bus metering
- Continuous or manual modes
- Part of a modular system
- Independent 2" or 4" modules
- 1/4 or 1/8 standard 19" rack case available
- Three-digit display

**IJS Synchronism Check Relay**



**Application**

- Bus or line synchronism check

**Protection and Control**

- Synchronism check
- Adjustable time delay
- Selectable phase calibration range
- Instantaneous bus and line undervoltage
- Time delay dead-line live-bus and/or deadbus live-line check

**Features**

- Telephone type relay units available
- Mechanical targets available
- Drawout case

# GE Multilin®

## Protection and Control

### Single Function Protection Relays

Voltage and Frequency Relays

## Section 18

#### TOV MID Modular Voltage Relay



##### Applications

- Automatic transfer equipment
- Automatic control systems
- Component for complex protection schemes

##### Protection and Control

- Instantaneous over and undervoltage
- Time delay over and undervoltage
- Phase to ground fault detection in isolated neutral systems
- Third harmonic filter (single-phase)

##### Features

- Part of a modular system
- Independent 2" modules
- 1/8 standard 19" rack cases available
- LED indicators and reset button
- Trip, auxiliary, and power supply alarm

#### IFV Time Delay Voltage Relay



##### Applications

- AC generators
- Ungrounded three-phase distribution system
- Time delay pickup or dropout

##### Protection and Control

- Time delay overvoltage
- Ground detection on ungrounded systems and equipment neutrals
- Instantaneous overvoltage available

##### Features

- Frequency compensation (optional)
- Target seal-in unit on all contacts
- Instantaneous, hinged armature type units (optional)
- Drawout case

#### CFVB Voltage Balance Relay



##### Application

- VT fuse failure detection

##### Protection and Control

- Voltage balance

##### Features

- Mechanical targets
- Drawout case

#### NBV Voltage Unbalance Relay



##### Applications

- Motor bus
- Detection of upstream blown fuse

##### Protection and Control

- Three-phase voltage unbalance

##### Applications

- System fault backup protection
- Generator fault backup protection

##### Protection and Control

- TOC unit with voltage restraint
- IOC unit available

##### Features

- Inverse time-current operating curve
- Two electrically separate contacts
- Target seal-in unit
- Induction unit design
- Drawout case



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

SFF Static Digital Frequency Relay



**Applications**

- Load shedding frequency schemes
- Extremely accurate frequency detection

**Protection and Control**

- Over and underfrequency with undervoltage cutoff
- Load shedding and restoration

**Features**

- Easy setpoint setup
- AC or DC control power
- Drawout case
- Up to four frequency setpoints

ICR Phase Sequence and Undervoltage



**Applications**

- AC machine undervoltage detection
- Reverse phase sequence detection
- Open phase detection on starting

**Protection and Control**

- Undervoltage
- Phase sequence
- Open phase
- Time delay available

**Features**

- Target seal-in units available
- Drawout case

Phase Voltage Relay



**Application**

- Protection of 3 phase electrical equipment

**Protection and Control**

- Protects against phase loss, low/high voltage, phase reversal and voltage unbalance
- Compact design
- Surface or Din rail mount
- UL Listed and CE Marked
- Door mounted adapter available

**BDD Percentage Differential with Harmonic Restraint**



**Application**

- Current differential single-phase

**Protection and Control**

- High-speed percentage differential
- Phase and ground fault detection
- Current restraint circuits available
- Percent differential slope selection

**Features**

- No auxiliary CT's are required
- Ratio matching taps
- Harmonic restraint prevents incorrect tripping upon transformer energization
- Self-contained target indicator
- Inherently selective
- Drawout case

**STD Percentage Differential with Harmonic Restraint**



**Applications**

- Power and autotransformer protection
- Current differential single-phase (three required per transformer)

**Protection and Control**

- High-speed percentage differential
- Harmonic restraint
- Hinged armature instantaneous unit

**Features**

- Adjustable restraint slope
- Inherently selective
- Drawout case

**CFD High-Speed Differential Relay**



**Applications**

- Generators, 2000 kVA and above
- Motors and synchronous condensers, 3000 hp (or kVA) and above

**Protection and Control**

- High-speed percent differential protection

**Features**

- Variable percentage slope operating characteristic
- Product restraint principle
- Drawout case



PVD Differential Voltage Relay



Key Values

- High security and reliability
- High speed protection
- Large installed base ... over 60 years of service experience
- Easy integration with timing relays for breaker failure function

Applications

- Bus differential high z voltage
- Shunt reactor differential protection
- Transformer high z ground differential

Protection and Control

- High-speed, high z voltage sensing
- High-seismic IOC unit
- Breaker failure protection (with suitable timing relay)

Features

- Replacement for earlier PVD models
- Thyrite stacks limit potential voltage across relay
- Drawout case

IJD Percentage Differential Relay



Applications

- AC rotating machines (IJD52)
- Power transformers (IJD53)

Protection and Control

- Fixed slope percentage differential

Features

- Single and three-phase units available
- Various percentage slopes available
- Electrically operated target seal-in unit
- Restraint current matching taps (IJD53)
- Drawout case

SBD Differential Voltage Relay



Key Values

- High security and reliability
- High speed protection
- Large installed base ... over 60 years of service experience
- Easy integration with timing relays for breaker failure function
- Sub-cycle protection

Applications

- Bus and feeder differential protection
- Shunt reactor differential protection

Protection and Control

- Sensitive, high-speed differential protection
- Phase and ground fault detection (requires three relays)
- Breaker failure initiation when used with a suitable timing relay
- High-impedance voltage measurement with overcurrent supervision



# GE Multilin®

## Protection and Control

### Single Function Protection Relays

Directional Relays

## Section 18

#### JBC/JBCG

#### Phase and Ground Direction Overcurrent Relays



##### Applications

- Directional phase fault protection (JBC)
- Directional ground fault protection (JBCG)

##### Protection and Control

- TOC
- IOC
- Voltage-restrained phase overcurrent

##### Features

- Mechanical targets
- Three inverse time/current characteristics
- Drawout case

#### JBCV Directional Relays

#### Directional overcurrent protection of feeders and transmission lines



- JBCV relays consist of three units, an instantaneous power-directional unit of the induction-cup type, a TOC unit of the induction-disk type, and an IOC unit of the induction-cup type

#### Timing Relays

#### SAM Static Timing Relay



##### Applications

- Accurate and repeatable timing functions
- Distance relay timing

##### Protection and Control

- Accurate repeatable timing for contact closure control

##### Features

- High-reliability solid-state components
- Single or dual timing units available
- Timing range of 0.10 to 9.99 sec
- Various output contact arrangements available
- Front panel settings adjustment
- Flush mounting
- Drawout case

#### IAV Time Delay Voltage Relay



##### Applications

- AC Generators (including Hydro)
- Distribution feeder
- Time delay pickup or dropout

##### Protection and Control

- Generator overvoltage
- Feeder over and undervoltage
- Ground detection

##### Features

- Frequency compensation (optional)
- Target seal-in unit (most units)
- Instantaneous units (optional)



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

CEB Distance Relays

---



**Offset mho directional distance**

—High-speed single-zone, offset mho directional phase distance relays

CEYG Distance Relays

---



**Reactance and mho phase directional distance relay**

—High-speed single-zone, mho directional distance relays

CEY Distance Relays

---



**Reactance and mho phase directional relay**

—High-speed, single-zone mho directional distance relays

**CEH Loss of Excitation Relay**



**Application**

- Generators (all types)

**Protection and Control**

- Loss of excitation
- Impedance unit
- Second z unit with a timer available

**Features**

- High-speed tripping
- Drawout case

**CEX Angle Impedance Relay**



**Applications**

- Line blinder applications (CEX57D or CEX57F)
- Line out-of step tripping (CEX57E/NAA19B)
- Generator out-of-step tripping (CEX57E/GSY51A)

**Protection and Control**

- Angle impedance in out-of-step tripping schemes
- Restrict tripping zone in transmission line schemes

**Features**

- Auxiliary telephone type unit available
- High-speed induction cup relay
- Drawout case

**GSY Generator Protection Relays**



**mho distance relay**

- For out-of-step generator protection used in conjunction with CEX relay

**GGP Power Differential Relay**



**Applications**

- Turbine-driven generators
- Prevent turbine damage

**Protection and Control**

- Three-phase reverse power

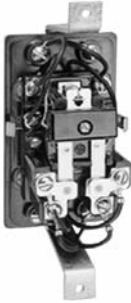
**Features**

- Suitable for unbalanced loads
- Up to 30 second delay included
- Electrically separate main and timing contacts
- Electrically operated target and seal-in unit
- Drawout case



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

**HGA 18 Reclosing Relays**



**Single-shot Reclosing Relays**

- Single-shot reclosing relays for distribution and transmission

**Capacitor Trip Device**



**Applications**

- Provide a power source in the event of a loss of AC control voltage
- Switchgear and motor control

**Features**

- Six models available
- Capacitor is continuously charged when control power is available
- Battery back - up is also available on certain models
- Inputs 120/240 VAC 50/60 Hz
- UL Listed and CUL

**SBC Static Breaker Backup Relays**



**Static breaker backup relay**

- Phase and ground IOC
- Built-in regulated power supply
- Fast reset current detectors
- Surge suppression on input circuits

Visit [www.GEMultilin.com/relays](http://www.GEMultilin.com/relays) to:

- View Guideform specifications
- Download instruction manuals
- Review applications notes and support documents
- Buy a relay online
- View product brochures



# GE Multilin® Protection and Control Single Function Auxiliary Relays

## Section 18

### Multicontact Auxiliary Relays

#### HEA Multicontact Auxiliary Relay



##### Application

- Contact multiplication

##### Protection and Control

- Trip and/or block close breaker control
- Electrically separate outputs available
- Various shaft lengths available

#### HSA Multicontact Auxiliary Relay



##### Application

- Contact multiplication

##### Protection and Control

- Trip and/or block close circuit breaker control
- Electrically separate contact outputs
- Universal target dropping
- Mechanical target
- High seismic capability

#### HFA Multicontact Auxiliary Relay



##### Application

- Contact multiplication

##### Protection and Control

- Standard, high-speed or variable time tripping available
- Manual, self or electric reset available
- Electrically separate contact circuits
- Molded case with three mounting options
- Drawout case available

### High-Speed Trip & Contact Relay

#### RDB86 High-Speed Trip and Lockout Relays



##### Applications

- Line breaker tripping and lockout
- Contact multiplication
- High-speed breaker circuits
- Transformer lockout

##### Protection and Control

- Circuit opening and/or closing
- Auto-cut contacts
- Electrically separated contact circuits
- Electrically or manually operated
- Semi-flush mounted case
- Back connected
- Custom mounted cases available



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Protection and Control Single Function Auxiliary Relays

## Section 18

### HAA Auxiliary or Annunciator Relay



#### Applications

- When a target is required
- When alarm or similar functions required
- Interposing relay in conjunction with transformer SP relay

#### Protection and Control

- Auxiliary contacts and targeting
- Current operated units available
- High-speed DC voltage operated units available
- Drawout case available
- Molded case with three mounting options available

### NAA Auxiliary Relay



#### Auxiliary Relay

- A large family of special purpose auxiliary relays

### NGA Auxiliary Relay



#### Application

- Contact Multiplication

#### Protection and Control

- Various pickup and dropout times available
- Telephone type unit
- Small molded case
- Front or back connections available
- Surge limiting available

### HMA Hinged Armature Auxiliary Relay



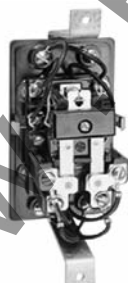
#### Application

- Contact multiplication

#### Protection and Control

- High-speed pickup
- Self-resetting
- Front or back connected
- Molded textolite case

### HGA Hinged Armature Auxiliary Relay



#### Application

- Contact multiplication

#### Protection and Control

- Standard, low and variable time pickup available
- AC undervoltage (low dropout)
- Molded case with four mounting options
- Drawout case available

#### Visit [www.GEMultilin.com/relays](http://www.GEMultilin.com/relays) to:

- View Guideform specifications
- Download instruction manuals
- Review applications notes and support documents
- Buy a relay online
- View product brochures





## Digital Metering Family—Electronic Power Metering

Energy/demand data logging meters

### Key Benefits

- Complete line of high-performance meters for power, energy and power quality for commercial, utilities, municipals, and IPP applications
- Record faults and events with time stamp - identify and respond to PQ events quickly
- Monitor reliability of breakers and relays to improve operational efficiencies
- Identify and manage peak demand - shed or shift loads
- Enhance levels of communication and data transmission
- Provide real time data on the web
- Built-in RTU functionality with I/Os
- Submetering cost allocation

### Applications

- View energy usage and generate bills
- Efficiently control and manage energy consumption
- Increase power distribution reliability
- Real-time PQ monitoring and analysis
- Improve substation automation solutions

### Features

#### Monitoring and Metering

- Current, voltage, real and reactive power, energy use, cost of power, power factor and frequency
- Revenue class metering with data logging
- Harmonic analysis to 255th order with flicker and waveform recording

#### Control

- Fully programmable set-points for alarms and relay activation
- 90msec. high-speed updates for control
- Built-in PLC & RTU functionality

#### Communications

- On-board RS-485, Ethernet TCP/IP and web capability
- Built-in communication ports using open architecture protocols
- Choice of LED and LCD touch screen display
- Analog and digital inputs and outputs



	Features	EPM 2000	EPM 6000	PQMII	EPM 9450	EPM 9650	EPM 9800	EPM 4000	EPM 1000
Front Panel	Display	•	•	•	•	•	•	•	•
	Keypad for configuration	•	•	•					
	PC Connection	•	•	•	•	•	•	•	•
	% Load Bar	•	•						
Actual Values	Voltage	•	•	•	•	•	•	•	•
	Current	•	•	•	•	•	•	•	•
	Frequency	•	•	•	•	•	•	•	•
Power	kW, kVAR, kVA	•	•	•	•	•	•	•	•
	Demand		•	•	•	•	•	•	•
	Bidirectional Power Measurement		•	•	•	•	•	•	•
Energy	kWh, kVARh, kVAh	•	•	•	•	•	•	•	•
	Power Factor	•	•	•	•	•	•	•	•
Accuracy (reference only)	Revenue Certifiable Metering		•		•	•	•	•	•
	Voltage	0.5%	0.1%	0.2%	0.01%	0.01%	0.02%	0.5%	0.5%
	Current	0.5%	0.1%	0.2%	0.01%	0.01%	0.05%	0.5%	0.5%
	kVA	1.0%	0.2%	0.4%	0.08%	0.08%	0.10%	0.5%	0.5%
Data Logging	Data Logging			•	•	•	•	•	•
Waveforms	Waveform capture			•	•	•	•		
	Waveform recorder			•		•	•		
Power Quality	Harmonics : Individual on meter			•	•	•	•		
	THD		•	•	•	•	•		
	Sag/Swell		•	•	•	•	•		
	K-Factor		•	•	•	•	•		
	Transient				•	•	•		
	Flicker					•	•		
I/O Points	Analog I/O			•	•	•	•		
	Control Relay			•	•	•	•		
	KYZ Pulse		•	•	•	•	•	•	•
	Digital I/O			•	•	•	•	•	•
Communications	RS-232			•	•	•			
	RS-485	•	•	•	•	•	•	•	•
	Serial Baud Rate	19,200	57,600	19,200	115,000	115,000	115,000	9,600	9,600
	Optical Port		•				•	•	•
	Modem				•	•	•	•	•
	Ethernet Port (optional)				•	•	•		
	Web Pages/Server				•	•	•		
Protocols	Modbus RTU	•	•	•	•	•	•	•	•
	DNP		•	•	•	•	•		

For the most current comparison list see: [www.GEMultilin.com/selector/meters.pdf](http://www.GEMultilin.com/selector/meters.pdf)

For information on GE Submeters or GE legacy meters see: [www.GEMultilin.com](http://www.GEMultilin.com)



## Metering

## EPM 9800 Series Power Quality Meter

Precision measurement, advanced communication, advanced PQ and alarm reporting, economical recording meter

## Key Benefits

- Socket type mounting design with advanced power quality recording and EN50160 Flicker compliance monitoring
- Revenue class .06% Watt/Hr metering with 20 years time of use calendar
- Comprehensive logging & recording capability
- Auto-calibration and temperature change compensation
- Advanced DNP 3.0 implementation
- High speed waveform recording with programmable 16 to 512 samples per cycle resolution
- Extensive harmonics capability provides a real-time harmonic analysis to the 128th order for every channel. Records THD to the 255th order peak
- Real time phasor analyzer monitors phase angles between the voltage and the currents
- Multiple communication option with 10/100BaseT Ethernet and web capability for data viewing over the web
- Up to 256 expandable digital and analog I/O modules for analysis and control

## Applications

- Advanced power quality monitoring
- Revenue class energy and power billing with .06% accuracy
- Control of external devices using I/Os
- Alarm and event notification over the web, email, pager or telephone

## Features

## Monitoring and Metering

- True RMS real-time power and energy parameters reporting
- 4 quadrant, high accuracy revenue metering
- Automatic dial-out for remote data downloads. Dial-In during outage notification
- Comprehensive events and alarms recording using GPS synchronized time stamps.
- Historical logs for energy, power events and alarms.
- Flicker and waveform recording
- Real-time PQ monitoring and analysis

## Communications

- RS 485 communication ports
- Optical port
- Internal ethernet TCP/IP
- Built-in dial-in and dial-out telephone modems
- DNP 3.0 level 2 plus, Modbus RTU and Modbus ASCII protocols
- Multiple analog, digital and relay inputs/outputs
- Programmable LCD display screen



# GE Multilin® Metering EPM 9800 Series Power Quality Meter Ordering

## Section 18

EPM 9800	*	*	*	*	*	*	Description
PL9800							LCD Graphical Display 2 RS 485 Serial Communication Ports (Modbus & DNP) 8 Internal Digital Inputs, 4 KYZ Pulse Outputs IR Port, IRIG-B Synchronization Port Flicker and Waveform Detection and Logging
Frequency	6						60 Hz
	5						50 Hz
Power Supply	S						Blade Powered - 102 to 550 VAC Auto Ranging
	E						External - 102 - 275 VAC/DC Auto Ranging
	D						External - 18 - 60 VDC Auto Ranging
	L						Blade Powered - 69 VAC
Form	9S						Rated Voltage 0-277 V L-N - 3E, 4W Wye Hook-up
	36S						Rated Voltage 0-277 V L-N - 2.5E, 4W Wye w/ Neutral
	45S						Rated Voltage 0-480 V L-L - 2E, 3W, Delta
	9A						Rated Voltage 0-277 V L-N - A Base Form
	SB						Switchboard - Available with "Power Supply" E and D Only
Logging Options	S						Standard -218 days of data logging, 63 Waveform Record, 1536 Flicker Log, 1024 System Events
	A						Advance -688 days of data logging, 95 Waveform Record, 5120 Flicker Log, 1024 System Events
Communications	R						Standard 2 RS485 serial communications ports (Modbus & DNP)
	W						Web - Standard with Internal 10/100 Base with Web Server and Ethernet Connection
	M						Modem - Standard with Internal 56k Dial Out Modem
	C						Combination - Standard Modem with Ethernet Gateway & Web
CT Secondary				20			5 Amp Phase CT Secondaries - Class 20
				2			1 Amp Phase CT Secondaries - Class 2

### Accessories: Analog Output Modules

**Note:** Accessories must be ordered separately from base meters.

PL9000	*	*	*	*	*	*	*	0	0	Description
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs

### Analog Input Modules

PL9000	*	*	*	*	0	0	0	0	0	Description
	8	A	I	1						8 Channel 0-1 mA Analog Inputs
	8	A	I	2						8 Channel 4-20 mA Analog Inputs
	8	A	I	3						8 Channel 0-5 VDC Analog Inputs
	8	A	I	4						8 Channel 0-10 VDC Analog Inputs

### Digital I/O Modules

PL9000	*	*	*	*	0	0	0	0	0	Description
	4	R	O	1						4 Channel Control Relay Outputs
	4	P	O	1						4 Channel kyz Solid State Pulse Outputs
	8	D	I	1						8 Channel Auxiliary Digital Status Inputs

### Auxiliary I/O Mounting

PL9000	M	B	I	O	0	0	0	0	0	Description
										I/O Mounting Bracket (One set per module group)

### Auxiliary I/O Power Supply

PL9000	P	S	I	O	0	0	0	0	0	Description
										I/O Auxiliary Power Supply (For more than 4 modules)

### 9000 Series Meter Display Module

PL9000	*	*	*	*	0	0	0	0	0	Description
	P	4	0	N						Three line LED Display
	P	6	0	N						Touch-Screen LCD Display

### 9000 Series Meter Software

PL9000	*	*	*	*	0	0	0	0	0	Description
	N	C	M	1						Communicator Software, Single User License
	N	C	M	5						Communicator Software, Five User License
	N	C	M	S						Communicator Software, Multiple User, Single Site License



# GE Multilin® Metering EPM 9000 Series Power Quality Meter

High Performance Power Meter and Data Acquisition Node

Section 18

## Key Benefits

- High-performance power quality and revenue class metering for critical power applications
- EN50160 flicker with up to 512 waveform samples per cycle and high-speed transient recording for complete power quality monitoring
- Provides heightened response time to power quality events for diagnostics and maintenance
- Built-in GPS clock sync capability for accurate time stamping of events and alarms for complete synchronized system monitoring
- Exceeds ANSI C-12 and IEC 687 specifications for accuracy with auto calibration using temperature compensation
- Built-in RTU functionality with multiple I/O modules for control
- Software and hardware triggers record waveform events. This allows the unit to be used for fault analysis, system apparatus monitoring and many other applications
- Records THD to the 255th order peak. Real-time harmonic analysis to the 128th order for every channel. This advanced harmonic recording capability has been traditionally available only in high-end power quality recorders
- Real time phasor analyzer monitors phase angles between the voltage and the currents
- Ethernet gateway with web server capability
- Up to 256 expandable I/O points for analysis and control

## Applications

- Revenue class metering and load aggregation for energy management
- Transformer loss compensation
- High-performance power quality monitoring of critical loads

## Features

### Protection and Control

- Fully programmable set-points for alarms and 90 millisecond relay activation for high-speed updates and control
- Built-in PLC & RTU functionality with complete range of expandable external I/Os

### Monitoring and Metering

- Current, voltage, real and reactive power, energy use, cost of power, power factor and frequency
- Laboratory grade 0.04% Watt-Hour accuracy
- Flicker and waveform recording
- Real-time PQ monitoring and harmonic analysis to 255th order

### Communications

- On-board ethernet and web server capability
- High-speed RS-485 and RS-232 Com Ports
- Multiple protocols including Modbus and DNP 3.0 level 2
- Built-in modem with dial-out capability
- Multiple analog, digital and relay inputs/outputs



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## Meters

**EPM 9450** - High performance power meter & data acquisition node

PL9450	*	*	*	A	*	0	0	0	0	Description
Frequency	0									60 Hz
	1									50 Hz
System Voltage		A								120/208 volts connection
		B								277/480 volts connection
Control Power			0							90-276 volts AC/DC power supply
			1							18-60 volts DC power supply
Features Options				A						Basic unit with 512 K memory, 8 digital inputs, 8 cycle of waveform (up to 512 samples/cycle), 100 days data log.
Communications					0					4 communication port
					1					User-selectable RS 485 Modbus and DNP - no modem or Ethernet connection
					2					TCP/IP Ethernet connection with web server and gateway capability
										Internal 56k modem connection with pass-through port

**EPM 9650** - High performance power meter & data acquisition node with memory

PL9650	*	*	*	A	*	0	0	0	0	Description
Frequency	0									60 Hz
	1									50 Hz
System Voltage		A								120/208 volts connection
		B								277/480 volts connection
Control Power			0							90-276 volts AC/DC power supply
			1							18-60 volts DC power supply
Features Options				A						Advance unit includes basic unit, with 2 Meg memory, Up to 162 days of data logging, up to 64 cycles of waveform recording
				B						Flicker includes advance unit plus Flicker with 4 Meg memory, 66 days of data logging
Communications					0					4 Communication port
					1					User-selectable RS 485 Modbus and DNP - no modem or Ethernet connection
					2					TCP/IP Ethernet connection with web server and gateway capability
										Internal 56k modem connection with pass-through port

## Accessories

PL9000	*	*	*	*	*	*	*	0	0	Analog Output Modules
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs
PL9000	*	*	*	*	0	0	0	0	0	Analog Input Modules
	8	A	I	1						8 Channel 0-1 mA Analog Inputs
	8	A	I	2						8 Channel 4-20 mA Analog Inputs
	8	A	I	3						8 Channel 0-5 VDC Analog Inputs
	8	A	I	4						8 Channel 0-10 VDC Analog Inputs
PL9000	*	*	*	*	0	0	0	0	0	Digital I/O Modules
	4	R	O	1						4 Channel Control Relay Outputs
	4	P	O	1						4 Channel kyz Solid State Pulse Outputs
	8	D	I	1						8 Channel Auxiliary Digital Status Inputs
PL9000	M	B	I	O	0	0	0	0	0	Auxiliary I/O Mounting Bracket (One set per module group)
PL9000	P	S	I	O	0	0	0	0	0	Auxiliary I/O Power Supply (For more than 4 modules)
PL9000	*	*	*	*	0	0	0	0	0	9000 Series Meter Display Module
	P	4	0	N						Three line LED Display
	P	6	0	N						Touch-Screen LCD Display
PL9000	*	*	*	*	0	0	0	0	0	9000 Series Meter Software
	N	C	M	1						Communicator Software, Single User License
	N	C	M	5						Communicator Software, Five User License
	N	C	M	S						Communicator Software, Multiple User, Single Site License



# GE Multilin® Metering PQM II Power Quality Meter

Continuous metering of three-phase systems

Section 18

## Key Benefits

- Power quality metering with waveform capture and historical data logging
- Easy to program and use with keypad and large illuminated 40 character display
- Multiple communication ports for integration with DCS and SCADA systems
- Supports DNP 3.0 and Modbus protocols
- Digital and analog I/Os for control and alarms
- Voltage disturbance recording capability for electrical sag and swell events.

