Multilin™
339
MOTOR PROTECTION SYSTEM

Intuitive protection and advanced communications for AC motors

KEY BENEFITS

- Enhanced Thermal Model including RTD and current unbalance biasing providing complete motor protection
- Detailed Motor Health Report providing critical motor data simplifying motor analysis
- Increase process uptime by trouble shooting problems faster with time stamped event reports, waveform capture, motor start and motor trending
- Increase security and reduce potential system risks with the Security Audit Trail capturing setting and command changes
- Powerful communication capabilities allowing seamless integration into most communication architectures
- Easy access to information via multiple communication network options including USB, Serial, Fiber & copper Ethernet
- Eliminate FT switches, needed for testing with the unique draw-out construction
- Reduced wiring with support for remote RTD's
- Reduce setup and configuration time with the Simplified Motor Setup screen
- Customized motor overload curve using Flex curves
- Draw out and non draw out options available

APPLICATIONS

- Small to Medium sized Medium Voltage AC Motors
- Protection of pumps, conveyors, fans, compressors, etc.
- Applications requiring fast and secure communications
- Harsh environments requiring protection against corrosive chemicals and humid environments

FEATURES

Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Phase and ground TOC and IOC
- Start supervision and inhibit
- Mechanical Jam
- Current Unbalance
- Overvoltage
- Undervoltage
- Under/Over Frequency
- Voltage Phase Reversal
- Acceleration Time
- Undercurrent / Underpower
- Starts per Hour

Enervista™ Software

- Enervista Software- an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices
- Simplified motor setting configurator

Metering & Monitoring

- Current Metering
- RTD Temperature
- Voltage Metering
- Power & Energy Metering
- Frequency Metering
- Event Recorder: 256 events with 1ms time stamping
- Oscillography with 32 samples per cycle and digital states
- IRIG-B clock synchronization
- Motor health diagnostics
- Security audit trail

User Interface

- 4X20 character LCD display
- Control panel with 12 LED indicators
- Front USB and rear serial & Ethernet ports
- Multiple Protocols:
  - IEC® 61850
  - IEC 61850 GOOSE
  - MODBUS TCP/IP, MODBUS RTU,
  - DNP 3.0, IEC 60870-5-104, IEC 60870-5-103

imagination at work
Overview
The 339 relay is a member of the 3 Series family of Multilin relays. This motor protective device is used to perform primary motor protection of medium voltage motor applications.

The basic protection functions of this relay include motor thermal model, time-delayed and instantaneous overcurrent, ground overcurrent and sensitive ground overcurrent protection. Additional control features such as logic control are available for applications that require additional motor control functionality.

The robust 339 streamlines user work flow processes and simplifies engineering tasks such as configuration, wiring, testing, commissioning, and maintenance. This cost-effective relay also offers enhanced features such as diagnostics, preventative maintenance, motor health reports and advanced security features.

Easy to Use

Drawout Construction
The 339 offers a complete drawout feature eliminating the need for rewiring after testing has been concluded. The withdrawable feature also eradicates the need to disconnect communication cables, e.g. fiber, copper, RJ45, etc and helps retain communication status even after a relay has been withdrawn from its case.

Effortless Retrofit
The compact and withdrawable feature of the 339 relay minimizes mounting requirements, enables easy retrofit to existing cases, and allows multiple relays to be mounted side by side on a panel. The 339 also provides a pluggable RS485 & IRIG-B connection for easy trouble shooting.

Easy to Configure

Fast & Simple Configuration
Providing ease-of-use functionality, the 339 allows for motor configuration in a simple one page setup screen. Therefore complete motor protection setup can be completed in one easy step.

Advanced Communications

Easy integration into new or existing infrastructure
With several Ethernet and serial port options, and a variety of communication protocols, the 339 provides advanced and flexible communication selections for new and existing applications.
Enhanced Diagnostics

Preventative Maintenance
The 339 allows users to track relay exposure to extreme environmental conditions by monitoring and alarming at high or low temperatures. This data allows users to proactively schedule regular maintenance work and upgrade activities.

Failure Alarm
The 339 detects and alarms on communication port and IRIG-B failures. The 339 also enables users to analyze system performance via diagnostics information such as event records, oscillography, etc. It issues detailed motor health reports and alarms when thresholds are exceeded.

