The Multilin 869 relay is a member of the Multilin 8 Series protective relay platform and has been designed for the protection, control and management of medium and large induction and synchronous motors.

The Multilin 869 provides advanced functionality for various types of applications such as high-speed protection, extensively customizable programmable logic, advanced motor monitoring and diagnostics, and flexible configuration capabilities.

Advanced communications of the 8 Series platform allows easy integration into process and electrical control systems for smoother asset monitoring and control.

**Key Benefits**

- Comprehensive motor protection for medium and large induction motors
- Advanced motor diagnostics with high-end fault and disturbance recording
- High-end cyber security such as AAA, Radius, RBAC, and Syslog helps enable NERC® CIP requirements
- Draw-out design simplifies testing and increases process uptime
- Wi-Fi connectivity minimizes system configuration and facilitates quick/easy relay programming and diagnostic retrieval
- Monitored environmental conditions helps reduce system downtime

**Key Applications**

- Wide range of motor applications for oil & gas, mining & metals, cement, and wastewater
- Comprehensive protection and management of medium to large motors; two-speed, VFD-driven, cyclic loading and synchronous motors
- Specific and advanced features for high inertia loads and reduced-voltage starting motors
- Stator protection of medium to large synchronous motors where field functions are provided by excitation panels
- Advanced predictive motor diagnostics and motor health visualization

**Innovative Technology & Design**

- Advanced motor protection, control and diagnostics capability
- Patented environmental monitoring and diagnostics
- Advanced, flexible and embedded communications: IEC® 61850 Ed2, IEC 62439/PRP, Modbus® RTU & TCP/IP, DNP3.0, IEC 60870-5-104
- Single setup and configuration across the platform
- Elimination of electrolytic capacitors
- Field swappable power supply
- Enhanced relay draw-out construction

**Exceptional Quality & Reliability**

- IPC A-610-E Class 3 manufacturing standards
- Highest reliability standards for electronics testing
- 100% Environmental Stress Screening and full functional testing
- Rated for IP54 (front) applications
- Standard Harsh Environment Conformal Coating

**Uncompromising Service & Support**

- Covered under GE’s 10 year warranty plan
- Designed, tested and manufactured by GE
Multilin 8 Series Platform Overview

From oil pumping and refining facilities, to open pit or underground mining and processing operations, to distribution utilities, companies demand solutions that ensure maximum process uptime, minimum operational and maintenance efforts, and have the durability to withstand harsh environmental conditions.

The Multilin 8 Series is GE’s next-generation protection and control relay platform designed for industrial and distribution utilities. The platform provides comprehensive protection and asset monitoring for critical feeders, motors, generators, and transformers.

Multilin 8 Series Platform - Application Example

The 8 Series is designed to solve the challenges that customers face in running their day-to-day operations including maximizing system and process uptime, simplifying system integration and maintenance, and extending the life of critical assets. Utilizing advanced design practices, superior technology (elimination of all electrolytic capacitors), and state-of-the-art test and manufacturing facilities, GE is raising the bar on system performance and reliability.

With advanced communications the 8 Series integrates easily and seamlessly into your new or existing control system, along with your other Multilin protection devices, providing a comprehensive solution for the end-to-end electrical system within your operations.
Exceptional Quality & Reliability

Industry-leading quality, reliability and design processes are at the core of GE’s next generation protective relay platform. With significant investments in state-of-the-art type test facilities that simulate a complete range of operating environments and manufactured to the IPC A-610 Class 3 standard, adhering to the highest reliability standards and ensuring rugged performance, each device completes Environmental Stress Screening prior to shipping from GE’s facility.

The Multilin 8 Series Protection Relays are manufactured in an ISO9001:2008 certified manufacturing facility.

Pioneering Technology & Design

The Multilin 869 is part of the 8 Series platform that provides comprehensive, high performance protection and control for feeder, motor, transformer and generator applications.

The Multilin 869 Motor Protection System offers a powerful solution for critical motor protection applications with advanced thermal model and voltage dependant curves for high inertial loads.

Utilizing decades of experience in motor protection, GE has implemented ease-of-use features, such as single screen set-ups delivering faster motor configuration and startup and motor health reports providing detailed motor diagnostic enabling quick and easy identification of motor issues.
The Multilin 8 Series products have an integrated protection integrity engine that utilizes customized algorithms, providing advanced diagnostics to ensure asset protection is not compromised.

Maintaining and safeguarding the electrical supply of an operation is critical to ensuring maximum process availability and performance.

The 8 Series incorporates the latest cyber security features, including password complexity, RADIUS authentication and role-based access control (RBAC), enabling customers to comply with NERC CIP and NISTIR 7628 requirements.

Understanding that customers need protection and control devices that must reliably operate in harsh and challenging environments, GE delivers the Multilin 8 Series with harsh conformal coating on all printed circuit boards and a patented environmental awareness module that provides real-time detection of environmental factors that affect product life, as part of its standard offering, delivering higher reliability and extended relay life.

Uncompromised Reliability & Service

Designed, manufactured and tested to industry standards at our state-of-the-art facilities, the Multilin 8 Series delivers maximum performance for today’s most demanding environments.

In addition to the superior technology and innovative design advancements that enable delivery of uncompromised performance and reliability, the Multilin 8 Series is also backed by GE’s 10 year warranty plan.

Multilin 869 Overview

Motors are the workhorses of any industrial plant. Industrial facilities depend on reliable and secure motor operation to keep their processes running. Regardless of the type of motor, the load it runs or the process requirements, a fully integrated protection and control scheme is critical to maintaining uninterrupted service to the entire facility.

The Multilin 869 Motor Protection System is a protection device designed for the management, protection and control of medium to large horsepower motors. The 869 provides comprehensive protection and control of various types of motors with different loads they run.

The 869 relay offers the ideal solution for protecting, monitoring and controlling motors from disturbances or faults. With a fast protection pass, running every 1/8th of a cycle, the 869 relay provides faster current, voltage, power and frequency protection elements. Supporting the latest in industry standard communication protocols, including IEC 62439/PRP and IEC 61850 Ed2, the Multilin 869 relay easily integrates into new or existing networks.

The 869 is an advanced motor protection relay that provides high performance protection, high-density I/O, extensive programmable logic and flexible configuration capabilities. With protection and control logic, the 869 allows for simplified coordination with upstream and downstream disconnect devices. The 869 also offers enhanced features, such as diagnostics, preventative maintenance, condition monitoring, security, and advanced communications options.
Protection & Control
As part of the 8 Series family, the Multilin 869 provides superior protection and control. The 869 offers comprehensive protection and control solutions for medium and large motors for various applications. It contains a full range of selectively enabled, self-contained protection and control elements.

