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 upgradable 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

Multilin

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 means 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)

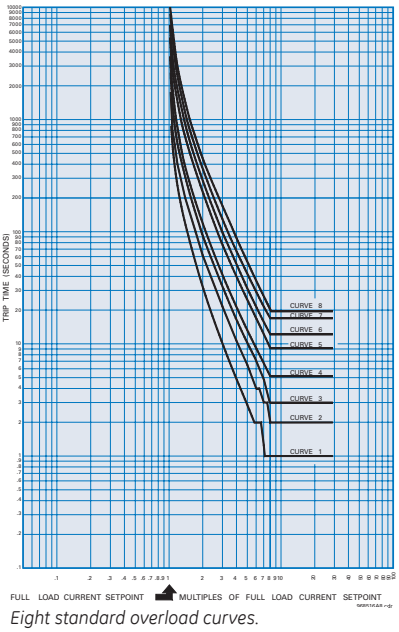
The undercurrent function is used to detect a decrease in motor current caused by a decrease in motor load. This is especially useful for indication of conditions such as loss of suction for pumps, loss of airflow for fans, or a broken belt for conveyors. A separate undercurrent alarm level may be set 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.

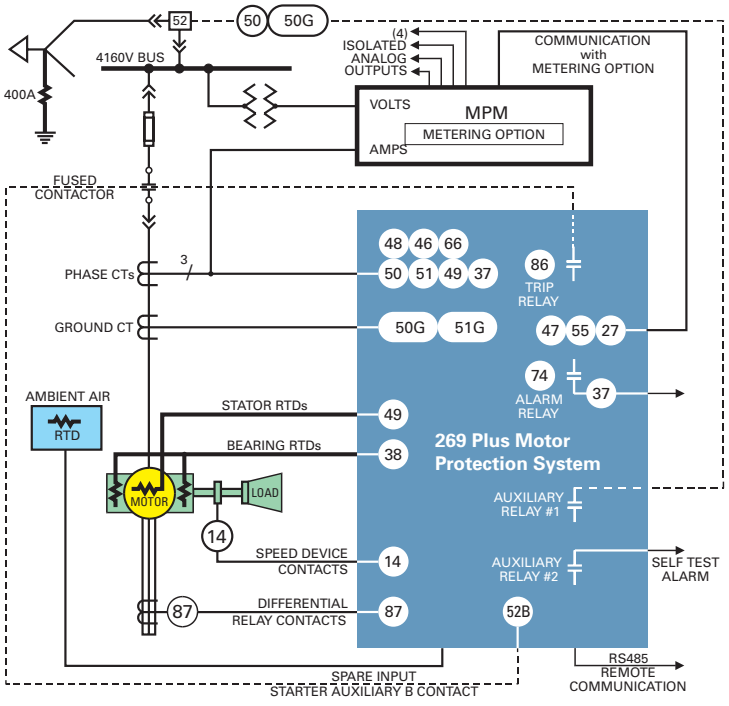
Rapid Trip/Mechanical Jam

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



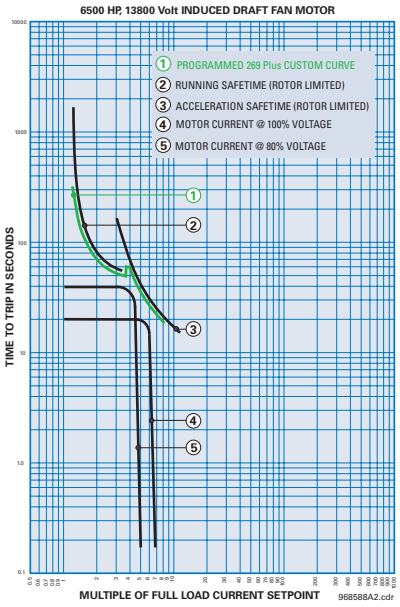
Eight standard overload curves.

Functional Block Diagram



ANSI Device Numbers & Functions

DEVICE	PROTECTION
14	Speed Device
37	Undercurrent/Minimum Load
38	Motor/Load Bearing Overtemperature
46	Unbalance - Negative Sequence
48	Multiple Starts/Locked Rotor
49	Stator Winding Overtemperature
49/51	Overload Curves/FlexCurve™
50	Short Circuit Mechanical Jam/RapidTrip
50G/51G	Zero Sequence Ground Fault
50N/51N	Residual Ground Fault
52B	Breaker
74	One Alarm Relay,Two Auxiliary Relays
86	Main Trip Latched Relay Auxiliary Relay No. 1 Auxiliary Relay No. 2
87	Differential Relay Contact Input
66	Starts per Hour
47	Volts Phase Reversal (Meter Option)
27	Undervoltage (Meter Option) Frequency (Meter Option)
55	Power Factor (Meter Option)



Typical FlexCurve™.

jam function to become active. The user may set the pickup level, the trip time delay and an alarm for early warning.

