269 Plus

MOTOR PROTECTION SYSTEM
Integrated protection and control for medium sized AC motors

KEY BENEFITS

- Enhanced Thermal Model including current unbalance and RTD biasing
- Temperature monitoring with programmable RTD inputs for Stator, Bearing and Ambient temperature protection
- Reduce troubleshooting time and maintenance costs – motor running and learned data, last trip data
- Simplify testing - Built in simulation features
- Cost Effective Access to information through standard RS485 serial ports using Modbus RTU
- Field upgradeable settings and firmware
- Installation flexibility - Remote display and drawout case options

APPLICATIONS

- Medium size motors

FEATURES

Protection and Control
- Thermal model biased with RTD and negative sequence current feedback
- Stator winding & bearing overtemperature
- Motor multiple starts
- 8 standard overload curves
- User defined overload FlexCurve™
- Undercurrent for load loss
- Locked rotor
- Rapid trip/mechanical jam
- Unbalance/single phasing
- Short circuit
- Ground fault
- Phase reversal (meter option)
- Variable lock-out time
- Latched main trip relay, alarm relay
- 2 auxiliary relays
- Emergency restart capability
- Pre-trip alarm warnings

Monitoring and Metering
- Current & Thermal Capacity metering
- Data Logger
- Learned & Statistical Data
- Optional voltage, power metering

Inputs and Outputs
- 12 RTDs, programmable
- 5 factory programmed digital inputs
- 4 output relays
- 1 programmable analog output

EnerVista™ Software
- State of the art software for configuration and commissioning GE Multilin products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 269 Plus into new or existing monitoring and control systems
Protection and Control
The 269 Plus is a digital relay designed to provide complete and accurate protection for industrial motors and their associated mechanical systems. Protection functions include:

Start and Running
The motor is protected under both acceleration and running conditions. An alarm or trip may occur based on acceleration time, the number of starts per hour, the time between starts, or motor overload conditions.

Overload
One of eight standard overload curves may be programmed based on manufacturer’s locked rotor time capability. Alternatively, the user may program a custom curve using the built-in FlexCurve™ function. The motor’s service factor value is entered as the overload pickup level.

FlexCurve™
A smooth custom overload curve is created within a selected range using FlexCurve™. This curve can be used to protect motors with different rotor damage and stator damage curves, allowing total motor design capacity with complete protection.

Unbalance (Negative Sequence)
Unbalanced supply voltages mean a large increase in the negative sequence current which can result in greatly increased rotor heating. The relay uses the ratio of the negative to positive sequence currents to bias the thermal model. Unbalance and phase loss protection is also provided.

Undercurrent (Minimum Load)
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 level may be set to provide early warning.

Ground Fault
For zero sequence ground fault protection, all three of the motor conductors must pass through a separate ground fault CT. CTs may be selected to detect either high impedance zero sequence ground faults or residual ground faults. The trip can be instantaneous or time delayed by up to 20 seconds. A low level of ground fault pickup is desirable for maximum stator winding protection. A 50:0.025 A CT or 5 A CT may be used for ground fault detection.

Rapid Trip/Mechanical Jam
Quick motor shut down can reduce damage to gears, bearings, and other mechanical parts associated with the drive combination. A current surge will cause the relay assigned to the rapid trip/mechanical jam function to trip.

Functional Block Diagram

ANSI Device Numbers & Functions

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</table>
Learned negative sequence contribution (K-factor)

To learn the cooldown time, the 269 Plus tracks the stator RTD temperature and calculates the rate of cooling. If an ambient air RTD is also used, the relay uses this value in its calculation. The learned accelerating $i^2t$ value is obtained by measuring actual inrush currents and acceleration time. This learned value is only accepted after sufficient starts have been sampled.

**Start Inhibit with Auto-Timed Lock-Out**

MotorMatch provides the 269 Plus with the true motor thermal capacity. When the Start Inhibit feature is enabled, the thermal memory has to sufficiently discharge to make the start possible. The 269 Plus uses the “learned start capacity required” to determine if sufficient thermal capacity is available for a start. The start inhibit lock-out time is automatically adjusted to allow for optimum motor usage.

**Emergency Restart**

It may be necessary to restart a faulted motor for reasons of production or safety. To override a start inhibit or overload trip lockout condition, the emergency restart feature can be used. This clears the thermal memory, allowing a manual reset and restart.

The 269 Plus can be programmed to provide a single shot emergency restart following an overload trip. The accumulated $i^2t$ value is automatically reduced to a level that would allow a restart. After the restart attempt, if the relay trips the motor again on running overload, it will remain latched for the appropriate lock-out time.

