Protection & Control
- Comprehensive overcurrent, voltage and frequency functions
- Synchrocheck and breaker failure
- Wide variety of protection curves
- Thermal model protection

Metering & Monitoring
- Comprehensive metering
- Event Recorder: 256 events with 1ms time stamping
- 32 samples per cycle oscillography
- IRIG-B or IEEE 1588 time synchronization
- Security audit trail and password control
- Relay health diagnostics

Communications
- Front USB and rear serial, Ethernet, Fiber and dual port options for seamless redundancy (IEC 62439-3, PRP & HSR)
- Multiple communication protocols including IEC 61850, IEC 61850 GOOSE, Modbus® TCP/IP, Modbus RTU, DNP 3.0, IEC 60870-5-104, IEC 60870-5-103 & OPC-UA (IEC 62541)

EnerVista Software
- Simplify setup and configuration
- Strong document archive and management system
- Full featured monitoring and data recording
- Maintenance and troubleshooting tool
- Seamless integration toolkit

Key Benefits
- Cost-effective and flexible protection and control for distribution and industrial feeder applications
- Ease of use and setup in one simple step
- Environmental monitoring system to monitor operating conditions and plan preventive maintenance
- Advanced power system diagnostics
- Flexible communications with multiple ports and protocols allowing seamless integration
- Arc flash mitigation via zone inter-tripping, flex curves, and multiple settings group
- Powerful Security Audit Trail tool to increase security and minimize system risks
- Application flexibility with the use of programmable logic elements
- Effortless draw-out construction eliminates requirement for test switches
- Draw-out or non draw-out options available
- Increase network availability by reducing failover time to zero through IEC® 62439-3 PRP and HSR support
- Provide precise time synchronization by support for IEEE® 1588 (Precise Time Protocol (PTP))
- Accelerated life cycle testing for high reliability

Applications
- Primary protection and control for medium and high voltage distribution utility and industrial overhead or cable feeder applications
- Protection of small and medium size distribution transformers
- Back-up protection of various HV applications
- Capacitor bank protection
- Advanced control applications including Cold Load Pickup, multi-shot recloser and multiple setting groups

Intuitive and Innovative Feeder Protection
The Multilin™ 350 is a member of the Multilin 3 Series protective relay platform and has been designed for the protection, control and management of feeders or related applications as a primary or backup protection device. This cost-effective protective device is used to perform advanced feeder protection, control and monitoring in a draw-out or non draw-out design for low, medium and high voltage applications. The 350 also offers enhanced features such as metering, monitoring and diagnostics, preventative maintenance, advanced communications and security.
Overview

The 350 relay is a member of the 3 Series family of Multilin relays. This protective device is used to perform primary or back-up circuit protection on medium or high voltage feeders and downstream protection for distribution utilities. The 350 can be used for a wide variety of protection applications in power system such as MV/LV transformer protection and capacitor bank protection.

The basic protection function of this relay includes multiple phase, ground, and neutral time and instantaneous overcurrent elements for coordination with upstream and downstream devices. Additionally, the device provides essential feeder breaker control features such as cold load pick up blocking, breaker failure, synchrocheck and autoreclose.

The robust 350 streamlines user work flow processes and simplifies engineering tasks such as configuration, wiring, testing, commissioning, and maintenance. This cost-effective relay also offers enhanced features such as diagnostics, preventative maintenance, arc flash mitigation and security.

Easy to Use

Drawout Construction
The 350 offers a complete drawout feature eliminating the need for rewiring after testing has been concluded. The withdrawable feature also eliminates the need to open the switch gear door and disconnect communication cables, e.g. Ethernet fiber, copper, RJ45, etc prior to removing the relay from the chassis.

Effortless Retrofit
The small and compact 350 enables multiple relays to be mounted side by side on medium voltage panels. It also allows easy retrofit into existing S1 and S2 cutouts with adapter plates. The 350 can be used with reducing collars when the depth of LV compartment is limited.

Easy to Configure

Fast & Simple Configuration
The 350 requires minimal settings for configuring standard feeder protection applications. The entire feeder protection setup can be completed in one easy step.

Advanced Communications

Easy Integration Into New or Existing Infrastructure
With several Ethernet and serial port options, and a variety of protocols, the 350 provides advanced and flexible communication selections for new and existing energy management, SCADA, and DCS systems. The 350 also provides the industry leading protocols such as PRP and HSR when any failover time in communication system is not tolerated.

