**Multilin™**

350

**FEEDER PROTECTION SYSTEM**

**Intuitive and Innovative Feeder Protection**

**KEY BENEFITS**

- Easy to use and intuitive overcurrent protection and control for feeder applications.
- Effortless draw-out construction eliminates requirement for test switches and reduces downtime.
- Environmental monitoring system to alarm on destructive operating conditions and plan preventative maintenance.
- Easy to use interface and set up in one simple step.
- Accelerated Life Cycle Tested to ensure reliability of relay operation under abnormal conditions.
- Advanced power system diagnostics to increase reliability through fault and disturbance recording capabilities.
- Flexible communications with multiple ports & protocols to allow seamless integration into new and existing infrastructure.
- 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 by tracking setting changes.
- Application flexibility with the use of programmable logic elements.
- Draw out and non-draw out options available.

**APPLICATIONS**

- Industrial feeders with enhanced breaker monitoring diagnostics, etc.
- Distribution utility downstream breaker protection.
- Medium voltage Utility feeders with advanced control features, Cold Load Pickup, auto reclose, multiple settings group, etc.

**FEATURES**

**Protection and Control**

- Phase, neutral and ground TOC and IOC.
- Phase Directional Overcurrent.
- Undervoltage, overvoltage, frequency.
- Neutral/ground directional Overcurrent.
- Negative sequence Overcurrent.
- ANSI, IAC, IEC, flex curves.
- Cable Thermal Model Protection.
- Breaker Failure.
- Cold Load Pick Up.
- Four-shot auto-reclose.
- 10 digital inputs, 7 contact outputs.
- Two setting groups.

**Metering & Monitoring**

- Event Recorder: 256 events.
- Oscillography with 32 samples per cycle.
- IRIG-B clock synchronization.
- Relay health diagnostics.
- Security audit trail.
- Metering - current, voltage, power, frequency.

**User Interface**

- 4 line display for easy viewing of key data.
- 12 LED indicators for quick diagnostics.
- Front USB and rear RS485 serial communications.
- Multiple Communication Protocols:
  - IEC® 61850
  - IEC 61850 GOOSE,
  - MODBUS TCP/IP, MODBUS RTU,
  - DNP 3.0, IEC 60870-5-104, IEC 60870-5-103.

**EnerVista™ Software**

- EnerVista Software - an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices.
- Quick & easy configuration requiring minimal settings for most feeder applications.
Overview

The 350 relay is a member of the 3 Series family of Multilin relays. This protective device is used to perform primary circuit protection on medium voltage feeders and downstream protection for distribution utilities.

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, and auto reclose.

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, eg. 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.

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.

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 options 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 enables 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.

Instantaneous Overcurrent (Phase, Ground, Neutral)
The instantaneous element provides fast clearance of high magnitude faults to prevent damage to the power infrastructure and the equipment connected to it.

Neutral Overcurrent
The neutral signal is derived as the residual sum of the three phase CTs eliminating the need for an additional ground sensor.

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 0º to 359º in steps of 1º.

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.

Protection Features

<table>
<thead>
<tr>
<th>Device</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>27P</td>
<td>Phase Undervoltage</td>
</tr>
<tr>
<td>27X</td>
<td>Auxiliary Undervoltage</td>
</tr>
<tr>
<td>49</td>
<td>Thermal Model</td>
</tr>
<tr>
<td>50P</td>
<td>Phase Instantaneous Overcurrent</td>
</tr>
<tr>
<td>50N</td>
<td>Neutral Instantaneous Overcurrent</td>
</tr>
<tr>
<td>50G</td>
<td>Ground/Sensitive Ground Instantaneous Overcurrent</td>
</tr>
<tr>
<td>50BF</td>
<td>Breaker Failure</td>
</tr>
<tr>
<td>50_2</td>
<td>Negative Sequence Overcurrent</td>
</tr>
<tr>
<td>51P</td>
<td>Phase Timed Overcurrent</td>
</tr>
<tr>
<td>51N</td>
<td>Neutral Timed Overcurrent</td>
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<tr>
<td>51G</td>
<td>Ground Timed Overcurrent</td>
</tr>
<tr>
<td>59K</td>
<td>Auxiliary Overvoltage</td>
</tr>
<tr>
<td>59N</td>
<td>Neutral Overvoltage</td>
</tr>
<tr>
<td>59_2</td>
<td>Negative Sequence Overvoltage</td>
</tr>
<tr>
<td>67G</td>
<td>Ground Directional Overvoltage</td>
</tr>
<tr>
<td>67N</td>
<td>Neutral Directional Overvoltage</td>
</tr>
<tr>
<td>79</td>
<td>Autoreclose</td>
</tr>
<tr>
<td>81U</td>
<td>Underfrequency</td>
</tr>
<tr>
<td>81O</td>
<td>Overfrequency</td>
</tr>
<tr>
<td>CLP</td>
<td>Cold Load Pickup</td>
</tr>
</tbody>
</table>