Cost Effective

Robust Design
The 339 is subjected to Accelerated Life Testing (ALT) to validate accurate relay functions under specified normal conditions. The device is further tested for durability through High Accelerated Life Testing (HALT), undergoing stress testing for extreme operating conditions.

Reduced Life Cycle Cost
The 339 is designed to reduce total installation and life cycle cost for motor protection. The draw out construction of the device reduces downtime during maintenance and decreases extra wiring needed for relay testing and commissioning.

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

Protection & Control
The 339 motor protection system is designed to protect and manage small to medium sized AC motors and driven equipment. Flexible and powerful, the 339 provides advanced motor protection, control and monitoring in one integrated, economical draw-out design. The 339 contains a full range of self contained protection and control elements as detailed in the Functional Block Diagram and Features table.

Motor Thermal Model
To provide optimal protection and maximum runtime, the 339 Motor Protection System employs GE's Industry leading advanced Thermal Model, consisting of six key elements:
- Overload Curves
- Unbalance Biasing
- Hot/Cold Safe Stall Ratio
- Motor Cooling Time Constants
- Thermal Inhibit and Emergency Restart
- RTD Biasing

FlexCurves™
A smooth custom overload curve is created using FlexCurves. These curves can be used to protect motors with different rotor damage and stator damage curves, allowing total motor design capacity with complete protection.

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

Frequency Protection
The 339 offers overfrequency and underfrequency protection elements that provide the ability to detect when the motor is operating at off-nominal frequencies which can cause damage to the process. In such cases, the protection elements can trip the motor off-line or can be used to signal to upstream protection and control devices to implement load-shedding schemes.

Unbalance (Negative Sequence) Biasing
Negative sequence current, which causes additional rotor heating, is not accounted for in the thermal limit curves provided by the manufacturer. The 339 measures current unbalance as a ratio of negative to positive sequence current. The thermal model is then biased to reflect the additional rotor heating.

RTD Biasing
The Thermal Model relies solely on measured current to determine motor heating, assuming an ambient temperature of 40°C and normal motor cooling. The actual motor temperature will increase due to abnormally high ambient temperatures or if the motor cooling systems have failed.

RTD Biasing enhances the motor thermal

ANSI® Device Numbers & Functions

<table>
<thead>
<tr>
<th>Device Number</th>
<th>Function</th>
<th>Device Number</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>27P</td>
<td>Phase UV</td>
<td>50P</td>
<td>Short Circuit</td>
</tr>
<tr>
<td>37</td>
<td>Undercurrent, Underpower</td>
<td>51P</td>
<td>Mechanical Jam</td>
</tr>
<tr>
<td>38</td>
<td>Bearing RTD, Stator/ Ambient/Other, RTD Trouble Alarm</td>
<td>50N</td>
<td>Neutral Instantaneous Overcurrent</td>
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<tr>
<td>46</td>
<td>Current Unbalance</td>
<td>59_2</td>
<td>Negative Sequence OV</td>
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<tr>
<td>47</td>
<td>Voltage Phase Reversal</td>
<td>59</td>
<td>Phase UV</td>
</tr>
<tr>
<td>48</td>
<td>Acceleration Time</td>
<td>66</td>
<td>Stot per Hour &amp; Time Between Starts, Restart Block, Thermal Inhibit</td>
</tr>
<tr>
<td>49</td>
<td>Thermal Protection/Stall Protection</td>
<td>81D</td>
<td>Overfrequency</td>
</tr>
<tr>
<td>50F</td>
<td>Greater Failure / Welded Contactor</td>
<td>81U</td>
<td>Underfrequency</td>
</tr>
<tr>
<td>50G</td>
<td>Ground Fault</td>
<td>86</td>
<td>Lockout</td>
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<tr>
<td></td>
<td></td>
<td>896814.CDR</td>
<td>VTFF</td>
</tr>
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</table>
model by calculating the thermal capacity used based on available Stator RTD temperatures.

RTD Biasing does not replace the TCU calculated using the motor current. It provides a second and independent measure of thermal capacity used. Based on a programmable curve, the 339 will calculate the TCU at any given temperature. This TCU is then compared to that of the thermal model, and the larger of the two will be used.