Enhanced Diagnostics

Preventative Maintenance
The 350 allows users to track relay exposure to extreme environmental conditions by monitoring and alarming at high ambient temperatures. This data allows users to proactively schedule regular maintenance work and schedule upgrade activities. The diagnostics data enables the user to understand degradation of electronics due to extreme conditions.
Cost Effective

Robust Design
The 350 is subjected to Accelerated Life Testing (ALT) to validate accurate relay function under specified normal conditions. The device is further tested for durability through Highly Accelerated Life Testing (HALT) where it undergoes extreme operating conditions. The robust 350 design ensures long term operation.

Reduced Life Cycle Cost
The 350 is designed to reduce total installation and life cycle cost for feeder protection. The draw-out construction of the device reduces downtime during maintenance and decreases extra wiring needed for relay testing and commissioning.

Multiple Options
Several option for protection & communications are provided to match basic to high end application requirements.

Protection
The 350 feeder protection system offers protection, control and monitoring in one integrated, economical and compact package.

Timed Overcurrent (Phase, Ground, Neutral)
The 350 has three-phase TOC elements which enable coordination with upstream and downstream protection devices such as fuses, overload relays, etc to maximize fault selectivity and minimize interruptions and downtime.

Multiple time current curves are available including IAC, IEC, ANSI and IEEE curves. Additional user programmable flex curves can be used to customize and meet specific coordination requirements. The TOC has both linear and instantaneous reset timing function to coordinate with electro-mechanical relays.

Sensitive Ground Overcurrent
Sensitive ground protection feature detects ground faults on high impedance grounded systems in order to limit damage to conductors and equipment. Special low ratio CT’s are used for this purpose to detect low magnitude ground faults.

Directional Overcurrent (Phase)
This element is intended to send a directional signal to an overcurrent element to prevent an operation when current is flowing in a particular direction.

The direction of current flow is determined by measuring the phase angle between the current from the phase CTs and the line-line voltage from the other two phases. The Maximum Torque Angle (MTA) can be set from 0° to 359° in steps of 1°.

Logic Designer

Sixteen logic elements available for applications such as manual control, interlocking, and peer to peer tripping.
Ground Directional
The Ground Directional element is used to discriminate whether a fault occurs in a forward or in a reverse direction, and it can be used either individually or as a part of the Ground Time, or Instantaneous over-current elements.

Neutral Directional
The Neutral Directional element is used to discriminate between faults that occur in the forward direction, and faults that occur in the reverse direction. The Neutral Directional element can be used either individually for control or alarm by energizing the auxiliary output relays, or as a part of the Neutral Time, or Instantaneous, over-current elements to define the tripping direction.

Over/Under Voltage Protection
Overvoltage/Undervoltage protection features can cause a trip or generate an alarm when the voltage exceeds a specified voltage setting for a specified time.

Frequency Protection
The 350 offers overfrequency and underfrequency elements to improve network (grid) stability using voltage or frequency based load shedding techniques.

It also provides back up protection when protecting feeders and other frequency sensitive power equipment.

Thermal Model
The cable thermal model element protects power apparatus like feeder cables against overheating due to excessive load. It estimates the temperature rise of current carrying conductors based on the amount of current flow (I^2R) and alarms when temperature rise exceeds a threshold value. This protection feature is essential to ensure the longevity of electrical feeders; particularly important to prevent premature cable failures, expensive repair costs and system down time.

Neutral/Ground Directional Overcurrent
The directional ground overcurrent isolates faulted feeders in ring bus or parallel feeder arrangements. It also allows detection of back feed of fault current from feeders with motors.

Control
Synchronism Check
The Synchrocheck element is used for monitoring the connection of two parts of the circuit by the close of a breaker. Breaker closing can be supervised by ΔV, Δf and ΔHz setpoints. This element verifies that voltages at both sides of the breaker are within the magnitude, angle and frequency limits set by the user before closing the breaker, in order to minimize internal damage that could occur due to the voltage difference, both in magnitude and angle.

Cold Load Pick Up
Cold Load Pick up allows automatic or manual blocking or raising of trip settings for a period after the breaker has been closed. This feature adapts the pick up of overcurrent elements to override the higher overload currents resulting from re-energization of feeder after a long period of time.

Breaker Failure
The Breaker Failure function is used to determine when a trip command sent to a breaker has not been executed within a selectable time delay. In the event of a breaker failure, the 350 will issue an additional signal to trip the breakers connected to the same busbar or signal the trip of upstream breakers.

