### 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

### 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 synchronziation
- 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, IEC60870-5-104, IEC60870-5-103
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.

339 Relay Features

Easy to Use - Draw out case

Easy to Configure - 1 simple step

Advanced & Flexible Communication Options

Diagnostic Alarms
Enhanced Diagnostics

Preventative Maintenance

The 339 allows user 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>
</tr>
</thead>
<tbody>
<tr>
<td>27P</td>
<td>Phase UV</td>
</tr>
<tr>
<td>37</td>
<td>Undercurrent, Underpower</td>
</tr>
<tr>
<td>38</td>
<td>Bearing RTD, Stall/ Ambient/Other, RTD Trouble Alarm</td>
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<tr>
<td>46</td>
<td>Current Unbalance</td>
</tr>
<tr>
<td>47</td>
<td>Voltage Phase Reversal</td>
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<tr>
<td>49</td>
<td>Acceleration Time</td>
</tr>
<tr>
<td>69</td>
<td>Thermal Protection/Stall Protection</td>
</tr>
<tr>
<td>08F</td>
<td>Ground Fault</td>
</tr>
<tr>
<td>50G</td>
<td>Over/Under Voltage Protection</td>
</tr>
<tr>
<td>51P</td>
<td>Mechanical Jam</td>
</tr>
<tr>
<td>50N</td>
<td>Neutral Instantaneous Overcurrent</td>
</tr>
<tr>
<td>59_2</td>
<td>Negative Sequence OV</td>
</tr>
<tr>
<td>05P</td>
<td>Freeze or Surge</td>
</tr>
<tr>
<td>06</td>
<td>Stotis per Hour &amp; Time Between Starts, Restart Block, Thermal Inhibit</td>
</tr>
<tr>
<td>08D</td>
<td>Overfrequency</td>
</tr>
<tr>
<td>08U</td>
<td>Underfrequency</td>
</tr>
<tr>
<td>06</td>
<td>Lockout</td>
</tr>
<tr>
<td>01F</td>
<td>VTFF VT Fuse Failure</td>
</tr>
</tbody>
</table>

www.GEDigitalEnergy.com
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.

IEC61850
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 IEC61850 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

Sixteen logic elements available for simple logic for applications such as manual control, interlocking, and peer to peer tripping.
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 GE Multin 339 relay provides motor diagnostic information in an 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 Load
- Current unbalance
- Ground current

Actual Values

The 339 provides users with the following metering information in order to accurately monitor the operating conditions of the motor:

- Current: Ia, Ib, Ic, in, Ig, Isg
- Phase-to-phase and phase-to-ground voltages: Vab, Vbn, Vcn, Vab, Vbn, Vcn
- Active power (3-phase) kW
- Reactive power (3-phase) kVAR
- Frequency
- Current Unbalance
- Motor load current as a % of full load
- Motor thermal capacity used
- Stator/Bearing/Ambient RTD temperature

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 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:

- IEC61850
- IEC61850 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.

The tools available in Viewpoint Maintenance include:

- Settings Security Audit Trail
- Device Health Report
- Comprehensive Fault Diagnostics

Power System Troubleshooting

Analyze power system disturbances with transient fault recorder and event records

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

Dimensions

[Dimensions diagram]
### Technical Specifications

<table>
<thead>
<tr>
<th>PASSWORD SECURITY</th>
<th>LEVEL ACCURACY</th>
<th>TIMING ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Reset</td>
<td>3 to 10 alpha-numeric characters</td>
<td>±0.5% per phase</td>
</tr>
<tr>
<td>Password</td>
<td>3 to 10 alpha-numeric characters for local or remote access</td>
<td>±0.5% per phase</td>
</tr>
<tr>
<td>Control Password</td>
<td>3 to 10 alpha-numeric characters for local or remote access</td>
<td>±0.5% per phase</td>
</tr>
</tbody>
</table>

#### NEUTRAL INSTANTANEOUS OVERCURRENT

- **Pickup Level:** 0.05 to 2.0 x CT in steps of 0.01 x CT
- **Dropout Level:** 96 to 99% of Pickup @ I > 1 x CT
- **Time Delay:** 0.00 to 300.00 sec in steps of 0.01 sec
- **Operate Time:** ≤ 30 ms @ 60Hz (I > 2 x PKP), 0 ms time delay
- **Timing Accuracy:** ±0.5% of total time