ANSI® Device Numbers & Functions

Latched Lockout available as a standard feature
350 Feeder Protection System

Logic Designer

<table>
<thead>
<tr>
<th>SETTING</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGIC ELEMENT 1</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Alarm #1</td>
</tr>
<tr>
<td>Function</td>
<td>Disabled</td>
</tr>
<tr>
<td>Asserted</td>
<td>On</td>
</tr>
<tr>
<td>Trigger 1</td>
<td>Contact Input 1 On</td>
</tr>
<tr>
<td>Trigger 2</td>
<td>Contact Input 2 On</td>
</tr>
<tr>
<td>Trigger 3</td>
<td>Logic Element 1 Trip FRP</td>
</tr>
<tr>
<td>Trigger Logic</td>
<td>AND</td>
</tr>
<tr>
<td>Timer Pickup Delay</td>
<td>2 ms</td>
</tr>
<tr>
<td>Timer Dropout Delay</td>
<td>5 ms</td>
</tr>
<tr>
<td>Relay 1</td>
<td>Relay 2</td>
</tr>
<tr>
<td>Block 1</td>
<td>Virtual Input 1 On</td>
</tr>
<tr>
<td>Block 2</td>
<td>Virtual Input 2 On</td>
</tr>
<tr>
<td>Block 3</td>
<td>Remote Input 1 On</td>
</tr>
<tr>
<td>Block Logic</td>
<td>OR</td>
</tr>
</tbody>
</table>

Sixteen logic elements available for applications such as manual control, interlocking, and peer to peer tripping.

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.

Arc Flash Mitigation

The 350 relay is equipped with multiple setting groups and two user definable inverse curves - FlexCurves A and B for fast and reliable arc-flash mitigation and breaker operation. In the event of an arc-flash, the relay can be set to communicate to any upstream or downstream devices via IEC 61850 GOOSE messaging.

Cable Thermal Model

The cable thermal mode element protects 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 alarams 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

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.

- 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.

Monitoring & Diagnostics

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

Power System Troubleshooting
Analyze power system disturbances with transient fault recorder and event records
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.

**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.

**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. Through the use of these ports, continuous monitoring and control from a remote computer, SCADA system or PLC is possible.

The 350 supports popular industry 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
- IEC 60870-5-104

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 setup 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

Feeder protection settings in one easy step

Fast and accurate configuration in one simple screen.
Typical Wiring Diagram

350 Feeder Protection System

Mounting

DIRECTION OF POWER FLOW FOR POSITIVE WATTS
POSITIVE DIRECTION OF LAGGING VARs

OUTPUT CONTACTS SHOWN WITH NO CONTROL POWER

COMMUNICATIONS WIRING IN INSTRUCTION MANUAL

OPEN DELTA VT CONNECTION

5.350 ±0.010
(131.1 mm ±0.25 mm)

4.100 ±0.010
(104.1 mm ±0.25 mm)

0.300
(7.6 mm)

6.900 ±0.010
(175.3 mm ±0.25 mm)

6.000 ±0.010
(152.4 mm ±0.25 mm)

4.000 ±0.010
(101.6 mm ±0.25 mm)
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 access to device interrogation and change of settings.

- **FRONT PORT:**
  - Electrically isolated front USB communication port

- **USER INTERFACE OPTIONS:**
  - Draw out and non draw out options available

**SETPOINT GROUP 1, 2:**
- These indicators are continuously on if corresponding group provides settings for protection elements.