Autoreclose
Reclose can be initiated externally or from an overcurrent protection. Up to four reclose operations are available, each with a programmable dead time. For each reclose shot, the relay can be programmed to block any overcurrent element.

Automation and Integration
Inputs & Outputs
The 350 features the following inputs and outputs for monitoring and control of typical feeder applications:

- 10 contact Inputs with programmable thresholds
- 2 Form A output relays for breaker trip and close with coil monitoring
- 5 Form C output relays

IEC 61850 GOOSE
The 350 supports IEC 61850 Logical Nodes which allows for digital communications to DCS, SCADA and higher level control systems. In addition, the 350 also supports IEC 61850 GOOSE communication, providing a means of sharing digital point state information between 350’s or other IEC 61850 compliant IED’s.

Power System Troubleshooting
Analyze power system disturbances with transient fault recorder and event records.
• Eliminates the need for hardwiring contact inputs to contact outputs via communication messaging.
• Transmits information from one relay to the next in as fast as 8 ms.
• Enables sequence coordination with upstream and downstream devices.
• When Breaker Open operation malfunctions, GOOSE messaging sends a signal to the upstream breaker to trip and clear the fault.

Logic Elements
The 350 relay has sixteen Logic Elements available for the user to build simple logic using the state of any programmed contact, virtual, remote input or the output operand of a protection or control element.

The logic provides for assigning up to three triggering inputs in an “AND/OR” gate for the logic element operation and up to three blocking inputs in an “AND/OR” gate for defining the block signal. Pickup and dropout timers are available for delaying the logic element operation and reset respectively.

Virtual Inputs
Virtual inputs allow communication devices the ability to write digital commands to the 350 relay. These commands could be open/close the breaker, changing setting groups, or blocking protection elements.

Multiple Settings Group
Two separate settings groups are stored in 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.

The two settings groups allow users to store seasonal settings – such as for summer and winter or alternate profiles such as settings during maintenance operations.

Event Recording
Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self test status. The 350 relay stores up to 256 events time tagged to the nearest millisecond. This provides the information required to determine sequence of events which facilitates diagnosis of relay operation. Event types are individually maskable in order to avoid the generation of undesired events, and includes the metered values at the moment of the event.

Oscillography/Transient Fault Recorder
The 350 captures current and voltage waveforms and digital channels at 32 samples per cycle. Multiple records can be stored in the relay at any given time with a maximum length of 192 cycles Oscillography is triggered either by internal signals or an external contact.

Trip/Close Coil Monitoring
The 350 can be used to monitor the integrity of both the breaker trip and closing coils and circuits. The supervision inputs monitor both the battery voltage level, while the outputs monitor the continuity of the trip and/or closing circuits, by applying a small current through the circuits.

Basic Metering
Metered values include:
• Current: Ia, Ib, Ic, In, Ig, Isg
• Phase-to-phase and phase-to-ground voltages for bus and line: Van, Vbn, Vcn, Vab, Vbc, Vca
• Active power (3-Phase)
• Reactive power (3-Phase)
• Frequency

Advanced Device Health Diagnostics
The 350 performs comprehensive device health diagnostic tests during startup and continuously at runtime to test its own major functions and critical hardware. These diagnostic tests monitor for conditions that could impact system reliability. Device status is communicated via SCADA communications and the front panel display. This continuous monitoring and early detection of possible issues helps improve system availability by employing predictive maintenance.

IEEE 1588 (Precise Time Protocol)
The IEEE 1588 Precision Time Protocol (PTP) is to synchronize the time between different nodes on an Ethernet network and it is used when very precise time synchronization is required.

It is possible to synchronize distributed clocks with an accuracy of less than 1 microsecond via Ethernet networks. PTP enables clock redundancy and reduces wiring and testing. It can operate over a complete facility and has the ability to compensate for lead length.

IRIG-B
IRIG-B is a standard time code format that allows time stamping of events to be synchronized among connected devices within 1 millisecond. An IRIG-B input is provided in the 350 to allow time synchronization using a GPS clock over a wide area. The 350 IRIG-B supports both AM and DC time synchronization with an auto detect feature that removes the requirement for manual selection.

Temperature Monitoring
The 350 continually monitors ambient temperature around the relay and alarms when the device is exposed to extreme temperatures and undesirable conditions such as air-conditioning unit or station heater failures.

The EnerVista Viewpoint maintenance tool allows users to review and analyze the time period a 350 relay is exposed to certain temperature ranges.