Stator Overtemperature

Overtemperature protection of the stator windings is provided by monitoring up to six stator RTDs. If less than six RTDs are used for stator monitoring, the remaining RTDs may be used for any other temperature monitoring function desired. Individual RTD alarm, high alarm and trip levels are set by the user.

Temperature Monitor

A total of 10 RTD inputs are available. Any RTD inputs not used for stator RTD protection can be used for other temperature monitoring functions. Separate alarm and trip level temperatures can be selected for each RTD.

MotorMatch

To obtain maximum use from the protected motor, the MotorMatch system modifies the initial relay parameters to match actual measured motor characteristics. The key elements include:

- Accumulated I^2t in the memory
- RTD input to the memory
- Learned cooldown time from run to stop
- Learned cooldown time from run-overload to run-normal
- Learned acceleration time
- 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.

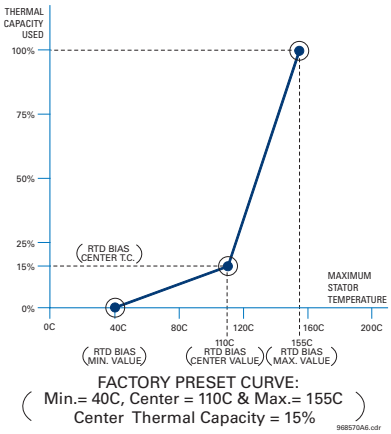
The 269 Plus can be programmed to provide a single shot emergency restart following an overload trip. The accumulated I^2t value is automatically reduced to a level that would allow a restart. After the restart attempt, if the relay trips the motor again on running overload, it will remain latched for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



RTD bias curve sample.

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.

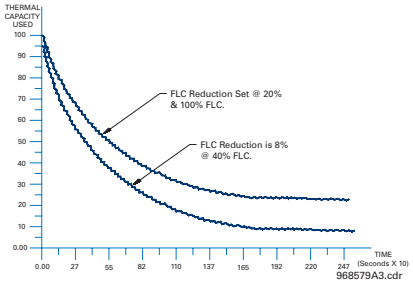
The FLC reduction is the amount of thermal capacity used when the motor is running at a constant 100% FLC condition. This represents the constant percentage difference between the cold damage curve and the hot damage curve. The running cool time is the time for the thermal memory to discharge from 100% 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.



269 Plus exponential cool down curve graph.

High resistance ground fault sensing can be accommodated using a 50:0.025 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
- Undercurrent
- 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™)

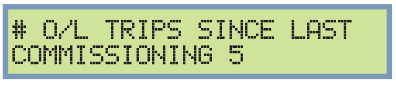
Statistical data of motor use for operations monitoring, maintenance, and fault diagnosis is provided by the StatTrac™ feature. Using the keypad, the user can display the running hours and number of starts since last commissioning, the total number of trips and their types, and the total mega-watt-hours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

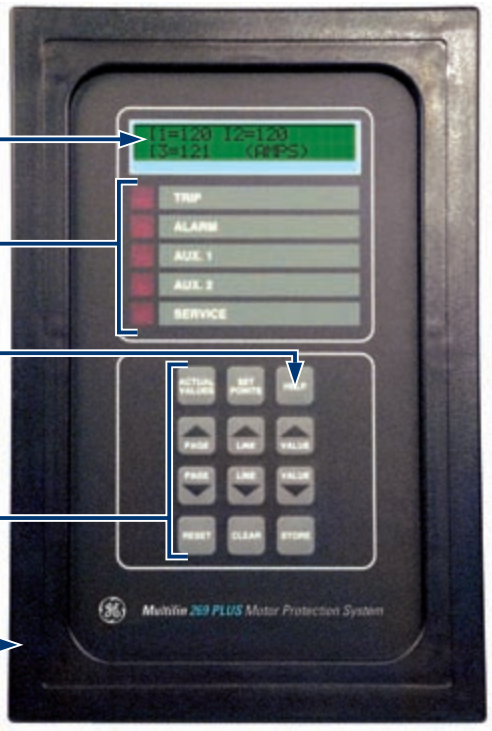
- OPC/DDE Server
- GE Multilin Drivers
- Automatic Event Retrieval
- Automatic Waveform Retrieval

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.

