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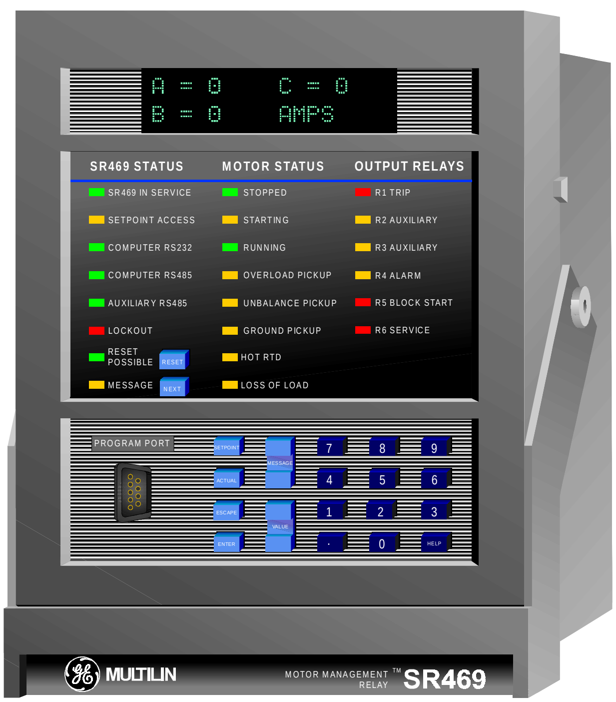
SR469

MOTOR MANAGEMENT RELAY®

Instruction Manual

SR469 Revision: 30D260A8.000
SR469 PC Software Revision: 2.6
Manual P/N: 1601-0057-D7



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The SR469 Motor Management Relay is a microprocessor based relay designed for the protection and management of medium and large horsepower motors and driven equipment. The SR469 is equipped with 6 output relays for trips, alarms, and start blocks. Motor protection, fault diagnostics, power metering, and RTU functions are integrated into one economical drawout package. The single line diagram of Figure 1-1 illustrates the SR469 functionality using the ANSI (American National Standards Institute) device numbers.

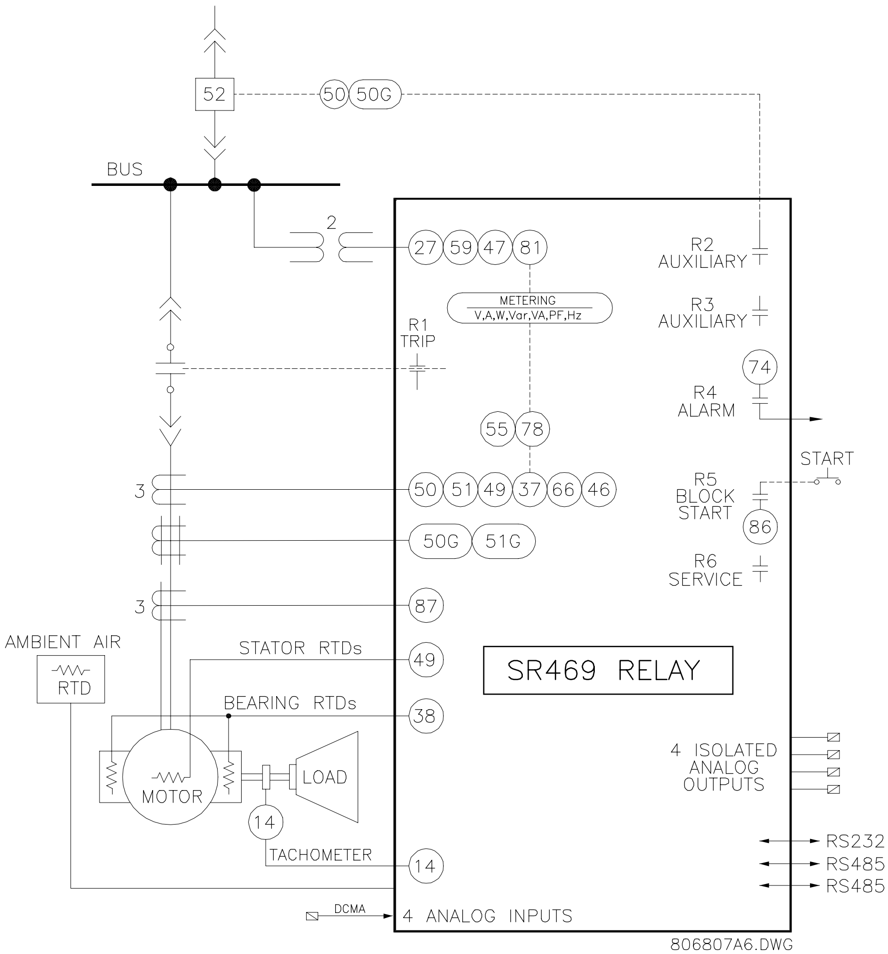

Figure 1-1 SINGLE LINE DIAGRAM

Typical applications include:

- Pumps
- Fans
- Compressors
- Mills
- Shredders
- Extruders
- Debarkers
- Refiners
- Cranes
- Conveyors
- Chillers
- Crushers
- Blowers

Some of the protection highlights are detailed here, a complete list may be found in Table 1-1. Four assignable digital inputs may be configured for a number of different features including tachometer or generic trip and alarm with a programmable name. The thermal model incorporates unbalance biasing, RTD feedback, and exponential cooling. In addition to the 15 standard overload curves, there is a custom curve feature and a curve specifically designed for the starting of high inertia loads, when the acceleration time exceeds the safe stall time. A second overload curve is provided for two-speed motors. Ground faults or earth leakage as low as 0.25A may be detected using the Multilin 50:0.025 ground CT. CT inputs for phase differential protection are also provided. The 12 RTD inputs provided may be individually field programmed for different RTD types. Voltage transformer inputs allow for numerous protection features based on voltage and power quantities. Four 4-20mA analog inputs may be used for tripping and alarming on any transducer input such as vibration, pressure, flow, etc.

Table 1-1 SR469 PROTECTION FEATURES

ANSI		Trip	Alarm	Block Start	Control
51	Overload	●	●	●	●
86	Overload Lockout			●	
66	Starts/Hour & Time Between Starts			●	
	Restart Block (Anti-Backspin Timer)			●	
50	Short Circuit & Short Circuit Backup	●		●	
	Mechanical Jam	●		●	●
32	Reverse Power	●	●	●	
37	Undercurrent/Underpower	●	●	●	
46	Current Unbalance	●	●	●	
50G/51G	Ground Fault & Ground Fault Backup	●	●	●	
87	Differential	●		●	
	Acceleration	●		●	
49	Stator RTD	●	●	●	
38	Bearing RTD	●	●	●	
	Other RTD & Ambient RTD	●	●	●	
	Open RTD Alarm		●		
	Short/Low RTD		●		
27/59	Undervoltage/Overvoltage	●	●	●	
47	Phase Reversal	●		●	
81	Frequency	●	●	●	
	Reactive Power	●	●	●	●
55/78	Power Factor	●	●	●	●
	Analog Input	●	●	●	
	Demand Alarm: A kW kvar kVA		●		●
	SR469 Self-Test, Service		●		
	Trip Coil Supervision		●		
	Welded Contactor		●		
	Breaker Failure		●		
	Remote Switch	●	●	●	
14	Speed Switch & Tachometer Trip	●	●	●	
	Load Shed Switch	●		●	
	Pressure Switch	●	●	●	
	Vibration Switch	●	●	●	
19	Reduced Voltage Start				●
48	Incomplete Sequence	●		●	●
	Remote Start/Stop				●
	Over Torque		●		
	Forced Relay Operation				●

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Fault diagnostics are provided through pretrip data, event record, trace memory, and statistics. Prior to issuing a trip, the SR469 will take a snapshot of the measured parameters and store them in a record with the cause of the trip. This pre-trip data may be viewed using the [NEXT] key before the trip is reset, or by accessing the last trip data of Actual Values page 1. The SR469 event recorder will store up to 40 time and date stamped events including the pre-trip data. Each time a trip occurs, the SR469 will store a trace of 8 cycles pre-trip and 8 cycles post-trip for all measured AC quantities. Trip counters record the number of occurrences of each type of trip. Minimum and maximum values for RTDs and analog inputs are also recorded. These features will enable the operator to pinpoint a problem quickly and with certainty.

Power metering is built into the SR469 as a standard feature. Table 1-2 outlines the metered parameters that are available to the operator or plant engineer either through the front panel or through the communications ports. The SR469 is equipped with 3 fully functional and independent communications ports. The front panel RS232 port may be used for SR469 setpoint programming, local interrogation or control, and upgrading of SR469 firmware. The Computer RS485 port may be connected to a PLC, DCS, or PC based man-machine interface program. The Auxiliary RS485 port may be used for redundancy or simultaneous interrogation and/or control from a second PLC, DCS, or PC program. There are also four 4-20 mA transducer outputs that may be assigned to any measured parameter. The range of these outputs is scaleable.

Additional features are outlined in Table 1-3.

Table 1-2 METERING

- Voltage
- Current and Amps Demand
- Real Power, kW Demand, kWh power consumption
- Apparent Power and kVA demand
- Reactive Power, kvar Demand, kvar consumption/generation
- Torque
- Frequency
- Power Factor
- RTD
- Speed in RPM with a Key Phasor Input
- User Programmable Analog Inputs

Table 1-3 ADDITIONAL FEATURES

- Drawout Case (for ease of maintenance and testing)
- Reduced Voltage Starting Control for a Single Transition
- Trip Coil Supervision
- Flash memory for easy firmware updates

All features of the SR469 are standard, there are no options. The phase CT secondaries must be specified at the time of order. The control power and analog output range must also be specified at the time of order. The SR469 differential CT inputs are field programmable for CTs with 1A or 5A secondaries. There are two ground CT inputs, one for the Multilin 50:0.025 core balance CT and one for a ground CT with a 1A or 5A secondary, also field programmable. The VT inputs will accommodate VTs in either a delta or wye configuration. The output relays are always non-failsafe with the exception of the service relay. The SR469 SETUP program is provided with each unit. A metal demo case may be ordered for demonstration or testing purposes. Other accessories are listed below.

469	*	*	*	
469				Basic unit
	P1			1A phase CT secondaries
	P5			5A phase CT secondaries
		LO		DC: 25-60 V; AC: 20-48 V @ 48-62 Hz
		HI		DC: 90-300 V; AC: 70-265 V @ 48-62 Hz
			A1	0-1 mA analog outputs
			A20	4-20 mA analog outputs

OTHER ACCESSORIES

469PC Program: Provided free with each relay
DEMO: Metal Carry Case in which SR469 unit may be mounted
SR 19-1 PANEL: Single cutout 19" panel
SR 19-2 PANEL : Dual cutout 19" panel
SCI MODULE: RS232 to RS485 converter box designed for harsh industrial environments
Phase CT: 50,75,100,150,200,250,300,350,400,500,600,750,1000
HGF3, HGF5, HGF8: For sensitive ground detection on high resistance grounded systems.
SR469 1⅜" Collar: For shallow switchgear, reduces the depth of the relay by 1 3/8"
SR469 3" Collar: For shallow switchgear, reduces the depth of the relay by 3"
Optional Mounting Kit: Additional mounting support 1819-0030

Figure 1-2 SR469 ORDER CODE

POWER SUPPLY

Options: LO / HI (must be specified when ordering)
Range: LO: DC: 20 to 60 Vdc
AC: 20 to 48 Vac @ 48 to 62 Hz
HI: DC: 90 to 300 Vdc
AC: 70 to 265 Vac @ 48 to 62 Hz
Power: 45 VA (max), 25VA typical
Proper operation time without supply voltage: 30 ms

PHASE CURRENT INPUTS

CT Primary: 1-5000 A
CT Secondary: 1 A or 5 A (must be specified with order)
Burden: Less than 0.2 VA at rated load
Conversion Range: 0.05-20 x CT
Accuracy: at < 2 x CT: ± 0.5% of 2 x CT
at ≥ 2 x CT: ± 1% of 20 x CT
CT Withstand: 1 second @ 80 times rated current
2 seconds @ 40 times rated current
continuous @ 3 times rated current

GROUND CURRENT INPUTS

CT Primary: 1-5000 A
CT Secondary: 1 A or 5 A (setpoint)
Burden: Less than 0.2 VA at rated load for 1A or 5A
Less than 0.25 VA for 50:0.025 @ 25A
Conversion Range: 0.02-1 x CT primary Amps
Accuracy: ± 0.5% of 1xCT for 5A
± 0.5% of 5xCT for 1A
± 0.125 A for 50:0.025
CT Withstand: 1 second @ 80 times rated current
2 seconds @ 40 times rated current
continuous @ 3 times rated current

DIFFERENTIAL PHASE CURRENT INPUTS

CT Primary: 1-5000A
CT Secondary: 1 A or 5 A (setpoint)
Burden: Less than 0.2 VA at rated load
Conversion Range: 0.02-1 x CT
Accuracy: ± 0.5% of 1xCT for 5A
± 0.5% of 5xCT for 1A
CT Withstand: 1 second @ 80 times rated current
2 seconds @ 40 times rated current
continuous @ 3 times rated current

VOLTAGE INPUTS

VT Ratio: 1.00-150.00:1 in steps of 0.01
VT Secondary: 273 Vac (Full Scale)
Conversion Range: 0.05-1.00 x Full Scale
Accuracy: ± 0.5% of Full Scale
Max. Continuous: 280 Vac
Burden: > 500 kΩ

DIGITAL INPUTS

Inputs: 9 opto-isolated inputs
External Switch: dry contact < 800Ω, or
open collector NPN transistor from sensor
6 mA sinking from internal 4KΩ pullup @ 24Vdc
with Vce < 4Vdc
SR469 Sensor Supply: +24Vdc @ 20 mA Max.

RTD INPUTS

RTDs: 3 wire type 100Ω Platinum (DIN.43760)
100Ω Nickel
120Ω Nickel
10 Ω Copper
} field programmable
RTD Sensing Current: 5mA
Isolation: 36 Vpk (Isolated with Analog Inputs and Outputs)
Range: -50 to +250 °C
Accuracy: ± 2 °C
Lead Resistance: 25Ω Max per lead for Pt and Ni type
3 Ω Max per lead for Cu type
No Sensor: >1000 Ω
Short/Low Alarm: < -50 °C

TRIP COIL SUPERVISION

Applicable Voltage: 20-300 Vdc / Vac
Trickle Current: 2-5mA

ANALOG CURRENT INPUTS

Current Inputs: 0-1 mA, 0-20mA or 4-20 mA (setpoint)
Input Impedance: 226 Ω +/-10%
Conversion Range: 0-21 mA
Accuracy: +/- 1% of full scale
Type: passive
Analog Input Supply: +24VDC @ 100mA max.
Response Time: ≤100 ms

COMMUNICATIONS PORTS

RS232 Port: 1, Front Panel, non-isolated
RS485 Ports: 2, Isolated together @ 36Vpk
Baud Rates: RS485: 300,1200,2400,4800,9600,19200
RS232: 9600
Parity: None, Odd, Even
Protocol: Modbus® RTU / half duplex

ANALOG CURRENT OUTPUT

Type: Active
Range: 4-20 mA, 0-1 mA (must be specified with order)
Accuracy: +/- 1% of full scale
4-20 mA maximum load: 1200 Ω
0-1mA maximum load: 10 kΩ
Isolation: 36 Vpk (Isolated with RTDs and Analog Inputs)
4 Assignable Outputs: phase A current
phase B current
phase C current
3 phase average current
ground current
phase AN (AB) voltage
phase BN (BC) voltage
phase CN (CA) voltage
3 phase average voltage
hottest stator RTD
hottest bearing RTD
hottest other RTD
RTD # 1-12
Power factor
3 phase Real power (kW)
3 phase Apparent power (kVA)
3 phase Reactive power (kvar)
Thermal Capacity Used
Relay Lockout Time
Current Demand
kvar Demand
kW Demand
kVA Demand
Motor Load
Torque

OUTPUT RELAYS

Configuration: 6 Electro-Mechanical Form C
Contact Material: silver alloy
Operate Time: 10ms
Max Ratings for 100000 operations

VOLTAGE		MAKE/CARRY CONTINUOUS	MAKE/CARRY 0.2s	BREAK	MAXIMUM LOAD
DC	30Vdc	10A	30A	10A	300W
RESISTIVE	125Vdc	10A	30A	0.5A	62.5W
	250Vdc	10A	30A	0.3A	75W
DC	30Vdc	10A	30A	5A	150W
INDUCTIVE	125Vdc	10A	30A	0.25A	31.3W
L/R=40ms	250Vdc	10A	30A	0.15A	37.5W
AC	120Vac	10A	30A	10A	2770VA
RESISTIVE	250Vac	10A	30A	10A	2770VA
AC	120Vac	10A	30A	4A	480VA
INDUCTIVE P.F.=0.4	250Vac	10A	30A	3A	750VA

TERMINALS

Low Voltage (A, B, C, D terminals):
12 AWG max
High Voltage (E, F, G, H terminals):
#8 ring lug, 10 AWG wire standard

OVERLOAD / STALL PROTECTION / THERMAL MODEL

Overload Curves: 15 Standard Overload Curves
Custom Curve
Voltage Dependent Custom Curve, for High Inertia Starting
(all curves time out against average phase current)
Curve Biasing: Phase Unbalance
Hot/Cold Curve Ratio
Stator RTD
Running Cool rate
Stopped Cool Rate
Line Voltage
Overload Pickup: 1.01 - 1.25 (for service factor)
Pickup Accuracy: as per Phase Current Inputs
Timing Accuracy: ±100ms or ± 2 % of total time
Elements: Trip and Alarm

PHASE SHORT CIRCUIT

Pick-up Level: 4.0 - 20.0 x CT primary in steps of 0.1 of any one phase
Time Delay: 0 - 1000 ms in steps of 10
Pickup Accuracy: as per Phase Current Inputs
Timing Accuracy: +50ms
Elements: Trip

MECHANICAL JAM

Pick-up Level: 1.01 - 3.00 x CT primary in steps of 0.01 of any one phase, blocked on start
Time Delay: 1-30 s in steps of 1
Pickup Accuracy: as per Phase Current Inputs
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Trip

UNDERCURRENT

Pick-up Level: 0.10 - 0.95 x CT primary in steps of 0.01 of any one phase
Time Delay: 1 - 60 s in steps of 1
Block From Start: 0 - 15000 s in steps of 1
Pickup Accuracy: as per Phase Current Inputs
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Trip and Alarm

CURRENT UNBALANCE

Unbalance: I_2/I_1 if Iavg>FLA
I_2/I_1 x Iavg/FLA if Iavg<FLA
Range: 0-100 % UB in steps of 1
Pick-up Level: 4 - 40 % UB in steps of 1,
Time Delay: 1 - 60 s in steps of 1
Pickup Accuracy: ±2%
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Trip and Alarm

GROUND INSTANTANEOUS

Pick-up Level: 0.1 - 1.0 x CT primary in steps of 0.01
Time Delay: 0 - 1000 ms in steps of 10
Pickup Accuracy: as per Ground Current Input
Timing Accuracy: +50ms
Elements: Trip and Alarm

PHASE DIFFERENTIAL INSTANTANEOUS

Pick-up Level: 0.05 - 1.0 x CT primary in steps of 0.01 of any one phase
Time Delay: 0 - 1000 ms in steps of 10
Pickup Accuracy: as per Phase Differential Current Inputs
Timing Accuracy: +50ms
Elements: Trip

ACCELERATION TIMER

Pickup: transition of no phase current to > overload pickup
Dropout: when current falls below overload pickup
Time Delay: 1.0 - 250.0 s in steps of 0.1
Timing Accuracy: ±100ms or ± 0.5 % of total time
Elements: Trip

JOGGING BLOCK

Starts/Hour: 1 - 5 in steps of 1
Time Between Starts: 1 - 500 min.
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Block

RESTART BLOCK

Time Delay: 1 - 50000 s in steps of 1
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Block

RTD

Pickup: 1 - 250 °C in steps of 1
Pickup Hysteresis: 2°C
Time Delay: 3 s
Elements: Trip and Alarm

UNDERVOLTAGE

Pick-up Level: Motor Starting: 0.60 - 0.99x Rated in steps of 0.01
Motor Running: 0.60 - 0.99x Rated in steps of 0.01 of any one phase
Time Delay: 0.1 - 60.0 s in steps of 0.1
Pickup Accuracy: as per Voltage Inputs
Timing Accuracy: <100 ms or ± 0.5 % of total time
Elements: Trip and Alarm

OVERVOLTAGE

Pick-up Level: 1.01 - 1.10x Rated in steps of 0.01 of any one phase
Time Delay: 0.1 - 60.0 s in steps of 0.1
Pickup Accuracy: as per Voltage Inputs
Timing Accuracy: ±100ms or ± 0.5 % of total time
Elements: Trip and Alarm

VOLTAGE PHASE REVERSAL

Configuration: ABC or ACB phase rotation
Timing Accuracy: 500 - 700 ms
Elements: Trip

FREQUENCY

Required Voltage: > 30% of full scale in Phase A
Overfrequency Pickup: 25.01 - 70.00 in steps of 0.01
Underfrequency Pickup: 20.00 - 60.00 in steps of 0.01
Accuracy: ± 0.02 Hz
Time Delay: 0.1 - 60.0 s in steps of 0.1
Timing Accuracy: <100ms or ± 0.5 % of total time
Elements: Trip and Alarm

REDUCED VOLTAGE START

Transition Level: 25 - 300 % FLA in steps of 1
Transition Time: 1 - 250 s in steps of 1
Transition Control: Current, Timer, Current and Timer

REMOTE SWITCH

Configurable: Assignable to Digital Inputs1- 4
Timing Accuracy: 100ms max.
Elements: Trip and Alarm

SPEED SWITCH

Configurable: Assignable to Digital Inputs1- 4
Time Delay: 1.0 - 250.0 s in steps of 0.1
Timing Accuracy: 100ms max.
Elements: Trip

LOAD SHED

Configurable: Assignable to Digital Inputs1- 4
Timing Accuracy: 100ms max.
Elements: Trip

PRESSURE SWITCH

Configurable: Assignable to Digital Inputs1- 4
Time Delay: 0.1 - 100.0 s in steps of 0.1
Block From Start: 0 - 5000 s in steps of 1
Timing Accuracy: ±100 ms or ± 0.5 % of total time
Elements: Trip and Alarm

VIBRATION SWITCH

Configurable: Assignable to Digital Inputs1- 4
Time Delay: 0.1 - 100.0 s in steps of 0.1
Timing Accuracy: ±100 ms or ± 0.5 % of total time
Elements: Trip and Alarm

DIGITAL COUNTER

Configurable: Assignable to Digital Inputs1- 4
Frequncy of Counting: <= 50 times a second
Range: 0- 1 000 000 000
Elements: Alarm

TACHOMETER

Configurable: Assignable to Digital Inputs1- 4
RPM Measurement: 100 - 7200 RPM
Duty Cycle of Pulse: > 10 %
Elements: Trip and Alarm

GENERAL PURPOSE SWITCH

Configurable: Assignable Digital Inputs1- 4
Time Delay: 0.1 - 5000.0 s in steps of 0.1
Block From Start: 0 - 5000 s in steps of 1
Timing Accuracy: ±100 ms or ± 0.5 % of total time
Elements: Trip and Alarm

POWER FACTOR

Range: 0.01 lead or lag to 1.00
Pick-up Level: 0.99 - 0.05 in steps of 0.01, Lead and Lag
Time Delay: 0.2 - 30.0 s in steps of 0.1
Block From Start: 0 - 5000 s in steps of 1
Pickup Accuracy: ± 0.02
Timing Accuracy: ± 100ms or ± 0.5 % of total time
Elements: Trip and Alarm

3 PHASE REAL POWER

Range: 0 - ±50000 kW
Underpower Pick-up: 1 - 25000 kW in steps of 1
Time Delay: 1 - 30 s in steps of 1
Block From Start: 0 - 15000 s in steps of 1
Pickup Accuracy: ±1% of √3x2xCTxVTxVT full scale @ Iavg < 2xCT
±1.5% of √3x20xCTxVTxVT full scale @ Iavg > 2xCT
Timing Accuracy: ±0.5 s or ± 0.5 % of total time
Elements: Trip and Alarm

3 PHASE APPARENT POWER

Range: 0 - 50000 kVA
Accuracy: ±1% of √3x2xCTxVTxVT full scale @ Iavg < 2xCT
±1.5% of √3x20xCTxVTxVT full scale @ Iavg > 2xCT

3 PHASE REACTIVE POWER

Range: 0 - ±50000 kvar
Pick-up Level: ± 1 - 25000 kvar in steps of 1
Time Delay: 0.2 - 30.0 s in steps of 0.1
Block From Start: 0 - 5000 s in steps of 1
Pickup Accuracy: ±1% of √3x2xCTxVTxVT full scale @ Iavg < 2xCT
±1.5% of √3x20xCTxVTxVT full scale @ Iavg > 2xCT
Timing Accuracy: ±100ms or ± 0.5 % of total time
Elements: Trip and Alarm

OVER TORQUE

Pickup Level: 1.0 to 999999.9 Nm/ftlb in steps of 0.1
torque unit is selectable under torque setup
Time Delay: 0.2 - 30.0 s in steps of 0.1
Pickup Accuracy: ±2.0%
Time Accuracy: ±100ms or 0.5% of total time
Elements: Alarm (FOR INDUCTION MOTORS ONLY)

METERED REAL POWER CONSUMPTION

Description: Continuous total of real power consumption.
Range: 0 - 2000000.000 MW-Hours.
Timing Accuracy: ±0.5 %
Update Rate: 5 seconds

METERED REACTIVE POWER CONSUMPTION

Description: Continuous total of reactive power consumption.
Range: 0 - 2000000.000 Mvar-Hours
Timing Accuracy: ±0.5 %
Update Rate: 5 seconds

METERED REACTIVE POWER GENERATION

Description: Continuous total of reactive power generation.
Range: 0 - 2000000.000 Mvar-Hours
Timing Accuracy: ±0.5 %
Update Rate: 5 seconds

FUSE

Hi-Volt: Current Rating: 2 A
Type: 5x20mm Slo-Blo Littelfuse, High Breaking Capacity
Model#: 215002
Lo-Volt: Current Rating: 3.15 A
Type: 5x20mm Slo-Blo Littelfuse, High Breaking Capacity
Model#: 2153.15

NOTE: External fuse must be used if the supply voltage exceeds 250V.

DEMAND

Metered Values: Maximum Phase Current
3 Phase Real Power
3 Phase Apparent Power
3 Phase Reactive Power
Measurement Type: Rolling Demand
Demand Interval: 5 - 90 minutes in steps of 1
Update Rate: 1 minute
Elements: Alarm

OTHER FEATURES

- Pre-Trip Data
- Event Recorder
- Trace Memory
- Starter Failure
- Fault Simulation
- VT Failure

ENVIRONMENT

Ambient Operating Temperature: -40°C - +60°C
Ambient Storage Temperature: -40°C - +80°C.
Humidity: Up to 90%, noncondensing.
Altitude: Up to 2000m
Pollution Degree: 2

NOTE: It is recommended that the SR469 be powered up at least once per year to prevent deterioration of electrolytic capacitors in the power supply.

BATTERY BACKUP

Used only when no control power to relay.
Life expectancy is ≥10 years with no control power to relay

CASE

Fully drawout (Automatic CT shorts)
Seal provision
Dust tight door
Panel or 19" rack mount
IP Class: IP20-X

PRODUCTION TESTS

Thermal Cycling: Operational test at ambient, reducing to -40°C and then increasing to 60°C
Dielectric Strength: 2.0 kV for 1 minute from relays, CTs, VTs, power supply to Safety Ground
DO NOT CONNECT FILTER GROUND TO SAFETY GROUND DURING TEST

TYPE TESTS

Dielectric Strength: Per IEC 255-5 and ANSI/IEEE C37.90
2.0 kV for 1 minute from relays, CTs, VTs, power supply to Safety Ground
DO NOT CONNECT FILTER GROUND TO SAFETY GROUND DURING TEST
Insulation Resistance: IEC255-5 500Vdc, from relays, CTs, VTs, power supply to Safety Ground
DO NOT CONNECT FILTER GROUND TO SAFETY GROUND DURING TEST
Transients: ANSI C37.90.1 Oscillatory (2.5kV/1MHz)
ANSI C37.90.1 Fast Rise (5kV/10ns)
Ontario Hydro A-28M-82
IEC255-4 Impulse/High Frequency Disturbance Class III Level
Impulse Test: IEC 255-5 0.5 Joule 5kV
RFI: 50 MHz/15W Transmitter
EMI: C37.90.2 Electromagnetic Interference @ 150 MHz and 450 MHz, 10V/m
Static: IEC 801-2 Static Discharge
Humidity: 95% non-condensing
Temperature: -40 °C to +60 °C ambient
Environment: IEC 68-2-38 Temperature/Humidity Cycle
Vibration: Sinusoidal Vibration 8.0g for 72 hrs

PACKAGING

Shipping Box:	12”x11”x10” (WxHxD) 30.5cm x 27.9cm x 25.4cm
Shipping Weight:	17 lbs Max / 7.7 kg

CERTIFICATION

ISO: Manufactured under an ISO9001 registered system.
UL: UL approved
CSA: CSA approved
CE: Conforms to EN 55011/CISPR 11, EN 50082-2
Conforms to IEC 947-1,1010-1

2.1.1 DESCRIPTION

The SR469 is packaged in the standard Multilin SR series arrangement, which consists of a drawout unit and a companion fixed case. The case provides mechanical protection to the unit, and is used to make permanent connections to all external equipment. The only electrical components mounted in the case are those required to connect the unit to the external wiring. Connections in the case are fitted with mechanisms required to allow the safe removal of the relay unit from an energized panel, such as automatic CT shorting. The unit is mechanically held in the case by pins on the locking handle, which cannot be fully lowered to the locked position until the electrical connections are completely mated. Any SR469 can be installed in any SR469 case, except for custom manufactured units that are clearly identified as such on both case and unit, and are equipped with an index pin keying mechanism to prevent incorrect pairings.

No special ventilation requirements need to be observed during the installation of the unit, but it can be cleaned with a damp cloth.

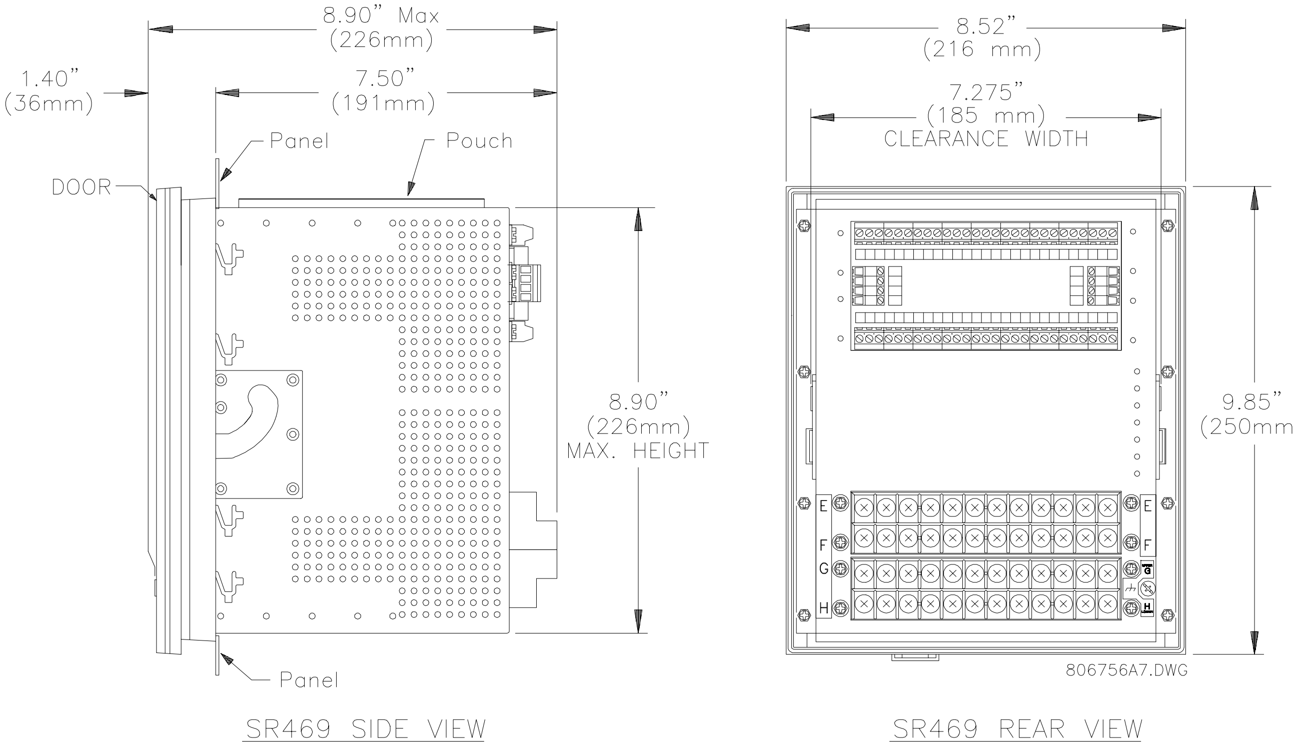


Figure 2-1 SR469 DIMENSIONS

Figure 2-2 SEAL ON DRAWOUT UNIT

To prevent unauthorized removal of the drawout unit, a wire lead seal can be installed in the slot provided on the handle as shown in Figure 2-2. With this seal in place, the drawout unit cannot be removed. A passcode or setpoint access jumper can be used to prevent entry of setpoints but still allow monitoring of actual values. If access to the front panel controls must be restricted, a separate seal can be installed on the outside of the cover to prevent it from being opened.

**** WARNING ** Hazard may result if the product is not used for its intended purpose.**

2.1.2 PRODUCT IDENTIFICATION

Each SR469 unit and case are equipped with a permanent label. This label is installed on the left side (when facing the front of the relay) of both unit and case. The case label details which units can be installed.

The case label details the following information:

- MODEL NUMBER
- MANUFACTURE DATE
- SPECIAL NOTES

The unit label details the following information:

- MODEL NUMBER
- TYPE
- SERIAL NUMBER
- MANUFACTURE DATE
- PHASE CURRENT INPUTS
- TAG
- OVERVOLTAGE CATEGORY
- INSULATION VOLTAGE
- POLLUTION DEGREE
- CONTROL POWER
- OUTPUT CONTACT RATING

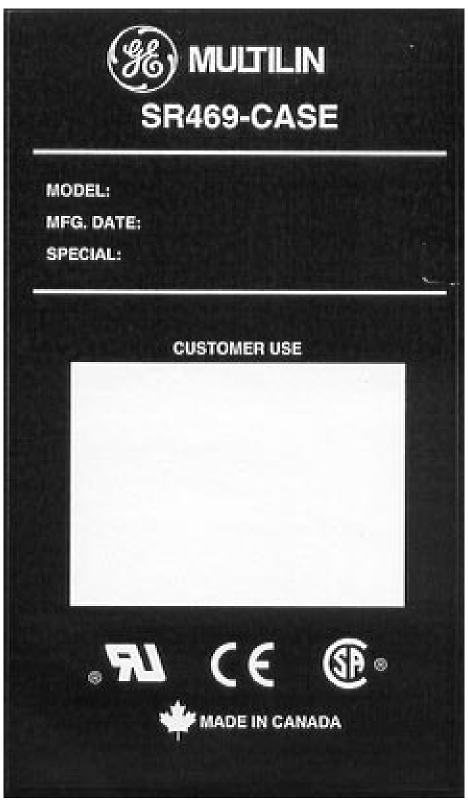


Figure 2-3 CASE IDENTIFICATION LABEL

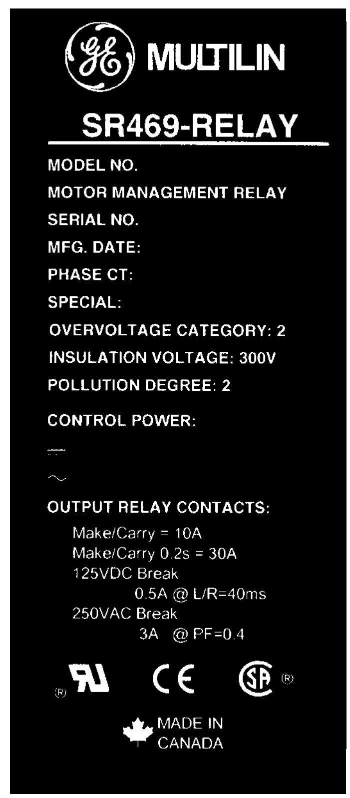


Figure 2-4 UNIT IDENTIFICATION LABEL

2.1.3 INSTALLATION

The SR469 case, alone or adjacent to another SR-series unit, can be installed in the panel of a standard 19 inch rack. (See Figure 2-5 and Figure 2-6 for panel cutout dimensions.) When mounting, provision must be made for the front door to swing open without interference to, or from, adjacent equipment. Normally the SR469 unit is mounted in its case when shipped from the factory, and should be removed before mounting the case in the supporting panel. Unit withdrawal is described in section 2.1.4.

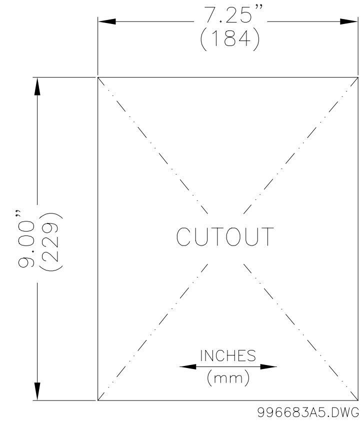


Figure 2-5 SINGLE SR469 CUTOUT PANEL

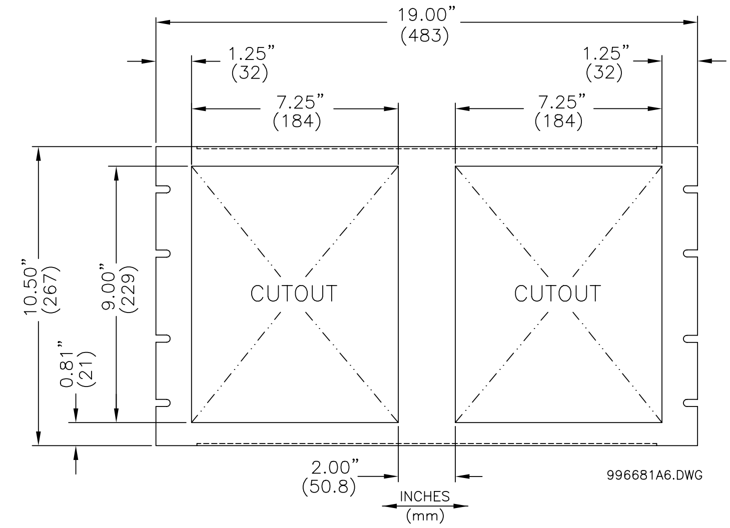


Figure 2-6 DOUBLE SR469 CUTOUT PANEL

After the mounting hole in the panel has been prepared, slide the SR469 case into the panel from the front. Applying firm pressure on the front to ensure the front bezel fits snugly against the front of the panel, bend out the pair of retaining tabs (to a horizontal position) from each side of the case, as shown in Figure 2-7. The case is now securely mounted, ready for panel wiring. If additional support is desired the SR optional mounting kit may be ordered.

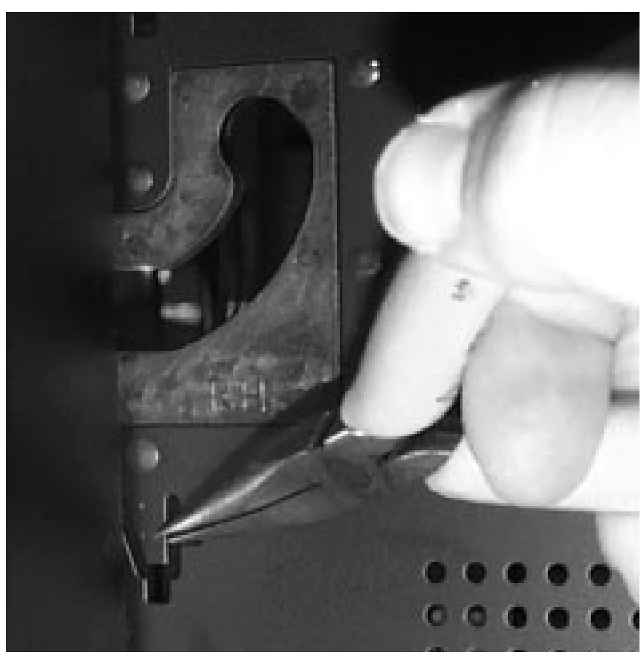


Figure 2-7 BEND UP MOUNTING TABS

2.1.4 UNIT WITHDRAWAL AND INSERTION

Figure 2-8 PRESS LATCH TO DISENGAGE HANDLE

Figure 2-9 ROTATE HANDLE TO STOP POSITION

Figure 2-10 SLIDE UNIT OUT OF THE CASE

To remove the unit from the case:
(1) Open the cover by grasping the center of the right side and then pulling the cover, which will rotate about the hinges on the left.
(2) Release the locking latch, located below the locking handle, by pressing upward on the latch with the tip of a screwdriver (see Figure 2-8).
(3) While holding the latch raised, grasp the locking handle in the center and pull firmly, rotating the handle up from the bottom of the unit until movement ceases (see Figure 2-9).
(4) Once the handle is released from the locking mechanism, the unit can freely slide out of the case when pulled by the handle. It may sometimes be necessary to adjust the handle position slightly to free the unit (Figure 2-10).

To insert the unit into the case:
(1) Raise the locking handle to the highest position.
(2) Hold the unit immediately in front of the case and align the rolling guide pins (near the hinges of the locking handle) to the guide slots on either side of the case.
(3) Slide the unit into the case until the guide pins on the unit have engaged the guide slots on either side of the case.

CAUTION: If an attempt is made to install a unit into a non-matching case, the mechanical key will prevent full insertion of the unit. Do not apply strong force in the following step or damage may result.

(4) Grasp the locking handle from the center and press down firmly, rotating the handle from the raised position toward the bottom of the unit.
(5) When the unit is fully inserted, the latch will be heard to click, locking the handle in the final position.

2.1.5 TERMINAL LOCATIONS

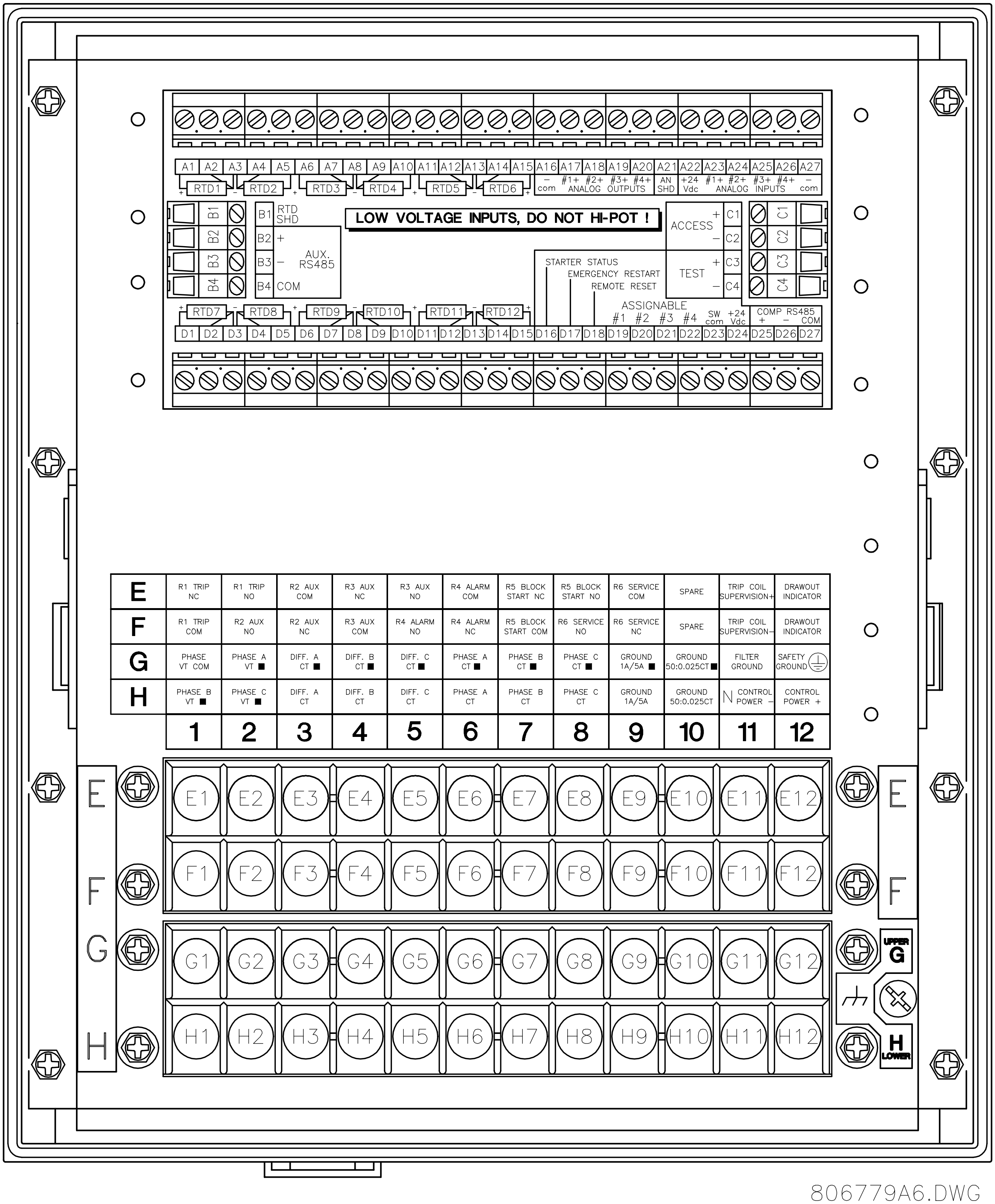


Figure 2-11 TERMINAL LAYOUT

Table 2-1 SR469 TERMINAL LIST

TERMINAL	WIRING CONNECTION
A01	RTD#1 HOT
A02	RTD#1 COMPENSATION
A03	RTD RETURN
A04	RTD#2 COMPENSATION
A05	RTD#2 HOT
A06	RTD#3 HOT
A07	RTD#3 COMPENSATION
A08	RTD RETURN
A09	RTD#4 COMPENSATION
A10	RTD#4 HOT
A11	RTD#5 HOT
A12	RTD#5 COMPENSATION
A13	RTD RETURN
A14	RTD#6 COMPENSATION
A15	RTD#6 HOT
A16	ANALOG OUT COMMON -
A17	ANALOG OUT1 +
A18	ANALOG OUT2 +
A19	ANALOG OUT3 +
A20	ANALOG OUT4 +
A21	ANALOG SHIELD
A22	ANALOG INPUT 24Vdc SUPPLY +
A23	ANALOG INPUT1+
A24	ANALOG INPUT2 +
A25	ANALOG INPUT3 +
A26	ANALOG INPUT4 +
A27	ANALOG INPUT COMMON -
B01	RTD SHIELD
B02	AUXILIARY RS485 +
B03	AUXILIARY RS485 –
B04	AUXILIARY RS485 COMMON
C01	ACCESS +
C02	ACCESS -
C03	SR469 UNDER TEST +
C04	SR469 UNDER TEST -
D01	RTD#7 HOT
D02	RTD#7 COMPENSATION
D03	RTD RETURN
D04	RTD#8 COMPENSATION
D05	RTD#8 HOT
D06	RTD#9 HOT
D07	RTD#9 COMPENSATION
D08	RTD RETURN
D09	RTD#10 COMPENSATION
D10	RTD#10 HOT
D11	RTD#11 HOT
D12	RTD#11 COMPENSATION
D13	RTD RETURN
D14	RTD#12 COMPENSATION
D15	RTD#12 HOT
D16	STARTER STATUS
D17	EMERGENCY RESTART
D18	REMOTE RESET
D19	ASSIGNABLE SW.01
D20	ASSIGNABLE SW.02
D21	ASSIGNABLE SW.03
D22	ASSIGNABLE SW.04
D23	SWITCH COMMON
D24	SWITCH +24Vdc
D25	COMPUTER 485 +
D26	COMPUTER 485 –
D27	COMPUTER RS485 COMMON

TERMINAL	WIRING CONNECTION
E01	R1 TRIP NC
E02	R1 TRIP NO
E03	R2 AUXILLIARY COMMON
E04	R3 AUXILLIARY NC
E05	R3 AUXILLIARY NO
E06	R4 ALARM COMMON
E07	R5 BLOCK START NC
E08	R5 BLOCK START NO
E09	R6 SERVICE COMMON
E10	not used
E11	COIL SUPERVISION+
E12	SR469 DRAWOUT INDICATOR
F01	R1 TRIP COMMON
F02	R2 AUXILLIARY NO
F03	R2 AUXILLIARY NC
F04	R3 AUXILLIARY COMMON
F05	R4 ALARM NO
F06	R4 ALARM NC
F07	R5 BLOCK START COMMON
F08	R6 SERVICE NO
F09	R6 SEVICE NC
F10	not used
F11	COIL SUPERVISION-
F12	SR469 DRAWOUT INDICATOR
G01	PHASE VT NEUTRAL
G02	PHASE A VT•
G03	DIFFERENTIAL A CT•
G04	DIFFERENTIAL B CT•
G05	DIFFERENTIAL C CT•
G06	PHASE A CT•
G07	PHASE B CT•
G08	PHASE C CT•
G09	1A/5A GROUND CT•
G10	50:0.025 GROUND CT•
G11	FILTER GROUND
G12	SAFETY GROUND
H01	PHASE B VT•
H02	PHASE C VT•
H03	DIFFERENTIAL A CT
H04	DIFFERENTIAL B CT
H05	DIFFERENTIAL C CT
H06	PHASE A CT
H07	PHASE B CT
H08	PHASE C CT
H09	1A/5A GROUND CT
H10	50:0.025 GROUND CT
H11	CONTROL POWER -
H12	CONTROL POWER +

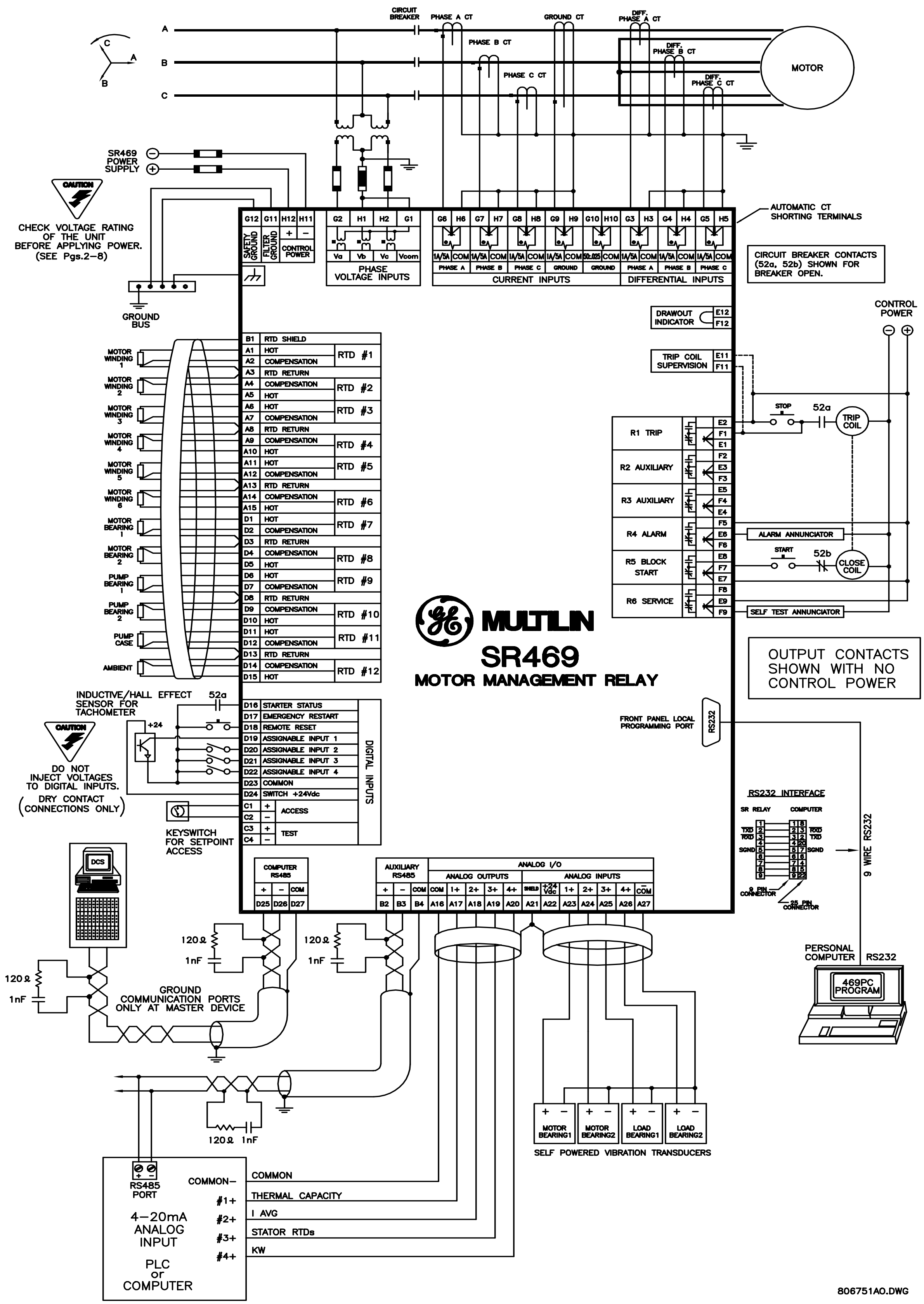


Figure 2-12 TYPICAL WIRING DIAGRAM

2.2.1 TYPICAL WIRING

A broad range of applications is available to the user and it is not possible to present typical connections for all possible schemes. The information in this section will cover the important aspects of interconnections, in the general areas of instrument transformer inputs, other inputs, outputs, communications and grounding. See and Table 2-1 for terminal arrangement, and for typical connections.

2.2.2 CONTROL POWER

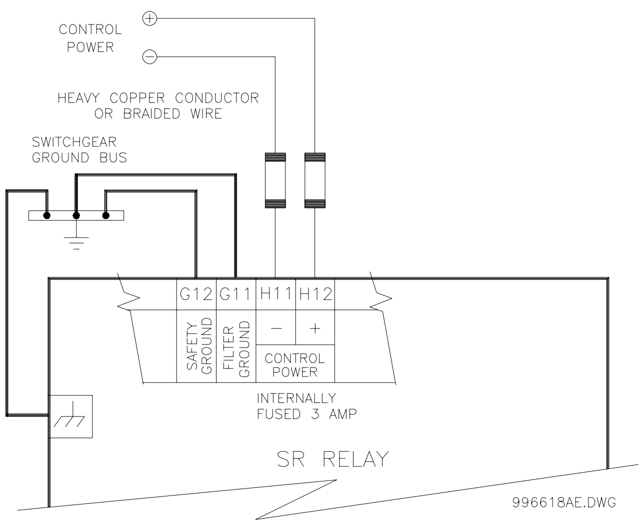


Figure 2-13 CONTROL POWER CONNECTION

CAUTION: Control power supplied to the SR469 must match the installed switching power supply. If the applied voltage does not match, damage to the unit may occur.

The order code from the terminal label on the side of the drawout unit specifies the nominal control voltage as one of the following:

LO: 20-60 Vdc
20-48 Vac
HI: 90-300 Vdc
70-265 Vac

Ensure applied control voltage and rated voltage on drawout case terminal label match. For example, the HI power supply will work with any DC voltage from 90 to 300 V, or AC voltage from 70 to 265 V. The internal fuse may blow if the applied voltage exceeds this range.

Extensive filtering and transient protection are built into the SR469 to ensure proper operation in harsh industrial environments. Transient energy must be conducted back to the source through the filter ground terminal. A separate safety ground terminal is provided for hi-pot testing.

All grounds MUST be hooked up for normal operation regardless of control power supply type.

2.2.3 PHASE CURRENT INPUTS

The SR469 has three channels for phase current inputs, each with an isolating transformer. There are no internal ground connections on the current inputs. Each phase CT circuit is shorted by automatic mechanisms on the SR469 case if the unit is withdrawn. The phase CTs should be chosen such that the FLA is no less than 50 % of the rated phase CT primary. Ideally, the phase CT primary should be chosen such that the FLA is 100 % of the phase CT primary or slightly less, never more. This will ensure maximum accuracy for the current measurements. The maximum phase CT primary current is 5000 A.

The SR469 will measure correctly up to 20 times the phase current nominal rating. Since the conversion range is large, 1 A or 5 A CT secondaries must be specified at the time of order such that the appropriate interposing CT may be installed in the unit. CTs chosen must be capable of driving the SR469 phase CT burden (see Specifications for ratings).

CAUTION: Verify that the SR469 nominal phase current of 1 A or 5 A matches the secondary rating and connections of the connected CTs. Unmatched CTs may result in equipment damage or inadequate protection. Polarity of the phase CTs is critical for Negative Sequence Unbalance calculation, power measurement, and residual ground current detection (if used).

See Appendix B for 2Φ CT configuration application note if this scheme is desired.

2.2.4 GROUND CURRENT INPUT

The SR469 has a dual primary isolating transformer for ground CT connection. There are no internal ground connections on the ground current inputs. The ground CT circuits are shorted by automatic mechanisms on the SR469 case if the unit is withdrawn. The 1A/5A tap is used either for zero sequence/core balance applications (see Figure 2-12) or residual ground connections where the summation of the three phase current CTs is passed through the ground current input (see Figure 2-14). The maximum ground CT primary current is 5000 A for the 1A/5A tap. Alternatively, the 50:0.025 ground CT input has been designed for sensitive ground current detection on high resistance grounded systems where the Multilin 50:0.025 core balance CT is to be used. In applications such as mines, where earth leakage current must be measured for personnel safety, primary ground current as low as 0.25A may be detected with the Multilin 50:0.025 CT. Only one ground CT input tap should be used on a given unit.

The SR469 will measure up to 5 A secondary current if the 1A/5A tap is used. Since the conversion range is relatively small, the 1A or 5A option is field programmable. Proper selection of this setpoint will ensure proper reading of primary ground current. The 1A/5A ground CT chosen must be capable of driving the SR469 ground CT burden (see Specifications for ratings). The SR469 will measure up to 25A of primary ground current if this tap is used in conjunction with the Multilin core balance CT.

NOTE: The zero sequence connection is recommended. Unequal saturation of CTs, size and location of motor, resistance of power system and motor core saturation density, etc. may cause false readings in the residually connected GF circuit.

NOTE: Only one ground input should be wired and the other input should be unconnected.

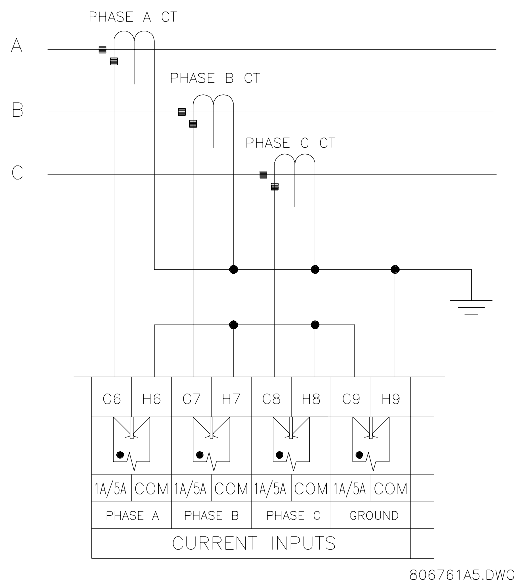


Figure 2-14 RESIDUAL GROUND CT CONNECTION

The exact placement of a zero sequence CT, so that only ground fault current will be detected, is shown in Figure 2-15. If the core balance CT is placed over shielded cable, capacitive coupling of phase current into the cable shield during motor starts may be detected as ground current unless the shield wire is also passed through the CT window. Twisted pair cabling on the zero sequence CT is recommended.

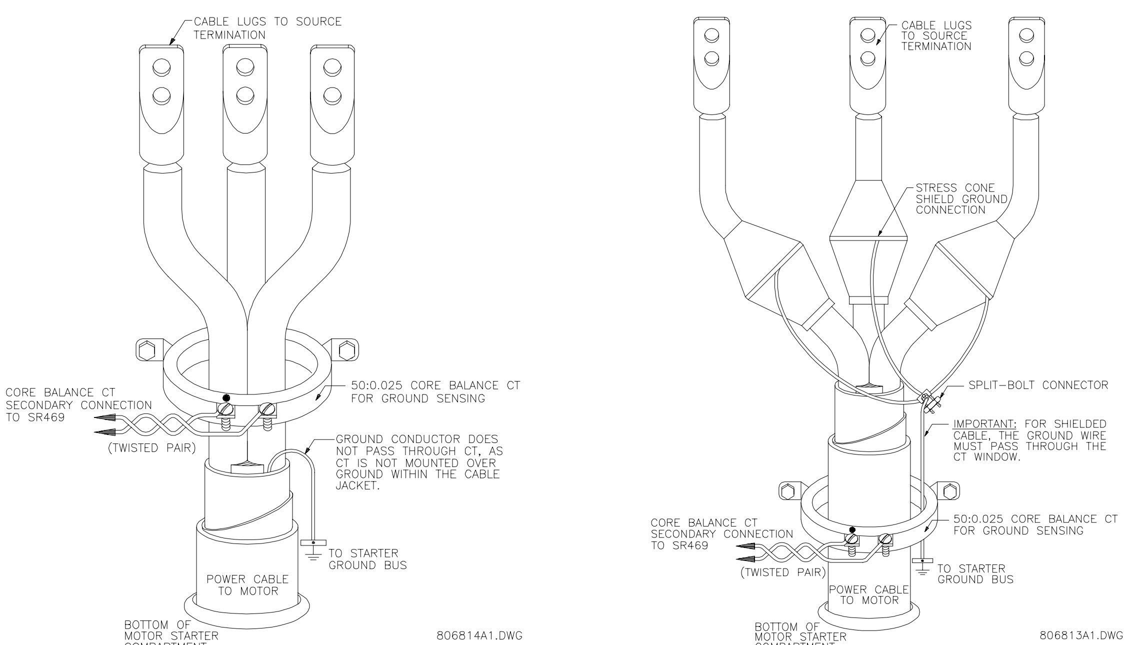


Figure 2-15 CORE BALANCE GROUND CT INSTALLATION

2.2.5 DIFFERENTIAL CURRENT INPUTS

The SR469 has three channels for differential current inputs, each with an isolating transformer. There are no internal ground connections on the current inputs. Each differential CT circuit is shorted by automatic mechanisms on the SR469 case if the unit is withdrawn. The maximum differential CT primary current is 5000 A.

The SR469 will measure up to 5 A secondary current for the differential CT inputs. Since the conversion range is relatively small, the 1A or 5A option is field programmable. Proper selection of this setpoint will ensure proper reading of primary phase differential current. The 1A/5A differential CT chosen must be capable of driving the SR469 differential CT burden (see Specifications for ratings).

The differential CTs may be core balance as shown in figure 2-16. Alternatively, the summation of two CTs per phase into the differential input will provide a larger zone of protection. If the summation of two CTs is used, observation of CT polarity is important (see Figure 2-17). The summation method may also be implemented using the phase CTs as in figure 2-18. They will have to have the same CT ratio.