GE Digital Energy
350 Feeder Protection System
Security

Security Audit Trail
The Security Audit Trail feature provides complete traceability of relay setting changes at any given time and is NERC® CIP compliant. The 350 maintains a history of the last 10 changes made to the 350 configuration, including modifications to settings and firmware upgrades.

Security Setting Reports include the following information:
• If Password was required to change settings
• MAC address of user making setting changes
• Listing of modified changes
• Method of setting changes - Keypad, Front serial port, Ethernet, etc.

Password Control
With the implementation of the Password Security feature in the 350 relay, extra measures have been taken to ensure unauthorized changes are not made to the relay. When password security is enabled, changing of setpoints or issuing of commands will require passwords to be entered. Separate passwords are supported for remote and local operators, and separate access levels support changing of setpoints or sending commands.

Advanced Communications
The 350 incorporates the latest communication technologies making it the easiest and the most flexible feeder protection relay for use and integration into new and existing infrastructures. The 350 relay provides the user with one front USB and one rear RS485 communication port. Also available with the 350 is a rear communication port with Ethernet Fiber and Copper. In case of implementing PRP and HSR redundancy protocols, the 350 provides two rear Fiber ports. Through the use of these ports, continuous monitoring and control from a remote computer, SCADA system or PLC is possible.

The 350 provides optional Parallel Redundancy Protocol (PRP) and High Availability Seamless Ring (HSR) according to the IEC 62439-3 standard that defines two protocols to increase network availability by reducing failover time to zero. Both ports are capable of simultaneously supporting the following protocols: Modbus TCP/IP, IEC 61850, DNP3 or IEC 60870-5-104, IEEE 1588, SNTP and OPC-UA.

The basic concept of both protocols, PRP and HSR, is to send identical frames over different paths and discard one of the copies in reception, at best. If an error occurs or one of the paths goes down, the frame travelling through the path will not reach its destination, but its copy remains intact and will reach the desired destination. This technology ensures high reliability and availability of communication networks by providing redundancy and zero reconfiguration time in the event of a failure. Fail-safe communications systems are crucial for industries and utilities with critical applications where no recovery time is tolerated.

The 350 supports popular industry leading standard protocols enabling easy, direct integration into electrical SCADA and HMI systems. The protocols supported by the 350 include:
• IEC 61850
• IEC 61850 GOOSE
• DNP 3.0
• Modbus RTU
• Modbus TCP/IP
• IEC 60870-5-103
• PRP & HSR (IEC 62439-3)
• OPC-UA
• IEEE 1588 for time synchronization

The 350 relay provides Precision Time Protocol (PTP) based on IEEE 1588 for precise time synchronization throughout a network. OPC-UA is another feature based on IEC 62541 that the 350 relay offers.

These protocols make it easy to connect to a Utility or Industrial automation system, eliminating the need for external protocol converter devices.

EnerVista Software
The EnerVista suite is an industry leading set of software programs that simplifies every aspect of using the 350 relay. The EnerVista suite provides all the tools to monitor the status of the protected asset, maintain the relay, and integrate the information measured into DCS or SCADA monitoring systems. Convenient COMTRADE and sequence of event viewers are an integral part of the 350 set up software and are included to ensure proper protection and system operation.

Simplified Feeder Setup
The 350 Feeder Protection System includes a simplified setup process. This simplified feeder
setup consists of minimal settings and can be accessed through the relay front panel or via the EnerVista Setup software. Once the information is entered, the simplified setup will generate a settings file, provide documentation indicating which settings are enabled, and an explanation of the parameters entered.

**Viewpoint Monitoring**

Viewpoint Monitoring is a simple to use and full featured monitoring and data recording software package for small systems. Viewpoint monitoring provides a complete HMI package with the following functionality:

- Plug and play device monitoring
- System single line monitoring and control
- Annunciator alarm screens
- Trending reports
- Automatic event retrieval
- Automatic waveform retrieval

**Display**

A 4 line liquid crystal display (LCD) allows visibility under varied lighting conditions. When the keypad and display are not being used, the metering summary page is displayed to show critical metered values.

**LEDs**

The 350 relay has twelve* LED’s (8 programmable) that provide status indication for various conditions of the relay and the system. The LED indications are color coded to indicate the type of event.

