

Multilin 869

Comprehensive Motor Protection and Management for Medium and Large Motors

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
- User Configurable Single Line Diagram with color display for local control, system status, and metering
- Advanced motor diagnostics with high-end fault and disturbance recording
- Integrated arc flash detection using light sensors supervised by over current to reduce incident energy and equipment damage
- 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
- Supporting the latest in communication protocols and networking technology, enabling seamless system integration and interoperability
- Optional Wi-Fi connectivity minimizes system configuration and facilitates safe relay programming and diagnostic retrieval

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 assembled by GE

Multilin 8 Series Platform Overview

From oil pumping and refining facilities, to open pit or underground mining and processing operations, to large or small utilities, customers 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 that provides comprehensive protection and asset monitoring for critical feeders, motors, generators, and transformers.

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.

With advanced communications the 8 Series integrates easily and seamlessly into new or existing DCS/SCADA system, along with other Multilin protection devices, providing a comprehensive solution for the end-to-end electrical system within the operations.

Multilin 8 Series Platform - Application Example



850 Feeder Protection System

- Advanced protection, control monitoring and diagnostics for distribution feeders
- Extensively customizable logic for complex interlocking and load shedding
- 2 CB control and 4 shot auto reclose




850 Distribution Feeder Protection

- Advanced protection, control monitoring and diagnostics for distribution feeders
- Extended device life and ease of maintenance with drawout construction & field swappable power supply
- Patented environmental monitoring




889 Generator Protection System

- Advanced unit differential protection
- Generator monitoring and diagnostics
- 100% stator ground protection



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 ISO® 9001:2008 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 critical assets in Industrial and utility environment.

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.



845 Transformer Protection System

Fault Analysis Tools

Category	Item	Status
Winding Hot Spots	W1	OK
	W2	OK
	W3	OK
Internal Short Circuit	ISC1	OK
	ISC2	OK
High Oil Temperature	HOT1	OK
	HOT2	OK

Winding Hot Spots
Internal Short Circuit
High Oil Temperature



869 Motor Management System

- Stator Windings Overheating and Turn to Turn Fault Detection
- Broken Rotor Bar Protection
- Bearing Temperature Monitoring

Motor Health Report

Motor Name	Motor No.	Motor PkV	Motor Amps
M1	1001	13.8	1000
M2	1002	13.8	1000
M3	1003	13.8	1000



850 Feeder Protection System

- Comprehensive voltage and current protection
- Advanced built-in main-tie-main schemes
- Redundant and reliable IEC 61850 communications

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

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.

With a fast protection pass, running every 1/8th of a cycle, the 869 relay provides faster current, voltage, power and frequency protection elements - helping to reduce stress on connected assets. The 869 supports the latest communication protocols, including IEC 62439/PRP and IEC 61850 Ed2, facilitating easy integration into new or existing SCADA/DCS networks.

WANT TO LEARN MORE?
EXPLORE IN 3D

1 Field Swappable Power Supply
Extends the usable life of the protection relay and minimizes costly, time consuming replacement and re-configuration.

2 Harsh Environment Conformal Coating
Standard on all printed circuit boards delivering higher reliability and extended relay life

3 No Electrolytic Capacitors
Increasing quality and reliability for continuous plant operations by removing high failure components (excluding low voltage power supply)

4 IPC A-610 Class 3 Manufacturing
Drives to the highest level of reliability standards delivering rugged performance

5 Robust Extruded Aluminum Chassis
Custom-designed extruded aluminum chassis delivering optimal thermal management to extend component life

6 Draw-Out
Providing simplified device fleet management

Switchgear Control and Configurable SLD

The Multilin 869 provides a configurable dynamic SLD up to six (6) pages for comprehensive switchgear control. Up to 15 digital and metering status elements can be configured per SLD page. These can be configured to show breakers, switches, metering, and status items.

Individual SLD pages can be selected for the default home screen pages. Automatic cycling through these pages can also be achieved through default screen settings.

The provision of such powerful control and display capability within the relay ("One Box concept) eliminates the need for external controls, switches and annunciation on the panel reducing equipment and engineering cost.

Annunciator panel and virtual PBs

The Multilin 869 offers a configurable annunciator panel that can be constructed to show up to 36 alarms in either self-reset mode or latched mode per ISA 18.1 standard similar to a physical annunciator panel; eliminating the need for physical one. The alarms can be displayed on the front panel in a configurable grid layout of 2x2 or 3x3.

The Multilin 869 extends the local control functionalities with 20 virtual pushbuttons that can be assigned for various functions. Each programmable pushbutton has its own programmable LED which can be used to acknowledge the action taken by the tab pushbutton.

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.

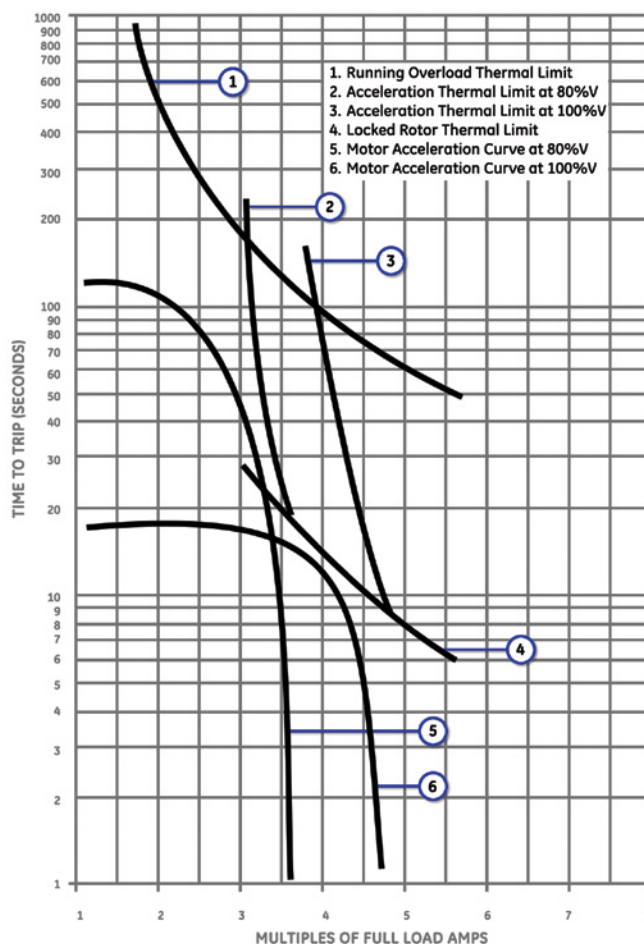
Motor Thermal Model

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

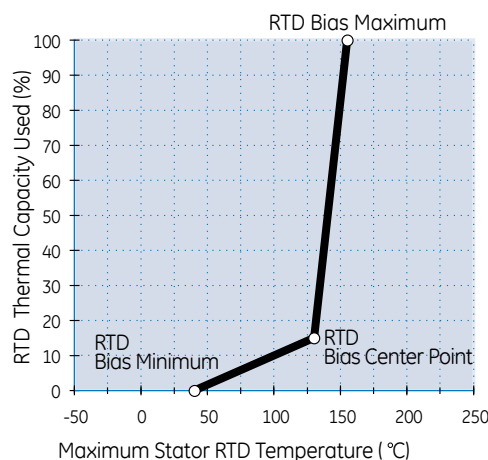
The flexibility of the Multilin 869 thermal models will allow proper set up and performance for applications, including high inertia and cyclic loads.