**Thermal Modeling**

A unique feature of the 269 Plus relay is its ability to compute the motor $i^2t$ value based on actual motor load current. The thermal model calculates this value in terms of thermal capacity used. The RTDs measuring the stator temperature act as a thermal capacity check to confirm the value calculated by the thermal model. The thermal capacity used is then updated to reflect the higher of the two values. This accounts for heat due to $i^2t$ as well as motor heating due to loss of cooling or extreme ambient temperatures.

**RTD Hot Motor Compensation**

When hot motor compensation is enabled, the RTD feedback on the actual stator temperature (as measured by the RTDs) checks the thermal capacity model. In addition, the 269 Plus allows the user to match the motor thermal characteristics with a dual slope RTD bias curve. The two part curve allows for easy fitting of hot and cold motor damage curves to the RTD bias feature.

**Exponential Cooldown**

The 269 Plus has a true exponential cooldown characteristic which mimics actual motor cooling rates. This allows motors to be load cycled more frequently since the initial rate of cooling is very steep. Two setpoints are required to use the exponential cooldown, the full load current (FLC) reduction and the running cool time.

The FLC reduction is the amount of thermal capacity used when the motor is running at a constant 100% FLC condition. This represents the constant percentage difference between the cold damage curve and the hot damage curve. The running cool time is the time for the thermal memory to discharge from 100% to 0% with the motor running in a non-overload condition. If the motor comes from an overloaded condition to a light load condition, then the cooling rate is much faster initially and the thermal capacity used would be reduced accordingly.
VFD Applications
The 269 Plus is capable of protecting motors fed from variable frequency drives (VFDs), including pulse width modulated (PWM) drives. The 269 Plus has been extensively tested with varying current waveforms and frequencies ranging from 15 to 300 Hz.

Current Transformers (CTs)
The 269 Plus receives its current input from user installed 5 A or 1 A secondary CTs. The CT ratio is programmed using the keypad. The maximum CT ratio is 1500:1 or 1500:5.

High resistance ground fault sensing can be accommodated using a 500.025 A zero sequence CT. A 5 A CT may be used for low resistance or solidly grounded systems.

Inputs and Outputs
The 269 Plus features a variety of input and output channels such as:

Speed Switch Input
The speed switch input terminals allow use of an external speed device. This is typically used to allow a locked rotor condition to be distinguished from a normal start, and to shut down following a short delay.

Differential Relay Input
Terminals are provided to accept contact closure from an external differential relay, and to provide a facility for grouping all protective functions through one main relay.

Spare Input
The spare input terminals can be configured to represent either a standard or a specific contact input. The 52b contact from a circuit breaker gives positive identification of the position of the breaker (open or closed), and should be used in applications to any synchronous machine or induction machine that may run unloaded.

Outputs
The 269 Plus has four output relay contacts. The trip relay acts as the main latched output relay. An alarm and two auxiliary output relays have been provided. The alarm relay and Auxiliary 1 relay may be programmed for latched or unlatched modes. The trip, alarm and Auxiliary 1 relays may be programmed fail-safe or non fail-safe. Auxiliary 2 is set to latched and fail-safe. The 269 Plus also has an analog output which can be used to indicate one of motor thermal capacity used, motor current, hottest stator RTD, bearing RTD or CT secondary current.

Monitoring and Metering
The 269 Plus offers advanced monitoring and metering functions that include:

Actual Values
Actual values can be viewed for:
- Average and individual phase currents
- RTD temperatures (hottest, individual, maximum)
- Unbalance ratio (%In/Ip)
- Ground leakage current
- Thermal capacity remaining/estimated time to trip at present overload level
- Motor load as a percent of full load
- Phase-to-phase or phase-to-neutral voltage (meter option)
- W, var, MWhr, PF, Hz (meter option)

Prior Alarms
The 269 Plus can trigger an alarm prior to a trip caused by the following conditions:
- Immediate overload/stall warning
- Ground fault
- Mechanical jam
- Unbalance
- Undervoltage
- RTD overtemperature, broken RTD sensor, low temperature RTD
- Self-test and service
- Under/overvoltage (meter option)
- Low power factor (meter option)

Fault Diagnosis
The relay displays the cause of a trip and shows the remaining lock-out time if applicable. In addition, the cause of the last trip and pre-trip values can be recalled for fault diagnosis.

Statistical Data (StatTrac™)
Statistical data of motor use for operations monitoring, maintenance, and fault diagnosis is provided by the StatTrac™ feature. Using the keypad, the user can display the running hours and number of starts since last commissioning, the total number of trips and their types, and the total mega-watt-hours (with the meter option).

