**Features and Benefits**

- FlexLogic™ and distributed FlexLogic™
- FlexElement™ universal comparator
- Virtual and expandable I/Os to reduce hardware costs
- Flash memory for easy upgrades
- Common drawout modules to reduce spare parts costs
- Common software and protection elements reduce training costs
- High-accuracy metering and oscillography and digital fault recording
- Peer-to-peer communications for reduced wiring and high-speed networking

**Applications**

- Substation and industrial plant automation of protection, control and metering
- Predictive maintenance through data analysis and trending
- enerVista.com compatible (see page 275)

**Monitoring and Metering**

- Current, voltage, power, power factor, frequency
- Contact input and output status
- 1024 time-tagged event recording, data logging and oscillography

**User Interfaces**

- URPC software for setting, monitoring
- RS232 port for local PC access and RS485 and Ethernet ports for remote access
- High-speed peer-to-peer Ethernet using MMS/UCA2, DNP 3.0, IEC and ModBus®/TCP protocols
- User-programmable LEDs and front panel display and keypad for local access
**FlexLogic™**

With GE’s extensive experience in the development of protection products and thoroughly tested algorithms, the UR Family of relays offer unparalleled high-performance protection. FlexLogic™ significantly simplifies the use of these algorithms while enabling powerful but flexible protection and control solutions. Traditionally, protective relay logic has been limited. Any unusual applications involving interlocks, blocking, or supervisory functions had to be hardwired using contact inputs and outputs if the requirement could be met at all. This would entail significant expense in implementation and troubleshooting. Alternatively, the only other option was to approach a manufacturer for a feature enhancement. If this approach was possible, it was rarely completed in a timely manner as the new feature had to be designed, implemented, and thoroughly tested.

Traditionally, protection logic was hard-coded and relatively inflexible.

FlexLogic™ minimizes the requirement for auxiliary components and wiring while making complex schemes easy to implement. The logic that determines the interaction of inputs, elements, and outputs is field programmable through the use of logic equations that are sequentially processed. The use of remote inputs and outputs in addition to hardware is available internally and on the communication ports for other relays to use (distributed FlexLogic™). The UR contact input/output capability is also expandable. The contact inputs can accept wet or dry contacts and contact outputs can be trip rated Form A, trip rated Form C, or Fast Form C.

High-Speed LAN Control

With the advent of the high-speed peer-to-peer communications LAN, a great deal of inter-device control wiring can be eliminated by performing inter-device control signaling via remote I/O over the LAN. As performance and functional requirements evolve to take advantage of the new possibilities brought about by high-speed peer-to-peer communications, the UR can just as easily evolve to remain in-step with user requirements and budgets.

Interoperability

Manufacturing Message Specification/Utility Communications Architecture (MMS/UCA2) protocol allows for the seamless connection of IEDs from multiple vendors. In addition to device interoperability, MMS/UCA2 is designed to control the substation via a LAN instead of through discrete wiring to an RTU. Peer-to-peer communication over Ethernet enables distributed control with a few IEDs and eliminates the need for an RTU to remote SCADA master. High-speed message transfer eliminates the need for large and costly hard-wired interconnections.

MMS/UCA2 enables high-speed trip and control via the substation LAN without complex fixed wiring to many auxiliary devices.
**FlexElement™**

**User-Definable Protection Functions**

In addition to state-of-the-art protection functions, the UR contains multiple universal comparators (FlexElement™). A FlexElement™ can be programmed to respond to any quantity measured by the relay (phase, ground and sequence currents and voltages, power, frequency, power factor, etc.). The element may respond to a signal or difference of any two signals. It can be programmed to respond to the level or rate-of-change of its input signal. Application examples include: positive sequence overcurrent, negative sequence overvoltage, overpower, low power factor, temperature differential, frequency rate-of-change, and more.

*FlexElement™ allows the user to program the relay to best suit custom requirements.*

**Protection**

**Multiple Settings Groups**

Six separate setting groups may be stored in the UR’s non-volatile memory. An easy-to-use and fully programmable mechanism is provided to instantly switch the active settings. Multiple settings groups apply to all the protection elements including line pickup and breaker failure.

**Monitoring and Metering**

**Basic Metering Functions**

Measured values include:

- Voltage phasors (both magnitude and phase angle)
- Voltage symmetrical components
- Current phasors
- Current symmetrical components
- Current true one-cycle RMS values
- Active, reactive, apparent power
- Power factor (all power values per phase and total)
- Energy and frequency

These signals are available for local display, accessible remotely using communications and can be stored in the oscillography record or data logger.

*Basic Recording Functions*

The recording capabilities of the UR include:

- Event recorder capable of storing 1024 time-tagged events (one microsecond tagging).
- Oscillography programmable by the trigger, content and sampling rate (maximum of 64 samples per cycle) and capable of storing up to 64 fault records.
- Data logger storing of up to 16 channels and programmable by content and sampling rate (from one second to one hour).

*Trip Circuit Monitoring*

DC battery voltage can be monitored across open output contacts, triggering an alarm when the voltage becomes virtually zero. A FlexLogic™ flag is set when the supervised circuit is interrupted. Current sensors in series with each trip contact can provide a series seal-in function.

**Communications**

**URPC Program**

The Windows®-based URPC program may be run on a PC with any Windows® operating system. The program may be used locally on the RS232 serial port or remotely on the other ports. It provides full access to the relay data with the following features:

- View actual values
- View relay status
- View/edit settings online/offline
- View event recorder for troubleshooting
- URPC tutorial for step-by-step help
- Relay firmware programming for upgrades

Metered parameters that may be viewed with the URPC program include current, voltage, apparent power (VA), real power (W), reactive power (var), and power factor.

*Current and voltage can be displayed in a graphical phasor format to analyze pre/post fault conditions.*

All status information such as target messages and digital input/output states may be viewed with the URPC program.