* 10 non programmable LEDs for the non draw-out design

**User Interface**

- **DISPLAY:** 4 line text for easy viewing of key data
- **LEDs:** 10/12 LED indicators for quick diagnostics
- **KEYPAD:** Ten button keypad for quick diagnostics
- **FRONT PORT:** Electrically isolated front USB communication port
- **USER INTERFACE OPTIONS:** Draw-out and non draw-out options available

**Feeder Protection Settings in One Easy Step**

Fast and accurate configuration in one simple screen.

**3 Series Setup Software Protection Summary** for viewing a summary of Protection & Control configuration.
Dimensions

Draw-out version

Non draw-out version

Mounting

3 Series Depth Reducing Collar
Technical Specifications

### Phase/Neutral/Time Overcurrent (53P/53X/53/10)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.05 to 20.00 x CT in steps of 0.03 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 99% of Pickup @ 1 x CT</td>
</tr>
<tr>
<td>Curve Shape</td>
<td>ANSI Extremely/Very/Moderately/ Normally Inverse</td>
</tr>
<tr>
<td>Curve Multiplier</td>
<td>0.05 to 50.00 in steps of 0.01</td>
</tr>
<tr>
<td>Reset Time</td>
<td>Instantaneous, Linear</td>
</tr>
<tr>
<td>Time Delay</td>
<td>±3% of expected inverse time or 1 cycle, whichever is greater</td>
</tr>
<tr>
<td>Accuracy</td>
<td>per CT input</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>per CT input</td>
</tr>
</tbody>
</table>

### Sensitive Ground Time Overcurrent (53SG)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.005 to 3 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 99% of Pickup @ 1 x CT</td>
</tr>
<tr>
<td>Curve Shape</td>
<td>ANSI Extremely/Very/Moderately/ Normally Inverse</td>
</tr>
<tr>
<td>Curve Multiplier</td>
<td>0.05 to 50.00 in steps of 0.01</td>
</tr>
<tr>
<td>Reset Time</td>
<td>Instantaneous, Linear</td>
</tr>
<tr>
<td>Time Delay</td>
<td>±3% of expected inverse time or 1 cycle, whichever is greater</td>
</tr>
<tr>
<td>Accuracy</td>
<td>per CT input</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>per CT input</td>
</tr>
</tbody>
</table>

### Phase/Auxiliary Ground Sequence Overvoltage (5P/53P/53X/53/10)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.005 to 3 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 99% of Pickup @ 1 x CT</td>
</tr>
<tr>
<td>Curve Shape</td>
<td>ANSI Extremely/Very/Moderately/ Normally Inverse</td>
</tr>
<tr>
<td>Curve Multiplier</td>
<td>0.05 to 50.00 in steps of 0.01</td>
</tr>
<tr>
<td>Reset Time</td>
<td>Instantaneous, Linear</td>
</tr>
<tr>
<td>Time Delay</td>
<td>±3% of expected inverse time or 1 cycle, whichever is greater</td>
</tr>
<tr>
<td>Accuracy</td>
<td>per CT input</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>per CT input</td>
</tr>
</tbody>
</table>

### Phase Directional (67P)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional</td>
<td>Co-existing forward and reverse</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>Phase Current, Dual</td>
</tr>
<tr>
<td>Polaring Voltage</td>
<td>Calculated using phase voltages (IVs must be connected in “Wye”</td>
</tr>
<tr>
<td>- 3V, measured from Vaux input (3V, provided by an open delta connection)</td>
<td></td>
</tr>
<tr>
<td>MTA</td>
<td>From 0º to 359º in steps of 1º</td>
</tr>
<tr>
<td>Angle Accuracy</td>
<td>±3º</td>
</tr>
<tr>
<td>Operation Delay</td>
<td>20 to 30 ms</td>
</tr>
</tbody>
</table>

### Neutral Directional (67N)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directionality</td>
<td>Co-existing forward and reverse</td>
</tr>
<tr>
<td>Polarizing Voltage</td>
<td>Calculated using phase voltages (IVs must be connected in “Wye”</td>
</tr>
<tr>
<td>- 3V, measured from Vaux input (3V, provided by an open delta connection)</td>
<td></td>
</tr>
<tr>
<td>MTA</td>
<td>From 0º to 359º in steps of 1º</td>
</tr>
<tr>
<td>Angle Accuracy</td>
<td>±3º</td>
</tr>
<tr>
<td>Operation Delay</td>
<td>20 to 30 ms</td>
</tr>
</tbody>
</table>