Motor Thermal Model
Many motor failures are directly or indirectly related to, or caused by, extensive heating of the different motor parts involved in electromechanical operation. Proven through several generations of GE’s Multilin motor relays, an enhanced thermal model is used in the 869 relay with seven major features:

- Motor thermal limit curves - NEMA® standard, voltage dependent and customized motor curves
- IEC 60255-8 thermal overload curves
- Smoothing filter for cyclic loads
- Current unbalance biasing
- Independent running and stopped exponential cooling curves
- Optional RTD biasing of the thermal model to adapt to real-time temperature measurements
- Compensation for hot/cold motor condition

The flexibility of the Multilin 869 thermal models will allow proper setup and performance for applications, including high inertia and cyclic loads.

Multilin 869 – Motor Protection System

Stator Differential
Differential protection is considered as the first line of protection for internal phase-to-phase or phase-to-ground faults for medium and large motors to provide sensitive and fast clearing protection against winding faults including turn-to-turn faults. The Multilin 869 provides two flavors of the stator current differential protection:

- Traditional dual slope percent differential enhanced with CT saturation detection and directional check for both AC and DC saturation providing exceptional security without sacrificing sensitivity.
- Core balanced differential protection enhanced with biasing during motor starting to inhibit differential protection during motor starting when inrush currents may upset differential protection.

All differential values are available in metering and oscillography allowing easy testing and troubleshooting.

Multilin 869 – Advanced Thermal Model
High inertia overload curves sample, 8500HP, 13.2kV, Reactor coolant Pump

Multilin 869 Stator Differential
Two-CT set and Core-Balanced configurations
VFD-Driven Motors
The Multilin 869 provides protection for motors fed through VFDs (Variable Frequency Drives). A wide range of the frequency tracking (3-72Hz) allows the 869 to track the motor frequency and adjust its sampling rate to accurately measure phasors. An advanced algorithm allows switchable current and voltage tracking in case VFD is bypassed.

To provide even more accurate phasor measurement, there is an option that filters ripples in phasors due to harmonics for major motor functions. Additionally, users may indicate a starting VFD frequency that helps the device to track the motor frequency faster and eliminate unnecessary delay in the averaging filter during motor startup that can cause delayed protection operation during motor failures.

Reduced Voltage Starting
The Multilin 869 can control the transition of a reduced voltage starter from reduced to full voltage based on “Current Only”, “Current and Time”, or “Current or Timer”. During this process, the relay continuously monitors the motor current to ensure an effective transition.

Multilin 869 – Motor Protection System

Functional Block Diagram

<table>
<thead>
<tr>
<th>DEVICE #</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Under speed</td>
</tr>
<tr>
<td>19</td>
<td>Motor Starter</td>
</tr>
<tr>
<td>27P</td>
<td>Phase Undervoltage</td>
</tr>
<tr>
<td>32P</td>
<td>Directional Power</td>
</tr>
<tr>
<td>37</td>
<td>Undercurrent</td>
</tr>
<tr>
<td>37P</td>
<td>Underpower</td>
</tr>
<tr>
<td>38</td>
<td>Bearing Temperature</td>
</tr>
<tr>
<td>46</td>
<td>Current Unbalance</td>
</tr>
<tr>
<td>47</td>
<td>Voltage Reversal</td>
</tr>
<tr>
<td>49</td>
<td>Thermal Model</td>
</tr>
<tr>
<td>50P</td>
<td>Mechanical Jam</td>
</tr>
<tr>
<td>50P</td>
<td>Motor Overload Alarm</td>
</tr>
<tr>
<td>50P</td>
<td>Motor Short Circuit</td>
</tr>
<tr>
<td>50</td>
<td>Phase/Neutral/Ground Instantaneous Overcurrent</td>
</tr>
<tr>
<td>50_L</td>
<td>Negative Sequence Instantaneous Overcurrent</td>
</tr>
<tr>
<td>50_L2</td>
<td>Acceleration Time</td>
</tr>
<tr>
<td>51</td>
<td>Phase/Neutral/ Ground Time Overcurrent</td>
</tr>
<tr>
<td>51G</td>
<td>Motor Ground Fault</td>
</tr>
<tr>
<td>51V</td>
<td>Voltage Restrained Phase Time Overcurrent</td>
</tr>
<tr>
<td>55</td>
<td>Power Factor</td>
</tr>
<tr>
<td>59P</td>
<td>Phase 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>59K</td>
<td>Auxiliary Overvoltage</td>
</tr>
<tr>
<td>66</td>
<td>Maximum starting rate</td>
</tr>
<tr>
<td>67P</td>
<td>Phase Directional Overcurrent</td>
</tr>
<tr>
<td>67N</td>
<td>Neutral Directional Overcurrent</td>
</tr>
<tr>
<td>81O/U</td>
<td>Over/Under frequency</td>
</tr>
<tr>
<td>86</td>
<td>Lock-out</td>
</tr>
<tr>
<td>87S</td>
<td>Percent Differential</td>
</tr>
<tr>
<td>VTFF</td>
<td>Fuse Failure</td>
</tr>
<tr>
<td>RTD Protection</td>
<td>Thermal Inhibit</td>
</tr>
</tbody>
</table>

GEDigitalEnergy.com
Two-Speed Thermal Model
The two-speed motor protection feature allows for the protection of motors that can operate at two different speeds. The algorithm integrates the heating at each speed into one thermal model.

The Multilin 869 automatically determines which settings should be active at any given time considering a transition from speed one to speed two within a period of time. The device has all required logic and time delays to safely transfer speeds.

Protection of Motors with High-Inertia Loads
The voltage dependent overload curve feature is tailored to protect motors which are used in high inertia load applications.

Voltage is continually monitored when the motor is started and during acceleration. The thermal limit curve is then adjusted accordingly. This enables the Multilin 869 to distinguish between a locked rotor condition, an accelerating condition and a running condition.

RTD Protection
The Multilin 869 supports up to 12 programmable RTD inputs that can be configured for an Alarm or Trip. The RTD voting option gives additional reliability to ignore any RTD failures.

The RTDs can be assigned to a group for monitoring the stator, bearing and ambient temperatures.

Underpower Protection
The Underpower element in the 869 is based on the three-phase real power (kW) measured from the phase currents and voltages. Underpower may be used to detect loss of load conditions. This may be used for more sensitive detection of load loss or pump cavitation or detecting process related issues.

Voltage and Frequency Protection
The voltage and frequency protection functions detect abnormal system conditions like over/under voltage, over/under frequency and/or phase reversal that are potentially hazardous to the motor.

Undercurrent Protection
The undercurrent protection element provides the ability to trip the motor due to external conditions that can cause the load being driven by the motor to drop below a pre-set level. This function is used to protect pumps from loss of suction, fans from loss of airflow due to a closed damper or a conveyor system due to a broken belt.