Features

Front View



DISPLAY
48 Character alpha-numeric backlit LCD display for viewing actual values, causes of alarms and trips, and programming setpoints

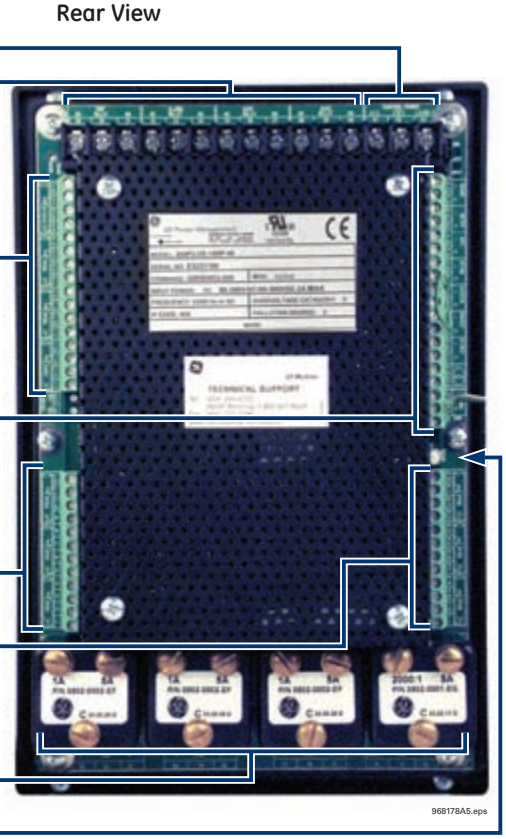
STATUS INDICATORS
4 LEDs indicate when an output is activated. When an LED is lit the cause of the output relay operation will be shown on the display
Service LED is lit during a self-test alarm

HELP KEY
Help key can be pressed at any time to provide additional information

KEYPAD
Used to select the display of actual values, causes of alarms, causes of trips, fault diagnosis and to program setpoints

Rugged, corrosion and flame retardant case.
Meets IP40X

Rear View



CONTROL POWER
120/125 AC/DC,
240/250 AC/DC,
24 DC, 48 DC

4 OUTPUT RELAYS
Programmable alarm and trip conditions activated by programmable setpoints, switch input, remote communication control

RTD 7-10
can be assigned to monitor motor and load bearings, and ambient temperature

INPUTS/OUTPUTS
- Spare input
- MPM (meter) com port
- Differential relay input
- Speed switch input
- Access input
- Emergency restart
- External reset
- Analog output
- RS485 com port