### UNDERFREQUENCY (81U)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.00 to 1.25 x VT in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>96 to 99% of pickup</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0.0 to 600.0 s in steps of 0.01</td>
</tr>
<tr>
<td>Operate Time</td>
<td>0 to 1 cycle (Time Delay selected)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
</tbody>
</table>

### OVERFREQUENCY (81O)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.00 to 1.25 x VT in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>96 to 99% of pickup</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0.0 to 600.0 s in steps of 0.01</td>
</tr>
<tr>
<td>Operate Time</td>
<td>0 to 1 cycle (Time Delay selected)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
</tbody>
</table>

### SYNCHROCHECK (25)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.00 to 1.25 x VT in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>96 to 99% of pickup</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0.0 to 600.0 s in steps of 0.01</td>
</tr>
<tr>
<td>Operate Time</td>
<td>0 to 3 cycles (AR Dead Time selected)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
</tbody>
</table>

### Load Event Recorder

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of events</td>
<td>256</td>
</tr>
<tr>
<td>Header</td>
<td>relay name, order code, firmware revision</td>
</tr>
<tr>
<td>Content</td>
<td>event number, date of event, cause of event, per-phase current, ground current, sensitive ground current, neutral current, per-phase voltage (IVs connected in “Wye”, or phase-phase voltages (IVs connected in “Delta”), system frequency, power, power factor, thermal capacity</td>
</tr>
<tr>
<td>Data Storage</td>
<td>Retained for 3 days</td>
</tr>
</tbody>
</table>

### Clock

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup</td>
<td>IRIG-B: Data and time daylight saving time</td>
</tr>
<tr>
<td></td>
<td>Auto-detect, shift or amplitude modulation</td>
</tr>
<tr>
<td></td>
<td>Amplitude modulated: 1 to 10 V pk-pk DC shift, TTL</td>
</tr>
<tr>
<td></td>
<td>Input impedance: 4kOhm ± 10% RTC</td>
</tr>
<tr>
<td></td>
<td>Accuracy: ±1 min/month</td>
</tr>
</tbody>
</table>

### Logic Elements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of logic elements</td>
<td>8</td>
</tr>
<tr>
<td>Trigger source</td>
<td>3</td>
</tr>
<tr>
<td>Inputs per element</td>
<td>3</td>
</tr>
<tr>
<td>Block inputs per element</td>
<td>3</td>
</tr>
<tr>
<td>Supported operations</td>
<td>AND, OR, NOT, Pickup / Dropout timers</td>
</tr>
<tr>
<td>Pickup timer</td>
<td>0 to 6000 ms in steps of 1 ms</td>
</tr>
<tr>
<td>Dropout timer</td>
<td>0 to 6000 ms in steps of 1 ms</td>
</tr>
</tbody>
</table>

### Breaker Control

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Asserted Contact Input, Logic Element, Virtual Input, Manual Command</td>
</tr>
<tr>
<td>Function</td>
<td>Opens/closes the feeder breaker</td>
</tr>
</tbody>
</table>

### Synchrocheck (25)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead/line Live for Line and Bus</td>
<td>Maximum voltage difference</td>
</tr>
<tr>
<td></td>
<td>0.02 to 1.25 x VT in steps of 0.01</td>
</tr>
<tr>
<td></td>
<td>Maximum angle difference</td>
</tr>
<tr>
<td></td>
<td>Maximum frequency slip</td>
</tr>
<tr>
<td></td>
<td>Maximum breaker closing time</td>
</tr>
<tr>
<td></td>
<td>Maximum source function</td>
</tr>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Dead Source</td>
</tr>
<tr>
<td></td>
<td>LD-DB Dead Line-Dead Bus</td>
</tr>
<tr>
<td></td>
<td>LL-DB Live Line-Dead Bus</td>
</tr>
<tr>
<td></td>
<td>DL-DB Dead Line-Live Bus</td>
</tr>
<tr>
<td></td>
<td>AL-DB Any Line-Dead Bus</td>
</tr>
<tr>
<td></td>
<td>DL-AL Any Line-Live Bus</td>
</tr>
<tr>
<td>Dead Source</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>LD-OI One Live-Other Dead</td>
</tr>
<tr>
<td></td>
<td>NWLB Not Both Live</td>
</tr>
</tbody>
</table>

### Autoreset (717)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronize attempts</td>
<td>Up to 4 shouts</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0 to 3 cycles (AR Dead Time selected)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
<tr>
<td>Elements</td>
<td>Inputs, Outputs, Breaker Status (52 statues)</td>
</tr>
</tbody>
</table>