Motor Start Supervision
Motor start supervision consists of the following features: Time-Between-Starts, Start-per-Hour, Restart Time and Start Inhibit. These elements are intended to guard the motor against excessive starting duty, which is normally defined by the motor manufacturer in addition to the thermal damage curves. The Emergency Restart enables the user to reset the Motor start supervisions in case of process needs.

The start inhibit function prevents the starting of a motor when the motor is too hot and does not have a sufficient amount of thermal capacity available to allow a start without being tripped offline. In case of emergency, the thermal capacity used and motor start supervision timers can be reset to allow a hot motor to start.
Breaker Failure Protection
The breaker failure protection element monitors for timely operation of the connected breaker. If a trip command is not successful in operating the breaker and clearing the fault, the breaker failure element can be used to send trip signals to upstream breakers to clear the fault.

Mechanical Jam and Acceleration Time
These two elements are used to prevent motor damage during abnormal operational conditions such as excessively long acceleration time or stalled rotors. The mechanical jam element senses increased loading associated with process or load related faults such as an overloaded conveyor.

The Multilin 869 protects the motor from overheating in cases of abnormal loading during motor starts. The motor can be tripped if the motor does not reach a running condition within the programmable motor acceleration time.

Synchronous Motor Protection
For synchronous motors with excitation system control that offers field winding protection, the Multilin 869 offers comprehensive stator protection functions in addition to features such as power factor based pull out protection and reactive power based alarm and trip functions.

Adaptive Protection
The Multilin 869 offers effective, reliable management of motors. With dynamic, sensitive settings, the 869 provides secure and dependable protection. With six setting groups, the 869 provides the sensitive settings range and groups required to ensure no compromise is made to meet changing system conditions. These setting groups can be enabled automatically or manually via digital inputs, virtual inputs or remote communications to address system needs, ensuring greater system reliability and efficiency.

FlexCurves™
For applications that require greater flexibility, FlexCurves can be used to define custom curve shapes. These curves can be used to protect motors with different rotor and stator damage curves, allowing complete protection over the total motor capacity.

Advanced Automation
The Multilin 869 incorporates advanced automation capabilities that exceeds what is found in most motor protection relays. This reduces the need for additional programmable controllers or discrete control relays including programmable logic, communication, and SCADA devices. Advanced automation also facilitates the Multilin 869 to integrate seamlessly with other protection/process systems.

FlexLogic™
FlexLogic is the powerful programming logic engine that provides the ability to create customized protection and control schemes, minimizing the need and associated costs of auxiliary components and wiring. Using FlexLogic, the 869 can be programmed to provide the required tripping logic along with custom scheme logic for motor breaker control.
Overview of the 869 Motor Health Report

Motor Status Summary

Monitoring & Diagnostics

The Multilin 869 includes high accuracy metering and recording for all AC signals. Voltage, current, and power metering are built into the relay as a standard feature. Current and voltage parameters are available as total RMS magnitude, and as fundamental frequency magnitude and angle.

Advanced Motor Diagnostics

The Multilin 869 provides advanced motor diagnostics including a broken rotor bar detection function. The broken rotor bar detection is a condition monitoring function that continuously monitors the motor’s health while in operation. The advanced Motor Current Signature Analysis (MCSA) continuously analyzes the motor current signature and based on preset algorithms will determine when a broken rotor bar is present in the motor.

With fully programmable alarms, the broken rotor bar function will provide early detection of rotor bar problems enabling maintenance personnel to schedule for predictive maintenance of the motor thereby preventing catastrophic motor failures.

By providing early indication of potential rotor problems, serious system issues can be avoided, such as reduced starting torque, overloads, torque and speed oscillation and bearing wear. With the broken rotor bar detection system, advanced warning of impending problems reduces catastrophic failures, maximizing motor life and system uptime.

Advanced Motor Health Report

The 869 motor health report provides a quick snapshot of the motor operating and diagnostic information in an easy way to allow users to make decisions about health of the motor. Based on the graphical representation and trend values of the motor historical data gathered by the 869, users can quickly identify process issues and maintenance requirements before damage occurs and costly repairs are required.
The motor health report quickly provides a motor operation summary with detailed information in seven categories.

- **Device Overview**: gives general information on the motor, including requested period, user name, device name, order code, firmware version, motor and system settings, and motor total running time.
- **Status Overview**: summarizes the historical learned data and gives an evaluation of the status of the motor, including the oldest and latest values of acceleration time, starting current, start thermal capacity used, average motor load, and average running time.
- **Trip Summary**: presents a summary of the events that have tripped the motor.
- **Motor Operating History**: counts the amount of events in terms of Motor Starting/Running, Manual Stop Commands, Trip Commands, Lockouts, Alarm Conditions, and Emergency Restarts.
- **Motor Starting Learned Data**: collects the learned data, including acceleration time, starting current, start thermal capacity used, average motor load, and average running time.
- **Motor Start Records**: displays the start data, including average of three-phase RMS currents, current unbalance, ground current, average of three-phase RMS voltages, thermal capacity used, frequency and motor status.
- **Motor Stopping/Tripping**: gives details on the events that are specifically related to the stopping and tripping of the motor.

### Breaker Health Monitoring

The breaker is monitored by the relay not only for detection of breaker failure, but also for the overall “breaker health” which includes:

- Breaker close and breaker open times
- Trip circuit monitoring
- Spring charging time
- Per-phase arcing current
- Trip counters

All algorithms provide the user with the flexibility to set up initial breaker trip counter conditions and define the criteria for breaker wear throughout a number of setpoints.

### Environmental Monitoring

The 869 implements a patented environmental monitoring system that measures and provides operating condition information. Reliable and secure operation of the 869 relay and other electronic devices in the vicinity may be affected by environmental factors. The 869 relay has been designed to meet or exceed required industry standards. Some operating conditions may be beyond those standards and reduce total lifespan of the device.

Typical environmental conditions that may affect electronic device reliability include voltage, current, temperature, humidity, dust, contaminants, mechanical stress, shock, radiation and intensity of electrical and magnetic fields. These environmental factors are different from natural weather conditions at particular installation conditions and are beneficial to monitor. The 869 relay’s built-in environmental awareness feature (patent “Systems and methods for predicting maintenance of intelligent electronic devices”) collects the histograms of operating conditions from the point the device is put into service. Monitored environmental conditions include temperature, humidity and transient voltage. The histogram of each environmental factor may be retrieved from the diagnostic page accessed through a PC running the EnerVista Multilin 8 Series Setup program.

![Environmental Health Report](image)

Environmental health report is available via Multilin PC Software
Metering

The Multilin 869 offers high accuracy power quality monitoring for fault and system disturbance analysis. The Multilin 8 Series delivers unmatched power system analytics through the following advanced features and monitoring and recording tools:

- Harmonics measurement up to 25th harmonic for both currents and voltages including THD.
- The length of the transient recorder record ranges from 31 cycles to 1549 cycles, depending on the user specified configuration. This gives the user the ability to capture long disturbance records which is critical for some applications.