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

RTD Biasing

The Thermal Model is also biased by the RTD's temperature feedback. This feature allows the relay to protect the motor against unusual high ambient temperatures or abnormal heating due to overvoltage or damaged bearings. The RTD biasing feature can correct for this temperature rising by forcing the TCU register up to the value appropriate to the temperature of the hottest stator RTD.



RTD bias curve

High-Inertia Load Applications

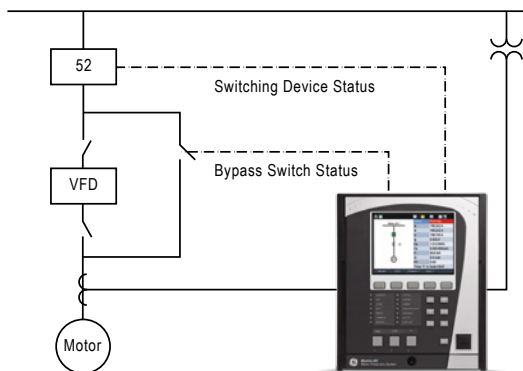
The voltage dependent overload curve feature in Thermal Model is tailored to protect motors which are used in high inertia load applications. Voltage is continually monitored when the motor is started and during acceleration. The thermal limit curve is then adjusted accordingly. This enables the Multilin 869 to distinguish between a locked rotor condition, an accelerating condition and a running condition.

VFD-Driven Motor Applications

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.

Thermal protection also considers the extra heating generated by the higher harmonics due to VFD to achieve the accurate response to the actual motor heating. RMS currents fed to the various motor protection elements are further processed through the averaging filter to eliminate oscillations in current signals to ensure the security.

Additionally, users may indicate a starting VFD frequency that helps the device to track the motor frequency faster and therefore accurately measures the phasor quantities, which, otherwise, could cause delayed or false protection operation of the protection.



Multilin 869 – VFD Driven Motor Protection with or without bypass switch

Cyclic Load Motor Applications

Input currents of a motor driving cyclic load can vary between very low to above the maximum allowable current during a load cycle. Variation in current magnitude results in motor heating and cooling depending on the heat and cooling time constants. Thermal overload protection response is made adaptive to the cyclic load based on the cooling time constants. In addition, to provide more accurate overload thermal model response to cyclic load, the input currents to the thermal model are averaged over the settable duty cycle interval. With a reciprocating load application, the number of cycles to average can be determined from current waveform capture using the Oscillography/Datalogger features in the GE motor protection relays.

Synchronous Motor Applications

869 provides functions essential to protect the synchronous motor during asynchronous operation while startup, during normal and overload operations and under fault conditions. In addition to stator protection and control, it provides protection and monitoring of exciting rotor during pull-out or loss of synchronism condition with elements like Out-of-Step, Loss-of-Field, Reactive Power, and Power Factor. With its well established

and matured Thermal Model, it prevents overheating of both stator and rotor windings during both synchronous and asynchronous operation. During asynchronous operation or startup, the thermal model with VD (voltage dependent) function provides protection against excessive heating in the damper winding due to stalled or locked rotor conditions.

Loss-of-Excitation Protection

Complete or partial loss of excitation to the synchronous rotor can occur due to various abnormal conditions, such as field circuit open or short, loss of supply to the excitation system, or unintentional trip of a field breaker and so on. Due to loss of excitation, the synchronous machine may act as an induction machine, which may cause the machine to over-speed (above synchronous speed) and draw reactive power (Var) from the system. Therefore, Loss of Excitation (LOE) protection is applied to protect synchronous machines from over-speeding, as well as to recover systems from voltage collapse.

Reactive Power

In a synchronous motor application, the reactive power element can be used to detect excitation system malfunction, e.g. under excitation, loss of excitation, etc. Once the 3-phase total reactive power exceeds the positive or negative level, for the specified delay, a trip or alarm occurs indicating a positive or negative kvar condition.

Power Factor

When 869 is applied to a synchronous machine; it is desirable not to trip or alarm on power factor until the field has been applied. Therefore, this feature can be blocked until the machine comes up to speed and the field is applied. From that point forward, the power factor trip and alarm elements will be active. Once the power factor is less than either the Lead or Lag level, for the specified delay, a trip or alarm will occur indicating a Lead or Lag condition. The power factor alarm can be used to detect loss of excitation and out of step.

Reduced Voltage Starting

Many induction and synchronous motor starting applications involve either reduced voltage (starting reactor or autotransformer) or part-winding starting methods. The 869 can control the transition of a reduced voltage starter from reduced to full voltage. That transition may be based on "Current Only", "Current and Timer", or "Current or Timer" (whichever comes first).

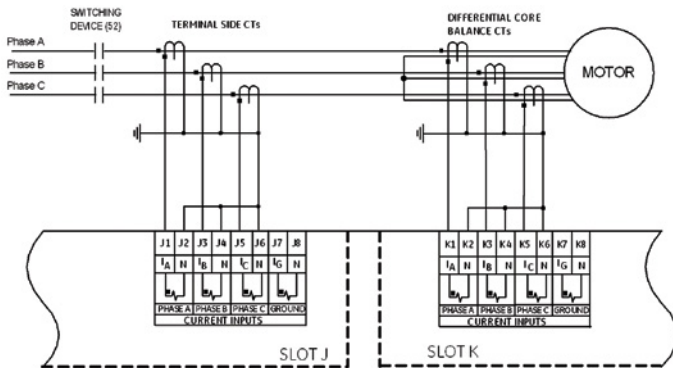
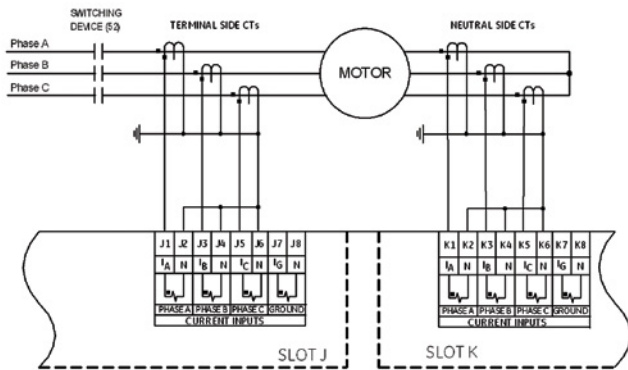
Stator Differential

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.

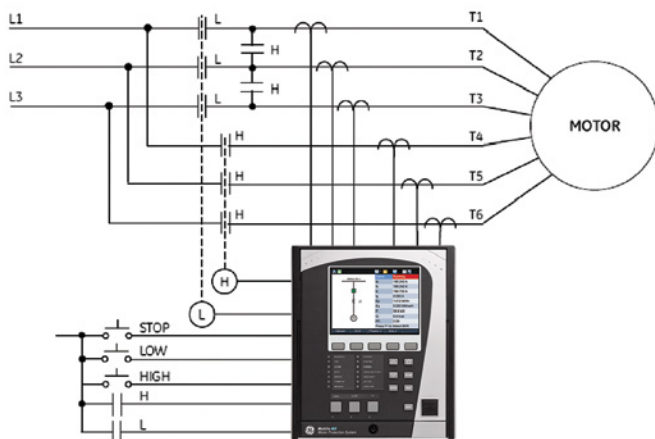


Multilin 869 Stator Differential
Two-CT set and Core-Balanced configurations

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 13 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.