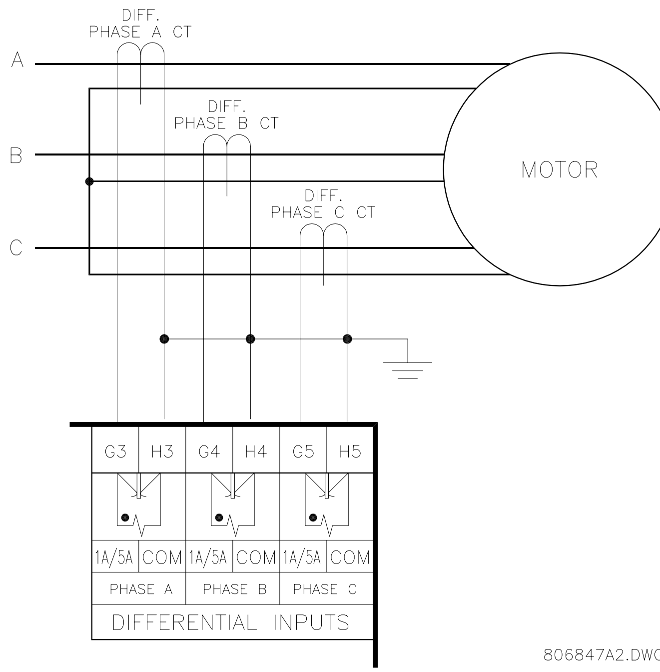


Figure 2-16 CORE BALANCE METHOD

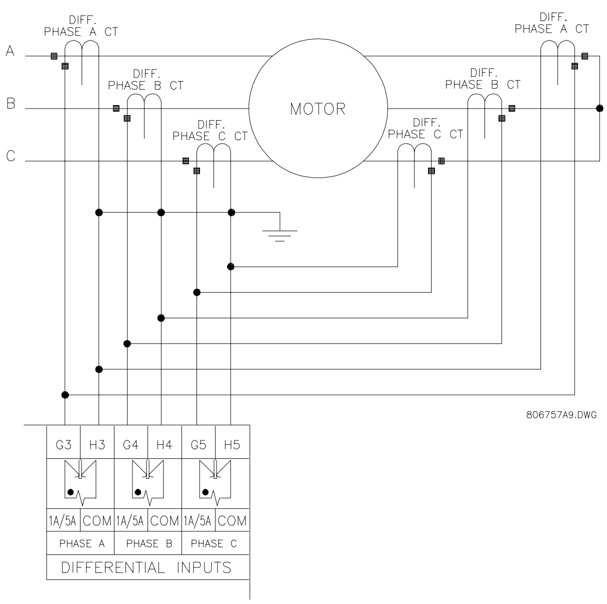


Figure 2-17 SUMMATION METHOD

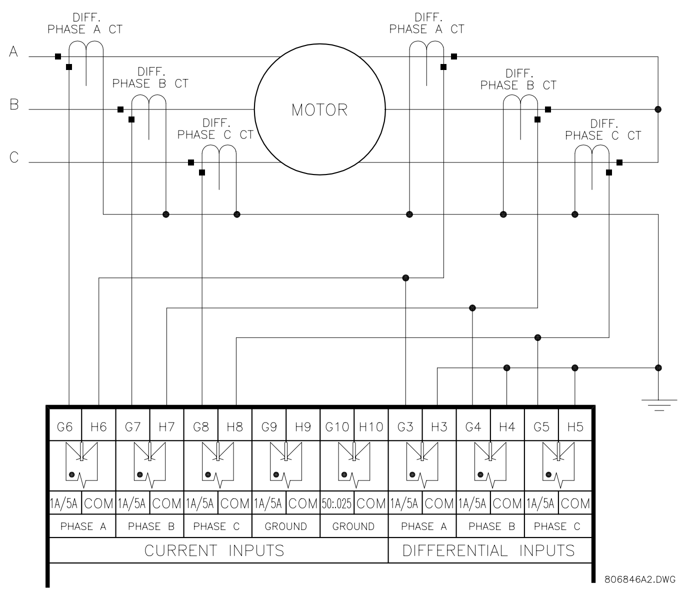


Figure 2-18 SUMMATION WITH PHASE CT METHOD

2.2.6 VOLTAGE INPUTS

The SR469 has three channels for AC voltage inputs, each with an isolating transformer. There are no internal fuses or ground connections on the voltage inputs. The maximum VT ratio is 150.00:1. The two VT connections are open delta (see Figure 2-12) or wye (see Figure 2-19). The voltage channels are connected in wye internally, which means that the jumper shown on the delta-source connection of Figure 2-13, between the phase B input and the SR469 neutral terminal, must be installed for open delta VTs.

Polarity of the VTs is critical for correct power measurement and voltage phase reversal operation.

Typically a 1A fuse is used to protect the inputs.

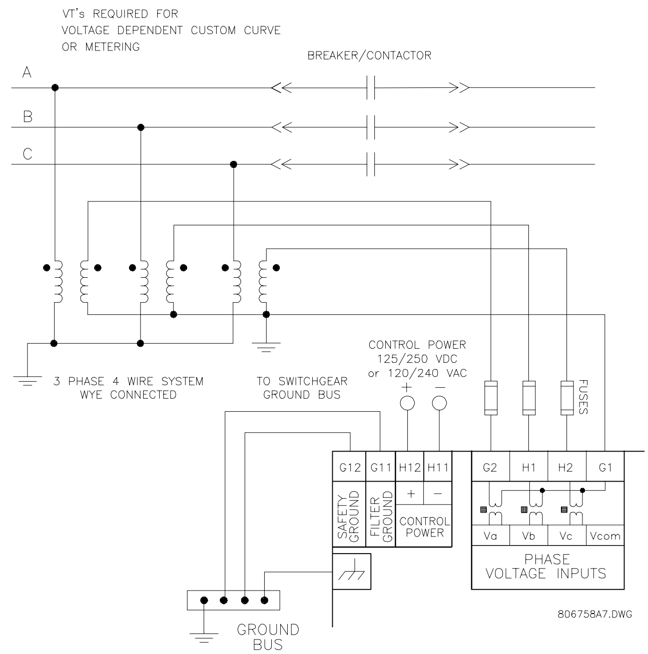


Figure 2-19 WYE VOLTAGE TRANSFORMER CONNECTION

2.2.7 DIGITAL INPUTS

There are 9 digital inputs that are designed for dry contact connections only. Two of the digital inputs, Access and Test have their own common terminal, the balance of the digital inputs share one common terminal (see Figure 2-12).

In addition, the +24Vdc switch supply is brought out for control power of an inductive or capacitive proximity probe. The NPN transistor output could be taken to one of the assignable digital inputs configured as a counter or tachometer. Refer to the Specifications section of this manual for maximum current draw from the +24Vdc switch supply.

CAUTION: DO NOT INJECT VOLTAGES TO DIGITAL INPUTS. DRY CONTACT CONNECTIONS ONLY.

2.2.8 ANALOG INPUTS

Terminals are provided on the SR469 for the input of four 0-1mA, 0-20mA, or 4-20mA current signals (field programmable). This current signal can be used to monitor any external quantity such as: vibration, pressure, flow, etc. The four inputs share one common return. Polarity of these inputs must be observed for proper operation The analog input circuitry is isolated as a group with the Analog Output circuitry and the RTD circuitry. Only one ground reference should be used for the three circuits. Transorbs limit this isolation to ±36 volts with respect to the SR469 safety ground.

In addition, the +24Vdc analog input supply is brought out for control power of loop powered transducers (see Figure 2-20). Refer to the Specifications section of this manual for maximum current draw from this supply.

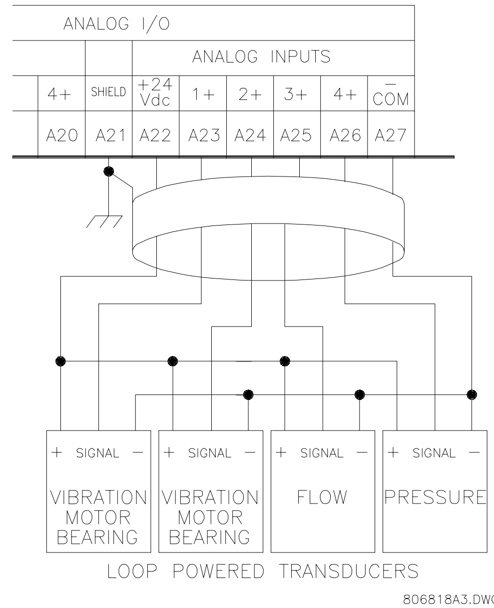


Figure 2-20 LOOP POWERED TRANSDUCER CONNECTION

2.2.9 ANALOG OUTPUTS

The SR469 provides 4 analog output channels, which when ordering are selected to provide a full-scale range of either 0-1 mA (into a maximum 10 kΩ impedance), or 4-20 mA (into a maximum 1200 Ω impedance). Each channel can be configured to provide full-scale output sensitivity for any range of any measured parameter.

As shown in the wiring diagram of Figure 2-12, these outputs share one common return. Polarity of these outputs must be observed for proper operation. Shielded cable should be used, with only one end of the shield grounded, to minimize noise effects.

The analog output circuitry is isolated as a group with the Analog Input circuitry and the RTD circuitry. Only one ground reference should be used for the three circuits. Transorbs limit this isolation to ±36 volts with respect to the SR469 safety ground.

If a voltage output is required, a burden resistor must be connected at the input of the SCADA measuring device. Ignoring the input impedance of the input, $R_{LOAD} = V_{FULL\ SCALE} / I_{MAX}$. For 0-1 mA, for example, if 5 V full scale is required to correspond to 1 mA, R_{LOAD} = 5 / 0.001 = 5000 ohms. For 4-20 mA, this resistor would be R_{LOAD} = 5 V / 0.020 = 250 ohms.

2.2.10 RTD SENSOR CONNECTIONS

The SR469 can monitor up to 12 RTD inputs for Stator, Bearing, Ambient, or Other temperature monitoring. The type of each RTD is field programmable as: 100Ω Platinum (DIN.43760), 100Ω Nickel, 120Ω Nickel, or 10 Ω Copper. RTDs must be three wire type. Every two RTDs shares a common return.

The SR469 RTD circuitry compensates for lead resistance, provided that each of the three leads is the same length. Lead resistance should not exceed 25Ω per lead for platinum and nickel type RTDs or 3Ω per lead for Copper type RTDs. Shielded cable should be used to prevent noise pickup in the industrial environment. RTD cables should be kept close to grounded metal casings and avoid areas of high electromagnetic or radio interference. RTD leads should not be run adjacent to or in the same conduit as high current carrying wires.

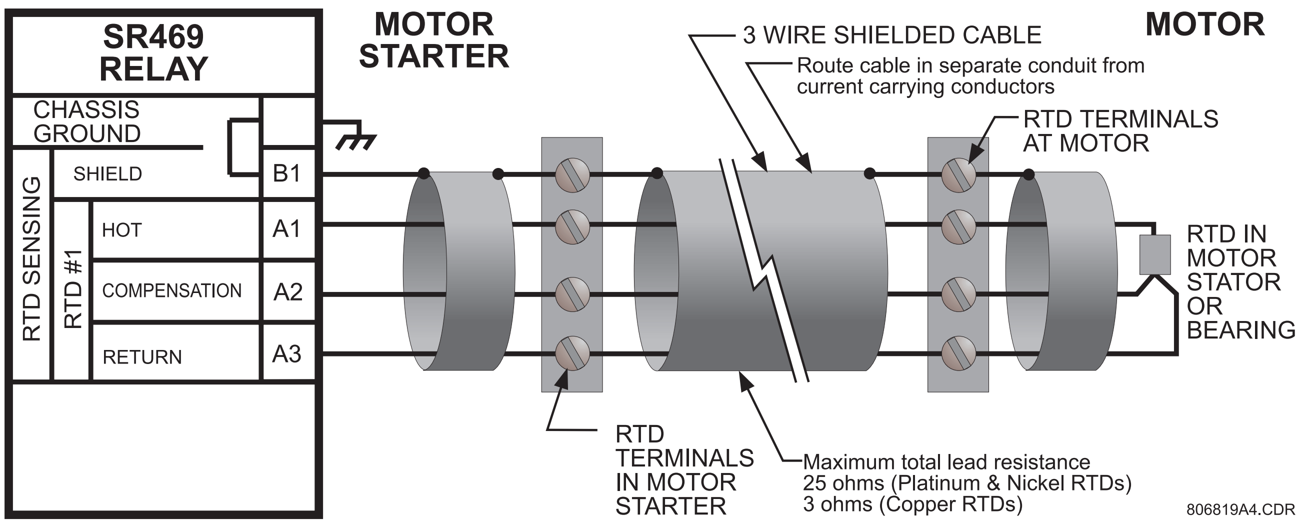


Figure 2-21 RTD WIRING

IMPORTANT: The RTD circuitry is isolated as a group with the Analog Input circuitry and the Analog Output circuitry. Only one ground reference should be used for the three circuits. Transorbs limit this isolation to ±36 volts with respect to the SR469 safety ground.

REDUCED RTD LEAD NUMBER APPLICATION: The SR469 requires three leads to be brought back from each RTD: Hot, Return and Compensation. This can be quite expensive. It is however possible to reduce the number of leads required to 3 for the first RTD and 1 for each successive RTD. Refer to Figure 2-22 for wiring configuration for this application.

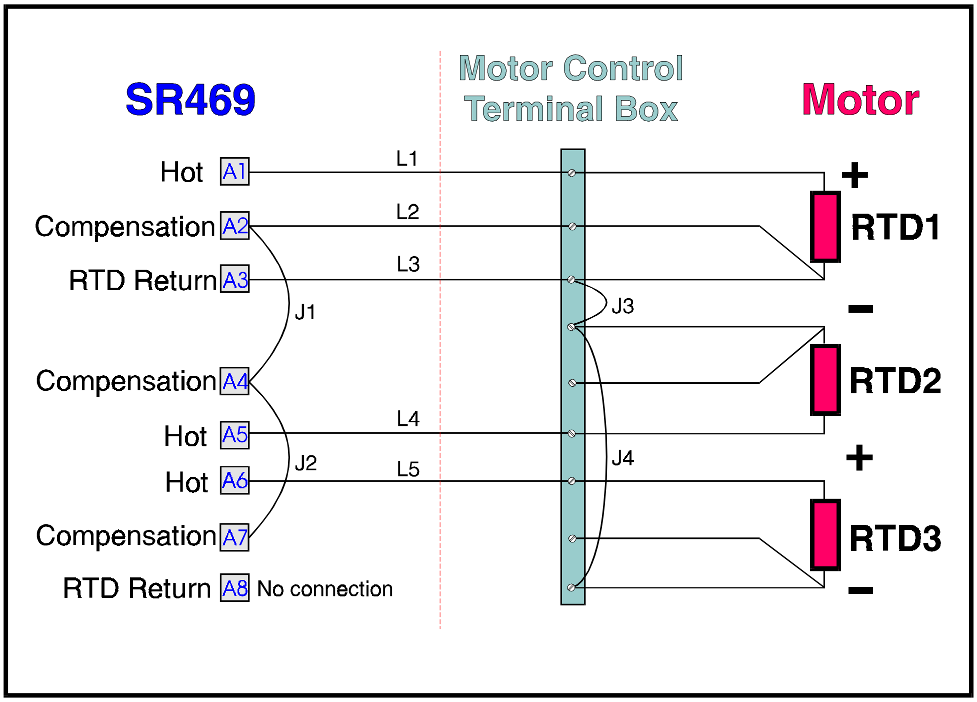


Figure 2-22 REDUCED WIRING RTDs

The Hot line for each RTD would have to be run as usual for each RTD. The Compensation and Return leads however, need only be run for the first RTD. At the motor RTD terminal box the RTD Return leads must be jumpered together with as short as possible jumpers. At the SR469 relay the Compensation leads must be jumpered together.

It can be noted that there is an error produced on each RTD equal to the voltage drop across the jumper on the RTD return. This error would increase on each successive RTD added.

$$V_{RTD1} = V_{RTD1}$$
$$V_{RTD2} = V_{RTD2} + V_{J3}$$
$$V_{RTD3} = V_{RTD3} + V_{J3} + V_{J4}$$
$$V_{RTD4} = V_{RTD4} + V_{J3} + V_{J4} + V_{J5}$$
etc...

This error is directly dependent on the length and gauge of the wire used for the jumpers and any error introduced by a poor connection. For RTD types other than 10C the error introduced by the jumpers is negligible.

This RTD wiring technique reduces the cost of wiring, however, the following disadvantages must be noted:

1. Error in temperature readings due to lead and connection resistances. **Not** recommended for 10C RTDs.
2. If the RTD Return lead to the SR469 or one of the jumpers breaks all RTDs from the point of the break on will read open.
3. If the Compensation lead breaks or one of the jumpers breaks all RTDs from the point of the break on will function without any lead compensation.

TWO WIRE RTD LEAD COMPENSATION: An example of how to add lead compensation to a two wire RTD may be seen in Figure 2-23.

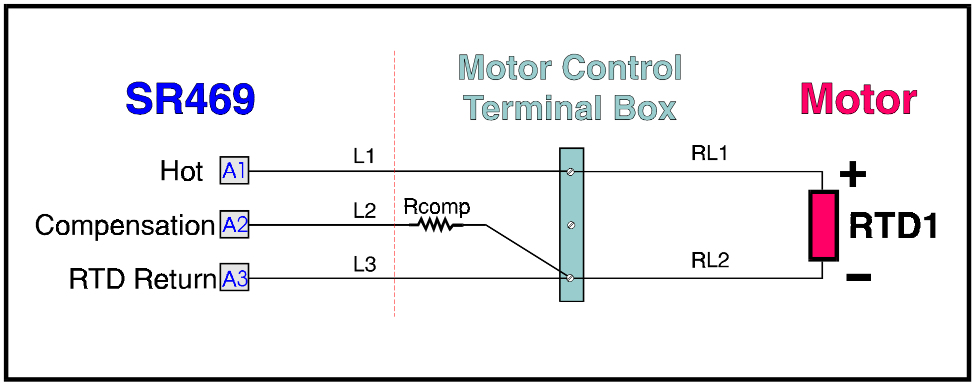


Figure 2-23 2 WIRE RTD LEAD COMPENSATION

The compensation lead L2 would be added and it would compensate for the Hot (L1) and the Return (L3) assuming they are all of equal length and gauge. To compensate for leads RL1 and RL2 a resistor, Rcomp, equal to the resistance of RL1 or RL2 could be added to the compensation lead though in many cases this is unnecessary.

GROUNDING OF RTDs: If it is required to ground one lead of the RTDs, this can be done at either the SR469 or at the motor. Grounding should **not** be done in both places as it could cause a circulating current to flow. Only RTD Return leads may be grounded.

When grounding at the SR469, only one Return lead need be grounded as all are hardwired together internally. No error will be introduced into the RTD reading by grounding in this manner.

If the RTD Return leads are tied together and grounded at the motor, only one RTD Return lead can be run back to the SR469. See Figure 2-24 for wiring example. Running more than one RTD Return lead back will cause significant errors as two or more parallel paths for the return current have been created. Use of this wiring scheme will cause errors in readings equivalent to that in the 'Reduced RTD Lead Number Application'.

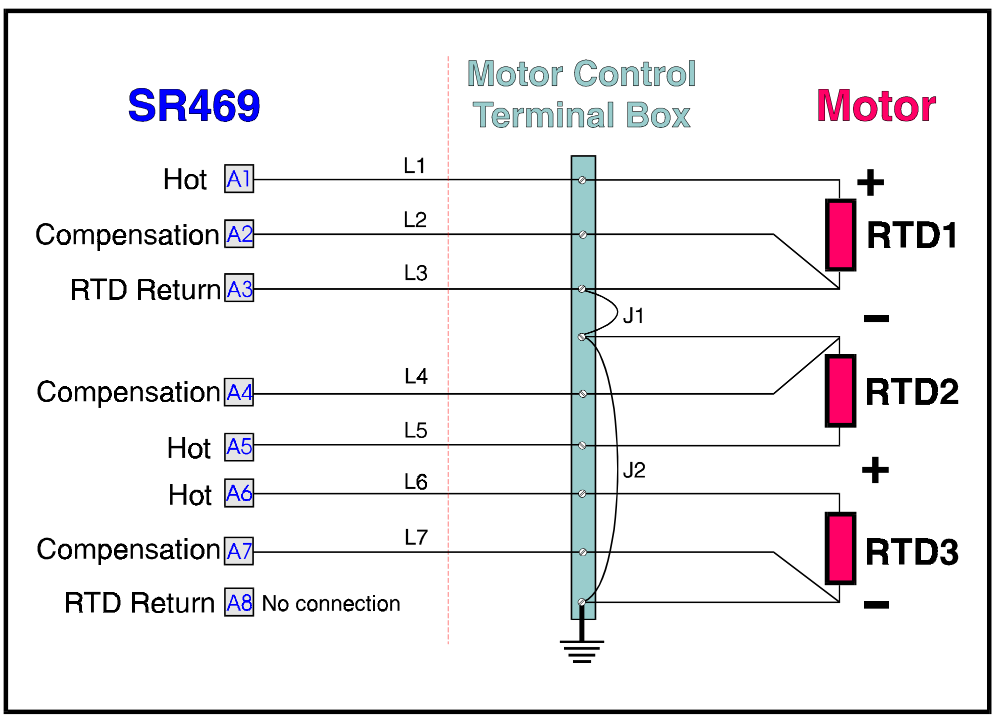


Figure 2-24 RTD ALTERNATE GROUNDING

2.2.11 OUTPUT RELAYS

There are six Form C output relays. (See specifications for ratings). Five of the six relays are always non-failsafe, R6 Service is always failsafe. As failsafe, R6 relay will be energized normally and de-energize when called upon to operate. It will also de-energize when control power to the SR469 is lost and therefore, be in its operated state. All other relays, being non-failsafe, will be de-energized normally and energize when called upon to operate. Obviously, when control power is lost to the SR469, these relays must be de-energized and therefore, they will be in their non-operated state. Shorting bars in the drawout case ensure that when the SR469 is drawn out, no trip or alarm occurs. The R6 Service output will however indicate that the SR469 has been drawn out. Each output relay has an LED indicator on the SR469 front panel that comes on while the associated relay is in the operated state.

R1 TRIP: The trip relay should be wired such that the motor is taken off line when conditions warrant. For a breaker application, the NO R1 Trip contact should be wired in series with the Breaker trip coil. For contactor applications, the NC R1 Trip contact should be wired in series with the contactor coil.

Supervision of a breaker trip coil, requires that the supervision circuit be paralleled with the R1 TRIP relay output contacts, as shown in Figure 2-12. With this connection made, the supervision input circuits will place an impedance across the contacts that will draw a current of 2 mA (for an external supply voltage from 30-250 Vdc) through the breaker trip coil. The supervision circuits respond to a loss of this trickle current as a failure condition. Circuit breakers equipped with standard control circuits have a breaker auxiliary contact permitting the trip coil to be energized only when the breaker is closed. When these contacts are open, as detected by the Starter Status Digital Input monitoring breaker auxiliary contacts, trip coil supervision circuit is automatically disabled. This logic provides that the trip circuit is monitored only when the breaker is closed.

R2 AUXILIARY, R3 AUXILIARY: The auxiliary relays may be programmed for numerous functions such as, trip echo, alarm echo, trip backup, alarm differentiation, control circuitry, etc. They should be wired as configuration warrants.

R4 ALARM: The alarm relay should connect to the appropriate annunciator or monitoring device.

R5 START BLOCK: The start block relay should be wired in series with the start pushbutton in either a breaker or contactor configuration to prevent motor starting. When a trip has not been reset on a breaker, the start block relay will prevent a start attempt that would only result in immediate trip. Also, any lockout functions are directed to the start block relay.

R6 SERVICE: The service relay will operate if any of the SR469 diagnostics detect an internal failure or on loss of control power. This output may be monitored with an annunciator, PLC or DCS.

If it is deemed that a motor is more important than a process, the service relay NC contact may also be wired in parallel with the trip relay on a breaker application or the NO contact may be wired in series with the trip relay on a contactor application. This will provide failsafe operation of the motor; that is, the motor will be tripped off line in the event that the SR469 is not protecting it. If however, the process is critical, annunciation of such a failure will allow the operator or the operation computer to either continue, or do a sequenced shutdown.

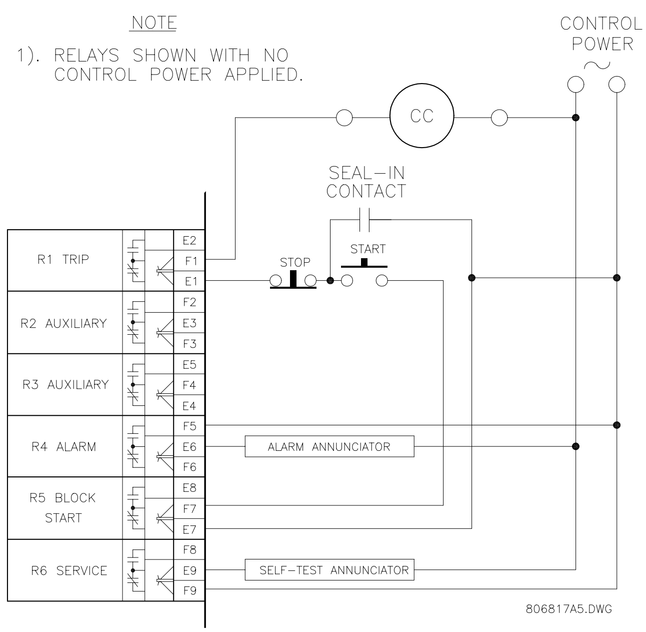


Figure 2-25 ALTERNATE WIRING FOR CONTACTORS

2.2.12 DRAWOUT INDICATOR

The Drawout Indicator is simply a jumper from E12 to F12 on the SR469 unit. When the SR469 is withdrawn from the case, terminals E12 and F12 will be open. This may be useful for differentiating between loss of control power as indicated by the R6 SERVICE relay and withdrawal of the unit.

2.2.13 RS485 COMMUNICATIONS PORTS

Two totally independent two-wire RS485 ports are provided. Up to 32 SR469's can be daisy-chained together on a communication channel without exceeding the driver capability. For larger systems, additional serial channels must be added. It is also possible to use commercially available repeaters to increase the number of relays on a single channel to more than 32. Suitable cable should have a characteristic impedance of 120 ohms (eg. Belden #9841) and total wire length should not exceed 4000 ft. Commercially available repeaters will allow for transmission distances greater than 4000 ft.

Voltage differences between remote ends of the communication link are not uncommon. For this reason, surge protection devices are internally installed across all RS485 terminals. Internally, an isolated power supply with an optocoupled data interface is used to prevent noise coupling. **To ensure that all devices in a daisy-chain are at the same potential, it is imperative that the common terminals of each RS485 port are tied together and grounded only once, at the master. Failure to do so may result in intermittent or failed communications.** The source computer/PLC/SCADA system should have similar transient protection devices installed, either internally or externally, to ensure maximum reliability. Ground the shield at one point only, as shown in Figure 2-26, to avoid ground loops.

Correct polarity is also essential. SR469's must be wired with all '+' terminals connected together, and all '–' terminals connected together. Each relay must be daisy-chained to the next one. Avoid star or stub connected configurations. The last device at each end of the daisy chain should be terminated with a 120 ohm 1/4 watt resistor in series with a 1nF capacitor across the '+' and '–' terminals. Observing these guidelines will result in a reliable communication system that is immune to system transients.

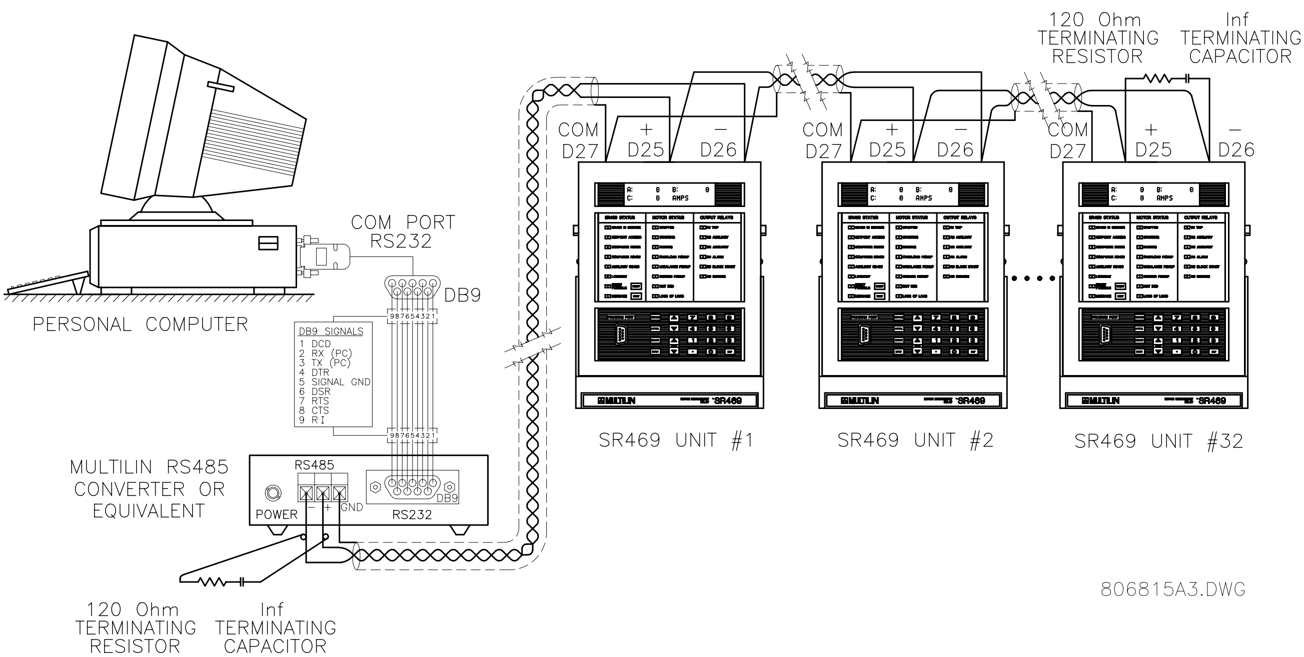
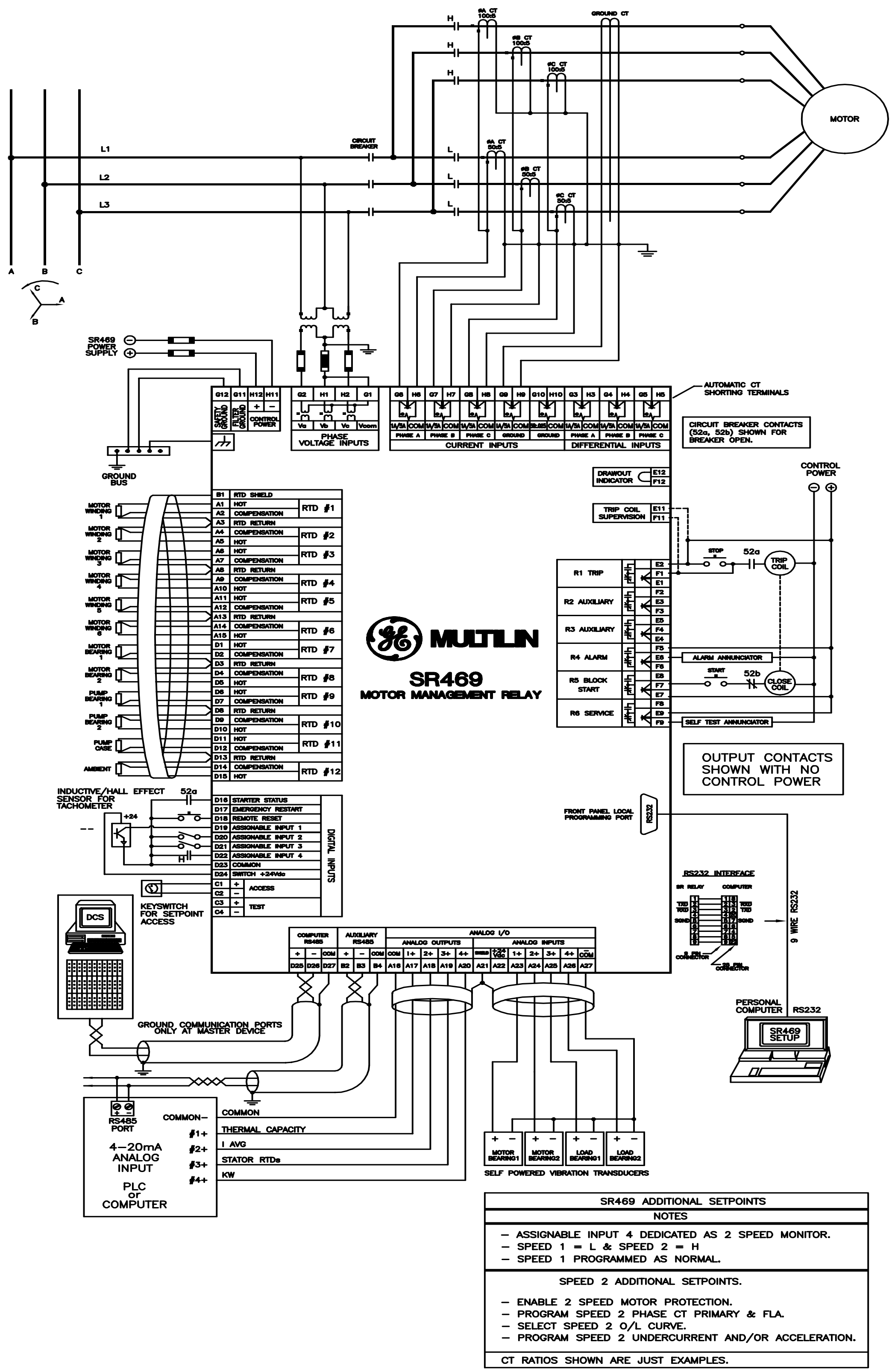


Figure 2-26 RS485 COMMUNICATIONS INTERFACE

2.2.14 TYPICAL 2 SPEED MOTOR WIRING



2.2.15 DIELECTRIC STRENGTH TESTING

It may be required to test a complete motor starter for dielectric strength (“flash” or hipot”) with the SR469 installed. The SR469 is rated for 2000Vdc isolation between relay contacts, CT inputs, VT inputs, trip coil supervision, and the safety ground terminal G12. Some precautions are required to prevent SR469 damage during these tests.

Filter networks and transient protection clamps are used between control power, trip coil supervision, and the filter ground terminal G11. This filtering is intended to filter out high voltage transients, radio frequency interference (RFI), and electomagnetic interference (EMI). The filter capacitors and transient suppressors could be damaged by application continuous high voltage. Disconnect filter ground terminal G11 during testing of control power and trip coil supervision. CT inputs, VT inputs, and output relays do not require any special precautions. Low voltage inputs (< 30V), RTDs, analog inputs, analog outputs, digital inputs, and RS485 communication ports are not to be tested for dielectric strength under any circumstance (see Figure 2-27).

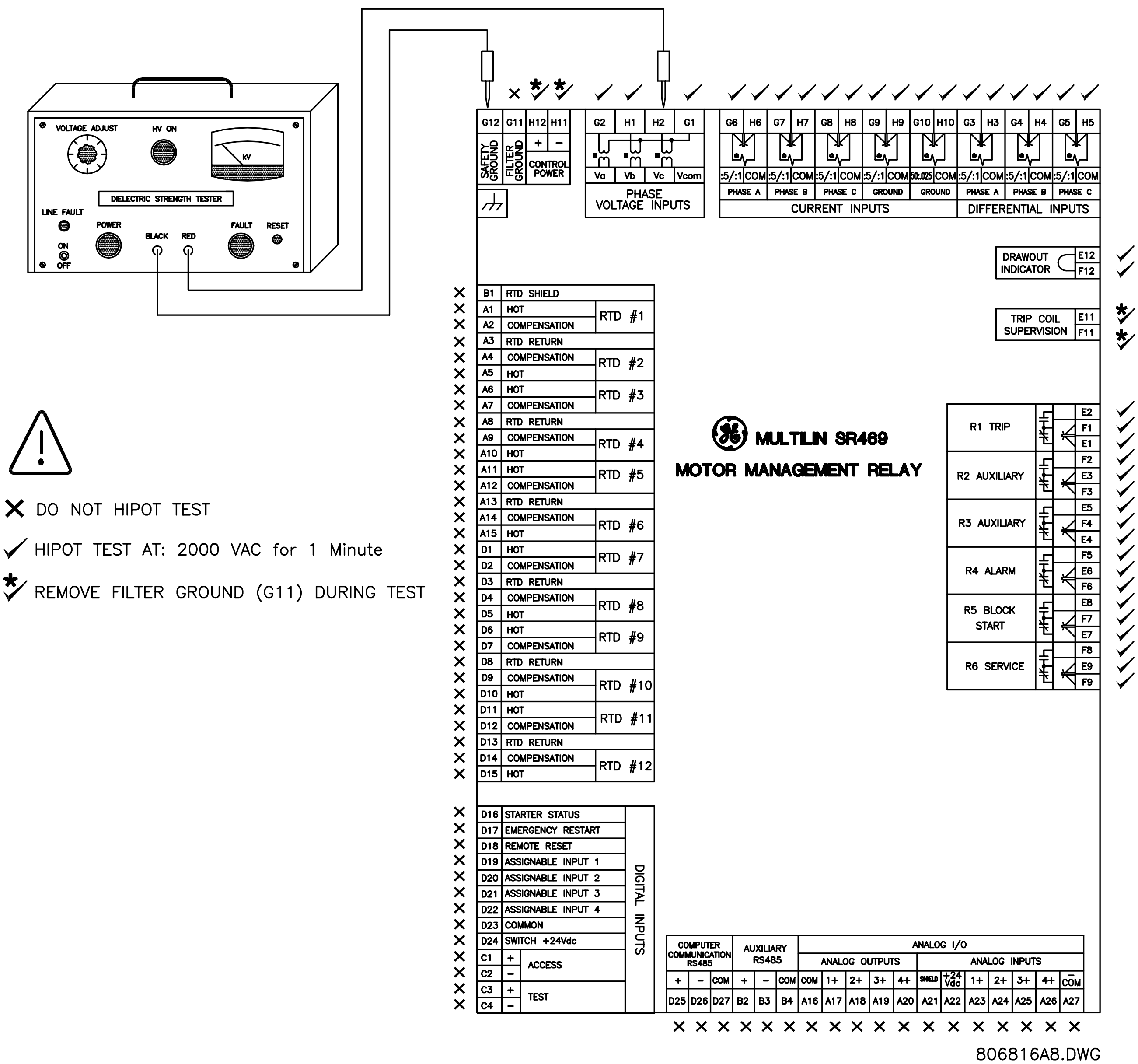


Figure 2-27 TESTING THE SR469 FOR DIELECTRIC STRENGTH

3.1.1 SR469 FACEPLATE

Figure 3-1 SR469 FACEPLATE

3.1.2 DISPLAY

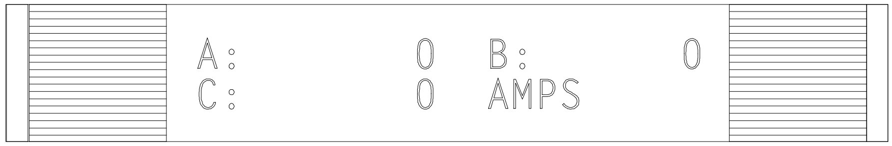


Figure 3-2 SR469 DISPLAY

All messages are displayed on a 40 character vacuum fluorescent display to make them visible under poor lighting conditions. Messages are displayed in plain English and do not require the aid of an instruction manual for deciphering. While the keypad and display are not actively being used, the display will default to user defined status messages. Any trip, alarm, or start block will automatically override the default messages and appear on the display.

Lamp Test: Press [HELP] key for 2 seconds to initiate lamp test.

3.1.3 LED INDICATORS

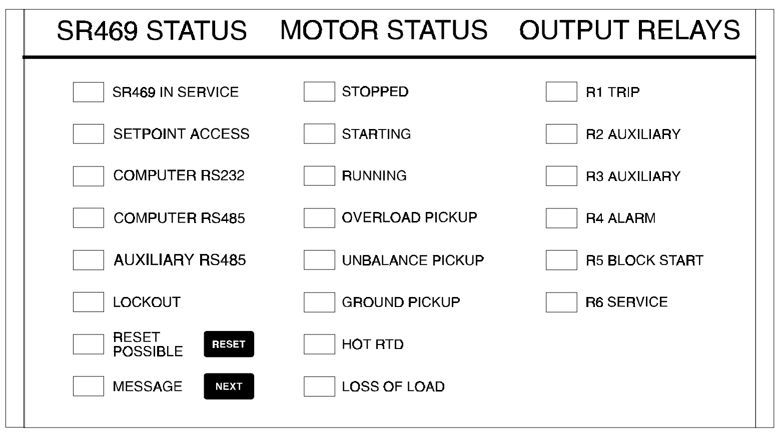


Figure 3-3 SR469 LED INDICATORS

There are three groups of LED indicators. They are SR469 Status, Motor Status, and Output Relays.

SR469 STATUS LED INDICATORS

- **SR469 IN SERVICE:** Control power is applied & all monitored I/O and internal systems are OK & the SR469 has been programmed & the SR469 is in protection mode, not simulation mode. When in simulation or testing mode, the LED indicator will flash.
- **SETPOINT ACCESS:** Access jumper is installed and passcode protection has been satisfied; setpoints may be altered and stored.
- **COMPUTER RS232:** Flashes when there is any activity on the comm. port. Remains on solid if incoming data is valid.
- **COMPUTER RS485:** Flashes when there is any activity on the comm. port. Remains on solid if incoming data is valid and intended for the slave address programmed in the relay.
- **AUXILIARY RS485:** Flashes when there is any activity on the comm. port. Remains on solid if incoming data is valid and intended for the slave address programmed in the relay.
- **LOCKOUT:** Indicates start attempts will be blocked either by a programmed lockout time or a condition that is still present.
- **RESET POSSIBLE:** A trip or latched alarm may be reset. Pressing the [RESET] key will clear said trip or alarm.
- **MESSAGE :** Flashes when a trip, alarm, or start block occurs. Pressing the next key will scroll through diagnostic messages. Remains solid when setpoint and actual value messages are being viewed. Pressing the [NEXT] key will return the display to the default messages.

MOTOR STATUS LED INDICATORS

- **STOPPED:** Indicates that the motor is stopped based on zero phase current and starter status auxiliary contact feedback.
- **STARTING**: Motor is starting.
- **RUNNING:** Motor is running normally below overload pickup level.
- **OVERLOAD:** Motor is running above overload pickup.
- **UNBALANCE PICKUP:** Level of current unbalance has exceeded the unbalance alarm or trip level.
- **GROUND PICKUP:** Level of ground current has exceeded the ground fault alarm or trip level.
- **HOT RTD:** One of the RTD measurements has exceeded its RTD alarm or trip level.
- **LOSS OF LOAD:** Average motor current has fallen below the undercurrent alarm or trip level. -OR- Power consumption has fallen below the underpower alarm or trip level.

OUTPUT RELAY LED INDICATORS

- **R1 TRIP:** R1 Trip relay has operated (energized).
- **R2 AUXILIARY:** R2 Auxiliary relay has operated (energized).
- **R3 AUXILIARY:** R3 Auxiliary relay has operated (energized).
- **R4 ALARM:** R4 Alarm relay has operated (energized).
- **R5 BLOCK START:** R5 Block Start relay has operated (energized).
- **R6 SERVICE:** R6 Service relay has operated (de-energized, R6 is failsafe, normally energized).

3.1.4 RS232 PROGRAM PORT

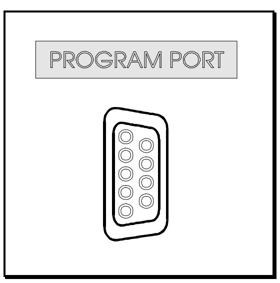


Figure 3-4 RS232 PROGRAM PORT

This port is intended for connection to a portable PC. Setpoint files may be created at any location and downloaded through this port using the SR469 SETUP program. Local interrogation of Setpoints and Actual Values is also possible. New firmware may be downloaded to the SR469 flash memory through this port. Upgrading of the relay firmware does not require a hardware Eprom change.

3.1.5 KEYPAD

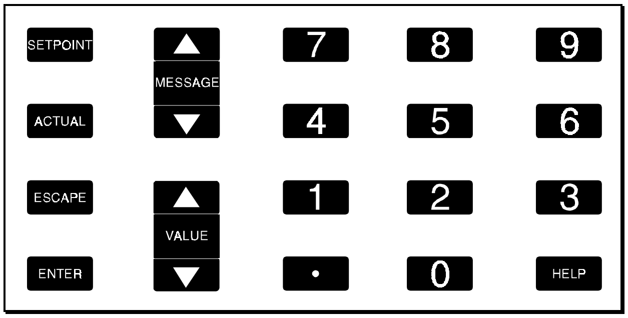


Figure 3-5 SR469 KEYPAD

The SR469 messages are organized into pages under the main headings, Setpoints and Actual Values. The [SETPOINT] key is used to navigate through the headers of pages of programmable parameters. The [ACTUAL] key is used to navigate through the headers of pages of measured parameters.

Each page is broken down further into logical subgroups of messages. The [MESSAGE] up and down keys may be used to navigate through the subgroups.

The [ENTER] key is dual purpose. It is used to enter the subgroups or store altered setpoint values.

The [ESCAPE] key is also dual purpose. It may be used to exit the subgroups or to return an altered setpoint to its original value before it has been stored.

The [VALUE] up and down key is used to scroll through variables in the setpoint programming mode. It will increment and decrement numerical setpoint values. Alternatively, these values may be entered with the numeric keypad.

The [HELP] key may be pressed at any time for context sensitive help messages.

3.1.6 ENTERING ALPHANUMERIC TEXT

In order to allow the SR469 to be customized for specific applications, there are several places where text messages may be programmed. One example is the MESSAGE SCRATCHPAD. To enter alphanumeric text messages, the following procedure should be followed:

Example: to enter the text, "Check Fluid Levels"

- press [.] to enter text edit mode,
- press the [VALUEs] or [VALUEt] key until 'C' appears, press [.] to advance the cursor to the next position,
- repeat step 2 for the remaining characters: h,e,c,k, ,F,l,u,i,d, ,L,e,v,e,l,s
- press [ENTER] to store

3.1.7 ENTERING +/- SIGNS

The SR469 does not have a '+' or '-' key. Negative numbers may be entered in one of two manners. First, immediately pressing the [VALUE UP] or [VALUE DOWN] key will cause the setpoint to scroll through its range including any negative numbers. Alternately, once a setpoint message is entered, after pressing at least one numeric key, pressing the [VALUE UP] or [VALUE DOWN] key will cause the sign to change if applicable.

3.1.8 SETPOINT ENTRY

In order to store any setpoints, terminals C1 and C2 (access terminals) must be shorted. (A key switch may be used for security). There is also a Setpoint Passcode feature that may be enabled to restrict access to setpoints. The passcode must be entered to allow the changing of setpoint values. A passcode of 0 effectively turns off the passcode feature and only the access jumper is required for changing setpoints. If no key is pressed for 5 minutes, access to setpoint values will be restricted until the passcode is entered again. To prevent setpoint access before the 5 minutes expires, the unit may be turned off and back on, the access jumper may be removed, or the SETPOINT ACCESS: Permitted setpoint may be changed to Restricted. The passcode cannot be entered until terminals C1 and C2 (access terminals) are shorted. When setpoint access is allowed, the 'SETPOINT ACCESS' indicator on the front of the SR469 unit will be lit.

Setpoint changes take effect immediately, even when motor is running. It is not recommended, however, to change setpoints while motor is running as any mistake could cause a nuisance trip.

The following procedure may be used to access and alter any setpoint message. This specific example will refer to entering a valid passcode in order to allow access to setpoints if the passcode was '469'.

1. The SR469 programming is broken down into pages by logical groups. Press [SETPOINTS] to cycle through the setpoint pages until the desired page appears on the screen. Press [MESSAGE t] to enter a page.

yy SETPOINTS **yy** S1 SR469 SETUP

2. Each page is broken further into subgroups. Press [MESSAGE t] and [MESSAGE s] to cycle through subgroups until the desired subgroup appears on the screen. Press [ENTER] to enter a subgroup.

y PASSCODE **y** [ENTER] for more

3. Each sub-group has one or more associated setpoint messages. Press [MESSAGE t] and [MESSAGE s] to cycle through setpoint messages until the desired setpoint message appears on the screen.

ENTER PASSCODE FOR ACCESS:

4. The majority of setpoint messages may be may be altered in a simple fashion by pressing [VALUE s] and [VALUE t] until the desired value appears and pressing [ENTER]. Setpoints that are strictly numeric may also be entered by pressing the numeric keys (including decimals) and pressing [ENTER]. If a setpoint is entered that is out of range, the original setpoint value will reappear. If a setpoint is entered that is out of step, an adjusted value will be stored (e.g. 101 for a setpoint that steps 95,100,105 will store as 100). If a mistake is made entering the new value, pressing [ESCAPE] will cause the value to revert to its original value. Text editing is a special case described in detail in 3.1.7 Entering +/– Signs. Each time a new setpoint is successfully stored, a message will flash on the display stating 'NEW SETPOINT HAS BEEN STORED'.

ENTER PASSCODE FOR ACCESS: 469

   Press [ENTER]
   FLASH:

NEW SETPOINT HAS BEEN STORED

   RETURNS:

SETPOINT ACCESS: PERMITTED

5. Press [ESCAPE] to exit a subgroup.

y PASSCODE **y** [ENTER] for more

6. Pressing [ESCAPE] numerous times will always bring the cursor to the top of the page.

yy SETPOINTS
yy S1 SR469 SETUP

4.1.1 TRIPS / ALARMS/ BLOCKS DEFINED

The SR469 Motor Management Relay has three basic categories of protection elements. They are TRIPS, ALARMS, and BLOCKS.

TRIPS

An SR469 trip feature may be assigned to any combination of the two Auxiliary relays, R2 and R3, in addition to the R1 Trip Relay. If a Trip becomes active, the appropriate LED (indicator) on the SR469 faceplate will illuminate to show which of the output relays has operated. In addition to the Trip relay(s), a trip will always operate the Block Start relay. All trip features are latched. Once a relay has been operated by a trip, the reset key must be pressed to reset that trip when the condition is no longer present. If there is a lockout time, the Block Start relay will not reset until the lockout time has expired. Immediately prior to issuing a trip, the SR469 takes a snapshot of motor parameters and stores them as pre-trip values which will allow for troubleshooting after the trip occurs. The cause of last trip message is updated with the current trip and the SR469 display defaults to that message. All trip features are automatically logged and date and time stamped as they occur. In addition, all trips are counted and logged as statistics such that any long term trends may be identified.

ALARMS

An SR469 alarm feature may be assigned to operate any combination of three output relays, R4 Alarm, R3 Auxiliary, and R2 Auxiliary. When an Alarm becomes active, the appropriate LED (indicator) on the SR469 faceplate will illuminate when an output relay(s) has operated. Each alarm feature may be programmed as latched or unlatched. Once a latched alarm feature becomes active, the reset key must be pressed to reset that alarm. If the condition that has caused the alarm is still present (e.g. hot RTD) the Alarm relay(s) will not reset until the condition is no longer present. If on the other hand, an unlatched alarm feature becomes active, that alarm will reset itself (and associated output relay(s)) as soon as the condition that caused the alarm ceases. As soon as an alarm occurs, the alarms messages are updated to reflect the alarm and the SR469 display defaults to that message. Since it may not be desirable to log all alarms as events, each alarm feature may be programmed to log as an event or not. If an alarm is programmed to log as an event, when it becomes active, it is automatically logged as a date and time stamped event

BLOCK START

An SR469 Block Start is a feature that prevents or inhibits the start of the motor based on some logic or algorithm. An SR469 Block Start feature is always assigned to the Block Start relay. In addition to the Trip relay(s), a trip will always operate Block Start relay. If the condition that has caused the trip is still present (e.g. hot RTD), or there is a lockout time when the Reset key is pressed, the Block Start relay will not reset until the condition is no longer present or the lockout time has expired. All blocking features are always unlatched and reset immediately when conditions that caused the block cease. In addition to becoming active in conjunction with trips, a block may become active once the motor stops. There are several features that operate as such: Starts/Hour, Time Between Starts, Start Inhibit, Restart Block, and SR469 Not Programmed. When a block becomes active, the block messages are updated to reflect the block (complete with lockout time if required) and the screen defaults to that message. Blocks are normally not logged as events. If however, a motor start or start attempt is detected when a block is active, it is automatically logged as a date and time stamped event. This scenario might occur if someone shorts across the block terminals and overrides the SR469 protection to start the motor.

4.1.2 RELAY ASSIGNMENT PRACTICES

There are six output relays. Five of the relays are always non-failsafe, the other (Service) is failsafe and dedicated to enunciate internal SR469 faults (these faults include Setpoint Corruption, failed hardware components, loss of control power, etc.). One of the output relays is dedicated as the Block Start relay; it is dedicated to features that are intended to block motor starting. The four remaining relays may be programmed for different types of features depending on what is required. One of the relays, R1 TRIP, is intended to be used as the main trip relay. Another relay, R4 ALARM, is intended to be used as the main alarm relay. The two relays that are left, R2 AUXILIARY and R3 AUXILIARY, are intended for special requirements.

When assigning features to R2 and R3, it is a good idea to decide early on what is required since features that may be assigned may conflict. For example, if R2 AUXILIARY is to be used for upstream trips, it cannot also be used for the control of a Reduced Voltage Start. Similarly, if R3 is to be dedicated as a relay to echo all alarm conditions to a PLC, it cannot also be used strictly to enunciate a specific alarm such as Undercurrent.

In order to ensure that conflicts in relay assignment do not occur, several precautions have been taken. All trips with the exception of the Short Circuit Backup Trip default to R1 TRIP output relay. All alarms default to the R4 ALARM relay. Only special control functions are defaulted to the R2 and R3 AUXILIARY relays. It is recommended that these assignments be reviewed once all the setpoints have been programmed.

4.1.3 SETPOINT MESSAGE MAP

Table 4-1 SETPOINT MESSAGE MAP

⇨ SETPOINT

yy S1 SETPOINTS
yy SR469 SETUP

- y PASSCODE
- y PREFERENCES
- y SERIAL PORTS
- y REAL TIME CLOCK
- y DEFAULT MESSAGES
- y MESSAGE SCRATCHPAD
- y CLEAR DATA
- y INSTALLATION

⇨ SETPOINT

yy S2 SETPOINTS
yy SYSTEM SETUP

- y CURRENT SENSING
- y VOLTAGE SENSING
- y POWER SYSTEM
- y SERIAL COM. CONTROL
- y REDUCED VOLTAGE *T

⇨ SETPOINT

yy S3 SETPOINTS
yy DIGITAL INPUTS

- y STARTER STATUS
- y ASSIGNABLE INPUT1
- y ASSIGNABLE INPUT2
- y ASSIGNABLE INPUT3
- y ASSIGNABLE INPUT4

⇨ SETPOINT

yy S4 SETPOINTS
yy OUTPUT RELAYS

- y RELAY RESET MODE

⇨ SETPOINT

yy S5 SETPOINTS
yy THERMAL MODEL

- y THERMAL MODEL
- y O/L CURVE SETUP

⇨ SETPOINT

yy S6 SETPOINTS
yy CURRENT ELEMENTS

- y SHORT CIRCUIT TRIP
- y OVERLOAD ALARM
- y MECHANICAL JAM
- y UNDERCURRENT
- y CURRENT UNBALANCE
- y GROUND FAULT
- y PHASE DIFFERENTIAL

⇨ SETPOINT

yy S7 SETPOINTS
yy MOTOR STARTING

- y ACCELERATION TIMER
- y START INHIBIT
- y JOGGING BLOCK
- y RESTART BLOCK

⇨ SETPOINT

yy S8 SETPOINTS
yy RTD TEMPERATURE

- y RTD TYPES
- y RTD #1
  THROUGH
- y RTD #12
- y OPEN RTD SENSOR
- y RTD SHORT/LOW TEMP

⇨ SETPOINT

yy S9 SETPOINTS
yy VOLTAGE ELEMENTS

- y UNDERVOLTAGE
- y OVERVOLTAGE
- y PHASE REVERSAL
- y FREQUENCY

⇨ SETPOINT

yy S10 SETPOINTS
yy POWER ELEMENTS

- y POWER FACTOR
- y REACTIVE POWER
- y UNDERPOWER
- y REVERSE POWER

⇨ SETPOINT

yy S11 SETPOINTS
yy MONITORING

- y TRIP COUNTER
- y STARTER FAILURE
- y CURRENT DEMAND
- y kW DEMAND
- y kvar DEMAND
- y kVA DEMAND
- y PULSE OUTPUT

⇨ SETPOINT

yy S12 SETPOINTS
yy ANALOG I/O

- y ANALOG OUTPUT 1
- y ANALOG OUTPUT 2
- y ANALOG OUTPUT 3
- y ANALOG OUTPUT 4
- y ANALOG INPUT 1
- y ANALOG INPUT 2
- y ANALOG INPUT 3
- y ANALOG INPUT 4
- y ANALOG IN 1-2 DIFF
- y ANALOG IN 3-4 DIFF

⇨ SETPOINT

yy S13 SETPOINTS
yy SR469 TESTING

- y SIMULATION MODE
- y PRE-FAULT SETUP
- y FAULT SETUP
- y TEST OUTPUT RELAYS
- y TEST ANALOG OUTPUT
- y COMM PORT MONITOR
- y MULTILIN USE ONLY

⇨ SETPOINT

yy S14 SETPOINTS
yy TWO-SPEED MOTOR

- y SPEED2 O/L SETUP
- y SPEED2 U/C
- y 2SPEED ACCELERATION

*T.........ASSIGNABLE INPUT4 dedicated as Two-Speed Monitor if Two-Speed Motor feature is used.
The two-speed motor protection is enabled in S2 SYSTEM SETUP\CURRENT SENSING.

4.2.1 PASSCODE

y PASSCODE y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	ENTER PASSCODE FOR ACCESS:	RANGE: from 1-8 digits, numeric This message seen only if the passcode is not zero and setpoint access is restricted
	ESCAPE / MESSAGE ⇳	SETPOINT ACCESS: Permitted	RANGE: Permitted, Restricted This message seen only if the passcode is zero or setpoint access is permitted
	ESCAPE / MESSAGE ⇧	CHANGE PASSCODE: No	RANGE: No, Yes This message seen only if the passcode is zero or setpoint access is permitted

FUNCTION:

In addition to the setpoint access jumper that must be installed on the rear terminals for setpoint programming, a passcode access security feature is also provided. When the SR469 is shipped from the factory, the passcode is defaulted to 0. Passcode protection is ignored when the passcode is 0. In this case only the setpoint access jumper is required for changing setpoints from the front panel. Passcodes are also ignored when programming setpoints via the RS485 computer port. However when programming setpoints using the front panel RS232 port and the 469SETUP program, a passcode is required if enabled.

- To enable passcode protection on a new relay, press [ENTER] then [MESSAGE DOWN] until the displayed message is:

  CHANGE PASSCODE?
No

- Select "Yes" and follow directions to enter a new passcode from 1-8 digits.

  ENTER NEW PASSCODE
FOR ACCESS:

  ENTER NEW PASSCODE
AGAIN:

- Once a passcode other than 0 is programmed, this passcode must be entered to gain setpoint access each time setpoint access is restricted.
- Assuming that a non zero passcode has been programmed and setpoint access is restricted, then selecting the passcode subgroup will cause this message to appear:

  ENTER PASSCODE FOR
ACCESS:

- Enter the correct passcode that was previously programmed. A flash message will advise if the code is incorrect and allow a retry. If it is correct and the setpoint access jumper is installed this message will appear:

  SETPOINT ACCESS:
Permitted

- In this mode, setpoints can now be entered. Exit the passcode message group using the [ESCAPE] key and program the appropriate setpoints. If no keys are pressed for 5 minutes, programming access will no longer be allowed and the passcode must be re-entered. Removing the setpoint access jumper or selecting "Restricted" at the SETPOINT ACCESS message will also disable setpoint access immediately.
- If a new passcode is required, gain setpoint access by entering the current valid passcode as already described. Then press [MESSAGE DOWN] to display the CHANGE PASSCODE message and follow directions.
- If an invalid passcode is entered, an encrypted passcode may be viewed by pressing the [HELP] key. Consult the factory service department with this number if the currently programmed passcode is unknown. Using a deciphering program, the passcode can be determined.

4.2.2 PREFERENCES

y PREFERENCES y [ENTER] for more	
DEFAULT MESSAGE CYCLE TIME: 2.0 s	RANGE: 0.5 - 10.0 STEP: 0.5
DEFAULT MESSAGE TIMEOUT: 300s	RANGE: 10-900 STEP: 1
AVERAGE MOTOR LOAD CALC. PERIOD: 15 min	RANGE: 1 - 90 STEP: 1
TEMPERATURE DISPLAY: Celsius	RANGE: Celsius, Fahrenheit
TRACE MEMORY TRIGGER POSITION: 25%	RANGE: 1 - 100 STEP: 1
TRACE MEMORY BUFFERS 8x14 CYCLES	RANGE:1x64, 2x42, 3x32, 4x35, 5x21, 6x18, 7x16, 8x14, 9x12, 10x11, 11x10, 12x9, 13x9, 14x8, 15x8, 16x7 Sets the partitioning of the waveform capture buffer.
DISPLAY UPDATE INTERVAL: 0.4s	RANGE: 0.1 - 6.0 STEP: 0.1
MOTOR LOAD FILTER INTERVAL: 0 cycles	RANGE: 0 - 32 STEP: 1 NOTE: 0 is off, setpoint hidden if frequency set to variable

FUNCTION:
Some of the SR469 characteristics can be modified to suit different situations. Normally "PREFERENCES" will not require changes.

DEFAULT MESSAGE CYCLE TIME: If multiple default messages are chosen, the SR469 display will automatically cycle through those messages. The time these messages remain on the display can be changed to accommodate different user reading rates.

DEFAULT MESSAGE TIMEOUT: If no keys are pressed for a period of time then the relay will automatically scan a programmed set of default messages. This time can be modified to ensure messages remain on the screen long enough during programming or reading actual values. Once default scanning starts, pressing any key will return the last message viewed to the screen.

AVERAGE MOTOR LOAD CALCULATION PERIOD: The period of time over which the average motor load is calculated may be adjusted with this setpoint. The calculation is a sliding window and is ignored during motor starting.

TEMPERATURE DISPLAY: Measurements of temperature may be displayed in either Celsius or Fahrenheit. Each Actual Value message where a temperature value is displayed will be denoted by either '°C' for Celsius, or '°F' for Fahrenheit. RTD Setpoints are always displayed in Celsius.

TRACE MEMORY TRIGGER POSITION: This determines the position of the trigger for waveform capture. The number programmed represents the percentage of cycles that will be captured and recorded in the trace memory buffer prior to the trigger (trip).

TRACE MEMORY BUFFERS: This determines the number of traces that will be captured and the number of cycles for each of the 10 waveforms captured. Note: 10 waveforms are captured for each trace showing all currents and voltages.