- 32 digital points and 16 analog values, assigned by the user, can be captured in the COMTRADE format by the transient recorder.
- Comprehensive data logger provides the recording of 16 analog values selected from any analog values calculated by the relay. Capture rates range from 16 ms, 20ms, 1 second, 30 seconds, 1 minute, 30 minutes, or 1 hour rate. This data capture flexibility allows the operator to measure power factor or reactive power flow (for example), for several hours or even days, enabling detailed analysis and corrective action to be taken, if required.

- Detailed Fault Report allows the user to identify the fault location, fault type and element(s) that triggered the 869 to trip. It carries other useful information, such as pre-fault and fault phasors, relay name and model, firmware revision and other details. The 869 stores fault reports for the last 16 events.
- 1024 Event Recorder chronologically lists all triggered elements with an accurate time stamp over a long period of time. The 869 stores the last 1024 events locally in the relay.

![Multilin 869 Phasor viewer](image1)

![Multilin 869 Event Recorder](image2)

The 869 monitoring system performance with oscillography and event records
Communications

The 869 provides advanced communications technologies for remote data and engineering access, making it easy and flexible to use and integrate into new and existing infrastructures. Direct support for fiber optic Ethernet provides high-bandwidth communications, allowing for low-latency controls and high-speed file transfers of relay fault and event record information. The 869 also supports two independent IP addresses, providing high flexibility for the most challenging of communication networks.

Providing several Ethernet and serial port options and supporting a wide range of industry standard protocols, the 869 enables easy, direct integration into DCS and SCADA systems. The 869 supports the following protocols:

- IEC 61850 Ed2, IEC 62439 / PRP
- DNP 3.0, IEC 60870-5-103, IEC 60870-5-104
- Modbus RTU, Modbus TCP/IP

The 869 has USB front port and Wi-Fi interfaces for ease of access to the relay.

Wi-Fi Connectivity:

- Simplify set-up and configuration
- Simplify diagnostic retrieval
- Eliminate personnel in front of switchgear
- WPA-2 security

Cyber Security

The 869 cyber security enables the device to deliver full cyber security features that help operators to comply with NERC CIP guidelines and regulations. AAA server support (RADIUS) enables integration with centrally managed authentication and accounting of all user activities and uses modern industry best practices and standards that facilitate NERC CIP requirements for authentication and password management.

RBAC (Role Based Access Control), which provides efficient administration of users and roles within devices, efficiently administrates users and roles. In addition, Event Recorder (Syslog for SEM) captures all cyber security related events within a SOE element (login, logout, invalid password attempts, remote/local access, user in session, settings change, FW update, etc.), and then serves and classifies data by security level using standard Syslog data format. This will enable integration with established SEM (Security Event Management) systems.

Software & Configuration

The EnerVista™ suite is an industry-leading set of software programs that simplifies every aspect of using the Multilin 869. EnerVista provides all the tools to monitor the status of the protected asset, maintain the device and integrate the information measured by the Multilin 8 Series into SCADA or DCS process control systems. The ability to easily view sequence of events is an integral part of the setup software, as postmortem event analysis is critical to proper system management.

EnerVista Launchpad

EnerVista Launchpad is a powerful software package that provides users with all of the setup and support tools needed for configuring and maintaining Multilin products.

The setup tools within Launchpad allow for the configuration of devices in real-time, by communicating via serial, Ethernet or modem connections, or offline by creating device setting files to be sent to devices at a later time. Included in Launchpad is a document archiving and management system that ensures critical documentation is up-to-date and available when needed.
Simplified Setup & On-Going Maintenance

The robust 869 streamlines user workflow processes and simplifies engineering tasks, such as configuration, wiring, testing, commissioning, and maintenance. Building on the history of simplified setup and configuration, the 869 relay has implemented simplified setup screens to assist in minimizing relay setup time. In addition, for local programming, the 869 comes with a fully functional Graphical Control Panel (GCP), which allows users to locally monitor the asset.

Ease-of-Use

Continuing its legacy in providing easy-to-use protective relay solutions, the 869 is designed to minimize product and system configurability requirements for quicker physical installation and for easier and simplified setup and configuration.

1. Easy to Use - Draw-out case
2. Easy to Configure - 1 simple step
3. Detailed Diagnostics
Full Color Graphical HMI Front Display
A large, full color Graphic Control Panel (GCP) ensures clear representation of critical status and measurements. When the keypad and display are not being used, the GCP will automatically revert to screen saver mode, which will turn off the display until one of the local pushbuttons is pushed.

The GCP can be used to view device and system status, alarms and event logs, and metering information. The GCP and navigation keys simplify relay configuration and setup, allowing users to make setting changes directly through the front panel.

LED Indicators for Quick Status Indication
The front panel includes user configurable LED’s. Each LED can be completely configured and named based on the application and user requirements. The color of each indicator conveys its importance.

Front View

Rear View
Technical Specifications

**POWER SUPPLY**

**Power Supply**
- Nominal DC Voltage: 125 to 250 V
- Minimum DC Voltage: 88 V
- Maximum DC Voltage: 300 V
- Nominal AC Voltage: 100 to 240 V at 50/60 Hz
- Minimum AC Voltage: 88 V at 50/60 Hz
- Maximum AC Voltage: 265 V at 50 to 60 Hz

**AC Currents**
- CT Rated Primary: 1 to 12000 A
- CT Rated Secondary: 1 A or 5 A based on relay ordering
- Nominal Frequency: 50 and 60 Hz

**AC Voltage**
- VT Range: 10 to 260 V
- Nominal Frequency: 20 to 65 Hz
- Burden: <0.25 VA at 120 V
- Conversion Range: 1 to 275 V
- Voltage Withstand: Continuous at 260 V to neutral
- Debounce Time: 0.0 to 16.0 ms in steps of 0.5 ms
- Selectable thresholds: 17, 33, 84, 166 VDC
- Type: Wet or Dry

**CONTACT INPUTS**
- Make and carry for: 0.2 s, 30 A per ANSI C37.90
- Form-A Relays
  - Configuration: 2 (two) electromechanical
  - Sensing current: 5 mA
  - Range: -40 to +250°C
  - Accuracy: ±2°C
- Form-C Relays
  - Configuration: Electromechanical
  - Operate time: <8 ms
  - Continuous current: 10 A
  - Make and carry for: 0.2 s, 30 A per ANSI C37.90