Current Unbalance

Unbalance current, also known as negative sequence current or I_2 , results in disproportionate rotor heating.

The current unbalance protection can detect when the motor's thermal capacity is exhausted and alarm and /or trip before the motor has heated substantially. For the 869 relay, unbalance is defined as the ratio of negative-sequence to positive-sequence current.

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.

Volts/Hz

To take care of over excitation that may result in saturation of the magnetic core or over heating due to stray flux.

In the 869, the per-unit volts-per-hertz (V/Hz) value is calculated using the maximum of the three-phase voltage inputs or the auxiliary voltage

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

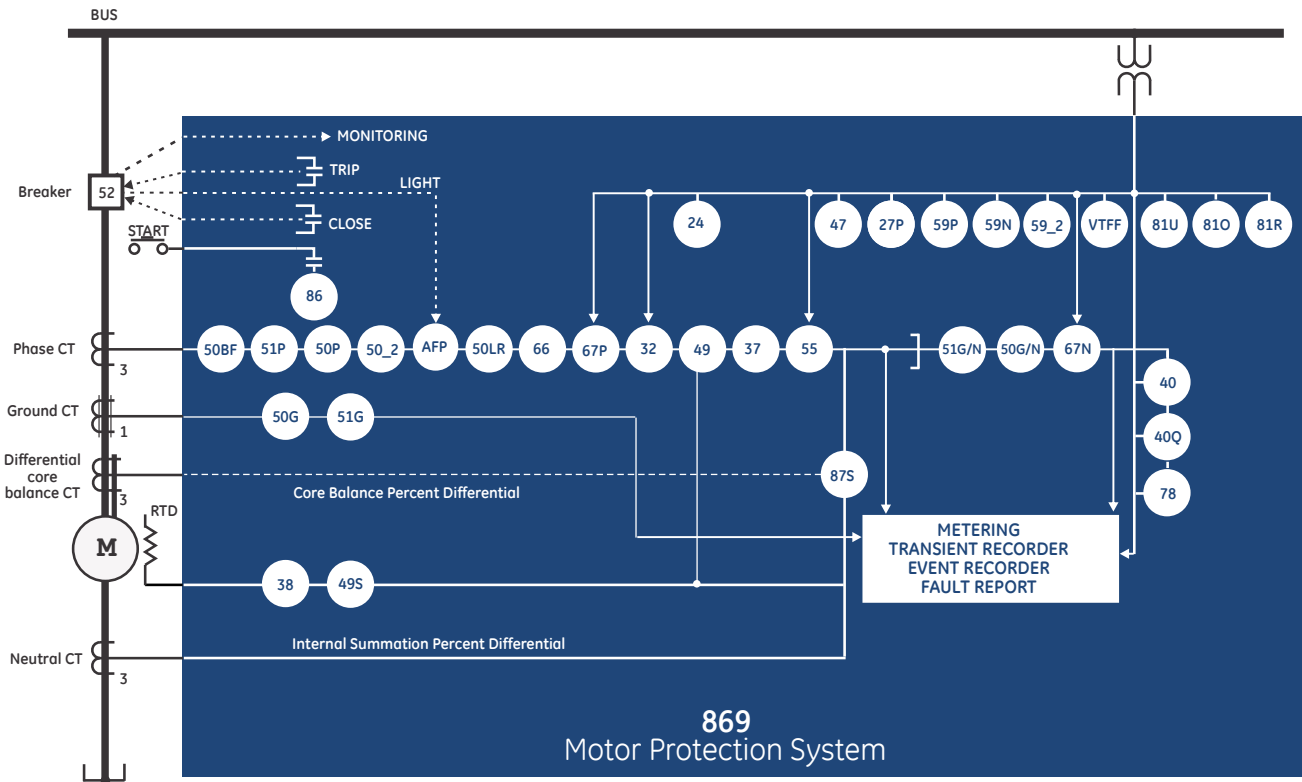
These two elements are used to prevent motor damage during abnormal operational conditions such as excessively long acceleration time or stalled rotors. The mechanical jam element senses increased loading associated with process or load related faults such as an overloaded conveyor.

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.

Functional Block Diagram



ANSI DEVICE	DESCRIPTION
12/14	Over Speed Protection/ Under Speed Protection
24	Volts per Hertz
27P	Phase Undervoltage
32	Directional Power
37	Undercurrent
37P	Underpower
38	Bearing RTD Temperature
40	Loss of Excitation
40Q	Reactive Power
46	Current Unbalance
47	Phase Reversal
49	Thermal Model
49S	Stator RTD Temperature
50BF	Breaker Failure

ANSI DEVICE	DESCRIPTION
50G	Ground Instantaneous Overcurrent
50SG	Ground Fault
50LR	Mechanical Jam
50N	Neutral Instantaneous Overcurrent
50P	Phase Instantaneous Overcurrent
50_2	Negative Sequence Instantaneous Overcurrent
51G	Ground Time Overcurrent
51N	Neutral Time Overcurrent
51P	Phase Time Overcurrent
52	AC Circuit Breaker
55	Power Factor
59N	Neutral Overvoltage

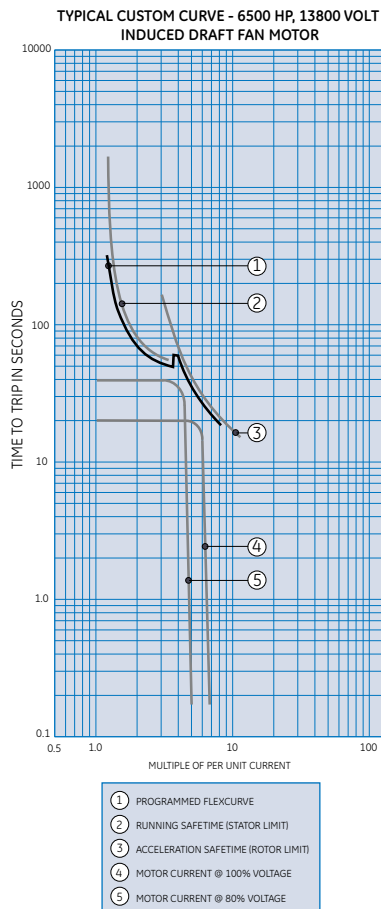
ANSI DEVICE	DESCRIPTION
59P	Phase Overvoltage
59X	Auxiliary Overvoltage
59_2	Negative Sequence Overvoltage
66	Maximum Starting Rate
67N	Neutral Directional Element
67P	Phase Directional Element
78	Out-of-Step Protection
81O	Overfrequency
81U	Underfrequency
81R	Frequency Rate of Change
86	Start Inhibit
87S	Stator Differential
AFP	Arc Flash Protection
VTFF	Voltage Transformer Fuse Failure

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.



Typical FlexCurve overload curve.

Integrated Arc Flash Protection

The Multilin 8 Series supports an integrated arc flash module providing constant monitoring of an arc flash condition within the switchgear, motor control centers, or panelboards. With a 2ms protection pass, the 8 Series is able to detect light and overcurrent using 4 arc sensors connected to the 8 Series relay. In situations where an arc flash/fault does occur, the relay is able to quickly identify the fault and issue a trip command to the associated breaker thereby reducing the total incident energy and minimizing resulting equipment damage.