**Hot / Cold Safe Stall Ratio**

The ratio defines the steady state level of thermal capacity used (TCU) by the motor. This level corresponds to normal operating temperature of a fully loaded motor and will be adjusted proportionally if the motor load is lower than rated.

**Motor Cool Time Constants**

The 339 has a true exponential cooldown characteristic which mimics actual motor cooling rates, providing that motor cooling time constants are available for both the stopped and running states. When ordered with RTD’s the stopped and running cool time constants will be calculated by the 339 based on the cooling rate of the hottest RTD, the hot/cold stall ratio, the ambient temperature, the measured motor load and the programmed service factor or overload pickup.

**Start Inhibit**

The Start Inhibit function prevents starting of a motor when insufficient thermal capacity is available or a motor start supervision function dictates inhibit.

**Motor Start Supervision**

Motor Start Supervision consists of the following features: Time-Between-Starts, Starts-per-hour, Restart Time.

These elements guard the motor against excessive starting duty, which is normally defined by the motor manufacturer in addition to the thermal damage curves.

**Undercurrent**

The undercurrent function is used to detect a decrease in motor current caused by a decrease in motor load. This is especially useful for indication of conditions such as:

- loss of suction for pumps, loss of airflow for fans, or a broken belt for conveyors. A separate undercurrent alarm may be set to provide early warning.

**Mechanical Jam**

During overload conditions, quick motor shutdown can reduce damage to gears, bearings and other mechanical parts associated with the drive combination.

**Ground Overcurrent**

For zero sequence ground overcurrent protection, all three of the motor conductors must pass through a separate ground CT. CTs may be selected to detect either high-impedance zero sequence ground or residual ground currents. The ground fault trip can be instantaneous or programmed for a time delay.

**RTD Protection**

The 339 provides programmable RTD inputs via the remote RMIO that are used for monitoring the Stator, Bearing and Ambient temperatures. Each RTD input has 2 operational levels: alarm and trip. The 339 supports RTD trip voting and provides open and short RTD monitoring.

The remote RMIO RTD module is used with the 339 in cases where RTD monitoring is required.
Inputs/Outputs
The 339 features the following inputs and outputs for monitoring and control of typical motor applications:

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

Advanced Automation

Logic Elements
The 339 relay has sixteen Logic Elements available for the user to build simple logic using the state of any programmed contact, virtual, or remote input, or an output operand from protection, or control elements.

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

Virtual Inputs
Virtual inputs allow communication devices the ability to write digital commands to the 339 relay. These commands could be starting or stopping the motor, changing setting groups or blocking protection elements.

IEC 61850
The 339 supports IEC 61850 Logical Nodes which allows for digital communications to DCS, SCADA and higher level control systems.

In addition, the 339 also supports IEC 61850 GOOSE communication, providing a means of sharing digital point state information between 339’s or other IEC 61850 compliant IED’s.

- Eliminates the need for hardwiring contact inputs to contact outputs via communication messaging.
- Transmits information from one relay to the next in as fast as 8 ms.
- Enables sequence coordination with upstream and downstream devices.
- When Breaker Open operation malfunctions, GOOSE messaging sends a signal to the upstream breaker to trip and clear the fault.

Monitoring & Diagnostics

Event Recording
Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self test status. The 339 stores up to 256 events time tagged to the nearest millisecond. This provides the information required to determine sequence of events which facilitates diagnosis of relay operation. Event types are individually maskable in order to avoid the generation of undesired events, and includes metered values and status of all the protection elements at the moment of the event.

Oscillography
The 339 captures current and voltage waveforms and digital channels at 32 samples per cycle. The oscillography record captures 8 individual channels allowing for detailed analysis. The oscillography is triggered either by internal signals or an external contact.

Statistical Data
The 339 records the following statistical data in order to assist in diagnosing common motor faults, as well as assisting in planning preventative maintenance.

- Total running hours
- Number of motor starts
- Total number of motor trips

Pre-Trip Alarms
The 339 can trigger an alarm prior to a trip caused by the following conditions:

- Thermal Overload
- Ground Fault
- Unbalance
- Undercurrent
Advanced Device Health Diagnostics

The 339 performs comprehensive device health diagnostic tests during startup and continuously at runtime to test its own major functions and critical hardware. These diagnostic tests monitor for conditions that could impact system reliability. Device status is communicated via SCADA communications and the front panel display. This continuous monitoring and early detection of possible issues helps improve system availability by employing predictive maintenance.