**CONTACT OUTPUTS**
- Number of inputs: 12
- Based on relay ordering
- Type: Wet or Dry
- Wet Contacts: 300 V DC maximum
- Selectable thresholds: 17, 33, 84, 166 VDC
- Tolerance: ±10%
- Recognition time: 1 ms (typical)
- Debounce time: 0.0 to 16.0 ms in steps of 0.5 ms
- Continuous current draw: 2 mA

**PROTECTION**
- Acceleration Time (377)
  - Acceleration Current: 1.00 to 10.00 × FLA in steps of 0.01
  - Acceleration Time: 0.5 to 180.00 seconds in steps of 0.01
  - Operating Mode: Definite Time, Adaptive

**GROUND FAULT**
- Pickup Level: For 1A/5A Ground CT Type: 0.01 to 10.00 × CT in steps of 0.01 CT
- Dropout Level: 97 to 98% of Pickup
- Alarm Pickup Delay: 0.00 to 180.00 s in steps of 0.01 s
- Trip Pickup Start Delay: 0.00 to 180.00 s in steps of 0.01 s
- Trip Pickup Run Delay: 0.00 to 180.00 s in steps of 0.01 s

**RTD Protection**
- Pickup: 1 to 250°C in steps of 1°C
- Pickup Hysteresis: 2°C
- Timer accuracy: <2 ms
- Elements: Trip and Alarm

**UNDERCURRENT**
- Operating condition: Three-phase real power
- Number of elements: 1, alarm and trip stages
- Trip/Alarm Pickup level: 1 to 25000 kW in steps of 1
- Pickup level accuracy: ±10% of reading
- Hysteresis: 3%
- Trip/Alarm Pickup delay: 0 to 180.00 s in steps of 0.01 s
- Timer accuracy: ±3% of delay time or ±10 ms, whichever is greater
- Operate time: > 45 ms at 60 Hz, <50 ms at 50 Hz

**MECHANICAL JAM**
- Arming Condition: Motor not starting
- Pickup Level: 1.00 to 10.00 × FLA in steps of 0.01
- Dropout Level: 97 to 98% of Pickup
- Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater
- Trip/Alarm Pickup Delay: 0.00 to 180.00 s in steps of 0.01 s
- Dropout Level: 0.00 to 180.00 s in steps of 0.01 s
- Timer accuracy: ±3% of delay setting or ±20 ms, whichever is greater

**UNDERCURRENT (377)**
- Operating Parameter: Per-phase current 1a, Ib, Ic (RMS)
- Pickup level: 0.10 to 0.95 × FLA in steps of 0.01
- Dropout level: 102 to 103% of Pickup
- Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater
- Operate time: <50 ms at 60 Hz
- Timer Accuracy: ±3% of delay setting or ±2 cycles (whichever is greater) from pickup to operate

**OVERLOAD ALARM**
- Operating parameter: Average phase current (RMS)
- Pickup Level: 0.50 to 3.00 × FLA in steps of 0.01 × FLA
- Dropout Level: 97 to 98% of Pickup
- Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater
- Timer Accuracy: ±3% of delay setting or ±1 cycle (whichever is greater) from pickup to operate

**POWER SUPPLY**

**Unbalance (46)**
- Unbalance: 12/11 × 100% if FLA ≤ FLA.
- Unbalance: 12/11 × 100% if FLA > 2.0 × FLA.

**Single Phasing (51V)**
- Single Phasing: 0.00 to 180.00 s in steps of 0.01 s
- Single Phasing Time Delay: 2 seconds
- Pickup accuracy: ±2%
- Operate time: <2 cycles at 1.10 × pickup
- Timiness accuracy: ±3% of delay setting or ±20 ms, whichever is greater

**SHORT CIRCUIT**
- Dropout Level: 97 to 98% of Pickup
- Pickup Delay: 0.00 to 180.00 s in steps of 0.01 s
- Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater
- Operate time: <2 cycles at 1.10 × pickup
- Timer Accuracy: ±3% of delay setting or ±2 cycles (whichever is greater) from pickup to operate

**RTD PROTECTION**
- Pickup: 1 to 250°C in steps of 1°C
- Pickup Hysteresis: 2°C
- Elements: Trip and Alarm

**THERMAL MODEL**
- Standard (Motor) curve, FlexCurve, Standard (Motor) curve with voltage dependent function, IEC curve
- Motor curve multiplier: 0.00 to 15.00 in steps of 0.01
- FlexCurve time multiplier: 0.00 to 600.00 in steps of 0.01
- IEC curve time constant: 0 to 1000 in steps of 1
- Thermal overload pickup: Overload factor × FLA
- Overload factor (OL): 1.00 to 1.50 in steps of 0.01
- Motor full load current (FLA): 1 to 5000 A in steps of 1 FLA

**AC Voltage**
- CT Rated Secondary: 1 A or 5 A based on relay ordering
- Nominal in a fixed linear relationship

**Nominal Measurements**
- 1 min/hr at 420 V to neutral
- – Timer Accuracy: ±3% of delay setting or ±½ cycle
- – Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater
- – Dropout Level: 97 to 98% of Pickup
- – Operate time: <45 ms at 60 Hz
- – Dropout level: 102 to 103% of Pickup
- – Operate time: > 2.0 × PKP with 0 ms time delay
- – Dropout level: 97 to 98% of Pickup
- – Operate time: > 2.0 × PKP with 0 ms time delay
- – Timing accuracy: ±3% of delay setting or ±2 cycles (whichever is greater) from pickup to operate
- – Elements: Trip or Alarm

**RTD PROTECTION**
- Pickup: 1 to 250°C in steps of 1°C
- Pickup Hysteresis: 2°C
- Elements: Trip and Alarm

**THERMAL MODEL**
- Standard (Motor) curve, FlexCurve, Standard (Motor) curve with voltage dependent function, IEC curve
- Motor curve multiplier: 0.00 to 15.00 in steps of 0.01
- FlexCurve time multiplier: 0.00 to 600.00 in steps of 0.01
- IEC curve time constant: 0 to 1000 in steps of 1
- Thermal overload pickup: Overload factor × FLA
- Overload factor (OL): 1.00 to 1.50 in steps of 0.01
- Motor full load current (FLA): 1 to 5000 A in steps of 1 FLA

**Phase/Neutral/Ground Time Overcurrent (51V)**
- Current: Phase or RMS
- Pickup Level: 0.050 to 30.000 × CT in steps of 0.001 × CT
- Dropout Level: 97 to 98% of Pickup
- Level Accuracy: For 0.1 to 2.0 × CT: ±0.5% of reading or ±0.4% of rated, whichever is greater; For > 2.0 × CT: ±1.5% of reading
- Curve Shape: IEEE Extremely/Very Moderately Inverse
- ANSI Extremely/Very Normally/ Moderately Inverse
- IEC Curve A/B/C and Short Inverse
- IEC Extremely/Very/Inverse/Short Inverse
- FlexCurve™ A, FlexCurve™ B, FlexCurve™ C, FlexCurve™ D, 1st, 1st, Definite Time
- Curve Multiplier: 0.05 to 600.00 in steps of 0.01
- Reset Time: Instantaneous, Timed
- Curve Timing Accuracy: ±3% of delay setting or ±2 cycles (whichever is greater) from pickup to operate