*URPC software allows easy viewing and editing of relay settings.*

Each UR has a sequence of events recorder which combines the recording of oscillography.
data. Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms, and self-test status. Each UR stores up to 1024 events with the date and time stamped to the nearest microsecond. This provides the information needed to determine a sequence of events, which can reduce troubleshooting time and simplify report generation in the event of system faults.

The oscillography records captured by the UR consist of current and voltage waveforms at 64 samples per cycle (up to 128 cycles), and digital parameter states. The number of pre-trigger and post-trigger cycles may also be selected. The oscillography feature of the URPC software is used to provide a visual display of power systems data and relay operation data captured during specific triggered events, and may be used for subsequent analysis.

In addition to its automatic generation of scheme logic diagrams, the URPC FlexLogic™ software interface simplifies control scheme programming. With its user-friendly design, individual equation definition parameters are entered on a line-by-line basis where they are easily defined and configured. In the event of a control scheme change, existing FlexLogic™ schemes may be conveniently modified within URPC via an insert/delete feature and uploaded to the UR. This significantly reduces the reconfiguration effort, saving time, money, and other valuable resources.

I ED programs like URPC are powerful tools that are regularly updated and provided at no charge. They can be downloaded from the GE Multilin website at www.GEindustrial.com/Multilin.

New Features

Direct I/O Messaging
This feature allows for the exchange of binary information (FlexLogic™ operands) between a number of UR IEDs over a dedicated fiber (single or multimode), RS422 or G.703 interface. No switching equipment is required as the IEDs are connected directly in a ring or redundant (dual) ring configuration. The feature is optimized for speed and intended for pilot-aided schemes, distributed FlexLogic™ applications or the extension of the I/O capabilities of a single UR chassis. In redundant ring configurations each message is sent simultaneously in both directions reducing delivery time and increasing dependability. Self-monitoring is built-in, allowing the user to ensure desired behavior of the scheme should the communications link fail. Using fiber optic connections and the direct I/O feature, one can network UR IEDs located up to 100 km apart without any extra communications equipment.

User-Programmable Push Buttons
Each UR can be ordered with optional large user-programmable push buttons. The push buttons are designed for use by field personnel for performing critical operations such as operating breakers, or locking out certain features in a secure and reliable way. Action of each push button is fully programmable. The push buttons can be labeled for ease of use while their operations are logged in the SOE record for troubleshooting purposes. Position of each push button is stored in a non-volatile memory so that it remains correct should the power supply fail and recover.

Redundant Power Supply
Each UR can be ordered with an optional redundant power supply. Both power supplies are operational all the time. Should a power supply or the battery system fail, the remaining supply takes over the entire load of the IED. Each power supply is specified independently; in particular they may be of two different voltage ranges. When used in conjunction with two independent battery systems, this feature provides substantial increase in protection availability.
UR Features

STATUS LED INDICATORS
- IN SERVICE: The relay is operating normally
- TROUBLE: Self-test detected a problem
- TEST MODE: The relay is in test mode
- TRIP: A trip command had been issued
- ALARM: An alarm condition is present
- PICKUP: Pickup condition detected

EVENT CAUSE LED INDICATORS
- VOLTAGE: Event caused by voltage
- CURRENT: Event caused by current
- FREQUENCY: Event caused by frequency
- OTHER: Event caused by other
- PHASE A: Phase was involved
- PHASE B: Phase was involved
- PHASE C: Phase was involved
- NEUTRAL/GROUND

RS232 SERIAL PORT
- Connect to a PC to run URPC
- Use for downloading settings, monitoring data, sequence of events reports, oscillography

EVENT CAUSE LED INDICATORS
- VOLTAGE: Event caused by voltage
- CURRENT: Event caused by current
- FREQUENCY: Event caused by frequency
- OTHER: Event caused by other
- PHASE A: Indicates which phase was involved
- PHASE B: Indicates which phase was involved
- PHASE C: Indicates which phase was involved
- NEUTRAL/GROUND

DISPLAY
- 40 character backlight LCD display visible in dim lighting conditions
- Used for programming, monitoring, status, fault diagnosis, user-programmable messages and settings

HOT KEYS
- RESET: Resets latched conditions
- USER 1 – 3: Open/close breakers

PROTECTIVE COVER
- Protects keypad when not in use
- Can be fitted with a seal

CUSTOMIZABLE LED PANEL
- Complements customizable programming feature
- Multi-format templates available

KEYPAD
- Numeric keypad and command keys allow full access to the relay
- Rubber keypad is dust tight and splash-proof with door
- Website address via HELP key for technical support

INTER-RELAY COMMUNICATION
- Fiber optic ELED and LASER
- G.703 (1 or 2 terminals) @ 64 kbps
- RS422 (1 or 2 terminals) @ 64 kbps

CONTACT INPUTS (Expandable)
- Configurable inputs may be used for:
  - Breaker status
  - Oscillography trigger
  - Control inputs
  - 0.5 msec scan time
  - User-programmable voltage threshold
  - User-programmable debounce time

CONTACT OUTPUTS (Expandable)
- Trip rated Form A relays with circuit monitors
- Form C relays that may be programmed for auxiliary functions
- Fast Form C relays for signaling

COMMUNICATIONS
- ModBus® RTU on RS485 @ 115 kbps
- MMS/UCA2, ModBus® TCP/IP, and DNP 3.0 on 10BaseT options

POWERFUL PROCESSORS
- Numerical data processing using a 32-bit CPU and 16-bit DSP (CT/VT)

MODULAR DESIGN
- Facilitates upgrades and replacement of units

CONTACT OUTPUTS (Expandable)
- Trip rated Form A relays with circuit monitors
- Form C relays that may be programmed for auxiliary functions
- Fast Form C relays for signaling

COMMUNICATIONS
- ModBus® RTU on RS485 @ 115 kbps
- MMS/UCA2, ModBus® TCP/IP, and DNP 3.0 on 10BaseT options
The following chart compares and lists all the features of the UR relays.