**TRIP:**
- Indicator turns on when relay detects a trip condition. Operates the Trip Relay to open the breaker.

**ALARM:**
- While relay detects an alarm condition, indicator flashes.

**PICKUP:**
- Indicator lights steady when any protection feature pickup threshold exceeded.

**Dimensions**

<table>
<thead>
<tr>
<th></th>
<th>DRAW-OUT DESIGN</th>
<th>NON DRAW-OUT DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in</td>
<td>mm</td>
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<tr>
<td>H</td>
<td>7.93</td>
<td>201.5</td>
</tr>
<tr>
<td>W</td>
<td>6.62</td>
<td>168.2</td>
</tr>
<tr>
<td>D</td>
<td>9.62</td>
<td>244.2</td>
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<td>W1</td>
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<td>D1</td>
<td>7.89</td>
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<tr>
<td>D2</td>
<td>1.73</td>
<td>43.8</td>
</tr>
<tr>
<td>H1</td>
<td>6.82</td>
<td>173.2</td>
</tr>
</tbody>
</table>
Technical Specifications

PHASE/NEUTRAL/GROUND TIME OVERCURRENT (51P/51N/51G)

**Pickup Level:** 0.05 to 0.00 x CT in steps of 0.01 x CT

**Dropout Level:** 97 to 99% of Pickup @ 1 x CT

**Directionality:** ANSI Extremely/Very/Moderately/ Normally Inverse

**Polarizing Voltage:** V<sub>c</sub> calculated using phase voltages (Vs must be calculated in “Wye”).
- From 0º to 359º in steps of 1º

**Threshold:** From 0º to 359º in steps of 1º

**MTA:** From 0º to 359º in steps of 1º

**Angle Accuracy:** ±4º

**Operation Delay:** 20 to 30 ms

NEUTRAL DIRECTIONAL (57N)

**Directionality:** Co-existing forward and reverse

**Polarizing Voltage:** V<sub>c</sub> calculated using phase voltages (Vs must be calculated in “Wye”).
- From 0º to 359º in steps of 1º

**Threshold:** From 0º to 359º in steps of 1º

**MTA:** From 0º to 359º in steps of 1º

**Angle Accuracy:** ±4º

**Operation Delay:** 20 to 30 ms

PHASE/AUXILIARY UNDERVOLTAGE (127/727X)

**Minimum Voltage:** Programmable from 0.00 to 1.25 x VT in steps of 0.01

**Pickup Level:** 0.00 to 1.25 x VT in steps of 0.01

**Duration:** 1 to 10000 in steps of 1

**Curve:** Definite Time, Inverse Time

**Accuracy:** ±3% of expected inverse time or 1 cycle, whichever is greater

**Level Accuracy:** Per voltage input

PHASE/AUXILIARY/NEUTRAL NEG. SEQ. OVERVOLTAGE

**Minimum Voltage:** Programmable from 0.00 to 1.25 x VT in steps of 0.01

**Pickup Level:** 0.00 to 1.25 x VT in steps of 0.01

**Duration:** 1 to 1000 in steps of 1

**Curve:** Definite Time, Inverse Time

**Accuracy:** ±3% of expected inverse time or 1 cycle, whichever is greater

**Level Accuracy:** Per voltage input

SENSITIVE GROUND INSTANTANEOUS OVERCURRENT (50S/50N/50G/50)

**Pickup Level:** 0.005 to 0.001 x CT in steps of 0.001 x CT

**Dropout Level:** 97 to 99% of Pickup @ 1 x CT

**Directionality:** ANSI Extremely/Very/Moderately/ Normally Inverse

**Polarizing Voltage:** V<sub>c</sub> calculated using phase voltages (Vs must be calculated in “Wye”).
- From 0º to 359º in steps of 1º

**Threshold:** From 0º to 359º in steps of 1º

**MTA:** From 0º to 359º in steps of 1º

**Angle Accuracy:** ±4º

**Operation Delay:** 20 to 30 ms

GROUNGROUND DIRECTIONAL (56G)

**Directionality:** Co-existing forward and reverse

**Polarizing Voltage:** V<sub>c</sub> calculated using phase voltages (Vs must be calculated in “Wye”).
- From 0º to 359º in steps of 1º