**Voltage Restricted Phase Time Overcurrent (51V)**
- Voltage Restraint: Modifies pickup from 0.1 < V < 0.9 VT
- Voltage Restraint: Modifies pickup from 0.1 < V < 0.9 VT
- Nominal in a fixed linear relationship
<table>
<thead>
<tr>
<th>Feature</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase/Neutral/Ground Instantaneous Overcurrent (50P/N/G) Current (for Phase IOC only)</td>
<td>Phasar or RMS</td>
</tr>
<tr>
<td>Current (for Neutral/ Ground IOC only)</td>
<td>Fundamental Phasar Magnitude</td>
</tr>
<tr>
<td>Pickup Level</td>
<td>0.050 to 30.000 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>For 0.1 to 2 x CT: ±0.5% of reading or ±0.4% of rated, whichever is greater For &gt; 2.0 x CT: ±1.5% of reading</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;12 ms typical at 3 x Pickup at 60 Hz</td>
</tr>
<tr>
<td>Voltage</td>
<td>Fundamental Phasar Magnitude</td>
</tr>
<tr>
<td>Minimum Voltage</td>
<td>0.00 to 1.50 x VT in steps of 0.01 x VT</td>
</tr>
<tr>
<td>Pickup Level</td>
<td>0.00 to 1.50 x VT in steps of 0.01 x VT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Phases Required for Operation</td>
<td>Any one, Any two, All three</td>
</tr>
<tr>
<td>Undervoltage Curves</td>
<td>Definite Time or Inverse Time</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.000 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;20 ms at 0.90 x pickup at 60 Hz</td>
</tr>
<tr>
<td>Curve Timing Accuracy</td>
<td>&lt;0.90 x pickup ±3% of curve delay or ±1 cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Phase Overvoltage (59P) Voltage</td>
<td>Fundamental Phasar Magnitude</td>
</tr>
<tr>
<td>Pickup Level</td>
<td>0.02 to 3.00 x VT in steps of 0.01 x VT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>±0.5% of reading from 15 to 208 V</td>
</tr>
<tr>
<td>Phases Required for Operation</td>
<td>Any one, Any two, All three</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.000 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;25 ms at 1.1 x pickup at 60 Hz</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>&lt;30 ms at 1.1 x pickup at 50 Hz</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Neutral Directional Overcurrent (67N) Directionality</td>
<td>Co-existing forward and reverse</td>
</tr>
<tr>
<td>Polarizing Voltage</td>
<td>Voltage, Current, Dual</td>
</tr>
<tr>
<td>Polarizing Voltage</td>
<td>Vₒ or VX</td>
</tr>
<tr>
<td>Polarizing Current</td>
<td>Ig</td>
</tr>
<tr>
<td>Operating Current</td>
<td>Iₒ</td>
</tr>
<tr>
<td>Level Sensing</td>
<td>3 x [Vₒ - K x Iₒ]</td>
</tr>
<tr>
<td>Restraint, K</td>
<td>0.000 to 3.000 in steps of 0.001</td>
</tr>
<tr>
<td>Characteristic Angle</td>
<td>40° to 90° in steps of 1°, independent for forward and reverse</td>
</tr>
<tr>
<td>Angle Accuracy</td>
<td>±2°</td>
</tr>
<tr>
<td>Pickup Level</td>
<td>0.050 to 30.000 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Operate Time (Non-directional)</td>
<td>&lt;16 ms at 3 x Pickup at 60 Hz</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>0.000 to 6000.000 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Dropout Delay</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;25 ms at 1.1 x pickup at 60 Hz</td>
</tr>
<tr>
<td>Curve Timing Accuracy</td>
<td>±1.1 x pickup ±3% of curve delay or ±1 cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Negative Sequence Instantaneous Overcurrent (50N) Current</td>
<td>Iₒ - 2 Fundamental Phasar Magnitude</td>
</tr>
<tr>
<td>Pickup Level</td>
<td>0.050 to 30.000 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Phase Directional Overcurrent (67P) Relay Connection</td>
<td>90°(Quadrature)</td>
</tr>
<tr>
<td>Quadrature Voltage</td>
<td>All phase seq.: phase A (Vbc), phase B (Vca), phase C (Vab)</td>
</tr>
<tr>
<td>ACB phase seq.: phase A (Vcb), phase B (Vab), phase C (Vba)</td>
<td></td>
</tr>
<tr>
<td>Polarizing Voltage Threshold</td>
<td>0.05 to 3.000 x VT in steps of 0.001 x VT</td>
</tr>
<tr>
<td>Threshold Sensitivity</td>
<td>0.05 x CT</td>
</tr>
<tr>
<td>Characteristic Angle</td>
<td>0° to 359° in steps of 1°</td>
</tr>
<tr>
<td>Angle Accuracy</td>
<td>±2°</td>
</tr>
<tr>
<td>Operation Time</td>
<td>Reverse to Forward transition: &lt;12 ms typically; Forward to Reverse transition: &lt;8 ms, typically</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Auxiliary Overvoltage (59O) Pickup Level</td>
<td>0.02 to 3.00 x VT in steps of 0.01 x VT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.000 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;25 ms at 1.1 x pickup at 60 Hz</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>&lt;30 ms at 1.1 x pickup at 50 Hz</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Neutral Overvoltage (59N) Pickup Level</td>
<td>0.02 to 3.00 x VT in steps of 0.01 x VT</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>97 to 98% of Pickup</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>±0.5% of reading from 15 to 208 V</td>
</tr>
<tr>
<td>Overvoltage Curves</td>
<td>Definite Time, Flex Curve A,B,C,D</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.000 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Operate Time</td>
<td>&lt;25 ms at 1.1 x pickup at 60 Hz</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>&lt;30 ms at 1.1 x pickup at 50 Hz</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Underfrequency (81U) Pickup Level</td>
<td>20.00 to 6500.00 Hz in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>Pickup + 0.03 Hz</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.00 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>0.000 to 6000.00 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Minimum Operating Voltage</td>
<td>0.000 to 1.250 x VT in steps of 0.001 x VT</td>
</tr>
<tr>
<td>Minimum Operating Current</td>
<td>0.000 to 30.000 x CT in steps of 0.001 x CT</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>±0.001 Hz</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
<tr>
<td>Overfrequency (81O) Pickup Level</td>
<td>20.00 to 6500.00 Hz in steps of 0.01</td>
</tr>
<tr>
<td>Dropout Level</td>
<td>Pickup - 0.03 Hz</td>
</tr>
<tr>
<td>Pickup Time Delay</td>
<td>0.000 to 6000.00 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Dropout Time Delay</td>
<td>0.000 to 6000.00 s in steps of 0.001 s</td>
</tr>
<tr>
<td>Minimum Operating Voltage</td>
<td>0.000 to 1.250 x VT in steps of 0.001 x VT</td>
</tr>
<tr>
<td>Level Accuracy</td>
<td>±0.001 Hz</td>
</tr>
<tr>
<td>Timer Accuracy</td>
<td>±3% of delay setting or ± ¼ cycle whichever is greater from pickup to operate</td>
</tr>
</tbody>
</table>