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<th>C60</th>
<th>D60</th>
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UR Technical Specifications

**PROTECTION GROUND DISTANCE**

**Characteristics:** Dynamic (100% memory-polarized) mho, or QUAD, selectable individually per zone

- **Number of zones:** 4
- **Directionality:** All zones reversible
- **Reach (secondary I2):** 0.02 – 250.000.00 in steps of 0.01 I2
- **Reach accuracy:** ±5% including the effect of CVT transients up an SIR of 30
- **Distance characteristic angle:** 30 – 90° in steps of 1°
- **Distance comparator limit angle:** 30 – 90° in steps of 1°
- **Directional sensitivity:** Characteristic: 30 – 90° in steps of 1°
- **Limit angle:** 90° to 90° in steps of 1°
- **Zero sequence compensation:** Z0/Z1 magnitude: 0.01 – 2.000 in steps of 0.001
- **ZIN/Z1 angle:** 0.01 – 80° in steps of 1°
- **Synchronizing Check**
  - **Max volts difference:** 0 – 100.000 V in steps of 1 V
  - **Max angle difference:** ±180° in steps of 1°
  - **Max freq difference:** 0.00 – 2.00 Hz in steps of 0.01 Hz
  - **Note:** Default source function available

**TAKE OFF (V/I)RHZ**

**Characteristics:**

- **Voltage:** Phasor only
- **Pickup level:** 0.80 – 4.00 in steps of 0.01 pu/VHz
- **Dropout level:** 97 – 96% of Pickup
- **Level accuracy:** ±5% of pickup
- **Timing curves:** Definite time, inverse A, B, and C
- **Pickup delay:** 0.00 – 1.000 in steps of 0.01 s
- **Operate time:** <30 ms I1 x Pickup (definite time and TOD = 0)
- **Timing accuracy:** ±3% or ±4 ms (whichever is greater)

**Phase U/V**

- **Min. voltage:** 1 – 1.5 power system cycles
- **Time accuracy:** ±3% or 4 ms, whichever is greater

**Phase Angle**

- **Angle accuracy:** 5 – 50° in steps of 1°
- **Angle accuracy:** ±2°
- **Pickup delay:** 0 – 45.535 in steps of 0.01 s
- **Rest delay:** 0 – 45.535 in steps of 0.01 s
- **Time accuracy:** ±3% or ±4 ms, whichever is greater
- **Operate time:** <30 ms I1 x Pickup

**RMS**

- **Current:** Phasor only
- **RMS level:** ±100 ms or 2% of total trip time

**PILOT SCHEMES**

- **Direct underreaching transfer trip (DUTT):**
- **Permissive underreaching transfer trip (PUTT):**
- **Permissive overreaching trip (POTT):**

**HYBRID POTT SCHEMES**

- **Directional comparison blocking scheme**

**LINE PICKUP**

- **PHASE IIC:** 0.05 – 30.00 in steps of 0.01 pu
- **PHASE UV:** 0 – 250 V

**PROTECTION ACCIDENTAL ENERGIZATION**

**Operating condition:** Overcurrent

- **Aiming condition:** Undervoltage and/or machine offline
- **Overcurrent pickup level:** 0.000 – 3.000 pu in steps of 0.001 pu
- **Overcurrent dropout level:** 97 – 98% of pickup
- **Overcurrent level accuracy:** ±5% of reading from 0.1 – 2.0 Hz CT rating

**UNDERVOLTAGE pickup level:** 0.000 – 3.000 pu in steps of 0.001 pu

**DROP OUT level:** 97 – 96% of pickup

**DROP OUT time:** 10 – 20 ms

**BUS INSTANTANEOUS DIFFERENTIAL**

- **Pickup level:** 2.00 – 9.999 pu in steps of 0.01 pu
- **Dropout level:** 97 – 96% of pickup
- **Dropout time:** 10 – 20 ms

**CT TROUBLE**

- **Pickup I1 & I2:** 0.02 – 2.000 pu in steps of 0.01 pu
- **Delay:** 1.0 – 60 s in steps of 1 s

**DISTURBANCE DETECTOR**

- **Response time:** to magnitudes of either positive, negative, or zero-sequence currents.
- **Response time:** two-cycle old quantities compared.
- **0.04 pu change triggers the disturbance detector.

**BREAKER FAILURE**

- **Mode:** 1-pole, 3-pole
- **Current supvs. pickup:** Phase, neutral
- **Current supvs. dropout:** 0.000 – 3.000 pu in steps of 0.001 pu
- **Current supvs. dropout:** 97% – 98% of pickup
- **Current supvs. accuracy:** ±5% of reading or ±1% of rated (whichever is greater)
- **From 0.1 – 2.0 x CT rating
- **From 1.0 – 2.0 x CT rating

**NEUTRAL OVERVOLTAGE**

- **Operating condition:** Overcurrent

- **Aiming condition:** Undervoltage and/or machine offline
- **Overcurrent pickup level:** 0.000 – 3.000 pu in steps of 0.001 pu
- **Overcurrent dropout level:** 97 – 98% of pickup
- **Overcurrent level accuracy:** ±5% of reading from 0.1 – 2.0 Hz CT rating

**THERMAL MODEL**

- **Power factor:**
- **Current level:** ±3% or ±4 ms, whichever is greater
- **Time accuracy:** ±3% or ±4 ms (whichever is greater)

**THERMAL MODEL**

- **Power factor:**
- **Current level:** ±3% or ±4 ms, whichever is greater
- **Time accuracy:** ±3% or ±4 ms (whichever is greater)

**THERMAL MODEL**

- **Power factor:**
- **Current level:** ±3% or ±4 ms, whichever is greater
- **Time accuracy:** ±3% or ±4 ms (whichever is greater)
PROTECTION