### Breaker Failure (508B)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup Level</td>
<td>0.05 to 20.00 x CT in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 99% of pickup</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0 to 1 cycle (Timer 1, Timer 2)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
</tbody>
</table>

### Breaker Trip Counter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Counter</td>
<td>1 to 10000 in steps of 1</td>
</tr>
</tbody>
</table>

### Cold Load Pickup Blocking

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Automatically (current level), or by command (asserted input)</td>
</tr>
<tr>
<td>Function</td>
<td>Block IOD functions, raise TOC pickup, for selected period of time</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0 to 1 cycle (Time 1, Timer 2)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.01 Hz</td>
</tr>
</tbody>
</table>

### Ambient Temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature</td>
<td>20°C to 80°C in steps of 1°C</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>-40°C to 20°C in steps of 1°C</td>
</tr>
<tr>
<td>Pickup</td>
<td>1 to 60 min in steps of 1 min</td>
</tr>
<tr>
<td>Drop</td>
<td>±50 ms (for time delay)</td>
</tr>
<tr>
<td>Temperature</td>
<td>Configurable 90 to 98% of pickup</td>
</tr>
</tbody>
</table>

### Generator

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing Accuracy</td>
<td>±1 second</td>
</tr>
</tbody>
</table>
**CONTACT INPUTS**

- Inputs: 8
- Selectable thresholds: 50/60 Hz
- Recognition time: 1/2 cycle
- Debounce time: 1 to 64 ms, selectable, in steps of 1 ms
- Continuous current draw: 2 mA
- Type: opto-isolated inputs
- External switch: wet contact
- Maximum input: 300 VDC

**PHASE & GROUND CURRENT INPUTS**

- CT Primary: 1 to 600 A
- Range: 0.02 to 20 × CT
- Input type: 1 A or 5 A (must be specified with order)
- Nominal frequency: 50/60 Hz
- Burden: <0.1 VA at rated load
- Accuracy: ±1% of reading + 0.2% of reading from 0.02 to 20 × CT ±20% of reading from 0.02 to 0.19 × CT
- CT withstand: 1 second at 100 × rated current 2 seconds at 40 × rated current continuous at 3 × rated current

**SENSITIVE GROUND CURRENT INPUT**

- CT Primary: 1 to 600 A
- Range: 0.02 to 3 × CT
- Input type: 1 A or 5 A (must be specified with order)
- Nominal frequency: 50/60 Hz
- Burden: <0.1 VA at rated load
- Accuracy: ±1% of reading at 0.1× CT +3% of reading from 0.02 to 3 × CT ±20% of reading from 0.02 to 0.19 × CT
- CT withstand: 1 second at 100 × rated current 2 seconds at 40 × rated current continuous at 3 × rated current

**PHASE/AUX VOLTAGE INPUTS**

- Source VT: 0.12 to 65 V / 50 to 220 V
- VT secondary: 50 to 240 V
- VT ratio: 1 to 5000 in steps of 1
- Nominal frequency: 50/60 Hz
- Accuracy: ±1.0% of reading
- Voltage withstand: 250 VAC continuous

**FORM-A RELAYS**

- Configuration: 2 fixed electromechanical
- Contact material: silver-alloy
- Operate time: <4 ms
- Continuous current: 10 A
- Make and carry for 0.2s: Break DC inductive, L/R=40 ms: 24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A 250 V / 0.2 A
- Break DC resistive: 24 V / 10 A 48 V / 6 A 125 V / 0.5 A 250 V / 0.3 A
- Break AC inductive: 720 VA @ 250 VAC Pilot duty A300
- Break AC resistive: 277 VAC / 10 A

**FORM-A VOLTAGE MONITOR**

- Applicable voltage: 20 to 250 VDC
- Trickle current: 1 to 2.5 mA

**TRIP / CLOSE SEAL-IN**

- Relay 1 trip seal-in: 0.00 to 9.99 s in steps of 0.01
- Relay 2 close seal-in: 0.00 to 9.99 s in steps of 0.01

**DIGITRIP POWER SUPPLY**

- Nominal: 120 to 240 VAC 125 to 250 VDC
- Range: 60 to 300 VAC (50 and 60 Hz)
- Fiber: 8 to 250 VDC
- Ride-through time: 35 ms

**LOW RANGE POWER SUPPLY**

- Nominal: 24 to 48 VDC
- Range: 20 to 60 VDC

**SALL RANGES**

- Voltage withstand: 2 × highest nominal voltage for 10 ms Power: 15 W nominal, 20 W maximum
- Consumption: 20 VA nominal, 28 VA maximum