GEDigitalEnergy.com Multilin 869 – Motor Protection System
Technical Specifications

**CONTROL**

- **Trip Bus**
  - Number of Elements: 6
  - Number of Inputs: 16
  - Pickup Time Delay: 0.00 to 6000.000 s in steps of 0.001 s
  - Dropout Time Delay: 0.00 to 6000.000 s in steps of 0.001 s
  - Operate Time: < 2 ms at 60 Hz
  - Timer Accuracy: ± 3% of delay setting or ± ¼ cycle (whichever is greater) from pickup to operate

**MONITORING**

- **Trip Circuit Monitor (Tcm)**
  - Applicable Voltage: 20 to 250 VDC
  - TRC: ≤ 2.5 mA
  - Timing Accuracy: ± 0.02

- **Close Circuit Monitor (Ccm)**
  - Applicable Voltage: 20 to 250 VDC
  - TRC: ≤ 2.5 mA
  - Timing Accuracy: ± 3% or ± 4 ms, whichever is greater

- **Power Factor (SS)**
  - Switch-In Level: 0.01 Lead to 1 to 0.01 Log in steps of 0.01
  - Dropout Level: 0.01 Lead to 1 to 0.01 Log in steps of 0.01
  - Delay: 0.000 to 6000.000 s in steps of 0.001 s
  - Minimum Operating Voltage: 0.00 to 1.25 x VT in steps of 0.01 x VT
  - Level Accuracy: ± 0.02
  - Timer Accuracy: ± 3% of delay setting or ± ¼ cycle (whichever is greater) from pickup to operate

- **Demand**
  - Measured Values: Phase A/B/C present and maximum current; Three-phase present and maximum real/reactive/apparent power
  - Measurement Type: Thermal (Exponential), 90% response time (programmed)
  - Block Interval / Rolling Demand: 5, 10, 15, 20, 30 minutes

**METERING**

- **RMS PARAMETERS**
  - Currents: Phase A, B, C, Neutral, Ground, and Sensitive Ground
  - Accuracy: ± 0.25% of reading or ± 0.2% of rated (whichever is greater) from 0.1 to 2.0 x CT
  - ± 1% of reading > 2.0 x CT

- **Voltages**
  - Parameters and Residual: Wye VTs: A-B, B-C, C-A, Neutral and Ground
  - Average Phase, Neutral, and Residual: Delta VTs: A-B, B-C, C-A
  - Neutral and Residual: Delta VTs: A-B, B-C, C-A
  - Accuracy: ± 0.5% of reading from 15 to 20 V or 1% open Delta connections

- **Real Power (Watts)**
  - Range: -214748364.8 kW to 214748364.7 kW
  - Parameters: 3-phase, per phase if VT is Wye
  - Accuracy: ± 1.0% of reading or 0.1 kW (whichever is greater) at -0.8 < PF ≤ 0.8 and 0 < PF < 1.0

- **Apparent Power (VA)**
  - Range: 0 kVA to 214748364.7 kVA
  - Parameters: 3-phase, per phase if VT is Wye
  - Accuracy: ± 1.0% of reading or 0.1 kVAR (whichever is greater) at -0.8 < PF ≤ 0.8 and 0 < PF < 1.0

- **Watt-Hours (Positive And Negative)**
  - Range: 214748364.8 Wh to 214748364.7 Wh
  - Parameters: 3-phase, per phase if VT is Wye
  - Accuracy: ± 0.2% of reading

- **Var-Hours (Positive And Negative)**
  - Range: 214748364.8 kVARh to 214748364.7 kVARh
  - Parameters: 3-phase, per phase if VT is Wye
  - Update Rate: 50 ms
  - Accuracy: ± 2.0% of reading

**RECORDING**

- **Learned Data Recorder**
  - Number of records: 250
  - Content:
    - Learned/fast acceleration time;
    - Learned/fast starting current;
    - Learned/fast start TCU; Learned average load,
    - Learned average real power,
    - Learned average reactive power,
    - Average power factor, Average run time (days/hours/minutes);
    - RTD maximum temperature

- **Motor Start Records**
  - Length: 6 records, each containing a total of 60 seconds of motor starting data
  - Trigger: Motor starting status
  - Trigger Position: 1 second pre-trigger duration
  - Sample Rate: 1 sample/200 ms

**PHASORS**

- **Currents:** Phase A, B, C, Neutral and Ground
  - Magnitude Accuracy:
    - ± 0.5% of reading or ± 0.2% of rated (whichever is greater) from 0.1 to 2.0 x CT
    - ± 1% of reading > 2.0 x CT
  - Angle Accuracy: 2°
### Testing and Certification