Self-monitoring and diagnostics of the sensors ensures the health of the sensors as well as the full length fiber cables. LEDs on the front panel display of the 869 can be configured to indicate the health of the sensors and its connections to the relay.



MV Switchgear or Motor Control Center

Multilin 8 Series

Fast, reliable arc flash protection with light-based arc flash sensors integrated within the Multilin 8 Series of protection & control devices. With arc flash detection in as fast as 2msec, the costs associated with equipment damage and unplanned downtime is significantly reduced.

Inputs and Outputs

The 869 provides a max of 21 Digital inputs and 15 Digital outputs with an option for 7 Analog Outputs (dc mA), 4 Analog Inputs (dc mA), 1 RTD input. The configurable analog inputs can be used to measure quantities fed to the relay from standard transducers. Each input can be individually set to measure 4-20 mA, 0-20 mA or 0-1 mA transducer signals.

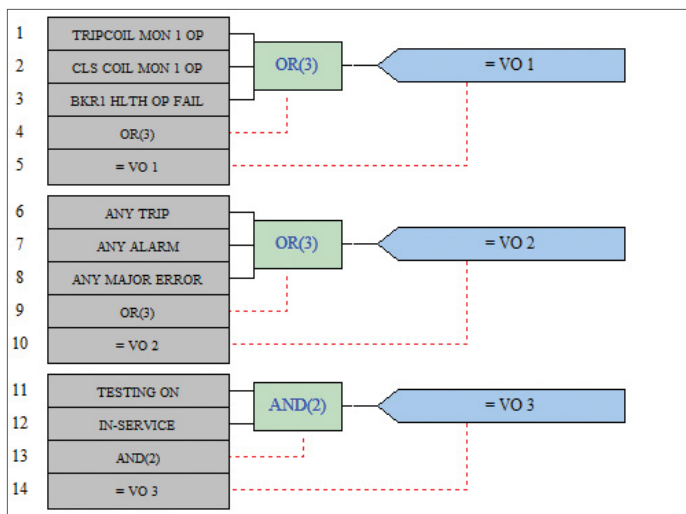
The 869 can also be set to issue trip or alarm commands based on signal thresholds. The configurable analog outputs can be used to provide standard transducer signals to local monitoring equipment. The analog outputs can be configured to provide outputs based on measured analog values, or calculated quantities. An optional general purpose transducer input allows a user-defined quantity to be monitored and used as part of the protection as defined by FlexLogic™.

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 (including interlocking with internal motor start supervision), interlocking schemes with adjacent protections and dynamic setting group changes.



FlexLogic allows the Multilin 869 to operate and control breakers and other auxiliary devices needed to fit most motor protection schemes and applications.

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.

Integrated Motor Monitoring & Diagnostics

Motor failures and faults can have a significant impact on a process, resulting in loss of revenue and material. Predictive maintenance and situational awareness to the motors operating condition can help reduce unplanned downtime and energy consumption - maximizing motor output and life.

The Multilin 869 offers an integrated, cost effective monitoring and diagnostics features that leverage existing relay data without the need for additional devices, sensors, wiring or training.

Motor monitoring & diagnostic features include stator turn to turn fault, broken rotor bar detection, roller bearing faults, foundation looseness, eccentricity, and misalignments. Using advanced Motor Current Signature Analysis (MCSA), the 869 continuously analyzes the motor current signature and based on preset algorithms will determine when an electrical, thermal or mechanical fault / failure condition exists in the motor.

By providing early indication of potential electrical, thermal or mechanical failures, serious system issues can be avoided, such as reduced starting torque, overloads, torque and speed oscillation and bearing wear.

With fully programmable alarms, the Electrical Signature Analysis or Motor Current Signature Analysis provides advanced warning and early detection of impending electrical, thermal or mechanical issues, enabling maintenance personnel to schedule for predictive maintenance of the motor thereby preventing catastrophic motor failures to maximize motor life, repair costs, 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.

Over speed

Any of the input contacts can be used to read the pulses from the input source to determine the speed of the motor. The source of the pulses can be an inductive proximity probe or Hall Effect gear tooth sensor. Two modes of speed: under speed and over speed can be defined.

Proactive Motor Management System

The Multilin 869 delivers a patented approach of integrating advanced monitoring and diagnostic capabilities. Without the cost or complexity of adding sensors, the powerful 869 delivers electrical, thermal, and mechanical failure mode detection for electric motors. With early detection and warning asset managers and operators are able to take proactive maintenance steps, reducing costs associated with unplanned downtime and expensive device repair or replacement.

When coupled with the 869's comprehensive protection & control functions, the 869 delivers a continuous, online, and holistic approach to motor management. Starting from detection of an anomaly or degradation of a motor component, to alarming of the condition, to recording and logging the signals and evolving changes, the 869 provides comprehensive condition-based monitoring and visualization.



Electrical Abnormalities

If undetected, insulation failure can evolve into phase or ground faults, causing equipment damage or loss and significant unplanned downtime. The 869's advanced motor monitoring and trending capabilities provides identification of critical electrical conditions including:

- Stator inter-turn insulation
- Phase-phase insulation
- Stator ground failure
- Loss of load/process
- Unbalance current
- Power factor
- Under/Over frequency

Thermal Abnormalities

The 869 continuously and proactively monitors the motor for Thermal Capacity Used (TCU) to provide early warning of thermal stresses including:

- Extreme starting conditions
- Ambient Temperature
- Forced cooling stops
- Harmonics
- Single phasing
- Unbalance current
- Increase load
- Locked rotor

Mechanical Abnormalities

Without the need for additional sensors or probes the 869 utilizes Electrical Signature Analysis (ESA) / Motor Current Signature Analysis (MCSA) to identify mechanical abnormalities in the motor including:

- Broken Rotor Bar
- Bearing Failure
- Mechanical Jam
- Static & Dynamic Eccentricity
- Foundation Looseness
- Misalignments

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.