#### NEUTRAL DIRECTIONAL OVERCURRENT

- **Directionality:** 0.005 to 3 x CT in steps of 0.001 x T
- **Voltage, Current, Duty:** Voltage, Current, Duty
- **Voltage:** - Calculated from VT phases (VTs must be connected in "Y" phase)
- **Duty:** Measured by Vaux input (3V0 provided by an external open delta connection)

#### INPUT CURRENT

- **Pickup Level:** 0.1 to 0.95 x FLA in steps of 0.01 x FLA
- **Dropout Level:** 101 to 104% of Pickup
- **Time Delay:** 1.00 to 60.00 s in steps of 1 s
- **Block from Start:** 0 to 600 s in steps of 1 s
- **Pickup Accuracy:** ±0.5% or ±0.5% of total time
- **Operate Time:** ±0.5% or ±0.5% of total time

### MECHANICAL JAM TRIP

- **Pickup Level:** 1.01 to 4.50 x FLA in steps of 0.01 x FLA
- **Dropout Level:** 96 to 99% of Pickup
- **Alarm Time Delay on Start:** 0.00 to 6.00 s in steps of 0.01 s
- **Alarm Time Delay on Run:** 0.00 to 6.00 s in steps of 0.01 s
- **Trip Time Delay on Start:** 0.00 to 6.00 s in steps of 0.01 s
- **Trip Time Delay on Run:** 0.00 to 6.00 s in steps of 0.01 s
- **Timing Accuracy:** ±0.5% or ±0.5% of total time

### PHASE/AUXILIARY UNDERVOLTAGE

- **Pickup Level:** 1.0 to 100% of MNR 1%
- **Dropout Level:** 101% to 104% of Pickup
- **Alarm Time Delay:** 1.0 to 60.00 s in steps of 0.1 s
- **Pickup Accuracy:** ±0.5% of total time

### MEANING OF THE INDICATORS

- **IN SERVICE:** This indicator will be on continuously lit if the relay is functioning normally and no major self-test errors have been detected.
- **TROUBLE:** Trouble indicator LED will be AMBER if there is a problem with the relay or if relay is not programmed.
- **LOCKOUT:** Lockout initiates when a lockout trip is active.
- **RUNNING:** Indicates that the motor is running in normal operation
- **STOPPED:** Indicates that the motor is stopped
- **STARTING:** Indicates that the motor is in the starting process
- **TRIP:** Indicates that the relay has tripped the motor offline based on predefined programmed conditions.
- **ALARM:** Indicates that the motor is currently operating in an alarm condition and may proceed to a trip condition if not addressed.
- **MAINTENANCE:** Environmental alarms such as ambient temperature alarm, coil monitor or trip counter.

The display messages are organized into Main Menus, Pages, and Sub-pages.

There are four main menus labeled Actual Values, Quick Setup, Setpoints, and Maintenance. Pressing the MENU key followed by the MESSAGE key scrolls through the four Main Menu Headers.

The ten button keypad allows users easy access to relay configuration and information.
**THERMAL PROTECTION**
- Locked Rotor: 2.0 to 11.0 x FLA in steps of 0.1 x FLA
- Current: Auto-detect when 3 ± 0.5
- Safe Stall Time: 1.0 to 600.0 s in steps of 0.1
- Curve Multiplier: 1.0 to 1.5 in steps of 1
- Pickup Level: 1.01 to 1.25 x FLA in steps of 0.01 x FLA
- Curve Biasing: Phase unbalance
- RC Update Rate: 3 cycles
- Pickup Accuracy: per phase current inputs
- Timing Accuracy: ± 200 ms or ± 2% of total time
- Elements: Trip and Alarm

**PHASE/AUXILIARY UNDERVOLTAGE**
- 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: Definite Time, Inverse Time
- Timing Accuracy: ± 0.5 or ± 0.1% of total time
- Level Accuracy: Per voltage input

**NEGATIVE SEQUENCE PHASE OVERVOLTAGE**
- 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
- Timing Accuracy: ± 0.5 or ± 0.1% of total time
- Level Accuracy: Per voltage input

**OVERCURRENT**
- Configuration: ABC or ACB phase rotation
- Time Delay: 100 ms
- Timing Accuracy: ± 0.1 ms
- Elements: Trip or Alarm

**UNDERFREQUENCY (BLU)**
- Minimum Voltage: 0.0 to 1.25 x VT in steps of 0.01
- Pickup Level: 40.0 to 70.0 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
- Timing Accuracy: ± 0.5 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
- Timers for single-speed: Stopped to running
- Timers for two-speed: Stopped to high speed, stopped to 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