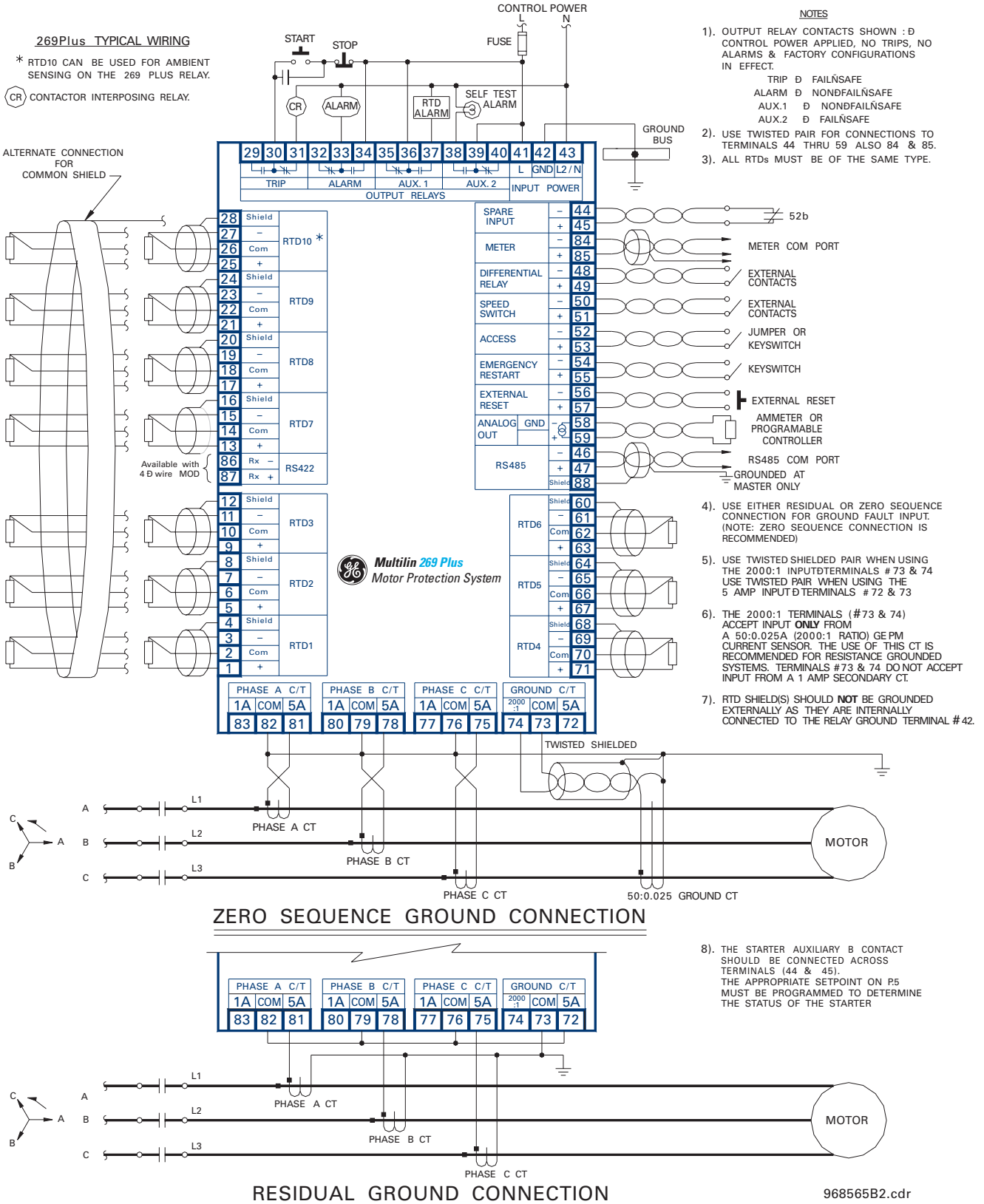
RTD 1-3
Typically used for stator winding protection

RTD 4-6
Typically used for stator winding protection

Phase and ground CT inputs

Contrast dial

Typical Wiring



ZERO SEQUENCE GROUND CONNECTION

RESIDUAL GROUND CONNECTION

(ALTERNATE)

NOTES

1). OUTPUT RELAY CONTACTS SHOWN : Ð CONTROL POWER APPLIED, NO TRIPS, NO ALARMS & FACTORY CONFIGURATIONS IN EFFECT.
TRIP Ð FAILŃSAFE
ALARM Ð NONDFAILŃSAFE
AUX.1 Ð NONDFAILŃSAFE
AUX.2 Ð FAILŃSAFE

2). USE TWISTED PAIR FOR CONNECTIONS TO TERMINALS 44 THRU 59 ALSO 84 & 85.

3). ALL RTDs MUST BE OF THE SAME TYPE.

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 INPUTDTERMINALS # 73 & 74 USE TWISTED PAIR WHEN USING THE 5 AMP INPUT Ð TERMINALS # 72 & 73

6). THE 2000:1 TERMINALS (#73 & 74) ACCEPT INPUT **ONLY** FROM A 50:0.025A (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 SHIELD(S) SHOULD **NOT** BE GROUNDED EXTERNALLY AS THEY ARE INTERNALLY CONNECTED TO THE RELAY GROUND TERMINAL # 42.

8). THE STARTER AUXILIARY B CONTACT SHOULD BE CONNECTED ACROSS TERMINALS (44 & 45). THE APPROPRIATE SETPOINT ON P.5 MUST BE PROGRAMMED TO DETERMINE THE STATUS OF THE STARTER

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Technical Specifications

PROTECTION

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: ±0.5% of full scale
(0.05 to 2 x phase CT primary amps setpoint)
±1.0% 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 C.T.)
1.0 to 10.0 A, 50:0.025 A (2000:1 ratio)
Full Scale: 1 x G/F CT primary amps setpoint
(5 A secondary C.T.)
10 A (2000:1 C.T.)
Accuracy: ±4% of G/F CT primary amps setpoint
(5 A secondary C.T.)
±0.3 A primary (2000:1 C.T.)
Frequency: 20 – 400 Hz, for 5 A CTs
20 to 150 Hz for 2000:1 CTs