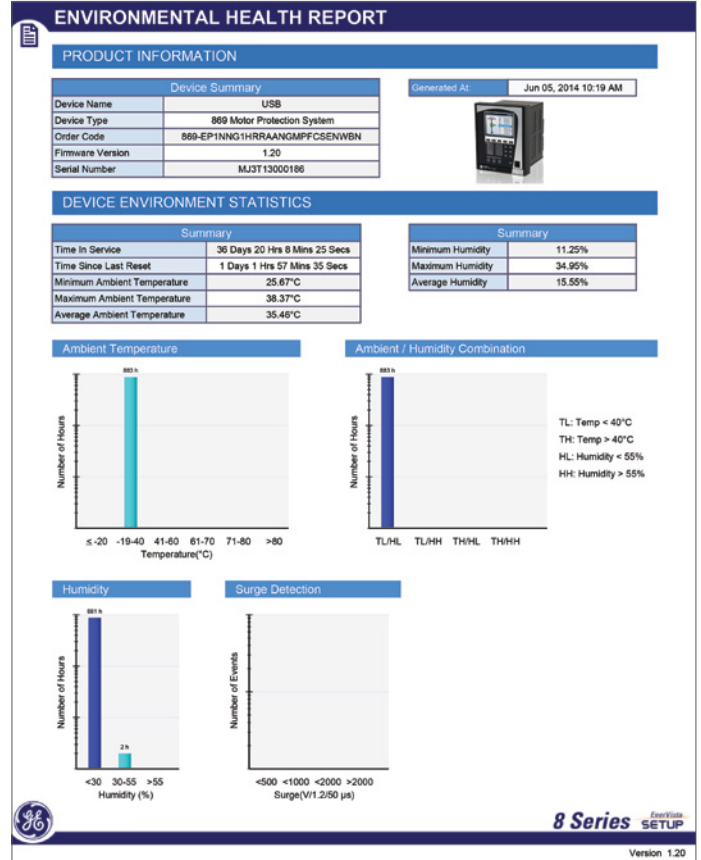
SETTING	PARAMETER
Total Breaker Trips	12
Trips Since Last Reset	9
Alarm Counter	4
Last Trip Time	2512 ms
Avg. of 5 Trip Time	1842 ms
Avg. of Trip Time	1856 ms
Last Close Time	725 ms
Avg. of 5 Close Time	948 ms
Avg. of Close Time	1217 ms
Last PH A Arc Time	0 ms
Avg. of 5 PH A Arc Time	0 ms

USB Records: Breakers

Multilin 8 Series Breaker Health Report available on the display or via the setup software

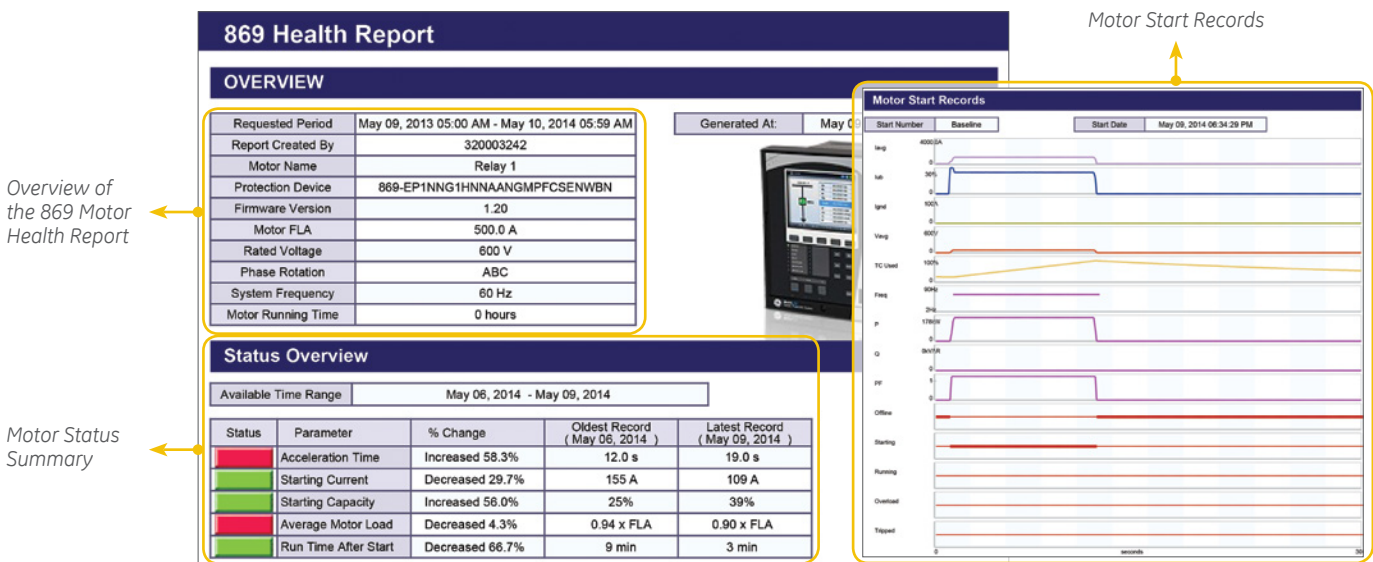
Environmental Monitoring

The Multilin 8 Series implements a patented environmental monitoring system that measures and provides operating condition information. Reliable and secure operation of the relay and other electronic devices in the vicinity may be affected by environmental factors. The 8 Series 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.



Environmental health report is available via Multilin PC Software

Multilin 869 Motor Health Report

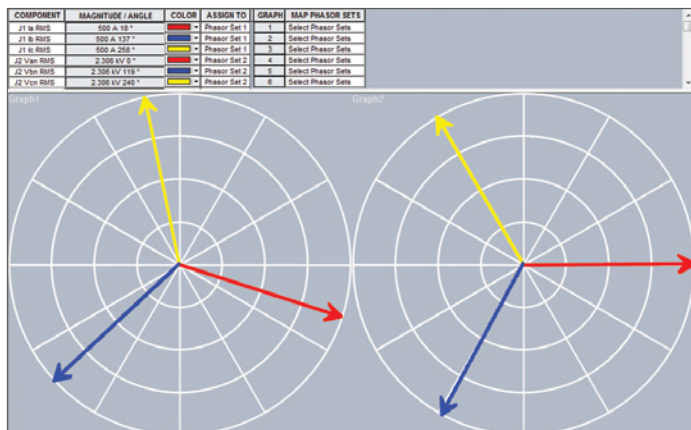


Typical environmental conditions that may affect electronic device reliability include voltage, current, temperature, humidity, dust, contaminants, mechanical stress, shock, radiation and intensity of electrical and magnetic fields. These environmental factors are different from natural weather conditions 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.

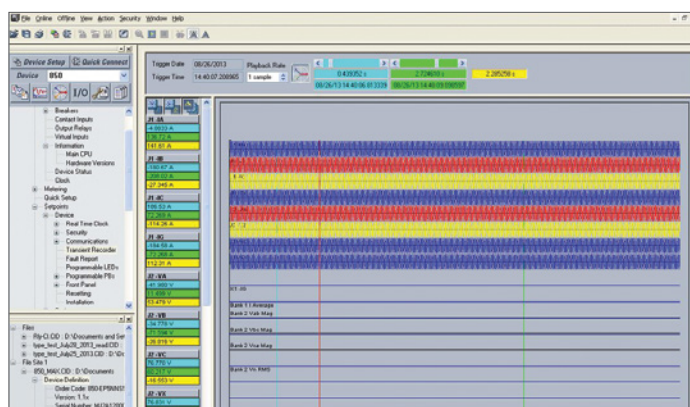
Metering

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



The 869 monitoring system performance with oscillography and event records

Event Number	Date/Time	Cause	Data
24154	Jun 5 2014 13:57:40.709625	Motor Tripped	
24153	Jun 5 2014 13:57:40.576361	Motor Running	
24152	Jun 5 2014 13:54:09.376890	Trip On	
24151	Jun 5 2014 13:54:09.374807	Thermal Trip OP	
24150	Jun 5 2014 13:54:09.374807	Setting Change	
24149	Jun 5 2014 13:54:08.541851	Role Admin Act	
24148	Jun 5 2014 13:54:08.258667	Login	
24147	Jun 5 2014 13:53:40.138449	Motor Overload	
24146	Jun 5 2014 13:53:31.109323	Motor Running	
24145	Jun 5 2014 13:53:27.460975	Motor Starting	
24144	Jun 5 2014 13:53:24.394397	Motor Stopped	
24143	Jun 5 2014 13:53:22.778460	Motor Running	

Multilin 869 Event Recorder

SETTING	PARAMETER
J1 Phase A THD	27.8 %
J1 Phase B THD	0.0 %
J1 Phase C THD	0.1 %
J1 Phase A 2	27.8 %
J1 Phase B 2	0.0 %
J1 Phase C 2	0.1 %
J1 Phase A 3	0.0 %
J1 Phase B 3	0.0 %
J1 Phase C 3	0.0 %

The 869 monitoring system performance with harmonic analysis

Communications

The Multilin 8 Series 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 8 Series also supports two independent IP addresses, providing high flexibility for the most challenging of communication networks.