DISPLAY UPDATE INTERVAL: This value represents the duration for which the metered current and voltage readings are averaged before being displayed. It does not affect relay protection or function timing in any way. It can be used to steady the display when readings are bouncing.

MOTOR LOAD FILTER INTERVAL: This value (when non-zero) will average current and PF for the programmed number of cycles using a running average technique. This setpoint is intended for use on synchronous motors running at low RPMs and driving reciprocating loads. The number of cycles to average can be determined by using current waveform capture. From viewing this waveform the number of cycles can be determined to complete one stroke. This value can be used as the starting point for the motor load filter interval. Additional fine tuning may be required.
Warning: This averaging may increase trip/alarm times by 16.7ms for every cycle averaged.

4.2.3 SERIAL PORTS

y SERIAL PORTS y [ENTER] for more	
SLAVE ADDRESS: 254	RANGE: 1-254 STEP:1
COMPUTER RS485 BAUD RATE: 9600	RANGE: 300, 1200, 2400, 4800, 9600, 19200
COMPUTER RS485 PARITY: None	RANGE: None, Odd, Even
AUXILIARY RS485 BAUD RATE: 9600	RANGE: 300, 1200, 2400, 4800, 9600, 19200
AUXILIARY RS485 PARITY: None	RANGE: None, Odd, Even

FUNCTION:
The SR469 is equipped with 3 serial communications ports supporting a subset of Modbus RTU protocol. The front panel RS232 has a fixed baud rate of 9600, a fixed data frame of 1 start/8 data/1stop/no parity. The front port is intended for local use only and will respond regardless of the slave address programmed. The front panel RS232 program port may be connected to a personal computer running the 469SETUP program. This program may be used for downloading and uploading setpoint files, or, it may be used to reprogram the SR469 software to the latest revision.

For RS485 communications, each SR469 must have a unique address from 1-254. Address 0 is the broadcast address which all relays listen to. Addresses do not have to be sequential but no two units can have the same address or conflicts resulting in errors will occur. Generally each unit added to the link will use the next higher address starting at 1. Baud rates can be selected as 300,1200, 2400, 4800, 9600, or 19200. The data frame is fixed at 1 start, 8 data, and 1 stop bits, while parity is optional. The computer RS485 port is a general purpose port for connection to a DCS, PLC, or PC. The Auxiliary RS485 port may be used for redundancy or, it may be used to talk to Auxiliary Multilin Devices in the future.

4.2.4 REAL TIME CLOCK

y REAL TIME CLOCK y [ENTER] for more	ENTER / ESCAPE	DATE (MM.DD.YYYY): 01/01/1994	RANGE: 01-12/01-31/1995-2094 STEP:1
	ESCAPE / MESSAGE	TIME (HH.MM.SS): 12:00:00	RANGE: 00-23:00-59:00.0-59 STEP:1

FUNCTION:

For events that are recorded by the event recorder to be correctly time/date stamped, the correct time and date must be entered. A battery backed internal clock runs continuously even when power is off. It has the same accuracy as an electronic watch approximately +/- 1 minute per month. It must be periodically corrected either manually through the front panel or via the clock update command over the RS485 serial link. If the approximate time an event occurred without synchronization to other relays is sufficient then entry of time/date from the front panel keys is adequate.

If the RS485 serial communication link is used then all the relays can keep time in synchronization with each other. A new clock time is pre-loaded into the memory map via the RS485 communications port by a remote computer to each relay connected on the communications channel. The computer broadcasts (address 0) a "set clock" command to all relays. Then all relays in the system begin timing at the exact same instant. There can be up to 100mS of delay in receiving serial commands so the clock time in each relay is +/- 100mS, +/- absolute clock accuracy in the PLC or PC. See the chapter on Communications for information on programming the time preload and synchronizing commands.

4.2.5 DEFAULT MESSAGES

y DEFAULT MESSAGES y [ENTER] for more	ENTER / ESCAPE	MOTOR STATUS: Stopped	RANGE: N/A
	ESCAPE / MESSAGE	A: 0 B: 0 C: 0 AMPS	RANGE: N/A
	ESCAPE / MESSAGE	MOTOR LOAD: 0.00 x FLA	RANGE: N/A
	ESCAPE / MESSAGE	CURRENT UNBALANCE: 0 %	RANGE: N/A
	ESCAPE / MESSAGE	DATE: 01/01/1995 TIME: 12:00:00	RANGE: N/A
	ESCAPE / MESSAGE	MULTILIN SR469 Motor Management Relay	RANGE: N/A

FUNCTION:
After a period of time, the display will change to the default display messages. Between 1-20 default messages can be selected. If more than one message is chosen, default messages will automatically scan in sequence changing at a rate determined by the setpoint S1 SR469 SETUP /PREFERENCES /DEFAULT MESSAGE CYCLE TIME. Any Actual Value can be selected for default display. In addition, up to 5 user programmable messages can be created and displayed (Message Scratchpad). For example, the relay could be set to alternately scan a motor identification message, the current in each phase and the hottest stator RTD. Default messages that are currently selected can be viewed in DEFAULT MESSAGES subgroup.

ADDING DEFAULT MESSAGES

Default messages can be added to the end of the default message list, as follows:

- Allow setpoint entry by entering the correct passcode at S1 SR469 SETUP /PASSCODE /ENTER PASSCODE FOR ACCESS (unless the passcode has already been entered or unless the passcode is 0 defeating the passcode security feature).
- Move to the message that is to be added to the default message list, using the [ENTER], [MESSAGE UP], and [MESSAGE DOWN] keys. The selected message can be any ACTUAL VALUE or MESSAGE SCRATCHPAD message.
- Press [ENTER]. The following message will be displayed for 5 seconds:

```
PRESS [ENTER] TO ADD
DEFAULT MESSAGE
```

- Press [ENTER] again while this message is being displayed to add the current message to the end of the default message list.
- If the procedure was followed correctly, the following flash message will be displayed:

```
DEFAULT MESSAGE
HAS BEEN ADDED
```

- To verify that the message was added, view the last message under the subheading S1 SR469 SETUP /DEFAULT MESSAGES

REMOVING DEFAULT MESSAGES

Default messages can be removed from the default message list, as follows:

- Allow setpoint entry by entering the correct passcode at S1 SR469 SETUP /PASSCODE /ENTER PASSCODE FOR ACCESS (unless the passcode has already been entered or unless the passcode is 0 defeating the passcode security feature).
- Move to the message that is to be removed from the default message list under the subheading S1 SR469 SETUP /DEFAULT MESSAGES.
- When the default message to be removed is displayed, press [ENTER]. The following message will be displayed:

```
PRESS [ENTER] TO
REMOVE MESSAGE
```

- Press [ENTER] while this message is being displayed to remove the current message out of the default message list.
- If the procedure was followed correctly, the following flash message will be displayed:

```
DEFAULT MESSAGE
HAS BEEN REMOVED
```

4.2.6 MESSAGE SCRATCHPAD

y MESSAGE SCRATCHPAD y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	TEXT 1	RANGE: 40 Character Alphanumeric
	ESCAPE / MESSAGE ⇳	TEXT 2	RANGE: 40 Character Alphanumeric
	ESCAPE / MESSAGE ⇳	TEXT 3	RANGE: 40 Character Alphanumeric
	ESCAPE / MESSAGE ⇳	TEXT 4	RANGE: 40 Character Alphanumeric
	ESCAPE / MESSAGE ⇧	MULTILIN SR469 MOTOR MANAGEMENT RELAY	RANGE: 40 Character Alphanumeric

FUNCTION:

Up to 5 message screens can be programmed under the Message Scratchpad area. These messages may be notes that pertain to the installation or the motor. In addition, these notes may be selected for scanning during default message display. This might be useful for reminding operators to perform certain tasks. The messages may be entered from the communications ports or through the keypad. To enter a 40 character message:

- Select the user message to be changed
- Press the [.] key to enter text mode. An underline cursor will appear under the first character.
- Use the [VALUE UP] / [VALUE DOWN] key to display the desired character. A space is selected like a character.

- Press the [.] key to advance to the next character. To skip over a character press the [.] key. If an incorrect character is accidentally stored, press the [.] key enough times to scroll the cursor around to the character.

- When the desired message is displayed press the [ENTER] key to store or the [ESCAPE] key to abort. The message is now permanently stored. Press [ESCAPE] to cancel the altered message.

4.2.7 CLEAR DATA

Menu	Keys	Message	Range
y CLEAR DATA y [ENTER] for more	ENTER / ESCAPE	CLEAR LAST TRIP DATA: No	RANGE: No, Yes
	ESCAPE / MESSAGE	RESET MWh and Mvarh METERS: No	RANGE: No, Yes
	ESCAPE / MESSAGE	CLEAR PEAK DEMAND DATA: No	RANGE: No, Yes
	ESCAPE / MESSAGE	CLEAR RTD MAXIMUMS: No	RANGE: No, Yes
	ESCAPE / MESSAGE	CLEAR ANALOG I/P MIN/MAX:No	RANGE: No, Yes
	ESCAPE / MESSAGE	CLEAR TRIP COUNTERS: No	RANGE: No, Yes
	ESCAPE / MESSAGE	PRESET DIGITAL COUNTER: No	RANGE: No, Yes
	ESCAPE / MESSAGE	CLEAR EVENT RECORD: No	RANGE: No, Yes

FUNCTION:

These commands may be used to clear various historical data.

CLEAR LAST TRIP DATA: The Last Trip Data may be cleared by executing this command.

RESET MWh and Mvarh METERS: Executing this command will reset the MWh and Mvarh metering to zero.

CLEAR PEAK DEMAND DATA: Execute this command to clear peak demand values.

CLEAR RTD MAXIMUMS: All maximum RTD temperature measurements are stored and updated each time a new maximum temperature is established. Execute this command to clear the maximum values.

CLEAR ANALOG I/P MIN/MAX: The minimum and maximum Analog Input values are stored for each Analog Input. Those minimum and maximum values may be cleared at any time.

CLEAR TRIP COUNTERS: There are counters for each possible type of trip. Those counters may be cleared by executing this command.

PRESET DIGITAL COUNTER: When one of the assignable Digital Inputs is configured as Counter, the counter may be preset with this command. If the counter is of the incrementing type, setting the preset value to 0 will effectively clear or reset the counter.

CLEAR EVENT RECORD: The event recorder saves the last 40 events, automatically overwriting the oldest event. If desired, all events can be cleared using this command to prevent confusion with old information.

4.2.8 INSTALLATION

y INSTALLATION y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	RESET MOTOR INFORMATION: No	RANGE: No, Yes
	ESCAPE / MESSAGE ⇧	RESET STARTER INFORMATION: No	RANGE: No, Yes

FUNCTION:

These commands may be used to clear various information and historical data when the SR469 is first applied on a new installation.

RESET MOTOR INFORMATION: Counters for number of motor starts and number of emergency restarts can be viewed in Actual Values. The SR469 also learns various motor characteristics through motor operation. These Learned Parameters include acceleration time, starting current, and starting thermal capacity. Total motor running hours may also be viewed in Actual Values. On a new installation or if new equipment is installed, all this information can be reset with this setpoint.

RESET STARTER INFORMATION: The total number of starter operations can be viewed in Actual Values. On a new installation or if maintenance work is done on the breaker or contactor, this accumulator can be cleared with this setpoint.

4.3.1 CURRENT SENSING

	y CURRENT SENSING y [ENTER] for more	
ENTER / ESCAPE	PHASE CT PRIMARY: Not Programmed	RANGE: 1-5000, Not Programmed STEP: 1
ESCAPE / MESSAGE	MOTOR FULL LOAD AMPS FLA: Not Programmed	RANGE: 1-5000, Not Programmed STEP: 1
ESCAPE / MESSAGE	GROUND CT : Multilin 50:0.025	RANGE: None, 1A Secondary, 5A Secondary, Multilin 50:0.025
ESCAPE / MESSAGE	GROUND CT PRIMARY: 100 A	RANGE: 1-5000, STEP: 1 NOTE: this message seen only if the Ground CT selection above is 1A or 5A Secondary
ESCAPE / MESSAGE	PHASE DIFFERENTIAL CT: None	RANGE: None, 1A Secondary, 5A Secondary
ESCAPE / MESSAGE	PHASE DIFFERENTIAL CT PRIMARY: 100 A	RANGE: 1 - 5000, STEP: 1 NOTE: this message seen only if the Differential CT selection above is 1A or 5A Secondary
ESCAPE / MESSAGE	ENABLE 2-SPEED MOTOR PROTECTION: No	RANGE: Yes, No
ESCAPE / MESSAGE	SPEED2 PHASE CT PRIMARY: 100 A	RANGE: 1 - 5000 STEP:1 NOTE: this message seen only if the 2-Speed motor protection is enabled
ESCAPE / MESSAGE	SPEED2 MOTOR FLA: 1 A	RANGE: 1 - 5000, STEP: 1 NOTE: this message seen only if the 2-Speed motor protection is enabled

FUNCTION:

As a safeguard, when a unit is received from the factory, the Phase CT primary and Motor FLA will be defaulted to 'Not Programmed'. A block start will indicate that the SR469 was never programmed. Once Phase CT Primary and Motor FLA are entered, the alarm will reset itself. The phase CT should be chosen such that the FLA is no less than 50 % of the rated phase CT primary. Ideally, the phase CT primary should be chosen such that the FLA is 100 % of the phase CT primary or slightly less, never more. The secondary value of 1 or 5 amps **must** be specified at the time of order, so that the proper hardware will be installed. A value for Motor Full Load Amps (FLA) must also be entered. The value may be taken from the motor nameplate or motor data sheets. Service Factor may be entered as Overload Pickup, described later (S5 PROTECTION under THERMAL MODEL).

For high resistance grounded systems, sensitive ground current detection is possible if the 50/.025 ground CT input is used. To use the 50/.025 input, select Multilin 50/.025 for the GROUND CT setpoint. No additional ground CT messages will appear. On solidly grounded systems, where fault currents may be quite large, the SR469 1A or 5A secondary ground CT input should be used for either Zero Sequence or Residual ground sensing. If the connection is Residual, the Ground CT Secondary and Primary values should be the same as the phase CT. If however, the connection is Zero Sequence, the Ground CT Secondary and Primary values must be entered. The Ground CT primary should be selected such that potential fault current does not exceed 20 times the primary rating. When relaying class CTs are purchased, this precaution will ensure that the Ground CT does not saturate under fault conditions.

A value for Differential CT Primary must be entered if the differential feature is to be used. If two CTs are used per phase in a vectorial summation configuration, the CTs should be chosen to ensure there is no saturation during motor starting. If however, a core balance CT is used for the differential protection in each phase, a low CT rating of 50 or 100 A allows for very sensitive differential protection.

When the 2-Speed motor feature is used, a value for a second set of Phase CTs and motor FLA must be entered here for Speed 2. If the Phase CTs are the same as the speed 1 phase CTs, simply enter the same value here as well.

EXAMPLE:

Motor Nameplate FLA: 87 A
Low Resistance Grounded, Maximum Fault: 400 A
SR469 purchased with 5 A phase CT Secondary
Ground Fault Detection to be Residual
Set: Phase CT Primary: 100
Motor Full Load Amps: 87
Ground CT: 5 A Secondary
Ground CT Primary: 100

Motor Nameplate FLA: 255 A
Solidly Grounded, Maximum Fault: 10000 A
Zero Sequence Ground CT: (10000/20) 500:1
Set: Phase CT Primary: 300
Motor Full Load Amps: 255
Ground CT: 5 A Secondary
Ground CT Primary: 500

Motor Nameplate FLA: 330 A
High Resistance Grounded, Maximum Fault: 5 A
Set: Phase CT Primary: 350
Motor Full Load Amps: 330
Ground CT: Multilin 50/.025

4.3.2 VOLTAGE SENSING

y VOLTAGE SENSING y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	VT CONNECTION TYPE: None	RANGE: Open Delta, Wye, None
	ESCAPE / MESSAGE ⇧	ENABLE SINGLE VT OPERATION: OFF	RANGE: AN, BN, CN, OFF or AB, CB, OFF NOTE: This message will only be seen if VT Connection Type is Wye or Open Delta.
	ESCAPE / MESSAGE ⇳	VOLTAGE TRANSFORMER RATIO: 35.00:1	RANGE: 1.00:1 - 300.00:1 STEP: 0.01
	ESCAPE / MESSAGE ⇧	MOTOR NAMEPLATE VOLTAGE: 4000V	RANGE: 100 - 20000 STEP: 1

FUNCTION:
The manner in which the voltage transformers are connected must be entered here. A value of ''None', indicates that no voltage measurement is required.

Note that phase reversal is disabled for single VT operation. All voltages are assumed balanced. Also, frequency is only available for AN or AB connections.

If voltage measurements are to be made, the turns ratio of the voltage transformers must be entered. The VT ratio must be chosen such that the secondary voltage of the VTs is between 40 and 240 V when the primary is at Motor Nameplate Voltage.

All voltage protection features that require a level setpoint are programmed as a percent of the Motor Nameplate Voltage or rated voltage. Where Motor Nameplate Voltage represents the rated design voltage line to line.

EXAMPLE:

ⓘ
Motor Nameplate Voltage is 4160 V
VTs are 4160/120 Open Delta

Set: VT Connection Type: Open Delta
VT Ratio: 34.67:1
Motor Nameplate Voltage: 4160

4.3.3 POWER SYSTEM

y POWER SYSTEM y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	NOMINAL SYSTEM FREQUENCY: 60 Hz	RANGE: 50 Hz, 60 Hz, Variable
	ESCAPE / MESSAGE ⇧	SYSTEM PHASE SEQUENCE: ABC	RANGE: ABC, ACB
	ESCAPE / MESSAGE ⇧	SPEED2 PHASE SEQUENCE: ABC	RANGE: ABC, ACB NOTE: this message seen only if the 2-Speed motor protection is enabled

FUNCTION:
The nominal system frequency must be entered here. This setpoint allows the SR469 to determine the internal sampling rate for maximum accuracy.

The SR469 may be used on variable frequency drives when the Nominal System Frequency is chosen as Variable. All of the elements function in the same manner with the following exceptions: the ratio of negative to positive sequence current is calculated from 0–30%, not 40%, and the voltage and power elements will work properly if the voltage waveform is approximately sinusoidal. An unfiltered voltage waveform from a pulse width modulated drive cannot be measured accurately; however, the current waveform is approximately sinusoidal and can be measured accurately. All current elements will function properly. Note, however, that undervoltage and underfrequency elements will not work as instantaneous using variable frequency. If variable is chosen, the filtering algorithm will increase trip and alarm times by up to a maximum of 270ms when the level is close to the threshold. If the level exceeds the threshold by a significant amount, trip and alarm times will decrease until they match the programmed delay. The exceptions to this increased time are the short circuit, ground fault, and differential elements which will trip as per specification.

If the sequence of phase rotation for a given plant is ACB rather than the standard ABC, the System Phase Sequence setpoint may be used to accommodate this. This setpoint allows the SR469 to properly calculate Phase Reversal, Negative Sequence, and power quantities. The Speed2 Phase Sequence can be programmed to accommodate the reversed motor rotation at Speed2.

4.3.4 SERIAL COMMUNICATION CONTROL

y SERIAL COM.CONTROL y [ENTER] for more	ENTER / ESCAPE	SERIAL COMMUNICATION CONTROL: Off	RANGE: On, Off
	ESCAPE / MESSAGE	ASSIGN START CONTROL RELAYS: Auxiliary2	RANGE: Auxiliary2, Aux2 & Aux3, Auxiliary3

If enabled, motor starting and stopping is possible via any of the three SR469 communication ports. Refer to the Communications chapter for command formats. When a stop command is issued, the R1 TRIP relay will be activated for 1 second to complete the trip coil circuit for a breaker application or break the contact coil circuit for a contactor application. When a start command is issued, the auxiliary relay assigned for starting control will be activated for 1 second to complete the close coil circuit for a breaker application or complete the start control circuit for a contactor application. A contactor sealing contact would be used to maintain the circuit.

To issue a start or stop command via communications see Chapter 6 section 6.3.3, function code 05 “Execute Operation”.

4.3.5 REDUCED VOLTAGE

y REDUCED VOLTAGE y [ENTER] for more	ENTER / ESCAPE	REDUCED VOLTAGE STARTING: Off	RANGE: On, Off
	ESCAPE / MESSAGE	ASSIGN CONTROL RELAYS: Auxiliary3	RANGE: Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	TRANSITION ON: Current Only	RANGE: Current Only, Current or Timer, Current and Timer
	ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: TRIP	RANGE: Trip, Trip & Aux.2, Trip & Aux.2 & Aux.3, Trip & Aux.3
	ESCAPE / MESSAGE	REDUCED VOLTAGE START LEVEL: 100% FLA	RANGE: 25 - 300 STEP: 1
	ESCAPE / MESSAGE	REDUCED VOLTAGE START TIMER: 200 s	RANGE: 1 - 500 STEP: 1

FUNCTION:

The SR469 is capable of controlling the transition of a reduced voltage starter from reduced to full voltage. That transition may be based on Current Only, Current and Time, or Current or Time (whichever comes first). When the SR469 measures the transition of no motor current to some value of motor current, a 'Start' is assumed to be occurring (typically current will rise quickly to a value in excess of FLA e.g. 3 x FLA). At this point, the Reduced Voltage Start Timer will be initialized with the programmed value in seconds.

- If Current Only is selected, when the motor current falls below the user's programmed Transition Level, transition will be initiated by activating the assigned output relay for 1 second. If the timer expires before that transition is initiated, an Incomplete Sequence Trip will occur activating the assigned trip relay(s).
- If Current or Timer is selected, when the motor current falls below the user's programmed Transition Level, transition will be initiated by activating the assigned output relay for 1 second. If the timer expires before that transition is initiated, the transition will be initiated regardless.
- If Current and Timer is selected, when the motor current falls below the user's programmed Transition Level and the timer expires, transition will be initiated by activating the assigned output relay for 1 second. If the timer expires before current falls below the Transition Level, an Incomplete Sequence Trip will occur activating the assigned trip relay(s).

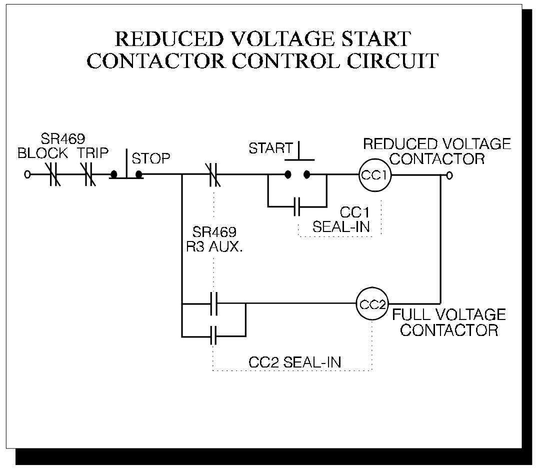


Figure 4-1 REDUCED VOLTAGE START CONTACTOR CONTROL CIRCUIT

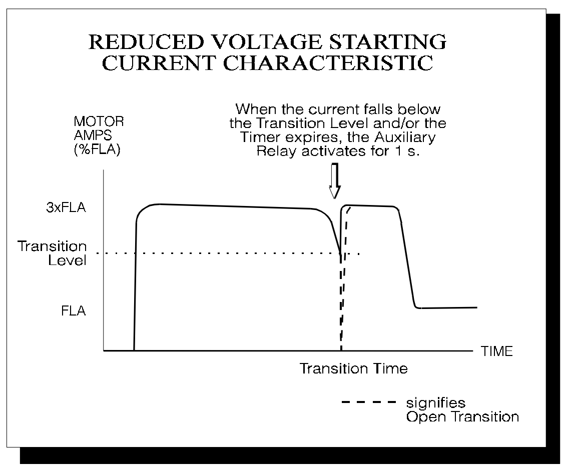


Figure 4-2 REDUCED VOLTAGE STARTING CURRENT CHARACTERISTIC

NOTE: If this feature is used, Starter Status Switch input must be either from a common control contact or a parallel combination of Auxiliary ‘a’ contacts or a series combination of Auxiliary ‘b’ contacts from the reduced voltage contactor and the full voltage contactor. Once transition is initiated, the SR469 will assume the motor is still running for at least 2 seconds. This will prevent the SR469 from recognizing an additional start if motor current goes to zero during an open transition.

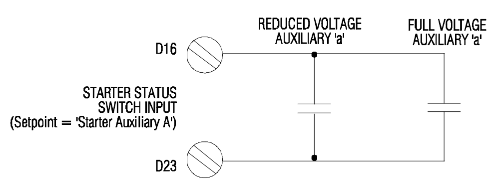


Figure 4-3 REDUCED VOLTAGE STARTER AUXILIARY A STATUS INPUT

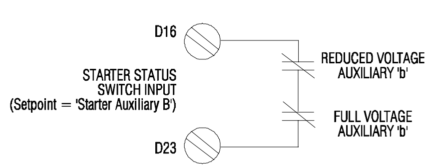


Figure 4-4 REDUCED VOLTAGE STARTER AUXILIARY B STATUS INPUT

Page 3 of setpoints has been designated the 'DIGITAL INPUTS' page. The SR469 has nine digital inputs.

Five of the SR469 digital inputs have been pre-assigned as switches having a specific function. Four of the five pre-assigned digital inputs are always functional and do not have any setpoint messages associated with them. The fifth, the Starter Status, may be configured for either an 'a' or 'b' auxiliary contact. The remaining four digital inputs are assignable; that is to say, the function that the input is used for may be chosen from one of a number of different functions. Some of those functions are very specific, others may be programmed to adapt to the user requirements. If the Two-Speed Motor feature is enabled, ASSIGNABLE INPUT4 will be dedicated as the Two-Speed Motor Monitor.

4.4.1 ACCESS SWITCH

Terminals C1 and C2 ***must*** be shorted to allow changing of any setpoint values. This safeguard is in addition to the setpoint passcode feature, which functions independently (S1 SR469 SETUP /PASSCODE).

4.4.2 TEST SWITCH

Once the SR469 is in service, it may be tested from time to time as part of a regular maintenance schedule. The relay will have accumulated statistical information relating historically to starter and motor operation. This information includes: last trip data, demand data (if the metering features are in use), MWh and Mvarh metering, RTD maximums, the event record, analog input minimums and maximums, number of motor trips, number of trips by type, total motor running hours, learned parameters, number of starter operations, number of motor starts, number of emergency restarts, and the digital counter. When the relay is under test, Shorting the SR469 Test input (C3 and C4) will prevent all of this data from being corrupted or updated. The SR469 in Service LED (indicator) will flash while the SR469 Test terminals are shorted.

4.4.3 EMERGENCY RESTART

Shorting terminals D17 and D23 will discharge the thermal capacity used to zero, zero any Starts/Hour Block lockout, zero any Time Between Starts Block lockout, and reset all Trips and Alarms so that a hot motor may be restarted. However, a Restart Block lockout will remain active (it may be used as a backspin timer) and any trip condition that is still present such as a hot RTD will still cause a trip. Therefore, while the terminals are shorted, the Trip and Block output relays will remain in their normal non-operated state. In the event of a real emergency, the Emergency Restart terminals should remain shorted until the emergency is over. Also, while the Emergency Restart terminals are shorted, a Service Alarm message will indicate any trips or blocks that are active. As the name implies, this feature should only be used in an emergency as it defeats the purpose of the Relay, PROTECTING THE MOTOR. Any Emergency Restart input transition from open to closed or closed to open will be logged as an event.

4.4.4 REMOTE RESET

Shorting terminals D18 and D23 will reset any trips or latched alarms provided that the condition that caused the alarm or trip is no longer present.

If there is a lockout time the Block Start relay will not reset until the lockout time has expired.

4.4.5 STARTER STATUS

y STARTER STATUS y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	STARTER STATUS SW: Starter Auxiliary a	RANGE: Starter Auxiliary a, Starter Auxiliary b

FUNCTION:

This input is ***necessary*** for all motors. The SR469 determines that a motor has stopped when the phase current falls below the level that the relay can measure (5% of CT primary). Monitoring an auxiliary contact from the breaker or contactor prevents the relay from detecting additional starts when an unloaded motor is loaded, or issuing a block start after an unloaded motor is started and running at less than 5% CT rated primary current.

Once 'Starter Auxiliary a' is chosen, terminals D16 and D23 will be monitored to detect the state of the breaker or contactor, open signifying the breaker or contactor is open and shorted signifying the breaker or contactor is closed. The SR469 will then determine that a motor has made the transition from 'running' to 'stopped' only when the measured current is less than 5% CT ratio **and** the 'a' contact is open.

Once 'Starter Auxiliary b' is chosen, the terminals D16 and D23 will be monitored to detect the state of the breaker or contactor, open signifying the breaker or contactor is closed and shorted signifying the breaker or contactor is open. The SR469 will then determine that a motor has made the transition from 'running' to 'stopped' only when the measured current is less than 5% CT ratio **and** the 'b' contact is closed.

4.4.6 ASSIGNABLE DIGITAL INPUTS

y ASSIGNABLE INPUT1 y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	INPUT 1 FUNCTION: Off	RANGE: Off , Remote Alarm, Remote Trip, Speed Switch Trip, Load Shed Trip, Pressure Sw. Alarm, Pressure Switch Trip, Vibration Sw. Alarm, Vibration Sw. Trip, Digital Counter, Tachometer, General Sw. A, General Sw. B, General Sw. C, General Sw. D, Capture Trace, Simulate Pre-Fault, Simulate Fault, Simulate Pre-Fault...Fault.
⇳ MESSAGE		*Messages that follow are dictated by the function chosen.*	
y ASSIGNABLE INPUT2 y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	INPUT 2 FUNCTION: Off	RANGE: Off , Remote Alarm, Remote Trip, Speed Switch Trip, Load Shed Trip, Pressure Sw. Alarm, Pressure Switch Trip, Vibration Sw. Alarm, Vibration Sw. Trip, Digital Counter, Tachometer, General Sw. A, General Sw. B, General Sw. C, General Sw. D, Capture Trace, Simulate Pre-Fault, Simulate Fault, Simulate Pre-Fault...Fault.
⇳ MESSAGE		*Messages that follow are dictated by the function chosen.*	
y ASSIGNABLE INPUT3 y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	INPUT 3 FUNCTION: Off	RANGE: Off , Remote Alarm, Remote Trip, Speed Switch Trip, Load Shed Trip, Pressure Sw. Alarm, Pressure Switch Trip, Vibration Sw. Alarm, Vibration Sw. Trip, Digital Counter,Tachometer, General Sw. A, General Sw. B, General Sw. C, General Sw. D, Capture Trace, Simulate Pre-Fault, Simulate Fault, Simulate Pre-Fault...Fault.
⇳ MESSAGE		*Messages that follow are dictated by the function chosen.*	
y ASSIGNABLE INPUT4 y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	INPUT 4 FUNCTION: Off	RANGE: Off , Remote Alarm, Remote Trip, Speed Switch Trip, Load Shed Trip, Pressure Sw. Alarm, Pressure Switch Trip, Vibration Sw. Alarm, Vibration Sw. Trip, Digital Counter, Tachometer, General Sw. A, General Sw. B, General Sw. C, General Sw. D, Capture Trace, Simulate Pre-Fault, Simulate Fault, Simulate Pre-Fault...Fault.
⇧ MESSAGE		*Messages that follow are dictated by the function chosen.*	

FUNCTION:

There are four user assignable digital inputs that may be configured to any one of a number of different functions, or turned Off. Once a function is chosen, any messages that follow may be used to set pertinent parameters for operation. Each function may only be chosen once. Assignable Inputs 1-4 will be activated by shorting D19 - D22 (respectively) with D23.

INPUT 4 FUNCTION IS
TWO-SPEED MONITOR

The two-speed motor protection is enabled in S2 SYSTEM SETUP\CURRENT SENSING. If the Two-Speed Motor feature is enabled, ASSIGNABLE INPUT4 will be dedicated as the Two-Speed Motor Monitor. Terminals D22 and D23 will be monitored for a contact closure. Closure of the contact will signify that the motor is in Speed 2 or High Speed. If the input is open, it signifies that the motor is in Speed 1. This allows the SR469 to determine which setpoints should be active at any given point in time.

4.4.7 DIGITAL INPUT FUNCTION: REMOTE ALARM

REMOTE ALARM NAME: Remote Alarm	RANGE: 20 Character Alphanumeric
REMOTE ALARM: Unlatched	RANGE: Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
REMOTE ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

Once the Remote Alarm function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. An alarm relay may be selected and the name of the alarm may be altered. A contact closure on the digital input assigned as Remote Alarm will cause an alarm within 100 ms with the name that has been chosen. Multiple sources may be used to trigger a remote alarm by paralleling inputs.

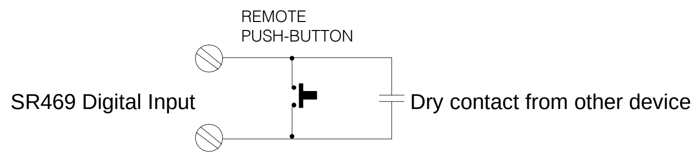


Figure 4-5 REMOTE ALARM FROM MULTIPLE SOURCES

4.4.8 DIGITAL INPUT FUNCTION: REMOTE TRIP

REMOTE TRIP NAME: Remote Trip	RANGE: 20 Character Alphanumeric
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3

FUNCTION:

Once the Remote Trip function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. A trip relay may be selected and the name of the trip may be altered. A contact closure on the digital input assigned as Remote Trip will cause a trip within 100 ms with the name that has been chosen. Multiple sources may be used to trigger a remote trip by paralleling inputs.

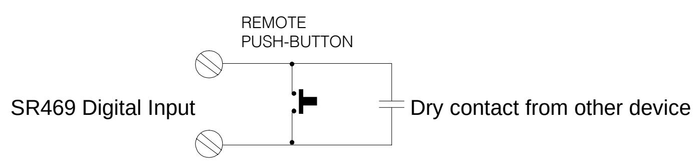


Figure 4-6 REMOTE TRIP FROM MULTIPLE SOURCES

4.4.9 DIGITAL INPUT FUNCTION: SPEED SWITCH TRIP

ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
SPEED SWITCH TRIP TIME DELAY: 5.0 s	RANGE: 1.0 - 250.0 STEP: 0.1

FUNCTION:

When this function is assigned to a digital input, the following will occur. When a transition from stopped to start is detected a timer will be loaded with the delay programmed. If that delay expires before a contact closure is detected, a trip will occur. Once the motor is stopped, the scheme is reset.

4.4.10 DIGITAL INPUT FUNCTION: LOAD SHED TRIP

ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3

FUNCTION:

Once the Load Shed Trip function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. A trip relay may be selected. A contact closure on the switch input assigned as Load Shed Trip will cause a trip within 100 ms

4.4.11 DIGITAL INPUT FUNCTION: PRESSURE SWITCH ALARM

BLOCK PRES.SW. ALARM FROM START: 0 s	RANGE: 0 - 5000 (0 indicates feature is active while motor is stopped as well as running) STEP: 1
PRESSURE SWITCH ALARM: Unlatched	RANGE: Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
PRESSURE SW. ALARM DELAY: 5.0 s	RANGE: 0.1 - 100.0 STEP: 0.1
PRESSURE SW. ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

Once the Pressure Switch Alarm function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. The Pressure Switch alarm feature may be blocked for a specified period of time from a motor start. A value of zero for the Block time indicates that the feature is always active, when the motor is stopped or running. After the block delay has expired, the digital input will be monitored. If a closure occurs, after the specified delay, an alarm will occur.

4.4.12 DIGITAL INPUT FUNCTION: PRESSURE SWITCH TRIP

BLOCK PRES.SW. TRIP FROM START: 0 s	RANGE: 0 - 5000 (0 indicates feature is active while motor is stopped as well as running) STEP: 1
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
PRESSURE SW. TRIP DELAY: 5.0 s	RANGE: 0.1 - 100.0 STEP: 0.1

FUNCTION:

Once the Pressure Switch Trip function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. The Pressure Switch trip feature may be blocked for a specified period of time from a motor start. A value of zero for the Block time indicates that the feature is always active, when the motor is stopped or running. After the block delay has expired, the digital input will be monitored. If a closure occurs, after the specified delay, a trip will occur.

4.4.13 DIGITAL INPUT FUNCTION: VIBRATION SWITCH ALARM

VIBRATION SWITCH ALARM: Unlatched	RANGE: Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Auxiliary3, Alarm & Aux2 & Aux3, Aux2 & Aux3, Auxiliary2, Auxiliary3
VIBRATION SW. ALARM DELAY: 5.0 s	RANGE: 0.1 - 100.0 STEP: 0.1
VIBRATION SW. ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

Once the Vibration Switch Alarm function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. When the motor is stopped or running, the digital input will be monitored. If a closure occurs, after the specified delay, an alarm will occur.

4.4.14 DIGITAL INPUT FUNCTION: VIBRATION SWITCH TRIP

ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
VIBRATION SW. TRIP DELAY: 5.0 s	RANGE: 0.1 - 100.0 STEP: 0.1

FUNCTION:

Once the Vibration Switch Trip function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. When the motor is stopped or running, the digital input will be monitored. If a closure occurs, after the specified delay, a trip will occur.

4.4.15 DIGITAL INPUT FUNCTION: DIGITAL COUNTER

COUNTER UNITS: Units	RANGE: 6 Characters Alpha-numeric
COUNTER PRESET VALUE: 0	RANGE: 0-1000000000 STEP: 1
COUNTER TYPE: Increment	RANGE: Increment, Decrement
COUNTER ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
COUNTER ALARM LEVEL: 100	RANGE: 0-1000000000 STEP: 1
COUNTER ALARM PICKUP: Over	RANGE: Over, Under
COUNTER ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

Once the Digital Counter function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. Each closure of the switch will be counted, by either adding or decrementing the counter value. An alarm may be configured when a certain count is reached. The counter value may be viewed in the ‘Counters’ sub-group of Actual Values, Page 4, ‘MAINTENANCE’

To initialize counter: Program value here and then go to Setpoints page 1 (S1), Clear Data section and change Preset Digital Counter to YES.

EXAMPLE:

A Capacitive proximity probe may be used to sense non-magnetic units that are passing by on a conveyor, glass bottles for instance. The probe could be powered from the +24V from the input switch power supply. The NPN transistor output could be taken to one of the assignable digital inputs configured as a counter.

4.4.16 DIGITAL INPUT FUNCTION: TACHOMETER

RATED SPEED: 3600 RPM	RANGE: 100-7200 STEP:1
TACHOMETER ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
TACHOMETER ALARM SPEED: 10 % Rated	RANGE: 5-100 STEP: 1
TACHOMETER ALARM DELAY: 1 s	RANGE: 1-250 STEP: 1
TACHOMETER ALARM EVENTS: Off	RANGE: On, Off
TACHOMETER TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
TACHOMETER TRIP SPEED: 10 % Rated	RANGE: 5-95 STEP: 1
TACHOMETER TRIP DELAY: 1 s	RANGE: 1-250 STEP: 1

FUNCTION:

Once the TACHOMETER function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. The period of time between each switch closure measured and converted to an RPM value based on one closure per revolution. A trip and alarm may be configured such that the motor or load must be at a certain speed within a set period of time from the initiation of motor starting. The tachometer trip and alarm are ignored while the motor is stopped. The RPM value may be viewed in the 'Speed' sub-group of Actual Values, Page 2, 'METERING'

EXAMPLE:

An inductive proximity probe or hall effect gear tooth sensor may be used to sense the key on the motor. The probe could be powered from the +24V from the input switch power supply. The NPN transistor output could be taken to one of the assignable switch inputs configured as a tachometer.

4.4.17 DIGITAL INPUT FUNCTION: GENERAL SWITCH A-D

SWITCH NAME: General Sw.A	RANGE: 12 Character Alphanumeric
GENERAL SWITCH A: Normally Open	RANGE: Normally Open, Normally Closed
BLOCK INPUT FROM START: 0 s	RANGE: 0 - 5000 (0 indicates feature is active while motor is stopped as well as running) STEP: 1
GENERAL SWITCH A ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
GENERAL SWITCH A ALARM DELAY: 5.0 s	RANGE: 0.1 - 5000.0 STEP: 0.1
GENERAL SWITCH A EVENTS: Off	RANGE: On, Off
GENERAL SWITCH A TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
GENERAL SWITCH A TRIP DELAY: 5.0 s	RANGE: 0.1 - 5000.0 STEP: 0.1

FUNCTION:

There are four General Switch functions that may be assigned to any of the four assignable digital inputs. Once a General Switch function is chosen for one of the assignable digital inputs, the setpoint messages shown here will follow the assignment message. An alarm and/or trip may then be configured for that input. The alarm and/or trip may be assigned a common name and a common block time from motor start if required (if the alarm is to be disabled until some period of time after he motor has been started). A value of zero for the Block time indicates that the feature is always active, when the motor is stopped or running. The switch may also be defined as normally open or normally closed. After the block delay has expired, the digital input will be monitored. If the switch is not in its normal state after the specified delay, an alarm or trip will occur.

4.4.18 DIGITAL INPUT FUNCTION: CAPTURE TRACE

FUNCTION:

This setting allows the user to capture a trace upon command via a switch input. The captured waveforms can then be displayed via the 469PC program.

4.4.19 DIGITAL INPUT FUNCTION: SIMULATE PRE-FAULT

FUNCTION:

This setting allows the user to start Simulate Pre-Fault mode as programmed in S13 via a switch input. This is typically used for relay or system testing.

4.4.20 DIGITAL INPUT FUNCTION: SIMULATE FAULT

FUNCTION:

This setting allows the user to start Simulate Fault mode as programmed in S13 via a switch input. This is typically used for relay or system testing.

4.4.21 DIGITAL INPUT FUNCTION: SIMULATE PRE-FAULT…FAULT

FUNCTION:

This setting allows the user to start Simulate Pre-Fault to Fault mode as programmed in S13 via a switch input. This is typically used for relay or system testing.

Five of the six output relays are always non-failsafe, R6 Service is always failsafe. As failsafe, R6 relay will be energized normally and de-energize when called upon to operate. It will also de-energize when control power to the SR469 is lost and therefore, be in its operated state. All other relays, being non-failsafe, will be de-energized normally and energize when called upon to operate. Obviously, when control power is lost to the SR469, the output relays must be de-energized and therefore, they will be in their non-operated state. Shorting bars in the drawout case ensure that when the SR469 is drawn out, no trip or alarm occurs. The R6 Service output will however indicate that the SR469 has been drawn out.

4.5.1 RELAY RESET MODE

y RELAY RESET MODE y [ENTER] for more	ENTER / ESCAPE	R1 TRIP: All Resets	RANGE: All Resets, Remote Reset Only, Keypad Reset Only
	ESCAPE / MESSAGE	R2 AUXILIARY: All Resets	RANGE: All Resets, Remote Reset Only, Keypad Reset Only
	ESCAPE / MESSAGE	R3 AUXILIARY: All Resets	RANGE: All Resets, Remote Reset Only, Keypad Reset Only
	ESCAPE / MESSAGE	R4 ALARM: All Resets	RANGE: All Resets, Remote Reset Only, Keypad Reset Only
	ESCAPE / MESSAGE	R5 BLOCK START Auto-Reset	RANGE: N/A
	ESCAPE / MESSAGE	R6 SERVICE: All Resets	RANGE: All Resets, Remote Reset Only, Keypad Reset Only

FUNCTION:

RESETTING THE SR469

A latched trip or alarm may be reset at any time, providing that the condition that caused the trip or alarm is no longer present. Unlatched trips and alarms will reset automatically once the condition is no longer present. If any condition may be reset, the Reset Possible LED will be lit. All Block Start features will reset automatically when the lockout time has expired and the trip has been reset.

The other relays may be programmed to All Resets which allows reset from the front keypad or the remote reset switch input or the communications port. Optionally, relays 1,2,3,4,6 may be programmed to reset by the Remote Reset Only (by the remote reset switch input or the communications port) or Keypad Reset Only (reset only by relay keypad).

WARNING: NO trip or alarm element must EVER be assigned to two output relays where one is Remote Reset Only and the other is Keypad Reset Only. The trip or alarm will be unresettable if this occurs.

EXAMPLE:

Serious trips such as Short Circuit and Ground Fault may be assigned to R2 so that they may only be reset via. the Remote Reset terminals (D18 and D23) or the Communication Port. The Remote Reset terminals would be connected to a keyswitch so that only authorized personnel could reset such a critical trip.

- Assign only Short Circuit and Ground Fault to R2
- Program R2 to Remote Reset Only

4.5.2 FORCE OUTPUT RELAY

y FORCE OUTPUT RELAY
y [ENTER] for more

ENTER / ESCAPE	OPERATE R1 RELAY: Disabled	RANGE: Disabled, Enabled
ESCAPE / MESSAGE	R1 OPERATE TIME: Static	RANGE: Static, 1 - 300 s
ESCAPE / MESSAGE	OPERATE R2 RELAY: Disabled	RANGE: Disabled, Enabled
ESCAPE / MESSAGE	R2 OPERATE TIME: Static	RANGE: Static, 1 - 300 s
ESCAPE / MESSAGE	OPERATE R3 RELAY: Disabled	RANGE: Disabled, Enabled
ESCAPE / MESSAGE	R3 OPERATE TIME: Static	RANGE: Static, 1 - 300 s
ESCAPE / MESSAGE	OPERATE R4 RELAY: Disabled	RANGE: Disabled, Enabled
ESCAPE / MESSAGE	R4 OPERATE TIME: Static	RANGE: Static, 1 - 300 s
ESCAPE / MESSAGE	OPERATE R5 RELAY: Disabled	RANGE: Disabled, Enabled
ESCAPE / MESSAGE	R5 OPERATE TIME: Static	RANGE: Static, 1 - 300 s

FUNCTION:

FORCING OUTPUT RELAYS

The output relays can be independently forced in static or dynamic mode. In static mode the selected relay will operate as long as it is in the ENABLED state. Only when the user enters DISABLE, will the selected relay reset. In dynamic mode the user specifies the operate time (1- 300 s) and the selected relay will operate for the specified duration.

The FORCE OUTPUT RELAY option is NOT allowed when the selected relay output is already active due to trip or alarm condition, when the SR469 is in start block condition, or when the SR469 is not in service.

IMPORTANT NOTE:

- THE FORCED RELAY WILL OVERRIDE ANY TRIP OR ALARM CONDITIONS.

(I.e. when the relay is forced and trip occurs, the relay will still be enabled when the trip condition is reset)

- CONTROL POWER LOSS IN THE SR469 WILL **RESET** ALL FORCED RELAYS.

4.6.1 MOTOR THERMAL LIMITS

One of the principle enemies of motor life is heat. When a motor is specified, the purchaser communicates to the manufacturer what the loading conditions and duty cycle will be, as well as, environment and other pertinent information about the driven load such as starting torque, etc. The manufacturer then provides a stock motor or builds a motor that should have a reasonable life under those conditions.

Motor thermal limits are dictated by the design of both the stator and the rotor. Motors have three modes of operation: locked rotor or stall (when the rotor is not turning), acceleration (when the rotor is coming up to speed), and running (when the rotor turns at near synchronous speed). Heating occurs in the motor during each of these conditions in very distinct ways. Typically, during motor starting, locked rotor and acceleration conditions, the motor is rotor limited. That is to say that the rotor will approach its thermal limit before the stator. Under locked rotor conditions, voltage is induced in the rotor at line frequency, 50 or 60 Hz. This voltage causes a current to flow in the rotor, also at line frequency, and the heat generated (I^2R) is a function of the effective rotor resistance. At 50 or 60 Hz, the reactance of the rotor cage causes the current to flow at the outer edges of the rotor bars. The effective resistance of the rotor is therefore at a maximum during a locked rotor condition as is rotor heating. When the motor is running at rated speed, the voltage induced in the rotor is at a low frequency (approx. 1 Hz) and therefore, the effective resistance of the rotor is reduced quite dramatically. During running overloads, the motor thermal limit is typically dictated by stator parameters. Some special motors might be all stator or all rotor limited. During acceleration, the dynamic nature of the motor slip dictates that rotor impedance is also dynamic, and a third overload thermal limit characteristic is necessary.

Figure 4-7 illustrates typical thermal limit curves. The motor starting characteristic is shown for a high inertia load @ 80% voltage. If the motor started quicker, the distinct characteristics of the thermal limit curves would not be required and the running overload curve would be joined with locked rotor safe stall times to produce a single overload curve.

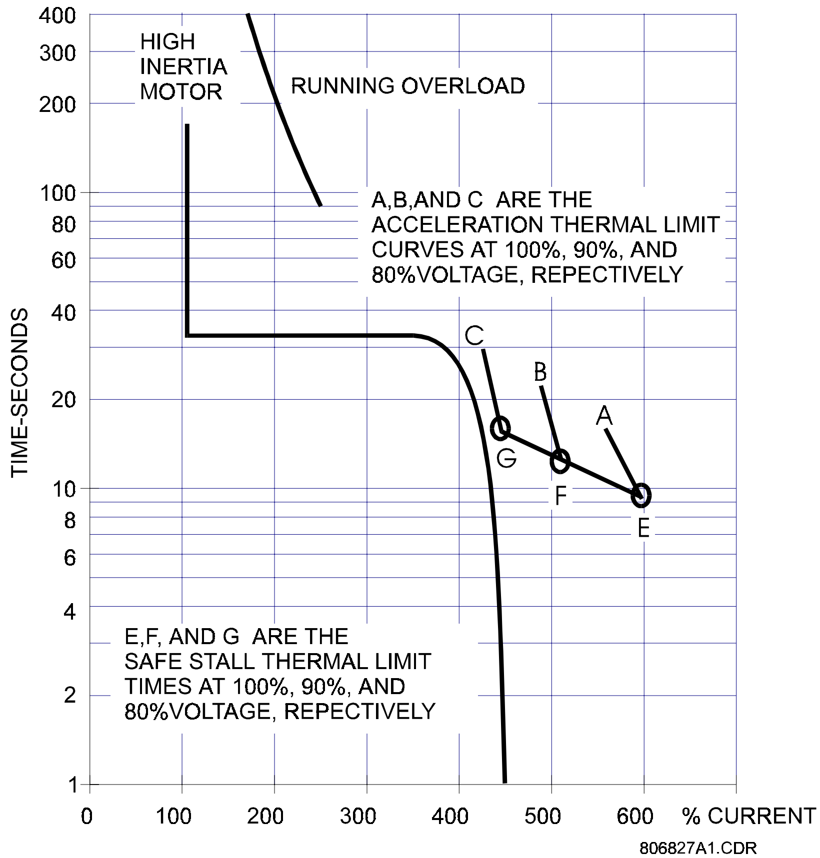


Figure 4-7 TYPICAL TIME-CURRENT AND THERMAL LIMIT CURVES (ANSI/IEEE C37.96)

The motor manufacturer should provide a safe stall time or thermal limit curves for any motor they sell. To program the SR469 for maximum protection, it is necessary to ask for these items when the motor is out for bid. These thermal limits are intended to be used as guidelines and their definition is not always precise. When operation of the motor exceeds the thermal limit, the motor insulation does not immediately melt. Rather, the rate of insulation degradation has reached a point that motor life will be significantly reduced if it is run any longer in that condition.

4.6.2 SR469 THERMAL MODEL

y THERMAL MODEL
y [ENTER] for more

SELECT CURVE STYLE: Standard	RANGE: Standard, Custom, Voltage Dependent
OVERLOAD PICKUP LEVEL:1.01 x FLA	RANGE: 1.01- 1.25 STEP: 0.01
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Aux.2, Trip & Aux.2 & Aux.3, Trip & Aux.3
UNBALANCE BIAS K FACTOR: 0	RANGE: 0-19 STEP:1 NOTE: a value of zero effectively defeats this feature
COOL TIME CONSTANT RUNNING: 15 min.	RANGE: 1 - 1000 STEP:1
COOL TIME CONSTANT STOPPED: 30 min.	RANGE: 1 -1000 STEP: 1
HOT/COLD SAFE STALL RATIO: 1.00	RANGE: 0.01 - 1.00 STEP:0.01
ENABLE RTD BIASING: No	RANGE: Yes, No
RTD BIAS MINIMUM: 40° C	RANGE: 0- RTD BIAS CENTER STEP:1
RTD BIAS CENTER POINT: 130° C	RANGE: RTD BIAS MINIMUM - RTD BIAS MAX STEP:1
RTD BIAS MAXIMUM: 155° C	RANGE: RTD BIAS CENTER - 250 STEP:1
THERMAL CAPACITY ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
THERMAL CAP. ALARM LEVEL: 75% USED	RANGE: 10-100% STEP: 1
THERMAL CAPACITY ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

The primary protective function of the SR469 is the thermal model. It consists of five key elements: the overload curve and overload pickup level, the unbalance biasing of the motor current while the motor is running, the motor cooling time constants, and the biasing of the thermal model based on Hot/Cold motor information and measured stator temperature. Each of these elements are described in detail in the sections that follow.

The SR469 integrates both stator and rotor heating into one model. Motor heating is reflected in a register called Thermal Capacity Used. If the motor has been stopped for a long period of time, it will be at ambient temperature and thermal capacity used should be zero. If the motor is in overload, once the thermal capacity used reaches 100%, a trip will occur. The thermal capacity used alarm may be used as a warning indication of an impending overload trip.

4.6.3 OVERLOAD CURVE SETUP

■ O/L CURVE SETUP ■ [ENTER] for more	ENTER / ESCAPE	STANDARD OVERLOAD CURVE NUMBER: 4	RANGE:1-15 STEP:1 NOTE: This message seen only if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.01x FLA: 17414.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.05x FLA: 3414.9 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.10x FLA: 1666.7 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.20x FLA: 795.4 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.30x FLA: 507.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.40x FLA: 364.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.50x FLA: 280.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 1.75x FLA: 169.7 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 2.00x FLA: 116.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 2.25x FLA: 86.1 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 2.50 x FLA: 66.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 2.75x FLA: 53.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 3.00x FLA: 43.7 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 3.25x FLA: 36.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 3.50x FLA: 31.1 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 3.75x FLA: 26.8 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 4.00x FLA: 23.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 4.25x FLA: 20.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 4.50x FLA: 18.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 4.75x FLA: 16.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 5.00x FLA: 14.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 5.50x FLA: 12.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	TIME TO TRIP AT 6.00x FLA: 10.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected

TIME TO TRIP AT 6.50x FLA: 8.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 7.00x FLA: 7.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 7.50x FLA: 6.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 8.00x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 10.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 15.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
TIME TO TRIP AT 20.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
MINIMUM ALLOWABLE LINE VOLTAGE:80%	RANGE: 70-95 STEP:1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
STALL CURRENT @ MIN Vline: 4.80 x FLA	RANGE: 2.00-15.00 STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SAFE STALL TIME @ MIN Vline: 20.0 s	RANGE: 0.5-999.9 STEP:0.1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
ACCEL. INTERSECT @ MIN Vline: 3.80xFLA	RANGE: 2.00-Istall @ min Vline STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected
STALL CURRENT @ 100% Vline: 6.00 x FLA	RANGE: 2.00-15.00 STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SAFE STALL TIME @ 100% Vline: 10.0 s	RANGE: 0.5-999.9 STEP:0.1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
ACCEL. INTERSECT @ 100% Vline: 5.00xFLA	RANGE: 2.00-Istall @ 100%Vline STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected

The overload curve accounts for motor heating during stall, acceleration, and running in both the stator and the rotor. The Overload Pickup setpoint dictates where the running overload curve begins as the motor enters an overload condition. This is useful for service factor motors as it allows the pickup level to be defined. The curve is effectively cut off at current values below this pickup.

Motor thermal limits consist of three distinct parts based on the three conditions of operation, locked rotor or stall, acceleration, and running overload. Each of these curves may be provided for both a hot motor and a cold motor. A hot motor is defined as one that has been running for a period of time at full load such that the stator and rotor temperatures have settled at their rated temperature. A cold motor is defined as a motor that has been stopped for a period of time such that the stator and rotor temperatures have settled at ambient temperature. For most motors, the distinct characteristics of the motor thermal limits are formed into one smooth homogeneous curve. Sometimes only a safe stall time is provided. This is acceptable if the motor has been designed conservatively and can easily perform its required duty without infringing on the thermal limit. In this case, the protection can be conservative and process integrity is not compromised. If a motor has been designed very close to its thermal limits when operated as required, then the distinct characteristics of the thermal limits become important.

The SR469 overload curve can take one of three formats, Standard, Custom Curve, or Voltage Dependent. Regardless of which curve style is selected, the SR469 will retain thermal memory in the form of a register called Thermal Capacity Used. This register is updated every 100ms using the following equation:

$$TC_{used_t} = TC_{used_{t-100ms}} + \frac{100ms}{time\_to\_trip} * 100\%$$

where: time_to_trip = time taken from the overload curve @ Ieq as a function of FLA

The overload protection curve should always be set slightly lower than the thermal limits provided by the manufacturer. this will ensure that the motor is tripped before the thermal limit is reached.
If the motor starting times are well within the safe stall times, it is recommended that the SR469 Standard Overload Curve be used. The standard overload curves are a series of 15 curves with a common curve shape based on typical motor thermal limit curves (see Figure 4-8 and Table 4-2).

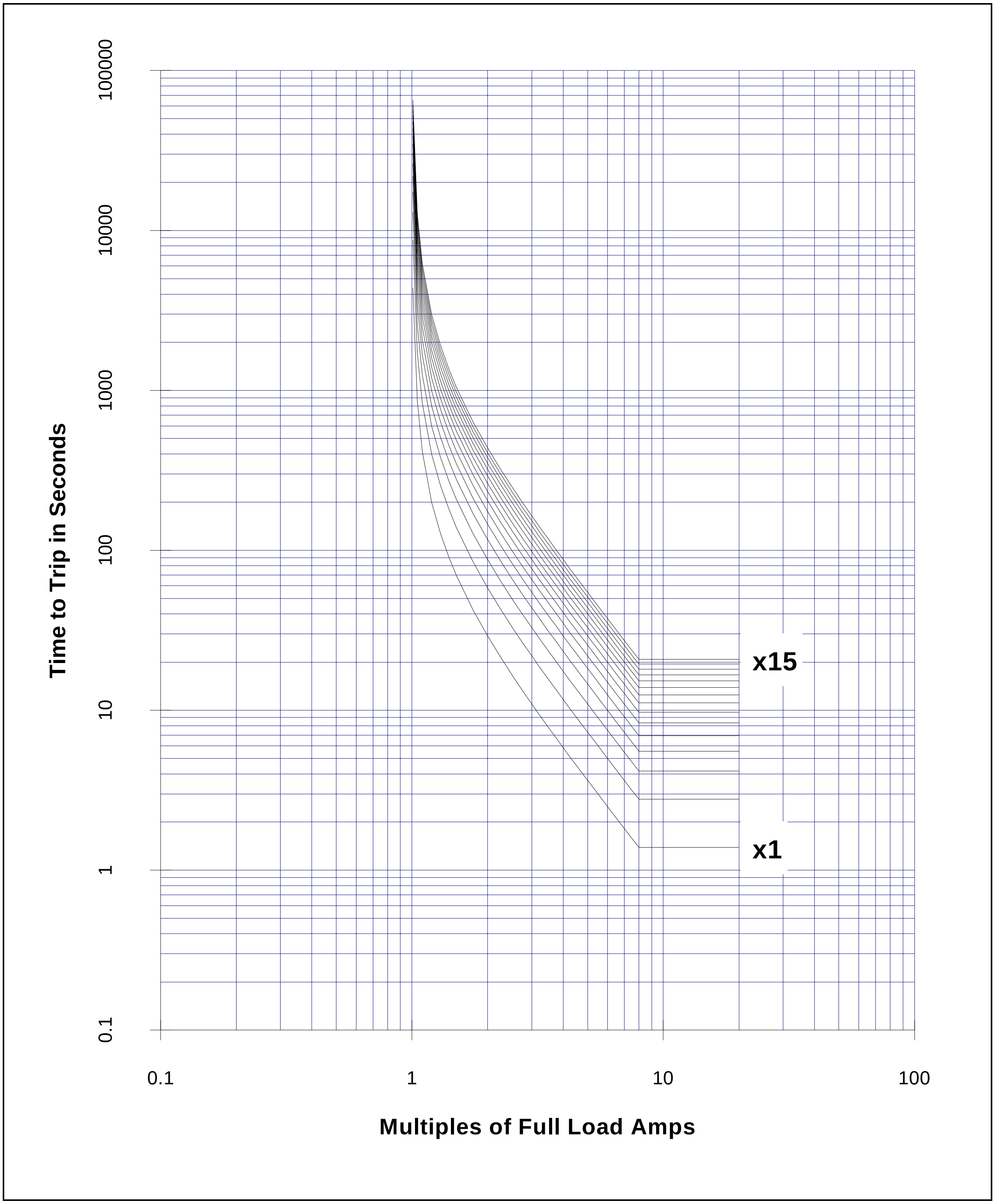


Figure 4-8 SR469 STANDARD OVERLOAD CURVES

Table 4-2 SR469 STANDARD OVERLOAD CURVES

PICKUP LEVEL (x FLA)	STANDARD CURVE MULTIPLIERS														
	x 1	x 2	x 3	x 4	x 5	x 6	x 7	x 8	x 9	x 10	x 11	x 12	x 13	x 14	x 15
1.01	4353.6	8707.2	13061	17414	21768	26122	30475	34829	39183	43536	47890	52243	56597	60951	65304
1.05	853.71	1707.4	2561.1	3414.9	4268.6	5122.3	5976.0	6829.7	7683.4	8537.1	9390.8	10245	11098	11952	12806
1.10	416.68	833.36	1250.0	1666.7	2083.4	2500.1	2916.8	3333.5	3750.1	4166.8	4583.5	5000.2	5416.9	5833.6	6250.2
1.20	198.86	397.72	596.58	795.44	994.30	1193.2	1392.0	1590.9	1789.7	1988.6	2187.5	2386.3	2585.2	2784.1	2982.9
1.30	126.80	253.61	380.41	507.22	634.02	760.82	887.63	1014.4	1141.2	1268.0	1394.8	1521.6	1648.5	1775.3	1902.1
1.40	91.14	182.27	273.41	364.55	455.68	546.82	637.96	729.09	820.23	911.37	1002.5	1093.6	1184.8	1275.9	1367.0
1.50	69.99	139.98	209.97	279.96	349.95	419.94	489.93	559.92	629.91	699.90	769.89	839.88	909.87	979.86	1049.9
1.75	42.41	84.83	127.24	169.66	212.07	254.49	296.90	339.32	381.73	424.15	466.56	508.98	551.39	593.81	636.22
2.00	29.16	58.32	87.47	116.63	145.79	174.95	204.11	233.26	262.42	291.58	320.74	349.90	379.05	408.21	437.37
2.25	21.53	43.06	64.59	86.12	107.65	129.18	150.72	172.25	193.78	215.31	236.84	258.37	279.90	301.43	322.96
2.50	16.66	33.32	49.98	66.64	83.30	99.96	116.62	133.28	149.94	166.60	183.26	199.92	216.58	233.24	249.90
2.75	13.33	26.65	39.98	53.31	66.64	79.96	93.29	106.62	119.95	133.27	146.60	159.93	173.25	186.58	199.91
3.00	10.93	21.86	32.80	43.73	54.66	65.59	76.52	87.46	98.39	109.32	120.25	131.19	142.12	153.05	163.98
3.25	9.15	18.29	27.44	36.58	45.73	54.87	64.02	73.16	82.31	91.46	100.60	109.75	118.89	128.04	137.18
3.50	7.77	15.55	23.32	31.09	38.87	46.64	54.41	62.19	69.96	77.73	85.51	93.28	101.05	108.83	116.60
3.75	6.69	13.39	20.08	26.78	33.47	40.17	46.86	53.56	60.25	66.95	73.64	80.34	87.03	93.73	100.42
4.00	5.83	11.66	17.49	23.32	29.15	34.98	40.81	46.64	52.47	58.30	64.13	69.96	75.79	81.62	87.45
4.25	5.12	10.25	15.37	20.50	25.62	30.75	35.87	41.00	46.12	51.25	56.37	61.50	66.62	71.75	76.87
4.50	4.54	9.08	13.63	18.17	22.71	27.25	31.80	36.34	40.88	45.42	49.97	54.51	59.05	63.59	68.14
4.75	4.06	8.11	12.17	16.22	20.28	24.33	28.39	32.44	36.50	40.55	44.61	48.66	52.72	56.77	60.83
5.00	3.64	7.29	10.93	14.57	18.22	21.86	25.50	29.15	32.79	36.43	40.08	43.72	47.36	51.01	54.65
5.50	2.99	5.98	8.97	11.96	14.95	17.94	20.93	23.91	26.90	29.89	32.88	35.87	38.86	41.85	44.84
6.00	2.50	5.00	7.49	9.99	12.49	14.99	17.49	19.99	22.48	24.98	27.48	29.98	32.48	34.97	37.47
6.50	2.12	4.24	6.36	8.48	10.60	12.72	14.84	16.96	19.08	21.20	23.32	25.44	27.55	29.67	31.79
7.00	1.82	3.64	5.46	7.29	9.11	10.93	12.75	14.57	16.39	18.21	20.04	21.86	23.68	25.50	27.32
7.50	1.58	3.16	4.75	6.33	7.91	9.49	11.08	12.66	14.24	15.82	17.41	18.99	20.57	22.15	23.74
8.00	1.39	2.78	4.16	5.55	6.94	8.33	9.71	11.10	12.49	13.88	15.27	16.65	18.04	19.43	20.82
10.00	1.39	2.78	4.16	5.55	6.94	8.33	9.71	11.10	12.49	13.88	15.27	16.65	18.04	19.43	20.82
15.00	1.39	2.78	4.16	5.55	6.94	8.33	9.71	11.10	12.49	13.88	15.27	16.65	18.04	19.43	20.82

NOTE: Above 8.0 x Pickup, the trip time for 8.0 is used.
This prevents the overload curve from acting as an instantaneous element

Standard Overload Curves Equation:

$$\text{Time\_To\_Trip} = \frac{\text{Curve\_Multiplier} \times 2.2116623}{0.025303373 \times (\text{Pickup} - 1)^2 + 0.050547581 \times (\text{Pickup} - 1)}$$

CUSTOM OVERLOAD CURVE

If the motor starting current does begin to infringe on the thermal damage curves, it may become necessary to use a custom curve to tailor the protection to the motor so that successful starting may be possible without compromising motor protection. Furthermore, the characteristics of the starting thermal damage curve (locked rotor and acceleration) and the running thermal damage curves may not fit together very smoothly. In this instance, it may become necessary to use a custom curve to tailor the motor protection to the motor thermal limits such that the motor may be started successfully and the motor may be utilized to its full potential without compromising protection. The distinct parts of the thermal limit curves now become more critical. For these conditions, it is recommended that the SR469 custom curve thermal model be used. The custom overload curve of the SR469 allows the user to program his own curve by entering trip times for 30 pre-determined current levels.