**Threshold:** From 0º to 359º in steps of 1º

**MTA:** From 0º to 359º in steps of 1º

**Angle Accuracy:** ±4º

**Operation Delay:** 20 to 30 ms

METERING SPECIFICATIONS

**Parameters:**
- 3-Phase Real Power (MVA)
- 3-Phase Reactive Power (Mvar)
- 3-Phase Apparent Power (MVA)
- Power Factor

**Accuracy:**
- ±0.05
- ±0.05 Hz

**Resolution:**
- 0.1 MVA
- 0.1 Mvar

**Range:**
- ±300 MVA
- ±3000 Mvar

**Data Storage:**
- RAM - battery backed-up

EVENT RECORDER

**Number of events:** 256

**Header:**
- relay name, order code, firmware revision

**Content:**
- event number, date of event, cause of event, per-phase current, ground current, sensitive ground current, neutral current, per-phase voltage (Vs connected in “Wye”), or phase-to-phase voltages (Vs connected in “Delta”), system frequency, power, power factor, thermal capacity

**Data Storage:**
- Retained for 3 days

CLOCK

**Setup:**
- Date and Time Daylight Saving Time

**iKIG-b:**
- Auto-detect (DC shift or Amplitude Modulated)

**Amplitude modulated:** 1 to 10 V pk-pk

**DC shift:** TTL

**Input impedance:** 40kOhm ± 10%

**RTC Accuracy:** ± 1 min / month

LOGIC ELEMENTS

**Number of logic inputs:** 8

**Trigger source inputs per element:** 3

**Block inputs per element:** 3

**Supported operations:** AND, OR, NOT, Pickup / Dropout timers

**Input:**
- 0 to 600 ms in steps of 1 ms

**Dropout timer:**
- 0 to 6000 ms in steps of 1 ms

BREAKER CONTROL

**Operation:**
- Assisted Contact Input, Logic Element, Virtual Input, Manual Command

**Function:**
- Opens / closes the breaker

ADO/REC/OFF (71J)

**Reclose attempts:**
- Up to 4 shots

**Time Delay:**
- 0 to 3 cycles IAR Dead Time selected

**Accuracy:**
- Inputs, Outputs, Breaker Status (52 status)

BREAKER FAILURE (50BF)

**Pickup Level:** 20.00 x CT in steps of 0.01

**Dropout Level:** 97 to 98% of pickup

**Time Delay:**
- 0 to 1 cycle (Timer 1, Timer 2)

**Level Accuracy:**
- per CT input

BREAKER TRIP COUNTER

**Trip Count Limit:**
- 1 to 10000 in steps of 1

COLD LOAD PICKUP BLOCKING

**Operation:**
- Automatically (command level), or by command (asserted input)

**Function:**
- Block DC functions, raise TOC pickup, for selected period of time

**Time Delay:**
- 0 to 1 cycle (Block Time)

**Accuracy:**
- ±50 ms (outage time ≤ 5 min)

- ±1 s (outage time > 5 min)

AMBIENT TEMPERATURE

**High Temperature:**
- 20°C to 80°C in steps of 1°C

**Pickup:**
- -40°C to 20°C in steps of 3°C

**Low Temperature:**
- 1 to 60 min in steps of 1 min

**Accuracy:**
- ±50 ms (outage time ≤ 5 min)

- ±1 s (outage time > 5 min)

**Temperature:**
- Configurable 90 to 98% of pickup

**Dropout:**
- ±10°C

**Accuracy:**
- ±1 second
### Contact Inputs
- **Inputs:** 8
- **Selective thresholds:** 17, 33, 84, 166 VDC
- **Recognition time:** 1/2 cycle
- **Debounce time:** 1 to 64 ms, selectable, in steps of 1 ms
- **Continuous current:** 2 mA
- **Type:** opto-isolated inputs
- **External switch:** wet contact
- **Maximum input voltage:** 300 VDC

### Phase & Ground Current Inputs
- **CT Primary:** 1 to 6000 A
- **Ranging:** 0.02 to 20 x 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 1 x CT
- **Response time:** 1 ms typical
- **Parity:** None, Odd, Even
- **Maximum:** 1200 m (4000 feet)
- **Isolation:** ≥2 kV
- **Protocol:** Modbus RTU, DNP 3.0, IEC 60870-5-103

### Sensitive Ground Current Input
- **CT Primary:** 1 to 600 A
- **Range:** 0.002 to 3 x 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 1 x CT
- **Response time:** 1 ms typical
- **Parity:** None, Odd, Even
- **Maximum:** 1200 m (4000 feet)
- **Isolation:** ≥2 kV
- **Protocol:** Modbus RTU, DNP 3.0, IEC 60870-5-103