Providing several Ethernet and serial port options, dual independent Ethernet Ports, and support for a wide range of industry standard protocols, the 8 Series enables easy, direct integration into DCS and SCADA systems. The 8 Series supports the following protocols:

- IEC 61850 Ed2, IEC 62439 / PRP
- DNP 3.0 serial, DNP 3.0 TCP/IP, 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/LDAP)

Enables integration with centrally managed authentication and accounting of all user activities and uses modern industry best practices and standards that meet and exceed NERC CIP requirements for authentication and password management.

Role Based Access Control (RBAC)

Efficiently administrate users and roles within the 869. The new and advanced access functions allow users to configure up to three roles for up to eight configurable users with independent passwords. The standard "Remote Authentication Dial In User Service" (Radius) is used for authentication.

Event Recorder (Syslog for SEM)

Capture 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 serve and classify data by security level using standard Syslog data format. This will enable integration with established SEM (Security Event Management) systems.



Cyber Security with Radius Authentication

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.

8 Series Setup Software

8 Series Setup Software is a single setup and configuration tool across the platform and can reduce device setup and configuration time.

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 including quick setup screens, protection summary, graphical logic editor, and a graphical run time logic monitor. 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.

Full Color Graphical HMI Front Display

A large, full color Graphic Control Panel (GCP) ensures clear representation of critical status and measurements. The GCP also supports a Single Line Diagram (Mimic) to represent the power system configuration of the asset being protected. 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.

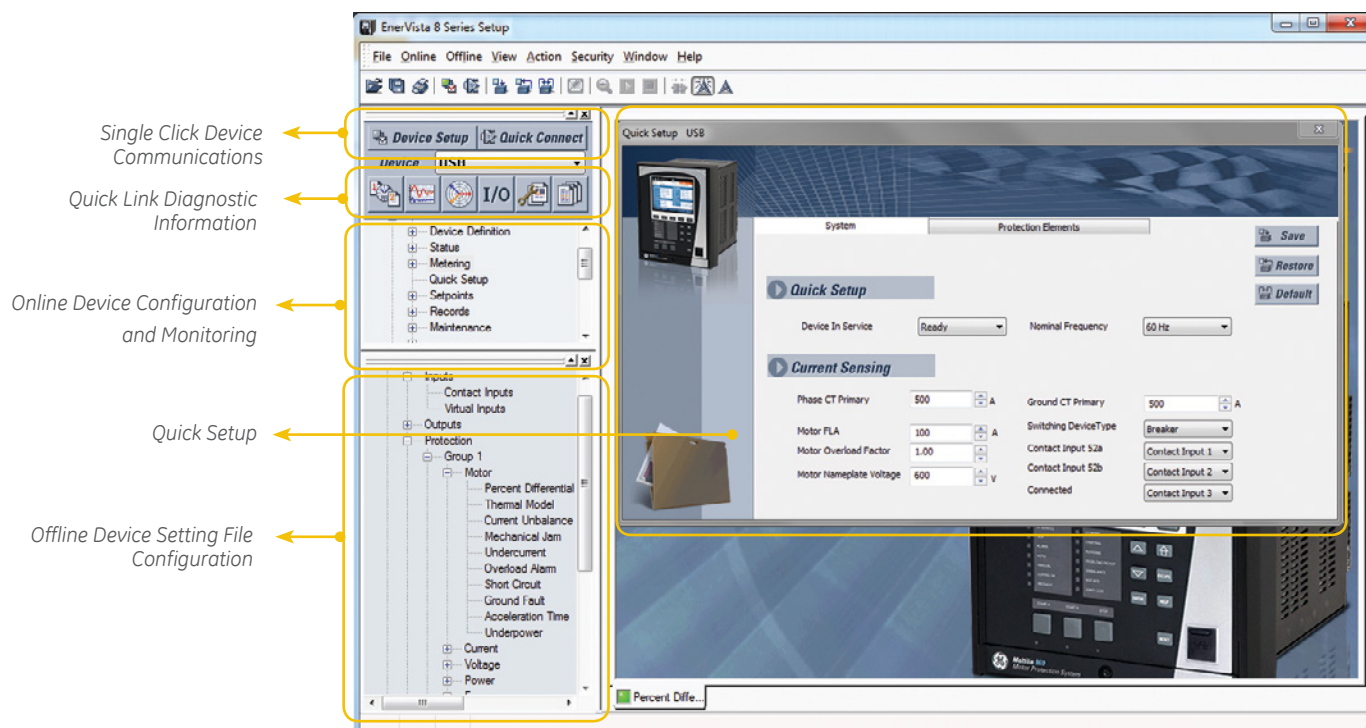
G = Green: General Condition

A = Amber: Alert Condition

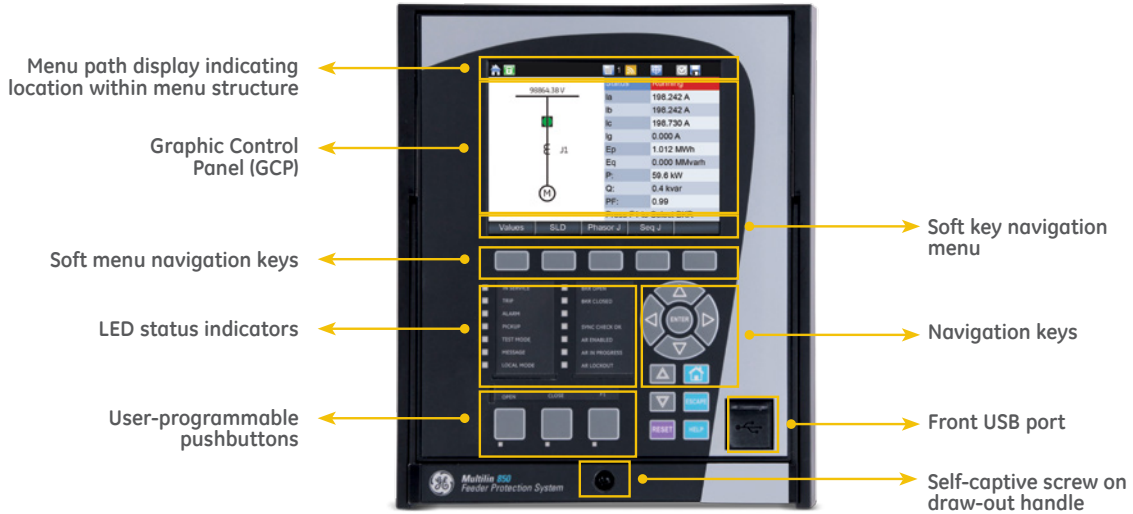
R = Red: Serious Alarm or Important Status

The 869 front panel provides 14 LED indicators and 3 LED pushbutton indicators. 10 LED's are user-programmable, while "In service" and "Pickup" LED's are non-programmable. "Trip" and "Alarm" LED's are not color programmable but can be assigned with selected operands.