It can be seen in Figure 4-9 that if the running overload thermal limit curve were smoothed into one curve with the locked rotor overload curve, the motor could not start at 80% line voltage. A custom curve is required.

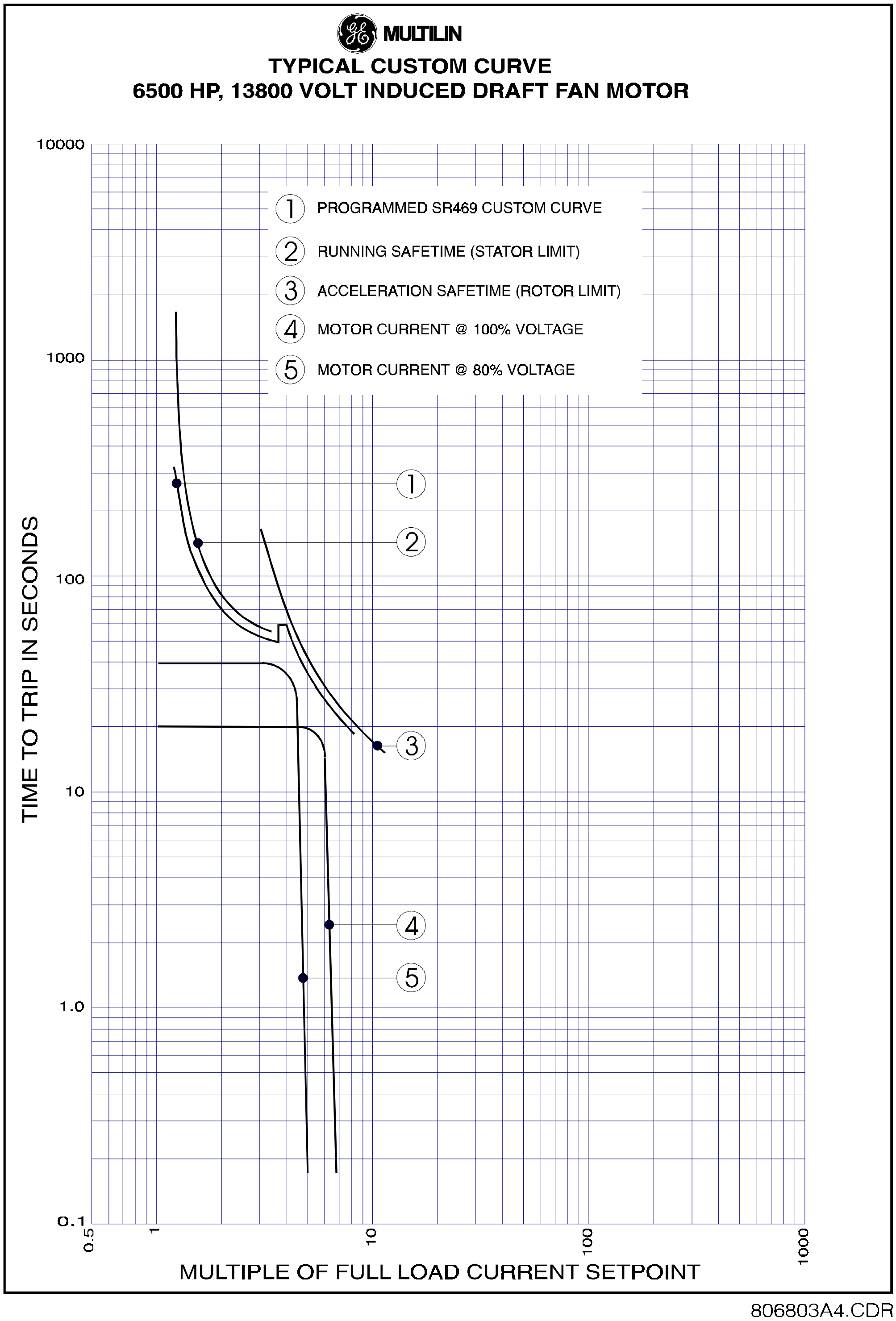


Figure 4-9 CUSTOM CURVE EXAMPLE

Note: During the interval of discontinuity, the longer of the two trip times is used to reduce the chance of nuisance tripping during motor starts.

VOLTAGE DEPENDENT OVERLOAD CURVE

If the motor is called upon to drive a high inertia load, it is quite possible and acceptable that the acceleration time exceeds the safe stall time. (Bearing in mind that a locked rotor condition is quite different than an acceleration condition). In this instance, each distinct portion of the thermal limit curve must be known and protection must be coordinated against that curve. The relay that is protecting the motor must be able to distinguish between a locked rotor condition, an accelerating condition and a running condition. The SR469 Voltage Dependent Overload Curve feature is tailored to protect these types of motors. Voltage is monitored constantly during motor starting and the acceleration thermal limit curve is adjusted accordingly.

The Voltage Dependent Overload Curve, is comprised of the three characteristic shapes of thermal limit curves as determined by the stall or locked rotor condition, acceleration, and running overload. The curve is constructed by entering a custom curve shape for the running overload protection curve. Next, a point must be entered for the acceleration protection curve at the point of intersection with the custom curve, based on the minimum allowable starting voltage as defined by the minimum allowable line voltage. Locked Rotor Current and safe stall time must also be entered for that voltage. A second point of intersection must be entered for 100% line voltage. Once again, the locked rotor current and the safe stall time must be entered, this time for 100% line voltage. The protection curve that is created from the safe stall time and intersection point will be dynamic based on the measured line voltage between the minimum allowable line voltage and the 100% line voltage. This method of protection inherently accounts for the change in motor speed as an impedance relay would. The change in impedance is reflected by motor terminal voltage and line current. For any given speed at any given line voltage, there is only one value of line current.

EXAMPLE: To illustrate the Voltage Dependent Overload Curve feature, the thermal limits of Figure 4-10 will be used.

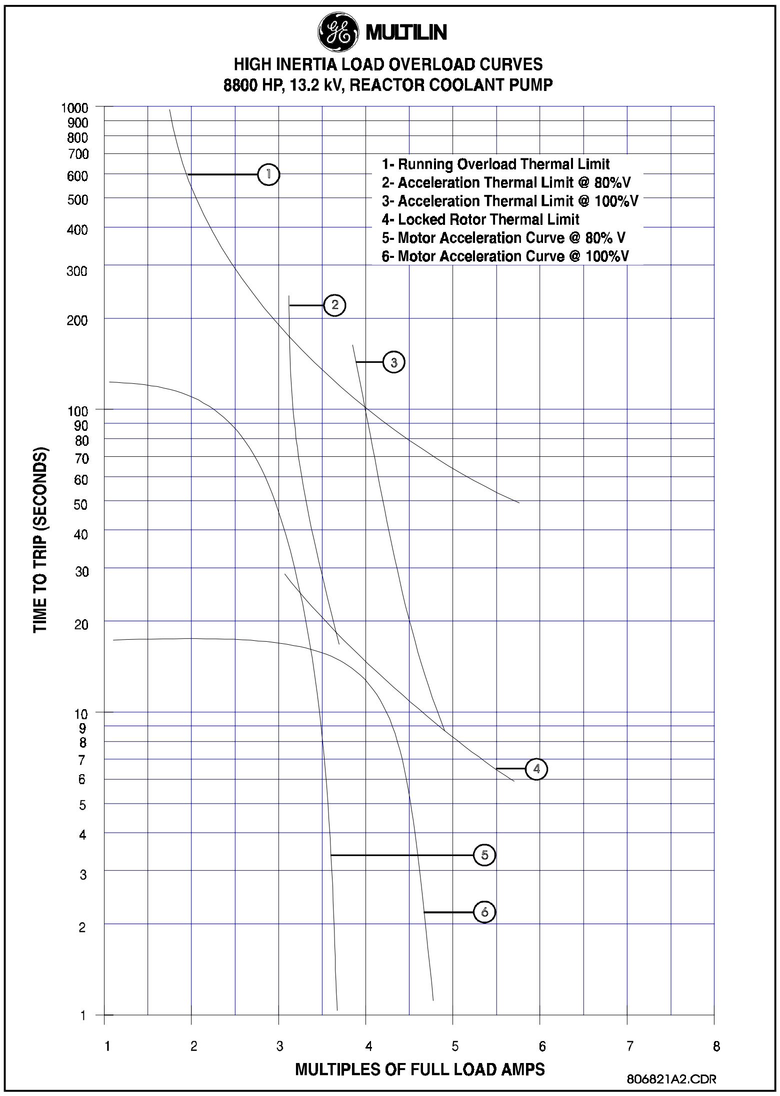


Figure 4-10 THERMAL LIMITS FOR HIGH INERTIAL LOAD

1. Construct a custom curve for the running overload thermal limit. If the curve does not extend to the acceleration thermal limits, extend it such that the curve intersects the acceleration thermal limit curves. (see Figure 4-11)

2. Enter the per unit current value for the acceleration overload curve intersect with the custom curve for 80% line voltage. Also enter the per unit current and safe stall protection time for 80% line voltage. (see Figure 4-12)

3. Enter the per unit current value for the acceleration overload curve intersect with the custom curve for 100% line voltage. Also enter the per unit current and safe stall protection time for 100% line voltage. (see Figure 4-12)

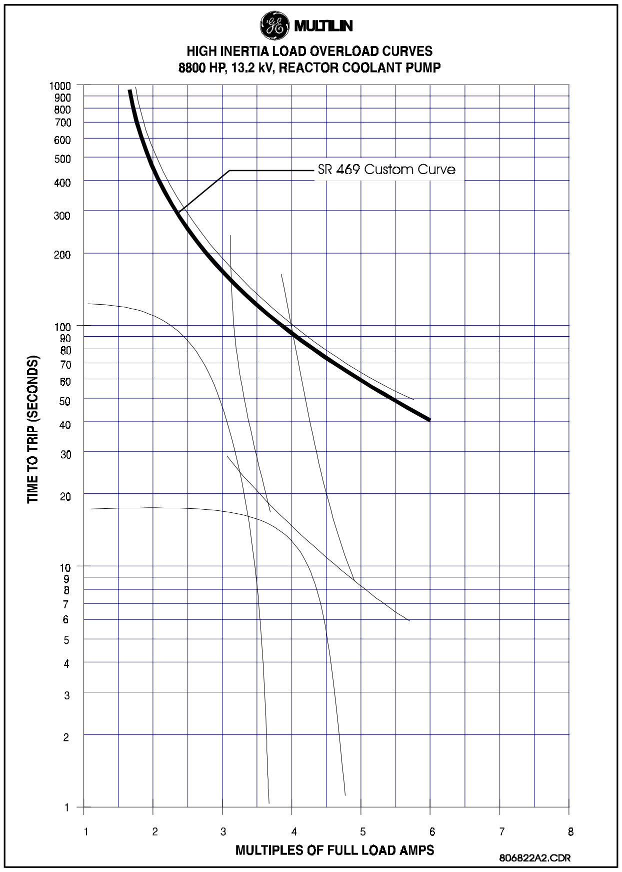


Figure 4-11 VOLTAGE DEPENDENT OVERLOAD (CUSTOM CURVE)

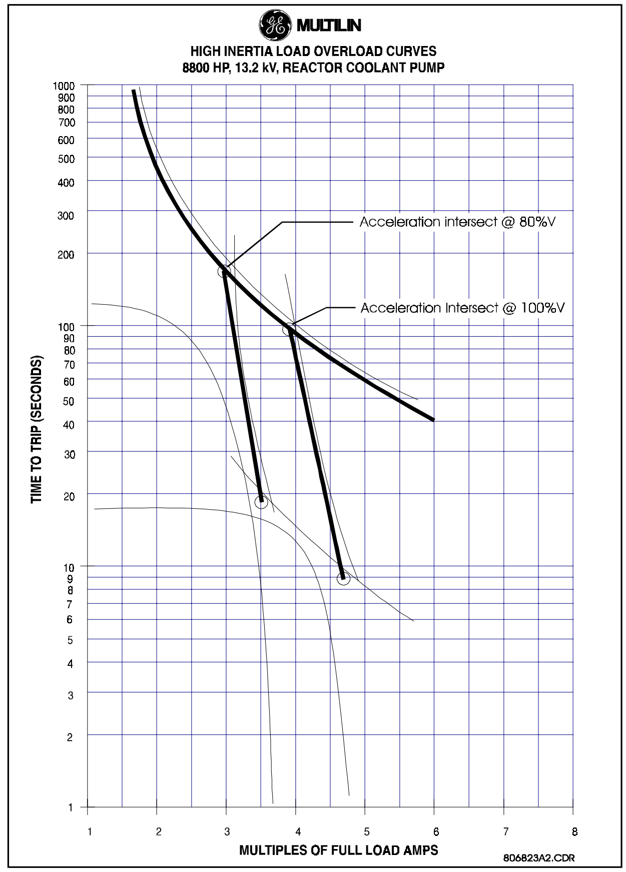


Figure 4-12 VOLTAGE DEPENDENT OVERLOAD (ACCELERATION CURVES)

The SR469 will take the information provided and create protection curves for any voltage between the minimum and 100%. For values above the voltage in question, the SR469 will extrapolate the safe stall protection curve to 110% voltage. This current level is calculated by taking the locked rotor current @ 100 voltage and multiplying by 1.10. For trip times above the 110% current level, the trip time of 110% will be used. (see Figure 4-13)

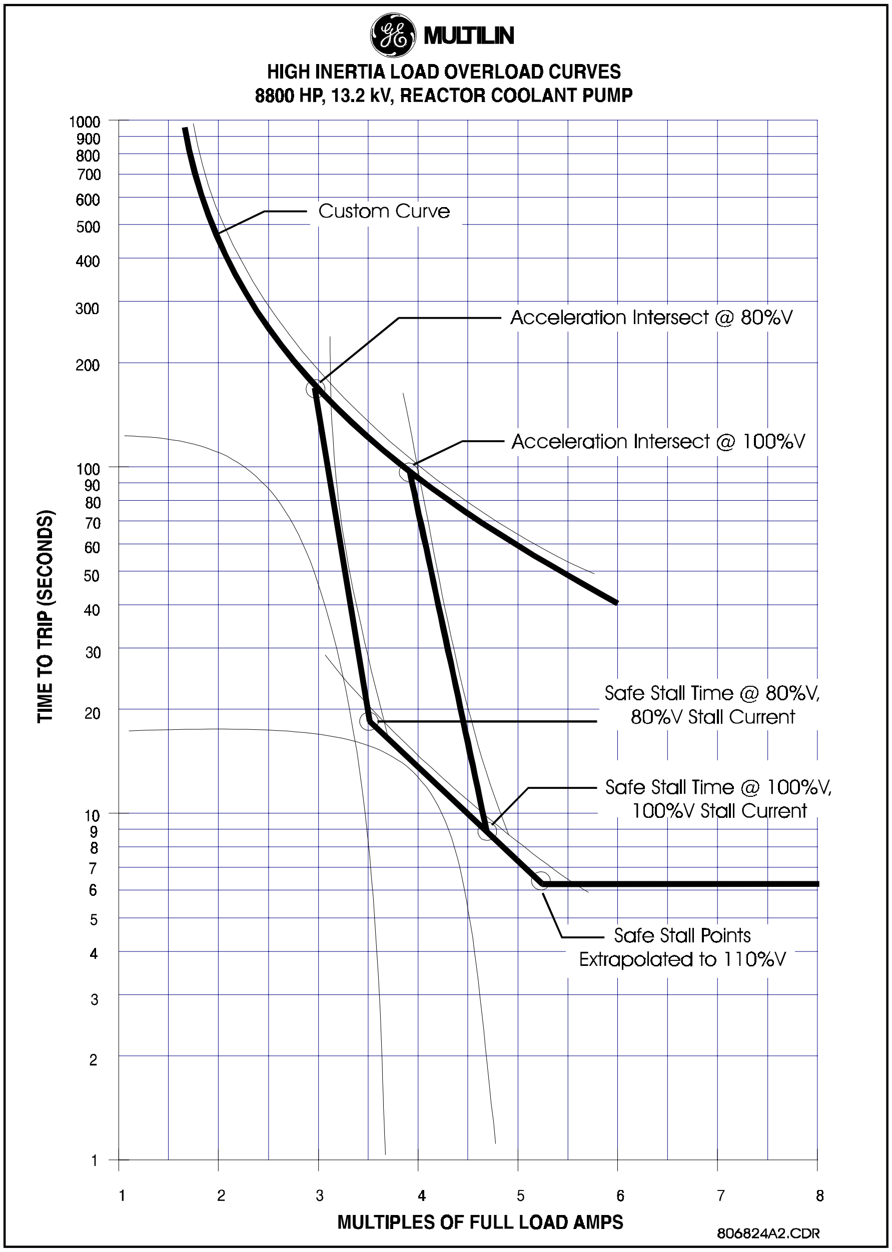


Figure 4-13 VOLTAGE DEPENDENT OVERLOAD PROTECTION CURVES

Note: The safe stall curve is in reality a series of safe stall points for different voltages. For a given voltage, there can only be one value of stall current and therefore, only one safe stall time.

.

Figure 4-14 and Figure 4-15 illustrate the resultant overload protection curves for 80% and 100% line voltage respectively. For voltages in between, the SR469 will shift the acceleration curve linearly and constantly based on measured line voltage during a motor start.

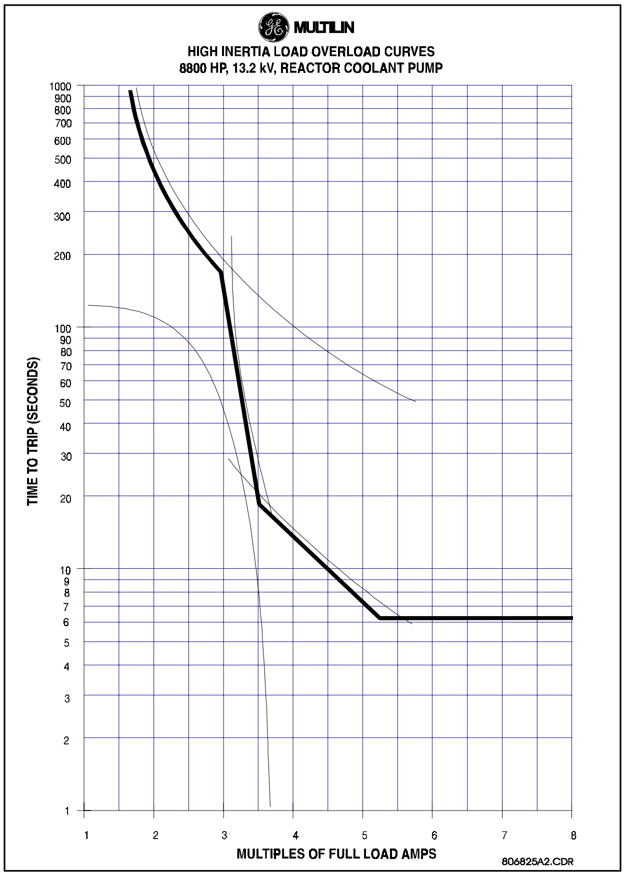


Figure 4-14 VOLTAGE DEPENDENT OVERLOAD PROTECTION @ 80% V

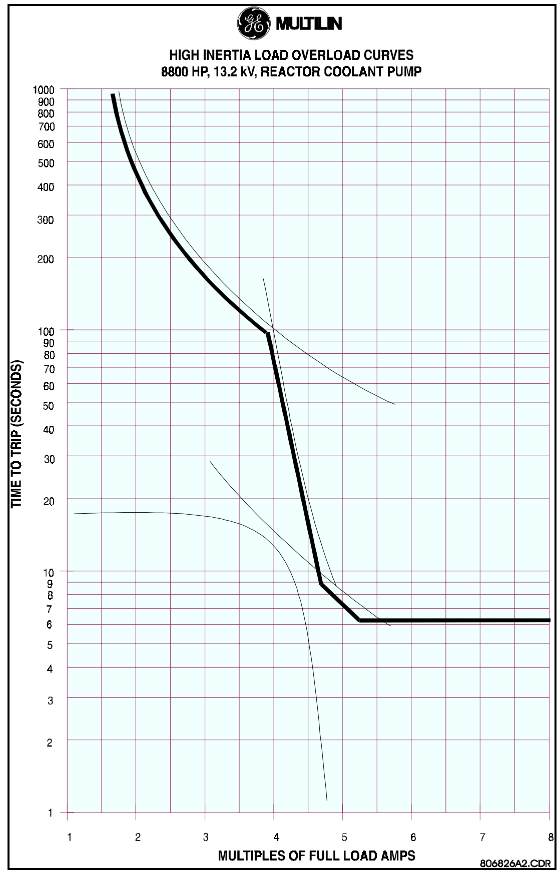


Figure 4-15 VOLTAGE DEPENDENT OVERLOAD PROTECTION @ 100% V

4.6.4 UNBALANCE BIAS

Unbalanced phase currents will also cause additional rotor heating that will not be accounted for by electromechanical relays and may not be accounted for in some electronic protective relays. When the motor is running, the rotor will rotate in the direction of the positive sequence current at near synchronous speed. Negative sequence current, which has a phase rotation that is opposite to the positive sequence current, and hence, opposite to the rotor rotation, will generate a rotor voltage that will produce a substantial rotor current. This induced current will have a frequency that is approximately 2 times the line frequency, 100 Hz for a 50 Hz system or 120 Hz for a 60 Hz system. Skin effect in the rotor bars at this frequency will cause a significant increase in rotor resistance and therefore, a significant increase in rotor heating. This extra heating is not accounted for in the thermal limit curves supplied by the motor manufacturer as these curves assume positive sequence currents only that come from a perfectly balanced supply and motor design.

The SR469 measures the ratio of negative to positive sequence current. The thermal model may be biased to reflect the additional heating that is caused by negative sequence current when the motor is running. This biasing is done by creating an equivalent motor heating current rather than simply using average current (Iper_unit). This equivalent current is calculated using the equation shown below .

$$Ieq = \sqrt{I_{per\_unit}^2\left(1 + k(I_2 / I_1)^2\right)}$$

where:
Ieq = equivalent motor heating current
Iper_unit = per unit current based on FLA
I_2 = negative sequence current
I_1 = positive sequence current
k = constant

Figure 4-16 shows recommended motor derating as a function of voltage unbalance as recommended by the American organization NEMA (National Electrical Manufacturers Association). Assuming a typical induction motor with an inrush of 6 x FLA and a negative sequence impedance of 0.167, voltage unbalances of 1,2,3,4,5 % equals current unbalances of 6,12,18,24,30% respectively. Based on this assumption, Figure 4-17 illustrates the amount of motor derating for different values of k entered for the setpoint Unbalance Bias k Factor. Note that the curve created when k=8 is almost identical to the NEMA derating curve.

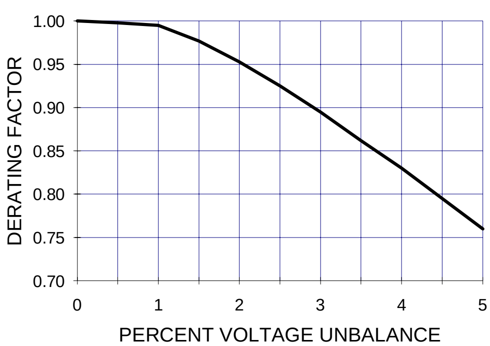


Figure 4-16 MEDIUM MOTOR DERATING FACTOR DUE TO UNBALANCED VOLTAGE (NEMA)

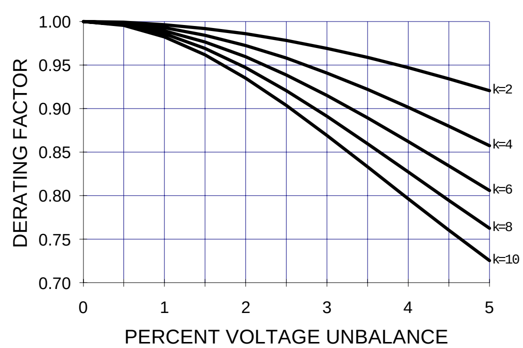


Figure 4-17 MEDIUM MOTOR DERATING FACTOR DUE TO UNBALANCED VOLTAGE (MULTILIN)

If a k value of 0 is entered, the unbalance biasing is defeated and the overload curve will time out against the measured per unit motor current. k may be calculated conservatively as:

$$k = \frac{175}{I_{LR}^2}$$ typical estimate

$$k = \frac{230}{I_{LR}^2}$$ conservative estimate

where I_{LR} is the per unit locked rotor current.

4.6.5 MOTOR COOLING

The SR469 thermal capacity used value is reduced in an exponential manner when the motor current is below the overload pickup setpoint. This reduction simulates motor cooling. The motor cooling time constants should be entered for both the stopped and running cases. A stopped motor will normally cool significantly slower than a running motor.

Motor cooling is calculated using the following formulas:

$$TC_{used} = (TC_{used\_start} - TC_{used\_end})(e^{-\frac{t}{\tau}}) + TC_{used\_end}$$

$$TC_{used\_end} = \left(\frac{I_{eq}}{overload\_pickup}\right)\left(1 - \frac{hot}{cold}\right)x100\%$$

where:

TCused	=	thermal capacity used
TCused_start	=	TC used value caused by overload condition
TCused_end	=	TC used value dictated by the hot/cold curve ratio when the motor is running, '0' when the motor is stopped.
t	=	time in minutes
τ	=	Cool Time Constant (running or stopped)
Ieq	=	equivalent motor heating current
overload_pickup	=	overload pickup setpoint as a multiple of FLA
hot/cold	=	hot/cold curve ratio

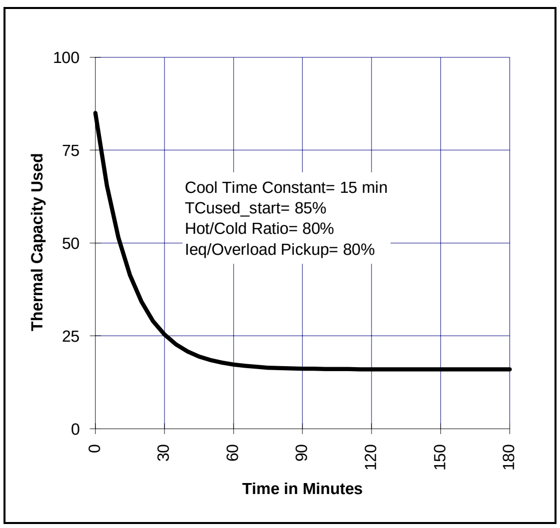


Figure 4-18 THERMAL MODEL COOLING 80% LOAD

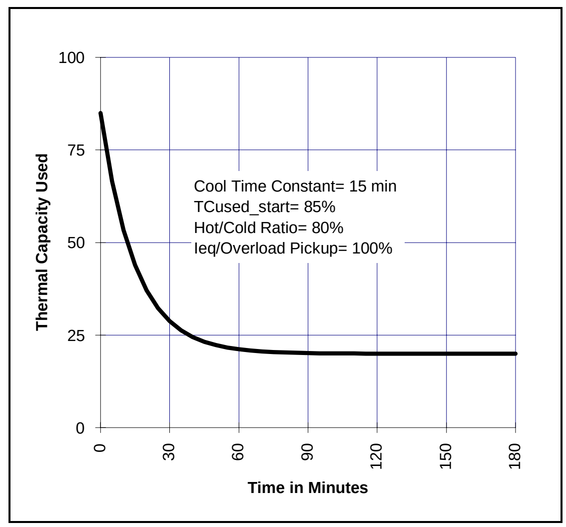


Figure 4-19 THERMAL MODEL COOLING 100% LOAD

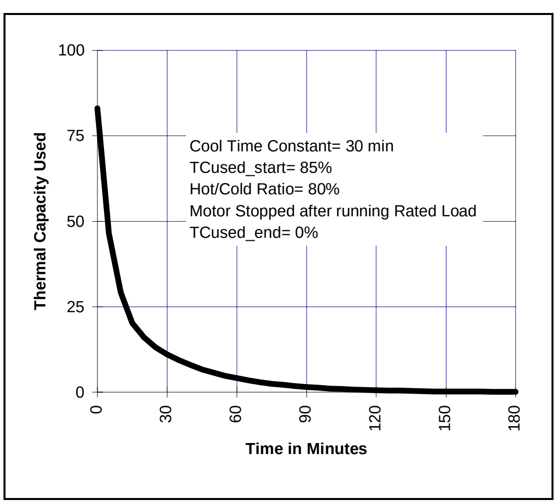


Figure 4-20 THERMAL MODEL COOLING MOTOR STOPPED

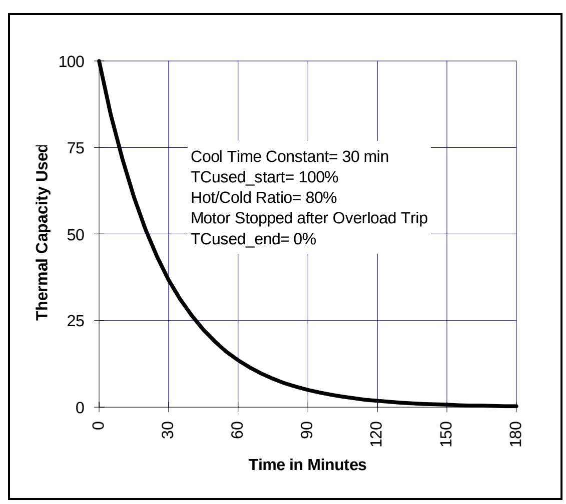


Figure 4-21 THERMAL MODEL COOLING MOTOR TRIPPED

4.6.6 HOT/COLD CURVE RATIO

The motor manufacturer will sometimes provide thermal limit information for a hot/cold motor. The SR469 thermal model will adapt for these conditions if the Hot/Cold Curve Ratio is programmed. The value entered for this setpoint dictates the level of thermal capacity used that the relay will settle at for levels of current that are below the Overload Pickup Level. When the motor is running at a level that is below the Overload Pickup Level, the thermal capacity used will rise or fall to a value based on the average phase current and the entered Hot/Cold Curve Ratio. Thermal capacity used will either rise at a fixed rate of 5% per minute or fall as dictated by the running cool time constant.

$$TC_{used\_end} = I_{eq} \times (1 - Hot / Cold) \times 100\%$$

Where: TCused_end = Thermal Capacity Used if Iper_unit remains steady state
Ieq = equivalent motor heating current
Hot/Cold = Hot/Cold Curve Ratio Setpoint

The hot/cold curve ratio may be determined from the thermal limit curves if provided or the hot and cold safe stall times. Simply divide the hot safe stall time by the cold safe stall time. If hot and cold times are not provided, there can be no differentiation and the hot/cold curve ratio should be entered as 1.00.

4.6.7 RTD BIAS

The SR469 thermal replica created by the features described in the sections above operates as a complete and independent model. The thermal overload curves however, are based solely on measured current, assuming a normal 40 °C ambient and normal motor cooling. If there is an unusually high ambient temperature, or if motor cooling is blocked, motor temperature will increase. If the motor stator has embedded RTDs, the SR469 RTD bias feature should be used to correct the thermal model.

The RTD bias feature is a two part curve, constructed using 3 points. If the maximum stator RTD temperature is below the RTD Bias Minimum setpoint (typically 40°C), no biasing occurs. If the maximum stator RTD temperature is above the RTD Bias Maximum setpoint (typically at the stator insulation rating or slightly higher), then the thermal memory is fully biased and thermal capacity is forced to 100% used. At values in between, the present thermal capacity used created by the overload curve and other elements of the thermal model, is compared to the RTD Bias thermal capacity used from the RTD Bias curve. If the RTD Bias thermal capacity used value is higher, then that value is used from that point onward. The RTD bias Center point should be set at the rated running temperature of the motor. The SR469 will automatically determine the thermal capacity used value for the center point using the Hot/Cold Safe stall ratio setpoint.

$$TC_{used} @ RTD\_Bias\_Center = (1 - Hot / Cold) \times 100\%$$

At < RTD_Bias_Center temperature,

$$RTD\_Bias\_TC_{used} = \frac{Temp_{actual} - Temp_{min}}{Temp_{center} - Temp_{min}} \times TC_{used} @ RTD\_Bias\_Center$$

At > RTD_Bias_Center temperature,

$$RTD\_Bias\_TC_{used} = \frac{Temp_{actual} - Temp_{center}}{Temp_{max} - Temp_{center}} \times (100 - TC_{used} @ RTD\_Bias\_Center) + TC_{used} @ RTD\_Bias\_Center$$

Where $RTD\_Bias\_TC_{USED}$ = TC used due to hottest stator RTD
$Temp_{ACTUAL}$ = Current temperature of hottest stator RTD
$Temp_{MIN}$ = RTD Bias minimum setpoint
$Temp_{CENTER}$ = RTD Bias center setpoint
$Temp_{MAX}$ = RTD Bias max setpoint
TC_{USED}@RTD_Bias_Center = TC used defined by HOT/COLD SAFE STALL RATIO setpoint

In simple terms, the RTD bias feature is real feedback of measured stator temperature. This feedback acts as correction of the thermal model for unforeseen situations. Since RTDs are relatively slow to respond, RTD biasing is good for correction and slow motor heating. The rest of the thermal model is required during starting and heavy overload conditions when motor heating is relatively fast.

It should be noted that the RTD bias feature alone cannot create a trip. If the RTD bias feature forces the thermal capacity used to 100%, the motor current must be above the overload pickup before an overload trip occurs. Presumably, the motor would trip on stator RTD temperature at that time.

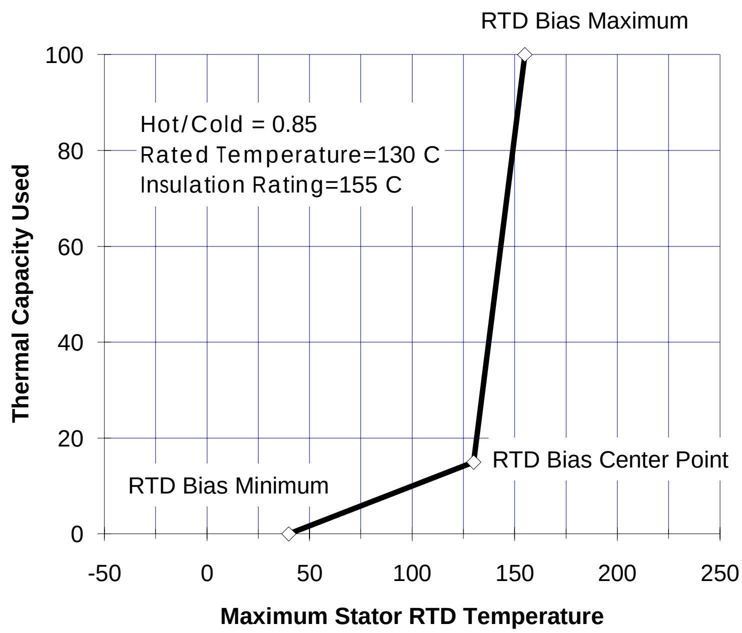


Figure 4-22 RTD BIAS CURVE

4.7.1 SHORT CIRCUIT

y SHORT CIRCUIT TRIP
y [ENTER] for more

ENTER / ESCAPE	SHORT CIRCUIT TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	SHORT CIRCUIT TRIP OVERREACH FILTER: Off	RANGE: On, Off
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3, Auxiliary 2, Aux2 & Aux3, Auxiliary 3
ESCAPE / MESSAGE	SHORT CIRCUIT TRIP PICKUP: 10.0 x CT	RANGE: 2.0 - 20.0 STEP: 0.1
ESCAPE / MESSAGE	INTENTIONAL S/C TRIP DELAY : 0 ms	RANGE: 0 - 1000 STEP: 10
ESCAPE / MESSAGE	SHORT CIRCUIT TRIP BACKUP: Off	RANGE: On, Off
ESCAPE / MESSAGE	ASSIGN BACKUP RELAYS: Auxiliary2	RANGE: Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	SHORT CIRCUIT TRIP BACKUP DELAY: 200 ms	RANGE: 10 - 2000 STEP:10

FUNCTION:

Note: Care must be taken when turning On this feature. If the interrupting device (contactor or circuit breaker) is not rated to break the fault current, this feature should be disabled. Alternatively, this feature may be assigned to an auxiliary relay and connected such that it trips an upstream device that is capable of breaking the fault current.

If turned On, the Short Circuit element will function as follows:

Once the magnitude of any one of either Ia, Ib, or Ic exceeds the Pickup Level × Phase CT Primary for a period of time specified by the Delay, a Trip will occur. There is also a backup trip feature that can be enabled. The backup delay should be greater than the short circuit delay plus the breaker clearing time. If the backup is On, and a Short Circuit trip has initiated, if the phase current to the motor persists for a period of time that exceeds the backup delay, a second trip will occur. It is intended that this second trip be assigned to R2 or R3 which would be dedicated as an upstream breaker trip relay.

Various situations (eg. charging a long line to the motor or power factor correction capacitors) may cause transient inrush currents during motor starting that may exceed the Short Circuit Pickup level only for a very short period of time. The Short Circuit time delay is adjustable in 10 ms increments. The delay can be fine tuned to an application such that it still responds very fast, but rides through normal operational disturbances. Normally, the Phase Short Circuit time delay will be set as quick as possible, 0 ms. Time may have to be increased if nuisance tripping occurs.

When a motor starts, the starting current (typically 6 × FLA for an induction motor) has an asymmetrical component. This asymmetrical current may cause one phase to see as much as 1.6 times the normal RMS starting current. If the short circuit level was set at 1.25 times the symmetrical starting current, it is probable that there would be nuisance trips during motor starting. A rule of thumb has been developed over time that short circuit protection at least 1.6 times the symmetrical starting current value. This allows the motor to start without nuisance tripping.

The overreach filter removes the DC component from the asymmetrical current present at the moment a fault occurs. This results in no overreach whatsoever, however, the response time slows slightly (10-15ms) but times still remain within specifications.

4.7.2 OVERLOAD ALARM

y OVERLOAD ALARM y [ENTER] for more	ENTER / ESCAPE	OVERLOAD ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	OVERLOAD ALARM DELAY: 0.1 s	RANGE: 0.1 - 60 STEP: 0.1
	ESCAPE / MESSAGE	OVERLOAD ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

If enabled as Latched or Unlatched, the Overload Alarm will function as follows: After a motor start, when the equivalent motor heating current exceeds the Overload Pickup, an alarm will occur. If programmed as unlatched, the alarm will reset itself when the motor is no longer in overload. If programmed as latched, once the overload condition is gone, the reset key must be pressed to reset the alarm. Event recording for all alarm features is optional.

EXAMPLE:

It may be desirable to have an unlatched alarm connected to a PLC that is controlling the load on a motor.

4.7.3 MECHANICAL JAM

y MECHANICAL JAM y [ENTER] for more	ENTER / ESCAPE	MECHANICAL JAM TRIP: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
	ESCAPE / MESSAGE	MECHANICAL JAM PICKUP: 1.50 x FLA	RANGE: 1.01 - 3.00 STEP: 0.01
	ESCAPE / MESSAGE	MECHANICAL JAM DELAY : 1 s	RANGE: 1 -30 STEP: 1

FUNCTION:

If turned On, the Mechanical Jam element will function as follows: After a motor start, once the magnitude of any one of either Ia, Ib, or Ic exceeds the Pickup Level × FLA for a period of time specified by the Delay, a Trip will occur. This feature may be used to indicate a stall condition when running. Not only does it protect the motor by taking it off-line quicker than the thermal model (overload curve), it may also prevent or limit damage to the driven equipment that may occur if motor starting torque persists on jammed or broken equipment.

The pickup level for the Mechanical Jam Trip should be set higher than motor loading during normal operations, but lower than the motor stall level. Normally the delay would be set to the minimum time delay, or set such that no nuisance trips occur due to momentary load fluctuations.

4.7.4 UNDERCURRENT

	■ UNDERCURRENT ■ [ENTER] for more	
ENTER / ESCAPE	BLOCK UNDERCURRENT FROM START: 0 s	RANGE: 0-15000 STEP: 1
ESCAPE / MESSAGE	UNDERCURRENT ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	UNDERCURRENT ALARM PICKUP: 0.70 x FLA	RANGE: 0.10 - 0.95 STEP: 0.01
ESCAPE / MESSAGE	UNDERCURRENT ALARM DELAY: 1 s	RANGE: 1 - 60 STEP: 1
ESCAPE / MESSAGE	UNDERCURRENT ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	UNDERCURRENT TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ESCAPE / MESSAGE	UNDERCURRENT TRIP PICKUP: 0.70 x FLA	RANGE: 0.10 - 0.99 STEP: 0.01
ESCAPE / MESSAGE	UNDERCURRENT TRIP DELAY 1 s	RANGE: 1 - 60 STEP:

FUNCTION:

If enabled, once the magnitude of either Ia, Ib, or Ic falls below the pickup level × FLA for a period of time specified by the Delay, a trip or alarm will occur. The Undercurrent element is active only when the motor is running and will be blocked upon the initiation of a motor start for a period of time defined by the setpoint U/C Block From Start (e.g. this block may be used to allow pumps to build up head before the undercurrent element trips). A value of 0 means the feature is not blocked from start. If a value other than 0 is entered, the feature will be disabled when the motor is stopped and also from the time a start is detected until the time entered expires. The pickup level should be set lower than motor loading during normal operations.

EXAMPLE:

If a pump is cooled by the liquid it pumps, loss of load may mean that the pump overheats, program undercurrent as enabled. If the motor loading should never fall below 0.75 × FLA, even for short durations, the Undercurrent Trip pickup could be set to 0.70 and the Undercurrent Alarm to 0.75. If the pump is always started loaded, the block from start feature should be disabled (programmed as 0).

- Time delay is typically set as quick as possible, 1 s.

4.7.5 CURRENT UNBALANCE

y CURRENT UNBALANCE y [ENTER] for more	
CURRENT UNBALANCE ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
CURRENT UNBALANCE ALARM PICKUP: 15 %	RANGE: 4 - 40 STEP: 1
CURRENT UNBALANCE ALARM DELAY: 1 s	RANGE: 1 - 60 STEP: 1
CURRENT UNBALANCE ALARM EVENTS: Off	RANGE: On, Off
CURRENT UNBALANCE TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
CURRENT UNBALANCE TRIP PICKUP: 20 %	RANGE: 4 - 40 STEP: 1
CURRENT UNBALANCE TRIP DELAY: 1 s	RANGE: 1 - 60 STEP: 1

FUNCTION:

SR469 unbalance is defined as the ratio of negative sequence current to positive sequence current, I_2/I_1, if the motor is operating at a load (Iavg) greater than FLA. If the motor Iavg is less than FLA, unbalance is defined as $I_2/I_1 \times$ Iavg/FLA. This derating is necessary to prevent nuisance alarms when a motor is lightly loaded. If enabled, once the magnitude of unbalance exceeds the Pickup Level for a period of time specified by the Delay, a trip and/or alarm will occur. If the unbalance level exceeds 40%, or when Iavg > 25% FLA and current in any one phase is zero, the motor will be considered single phasing and a trip will occur within 2 seconds. Single Phasing protection is disabled if the Unbalance Trip feature is turned Off.

When setting the unbalance pickup level, it should be noted that a 1% voltage unbalance typically translates into a 6 % current unbalance. Therefore, in order to prevent nuisance trips or alarms, the pickup level should not be set too low. Also, since short term unbalances are common, a reasonable delay should be set to avoid nuisance trips or alarms. It is recommended that the Unbalance Thermal Bias feature be used to bias the Thermal Model to account for motor heating that may be caused by cyclic short term unbalances.

NOTE: Unusually high unbalance levels may be caused by incorrect phase CT wiring.

EXAMPLE:

Fluctuations of current unbalance levels are typically caused by the supply voltage; it may be desirable to have a latched alarm to capture any such fluctuations that go beyond the Unbalance Alarm parameters. Also, a trip is recommended.

If the supply voltage is normally unbalanced up to 2 %, the current unbalance a typical motor would see is 2 × 6 = 12%, set the alarm pickup at 15 and the trip pickup at 20 to prevent nuisance tripping. 5 or 10 seconds is a reasonable delay.

4.7.6 GROUND FAULT

y GROUND FAULT
y [ENTER] for more

ENTER / ESCAPE	GROUND FAULT OVERREACH FILTER: Off	RANGE: On, Off
ESCAPE / MESSAGE	GROUND FAULT ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	GROUND FAULT ALARM PICKUP: 0.10 x CT	RANGE: 0.10 - 1.00 STEP: 0.01 This message seen only if the Ground CT is programmed as 1A or 5A secondary
ESCAPE / MESSAGE	GROUND FAULT ALARM PICKUP: 1.00 A	RANGE: 0.25-25.00 STEP: 0.01 This message seen only if the Ground CT is programmed as Multilin 50:0.025
ESCAPE / MESSAGE	INTENTIONAL GF ALARM DELAY : 0 ms	RANGE: 0 - 1000 STEP: 10
ESCAPE / MESSAGE	GROUND FAULT ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	GROUND FAULT TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3, Auxiliary 2, Aux2 & Aux3, Auxiliary 3
ESCAPE / MESSAGE	GROUND FAULT TRIP PICKUP: 0.20 x CT	RANGE: 0.10 - 1.00 STEP: 0.01 This message seen only if the Ground CT is not programmed as Multilin 50:0.025.
ESCAPE / MESSAGE	GROUND FAULT TRIP PICKUP: 1.00 A	RANGE: 0.25-25.00 STEP: 0.01 This message seen only if the Ground CT is programmed as Multilin 50:0.025
ESCAPE / MESSAGE	INTENTIONAL GF TRIP DELAY : 0 ms	RANGE: 0 - 1000 STEP: 10
ESCAPE / MESSAGE	GROUND FAULT TRIP BACKUP: Off	RANGE: On, Off
ESCAPE / MESSAGE	ASSIGN BACKUP RELAYS: Auxiliary2	RANGE: Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	GROUND FAULT TRIP BACKUP DELAY: 200 ms	RANGE: 10 - 2000 STEP: 10

FUNCTION:

The Ground Fault element will function as follows: Once the magnitude of ground current exceeds the Pickup Level × Ground CT Primary (S1 SYSTEM SETUP /CURRENT SENSING) for a period of time specified by the Delay, a trip and/or alarm will occur. There is also a backup trip feature that can be enabled. If the backup is On, and a Ground Fault trip has initiated, if the ground current persists for a period of time that exceeds the backup delay, a second trip will occur. It is intended that this second trip be assigned to R2 or R3 which would be dedicated as an upstream breaker trip relay. The Ground Fault Trip Backup delay must be set to a time longer than the breaker clearing time.

Note: Care must be taken when turning On this feature. If the interrupting device (contactor or circuit breaker) is not rated to break ground fault current (low resistance or solidly grounded systems), the feature should be disabled. Alternately, the feature may be assigned to an auxiliary relay and connected such that it trips an upstream device that is capable of breaking the fault current.

Various situations (eg. contactor bounce) may cause transient ground currents during motor starting that may exceed the Ground Fault Pickup levels only for a very short period of time. The Ground Fault time delays are adjustable in 10 ms increments. The delay can be fine tuned to an application such that it still responds very fast, but rides through normal operational disturbances. Normally, the Ground Fault time delays will be set as quick as possible, 0 ms. Time may have to be increased if nuisance tripping occurs.

Special care must be taken when the ground input is wired to the phase CTs in a residual connection. When a motor starts, the starting current (typically 6 × FLA for an induction motor) has an asymmetrical component. This asymmetrical current may cause one phase to see as much as 1.6 times the normal RMS starting current. This momentary DC component will cause each of the phase CTs to react differently and the net current into the ground input of the SR469 will not be negligible. A 20 ms block of the ground fault elements when the motor starts enables the SR469 to ride through this momentary ground current signal.

The overreach filter removed the DC component from the asymmetrical current present at the moment a fault occurs. This results in no overreach whatsoever, however, the response time slows slightly (10-15ms) but times still remain within specifications.

4.7.7 PHASE DIFFERENTIAL

y PHASE DIFFERENTIAL
y [ENTER] for more

ENTER / ESCAPE	PHASE DIFFERENTIAL TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3, Auxiliary 2, Aux2 & Aux3, Auxiliary 3
ESCAPE / MESSAGE	STARTING DIFF. TRIP PICKUP: 0.10 xCT	RANGE: 0.05 - 1.00 STEP: 0.01
ESCAPE / MESSAGE	STARTING DIFF. TRIP DELAY: 0 ms	RANGE: 0 - 1000 STEP: 10
ESCAPE / MESSAGE	RUNNING DIFF. TRIP PICKUP: 0.10 x CT	RANGE: 0.05 - 1.00 STEP: 0.01
ESCAPE / MESSAGE	RUNNING DIFF. TRIP DELAY: 0 ms	RANGE: 0 - 1000 STEP: 10

FUNCTION:

The setpoints here may be used to program the Differential element if the Differential feature is in use. This feature consists of three instantaneous overcurrent elements for phase differential protection. Differential protection may be considered first line protection for phase to phase or phase to ground faults. In the event of such a fault, differential protection may limit the damage that may occur.

Note: Care must be taken when enabling this feature. If the interrupting device (contactor or circuit breaker) is not rated to break potential faults, the feature should be disabled. Alternately, the feature may be assigned to an auxiliary relay and connected such that it trips an upstream device that is capable of breaking the fault current. A low level differential fault can develop into a short circuit in an instant.

The Differential Trip element will function as follows: Once the magnitude of either Ia_{IN}-Ia_{OUT}, Ib_{IN}-Ib_{OUT}, or Ic_{IN}-Ic_{OUT} (phase differential) exceeds the Pickup Level x Differential CT Primary for a period of time specified by the Delay, a trip will occur. Separate pickup levels and delays are provided for motor starting and running conditions.

The Differential trip element is programmable as a fraction of the rated CT. The level may be set more sensitive if the Differential CTs are connected in a flux balancing configuration (3 CTs). If 6 CTs are used in a summing configuration, during motor starting, the values from the two CTs on each phase may not be equal as the CTs are not perfectly identical. (Asymmetrical currents may cause the CTs on each phase to have different outputs.) To prevent nuisance tripping in this configuration, the starting differential level may have to be set less sensitive, or the starting differential time delay may have to be extended to ride through the problem period during start. The running differential delay can then be fine tuned to an application such that it responds very fast to sensitive (low) differential current levels.

4.8.1 ACCELERATION TIMER

■ ACCELERATION TIMER ■ [ENTER] for more	ENTER / ESCAPE	ACCELERATION TIMER TRIP: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
	ESCAPE / MESSAGE	ACCELERATION TIMER FROM START: 10.0 s	RANGE: 1.0 - 250.0 STEP: 0.1

FUNCTION:

The SR469 Thermal Model is designed to protect the motor under both starting and overload conditions. The Acceleration Timer trip feature may be used in addition to that protection. If for example, the motor should always start in 2 seconds, but the safe stall time is 8 seconds, there is no point letting the motor remain in a stall condition for 7 or 8 seconds when the thermal model would take it off line. Furthermore, the starting torque applied to the driven equipment for that period of time could cause severe damage.

If enabled , the Acceleration Timer trip element will function as follows: A motor start is assumed to be occurring when the SR469 measures the transition of no motor current to some value of motor current. Typically current will rise quickly to a value in excess of FLA (e.g. 6 x FLA). At this point, the Acceleration Timer will be initialized with the entered value in seconds. If the current does not fall below the overload curve pickup level before the timer expires, an acceleration trip will occur. If the acceleration time of the motor is variable, this feature should be set just beyond the longest acceleration time.

Note: Some motor softstarters may allow current to ramp up slowly while others may limit current to less than Full Load Amps throughout the start. In these cases, as a generic relay that must protect all motors, the SR469 cannot differentiate between a motor that has a slow ramp up time and one that has completed a start and gone into an overload condition. Therefore, if the motor current does not rise to greater than full load within 1 second on start, the acceleration timer feature is ignored. In any case, the motor is still protected by the overload curve.

4.8.2 START INHIBIT

■ START INHIBIT ■ [ENTER] for more	ENTER / ESCAPE	START INHIBIT BLOCK: Off	RANGE: On, Off
	ENTER / ESCAPE	TC USED MARGIN: 25 %	RANGE: 0 - 25

FUNCTION:

The Start Inhibit feature is intended to help prevent tripping of the motor during start if there is insufficient thermal capacity for a start. The largest value of thermal capacity used from the last five successful starts is multiplied by (1 + TC USED MARGIN) and stored as thermal capacity used on start. This thermal capacity margin is used to ensure that a motor start will be successful. If the number is greater than 100% , 100% is stored as thermal capacity used on start. A successful motor start is one in which phase current rises from 0 to greater than overload pickup and then, after acceleration, falls below the overload curve pickup level. If the Start Inhibit feature is enabled, each time the motor is stopped, the amount of thermal capacity available (100% - Thermal Capacity Used) is compared to the Thermal Capacity Used On Start. If the thermal capacity available does not exceed the Thermal Capacity Used On Start, or is not equal to 100 %, the Start Inhibit Block will become active until there is sufficient thermal capacity. When a block occurs, the lockout time will be equal to the time required for the motor to cool to an acceptable temperature for a start. This time will be a function of the Cool Time Constant Stopped programmed at S5 THERMAL MODEL.

If this feature is turned Off, thermal capacity used must reduce to 15% before an overload lockout resets. This feature should be turned off if the load varies for different starts.

EXAMPLE:

If the thermal capacity used for the last 5 starts is 24, 23, 27, 25, and 21% respectively, learned starting capacity is 27% x 1.25= 33.75% used. If the motor stops with 90% thermal capacity used, a start block will be issued.

When the motor has cooled and the level of thermal capacity used has fallen to 66%, a start will be permitted. If the Cool Time Constant Stopped is programmed for 30 minutes, lockout time will be equal to:

$$TCused = TCused\_start(e^{-t/\tau})$$

$$66\% = 90\%(e^{-t/30})$$

$$t = \ln(66/90) \times -30$$

$$t = 9.3 \text{ minutes}$$

4.8.3 JOGGING BLOCK

JOGGING BLOCK [ENTER] for more	ENTER / ESCAPE	JOGGING BLOCK: Off	RANGE: On, Off
	ESCAPE / MESSAGE	MAX. STARTS/HOUR PERMISSIBLE: 3	RANGE: 1 - 5 STEP: 1
	ESCAPE / MESSAGE	TIME BETWEEN STARTS PERMISSIBLE: 10 min	RANGE: 0 - 500 STEP: 1

FUNCTION:

The Jogging Block feature may be used to prevent operators from jogging the motor (multiple starts and stops that are performed in rapid succession.) It consists of two distinct elements, Starts/Hour and Time Between Starts.

The STARTS/HOUR feature does not guarantee that a certain number of starts or start attempts will be allowed within an hour, rather, it ensures that a certain number of start attempts will not be exceeded within an hour. Similarly, the TIME BETWEEN STARTS feature does not guarantee another start will be permitted if the Time Between Starts time elapses after the most recent start; rather, it ensures a minimum time between starts. If however, the first start attempt from cold is unsuccessful due to a jam or it takes long because the process is overloaded, the Thermal Model might reduce the number of starts that can be attempted within an hour. It may also cause a lockout time that exceeds a Time Between Starts lockout that may have been active. Such a thermal lockout will remain until the motor has cooled to an acceptable temperature for a start.

STARTS / HOUR

A motor start is assumed to be occurring when the SR469 measures the transition of no motor current to some value of motor current. At this point, one of the STARTS/HOUR timers is loaded with 60 minutes. Even unsuccessful start attempts will be logged as starts for this feature. Once the motor is stopped, the number of starts within the past hour is compared to the number of starts allowable. If the two numbers are the same, a block will occur. If a block occurs, the lockout time will be equal to the longest time elapsed since a start within the past hour, subtracted from one hour.

EXAMPLE:

STARTS/HOUR are programmed at 2,

- one start occurs at T = 0 min,
- a second start occurs at T = 17 min,
- the motor is stopped at T = 33 min,
- a block occurs
- the lockout time would be 1 hour - 33 min = 27 min

TIME BETWEEN STARTS

A motor start is assumed to be occurring when the SR469 measures the transition of no motor current to some value of motor current. At this point, the Time Between Starts timer is loaded with the entered time. Even unsuccessful start attempts will be logged as starts for this feature. Once the motor is stopped, if the time elapsed since the most recent start is less than the Time Between Starts setpoint, a block will occur. If a block occurs, the lockout time will be equal to the time elapsed since the most recent start subtracted from the Time Between Starts setpoint. A value of 0 effectively disables this element of the Jogging Block feature.

EXAMPLE:

Time Between Starts is programmed = 25 min
a start occurs at T = 0 min,
the motor is stopped at T = 12 min
a block occurs
the lockout time would be 25 min -12 min = 13 min.

4.8.4 RESTART BLOCK

y RESTART BLOCK y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	RESTART BLOCK: Off	RANGE: On, Off
	ESCAPE / MESSAGE ⇧	RESTART BLOCK TIME: 1 s	RANGE: 1-50000 STEP: 1

FUNCTION:

The Restart Block feature may be used to ensure that a certain amount of time passes between stopping a motor and restarting that motor. This timer feature may be very useful for some process applications or motor considerations. If a motor is on a down-hole pump, after the motor stops, the liquid may fall back down the pipe and spin the rotor backwards. It would be very undesirable to start the motor at this time. In another scenario, a motor may be driving a very high inertia load. Once the supply to the motor is disconnected, the rotor may continue to turn for a long period of time as it decelerates. The motor has now become a generator and applying supply voltage out of phase may result in catastrophic failure.

Note: The Restart Block feature is strictly a timer. The SR469 does not sense rotor rotation.

4.9.1 RTD TYPES

y RTD TYPES y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	STATOR RTD TYPE: 100 Ohm Platinum	RANGE: 100 Ohm Platinum, 120 Ohm Nickel, 100 Ohm Nickel, 10 Ohm Copper
	ESCAPE / MESSAGE ⇳	BEARING RTD TYPE: 100 Ohm Platinum	RANGE: 100 Ohm Platinum, 120 Ohm Nickel, 100 Ohm Nickel, 10 Ohm Copper
	ESCAPE / MESSAGE ⇳	AMBIENT RTD TYPE: 100 Ohm Platinum	RANGE: 100 Ohm Platinum, 120 Ohm Nickel, 100 Ohm Nickel, 10 Ohm Copper
	ESCAPE / MESSAGE ⇧	OTHER RTD TYPE: 100 Ohm Platinum	RANGE: 100 Ohm Platinum, 120 Ohm Nickel, 100 Ohm Nickel, 10 Ohm Copper

FUNCTION:

Each of the twelve RTD s of the SR469 may be configured as None or any one of four application types, Stator, Bearing, Ambient, or Other. Each of those types may in turn be any one of four different RTD types: 100 ohm Platinum, 120 ohm Nickel, 100 ohm Nickel, 10 ohm Copper. The table below lists RTD resistance VS Temperature.