OVERLOAD CURVES

Trip Time Accuracy:
±1 sec up to 13 sec
±8% of trip time over 13 sec
Detection Level:
±1% of primary CT amps

RELAY LOCK-OUT TIME

Accuracy: ±1 min with control power applied
±20% of total lock-out time with no control power applied

UNBALANCE

Display Accuracy:
±2 percentage points of true negative sequence unbalance (In/Ip)

EXPONENTIAL COOLDOWN

Accuracy: ±2% of true exponential

RUNNING HOURS COUNTER

Accuracy: ±1%

POWER SUPPLY

CONTROL POWER

Input: LO: 20 – 60 VDC
20 – 48 VAC: 50/60 Hz
HI:80 – 300 VDC
65 – 265 VAC: 50/60 Hz
Maximum power consumption:
20 VA
Holdup: 100 ms (@ 120 VAC/125 VDC)

INPUTS

RTD INPUTS

Sensor types: 10 Ω copper
100 Ω nickel
120 Ω nickel
100 Ω platinum
(specified with order)
Display accuracy: ±2° C
Trip/alarm setpoint range: 0 – 200° C
Dead band: 3° C
Maximum lead resistance: 25% of RTD 0° C resistance

OUPUTS

RELAY CONTACTS

Voltage		M/C cont.	M/C 0.2 sec	Break
AC resistive	30 VDC	10 A	30 A	10 A
	125 VDC	10 A	30 A	0.5 A
	250 VDC	10 A	30 A	0.3 A
DC inductive (L/R = 7 ms)	30 VDC	10 A	30 A	5 A
	125 VDC	10 A	30 A	0.25 A
	250 VDC	10 A	30 A	0.15 A
AC resistive	120 VAC	10 A	30 A	10 A
	250 VAC	10 A	30 A	10 A
AC inductive PF=0.4	120 VAC	10 A	30 A	4 A
	250 VAC	10 A	30 A	3 A
Configuration:	Form C NO/NC			
Contacts:	Silver Alloy			
Minimal permissible load:	5 VDC, 100 mA; 12VAC, 100 mA			

ANALOG CURRENT OUTPUT (4 – 20 MA STANDARD)

	PROGRAMMABLE		
Output	0 – 1 mA	0 – 20 mA	4 – 20 mA
Max load	2000 Ω	300 Ω	300 Ω
Max output	1.01 mA	20.2 mA	20.2 mA

Accuracy ±1% of full scale reading
Polarity Terminal 58 ("–") must be at ground potential (ie. output is not isolated)
Isolation Non-isolated, active source
Update time: 250 ms max

PRODUCTION TESTS

DIELECTRIC STRENGTH TEST

2200 VAC, 50/60 Hz, for 1 sec
Ground (terminal 42) to Output contacts (terminals 29 to 40)
Control power (terminals 41 and 43)
Current transformer inputs (terminals 72 to 83)

*Specifications subject to change without notice.

CT BURDEN DUE TO CONNECTION OF 269 PLUS RELAY

	CT input	Burden	
	(A) 1 A	(VA) 0.04	(mΩ) 43
Phase CT (1 A)	4 A	0.5	31
	13 A	4.8	28
Phase CT (5 A)	5 A	0.06	2.4
	20 A	1	2.5
	65 A	8.5	2.01
G/F CT (5 A)	5 A	0.08	3
	10 A	0.3	3
G/F CT (50:0.025)	0.025 A	0.435	696 Ω
	0.1 A	3.29	329 Ω
	0.5 A	50	200 Ω

ENVIRONMENTAL

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

TYPE TESTS

Dielectric strength: 2.0 kV for 1 min to relays, CTs, power supply
Insulation resistance: IEC255-5, 500 VDC
Transients: ANSI C37.90.1 oscillatory 2.5 kV/1 MHz
ANSI C37.90.1 fast rise 5 kV/10 ns
Ontario Hydro A-28M-82
IEC255-4 impulse/high frequency disturbance
Class III level
Impulse test: IEC 255-5 0.5 J 5 kV
RFI: 50 MHz/15 W transmitter
EMI: C37.90.2 electromagnetic interference @ 150 MHz and 450 MHz, 10 V/m
Static: IEC 801-2 static discharge
Humidity: 95% non-condensing
Temperature: -25° C to +60° C ambient
Environment: IEC 68-2-38 temperature/humidity cycle
Dust/moisture: NEMA 12/IP53