## Applications

- Metering of distribution feeders, transformers, generators, capacitor banks and motors
- Medium and low voltage systems
- Commercial, industrial, utility
- Flexible control for demand load shedding, power factor, etc.

## Features

### Monitoring and Metering

- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- V I unbalance
- True PF crest and K factor
- Hz W var VA
- Wh varh VAh W cost
- Demand: A W var VA
- Harmonic analysis through 63rd with THD and TIF
- Event recorder - 150 events
- Waveform capture
- Data logger -98,000 events
- Voltage Disturbance Recorder (VDR) -500 events

## Ordering

PQM II	*	*	*	Description
PQM II				Basic unit with display, all current/voltage/power measurements, 1-RS485 comm port, 1 RS232 comm port
	T20			Transducer option; 4 isolated analog outputs 0 – 20 mA and 4 – 20 mA, assignable to all measured parameters, 4 – 20 mA analog input, 2nd RS485 comm port
	T1			Transducer option; 4 isolated analog outputs 0 – 1 mA, assignable to all measured parameters, 4 – 20 mA analog input, 2nd RS485 comm port
		C		Control option; 3 additional programmable output relays (total of 4), 4-programmable switch inputs
		A		Power analysis option; harmonic analysis, triggered trace memory waveform capture, event record, data logger, voltage disturbance recorder (VDR)

### Modifications:

MOD 501:	20 – 60 VDC/20 – 48 VAC control power
MOD 502:	Tropicalization
MOD 504:	Removable terminal blocks
MOD 507:	-40 to +60° C temperature operation

### Control Power:

90 – 300 VDC/70 – 265 VAC standard
20 – 60 VDC/20 – 48 VAC (MOD 501)



## Features (continued)

### Communications

- Front RS232 serial port (1,200 to 19,200 bps)
- Two rear RS485 serial ports with ModBus and DNP 3.0 protocol
- Ethernet connectivity provided by MultiNet®
- EnerVista® software is provided for setup and monitoring functions
- External dial-in modem capabilities

### Protection and Control

- Load shedding
- Power factor control
- Pulse input totalizing

## Accessories for the PQM II

Multilink Ethernet Switch	ML1600-HI-A2-A2
MultiNet®	MultiNet-FE
Viewpoint Monitoring	VP-1

## Visit [www.GEMultilin.com/PQMII](http://www.GEMultilin.com/PQMII) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a PQM II online



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

GE Multilin®  
Metering  
EPM 6000 Power Meter

Continuous metering of three-phase systems

Key Benefits

- High accuracy multifunction power meter
- Superior performance at competitive pricing
- Ultra compact, easy to install, program and use
- 0.2% class revenue certifiable energy and demand metering
- Total harmonic distortion (%THD)
- Fits both ANSI and DIN cutout
- Large 3 line .56" bright LED display for better visibility and longer life
- User programmable for different system voltages and current measurements
- Standard Modbus and DNP communications

Applications

- Continuous metering of electrical loads such as generator panels, feeders, switchgear etc.
- Provides remote status when used with EnerVista® suite of software
- Low and medium voltage applications
- Replaces multiple analog meters saving space and installation costs

Features

Monitoring and Metering

- True RMS multifunction measurements including voltage, current, power, freq., energy, etc.
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) accuracy classes
- Future field upgradeable for added functionality without removing installed meter
- Load percentage graphical bar for instant load visualization

Communications

- RS485 Modbus and DNP 3.0 Protocol up to 57.6K Baud
- 3 Line .56" Bright Red LED Display
- Front IrDA Port laptop communication
- Pulse output for accuracy testing and energy



Ordering

PL 6000	*	*	*	Description
	5			50 Hz AC frequency system
	6			60 Hz AC frequency system
		5A		5 Amps
		1A		1 Amp
			0	No THD option
			THD	THD, Limit Alarms & one pulse Output

Example - EPM 6000 for 60Hz system with 1 Amp secondary current with THD, Limit Alarms & one additional pulse output. PL600061ATHD

Visit [www.GEMultilin.com/EPM6000](http://www.GEMultilin.com/EPM6000) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 6000 online



# GE Multilin® Metering EPM 2000 Digital Power Meter

Economical Multi-Function Meter

Section 18

## Key Benefits

- Economical meter for Circuit Monitoring of Panels, Main Feeds, Branch Circuits, Gensets & equipment with communications
- Universal operation - 50 / 60 Hz, user programmable for high, medium or low voltage circuits
- DIN Standard 96 x 96 mm size for easy installation in new and retrofit Panels
- True RMS measurement more than 40 electrical parameters
- Instant load verification through analog type loadbar

## Applications

- Continuous metering of electrical loads such as generator panels, feeders, switchgear etc.
- Low and Medium voltage applications
- Provides remote status when used with EnerVista® suite of software

## Features

### Monitoring and Metering

- Measures 3-phase real-time amps, volts, power, energy, power factor and frequency
- Monitors equipment “run hours”, “on hours” and interruptions (outages)

### Communications

- Brilliant 3 line LED Display
- Auto Scrolling features
- Standard RS-485 Modbus communications



## Ordering

PL 2000	Description
System Voltage	80 - 270V AC 100 - 270V DC
Input Voltage	48 - 270 VLN 80 - 500 VLL
Communication	Modbus RS 485

Visit [www.GEMultilin.com/EPM2000](http://www.GEMultilin.com/EPM2000) to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 2000 online



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

#### Key Benefits

- Multi-point energy demand data logging
- Revenue certifiable metering
- Meets ANSI C12.1 & C12.16 accuracy
- Wall mountable easy-to-install enclosures
- Local LCD viewing
- Communication over existing AC Power Lines (PLC) or Modbus RTU

#### Applications

- Ideal for commercial, residential and industrial sub-metering applications requiring multi-point energy data logging. This includes multi-point high rise, garden style apartment, condos, or office suites.

#### Features

##### Monitoring and Metering

- Real-time per-phase viewing of voltage, current, power factor, phase angle, watts, VARs, VA, and frequency
- Event reporting with time and date stamps regarding power consumption, demand resets, power-ups/power downs, and is available via LCD for viewing

##### Communications

- PLC Communication (Power Line Communications)
- Modbus RS 485 (optional)
- Up to 48 pulse inputs (optional)
- IEC optical front panel interface for programming



## Ordering

The EPM4000 meter comes standard with Power Line Carrier (PLC) communications protocol. A Transponder is required when using PLC communication. When the Modbus communication modification is selected, no Transponder is required.

### EPM 4000 Residential (R)

Single-phase 120/208 or 120/240 Volts connections. Residential use measures kWh only (no demand measurement)

PL 4000	*	*	*	*	Description
Application Type	R				Residential - 120/208 or 120/240 Volts single phase
No. of Metering Points					
for 120/208 Volts System	03				3 Single Phase Metering Points - 120/208 V
	06				6 Single Phase Metering Points - 120/208 V
	09				9 Single Phase Metering Points - 120/208 V
	12				12 Single Phase Metering Points - 120/208 V
for 120/240 Volts System					
	12				12 Single Phase Metering Points - 120/240 V
	18				18 Single Phase Metering Points - 120/240 V
	24				24 Single Phase Metering Points - 120/240 V
CTs			L		0.1 amps CT Secondary input
			H		5 amps CT Secondary input
Voltage				120	120/208 Volts Connection Single Phase Only
				240	240 Volts - Single phase Only

### EPM 4000 Commercial (C)

Three-phase 120/208, 277/480, or 347/600 Volts connections. Delta optional.

Commercial use measures kWh and kW Demand

PL 4000	*	*	*	*	Description
Application Type	C				Commercial - 120/208, 277/480 or 347/600 Volts three phase
No. of Metering Points	06				6, Three Phase Metering Points
	08				8, Three Phase Metering Points
CTs			L		0.1 amps CT Secondary input
			H		5 amps CT Secondary input
Voltage				120	120/208 Volts Connection 3 Phase Only
				277	277/480 Volts - 3 Phase Only
				347	347/600 Volts - 3 Phase Only

### Modifications:

PL4000MOD Modbus Communications

This modification must be selected at time of order to factory convert the meter from PLC to Modbus communication.

### OPTIONS

PL4000C12L480DEL	EPM 4000, 480V Delta 3-phase 4-wire 12 meters - 0.1A CT secondary
PL4000C12H600DEL	EPM 4000, 600V Delta 3-phase 3-wire 12 meters - 5A CT secondary

### CTS SOLID CORE (0.1 A Secondary)

PLSUBCTSL050	50/0.1A
PLSUBCTSL101	100/0.1A
PLSUBCTSL201	200/0.1A
PLSUBCTSL401	400/0.1A
PLSUBCTSL201CDN	2/5DARL(Canadian)

### CTS SPLIT CORE (0.1 A Secondary)

PLSUBCTSP050	50/0.1A
PLSUBCTSP101	100/0.1A
PLSUBCTSP201	200/0.1A
PLSUBCTSP401	400/0.1A
PLSUBCTSP801	800/0.1A

### CTS SOLID CORE

PLSUBCTSL201CDN	200/5A (Canadian)
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### TRANSPONDER

Transponder required for standard PLC Communication version of EPM 1000 and EPM 4000. Transponder not required when using Modbus version of EPM 1000 and EPM 4000

MODELS	Voltage	Options
PLMODXPONDER120V	120/208*	Modem
PL485XPONDER120V	120/208	RS-485
PLMODXPONDER277V	277/480	Modem
PL485XPONDER277V	277/480	RS-485
PLMODXPONDER347V	347/600	Modem
PL485XPONDER347V	347/600	RS-485

\* same model works for 120/240

Pulse Inputs (for more information contact your local sales office)

PL4000PULSINA
PL4000PULSINB
PL4000PULSINC
PL4000PULSIND



Publications and Reference: See Section 22 for a complete list of additional product-related publications

# GE Multilin® Metering EPM 1000 Sub-Metering System

Single-point sub meter with data-logging

## Section 18

### Key Benefits

- Revenue certifiable metering
- Meets ANSI C12.1 and C12.16 accuracy
- Local LCD viewing
- Easy to use energy/demand data logging meter, suitable for new construction or retrofit application
- Provides all basic information required for billing purposes
- Power Line Communication (PLC) over the existing power lines. No additional wiring installation is necessary
- Single part number provides a complete package that includes CTs
- Low cost, wall mount simple to use saves installation costs. Rugged metal enclosure is designed for fast installation and is tamper resistant

### Applications

- Ideal for commercial and industrial sub-metering applications

### Features

#### Monitoring and Metering

- Real-time per-phase viewing of voltage, current, power factor, phase angle, watts, VARs, VA, and frequency
- Event reporting with time and date stamps regarding power consumption, demand resets, power-ups/downs, and is available via LCD for viewing

#### Communications

- PLC (Power Line Communications) with transponder
- Modbus Communication via RS485 (options)
- Up to 4 pulse inputs (optional)
- IEC optical front panel interface for programming



### Dimensions

#### Solid Core

##### 50 amp Solid Core CTs:

Outer window diameter 1.35"  
Inner window diameter 0.60"

##### 100 & 200 amp Solid Core CTs

Outer window diameter 2.7"  
Inner window diameter 1.1"

##### 400 amp Solid Core CTs

Outer window diameter 3.56"  
Inner window diameter 1.56"

#### Split Core

##### 50 amp Split Core CTs:

Outer window 2.8" x 3.5"  
Inner window 1.8" x 1.3"

##### 100, 200 & 400 amp Split Core CTs:

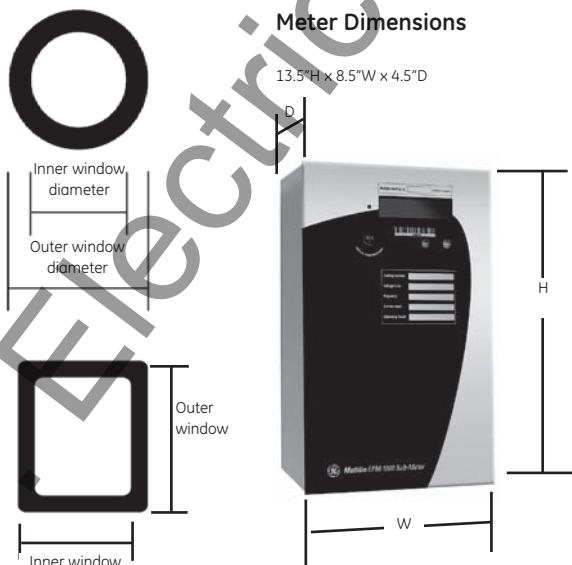
Outer window 4.9" x 4.3"  
Inner window 3.5" x 2.4"

##### 800 amp Split Core CTs:

Outer window 7.3" x 5.9"  
Inner window 5.0" x 3.0"

#### Meter Dimensions

13.5"H x 8.5"W x 4.5"D





# GE Multilin® Metering EPM 1000 Sub-Metering System

## Section 18

### Ordering

The EPM1000 meter comes standard with Power Line Carrier (PLC) communications protocol. A Transponder is required when using PLC communication. When the Modbus communication modification is selected, no Transponder is required.

PL 1000	*	CT	*	Description
System Voltage	208			120/208 Volts Connection
	480			277/480 Volt Connection
CT's Required		SP101		Split Core, 100 A CTs - Set of 3
		SP201		Split Core, 200 A CTs - Set of 3
		SP401		Split Core, 400 A CTs - Set of 3
		SP801		Split Core, 800 A CTs - Set of 3
		SP162		Split Core, 1600 A CTs - Set of 3
		SP322		Split Core, 3200 A CTs - Set of 3
		SL050		Solid Core, 50 A CTs - Set of 3
		SL101		Solid Core, 100 A CTs - Set of 3
		SL201		Solid Core, 200 A CTs - Set of 3
		SL401		Solid Core, 400 A CTs - Set of 3
Demand Version			K	KWh Version
			D	Demand Version

### Example:

EPM 1000, for demand metering applications, 277/480 VAC system voltage, 1500A mains, 60 Hz, on an existing facility (split core CTs) P/N = **PL1000480SP162D**

### Modifications:

PL1000PULSIN10	Pulse Inputs
PL1000MOD	Modbus Communications (This modification can be selected at time of order to factory convert the meter from PLC to Modbus communication. A field retrofit kit is also available for the EPM 1000).

### Accessories:

Transponder Models	Voltage	Options	
PL MODXPONDER120V	120/208*	Modem	Data Collector for PLC
PL 485XPONDER120V	120/208	RS-485	Data Collector for PLC
PL MODXPONDER277V	277/480	Modem	Data Collector for PLC
PL 485XPONDER277V	277/480	RS-485	Data Collector for PLC
PL MODXPONDER347V	347/600	Modem	Data Collector for PLC
PL 485XPONDER120V	347/600	RS-485	Data Collector for PLC

\* same model works for 120/240

NOTE: Transponder can handle up to 200 meter points.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

### [Multiplex Family Overview](#)

[page 18-135](#)

GE Multilin® offers a full suite of highly reliable Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) optical communication multiplexers. These include the JungleMUX SONET Multiplexer, the TN1U SDH Multiplexer and the TN1Ue SDH Multiplexer. Lentrionics Multiplexers are designed for electric power utility, transportation, oil, gas, water and industrial applications. This powerful family of fiber optic multiplexers has a modular design for ease of maintenance, configuration flexibility and expandability.

### [JungleMUX™ Sonet Multiplexer](#)

[page 18-138](#)

#### **OC-1/OC-3/OC-12stem**

The JungleMUX™ SONET Multiplexer delivers robust SONET telecommunications for wide area communication applications that requires a mix of proprietary and legacy standards based optical communications equipment.

### [JungleMUX™ T1 Multiplexer](#)

[page 18-138](#)

#### **OC-1/OC-3/OC-12stem**

The JungleMUX™ T1 Multiplexer delivers robust wide area networking over T1 leased lines for communication applications that requires a mix of proprietary and legacy standards based optical communications equipment.

### [TN1U SDH Multiplexer](#)

[page 18-139](#)

#### **STM-1/STM-4**

The TN1U SDH Multiplexer delivers the benefits of the ITU-T SDH telecommunications standards to Ethernet solutions as well as applications previously serviced by a mix of proprietary and legacy standards based optical communications equipment.

### [TN1Ue SDH Multiplexer](#)

[page 18-139](#)

#### **STM-1/STM-4**

The TN1Ue SDH Multiplexer delivers the benefits of the ITU-T SDH telecommunications standards to Ethernet solutions as well as applications previously serviced by a mix of proprietary and legacy standards based optical communications equipment. The enclosed shelf design provides additional security in sensitive Electromagnetic interference (EMI) environments.

### [VistaNET® Network Management System \(NMS\)](#)

[page 18-140](#)

For a more flexible NMS, VistaNET® can be provisioned as a standalone or a client-server LAN/WAN solution, permitting centralized or distributed network management.



**Multiplexer Family Telecommunication Multiplexers**

Versatile, reliable and rugged solutions for fiber optic, microwave radio and leased line networks

**Applications**

**Electric Utility**

- Ethernet WAN/IP
- Protective relaying
- Substation automation
- Telemetry/SCADA
- Voice
- Video surveillance

**Transportation**

- Video surveillance
- Toll collection
- Traffic monitoring and control
- Emergency voice
- Signaling
- Loop detection
- Variable message signs (VMS)

**Pipeline**

- Oil, gas, refined products, water, slurry
- Leak detection
- Hydraulic control
- Pipeline SCADA
- Video surveillance
- Ethernet WAN/IP
- Voice

**Industrial**

- Oil and gas production field SCADA
- Mining and petrochemical plant electric distribution network protection and control
- Energy management
- Ethernet WAN/IP
- Video surveillance
- Video process monitoring



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

**Unit Assembly Description**

JungleMUX/TN1U/TN1Ue

<b>Data Interface Units</b>	
<b>Low Speed Data</b>	<b>B86448</b>
<ul style="list-style-type: none"> <li>• RS232 interface</li> <li>• Sub-rate multiplexing</li> <li>• Point-to-point and multi-point</li> </ul>	
<b>High Speed Data</b>	<b>B86446</b>
<ul style="list-style-type: none"> <li>• 64 kb/s (56 kb/s) rates</li> <li>• RS422, V.35 and G.703 interfaces</li> </ul>	
<b>Nx64 kb/s Data Electrical</b>	<b>B86464</b>
<ul style="list-style-type: none"> <li>• N x 64 kb/s channels (N=1 to 12)</li> <li>• V.35 interface</li> </ul>	
<b>DS-1 (1.54 Mb/s) Data</b>	<b>B86437</b>
<b>E-1 (2.048 Mb/s) Data</b>	<b>B86439</b>
<b>DS-3 (44.7 Mb/s) Data</b>	<b>B86491</b>
<ul style="list-style-type: none"> <li>• Establishes full duplex point-to-point DS-3 circuit</li> <li>• Drop equipment connections for DACS, M13 multiplexer or any other DS-3 terminating equipment</li> </ul>	
<b>Ethernet</b>	<b>B86438/B86418</b>
<ul style="list-style-type: none"> <li>• IP connectivity</li> <li>• LAN/WAN interconnect</li> <li>• 10/100 Mb/s learning bridge</li> <li>• Intelligent multi-port switch features</li> <li>• IEEE 802.1Q, 802.1p, 802.1d, 802.1u</li> </ul>	
<b>Voice Units</b>	
<b>4 Wire Voice Frequency</b>	<b>B86444</b>
<ul style="list-style-type: none"> <li>• Optional E&amp;M signaling</li> <li>• Point-to-point and multi-point</li> </ul>	
<b>2 Wire Voice Frequency</b>	<b>B86449</b>
<ul style="list-style-type: none"> <li>• Optional E&amp;M signaling</li> </ul>	
<b>2 Wire Foreign Exchange</b>	<b>B86445</b>
<ul style="list-style-type: none"> <li>• Loop or ground start signaling</li> </ul>	
<b>2 Wire Foreign Subscriber</b>	<b>B86445</b>
<ul style="list-style-type: none"> <li>• Remote PABX extension</li> </ul>	
<b>Video Units</b>	
<b>Video Mapper 10</b>	<b>B86411</b>
<ul style="list-style-type: none"> <li>• Provides video WAN of 12 Mb/s</li> </ul>	
<b>Video Mapper 40</b>	<b>B86410</b>
<ul style="list-style-type: none"> <li>• Provides video WAN of 48 Mb/s</li> </ul>	
<b>Video Input/Output</b>	<b>B86412</b>
<ul style="list-style-type: none"> <li>• NTSC or PAL analog video signal transport</li> <li>• MPEG-4 compression options</li> <li>• 56 kb/s to 10 Mb/s bandwidth</li> <li>• 1 to 30 frames/second update rate</li> <li>• PTZ camera control</li> <li>• Stereo quality audio</li> <li>• Data &amp; control I/O</li> </ul>	
<b>Remote Video Assembly</b>	<b>B86414</b>



## Unit Assembly Description

JungleMUX/TN1U/TN1Ue

Teleprotection Units	
<b>Transfer Trip</b>	<b>B86441/B86442</b>
<ul style="list-style-type: none"> <li>• Separate transmit and receive units</li> <li>• Optional test panel</li> </ul>	
<b>Current Differential Relay</b>	<b>B86443</b>
<ul style="list-style-type: none"> <li>• Various pilot wire relay interfaces</li> </ul>	
<b>Nx64 kb/s Data Optical</b>	<b>B86464</b>
<ul style="list-style-type: none"> <li>• N x 64 kb/s channels (N=1 to 12)</li> <li>• IEEE C37.94 compliant, standard for fiber optic connection to protective relays</li> </ul>	
Additional Units	
<b>Contact Input/Output</b>	<b>B86463</b>
<ul style="list-style-type: none"> <li>• Transport of contact closure</li> </ul>	
<b>Orderwire</b>	<b>B86471</b>
<ul style="list-style-type: none"> <li>• Party line voice circuit carried on 64 kb/s channel of either transport or path overhead</li> <li>• DTMF signaling</li> </ul>	
<b>Channelized T1</b>	<b>B86486</b>
<ul style="list-style-type: none"> <li>• Access remote T1 networks at DSO level</li> <li>• Extend JungleMUX networks across microwave radio, leased lines, foreign SONET networks</li> <li>• Provides cross-connect capability at JungleMUX SONET network edge</li> </ul>	



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## **Jungle MUX SONET Multiplexer**

The ideal optical networking solution for electric utility, transportation, pipeline and industrial applications

### **Key Benefits**

- Functions as a SONET OC-1, OC-3 or OC-12 drop-and-insert multiplexer with up to 672, 2016, or 8064 DS-0 channel drop capacity
- Robust environmental design
- Supports point-to-point, linear add/drop, ring and multiple ring plus spur network topologies
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and test equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual DS-0 signal
- Allows common NMS integration using IP
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface

### **Application Modules**

- Ethernet WAN/IP
- Video, voice, data and teleprotection
- DS-1, DS-3
- Digital telemetry and orderwire
- Channelized T1

## **Jungle MUX T1 Multiplexer**

Versatile, reliable and rugged solution to extend telecommunication applications over fiber optic, microwave radio and leased line networks