NEGATIVE-SEQUENCE OVERVOLTAGE

Dropout level: 97% – 98% of pickup
Level accuracy: ±3% or ±20 ms (whichever is greater)
Pickup delay: 0 – 600 ms in steps of 0.01 s
Reset delay: 0 – 600 ms in steps of 0.01 s
Time accuracy: ±2% or ±20 ms (whichever is greater)
Operate time: <30 ms @ 1.10 pickup @ 60 Hz

100% STATOR GROUND

Operating quantity: \(V_{neutral,3rd}/V_{neutral,3rd} + V_{zero,3rd}\)
Pickup level: 0 – 600% in steps of 0.01 s
Dropout level: 97% – 98% of pickup
Level accuracy: ±2% of reading from 1 – 120 V
Pickup delay: 0 – 600% in steps of 0.01 s

PHASE DIRECTIONAL

Connection: Quadrature (90°)
Characteristic angle: 0° – 360° in steps of 1°
Angle accuracy: ±2°

Three harmonic supervision level:

Operate time: 0.0001 – 1000 ms in steps of 0.0001 s
Time accuracy: ±3% or ±20 ms (whichever is greater)
Pickup delay: 0 – 600% in steps of 0.01 s

NEUTRAL DIRECTIONAL OVERCURRENT

Directionality: Co-existing forward and reverse
Polarizing Voltage: V, O or VX
Polarizing value: V2
Polarizing current: i2
Polarizing output: i, O or i2
Angle accuracy:

Offset impedance:

Limit angle:

MINUS SEQUENCE

Angle accuracy:

MINUS SEQUENCE DIFFERENTIAL

The angle accuracy is ±3% or ±20 ms (whichever is greater).

OVER CURRENT

Level accuracy:

Operate time:

NEG. SEQ. DIRECTIONAL I/O

Directionality: Co-existing forward and reverse
Polarizing Voltage: V, O or VX
Polarizing value: V2
Polarizing current: i2
Polarizing output: i, O or i2
Angle accuracy:

Offset impedance:

Limit angle:

OPERATE TIME

LEVEL ACCURACY

POWER SWING BLOCKING/OFF-STEP TRIPPING

HARMONICS

LINE CURRENT DIFFERENTIATION

Index: L, K, L’; K’; K+1
Level accuracy:

Characteristics angle:

Angle accuracy:

Operate time:

HARMONICS

DATUM SIGNAL

Directional: Co-existing forward and reverse
Polarizing Voltage: V, O or VX
Polarizing value: V2
Polarizing current: i2
Polarizing output: i, O or i2
Angle accuracy:

Offset impedance:

Limit angle:

OPERATE TIME

LEVEL ACCURACY

LINE CURRENT DIFFERENTIATION

Index: L, K, L’; K’; K+1
Level accuracy:

Characteristics angle:

Angle accuracy:

Operate time:

HARMONICS

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OPERATE TIME

LEVEL ACCURACY

LINE CURRENT DIFFERENTIATION

Index: L, K, L’; K’; K+1
Level accuracy:

Characteristics angle:

Angle accuracy:

Operate time:

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OPERATE TIME

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Index: L, K, L’; K’; K+1
Level accuracy:

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OPERATE TIME

LEVEL ACCURACY

LINE CURRENT DIFFERENTIATION

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Level accuracy:

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OPERATE TIME

LEVEL ACCURACY

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Level accuracy:

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Angle accuracy:

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HARMONICS

DATUM SIGNAL

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OPERATE TIME

LEVEL ACCURACY

LINE CURRENT DIFFERENTIATION

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Level accuracy:

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Angle accuracy:

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Limit angle:

OPERATE TIME

LEVEL ACCURACY

LINE CURRENT DIFFERENTIATION

Index: L, K, L’; K’; K+1
Level accuracy:

Characteristics angle:

Angle accuracy:
UR Technical Specifications cont...

**INPUTS**

**AC CURRENT**
- CT rated primary: 1 – 50 000 A
- CT rated secondary: 1 or 5 A by connection
- Frequency range: 20 – 65 Hz
- Relay burden: < 0.2 VA at rated secondary
- Conversion range: 0.1 – 46 x CT rating RMS symmetrical
- Current withstand: 1 sec. @ 100 times rated Cont. @ 10 times rated

**AC SENSITIVE GROUND CURRENT**
- Tap Position input: 3-wire or 4-wire
- Sensing current: 0.1 mA or 10 mA (based on input range)
- Type: Platinum (DIN.43760)
- Accuracy: ±10%
- Isolation: 300 Vpk

**ANALOG INPUTS**
- General purpose input:
  - Type: Voltage: 1 – 10 V, 4 – 20 mA
  - Input impedance: 250 kΩ ±10%
- Conversion range: 1 – 21 mA
- Accuracy: ±1% of full scale
- Tap Position input:
  - Type: resistance (ohms)
  - Ranges: 0 – 100 Ohm or 0 – 5 kΩ (programmable)
- Bias current: 1 mA or 10 mA (based on input range)
- Accuracy: ±1% of full scale
- RTD input:
  - Type: 3-wire: 100 Ω platinum (DIN.43760)
  - 100 Ω nickel
  - Sensing current: 5 mA
  - Type: 2-wire: 10 Ω copper
- Sensing current: 5 mA
- Accuracy: ±2°C
- Isolation: 300 Vpk

**COMMUNICATIONS**

**RS232:**
- Port: Front port (115,200 bps, ModBus® RTU)

**RS485:**
- Port: Front port (115,200 bps, ModBus® RTU)

**Ethernet port:**
- 10 BaseF, or redundant 10 BaseF; 1 or 2 rear ports (up to 115,000 bps, ModBus® RTU, DNP 3.0) isolated together
- Front port (19,200 bps, ModBus® RTU)
- @ 36Vpk
- Fiber optic with ST connector

- IEC 60870 (10BaseF: 820 nm, multi-mode, IEC 60870-5-101, 95%, variant 1, 95%)