PACKAGING

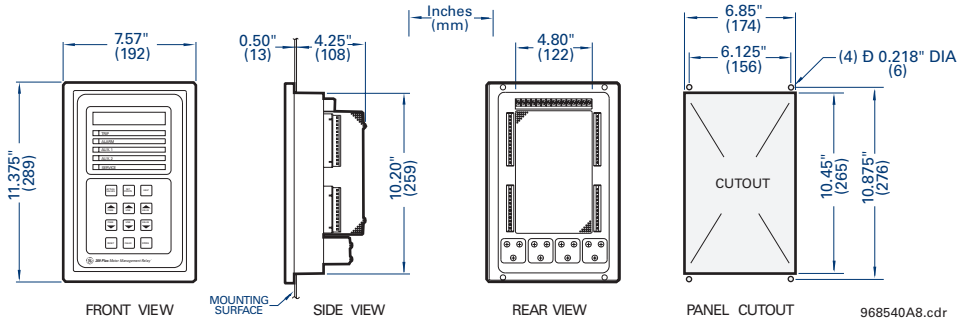
Weight: 8.6 lbs (3.9 kg)
Shipping Dimensions: 16" x 11" x 7"
(40.6 cm x 27.9 cm x 43.2 cm)

APPROVALS

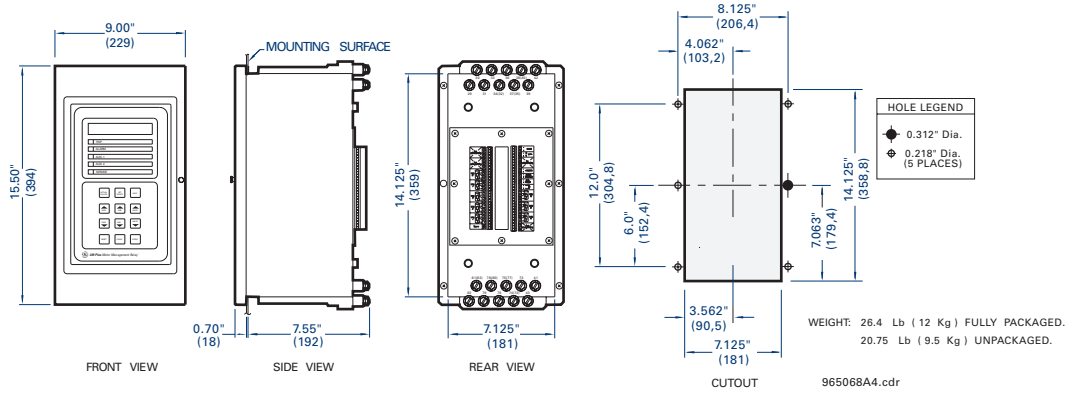
ISO: Manufactured to an ISO9001 Certified Program
UL: Recognized under E83849
CSA: Approved under LR41286
CE: Conforms to IEC 947-1, 1010-1
Conforms to EN55011/CISPR11, EN50082-2

Dimensions

269 Plus



269 Plus Drawout



Ordering

269 PLUS	*	*	*	*	*	*	
269PLUS							269 Plus motor management relay®
	SV						Standard version
	D/O						Drawout version
							Phase CT[1] / **Ground CT (required for D/O only)**
		1					:5 / 2000:1
		2					:5 / :5
		3					:1 / 2000:1
		4					:1 / :5

Relay fail safe code[2] (required for D/O only)

	Trip	Alarm	Aux1	Aux 2
1	FS	NFS	NFS	FS
2	NFS	FS	NFS	FS
3	FS	FS	NFS	FS
4	NFS	NFS	FS	FS
5	FS	NFS	FS	FS
6	NFS	FS	FS	FS
7	FS	FS	FS	FS
8	NFS	NFS	NFS	FS

Relay contact arrangement[3] (required for D/O only)

	Alarm	Aux1	Aux2
1	N.O.	N.O.	N.O.
2	N.O.	N.O.	N.C.
3	N.O.	N.C.	N.O.
4	N.O.	N.C.	N.C.
5	N.C.	N.O.	N.O.
6	N.C.	N.O.	N.C.
7	N.C.	N.C.	N.O.
8	N.C.	N.C.	N.C.

				100P			100 Ohm platinum RTD
				10C			10 Ohm copper RTD
				100N			100 Ohm nickel RTD
				120N			120 Ohm nickel RTD
					HI		80 – 300 VDC/65 – 265 VAC control power
					LO		20 – 60 VDC/20 – 48 VAC control power

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