Self-Test
A continuous self-check is maintained with or without the motor running, and an alarm is provided for relay internal malfunctions. The alarm triggers a status indication on the front panel and sends a signal to a user-selectable output relay.

MPM Motor Protection Meter
This optional module provides additional measurement and output capabilities. It can only be used as an external option module. One MPM module can be connected to the 269 Plus via a dedicated serial communication link.

EnerVista™ Software
The EnerVista™ Suite is an industry leading set of software programs that will simplify every aspect of using the 369 relay. Tools to monitor the status of your motor, maintain your relay, and integrate information measured by the 369 into HMI or SCADA monitoring systems are available. Also provided are the utilities to analyze the cause of faults and system disturbances using the powerful waveform and Sequence of Event viewers that come with the EnerVista 369 Setup Software that is included with each relay.

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 GE Multilin products. 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

**EnerVista™ Integrator**

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

- OPC/DDE Server
- GE Multilin Drivers
- Automatic Event Retrieval
- Automatic Waveform Retrieval

**Drawout Case Option**

The 269 Plus can be ordered with a drawout case option. All of the features available for the standard model are included with the drawout model. Shorting contacts across the CT inputs and main trip output relay contacts allow for removal of the relay for bench testing without shutdown of the motor. The relay can also be tested while remaining in the case using a test plug (XLA test plug) connected to test equipment.
**Typical Wiring**

**269Plus_TYPICAL WIRING**

- RTD10 can be used for ambient sensing on the 269 Plus relay or contactor interposing relay.
- Alternate connection for common shield.

**Notes:**

1. Output relay contacts shown: D.C. control power applied, no trips, no alarms & factory configurations in effect.
   - Trip: D fail-safe
   - Alarm: D non-fail-safe
   - Aux.1: D non-fail-safe
   - Aux.2: D fail-safe

2. Use twisted pair for connections to terminals 44 thru 59 also 84 & 85.
3. All RTD must be of the same type.

**Available with 4-way MOD:**

**Connections:**

- Use twisted shielded pair when using the 2000:1 input terminals #73 & 74.
- Use twisted pair when using the 5 amp input terminals #72 & 73.

**Five Amp Input Terminals:**

- Use either residual or zero sequence connection for ground fault input (note: zero sequence connection is recommended).

**Grounded at Master Only:**

- Use twisted pair for connections to terminals 44 thru 59 also 84 & 85.
- All RTDs must be of the same type.

**Notes:**

4. Use either residual or zero sequence connection for ground fault input (note: zero sequence connection is recommended).

5. Use twisted shielded pair when using the 2000:1 input terminals #73 & 74.

6. The 2000:1 terminals (#73 & 74) accept input only from a 50.0.0.25A (2000:1 Ratio GE PM) current sensor. The use of this CT is recommended for resistance grounded systems. Terminals #73 & 74 do not accept input from a 1 amp secondary CT.

7. RTD shields should not be grounded externally as they are internally connected to the relay ground terminal #42.

**Zero Sequence Ground Connection:**

- The starter auxiliary B contact should be connected across terminals 44 & 45. The appropriate setpoint on RT5 must be programmed to determine the status of the starter.

**Residual Ground Connection (Alternate):**

- The appropriate setpoint on RT5 must be programmed to determine the status of the starter.
Technical Specifications

PHASE CURRENT INPUTS
Conversion: Calibrated RMS, sample 2 ms
Range: 0.05 to 12 x phase CT primary amps setpoint
Full Scale: 12 x phase CT primary amps setpoint
Accuracy: ±5% of full scale
(over 2 x phase CT primary amps setpoint)
Frequency: 20 – 400 Hz

GROUND FAULT CURRENT INPUT
Conversion: Calibrated RMS, sample time 2 ms
Range: 0.1 to 1.0 x G/F CT primary amps setpoint (5 A secondary CT)
1.0 to 100 A, 500/0.025 A (2001 ratio)
Full Scale: 1 x G/F CT primary amps setpoint (5 A secondary CT)
10 A (2001 CT)
Accuracy: ±4% of G/F CT primary amps setpoint (5 A secondary CT)
(0.05 to 2 x phase CT primary amps setpoint)
Frequency: 20 – 400 Hz, for 5 A CTs

OVERLOAD CURVES
Trip Time Accuracy:
±1% of primary CT amps
Detection Level:
±1% of primary CT amps
Relay Lock-Out Time:
 ±1% of primary CT amps

UNBALANCE
Display Accuracy:
±2% percentage points of true reading
Exponential Cool Down:
±1% of true unbalance
Running Hours Counter:
Accuracy: ±1%