- **TYPE TESTS**
  - Electrical fast transient: ANSI/IEEE C37.90.1
  - Oscillatory transient: ANSI/IEEE C37.90.1
  - Surge immunity: ANSI/IEEE C37.90
  - Electrostatic discharge: ANSI/IEEE C37.90

- RFI susceptibility:
  - ANSI/IEEE C37.90
  - EN 61000-4-3

- **ENVIRONMENTAL**
  - Operating temperatures:
    - Cold: IEC 60068-2-1, 16 hours at -40°C
    - Dry test: IEC 60068-2-2, 16 hours at 85°C
  - Humidity (Non-Condensing):
    - ANSI/IEEE C37.90
  - Altitude: Up to 2000 m

- **APPROVALS**
  - UL cerification applied for
  - CSA certification applied for
  - Compliant
  - Manufactured under an ISO9001 registered system
A Growing Family

Since its inception in 1998, the UR Family has quickly evolved, delivering an expanding range of protection, monitoring and control products to our customers.

B30 Bus Protection

The B30 provides bus protection and metering in one integrated package. Low-impedance bus differential elements, which can be applied either with or without restraint, provide high-speed protection.

B90 Bus Differential Relay

The B90 provides integrated protection and breaker failure for re-configurable LV, HV and EHV busbars with up to 24 feeders. The B90 also includes isolator monitoring for dynamic bus replica and multi-zone bus differential protection. The B90 features scaleable architecture and high-speed digital communications.

C30 Control

The C30 is a digital controller that provides digital I/O and programmable logic. It also includes transducer I/O, digital elements and digital counters that can count function operations, the change of state of an external contact, or pulses from a watt-hour meter.

C60 Breaker Management

The C60 provides breaker monitoring and control including breaker failure protection, synchroinism check, autoreclosure, and power metering in one integrated package. The IED can be applied for breaker-and-a-half configurations in single or three-pole tripping applications.

D60 Line Distance

The D60 is intended for use on transmission lines of any voltage level, in single-pole or three-phase tripping applications. Its primary function consists of four phase and ground distance zones of protection (mho or quadrilateral), with built-in-logic for the five common pilot-aided schemes.

F35 Multiple Feeder Management

The F35 provides feeder protection and power metering for up to five feeders with busbar voltage measurement or six feeders without busbar voltage, in one integrated package.

F60 Feeder Management

The F60 provides feeder protection, monitoring and metering in one integrated package. Protection functions include phase, neutral, ground and negative sequence overcurrent, over and undervoltage, over and underfrequency, phase, neutral and negative sequence directional functions as well as, optional, high-impedance fault detection element.

G60 Generator Management

The G60 is intended for the protection of AC generators. It may be used on any size of generator driven by steam, gas and hydraulic turbine.

L60 Line Phase Comparison

The L60 is a digital line phase comparison relay system which provides protection for HV and EHV transmission lines. It retrofits earlier GE SLD relays and may be applied on or adjacent to series-compensated lines for three-pole tripping applications.

L90 Line Differential

The L90 is a digital phase segregated current differential relay intended for use on transmission lines of any voltage level including series compensated lines. By utilizing an innovative current differential scheme with adaptive restraint the relay is allowed to be sensitive yet secure.

M60 Motor Management

The M60 is intended for the protection of medium and large horsepower induction motors.

T35 Transformer Management

The T35 is a three-phase transformer relay with up to six restraints. The T35 is the ideal protection for multi-winding power transformers, where the windings are connected to more than one breaker such as in breaker-and-a-half schemes, or to more than two breakers.

T60 Transformer Management

The T60 is a three-phase, multiple winding, transformer relay intended for the primary protection of small, medium and large power transformers.

Ordering

Complete product brochures, instruction manuals, application papers, software, and online ordering are available from our website at www.GEindustrial.com/Multilin.

Accessories


enerVista enabled See page 275.

www.enerVista.com
Features and Benefits
- Advanced 16-bit microprocessor
- Configurable logic, curves, digital I/Os and LEDs
- Flash memory for field upgrades
- Two settings groups
- Modular construction for serviceability and reduced spare costs

Applications
- Feeder protection, any voltage level
- 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
Directional power protection
enerVista.com compatible (see page 275)

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

User Interfaces
- M+PC software for setting, monitoring
- RS232 port, faceplate accessible (19,200 bps, ModBus® RTU)
- RS485 rear port (19,200 bps, ModBus® RTU)
- LED dot matrix display and keypad
- Target LED indicators

An economical choice for standard digital relaying applications.
Protection

Multiple Settings Groups
Two separate settings groups are stored in the nonvolatile memory, with only one group active at a given time. Switching between setting groups 1 and 2 can be done by means of a setting, a communication command or contact input activation.

This allows users to have access to main relay functionalities in an extremely simple, user-friendly way by entering only main settings. Access to complete functionality for more complex use is available through advanced settings.

Features and Benefits

Event Recording
Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self-test status. M Family relays store up to 32 events, time tagged to the nearest millisecond. This information is invaluable in determining power system and relay operations. A user can inhibit the logging of selected events to aid in post-event analysis.

Oscillography
M Family relays capture current waveforms and digital channels at eight samples per cycle. One oscillography record with a maximum length of 32 cycles is stored in memory. Oscillography is triggered either by internal signals or external contacts.

Configurable I/Os
M Family products have two configurable contact inputs and four configurable contact outputs. The configurable outputs can be latched. These units also have a fixed Trip and Service contact output.

User Interfaces

Faceplate LEDs
Six LEDs are provided on the relay faceplate. Two are assigned to indirect trip status and relay in service. Four LEDs are user-configurable, and can be assigned to various duties (trips, alarms, etc.) LEDs can be set to flash on/off and to be latched.

Keypad and Display
A three button keypad allows user access for easy relay interrogation and change of settings. Metering data, last trip information and settings are displayed through the LED dot matrix display. Note that full access to the event and oscillography records and unit configuration is possible only through PC communication.