IRIG-B

IRIG-B is a standard time code format that allows time stamping of events to be synchronized among connected devices within 1 milliseconds. An IRIG-B input is provided in the 339 to allow time synchronization using a GPS clock over a wide area. The 339 IRIG-B supports both AM and DC time synchronization with an auto detect feature that removes the requirement for manual selection.

Motor Health Report

The Multilin 339 relay provides motor diagnostic information in a legible easy to use format that enables the user to make informed decisions on the health of their motor.

Based on the graphical representation and trended values of the motor data gathered by the 339, this enables users to quickly identify process and motor issues prior to a process failure.

The 339 Motor Health Report provides a summary page detailing information on related motor performance.

The following information is detailed in the 339 Motor Health Report:

- Motor Acceleration Time
- Starting Current
- Thermal capacity used during starting
- Average Motor Load
- Average Phase currents
- Current unbalance
- Ground current

Security

Security Audit Trail

In accordance with NERC CIP security reporting requirements and to provide complete traceability, the 339 maintains a history of the last 10 changes made to the 339 configuration, including modifications to settings and firmware upgrades. In addition, the Security Audit Trail records the last ten commands sent to the relay through communications or from the front panel.

Security Setting Report includes the following information:

- If Password was required to change settings
- MAC address of user making setting changes
- Listing of modified changes
- Method of setting changes - Keypad, Front serial port, Ethernet, etc.

The 339 Motor Start / Stop Report

Report Generated: October 2 2009
Motor Name: Recovery Pump 14
Motor FLA: 120A
Protection Device: 339-E-P1-G1-H-S-N-1-E-D-N

1 Status Overview

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<thead>
<tr>
<th>Status</th>
<th>Increased / Decreased</th>
<th>Time</th>
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<tbody>
<tr>
<td>Acceleration Time</td>
<td>Increased 3.8%</td>
<td>From May 2009 to October 2009</td>
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<tr>
<td>Starting Current</td>
<td>Increased 3.5%</td>
<td>From May 2009 to October 2009</td>
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<tr>
<td>System Voltage during Start</td>
<td>Decreased 0.5%</td>
<td>From May 2009 to October 2009</td>
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<tr>
<td>Current Unbalance</td>
<td>Decreased 9.0%</td>
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<tr>
<td>Learned Average Run Time after start</td>
<td>Decreased 27.0%</td>
<td>From May 2009 to October 2009</td>
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2 Trip Summary

<table>
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<th>Trip Type</th>
<th>Number</th>
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<td>Overload / High Temp Trips</td>
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<tr>
<td>Current Based Trips</td>
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<td>Voltage / Frequency Trips</td>
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<tr>
<td>Manual Stop Commands</td>
<td>29</td>
</tr>
</tbody>
</table>

The Motor Heath Report allows you to easily “see” how your motor is doing:

- Start/stop history
- Comprehensive trip details
- Learned acceleration time and starting current
- Many other motor health details
Password Control
With the implementation of the Password Security feature in the 339 relay, extra measures have been taken to ensure unauthorized changes are not made to the relay. When password security is enabled, changing of setpoints or issuing of commands will require passwords to be entered. Separate passwords are supported for remote and local operators, and separate access levels support changing of setpoints or sending commands.

Advanced Communications
The 339 utilizes the most advanced communication technologies today making it the easiest and most flexible motor protection relay to use and integrate into new and existing infrastructures. Multiple communication ports and protocols allow control and easy access to information from the 339. All communication ports are capable of communicating simultaneously.

The 339 supports the most popular industry standard protocols enabling easy, direct integration into electrical SCADA and HMI systems. Modbus RTU is provided as standard with a RS485 networking port. The following optional protocols are available:

- IEC 61850
- IEC 61850 GOOSE
- DNP 3.0,
- Modbus RTU,
- Modbus TCP/IP,
- IEC 60870-5-104,
- IEC 60870-5-103

Easy to Use
Simplified Motor Setting
Included with every 339 Motor Protection System is the Multilin Simplified Motor Setup. The Simplified Motor Setup provides users with a quick and easy method to setup and start the motor and process in applications that require fast commissioning.