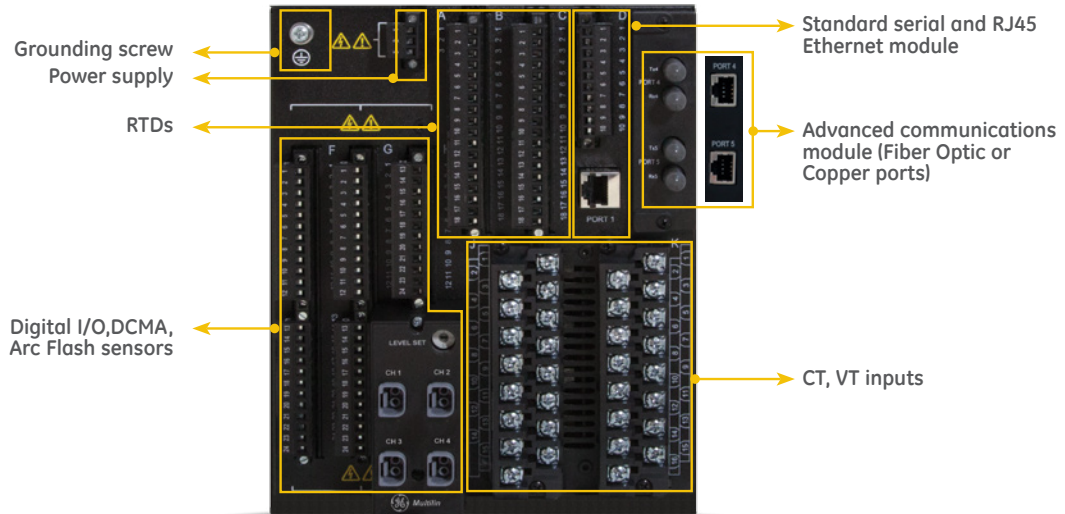
User-programmable LED's can be turned on by a selection of FlexLogic operands representing protection, control or monitoring elements. Each LED can be configured to be self-reset or latched and labeled based on the application and user requirements. User-programmable LED's can be selected to be either Red, Green or Amber to give the distinctive indication of selected operations.



Front View

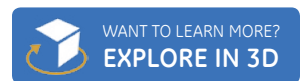


Rear View



Optional IP20 cover available

Dimensions & Mounting




Retrofit Existing Multilin SR Devices in Minutes

Traditionally, retrofitting or upgrading an existing relay has been a challenging and time consuming task often requiring re-engineering, panel modifications, and re-wiring. The Multilin 8 Series Retrofit Kit provides a quick, 3-step solution to upgrade previously installed Multilin SR protection relays, reducing upgrade costs.

With the new 8 Series Retrofit Kit, users are able to install a new 869 Motor Protection System without modifying existing panel or switchgear cutouts, re-wiring, or need for drawing changes and re-engineering time and cost.

With this three-step process, operators are able to upgrade existing SR relays in as fast as 21 minutes, simplifying maintenance procedures and reducing system downtime.


1



Update Settings File

EnerVista 8 Series Setup Software provides automated setting file conversion with graphical report to quickly and easily verify settings and identify any specific settings that may need attention.

2



Replace Relay

Simply remove the upper, lower and low voltage terminal blocks and then remove the SR chassis from the panel. No need to disconnect any of the field wiring.

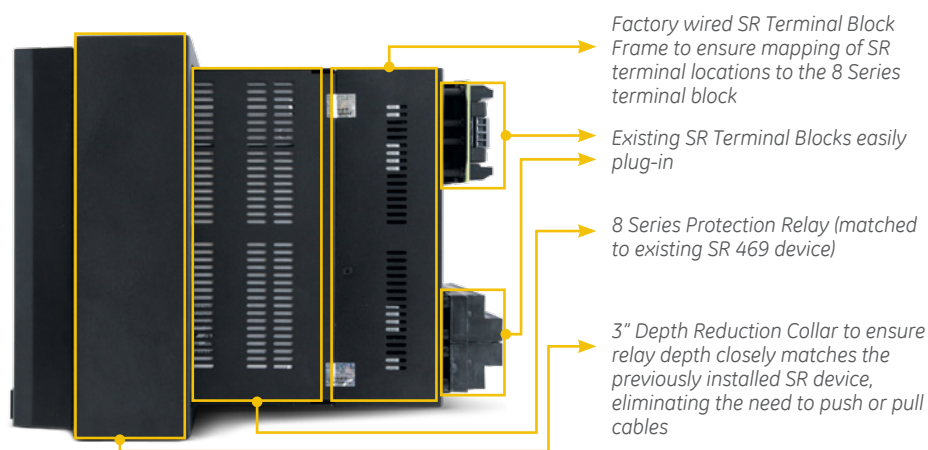
3



Plug & Play Reconnection

Insert the new 8 Series Retrofit chassis into the switchgear and simply plug-in the old terminal blocks - there is need to make any cut-out modifications or push and pull cables.

The 8 Series Retrofit Kit comes factory assembled and tested as a complete unit with the 8 Series protection device and includes replacement hardware (terminal blocks and screws) if the existing hardware is significantly aged or damaged.



Explore in Detail

Visit us online to explore the SR to 8 Series retrofit kit in detail using our interactive app. www.GEGridSolutions.com/8SeriesRetrofitKit