CONTROL POWER
Input: 120 – 60 VDC
0 – 48 VAC 50/60 Hz
65 – 265 VAC 50/60 Hz
Maximum power consumption:
20 VA
Holdup: 100 ms (@ 120 VAC/125 VDC)

ANALOG CURRENT INPUTS
RTD Inputs
Sensor types:
10 kΩ copper
100 kΩ nickel
100 Ohm platinum
(Specified with order)
Display accuracy:
±2°C
Trip time:
±1% of full scale reading
Accuracy:
±20% of total lock-out time with no control power applied

MOTOR PROTECTION SYSTEM
269 Plus

Dimensions

Environmental
Operating temperature range:
-25°C to +60°C
Humidity:
Up to 95% non-condensing
Altitude:
Up to 2000 m
Pollution degree:
2

Dielectric strength:
2.0 kV for 1 mm to relays, C.T., power supply
Insulation resistance:
IEC255-5, 500 VDC
Transients:
ANSI C37.90.1 oscillatory 2.5 ns
ANSI C37.90.1 fast rise 5 kV/10 ns
Ontario Hydro A-28M-82
IEC255-4-1 impulse/high frequency
Dielectric strength:
@ 150 MHz and 450 MHz, 10 V/µs
Static:
IEC 801-2 static discharge
Humidity:
95% non-condensing
Temperature:
-25°C to +60°C ambient
Environment:
IEC60-2-38 temperature/humidity cycle
Dust/Moisture:
NEMA 12/IP53

Shipping Dimensions:
16" x 11" x 7" (40.6 cm x 27.9 cm x 18.3 cm)

Weight:
8.6 lbs (3.9 kg)

APPROVALS
ISO: Manufactured to IIS09001 Certified Program
UL: Recognized under E38894
CSA: Approved under LR41286
Conforms to IEC 947-1, 1010-1
Conforms to EN50581/CSP4/P11, EN50082-2

MOTOR PROTECTION SYSTEM
269 Plus

Output
250 VAC, 10 A, 30 A, 3 A
AC inductive: 120 VAC, 10 A, 30 A, 3 A
AC resistive: 250 VAC, 10 A, 30 A, 3 A
AC inductive: 125 VAC, 10 A, 30 A, 3 A
Configuration: Form C NO/NC
Contacts: Silver Alloy
Minimum permissible load:
5 VDC, 100 mA, 12VAC, 100 mA

Programmable
Voltage:
AC 120 VAC, 208 VAC, 234 VAC, 277 VAC
Output max:
20 VA
Output max:
500VA, 2080VA, 3000 VA

Protection Tests
Dielectric Strength Test
2200 VAC 50/60 Hz, for 1 sec
Ground terminal 42 to output contacts (terminals 29 to 40)
Current transformer inputs (terminals 29 to 40)
Control power (terminals 41 and 43)

Dimensions

269 Plus

269 Plus Drawout

WEIGHT:
26.4 lbs (12 kg) FULLY PACKAGED
20.76 lbs (9.4 kg) UNPACKAGED

Dimensions: 123.2 x 183 x 76.2 mm (4.8 x 7.2 x 3.0 in)

Control Power
Input: 120 – 60 VDC
0 – 48 VAC 50/60 Hz
65 – 265 VAC 50/60 Hz
Maximum power consumption:
20 VA
Holdup: 100 ms (@ 120 VAC/125 VDC)

Accuracy:
±1% of sample time reading
Polarity:
Terminal 58 (‘–’) must be at ground
Accuracy:
±1% of full scale reading
Update time:
250 ms max

Protection Tests:
ANSI C37.90.1 fast rise 5 kV/10 ns
Ontario Hydro A-28M-82
IEC255-4-1 impulse/high frequency
Dielectric strength:
@ 150 MHz and 450 MHz, 10 V/µs
Static:
IEC 801-2 static discharge
Humidity:
95% non-condensing
Temperature:
-25°C to +60°C ambient
Environment:
IEC60-2-38 temperature/humidity cycle
Dust/Moisture:
NEMA 12/IP53

Weight:
8.6 lbs (3.9 kg)
### Ordering

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<th>269 PLUS</th>
<th>269 Plus motor management relay*</th>
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### Accessories for the 269 Plus:
- Multinet Serial to Ethernet converter: Multinet-FE
- Viewpoint Monitoring: VP-1
- D485 Devicenet converter: D485-C
- P485 Profibus converter: P485-C

### Visit www.GEMultilin.com/269Plus to:
- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 269 Plus online