The Simplified Motor Setup will generate a complete 339 setting file based on the motor nameplate and system information entered by the user. Once all the information is entered, the Simplified Motor Setup will generate the settings file, as well as provide the documentation indicating which settings were enabled, along with an explanation of the specific parameters entered. The Simplified Motor Setup will provide a detailed setting file in PDF format that can be saved or printed for future reference.

Enervista Software
The Enervista suite is an industry leading set of software programs that simplifies every aspect of using the 339 relay. The Enervista suite provides all the tools to monitor the status of the protected asset, maintain the relay, and integrate the information measured into DCS or SCADA monitoring systems. Convenient COMTRADE and sequence of event viewers are an integral part of the 339 set up software and are included to ensure proper protection and system operation.

Launchpad
Enervista Launchpad is a powerful software package that provides users with all of the set up and support tools needed for configuring and maintaining GE products. The setup software within Launchpad allows configuring devices in real time by communicating using serial, Ethernet or modem connections, or offline by creating 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. Documents made available include:

- Manuals
- Application Notes
- Guideform Specifications
- Brochures
- Wiring Diagrams
- FAQs
- Service Bulletins

**Viewpoint Monitoring**

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

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

**Viewpoint Maintenance**

Viewpoint Maintenance provides tools that will increase the security of the 339 Motor Protection System. Viewpoint Maintenance will create reports on the operating status of the relay, and simplify the steps to troubleshoot protected motors.

**Power System Troubleshooting**

Analyze power system disturbances with transient fault recorder and event records

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**Dimensions**

<table>
<thead>
<tr>
<th></th>
<th>DRAW-OUT DESIGN</th>
<th>NON DRAW-OUT DESIGN</th>
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<tr>
<td></td>
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**EnerVista Integrator**

EnerVista Integrator is a toolkit that allows seamless integration of Multilin devices into new or existing automation systems. Included in the EnerVista Integrator is:

- OPC/DDE Server
- Multilin Devices
- Automatic Event Retrieval
- Automatic Waveform Retrieval
339 Motor Protection System

Wiring Diagram

CONTROL POWER

BREAKER CONTROL CIRCUIT

CONTACTOR CONTROL CIRCUIT

PERSONAL COMPUTER

4 WIRE ETHERNET

COMMUNICATIONS

OPEN DELTA VT CONNECTION

COMMUNICATIONS WIRING IN INSTRUCTION MANUAL

Wiring Diagram
### Technical Specifications

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

#### NEUTRAL INSTANTANEOUS UNDERCURRENT (5/7N)
- Timing Accuracy:
- Pickup Accuracy:
- Alarm Time Delay:
- Dropout Level:
- Pickup Level:

#### NEUTRAL DIRECTIONAL OVERCURRENT (6/7N)
- Directional:
- Polarizing:
- Polarizing Voltage:
- Polarizing Current
- MTA:
- Angle Accuracy:
- Operation Delay:

#### INPUT CURRENT
- Pickup Level:
- Dropout Level:
- Time Delay:
- Block from Start:
- Pickup Accuracy:
- Level Accuracy:

#### CURRENT UNBALANCE
- Unbalance Pickup Level:
- Unbalance Time Delay:
- Single Phasing Pickup Level:
- Single Phasing Time Delay:
- Timing Accuracy:

#### LOAD INCREASE ALARM
- Pickup Level:
- Time Delay:
- Pickup Hysteresis:
- Time Delay on Start:
- Alarm Time Delay on Run:
- Pickup Accuracy:
- Timing Accuracy:

#### SHORT CIRCUIT
- Pickup Level:
- Dropout Level:
- Time Delay:
- Alarm Time Delay:
- Pickup Accuracy:
- Operate Time:
- Timing Accuracy:

#### OVERCURRENT
- Pickup Level:
- Time Delay:
- Dropout Level:
- Single Phasing:
- Timing Accuracy:

#### UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Alarm Time Delay on Run:
- Pickup Accuracy:
- Timing Accuracy:

#### UNDERVOLTAGE
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:

#### MECHANICAL JAM TRIP
- Pickup Level:
- Dropout Level:
- Alarm Time Delay on Run:
- Alarm Time Delay on Start:
- Trip Time Delay on Run:
- Trip Time Delay on Start:
- Pickup Accuracy:
- Timing Accuracy:

#### GROUND FAULT
- Pickup Level:
- Alarm Time Delay on Run:
- Trip Time Delay on Run:
- Pickup Accuracy:
- Timing Accuracy:

#### PHASE/AUXILIARY UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:

#### PASSWORD SECURITY
- Master Reset:
- Settings Password:
- Control Password:

#### SHOW/NO SHOW men:US
- Control Password:
- Alarm Password:
- Settings Password:
- Master Reset:

#### SETTINGS PASSWORD
- Settings Password:
- Control Password:
- Alarm Password:

#### PASSWORD SECURITY
- Master Reset:
- Settings Password:
- Control Password:

#### MECHANICAL JAM TRIP
- Pickup Level:
- Dropout Level:
- Alarm Time Delay on Run:
- Alarm Time Delay on Start:
- Trip Time Delay on Run:
- Trip Time Delay on Start:
- Pickup Accuracy:
- Timing Accuracy:

#### PHASE/AUXILIARY UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:

#### UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:

#### UNDervoltage
- Pickup Level:
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- Dropout Level:
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- Pickup Accuracy:
- Timing Accuracy:

#### UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:

#### UNDervoltage
- Pickup Level:
- Time Delay:
- Dropout Level:
- Alarm Time Delay:
- Pickup Accuracy:
- Timing Accuracy:
Technical Specifications (Continued)

**THERMAL PROTECTION (49)**
- Locked Rotor: 2.0 to 11.0 x FLA in steps of 0.1 x FLA
- Current
- Safe Stall Time: 1.0 to 600.0 s in steps of 0.1 s
- Curve Multiplier: 1.0 x to 1.5 x in steps of 1
- Pickup Level: 1.01 to 2.5 x FLA in steps of 0.01 x FLA
- Curve Biasing: Phase unbalance
  - Hot/cold biasing
  - Stationary biasing
  - Exponential running and Stopped cooling rates
- TCU Update Rate: 3 cycles/min
- Pickup Accuracy: per phase current inputs
- Timing Accuracy: ± 200 ms or ± 0.2% of total time
- Elements: Trip and Alarm

**PHASE/Â€AUXILIARY UNDERTENSION (27P/27F)**
- Minimum Voltage: Programmable from 0.00 to 1.25 x VT in steps of 0.01
- Pickup Level: 0.00 to 1.25 x VT in steps of 0.01
- Dropout Level: 101 to 104% of pickup
- Curve: Infinite, Time, Inverse Time
- Time Delay: 0.1 to 600.0 s in steps of 0.1
- Operate Time: Time delay ± 30 ms @ 60 Hz (V < 0.85 x PKP) or ± 40 ms @ 50 Hz (V < 0.85 x PKP)
- Time Accuracy: ± 0.1% of expected time, or 1 cycle, whichever is greater
- Level Accuracy: Per voltage input

**NEGATIVE SEQUENCE/PHASE OVERVOLTAGE (59P/59 2)**
- Pickup Level: 0.00 to 1.25 x VT in steps of 0.01
- Dropout Level: 96 to 99% of pickup
- Time Delay: 0.1 to 600.0 s in steps of 0.1
- Operate Time: Time delay ± 30 ms @ 60 Hz (V < 0.85 x PKP)
- Timing Accuracy: ± 0.5 s or ± 0.3% of total time
- Level Accuracy: Per voltage input

**OVERFREQUENCY (51)**
- Configuration: ABC or ACB phase rotation
- Time Delay: 100 ms
- Timing Accuracy: ± 0.1%
- Elements: Trip or Alarm

**UNDERFREQUENCY (81U)**
- Minimum Voltage: 0.00 to 1.25 x VT in steps of 0.01
- Pickup Level: 40.00 to 70.00 Hz in steps of 0.01
- Dropout Level: Pickup ± 0.03 Hz
- Time Delay: 0.1 to 600.0 s in steps of 0.1
- Operate Time: Time delay ± 0.5 s or ± 0.5% of total time
- Timing Accuracy: ± 0.1 s or ± 0.1% of total time
- Level Accuracy: ± 0.1 Hz
- Elements: Trip and Alarm