**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
- Sampling Rate: 1 cycle, 1 second, 1 minute, 1 hour
- Trigger Sources: All logic elements, Logic operand: Any Trip PKP/DOP/DPO. Any Alarm PKP/DOP/DPO
- Mode: Continuous or triggered

**TRANSIENT RECORDER**
- Buffer size: 32, 64, 128
- No. of buffers: 1x192, 3, 64, 632
- No. of channels: 14
- Sampling rate: 32 samples per cycle
- Triggers: Manual Command, Virtual Input
- Data: AC input channels, Logic Element
- Data Storage: RAM - battery backed-up

**LEARNED DATA RECORDER**
- Number of events: 256
- Header: Date, number of records
- Content: learned acceleration time, learned starting time, learned starting current, last starting current, last starting capacity, last acceleration time, average motor load, learned, average run time after start (days, average run time after start (months)
- Data Storage: Non-volatile memory

**LOGIC ELEMENTS**
- Number of logic elements: 16
- Trigger source inputs: per element: 3
- Black inputs per element: 3
- Supported inputs: AND, OR, NOT, Pickup / Dropout
- Pickup timer: 0 to 6000 ms in steps of 1 ms
- Dropout timer: 0 to 6000 ms in steps of 1 ms

**BREAKER COUNTER**
- Operation: Asserted: Contact Input, Logic Element, Virtual Input, Manual Command, Remote Input
- Function: Opens/Closes the motor breaker

**MEASUREMENT SPECIFICATIONS**
- Parameter: 3-Phase Real Power (kW)
- Accuracy: ±1% of full scale
- Resolution: 0.1 kW
- Range: ±100.000 kW
- VT secondary range: 100 to 20000 V
- VT conversion: 50 to 240 V
- VT ratio: 1 to 300 in steps of 1
- Nominal: 50/60 Hz
- Accuracy: ±0.5% throughput range
- Voltage withstand: 260 VAC continuous

**THRESHOLD INHIBIT**
- Thermal Start Inhibit: 0 to 25 Hz in steps of 1 Hz
- Maximum: 1 to 5 starts in steps of 1
- Time Between: Time Between Starts: 1 to 3600 s in steps of 1 s
- Reset: Restart inhibit delay: 1 to 50000 s in steps of 1 s

**BREAKER FAILURE WELDED CONTACOR**
- Trip Counter Limit (Pickup): 1 to 10000 steps in 1 s

**THERMAL INHIBIT**
- Function: Defeats all motor start inhibit features, resets altrip alarms and discharges the thermal capacity to zero so that a hot motor can be restarted in the event of an emergency
- 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

**ALARM**
- High Temperature Pickup: 20°C to 80°C in steps of 1°C
- Temperature Level: -40°C to 20°C in steps of 1°C
- Temperature Level: 1 to 60 min in steps of 1 min
- Temperature Level: Configurable 90 to 98% of pickup
- Temperature Level: 2 mK
- Type: opto-isolated inputs

**CONTACT INPUTS**
- Selectable thresholds: 17, 33, 84, 166 VDC
- Recognition time: 1/2 cycle
- Deboosing time: 1 to 64 ms, selectable, in steps of 1 ms
- Continuous current draw: 2 mA

**WATER TEMPERATURE INHIBIT**
- Maximum: 300 VDC

**GAGE INPUT**
- Range: ±0.5 to 15.0 A
- Resolution: 0.1 A
- Accuracy (CBCT): ±0.1 A (0.5 to 3.99 A)
- ±0.2 A (4.0 A to 15 A)

**PHASE VOLTAGE INHIBIT**
- Source: 100 to 20000 V
- VT secondary range: 50 to 240 V
- VT ratio: 1 to 300 in steps of 1
- Nominal: 50/60 Hz
- Accuracy: ±1.0% throughput range
- Voltage withstand: 260 VAC continuous

**CONTACT INPUTS**
- Selectable thresholds: 17, 33, 84, 166 VDC
- Recognition time: 1/2 cycle
- Deboosing 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
# Technical Specifications (Continued)

## PHASE & GROUND CURRENT INPUTS

| CT Primary | 30 to 1500 A |
| CT Range | 0.05 to 20 x CT |
| CT Input type | 1 A or 5 A (must be specified with order) |
| CT Nominal frequency | 50/60 Hz |
| CT Burden | <0.1 VA at rated load |
| CT Accuracy | ±3% of reading at 1 x CT |
| CT% 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 100 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 |
| Range | 40.00 to 70.00 Hz |