### **Key Benefits**

- T1 Multiplexer with integrated digital cross connect
- Environmentally hardened – meets IEEE 1613 specifications including SWC, RFI and ESD requirements
- Hot swappable units
- Multiple configurations:
  - Terminal Multiplexer
  - Add/Dropp Multiplexer
  - Cross Connect (DAX)
- Supports full duplex 1.544 Mb/s channelized T1 circuits (ITU-T G.703 compliant)
- Wide range of DS0 applications – common interface units with JungleMUX SONET Multiplexers
- Multiple powering options
- Local and remote configuration via existing VistaNET® network management tools
- Optional redundant control and T1 line unit (CDAX Unit)

### **Application Modules**

- Voice
- Data
- Teleprotection
- Digital telemetry
- Power: 24/48/130 VDC, 115 VAC





# GE Multilin® Communications TN1U SCH Multiplexer

Section 18

The ideal optical networking solution for electric utility, transportation, pipeline and industrial applications

## Key Benefits

- Functions as an STM-1/STM-4 drop-and-insert multiplexer with up to 252 VC-12 drop capability
- Robust environmental design
- Supports two fibre linear applications, self-healing D-P rings, multiple rings and rings plus spurs
- Supports multiple STM-1 or STM-4 rings interconnected through synchronous TIE links
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual 64 kb/s channel
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface

## Application Modules

- Ethernet WAN
- Video, voice, data and teleprotection
- Channelized E1
- Digital telemetry and orderwire



## TN1UeSDH Multiplexer

### Key Benefits

- Functions as an STM-1/STM-4 drop-and-insert multiplexer with up to 252 VC-12 drop capability
- Robust environmental design
- Utility hardened
- Supports two fibre linear applications, self-healing D-P rings, multiple rings and rings plus spurs
- Supports multiple STM-1 or STM-4 rings interconnected through synchronous TIE links
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual 64 kb/s channel
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface



### Application Modules

- Ethernet WAN
- Video, voice, data and teleprotection
- Channelized E1
- Digital telemetry and orderwire



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

## **VistaNET® Network Management System (NMS)**

VistaNET®, the next generation of software tools to manage GE Multilin®'s JungleMUX SONET and T1, 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 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



### **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 Lentriconics Multiplexer optical networks
- VistaNET® Serial Communication Port Expansion is a 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 application to run on a Windows 2000, NT or XP PC or LAN server computer
- IP Service Unit (IPSU) is the IP version of the JungleMUX service unit, but contains an embedded computer and server gateway software package, as well as a TCP/IP Ethernet connection for NMS access
- 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 Clear alarms

Visit [www.GEMultilin.com/VistaNET](http://www.GEMultilin.com/VistaNET) to:

- Log into User website
- Download software
- Request more information
- View Multiplexer brochures



<b>VistaNET® Network Interface (VNI)</b>	<b>8645-01</b>
<ul style="list-style-type: none"> <li>• Standard NMS offering</li> <li>• Remote configuration and monitoring of rings, nodes and units</li> <li>• Provides two serial communication port connection privileges from a PC or laptop to network segments</li> <li>• VistaNET® Local Access (VLA) RTU license included</li> <li>• Provides for VNI client functionality in client-server TCP/IP Ethernet NMS implementation</li> </ul>	
<b>VistaNET® Local Access (VLA)</b>	<b>86456-02</b>
<ul style="list-style-type: none"> <li>• Thrifty, rudimentary NMS offering for small networks</li> <li>• Local configuration and troubleshooting of units</li> <li>• Remote monitoring of rings, nodes and units</li> <li>• RTU license per node</li> <li>• Provides two serial communication port connections privileges from a PC or laptop to network segments and local units</li> <li>• Included with VNI RTU license</li> </ul>	
<b>VistaNET® Upgrade from JNCI/TNCI</b>	<b>86456-03</b>
<ul style="list-style-type: none"> <li>• License for upgrading from JNCI/TNCI to VistaNET</li> </ul>	
<b>VistaNET® Server Application (VSA)</b>	<b>86456-04</b>
<ul style="list-style-type: none"> <li>• Creates client-server TCP/IP Ethernet NMS environment for a network segment</li> <li>• Provides server gateway functionality from a PC or LAN server computer, when a NMS serial communications port connection to a network segment is required</li> <li>• Provides one serial communication port connection privilege to the network segment and up to three TCP/IP Ethernet connection privileges for VNI clients</li> <li>• Single instance of VSA required for each serial communications port connection to a network segment</li> <li>• RTU license per instance of VSA</li> <li>• Each VSA instance supports up to 50 nodes</li> </ul>	
<b>VNI Serial Communication Port Expansion</b>	<b>86456-05</b>
<ul style="list-style-type: none"> <li>• RTU license for one additional VNI serial communication port connection privilege to a network segment</li> </ul>	
<b>VNI Serial Communication Port Expansion</b>	<b>86456-06</b>
<ul style="list-style-type: none"> <li>• Provides SNMP functionality</li> </ul>	
<b>IP Service Unit (IPSU)</b>	<b>B86434-03</b>
<ul style="list-style-type: none"> <li>• Downloadable option selectable from website</li> <li>• Each IPSU supports up to 25 nodes</li> <li>• Multiple IPSUs per network segment provide redundancy</li> </ul>	
<b>Equipped with VistaNET® Server Package</b>	<b>84634-51 (Downloadable)</b>
<ul style="list-style-type: none"> <li>• Creates client-server TCP/IP Ethernet NMS environment (downloadable) for a network segment</li> <li>• VSP server gateway functionality embedded within IPSU</li> <li>• Provides up to three TCP/IP connection privileges for VNI clients</li> </ul>	
<b>Equipped with SNMP Support Package</b>	<b>86434-61 (Downloadable)</b>
<ul style="list-style-type: none"> <li>• Provides UDP/IP Ethernet NMS connection from a network (downloadable) segment to a third-party SNMP Manager</li> </ul>	

### Ordering

To order GE Multilin® Multiplexer Family products please refer to the sales offices listing at the back of the catalog. Any individual contact listing with the annotation (T) for Telecommunications, can provide you with product and pricing information.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

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**MDS Mercury 900™ - License-free Industrial Broadband**



**Multimegabit Industrial Mobility Solutions**

Multi-megabit speed and long range allows multiple services on one infrastructure. The Mercury 900™ is an industrial wireless Ethernet solution with advanced cyber-security. Featuring Quality of Service, Mercury can be optimized for your specific application, whether mobile data, video surveillance, VoIP, or SCADA polling, or multiple applications on the same network.

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**MDS NETio™ - Wireless Analog and Discrete I/O**



**Tremendous Flexibility and Expandability Dramatically Extends Industrial Networking**

Align your throughput and distance requirements with the most uniquely scalable wireless solution— the MDS NETio™. Reduce wiring and termination costs between controllers and remote I/O points. The NETio regenerates I/O signals or can carry serial and or IP/Ethernet payload and I/O. Address the I/O directly with protocols including Modbus, Modbus TCP, DNP.3 and more. Expansion modules and wireless expansion (WeXP) permit accommodation of a user's I/O count and distance requirements.

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**MDS iNET-II 900™ - 1 Mbps, License-free**



**The Industry Leader At Megabit Speeds**

Megabit speed, exceptional range, and enhanced security are the benefits of the MDS iNET-II 900™. Industrial-grade performance allows the iNET-II to function robustly in extended temperature ranges and in more extreme environments, while Ethernet and serial interfaces permit the smooth migration of existing or legacy serial devices to IP networks. The iNET-II is well suited to both fixed and mobile applications and provides the lowest cost of ownership.

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**MDS iNET 900™ - License Free**



**The Standard-Bearer for Industrial Wireless License-Free Networking**

The longest-range high-speed industrial wireless solution in its class, the MDS iNET 900™, offers multiple layers of cyber security and industrial-grade performance. Offering robust operation in greater temperature ranges and more extreme environments, the iNET delivers both Ethernet and serial interfaces and enables the smooth migration of existing serial devices into an IP network.

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**MDS entraNET™ at 900 MHz and 2.4 GHz and the EZ Remote**



**Extended Range IP Networking**

The MDS entraNET 900™ is an exceptionally long-range frequency hopping wireless solution, offering robust performance in extreme environmental conditions while keeping power consumption low and data rates high. Both serial and Ethernet 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 for systems that bring mission-critical, revenue-generating data from assets such as oil and gas wells, compressor stations, pipelines, and fluid storage tanks over Ethernet or a serial gateway and onto IP-based networks.

Wideband License-Free Point to Point

MDS FIVE.8™ - License-free, Scalable to 100 Mbps and Multiple T1/E1s



Highly Efficient High-Speed Backhaul Solutions

The MDS FIVE.8™ 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 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 FIVE.8 can be used for network aggregation, backhaul or to extend an existing network.

Wideband Licensed Point to Point

MDS LEDR™ - 400 MHz, 900 MHz and 1.4 GHz Licensed Point-to-Point Solutions



Scalable, Secure Backhaul Solutions

These radios are designed to operate in a point-to-point environment with a wide range of applications. They are especially effective for telecommunications access and transport links, wireless backbones for SCADA systems, and for use as backhaul to extend existing telecommunication channels.

LEDR Subrate Series

The Subrate LEDR™ microwave radio family provides full duplex, scalable bandwidth, and capacity from 64 kbps to 768 kbps in a 200 kHz channel. The Subrate LEDR is designed to connect to any industry standard EIA-530, V.35, fractional T1 or E1 source. Available in protected configurations with front panel displays, integrated HTML web servers, and SNMP Network Management systems, these radios offer easy management and monitoring of your entire wireless network.

LEDR Full Rate Series

The Full Rate LEDR™ microwave radio family provides full duplex, scalable bandwidth, and capacity from 1 X E1 (2.048 Mbps) in a 500 kHz channel up to a 4 X E1 (8.192 Mbps) in a 2 MHz channel. The Full Rate LEDR is designed to connect to any industry standard E1 G.703 source.

Narrowband Licensed Point to Multipoint

MDS Transceiver Series x710



The Long-Range Industry Workhorse

The MDS x710 Transceiver Series is a price/performance leader for licensed radios in the 220-222 MHz, 220-240 MHz, 330-512 MHz, and 800-960 MHz frequency ranges. These radios provide excellent throughput and exceptional range for a wide variety of multiple address systems. Transparent, direct asynchronous communication offers real-time communications capabilities, and no additional software or programming is necessary to implement solutions using standard asynchronous protocols. With its exceptional design, the Transceiver Series offers excellent performance—even when confronted with interference or challenging signal paths.

MDS Master Station Series x790



New Standards for Excellence

The MDS Master Station Series is available in the 330-512 MHz and 800-960 MHz frequency ranges, and may be configured for full duplex, half-duplex or simplex operation. Available in a number of redundant configurations, the Master Station Series radio is configurable as a master station or remote radio. The Master Station also delivers increased throughput and longer-range alternatives for Multiple Address Systems needs.





**MDS TransNET 900™ and MDS TransNET 2400™**



**Reliable Serial Communications for Complex SCADA Requirements**

Today's SCADA/Telemetry systems require the transmission of large amounts of data at ever increasing speeds. The MDS TransNET 900™ is an extremely flexible serial radio, offering frequency hopping operation and data rates as high as 115.2 kbps. 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 data transmission.

**Other MDS Products**

**MDS SCADAcrypt™ —Protect Your Critical Serial Data with AES 256 Bit Encryption**

**Legacy Networks, Munitions-Grade Security**

The MDS SCADAcrypt™ secures your entire wireless network from the originating device to the host on point-to-point or point-to-multipoint links. Strengthen security at your own pace by adding new units as needed; a single command from the web server interface enables system-wide security. Simple, reliable, impenetrable.

**MDS InSite™ and MDS NETview™—Proactive Network Management and Diagnostics**

**Wireless Networking@Your Command**

MDS InSite™ is designed for comprehensive field diagnostics or daily monitoring from a central location. The MDS NETview MSTM uses the SNMP industry standard protocols and allows performance monitoring, configuration, and control of MDS equipment and other SNMP devices.

**Spectrum Leasing**

**Leasing Options for Robust Solutions and Rapid Deployment**

MDS 900 MHz Licensed Channels for lease allow immediate deployment of an MDS Licensed network. Ask us about leasing arrangements for rapid solutions deployment.

**Accessories**

**A Full Range of Wireless Products**

Additional wireless solutions include: MDS Packaged Radios, the OEM series, licensed point to multipoint IP radios, MDS Multiplexers and the MDS ClearWave™ Antennas.



## Multilink Ethernet Communication Switches

Ethernet Communications for Industrial Automation, Power Utility, and Traffic Control markets

### Key Benefits

The MultiLink family is a line of Industrial and Substation Hardened Ethernet Switches that will provide you with secure, reliable communications with 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, even under the worst environmental and transient conditions.

#### Ability to Withstand Harsh Environments

- IEC61850-3 compliant for harsh substation environments
- IEEE 1613 Class 2 compliant for transient immunity
- IP 40 rated for environmental protection
- -40°C to +85°C Operating temperature without fans

#### High Degree of Network and Management Security

- SNMPv3 Encryption
- Secure Web Management
- Remote Access Security
- Radius & TACACS+ for secure password authentication

#### Enhanced Reliability with Fast Fault Recovery

- Network Ring Recovery of less than 5ms per switch
- Link-Loss-Alert for detecting broken 10Mbit & 100Mbit fiber connections
- Redundant power supplies with mixed inputs voltages available

#### Simple Switch Configuration and System Integration

- Powerful web interface for entire switch configuration
- Enhanced web statistics simplifying troubleshooting
- Modbus TCP/IP support for Monitoring & System Integration

#### Support of all Common Network Communication Ports

- 10Mbit, 100Mbit, 1000Mbit Ports
- ST, SC, LC, and MTRJ Multimode and Singlemode Fiber Optics
- 10/100Mbit Auto-negotiating RJ45 Copper Ports
- Copper and Fiber Optic Gigabit Ports



ML2400  
19" Rack-mounted Managed Switch



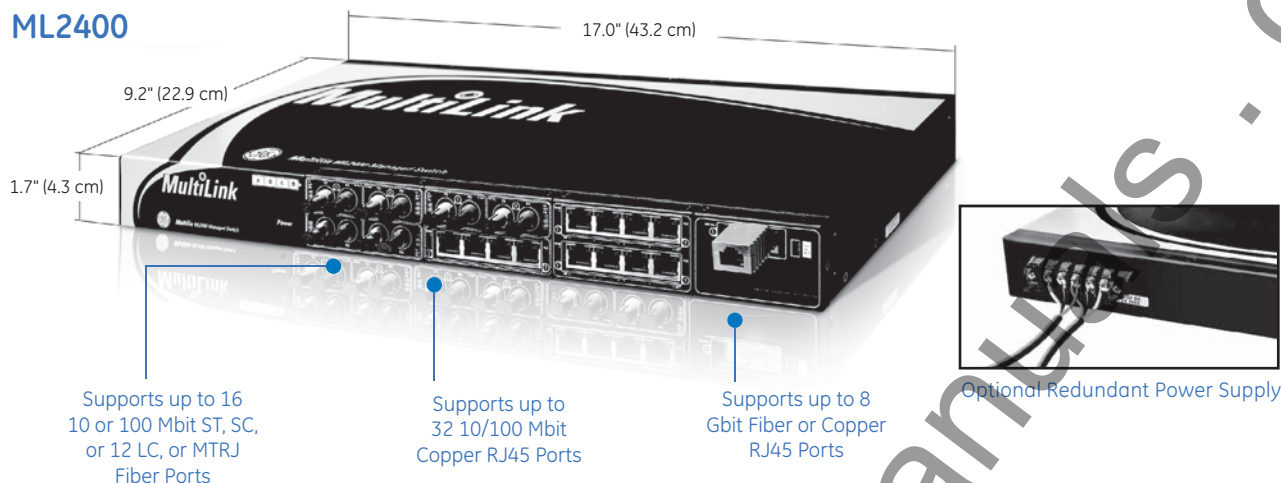
ML1600  
9" Panel-mounted Managed Switch



ML600  
Unmanaged Compact Switch



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



### ML2400 Managed Ethernet 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.

### Ordering

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

### Accessories for the ML2400

Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet®	Multinet-FE
EnerVista® Integrator	EVI-1000

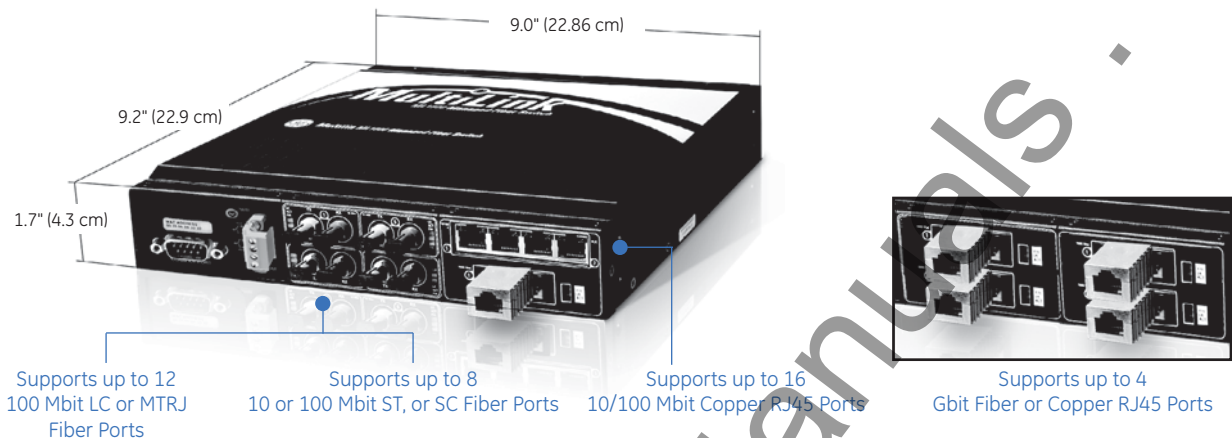
\* Additional modules and configurations available. Please see the Online Store for the latest module availability.

Visit [www.GEMultilin.com/ML2400](http://www.GEMultilin.com/ML2400) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML2400 online
- View the Multilink Family brochure



## ML1600



### ML1600 Managed Ethernet 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. 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.

### Ordering

ML1600 Module	-	**	-	**	**	-	*	Base Unit
Power Supply		AC		A	B			100-240 VAC Power Supply 110-250 VDC/100-240 VAC Power Supply 48 VDC Power Supply
Modules		HI		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
		LO		A2	A2			2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A3	A3			2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A4	A4			2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A5	A5			2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper
				A6	A6			4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A7	A7			8 x 100 Mbit - LC mm Fiber
				A8	A8			4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AA	AA			8 x 100 Mbit - LC sm Fiber
				AB	AB			2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper
				AC	AC			2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber
				AD	AD			8 x 100 Mbit - MTRJ mm Fiber
				AE	AE			4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AF	AF			2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper
				AH	AH			1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber
				AJ	AJ			1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper
				AK	AK			2 x 1000 Mbit - SC mm Fiber 2km
				G3	G3			1 x 1000 Mbit - RJ45 Copper
				G4	G4			1 x 1000 Mbit - SC sm Fiber 10km
				G5	G5			1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber
				G6	G6			1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper
				G7	G7			2 x 1000 Mbit - RJ45 Copper
				G8	G8			1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber
				GC	GC			1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper
				GD	GD			2 x 1000 Mbit - SC sm Fiber 10km
				GE	GE			
				GF	GF			
				GH	GH			
				GJ	GJ			
Harsh Environment						X		Standard Environment
						H		Harsh Chemical Environment Option

### Accessories for the ML1600

Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet®	Multinet-FE
EnerVista® Integrator	EVI-1000

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

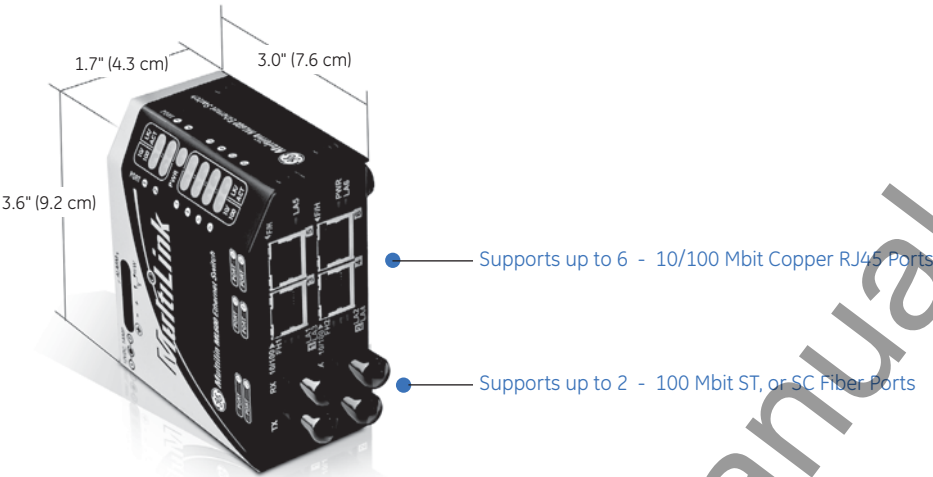
Visit [www.GEMultilin.com/ML1600](http://www.GEMultilin.com/ML1600) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML1600 online
- View the Multilink Family brochure



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

ML600



ML600 Compact Ethernet 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.

Ordering

ML600	-	**	-	**	-	Base Unit
Power Supply		AC				External 100 - 240 VAC Adaptor
		HI				30 - 60 VDC Power Supply
		LO				10 - 36 VDC Power Supply
Modules				XX		None
				B1		6 x 10/100 Mbit - RJ45 Copper
				B2		2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit - RJ45 Copper
				B3		2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit - RJ45 Copper
				B4		2 x 100 Mbit - SC sm Fiber + 4 x 10/100 Mbit - RJ45 Copper

Accessories for the ML600

Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet®	Multinet-FE
EnerVista® Integrator	EVI-1000

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

Visit [www.GEMultilin.com/ML600](http://www.GEMultilin.com/ML600) to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML600 online
- View the Multilink Family brochure



# GE Multilin® Communications Media and Protocol Converters

## Multinet®

page 18-150

MultiNet® is a communications module that provides GE Multilin® serial ModBus IEDs with ModBus TCP/IP communications over Ethernet, allowing connection to fiber optic LAN and WAN network systems.

## F485

page 18-151

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.

## D485

page 18-151

The D485 Modbus to DeviceNet Converter acts as a gateway between a Modbus RTU network and a DeviceNet network. Integration of Modbus devices into DeviceNet networks is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.

## P485

page 18-151

The P485 Modbus to Profibus Converter acts as a gateway between a Modbus RTU network and a Profibus-DP network. Integration of Modbus devices into Profibus networks is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.

## USB2Serial Converter

page 18-151

This cable is the solution for users who want to communicate with GE Multilin® IEDs 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.