**ACCELERATION TIME TRIP**
- Pickup Level: Motor start condition
- Dropout Level: Motor run, trip, or stop condition
- Time Delay: Stopped to running
- Timers for single-speed: Stopped to high speed
- Timers for two-speed: low speed, low to high speed
- Time Delay: 1.0 to 250.0 s in steps of 0.1
- Timing Accuracy: ± 200 ms or ± 1% of total time

**MOTOR DATA LOGGER**
- Length: 6 buffers, containing a total of 30 seconds of motor starting data
- Trigger: Motor start status
- Trigger Position: 1-second pre-trigger duration
- Logging Rate: 1 sample/200 ms

**METERING SPECIFICATIONS**
- Parameter
  - 3-Phase Real Power (kW)
  - 3-Phase Reactive Power (kVAR)
  - 3-Phase Apparent Power (kVA)
  - 1-Phase Positive Watt OSS (MWh)
  - 1-Phase Negative Watt OSS (MWh)
  - 1-Phase Positive Var OSS (MVAR)
  - 1-Phase Negative Var OSS (MVAR)
  - Power Factor
  - Frequency
- Accuracy
- Resolution
- Range
- 0.1 kW
- ±1% of full scale
- ±100.000.000 kW
- 0.1 kVAR
- ±1% of full scale
- ±100.000.000 kVAR
- 0.1 kVA
- ±1% of full scale
- ±100000.000 kVA
- 0.001 MWh
- ±2% of full scale
- ±50000.000 MWh
- 0.001 MVAr
- ±2% of full scale
- ±50000.000 MVAr
- ±0.05
- ±0.05 Hz
- ±0.5 s
- ±0.5 s
- ±0.001 MWh
- ±0.001 MVAR
- ±0.99 to 1.00
- ±0.99 to 1.00
- ±0.99 to 1.00
- ±0.99 to 1.00

**FUSE FAIL**
- Time Delay: 1 s
- Timing Accuracy: ±0.5 s
- Elements: Trip or Alarm

**DATA LOGGER**
- Number of Channels: 10
- Parameters: Any available analog actual value
- Parameters: Any available analog actual value
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**TRANSIENT RECORDER**
- Buffer size: 1 s
- No. of buffers: 1 x 192, 3 x 64, 6 x 32
- No. of channels: 16
- Sampling rate: 32 samples per cycle
- Triggers: Manual Command
  - Virtual Input
  - Logic Element
  - Element Pickup
  - Trip/Dropout
  - Alarm
- Data: AC input channels
- Data storage: RAM - battery backed-up

**LEARNED DATA RECORDER**
- Number of events: 256
- Content: event number, date of event, cause of event, per-phase current, ground current, sensitive ground current, neutral current, per-phase voltage (VTs connected in "Wye"), or phase-phase voltage (VTS connected in "Delta"), system frequency, power, power factor, power factor, thermal capacity, motor load, current unbalance
- Data Storage: Non-volatile memory

**LOGIC ELEMENTS**
- Number of logic elements: 16
- Trigger source inputs per element: 3
- Black inputs per element: 3
- Supported: AND, OR, NOT, Pickup / Dropout
- Operations: temperature
- Pickup timer: 0 to 6000 ms in steps of 1 ms
- Dropout timer: 0 to 6000 ms in steps of 1 ms
- Data Accuracy: ±0.1 Hz
- Timing Accuracy: ±0.1 second

**BREAKER FAILURE/WELDED CONTACTOR**
- Trip Counter Limit (Pickup): 1 to 10000 in steps of 1

**TIMING RESTART**
- Function: Maintains cycle start features, resets all tripping and alarm alarms, and discharges the thermal capacity to zero
- Operation: Contact Input 1 to 10, Virtual Input 1 to 32, Logic Element 1 to 16, Remote Input 1 to 32

**LOCKOUT RESET**
- Function: Reset any lockout trips when this feature is configured
- Operation: Contact Input 1 to 10, Virtual Input 1 to 32, Logic Element 1 to 16, Remote Input 1 to 32

**RESET**
- Function: Resets any alarms and non-lockout trips when LOCKOUT RESET is configured, or resets any alarms and trip lockout and non-lockout trips when LOCKOUT RESET is not configured
- Operation: Contact Input 1 to 10, Virtual Input 1 to 32, Logic Element 1 to 16, Remote Input 1 to 32