Self-Test Diagnostics
Comprehensive self-test diagnostics occur at power up and continuously during relay operation. Any problem found by self-tests causes an alarm and an event is logged.

Communications
A front mounted RS232 and a rear RS485 port allow easy user interface via a PC. ModBus® RTU protocol is used for all ports. The relay supports baud rates from 300 to 19,200 bps. Up to 32 M Family relays can be addressed on a single communications channel. A unique address must be assigned to each relay via a setting when multiple relays are connected.

M+PC Software
A single PC software package is required to access, configure, and monitor all relays in the M Family regardless of their model, application, or available options. The M+PC software extracts the model number, version, and configuration parameters from the connected relay to display only the relevant data and options for the relay with which it is communicating. This eliminates having to manually configure the relay within the software and provides a simple and easy to use operator user interface.

All M Family products are supplied with Windows®-based M+PC software. M+PC allows communication among M Family relays for monitoring, setting changes, information and configuration.
The M+PC software program may be run on a PC with the Windows® 95/98/NT operating systems. The program may be used locally on the RS232 front serial port or remotely on the RS485 port. It provides full access to the relay data with the following features:

- View actual values
- View relay status
- View/edit settings on-line/off-line
- View event recorder for troubleshooting
- Configure inputs, outputs and LEDs through programmable logic
- Utilize a custom protection curve
- Upgrade relay firmware

All status information such as target messages and digital I/O states may be viewed with the M+PC software.

**Evaluation**

M+PC software may be used off-line to simulate the connection to any M Family relay. This mode allows the user to:

- View status, settings and protection units incorporated in the selected model
- Create setting files for future download to the physical relay

**Dimensions**

The M Family of products have a drawout construction in four-inch wide modules for relays including current channels or in two-inch wide modules for relays including only voltage channels. These drawout modules may be mounted in standard 19” racks, half racks, individual cases, or supplied with depth reducing collar for space efficiency.

**M Family Feature Comparison**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>DEVICE</th>
<th>MIF</th>
<th>MIG</th>
<th>MIN</th>
<th>MIP</th>
<th>MIV</th>
<th>MIW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase Undervoltage</td>
<td>27P</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Low Forward Power</td>
<td>32LF</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Reverse Power</td>
<td>32RP</td>
<td></td>
<td></td>
<td>✓</td>
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<td></td>
</tr>
<tr>
<td>Loss of Excitation</td>
<td>40</td>
<td></td>
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<tr>
<td>Current Unbalance</td>
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<tr>
<td>Voltage Unbalance</td>
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</tr>
<tr>
<td>Thermal Image Unit</td>
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<td></td>
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<tr>
<td>Ground Overvoltage</td>
<td>59N</td>
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</tr>
<tr>
<td>Ground IOC</td>
<td>60NH/50NL</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Phase IOC</td>
<td>50PH/50PL</td>
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<td>✓</td>
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<tr>
<td>Ground TOC</td>
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<tr>
<td>Phase TOC</td>
<td>51P</td>
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<tr>
<td>Phase Overvoltage</td>
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<tr>
<td>Fuse Failure</td>
<td>V1FF</td>
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<tr>
<td>Ground Directional</td>
<td>67N</td>
<td></td>
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<tr>
<td>Isolated Ground Directional</td>
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<td>Loss of Mains</td>
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<td>Overfrequency</td>
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<td>Underfrequency</td>
<td>81U</td>
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<tr>
<td>Starts per Hour and Locked Rotor</td>
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<tr>
<td>Undercurrent</td>
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<tr>
<td>Restricted Earth Fault</td>
<td>87R</td>
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<tr>
<td>Breaker Failure Protection</td>
<td>O</td>
<td></td>
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<tr>
<td>Programmable I/O and LEDs</td>
<td>O</td>
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<tr>
<td>Breaker Arcing Current</td>
<td>O</td>
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<tr>
<td>Programmable Logic</td>
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<tr>
<td>Multiple Settings Groups</td>
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</tr>
<tr>
<td>Event Recorder</td>
<td>O</td>
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<tr>
<td>Oscillography</td>
<td>O</td>
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<tr>
<td>Thermal Capacity</td>
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<tr>
<td>Alphanumeric Display</td>
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<tr>
<td>Three-Button Keypad</td>
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<tr>
<td>ModBus® Communications</td>
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</tr>
</tbody>
</table>

**Dimensions (Inches/mm)**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Dimensions A (Inches/mm)</th>
<th>Dimensions B (Inches/mm)</th>
<th>Dimensions C (Inches/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIF, MIV</td>
<td>4.15 (106.6)</td>
<td>3.33 (85)</td>
<td>2.33 (59)</td>
</tr>
<tr>
<td>MIF, MIG, MIN, MW</td>
<td>6.15 (166.4)</td>
<td>5.35 (136)</td>
<td>4.33 (110)</td>
</tr>
<tr>
<td>Half Rack M550</td>
<td>10.67 (271)</td>
<td>9.92 (252)</td>
<td>8.88 (228)</td>
</tr>
<tr>
<td>Full Rack M100</td>
<td>18.06 (484)</td>
<td>18.30 (465)</td>
<td>17.36 (441)</td>
</tr>
</tbody>
</table>