# GE Multilin® Communications

## Multinet® Serial to Ethernet Converter

Ethernet communications made simple for any GE Multilin® IED

## Section 18

### Key Benefits

- Converts Modbus RTU over RS485 into Modbus TCP/IP over Ethernet
- 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

### Applications

Provides Modbus TCP/IP communications to the following Multilin devices:

- 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 that simplifies every aspect of working with GE Multilin® devices

### Mounting



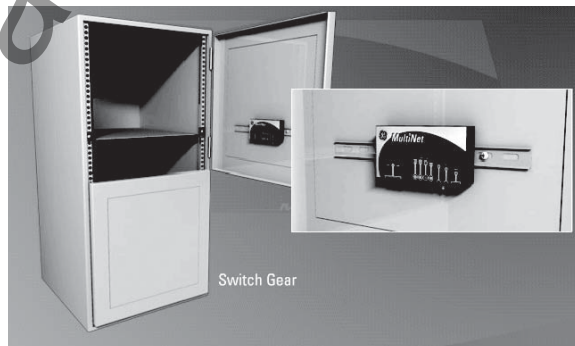
Rail Mounted



### Features

#### User Interfaces

- 10BaseT: RJ45 connection
- 10BaseF: 820 nm, multi-mode, fiber optic with ST connector
- RS485 2-wire, half duplex, isolated



Example of Multinet rail mounted in Switch Gear

### 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](http://www.GEMultilin.com/Multinet) to:

- Watch MultiNet® installation video
- Download the instruction manual
- Review applications notes and support documents
- Buy a MultiNet® online
- View the MultiNet® brochure





**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

Visit [www.GEMultilin.com/F485](http://www.GEMultilin.com/F485) to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a F485 online

**D485**



**Modbus to DeviceNet Converter**

- Integrate GE protective relays, meters or other Modbus-compliant devices into DeviceNet networks
- Easy-to-use, PC-based EnerVista® Setup Software for simple configuration
- Connects up to 10 Modbus devices to a DeviceNet network
- Supports DeviceNet “Adapter” functionality (Profile Number 12)
- Supports DeviceNet baud rates 125 Kbps, 250 Kbps and 500 Kbps
- Supports up to 50 Modbus Transactions
- Connects to DeviceNet network using 5-pin linear DeviceNet plug
- Supports Modbus baud rate of 1200bps to 57600bps
- Modbus interfaces supported: RS232, RS422, RS485
- DIN-rail mountable
- 24 VDC input power

Visit [www.GEMultilin.com/D485](http://www.GEMultilin.com/D485) to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a D485 online

**P485**



**Modbus to Profibus Converter**

- Integrate GE protective relays, meters or other Modbus-compliant devices into Profibus networks
- Easy-to-use, PC-based EnerVista® Setup Software for simple configuration
- Connects up to 10 Modbus devices to a Profibus network
- Complete Profibus-DP slave functionality as per IEC61158
- Supports Profibus baud rate of 9.6Kbps to 12 Mbps
- Profibus interface supported: RS485
- Supports Modbus baud rate of 1200bps to 57600bps
- Modbus interfaces supported: RS232, RS422, RS485
- Supports up to 50 Modbus Transactions
- DIN-rail mountable
- 24 VDC input power
- CE, UL and cUL certified

Visit [www.GEMultilin.com/P485](http://www.GEMultilin.com/P485) to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a P485 online

**USB2Serial**



**USB to Serial Cable Converter**

- Designed for high speed transmissions for optimal performance
- Premium quality, flexible 6 ft long cable
- Ergonomic molding for easy connections
- RS-232C standard compliant
- Powered by your computer's USB bus
- DB 9 male connector

Visit [www.GEMultilin.com/usb2serial](http://www.GEMultilin.com/usb2serial) to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a USB2Serial online



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Power Sensing Instrument Transformers

Low Voltage Current Transformers – 600 Volt Class Indoor Type

## Section 18

### Split Core Current Transformers



#### Applications

- Energy management
- Load surveys
- Sub metering

#### Features

- Window sizes from 0.75 x 0.75 to 12 x 30 inches
- Ratios from 100:5A to 10,000:5A
- Voltage output available
- Weather proof model available
- UL Recognized and CSA Approved

### Auxiliary Current Transformers



#### Applications

- Designed for use in the secondary of main current transformers to change the ratio for metering or relaying applications

#### Features

- Several models available
- Wound primary up to 50A
- IEEE or IEC metering and relay class
- Summation CT's up to six secondaries
- UL Recognized and CSA Approved

### Three Phase Current Transformers



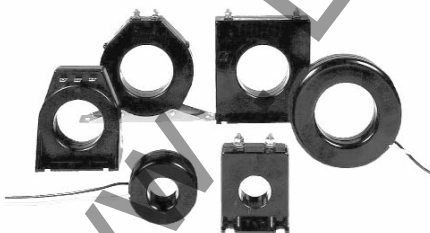
#### Applications

- Three phase metering and motor over-load protection

#### Features

- Over 50 models available
- Saves space and reduces installation time
- Zero sequence core in the same package available for most models
- Ratios from 50:5A to 4000:5A
- UL Recognized and CSA Approved

### Current Transformers



#### Applications

- For use with ammeters in panelboards, control panels and engine generators

#### Features

- Wide range of window sizes
- Ratios 50:5A to 2000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Integral feet or mounting brackets available
- UL Listed and CSA Approved



# GE Multilin® Power Sensing Instrument Transformers

Low Voltage Current Transformers – 600 Volt Class Indoor Type

## Section 18

### Current Transformers



#### Applications

- For metering and relaying applications in low voltage switchboards, switchgear and motor control

#### Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Multi ratios model available
- Designed to meet IEEE C57. 13 or IEC 60044-1
- UL listed and CSA Approved

### Current Transformers



#### Applications

- Designed for specific mount applications in low and medium voltage switchgear

#### Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Multi ratios model available
- Designed to meet IEEE C57. 13
- UL listed and CSA Approved

### Current Transformers



#### Applications

- For ammeters, wattmeters, and cross current compensation applications

#### Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Integral feet or mounting brackets available
- UL Listed and CSA Approved

### Ground Fault Sensors



#### Applications

- To sense zero sequence ground fault currents

#### Features

- Window sizes up to 30x 10 inches are available
- Ratios 50:5A and up
- Special ratios and physical sizes built to customer specifications
- UL Recognized and CSA Approved



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Power Sensing Instrument Transformers

Low Voltage Current Transformers – 600 Volt Class Indoor Type

## Section 18

### Ground Fault Sensors Type HGF



#### Applications

- Designed to match the ground fault input of GE Multilin® motor protection relays

#### Features

- Window sizes 3.75" , 5.75" or 8.13"
- Ratio 50:0.025A 60 Hz
- IEC versions also available
- UL and CUL recognized

### Current Transformers



#### Applications

- Designed for operation of meters and instruments
- Utility metering
- Mounts directly on busbars or padmount transformer spade

#### Features

- Window sizes 3.46" x 4.16"
- Ratios 200:5 to 4000:5
- Meet ANSI C12 size and mounting

### Current Transformers



#### Applications

- Designed for operation of meters and instruments
- Utility metering small window

#### Features

- Designed for outdoor service
- Encapsulated in cast polyurethane resin
- Compression type terminals
- Ratios from 100:5A to 800:5A
- Dual ratio models available
- Engraved aluminum name plate
- Meet ANSI C12 size and mounting

### Current Transformers



#### Applications

- Designed for operation of meters and instruments
- Utility metering large window

#### Features

- Designed for outdoor service
- Compression type terminals
- Ratios from 200:5A to 4000:5A
- Dual ratio models available
- Engraved aluminum name plate
- Meet ANSI C12 size and mounting



### Voltage Transformers



#### Applications

- For single phase voltage measurement in AC power systems

#### Features

- Resin cast moulded plastic cases
- Integral fuses available on some models
- Designed to meet IEEE C57.13
- 50Hz design available
- UL Recognized and CSA Approved

### Voltage Transformers



#### Applications

- For three phase voltage measurement in AC power systems

#### Features

- Resin cast moulded plastic cases
- Integral fuses available on some models
- Designed to meet IEEE C57.13
- 50Hz design available
- UL Recognized and CSA Approved

### JVA Voltage Transformers



#### Applications

- Designed for indoor and outdoor service; suitable for operation meters, instrument transformers, relays, and control devices.
- Utility metering

#### Features

- Housed in a resin filled plastic case
- Compression type terminals
- 50Hz design available
- Transparent plastic terminals cover
- Engraved aluminum nameplate
- Designed to meet IEEE C57.13



# GE Multilin® Power Sensing Instrument Transformers

Bushing Current Transformers – 600 Volt Class

## Section 18

### Cast Resin Unit



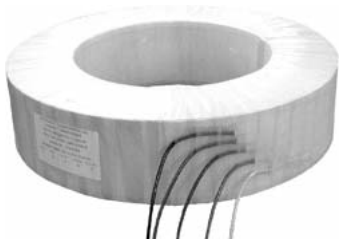
#### Applications

- For use over bushings of power transformers and dead tank circuit breakers
- For metering and relaying applications

#### Features

- Indoor or outdoor service
- 600V class to IEEE C57.13 or IEC 60044-1
- Ratios 50:5 to 25000:5
- Single and multi ratios available
- Optional ground shield available

### Taped Unit



#### Applications

- Designed to customers specifications for metering and relaying applications
- High voltage circuit breakers and power transformers

#### Features

- 600V class to IEEE C57.13 - 1993
- Single and multi ratio designs available
- Leads or terminals available
- Designs for use in oil are available

### Board Mounted Unit



#### Applications

- Designed for mounting and stacking over the bushings of large generators
- For metering and relaying applications

#### Features

- Ratios up to 40,000:5A
- 1 Amp secondaries and IEC design available
- 600V class 50 or 60Hz
- Shield winding available

### Medium Voltage Current and Potential Transformers – 5kV to 38kV Indoor Type Voltage Transformers



#### Applications

- Indoor voltage transformers for metering and relaying applications in AC power systems

#### Features

- Vacuum cast polyurethane resin
- Designed to meet IEEE C57.13
- 5kV to 34.5kV with BIL rating up to 200kV
- UL Recognized and CSA Approved

### Current Transformers



#### Applications

- Indoor current transformers for metering and relaying applications in AC power systems

#### Features

- Vacuum cast polyurethane resin
- Designed to meet IEEE C57.13
- 5kV to 34.5kV with BIL rating up to 200kV
- UL Recognized and CSA Approved





# GE Multilin® Power Sensing Instrument Transformers

Control Power Transformers – 5kV to 38kV Indoor Type

## Single Phase Cast Coil Transformers



### Applications

- To provide control power in medium voltage switchgear

### Features

- Vacuum cast primary coil using epoxy resin
- Single phase rating from 5 kVA to 37.5 kVA
- Voltage rating 5 to 15 kV and BIL rating to 95 kV BIL

## Single Phase Cast Coil Transformers



### Applications

- To provide control power in medium voltage switchgear
- Generator neutral grounding transformer

### Features

- Vacuum cast primary and secondary coils using epoxy resin
- Single phase rating from 25 kVA to 75 kVA
- Voltage rating 5 to 34.5kV and BIL rating to 150 kV BIL

## Three Phase Cast Coil Transformers



### Application

- To provide control power in medium voltage switchgear

### Features

- Vacuum cast using epoxy resin
- Three phase rating from 15 kVA to 150 kVA
- Voltage rating 5 to 34.5kV and BIL rating to 150 kV BIL
- Horizontal and vertical mounting available in some models

## Current Transducers – 600 Volt Class

### Current Transducers



### Applications

- Process control
- Industrial measurement

### Features

- Models available for 5 to 600 primary AC current
- Output 4-20 mA dc
- UL recognized



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

**GE Multilin®**  
**Power Sensing**  
**Instrument Transformers**  
IEC-Rated Instrument Transformers  
Current Transformers (Low Voltage)

**Section 18**



**Applications**

- Suitable for measuring applications in AC power systems

**Features**

- Available for indoor applications
- DIN rail mounting
- Designed to meet IEC 60044-1
- 720V rated

Current Transformers (Medium Voltage)



**Applications**

- Suitable for measuring and protection applications in AC power systems

**Features**

- Available for indoor or outdoor applications
- Vacuum cast in epoxy resin
- Designed to meet IEC 60044-1
- Available from 12 to 36 kV
- Multiple core designs available for measuring and protection in one package

Voltage Transformers (Medium Voltage)



**Applications**

- Suitable for measuring and protection applications in AC power systems

**Features**

- Available for indoor or outdoor applications
- Vacuum cast in epoxy resin
- Designed to meet IEC 60044-2
- Available from 12 to 36 kV
- Rated Voltage Factor: 1.2/1.9 (Continuous/8 hours)

Visit [www.GEMultilin.com/IT](http://www.GEMultilin.com/IT) to:

- View catalog sheets
- Review applications Notes and support documents
- Buy an instrument transformer online
- View the product brochures



**SB-1 Control and Transfer Switches**



Rotary switch for circuit breaker control, motor control or instrument transfer.

**Applications**

- Control of electrically operated circuit breakers, valves, motors, etc.

**Features**

- Transfer current and potential to instruments and relays
- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 16 stages (32 contacts)
- Tandem mechanisms available
- Yale lock or locking handle available
- Silver to silver positive wiping action contacts

- Rated 600 V, 20 A continuous (250 A for three seconds)
- Palladium contacts for low level instrument circuits available
- Pull-to-lock and pull-to-turn actions available
- Up to 12 positions, 360° rotation
- Four types of escutcheons (switch face plates)
- Eight types of fixed handles (black only)
- Three types of removable handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

**SB-9 Master Control Switches**



Rotary switch for frequent control of circuit breaker, motor, or magnetic switch.

**Applications**

- Steel mills, petroleum/chemical plants, power plants, heavy industries
- Repetitive positive positioning operation (thousands/week)

**Features**

- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 16 stages (32 contacts)
- Tandem mechanisms available
- Yale lock or locking handle available
- Silver to silver positive wiping action contacts
- Rated 600 V, 20 A continuous (250 A for three seconds)

- Palladium contacts for low level instrument circuits available
- Pull-to-lock and pull-to-turn actions available
- More positive positioning than SB-1
- Better insulation to ground than SB-1
- More substantial bearings than SB-1
- Up to 12 positions, 360° rotation
- Four types of escutcheons (switch face plates)
- Eight types of fixed handles
- Three types of removable handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

**Series 95 Heavy Duty Rotary Switches**



**Applications**

- Circuit breaker control switches
- Ammeter/voltmeter selector switches
- Lock-out relays (LOR)

**Features**

- Self cleaning silver plated contacts
- Standard 3 - hole mounting
- Pull -to - lock mechanism available
- Continuous 600v 30A rating
- UL Recognized and CUL



**SB-10 Control and Transfer Switches**



Rotary / lateral switches for circuit breaker control, motor control or instrument transfer.

**Applications**

- Control of electrically-operated circuit breakers, valves, motors, etc.
- Transfer current and potential to instruments and relays

**Features**

- Lateral action eliminates second separate switch
- Two electrically separate and mechanically independent switches in one device
- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 12 stages (24 contacts) of rotary contacts (includes lateral and rotary)
- Up to four stages (eight contacts) of lateral contacts (in-out action)
- Lateral action interlock with rotary position available
- Tandem mechanisms available
- Yale lock above handle available
- Silver to silver positive wiping action contacts
- Rated 600 V, 20 A continuous (250 A for three seconds)
- Palladium contacts for low level instrument circuits available
- Up to 12 rotary positions, 360° rotation
- Three escutcheons types (switch face plates)
- Seven types of fixed handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

**SBM Control and Transfer Switches**



Rotary switch for circuit breaker control, motor control or instrument transfer.

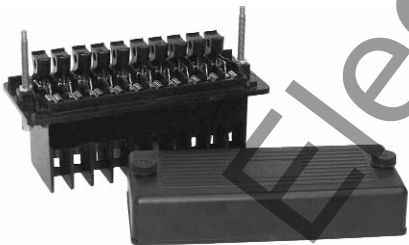
**Applications**

- Control of electric-operated circuit breakers, valves, motors, etc.
- Transfer current and potential to instruments and relays

**Features**

- Limited space applications
- Compact design
- Up to 10 stages (20 contacts)
- Double surface cams (one cam per contact)
- Add-a-stage feature for adding up to two stages
- Electrically separate and mechanically independent doublebreak contacts
- Standard mounts on panels up to 1/4" (up to 1.5" available)
- Rated 600 V, 20 A continuous
- Silver to silver positive wiping action contacts
- Pull-to-lock action available
- Up to eight positions, 360° rotation
- Three types of escutcheons (switch face plates)
- Eight types of fixed handles
- Three types of removable handles
- Handles to match SB-1 available
- Maintained or spring return switch action
- UL recognized

**FT and RT Test Switch**



**Applications**

- Multi - circuit testing of switchboard relays, meters and Instruments

**Features**

- Semi - flush panel mounting
- Mounting base and cover
- Up To 10 Individual knife blade switches
- Clear cover and colored handles available
- UL Recognized and CUL
- Available as a rack mounted assembly

### Indicator Lights

#### ET-16 Incandescent Indicating Lights



—Various voltages and color caps available

#### ET-16 LED Light Emitting Diodes



—Various voltages, LED colors and color caps available

#### ET-17 Neon Indicating Light



—Various voltages and color caps available

### Test Equipment

#### 515 Blocking and Test Module



—Provides an effective means of trip blocking, relay isolation, and testing of protective relays

#### PK-2 Test Block and Plugs



—Facilitates the testing of AC instruments, meters and relays

#### XCA Test Probes and Plugs



—Test probes and plugs for C-case drawout relays

#### XLA Test Plugs



—Test plugs for drawout relays

### Terminal Blocks

#### 116B407 Pullout Fuse Blocks



—Class J pullout blocks, available in two or three-fuse modes

#### Terminal Blocks for Connecting Leads



- EB-25 - washerhead binding screws
- EB-26 - clamp type connectors
- EB-27 - short circuit strips
- IKU - Control wire termination, Rated for 600V, 50 Amp

#### EB-1 Terminal Block



- Used where a high current rated block is required
- Rated for 600 V – 100 A circuits

#### EB-2 Terminal Block



- Used where a high current rated block is required
- Rated for 600 V – 100 A circuits

#### EB-4 Terminal Block



- Provided with 2, 4 or 6 points
- Rated for 600 V – 30 A circuits



# GE Multilin® Test Equipment RTT Desktop Test Set

Economical current, voltage, and digital input injection test set

## Section 18

### Key Benefits

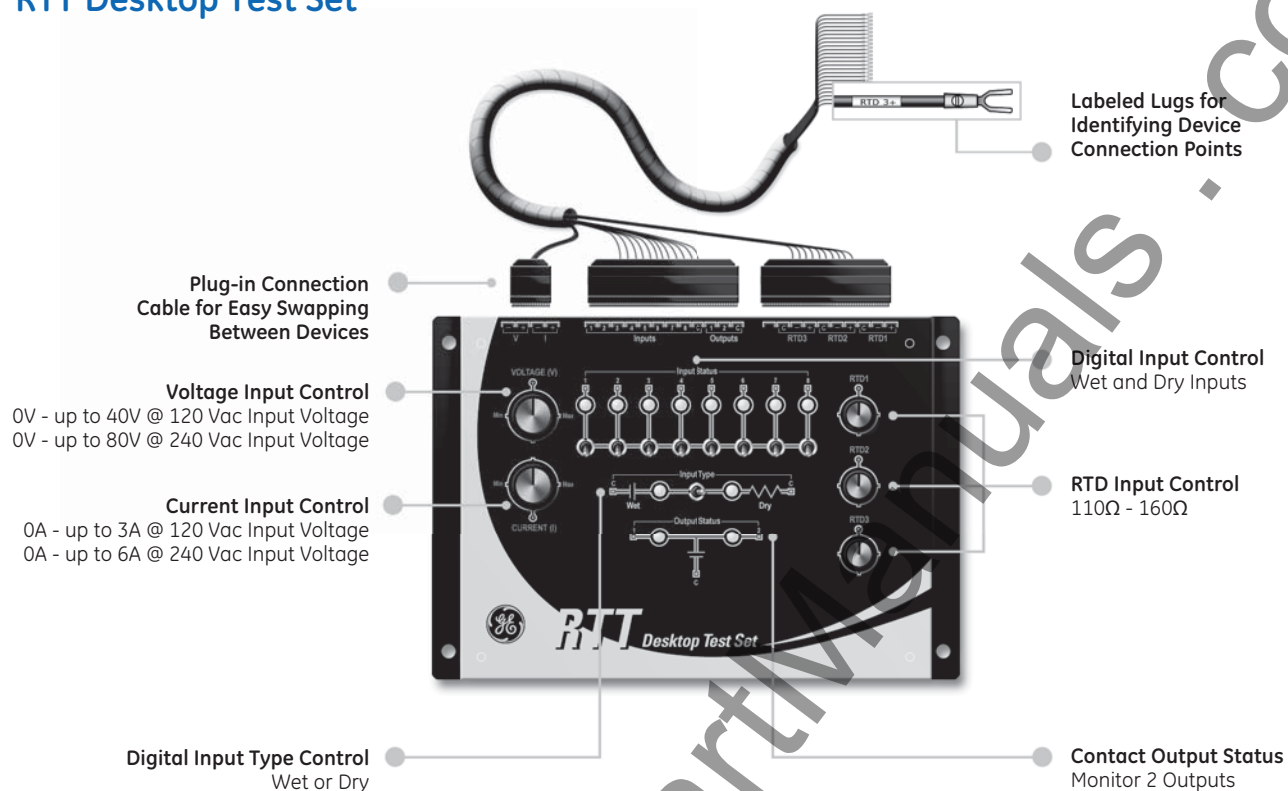
- Economical method for testing the operation of protection relays, meters, and PLC's
- Cost effective tools for performing hands on relay, meter, or PLC training
- Real time control of relays and meter input including AC voltage, AC current, digital inputs, and RTDs
- Provides a method for testing protective relay and meter settings files before sending to the field for commissioning
- Effective tool for validating the operation of logic schemes designed in protective relays and programmable logic controllers

### Features

- Single phase AC current injection  
( 0 to 3 Amps @ 120 Vac input voltage )  
( 0 to 6 Amps @ 240 Vac input voltage )
- Single phase AC voltage injection  
( 0 to 40 Volts @ 120 Vac input voltage )  
( 0 to 80 Volts @ 240 Vac input voltage )
- Force the status of 8 Digital Inputs ( Wet and Dry )
- Monitor the status of 2 Contact Outputs
- Control of 3 RTDs (Resistance Temperature Detectors)  
( 110 to 160 Ohms )
- Removable Device Connection cables for easy switching between multiple relays and meters
- UL Listed and CE Certified
- Operate at both 120 Vac and 240 Vac input power
- Includes detailed wiring diagrams for connecting to most GE Multilin® protective relaying and metering devices







## Ordering

Base	Description
RTT	Desktop Test Set with one device connection cable

## Accessories:

RTT-Cable	Additional device connection cable
-----------	------------------------------------

Visit [www.GEMultilin.com/RTT](http://www.GEMultilin.com/RTT) to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a RTT online

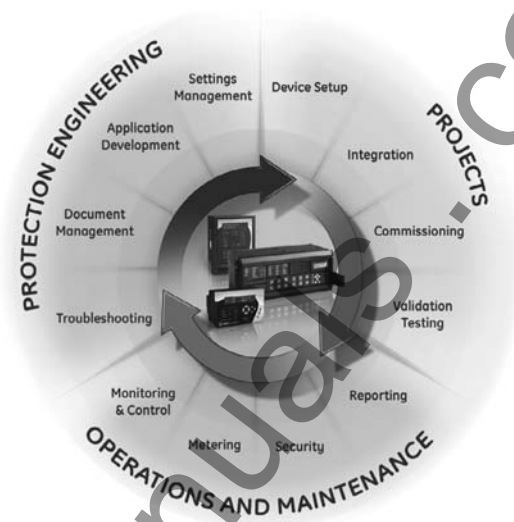


**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Software EnerVista® Suite

The EnerVista® suite is designed to simplify every aspect of your workflow processes

## Section 18



### Launchpad

page 18-165

#### Device Setup & Document Management Toolset

Launchpad is the powerful toolset management engine for all of the support resources needed for GE Multilin® products, including setup software, manuals and firmware files. The Launchpad subscription mechanism ensures that all of your necessary files are kept up-to-date and most importantly you only receive updates on the information you are interested in. The EnerVista® Setup tools provide a consistent look-and-feel for all GEMultilin devices, shortening the learning curve needed to be productive.

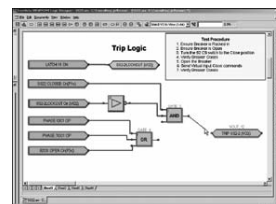


### Viewpoint Engineer

page 18-168

#### Logic, IEC61850 System Configuration and Real-Time Monitoring

Viewpoint Engineer is the most advanced tool for protection & control engineers and commissioning staff available. Use the full-featured Graphical Logic Designer to build and annotate complex FlexLogic™ and then observe it in real-time with the Graphical Logic Monitor. Use the System Designer option to design and annotate IEC61850 communication schemes, including ICD file import and SCD file export for non-GE IEDs.

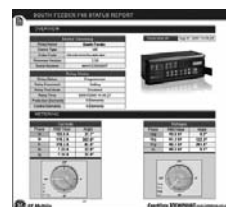


### Viewpoint Maintenance

page 18-172

#### Security Auditing, Device and Asset Health Reporting and Fault Data Retrieval

Comprehensive Security Report outlines changes to device settings, including the MAC address if the change was made via Ethernet for compliance with NERC Critical Infrastructure Protection standards. Device and Asset Status Reports detail current and historical health for both the IED and the asset being protected.



### Viewpoint Monitoring

page 18-176

#### Easy-to-Use Visualization and Data Recording for Small Systems

Viewpoint Monitoring provides simplified visualization of real-time data from all GE Multilin® using ready-made Plug-and-Play screens. Built-in data logger, alarm annunciator and time synchronization round out this HMI package. Third-party devices can be incorporated using either generic Modbus RTU or Modbus TCP/IP or IEC61850 and optional OPC/DDE server connectivity can link to existing facility DCS or SCADA systems.



### Ingetrator

page 18-186

#### OPC Connectivity to Automation and Historian Applications

Seamless integration of GE Multilin® and generic Modbus devices into existing DCS, SCADA systems and other data consumer applications (data historians, data visualization tools) using standard open OPC/DDE connectivity.