Table 4-3 RTD TEMPERATURE vs. RESISTANCE

TEMP °Celsius	TEMP °Fahrenheit	100 OHM Pt (DIN 43760)	120 OHM Ni	100 OHM Ni	10 OHM Cu
-50	-58	80.31	86.17	71.81	7.10
-40	-40	84.27	92.76	77.30	7.49
-30	-22	88.22	99.41	82.84	7.88
-20	-4	92.16	106.15	88.45	8.26
-10	14	96.09	113.00	94.17	8.65
0	32	100.00	120.00	100.00	9.04
10	50	103.90	127.17	105.97	9.42
20	68	107.79	134.52	112.10	9.81
30	86	111.67	142.06	118.38	10.19
40	104	115.54	149.79	124.82	10.58
50	122	119.39	157.74	131.45	10.97
60	140	123.24	165.90	138.25	11.35
70	158	127.07	174.25	145.20	11.74
80	176	130.89	182.84	152.37	12.12
90	194	134.70	191.64	159.70	12.51
100	212	138.50	200.64	167.20	12.90
110	230	142.29	209.85	174.87	13.28
120	248	146.06	219.29	182.75	13.67
130	266	149.82	228.96	190.80	14.06
140	284	153.58	238.85	199.04	14.44
150	302	157.32	248.95	207.45	14.83
160	320	161.04	259.30	216.08	15.22
170	338	164.76	269.91	224.92	15.61
180	356	168.47	280.77	233.97	16.00
190	374	172.46	291.96	243.30	16.39
200	392	175.84	303.46	252.88	16.78
210	410	179.51	315.31	262.76	17.17
220	428	183.17	327.54	272.94	17.56
230	446	186.82	340.14	283.45	17.95
240	464	190.45	353.14	294.28	18.34
250	482	194.08	366.53	305.44	18.73

4.9.2 RTDS 1-6

y RTD #1
y [ENTER] for more

ENTER / ESCAPE	RTD #1 APPLICATION: Stator	RANGE: Stator, Bearing, Ambient, Other, None
ESCAPE / MESSAGE	RTD #1 NAME:	RANGE: 8 Character Alphanumeric
ESCAPE / MESSAGE	RTD #1 ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	RTD #1 ALARM TEMPERATURE: 130⁰ C	RANGE: 1- 250 STEP: 1
ESCAPE / MESSAGE	RTD #1 HIGH ALARM: OFF	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	HIGH ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	RTD #1 HIGH ALARM TEMPERATURE: 130°C	RANGE: 1 - 250 STEP: 1
ESCAPE / MESSAGE	RTD #1 ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	RTD #1 TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	RTD #1 TRIP VOTING: RTD #1	RANGE: RTD #1, RTD #2, RTD #3, RTD #4, RTD #5, RTD #6, RTD #7, RTD #8, RTD #9, RTD #10, RTD #11, RTD #12
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ESCAPE / MESSAGE	RTD #1 TRIP TEMPERATURE: 155⁰ C	RANGE: 1- 250 STEP: 1

FUNCTION:

RTDs 1 through 6 default to Stator RTD type. There are individual alarm and trip configurations for each RTD. This allows one of the RTDs to be turned off if it malfunctions. The alarm level is normally set slightly above the normal running temperature. The high alarm is usually set as a warning of a trip or to initiate an orderly shutdown before tripping occurs. The trip level is normally set at the insulation rating. Trip voting has been added for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip will be issued. If the RTD is chosen to vote with itself, the voting feature is disabled. Each RTD name may be changed if desired.

4.9.3 RTDs 7 - 10

y RTD #7
y [ENTER] for more

RTD #7 APPLICATION: Bearing	RANGE: Stator, Bearing, Ambient, Other, None
RTD #7 NAME:	RANGE: 8 Character Alphanumeric
RTD #7 ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
RTD #7 ALARM TEMPERATURE: 80° C	RANGE: 1- 250 STEP: 1
RTD #7 HIGH ALARM: OFF	RANGE: Off, Latched, Unlatched
HIGH ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
RTD #7 HIGH ALARM TEMPERATURE: 80°C	RANGE: 1 - 250 STEP: 1
RTD #7 ALARM EVENTS: Off	RANGE: On, Off
RTD #7 TRIP: Off	RANGE: Off, Latched, Unlatched
RTD #7 TRIP VOTING: RTD #7	RANGE: RTD #1, RTD #2, RTD #3, RTD #4, RTD #5, RTD #6, RTD #7, RTD #8, RTD #9, RTD #10, RTD #11, RTD #12
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
RTD #7 TRIP TEMPERATURE: 90° C	RANGE: 1- 250 STEP: 1

FUNCTION:

RTDs 7 through 10 default to Bearing RTD type. There are individual alarm and trip configurations for each RTD. This allows one of the RTDs to be turned off if it malfunctions. The alarm level, high alarm level and the trip level are normally set slightly above the normal running temperature, but below the bearing temperature rating. Trip voting has been added for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip will be issued. If the RTD is chosen to vote with itself, the voting feature is disabled. Each RTD name may be changed if desired.

4.9.4 RTD 11

y RTD #11
y [ENTER] for more

RTD #11 APPLICATION: Other	RANGE: Stator, Bearing, Ambient, Other, None
RTD #11 NAME:	RANGE: 8 Character Alphanumeric
RTD #11 ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
RTD #11 ALARM TEMPERATURE: 80^{0} C	RANGE: 1- 250 STEP: 1
RTD #11 HIGH ALARM: OFF	RANGE: Off, Latched, Unlatched
HIGH ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
RTD #11 HIGH ALARM TEMPERATURE: 80°C	RANGE: 1 - 250 STEP: 1
RTD #11 ALARM EVENTS: Off	RANGE: On, Off
RTD #11 TRIP: Off	RANGE: Off, Latched, Unlatched
RTD #11 TRIP VOTING: RTD #11	RANGE: RTD #1, RTD #2, RTD #3, RTD #4, RTD #5, RTD #6, RTD #7, RTD #8, RTD #9, RTD #10, RTD #11, RTD #12
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
RTD #11 TRIP TEMPERATURE: 90^{0} C	RANGE: 1- 250 STEP: 1

FUNCTION:

RTD 11 defaults to Other RTD type. The Other selection allows the RTD to be used to monitor any temperature that might be required, either for a process or additional bearings or other. There are individual alarm, high alarm and trip configurations for this RTD. Trip voting has been added for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip will be issued. If the RTD is chosen to vote with itself, the voting feature is disabled. The RTD name may be changed if desired.

4.9.5 RTD 12

y RTD #12
y [ENTER] for more

ENTER / ESCAPE	RTD #12 APPLICATION: Ambient	RANGE: Stator, Bearing, Ambient, Other, None
ESCAPE / MESSAGE	RTD #12 NAME:	RANGE: 8 Character Alphanumeric
ESCAPE / MESSAGE	RTD #12 ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	RTD #12 ALARM TEMPERATURE: 60º C	RANGE: 1- 250 STEP: 1
ESCAPE / MESSAGE	RTD #12 HIGH ALARM: OFF	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	HIGH ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	RTD #12 HIGH ALARM TEMPERATURE: 60°C	RANGE: 1 - 250 STEP: 1
ESCAPE / MESSAGE	RTD #12 ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	RTD #12 TRIP: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	RTD #12 TRIP VOTING: RTD #12	RANGE: RTD #1, RTD #2, RTD #3, RTD #4, RTD #5, RTD #6, RTD #7, RTD #8, RTD #9, RTD #10, RTD #11, RTD #12
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ESCAPE / MESSAGE	RTD #12 TRIP TEMPERATURE: 80º C	RANGE: 1- 250 STEP: 1

FUNCTION:

RTDs 12 defaults to Ambient RTD type. The Ambient selection allows the RTD to be used to monitor ambient temperature for input into the thermal model. This sensor is required for the Learned cooling feature of the thermal model (See 3.5 Thermal Model). There are individual alarm, high alarm and trip configurations for this RTD. Trip voting has been added for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip will be issued. If the RTD is chosen to vote with itself, the voting feature is disabled. The RTD name may be changed if desired.

4.9.6 OPEN RTD SENSOR

y OPEN RTD SENSOR y [ENTER] for more	ENTER / ESCAPE	OPEN RTD SENSOR ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	OPEN RTD SENSOR ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

The SR469 has an Open RTD Sensor Alarm. This alarm will look at all RTDs that have either an alarm or trip programmed and determine if an RTD connection has been broken. Any RTDs that do not have a trip or alarm associated with them will be ignored for this feature. When a broken sensor is detected, the assigned output relay will operate and a message will appear on the display identifying the RTD that is broken. It is recommended that if this feature is used, the alarm be programmed as latched so that intermittent RTDs are detected and corrective action may be taken.

4.9.7 RTD SHORT/LOW TEMP

y RTD SHORT/LOW TEMP y [ENTER] for more	ENTER / ESCAPE	RTD SHORT/LOW TEMP ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	RTD SHORT/LOW TEMP ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

The SR469 has an RTD Short/Low Temperature alarm. This alarm will look at all RTDs that have either an alarm or trip programmed and determine if an RTD has either a short or a very low temperature (less than -50°C). Any RTDs that do not have a trip or alarm associated with them will be ignored for this feature. When a short/low temperature is detected, the assigned output relay will operate and a message will appear on the display identifying the RTD that caused the alarm. It is recommended that if this feature is used, the alarm be programmed as latched so that intermittent RTDs are detected and corrective action may be taken.

4.10.1 UNDERVOLTAGE

■ UNDERVOLTAGE ■ [ENTER] for more	
U/V ACTIVE ONLY IF BUS ENERGIZED: No	RANGE: No, Yes
UNDERVOLTAGE ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
UNDERVOLTAGE ALARM PICKUP: 0.85xRATED	RANGE: 0.60 - 0.99 STEP: 0.01
STARTING U/V ALARM PICKUP: 0.85xRATED	RANGE: 0.60 - 0.99, Off STEP: 0.01
UNDERVOLTAGE ALARM DELAY: 3.0 s	RANGE: 0.0 - 60.0 STEP: 0.1
UNDERVOLTAGE ALARM EVENTS: Off	RANGE: On, Off
UNDERVOLTAGE TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
UNDERVOLTAGE TRIP PICKUP: 0.80xRATED	RANGE: 0.60 - 0.99 STEP: 0.01
STARTING U/V TRIP PICKUP: 0.80xRATED	RANGE: 0.60 - 0.99, Off STEP: 0.01
UNDERVOLTAGE TRIP DELAY: 3.0 s	RANGE: 0.0 - 60.0 STEP: 0.1

FUNCTION:

The “U/V Active Only If Bus Energized” setpoint may be used to prevent nuisance alarms or trips when the bus is not energized. If ‘Yes’ is programmed for this setpoint, at least one voltage must be greater than 20% of the nominal nameplate voltage rating for any alarm or trip. If the load is high inertia, it may be desirable to ensure that the motor is tripped off line or prevented from starting in the event of a total loss of line voltage. Programming ‘No’ for the block setpoint will ensure that the motor is tripped and may be restarted only after the bus is re-energized.

If the undervoltage alarm or trip feature is enabled, once the magnitude of either Va, Vb, or Vc falls below the Pickup Level while running or Starting Pickup Level while starting, for a period of time specified by the Delay, a trip or alarm will occur. (Pickup levels are multiples of motor nameplate voltage).

An undervoltage on running motor with a constant load will result in increased current. The relay thermal model will typically pickup this condition and provide adequate protection. This setpoint may however, be used in conjunction with the time delay to provide additional protection that may be programmed for advance warning by tripping.

Attempting to start a large motor when the supply voltage is already down may also be undesirable. An undervoltage of significant proportions that persists while starting a motor may prevent the motor from coming up to rated speed. This may be especially critical for a synchronous motor. This feature may be used in with a time delay to provide protection for undervoltage conditions before and during starting.

4.10.2 OVERVOLTAGE

■ OVERVOLTAGE
■ [ENTER] for more

OVERVOLTAGE ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
OVERVOLTAGE ALARM PICKUP: 1.05xRATED	RANGE: 1.01 - 1.20 STEP: 0.01
OVERVOLTAGE ALARM DELAY: 3.0 s	RANGE: 0.5 - 60.0 STEP: 0.1
OVERVOLTAGE ALARM EVENTS: Off	RANGE: On, Off
OVERVOLTAGE TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
OVERVOLTAGE TRIP PICKUP: 1.10xRATED	RANGE: 1.01 - 1.20 STEP: 0.01
OVERVOLTAGE TRIP DELAY: 3.0 s	RANGE: 0.5 - 60.0 STEP: 0.1

FUNCTION:

If enabled, once the magnitude of either Va, Vb, or Vc rises above the Pickup Level for a period of time specified by the Delay, a trip or alarm will occur. (Pickup levels are multiples of motor nameplate voltage).

An overvoltage on running motor with a constant load will result in decreased current. However, iron and copper losses increase, causing an increase in motor temperature. The current overload relay will not pickup this condition and provide adequate protection. Therefore, the overvoltage element may be useful for protecting the motor in the event of a sustained overvoltage condition.

4.10.3 PHASE REVERSAL

■ PHASE REVERSAL
■ [ENTER] for more

PHASE REVERSAL TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3

FUNCTION:

The SR469 can detect the phase rotation of the three phase voltage. If the Phase Reversal feature is turned on when all 3 phase voltages are greater than 50% motor nameplate voltage and the phase rotation of the three phase voltages is not the same as the setpoint, a trip and block start will occur in 500ms to 700ms.

NOTE: This feature does not work when single VT operation is enabled.

4.10.4 FREQUENCY

y FREQUENCY
y [ENTER] for more

Display (ENTER / ESCAPE / MESSAGE)	Range
FREQUENCY ALARM : Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
OVER FREQUENCY ALARM LEVEL: 60.50 Hz	RANGE: 25 .01 - 70.00 STEP: 0.01
UNDER FREQUENCY ALARM LEVEL: 59.50 Hz	RANGE: 20.00 - 60.00 STEP: 0.01
FREQUENCY ALARM DELAY: 1.0 s	RANGE: 0.0 -60.0 STEP: 0.1
FREQUENCY ALARM EVENTS: Off	RANGE: On, Off
FREQUENCY TRIP : Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
OVER FREQUENCY TRIP LEVEL: 60.50 Hz	RANGE: 25 .01 - 70.00 STEP: 0.01
UNDER FREQUENCY TRIP LEVEL: 59.50 Hz	RANGE: 20.00 - 60.00 STEP: 0.01
FREQUENCY TRIP DELAY: 1.0 s	RANGE: 0.0 -60.0 STEP: 0.1

FUNCTION:

The Frequency elements operate as follows. Once the frequency of the phase AN or AB voltage (depending on wye or delta connection) is out of range of the Over and Under frequency setpoints, a trip or alarm will occur.

EXAMPLE:

This feature may be useful for load shedding applications on large motors. It could also be used to load shed an entire feeder if the trip was assigned to an upstream breaker.

4.11.1 POWER MEASUREMENT CONVENTIONS

By convention, an induction motor consumes Watts and vars. This condition is displayed on the SR469 as +Watts and +vars. A synchronous motor can consume Watts and vars or consume Watts and generate vars. These conditions are displayed on the SR469 as +Watts, +vars, and +Watts, -vars respectively. (see Figure 4-23).

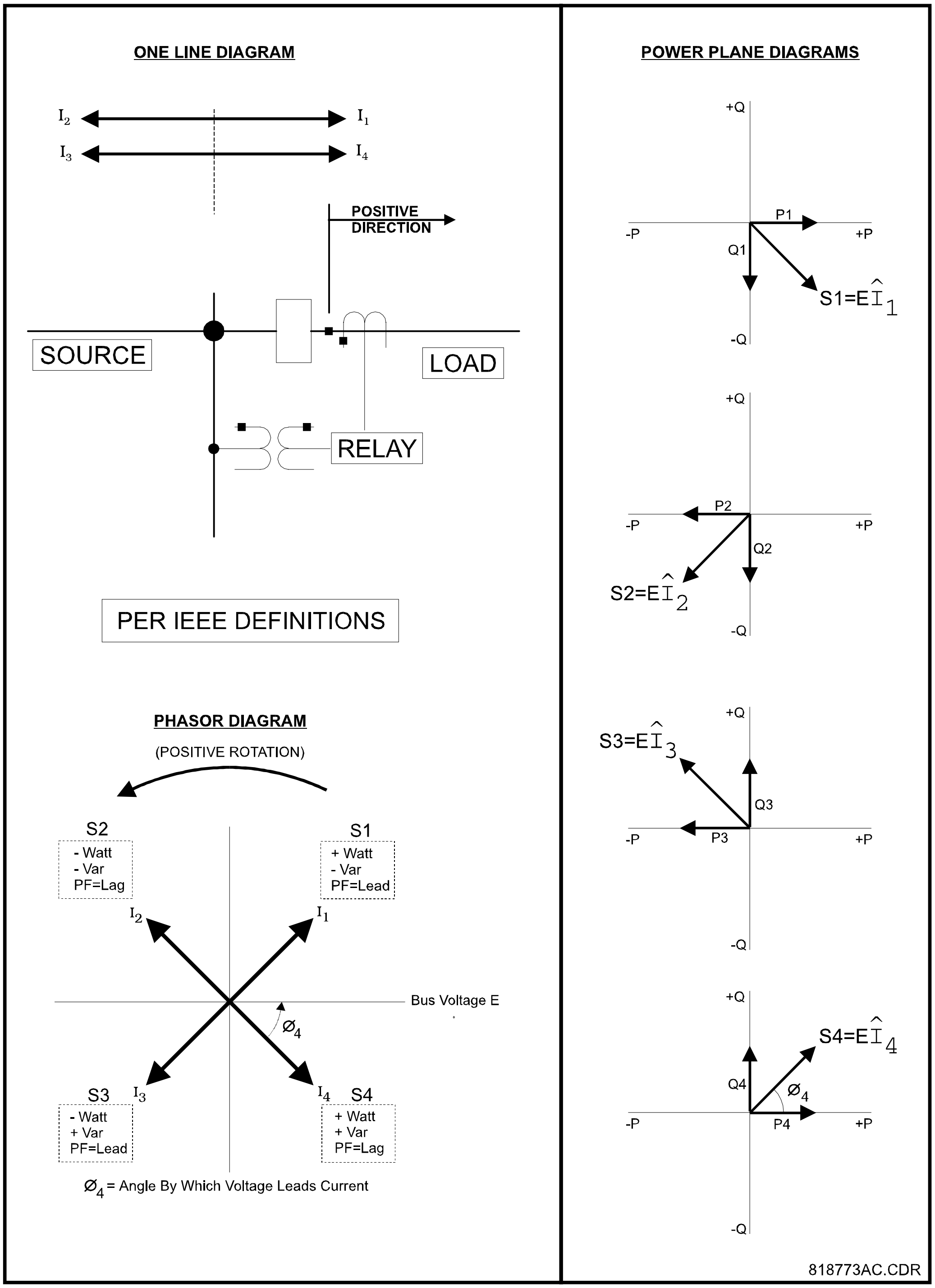


Figure 4-23 POWER MEASUREMENT CONVENTIONS

4.11.2 POWER FACTOR

y POWER FACTOR
y [ENTER] for more

ENTER / ESCAPE	BLOCK PF ELEMENT FROM START: 1 s	RANGE: 0 - 5000 STEP: 1
ESCAPE / MESSAGE	POWER FACTOR ALARM : Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	POWER FACTOR LEAD ALARM LEVEL: Off	RANGE: 0.05 - 0.99, Off STEP: 0.01
ESCAPE / MESSAGE	POWER FACTOR LAG ALARM LEVEL: Off	RANGE: 0.05 - 0.99, Off STEP: 0.01
ESCAPE / MESSAGE	POWER FACTOR ALARM DELAY: 1.0 s	RANGE: 0.2 - 30.0 STEP: 0.1
ESCAPE / MESSAGE	POWER FACTOR ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	POWER FACTOR TRIP : Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ESCAPE / MESSAGE	POWER FACTOR LEAD TRIP LEVEL: Off	RANGE: 0.05 - 0.99, Off STEP: 0.01
ESCAPE / MESSAGE	POWER FACTOR LAG TRIP LEVEL: Off	RANGE: 0.05 - 0.99, Off STEP: 0.01
ESCAPE / MESSAGE	POWER FACTOR TRIP DELAY: 1.0 s	RANGE: 0.2- 30.0 STEP: 0.1

FUNCTION:

If the SR469 is applied on a synchronous motor, it is desirable not to trip or alarm on power factor until the field has been applied. Therefore, this feature can be blocked until the motor comes up to speed and the field is applied. From that point forward, the power factor trip and alarm elements will be active. Once the power factor is less than either the Lead or Lag level, for the specified delay, a trip or alarm will occur indicating a Lead or Lag condition. The power factor alarm can be used to detect loss of excitation and out of step.

4.11.3 REACTIVE POWER

y REACTIVE POWER
y [ENTER] for more

BLOCK kvar ELEMENT FROM START: 1 s	RANGE: 0 - 5000 STEP: 1
REACTIVE POWER ALARM : Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
POSITIVE kvar ALARM LEVEL: 10 kvar	RANGE: 1 - 25000 STEP: 1
NEGATIVE kvar ALARM LEVEL: 10 kvar	RANGE: 1 - 25000 STEP: 1
REACTIVE POWER ALARM DELAY: 1.0 s	RANGE: 0.2 - 30.0 STEP: 0.1
REACTIVE POWER ALARM EVENTS: Off	RANGE: On, Off
REACTIVE POWER TRIP : Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
POSITIVE kvar TRIP LEVEL: 25 kvar	RANGE: 1 - 25000 STEP: 1
NEGATIVE kvar TRIP LEVEL: 25 kvar	RANGE: 1 - 25000 STEP: 1
REACTIVE POWER TRIP DELAY: 1.0 s	RANGE: 0.2 - 30.0 STEP: 0.1

FUNCTION:

If the SR469 is applied on a synchronous motor, it is desirable not to trip or alarm on kvar until the field has been applied. Therefore, this feature can be blocked until the motor comes up to speed and the field is applied. From that point forward, the kvar trip and alarm elements will be active. Once the kvar level exceeds either the positive or negative level, for the specified delay, a trip or alarm will occur indicating a positive or negative kvar condition. The reactive power alarm can be used to detect loss of excitation and out of step.

4.11.4 UNDERPOWER

■ UNDERPOWER ■ [ENTER] for more	
BLOCK UNDERPOWER FROM START: 0 s	RANGE: 0 - 15000 STEP: 1
UNDERPOWER ALARM : Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
UNDERPOWER ALARM LEVEL: 2 kW	RANGE: 1 - 25000 STEP: 1
UNDERPOWER ALARM DELAY: 1 s	RANGE: 1 - 30 STEP: 1
UNDERPOWER ALARM EVENTS: Off	RANGE: On, Off
UNDERPOWER TRIP : Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
UNDERPOWER TRIP LEVEL: 1 kW	RANGE: 1 - 25000 STEP: 1
UNDERPOWER TRIP DELAY: 1 s	RANGE: 1 - 30 STEP: 1

FUNCTION:

If enabled, once the magnitude of 3∅ total power falls below the Pickup Level for a period of time specified by the Delay, a trip or alarm will occur. The Underpower element is active only when the motor is running and will be blocked upon the initiation of a motor start for a period of time defined by the setpoint Block Element From Start (e.g. this block may be used to allow pumps to build up head before the underpower element trips or alarms). A value of 0 means the feature is not blocked from start. If a value other than 0 is entered, the feature will be disabled when the motor is stopped and also from the time a start is detected until the time entered expires. The pickup level should be set lower than motor loading during normal operations.

EXAMPLE:

Underpower may be used to detect loss of load conditions. Loss of load conditions will not always cause a significant loss of current. Power is a more accurate representation of loading and may be used for more sensitive detection of load loss or pump cavitation. This may be especially useful for detecting process related problems.

4.11.5 REVERSE POWER

y REVERSE POWER
y [ENTER] for more

ENTER / ESCAPE	BLOCK REVERSE POWER FROM START: 0 s	RANGE: 0 - 50000 STEP: 1
ESCAPE / MESSAGE	REVERSE POWER ALARM : Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	REVERSE POWER ALARM LEVEL: 1 kW	RANGE: 1 - 25000 STEP: 1
ESCAPE / MESSAGE	REVERSE POWER ALARM DELAY: 1 s	RANGE: 0.2 - 30.0 STEP: 0.1
ESCAPE / MESSAGE	REVERSE POWER ALARM EVENTS: Off	RANGE: On, Off
ESCAPE / MESSAGE	REVERSE POWER TRIP : Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ESCAPE / MESSAGE	REVERSE POWER TRIP LEVEL: 1 kW	RANGE: 1 - 25000 STEP: 1
ESCAPE / MESSAGE	REVERSE POWER TRIP DELAY: 1 s	RANGE: 0.2 - 30.0 STEP: 0.1

If enabled, once the magnitude of 3∅ total power exceeds the Pickup Level in the reverse direction (negative kW) for a period of time specified by the Delay, a trip or alarm will occur.

NOTE: The minimum magnitude of power measurement is determined by the phase CT minimum of 5 % rated CT primary. If the level for reverse power is set below that level, a trip or alarm will only occur once the phase current exceeds the 5% cutoff.

4.11.6 TORQUE SETUP

y TORQUE SETUP
y [ENTER] for more

ENTER / ESCAPE	TORQUE METERING DISABLED	RANGE: DISABLED/ENABLED STEP: N/A
ESCAPE / MESSAGE	STATOR RESISTANCE 0.004 mΩ	RANGE: 0.001 to 50.00 STEP: 0.001
ESCAPE / MESSAGE	POLE PAIRS: 2	RANGE: 2 to 128 STEP: 2
ESCAPE / MESSAGE	TORQUE UNIT: Newton-meter	RANGE: Newton-meter / Foot-pound STEP: N/A

FUNCTION:

Before torque can be determined for a motor the motors stator resistance and number of pole pairs must be entered here. The base stator resistance can be determined from the motor's rated voltage and rated current. The torque metering is intended for induction motors only. In addition, only positive torque is calculated. Please consult motor specification for the stator resistance and the pole pairs.

The default unit for torque is SI unit of Newton-meter. The torque unit is selectable to either Newton-meter or foot-pound.

Note: 1 Nm = 0.738 ftlb

4.11.7 OVER TORQUE SETUP

y OVERTORQUE
y [ENTER] for more

ENTER / ESCAPE	OVERTORQUE ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary 3, Auxiliary 2, Aux2 & Aux3, Auxiliary 3
ESCAPE / MESSAGE	OVER TORQUE ALARM LEVEL: 4000.0 Nm	RANGE: 1.0 to 999999.9 STEP: 0.1
ESCAPE / MESSAGE	OVER TORQUE ALARM DELAY: 1.0s	RANGE: 0.2 to 30 STEP: 0.1
ESCAPE / MESSAGE	OVER TORQUE ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

If it is desired to detect an overtorque condition on a motor, usually done to protect devices driven by the motor, it can be set up here. The assigned relay will activate when the torque measured exceeds the specified level for the specified time duration.

4.12.1 TRIP COUNTER

y TRIP COUNTER
y [ENTER] for more

ENTER / ESCAPE	TRIP COUNTER ALARM: Off	RANGE: Off, Latched, Unlatched
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ESCAPE / MESSAGE	TRIP COUNTER ALARM: 25 TRIPS	RANGE: 1 - 50000 STEP: 1
ESCAPE / MESSAGE	TRIP COUNTER ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

The Trip Counter alarm will function as follows: when the Trip Counter Limit is reached, an alarm will occur. The trip counter must be cleared or the alarm level raised and the reset key must be pressed (if the alarm was latched) to reset the alarm.

EXAMPLE:

It might be useful to set a Trip Counter alarm at 100 such that if 100 trips occur, the resulting alarm would prompt the operator or supervisor to investigate the type of trips that have occurred. A breakdown of trips by type may be found on A3 MAINTENANCE, under TRIP COUNTERS. If a trend is detected, it would warrant further investigation.

4.12.2 STARTER FAILURE

Display	Keys	Setpoint	Range
y STARTER FAILURE y [ENTER] for more	ENTER / ESCAPE	STARTER FAILURE ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	STARTER TYPE: Breaker	RANGE: Breaker, Contactor
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	STARTER FAILURE DELAY: 100 ms	RANGE: 10 - 1000 STEP: 10
	ESCAPE / MESSAGE	SUPERVISION OF TRIP COIL: Disabled	RANGE: Disabled, 52 Closed, 52 Open/Closed *Seen only if Starter Type is Breaker.
	ESCAPE / MESSAGE	STARTER FAILURE ALARM EVENTS: Off	RANGE: On, Off

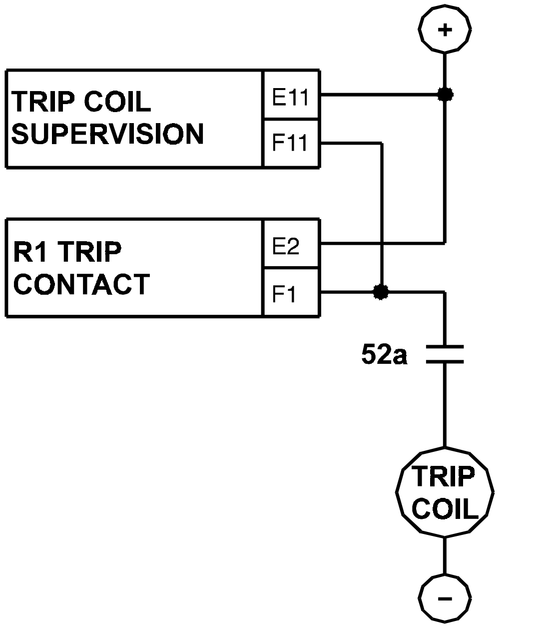
FUNCTION:

If the Starter Failure alarm feature is enabled as latched or unlatched, any time the SR469 initiates a trip, it will monitor the Starter Status input and the motor current. If the starter status contacts do not change state or motor current does not drop to zero after the programmed time delay, an alarm will occur. The time delay should be slightly longer than the breaker or contactor operating time. In the event that an alarm does occur, if Breaker was chosen as the starter type, the alarm will be Breaker Failure. If on the other hand, Contactor was chosen for starter type, the alarm will be Welded Contactor.

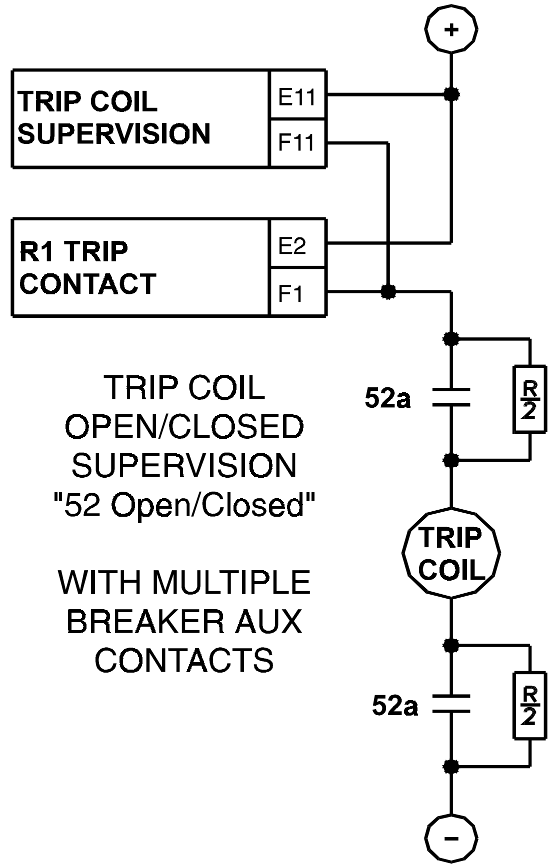
Also, if the starter type chosen is Breaker, Trip Coil Supervision may be enabled.

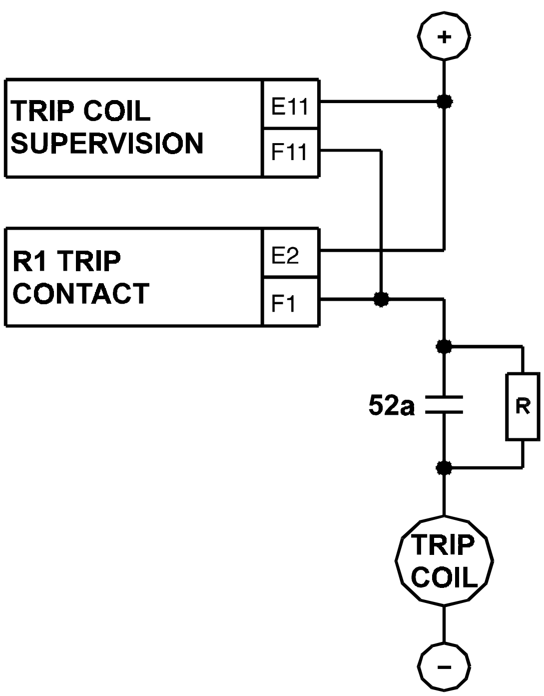
If *52 Closed* is selected, the trip coil supervision circuitry will monitor the trip coil circuit for continuity any time that the starter status input indicates that the breaker is closed or motor current is detected. If that continuity is broken, a Starter Failure alarm will indicate Trip Coil Supervision.

If *52 Open/Closed* is selected, the trip coil supervision circuitry will monitor the trip coil circuit for continuity at all times regardless of breaker state. This requires an alternate path around the 52a contacts in series with the trip coil when the breaker is open. See the following figure for modifications to the wiring and proper resistor selection. If that continuity is broken, a Starter Failure alarm will indicate Trip Coil Supervision.



TRIP COIL CLOSED SUPERVISION
"52 Closed"





TRIP COIL OPEN/CLOSED SUPERVISION
"52 Open/Closed"

VALUE OF RESISTOR 'R'

SUPPLY	OHMS	WATTS
48 VDC	10 K	2
125 VDC	25 K	5
250 VDC	50 K	5

Figure 4-24 TRIP COIL SUPERVISION

4.12.3 CURRENT, kw, kvar, kVA DEMAND

y CURRENT DEMAND y [ENTER] for more	ENTER / ESCAPE	CURRENT DEMAND PERIOD: 15 min	RANGE: 5 -90 STEP: 1
	ESCAPE / MESSAGE	CURRENT DEMAND ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	CURRENT DEMAND LIMIT: 100 A	RANGE: 10-100000 STEP: 1
	ESCAPE / MESSAGE	CURRENT DEMAND ALARM EVENTS: Off	RANGE: On, Off
y kW DEMAND y [ENTER] for more	ENTER / ESCAPE	kW DEMAND PERIOD: 15 min	RANGE: 5 -90 STEP: 1
	ESCAPE / MESSAGE	kW DEMAND ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	kW DEMAND LIMIT: 100 kW	RANGE: 1 - 50000
	ESCAPE / MESSAGE	kW DEMAND ALARM EVENTS: Off	RANGE: On, Off
y kvar DEMAND y [ENTER] for more	ENTER / ESCAPE	kvar DEMAND PERIOD: 15 min	RANGE: 5 -90 STEP: 1
	ESCAPE / MESSAGE	kvar DEMAND ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	kvar DEMAND LIMIT: 100 kvar	RANGE: 1 - 50000
	ESCAPE / MESSAGE	kvar DEMAND ALARM EVENTS: Off	RANGE: On, Off
y kVA DEMAND y [ENTER] for more	ENTER / ESCAPE	kVA DEMAND PERIOD: 15 min	RANGE: 5 -90 STEP: 1
	ESCAPE / MESSAGE	kVA DEMAND ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
	ESCAPE / MESSAGE	kVA DEMAND LIMIT: 100 kVA	RANGE: 1 - 50000
	ESCAPE / MESSAGE	kVA DEMAND ALARM EVENTS: Off	RANGE: On, Off

FUNCTION:

The SR469 can measure the demand of the motor for several parameters (current, kW, kvar, kVA). The demand values of motors may be of interest for energy management programs where processes may be altered or scheduled to reduce overall demand on a feeder.

Demand is calculated in the following manner. Every minute, an average magnitude is calculated for current, +kW, +kvar, and kVA based on samples taken every 5 seconds. These values are stored in a FIFO (First In, First Out buffer).The size of the buffer is dictated by the period that is selected for the setpoint. The average value of the buffer contents is calculated and stored as the new demand value every minute. Demand for real and reactive power is only positive quantities (+kW and +kvar).

$$DEMAND = \frac{1}{N}\sum_{n=1}^{N}\left|Average_n\right|$$ where: N= programmed Demand Period in minutes, n= time in minutes

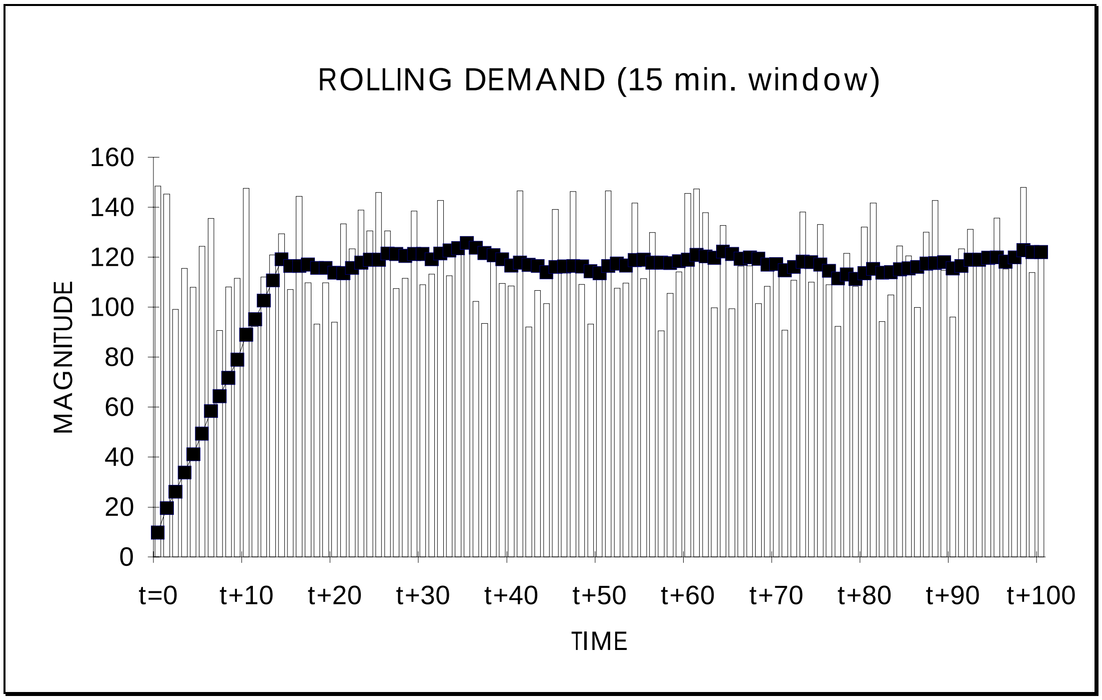


Figure 4-25 ROLLING DEMAND (15 min. window)

4.12.4 PULSE OUTPUT

y PULSE OUTPUT
y [ENTER] for more

ENTER / ESCAPE	POS kWh PULSE OUTPUT RELAY: OFF	RANGE: Auxiliary2, Auxiliary3, Alarm, OFF
ESCAPE / MESSAGE	POS kWh PULSE OUTPUT INTERVAL: 1 kWh	RANGE: 1 - 50000 STEP: 1
ESCAPE / MESSAGE	POS kvarh PULSE OUT RELAY: OFF	RANGE: Auxiliary2, Auxiliary3, Alarm, OFF
ESCAPE / MESSAGE	POS kvarh PULSE OUT INTERVAL: 1 kvarh	RANGE: 1 - 50000 STEP: 1
ESCAPE / MESSAGE	NEG kvarh PULSE OUT RELAY: OFF	RANGE: Auxiliary2, Auxiliary3, Alarm, OFF
ESCAPE / MESSAGE	NEG kvarh PULSE OUT INTERVAL: 1 kvarh	RANGE: 1 - 50000 STEP: 1
ESCAPE / MESSAGE	RUNNING TIME PULSE RELAY: OFF	RANGE: Auxiliary2, Auxiliary3, Alarm, OFF
ESCAPE / MESSAGE	RUNNING TIME PULSE INTERVAL: 0 sec	RANGE: 1 - 50000 STEP: 1

FUNCTION:

This feature configures one or more of the output relays as a pulsed output. When the programmed interval has transpired the assigned relay will be activated for 1 second. Note: this feature should be programmed such that no more than one pulse per second will be required or the pulsing will lag behind the interval activation.

4.13.1 ANALOG OUTPUTS 1-4

y ANALOG OUTPUT 1 y [ENTER] for more	ENTER ⇨ / ESCAPE ⇦	ANALOG OUTPUT 1: Therm. Capacity Used	RANGE: See Analog Output Table, Table 4-4
	ESCAPE / MESSAGE ⇳	THERM.CAPACITY USED MIN: 0 %	RANGE: 0 - 100 STEP: 1
	ESCAPE / MESSAGE ⇧	THERM. CAPACITY USED MAX: 100 %	RANGE: 0 - 100 STEP: 1
y ANALOG OUTPUT 2 y [ENTER] for more	ENTER ⇨ / ESCAPE ⇦	ANALOG OUTPUT 2: Motor Load	RANGE: See Analog Output Table, Table 4-4
	ESCAPE / MESSAGE ⇳	MOTOR LOAD MIN: 0.00 x FLA	RANGE: 0.00 - 20.00 STEP: 0.01
	ESCAPE / MESSAGE ⇧	MOTOR LOAD MAX: 1.50 x FLA	RANGE: 0.0 - 20.0 STEP: 0.01
y ANALOG OUTPUT 3 y [ENTER] for more	ENTER ⇨ / ESCAPE ⇦	ANALOG OUTPUT 3: Hottest Stator RTD	RANGE: See Analog Output Table, Table 4-4
	ESCAPE / MESSAGE ⇳	HOTTEST STATOR RTD MIN: 0 °C	RANGE: -50 to +250 STEP: 1
	ESCAPE / MESSAGE ⇧	HOTTEST STATOR RTD MAX: 250 °C	RANGE: : -50 to +250 STEP: 1
y ANALOG OUTPUT 4 y [ENTER] for more	ENTER ⇨ / ESCAPE ⇦	ANALOG OUTPUT 4: Real Power (kW)	RANGE: See Analog Output Table, Table 4-4
	ESCAPE / MESSAGE ⇳	REAL POWER (kW) MIN: 0 kW	RANGE: -50000 to +50000 STEP: 1
	ESCAPE / MESSAGE ⇧	REAL POWER (kW) MAX: 100 kW	RANGE: -50000 to +50000 STEP: 1

FUNCTION:

The SR469 has four analog output channels (4-20mA or 0-1mA as ordered). Each channel may be individually configured to represent a number of different measured parameters as shown in the table below. The minimum value programmed represents the 4mA output. The maximum value programmed represents the 20mA output. If the minimum is programmed lower than the maximum the output will function in reverse. All four of the outputs are updated once every 50ms. Each parameter may only be used once.

EXAMPLE:

The analog output parameter may be chosen as Hottest Stator RTD for a 4-20mA output. If the minimum is set for 0 and the maximum is set for 250, when the Hottest Stator RTD temperature is 0, the analog output channel will output 4 mA. When the Hottest Stator RTD is 125, the analog output channel will output 12 mA. When the Hottest Stator RTD is 250, the analog output channel will output 20 mA.

Table 4-4 ANALOG OUTPUT PARAMETER SELECTION TABLE

ANALOG OUTPUT PARAMETER SELECTION TABLE

PARAMETER NAME	RANGE / UNITS	STEP	DEFAULT Minimum	DEFAULT Maximum
Phase A Current	0-100000 AMPS	1	0	100
Phase B Current	0-100000 AMPS	1	0	100
Phase C Current	0-100000 AMPS	1	0	100
Avg. Phase Current	0-100000 AMPS	1	0	100
AB Line Voltage	50-20000 VOLTS	1	3200	4500
BC Line Voltage	50-20000 VOLTS	1	3200	4500
CA Line Voltage	50-20000 VOLTS	1	3200	4500
Avg. Line Voltage	50-20000 VOLTS	1	3200	4500
Phase AN Voltage	50-20000 VOLTS	1	1900	2500
Phase BN Voltage	50-20000 VOLTS	1	1900	2500
Phase CN Voltage	50-20000 VOLTS	1	1900	2500
Avg. Phase Voltage	50-20000 VOLTS	1	1900	2500
Hottest Stator RTD	-50 to +250°C or -58 to +482°F	1	0	200
Hottest Bearing RTD	-50 to +250°C or -58 to +482°F	1	0	200
Ambient RTD	-50 to +250°C or -58 to +482°F	1	-50	60
RTD #1 - 12	-50 to +250°C or -58 to +482°F	1	-50	250
Power Factor	0.01 to 1.00 lead/lag	0.01	0.8 lag	0.8lead
Reactive Power	-50000 to 50000 kvar	1	0	750
Real Power	-50000 to 50000 kW	1	0	1000
Apparent Power	0 to 50000 kVA	1	0	1250
Thermal Capacity Used	0-100 %	1	0	100
Relay Lockout Time	0-500 MINUTES	1	0	150
Current Demand	0-100000 AMPS	1	0	700
kvar Demand	0 -50000 kvar	1	0	1000
kW Demand	0 -50000 kW	1	0	1250
kVA Demand	0 -50000 kVA	1	0	1500
Motor Load	0.00 - 20.00 x FLA	0.01	0.00	1.25
Analog Inputs 1-4	-50000 to +50000	1	0	+50000
Tachometer	100 to 7200 RPM	1	3500	3700
MWhrs	0.000 to 999999.999 MWhrs	0.001	50.000	100.000
Analog In Diff 1-2	-50000 to +50000	1	0	100
Analog In Diff 3-4	-50000 to +50000	1	0	100
Torque	0 to 999999.9	0.1	0	100

4.13.2 ANALOG INPUTS 1-4

y ANALOG INPUT 1
y [ENTER] for more

ANALOG INPUT1: Disabled	RANGE: Disabled, 4-20mA, 0-20mA, 0-1mA
ANALOG INPUT1 NAME: Analog I/P 1	RANGE: 12 Character Alphanumeric
ANALOG INPUT1 UNITS: Units	RANGE: 6 Character Alphanumeric
ANALOG INPUT1 MINIMUM: 0	RANGE: -50000 to +50000 STEP: 1
ANALOG INPUT1 MAXIMUM: 100	RANGE: -50000 to +50000 STEP: 1
ANALOG INPUT1 BLOCK FROM START: 0 s	RANGE: 0-5000 STEP: 1
ANALOG INPUT1 ALARM: Off	RANGE: Off, Latched, Unlatched
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Aux2 & Aux3, Alarm & Auxiliary3, Auxiliary2, Aux2 & Aux3, Auxiliary3
ANALOG INPUT1 ALARM Level: 10 Units	RANGE: -50000 to +50000 STEP: 1 *Units will reflect the "Analog Input1 units" as entered above
ANALOG INPUT1 ALARM PICKUP: Over	RANGE: Over, Under
ANALOG INPUT1 ALARM DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1
ANALOG INPUT1 ALARM EVENTS: OFF	RANGE: On, Off
ANALOG INPUT1 TRIP: Off	RANGE: Off, Latched, Unlatched
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip & Auxiliary 2, Trip & Aux2 & Aux3, Trip & Auxiliary3
ANALOG INPUT1 TRIP Level: 20 Units	RANGE: -50000 to +50000 STEP: 1 *Units will reflect the units as entered above
ANALOG INPUT1 TRIP PICKUP: Over	RANGE: Over, Under
ANALOG INPUT1 TRIP DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1

FUNCTION:

There are 4 analog inputs, 4-20mA, 0-20mA, or 0-1mA as selected. These inputs may be used to monitor transducers such as vibration monitors, tachometers, pressure transducers, etc. These inputs may be used for alarm and tripping purposes. The inputs are sampled every 50 ms. The level of the analog input is also available over the communications port.

Before the input may be used, it must be configured. A name may be assigned for the input, units may be assigned, and a minimum and maximum value may be assigned. Also, the trip and alarm features may be blocked from start for a specified time delay. If the block time is 0, there is no block and the trip and alarm features will be active when the motor is stopped or running. If a time is programmed other than 0, the feature will be disabled when the motor is stopped and also from the time a start is detected until the time entered expires. Once the input is setup, both the trip and alarm features may be configured. In addition to programming a level and time delay, the PICKUP setpoint may be used to dictate whether the feature picks up when the measured value is over or under the level.

EXAMPLES:

If a pressure transducer is to be used for a pump application, program the name as 'Pressure'. The units as 'PSI'. The minimum as 0, the maximum as 500. If there is no pressure until the pump is up and running for 5 mins and pressure builds up, program the Block From Start as 6 mins (360s). The alarm may be fed back to a PLC for when pressure is under 300 PSI. Program a reasonable delay, 3 s, and pickup 'Under'.

If a vibration transducer is to be used, program the name as 'Vibration'. The units as 'mm/s'. The minimum as 0, the maximum as 25. Program the Block From Start as 0 mins. Set the alarm for a reasonable level slightly higher than the normal vibration level. Program a delay, 3 s, and pickup 'Over'.

4.13.3 ANALOG IN DIFF 1-2

y ANALOG IN DIFF 1-2
y [ENTER] for more

ENTER / ESCAPE	ANALOG IN DIFF 1-2 Disabled	RANGE: Disabled, Enabled NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 NAME: Analog 1-2	RANGE: 12 Character Alphanumeric NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 COMPARISON: % Diff	RANGE: % Diff, Abs Diff NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 LOGIC: 1<>2	RANGE: 1<>2, 1>2, 2>1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 ACTIVE: Always	RANGE: Always, Start/Run NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	A/I DIFF 1-2 BLOCK FROM START: 0s	RANGE: 0 - 5000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 ALARM: OFF	RANGE: OFF, Latched, Unlatched NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Auxiliary3, Alarm & Aux2 & Aux3, Auxiliary2, Aux2 & Aux3, Auxiliary3 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 ALARM LEVEL: 10 %	RANGE: 0 - 500 STEP: 1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled and % Diff is set.
ESCAPE / MESSAGE	A/I DIFF 1-2 ALARM LEVEL: 10 Units	RANGE: 0 - 50000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled and Abs Diff is set.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 ALARM DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 EVENTS: OFF	RANGE: OFF, ON NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 TRIP: OFF	RANGE: OFF, Latched, Unlatched NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip&Auxiliary2, Trip&Aux2&Aux3, Trip&Auxiliary3 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 TRIP LEVEL: 10 %	RANGE: 0 - 500 STEP: 1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled and % Diff is set.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 TRIP LEVEL: 10 Units	RANGE: 0 - 50000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled and Abs Diff is set.
ESCAPE / MESSAGE	ANALOG IN DIFF 1-2 TRIP DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1 NOTE: This can only be viewed if Analog Inputs 1 and 2 are enabled.

FUNCTION:

This feature allows the relay to compare two of the analog inputs and activate alarms or trips based on the difference between them. The difference can either be in the form of an absolute difference in units or a percentage difference. The second analog input (2 for 1-2) is used as the reference value for percentage calculations. The logic for the comparison can also be selected as one input greater than the other (1>2) or vice versa (2>1) or as absolute difference (1<>2).

Note that the analog inputs to be compared must be programmed prior to programming this feature. They must also be programmed with the same units type.

EXAMPLE:

Dual Motor Drive System: Two motors on a dual motor drive are each protected by SR469s. The motors should be at the same power level (kWs). Connect the analog outputs (programmed for kWs) from both relays to one of the relays analog inputs. Program the analog input differential feature to monitor the two motors kWs and trip at a predetermined level.

4.13.4 ANALOG IN DIFF 3-4

y ANALOG IN DIFF 3-4
y [ENTER] for more

ANALOG IN DIFF 3-4 Disabled	RANGE: Disabled, Enabled NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 NAME: Analog 3-4	RANGE: 12 Character Alphanumeric NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 COMPARISON: % Diff	RANGE: % Diff, Abs Diff NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 LOGIC: 3<>4	RANGE: 3<>4, 3>4, 4>3 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 ACTIVE: Always	RANGE: Always, Start/Run NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
A/I DIFF 3-4 BLOCK FROM START: 0s	RANGE: 0 - 5000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 ALARM: OFF	RANGE: OFF, Latched, Unlatched NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ASSIGN ALARM RELAYS: Alarm	RANGE: Alarm, Alarm & Auxiliary2, Alarm & Auxiliary3, Alarm & Aux2 & Aux3, Auxiliary2, Aux2 & Aux3, Auxiliary3 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 ALARM LEVEL: 10 %	RANGE: 0 - 500 STEP: 1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled and % Diff is set.
A/I DIFF 3-4 ALARM LEVEL: 10 Units	RANGE: 0 - 50000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled and Abs Diff is set.
ANALOG IN DIFF 3-4 ALARM DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 EVENTS: OFF	RANGE: OFF, ON NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ANALOG IN DIFF 3-4 TRIP: OFF	RANGE: OFF, Latched, Unlatched NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.
ASSIGN TRIP RELAYS: Trip	RANGE: Trip, Trip&Auxiliary2, Trip&Aux2&Aux3, Trip&Auxiliary3 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled and % Diff is set.
ANALOG IN DIFF 3-4 TRIP LEVEL: 10 %	RANGE: 0 - 500 STEP: 1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled and % Diff is set.
ANALOG IN DIFF 3-4 TRIP LEVEL: 10 Units	RANGE: 0 - 50000 STEP: 1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled and Abs Diff is set.
ANALOG IN DIFF 3-4 TRIP DELAY: 0.1 s	RANGE: 0.1 - 300.0 STEP: 0.1 NOTE: This can only be viewed if Analog Inputs 3 and 4 are enabled.

FUNCTION:

This feature allows the relay to compare two of the analog inputs and activate alarms or trips based on the difference between them. The difference can either be in the form of an absolute difference in units or a percentage difference. The second analog input (4 for 3-4) is used as the reference value for percentage calculations. The logic for the comparison can also be selected as one input greater than the other (3>4) or vice versa (4>3) or as absolute difference (3<>4).

Note that the analog inputs to be compared must be programmed prior to programming this feature. They must also be programmed with the same units type.

4.14.1 SIMULATION MODE

y SIMULATION MODE y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	SIMULATION MODE: Off	RANGE: Off, Simulate Pre-Fault, Simulate Fault, Pre-Fault to Fault
	ESCAPE / MESSAGE ⇧	PRE-FAULT TO FAULT TIME DELAY: 15 s	RANGE: 0 - 300 STEP: 1

FUNCTION:

The SR469 may be placed in several simulation modes. This simulation may be useful for several purposes. First, it may be used to understand the operation of the SR469 for learning or training purposes. Second, simulation may be used during startup to verify that control circuitry operates as it should in the event of a trip, alarm, or block start. In addition, simulation may be used to verify that set-points had been set properly in the event of fault conditions.

Simulation mode may be entered only if the motor is stopped and there are no trips, alarms, or block starts active. The values entered as Pre-Fault Values will be substituted for the measured values in the SR469 when the simulation mode is 'Simulate Pre-Fault'. The values entered as Fault Values will be substituted for the measured values in the SR469 when the simulation mode is 'Simulate Fault'. If the simulation mode: Pre-Fault to Fault is selected, the Pre-Fault values will be substituted for the period of time specified by the delay, followed by the Fault values. If a trip occurs, simulation mode will revert to Off. Selecting 'Off' for the simulation mode will place the SR469 back in service. If the SR469 measures phase current or control power is cycled, simulation mode will automatically revert to Off.

If the SR469 is to be used for training, it might be desirable to allow all learned parameters, statistical information, and event recording to update when operating in simulation mode. If however, the SR469 has been installed and will remain installed on a specific motor, it might be desirable to short the SR469 Test input (C3 and C4) to prevent all of this data from being corrupted or updated. In any case, when in simulation mode, the SR469 in Service LED (indicator) will flash, indicating that the SR469 is not in protection mode.

4.14.2 PRE-FAULT SETUP

■ PRE-FAULT SETUP ■ [ENTER] for more	ENTER / ESCAPE	PRE-FAULT CURRENT PHASE A: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
	ESCAPE / MESSAGE	PRE-FAULT CURRENT PHASE B: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
	ESCAPE / MESSAGE	PRE-FAULT CURRENT PHASE C: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
	ESCAPE / MESSAGE	PRE-FAULT GROUND CURRENT: 0.0 A	RANGE: 0.0 - 5000.0 STEP: 0.1
	ESCAPE / MESSAGE	PRE-FAULT VOLTAGES VLINE: 1.00 x RATED	RANGE: 0.00 - 1.10 STEP: 0.01
	ESCAPE / MESSAGE	PRE-FAULT CURRENT LAGS VOLTAGE: 0 °	RANGE: 0 - 359 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT DIFF AMPS: IDIFF: 0.00 x CT	RANGE: 0.00 - 1.10 STEP: 0.01
	ESCAPE / MESSAGE	PRE-FAULT STATOR RTD TEMP: 40 °C	RANGE: -50 to +250 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT BEARING RTD TEMP: 40 °C	RANGE: -50 to +250 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT OTHER RTD TEMP: 40 °C	RANGE: -50 to +250 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT AMBIENT RTD TEMP: 40 °C	RANGE: -50 to +250 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT SYSTEM FREQUENCY: 60.0 Hz	RANGE: 45.0 - 70.0 STEP: 0.1
	ESCAPE / MESSAGE	PRE-FAULT ANALOG INPUT 1: 0 %	RANGE: 0 - 100 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT ANALOG INPUT 2: 0 %	RANGE: 0 - 100 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT ANALOG INPUT 3: 0 %	RANGE: 0 - 100 STEP: 1
	ESCAPE / MESSAGE	PRE-FAULT ANALOG INPUT 4: 0 %	RANGE: 0 - 100 STEP: 1

FUNCTION:

The values entered under Pre-Fault Values will be substituted for the measured values in the SR469 when the simulation mode is 'Simulate Pre-Fault'.

4.14.3 FAULT SETUP

y FAULT SETUP
y [ENTER] for more

FAULT CURRENT PHASE A: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
FAULT CURRENT PHASE B: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
FAULT CURRENT PHASE C: 0.00 x CT	RANGE: 0.00 - 20.00 STEP: 0.01
FAULT GROUND CURRENT: 0.0 A	RANGE: 0.0 - 5000.0 STEP: 0.1
FAULT VOLTAGES VLINE: 1.00 x RATED	RANGE: 0.00 - 1.10 STEP: 0.01
FAULT CURRENT LAGS VOLTAGE: 0 °	RANGE: 0 - 359 STEP: 1
FAULT DIFF AMPS: IDIFF: 0.00 x CT	RANGE: 0.00 - 1.10 STEP: 0.01
FAULT STATOR RTD TEMP.: 40 °C	RANGE: -50 to +250 STEP: 1
FAULT BEARING RTD TEMP.: 40 °C	RANGE: -50 to +250 STEP: 1
FAULT OTHER RTD TEMP.: 40 °C	RANGE: -50 to +250 STEP: 1
FAULT AMBIENT RTD TEMP.: 40 °C	RANGE: -50 to +250 STEP: 1
FAULT SYSTEM FREQUENCY: 60.0 Hz	RANGE: 45.0 - 70.0 STEP: 0.1
FAULT ANALOG INPUT 1: 0 %	RANGE: 0 - 100 STEP: 1
FAULT ANALOG INPUT 2: 0 %	RANGE: 0 - 100 STEP: 1
FAULT ANALOG INPUT 3: 0 %	RANGE: 0 - 100 STEP: 1
FAULT ANALOG INPUT 4: 0 %	RANGE: 0 - 100 STEP: 1

FUNCTION:

The values entered under Fault Values will be substituted for the measured values in the SR469 when the simulation mode is 'Simulate Fault'.

4.14.4 TEST OUTPUT RELAYS

y TEST OUTPUT RELAYS
y [ENTER] for more

FORCE OPERATION OF RELAYS: Disabled	RANGE: Disabled, R1 Trip, R2 Auxiliary, R3 Auxiliary, R4 Alarm, R5 Block, R6 Service, All Relays, No Relays

FUNCTION:

In addition to the simulation modes, the Test Output Relays setpoint may be used during startup or testing to verify that the output relays are functioning correctly.

The Output relays can only be forced to operate only if the motor is stopped and there are no trips, alarms, or start blocks active. If any relay is forced to operate, the relay will toggle from its normal state when there are no trips, alarms, or blocks to its active state. The appropriate relay indicator will illuminate at that time. Selecting 'None' will place the output relays back in service. If the SR469 measures phase current or control power is cycled, the Force Operation of Relays setpoint will automatically become disabled and the output relays will revert back to their normal states.

If any relay is forced, the SR469 in Service indicator will flash, indicating that the SR469 is not in protection mode.

4.14.5 TEST ANALOG OUTPUT

y TEST ANALOG OUTPUT
y [ENTER] for more

ENTER ⇨ / ⇦ ESCAPE	FORCE ANALOG OUTPUTS FUNCTION: Disabled	RANGE: Enabled, Disabled
ESCAPE / MESSAGE ⇳	ANALOG OUTPUT 1 FORCED VALUE: 0 %	RANGE: 0 - 100 STEP: 1
ESCAPE / MESSAGE ⇳	ANALOG OUTPUT 2 FORCED VALUE: 0 %	RANGE: 0 - 100 STEP: 1
ESCAPE / MESSAGE ⇳	ANALOG OUTPUT 3 FORCED VALUE: 0 %	RANGE: 0 - 100 STEP: 1
ESCAPE / MESSAGE ⇧	ANALOG OUTPUT 4 FORCED VALUE: 0 %	RANGE: 0 - 100 STEP: 1

FUNCTION:

In addition to the simulation modes, the Test Analog Output setpoints may be used during startup or testing to verify that the analog outputs are functioning correctly.

The Analog Outputs can only be forced if the motor is stopped and there are no trips, alarms, or start blocks active. When the Force Analog Outputs Function is enabled, the output will reflect the forced value as a percentage of the range 4-20mA or 0-1mA. Selecting 'Disabled' will place all four the analog output channels back in service, reflecting the parameters programmed to each. If the SR469 measures phase current or control power is cycled, the Force Analog Output Function is automatically disabled and all analog outputs will revert back to their normal state.

Any time the analog outputs are forced, the SR469 in Service indicator will flash, indicating that the SR469 is not in protection mode.

4.14.6 COMM PORT MONITOR

y COMM PORT MONITOR
y [ENTER] for more

ENTER ⇨ / ⇦ ESCAPE	MONITOR COMM. PORT: Computer RS485	RANGE: Computer RS485, Auxiliary RS485, Front Panel RS232
ESCAPE / MESSAGE ⇳	CLEAR COMM. BUFFERS: No	RANGE: No, Yes
ESCAPE / MESSAGE ⇳	LAST Rx BUFFER: Received OK	RANGE: Buffer Cleared, Received OK, Wrong Slave Addr., Illegal Function, Illegal Count, Illegal Reg. Addr., CRC Error, Illegal Data,
ESCAPE / MESSAGE ⇳	Rx1: 02,03,00,67,00, 03,B4,27,//-------------	RANGE: Received data in HEX
ESCAPE / MESSAGE ⇳	Rx2: ------------------- -------------------------	RANGE: Received data in HEX
ESCAPE / MESSAGE ⇳	Tx1: 02,03,06,00,64, 00,0A,00,0F,//--------	RANGE: Transmitted data in HEX
ESCAPE / MESSAGE ⇧	Tx2: ------------------- -------------------------	RANGE: Transmitted data in HEX

FUNCTION:

During the course of troubleshooting communications problems, it can be very useful to see the data that is first being transmitted to the SR469 from some master device, and then see the data that the SR469 transmits back to that master device. The messages shown here should make it possible to view that data. Any of the three communications ports may be monitored. After the Comm. Buffers have been cleared, any data received from the communications port being monitored will be stored in the Rx1 and Rx2 buffers with '//' acting as a character break between messages. If the SR469 transmits a message, it will appear in the Tx1 and Tx2 buffers. In addition to these buffers, there is a message that will indicate the status of the last received message.

4.14.7 MULTILIN USE ONLY

y MULTILIN USE ONLY y [ENTER] for more	ENTER ⇨ ⇦ ESCAPE	MULTILIN USE ONLY CODE: 0	RANGE: N/A

FUNCTION:

This section is for use by Multilin personnel for testing and calibration purposes.

The SR469 has a 2-Speed Motor feature. This feature is intended to provide proper protection for a two-speed motor where there will be two different full load values. The algorithm integrates the heating at each speed into one thermal model using a common thermal capacity used register value for both speeds.

If the Two-Speed Motor feature is used, ASSIGNABLE INPUT4 will be dedicated as the Two-Speed Motor Monitor. Terminals D22 and D23 will be monitored for a contact closure. Closure of the contact will signify that the motor is in Speed 2. If the input is open, it signifies that the motor is in Speed 1. This allows the SR469 to determine which setpoints should be active at any given point in time.