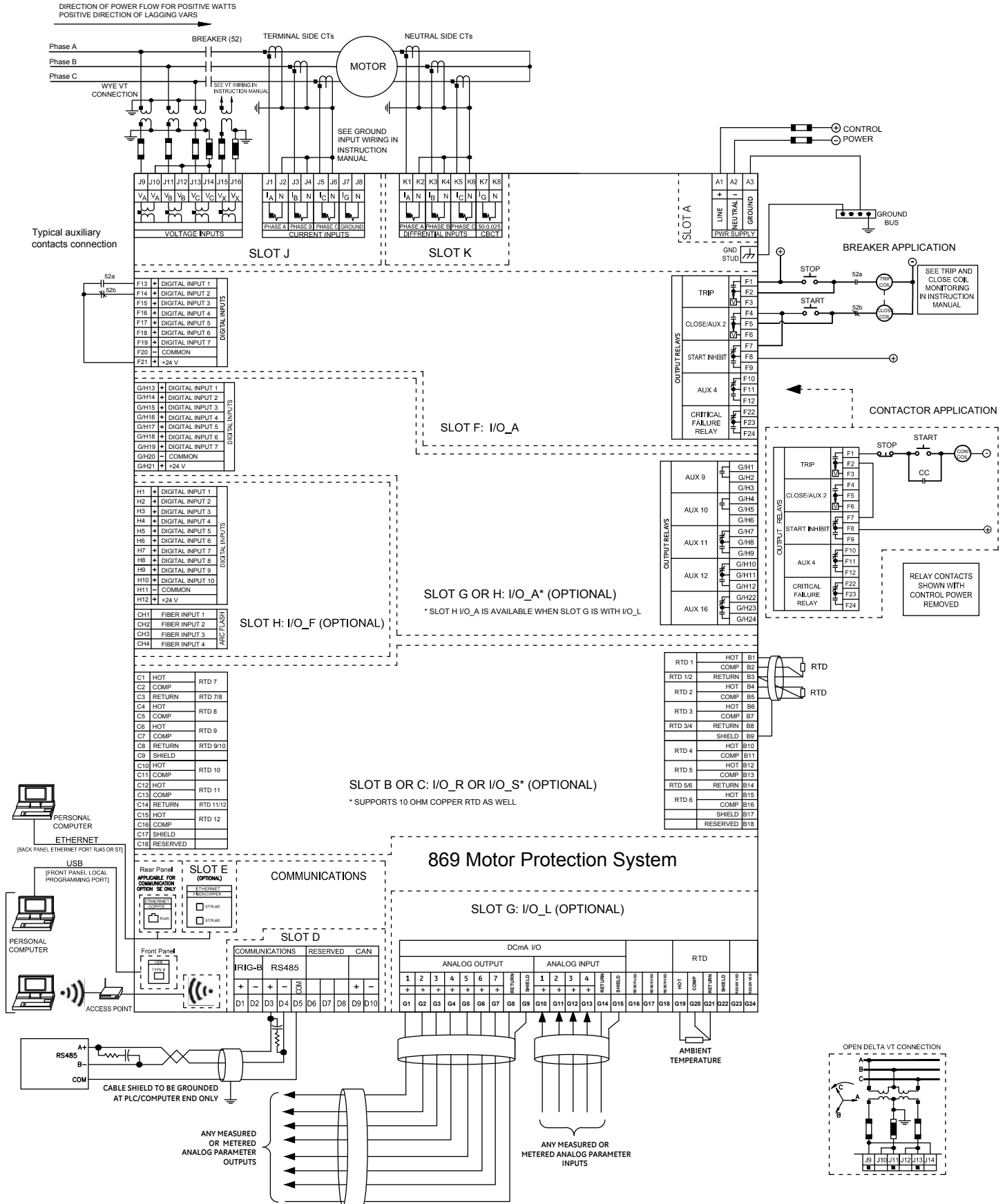
Multilin 8 Series Retrofit: Solutions Explorer Application

Certifications and Environmental Specifications

APPROVALS		
	APPLICABLE COUNCIL DIRECTIVE	ACCORDING TO
CE compliance	Low voltage directive	EN60255-5 / EN60255-27
	EMC Directive	EN60255-26 / EN50263 EN61000-6-2 / EN61000-6-4
North America	cULus	UL508 UL1053 C22.2.No 14
ISO	Manufactured under a registered quality program	ISO9001

ENVIRONMENTAL	
Ambient temperatures:	
Storage/Shipping:	-40°C to 85°C
Operating:	-40°C to 60°C (continuous)
Humidity:	Operating up to 95% (non condensing) @ 55°C (As per IEC60068-2-30 Variant 2, 6days)
Altitude:	2000m (max)
Pollution Degree:	II
Overvoltage Category:	III
Ingress Protection:	IP54 Front

Typical Wiring



Ordering

869	E	**	**	**	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	N	Description	
Base Unit	869																				Motor Protection Relay (Standard : English Language; High Voltage PS, Graphical Control Panel)	
Application	E																				English	
Phase Currents - Slot J Bank 1/2		P1																			1A three phase current inputs (J1)	
Phase Currents - Slot K Bank 2/2		P5																			5A three phase current inputs (J1)	
			NN																		No phase current inputs	
			P1																		1A three phase current inputs (K1)	
			P5																		5A three phase current inputs (K1)	
Ground Currents				G1																	1A ground current input (qty 1 per phase current bank)	
				G5																	5A ground current input (qty 1 per phase current bank)	
				B1																	1A ground (J1) + 50:0.025A (K1, included with 'current protection' M option only)	
				B5																	5A ground (J1) + 50:0.025A (K1, included with 'current protection' M option only)	
Power Supply					H																110 - 250 V dc/110 - 230 Vac	
					L																24 - 48 VDC	
Slot B - LV I/O						N															None	
						R															6 x RTDs (Pt100, Ni100, Ni120)	
						S															6 x RTDs (Pt100, Ni100, Ni120, Cu10)	
Slot C - LV I/O							N														None	
							R														6 x RTDs (Pt100, Ni100, Ni120)	
							S														6 x RTDs (Pt100, Ni100, Ni120, Cu10)	
Slot F - HV I/O*								A													2 Form A (Vmon), 3 Form C, 7 Digital Inputs (Low / High voltage, Int/Ext supply)	
Slot G - HV I/O*									N												None	
									A												2 Form A (Vmon), 3 Form C, 7 Digital Inputs (Low / High voltage, Int/Ext supply)	
										L											7 DcmA O/P + 4 DcmA I/P + 1 RTD	
Slot H - HV I/O*											N										None	
											F										10 Digital Inputs + 4 Arc flash inputs	
											A										2 Form A (Vmon), 3 Form C, 7 Digital Inputs (Low / High voltage, Int/Ext supply)	
Faceplate												M									Basic Membrane Keypad	
												G									Rugged keypad	
Current Protection													S								Basic = 14, 19, 37, 38, 46, 49, 50P, 50N, 50G, 50_2, 50LR, 51P, 51N, 51G, 66, 86,	
														M							Standard = Basic + 51_2, 67P, 67N, 87 (2nd CT Bank required for 87)	
Voltage Monitoring & Protection															S						Standard = 27P, 27x, 47, 59P, 59N, 59X, 810, 81U, VTFE	
															P						Advanced = Standard + 32, 55, 59_2, 81R	
Control																B					Basic = Setpoint Group Control, Breaker / Contactor Control, Virtual Inputs, Trip Bus	
																F					Standard = Basic + FlexLogic, 50BF	
Monitoring																	B				Basic = Motor Health Report, Motor Start Report, Data Logger	
																	C				Standard = Basic + Motor Learned Data, Breaker Health Report, Broken Rotor Bar	
																		A			Advanced = Standard + Harmonic Detection, Stator Inter-Turn Fault	
																		E			Comprehensive Motor Monitoring & Diagnostics	
Communications																	S	E			Standard = Front USB, 1xRS485 : Modbus RTU, DNP3.0, IEC60870-5-103 + 1xEthernet Copper: Modbus TCP, DNP3.0 TCP	
																	1	E			Advanced = Front USB, 1 x Rear RS485 + 2 x Ethernet, MODBUS RTU / TCP, DNP3.0, IEC 60870-5-103/104, 1588, SNTCP, OPC UA	
																		1	P		Advanced + PRP	
																		2	A		Advanced + IEC 61850	
																		2	E		Advanced + PRP + IEC 61850	
Advanced Communications Connector																			N		None	
																				S	ST, Multi-mode Fiber 1310nm	
																				C	RJ45, Copper 10/100M	
Wireless Communication																				N	None	
																				W	WiFi 802.11	
Security																					B	Basic
																					A	Advanced - CyberSentry Level 1

Note: Harsh Environment Coating is a standard feature on all 8 series units.
 *HV I/O, Option A - Max 2 across slots F through H
 Arc Flash Detection (Option F): Includes 4 x Arc Flash sensors, each 18 feet long



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imagination at work