#### Device Setup and Document Management Toolset

EnerVista® Launchpad is a software package that provides you with a full set of powerful device setup and support tools for your GE Multilin® devices. Launchpad is included with your purchase of GE Multilin® products and will increase your productivity by keeping your support documents and application software up-to-date and at your fingertips

#### Key Benefits

- Provides a simple and intuitive method for configuring all GE Multilin® devices
- Ensures setup software, manuals and other support documentation is available to you and is always up to date
- Supplies all the tools necessary for analyzing faults to get your equipment back up and running

#### Key Features

- Configure and access all GE Multilin® devices from a single application
- Create and edit setting files offline or in real-time directly to your relays and meters
- Manage all of your support documents in a single reference library
- Receive automatic notification of new software and documentation as soon as it is made available
- Contains COMTRADE and event viewers to assist with analyzing fault information

#### A Complete Up-To-Date Reference Library

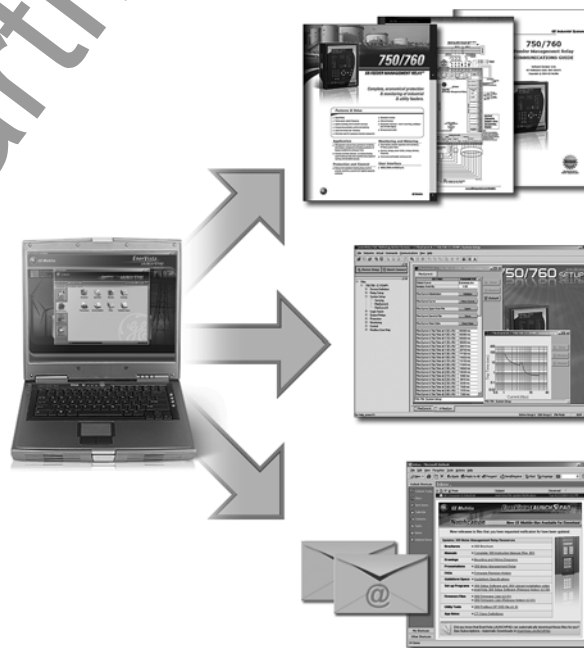
EnerVista® Launchpad will make sure that all necessary documents, setup programs and software tools are up-to-date by automatically retrieving them from our web site or Product CD, or by sending you an email whenever GE Multilin® makes new information available.

#### Manage all of your Support Documents in a Single Desktop Library

Launchpad offers a complete library of document resources that is automatically update and organized for you.

The Document Library includes:

- Manuals
- Application Notes
- Service Bulletins
- Guideform Specifications
- Drawings
- Support Documents
- FAQ's
- Brochures



**All critical information about GE Multilin® products will be up to date and at your fingertips**

Launchpad's subscription application will keep you up-to-date on the new product resources as soon as they are available. Launchpad will allow you to sign up to receive notification about new information by one of the following methods:

- Alerting you whenever you open up EnerVista® Launchpad
- Emailing you about the new resource available
- Automatically downloading new documents into Launchpad



### Single Launching Point for All Setup Programs

EnerVista® Launchpad's IED Setup page gives you a single point of entry to configure your GE Multilin® devices. Additionally, EnerVista® Launchpad will:

- Instantly identify when a new version of the setup software is available
- Provide downloading and installation of new versions of the Setup Software with a single click of a button
- Provide a method for directly installing new setup programs without having to navigate to the web site



### Easily Configure Your GE Multilin® Devices

Included with the purchase of your GE Multilin® products, EnerVista® Launchpad includes a single platform to configure all of your GE Multilin® devices. Launchpad will allow you to configure your devices in real-time by communicating to them using a serial, Ethernet, or modem connection, or offline allowing for programming of your devices at a later time.

### Common Tool to configure all GE Multilin® Devices

The EnerVista® setup software contains tools to simplify device configuration including:

- Quick Connect for single click communications to all serial and Ethernet devices
- Send and retrieve settings directly to all devices
- Communicate to multiple devices at one time to simplify relay coordination
- Lock setting files to device serial numbers to eliminate chances of human error
- Create setting file templates to reduce the number of settings needed to configure similar devices
- Copy and paste settings from one relay setting file for use in another
- Locking setting files with passwords to prevent changing or tampering
- Supports multiple languages including English, French, Russian and Chinese



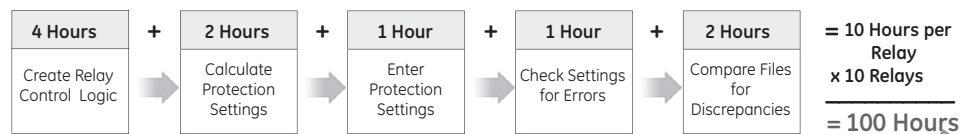
Configure relay and meter settings  
with easy-to-use configuration tools

Increase security and reduce  
mistakes by locking a setting file  
to a device serial number

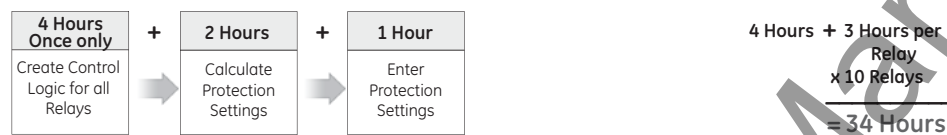
### Create Templates to Reduce Configuration Time

The template creation tool included with EnerVista® Launchpad will greatly reduce the amount of time required to configure relays that are performing similar functions. The example below demonstrates how the time required to configure 10 similar relays can be reduced by up to one third using Launchpad templates.

#### Traditional Device Configuration Method



#### Launchpad Template Configuration Method

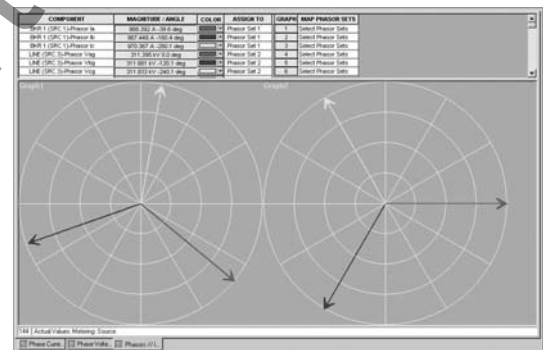


### Real-Time Device Monitoring

The EnerVista® Launchpad Setup programs will allow you to communicate to your protection and metering devices in real-time to monitor their status and the status of the assets they are protecting. This software can communicate with your devices using a serial, Ethernet, or modem connection, thereby allowing you to monitor your power system devices from any local or remote location.

#### Instant Feedback About the Status of your Equipment

- Monitor the power system levels measured by your relays and meters including: voltage, current, power, energy and symmetrical components
- Reduce commissioning test time by easily identifying the status of all device inputs and outputs
- Observe current and voltage quantities in a phasor diagram viewer
- Identify power system problems by viewing active targets detected by your relays
- Remotely view and control the front panel of your relay or meter as if you were in front of the device

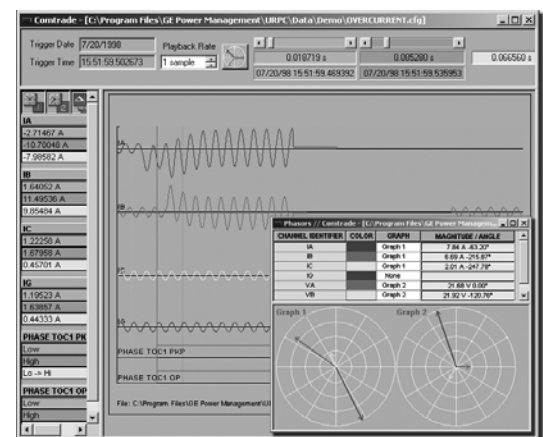


Monitor all measured power system levels from your desktop

### Fault Diagnostic Utilities

The EnerVista® Launchpad comes with all of the tools required to analyze power system faults.

- COMTRADE viewer showing both analog and digital data recorded at the time of the fault
- Playback fault records in a graphical phasor viewer to analyze the affect on power system quantities throughout the fault sequence
- Step through the events recorded in your devices in an accurately time-stamped Sequence of Events viewer



Analyze faults using COMTRADE Waveform Viewers showing both analog and digital status information





### System Configurator and Commissioning Toolset

Viewpoint Engineer is a set of tools that will allow you manage, configure, and test your UR and UR<sup>Plus</sup> relays at a system level in an easy to use graphical drag-and-drop environment. This software will streamline the steps required to configure devices, commission relays and manage the assets in your power system .

### Key Benefits

- Reduce the amount of time required to create complex logic schemes
- Program Remote I/O communications for multiple relays in an intuitive graphical interface
- Simplify commissioning by identifying the status of the relay logic in real-time
- Test protection relaying at a system or substation level rather than as an isolated device
- Provides a means for managing all documentation about all assets in your substation
- Decreases the number of support documents engineers require for commissioning and maintenance

### Key Features

- Configure UR and UR<sup>Plus</sup> relays in an intuitive Graphical environment
- Program Remote I/O relay communication settings for multiple devices in one simple step
- Evaluate the status of FlexLogic™ equations and Remote I/O messaging in real time
- Annotate UR and UR<sup>Plus</sup> settings and store this documentation in the setting file
- Link support documents to the System Designer Project to create a single location for substation asset management

### System Designer

#### Design Control Logic at a System or Substation Level

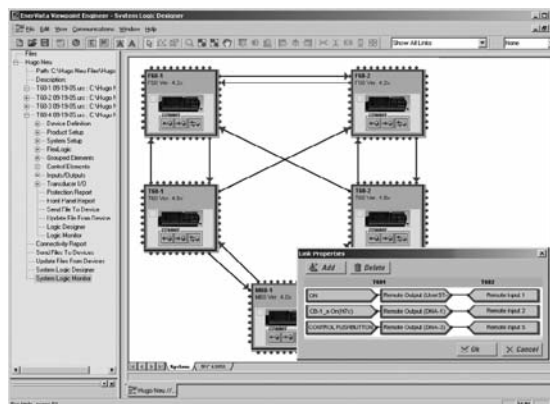
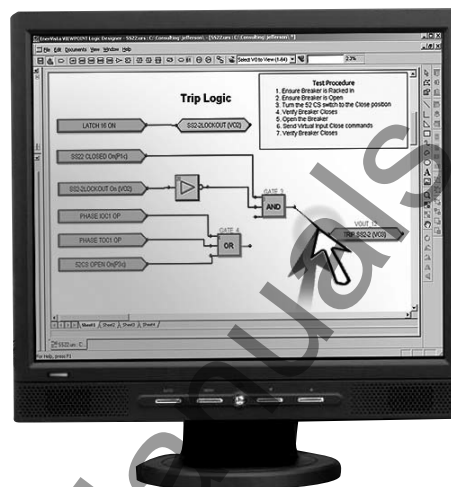
The System Designer allows you to inter-connect the control logic distributed across multiple UR and UR<sup>Plus</sup> devices by programming Remote I/O messages in an intuitive, graphical drag-&-drop environment.

#### System Level Settings Configuration

- Design automation logic distributed across multiple UR and UR<sup>Plus</sup> devices
- Configure Remote I/O messaging in both the Sending and Receiving devices in one simple step
- View “Virtual Wiring” communication diagrams in a manner that is similar to hard wiring schematics

#### Multiple Setting Files Created

- Configure the settings for multiple UR and UR<sup>Plus</sup> devices at one time
- A separate setting file will be created for each UR device used in the System Logic Designer



**Configure Remote I/O communications for multiple relays in one easy drag-&-drop step**



### Connectivity Report

The connectivity report provides a detailed report of all peer-to-peer mappings between the settings files associated with a project, including:

- IEC61850 GSSE/GOOSE and UCA2 GOOSE messaging
- Direct I/O configured between the UR relays.

The report will be generated as a PDF for simple archiving and emailing. A separate PDF report will be generated for each UR or UR<sup>Plus</sup> device

### Document System Level Setting Diagrams

- Annotate Remote I/O System diagrams to describe Inter-Relay messaging for testing engineers
- Documentation of Remote I/O System diagram stored in a project folder for permanent archiving

### IEC61850 Configurator

#### Import ICD and Generate SCD files using a single application

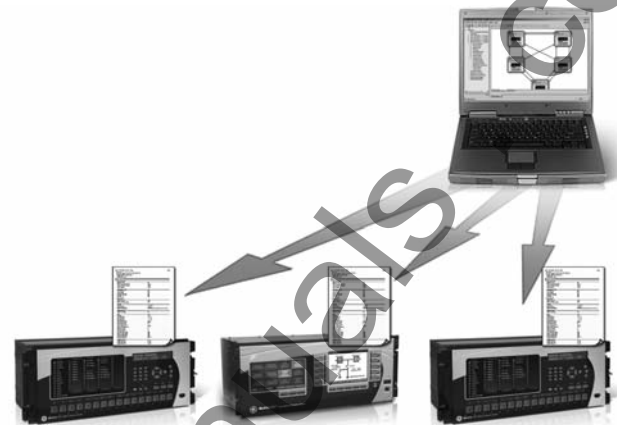
The IEC61850 enables system level configuration of the communications between all IEC61850 devices.

#### Importing ICD Files

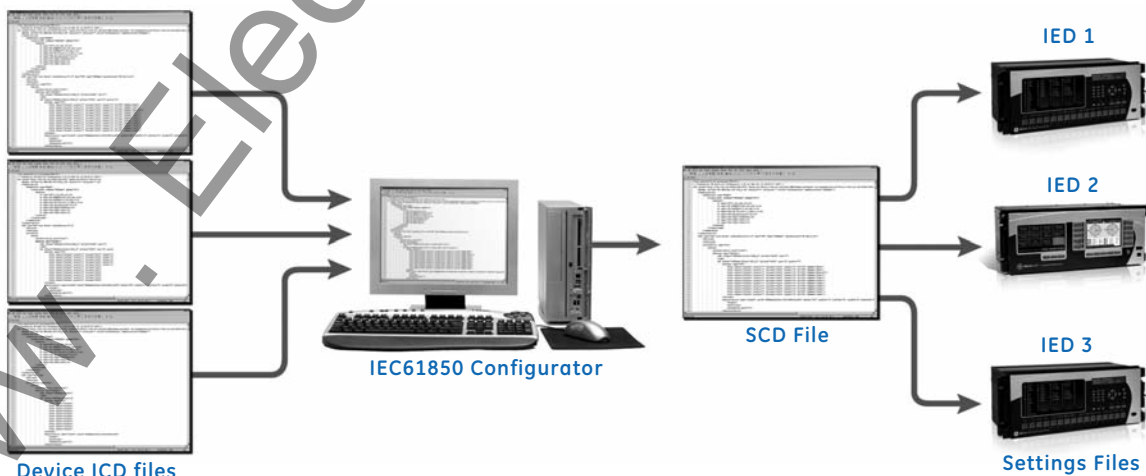
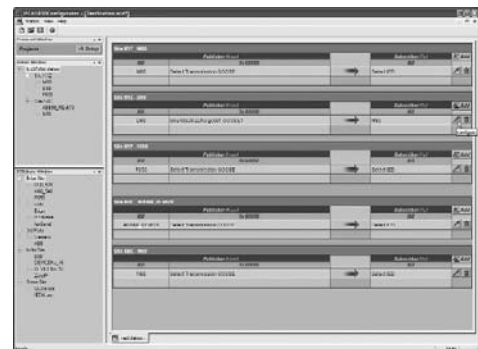
- Import ICD files from any IEC61850 Compliant device
- Create a library of ICD files, organized by device location, device type, or project
- View file information in an easy to understand ICD viewer

#### Create SCD Files

- Organize files by creating projects. Project files contain all subnet communication parameters as well as the associated device ICD files
- Configure the communications between relays by having the IED's subscribe to the appropriate transmission GOOSE messages
- The saved project becomes the SCD file needed to generate the GOOSE reception settings files for the IED's in the system



Viewpoint Engineer will create a separate setting file for each UR or UR<sup>Plus</sup> device that is configured in the System Designer. These setting files will contain all communication settings needed for Remote I/O communications



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

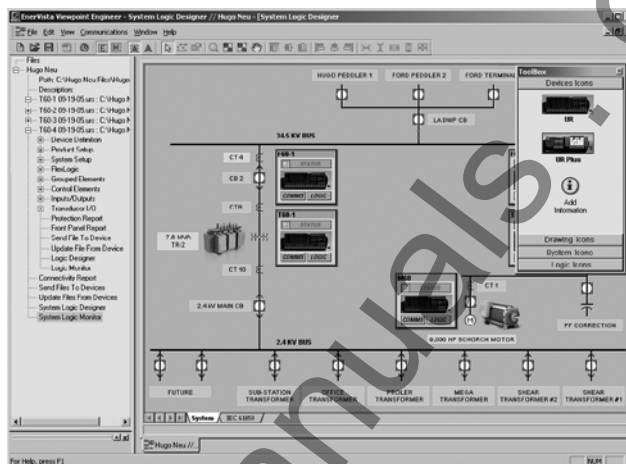
### Asset Manager

#### Manage all Assets in Your Substation or Power System

The Asset Manager will provide you with a tool to archive and manage critical information about any asset in your substation. All information in your power system can be stored in a Project Folder that can be shared between engineers and act as a single repository for any information required for your installed equipment.

#### Central Link to all Critical Information

- Create a Project folder that will act as a single location to reference all information about equipment in a substation
- Create an intuitive layout and navigation interface for your project by importing existing schematics or using the drawing tools provided
- Link documents, drawings, or setting files for all substation equipment into the project for complete system asset management
- Launch directly from the Asset Manager into the System Designer or Graphical FlexLogic™ Designer for programming your devices



Create a Project that will identify, document, and archive information about all assets in your substation (relays, breakers, transformers etc.)

### Graphical FlexLogic™ Designer

#### Design FlexLogic™ with Drag-&-Drop Ease

Simplify the process of creating complex control logic for substation automation in your UR and UR<sup>Plus</sup> relays to perform functions such as advanced tripping, reclosing and transfer schemes.

#### Simplified Control Logic Creation

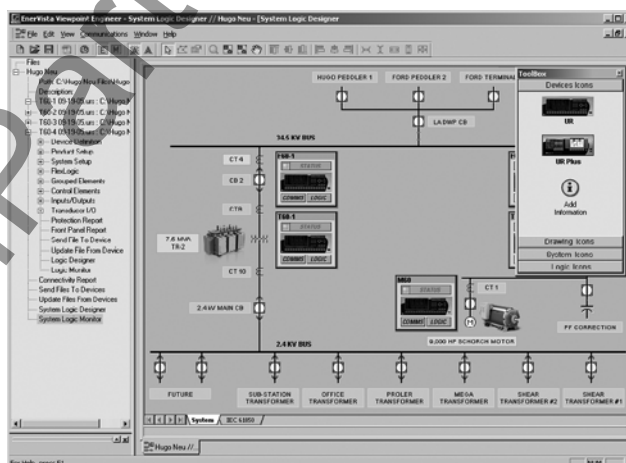
- Create FlexLogic™ with drag-and-drop ease
- Connect outputs of FlexLogic™ equations directly to contact outputs and LEDs
- Configure logic over multiple worksheets to keep logic structured and organized

#### Documentation of Settings

- Annotate control logic with documentation and graphics
- Store all settings documentation directly in UR and UR<sup>Plus</sup> setting files

#### Powerful Intuitive Compiler

- Optimizes FlexLogic™ equations to use as few lines as necessary
- Detects and alerts user of errors and problems in FlexLogic™ design



Design and document UR control logic in one intuitive application

### Logic Analyzer

#### Real-Time Feedback of FlexLogic™ Status

When connected to your UR or UR<sup>Plus</sup> relays, Viewpoint Engineer will provide real-time feedback of the status of the FlexLogic™ inputs, logic gates, timers, latches and outputs for every equation in the relay.

#### Simplified Troubleshooting

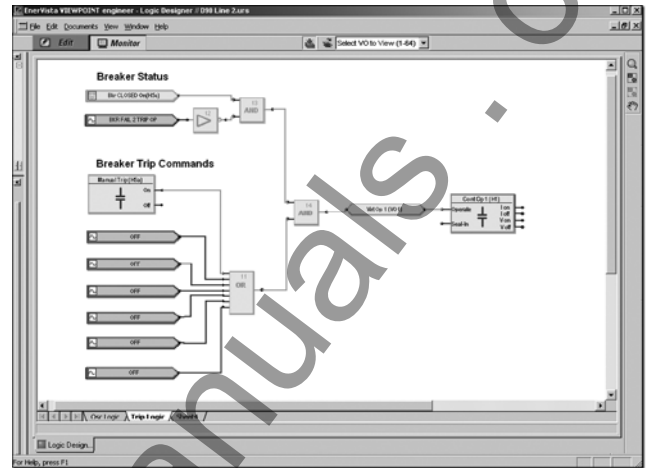
- Follow the operation of your UR relay through each step of the FlexLogic™ equations
- Detect problems in wiring or programming by viewing the status of all inputs in one screen
- Determine which inputs are causing each logic gate to be asserted
- Identify the logic that is causing the relay to not act as expected

#### Real-Time Feedback of Peer-to-Peer Message Status

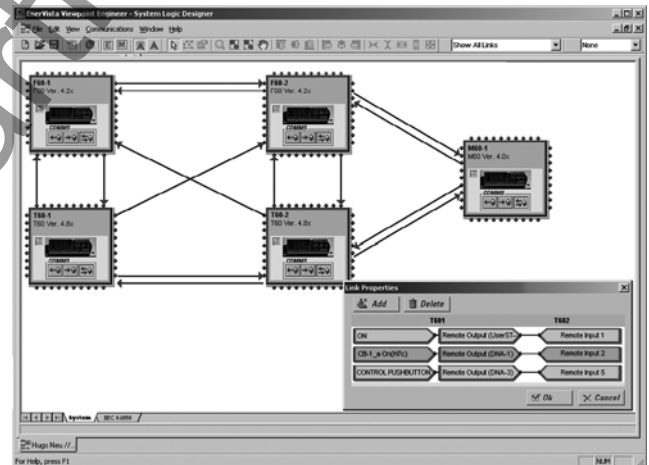
Connecting Viewpoint Engineer to the local area network allows you to receive real-time feedback of the status of Remote I/O messages from both the relay sending the message and the relay receiving the Remote I/O message.

#### Simplified System Troubleshooting

- Determine the status of all Remote I/O messages sent to other devices in the network
- Verifies that Remote I/O signals are received and interpreted correctly by the intended devices
- Reads settings from UR and UR<sup>Plus</sup> devices on the network and automatically creates a Remote I/O System Diagram
- Analyzes the settings in all UR and UR<sup>Plus</sup> devices and verifies correct programming between sending and receiving devices



Relay internal logic represented visually to simplify commissioning and troubleshooting



Analyze the status of Remote I/O messages from both the Sending and Receiving devices in Real- Time

### Viewpoint Engineer Software Selection Guide

VPE	*	*	*	EnerVista® Viewpoint Engineer
	1			Single License
	5			5 Pack
	10			10 Pack
	50			50 Pack
		S		No System Designer With System Designer Option
			G1	Standard 1 Year Updates Additional 1 Year Updates



# GE Multilin® Software EnerVista® Viewpoint Maintenance

## Section 18

### Troubleshooting and Reporting Tools

Viewpoint Maintenance is a must-have tool for any integrators or electrical staff involved in power system protection and maintenance. This software increases the security of your relays, reports your device's operating status and simplifies the steps to troubleshoot your device.

### Key Benefits

- Reduce the time required to perform maintenance on your device
- Increase the security of your relays by identifying relay settings that have been changed
- Avoid costly downtime by reducing the time required to collect data for troubleshooting faults
- Improve maintenance scheduling by prioritizing service needed for your power system equipment
- Identify potential system problems before they become critical

### Key Features

- Security Audit Trail tracks settings and configuration changes, who changed them, and the time and method of the change
- Single button click to download and compile all fault diagnostics into a single zip file for easy sharing with engineers who can help assess system problems
- Retrieve critical system information that will help assess potential system faults
- On-line and hard copy reports for easy viewing
- Easily identify the file name of the settings file loaded on the relays
- Support for the following GE Multilin® IEDs: 369, 469, 489, 745, 750/760, PQM II, B30, C30, C60, D30, D60, F35, F60, G30, G60, L60, L90, M60, N60, T35, T60\*

\*Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.





### Security Audit Trail\*

The Security Audit Trail feature in Viewpoint Maintenance is the first of its kind, automatically tracking the details of settings changes to your relays along with the MAC address of the user who changed them. This traceability helps map out where a problem may have occurred and will help improve maintenance procedures to prevent them from happening again. This is also a valuable tool for ensuring the system configuration is the same as when it was commissioned.