### Phase/Aux Voltage Inputs
- **Source VF:** 0.12 to 65 V/s 50 to 220 V
- **VT secondary:** 50 to 220 V
- **VT ratio:** 1 to 5000 in steps of 1
- **Nominal frequency:** 50/60 Hz
- **Accuracy:** ±1% of reading
- **Voltage withstand:** 260 VAC continuous

### FORM-A Relays
- **Configuration:** 2 (local electromechanical)
- **Contact material:** Silver-alloy
- **Operate time:** ≤8 ms
- **Continuous current:** 10 A
- **Make and carry:** 30 A per ANSI C37.90
- **Break (DC inductive, L/R=40 ms):** 24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A
- **Break (AC inductive):** 720 VA @ 250 VAC Pilot duty A300
- **Break (AC resistive):** 277 V / 10 A

### FORM-A Voltage Monitor
- **Applicable voltage:** 20 to 250 VAC
- **Trickle current:** 1 to 2.5 mA

### FORM-C Relays
- **Configuration:** 5 (local electromechanical)
- **Contact material:** Silver-alloy
- **Operate time:** ≤8 ms
- **Continuous current:** 10 A
- **Make and carry:** 30 A per ANSI C37.90
- **Break (DC inductive, L/R=40 ms):** 24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A
- **Break (AC inductive):** 720 VA @ 250 VAC Pilot duty A300
- **Break (AC resistive):** 277 V / 10 A

### Trip/Close Seal-in
- **Relay 1 trip seal-in:** 0.00 s to 9.99 s in steps of 0.01
- **Relay 2 close:** 0.00 s to 9.99 s in steps of 0.01

### High Range Power Supply
- **Nominal:** 120 to 240 VAC (125 to 250 VDC)
- **Range:** 60 to 300 VAC (ISO and 60 Hz)
- **84 to 250 VDC
- **Ride-through time:** 35 ms

### Low Range Power Supply
- **Nominal:** 24 to 48 VDC
- **Range:** 20 to 60 VDC

### All Ranges
- **Voltage withstand:** 2 x highest nominal voltage for 10 ms
- **Power:** 15 W nominal, 20 W maximum
- **consumption:** 20 VA nominal, 28 VA maximum

### Ethernet (Copper)
- **Modes:** 10/100/1000 Mbit Multi-mode
- **Connector:** RJ-45
- **Protocol:** Modbus TCP/IP, DNP 3.0, IEC 60870-5-103

### Ethernet (Fiber)
- **Fiber type:** 10/100/1000 Mbit Multi-mode
- **Wavelength:** 1300 nm
- **Connector:** RJ-45
- **Transmit power:** -20 dBm
- **Receiver:** -31 dBm
- **Power budget:** 9 dB
- **Maximum input power:** -11.8 dBm
- **Typical distance:** 2 km (1.25 miles)
- **Duplex:** Half Duplex
- **Protocol:** Modbus TCP/IP, DNP 3.0, IEC 60870-5-104, IEC 61850 GOOSE

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

### Certification
- **Low voltage directive ENE60255-5 / ENE60525-7 / IEC61300-1
- **CE:** EMV Directive ENE60525-26 / EN60261, EN61000-6-2, UL508
- **North America:** cULus UL1053, C22.2 No 14
- **ISO:** Manufactured under a registered quality program ISO9001