<table>
<thead>
<tr>
<th>TEST</th>
<th>REFERENCE STANDARD</th>
<th>TEST LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric voltage withstand</td>
<td>EN60255-5/IEC 60255-27</td>
<td>2.3 kV</td>
</tr>
<tr>
<td>Impulse voltage withstand</td>
<td>EN60255-5/IEC 60255-27</td>
<td>5kV</td>
</tr>
<tr>
<td>Damped Oscillatory</td>
<td>IEC61000-4-1/IEC60255-22-1</td>
<td>2.5 kV CM, 1 kV DM</td>
</tr>
<tr>
<td>Electrostatic Discharge</td>
<td>EN61000-4-2/IEC60255-22-2</td>
<td>Level 4</td>
</tr>
<tr>
<td>RF Immunity</td>
<td>EN61000-4-3/IEC60255-22-3</td>
<td>Level 3</td>
</tr>
<tr>
<td>Fast Transient Disturbance</td>
<td>EN61000-4-4/IEC60255-22-4</td>
<td>Class A and B</td>
</tr>
<tr>
<td>Surge Immunity</td>
<td>EN61000-4-5/IEC60255-22-5</td>
<td>Level 3 &amp; 4</td>
</tr>
<tr>
<td>Conducted RF Immunity</td>
<td>EN61000-4-6/IEC60255-22-6</td>
<td>Level 3</td>
</tr>
<tr>
<td>Power Frequency Immunity</td>
<td>EN61000-4-7/IEC60255-22-7</td>
<td>Class A &amp; B</td>
</tr>
<tr>
<td>Voltage interruption and Ripple DC</td>
<td>IEC60255-11</td>
<td>PQT levels based on IEC61000-4-29, IEC61000-4-11 and IEC61000-4-17</td>
</tr>
<tr>
<td>Radiated &amp; Conducted Emissions</td>
<td>CISPR11/CISPR22/IEC60255-25</td>
<td>Class A</td>
</tr>
<tr>
<td>Sinusoidal Vibration</td>
<td>IEC60256-21-1</td>
<td>Class 1</td>
</tr>
<tr>
<td>Shock &amp; Bump</td>
<td>IEC60256-21-2</td>
<td>Class 1</td>
</tr>
<tr>
<td>Seismic</td>
<td>IEC60256-21-3</td>
<td>Class 2</td>
</tr>
<tr>
<td>Power magnetic Immunity</td>
<td>IEC61000-4-8</td>
<td>Class 5</td>
</tr>
<tr>
<td>Pulse Magnetic Immunity</td>
<td>IEC61000-4-9</td>
<td>Class 4</td>
</tr>
<tr>
<td>Damped Magnetic Immunity</td>
<td>IEC61000-4-10</td>
<td>Class 4</td>
</tr>
<tr>
<td>Voltage Dip &amp; interruption</td>
<td>IEC61000-4-11</td>
<td>0, 40, 70, 80% dips, 250/300 cycle interrupts</td>
</tr>
<tr>
<td>Conducted RF Immunity D-150kHz</td>
<td>IEC61000-4-16</td>
<td>Level 4</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IEC60529</td>
<td>IP5A front</td>
</tr>
<tr>
<td>Environmental (Cold)</td>
<td>IEC602068-2-1</td>
<td>40°C 16 hrs</td>
</tr>
<tr>
<td>Environmental (Dry heat)</td>
<td>IEC602068-2-2</td>
<td>85°C 16hrs</td>
</tr>
<tr>
<td>Relative Humidity Cyclic</td>
<td>IEC602068-2-30</td>
<td>6day variant 2</td>
</tr>
<tr>
<td>EFT</td>
<td>IEEE/ANSI C37.90.1</td>
<td>4kV, 2.5 kHz</td>
</tr>
<tr>
<td>Damped Oscillatory</td>
<td>IEEE/ANSI C37.90.1</td>
<td>2.5kV, 1 MHz</td>
</tr>
<tr>
<td>RF Immunity</td>
<td>IEEE/ANSI C37.90.2</td>
<td>20V/m, 80 MHz to 1GHz</td>
</tr>
<tr>
<td>ESD</td>
<td>IEEE/ANSI C37.90.3</td>
<td>800 V, 15 kV AD</td>
</tr>
<tr>
<td>Safety</td>
<td>UL508</td>
<td>e57838 NKCR</td>
</tr>
<tr>
<td></td>
<td>UL C22.2-14</td>
<td>e57838 NKCR7</td>
</tr>
</tbody>
</table>

### Approvals

<table>
<thead>
<tr>
<th>APPROVALS</th>
<th>APPLICABLE COUNCIL DIRECTIVE</th>
<th>ACCORDING TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE/Compliance</td>
<td>Low voltage directive</td>
<td>EN60255-5 / EN60255-27</td>
</tr>
<tr>
<td></td>
<td>EMC Directive</td>
<td>EN602068-2-1 / EN602068-2-2 / EN61000-6-4</td>
</tr>
<tr>
<td>North America</td>
<td>cULus</td>
<td>UL508 UL10153 C22.2-No 14</td>
</tr>
<tr>
<td>ISO</td>
<td>Manufactured under a registered quality program</td>
<td>ISO9001</td>
</tr>
</tbody>
</table>

### Environmental

<table>
<thead>
<tr>
<th>ENVIRONMENTAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperatures:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>Storage/Shipping</td>
<td>-40°C to 60°C</td>
</tr>
<tr>
<td>Operating</td>
<td>Operating up to 95% non-condensing @ 55°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>As per IEC60068-2-2-3D Variant 2, 6days</td>
</tr>
<tr>
<td>Altitude</td>
<td>2000m max</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>3</td>
</tr>
<tr>
<td>Overvoltage Category</td>
<td>III</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP5A front</td>
</tr>
</tbody>
</table>

GEDigitalEnergy.com
### Ordering

<table>
<thead>
<tr>
<th>Base Unit</th>
<th>Language</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>869 E ** ** ** * *</td>
<td>E</td>
<td>Motor Protection Relay (Standard: English Language; High Voltage PS, Graphical Control Panel)</td>
</tr>
</tbody>
</table>

| Phase Currents - Slot J Bank 1/2 | | 1A three phase current inputs (U1) | 5A three phase current inputs (U1) |
| Phase Currents - Slot K Bank 2/2 | | No phase current inputs | 1A three phase current inputs | 5A three phase current inputs |

| Ground Currents | | 1A ground input | 5A ground input | 1A ground + CBCT (included with current protection M option only) | 5A ground + CBCT (included with current protection M option only) |

| Power Supply | | 110 - 250 V dc/110 - 230 Vac |

| Slot B - LV I/O | | None | 6 X RTDS |
| Slot C - LV I/O | | None | 6 X RTDS |
| Slot F - HV I/O | | 2 Form A (Vmon), 3 Form C, 7 Digital Inputs (Low / High voltage, Int/Ext supply) |
| Slot G - HV I/O | | None | 2 Form A (Vmon), 3 Form C, 7 Digital Inputs (Low / High voltage, Int/Ext supply) |
| Slot H - HV I/O | | None | None |

| Faceplate | | Color Graphical Display |


| Control | | Basic = Breaker / Contactor Control | Standard = Basic + FlexLogic, 50BF, Trip Bus |

| Monitoring | | Basic = Motor Health Report, Motor Learned Data | Motor Start Report, Data Logger | Basic = Motor Health Report, Motor Learned Data, Broken Rotor Bar |

| Communications | | Standard = USB, 1xRJ45: Modbus RTU, DNP3.0, IEC60870-5-103 + 1xEthernet Copper: Modbus TCP | Advanced = USB, 1xRJ45: Modbus RTU, DNP3.0, IEC60870-5-103 + 2xEthernet Fiber: Modbus TCP/IP, DNP3.0, IEC 60870-5-104, SNT, 1588 | Advanced = PRP + IEC 61850 Ed2 |

| Fiber Optic Connector | | None | ST, Multi-mode 850nm |

| Wireless Communication | | None | WiFi 802.11 |

| Security | | Basic | Advanced - CyberSentry Level 1 |

Note: Harsh Environment Coating is a standard feature on all 8 series units.