INPUT 4 FUNCTION IS TWO-SPEED MONITOR

The two-speed motor protection is enabled in S2 SYSTEM SETUP\CURRENT SENSING.

4.15.1 SPEED2 O/L SETUP

y SPEED2 O/L SETUP y [ENTER] for more	ENTER / ESCAPE	SPEED2 STANDARD CURVE NUMBER: 4	RANGE:1-15 STEP:1 NOTE: This message seen only if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.01x FLA: 17414.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.05x FLA: 3414.9 s	Range: 0.5-99999.9 STEP:0.1 Note: This Message Cannot Be Altered If Standard Curve Style Is Selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.10x FLA: 1666.7 s	Range: 0.5-99999.9 STEP:0.1 Note: This Message Cannot Be Altered If Standard Curve Style Is Selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.20x FLA: 795.4 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.30x FLA: 507.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.40x FLA: 364.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.50x FLA: 280.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 1.75x FLA: 169.7 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 2.00x FLA: 116.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 2.25x FLA: 86.1 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 2.50 x FLA: 66.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 2.75x FLA: 53.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 3.00x FLA: 43.7 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 3.25x FLA: 36.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 3.50x FLA: 31.1 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 3.75x FLA: 26.8 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
	ESCAPE / MESSAGE	SPEED2 TRIP AT 4.00x FLA: 23.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected

SPEED2 TRIP AT 4.25x FLA: 20.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 4.50x FLA: 18.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 4.75x FLA: 16.2 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 5.00x FLA: 14.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 5.50x FLA: 12.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 6.00x FLA: 10.0 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 6.50x FLA: 8.5 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 7.00x FLA: 7.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 7.50x FLA: 6.3 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 8.00x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 10.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 15.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 TRIP AT 20.0x FLA: 5.6 s	RANGE: 0.5-99999.9 STEP:0.1 NOTE: This message cannot be altered if Standard Curve Style is selected
SPEED2 MIN ALLOWABLE LINE VOLTAGE:80%	RANGE: 70-95 STEP:1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 ISTALL @ MIN Vline: 4.80 x FLA	RANGE: 2.00-15.00 STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 SAFE STALL @ MIN Vline: 20.0 s	RANGE: 0.5-999.9 STEP:0.1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 ACL INTERSECT @MIN Vline: 3.80xFLA	RANGE: 2.0 - IStall @ min. Vline STEP:0.01 *ACL is an abbreviation of Acceleration NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 ISTALL @ 100% Vline: 6.00 x FLA	RANGE: 2.00-15.00 STEP:0.01 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 SAFE STALL @ 100% Vline: 10.0 s	RANGE: 0.5-999.9 STEP:0.1 NOTE: This message seen only if Voltage Dependent Curve Style is selected
SPEED2 ACL INTERSECT @100% Vlin: 5.00xFLA	RANGE: 2.00-IStall @ 100% Vline STEP:0.01 *ACL is an abbreviation of Acceleration NOTE: This message seen only if Voltage Dependent Curve Style is selected

FUNCTION:

All of the Thermal Model parameters (Overload Curve Style, Overload Pickup, Unbalance K Factor, Hot/Cold Safe Stall Ratio, RTD Bias, Cooling Time Constants) set for Speed 1 will be identical for Speed 2. A second overload curve setup may be programmed here for Speed 2, High Speed.

4.15.2 SPEED2 UNDERCURRENT

y SPEED2 U/C y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	BLOCK SPEED2 U/C FROM START: 0 s	RANGE: 0-15000 STEP: 1
	ESCAPE / MESSAGE ⇳	SPEED2 U/C ALARM: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE ⇳	SPEED2 U/C ALARM PICKUP: 0.70 x FLA	RANGE: 0.10 - 0.95 STEP: 0.01
	ESCAPE / MESSAGE ⇳	SPEED2 U/C ALARM DELAY 1 s	RANGE: 1 - 60 STEP: 1
	ESCAPE / MESSAGE ⇳	SPEED2 U/C ALARM EVENTS: Off	RANGE: On, Off
	ESCAPE / MESSAGE ⇳	SPEED2 U/C TRIP: Off	RANGE: Off, Latched, Unlatched
	ESCAPE / MESSAGE ⇳	SPEED2 U/C TRIP PICKUP: 0.70 x FLA	RANGE: 0.10 - 0.99 STEP: 0.01
	ESCAPE / MESSAGE ⇧	SPEED2 U/C TRIP DELAY 1 s	RANGE: 1 - 60 STEP:

FUNCTION:

The addition of a second Undercurrent trip or alarm level may be useful as it will indicate if the wrong setpoints are being used for the wrong speed i.e. normal running current for Speed 2 may be undercurrent for Speed 1 .

4.15.3 SPEED2 ACCELERATION

y 2SPEED ACCEL. y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	SPEED2 ACCEL. TIMER FROM START: 10.0 S	RANGE: 1.0 - 250.0 STEP: 0.1
	ESCAPE / MESSAGE ⇳	ACCEL. TIMER FROM SPEED1-2: 10.0 S	RANGE: 1.0 - 250.0 STEP: 0.1
	ESCAPE / MESSAGE ⇳	SPEED SWITCH TRIP SPEED2 DELAY: 5.0 s	RANGE: 1.0 - 250.0 STEP: 0.1 * Seen only if one of the digital inputs is assigned as Speed Switch
	ESCAPE / MESSAGE ⇧	SPEED2 RATED SPEED: 3600 RPM	RANGE: 100-7200 STEP: 1 *Seen only if one of the digital inputs is assigned as Tachometer

FUNCTION:

Two additional Acceleration timers are provided for the two speed motor feature. One timer is for a start in Speed 2 from a stopped condition. The other is an acceleration timer for the transition from Speed 1 to Speed 2. Also, while the motor is running, the SR469 will ignore Mechanical Jam protection during the acceleration from Speed 1 to Speed 2 until the motor current has dropped below Speed 2 FLA x Overload Pickup value, or the Speed 1-2 acceleration time has expired. At that point in time, the Mechanical Jam feature will be enabled with the Speed 2 FLA

5.1.1 ACTUAL VALUES MESSAGES

Measured values, maintenance and fault analysis information are accessed in the Actual Value mode. Actual values may be accessed via one of the following methods:

1) Front panel, using the keys and display.
2) Front program port, and a portable computer running the 469SETUP program supplied with the relay.
3) Rear terminal RS485 port, and a PLC/SCADA system running user-written software.

Any of these methods can be used to view the same information. A computer, however, makes viewing much more convenient, since many variables may be viewed at the same time.

Actual value messages are organized into logical groups, or pages, for easy reference, as shown below. All actual value messages are illustrated and described in blocks throughout this chapter. All values shown in these message illustrations assume that no inputs (besides control power) are connected to the SR469.

Table 5-1 ACTUAL VALUE MESSAGE MAP

⇨ ACTUAL

yy A1 ACTUAL VALUES
yy STATUS

- ▌MOTOR STATUS
- y LAST TRIP DATA
- y ALARM STATUS
- y START BLOCKS
- y DIGITAL INPUTS
- y REAL TIME CLOCK

⇨ ACTUAL

yy A2 ACTUAL VALUES
yy METERING DATA

- y CURRENT METERING
- y TEMPERATURE
- y VOLTAGE METERING
- y SPEED
- y POWER METERING
- y DEMAND METERING
- y ANALOG INPUTS
- y PHASORS

⇨ ACTUAL

yy A3 ACTUAL VALUES
yy LEARNED DATA

- y MOTOR STARTING
- y AVERAGE MOTOR LOAD
- y RTD MAXIMUMS
- y ANALOG IN MIN/MAX

⇨ ACTUAL

yy A4 ACTUAL VALUES
yy MAINTENANCE

- y TRIP COUNTERS
- y GENERAL COUNTERS
- y TIMERS

⇨ ACTUAL

yy A5 ACTUAL VALUES
yy EVENT RECORD

- y [ENTER] EVENT 01
- y [ENTER] EVENT 02
- y [ENTER] EVENT 03
- |
- y [ENTER] EVENT 40

⇨ ACTUAL

yy A6 ACTUAL VALUES
yy PRODUCT INFO.

- y SR469 MODEL INFO.
- y CALIBRATION INFO.

In addition to the Actual Value messages, there are also Diagnostic messages and Flash messages that appear only when certain conditions occur. They are described later in this chapter.

5.2.1 MOTOR STATUS

y MOTOR STATUS y [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	MOTOR STATUS: Stopped	RANGE: Tripped, Stopped, Starting, Running, Overload
	ESCAPE / MESSAGE ⇳	MOTOR THERMAL CAPACITY USED: 0 %	RANGE: 0 -100
	ESCAPE / MESSAGE ⇧	ESTIMATED TRIP TIME ON OVERLOAD: Never	RANGE: 0 - 10000s, Never
	ESCAPE / MESSAGE ⇧	MOTOR SPEED: Low Speed	RANGE: High Speed, Low Speed NOTE: This message is only seen if the Two Speed motor feature is enabled.

DESCRIPTION:

These messages describe the status of the motor at any given point in time. If the motor has been tripped and the SR469 has not yet been reset, the MOTOR STATUS will be 'Tripped'. The Thermal Capacity Used reflects an integrated value of both the Stator and Rotor Thermal Capacity Used. The values for Estimated Trip Time On Overload will appear whenever the SR469 picks up on the overload curve.

5.2.2 LAST TRIP DATA

y LAST TRIP DATA
y [ENTER] for more

CAUSE OF LAST TRIP: No Trip To Date	RANGE: No Trip To Date, Incomplete Sequence, Remote Trip, Speed Switch, Load Shed, Pressure Switch, Vibration Switch, General Sw., Overload, Short Circuit, Mechanical Jam, Undercurrent, Current Unbalance, Ground Fault, Phase Differential, Acceleration, Tachometer, RTDs 1-12, Undervoltage, Overvoltage, Phase Reversal, Frequency, Reactive Power, Power Factor, Underpower, Analog Inputs 1-4
TIME OF LAST TRIP: 09:00:00.00	RANGE: Hour/Min/Sec
DATE OF LAST TRIP: Jan 01 1995	RANGE: Mon/Day/Year
MOTOR SPEED DURING TRIP: Low Speed	RANGE: High Speed, Low Speed NOTE: this message is seen only if the Two-Speed motor feature is enabled
TACHOMETER Pretrip: 3600 RPM	RANGE: 0-3600 NOTE: this message is seen only if one of the Assignable Digital Inputs is programmed as Tachometer
A: 0 B: 0 C: 0 A PreTrip	RANGE: 0-100000
MOTOR LOAD: 0.00 x FLA PreTrip	RANGE: 0 - 20.00
CURRENT UNBALANCE Pretrip: 0 %	RANGE: 0-100
GROUND CURRENT Pretrip: 0.00 Amps	RANGE: 0.0-5000.0
A: 0 B: 0 C: 0A Diff.PreTrip	RANGE: 0-5000 NOTE: this message is not seen if the Differential CT is programmed as “None”
HOTTEST STATOR RTD RTD#1: 0°C PreTrip	RANGE: -50 to +250 NOTE: this message seen only if at least 1 RTD is programmed as ‘STATOR’
HOTTEST BEARING RTD RTD#7: 0°C PreTrip	RANGE: -50 to +250 NOTE: this message seen only if at least 1 RTD is programmed as ‘BEARING’
HOTTEST OTHER RTD RTD#11: 0°C PreTrip	RANGE: -50 to +250 NOTE: this message seen only if at least 1 RTD is programmed as ‘OTHER’
AMBIENT RTD RTD#12: 0°C PreTrip	RANGE: -50 to +250 NOTE: this message seen only if at least 1 RTD is programmed as ‘AMBIENT’
Vab: 0 Vbc: 0 Vca: 0 V PreTrip	RANGE: 0-20000 NOTE: This message is not seen if VT Connection is programmed as ‘None’
Van: 0 Vbn: 0 Vcn: 0 V PreTrip	RANGE: 0-20000 NOTE: This message seen only if VT Connection is programmed as ‘Wye’
PRETRIP SYSTEM FREQUENCY: 0.00 Hz	RANGE: 0.00, 20.00 - 120.00 NOTE: This message is not seen if VT Connection is programmed as ‘None’
0 kW 0 kVA 0 kvar PreTrip	RANGE: -50000 to +50000 NOTE: This message is not seen if VT Connection is ‘None’
POWER FACTOR Pretrip: 0.00	RANGE: 0.01-0.99 Lead or Lag, 0.00, 1.00 NOTE: This message is not seen if VT Connection is ‘None’
ANALOG INPUT 1 Pretrip: 0 Units	RANGE: -50000 to +50000 NOTE: This message seen only if the Analog Input is in use
ANALOG INPUT 2 Pretrip: 0 Units	RANGE: -50000 to +50000 NOTE: This message seen only if the Analog Input is in use
ANALOG INPUT 3 Pretrip: 0 Units	RANGE: -50000 to +50000 NOTE: This message seen only if the Analog Input is in use
ANALOG INPUT 4 Pretrip: 0 Units	RANGE: -50000 to +50000 NOTE: This message seen only if the Analog Input is in use

DESCRIPTION:
Immediately prior to issuing a trip, the SR469 takes a snapshot of motor parameters and stores them as pre-trip values which will allow for troubleshooting after the trip occurs. The cause of last trip message is updated with the current trip and the screen defaults to that message. All trip features are automatically logged as date and time stamped events as they occur. This information may include motor

speed (2-Speed feature or Assignable Digital Input), phase and ground currents, RTD temperatures, voltages, frequency, power quantities, and analog inputs. This information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA.

NOTE: Phase, differential and ground currents are recorded 1 cycle prior to the trip. All other pre-trip data is recorded 50 ms prior to the trip. Thus some values will not be recorded upon instantaneous trips during a start if the trip is less than 50 ms.

5.2.3 ALARM STATUS

y ALARM STATUS
y [ENTER] for more

Display	Description
NO ALARMS	RANGE: N/A Note: This message seen when no alarms are active
Remote alarm STATUS: Active	RANGE: Active, Latched *The first line of this alarm message will reflect the Switch Name as programmed Note: Alarm status is 'Active ' if the condition that caused the alarm is still present
PRESSURE SWITCH ALARM STATUS:Active	RANGE: Active, Latched Note: Alarm status is 'Active ' if the condition that caused the alarm is still present
VIBRATION SWITCH ALARM STATUS:Active	RANGE: Active, Latched Note: Alarm status is 'Active ' if the condition that caused the alarm is still present
DIG. COUNTER ALARM: 1 000 000 000 Units	RANGE: Active, Latched Note: The current value of the digital counter will be shown here
TACHOMETER ALARM: 3000 RPM	RANGE: 0-3600 Note: The current measurement of the Tachometer Digital input will be shown here
General Sw.A ALARM STATUS:Active	RANGE: Active, Latched *The first line of this alarm message will reflect the Switch Name as programmed Note: Alarm status is 'Active ' if the condition that caused the alarm is still present
THERMAL CAPACITY ALARM: 100% USED	RANGE: 1 - 100 Note: Value of thermal capacity used is shown here.
XX.XX x FLA OVERLOAD TIME TO TRIP: XXXXX S	RANGE: 0-99999 Note: Overload level and estimated time to trip will be shown here
UNDERCURRENT ALARM Ia= 85 A 85% FLA	RANGE: 1-5000, 5 - 99 Note: Value of the lowest phase current will be shown here
CURRENT UNBALANCE ALARM: 15 %	RANGE: 0 - 100 Note: reflects the present unbalance level
GROUND FAULT ALARM: 25.3 A	RANGE: 0.1 - 5000 Note: reflects the present ground current level
Stator RTD #1 ALARM: 135° C	RANGE: -50 to +250 *The first line of this alarm message will be the RTD Name as programmed for 1-12 Note: reflects the present RTD temperature
OPEN SENSOR ALARM: RTD # 1 2 3 4 5 6 ...	RANGE: the number of the RTD with the open sensor as programmed for RTDs 1-12
SHORT/LOW TEMP ALARM RTD# 7 8 9 10 11 ...	RANGE: 1-12 Note: reflects the number of the RTD with the short/low temp. alarm
UNDERVOLTAGE ALARM Vab= 3245V 78% Rated	RANGE: 0 - 20000, 50 -99 Note: Value of the lowest line to line voltage will be shown here
OVERVOLTAGE ALARM Vab=4992V 120% Rated	RANGE: 0 - 20000, 101 - 150 Note: Value of the lowest line to line voltage will be shown here
SYSTEM FREQUENCY ALARM: 59.4 Hz	RANGE: 0.00, 20.00 120.00 Note: Value of system voltage frequency will be shown here
POWER FACTOR ALARM PF: 0.00	RANGE: 0.01-0.99 Lead or Lag, 0.00, 1.00 Note: Current Power Factor will be shown here
REACTIVE POWER ALARM: +2000 kvar	RANGE: -50000 to +50000 Note: Current kvar value will be shown here
UNDERPOWER ALARM: 200 kW	RANGE: -50000 to +50000 Note: Current kW value will be shown here
TRIP COUNTER ALARM: 25 Trips	RANGE: 1- 10000 Note: The total number of motor trips will be displayed here
STARTER FAILURE: Trip Coil Super	RANGE: Trip Coil Super, Welded Contactor, Breaker Failure Note: The type of failure will be displayed here
CURRENT DEMAND ALARM: 1053 A	RANGE: 1 - 10000 Note: The current value of Running Current Demand will be shown here
kW DEMAND ALARM: 505 kW	RANGE: -50000 to +50000 Note: The current value of Running kW Demand will be shown here

ESCAPE / MESSAGE	kvar DEMAND ALARM: - 2000 kvar	RANGE: -50000 to +50000 Note: The current value of Running kW Demand will be shown here
ESCAPE / MESSAGE	kVA DEMAND ALARM: 2062 kVA	RANGE: 0 to +50000 Note: The current value of Running kVA Demand will be shown here
ESCAPE / MESSAGE	Analog I/P 1 ALARM: 201 Units	RANGE: -50000 to +50000 *The alarm message will reflect the Analog Input name and units as programmed, Note: The level of the analog input will be shown here
ESCAPE / MESSAGE	EMERGENCY RESTART: Trip Still Present	RANGE: Trip Still Present, Block Still Present, No Trips & No Blocks
ESCAPE / MESSAGE	ALARM, SR469 NOT INSERTED PROPERLY	Note: If the SR469 chassis is only partially engaged with the SR469 case, this Service alarm will appear after 1 second. Secure the chassis handle to ensure that all contacts mate properly.
ESCAPE / MESSAGE	SR469 NOT IN SERVICE Simulation Mode	Range: Not Programmed, Simulation Mode, Output Relays Forced, Analog Output Forced, Test Switch Shorted.
ESCAPE / MESSAGE	RTD #1 HI ALARM: 135°C	RANGE: 1 - 250 Note: Similar Hi Alarms will occur for the other RTDs. The alarm message will reflect the alarm name as programmed.
ESCAPE / MESSAGE	Analog 1-2 ALARM: 50%	RANGE: 0 - 999 (% Diff) or 0 - 99999 (Abs Diff) * The alarm message will reflect the Analog Input name and units as programmed.
ESCAPE / MESSAGE	Analog 3-4 ALARM: 50%	RANGE: 0 - 999 (% Diff) or 0 - 99999 (Abs Diff) * The alarm message will reflect the Analog Input name and units as programmed.

DESCRIPTION:

Any active alarms may be viewed here.

5.2.4 START BLOCKS

y START BLOCKS
y [ENTER] for more

ENTER / ESCAPE	NO START BLOCKS ACTIVE	RANGE: N/A Note: This message seen when no start blocks are active
ESCAPE / MESSAGE	OVERLOAD LOCKOUT BLOCK: 25 min	RANGE: 0 - 500 NOTE: this message is seen only after an overload trip
ESCAPE / MESSAGE	START INHIBIT BLOCK LOCKOUT TIME: 20 min	RANGE: 1 - 2500
ESCAPE / MESSAGE	STARTS/HOUR BLOCK LOCKOUT TIME: 20 min	RANGE: 1 - 60
ESCAPE / MESSAGE	TIME BETWEEN STARTS LOCKOUT TIME: 20 min	RANGE: 1 - 500
ESCAPE / MESSAGE	RESTART BLOCK LOCKOUT: 3 min 49 s	RANGE: 1s to 833 min
ESCAPE / MESSAGE	BLOCK START SR469 NOT PROGRAMMED	RANGE: N/A NOTE: This message seen if the Phase CT Primary and Motor FLA not programmed

DESCRIPTION:

Any active blocking functions may be viewed here.

5.2.5 DIGITAL INPUTS

y DIGITAL INPUTS
y [ENTER] for more

ENTER ⇨ / ESCAPE ⇦

ACCESS SWITCH STATE: Open	ENTER / ESCAPE	RANGE: Open, Shorted
TEST SWITCH STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
STARTER STATUS SWITCH STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
EMERGENCY RESTART SWITCH STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
REMOTE RESET SWITCH STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
ASSIGNABLE DIGITAL INPUT1 STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
ASSIGNABLE DIGITAL INPUT2 STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
ASSIGNABLE DIGITAL INPUT3 STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
ASSIGNABLE DIGITAL INPUT4 STATE: Open	ESCAPE / MESSAGE ⇳	RANGE: Open, Shorted
TRIP COIL SUPERVISION: No Coil	ESCAPE / MESSAGE ⇧	RANGE: No Coil, Coil

DESCRIPTION:

The messages shown here may be used to monitor Digital Input status. This may be useful during relay testing or during installation.

NOTE: Digital Input states will read as shorted if assigned as a tachometer.

5.2.6 REAL TIME CLOCK

y REAL TIME CLOCK
y [ENTER] for more

ENTER ⇨ / ESCAPE ⇦

DATE: 01/01/1994 TIME: 12:00:00	RANGE: 01-12/10-31/1995-2094 RANGE: 00-23:00-59:00 -59

DESCRIPTION:

The time and date from the SR469 Real Time Clock May be Viewed here.

5.3.1 CURRENT METERING

y CURRENT METERING
y [ENTER] for more

ENTER / ESCAPE	A: 0 B: 0 C: 0 Amps	RANGE: 0 - 100000
ESCAPE / MESSAGE	AVERAGE PHASE CURRENT: 0 Amps	RANGE: 0 - 100000
ESCAPE / MESSAGE	MOTOR LOAD: 0.00 x FLA	RANGE: 0 - 20.00
ESCAPE / MESSAGE	CURRENT UNBALANCE: 0 %	RANGE: 0 - 9999
ESCAPE / MESSAGE	U/B BIASED MOTOR LOAD: 0.00 x FLA	Range: 0.00 - 20.00
ESCAPE / MESSAGE	GROUND CURRENT: 0.0 Amps	RANGE: 0.0 - 5000.0 NOTE: this message seen if the ground CT has 1 or 5A secondary
ESCAPE / MESSAGE	GROUND CURRENT: 0.00 Amps	RANGE: 0.00- 25.00 NOTE: this message seen if the ground CT is Multilin 50/.025
ESCAPE / MESSAGE	A: 0 B: 0 C: 0 Amps Diff.	RANGE: 0 - 5000

DESCRIPTION:

All measured current values are displayed here. SR469 unbalance is defined as the ratio of negative sequence current to positive sequence current, I_2/I_1, if the motor is operating at a load (Iavg) greater than FLA. If the motor Iavg is less than FLA, unbalance is defined as $I_2/I_1 \times$ Iavg/FLA. This derating is necessary to prevent nuisance alarms and trips when a motor is lightly loaded. Unbalance Bias Motor Load shows the equivalent motor heating current caused by the unbalance k factor.

5.3.2 TEMPERATURE

y TEMPERATURE
y [ENTER] for more

HOTTEST STATOR RTD RTD#1: 40 o C	RANGE: -50 to +250, No RTD (open), --- (shorted) NOTE: this message seen only if at least 1 RTD is programmed as 'STATOR'
RTD #1 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #2 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #3 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #4 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #5 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #6 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #7 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #8 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #9 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #10 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #11 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
RTD #12 TEMPERATURE: 40° C	RANGE: -50 to +250, No RTD (open), --- (shorted) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed

DESCRIPTION:

The current level of the 12 RTDs will be displayed here. If the RTD is not connected, the value will be 'No RTD'.

If no RTDs are programmed in S8 RTD TEMPERATURE, the following flash message will appear when an attempt is made to enter this group of messages.

THIS FEATURE NOT
PROGRAMMED

5.3.3 VOLTAGE METERING

▮ VOLTAGE METERING ▮ [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	Vab: 0 Vbc: 0 Vca: 0 Volts	RANGE: 0 - 20000 NOTE: This message is not seen if VT Connection is programmed as 'None'
	ESCAPE / MESSAGE ⇳	AVERAGE LINE VOLTAGE: 0 Volts	RANGE: 0 - 20000 NOTE: This message is not seen if VT Connection is programmed as 'None'
	ESCAPE / MESSAGE ⇳	Van: 0 Vbn: 0 Vcn: 0 Volts	RANGE: 0 - 20000 NOTE: This message seen only if VT Connection is programmed as 'Wye'
	ESCAPE / MESSAGE ⇳	AVERAGE PHASE VOLTAGE: 0 Volts	RANGE: 0 - 20000 NOTE: This message seen only if VT Connection is programmed as 'Wye'
	ESCAPE / MESSAGE ⇧	SYSTEM FREQUENCY: 0.00 Hz	RANGE: 0.00, 20.00 - 120.00

DESCRIPTION:

Measured voltage parameters will be displayed here.

If no VT connection type is programmed in S2 SYSTEM SETUP, the following flash message will appear when an attempt is made to enter this group of messages.

```
THIS FEATURE  NOT
PROGRAMMED
```

5.3.4 SPEED

▮ SPEED ▮ [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	TACHOMETER: 0 RPM	RANGE: 0-3600 NOTE: This message seen only if a Digital Input is configured as Tachometer

DESCRIPTION:

If the Tachometer function is assigned to one of the digital inputs, the tachometer readout may be viewed here.

If no digital input is configured as tachometer in S3 DIGITAL INPUTS the following flash message will appear when an attempt is made to enter this group of messages.

```
THIS FEATURE  NOT
PROGRAMMED
```

5.3.5 POWER METERING

yPOWER METERING
y [ENTER] for more

Keys	Display	Range
ENTER / ESCAPE	POWER FACTOR: 0.00	RANGE: 0.01-0.99 Lead or Lag, 0.00, 1.00
ESCAPE / MESSAGE	REAL POWER: 0 kW	RANGE: 0 - ±50000
ESCAPE / MESSAGE	REAL POWER: 0 hp	RANGE: 0 - ±67024
ESCAPE / MESSAGE	REACTIVE POWER: 0 kvar	RANGE: 0 - ±50000
ESCAPE / MESSAGE	APPARENT POWER: 0 kVA	RANGE: 0 - 50000
ESCAPE / MESSAGE	POSITIVE WATTHOURS: 0.000 MWh	RANGE: 0.000 - 999999.999
ESCAPE / MESSAGE	POSITIVE VARHOURS: 0.000 Mvarh	RANGE: 0.000 - 999999.999
ESCAPE / MESSAGE	NEGATIVE VARHOURS: 0.000 Mvarh	RANGE: 0.000 - 999999.999
ESCAPE / MESSAGE	TORQUE: 000.0 Nm	RANGE: 0.0 - 999999.9 NOTE: This message is seen only if the TORQUE METERING is enabled.

DESCRIPTION:

The values for power metering and 3∅ total power quantities are displayed here. Watthours and varhours can also be seen here.

NOTE: An induction motor by convention consumes Watts and vars (+Watts and +vars). A synchronous motor can generate vars (–vars) and feed them back to the power system.

If no VT Ratio is programmed in S2 SYSTEM SETUP, the following flash message will appear when an attempt is made to enter this group of messages.

THIS FEATURE NOT
PROGRAMMED

5.3.6 TORQUE ALARM MESSAGE

TORQUE
ALARM: 000.0

Alarm Status

The above message will appear in the Alarm Status Event Record (if programmed) and as a display message when an overtorque alarm occurs.

5.3.7 DEMAND METERING

	y DEMAND METERING y [ENTER] for more	
ENTER ⇨ / ESCAPE ⇦	CURRENT DEMAND: 0 Amps	RANGE: 0 - 100000
ESCAPE / MESSAGE ⇳	REAL POWER DEMAND: 0 kW	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇳	REACTIVE POWER DEMAND: 0 kvar	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇳	APPARENT POWER DEMAND: 0 kVA	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇳	PEAK CURRENT DEMAND: 0 Amps	RANGE: 0 - 100000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇳	PEAK REAL POWER DEMAND: 0 kW	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇳	PEAK REACTIVE POWER DEMAND: 0 kvar	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.
ESCAPE / MESSAGE ⇧	PEAK APPARENT POWER DEMAND: 0 kVA	RANGE: 0 - 50000 NOTE: This message is not seen if VT Ratio is programmed as 'None'.

DESCRIPTION:

The values for current and power demand are shown here. Peak Demand information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA. Demand is shown only for positive real and positive reactive power (+Watts, +vars).

5.3.8 ANALOG INPUTS

	y ANALOG INPUTS y [ENTER] for more	
ENTER ⇨ / ESCAPE ⇦	Analog I/P 1 0 Units	RANGE: -50000 to +50000 * Message seen only if analog input is programmed *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇳	Analog I/P 2 0 Units	RANGE: -50000 to +50000 * Message seen only if analog input is programmed *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇳	Analog I/P 3 0 Units	RANGE: -50000 to +50000 * Message seen only if analog input is programmed *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇧	Analog I/P 4 0 Units	RANGE: -50000 to +50000 * Message seen only if analog input is programmed *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇧	Analog 1-2 0 Percent	RANGE: -5100 to +4900 * Message seen only if analog in diff 1-2 set to % Diff. *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇧	Analog 1-2 0 Units	RANGE: -100000 to +100000 * Message seen only if analog in diff 1-2 set to Abs Diff. *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇧	Analog 3-4 0 Percent	RANGE: -5100 to +4900 * Message seen only if analog in diff 3-4 set to % Diff. *The alarm message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE ⇧	Analog 3-4 0 Units	RANGE: -100000 to +100000 * Message seen only if analog in diff 3-4 set to Abs Diff. *The alarm message will reflect the Analog Input name and units as programmed,

DESCRIPTION:

The values for analog inputs are shown here. The name of the input and the units will reflect those programmed for each input.

If no Analog Inputs are programmed in S12 ANALOG I/O, the following flash message will appear when an attempt is made to enter this group of messages.

THIS FEATURE NOT
PROGRAMMED

5.3.9 PHASORS

y PHASORS
y [ENTER] for more

ENTER ⇨ **Va PHASOR:** 0.0% at 0° Lag
ESCAPE ⇦

ESCAPE / MESSAGE ⇳ **Vb PHASOR:** 0.0% at 0° Lag

ESCAPE / MESSAGE ⇳ **Vc PHASOR:** 0.0% at 0° Lag

ESCAPE / MESSAGE ⇳ **Ia PHASOR:** 0.0% at 0° Lag

ESCAPE / MESSAGE ⇳ **Ib PHASOR:** 0.0% at 0° Lag

ESCAPE / MESSAGE ⇧ **Ic PHASOR:** 0.0% at 0° Lag

DESCRIPTION:

To aid in wiring the following table can be used to determine if VTs and CTs are on the correct phases and that their polarity is correct. Problems arising from incorrect wiring are extremely high unbalance levels (CTs) or erroneous power readings (CTs and VTs) or phase reversal trips (VTs).

To correct wiring simply start the motor and record the phasors. Using the table below along with recorded phasors, system rotation, VT connection type and motor power factor the correct phasors can be determined. Note that Va (Vab if delta) is always assumed to be zero degrees and is the reference for all angle measurements.

Common problems include: Phase currents 180 degrees from proper location (CT polarity reversed)
Phase currents or voltages 120 or 240 degrees out (CT/VT on wrong phase)

3∅ Wye VT Connection

ABC Rotation	**72.5°=0.3 pf lag**	**45°=0.7 pf lag**	**0°=1.00 pf**	**-45°=0.7 pf lead**	**-72.5°=0.2 pf lead**
Va	0	0° lag	0° lag	0° lag	0
Vb	120	120	120	120	120
Vc	240	240	240	240	240
Ia	75	45	0	315	285
Ib	195	165	120	75	45
Ic	315	285	240	195	165
kW	+	+	+	+	+
kVAR	+	+	0	-	-
kVA	+	+	+ (=kW)	+	+
ACB Rotation	**72.5°=0.3 pf lag**	**45° = 0.7 pf lag**	**0° = 1.00 pf**	**-45° = 0.7 pf lead**	**72.5°=0.2 pf lead**
Va	0	0° lag	0° lag	0° lag	0
Vb	240	240	240	240	240
Vc	120	120	120	120	120
Ia	75	45	0	315	285
Ib	315	285	240	195	165
Ic	195	165	120	75	45
kW	+	+	+	+	+
kVAR	+	+	0	-	-
kVA	+	+	+ (=kW)	+	+

3∅ Open Delta VT Connection

ABC Rotation	72.5°=0.3 pf lag	45° = 0.7 pf lag	0° = 1.00 pf	-45° = 0.7 pf lead	-72.5°=0.3 pf lead
Va	0	0°	0°	0°	0
Vb	----	----	----	----	----
Vc	300	300	300	300	300
Ia	100	75	30	345	320
Ib	220	195	150	105	80
Ic	340	315	270	225	200
kW	+	+	+	+	+
kVAR	+	+	0	-	-
kVA	+	+	+ (=kW)	+	+
ACB Rotation	**72.5°=0.3 pf lag**	**45° = 0.7 pf lag**	**0° = 1.00 pf**	**-45° = 0.7 pf lead**	**-72.5°=0.3 pf lead**
Va	0	0°	0°	0°	0
Vb	----	----	----	----	----
Vc	60	60	60	60	60
Ia	45	15	330	285	260
Ib	285	255	210	165	140
Ic	165	135	90	45	20
kW	+	+	+	+	+
kVAR	+	+	0	-	-
kVA	+	+	+ (=kW)	+	+

5.4.1 MOTOR STARTING

◆MOTOR STARTING ◆ [ENTER] for more	ENTER / ESCAPE	LEARNED ACCELERATION TIME: 0.0 s	RANGE: 0.0 - 200.0
	ESCAPE / MESSAGE	LEARNED STARTING CURRENT: 0 A	RANGE: 0 - 50000
	ESCAPE / MESSAGE	LEARNED STARTING CAPACITY: 0 % used	RANGE: 0 - 100
	ESCAPE / MESSAGE	LAST ACCELERATION TIME: 0.0 s	RANGE: 0.0 - 200.0 0 x 03C4
	ESCAPE / MESSAGE	LAST STARTING CURRENT: 0 A	RANGE: 0 - 50000 0 x 03C5
	ESCAPE / MESSAGE	LAST STARTING CAPACITY: 0% used	RANGE: 0 - 100 0 x 03C6

DESCRIPTION:

The SR469 learns the acceleration time, the starting current, as well as, the thermal capacity required during motor starts. This data is accumulated based on the last five starts. The SR469 also keeps statistics for last acceleration time, last starting current, and last starting capacity**.** This information can be reset to default using the setpoint in S1 SR469 SETUP under INSTALLATION.

If motor load during starting is relatively consistent, the learned acceleration time may be used to fine tune the acceleration protection. Learned acceleration time will be the longest time of the last five successful starts. The time is measured from the transition of motor current from zero to greater than Overload Pickup, until line current falls below the Overload Pickup level.

Learned Starting Current is measured 200ms after the transition of motor current from zero to greater than Overload Pickup. This should ensure that the measured current is symmetrical. The value displayed is the average of the last 5 successful starts. NOTE: If there are less than 5 starts, 0's will be averaged in for the full 5 starts.

The learned starting capacity is used by the SR469 to determine if there is enough thermal capacity to permit a start. The largest value of thermal capacity used from the last five successful starts is multiplied by 1.25 and stored as thermal capacity used on start. This 25% margin is used to ensure that a motor start will be successful. If the number is greater than 100% , 100% is stored as thermal capacity used on start. If there is not enough thermal capacity for a start, a start inhibit will be issued. Starting will be blocked until there is sufficient thermal capacity.

EXAMPLE:

If the thermal capacity used for the last 5 starts is 24, 23, 27, 25, and 21% respectively, learned starting capacity is 27% x 1.25= 33.75% used. If the motor stops with 90% thermal capacity used, a start block will be issued.

When the motor has cooled and the level of thermal capacity used has fallen to 66%, a start will be permitted.

5.4.2 AVERAGE MOTOR LOAD

◆ AVERAGE MOTOR LOAD ◆ [ENTER] for more	ENTER / ESCAPE	AVERAGE MOTOR LOAD LEARNED: 0.00 x FLA	RANGE: 0.00 - 20.00

DESCRIPTION:

The SR469 can learn the average motor load over a period of time. This time is specified by the setpoint in the preferences section of S1 SR469 SETUP (default 15 minutes). The calculation is a sliding window and is ignored during motor starting.

5.4.3 RTD MAXIMUMS

y RTD MAXIMUMS y [ENTER] for more	ENTER ⇨ / ESCAPE ⇦	RTD #1 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #2 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #3 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #4 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #5 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #6 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #7 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #8 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #9 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #10 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇳	RTD #11 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed
	ESCAPE / MESSAGE ⇧	RTD#12 MAX. TEMP.: 40° C	RANGE: -50 to +250, --- (no RTD) * Message not seen if RTD programmed as "None" * The first line of this message will reflect the RTD name as programmed

DESCRIPTION:

The SR469 will learn the maximum temperature for each RTD. This information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA.

If no RTDs are programmed in S8 RTD TEMPERATURE, the following flash message will appear when an attempt is made to enter this group of messages.

THIS FEATURE NOT PROGRAMMED

5.4.4 ANALOG IN MIN/MAX

y ANALOG INPUTS
y [ENTER] for more

ENTER / ESCAPE	Analog I/P 1 MIN:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 1 MAX:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 2 MIN:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 2 MAX:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 3 MIN:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 3 MAX:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 4 MIN:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,
ESCAPE / MESSAGE	Analog I/P 4 MAX:0 Units	RANGE: -50000 to +50000 * Message not seen if analog input programmed as "None" *The message will reflect the Analog Input name and units as programmed,

DESCRIPTION:

The SR469 will learn the Minimum and Maximum values of the analog inputs since they were last cleared. This information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA. When the data is cleared, the present value of each analog input will be loaded as a starting point for both minimum and maximum. The name of the input and the units will reflect those programmed for each input.

If no Analog Inputs are programmed in S12 ANALOG I/O, the following flash message will appear when an attempt is made to enter this group of messages.

THIS FEATURE NOT
PROGRAMMED

5.5.1 TRIP COUNTERS

y TRIP COUNTERS / y [ENTER] for more	
TOTAL NUMBER OF TRIPS: 0	RANGE: 0 - 50000
INCOMPLETE SEQUENCE TRIPS: 0	RANGE: 0 -50000 * Caused by the Reduced Voltage Start Feature
INPUT SWITCH TRIPS: 0	RANGE: 0 -50000 *Caused by Remote, Speed, Load Shed, Pressure, Vibration, or General Purpose Switch Trip Features
TACHOMETER TRIPS: 0	RANGE: 0 -50000 *Caused by Assignable Digital Input Programmed as Tachometer
OVERLOAD TRIPS: 0	RANGE: 0 -50000
SHORT CIRCUIT TRIPS: 0	RANGE: 0 -50000
MECHANICAL JAM TRIPS: 0	RANGE: 0 -50000
UNDERCURRENT TRIPS: 0	RANGE: 0 -50000
CURRENT UNBALANCE TRIPS: 0	RANGE: 0 -50000
GROUND FAULT TRIPS: 0	RANGE: 0 -50000
PHASE DIFFERENTIAL TRIPS: 0	RANGE: 0 -50000
ACCELERATION TIMER TRIPS: 0	RANGE: 0 -50000
STATOR RTD TRIPS: 0	RANGE: 0 -50000
BEARING RTD TRIPS: 0	RANGE: 0 -50000
OTHER RTD TRIPS: 0	RANGE: 0 -50000
AMBIENT RTD TRIPS: 0	RANGE: 0 -50000
UNDERVOLTAGE TRIPS: 0	RANGE: 0 -50000
OVERVOLTAGE TRIPS: 0	RANGE: 0 -50000
PHASE REVERSAL TRIPS: 0	RANGE: 0 -50000
VOLTAGE FREQUENCY TRIPS: 0	RANGE: 0 -50000
POWER FACTOR TRIPS: 0	RANGE: 0 -50000
REACTIVE POWER TRIPS: 0	RANGE: 0 -50000
REVERSE POWER TRIPS: 0	RANGE: 0 -50000
UNDERPOWER TRIPS: 0	RANGE: 0 -50000

Analog I/P 1 TRIPS: 0	RANGE: 0 -50000 *The message will reflect the Analog Input name and units as programmed,
Analog I/P 2 TRIPS: 0	RANGE: 0 -50000 *The message will reflect the Analog Input name and units as programmed,
Analog I/P 3 TRIPS: 0	RANGE: 0 -50000 *The message will reflect the Analog Input name and units as programmed,
Analog I/P 4 TRIPS: 0	RANGE: 0 - 50000 *The message will reflect the Analog Input name and units as programmed,
Analog 1-2 TRIPS: 0	RANGE: 0 - 50000 *The message will reflect the Analog Input name and units as programmed,
Analog 3-4 TRIPS: 0	RANGE: 0 - 50000 *The message will reflect the Analog Input name and units as programmed,

DESCRIPTION: A breakdown of number of trips by type is displayed here. When the Total reaches 50000, all counters reset. This information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA.

5.5.2 GENERAL COUNTERS

y GENERAL COUNTERS
y [ENTER] for more

NUMBER OF MOTOR STARTS: 0	RANGE: 0 - 50000
NUMBER OF EMERGENCY RESTARTS: 0	RANGE: 0 -50000
NUMBER OF STARTER OPERATIONS: 0	RANGE: 0 -50000
DIGITAL COUNTER: 0 Units	RANGE: 0 - 1 000 000 000 *Seen only if one of the Assignable Digital Inputs is programmed as Digital Counter

DESCRIPTION:

Two of the SR469 General counters will count the number of motor starts or start attempts and the number of Emergency Restarts performed to start a given motor over time. This may be useful information when troubleshooting a motor failure. When either of these counters reaches 50000, that counter will reset to 0. This information can be cleared using the setpoint in S1 SR469 SETUP under INSTALLATION, RESET MOTOR INFORMATION. Another of the SR469 General counters will count the number of starter operations performed over time. This counter is incremented any time the motor is stopped, either by a trip or normal stop. This may be useful information for starter maintenance. When the counter reaches 50000, that counter will reset to 0. This information can be cleared using the setpoint in S1 SR469 SETUP under INSTALLATION, RESET STARTER INFORMATION. If one of the Assignable Digital Inputs is programmed as Digital Counter, that counter measurement will appear here. The counter can be reset to zero if the counter is of the incrementing type or pre-set to a predetermined value using the setpoint in S1 SR469 SETUP under CLEAR DATA.

5.5.3 TIMERS

y TIMERS
y [ENTER] for more

MOTOR RUNNING HOURS: 0 hr	RANGE: 0 - 100000
TIME BETWEEN STARTS TIMER: 0 min	RANGE: 0 - 500
STARTS/HOUR TIMERS 0 0 0 0 0 min	RANGE: 0 - 60

DESCRIPTION:
One of the SR469 timers accumulates the total running time for the Motor. This may be useful for scheduling routine maintenance. When this timer reaches 100 000, it will reset to 0. This timer can be cleared using the setpoints in S1 SR469 SETUP under INSTALLATION, RESET MOTOR INFORMATION.

The TIme Between Starts timer may also be viewed here. This may be useful for planning a motor shutdown. The Starts/Hour timer may also be viewed here.

5.6.1 EVENT01 -EVENT40

ENTER / ESCAPE	▼ [ENTER] EVENT 01 No Event	
	TIME OF EVENT 01: 00:00:00.0	RANGE: Hour/Min/Sec
ESCAPE / MESSAGE	DATE OF EVENT 01: Jan. 01, 1992	RANGE: Mon/Day/Year
ESCAPE / MESSAGE	MOTOR SPEED DURING EVENT01: Low Speed	RANGE: High Speed, Low Speed NOTE: this message is seen only if one of the Two-Speed feature is used
ESCAPE / MESSAGE	TACHOMETER DURING EVENT01: 0 RPM	RANGE: 0-3600 NOTE: this message is seen only if one of the Digital Inputs is programmed as Tachometer
ESCAPE / MESSAGE	A: 0 B: 0 C: 0 A EVENT01	RANGE: 0-100000
ESCAPE / MESSAGE	MOTOR LOAD EVENT01:0.00 x FLA	RANGE: 0 - 20.00
ESCAPE / MESSAGE	CURRENT UNBALANCE EVENT01: 0 %	RANGE: 0-100
ESCAPE / MESSAGE	GROUND CURRENT EVENT01: 0.00 A	RANGE: 0.0-5000.0
ESCAPE / MESSAGE	A: 0 B: 0 C: 0 A Diff. EV01	RANGE: 0-5000 NOTE: This message seen only if Phase Differential CT is programmed.
ESCAPE / MESSAGE	HOTTEST STATOR RTD: 0°C EVENT01	RANGE: -50 to +250, --- (No RTD) NOTE: this message seen only if at least 1 RTD is programmed as 'STATOR'
ESCAPE / MESSAGE	HOTTEST BEARING RTD: 0°C EVENT01	RANGE: -50 to +250, --- (No RTD) NOTE: this message seen only if at least 1 RTD is programmed as 'BEARING'
ESCAPE / MESSAGE	HOTTEST OTHER RTD: 0°C EVENT01	RANGE: -50 to +250, --- (No RTD) NOTE: this message seen only if at least 1 RTD is programmed as 'OTHER'
ESCAPE / MESSAGE	AMBIENT RTD: 0°C EVENT01	RANGE: -50 to +250, --- (No RTD) NOTE: this message seen only if at least 1 RTD is programmed as 'AMBIENT'
ESCAPE / MESSAGE	Vab: 0 Vbc: 0 Vca: 0 V EVENT01	RANGE: 0-20000 NOTE: This message not seen if VT Connection is programmed as 'None'
ESCAPE / MESSAGE	Van: 0 Vbn: 0 Vcn: 0 V EVENT01	RANGE: 0-20000 NOTE: This message seen only if VT Connection is programmed as 'Wye'
ESCAPE / MESSAGE	SYSTEM FREQUENCY EVENT01: 0.00 Hz	RANGE: 0.00, 20.00 - 120.00 NOTE: This message not seen if VT Connection is programmed as 'None'
ESCAPE / MESSAGE	0 kW 0 kVA 0 kvar EVENT01	RANGE: -50000 to +50000 NOTE: This message not seen if VT Connection is programmed as 'None'
ESCAPE / MESSAGE	POWER FACTOR EVENT01: 0.00	RANGE: 0.01-0.99 Lead or Lag, 0.00, 1.00 NOTE: This message not seen if VT Connection is programmed as 'None'
ESCAPE / MESSAGE	Torque EVENT01: 0.0 Nm	RANGE: 0.0 to -999999.9 NOTE: This message is seen only if TORQUE METERING is enabled.
ESCAPE / MESSAGE	Analog I/P 1 EVENT01: 0 Units	RANGE: -50000 to +50000
ESCAPE / MESSAGE	Analog I/P 2 EVENT01: 0 Units	RANGE: -50000 to +50000
ESCAPE / MESSAGE	Analog I/P 3 EVENT01: 0 Units	RANGE: -50000 to +50000
ESCAPE / MESSAGE	Analog I/P 4 EVENT01: 0 Units	RANGE: -50000 to +50000

DESCRIPTION:

The SR469 Event Recorder Stores motor and system information each time an event occurs. The description of the event is stored and a time and date stamp is also added to the record for troubleshooting purposes. Events include, all trips, any alarm optionally (except Service Alarm, and SR469 Not Inserted Alarm, which always records as events), loss of control power to the SR469, application of control power to the SR469, Emergency Restarts, and Motor Starts when a blocking function is active. The latter event could occur if the Block Start contacts were shorted out to bypass the SR469 and start the motor.

EVENT 01 is the most recent event, and EVENT 40 will be the oldest event. Each new event bumps the other event records up one until EVENT 40 is reached. The event record in EVENT 40 is lost when a new event occurs. This information can be cleared using the setpoint in S1 SR469 SETUP under CLEAR DATA.

Table 5-2 CAUSE OF EVENT TABLE

TRIPS	ALARMS (optional events)	OTHER
Incomplete Seq Trip	Remote Alarm	Service Alarm
Remote Trip	Pressure Sw. Alarm	Control Power Lost
Speed Switch Trip	Vibration Sw. Alarm	Control Power Applied
Load Shed Trip	Counter Alarm	Emergency Rst.Close
Pressure Sw. Trip	Tachometer Alarm	Emergency Rst. Open
Vibration Sw.Trip	General Sw.A Alarm	Start While Blocked
Tachometer Trip	General Sw.B Alarm	SR469 Not Inserted
General Sw.A Trip	General Sw.C Alarm	Simulation Started
General Sw.B Trip	General Sw.D Alarm	Simulation Stopped
General Sw.C Trip	Thermal Model Alarm	Forced Relay
General Sw.D Trip	Overload Alarm	
Overload Trip	Undercurrent Alarm	
Short Circuit Trip	Current U/B Alarm	
Short Circuit Backup	Ground Fault Alarm	
Mechanical Jam Trip	Stator RTD 1 Alarm	
Undercurrent Trip	Stator RTD 2 Alarm	
Current U/B Trip	Stator RTD 3 Alarm	
Ground Fault Trip	Stator RTD 4 Alarm	
Ground Fault Backup	Stator RTD 5 Alarm	
Differential Trip	Stator RTD 6 Alarm	
Acceleration Trip	Bearing RTD 7 Alarm	
Stator RTD 1 Trip	Bearing RTD 8 Alarm	
Stator RTD 2 Trip	Bearing RTD 9 Alarm	
Stator RTD 3 Trip	Bearing RTD10 Alarm	
Stator RTD 4 Trip	RTD11 Alarm	
Stator RTD 5 Trip	Ambient RTD12 Alarm	
Stator RTD 6 Trip	Open RTD Alarm	
Bearing RTD 7 Trip	Short/Low RTD Alarm	
Bearing RTD 8 Trip	Undervoltage Alarm	
Bearing RTD 9 Trip	Overvoltage Alarm	
Bearing RTD10 Trip	Volt. Frequency Alarm	
RTD11 Trip	Reactive Power Alarm	
Ambient RTD12 Trip	Underpower Alarm	
Undervoltage Trip	Trip Counter Alarm	
Overvoltage Trip	Trip Coil Super	
Phase Reversal Trip	Welded Contactor	
Volt. Frequency Trip	Breaker Failure	
Reactive Power Trip	Current Demand Alarm	
Power Factor Trip	kW Demand Alarm	
Underpower Trip	kvar Demand Alarm	
Analog I/P 1 Trip	kVA Demand Alarm	
Analog I/P 2 Trip	Analog I/P 1 Alarm	
Analog I/P 3 Trip	Analog I/P 2 Alarm	
Analog I/P 4 Trip	Analog I/P 3 Alarm	
Single Phasing (Unbalanced)	Analog I/P 4 Alarm	
	Overtorque	

5.7.1 SR469 MODEL INFO

■ SR469 MODEL INFO ■ [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	ORDER CODE: SR469-P5-HI-A20	RANGE: SR469 - P5/P1 - HI/LO - A20/A1
	ESCAPE / MESSAGE ⇳	SR469 SERIAL NO: A3050001	RANGE: A3050001- A309999
	ESCAPE / MESSAGE ⇳	SR469 REVISION: 30C100A4.000	RANGE: 30A100A4.000 - 30Z999A4.999
	ESCAPE / MESSAGE ⇧	SR469 BOOT REVISION: 30C100A4.000	RANGE: 30A100A4.000 - 30Z999A4.999

DESCRIPTION:

All of the SR469 Model information may be viewed here when the unit is powered up. In the event of a product software upgrade or service question, the information shown here should be jotted down prior to any inquiry.

5.7.2 CALIBRATION INFO

■ CALIBRATION INFO ■ [ENTER] for more	ENTER ⇨ / ⇦ ESCAPE	ORIGINAL CALIBRATION DATE: Jan 01 1995	RANGE: Mon/Day/Year
	ESCAPE / MESSAGE ⇧	LAST CALIBRATION DATE: Jan 01 1995	RANGE: Mon/Day/Year

DESCRIPTION:

The date of the original calibration and last calibration may be viewed here.

5.8.1 DIAGNOSTIC MESSAGES FOR OPERATORS

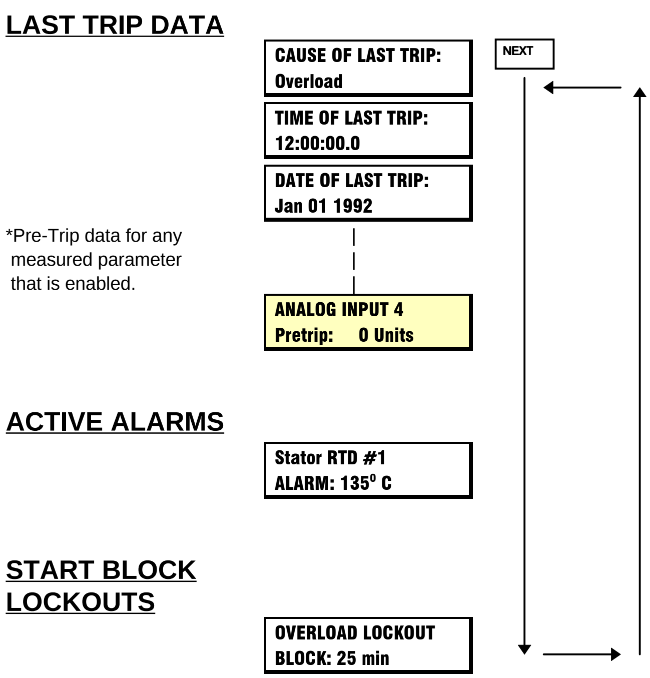
In the event of a Trip, Alarm, or Start Block, some of the Actual Value messages are very helpful in diagnosing the cause of the condition. The SR469 will automatically default to the most important message. The hierarchy is Trip and PreTrip messages, Alarm, and lastly, Start Block Lockout. In order to simplify things for the operator, the Message LED (indicator) will flash prompting the operator to press the [NEXT] key. When the [NEXT] key is pressed, the SR469 will automatically display the next relevant message and continue to cycle through the messages with each keypress. When all of these conditions have cleared, the SR469 will revert back to the normal default messages.

Any time the SR469 is not displaying the default messages because other Actual Value or Setpoint messages are being viewed and there are no trips, alarms, or blocks, the Message LED (indicator) will be on solid. From any point in the message structure, pressing the [NEXT] key will cause the SR469 to revert back to the normal default messages. When normal default messages are being displayed, pressing the [NEXT] will cause the SR469 to display the next default message immediately.

EXAMPLE:

If an Overload Trip occurred, an RTD alarm may also occur as a result of the overload, and a lockout time would be associated with the Trip. The SR469 would automatically default to the Cause of Last Trip Message at the top of the LAST TRIP DATA queue of A1 ACTUAL VALUES. The Message LED (indicator) would flash. Pressing the [NEXT] key would cycle through the TIME and Date Stamp information as well as all of the Pre-Trip Data. When the bottom of this queue is reached, an additional press of the [NEXT] key would normally return to the top of the queue . However, because there is an alarm active, the display will skip to the alarm message at the top of the ALARM STATUS queue of A1 ACTUAL VALUES. Similarly, another press of the [NEXT] would cause the SR469 to skip to the Start Block Lockout message at the top of the START BLOCK queue A1 ACTUAL VALUES. Finally, another press of the [NEXT] key will cause the SR469 to return to the original Cause of Last Trip message, and the cycle could be repeated.

When the [RESET] has been pressed, the hot RTD condition is no longer present, and the lockout time has expired, the display will revert back to the normal Default Messages.



5.8.2 FLASH MESSAGES

Flash messages are warning, error, or general information messages that are temporarily displayed in response to certain key presses. These messages are intended to assist with navigation of the SR469 messages by explaining what has happened or by prompting the user to perform certain actions.

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Table 5-3 FLASH MESSAGES

NEW SETPOINT HAS BEEN STORED	ROUNDED SETPOINT HAS BEEN STORED	* OUT OF RANGE! ENTER: ####-##### by #	ACCESS DENIED, SHORT ACCESS SWITCH	ACCESS DENIED, ENTER PASSCODE
INVALID PASSCODE ENTERED !	NEW PASSCODE HAS BEEN ACCEPTED	PASSCODE SECURITY NOT ENABLED, ENTER 0	PLEASE ENTER A NON-ZERO PASSCODE	SETPOINT ACCESS IS NOW PERMITTED
SETPOINT ACCESS IS NOW RESTRICTED	DATE ENTRY WAS NOT COMPLETE	DATE ENTRY OUT OF RANGE	TIME ENTRY WAS NOT COMPLETE	TIME ENTRY OUT OF RANGE
NO TRIPS OR ALARMS TO RESET	RESET PERFORMED SUCCESSFULLY	ALL POSSIBLE RESETS HAVE BEEN PERFORMED	CONDITION IS PRESENT RESET NOT POSSIBLE	ARE YOU SURE? PRESS [ENTER] TO VERIFY
PRESS [ENTER] TO ADD DEFAULT MESSAGE	DEFAULT MESSAGE HAS BEEN ADDED	DEFAULT MESSAGE LIST IS FULL	PRESS [ENTER] TO REMOVE MESSAGE	DEFAULT MESSAGE HAS BEEN REMOVED
DEFAULT MESSAGES 6 of 20 ARE ASSIGNED	INPUT FUNCTION ALREADY ASSIGNED	INVALID SERVICE CODE ENTERED	KEY PRESSED IS INVALID HERE	DATA CLEARED SUCCESSFULLY
TOP OF PAGE	END OF PAGE	TOP OF LIST	END OF LIST	MOTOR STARTING ψψ1ψψ2ψψ3ψψ4ψψ5 ψψ6ψψ
[.] KEY IS USED TO ADVANCE THE CURSOR	NO ALARMS ACTIVE	NO START BLOCKS ACTIVE	THIS FEATURE NOT PROGRAMMED	*Appropriate values will be substituted for the # signs

NEW SETPOINT HAS BEEN STORED: This message appear each time a setpoint has been altered and stored as shown on the display.

ROUNDED SETPOINT HAS BEEN STORED: Since the SR469 has a numeric keypad, a setpoint value may entered that is in between valid setpoint values. The SR469 will detect this condition and store a value that has been rounded to the nearest valid setpoint value. To find the valid range and step for a given setpoint, simply press the [HELP] key while the setpoint is being displayed.

OUT OF RANGE! ENTER: #### - ##### by #: If a setpoint value that is outside of the acceptable range of values is entered, the SR469 will display this message, substituting the proper values for that setpoint. An appropriate value may then be entered.

ACCESS DENIED, SHORT ACCESS SWITCH: In order to store any setpoint values, the Access Switch must be shorted. If this message appears and it is necessary to change a setpoint, short the Access terminals C1 & C2.

ACCESS DENIED, ENTER PASSCODE: The SR469 has a PASSCODE SECURITY feature. If that feature has been enabled, not only do the Access Switch terminals have to be shorted, but the Passcode must also be entered. If the correct passcode has been lost or forgotten, contact the factory with the Encrypted access code. All passcode features may be found in S1 SR469 SETUP under PASSCODE.

INVALID PASSCODE ENTERED: If an invalid passcode is entered for passcode security feature, this message will flash on the display.

NEW PASSCODE HAS BEEN ACCEPTED: When changing the Passcode for the Passcode Security feature, this message will appear as an acknowledge that the new passcode has been accepted.

PASSCODE SECURITY NOT ENABLED, ENTER 0: The Passcode Security feature is disabled whenever the passcode is zero (factory default). Any attempts to enter a passcode when the feature is disabled will result in this flash message. It is meant to prompt the user to enter 0 as the passcode. When this has been done, the feature may be enabled by entering a non-zero passcode.

PLEASE ENTER A NON-ZERO PASSCODE: If the passcode is zero, the passcode security feature is disabled. If the Change Passcode Setpoint is entered as yes, this flash message will appear prompting the user to enter a non-zero passcode which in turn will enable the feature.

SETPOINT ACCESS IS NOW PERMITTED: Any time that the Passcode Security feature is enabled and a valid passcode is entered, this flash message will appear to notify that the Setpoint s may now be altered and stored.

SETPOINT ACCESS IS NOW RESTRICTED: IF the passcode security feature is enabled and a valid passcode has been entered, when the setpoint under S1 SR469 SETUP, PASSCODE, SETPOINT ACCESS: is altered to 'Restricted', this message will appear. Also, any time that Setpoint access is permitted and the access jumper is removed, this message will also appear.

DATE ENTRY WAS NOT COMPLETE: Since the Date setpoint is special, consisting of MM/DD/YYYY, if the enter key is pressed before all of the information has been entered, this message will appear and the new value will not be store. Another attempt will have to be made with the complete information.

DATE ENTRY WAS OUT OF RANGE: If and invalid entry is made for the date (eg. 15 entered for month), this message will appear.

TIME ENTRY WAS NOT COMPLETE: Since the Time setpoint is special, consisting of HH/MM/SS.S, if the enter key is pressed before all of the information has been entered, this message will appear and the new value will not be store. Another attempt will have to be made with the complete information.

TIME ENTRY WAS OUT OF RANGE: If and invalid entry is made for the time (eg. 35 entered for hour), this message will appear.

NO TRIPS OR ALARMS TO RESET: If the [RESET] key is pressed when there are no trips or alarms present, this message will appear.

RESET PERFORMED SUCCESSFULLY: If all trip and alarm features that are active can be cleared (i.e. the conditions that caused these trips and/or alarms are no longer present), then this message will appear when a RESET is performed, indicating that all trips and alarms have been cleared.

ALL POSSIBLE RESETS HAVE BEEN PERFORMED: If only some of the trip and alarm features that are active can be cleared (ie. the conditions that caused some of these trips and/or alarms are still present), then this message will appear when a RESET is performed, indicating that only trips and alarms that could be reset have been reset.

CONDITION IS PRESENT RESET NOT POSSIBLE: If no trip and alarm features that are active can be cleared (ie. the condition that caused these trips and/or alarms is still present), then this message will appear when the [RESET] key is pressed.

ARE YOU SURE? PRESS [ENTER] TO VERIFY: If the [RESET] key is pressed and resetting of any trip or alarm feature is possible, this message will appear to ask for verification of the operation. If [RESET] is pressed again while the message is still on the display, the reset will be performed.

PRESS [ENTER] TO ADD DEFAULT MESSAGE: Anywhere in the SR469 Actual Value Message Structure, if the [ENTER] key is pressed, this message will appear to prompt the user to press [ENTER] to add a new default message. To add a new default message, [ENTER] must be pressed while this message is being displayed.

DEFAULT MESSAGE HAS BEEN ADDED: Any time a new default message is added to the Default message list, this message will appear as verification.

DEFAULT MESSAGE LIST IS FULL: If an attempt is made to add a new default message to the default message list when 20 messages are already assigned, this message will appear. In order to add a message, one of the existing messages must be removed.