**SERIAL**

- RS485 port: Opto-coupled
- Baud rates: up to 115 kbps
- Response time: 1 ms typical
- Parity: None, Odd, Even
- Maximum: 1200 m (4000 feet)
- Distance: 2 km (1.25 miles)
- Isolation: 2 kV
- Protocol: Modbus RTU, DNP 3.0, IEC 60870-5-103

**ETHERNET (FIBER)**

- Connector: RJ-45
- Protocol: Modbus TP/DR, DNP 3.0, IEC 60870-5-10, IEC 61850 GOOSE

**ETHERNET (COPPER)**

- Connector: RJ-45
- Protocol: Modbus TP/DR, DNP 3.0, IEC 60870-5-10, IEC 61850 GOOSE

**WEBSITE**

- Standard specification: Compliant with USB 2.0
- Data transfer rate: 115 kbps

**CERTIFICATION**

- Low voltage directive EN60255-5 / EN60255-27 / EN16010-2
- CE: cULus UL1053, C22.2 No.14
- North America: UL508, CSA C22.2 No.14
- ISO: Manufactured under a registered quality program GS09001

**TYP TESTS**

- Dielectric voltage withstand: 2.3kV
- Impulse voltage withstand: 5kV
- Damped: IEC 61000-4-18
- Oscillatory: IEC 61000-4-21
- Electrostatic: EN61000-4-27
- Discharge: EN60950-22-2
- RF immunity: EN61000-4-3 / IEC 61000-4-22-5
- Fast Transient: EN61000-4-22-4
- Disturbance: EN61000-4-22-5
- Surge Immunity: EN61000-4-22-6
- Conducted RF: EN61000-4-22-7
- Power Frequency Immunity: EN61000-4-22-8
- Voltage: EN61000-4-22-9
- Radiation and Ripple DC: CIDSP11, CIDSPR22
- Conducted: IEC 61055-23
- Emissions: EN61000-4-22-10
- Sinusoidal Vibration: EN61000-4-22-11
- Shock & Bump: EN61000-4-22-12
- High Altitude: EN61000-4-22-13
- Power Magnetic Immunity: EN61000-4-22-14
- Pulse Magnetic Immunity: EN61000-4-22-15
- Damped Magnetic Immunity: EN61000-4-22-16
- Voltage Dip & Interruption: EN61000-4-22-17

**DIMENSIONS**

- Size: Refer to Dimensions Chapter
- Weight: 4.1 kg (9.0 lb)

**OPERATING ENVIRONMENT**

- Ambient operating: -40°C to 60°C (-40°F to 140°F)
- Temperature: -25°C to 85°C (-13°F to 185°F)
- Ambient storage / shipping: -40°C to +85°C (-40°F to +185°F)
- Humidity: Operating up to 95% (non condensing)
- Pollution degree: II
- Overvoltage category: III
- Ingress Protection: IP40 Front, IP10 back

**GE Digital Energy**

- Website: GEDigitalEnergy.com
## Ordering

<table>
<thead>
<tr>
<th>Base Unit</th>
<th>Language</th>
<th>Phase Currents</th>
<th>Ground Currents</th>
<th>Power Supply</th>
<th>Faceplate</th>
<th>Current Protection</th>
<th>Control</th>
<th>Options</th>
<th>Communications</th>
<th>Case Design</th>
<th>Harsh Environment</th>
</tr>
</thead>
</table>

**.Description**

- Base Unit: 350
- Language: E
- Phase Currents: P1
- Ground Currents: G1
- Power Supply: L
- Faceplate: E
- Control: N
- Options: Standard Communication - 24 - 48 Vdc

### Ordering Notes:

1. G1/G5 and S1/S5 must match corresponding P1/P5 - there cannot be 5A and 1A mixing
2. "4E" and "5E" communication options are available only on draw-out version

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**Related Products / Accessories**

- MultiSync 100 - GPS Clock MultiSync100-P
- 350 Retrofit Kit For 735 1819-0103
- 350 Retrofit Kit For IAC Relay 1819-0102
- 350 Retrofit Kit For S1/S2 Cut-Out 1819-0100
- SR3 Depth reducing collar - 1.375" 1009-0314
- SR3 Depth reducing collar - 3.00" 1009-0313

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**GE Digital Energy**

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Direct: +1 678-844-6777

GEDigitalEnergy.com

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