### Security Audit Trail Features:

- Date and time of hardware, firmware or setting changes made to your relays
- Logging of the MAC address of computers making settings changes
- Track method of how settings changes were made (i.e. keypad, serial port, Ethernet)
- Printer-friendly option to view hard copy reports
- Filter by date to identify changes to settings over time
- Ability to identify the name of settings files for accurate identification

**EAST LANE 2 SECURITY/CHANGE HISTORY REPORT**  
Generated at: Sep 09 2005 14:30:40

**Device Summary**

Device Name:	East Lane 2
Device Type:	UR 190
Order Code:	190-H03HDH-HBA-WYC
Firmware Version:	4.60
Serial Number:	MAGC0400000127
IP Address:	3. 94.247.167

**Settings Summary**

Setting File Name:	FAST_LINE-2.urs
Last Changed:	Sep 09 2005 14:18:03.070200 via Ethernet
Changed by Whom (MAC Address):	0008742D6FD0

**Setting Changes History**

Event	Date of Change	# of Changes	Password Entered	Method of Change	Changed by Whom (MAC address)	Filename Uploaded	Status	Firm. Version
144	09/09/05 02:18 PM	15	No	Ethernet	0008742D6FD0	FAST_LINE-2.urs	In Service	4.60
143	08/28/05 09:15 AM	1	No	Keypad			In Service	4.60
142	08/25/05 08:29 AM	1	No	Keypad			In Service	4.60
141	08/25/05 06:02 AM	1	No	Keypad			In Service	4.60
140	08/24/05 09:45 AM	18	No	Ethernet	00B0D0D2EA63	FAST_LINE-2.urs	In Service	4.60
139	08/09/05 05:12 AM	3	No	Ethernet	00B0D0D2EA63		Service Out of	4.60
138	08/09/05 03:12 AM	16	No	Ethernet	00B0D0D2EA63		Service Out of	4.60
137	09/09/05 02:30 PM	22	No	Ethernet	0008749784BF		Service Out of	4.60
136	09/09/05 02:30 PM	12	No	Ethernet	0008749784BF		Service Out of	4.60
135	09/09/05 02:30 PM	3	No	Ethernet	00B0D0D2EA63		Service Out of	4.60

**Setting Changes Detail History**

Event	Date of Change	Old Value	New Value	Item	Modbus Address
144	09/09/05 02:18 PM	Disabled	Enabled	Auxiliary UV 1 Events	0x6620
144	09/09/05 01:10 PM	Disabled	Enabled	Auxiliary UV 1 Function	0x6620
144	09/09/05 12:45 PM	Disabled	Enabled	Neutral OV 1 Events	0x6900
144	09/09/05 12:10 PM	0.300 p.u.	0.85 p.u.	Neutral OV 1 Pickup	0x6900
144	09/09/05 11:05 AM	Disabled	Enabled	Neutral OV 1 Function	0x6900
144	09/09/05 03:05 AM	Not Programmed	Programmed	Relay Programmed State	0x43E0
144	08/24/05 09:49 AM	None	F5	Source x Auxiliary VT	0x458A
144	08/24/05 03:05 AM	None	F5	Source x Phase VT	0x458A
144	08/24/05 01:12 AM	None	F1	Source x Ground CT	0x458A
144	08/23/05 11:20 PM	None	F1	Source x Phase CT	0x458A
144	08/23/05 09:40 PM	None	F5	Source x Auxiliary VT	0x4583
144	08/23/05 06:33 PM	None	F5	Source x Phase VT	0x4583
144	08/23/05 04:15 PM	None	F1	Source x Ground CT	0x4583
144	08/23/05 02:21 PM	None	F1	Source x Phase CT	0x4583
144	08/23/05 02:02 PM	1.00:1	24000.00:1	Phase VT x Ratio	0x4502
143	08/23/05 01:30 PM	1A	85000A	Phase CT x Primary	0x4480
142	08/23/05 12:30 PM	Off	SRC 2 Pc	Data Logger Channels	0x418C
141	08/23/05 11:21 AM	Off	SRC 2 Vcg RMS	Data Logger Channels	0x418A
140	08/23/05 11:01 AM	Off	SRC 1 Vbg RMS	Data Logger Channels	0x418B
140	08/23/05 10:10 AM	Off	SRC 2 V.1 Angle	Data Logger Channels	0x4186
140	08/23/05 06:19 AM	Off	SRC 1 Vca RMS	Data Logger Channels	0x4184

**GE Multilin** **EnerVista VIEWPOINT maintenance**

- Date and Time that the Security Report was generated
- Description of the GE Multilin® Relay
  - Equipment Name
  - Relay Model Number and Firmware version
  - Relay Serial Number
- Summary of the last time the configuration was changed
  - Name of settings file
  - Who loaded the file
  - When the file was loaded
- History of last 10 occurrences the configuration was changed
  - Date and time of configuration change
  - Number of settings changed at this time
  - Method used to change the relay settings
  - MAC address of computer sending settings
  - Name of the setting file sent to the Relay
  - The relay status after the settings changes
- Detailed description of all changes made to the relay's configuration
  - Date and time of configuration change
  - Description of the setting that was changed
  - Setting value before change was made
  - Setting value after change was made
- Convenient File Format
  - On-line and off-line copies
  - Easily zip these reports with other pertinent files such as settings files and fault reports to share with engineers

\*Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



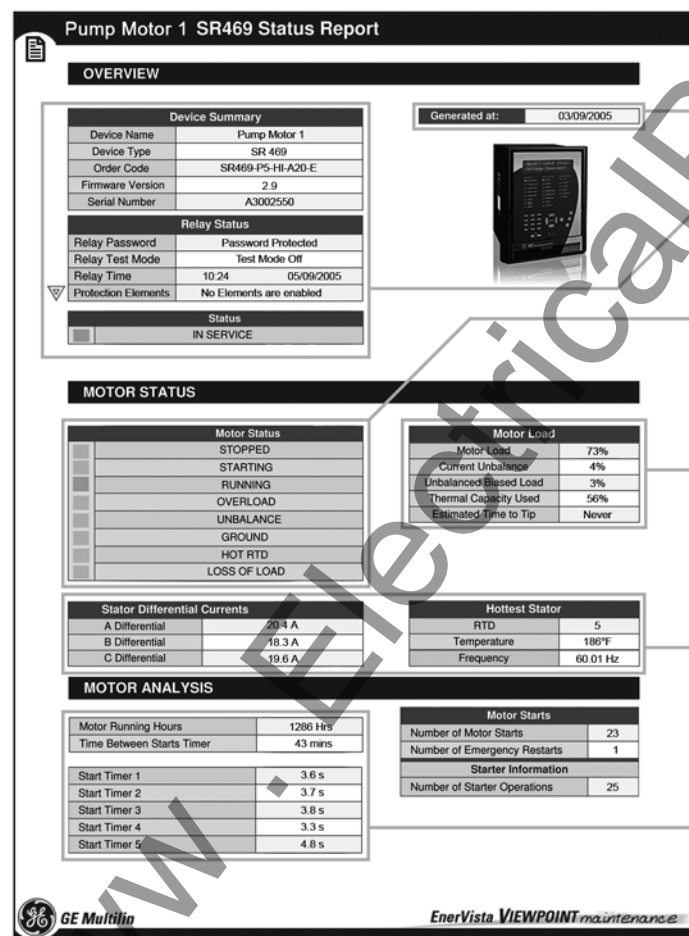
### Device Status Reports\*

Reduce the time required to perform maintenance on your device by receiving a report that shows the health and operating status of your relays, meters, and the power system being monitored.

#### Status Reports Include:

- Current operating condition of the GE Multilin® device
- Operating status of the equipment being protected
- Critical device settings that have not been programmed
- Operating history of the monitored devices
- Maintenance issues that need to be addressed
- LED simulated view of equipment targets and alarms detected

\* Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



- Date and Time that the Status Report was generated
- Description of the GE Multilin® Relay and equipment being protected
  - Equipment Name
  - Relay Model Number and Firmware version
  - Relay serial Number
  - Intelligent Reporting raises red flags to draw attention to disabled protection or control elements
- Equipment Targets and Alarms detected by the relay
  - Motor Overload
  - Hot RTD Alarm
  - Loss of Load
- Current Operating Condition of the equipment
  - Motor Speed
  - Transformer Load
  - Tap Changer Position
  - Estimated Time to Trip
- Critical information that can aid in anticipating faults
  - Differential Currents
  - Temperature
  - Frequency
- Historical Information about the asset that aids in predicting maintenance requirements
  - Motor Running hours
  - Accumulated Loss of Life
  - Number of Breaker Operations

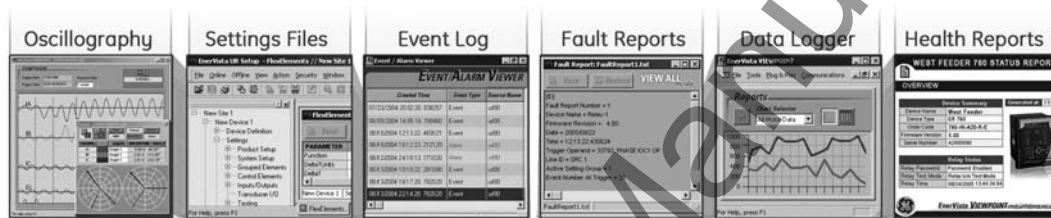


### Comprehensive Fault Diagnostics\*

Reduce time required to collect data for troubleshooting a fault with Viewpoint Maintenance. There is no need to access the setup program for the device or sift through settings to figure out what data is needed. With the click of a button, Viewpoint Maintenance will gather the required information including pertinent settings files, oscillography, events, fault reports, data logger and health reports and package it into a single zip file to allow for easy sharing with engineers to assist with your fault analysis.

### Fault Diagnostics Features:

- Effortlessly collect the data required to diagnose a fault
- Automatically package all pertinent information into a .zip for easy file sharing
- Eliminate costly hours of troubleshooting by filtering data at the click of a button
- Assess why and how the fault occurred to improve preemptive maintenance procedures
- Avoid costly downtime and customer interruptions
- Reduce the amount of time required to troubleshoot a fault to get your system back up and running



① At the click of a button Viewpoint Maintenance will gather all required information including pertinent Settings Files, Oscillography, Events, Fault , Data Logger and Health Reports...

② ...Viewpoint Maintenance then automatically packages and compresses these files into a single .zip file...

③ ...and stores the zipped file on your hard drive for easy emailing to your engineers or instantly emails to GE Tech support



### Viewpoint Maintenance Software Selection Guide

VPM	*	*	EnerVista® Viewpoint Maintenance
1			Single License
5			5 Pack
10			10 Pack
50			50 Pack
		G1	Standard 1 Year Updates
		G2	Additional 1 Year Updates
		G3	Additional 2 Year Updates
			Additional 3 Year Updates

\* Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



Publications and Reference: See Section 22 for a complete list of additional product-related publications

**Easy to Use Monitoring and Data Recording for Small Systems**

Viewpoint Monitoring is a powerful yet simple to use monitoring and data recording software application for small systems that will provide you with total visibility and control of your power system or substation. By communicating with your Intelligent Electronic Devices (IED's), Viewpoint Monitoring will give you an overall view of your entire power system as well as collect critical real-time and historical disturbance data to assist with analyzing past or impending power system events.

**Key Benefits**

- Save time and cost integrating your GE Multilin® devices using pre-programmed memory maps
- Reduces fault analysis time by storing critical fault data in a central location
- Perform load analysis by recording and trending power equipment load levels
- Automatically generated monitoring screens provide instant equipment visibility.

**Key Features**

- Plug-and-Play analysis of power system equipment
- Single-line monitoring and control
- Communicate with any Modbus compliant IED
- Simplify the monitoring of devices from multiple vendors
  - IEC61850 option
- Pre-configured memory maps of GE Multilin® devices
- Annunciator alarming with visual, audio, and email notification
- Trending of up to 500 power system data points with 1 minute resolution
- Automatic collection of events and waveforms from GE Multilin® devices
- Construct single-line monitoring screens in minutes with drag-and-drop ease
- Diagnose waveform fault data recorded in power system devices



### Plug-and-Play Monitoring

#### Instantly View Device and Asset Monitoring Screens

Viewpoint Plug and Play monitoring is a series of pre-configured modules for analyzing the health and status of your power system equipment. Viewpoint Monitoring will detect the devices you are using and automatically generate monitoring screens that are tailored to your devices and wiring configurations. Save hours of engineering effort and begin monitoring your protection devices right away.

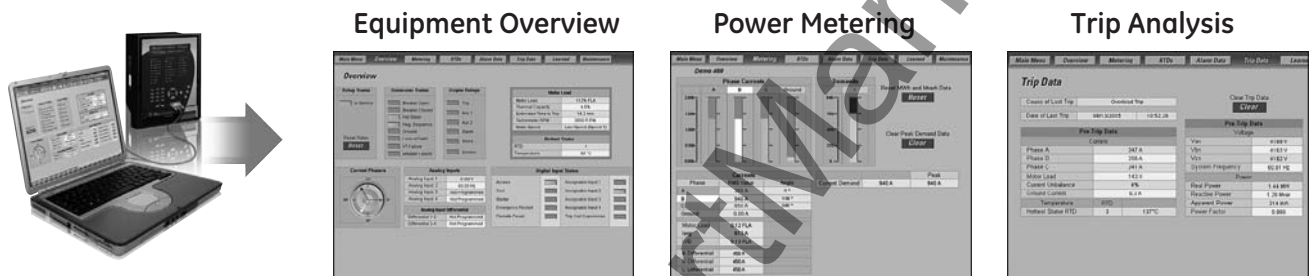
#### Auto-Discovery of Devices

Viewpoint Monitoring reduces integration time, as well as the opportunity for error when configuring your devices, by automatically detecting and configuring your UR devices.

### Viewpoint Monitoring Advantage

#### How to save time and costs using Viewpoint Monitoring

Example of connecting and communicating with a 469 Motor Protection Relay to monitor the following relay and motor data:



#### Overview

- Operating condition of your motor
- Status of your GE Multilin® Relay

#### Metering

- All metering quantities (Amps, Volts, Power, Demand)
- Motor temperature monitored by the RTD's

#### Alarms

- Active Alarms detected by the relay
- Latched Alarms that require clearing

#### Trip

- Cause of the last motor trip
- Pre-trip data

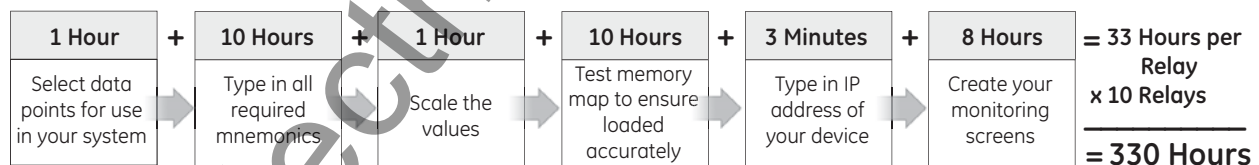
#### Learned

- Learned motor and RTD data
- Learned motor load

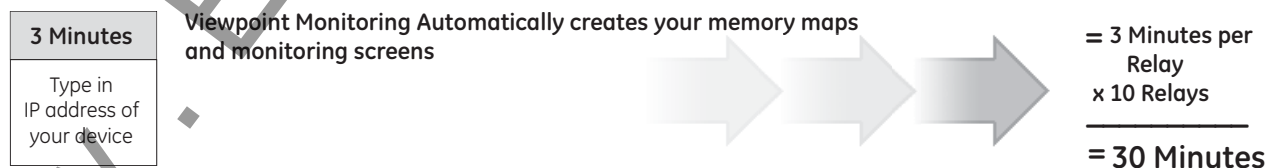
#### Maintenance

- Trip counters and motor starts
- Total motor running hours

### With other HMIs



### With Viewpoint Monitoring



### Plug-and-Play Motor Monitoring

#### Use Viewpoint Monitoring with your Motor Protection Equipment

Instantly created overview screens will show the operating condition of your motor and the status of your GE Multilin® Relay. Additional monitoring screens available can show you the value of all metering quantities, the motor temperature monitored by the RTDs and any alarms that have been detected by the relay. Historical data that is shown on other available screens can indicate the cause of the last motor trip, operating information the relay has learned about the motor, and any maintenance issues that may need addressing.

Instantly view critical information such as:

- Number of motor starts
- Learned motor starting current
- Motor running hours
- History of motor trips
- Real time power quantities (amps, motor load)
- Motor temperature

### Supported Devices

- M60 Motor Protection System
- 469 Motor Protection System
- 369 Motor Protection System
- 269 Motor Protection System
- 239 Motor Protection System
- MM300™ Motor Management System
- MM2/MM3 Intelligent MCC Controller
- SPM Synchronous Motor Protection System
- RRTD Remote RTD Module



View motor status using digital inputs, analog inputs and RTD inputs

### Plug-and-Play Transformer Monitoring

#### Use Viewpoint Monitoring with your Transformer Protection Equipment

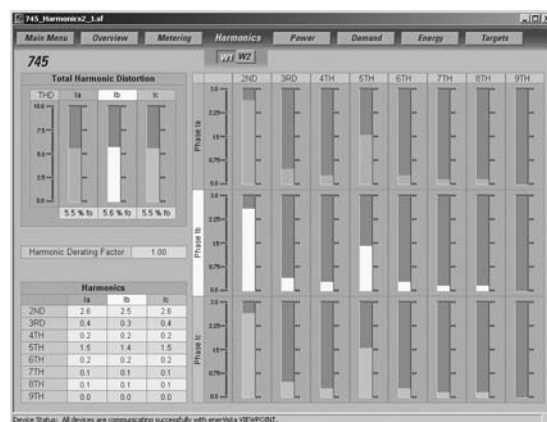
Instantly created overview screens will show the operating condition of your transformer and the status of your GE Multilin® relay. Additional monitoring screens allow further analysis of your transformer by viewing the metering, power, demand, energy, and harmonic data that is being measured by your relay.

Instantly view critical information such as:

- Transformer energization status
- Real time power quantities (amps, transformer loading, demand)
- Current harmonic analysis
- Accumulated loss of life
- Tap changer position
- Hottest transformer winding temperature

### Supported Devices

- T60 Transformer Protection System
- T35 Transformer Protection System
- 745 Transformer Protection System



Monitor total harmonic content in each phase for all windings



### Plug-and-Play Generator Monitoring

#### Use Viewpoint Monitoring with your Generator Protection Equipment

Instantly created overview screens show the operating condition of your generator and the status of your GE Multilin® relay. Further generator analysis can be performed with additional monitoring screens that monitor the value of all metered quantities, the generator temperature monitored by RTD's, and any alarms that have been detected by the relay. Additional screens provide historical information, indicating cause of the last generator trip, operating information the relay has learned about the generator, and any maintenance issues that may need addressing.

Instantly view critical information such as:

- Generator loading
- Real time power quantities (amps, volts)
- Cause of trip data
- Generator running hours
- History of generator trips
- Generator temperature

### Supported Devices

- G60 Generator Protection System
- G30 Generator Protection System
- 489 Generator Protection System



Improve maintenance efficiency by analyzing trip operations

### Plug-and-Play Feeder Monitoring

#### Use Viewpoint Monitoring with your Feeder Protection Equipment

Instantly created overview screens will show the operating condition of your feeder and the status of your GE Multilin® relay. Additional monitoring screens are available for analyzing all metering quantities, along with the power, demand and energy values that may be measured by the relay. If supported by the relay, synchronism screens will also be available for helping to determine if it is safe to close the breaker and energize the feeder.

Instantly view critical information such as:

- Breaker status
- Accumulated breaker arcing current
- Real time power quantities (amps, volts, demand, energy)
- Synchronism data

### Supported Devices

- F60 Feeder Protection System
- F35 Multiple Feeder Protection System
- 750/760 Feeder Protection System
- F650 Feeder Protection System
- 735/737 Feeder Protection System



Easily monitor synchronism levels needed for reclosing of circuit breakers





### Plug-and-Play Breaker Monitoring

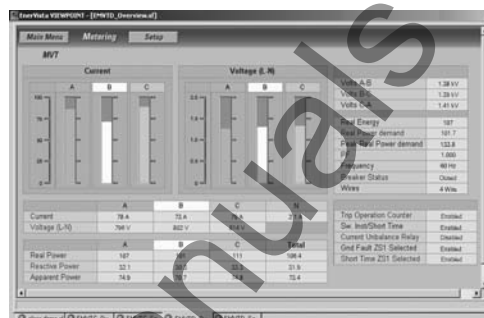
#### Use Viewpoint Monitoring with your Breaker Equipment

Instantly view critical information such as:

- Breaker status
- Number of breaker trip operations
- Real time current, voltage and power levels

### Supported Devices

- MVT Microversa Trip Unit
- EMVT Enhanced Microversa Trip unit



### Plug-and-Play Power Quality Monitoring

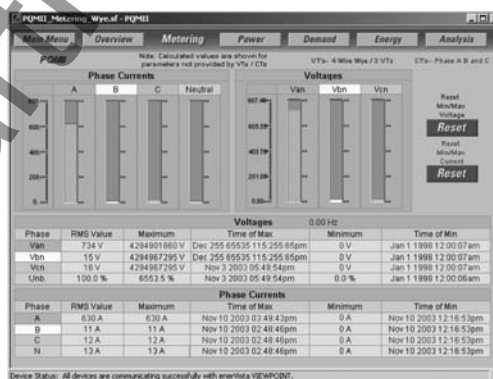
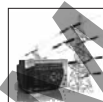
#### Use Viewpoint Monitoring with your Power Quality Equipment

Instantly view critical information such as:

- Power quality and equipment status
- Load unbalances using real-time and maximum & minimum values
- Cost of energy using inputs from revenue meters
- Amount of total harmonic distortion on the power system

### Supported Devices

- PQM / PQM II Power Quality Meter
- EPM 1000 Electronic Power Meter
- EPM 4000 Electronic Power Meter
- EPM 5000 Electronic Power Meter
- EPM 5200/5300/5350 Electronic Power Meter
- EPM 9450/9650 Electronic Power Meter



### Plug-and-Play Backup Power Monitoring

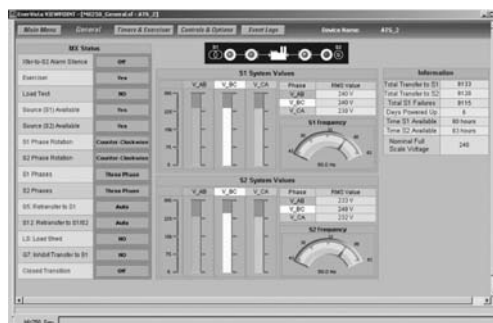
#### Use Viewpoint Monitoring with your Backup Equipment

Instantly view critical information such as:

- Availability of normal and emergency power sources
- Status of power source connections
- Real time voltages and frequency
- Switch status, timer settings, and control switch position
- Stored events and exerciser schedules

### Supported Devices

- MX200 Controller
- MX150 Controller
- MX250 Controller
- Lan Pro UPS
- SG-Series UPS





### Single-Line Monitoring and Control

#### View the status of your Power System on Customizable Single-line Diagrams

Viewpoint Monitoring provides the tools to easily create customized single-line diagrams, providing full monitoring and control. This powerful tool will communicate with your supported devices and put your facility's energy system at your fingertips from either a local or a remote location.

#### Monitor all Power System Devices

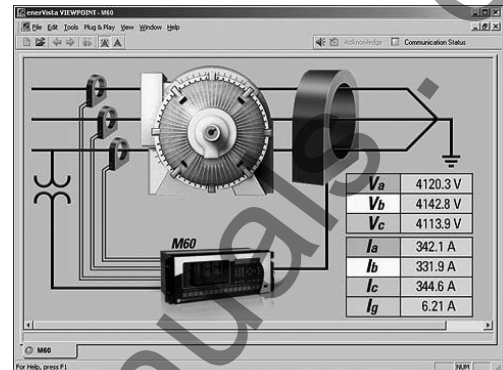
- Provide a system wide view of your power system on one single-line monitoring screen
- Analyze the magnitude of all critical power quantities measured by your devices
- Generate alarm warnings when measured values exceed critical levels
- Create links to multiple monitoring screens to analyze power system equipment in more details

#### Control Power System Equipment from Remote Locations

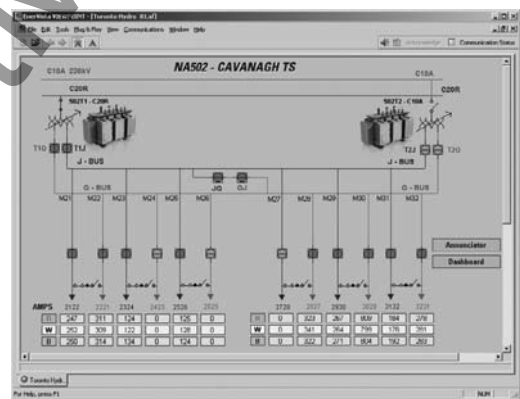
- Send commands to your devices to control and change the status of power system equipment (breakers, switches, isolators)
- Verifies intent of operation by requiring a two-step process by the operator sending the command
- Validates users authority by requiring passwords to be sent to protection relays or other devices before operation occurs

#### Easily Create Customized Single Line Monitoring Screens

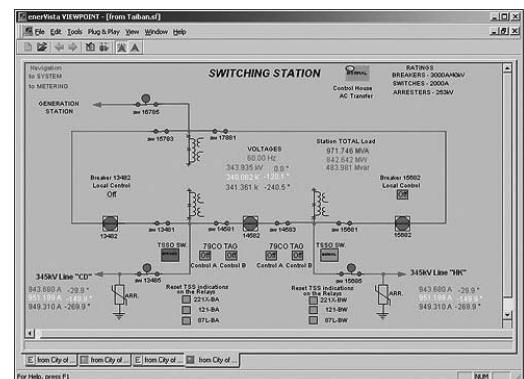
- Drag and Drop tools for creating single line diagrams
- Provides all necessary symbols for replicating power systems (transformers, breakers, CT's and PT's)
- Import graphics to make single-line diagrams intuitive and easy to understand
- Contains pre-loaded memory maps for easy displaying of power system values and status
- Provides ability to create customized or "Virtual" monitoring points in a powerful Formula Editor



Monitor the status and loading of your motors from anywhere in your facility



Monitor the status of your entire power system on one screen



Easily monitor the state of your power system



### Automatic Event and Waveform Retrieval

Automated archiving of event and waveform data from GE Multilin® devices ensures you will always have data available for diagnosing power system events.