PRESS [ENTER] TO REMOVE MESSAGE: Under S1 SR469 SETUP, DEFAULT MESSAGES, if the[.] key is pressed, immediately followed by the [ENTER] key, this message will appear to prompt the user to press [ENTER] to remove a default message. To remove the default message, [ENTER] must be pressed while this message is being displayed.

DEFAULT MESSAGE HAS BEEN REMOVED: Any time a default message is removed from the Default message list, this message will appear as verification.

DEFAULT MESSAGES 6 of 20 ARE ASSIGNED: This message will appear each time the DEFAULT MESSAGES subgroup of S1 SR469 SETUP is entered. It is intended to notify the user of the number of default messages that are assigned.

INPUT FUNCTION IS ALREADY ASSIGNED: The Assignable Digital Input functions may only be used once. If an attempt is made to assign the same function to two different switches, this message will appear.

INVALID SERVICE CODE ENTERED: Under S13 SR469 TESTING, MULTILIN USE ONLY, if an invalid code is entered, this message will appear.

KEY PRESSED HERE IS INVALID: Under certain situations, certain keys have no function (eg. any number key while viewing Actual Values). If a key is pressed where it should have no function, this message will appear.

DATA CLEARED SUCCESSFULLY: Under S1 SR469 SETUP, CLEAR DATA or INSTALLATION, if data is cleared or reset, this message will appear to confirm that action.

TOP OF PAGE: This message will indicate when the top of a page has been reached.

BOTTOM OF PAGE: This message will indicate when the bottom of a page has been reached.

TOP OF LIST: This message will indicate when the top of subgroup has been reached.

BOTTOM OF LIST: This message will indicate when the bottom of a subgroup has been reached.

[.] KEY IS USED TO ADVANCE THE CURSOR: Any time a setpoint that requires text editing is viewed, this message will appear immediately to prompt the user to use the [.] key for cursor control. If the setpoint is not altered for 1 minute, the message will flash again.

NO ALARMS ACTIVE: If an attempt is made to enter the Alarm Status message subgroup, but there are no active alarms, this message will appear.

NO START BLOCKS ACTIVE: If an attempt is made to enter Start Blocks message subgroup of A1 Actual Values, but there are no active Start Blocks, this message will appear.

THIS FEATURE NOT PROGRAMMED: If an attempt is made to enter an actual value message subgroup, when the setpoints are not configured for that feature, this message will appear.

6.1.1 ELECTRICAL INTERFACE

The hardware or electrical interface is one of the following: one of two 2-wire RS485 ports from the rear terminal connector or the RS232 from the front panel connector. In a 2-wire RS485 link, data flow is bi-directional. Data flow is half duplex for both the RS485 and the RS232 ports. That is, data is never transmitted and received at the same time. RS485 lines should be connected in a daisy chain configuration (avoid star connections) with a terminating network installed at each end of the link, i.e. at the master end and at the slave farthest from the master. The terminating network should consist of a 120 Ohm resistor in series with a 1 nF ceramic capacitor when used with Belden 9841 RS485 wire. The value of the terminating resistors should be equal to the characteristic impedance of the line. This is approximately 120 Ohms for standard #22 AWG twisted pair wire. Shielded wire should always be used to minimize noise. Polarity is important in RS485 communications. Each '+' terminal of every SR469 must be connected together for the system to operate. See chapter 2 INSTALLATION for details on correct serial port wiring.

6.2.1 MODBUS RTU PROTOCOL

The SR469 implements a subset of the AEG Modicon Modbus RTU serial communication standard. Many popular programmable controllers support this protocol directly with a suitable interface card allowing direct connection of relays. Although the Modbus protocol is hardware independent, the SR469 interfaces include two 2-wire RS485 ports and one RS232 port. Modbus is a single master, multiple slave protocol suitable for a multi-drop configuration as provided by RS485 hardware. In this configuration up to 32 slaves can be daisy-chained together on a single communication channel.

The SR469 is always a slave. It cannot be programmed as a master. Computers or PLCs are commonly programmed as masters. The Modbus protocol exists in two versions: Remote Terminal Unit (RTU, binary) and ASCII. Only the RTU version is supported by the SR469. Monitoring, programming and control functions are possible using read and write register commands.

6.2.2 DATA FRAME FORMAT AND DATA RATE

One data frame of an asynchronous transmission to or from an SR469 is default to 1 start bit, 8 data bits, and 1 stop bit. This produces a 10 bit data frame. This is important for transmission through modems at high bit rates (11 bit data frames are not supported by Hayes modems at bit rates of greater than 300 bps). The parity bit is optional as odd or even. If it is programmed as odd or even, the data frame consists of 1 start bit, 8 data bits, 1 parity bit, and 1 stop bit.

Modbus protocol can be implemented at any standard communication speed. The SR469 RS485 ports support operation at 1200, 2400, 4800, 9600, and 19200 baud. The front panel RS232 baud rate is fixed at 9600 baud.

6.2.3 DATA PACKET FORMAT

A complete request/response sequence consists of the following bytes (transmitted as separate data frames):

Master Request Transmission:

SLAVE ADDRESS	-	1 byte
FUNCTION CODE	-	1 byte
DATA	-	variable number of bytes depending on FUNCTION CODE
CRC	-	2 bytes

Slave Response Transmission:

SLAVE ADDRESS	-	1 byte
FUNCTION CODE	-	1 byte
DATA	-	variable number of bytes depending on FUNCTION CODE
CRC	-	2 bytes

SLAVE ADDRESS - This is the first byte of every transmission. This byte represents the user-assigned address of the slave device that is to receive the message sent by the master. Each slave device must be assigned a unique address and only the addressed slave will respond to a transmission that starts with its address. In a master request transmission the SLAVE ADDRESS represents the address of the slave to which the request is being sent. In a slave response transmission the SLAVE ADDRESS represents the address of the slave that is sending the response. Note: A master transmission with a SLAVE ADDRESS of 0 indicates a broadcast command. Broadcast commands can be used for specific functions.

FUNCTION CODE - This is the second byte of every transmission. Modbus defines function codes of 1 to 127. The SR469 implements some of these functions. In a master request transmission the FUNCTION CODE tells the slave what action to perform. In a slave response transmission if the FUNCTION CODE sent from the slave is the same as the FUNCTION CODE sent from the master indicating the slave performed the function as requested. If the high order bit of the FUNCTION CODE sent from the slave is a 1 (i.e. if the FUNCTION CODE is > 127) then the slave did not perform the function as requested and is sending an error or exception response.

DATA - This will be a variable number of bytes depending on the FUNCTION CODE. This may be Actual Values, Setpoints, or addresses sent by the master to the slave or by the slave to the master. Data is sent MSByte first followed by the LSByte.

CRC - This is a two byte error checking code. CRC is sent LSByte first followed by the MSByte.

6.2.4 ERROR CHECKING

The RTU version of Modbus includes a two byte CRC-16 (16 bit cyclic redundancy check) with every transmission. The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (11000000000000101B). The 16 bit remainder of the division is appended to the end of the transmission, LSByte first. The resulting message including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred.

If an SR469 Modbus slave device receives a transmission in which an error is indicated by the CRC-16 calculation, the slave device will not respond to the transmission. A CRC-16 error indicates than one or more bytes of the transmission were received incorrectly and thus the entire transmission should be ignored in order to avoid the SR469 performing any incorrect operation.

The CRC-16 calculation is an industry standard method used for error detection. An algorithm is included here to assist programmers in situations where no standard CRC-16 calculation routines are available.

<u>CRC-16 Algorithm</u>

Once the following algorithm is complete, the working register "A" will contain the CRC value to be transmitted. Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The MSbit of the characteristic polynomial is dropped since it does not affect the value of the remainder. The following symbols are used in the algorithm:

-->	data transfer
A	16 bit working register
AL	low order byte of A
AH	high order byte of A
CRC	16 bit CRC-16 value
i,j	loop counters
(+)	logical exclusive or operator
Di	i-th data byte (i = 0 to N-1)
G	16 bit characteristic polynomial = 1010000000000001 with MSbit dropped and bit order reversed
shr(x)	shift right (the LSbit of the low order byte of x shifts into a carry flag, a '0' is shifted into the

MSbit of the high order byte of x, all other bits shift right one location

algorithm:

1. FFFF hex --> A		
2. 0 --> i		
3. 0 --> j		
4. Di (+) AL --> AL		
5. j+1 --> j		
6. shr(A)		
7. is there a carry?	No: go to 8.	
	Yes: G (+) A --> A	
8. is j = 8?	No: go to 5.	
	Yes: go to 9.	
9. i+1 --> i		
10. is i = N?	No: go to 3.	
	Yes: go to 11.	
11. A --> CRC		

6.2.5 TIMING

Data packet synchronization is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If three and one half character times elapse without a new character or completion of the packet, then the communication link must be reset (i.e. all slaves start listening for a new transmission from the master). Thus at 9600 baud a delay of greater than 3.5 * 1/9600 * 10 = 3.65 ms will cause the communication link to be reset.

6.3.1 SUPPORTED MODBUS FUNCTIONS

The following functions are supported by the SR469:

01 - Read Relay Coil
02 - Read Digital Input Status
03 - Read Setpoints and Actual Values
04 - Read Setpoints and Actual Values
05 - Execute Operation
06 - Store Single Setpoint
07 - Read Device Status
08 - Loopback Test
16 - Store Multiple Setpoints

6.3.2 FUNCTION CODES 01 AND 02 - READ RELAY COIL AND DIGITAL INPUT STATUS

Modbus implementation:	Read Coil and Input Status
SR469 Implementation:	Read Relay Coil and Digital Input Status

For the SR469 implementation of Modbus, these commands can be used to read Relay Coil Status or Digital Input Status.

Function 01

The standard implementation requires the following: slave address (one byte), function code (one byte), starting relay coil (two byte), number of coils to read (two bytes), and CRC (two bytes). The slave response is the slave address (one byte), function code (one byte), byte count of relay coil mask (one byte – always 01 since only six relay coils in the relay), bit mask indicating the status of requested relay coils (one byte), and CRC (two bytes).

Function 02

The standard implementation requires the following: slave address (one byte), function code (one byte), starting digital input (two byte), number of digital inputs to read (two bytes), and CRC (two bytes). The slave response is the slave address (one byte), function code (one byte), byte count of digital input mask (one byte), bit mask indicating the status of requested digital inputs (one or two bytes), and CRC (two bytes).

Note: the CRC is sent as a two byte number with the low order byte sent first.

Message Format and Example:

Function 01:

Request slave 11 to respond with status of relay coil 3 to 5:

Relay	*Status*
R1	*Energized*
R2	*De-energized*
R3	*De-energized*
R4	*De-energized*
R5	*Energized*
R6	*Energized*
Bit Mask	*0011 0001 (0 x 31)*

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	01	read relay coil status
STARTING RELAY COIL	2	00 03	starting at relay coil 3
NUMBER OF RELAYS	2	00 03	3 relay coils (i.e. R3, R4, R5)
CRC	2	8C A1	CRC calculated by the master
Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	01	read relay coil status
BYTE COUNT	1	01	1 byte bit mask
BIT MASK	1	10	bit mask of requested relay (0001 0000)
CRC	2	53 9C	CRC calculated by the slave

NOTE: If STARTING RELAY COIL (STARTING DIGITAL INPUT) of Zero is entered, then SR469 will default it to One.
If the NUMBER OF RELAYS (NUMBER OF DIGITAL INPUTS) requested exceeds the number of relays available then user will be prompted with a “ILLEGAL DATA” message.

Function 02:

EX1: Request slave 11 to respond with status of digital inputs 5 to 9:

Digital Input	*Status*
D1: Access	*Closed*
D2: Test	*Open*
D3: Starter Status	*Open*
D4: Emergency Restart	*Open*
D5: Remote Reset	*Closed*
D6: Assignable Input1	*Closed*
D7: Assignable Input2	*Closed*
D8: Assignable Input3	*Open*
D9: Assignable Input4	*Closed*
Bit Mask(LSB)	*0111 0001*
Bit Mask(MSB)	*0000 0001*

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	02	read digital input status
STARTING RELAY COIL	2	00 05	starting at digital input 5
NUMBER OF RELAYS	2	00 05	5 DI (i.e. D5, D6, D7, D8, D9)
CRC	2	A8 A2	CRC calculated by the master
Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	02	read digital input status
BYTE COUNT	1	02	2 byte bit masks
BIT MASK (LSB)	1	71	bit mask of requested DI
BIT MASK (MSB)	1	01	
CRC	2	C5 B9	CRC calculated by the slave

EX2: Request slave 11 to respond with status of digital inputs 1 to 4:

Digital Input	*Status*
D1: Access	*Closed*
D2: Test	*Open*
D3: Starter Status	*Open*
D4: Emergency Restart	*Open*
D5: Remote Reset	*Closed*
D6: Assignable Input1	*Closed*
D7: Assignable Input2	*Closed*
D8: Assignable Input3	*Open*
D9: Assignable Input4	*Closed*
Bit Mask(LSB)	*0111 0001*

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	02	read digital input status
STARTING RELAY COIL	2	00 01	starting at digital input 5
NUMBER OF RELAYS	2	00 04	5 DI (i.e. D5, D6, D7, D8, D9)
CRC	2	28 A3	CRC calculated by the master
Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	02	read digital input status
BYTE COUNT	1	01	1 byte bit masks
BIT MASK	1	01	bit mask of requested DI
CRC	2	63 90	CRC calculated by the slave

6.3.3 FUNCTION CODES 03 AND 04 - READ SETPOINTS AND ACTUAL VALUES

Modbus implementation: Read Input and Holding Registers
SR469 Implementation: Read Setpoints and Actual Values

For the SR469 implementation of Modbus, these commands can be used to read any Setpoint ("holding registers") or Actual Value ("input registers"). Holding and input registers are 16 bit (two byte) values transmitted high order byte first. Thus all SR469 Setpoints and Actual Values are sent as two bytes. The maximum number of registers that can be read in one transmission is 125. Function codes 03 and 04 are configured to read setpoints or actual values interchangeably because some PLCs do not support both function codes.

The slave response to these function codes is the slave address, function code, a count of the number of data bytes to follow, the data itself and the CRC. Each data item is sent as a two byte number with the high order byte sent first. The CRC is sent as a two byte number with the low order byte sent first.

Message Format and Example:

Request slave 11 to respond with 2 registers starting at address 0308.
For this example the register data in these addresses is:

Address	*Data*
0308	*0064*
0309	*000A*

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	03	read registers
DATA STARTING ADDRESS	2	03 08	data starting at 0308
NUMBER OF SETPOINTS	2	00 02	2 registers (4 bytes total)
CRC	2	45 27	CRC calculated by the master

Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	03	read registers
BYTE COUNT	1	04	2 registers = 4 bytes
DATA 1	2	00 64	value in address 0308
DATA 2	2	00 0A	value in address 0309
CRC	2	EB 91	CRC calculated by the slave

6.3.4 FUNCTION CODE 05 - EXECUTE OPERATION

Modbus Implementation: Force Single Coil
SR469 Implementation: Execute Operation

This function code allows the master to request an SR469 to perform specific command operations. The command numbers listed in the Commands area of the memory map correspond to operation code for function code 05.

The operation commands can also be initiated by writing to the Commands area of the memory map using function code 16. Refer to FUNCTION 16 - STORE MULTIPLE SETPOINTS for complete details.

Supported Operations

Reset SR469 (operation code 1)
Motor Start (operation code 2)
Motor Stop (operation code 3)
Waveform Trigger (operation code 4)

Message Format and Example:

Reset SR469 (operation code 1).

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00	reset command (operation code 1)
		01	
CODE VALUE	2	FF	perform function
		00	
CRC	2	DD	CRC calculated by the master
		50	
Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00	reset command (operation code 1)
		01	
CODE VALUE	2	FF	perform function
		00	
CRC	2	DD	CRC calculated by the slave
		50	

6.3.5 FUNCTION CODE 06 - STORE SINGLE SETPOINT

Modbus Implementation: Preset Single Register
SR469 Implementation: Store Single Setpoint

This command allows the master to store a single setpoint into the memory of an SR469. The slave response to this function code is to echo the entire master transmission.

Message Format and Example:

Request slave 11 to store the value 01F4 in Setpoint address 1180
After the transmission in this example is complete, Setpoints address 1180 will contain the value 01F4.

Master Transmission	Bytes	Example (hex)	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	11	Setpoint address 1180
		80	
DATA	2	01	data for address 1180
		F4	
CRC	2	8D	CRC calculated by the master
		A3	

Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	06	store single Setpoint
DATA STARTING ADDRESS	2	11	Setpoint address 1180
		80	
DATA	2	01	data stored in address 1180
		F4	
CRC	2	8D	CRC calculated by the slave
		A3	

6.3.6 FUNCTION CODE 07 - READ DEVICE STATUS

Modbus Implementation: Read Exception Status
SR469 Implementation: Read Device Status

This is a function used to quickly read the status of a selected device. A short message length allows for rapid reading of status. The status byte returned will have individual bits set to 1 or 0 depending on the status of the slave device.

SR469 General Status Byte:

LSBit	B0: R1 Trip relay operated = 1
	B1: R2 Auxiliary relay operated = 1
	B2: R3 Auxiliary relay operated = 1
	B3: R4 Alarm relay operated = 1
	B4: R5 Block Start relay operated = 1
	B5: R6 Service relay operated = 1
	B6: Stopped = 1
MSBit	B7: Running =1

Note: if status is neither stopped or running, motor is starting.

Message Format and Example:

Request status from slave 11.

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	07	read device status
CRC	2	47	CRC calculated by the master
		42	
Slave Response			
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	07	read device status
DEVICE STATUS	1	59	status = 01011001 in binary
CRC	2	C2	CRC calculated by the slave
		08	

6.3.7 FUNCTION CODE 08 - LOOPBACK TEST

Modbus Implementation: Loopback Test
SR469 Implementation: Loopback Test

This function is used to test the integrity of the communication link. The SR469 will echo the request.

Message Format and Example:

Loopback test from slave 11.

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	08	loopback test
DIAG CODE	2	00	must be 00 00
		00	
DATA	2	00	must be 00 00
		00	
CRC	2	E0	CRC calculated by the master
		A1	

Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	08	loopback test
DIAG CODE	2	00	must be 00 00
		00	
DATA	2	00	must be 00 00
		00	
CRC	2	E0	CRC calculated by the slave
		A1	

6.3.8 FUNCTION CODE 16 - STORE MULTIPLE SETPOINTS

Modbus Implementation: Preset Multiple Registers
SR469 Implementation: Store Multiple Setpoints

This function code allows multiple Setpoints to be stored into the SR469 memory. Modbus "registers" are 16 bit (two byte) values transmitted high order byte first. Thus all SR469 setpoints are sent as two bytes. The maximum number of Setpoints that can be stored in one transmission is dependent on the slave device. Modbus allows up to a maximum of 60 holding registers to be stored. The SR469 response to this function code is to echo the slave address, function code, starting address, the number of Setpoints stored, and the CRC.

Message Format and Example:

Request slave 11 to store the value 01F4 to Setpoint address 1180 and the value 01DE to setpoint address 1181. After the transmission in this example is complete, SR469 slave 11 will have the following Setpoints information stored:

Address	*Data*
1180	*01F4*
1181	*01DE*

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	10	store Setpoints
DATA STARTING ADDRESS	2	11	Setpoint address 1180
		80	
NUMBER OF SETPOINTS	2	00	2 Setpoints (4 bytes total)
		02	
BYTE COUNT	1	04	4 bytes of data
DATA 1	2	01	data for address 1180
		F4	
DATA 2	2	01	data for address 1181
		DE	
CRC	2	DB	CRC calculated by the master
		B1	

Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	10	store Setpoints
DATA STARTING ADDRESS	2	11	Setpoint address 1180
		80	
NUMBER OF SETPOINTS	2	00	2 setpoints
		02	
CRC	2	45	CRC calculated by the slave
		B6	

6.3.9 FUNCTION CODE 16 - PERFORMING COMMANDS

Some PLCs may not support execution of commands using function code 5 but do support storing multiple setpoints using function code 16. To perform this operation using function code 16 (10H), a certain sequence of commands must be written at the same time to the SR469. The sequence consists of : Command Function register, Command operation register and Command Data (if required). The Command Function register must be written with the value of 5 indicating an execute operation is requested. The Command Operation register must then be written with a valid command operation number from the list of commands shown in the memory map. The Command Data registers must be written with valid data if the command operation requires data. The selected command will execute immediately upon receipt of a valid transmission.

Message Format and Example:

Perform a reset on SR469 (operation code 1).

Master Transmission	**Bytes**	**Example (hex)**	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	10	store Setpoints
DATA STARTING ADDRESS	2	00 80	Setpoint address 0080
NUMBER OF SETPOINTS	2	00 02	2 Setpoints (4 bytes total)
BYTE COUNT	1	04	4 bytes of data
COMMAND FUNCTION	2	00 05	data for address 0080
COMMAND OPERATION	2	00 01	data for address 0081
CRC	2	0B D6	CRC calculated by the master

Slave Response			
SLAVE ADDRESS	1	0B	message from slave 11
FUNCTION CODE	1	10	store Setpoints
DATA STARTING ADDRESS	2	00 80	Setpoint address 0080
NUMBER OF SETPOINTS	2	00 02	2 setpoints
CRC	2	40 8A	CRC calculated by the slave

6.4.1 ERROR RESPONSES

When an SR469 detects an error other than a CRC error, a response will be sent to the master. The MSbit of the FUNCTION CODE byte will be set to 1 (i.e. the function code sent from the slave will be equal to the function code sent from the master plus 128). The following byte will be an exception code indicating the type of error that occurred.

Transmissions received from the master with CRC errors will be ignored by the SR469.

The slave response to an error (other than CRC error) will be:

SLAVE ADDRESS	- 1 byte
FUNCTION CODE	- 1 byte (with MSbit set to 1)
EXCEPTION CODE	- 1 byte
CRC	- 2 bytes

The SR469 implements the following exception response codes.

01 - ILLEGAL FUNCTION
The function code transmitted is not one of the functions supported by the SR469.

02 - ILLEGAL DATA ADDRESS
The address referenced in the data field transmitted by the master is not an allowable address for the SR469.

03 - ILLEGAL DATA VALUE
The value referenced in the data field transmitted by the master is not within range for the selected data address.

6.5.1 MEMORY MAP INFORMATION

The data stored in the SR469 is grouped as Setpoints and Actual Values. Setpoints can be read and written by a master computer. Actual Values are read only. All Setpoints and Actual Values are stored as two byte values. That is, each register address is the address of a two byte value. Addresses are listed in hexadecimal. Data values (Setpoint ranges, increments, factory values) are in decimal.

Note: Many Modbus communications drivers add 40001d to the actual address of the register addresses. For example: if address 0h was to be read, 40001d would be the address required by the Modbus communications driver; if address 320h (800d) was to be read, 40801d would be the address required by the Modbus communications driver.

6.5.2 USER DEFINABLE MEMORY MAP AREA

The SR469 has a powerful feature, called the User Definable Memory Map, which allows a computer to read up to 124 non-consecutive data registers (setpoints or actual values) by using one Modbus packet. It is often necessary for a master computer to continuously poll various values in each of the connected slave relays. If these values are scattered throughout the memory map, reading them would require numerous transmissions and would burden the communication link. The User Definable Memory Map can be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by reading these consecutive locations.

The User Definable area has two sections:

1. A Register Index area (memory map addresses 0180h-01FCh) that contains 125 Actual Values or Setpoints register addresses.
2. A Register area (memory map addresses 0100h-017Ch) that contains the data at the addresses in the Register Index.

Register data that is separated in the rest of the memory map may be remapped to adjacent register addresses in the User Definable Registers area. This is accomplished by writing to register addresses in the User Definable Register Index area. This allows for improved through-put of data and can eliminate the need for multiple read command sequences.

For example, if the values of Average Phase Current (register address 0306h) and Hottest Stator RTD Temperature (register address 0320h) are required to be read from an SR469, their addresses may be remapped as follows:

1. Write 0306h to address 0180h (User Definable Register Index 0000) using function code 06 or 16.
2. Write 0307h to address 0181h (User Definable Register Index 0001) using function code 06 or 16.
   (Average Phase Current is a double register number)
3. Write 0320h to address 0182h (User Definable Register Index 0001) using function code 06 or 16.

A read (function code 03 or 04) of registers 0100h (User Definable Register 0000) and 0101h (User Definable Register 0001) will return the Phase A Current and register 0102h (User Definable Register 0002) will return Hottest Stator RTD Temperature.

6.5.3 EVENT RECORDER

The SR469 event recorder data starts at address 3000h. Address 3003h is a pointer to the event of interest (1 representing the latest event and 40 representing the oldest event). To retrieve event 1, write ‘1’ to the Event Record Selector (3003h) and read the data from 3004h to 3022h. To retrieve event 2, write ‘2’ to the Event Record Selector (3003h) and read the data from 3004h to 3022h. All 40 events may be retrieved in this manner. The time and date stamp of each event may be used to ensure that all events have been retrieved in order without new events corrupting the sequence of events (event 1 should be more recent than event 2, event 2 should be more recent than event 3, etc...).

6.5.4 WAVEFORM CAPTURE

The SR469 stores a number of cycles of A/D samples each time a trip occurs in a trace buffer, determined by the setpoint in S1 Preferences, Trace Memory Buffers. The Trace Memory Trigger is set up in S1 Preferences and this determines how many pre-trip and post-trip cycles are stored. The trace buffer is time and date stamped and may be correlated to a trip in the event record. 10 waveforms are captured this way when a trip occurs. These are the 3 phase currents, 3 differential currents, ground current and 3 voltage waveforms. This information is stored in volatile memory and will be lost if power is cycled to the relay.

To access the captured waveforms, select the waveform of interest by writing its trace memory channel (see following table) to the Trace Memory Channel Selector (address 30F1h). Then read the trace memory data from address 3100h to 3400h. There are 12 samples per cycle for each of the cycles. The values read are in actual amperes or volts.

TRACE MEMORY CHANNEL	WAVEFORM
0	Phase A current
1	Phase B current
2	Phase C current
3	Differential phase A current
4	Differential phase B current
5	Differential phase C current
6	Ground current
7	Phase A voltage
8	Phase B voltage
9	Phase C voltage

Address 30F8h shows the number of traces taken. To access the latest use the value at address 30F0h. To access more than 1 trace, reduce this value to access the older traces.

SR 469 MEMORY MAP

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
Product ID (Addresses 0000 -007F)								
PRODUCT ID	0000	Multilin Product Device Code	N/A	N/A	N/A	N/A	F1	30
	0001	Product Hardware Revision	1	26	1	N/A	F15	N/A
	0002	Product Software Revision	N/A	N/A	N/A	N/A	F16	N/A
	0003	Product Modification Number	0	999	1	N/A	F1	N/A
	0004	Reserved						
	...	...						
	000F	Reserved						
	0010	Boot Program Revision	N/A	N/A	N/A	N/A	F16	N/A
	0011	Boot Program Modification Number	0	999	1	N/A	F1	N/A
	0012	Reserved						
	...	...						
	007F	Reserved						
Commands (Addresses 0080 -00FF)								
COMMANDS	0080	Command Function Code						
	0081	Reserved						
	0088	Communications Port Passcode	0	99999999	1	N/A	F12	0
	00F0	Time (Broadcast)	N/A	N/A	N/A	N/A	F24	N/A
	00F2	Date (Broadcast)	N/A	N/A	N/A	N/A	F18	N/A
	...	...						
	00FF	Reserved						
User Map (Addresses 0100 -017F)								
USER MAP VALUES	0100	User Map Value # 1	---	---	---	---	---	---
	0101	User Map Value # 2	---	---	---	---	---	---
	...	...						
	017C	User Map Value # 125	---	---	---	---	---	---
	017D	Reserved						
	...	...						
	17FF	Reserved						
USER MAP ADDRESSES	0180	User Map Address # 1	0	3FFF	1	hex	F1	0
	0181	User Map Address # 2	0	3FFF	1	hex	F1	0
	...	...						
	01FC	User Map Address # 125	0	3FFF	1	hex	F1	0
	01FD	Reserved						
	...	...						
	01FF	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
Actual Values (Addresses 0200 -0FFF)								
MOTOR STATUS	0200	Motor Status	0	4	1	-	FC133	0
	0201	Motor Thermal Capacity Used	0	100	1	%	F1	0
	0202	Estimated Time to Trip on Overload	-1	99999	1	s	F20	-1
	0204	Motor Speed	0	1	1	-	FC135	0
	0205	Communication Setpoint Access	0	1	N/A	N/A	F126	N/A
	0206	Reserved						
	...	...						
	020F	Reserved						
SYSTEM STATUS	0210	General Status	0	65535	1	-	FC140	0
	0211	Output Relay Status	0	63	1	-	FC141	0
	0212	Reserved						
	...							
	021F	Reserved						
LAST TRIP DATA	0220	Cause of Last Trip	0	45	1	-	FC134	0
	0221	Time of Last Trip (2 words)	N/A	N/A	N/A	N/A	F19	N/A
	0223	Date of Last Trip (2 words)	N/A	N/A	N/A	N/A	F18	N/A
	0225	Motor Speed During Trip	0	1	1	-	FC135	0
	0226	Pre-Trip Tachometer RPM	0	3600	1	R.P.M.	F1	0
	0227	Phase A Pre-Trip Current	0	100000	1	A	F9	0
	0229	Phase B Pre-Trip Current	0	100000	1	A	F9	0
	022B	Phase C Pre-Trip Current	0	100000	1	A	F9	0
	022D	Pre-Trip Motor Load	0	2000	1	FLA	F3	0
	022E	Pre-Trip Current Unbalance	0	100	1	%	F1	0
	022F	Pre-Trip Ground Current	0	500000	1	A	F11	0
	0231	Phase A Pre-Trip Differential Current	0	5000	1	A	F1	0
	0232	Phase B Pre-Trip Differential Current	0	5000	1	A	F1	0
	0233	Phase C Pre-Trip Differential Current	0	5000	1	A	F1	0
	0234	Hottest Stator RTD During Trip	0	12	1	-	F1	0
	0235	Pre-Trip Temperature of Hottest Stator RTD	-50	250	1	°C	F4	0
	0236	Hottest Bearing RTD During Trip	0	12	1	-	F1	0
	0237	Pre-Trip Temperature of Hottest Bearing RTD	-50	250	1	°C	F4	0
	0238	Hottest Other RTD During Trip	0	12	1	-	F1	0
	0239	Pre-Trip Temperature of Hottest Other RTD	-50	250	1	°C	F4	0
	023A	Hottest Ambient RTD During Trip	0	12	1	-	F1	0
	023B	Pre-Trip Ambient RTD Temperature	-50	250	1	°C	F4	0
	023C	Pre-Trip Voltage Vab	0	20000	1	V	F1	0
	023D	Pre-Trip Voltage Vbc	0	20000	1	V	F1	0
	023E	Pre-Trip Voltage Vca	0	20000	1	V	F1	0
	023F	Pre-Trip Voltage Van	0	20000	1	V	F1	0
	0240	Pre-Trip Voltage Vbn	0	20000	1	V	F1	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	0241	Pre-Trip Voltage Vcn	0	20000	1	V	F1	0
	0242	Pre-Trip System Frequency	0	12000	1	Hz	F3	0
	0243	Pre-Trip Real Power	-50000	50000	1	kW	F12	0
	0245	Pre-Trip Reactive Power	-50000	50000	1	kvar	F12	0
	0247	Pre-Trip Apparent Power	0	50000	1	kVA	F1	0
	0248	Pre-Trip Power Factor	-99	100	1	-	F21	0
	0249	Analog Input #1 Pre-Trip	-50000	50000	1	-	F12	0
	024B	Analog Input #2 Pre-Trip	-50000	50000	1	-	F12	0
	024D	Analog Input #3 Pre-Trip	-50000	50000	1	-	F12	0
	024F	Analog Input #4 Pre-Trip	-50000	50000	1	-	F12	0
	0251	Reserved						
	...							
	025B	Reserved						
	025C	Pre-Trip Temp. of Hottest Stator RTD (°F)	-58	482	1	°F	F4	32
	025D	Pre-Trip Temp. of Hottest Bearing RTD (°F)	-58	482	1	°F	F4	32
	025E	Pre-Trip Temp. of Hottest Other RTD (°F)	-58	482	1	°F	F4	32
	025F	Pre-Trip Temp. of Hottest Ambient RTD (°F)	-58	482	1	°F	F4	32
	0260	Reserved						
	...	...						
	0264	Reserved						
ALARM STATUS	0265	Remote Alarm Status	0	4	1	-	FC123	0
	0266	Pressure Switch Alarm Status	0	4	1	-	FC123	0
	0267	Vibration Switch Alarm Status	0	4	1	-	FC123	0
	0268	Digital Counter Alarm Status	0	4	1	-	FC123	0
	0269	Tachometer Alarm Status	0	4	1	-	FC123	0
	026A	General Switch A Alarm Status	0	4	1	-	FC123	0
	026B	General Switch B Alarm Status	0	4	1	-	FC123	0
	026C	General Switch C Alarm Status	0	4	1	-	FC123	0
	026D	General Switch D Alarm Status	0	4	1	-	FC123	0
	026E	Thermal Capacity Alarm	0	4	1	-	FC123	0
	026F	Overload Alarm Status	0	4	1	-	FC123	0
	0270	Undercurrent Alarm Status	0	4	1	-	FC123	0
	0271	Current Unbalance Alarm Status	0	4	1	-	FC123	0
	0272	Ground Fault Alarm Status	0	4	1	-	FC123	0
	0273	RTD #1 Alarm Status	0	4	1	-	FC123	0
	0274	RTD #2 Alarm Status	0	4	1	-	FC123	0
	0275	RTD #3 Alarm Status	0	4	1	-	FC123	0
	0276	RTD #4 Alarm Status	0	4	1	-	FC123	0
	0277	RTD #5 Alarm Status	0	4	1	-	FC123	0
	0278	RTD #6 Alarm Status	0	4	1	-	FC123	0
	0279	RTD #7 Alarm Status	0	4	1	-	FC123	0
	027A	RTD #8 Alarm Status	0	4	1	-	FC123	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	027B	RTD #9 Alarm Status	0	4	1	-	FC123	0
	027C	RTD #10 Alarm Status	0	4	1	-	FC123	0
	027D	RTD #11 Alarm Status	0	4	1	-	FC123	0
	027E	RTD #12 Alarm Status	0	4	1	-	FC123	0
	027F	Open RTD Sensor Alarm Status	0	4	1	-	FC123	0
	0280	Short Sensor/Low Temp Alarm Status	0	4	1	-	FC123	0
	0281	Undervoltage Alarm Status	0	4	1	-	FC123	0
	0282	Overvoltage Alarm Status	0	4	1	-	FC123	0
	0283	System Frequency Alarm Status	0	4	1	-	FC123	0
	0284	Power Factor Alarm Status	0	4	1	-	FC123	0
	0285	Reactive Power Alarm Status	0	4	1	-	FC123	0
	0286	Underpower Alarm Status	0	4	1	-	FC123	0
	0287	Trip Counter Alarm Status	0	4	1	-	FC123	0
	0288	Starter Failure Alarm	0	4	1	-	FC123	0
	0289	Current Demand Alarm Status	0	4	1	-	FC123	0
	028A	kW Demand Alarm Status	0	4	1	-	FC123	0
	028B	kvar Demand Alarm Status	0	4	1	-	FC123	0
	028C	kVA Demand Alarm Status	0	4	1	-	FC123	0
	028D	Analog Input 1 Alarm Status	0	4	1	-	FC123	0
	028E	Analog Input 2 Alarm Status	0	4	1	-	FC123	0
	028F	Analog Input 3 Alarm Status	0	4	1	-	FC123	0
	0290	Analog Input 4 Alarm Status	0	4	1	-	FC123	0
	0291	Reverse Power Alarm Status	0	4	1	-	FC123	0
	0292	RTD #1 High Alarm Status	0	4	1	-	FC123	0
	0293	RTD #2 High Alarm Status	0	4	1	-	FC123	0
	0294	RTD #3 High Alarm Status	0	4	1	-	FC123	0
	0295	RTD #4 High Alarm Status	0	4	1	-	FC123	0
	0296	RTD #5 High Alarm Status	0	4	1	-	FC123	0
	0297	RTD #6 High Alarm Status	0	4	1	-	FC123	0
	0298	RTD #7 High Alarm Status	0	4	1	-	FC123	0
	0299	RTD #8 High Alarm Status	0	4	1	-	FC123	0
	029A	RTD #9 High Alarm Status	0	4	1	-	FC123	0
	029B	RTD #10 High Alarm Status	0	4	1	-	FC123	0
	029C	RTD #11 High Alarm Status	0	4	1	-	FC123	0
	029D	RTD #12 High Alarm Status	0	4	1	-	FC123	0
	029E	Analog Diff 1-2 Alarm Status	0	4	1	-	FC123	0
	029F	Analog Diff 3-4 Alarm Status	0	4	1	-	FC123	0
	02A0	Over Torque Alarm Status	0	4	1	-	FC123	0
	02A1	Reserved						
	...	...						
	02AE	Reserved						
	02AF	Self Test Alarm	0	FFFF	1	-		0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
START BLOCKS	02B0	Overload Lockout Block	0	500	1	min	F1	0
	02B1	Start Inhibit Block Lockout Time	1	500	1	min	F1	1
	02B2	Starts/Hour Block Lockout Time	1	60	1	min	F1	1
	02B3	Time Between Starts Lockout Time	1	500	1	min	F1	1
	02B4	Restart Block Lockout	1	30000	1	s	F1	1
	02B5	Reserved						
	...	...						
	02CF	Reserved						
DIGITAL INPUTS	02D0	Access Switch Status	0	1	1	-	FC131	0
	02D1	Test Switch Status	0	1	1	-	FC131	0
	02D2	Starter Switch Status	0	1	1	-	FC131	0
	02D3	Emergency Restart Switch Status	0	1	1	-	FC131	0
	02D4	Remote Reset Switch Status	0	1	1	-	FC131	0
	02D5	Assignable Switch #1 Status	0	1	1	-	FC131	0
	02D6	Assignable Switch #2 Status	0	1	1	-	FC131	0
	02D7	Assignable Switch #3 Status	0	1	1	-	FC131	0
	02D8	Assignable Switch #4 Status	0	1	1	-	FC131	0
	02D9	Trip Coil Supervision	0	1	1	-	FC132	0
	02DA	Reserved						
	...	...						
	02FB	Reserved						
REAL TIME CLOCK	02FC	Date (Read Only)	N/A	N/A	N/A	N/A	F18	N/A
	02FE	Time (Read Only)	N/A	N/A	N/A	N/A	F19	N/A
CURRENT METERING	0300	Phase A Current	0	100000	1	A	F9	0
	0302	Phase B Current	0	100000	1	A	F9	0
	0304	Phase C Current	0	100000	1	A	F9	0
	0306	Average Phase Current	0	100000	1	A	F9	0
	0308	Motor Load	0	2000	1	FLA	F3	0
	0309	Current Unbalance	0	100	1	%	F1	0
	030A	Equivalent Motor Load	0	2000	1	FLA	F3	0
	030B	Ground Current	0	500000	1	A	F11	0
	030D	Phase A Differential Current	0	5000	1	A	F1	0
	030E	Phase B Differential Current	0	5000	1	A	F1	0
	030F	Phase C Differential Current	0	5000	1	A	F1	0
	0310	Reserved						
	...	...						
	031F	Reserved						
TEMPERATURE	0320	Hottest Stator RTD	-50	250	1	°C	F4	0
	0321	RTD #1 Temperature	-50	250	1	°C	F4	0
	0322	RTD #2 Temperature	-50	250	1	°C	F4	0
	0323	RTD #3 Temperature	-50	250	1	°C	F4	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	0324	RTD #4 Temperature	-50	250	1	°C	F4	0
	0325	RTD #5 Temperature	-50	250	1	°C	F4	0
	0326	RTD #6 Temperature	-50	250	1	°C	F4	0
	0327	RTD #7 Temperature	-50	250	1	°C	F4	0
	0328	RTD #8 Temperature	-50	250	1	°C	F4	0
	0329	RTD #9 Temperature	-50	250	1	°C	F4	0
	032A	RTD #10 Temperature	-50	250	1	°C	F4	0
	032B	RTD #11 Temperature	-50	250	1	°C	F4	0
	032C	RTD #12 Temperature	-50	250	1	°C	F4	0
	032D	Reserved						
	032E	Reserved						
	032F	Reserved						
	0330	Hottest Stator RTD (in Fahrenheit)	-58	482	1	°F	F4	32
	0331	RTD #1 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0332	RTD #2 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0333	RTD #3 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0334	RTD #4 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0335	RTD #5 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0336	RTD #6 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0337	RTD #7 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0338	RTD #8 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	0339	RTD #9 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	033A	RTD #10 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	033B	RTD #11 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	033C	RTD #12 Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	033D	Reserved						
	033E	Reserved						
	033F	Reserved						
VOLTAGE METERING	0340	Vab	0	20000	1	V	F1	0
	0341	Vbc	0	20000	1	V	F1	0
	0342	Vca	0	20000	1	V	F1	0
	0343	Average Line Voltage	0	20000	1	V	F1	0
	0344	Van	0	20000	1	V	F1	0
	0345	Vbn	0	20000	1	V	F1	0
	0346	Vcn	0	20000	1	V	F1	0
	0347	Average_Phase_Voltage	0	20000	1	V	F1	0
	0348	System Frequency	0	12000	1	Hz	F3	0
	0349	Reserved						
	...	...						
	035F	Reserved						
SPEED	0360	Tachometer RPM	0	3600	1	R.P.M.	F1	0
	0361	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...	...						
	036F	Reserved						
POWER METERING	0370	Power Factor	-99	100	1	-	F21	0
	0371	Real Power	-50000	50000	1	kW	F12	0
	0373	Real Power (HP)	0	65000	1	hp	F1	0
	0374	Reactive Power	-50000	50000	1	kvar	F12	0
	0376	Apparent Power	0	50000	1	kVA	F1	0
	0377	MWh Consumption	0	999999999	1	MWh	F17	0
	0379	Mvarh Consumption	0	999999999	1	Mvarh	F17	0
	037B	Mvarh Generation	0	999999999	1	Mvarh	F17	0
	037D	Torque	0	9999999	1	Nm/ftlb	F2	0
	037F	Reserved						
	...	...						
	038F	Reserved						
DEMAND METERING	0390	Current Demand	0	100000	1	A	F9	0
	0392	Real Power Demand	-50000	50000	1	kW	F12	0
	0394	Reactive Power Demand	-50000	50000	1	kvar	F12	0
	0396	Apparent Power Demand	0	50000	1	kVA	F1	0
	0397	Peak Current Demand	0	100000	1	A	F9	0
	0399	Peak Real Power Demand	-50000	50000	1	kW	F12	0
	039B	Peak Reactive Power Demand	-50000	50000	1	kvar	F12	0
	039D	Peak Apparent Power Demand	0	50000	1	kVA	F1	0
	039E	Reserved						
	...							
	03AF	Reserved						
ANALOG INPUTS	03B0	Analog I/P 1	-50000	50000	1	-	F12	0
	03B2	Analog I/P 2	-50000	50000	1	-	F12	0
	03B4	Analog I/P 3	-50000	50000	1	-	F12	0
	03B6	Analog I/P 4	-50000	50000	1	-	F12	0
	03B8	Analog Diff 1-2 Absolute	-100000	100000	1	-	F12	0
	03BA	Analog Diff 3-4 Absolute	-100000	100000	1	-	F12	0
	03BC	Reserved						
	...	...						
	03BF	Reserved						
MOTOR STARTING	03C0	Learned Acceleration Time	0	2000	1	s	F2	0
	03C1	Learned Starting Current	0	50000	1	A	F9	0
	03C3	Learned Starting Capacity	0	100	1	%	F1	0
	03C4	Last Acceleration Time	0	2000	1	s	F2	0
	03C5	Last Starting Current	0	50000	1	A	F9	0
	03C7	Last Starting Capacity	0	100	1	%	F1	0
	03C8	Reserved						
	...	...						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	03CF	Reserved						
AVERAGE MOTOR LOAD	03D0	Average Motor Load Learned	0	2000	1	x FLA	F3	5
	03D1	Reserved						
	...	...						
	03DF	Reserved						
RTD MAXIMUMS	03E0	RTD # 1 Max. Temperature	-50	250	1	°C	F4	0
	03E1	RTD # 2 Max. Temperature	-50	250	1	°C	F4	0
	03E2	RTD # 3 Max. Temperature	-50	250	1	°C	F4	0
	03E3	RTD # 4 Max. Temperature	-50	250	1	°C	F4	0
	03E4	RTD # 5 Max. Temperature	-50	250	1	°C	F4	0
	03E5	RTD # 6 Max. Temperature	-50	250	1	°C	F4	0
	03E6	RTD # 7 Max. Temperature	-50	250	1	°C	F4	0
	03E7	RTD # 8 Max. Temperature	-50	250	1	°C	F4	0
	03E8	RTD # 9 Max. Temperature	-50	250	1	°C	F4	0
	03E9	RTD # 10 Max. Temperature	-50	250	1	°C	F4	0
	03EA	RTD # 11 Max. Temperature	-50	250	1	°C	F4	0
	03EB	RTD # 12 Max. Temperature	-50	250	1	°C	F4	0
	03EC	Reserved						
	...	...						
	03EF	Reserved						
	03F0	RTD # 1 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F1	RTD # 2 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F2	RTD # 3 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F3	RTD # 4 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F4	RTD # 5 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F5	RTD # 6 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F6	RTD # 7 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F7	RTD # 8 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F8	RTD # 9 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03F9	RTD # 10 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03FA	RTD # 11 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03FB	RTD # 12 Max. Temperature (in Fahrenheit)	-58	482	1	°F	F4	32
	03FC	Reserved						
	...	...						
	03FF	Reserved						
ANALOG INPUTS MIN / MAX	0400	Analog I/P 1 Minimum	-50000	50000	1	-	F12	0
	0402	Analog I/P 1 Maximum	-50000	50000	1	-	F12	0
	0404	Analog I/P 2 Minimum	-50000	50000	1	-	F12	0
	0406	Analog I/P 2 Maximum	-50000	50000	1	-	F12	0
	0408	Analog I/P 3 Minimum	-50000	50000	1	-	F12	0
	040A	Analog I/P 3 Maximum	-50000	50000	1	-	F12	0
	040C	Analog I/P 4 Minimum	-50000	50000	1	-	F12	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	040E	Analog I/P 4 Maximum	-50000	50000	1	-	F12	0
	0410	Reserved						
	...							
	041F	Reserved						
	0420	Original Calibration Date	N/A	N/A	N/A	N/A	F18	N/A
	0422	Last Calibration Date	N/A	N/A	N/A	N/A	F18	N/A
	0424	Reserved						
	...	...						
	042F	Reserved						
TRIP COUNTERS	0430	Total Number of Trips	0	50000	1	-	F1	0
	0431	Incomplete Sequence Trips	0	50000	1	-	F1	0
	0432	Input Switch Trips	0	50000	1	-	F1	0
	0433	Tachometer Trips	0	50000	1	-	F1	0
	0434	Overload Trips	0	50000	1	-	F1	0
	0435	Short Circuit Trips	0	50000	1	-	F1	0
	0436	Mechanical Jam Trips	0	50000	1	-	F1	0
	0437	Undercurrent Trips	0	50000	1	-	F1	0
	0438	Current Unbalance Trips	0	50000	1	-	F1	0
	0439	Ground Fault Trips	0	50000	1	-	F1	0
	043A	Phase Differential Trips	0	50000	1	-	F1	0
	043B	Motor Acceleration Trips	0	50000	1	-	F1	0
	043C	Stator RTD Trips	0	50000	1	-	F1	0
	043D	Bearing RTD Trips	0	50000	1	-	F1	0
	043E	Other RTD Trips	0	50000	1	-	F1	0
	043F	Ambient RTD Trips	0	50000	1	-	F1	0
	0440	Undervoltage Trips	0	50000	1	-	F1	0
	0441	Overvoltage Trips	0	50000	1	-	F1	0
	0442	Voltage Phase Reversal Trips	0	50000	1	-	F1	0
	0443	Voltage Frequency Trips	0	50000	1	-	F1	0
	0444	Power Factor Trips	0	50000	1	-	F1	0
	0445	Reactive Power Trips	0	50000	1	-	F1	0
	0446	Underpower Trips	0	50000	1	-	F1	0
	0447	Analog I/P 1 Trips	0	50000	1	-	F1	0
	0448	Analog I/P 2 Trips	0	50000	1	-	F1	0
	0449	Analog I/P 3 Trips	0	50000	1	-	F1	0
	044A	Analog I/P 4 Trips	0	50000	1	-	F1	0
	044B	Reverse Power Trips	0	50000	1	-	F1	0
	044C	Analog Diff 1-2 Trips	0	50000	1	-	F1	0
	044D	Analog Diff 3-4 Trips	0	50000	1	-	F1	0
	044E	Reserved						
	...	...						
	046F	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
GENERAL COUNTERS	0470	Number of Motor Starts	0	50000	1	-	F1	0
	0471	Number of Emergency Restarts	0	50000	1	-	F1	0
	0472	Number of Starter Operations	0	50000	1	-	F1	0
	0473	Digital Counter	0	1000000000	1	-	F9	0
	0475	Reserved						
	...	...						
	049F	Reserved						
TIMERS	04A0	Motor Running Hours	1	100000	1	hr	F9	0
	04A2	Time Between Starts Timer	0	500	1	min	F1	0
	04A3	Start Timer 1	0	60	1	min	F1	0
	04A4	Start Timer 2	0	60	1	min	F1	0
	04A5	Start Timer 3	0	60	1	min	F1	0
	04A6	Start Timer 4	0	60	1	min	F1	0
	04A7	Start Timer 5	0	60	1	min	F1	0
	04A8	Reserved						
	...	...						
	04BF	Reserved						
SR469 MODEL INFO.	04C0	Order Code	0	65535	1	N/A	FC136	N/A
	04C1	Relay Serial Number	3050001	N/A	1	-	F9	N/A
	04C3	Reserved						
	...	...						
	04DF	Reserved						
CALIBRATIO N INFO.	04E0	Original Calibration Date	N/A	N/A	N/A	N/A	F18	N/A
	04E2	Last Calibration Date	N/A	N/A	N/A	N/A	F19	N/A
	04E4	Reserved						
	...	...						
	04FF	Reserved						
PHASORS	0500	Va Angle	0	359	1	°	F1	N/A
	0501	Vb Angle	0	359	1	°	F1	N/A
	0502	Vc Angle	0	359	1	°	F1	N/A
	0503	Ia Angle	0	359	1	°	F1	N/A
	0504	Ib Angle	0	359	1	°	F1	N/A
	0505	Ic Angle	0	359	1	°	F1	N/A
	0506	Reserved						
	...	...						
	0FFF	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
Setpoints (Addresses 1000 -1FFF)								
PREFEREN-CES	1000	Default Message Cycle Time	5	100	5	s	F2	20
	1001	Default Message Timeout	10	900	1	s	F1	300
	1002	Reserved						
	1003	Average Motor Load Calculation Period	1	90	1	min	F1	15
	1004	Temperature Display Units	0	1	1	-	FC100	0
	1005	Trace Memory Trigger Position	1	100	1	%	F1	25
	1006	Trace Memory Buffers	1	16	1	cycles	F1	8
	1007	Display Update Interval	0.1	6.0	0.1	s	F2	0.4
	1008	Cyclic Load Filter Interval	0	32	1	cycles	F1	0
	1009	Passcode (Write Only)	0	99999999	1	N/A	F12	0
	100B	Encrypted Passcode (Read Only)	N/A	N/A	N/A	N/A	F12	N/A
	1008	Reserved						
	...							
	100F	Reserved						
RS485 SERIAL PORTS	1010	Slave Address	1	254	1	-	F1	254
	1011	Computer RS485 Baud Rate	0	5	1	-	FC101	4
	1012	Computer RS485 Parity	0	2	1	-	FC102	0
	1013	Auxiliary RS485 Baud Rate	0	5	1	-	FC101	4
	1014	Auxiliary RS485 Parity	0	2	1	-	FC102	0
	1015	Reserved						
	...							
	102F	Reserved						
REAL TIME CLOCK	1030	Date	N/A	N/A	N/A	N/A	F18	N/A
	1032	Time	N/A	N/A	N/A	N/A	F19	N/A
	1034	Reserved						
	...							
	103F	Reserved						
DEFAULT MESSAGES	1040	Reserved						
	...							
	105F	Reserved						
MESSAGE SCRATCHPAD	1060	1st and 2nd Char of First Scratchpad Message	32	127	1	-	F1	'Te'
	1061	3rd and 4th Char of First Scratchpad Message	32	127	1	-	F1	'xt'
	...							
	1073	39th and 40th Char of First Scratchpad Message	32	127	1	-	F1	' '
	1074	Reserved						
	...							
	107F	Reserved						
	1080	1st and 2nd Char of Second Scratchpad Message	32	127	1	-	F1	'Te'
	1081	3rd and 4th Char of Second Scratchpad Message	32	127	1	-	F1	'xt'

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...							
	1093	39th and 40th Char of Second Scratchpad Msg	32	127	1	-	F1	‘ ‘
	1094	Reserved						
	...							
	109F	Reserved						
	10A0	1st and 2nd Char of 3rd Scratchpad Message	32	127	1	-	F1	‘Te’
	10A1	3rd and 4th Char of 3rd Scratchpad Message	32	127	1	-	F1	‘xt’
	...							
	10B3	39th and 40th Char of 3rd Scratchpad Message	32	127	1	-	F1	‘ ‘
	10B4	Reserved						
	...							
	10BF	Reserved						
	10C0	1st and 2nd Char of 4th Scratchpad Message	32	127	1	-	F1	‘Te’
	10C1	3rd and 4th Char of 4th Scratchpad Message	32	127	1	-	F1	‘xt’
	...							
	10D3	39th and 40th Char of 4th Scratchpad Message	32	127	1	-	F1	‘ ‘
	10D4	Reserved						
	...							
	10DF	Reserved						
	10E0	1st and 2nd Char of 5th Scratchpad Message	32	127	1	-	F1	‘Mu’
	10E1	3rd and 4th Char of 5th Scratchpad Message	32	127	1	-	F1	‘lt’
	...							
	10F3	39th and 40th Char of 5th Scratchpad Message	32	127	1	-	F1	‘ ‘
	10F4	Reserved						
	...							
	112F	Reserved						
CLEAR DATA	1130	Clear Last Trip Data Prompt	0	1	1	-	FC103	0
	1131	Reset MWh and Mvarh Meters	0	1	1	-	FC103	0
	1132	Clear Peak Demand Data	0	1	1	-	FC103	0
	1133	Clear RTD Maximums	0	1	1	-	FC103	0
	1134	Clear Analog Input Min/Max Data	0	1	1	-	FC103	0
	1135	Clear Trip Counters	0	1	1	-	FC103	0
	1136	Preset Digital Counter	0	1	1	-	FC103	0
	1137	Clear Event Records	0	1	1	-	FC103	0
	1138	Reserved						
	...							
	113F	Reserved						
INSTAL-LATION	1140	Reset Motor Information	0	1	1	-	FC103	0
	1141	Reset Starter Information	0	1	1	-	FC103	0
	1142	Reserved						
	...							
	117F	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
CURRENT SENSING	1180	Phase CT Primary	1	5001	1	A	F1	5001
	1181	Motor Full Load Amps	1	5001	1	A	F1	5001
	1182	Ground CT Type	0	3	1	-	FC104	3
	1183	Ground CT Primary	1	5000	1	A	F1	100
	1184	Phase Differential CT Type	0	2	1	-	FC105	0
	1185	Phase Differential CT Primary	1	5000	1	A	F1	100
	1186	Enable Two Speed Motor Option	0	1	1	-	FC103	0
	1187	Speed Two Phase CT Primary	1	5000	1	A	F1	100
	1188	Speed Two Motor Full Load Amps	1	5000	1	A	F1	1
	1189	Reserved						
	...							
	119F	Reserved						
VOLTAGE SENSING	11A0	Voltage Transformer Connection Type	0	2	1	-	FC106	0
	11A1	Voltage Transformer Ratio	100	30000	1	-	F3	3500
	11A2	Motor Nameplate Voltage	100	20000	1	V	F1	4000
	11A3	Enable Single VT Connection	0	1	1	-	FC143	0
	11A4	Reserved						
	...							
	11BF	Reserved						
POWER SYSTEM	11C0	Nominal System Frequency	0	1	1	-	FC107	0
	11C1	System Phase Sequence	0	1	1	-	FC124	0
	11C2	Speed2 Phase Sequence	0	1	1	-	FC124	0
	11C3	Reserved						
	...							
	11C7	Reserved						
SERIAL COM. CONTROL	11C8	Serial Communication Control	0	1	1	-	FC103	0
	11C9	Assign Start Control Relays	0	2	1	-	FC137	0
	11CA	Reserved						
	...							
	11CF	Reserved						
REDUCED VOLTAGE	11D0	Reduced Voltage Starting	0	1	1	-	FC103	0
	11D1	Control Relays for Reduced Voltage Starting	0	2	1	-	FC137	2
	11D2	Transition On	0	2	1	-	FC108	0
	11D3	Reduced Voltage Start Level	25	300	1	% FLA	F1	100
	11D4	Reduced Voltage Start Timer	1	500	1	s	F1	200
	11D5	Incomplete Sequence Trip Relays	0	3	1	-	FC111	0
	11D6	Reserved						
	...							
	122F	Reserved						
STARTER STATUS	1230	Starter Status Switch	0	1	1	-	FC109	0
	1231	Reserved						
	...							