* MIV, MIP excluded
# M Family Modular Microprocessor Relays

## M Family Common Technical Specifications

### PROTECTION

<table>
<thead>
<tr>
<th>PHASE TIME OVERCURRENT (51P)</th>
<th>10 – 240% of CT rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time, inverse, very inverse, extremely inverse, custom</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUND TIME OVERCURRENT (51N)</th>
<th>10 – 240% of CT rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time, inverse, very inverse, extremely inverse, custom</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
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</tr>
<tr>
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<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### PHASE INSTANTANEOUS (50PH & 50PL) | 10 – 200% of CT rating |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### GROUND INSTANTANEOUS (50N & 50NL) | 10 – 200% of CT rating |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
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</tr>
<tr>
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<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### GROUND DIRECTIONAL (67N) | 30 V to 600 V in steps of 1 V |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### PETERSEN COIL GROUND DIRECTIONAL (67PC) | 30 V to 600 V in steps of 1 V |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### DIRECTIONAL REVERSE POWER (32RP) | 0.1 – 100% of CT rating |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### DIRECTIONAL FORWARD POWER (32LF) | 0.1 – 100% of CT rating |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time multiplier</td>
<td>0.05 – 2.00 in steps of 0.01</td>
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<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% in the complete range</td>
</tr>
<tr>
<td>Level</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### OVERFREQUENCY (81O) | 2.0 to 60 V or 10 to 250 V in steps of 0.1 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time delay</td>
<td>0.0 to 600 sec in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% over the complete range</td>
</tr>
<tr>
<td>Voltage/Current</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### INSTANTANEOUS (50PH & 50PL) | 2.0 to 60 V or 10 to 250 V in steps of 0.1 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve shapes</td>
<td>Definite time</td>
</tr>
<tr>
<td>Time delay</td>
<td>0.0 to 600 sec in steps of 0.01</td>
</tr>
<tr>
<td>Definite time</td>
<td>Up to 99.99 sec (10 msec steps)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% over the complete range</td>
</tr>
<tr>
<td>Voltage/Current</td>
<td>Greater of ±3% or ±25 ms</td>
</tr>
</tbody>
</table>

### POWER SUPPLY

<table>
<thead>
<tr>
<th>DC voltage</th>
<th>2.0 V ± 2% for C = 50 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC voltage</td>
<td>5.0 V ± 2% for C = 10 A</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Nominal phase current</td>
<td>1 or 5 A (depending on model)</td>
</tr>
<tr>
<td>Nominal ground current</td>
<td>1 or 5 A (depending on model)</td>
</tr>
<tr>
<td>Approximate auxiliary voltage</td>
<td>24 – 44 VDC, ±20%</td>
</tr>
<tr>
<td>Speed</td>
<td>300 to 1,900 bps</td>
</tr>
</tbody>
</table>

### MECHANICAL CHARACTERISTICS

- Metal package in quarter 19" rack and four units high
- Frontal MMI with display and keypad
- DBB connector for R8232 ports on the front (I) and R8458 on the rear
- Protection class IP52 (according to IEC 529)

### ENVIRONMENTAL

<table>
<thead>
<tr>
<th>Temperature Storage</th>
<th>-40° C to +60° C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Operation</td>
<td>0° C to +50° C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Up to 95% without condensing</td>
</tr>
</tbody>
</table>

### APPROVALS

- ANSI/IEEE C37.90.1
- ANSI/IEEE C37.90.2
- EN55022 Class B
- CE: Conforms to EN50118/CISPR 11, EN 50082-2, EN50522 Class B

### PACKAGING

- Two 4-rack: 9.9 lbs (4.5 kgs) 7 lbs (3.2 kg)
- One 8-rack: 38.9 lbs (17.6 kg) 30 lbs (13.6 kg)

*Specifications subject to change without notice.

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For an electronic version of the M Family guideform specifications, please visit: www.GEindustrial.com/Multilin/specs, fax your request to 905-201-2098 or email to literature.multilin@indsys.ge.com.
Features and Benefits
- Expandable I/Os
- Flash memory for field upgrades
- Drawout construction for serviceability
- DNP 3.0 Level 2 support
- IRIG-B time synchronization
- URPC available for select products in the SR Family

Applications
- Motor management
- Generator management
- Transformer management
- Feeder management
- enerVista.com compatible (see page 275)

Monitoring and Metering
- Digital oscillography capture
- Digital status HMI
- Event recording
- Self-diagnostics

User Interfaces
- SRPC software for setting, monitoring
- RS232 port, faceplate accessible (9,600 baud)
- RS485 port (19,200 bps, ModBus® RTU)
- Second RS485 or RS422 port
- 2x20 character display and keypad
- Target LED indicators
Description
The SR Family of protection relays is a microprocessor based multi-functional line of products. By providing an economical system for protection, control, monitoring and metering, and both local and remote user interfaces in one assembly, the SR relays effectively eliminate the need for expensive discrete components.

In addition to traditional current and voltage inputs, the SR Family also offers several analog and digital inputs. These inputs provide the relay with vital information such as vibration, pressure, temperature, and breaker status. Several additional output relays are available for flexibility in creating custom protection schemes.

The SR Family offers analog outputs which eliminate the need for external transducers. When connected to a PLC for process control, the result is truly real time. With the exception of the 735/737, all SR relays have three independent communications ports: a rear RS485 port, a second rear RS485 or RS422 port and a front panel RS232 port for easy local PC access. The rear ports offer remote communications or connection to a DCS, SCADA, or PLC. All three ports support the ModBus® RTU protocol. In addition, the 489, 745, 750 and 760 all support Distributed Network Protocol (DNP) 3.0 Level 2. All communications ports may be active simultaneously.

With the exception of the 735/737, all relays utilize Windows®-based software for communication, monitoring and metering. The software can also provide a simulation for training and testing. Actual values, setpoints, status, trending, and waveform capture information may all be viewed via the software, and can be used for troubleshooting.

All units feature drawout construction. When removed, the CT secondaries will automatically be connected to prevent dangerous high voltages from open CTs.

URPC Program
The URPC program allows the user to create single-line diagrams for substation and system monitoring schemes. Additionally, annunciator panel viewing, metering, and setting changes can also be performed using the program. With the URPC program the user can access multiple SRs or different devices for metering in real time. The program may be used locally through the RS232 serial port or remotely through the other ports on the device.