## RTD INPUTS

| RTD Type | 100 ohm platinum (DIN 43 466) |
| RTD Sensing | 5 mA |
| RTD Current | 2 mA from base unit |
| RTD Distance | 250 m maximum |
| RTD Range | -50 to +250°C |
| RTD Accuracy | ±0.3°C |
| Lead Resistance | 25 ohm max per lead |

## FORM-A VOLTAGE MONITOR

| Applicable voltage | 20 to 250 VDC |
| Trickle current | 1.25 mA |

## FORM-B RELAYS

| Configuration | 2 (two) electromechanical |
| Contact material | silver-allow |
| Trickle current | < 8 ms |
| Continuous current | 10 A |
| Make and carry for 0.2s | 30 A per ANSI C37.90 |
| Break DC (inductive, L/R=40 ms) | 24 V / 1 A, 48 V / 0.5 A, 125 V / 0.3 A |
| Break DC (resistive) | 24 V / 1 A, 48 V / 0.5 A, 125 V / 0.3 A |
| Break (AC) (inductive) | 720 VA @ 250 VAC Pilot duty A300 |
| Break (AC) (resistive) | 277 VA / 10 A |

## ALL RANGES

| Voltage withstand | 2 x highest nominal voltage for 10 ms |
| Power consumption | 20 VA nominal, 20 VA maximum |

## SIGNAL

### RTAS5 part
- Opto-coupled
- Baud rates: up to 115 kbps
- Response time: 1 ms typical
- Parity: None, Odd, Even
- Maximum distance: 1200 m (4000 feet)
- Isolation: 2 kV
- Protocol: Modbus RTU, DNP 3.0, IEC 60870-5-103

### ETHERNET (COPPER)
- Modes: 10/100 MB (auto-detect)
- Connector: RJ-45
- Protocol: Modbus TCP/IP, DNP 3.0, IEC 60870-5-104, IEC 61850 GOOSE

### ETHERNET (FIBER)
- Fiber types: 100 MB Multi-mode
- Wavelength: 1300 nm
- Connector: MTRJ
- Transmit power: -20 dBm
- Receiver sensitivity: -31 dBm
- Power budget: 9 dB
- Maximum input power: -11.8 dBm
- Distance: 2 km (1.25 miles)
- Protocol: Modbus TCP/IP, DNP 3.0, IEC 60870-5-104, IEC 61850 GOOSE

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

## DIMENSIONS

| Size | Refer to Dimensions Chapter 4.1 kg (9.0 lb) |

## CERTIFICATION

- Low voltage directive EN60255-5 / EN60255-27 / EN61000-5-1
- EMC Directive EN60255-26 / EN50263, EN61000-6-2, UL508

## TYPE TESTS

### Dielectric voltage withstand:
- Impulse voltage withstand: 2.5 kV CM, 1 kV DM
- Oscillatory: IEC60068-2-11
- Electric shock: IEC60068-2-1
- Discharge: IEC60068-2-2
- RF immunity: IEC60068-4-2
- Fast Transient Disturbance: IEEE C37.90.1
- Surge Immunity: IEC60068-4-5
- Conducted RF Immunity: IEC60068-4-6
- Power Frequency Magnetic Field: IEC60068-4-8
- Radiated & Conducted Emissions: Class A
- Sinusoidal Vibration: Class A
- Shock & Bump: Class A

### Voltage Dip & Interruption:
- Voltage dip: 10%, 20%, 30%, 40%, 50%, 60%, 80%, 90%, 100%
- Voltage dip time: 10 ms, 100 ms, 1 s, 10 s, 100 s

### Ingress Protection:
- IEC60529
- Environmental (Dry)
- Environmental (Environmental (Dry) Heat)
- Relative Humidity: 65% variation
- Cyclic Voltage: 3 x 3 kV / 3 x 3 kV / 3 x 3 kV / 3 x 3 kV
- Fast Transient: IEEE C37.90.1
- SWC Damped: IEEE C37.90.1
- Electrical Characteristics: 8 kV CD, 15 kV AD

### OPERATING ENVIRONMENT

- Ambient operating temperature: -40°C to +85°C
- Ambient storage / shipping temperature: -40°C to +105°C
- Humidity: Operating up to 95% non-condensing @ 55°C (max. 90°C)
- Pollution degree: II
- Overvoltage category: III
- Ingress Protection: IP40 Front, IP10 Back

### Ordering Notes:
- G1/G5 and S1/S5 must match corresponding P1/P5
- 349 Motor Protection System