**AMBIENT TEMPERATURE**
- High Temperature: 20°C to 80°C in steps of 1°C
- Low Temperature: -40°C to 20°C in steps of 1°C
- Temperature: Configurable 90 to 98% of pickup
- Temperature Accuracy: ±10°C
- Timing Accuracy: ±1 second

**CONTACT INPUTS**
- Inputs: 10
- Selectable thresholds: 17, 33, 84, 166 VDC
- Recognition time: 1/2 cycle
- Debounce time: 1 to 64 ms, selectable, in steps of 1 ms
- Continuous current draw: 2 mA
- Type: opto-isolated inputs
- Maximum input voltage: 300 VDC

**CABIN INPUT (0.025**
- Range: 0.5 to 15.0 A
- Nominal frequency: 50 or 60 Hz
- Accuracy (CBCT): ±0.1 A (0.5 to 3.99 A) ±0.2 A (4.0 A to 15 A)

**PHASE VOLTAGE INPUTS**
- Source VT: 100 to 200000 V
- Secondary VT: 50 to 240 V
- VT ratio: 1 to 300 in steps of 1
- Nominal frequency: 50 or 60 Hz
- Accuracy: ±1.0% throughout range
- Voltage withstand: 260 VAC continuous

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Rhage & Ground/CURRENT INPUTS

CT Primary: 30 to 1500 A
Range: 0.05 to 20 x CT
Input type: 1 A or 5 A (must be specified with order)
Nominal frequency: 50/60 Hz
Burden: <0.1 VA at rated load
Accuracy: ±3% of reading at 1x CT
±5% of reading from 0.2 to 20 x CT
±20% of reading from 0.02 to 0.19 x CT
CT withstand: 1 second at 10 x rated current
2 seconds at 40 x rated current
continuous at 3 x rated current

FREQUENCY

Accuracy: ±0.05 Hz
Resolution: 0.01 Hz

RTD LEVELS

RTD Type: 100 ohm platinum (DIN.43760)
RTD Sensing Current: 5 mA
Current: 2 kV from base unit
Distance: 250 m maximum
Accuracy: ±0.1°C
Lead Resistance: 25 Ohm max per lead

FORM-A VOLTAGE MONITOR

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

FORM-B RELAYS

Configuration: 5 (five) electromechanical
Contact material: silver-alloy
Operate time: ~8 ms
Continuous current: 10 A
Make and carry for 0.2 s:
30 A per ANSI C37.90
Break (DC Inductive) L/R=40 mS:
24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A
250 V / 0.2 A
Break (DC) Resistive:
24 V / 10 A 48 V / 8 A 6 A 125 V / 0.5 A
250 V / 0.3 A
Break (AC) Inductive:
720 VA @ 250 VAC Pilot duty A300
Break (AC) Resistive:
277 VAC / 10 A

ALL RANGES

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

EN 61000-4-5

ISOLATION

RTD withstand: 2 × highest nominal voltage for 10 ms
Accuracy:
FREQUENCY

CT primary:
Accuracy:
Operate time:
Continuous current:
Make and carry for 0.2 s:
Break (DC Inductive) L/R=40 mS:
Break (DC) Resistive:
Break (AC) Inductive:
Break (AC) Resistive:

All ranges

Voltage withstand:
Power:
Consumption:

ETHERNET (COPPER)

Modes:
Connector:
Protocol:
Ethernet (Fiber)

Fiber type:
Wavelength:
Connector:
Transmit power:
Receiver sensitivity:
Power budget:
Maximum input power:
Typical distance:
Duplex:
Protocol:
Protocol:

USB

Standard specification:
Data transfer rate:

DIMENSIONS

Size:
Weight:

CERTIFICATION

Low voltage directive EN60255-5 / EN60255-27 / EN60100-1

CE:
EMC Directive EN60255-26 / EN50623.
ISO: 8501

IP: 10 Back

OPERATING ENVIRONMENT

Ambient operating temperature:
Ambient storage / shipping temperature:
Humidity:

POLLUTION DEGREE

Ingress Protection:

ORDERING

Base Unit
Language
Phase currents
339 Ground Currents
Power Supply
Input/Output
339 Current Protection
339 Other Options
Communications
Case Design
Harsh Environment

Ordering Notes: II G1/G5 and S1/S5 must match corresponding P1/P5; there cannot be 5A and 1A mixing.