### Type Tests
- **Dielectric voltage withstand:** EN60625-5 / 5kV
- **Impulse voltage withstand:** Damped: IEC 61000-4-18 / 2.5kV CM, 1kV
- **Oscillating:** IEC 60255-22-2 / DM
- **Electrostatic:** IEC 60255-4-2 / Level 4
- **Discharge:** IEC 60255-24-3 / Class A & 8
- **RF immunity:** IEC 60255-22-3 / Level 3
- **Fast transient:** EN61000-4-4 / Class A & B
- **Disturbance:** IEC 60255-22-4 / Level 3
- **Surge immunity:** IEC 60255-22-5 / Level 3 & 4
- **Conducted RF:** EN61000-4-6 / Class A & B
- **Immunity:** IEC 60255-22-7 / Level 3
- **Power Frequency Immunity:** IEC 60255-4-7 / Class A & B
- **Ripple & Noise:** IEC 60255-5-11
- **Radiated & Conducted:** CISPR 11 / CISPR 22
- **Damped:** IEC 60255-25 / Class A
- **Emissions:** Sinusoidal
- **Vibration:** IEC 60255-21-1 / Class 1
- **Shock & Bump:** IEC 60255-21-2 / Class 1
- **Siesmic:** IEC 60255-21-3 / Class 2
- **Power magnetic immunity:** IEC 60600-4-8 / Level 5
- **Pulse Magnetic immunity:** IEC 60600-4-9 / Level 4
- **Damped Magnetic immunity:** IEC 60600-4-10 / Level 4
- **Voltage dip & interruption:** IEC 60600-4-11 / 0, 40, 70, 80% dips, 250 ms cycle interrupts
- **Damped:** IEC 60600-4-12 / 2.5kV CM, 1kV
- **Oscillating:** Conducted RF: IEC 60600-4-16 / Level 4
- **Immunity 0-150kHz:** IEC 60600-4-17 / 15% ripple
- **Ingress Protection:** IEC 60529
- **Environmental (Dry):** IEC 60636-2-3 / 60°C 16hrs
- **Immunity (Damp):** IEC 60636-2-2 / 85°C 16hrs
- **Relative Humidity:** IEC 60636-2-30 / 60°C 16hrs
- **Shock & Bump:** IEC 60636-2-30 / 60°C 16hrs
- **Relative Humidity:** IEC 60636-2-30 / 60°C 16hrs
- **Power magnetic immunity:** IEC 60600-4-8 / Level 5
- **Pulse Magnetic immunity:** IEC 60600-4-9 / Level 4
- **Damped Magnetic immunity:** IEC 60600-4-10 / Level 4

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

### Operating Environment
- **Ambient temperature:** -40°C to +85°C (-40°F to +185°F)
- **Ambient storage / shipping temperature:** -40°C to +85°C (-40°F to +185°F)
- **Humidity:** Operating up to 95% (non-condensing) @ 35°C (As per IEC 60608-2-10 Variant 2, 6days)
- **Pollution degree:** III
- **Overvoltage:** III
- **Ingress Protection:** IP40 Front, IP10 back
**Ordering**

<table>
<thead>
<tr>
<th>Description</th>
<th>Language</th>
<th>Phases</th>
<th>Grounds</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>
<tbody>
<tr>
<td>English (with programmable LEDs) for Draw out option only</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>Extended Overcurrent Protection - 49, 50P(2), 50G(2), 50N(2), 51P(1), 51G(1), 51N(1)</td>
<td>C</td>
<td>M</td>
<td>Standard + Ethernet (Copper &amp; Fiber - MTRJ MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE)</td>
<td>C</td>
<td>H</td>
</tr>
<tr>
<td>5A three phase current inputs</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>No Selection</td>
<td>N</td>
<td>N</td>
<td>No Selection</td>
<td>D</td>
<td>H</td>
</tr>
<tr>
<td>1A ground current input</td>
<td>L</td>
<td>1</td>
<td></td>
<td></td>
<td>S</td>
<td>Standard Overcurrent Protection - 67N(1), 67G(1) + Voltage Metering</td>
<td>N</td>
<td>N</td>
<td>Directional Neutral Overcurrent Protection 67N(1), 67G(1) + Voltage Metering</td>
<td>D</td>
<td>N</td>
</tr>
<tr>
<td>1A sensitive ground current input</td>
<td>L</td>
<td>1</td>
<td></td>
<td></td>
<td>S</td>
<td>Advanced overcurrent protection - 49, 50P(2), 50G(2), 50N(2), 51P(1), 51G(1), 51N(1)</td>
<td>E</td>
<td>M</td>
<td>Standard + Ethernet (Copper &amp; Fiber - MTRJ MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE)</td>
<td>E</td>
<td>H</td>
</tr>
<tr>
<td>5A sensitive ground current input</td>
<td>L</td>
<td>1</td>
<td></td>
<td></td>
<td>S</td>
<td>No Selection</td>
<td>N</td>
<td>N</td>
<td>No Selection</td>
<td>D</td>
<td>H</td>
</tr>
</tbody>
</table>

Note: 1) G1/G5 and S1/S5 must match corresponding P1/P5 - there cannot be 5A and 1A mixing

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**Accessories for the 350**

- Multilink Ethernet Switch ML2400-F-HI-HI-A2-A2-A6-G1
- Viewpoint Maintenance VPM-1
- Viewpoint Monitoring IEC 61850 VP-1-61850

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**Visit GEMultilin.com/350 to:**

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