### Event Logging

The event records from GE Multilin® devices can be automatically downloaded from each device and stored in a system wide sequence of event record. Viewpoint Monitoring will continually poll each GE Multilin® device to see if any new events have been added to that device's event record. Once a new event has been detected, the event record will be downloaded and the new events will be stored in the system wide sequence of events record.

### Waveform Archiving

The waveform (oscillography) files from GE Multilin® devices can be automatically downloaded from each device and stored on your hard drive. Viewpoint Monitoring will continually poll each GE Multilin® device to see if any new waveform files have been created. Once a new waveform has been detected, the file will be downloaded and stored onto your PC.

### Event Viewing

The Event Viewer stores and displays information about all of the events recorded in your system. Each event in the record contains the following information:

- Event Time
- Event Type
- Source Name
- Source Type
- Event Cause

This data can be sorted by any of the fields indicated above.

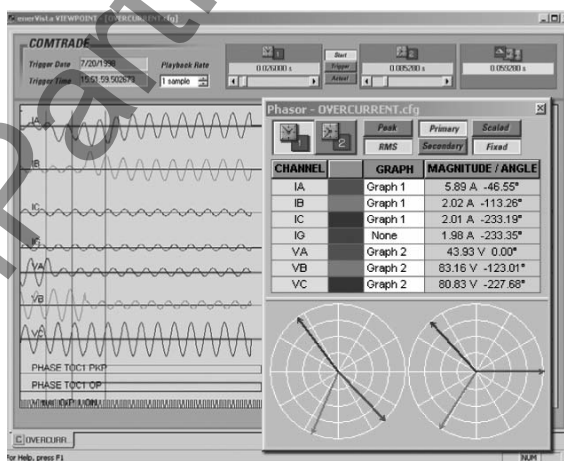
### Waveform Viewing

Diagnose waveform fault data that has been recorded in any power system device in a Time-based, Phasor Quantity or Tabular view. This Waveform View utility will also allow you to:

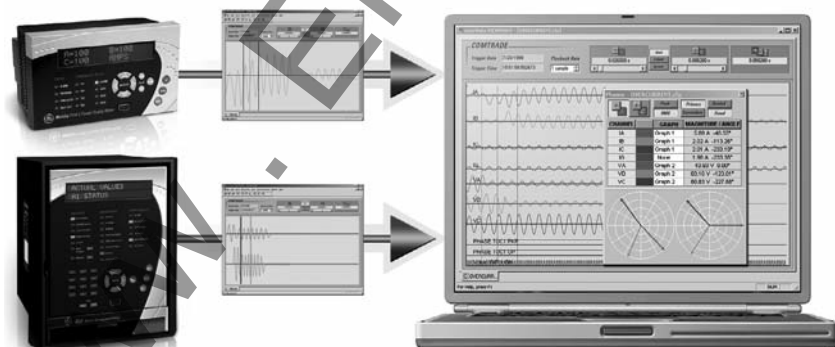
- Convert waveforms that were stored in CSV format to COMTRADE compatible files (SR Family, PQM)
- Merge and overlay waveforms that were recorded from multiple devices
- Identify the harmonic content in the monitored parameters

Created Time	Event Type	Source Name	Source Type	Event	Event Code	Acknowledge
10/02/2005 13:41:27.745683	Alarm	T60_4	UR	Contact Input 2 On	1005	Alarm Information - Unacknowledged
10/02/2005 13:41:27.747480	Alarm	T60_4	UR	Contact Input 2 Off	1538	Alarm Information - Unacknowledged
10/02/2005 13:39:37.249030	Alarm	T60_2	UR	PHASE TOCI DPO A	42000	Alarm Information - Unacknowledged
10/02/2005 13:39:37.232054	Alarm	T60_2	UR	PHASE TOCI PKP A	34255	Alarm Information - Unacknowledged
10/02/2005 13:39:37.168192	Alarm	T60_2	UR	PHASE TOCI DPO A	42000	Alarm Information - Unacknowledged
10/02/2005 13:39:37.168192	Alarm	T60_2	UR	PHASE TOCI DPO C	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.168192	Alarm	T60_2	UR	PHASE TOCI DPO B	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.121770	Alarm	T60_4	UR	PHASE TOCI DPO B	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.113444	Alarm	T60_4	UR	PHASE TOCI DPO C	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.113444	Alarm	T60_4	UR	PHASE TOCI DPO A	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.113444	Alarm	T60_4	UR	PHASE TOCI PKP A	43524	Alarm Information - Unacknowledged
10/02/2005 13:39:37.020708	Alarm	T60_2	UR	Virtual Output To	3000	Alarm Information - Unacknowledged
10/02/2005 13:39:37.020708	Alarm	T60_2	UR	PHASE TOCI DPO A	41905	Alarm Information - Unacknowledged
10/02/2005 13:39:37.024542	Alarm	T60_2	UR	PHASE TOCI PKP B	42000	Alarm Information - Unacknowledged
10/02/2005 13:39:37.005794	Alarm	T60_2	UR	PHASE TOCI PKP C	44033	Alarm Information - Unacknowledged
10/02/2005 13:39:37.005794	Alarm	T60_2	UR	PHASE TOCI PKP B	25841	Alarm Information - Unacknowledged
10/02/2005 13:39:37.005794	Alarm	T60_2	UR	PHASE TOCI PKP C	38913	Alarm Information - Unacknowledged
10/02/2005 13:39:37.007712	Alarm	T60_2	UR	PHASE TOCI PKP C	29937	Alarm Information - Unacknowledged

Create system wide Sequence of Event Records to determine that your equipment operated correctly for power system Faults



Analyze waveform fault data recorded from your devices



### Trending Reports

#### Create a Historical Archive of Monitored Data from Multiple Devices

##### Data Logging

- Log and Trend the value of any monitored analog or digital point
- View logged data for any recorded time period you desire

##### Records

- Create up to 10 customized records
- Store up to 50 points per record for 500 points logged in total

##### Chart

- View logged data in a pre-configured or customized date range for trending analysis

##### Archiving Data

- Manually archive recorded data for storage onto network drives to free space on your local computer

##### Exporting Data and Print

- Export data into an Excel format for easy data manipulation and analysis
- Printer-friendly option for the data that is logged in the trending reports

### Annunciator Alarming

#### Receive Instant Notification of System Alarms from any Device on your Network

Viewpoint Monitoring Annunciator Alarming enables you to monitor any measured value and generate alarms whenever a digital status changes state, or an analog value drifts beyond a preset value.

##### System Alarming

- Create an alarm on the changing of state of any monitored digital point or when an analog point changes beyond any programmed threshold.
- Alarms can be performed through visual, audio, or e-mail notification

##### Audio Notification

- Separate sounds for Alert Status and Alarm Status
- Audio notification of alarms and alerts will continue until the alarm state is acknowledged by the operator

##### Visual Notification

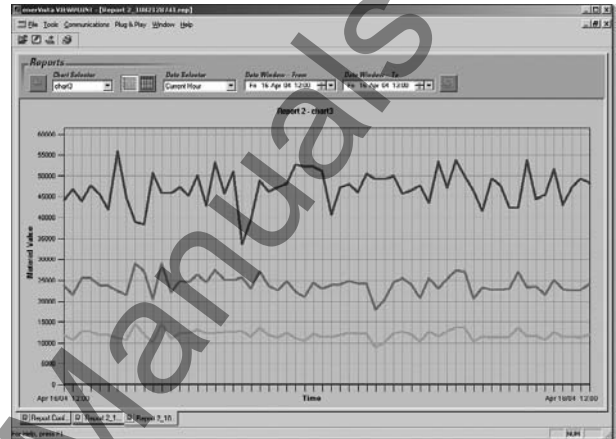
- Annunciator screen shows the status of the monitored point
- The alarmed point will flash in a color chosen by the user until the Alarm is reset by the operator

##### Email Notification

- Alarming of any monitored point can automatically generate an email to notify users of the alarm
- A different email address can be entered for each monitored point

### Historical Record of Monitored Data

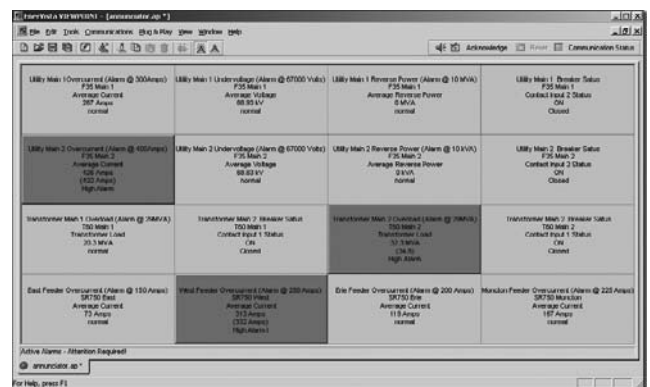
- Trend up to 500 data points
- Records data with 1 minute resolution indefinitely
- View data in time based graphical or tabular format



Log power level data from multiple devices at one time

### Instant Alarm Notification

- Create alarms on any monitored analog or digital data point
- Receive alarm warnings through Audio, Visual or Email Notification



Get Instant notification of system alarms from any device on your network



### Third Party Device Support

Any 3rd Party Device that supports the Modbus RTU or Modbus TCP/IP protocol can be added to the Viewpoint Monitoring database.

This allows you to use other non-GE Multilin® devices that may be found in your facility in Viewpoint Monitoring.

3rd party devices can be used in your:

#### Single-Line Diagrams

- Read the status of digital point
- Read the value of analog data
- Send commands to control power system equipment

#### Annunciator Panel

- Alarm when analog value surpasses a preset level
- Alarm when digital points change state

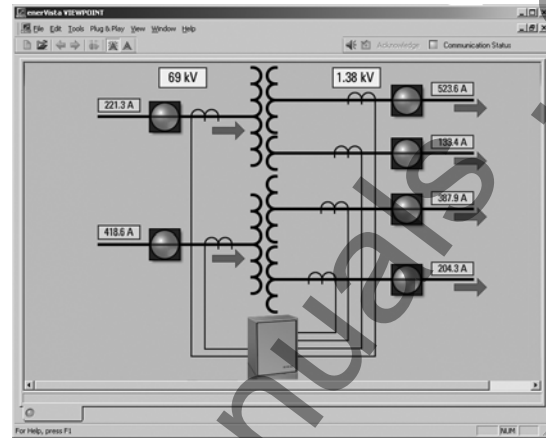
#### Trending Reports

- Log the value of analog points over prolonged time periods
- Log the status of digital points on your device

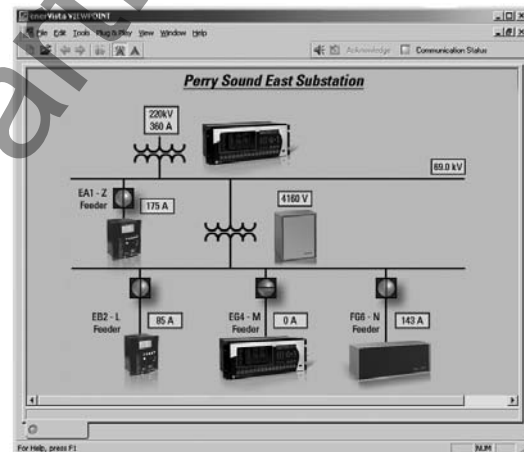
### Viewpoint IEC61850 Option

The Viewpoint IEC61850 option gives you all of the power and functionality of Viewpoint Monitoring and expands it into communicating with any IEC61850 compliant device. This is one of the first HMIs that uses the IEC61850 protocol to offer real-time monitoring, trending and alarming seamlessly across all IEC61850 compliant devices in your substation.

- Communicate with any IEC61850 device
- Simplify the process of integrating multiple vendor's devices into a monitoring system
- Viewpoint Monitoring automatically retrieves memory maps from any IEC61850 compliant devices
- Start monitoring your devices immediately
- Standardization of naming of all power system quantities across all vendors



Easily integrate third party devices into Single-Line Diagrams, Annunciator Alarms, and Trending Reports



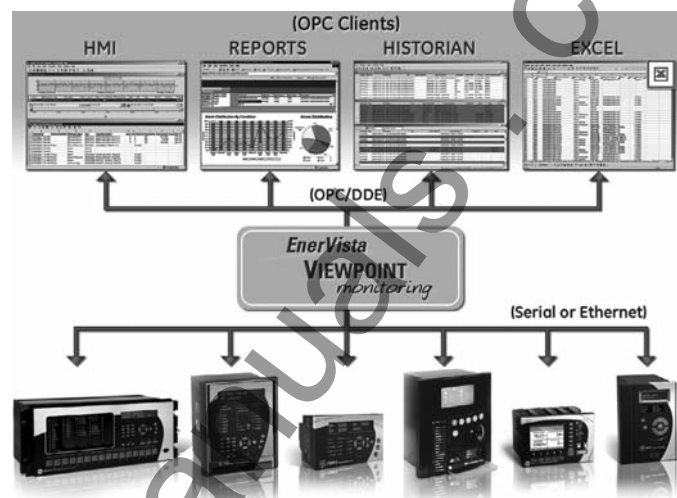
Monitor all of the IEC61850 compatible devices in your substation



#### OPC/DDE Server Option

Viewpoint Monitoring can send the data that is being read from the relays and meters to any third party OPC compliant automation or monitoring system. With the pre-configured memory maps of GE Multilin® devices that comes with Viewpoint Monitoring, you can reduce the time and effort required to import essential data into your monitoring, automation and control systems.

- Send up to 3000 data points (Base package) or 9000 (Extended package) data points to an OPC/DDE client
- Supports the entire library of devices that comes with Viewpoint Monitoring
- Provides the ability to send data from third party devices added to the Viewpoint Monitoring database



Integrate the data retrieved by Viewpoint Monitoring into a larger monitoring or automation system

#### Viewpoint Monitoring Software Selection Guide

VP	*	*	*	*	Viewpoint Monitoring Base Package -50 devices/3000 points
	1 5 10 50				Single Pack 5 Pack 10 Pack 50 Pack
		61850 OPC			No Additional Option IEC61850 Option OPC/DDE Server Option
			G1		Standard 1 Year Updates Additional 1 Year Updates
				E	Extended Package Option -150 devices/9000 points



#### Powerful OPC/DDE Server For GE Multilin® Devices

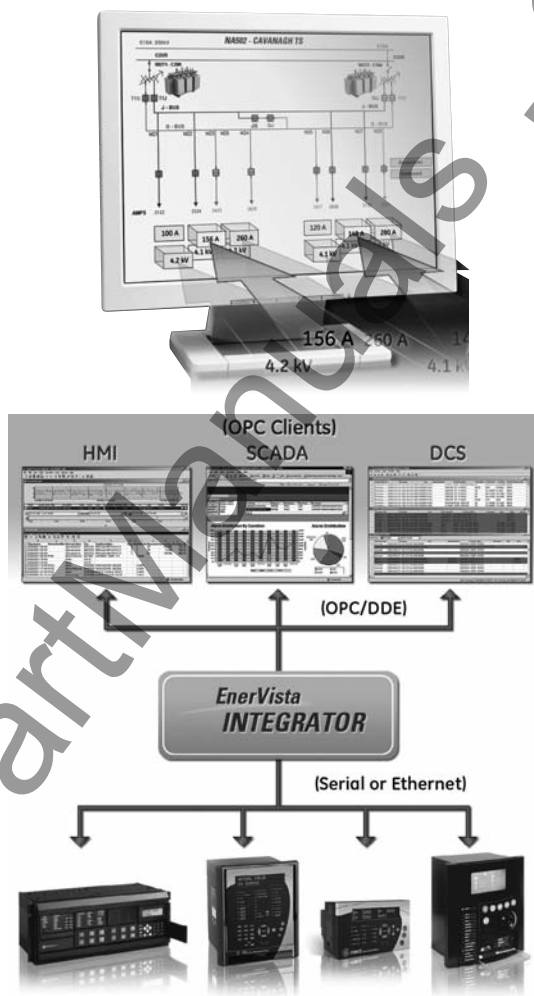
EnerVista® Integrator enables you to seamlessly integrate data from your GE Multilin® device into a new or existing automation system. With EnerVista® Integrator, you receive pre-configured memory maps for all GE Multilin® devices, reducing the time and effort required to import essential data into your EMS, DCS, or SCADA systems.

#### Key Benefits

- Reduce the time and cost required to integrate GE Multilin® relays and meters into new or existing DCS, energy management or SCADA systems.
- Ensures fault data recorded in relays and meters is archived and always available for fault analysis
- Requires no firmware upgrades or setting changes to incorporate GE Multilin® devices into monitoring systems
- Allows for integrating of 3rd party Modbus devices into OPC compliant monitoring systems
- Windows Vista compatible

#### Key Features

- Provides data from GE Multilin® devices to any OPC or DDE client (i.e. Cimplicity, iFIX, WonderWare, Citect)
- Contains pre-configured memory maps for most GE Multilin® devices
- Automatically collect event records stored in GE Multilin® devices
- Merge event records from multiple GE Multilin® devices into a single system wide Sequence-of-Event Record
- Automatically retrieve waveforms recorded in GE Multilin® devices and archives them onto the server's hard-drive
- Communicate with up to 300 devices using up to 30000 tags (points) of data



**EnerVista® Integrator will efficiently link the information from your GE Multilin® devices to your monitoring, control and data collection systems.**



### Powerful OPC/DDE Server for GE Multilin® Devices

EnerVista® Integrator is designed to provide seamless integration of your GE Multilin® devices into any new or existing monitoring or control system. Containing the memory maps for most GE Multilin® devices, EnerVista® Integrator eliminates the need for programming all of the mnemonics previously associated with HMI and SCADA system integration, greatly reducing the cost and time for commissioning.

### Device Setup

Configuring GE Multilin® devices in EnerVista® Integrator is as simple as establishing communication with the device.

- Intuitive setup allows configuration of devices similar to EnerVista® Viewpoint and EnerVista® Setup software
- Provides configuration settings for both serial or Ethernet communications
- Allows testing of communications to ensure the device has been configured correctly

### Third Party Devices

Non-GE devices that support Modbus RTU or Modbus TCP/IP can be integrated into EnerVista® Integrator, providing a simple way to incorporate all of your devices into a OPC/DDE monitoring and control system.

- Add third party devices that support Modbus RTU or Modbus TCP/IP
- Configure Modbus mnemonics directly in Viewpoint Integrator
- Reduce integration time for multiple installations of Viewpoint Integrator by importing and exporting mnemonics files

### Automatic Event and Waveform Retrieval

Automated archiving of event and waveform data from GE Multilin® devices ensures you will always have data available for diagnosing power system events.

### Event Logging

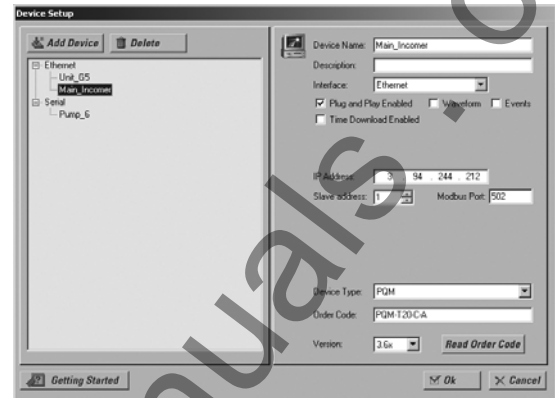
The event records from GE Multilin® devices can be automatically downloaded from each device and stored in a system wide sequence of event record. Viewpoint Monitoring will continually poll each GE Multilin® device to see if any new events have been added to that device's event record. Once a new event has been detected, the event record will be downloaded and the new events will be stored in the system wide sequence of events record.

### Event Viewing

The Event Viewer stores and displays information about all of the events recorded in your system. Each event in the record contains the following information:

- Event Time
- Event Type
- Source Name
- Source Type
- Event Cause

This data can be sorted by any of the fields indicated above.



Common look-and-feel Device Setup for connecting both GE Multilin® and third-party IEDs via OPC/DDE.

Event Time	Event Type	Source Name	Source Type	Event	Event Code	Acknowledge
10/10/2000 13:41:27	Alarm	TBL_4	UPS	Contact Input 2 OK	1026	Alarm Information - Unacknowledged
10/10/2000 13:41:27	Alarm	TBL_4	UPS	Contact Input 2 OK	1026	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE TOC1 DPO A	4000	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE TOC1 PNP A	3800	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE TOC1 DPO A	4000	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE TOC1 DPO C	4040	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE TOC1 DPO B	400A	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_4	UPS	PHASE TOC2 DPO B	4002	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_4	UPS	PHASE TOC1 DPO C	4040	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_4	UPS	PHASE TOC2 DPO B	400A	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_4	UPS	PHASE TOC2 DPO C	4005	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_4	UPS	PHASE TOC1 DPO A	4000	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	Unack Delay 10 Sec	3000	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC DPO A	4100	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC DPO B	4000	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC DPO C	4002	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC PNP B	3900	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC DPO B	3900	Alarm Information - Unacknowledged
10/10/2000 13:39:37	Alarm	TBL_2	UPS	PHASE IOCC DPO C	3900	Alarm Information - Unacknowledged

Create system wide Sequence of Event Records to determine that your equipment operated correctly for power system Faults



### Device Setup

EnerVista® Integrator Device Setup is designed to allow quick configuration of your GE Multilin® devices. Third party devices that support Modbus RTU or Modbus TCP/IP can also be configured in the Device Setup.

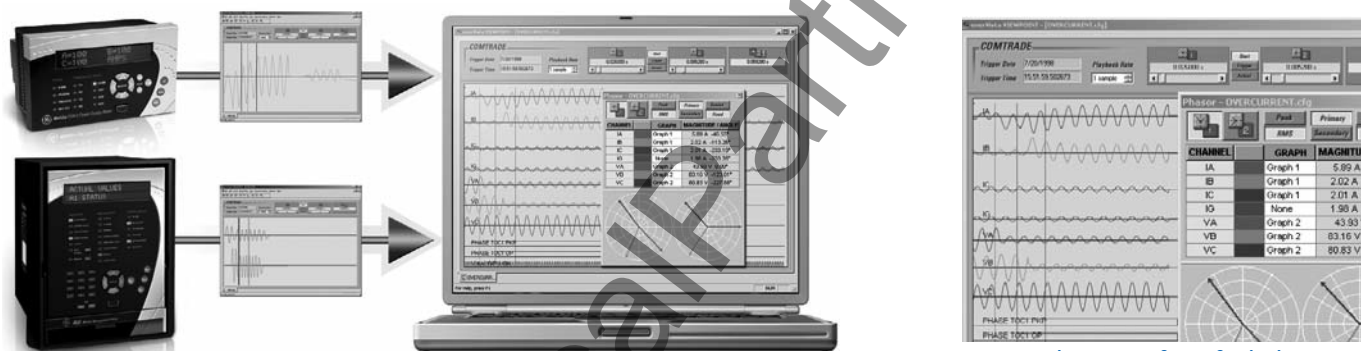
### Waveform Archiving

The waveform (oscillography) files from GE Multilin® devices can be automatically downloaded from each device and stored on your hard drive. Viewpoint Monitoring will continually poll each GE Multilin® device to see if any new waveform files have been created. Once a new waveform has been detected, the file will be downloaded and stored onto your PC.