Dimensions
Overall dimensions on 489, 745, 750/760, 735/737 and 469 are identical. Terminal configurations vary and are not as shown.
Features and Benefits
- Modular system
- Independent two-inch or four-inch modules
- Modules have their own power supply and signaling elements
- Mounting in standard half or full 19" rack
- Available in individual cases

Application
- Low and medium voltage industrial installations

Protection Modules
- MFF: Frequency relay
- MGC: Generator relay
- MLJ: Synchronism check relay
- TCW: Power reversal relay
- TOV: Undervoltage and overvoltage

User Interfaces
- Front panel programming
- LED indicators
- Two or three-digit displays for most modules
Description

The MID system provides user configurable modular protection units for all low and medium voltage industrial installations. Typical applications are interconnection systems for customer power company connection, mini-centers, co-generation, and equipment including generators, motors, transformers, and capacitor banks.

The modules are independent two-inch or four-inch units with their own power supply, setting and signaling elements. These drawout relays may be mounted in standard 19" racks, half racks, or individual cases. Excess rack space is covered with empty modules to leave space for future expansion.

The protective functions of the system depend on which of the five protection component relays are selected.

- MFF: Over and underfrequency
- MGC: Small generator protection
- MLJ: Bus and line synchronism check
- TCW: Directional power
- TOV: Over and undervoltage

This modular system provides a high level of quality, reliability and easy installation.

Dimensions

<table>
<thead>
<tr>
<th>ITEM DESCRIPTION</th>
<th>DIMENSIONS (INCHES/(mm))</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MFF, TOV, TCW, MLJ</td>
<td>A 4.20 (107)  B 3.46 (88)  C 2.52 (64)</td>
<td></td>
</tr>
<tr>
<td>MGC</td>
<td>A 6.36 (162)  B 5.61 (143)  C 4.67 (119)</td>
<td></td>
</tr>
<tr>
<td>MID 050</td>
<td>A 10.67 (271)  B 9.92 (252)  C 8.98 (228)</td>
<td></td>
</tr>
<tr>
<td>MID 100</td>
<td>A 19.05 (484)  B 18.30 (465)  C 17.35 (441)</td>
<td></td>
</tr>
</tbody>
</table>
Digital Distribution System Family

**Features and Benefits**
- Distributed protection and control per bay, through graphic display
- IRIG-B time synchronization
- Common GE-NESIS software platform

**Applications**
- Protection and control devices for feeders, transformers, busbars
- Substation automation
- Distributed RTUs for control automation
- Management of power distribution equipment
- enerVista.com compatible (see page 275)

**Protection and Control**
- DMS: Bay protection and control unit
- SMOR-B: Multifunction feeder protection
- DTP-B: Digital transformer protection
- DBF: Digital breaker failure protection
- DRS: Digital reclosing system
- DTR: Digital tap changer
- DFF: Digital frequency protection
- Alarm management
- Remote device status and operations

**Metering and Monitoring**
- System metering
- Oscillography recording
- Remote device status and operations
- Substation RTU

**User Interface**
- LCD display and keypad for local access
- M-LINK and ModBus® protocols for PC communications

Integrated protection and control IEDs for electrical substations.
Description

The DDS Family of devices provides economical protection, control, metering and monitoring functionality to electrical utilities and industrial customers.

The DDS Family can virtually replace a complete set of discrete devices such as electromechanical relays, meters, annunciator panels, push buttons, transducers, auxiliary relays, and mimic drawings.

All family members share a common look and feel. The local HMI is composed of an LCD display, 20 character keypad, configurable LEDs and, in the case of the DMS and DTR, a configurable graphic display. This common look reduces the costs incurred in training personnel.

In addition to the front RS232 local communication port, there are also one or two rear ports available. The rear ports are for RS232, RS485, or glass/plastic fiber optics.

The DDS Family supports both GE M-Link and ModBus® RTU open protocols. M-Link is faster (115,200 bps) and preferably used in applications where only GE devices are used. ModBus® RTU is slower (19,200 bps) and widely used in combination with third-party ModBus® devices.

The units are housed in two different types of 19" racks with a modular construction (4U and 2U high). Alternatively there is a half 19" 4U high SMOR box.

Each unit may contain a wide range of protection and/or control modules, as well as I/O cards, an optional redundant power supply (DMS units only), a magnetic module, independent CPU cards for protection, control and communications (DMS and DTR models).

All the elements of the DDS Family can be combined to create a GE-NESSIS-DDS integrated protection and control system. This scheme provides a complete substation HMI plus an open link to the dispatch center in several SCADA protocols (IEC 870-5/101, DNP 3.0, Indactic 20-33, Wisp + etc.).

The GE-NESSIS-DDS architecture is simple and highly efficient. The complete system is divided in three levels, connected via communications. Level 1 includes protection and control units at bay level. Level 2 includes the concentrator (one or several PCs), controller at substation level, and Level 3 is the dispatch or control center of the utility company or industrial plant.

GE-NESSIS (General Electric Network Substation Integration Software)

There is one unique suite of software programs for remote communication. It is composed of different applications:

GE-LOCAL is used for online connection with the device. It allows viewing of unit status, viewing and changing settings, retrieving events and oscillography and producing commands.

GE-INTRO, normally used offline, allows the user to configure the I/O logic by using And, Or and Not logic gates. In the DMS module it also permits the creation of custom screens in the graphic display and program operation interlockings. For all units the LEDs are configured with this tool.

GE-OSC is the oscillography tool. It allows visualization of the waveform (both in sine form or as phasors) and post-fault studies.

GE-POWER is the online software for HMI and Level 1 to 3 communication that allows real time communication and system operation. It allows viewing of substation online diagrams, including status, measures, and individual bays. It provides access to the settings and operations, and integrates data from the different bays in a common substation database.

GE-CONF allows offline user configuration of HMI screens, databases and Level 2 functionality, including users management, access levels and passwords.

GE-FILES is a system recording configuration and analysis tool that allows the creation of custom-made event, log, alarm and metering reports.