### Waveform Viewing

Diagnose waveform fault data that has been recorded in any power system device in a Time-based, Phasor Quantity or Tabular view. This Waveform View utility will also allow you to:

- Convert waveforms that were stored in CSV format to COMTRADE compatible files (SR Family, PQM)
- Merge and overlay waveforms that were recorded from multiple devices
- Identify the harmonic content in the monitored parameters



Analyze waveform fault data  
recorded from your devices

### Integrator Software Selection Guide

EVI	* EnerVista™ Integrator
1000	1000 Point License OPC/DDE Server with Waveform and Event Server
5000	5000 Point License OPC/DDE Server with Waveform and Event Server
30000	30000 Point License OPC/DDE Server with Waveform and Event Server

### Integrator Add-On Packages

#### Cimplicity HMI Packages

PLCMCSWCMPLG01	EnerVista® Integrator 30,000 points GE Device Wizard Screens for Cimplicity DDE Simulator
PLCMPLMODBRTG01	EnerVista® Integrator 30,000 points Cimplicity Runtime License
PLCMPLWIZG01	EnerVista® Integrator 30,000 points Cimplicity Development License GE Device Wizard Screens for Cimplicity DDE Simulator
PLCMPLVIEWERG01	Cimplicity Viewnode Waveform Viewer and Event Logger

#### WonderWare HMI Packages

PL50PMCSMWWG01	EnerVista® Integrator 30,000 points GE Device Wizard Screens for InTouch DDE Simulator
PL50MODBRTG01	EnerVista® Integrator 30,000 points InTouch Runtime License
PL50PMCSWIZG01	EnerVista® Integrator 30,000 points InTouch Development License GE Device Wizard Screens for InTouch DDE Simulator
PL50PMCSVIEWG01	InTouch Viewnode Waveform Viewer and Event Logger



#### Unlock the Full Potential of your Electrical Network

For utilities, building owners, plant managers, plant engineers and maintenance departments, it has become an incredible challenge to understand all aspects of increasingly complex facilities having an array of equipment and processes. Hard lessons on the importance of energy management are being learned across all business sectors in the form of:

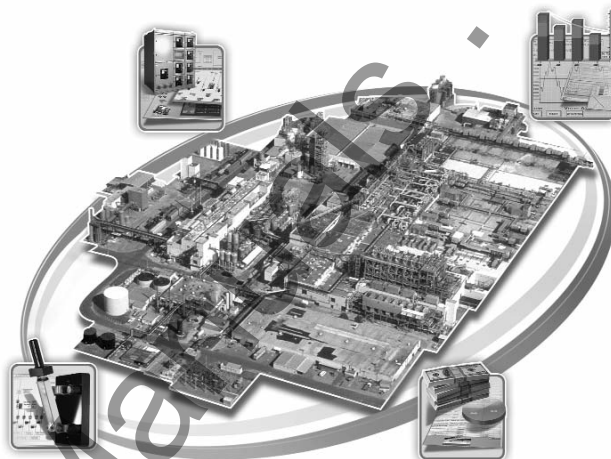
- Energy costs escalating out of control
- Revenue robbing process downtime
- Premature equipment failure
- Expensive system capacity upgrades

A large problem in facilities is the relative unknown about the use of energy and the power quality of the electrical network. The primary source of power and energy information comes from the few lines of data on the monthly power bill. Using only this, facility managers are being asked to develop strategies for energy savings, understand capacity profiles, and correct systems inefficiencies. Making decisions based on the 'final score' information of a power bill is a game plan for disappointment involving guesswork in analyzing problems, and implementation of trial & error solutions.

A clearer picture of exactly what is happening in a facility is a necessity. Data on not only the real-time status of a system, but also historical trending is essential, day-by-day, hour-by-hour, and minute-by-minute. For facility managers, the costly reality has been that what they don't know is hurting them. PMCS from GE Multilin® is the tool to shift the thinking to "What you do know, can help you"

#### PMCS – Fully Integrated Energy Management Systems

Let GE Multilin® help you shed some light on the unknowns of your system by providing a full, clear picture of your facility, and providing easy to use tools for implementing effective solutions. PMCS is a fully integrated Energy Management System that will reduce your cost of energy by optimizing the methods used to control both processes and equipment in order to utilize energy more economically and efficiently.

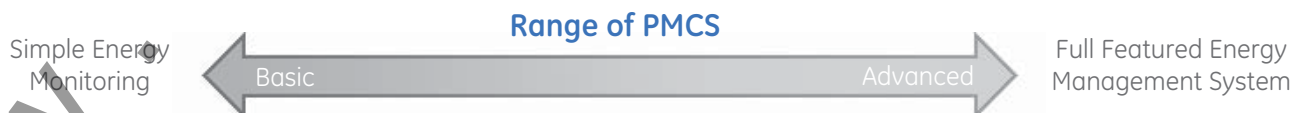


#### PMCS delivers a complete solution:

- Site Evaluation and Consultation
- Overall Project Management
- Complete Device Integration
- Communications Setup & Testing
- Site Specific Graphical Interfaces
- Hands On Training



PMCS (Power Management Control Systems) is a customized solution that can range from simple remote monitoring to a completely engineered automated control system. With PMCS you gain real-time access to GE Multilin® Intelligent Electrical Devices (IEDs), as well as to many other installed third party devices and systems. Integrated with HMI client software, PMCS delivers the graphical representations of substation equipment status, energy trends, remote control of devices, and automated responses to system conditions.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

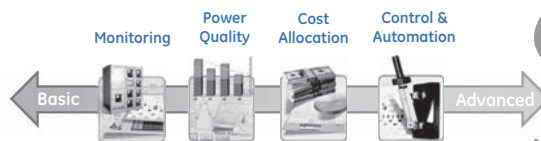
# GE Multilin® Value Added Services PMCS Energy Management Systems

## Section 18

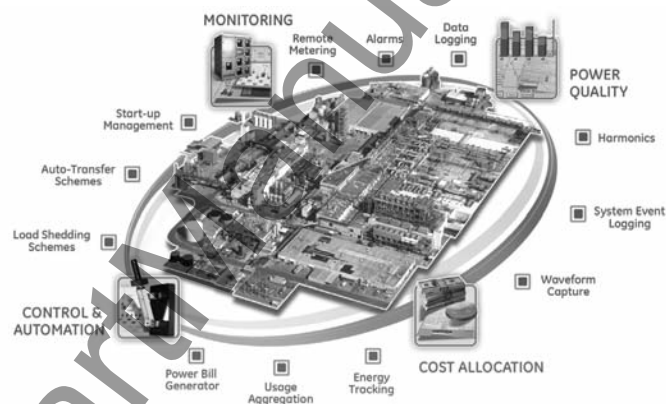
### BENEFITS

PMCS provides the tools to control energy costs, minimize downtime and outages, and optimize operations to increase productivity.

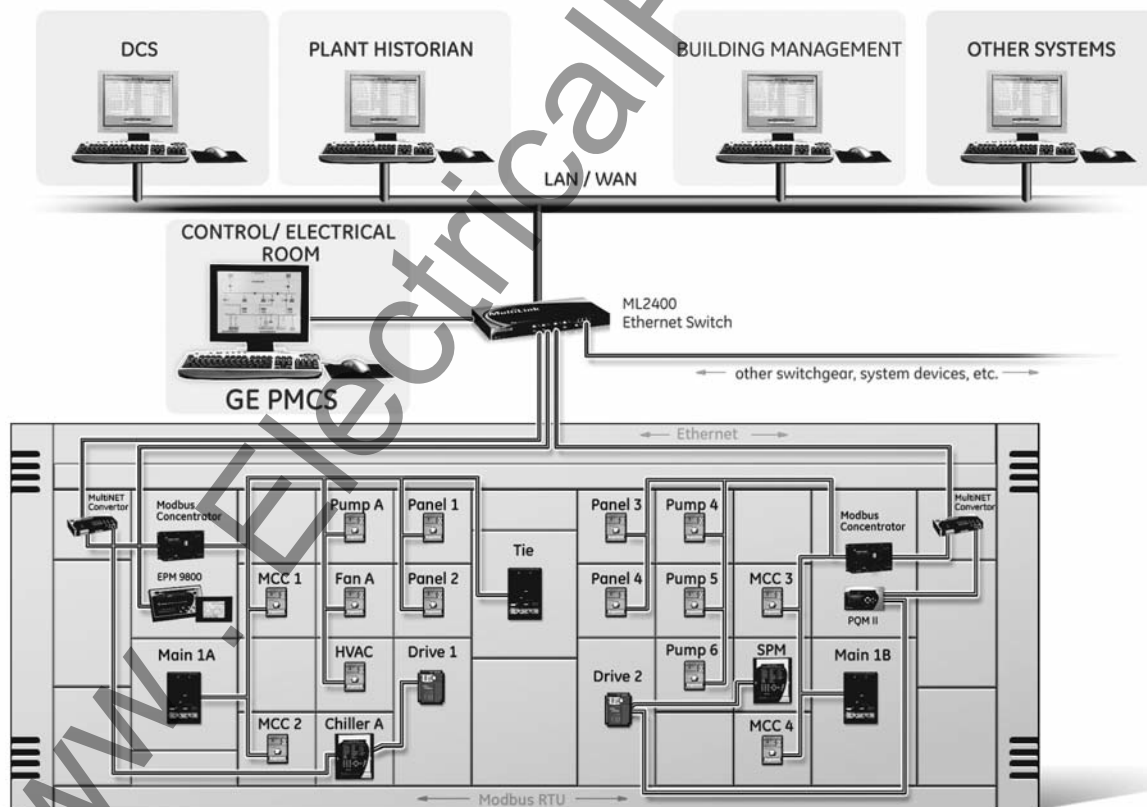
- Less downtime – Identify and correct problems before they lead to loss of power and/or costly damage to loads such as production equipment and computers.
- Reduced energy costs – Find ways to conserve power, correct billing errors, and reduce peak usage surcharges
- Improved predictive maintenance – Identify simple maintenance tasks so you can make scheduled corrections before they become problems.
- Faster corrective maintenance – Quickly pinpoint the root cause of problems using tools such as time-tagged alarms, sequence of events logs, and triggered waveform capture.
- Increased safety – Provide a centralized source of information, reducing the need for physical contact with equipment and reduce shop-floor or substation presence.
- Higher productivity – Free up maintenance and repair personnel to perform other needed duties.
- Improved power quality – Identify sources of “dirty” power, otherwise invisible, and take corrective action to save wear, and possible damage to critical production equipment and other loads.



PMCS delivers these benefits by implementing combinations of the four functional modules creating the most effective energy management system. The functional modules are Monitoring, Power Quality, Cost Allocation, and Control & Automation.



### Multiple Devices, Multiple Protocols . . . One Easy to Use System





## GE Multilin® Value Added Services Advanced Training Services

Section 18

In today's world of rapidly advancing technology and product innovation, GE Multilin® is committed to providing our customers with the high quality training they need to be safe, efficient, and successful. With GE Multilin® Advanced Training Services, we offer world-class CEU recognized courses in the areas of Power System Protection, Control, Maintenance, Communications, and Monitoring for:

- Protection Engineers
- Maintenance & Electrical Personnel
- HMI & System Integrators
- Power System Consultants

The skills learned through our courses will help maximize your organization's potential by helping meld a skilled workforce with powerful products.

### GE Multilin® Training Centers

At our Training Centers, we offer regularly scheduled published courses with open enrollment. Our advanced Training Centers, located in North America and Europe, contain equipment for hands-on interaction using:

- Relays & meters
- Relay test tools
- Communications equipment
- Personal computers

The key to the success of our training centers is our talented group of instructors. At GE Multilin®, we pride ourselves on having seasoned instructors with years of experience in the protection industry who specialize in teaching technical topics.

At the GE Multilin® Training Centers, class sizes are kept small so instructors can interact with each student. Students receive comprehensive course manuals with the course notes and detailed lab exercises to ensure they can apply this knowledge in their workplace.

We also take our training on the road throughout the year by presenting our most popular training sessions at different North American centers. Visit [www.gemultilin.com/training](http://www.gemultilin.com/training) to keep updated as to when new locations, dates and course topics are added.



### On-Site Training Courses

To increase the number of employees who can benefit from our training, we offer the option of conducting training courses at your facility. These on-site courses can be customized to the specific range of topics you want covered. We provide all the necessary equipment and literature needed to duplicate the environment we offer at our Training Centers.



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications

# GE Multilin® Value Added Services Advanced Training Services

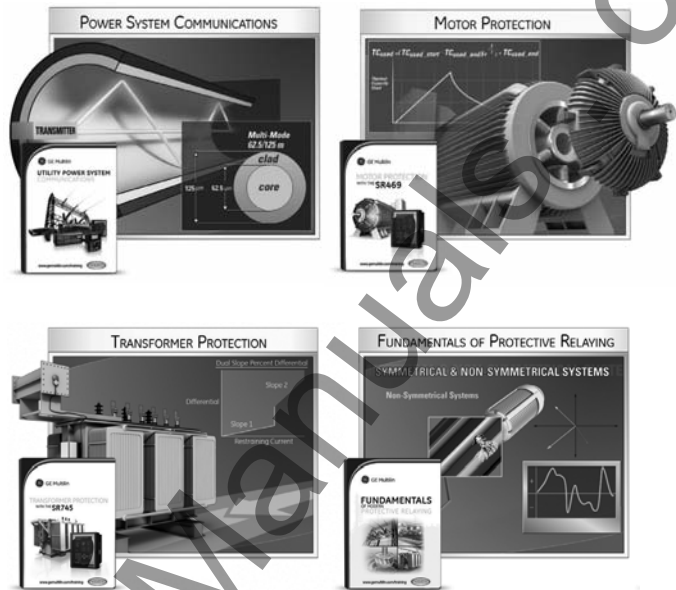
## Section 18

### Interactive Learning CDs

GE Multilin® offers the largest selection of computer-based training in the industry. Our interactive learning CDs cover concepts from the basics of protection theory, to configuring advanced relays. These interactive multimedia presentations make complex concepts easy to understand. Students are able to learn at their own pace and review the course material as often as desired.

### CEU Credits Now Offered

The Advanced Training Center at GE Multilin® is authorized by the International Association for Continuing Education and Training (IACET) to award Continuing Education Units (CEU) to participants who successfully complete our training courses. These CEU credits allow Engineers and Technicians to maintain their professional accreditation. Please refer to the course agenda for the number of credits awarded.



### Our Most Popular Courses and Learning CDs

Theoretical Courses	Catalog Number
Fundamentals of Modern Protective Relaying	TRNG-FMPR
Power System Protection for Industrial Facilities	TRNG-PIND
Power System Protection for Utilities	TRNG-UIIND
Industrial Power System Communications	TRNG-ICOM
Introduction to the IEC61850 Protocol	TRNG-61850

Product Application Courses	Catalog Number
Distribution Protection Principles and Relaying (SR745, SR750, SR760)	TRNG-DIST
Motor Protection Principles and Relaying (239, 369, SR469, SPM)	TRNG-MOTR
Generator Protection Principles and Relaying (SR489, DGP, G60)	TRNG-GEN
Transmission Line Protection Principles and Relaying (ALPS, D60, L90, L60)	TRNG-LINE
UR Platform	TRNG-URPL

Interactive Learning CDs	Catalog Number
Fundamentals of Modern Protective Relaying	TRCD-FMPR-C-S-1
Utility Power System Communications	TRCD-UCOM-C-S-1
IEC61850	TRCD-61850-C-S-1
Motor Protection with SR469	TRCD-M469-C-S-1
Distance Protection with the D60 Relay	TRCD-D60-C-S-1
Transformer Protection with the SR745	TRCD-SR745-C-S-1
Generator Protection with the SR489	TRCD-SR489-C-S-1

Check with [www.GEMultilin.com/training](http://www.GEMultilin.com/training) for our complete list of training courses and CDs.





#### Consulting Services

GE Multilin® offers a wide range of services to assist you with solutions to your Power Protection challenges. Our team of experienced Consulting Services Engineers can help you with end-to-end solutions or specific activities including designing, commissioning and maintaining protective relaying systems and power system protection devices.

#### Design of Protection & Automation Solutions

From new power systems to the upgrade of existing systems, trust the experience of GE Multilin® to evaluate, design and deliver.

##### Performing Protection System Studies

- Arc Flash Studies
- Load Flow & Fault Studies
- System & Relay Coordination Studies
- System Transient Studies using EMTP and RTDS

##### Reviewing Relay Logic & Settings Files

- Recommending changes to meet IEEE, NERC Standards
- Improving IED Utilization

##### Designing Customized Protection & Automation Systems

- Creating Relay Settings Files
- Developing Engineering Drawings
- Equipment Selection
- End-to-End Solutions

##### Designing Wide Area Protection Schemes

- High-speed Digital Teleprotection
- Transmission/Distribution Remedial Action Schemes (RAS)
- System-Wide Peer-to-Peer Communications using IEC61850 GSSE/GOOSE

##### Creating Automatic Transfer Schemes

- Developing Custom Logic and Settings Files
- In-house Verification Testing



#### Power System Modeling and Protection Performance Testing

At our in-house RTDS Lab, GE Multilin® engineers create highly accurate computer models of your power system and its components (based on EMTP) in order to perform real-time closed loop testing. System behavior can be simulated and analyzed under a variety of fault conditions.

Literally thousands of fault scenarios can be run on your system model using automated test scripts. Our engineers analyze the results and manually step you through any abnormal or unexpected system operations. We then assist with recommendations on alternate protection schemes, equipment selection, and optimizing relay settings and control logic. RTDS test results and our recommendations for system improvement, are provided in a detailed report along with the relay event records and oscillography files.

GE Multilin® can help you understand how your power system and its protection and control devices will respond to failure situations. Gain the assurance and peace of mind of knowing that your protection and control functions will operate as required when you need them most.

#### Real Time Digital Simulator (RTDS) Testing

- Time-domain (transient) modeling of large power systems
- Playback of large COMTRADE files for protection testing
- Flexible AC Transmission Systems (FACTS), wind generator modeling

#### Protection Scheme Performance Verification

- Validate protective relaying schemes against customer power system
- Parallel performance testing of different protection philosophies
- Testing of GE and non-GE protection IEDs
- Scheme testing using IEC61850 GOOSE/GSSE
- Complete test reports and documentation including event sequence and oscillography

#### On-Site Field Services

Have the experts who design and build your relays help you evaluate, test and commission your protection and control system. Our team of knowledgeable field engineers can test and verify that your protection devices are connected properly and will operate as designed.

#### Site/System Surveys

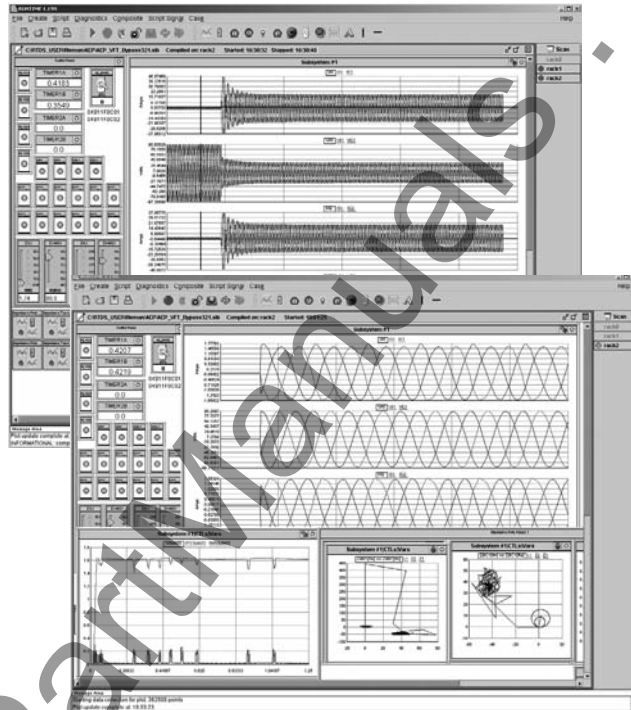
- Document Existing Protection and Control Systems
- Recommendations Report

#### Protection System Commissioning

- Relay & Panel Testing
- Wiring Verification

#### Protection System Field Troubleshooting

- Fault Data Collection & Analysis
- Recommendations & Solutions
- Upgrading Relay Firmware
- Uploading Relay Settings Files



### Global One Stop Solutions

GE Multilin® Packaged Solutions is a comprehensive offering that brings tremendous value to our customers in meeting their power system protection, control, metering and communication needs. By providing a complete solution where all of the parts are engineered to work together, Packaged Solutions save time and money while increasing performance and reliability. Join the growing number of satisfied Utility and Industrial customers who trust GE Multilin®'s expertise to handle the following project requirements:

- Project Management
- Material Procurement & Sourcing
- Panel Design & Construction
- Relay setting upload
- Panel testing & protection verification
- Commissioning

Choose from a number of available pre-engineered Packaged Solutions, or work with GE Multilin® Consulting Services to provide a custom package to best fit the application. Indoor or outdoor, free standing or pole-mounted, our repeatable and ready-to-install solutions use highly reliable GE Multilin® products for a wide variety of applications.

- Generators and Distributed Generation (DG)
- Transformers & Reactors
- Transmission and Sub-transmission Lines
- Capacitor Banks
- Distribution Feeders
- Reclosers & Pole-top RTUs
- Motors and Pumps
- Power Quality and Revenue Metering
- Remedial Action Schemes (RAS)
- Wide-Area Special Protection Systems (SPS)

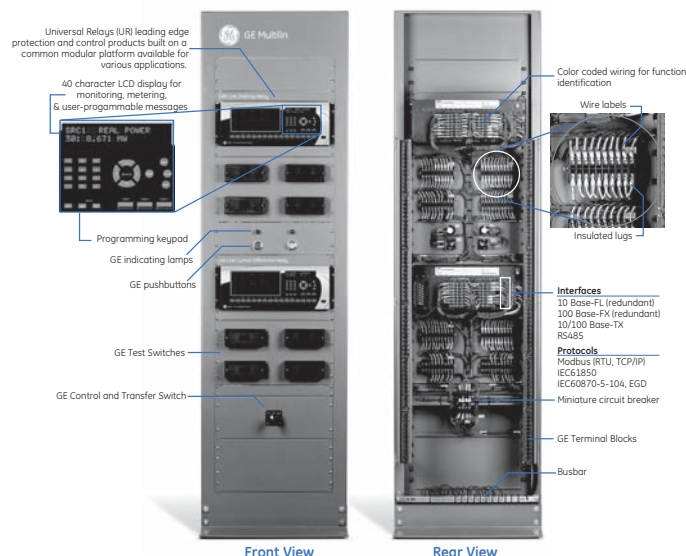
GE Multilin® Packaged Solutions has the flexibility to create the look, feel, and functionality required to suit our global customer's. Panels are provided with powder coated painted finish available in any single color to match specific project specifications.

All wiring used in our solutions is either flame resistant or selfextinguishing and conforms to international standards and individual customer requirements. Wiring is run in the ducting to keep the layout organized, and color-coded by function for easy identification (example: Green for Ground, Blue for DC Power, Red for CT's, Black for VTs).

Labelling is also fully customizable from our standard white on black, with laminated panel labels fitted on the front, back, and inside of cubicles. Terminal block markings and test switch labels are provided to customer specifications. Customized LED labels on the relays can also be created to match the programmed functionality of the devices.



### Freestanding Rack



**Publications and Reference:** See Section 22 for a complete list of additional product-related publications



# GE Multilin®

## Protection, Control, Metering and Communication Solutions

### Product Upgrades and Replacements

## Section 18

#### [SR Relays Basic to Enhanced Upgrade](#)

Upgrade basic SR System to enhanced SR System

#### [169/269 to 369](#)

Replace 169 Motor Management Relay® with the 369 Motor Protection System

#### [139 to 239](#)

Replace 139 Motor Management Relay® with the 239 Motor Protection System

#### [P4A to 239](#)

Replace P4A Protection Relay with the 239 Motor Protection System

#### [MTMPlus to PQM II](#)

Replace MTMPlus Meter with the PQM II Power Quality Meter

#### [IAC, IFC, SLR, ACR, MDP to MIF II](#)

Replace IAC, IFC, SLR, ACR, MDP Protection Relays with the MIF II Feeder Protection System

#### [DGP Digital Generator Protection Replacement](#)

Replace DGP with the G60, G30, 489 or G650

#### [ALPSTM Advanced Line Protection System Replacement](#)

Replace ALPSTM with the L90, L60, D60 or D30

#### [LPS-OTM Generator Backup Protection Replacement](#)

Replace LPS-OTM with the D60 or G60

#### [LPS-DTM Line Protection System Replacement](#)

Replace LPS-DTM with the L90, L60, D60 or D30