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	123F	Reserved						
ASSIGNABLE INPUTS	1240	Assignable Input 1 Function	0	18	1	-	FC110	0
	1241	Assignable Input 2 Function	0	18	1	-	FC110	0
	1242	Assignable Input 3 Function	0	18	1	-	FC110	0
	1243	Assignable Input 4 Function	0	18	1	-	FC110	0
	1244	Reserved						
	...							
	1259	Reserved						
Remote Alarm	125A	1st and 2nd char. of Remote Alarm Name	0	65535	1	-	F22	‘Re’
	125B	3rd and 4th char. of Remote Alarm Name	0	65535	1	-	F22	‘mo’
	...							
	1263	19th and 20th char. of Remote Alarm Name	0	65535	1	-	F22	‘ ‘
	1264	Remote Alarm Function	1	2	1	-	FC115	2
	1265	Remote Alarm Relays	0	6	1	-	FC113	0
	1266	Remote Alarm Events	0	1	1	-	FC103	0
	1267	Reserved						
	...	...						
	1279	Reserved						
Remote Trip	127A	1st and 2nd char. of Remote Trip Name	0	65535	1	-	F22	‘Re’
	127B	3rd and 4th char. of Remote Trip Name	0	65535	1	-	F22	‘e’
	...							
	1283	19th and 20th char. of Remote Trip Name	0	65535	1	-	F22	‘ ’
	1284	Remote Trip Relays	0	3	1	-	FC111	0
	1285	Reserved						
	...							
	128F	Reserved						
Speed Switch Trip	1290	Speed Switch Trip Relays	0	3	1	-	FC111	0
	1291	Speed Switch Trip Delay	10	2500	1	s	F2	50
	1292	Reserved						
	...	...						
	129F	Reserved						
Load Shed Trip	12A0	Load Shed Trip Relays	0	3	1	-	FC111	0
	12A1	Reserved						
	...	...						
	12AF	Reserved						
Pressure Switch Alarm	12B0	Block Pressure Switch Alarm from Start	0	5000	1	s	F1	0
	12B1	Pressure Switch Alarm Function	1	2	1	-	FC115	2
	12B2	Pressure Switch Alarm Relays	0	6	1	-	FC113	0
	12B3	Pressure Switch Alarm Delay	1	1000	1	s	F2	50
	12B4	Pressure Switch Alarm Events	0	1	1	-	FC103	0
	12B5	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...							
	12BF	Reserved						
Pressure Switch Trip	12C0	Block Pressure Switch Trip from Start	0	5000	1	s	F1	0
	12C1	Pressure Switch Trip Relays	0	3	1	-	FC111	0
	12C2	Pressure Switch Trip Delay	1	1000	1	s	F2	50
	12C3	Reserved						
	...							
	12CF	Reserved						
Vibration Switch Alarm	12D0	Vibration Switch Alarm Function	1	2	1	-	FC115	2
	12D1	Vibration Switch Alarm Relays	0	6	1	-	FC113	0
	12D2	Vibration Switch Alarm Delay	1	1000	1	s	F2	50
	12D3	Vibration Switch Alarm Events	0	1	1	-	FC103	0
	12D4	Reserved						
	...							
	12DF	Reserved						
Vibration Switch Trip	12E0	Vibration Switch Trip Relays	0	3	1	-	FC111	0
	12E1	Vibration Switch Trip Delay	1	1000	1	s	F2	50
	12E2	Reserved						
	...							
	12F2	Reserved						
Digital Counter	12F3	1st and 2nd char. of Counter Units Name	0	65535	1	-	F22	‘Un’
	12F4	3rd and 4th char. of Counter Units Name	0	65535	1	-	F22	‘it’
	12F5	5th and 6th char. of Counter Units Name	0	65535	1	-	F22	‘s ‘
	12F6	Counter Preset Value	0	1000000000	1	-	F9	0
	12F8	Counter Type	0	1	1	-	FC114	0
	12F9	Counter Alarm	0	2	1	-	FC115	0
	12FA	Counter Alarm Relays	0	6	1	-	FC113	0
	12FB	Counter Alarm Level	0	1000000000	1	-	F9	100
	12FD	Counter Alarm Pickup	0	1	1	-	FC130	0
	12FE	Counter Alarm Events	0	1	1	-	FC103	0
	12FF	Reserved						
	...	...						
	130F	Reserved						
Tachometer	1310	Rated Speed	100	7200	1	RPM	F1	3600
	1311	Tachometer Alarm	0	2	1	-	FC115	0
	1312	Tachometer Alarm Relays	0	6	1	-	FC113	0
	1313	Tachometer Alarm Speed	5	100	1	% Rated	F1	10
	1314	Tachometer Alarm Delay	1	250	1	s	F1	1
	1315	Tachometer Alarm Events	0	1	1	-	FC103	0
	1316	Tachometer Trip	0	2	1	-	FC115	0
	1317	Tachometer Trip Relays	0	3	1	-	FC111	0
	1318	Tachometer Trip Speed	5	95	1	% Rated	F1	10

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1319	Tachometer Trip Delay	1	250	1	s	F1	1
	131A	Reserved						
	...							
	1335	Reserved						
General Switch A	1336	1st and 2nd char. of General Switch A Name	0	65535	1	-	F22	'Ge'
	1337	3rd and 4th char. of General Switch A Name	0	65535	1	-	F22	'ne'
	...							
	133B	11th and 12th char. of General Switch A Name	0	65535	1	-	F22	' '
	133C	General Switch A Normal State	0	1	1	-	FC116	0
	133D	General Switch A Block Input From Start	0	5000	1	s	F1	0
	133E	General Switch A Alarm	0	2	1	-	FC115	0
	133F	General Switch A Alarm Relays	0	6	1	-	FC113	0
	1340	General Switch A Alarm Delay	1	50000	1	s	F2	50
	1341	General Switch A Alarm Events	0	1	1	-	FC103	0
	1342	General Switch A Trip	0	2	1	-	FC115	0
	1343	General Switch A Trip Relays	0	3	1	-	FC111	0
	1344	General Switch A Trip Delay	1	50000	1	s	F2	50
	1345	Reserved						
	...							
	1365	Reserved						
General Switch B	1366	1st and 2nd char. of General Switch B Name	0	65535	1	-	F22	'Ge'
	1367	3rd and 4th char. of General Switch B Name	0	65535	1	-	F22	'ne'
	...							
	136B	11th and 12th char. of General Switch B Name	0	65535	1	-	F22	' '
	136C	General Switch B Normal State	0	1	1	-	FC116	0
	136D	General Switch B Block Input From Start	0	5000	1	s	F1	0
	136E	General Switch B Alarm	0	2	1	-	FC115	0
	136F	General Switch B Alarm Relays	0	6	1	-	FC113	0
	1370	General Switch B Alarm Delay	1	50000	1	s	F2	50
	1371	General Switch B Alarm Events	0	1	1	-	FC103	0
	1372	General Switch B Trip	0	2	1	-	FC115	0
	1373	General Switch B Trip Relays	0	3	1	-	FC111	0
	1374	General Switch B Trip Delay	1	50000	1	s	F2	50
	1375	Reserved						
	...							
	1395	Reserved						
General Switch C	1396	1st and 2nd char. of General Switch C Name	0	65535	1	-	F22	'Ge'
	1397	3rd and 4th char. of General Switch C Name	0	65535	1	-	F22	'ne'
	...							
	139B	11th and 12th char. of General Switch C Name	0	65535	1	-	F22	' '
	139C	General Switch C Normal State	0	1	1	-	FC116	0
	139D	General Switch C Block Input From Start	0	5000	1	s	F1	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	139E	General Switch C Alarm	0	2	1	-	FC115	0
	139F	General Switch C Alarm Relays	0	6	1	-	FC113	0
	13A0	General Switch C Alarm Delay	1	50000	1	s	F2	50
	13A1	General Switch C Alarm Events	0	1	1	-	FC103	0
	13A2	General Switch C Trip	0	2	1	-	FC115	0
	13A3	General Switch C Trip Relays	0	3	1	-	FC111	0
	13A4	General Switch C Trip Delay	1	50000	1	s	F2	50
	13A5	Reserved						
	...							
	13C5	Reserved						
General Switch D	13C6	1st and 2nd char. of General Switch D Name	0	65535	1	-	F22	‘Ge’
	13C7	3rd and 4th char. of General Switch D Name	0	65535	1	-	F22	‘ne’
	...							
	13CB	11th and 12th char. of General Switch D Name	0	65535	1	-	F22	‘ ‘
	13CC	General Switch D Normal State	0	1	1	-	FC116	0
	13CD	General Switch D Block Input From Start	0	5000	1	s	F1	0
	13CE	General Switch D Alarm	0	2	1	-	FC115	0
	13CF	General Switch D Alarm Relays	0	6	1	-	FC113	0
	13D0	General Switch D Alarm Delay	1	50000	1	s	F2	50
	13D1	General Switch D Alarm Events	0	1	1	-	FC103	0
	13D2	General Switch D Trip	0	2	1	-	FC115	0
	13D3	General Switch D Trip Relays	0	3	1	-	FC111	0
	13D4	General Switch D Trip Delay	1	50000	1	s	F2	50
	13D5	Reserved						
	...							
	14FF	Reserved						
RELAY RESET MODE	1500	Reset Mode R1 TRIP	0	2	1	-	FC117	0
	1501	Reset Mode R2 AUXILIARY	0	2	1	-	FC117	0
	1502	Reset Mode R3 AUXILIARY	0	2	1	-	FC117	0
	1503	Reset Mode R4 ALARM	0	2	1	-	FC117	0
	1504	Reserved						
	1505	Reset Mode R6 SERVICE	0	2	1	-	FC117	0
FORCE OUTPUT RELAY	1506	Force R1 Output Relay	0	1	1	-	FC126	0
	1507	Force R1 Operate Time	0	300	1	s	F1	0
	1508	Force R2 Output Relay	0	1	1	-	FC126	0
	1509	Force R2 Operate Time	0	300	1	s	F1	0
	150A	Force R3 Output Relay	0	1	1	-	FC126	0
	150B	Force R3 Operate Time	0	300	1	s	F1	0
	150C	Force R4 Output Relay	0	1	1	-	FC126	0
	150D	Force R4 Operate Time	0	300	1	s	F1	0
	150E	Force R5 Output Relay	0	1	1	-	FC126	0
	150F	Force R5 Operate Time	0	300	1	s	F1	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1510	Reserved						
	...							
	157F	Reserved						
THERMAL MODEL	1580	Curve Style	0	2	1	-	FC128	0
	1581	Overload Pickup Level	101	125	1	x FLA	F3	101
	1582	Unbalance k Factor	0	12	1	-	F1	0
	1583	Cool Time Constant Running	1	1000	1	min	F1	15
	1584	Cool Time Constant Stopped	1	1000	1	min	F1	30
	1585	Hot/Cold Safe Stall Ratio	1	100	1	-	F3	100
	1586	RTD Biasing	0	1	1	-	FC103	0
	1587	RTD Bias Minimum	0	250	1	°C	F1	40
	1588	RTD Bias Center Point	0	250	1	°C	F1	130
	1589	RTD Bias Maximum	0	250	1	°C	F1	155
	158A	Thermal Capacity Alarm	0	2	1	-	FC115	0
	158B	Thermal Capacity Alarm Relays	0	6	1	-	FC113	0
	158C	Thermal Capacity Alarm Level	10	100	1	% used	F1	75
	158D	Thermal Capacity Alarm Events	0	1	1	-	FC103	0
	158E	Overload Trip Relays	0	3	1	-	FC111	0
	158F	Reserved						
	...							
	15AE	Reserved						
O/L CURVE SETUP	15AF	Standard Overload Curve Number	1	15	1	-	F1	4
	15B0	Time to Trip at 1.01 x FLA	5	999999	1	s	F10	174145
	15B2	Time to Trip at 1.05 x FLA	5	999999	1	s	F10	34149
	15B4	Time to Trip at 1.10 x FLA	5	999999	1	s	F10	16667
	15B6	Time to Trip at 1.20 x FLA	5	999999	1	s	F10	7954
	15B8	Time to Trip at 1.30 x FLA	5	999999	1	s	F10	5072
	15BA	Time to Trip at 1.40 x FLA	5	999999	1	s	F10	3646
	15BC	Time to Trip at 1.50 x FLA	5	999999	1	s	F10	2800
	15BE	Time to Trip at 1.75 x FLA	5	999999	1	s	F10	1697
	15C0	Time to Trip at 2.00 x FLA	5	999999	1	s	F10	1166
	15C2	Time to Trip at 2.25 x FLA	5	999999	1	s	F10	861
	15C4	Time to Trip at 2.50 x FLA	5	999999	1	s	F10	666
	15C6	Time to Trip at 2.75 x FLA	5	999999	1	s	F10	533
	15C8	Time to Trip at 3.00 x FLA	5	999999	1	s	F10	437
	15CA	Time to Trip at 3.25 x FLA	5	999999	1	s	F10	366
	15CC	Time to Trip at 3.50 x FLA	5	999999	1	s	F10	311
	15CE	Time to Trip at 3.75 x FLA	5	999999	1	s	F10	268
	15D0	Time to Trip at 4.00 x FLA	5	999999	1	s	F10	233
	15D2	Time to Trip at 4.25 x FLA	5	999999	1	s	F10	205
	15D4	Time to Trip at 4.50 x FLA	5	999999	1	s	F10	182
	15D6	Time to Trip at 4.75 x FLA	5	999999	1	s	F10	162

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	15D8	Time to Trip at 5.00 x FLA	5	999999	1	s	F10	146
	15DA	Time to Trip at 5.50 x FLA	5	999999	1	s	F10	120
	15DC	Time to Trip at 6.00 x FLA	5	999999	1	s	F10	100
	15DE	Time to Trip at 6.50 x FLA	5	999999	1	s	F10	85
	15E0	Time to Trip at 7.00 x FLA	5	999999	1	s	F10	73
	15E2	Time to Trip at 7.50 x FLA	5	999999	1	s	F10	63
	15E4	Time to Trip at 8.00 x FLA	5	999999	1	s	F10	56
	15E6	Time to Trip at 10.0 x FLA	5	999999	1	s	F10	56
	15E8	Time to Trip at 15.0 x FLA	5	999999	1	s	F10	56
	15EA	Time to Trip at 20.0 x FLA	5	999999	1	s	F10	56
	15EC	Reserved						
	...							
	15FF	Reserved						
	1600	Minimum Allowable Line Voltage	70	95	1	% Rated	F1	80
	1601	Stall Current at Min Vline	200	1500	1	x FLA	F3	480
	1602	Safe Stall Time at Min Vline	5	9999	1	s	F2	200
	1603	Accel. Intersect at Min Vline	200	1500	1	x FLA	F3	380
	1604	Stall Current at 100 % Vline	200	1500	1	x FLA	F3	600
	1605	Safe Stall Time at 100 % Vline	5	9999	1	s	F2	100
	1606	Accel. Intersect at 100 % Vline	200	1500	1	x FLA	F3	500
	1607	Reserved						
	...							
	163F	Reserved						
SHORT CIRCUIT TRIP	1640	Short Circuit Trip	0	2	1	-	FC115	0
	1641	Overreach Filter	0	1	1	-	FC103	0
	1642	Short Circuit Trip Relays	0	6	1	-	FC118	0
	1643	Short Circuit Trip Pickup	20	200	1	x CT	F2	100
	1644	Intentional Short Circuit Trip Delay	0	1000	10	ms	F1	0
	1645	Short Circuit Trip Backup	0	1	1	-	FC103	0
	1646	Short Circuit Backup Relays	0	2	1	-	FC119	0
	1647	Short Circuit Trip Backup Delay	10	2000	10	ms	F1	200
	1648	Reserved						
	...							
	164F	Reserved						
OVERLOAD ALARM	1650	Overload Alarm	0	2	1	-	FC115	0
	1651	Overload Alarm Relays	0	6	1	-	FC113	0
	1652	Overload Alarm Events	0	1	1	-	FC103	0
	1653	Overload Alarm Delay	1	600	1	s	F2	0
	1654	Reserved						
	...							
	165F	Reserved						
MECHANICAL	1660	Mechanical Jam Trip	0	2	1	-	FC115	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
JAM	1661	Mechanical Jam Trip Relays	0	3	1	-	FC111	0
	1662	Mechanical Jam Pickup	101	300	1	x FLA	F3	150
	1663	Mechanical Jam Delay	1	30	1	s	F1	1
	1664	Reserved						
	...							
	166F	Reserved						
UNDER-CURRENT	1670	Block Undercurrent from Start	0	15000	1	s	F1	0
	1671	Undercurrent Alarm	0	2	1	-	FC115	0
	1672	Undercurrent Alarm Relays	0	6	1	-	FC113	0
	1673	Undercurrent Alarm Pickup	10	95	1	x FLA	F3	70
	1674	Undercurrent Alarm Delay	1	60	1	s	F1	1
	1675	Undercurrent Alarm Events	0	1	1	-	FC103	0
	1676	Undercurrent Trip	0	2	1	-	FC115	0
	1677	Undercurrent Trip Relays	0	3	1	-	FC111	0
	1678	Undercurrent Trip Pickup	10	99	1	x FLA	F3	70
	1679	Undercurrent Trip Delay	1	60	1	s	F1	1
	167A	Reserved						
	...							
	167F	Reserved						
CURRENT UNBALANCE	1680	Current Unbalance Alarm	0	2	1	-	FC115	0
	1681	Current Unbalance Alarm Relays	0	6	1	-	FC113	0
	1682	Current Unbalance Alarm Pickup	4	40	1	%	F1	15
	1683	Current Unbalance Alarm Delay	1	60	1	s	F1	1
	1684	Current Unbalance Alarm Events	0	1	1	-	FC103	0
	1685	Current Unbalance Trip	0	2	1	-	FC115	0
	1686	Current Unbalance Trip Relays	0	3	1	-	FC111	0
	1687	Current Unbalance Trip Pickup	4	40	1	%	F1	20
	1688	Current Unbalance Trip Delay	1	60	1	s	F1	1
	1689	Reserved						
	...							
	169F	Reserved						
GROUND FAULT	16A0	Reserved						
	16A1	Ground Fault Alarm	0	2	1	-	FC115	0
	16A2	Ground Fault Alarm Relays	0	6	1	-	FC113	0
	16A3	Ground Fault Alarm Pickup	10	100	1	x CT	F3	10
	16A4	Alarm Pickup for Multilin CT 50 / .025	25	2500	1	A	F3	100
	16A5	Intentional GF Alarm Delay	0	1000	10	ms	F1	0
	16A6	Ground Fault Alarm Events	0	1	1	-	FC103	0
	16A7	Ground Fault Trip	0	2	1	-	FC115	0
	16A8	Ground Fault Trip Relays	0	6	1	-	FC118	0
	16A9	Ground Fault Trip Pickup	10	100	1	x CT	F3	20
	16AA	Trip Pickup for Multilin CT 50 / .025	25	2500	1	A	F3	100

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	16AB	Intentional GF Trip Delay	0	1000	10	ms	F1	0
	16AC	Ground Fault Trip Backup	0	1	1	-	FC103	0
	16AD	Ground Fault Trip Backup Relays	0	2	1	-	FC119	0
	16AE	Ground Fault Trip Backup Delay	10	2000	10	ms	F1	200
	...	Reserved						
	16BF	Reserved						
PHASE DIFFERENTIA L	16C0	Phase Differential Trip	0	2	1	-	FC115	0
	16C1	Phase Differential Trip Relays	0	6	1	-	FC118	0
	16C2	Differential Trip Pickup While Starting	5	100	1	x CT	F3	10
	16C3	Differential Trip Delay While Starting	0	60000	10	ms	F1	0
	16C4	Differential Trip Pickup While Running	5	100	1	x CT	F3	10
	16C5	Differential Trip Delay While Running	0	1000	10	ms	F1	0
	16C4	Reserved						
	...							
	16CF	Reserved						
ACCELERATIO N TIMER	16D0	Acceleration Timer Trip	0	2	1	-	FC115	0
	16D1	Acceleration Timer Trip Relays	0	3	1	-	FC111	0
	16D2	Acceleration Timer from Start	10	1000	1	s	F2	100
	16D3	Reserved						
	...							
	16DF	Reserved						
START INHIBIT	16E0	Start Inhibit Block	0	1	1	-	FC103	0
	16E1	Thermal Capacity Used Margin	0	25	1	%	F1	25
	16E2	Reserved						
	...							
	16EF	Reserved						
JOGGING BLOCK	16F0	Jogging Block	0	1	1	-	FC103	0
	16F1	Maximum Starts/Hour Permissible	1	5	1	-	F1	3
	16F2	Time Between Starts	0	500	1	min	F1	10
	16F3	Reserved						
	...							
	16FF	Reserved						
RESTART BLOCK	1700	Restart Block	0	1	1	-	FC103	0
	1701	Restart Block Time	1	50000	1	s	F1	1
	1702	Reserved						
	...							
	177F	Reserved						
RTD	1780	Stator RTD Type	0	3	1	-	FC120	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
TYPES	1781	Bearing RTD Type	0	3	1	-	FC120	0
	1782	Ambient RTD Type	0	3	1	-	FC120	0
	1783	Other RTD Type	0	3	1	-	FC120	0
	1784	Reserved						
	...							
	178F	Reserved						
RTD #1	1790	RTD #1 Application	0	4	1	-	FC121	1
	1791	RTD #1 Alarm	0	2	1	-	FC115	0
	1792	RTD #1 Alarm Relays	0	6	1	-	FC113	0
	1793	RTD #1 Alarm Temperature	1	250	1	°C	F1	130
	1794	RTD #1 Alarm Events	0	1	1	-	FC103	0
	1795	RTD #1 Trip	0	2	1	-	FC115	0
	1796	RTD #1 Trip Voting	1	12	1	-	FC122	1
	1797	RTD #1 Trip Relays	0	3	1	-	FC111	0
	1798	RTD #1 Trip Temperature	1	250	1	°C	F1	155
	1799	1st and 2nd char. of RTD #1 Name	0	65535	1	-	F22	‘ ‘
	...							
	179C	7th and 8th char. of RTD #1 Name	0	65535	1	-	F22	‘ ‘
	179D	Reserved						
	...							
	17AD	Reserved						
	17AE	RTD #1 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	17AF	RTD #1 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #2	17B0	RTD #2 Application	0	4	1	-	FC121	1
	17B1	RTD #2 Alarm	0	2	1	-	FC115	0
	17B2	RTD #2 Alarm Relays	0	6	1	-	FC113	0
	17B3	RTD #2 Alarm Temperature	1	250	1	°C	F1	130
	17B4	RTD #2 Alarm Events	0	1	1	-	FC103	0
	17B5	RTD #2 Trip	0	2	1	-	FC115	0
	17B6	RTD #2 Trip Voting	1	12	1	-	FC122	2
	17B7	RTD #2 Trip Relays	0	3	1	-	FC111	0
	17B8	RTD #2 Trip Temperature	1	250	1	°C	F1	155
	17B9	1st and 2nd char. of RTD #2 Name	0	65535	1	-	F22	‘ ‘
	...							
	17BC	7th and 8th char. of RTD #2 Name	0	65535	1	-	F22	‘ ‘
	17BD	Reserved						
	...							
	17CD	Reserved						
	17CE	RTD #2 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	17CF	RTD #2 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #3	17D0	RTD #3 Application	0	4	1	-	FC121	1
	17D1	RTD #3 Alarm	0	2	1	-	FC115	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	17D2	RTD #3 Alarm Relays	0	6	1	-	FC113	0
	17D3	RTD #3 Alarm Temperature	1	250	1	°C	F1	130
	17D4	RTD #3 Alarm Events	0	1	1	-	FC103	0
	17D5	RTD #3 Trip	0	2	1	-	FC115	0
	17D6	RTD #3 Trip Voting	1	12	1	-	FC122	3
	17D7	RTD #3 Trip Relays	0	3	1	-	FC111	0
	17D8	RTD #3 Trip Temperature	1	250	1	°C	F1	155
	17D9	1st and 2nd char. of RTD #3 Name	0	65535	1	-	F22	‘ ‘
	...							
	17DC	7th and 8th char. of RTD #3 Name	0	65535	1	-	F22	‘ ‘
	17DD	Reserved						
	...							
	17ED	Reserved						
	17EE	RTD #3 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	17EF	RTD #3 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #4	17F0	RTD #4 Application	0	4	1	-	FC121	1
	17F1	RTD #4 Alarm	0	2	1	-	FC115	0
	17F2	RTD #4 Alarm Relays	0	6	1	-	FC113	0
	17F3	RTD #4 Alarm Temperature	1	250	1	°C	F1	130
	17F4	RTD #4 Alarm Events	0	1	1	-	FC103	0
	17F5	RTD #4 Trip	0	2	1	-	FC115	0
	17F6	RTD #4 Trip Voting	1	12	1	-	FC122	4
	17F7	RTD #4 Trip Relays	0	3	1	-	FC111	0
	17F8	RTD #4 Trip Temperature	1	250	1	°C	F1	155
	17F9	1st and 2nd char. of RTD #4 Name	0	65535	1	-	F22	‘ ‘
	...							
	17FC	7th and 8th char. of RTD #4 Name	0	65535	1	-	F22	‘ ‘
	17FD	Reserved						
	...							
	180D	Reserved						
	180E	RTD #4 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	180F	RTD #4 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #5	1810	RTD #5 Application	0	4	1	-	FC121	1
	1811	RTD #5 Alarm	0	2	1	-	FC115	0
	1812	RTD #5 Alarm Relays	0	6	1	-	FC113	0
	1813	RTD #5 Alarm Temperature	1	250	1	°C	F1	130
	1814	RTD #5 Alarm Events	0	1	1	-	FC103	0
	1815	RTD #5 Trip	0	2	1	-	FC115	0
	1816	RTD #5 Trip Voting	1	12	1	-	FC122	5
	1817	RTD #5 Trip Relays	0	3	1	-	FC111	0
	1818	RTD #5 Trip Temperature	1	250	1	°C	F1	155
	1819	1st and 2nd char. of RTD #5 Name	0	65535	1	-	F22	‘ ‘

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...							
	181C	7th and 8th char. of RTD #5 Name	0	65535	1	-	F22	' '
	181D	Reserved						
	...							
	182D	Reserved						
	182E	RTD #5 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	182F	RTD #5 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #6	1830	RTD #6 Application	0	4	1	-	FC121	1
	1831	RTD #6 Alarm	0	2	1	-	FC115	0
	1832	RTD #6 Alarm Relays	0	6	1	-	FC113	0
	1833	RTD #6 Alarm Temperature	1	250	1	°C	F1	130
	1834	RTD #6 Alarm Events	0	1	1	-	FC103	0
	1835	RTD #6 Trip	0	2	1	-	FC115	0
	1836	RTD #6 Trip Voting	1	12	1	-	FC122	6
	1837	RTD #6 Trip Relays	0	3	1	-	FC111	0
	1838	RTD #6 Trip Temperature	1	250	1	°C	F1	155
	1839	1st and 2nd char. of RTD #6 Name	0	65535	1	-	F22	' '
	...							
	183C	7th and 8th char. of RTD #6 Name	0	65535	1	-	F22	' '
	183D	Reserved						
	...							
	184D	Reserved						
	184E	RTD #6 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	266
	184F	RTD #6 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	311
RTD #7	1850	RTD #7 Application	0	4	1	-	FC121	2
	1851	RTD #7 Alarm	0	2	1	-	FC115	0
	1852	RTD #7 Alarm Relays	0	6	1	-	FC113	0
	1853	RTD #7 Alarm Temperature	1	250	1	°C	F1	80
	1854	RTD #7 Alarm Events	0	1	1	-	FC103	0
	1855	RTD #7 Trip	0	2	1	-	FC115	0
	1856	RTD #7 Trip Voting	1	12	1	-	FC122	7
	1857	RTD #7 Trip Relays	0	3	1	-	FC111	0
	1858	RTD #7 Trip Temperature	1	250	1	°C	F1	90
	1859	1st and 2nd char. of RTD #7 Name	0	65535	1	-	F22	' '
	...							
	185C	7th and 8th char. of RTD #7 Name	0	65535	1	-	F22	' '
	185D	Reserved						
	...							
	186D	Reserved						
	186E	RTD #7 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	176
	186F	RTD #7 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	194
RTD #8	1870	RTD #8 Application	0	4	1	-	FC121	2

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1871	RTD #8 Alarm	0	2	1	-	FC115	0
	1872	RTD #8 Alarm Relays	0	6	1	-	FC113	0
	1873	RTD #8 Alarm Temperature	1	250	1	°C	F1	80
	1874	RTD #8 Alarm Events	0	1	1	-	FC103	0
	1875	RTD #8 Trip	0	2	1	-	FC115	0
	1876	RTD #8 Trip Voting	1	12	1	-	FC122	8
	1877	RTD #8 Trip Relays	0	3	1	-	FC111	0
	1878	RTD #8 Trip Temperature	1	250	1	°C	F1	90
	1879	1st and 2nd char. of RTD #8 Name	0	65535	1	-	F22	‘ ‘
	...							
	187C	7th and 8th char. of RTD #8 Name	0	65535	1	-	F22	‘ ‘
	187D	Reserved						
	...							
	188D	Reserved						
	188E	RTD #8 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	176
	188F	RTD #8 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	194
RTD #9	1890	RTD #9 Application	0	4	1	-	FC121	2
	1891	RTD #9 Alarm	0	2	1	-	FC115	0
	1892	RTD #9 Alarm Relays	0	6	1	-	FC113	0
	1893	RTD #9 Alarm Temperature	1	250	1	°C	F1	80
	1894	RTD #9 Alarm Events	0	1	1	-	FC103	0
	1895	RTD #9 Trip	0	2	1	-	FC115	0
	1896	RTD #9 Trip Voting	1	12	1	-	FC122	9
	1897	RTD #9 Trip Relays	0	3	1	-	FC111	0
	1898	RTD #9 Trip Temperature	1	250	1	°C	F1	90
	1899	1st and 2nd char. of RTD #9 Name	0	65535	1	-	F22	‘ ‘
	...							
	189C	7th and 8th char. of RTD #9 Name	0	65535	1	-	F22	‘ ‘
	189D	Reserved						
	...							
	18AD	Reserved						
	18AE	RTD #9 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	176
	18AF	RTD #9 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	194
RTD #10	18B0	RTD #10 Application	0	4	1	-	FC121	2
	18B1	RTD #10 Alarm	0	2	1	-	FC115	0
	18B2	RTD #10 Alarm Relays	0	6	1	-	FC113	0
	18B3	RTD #10 Alarm Temperature	1	250	1	°C	F1	80
	18B4	RTD #10 Alarm Events	0	1	1	-	FC103	0
	18B5	RTD #10 Trip	0	2	1	-	FC115	0
	18B6	RTD #10 Trip Voting	1	12	1	-	FC122	10
	18B7	RTD #10 Trip Relays	0	3	1	-	FC111	0
	18B8	RTD #10 Trip Temperature	1	250	1	°C	F1	90

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	18B9	1st and 2nd char. of RTD #10 Name	0	65535	1	-	F22	‘ ‘
	...							
	18BC	7th and 8th char. of RTD #10 Name	0	65535	1	-	F22	‘ ‘
	18BD	Reserved						
	...							
	18CD	Reserved						
	18CE	RTD #10 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	176
	18CF	RTD #10 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	194
RTD #11	18D0	RTD #11 Application	0	4	1	-	FC121	4
	18D1	RTD #11 Alarm	0	2	1	-	FC115	0
	18D2	RTD #11 Alarm Relays	0	6	1	-	FC113	0
	18D3	RTD #11 Alarm Temperature	1	250	1	°C	F1	80
	18D4	RTD #11 Alarm Events	0	1	1	-	FC103	0
	18D5	RTD #11 Trip	0	2	1	-	FC115	0
	18D6	RTD #11 Trip Voting	1	12	1	-	FC122	11
	18D7	RTD #11 Trip Relays	0	3	1	-	FC111	0
	18D8	RTD #11 Trip Temperature	1	250	1	°C	F1	90
	18D9	1st and 2nd char. of RTD #11 Name	0	65535	1	-	F22	‘ ‘
	...							
	18DC	7th and 8th char. of RTD #11 Name	0	65535	1	-	F22	‘ ‘
	18DD	Reserved						
	...							
	18ED	Reserved						
	18EE	RTD #11 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	176
	18EF	RTD #11 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	194
RTD #12	18F0	RTD #12 Application	0	4	1	-	FC121	3
	18F1	RTD #12 Alarm	0	2	1	-	FC115	0
	18F2	RTD #12 Alarm Relays	0	6	1	-	FC113	0
	18F3	RTD #12 Alarm Temperature	1	250	1	°C	F1	60
	18F4	RTD #12 Alarm Events	0	1	1	-	FC103	0
	18F5	RTD #12 Trip	0	2	1	-	FC115	0
	18F6	RTD #12 Trip Voting	1	12	1	-	FC122	12
	18F7	RTD #12 Trip Relays	0	3	1	-	FC111	0
	18F8	RTD #12 Trip Temperature	1	250	1	°C	F1	80
	18F9	1st and 2nd char. of RTD #12 Name	0	65535	1	-	F22	‘ ‘
	...							
	18FC	7th and 8th char. of RTD #12 Name	0	65535	1	-	F22	‘ ‘
	18FD	Reserved						
	...							
	190D	Reserved						
	190E	RTD #12 Alarm Temperature (in Fahrenheit)	34	482	1	°F	F1	140
	190F	RTD #12 Trip Temperature (in Fahrenheit)	34	482	1	°F	F1	176

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
OPEN RTD SENSOR	1910	Open RTD Sensor Alarm	0	2	1	-	FC115	0
	1911	Open RTD Sensor Alarm Relays	0	6	1	-	FC113	0
	1912	Open RTD Sensor Alarm Events	0	1	1	-	FC103	0
	1913	Reserved						
	...							
	191F	Reserved						
RTD SHORT/LOW TEMP	1920	RTD Open / Low Temp Alarm	0	2	1	-	FC115	0
	1921	RTD Open / Low Temp Alarm Relays	0	6	1	-	FC113	0
	1922	RTD Open / Low Temp Alarm Events	0	1	1	-	FC103	0
	1923	Reserved						
	...	...						
	192F	Reserved						
RTD HIGH ALARMS	1930	RTD #1 Hi Alarm	0	2	1	-	FC115	0
	1931	RTD #1 Hi Alarm Relays	0	6	1	-	FC113	0
	1932	RTD #1 Hi Alarm Level	1	250	1	°C	F1	130
	1933	Reserved						
	1934	RTD #2 Hi Alarm	0	2	1	-	FC115	0
	1935	RTD #2 Hi Alarm Relays	0	6	1	-	FC113	0
	1936	RTD #2 Hi Alarm Level	1	250	1	°C	F1	130
	1937	Reserved						
	1938	RTD #3 Hi Alarm	0	2	1	-	FC115	0
	1939	RTD #3 Hi Alarm Relays	0	6	1	-	FC113	0
	193A	RTD #3 Hi Alarm Level	1	250	1	°C	F1	130
	193B	Reserved						
	193C	RTD #4 Hi Alarm	0	2	1	-	FC115	0
	193D	RTD #4 Hi Alarm Relays	0	6	1	-	FC113	0
	193E	RTD #4 Hi Alarm Level	1	250	1	°C	F1	130
	193F	Reserved						
	1940	RTD #5 Hi Alarm	0	2	1	-	FC115	0
	1941	RTD #5 Hi Alarm Relays	0	6	1	-	FC113	0
	1942	RTD #5 Hi Alarm Level	1	250	1	°C	F1	130
	1943	Reserved						
	1944	RTD #6 Hi Alarm	0	2	1	-	FC115	0
	1945	RTD #6 Hi Alarm Relays	0	6	1	-	FC113	0
	1946	RTD #6 Hi Alarm Level	1	250	1	°C	F1	130
	1947	Reserved						
	1948	RTD #7 Hi Alarm	0	2	1	-	FC115	0
	1949	RTD #7 Hi Alarm Relays	0	6	1	-	FC113	0
	194A	RTD #7 Hi Alarm Level	1	250	1	°C	F1	80
	194B	Reserved						
	194C	RTD #8 Hi Alarm	0	2	1	-	FC115	0
	194D	RTD #8 Hi Alarm Relays	0	6	1	-	FC113	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	194E	RTD #8 Hi Alarm Level	1	250	1	°C	F1	80
	194F	Reserved						
	1950	RTD #9 Hi Alarm	0	2	1	-	FC115	0
	1951	RTD #9 Hi Alarm Relays	0	6	1	-	FC113	0
	1952	RTD #9 Hi Alarm Level	1	250	1	°C	F1	80
	1953	Reserved						
	1954	RTD #10 Hi Alarm	0	2	1	-	FC115	0
	1955	RTD #10 Hi Alarm Relays	0	6	1	-	FC113	0
	1956	RTD #10 Hi Alarm Level	1	250	1	°C	F1	80
	1957	Reserved						
	1958	RTD #11 Hi Alarm	0	2	1	-	FC115	0
	1959	RTD #11 Hi Alarm Relays	0	6	1	-	FC113	0
	195A	RTD #11 Hi Alarm Level	1	250	1	°C	F1	80
	195B	Reserved						
	195C	RTD #12 Hi Alarm	0	2	1	-	FC115	0
	195D	RTD #12 Hi Alarm Relays	0	6	1	-	FC113	0
	195E	RTD #12 Hi Alarm Level	1	250	1	°C	F1	60
	195F	Reserved						
UNDER-VOLTAGE	1960	Undervoltage Active Only If Bus Energized	0	1	1	-	FC103	0
	1961	Undervoltage Alarm	0	2	1	-	FC115	0
	1962	Undervoltage Alarm Relays	0	6	1	-	FC113	0
	1963	Undervoltage Alarm Pickup	60	99	1	x Rated	F3	85
	1964	Starting Undervoltage Alarm Pickup	60	100[1]	1	x Rated	F3	85
	1965	Undervoltage Alarm Delay	0	600	1	s	F2	30
	1966	Undervoltage Alarm Events	0	1	1	-	FC103	0
	1967	Undervoltage Trip	0	2	1	-	FC115	0
	1968	Undervoltage Trip Relays	0	3	1	-	FC111	0
	1969	Undervoltage Trip Pickup	60	99	1	x Rated	F3	80
	196A	Starting Undervoltage Trip Pickup	60	100[1]	1	x Rated	F3	80
	196B	Undervoltage Trip Delay	0	600	1	s	F2	30
	196C	Reserved						
	...							
	197F	Reserved						
OVER-VOLTAGE	1980	Overvoltage Alarm	0	2	1	-	FC115	0
	1981	Overvoltage Relays	0	6	1	-	FC113	0
	1982	Overvoltage Alarm Pickup	101	120	1	x Rated	F3	105
	1983	Overvoltage Alarm Delay	5	600	1	s	F2	30
	1984	Overvoltage Alarm Events	0	1	1	-	FC103	0
	1985	Overvoltage Trip	0	2	1	-	FC115	0
	1986	Overvoltage Trip Relays	0	3	1	-	FC111	0
	1987	Overvoltage Trip Pickup	101	120	1	x Rated	F3	110
	1988	Overvoltage Trip Delay	5	600	1	s	F2	30

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1989	Reserved						
	...							
	199F	Reserved						
PHASE REVERSAL	19A0	Voltage Phase Reversal Trip	0	2	1	-	FC115	0
	19A1	Voltage Phase Reversal Trip Relays	0	3	1	-	FC111	0
	19A2	Reserved						
	...							
	19AF	Reserved						
VOLTAGE FREQUENCY	19B0	Voltage Frequency Alarm	0	2	1	-	FC115	0
	19B1	Voltage Frequency Alarm Relays	0	6	1	-	FC113	0
	19B2	Overfrequency Alarm Level	2501	7000	1	Hz	F3	6050
	19B3	Underfrequency Alarm Level	2000	6000	1	Hz	F3	5950
	19B4	Voltage Frequency Alarm Delay	0	600	1	s	F2	10
	19B5	Voltage Frequency Alarm Events	0	1	1	-	FC103	0
	19B6	Voltage Frequency Trip	0	2	1	-	FC115	0
	19B7	Voltage Frequency Trip Relays	0	3	1	-	FC111	0
	19B8	Overfrequency Trip Level	2501	7000	1	Hz	F3	6050
	19B9	Underfrequency Trip Level	2000	6000	1	Hz	F3	5950
	19BA	Voltage Frequency Trip Delay	0	600	1	s	F2	10
	19BB	Reserved						
	...							
	19CF	Reserved						
POWER FACTOR	19D0	Block Power Factor Element from Start	0	5000	1	s	F1	1
	19D1	Power Factor Alarm	0	2	1	-	FC115	0
	19D2	Power Factor Alarm Relays	0	6	1	-	FC113	0
	19D3	Power Factor Lead Alarm Level	5	100	1	-	F3	100
	19D4	Power Factor Lag Alarm Level	5	100	1	-	F3	100
	19D5	Power Factor Alarm Delay	2	300	1	s	F1	10
	19D6	Power Factor Alarm Events	0	1	1	-	FC103	0
	19D7	Power Factor Trip	0	2	1	-	FC115	0
	19D8	Power Factor Trip Relays	0	3	1	-	FC111	0
	19D9	Power Factor Lead Trip Level	5	100	1	-	F3	100
	19DA	Power Factor Lag Trip Level	5	100	1	-	F3	100
	19DB	Power Factor Trip Delay	2	300	1	s	F1	10
	19DC	Reserved						
	...							
	19EF	Reserved						
REACTIVE POWER	19F0	Block kvar Element from Start	0	5000	1	s	F1	1
	19F1	Reactive Power Alarm	0	2	1	-	FC115	0
	19F2	Reactive Power Alarm Relays	0	6	1	-	FC113	0
	19F3	Positive Reactive Power Alarm Level	1	25000	1	kvar	F1	10
	19F4	Negative Reactive Power Alarm Level	1	25000	1	kvar	F1	10

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	19F5	Reactive Power Alarm Delay	2	300	1	s	F2	10
	19F6	Reactive Power Alarm Events	0	1	1	-	FC103	0
	19F7	Reactive Power Trip	0	2	1	-	FC115	0
	19F8	Reactive Power Trip Relays	0	3	1	-	FC111	0
	19F9	Positive Reactive Power Trip Level	1	25000	1	kvar	F1	25
	19FA	Negative Reactive Power Trip Level	1	25000	1	kvar	F1	25
	19FB	Reactive Power Trip Delay	2	300	1	s	F2	10
	19FC	Reserved						
	...							
	1A0F	Reserved						
UNDER-POWER	1A10	Block Underpower From Start	0	15000	1	s	F1	0
	1A11	Underpower Alarm	0	2	1	-	FC115	0
	1A12	Underpower Alarm Relays	0	6	1	-	FC113	0
	1A13	Underpower Alarm Level	1	25000	1	kW	F1	2
	1A14	Underpower Alarm Delay	1	30	1	s	F1	1
	1A15	Underpower Alarm Events	0	1	1	-	FC103	0
	1A16	Underpower Trip	0	2	1	-	FC115	0
	1A17	Underpower Trip Relays	0	3	1	-	FC111	0
	1A18	Underpower Trip Level	1	25000	1	kW	F1	1
	1A19	Underpower Trip Delay	1	30	1	s	F1	1
	1A1A	Reserved						
	...							
	1A1F	Reserved						
REVERSE POWER	1A20	Block Reverse Power From Start	0	5000	1	s	F1	0
	1A21	Reverse Power Alarm	0	2	1	-	FC115	0
	1A22	Reverse Power Alarm Relays	0	6	1	-	FC113	0
	1A23	Reverse Power Alarm Level	1	25000	1	kW	F1	1
	1A24	Reverse Power Alarm Delay	2	300	1	s	F1	10
	1A25	Reverse Power Alarm Events	0	1	1	-	FC103	0
	1A26	Reverse Power Trip	0	2	1	-	FC115	0
	1A27	Reverse Power Trip Relays	0	3	1	-	FC111	0
	1A28	Reverse Power Trip Level	1	25000	1	kW	F1	1
	1A29	Reverse Power Trip Delay	2	300	1	s	F1	10
	1A2A	Reserved						
	...							
	1A2F	Reserved						
TORQUE SETUP	1A30	Torque Metering	0	1	1	N/A	FC126	0
	1A30	Stator Resistance	1	50000	1	mΩ	F17	4
	1A31	Pole Pairs	2	128	2	-	F1	2
	1A32	Torque Unit	0	1	1	-	FC148	0
	1A33	Reserved						
	1A3F	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
OVERTORQUE SETUP	1A40	Overtorque Alarm	0	2	1	-	FC115	0
	1A41	Overtorque Alarm Relays	0	6	1	-	FC113	0
	1A42	Overtorque Alarm Level	10	9999999	1	Nm/ftlb	F2	40000
	1A44	Overtorque Alarm Delay	2	300	1	s	F2	10
	1A45	Overtorque Alarm Events	0	1	1	-	FC103	0
	1A46	Reserved						
	...							
	1A7F	Reserved						
TRIP COUNTER	1A80	Trip Counter Alarm	0	2	1	-	FC115	0
	1A81	Trip Counter Alarm Relays	0	6	1	-	FC113	0
	1A82	Trip Counter Alarm Level	1	50000	1	-	F1	25
	1A83	Trip Counter Alarm Events	0	1	1	-	FC103	0
	1A84	Reserved						
	...							
	1A8F	Reserved						
STARTER FAILURE	1A90	Starter Failure Alarm	0	2	1	-	FC115	0
	1A91	Starter Type	0	1	1	-	FC125	0
	1A92	Starter Failure Alarm Relays	0	6	1	-	FC113	0
	1A93	Starter Failure Alarm Delay	10	1000	10	ms	F1	100
	1A94	Supervision of Trip Coil	0	2	1	-	FC142	0
	1A95	Starter Failure Alarm Events	0	1	1	-	FC103	0
	1A96	Reserved						
	...							
	1ACF	Reserved						
CURRENT DEMAND	1AD0	Current Demand Period	5	90	1	min	F1	15
	1AD1	Current Demand Alarm	0	2	1	-	FC115	0
	1AD2	Current Demand Alarm Relays	0	6	1	-	FC113	0
	1AD3	Current Demand Alarm Level	10	100000	1	A	F9	100
	1AD5	Current Demand Alarm Events	0	1	1	-	FC103	0
	1AD6	Reserved						
	...							
	1ADF	Reserved						
kW DEMAND	1AE0	kW Demand Period	5	90	1	min	F1	15
	1AE1	kW Demand Alarm	0	2	1	-	FC115	0
	1AE2	kW Demand Alarm Relays	0	6	1	-	FC113	0
	1AE3	kW Demand Alarm Level	1	50000	1	kW	F1	100
	1AE4	kW Demand Alarm Events	0	1	1	-	FC103	0
	1AE5	Reserved						
	...							
	1AEF	Reserved						
kvar	1AF0	kvar Demand Period	5	90	1	min	F1	15

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
DEMAND	1AF1	kvar Demand Alarm	0	2	1	-	FC115	0
	1AF2	kvar Demand Alarm Relays	0	6	1	-	FC113	0
	1AF3	kvar Demand Alarm Level	1	50000	1	kvar	F1	100
	1AF4	kvar Demand Alarm Events	0	1	1	-	FC103	0
	1AF5	Reserved						
	...							
	1AFF	Reserved						
kVA DEMAND	1B00	kVA Demand Period	5	90	1	min	F1	15
	1B01	kVA Demand Alarm	0	2	1	-	FC115	0
	1B02	kVA Demand Alarm Relays	0	6	1	-	FC113	0
	1B03	kVA Demand Alarm Level	1	50000	1	kVA	F1	100
	1B04	kVA Demand Alarm Events	0	1	1	-	FC103	0
	1B05	Reserved						
	...	...						
	1B0F	Reserved						
PULSE OUTPUT	1B10	Positive kWh Pulse Output Relay	0	3	1	-	FC144	0
	1B11	Positive kWh Pulse Output Interval	1	50000	1	kWh	F1	1
	1B12	Positive kvarh Pulse Output Relay	0	3	1	-	FC144	0
	1B13	Positive kvarh Pulse Output Interval	1	50000	1	kvarh	F1	1
	1B14	Negative kvarh Pulse Output Relay	0	3	1	-	FC144	0
	1B15	Negative kvarh Pulse Output Interval	1	50000	1	kvarh	F1	1
	1B16	Running Time Pulse Relay	0	3	1	-	FC144	0
	1B17	Running Time Pulse Interval	1	50000	1	sec	F1	0
	1B18	Reserved						
	...							
	1B3F	Reserved						
ANALOG OUTPUTS	1B40	Analog Output 1 Selection	0	46	1	-	FC127	0
	1B41	Analog Output 2 Selection	0	46	1	-	FC127	0
	1B42	Analog Output 3 Selection	0	46	1	-	FC127	0
	1B43	Analog Output 4 Selection	0	46	1	-	FC127	0
	1B44	Phase A Current Minimum	0	100000	1	A	F9	0
	1B46	Phase A Current Maximum	0	100000	1	A	F9	100
	1B48	Phase B Current Minimum	0	100000	1	A	F9	0
	1B4A	Phase B Current Maximum	0	100000	1	A	F9	100
	1B4C	Phase C Current Minimum	0	100000	1	A	F9	0
	1B4E	Phase C Current Maximum	0	100000	1	A	F9	100
	1B50	Average Phase Current Minimum	0	100000	1	A	F9	0
	1B52	Average Phase Current Maximum	0	100000	1	A	F9	100
	1B54	AB Line Voltage Minimum	50	20000	1	V	F1	3200
	1B55	AB Line Voltage Maximum	50	20000	1	V	F1	4500
	1B56	BC Line Voltage Minimum	50	20000	1	V	F1	3200
	1B57	BC Line Voltage Maximum	50	20000	1	V	F1	4500

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1B58	CA Line Voltage Minimum	50	20000	1	V	F1	3200
	1B59	CA Line Voltage Maximum	50	20000	1	V	F1	4500
	1B5A	Average Line Voltage Minimum	50	20000	1	V	F1	3200
	1B5B	Average Line Voltage Maximum	50	20000	1	V	F1	4500
	1B5C	Phase AN Voltage Minimum	50	20000	1	V	F1	1900
	1B5D	Phase AN Voltage Maximum	50	20000	1	V	F1	2500
	1B5E	Phase BN Voltage Minimum	50	20000	1	V	F1	1900
	1B5F	Phase BN Voltage Maximum	50	20000	1	V	F1	2500
	1B60	Phase CN Voltage Minimum	50	20000	1	V	F1	1900
	1B61	Phase CN Voltage Maximum	50	20000	1	V	F1	2500
	1B62	Average Phase Voltage Minimum	50	20000	1	V	F1	1900
	1B63	Average Phase Voltage Maximum	50	20000	1	V	F1	2500
	1B64	Hottest Stator RTD Minimum	-50	250	1	°C	F4	0
	1B65	Hottest Stator RTD Maximum	-50	250	1	°C	F4	200
	1B66	Hottest Bearing RTD Minimum	-50	250	1	°C	F4	0
	1B67	Hottest Bearing RTD Maximum	-50	250	1	°C	F4	200
	1B68	Hottest Ambient RTD Minimum	-50	250	1	°C	F4	-50
	1B69	Hottest Ambient RTD Maximum	-50	250	1	°C	F4	60
	1B6A	RTD #1 Minimum	-50	250	1	°C	F4	-50
	1B6B	RTD #1 Maximum	-50	250	1	°C	F4	250
	1B6C	RTD #2 Minimum	-50	250	1	°C	F4	-50
	1B6D	RTD #2 Maximum	-50	250	1	°C	F4	250
	1B6E	RTD #3 Minimum	-50	250	1	°C	F4	-50
	1B6F	RTD #3 Maximum	-50	250	1	°C	F4	250
	1B70	RTD #4 Minimum	-50	250	1	°C	F4	-50
	1B71	RTD #4 Maximum	-50	250	1	°C	F4	250
	1B72	RTD #5 Minimum	-50	250	1	°C	F4	-50
	1B73	RTD #5 Maximum	-50	250	1	°C	F4	250
	1B74	RTD #6 Minimum	-50	250	1	°C	F4	-50
	1B75	RTD #6 Maximum	-50	250	1	°C	F4	250
	1B76	RTD #7 Minimum	-50	250	1	°C	F4	-50
	1B77	RTD #7 Maximum	-50	250	1	°C	F4	250
	1B78	RTD #8 Minimum	-50	250	1	°C	F4	-50
	1B79	RTD #8 Maximum	-50	250	1	°C	F4	250
	1B7A	RTD #9 Minimum	-50	250	1	°C	F4	-50
	1B7B	RTD #9 Maximum	-50	250	1	°C	F4	250
	1B7C	RTD #10 Minimum	-50	250	1	°C	F4	-50
	1B7D	RTD #10 Maximum	-50	250	1	°C	F4	250
	1B7E	RTD #11 Minimum	-50	250	1	°C	F4	-50
	1B7F	RTD #11 Maximum	-50	250	1	°C	F4	250
	1B80	RTD #12 Minimum	-50	250	1	°C	F4	-50
	1B81	RTD #12 Maximum	-50	250	1	°C	F4	250

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1B82	Power Factor Minimum	-99	100	1	lead/lag	F21	0.8 lag
	1B83	Power Factor Maximum	-99	100	1	lead/lag	F21	0.8lead
	1B84	Reactive Power Minimum	-50000	50000	1	kvar	F12	0
	1B86	Reactive Power Maximum	-50000	50000	1	kvar	F12	750
	1B88	Real Power Minimum	-50000	50000	1	kW	F12	0
	1B8A	Real Power Maximum	-50000	50000	1	kW	F12	1000
	1B8C	Apparent Power Minimum	0	50000	1	kVA	F1	0
	1B8D	Apparent Power Maximum	0	50000	1	kVA	F1	1250
	1B8E	Thermal Capacity Used Minimum	0	100	1	% used	F1	0
	1B8F	Thermal Capacity Used Maximum	0	100	1	% used	F1	100
	1B90	Relay Lockout Time Minimum	0	500	1	min	F1	0
	1B91	Relay Lockout Time Maximum	0	500	1	min	F1	150
	1B92	Current Demand Minimum	0	100000	1	A	F9	0
	1B94	Current Demand Maximum	0	100000	1	A	F9	700
	1B96	kvar Demand Minimum	0	50000	1	kvar	F1	0
	1B97	kvar Demand Maximum	0	50000	1	kvar	F1	1000
	1B98	kW Demand Minimum	0	50000	1	kW	F1	0
	1B99	kW Demand Maximum	0	50000	1	kW	F1	1250
	1B9A	kVA Demand Minimum	0	50000	1	kVA	F1	0
	1B9B	kVA Demand Maximum	0	50000	1	kVA	F1	1500
	1B9C	Motor Load Minimum	0	2000	1	x FLA	F3	0
	1B9D	Motor Load Maximum	0	2000	1	x FLA	F3	125
	1B9E	Analog Input 1 Minimum	-50000	50000	1	-	F12	0
	1BA0	Analog Input 1 Maximum	-50000	50000	1	-	F12	50000
	1BA2	Analog Input 2 Minimum	-50000	50000	1	-	F12	0
	1BA4	Analog Input 2 Maximum	-50000	50000	1	-	F12	50000
	1BA6	Analog Input 3 Minimum	-50000	50000	1	-	F12	0
	1BA8	Analog Input 3 Maximum	-50000	50000	1	-	F12	50000
	1BAA	Analog Input 4 Minimum	-50000	50000	1	-	F12	0
	1BAC	Analog Input 4 Maximum	-50000	50000	1	-	F12	50000
	1BAE	Tachometer Min	100	7200	1	R.P.M.	F1	3500
	1BAF	Tachometer Max	100	7200	1	R.P.M.	F1	3700
	1BB0	MWh Minimum	0	999999999	1	MWh	F17	50000
	1BB2	MWh Maximum	0	999999999	1	MWh	F17	100000
	1BB4	Reserved						
	...	...						
	1BBF	Reserved						
	1BC0	Torque Minimum	0	9999999	1	Nm/ftlb	F2	0
	1BC2	Torque Maximum	0	9999999	1	Nm/ftlb	F2	0
	1BC4	Reserved						
	…							
	1BD3	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1BD4	Hottest Stator RTD Minimum (in Fahrenheit)	-58	482	1	°F	F4	32
	1BD5	Hottest Stator RTD Maximum (in Fahrenheit)	-58	482	1	°F	F4	392
	1BD6	Hottest Bearing RTD Minimum (in Fahrenheit)	-58	482	1	°F	F4	32
	1BC7	Hottest Bearing RTD Maximum (in Fahrenheit)	-58	482	1	°F	F4	392
	1BD8	Hottest Ambient RTD Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BD9	Hottest Ambient RTD Maximum (in Fahrenheit)	-58	482	1	°F	F4	140
	1BDA	RTD #1 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BDB	RTD #1 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BDC	RTD #2 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BDD	RTD #2 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BDE	RTD #3 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BDF	RTD #3 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BE0	RTD #4 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BE1	RTD #4 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BE2	RTD #5 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BE3	RTD #5 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BE4	RTD #6 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BE5	RTD #6 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BE6	RTD #7 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BE7	RTD #7 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BE8	RTD #8 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BE9	RTD #8 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BEA	RTD #9 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BEB	RTD #9 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BEC	RTD #10 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BED	RTD #10 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BEE	RTD #11 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BEF	RTD #11 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BF0	RTD #12 Minimum (in Fahrenheit)	-58	482	1	°F	F4	-57
	1BF1	RTD #12 Maximum (in Fahrenheit)	-58	482	1	°F	F4	482
	1BF2	Reserved						
	...	...						
	1BF7	Reserved						
	1BF8	Analog Input Diff 1-2 Minimum	-50000	50000	1	-	F12	0
	1BFA	Analog Input Diff 1-2 Maximum	-50000	50000	1	-	F12	100
	1BFC	Analog Input Diff 3-4 Minimum	-50000	50000	1	-	F12	0
	1BFE	Analog Input Diff 3-4 Maximum	-50000	50000	1	-	F12	100
	1C00	Reserved						
	...							
	1C0A	Reserved						
ANALOG INPUT 1	1C0B	Analog Input 1 Setup	0	3	1	-	FC129	0
	1C0C	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...							
	1C0F	Reserved						
	1C10	1st and 2nd char. of Analog Input 1 Units	0	65535	1	-	F22	‘Un’
	...							
	1C12	5th and 6th char. of Analog Input 1 Units	0	65535	1	-	F22	‘ ’
	1C13	Analog Input 1 Minimum	-50000	50000	1	-	F12	0
	1C15	Analog Input 1 Maximum	-50000	50000	1	-	F12	100
	1C17	Block Analog Input 1 From Start	0	5000	1	s	F1	0
	1C18	Analog Input 1 Alarm	0	2	1	-	FC115	0
	1C19	Analog Input 1 Alarm Relays	0	6	1	-	FC113	0
	1C1A	Analog Input 1 Alarm Level	-50000	50000	1	-	F12	10
	1C1C	Analog Input 1 Alarm Pickup	0	1	1	-	FC130	0
	1C1D	Analog Input 1 Alarm Delay	1	3000	1	s	F2	1
	1C1E	Analog Input 1 Alarm Events	0	1	1	-	FC103	0
	1C1F	Analog Input 1 Trip	0	2	1	-	FC115	0
	1C20	Analog Input 1 Trip Relays	0	3	1	-	FC111	0
	1C21	Analog Input 1 Trip Level	-50000	50000	1	-	F12	20
	1C23	Analog Input 1 Trip Pickup	0	1	1	-	FC130	0
	1C24	Analog Input 1 Trip Delay	1	3000	1	s	F2	1
	1C25	1st and 2nd char. of Analog Input 1 Name	0	65535	1	-	F22	‘An’
	...							
	1C2A	11th and 12th char. of Analog Input 1 Name	0	65535	1	-	F22	‘ ‘
	1C2B	Reserved						
	...							
	1C4A	Reserved						
ANALOG INPUT 2	1C4B	Analog Input 2 Setup	0	3	1	-	FC129	0
	1C4C	Reserved						
	...							
	1C4F	Reserved						
	1C50	1st and 2nd char. of Analog Input 2 Units	0	65535	1	-	F22	‘Un’
	...							
	1C52	5th and 6th char. of Analog Input 2 Units	0	65535	1	-	F22	‘ ’
	1C53	Analog Input 2 Minimum	-50000	50000	1	-	F12	0
	1C55	Analog Input 2 Maximum	-50000	50000	1	-	F12	100
	1C57	Block Analog Input 2 From Start	0	5000	1	s	F1	0
	1C58	Analog Input 2 Alarm	0	2	1	-	FC115	0
	1C59	Analog Input 2 Alarm Relays	0	6	1	-	FC113	0
	1C5A	Analog Input 2 Alarm Level	-50000	50000	1	-	F12	10
	1C5C	Analog Input 2 Alarm Pickup	0	1	1	-	FC130	0
	1C5D	Analog Input 2 Alarm Delay	1	3000	1	s	F2	1
	1C5E	Analog Input 2 Alarm Events	0	1	1	-	FC103	0
	1C5F	Analog Input 2 Trip	0	2	1	-	FC115	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1C60	Analog Input 2 Trip Relays	0	3	1	-	FC111	0
	1C61	Analog Input 2 Trip Level	-50000	50000	1	-	F12	20
	1C63	Analog Input 2 Trip Pickup	0	1	1	-	FC130	0
	1C64	Analog Input 2 Trip Delay	1	3000	1	s	F2	1
	1C65	1st and 2nd char. of Analog Input 2 Name	0	65535	1	-	F22	'An'
	...							
	1C6A	11th and 12th char. of Analog Input 2 Name	0	65535	1	-	F22	' '
	1C6B	Reserved						
	...							
	1C8A	Reserved						
ANALOG INPUT 3	1C8B	Analog Input 3 Setup	0	3	1	-	FC129	0
	1C8C	Reserved						
	...							
	1C8F	Reserved						
	1C90	1st and 2nd char. of Analog Input 3 Units	0	65535	1	-	F22	'Un'
	...							
	1C92	5th and 6th char. of Analog Input 3 Units	0	65535	1	-	F22	' '
	1C93	Analog Input 3 Minimum	-50000	50000	1	-	F12	0
	1C95	Analog Input 3 Maximum	-50000	50000	1	-	F12	100
	1C97	Block Analog Input 3 From Start	0	5000	1	s	F1	0
	1C98	Analog Input 3 Alarm	0	2	1	-	FC115	0
	1C99	Analog Input 3 Alarm Relays	0	6	1	-	FC113	0
	1C9A	Analog Input 3 Alarm Level	-50000	50000	1	-	F12	10
	1C9C	Analog Input 3 Alarm Pickup	0	1	1	-	FC130	0
	1C9D	Analog Input 3 Alarm Delay	1	3000	1	s	F2	1
	1C9E	Analog Input 3 Alarm Events	0	1	1	-	FC103	0
	1C9F	Analog Input 3 Trip	0	2	1	-	FC115	0
	1CA0	Analog Input 3 Trip Relays	0	3	1	-	FC111	0
	1CA1	Analog Input 3 Trip Level	-50000	50000	1	-	F12	20
	1CA3	Analog Input 3 Trip Pickup	0	1	1	-	FC130	0
	1CA4	Analog Input 3 Trip Delay	1	3000	1	s	F2	1
	1CA5	1st and 2nd char. of Analog Input 3 Name	0	65535	1	-	F22	'An'
	...							
	1CAA	11th and 12th char. of Analog Input 3 Name	0	65535	1	-	F22	' '
	1CAB	Reserved						
	...							
	1CCA	Reserved						
ANALOG INPUT 4	1CCB	Analog Input 4 Setup	0	3	1	-	FC129	0
	1CCC	Reserved						
	...							
	1CCF	Reserved						
	1CD0	1st and 2nd char. of Analog Input 4 Units	0	65535	1	-	F22	'Un'

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	...							
	1CD2	5th and 6th char. of Analog Input 4 Units	0	65535	1	-	F22	‘ ’
	1CD3	Analog Input 4 Minimum	-50000	50000	1	-	F12	0
	1CD5	Analog Input 4 Maximum	-50000	50000	1	-	F12	100
	1CD7	Block Analog Input 4 From Start	0	5000	1	s	F1	0
	1CD8	Analog Input 4 Alarm	0	2	1	-	FC115	0
	1CD9	Analog Input 4 Alarm Relays	0	6	1	-	FC113	0
	1CDA	Analog Input 4 Alarm Level	-50000	50000	1	-	F12	10
	1CDC	Analog Input 4 Alarm Pickup	0	1	1	-	FC130	0
	1CDD	Analog Input 4 Alarm Delay	1	3000	1	s	F2	1
	1CDE	Analog Input 4 Alarm Events	0	1	1	-	FC103	0
	1CDF	Analog Input 4 Trip	0	2	1	-	FC115	0
	1CE0	Analog Input 4 Trip Relays	0	3	1	-	FC111	0
	1CE1	Analog Input 4 Trip Level	-50000	50000	1	-	F12	20
	1CE3	Analog Input 4 Trip Pickup	0	1	1	-	FC130	0
	1CE4	Analog Input 4 Trip Delay	1	3000	1	s	F2	1
	1CE5	1st and 2nd char. of Analog Input 4 Name	0	65535	1	-	F22	‘An’
	...							
	1CEA	11th and 12th char. of Analog Input 4 Name	0	65535	1	-	F22	‘ ‘
	1CEB	Reserved						
	..							
	1CFF	Reserved						
SIMULATION MODE	1D00	Simulation Mode	0	3	1	-	FC138	0
	1D01	Pre-Fault to Fault Time Delay	0	300	1	s	F1	15
		Reserved						
	...							
	1D0F	Reserved						
PRE-FAULT VALUES	1D10	Pre-Fault Current Phase A	0	2000	1	x FLA	F3	0
	1D11	Pre-Fault Current Phase B	0	2000	1	x FLA	F3	0
	1D12	Pre-Fault Current Phase C	0	2000	1	x FLA	F3	0
	1D13	Pre-Fault Ground Current	0	50000	1	A	F2	0
	1D14	Pre-Fault Line Voltages	0	110	1	x Rated	F3	100
	1D15	Pre-Fault Current Lags Voltage	0	359	1	°	F1	0
	1D16	Stator RTD Pre-Fault Temperature	-50	250	1	°C	F4	40
	1D17	Bearing RTD Pre-Fault Temperature	-50	250	1	°C	F4	40
	1D18	Other RTD Pre-Fault Temperature	-50	250	1	°C	F4	40
	1D19	Ambient RTD Pre-Fault Temperature	-50	250	1	°C	F4	40
	1D1A	Pre-Fault System Frequency	450	700	1	Hz	F2	600
	1D1B	Pre-Fault Analog Input 1	0	100	1	% range	F1	0
	1D1C	Pre-Fault Analog Input 2	0	100	1	% range	F1	0
	1D1D	Pre-Fault Analog Input 3	0	100	1	% range	F1	0
	1D1E	Pre-Fault Analog Input 4	0	100	1	% range	F1	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1D1F	Pre-Fault Differential Current	0	110	1	xCT	F3	0
	1D20	Reserved						
	...							
	1D3B	Reserved						
	1D3C	Pre-Fault Stator RTD Temperature (in Fahr.)	-58	482	1	°F	F4	104
	1D3D	Pre-Fault Bearing RTD Temperature (in Fahr.)	-58	482	1	°F	F4	104
	1D3E	Pre-Fault Other RTD Temperature (in Fahr.)	-58	482	1	°F	F4	104
	1D3F	Pre-Fault Ambient RTD Temperature (in Fahr.)	-58	482	1	°F	F4	104
FAULT VALUES	1D40	Fault Current Phase A	0	2000	1	x FLA	F3	0
	1D41	Fault Current Phase B	0	2000	1	x FLA	F3	0
	1D42	Fault Current Phase C	0	2000	1	x FLA	F3	0
	1D43	Fault Ground Current	0	50000	1	A	F2	0
	1D44	Fault Line Voltages	0	110	1	x Rated	F3	100
	1D45	Fault Current Lags Voltage	0	120	30	°	F1	0
	1D46	Stator RTD Fault Temperature	-50	250	1	°C	F4	40
	1D47	Bearing RTD Fault Temperature	-50	250	1	°C	F4	40
	1D48	Other RTD Fault Temperature	-50	250	1	°C	F4	40
	1D49	Ambient RTD Fault Temperature	-50	250	1	°C	F4	40
	1D4A	Fault System Frequency	450	700	1	Hz	F2	600
	1D4B	Fault Analog Input 1	0	100	1	% range	F1	0
	1D4C	Fault Analog Input 2	0	100	1	% range	F1	0
	1D4D	Fault Analog Input 3	0	100	1	% range	F1	0
	1D4E	Fault Analog Input 4	0	100	1	% range	F1	0
	1D4F	Fault Differential Current	0	110	1	xCT	F3	0
	1D50	Reserved						
	...							
	1D7B	Reserved						
	1D7C	Fault Stator RTD Temperature (in Fahrenheit)	-58	482	1	°F	F4	104
	1D7D	Fault Bearing RTD Temperature (in Fahrenheit)	-58	482	1	°F	F4	104
	1D7E	Fault Other RTD Temperature (in Fahrenheit)	-58	482	1	°F	F4	104
	1D7F	Fault Ambient RTD Temperature (in Fahrenheit)	-58	482	1	°F	F4	104
TEST OUTPUT RELAYS	1D80	Force Operation of Relays	0	8	1	-	FC139	0
	1D81	Reserved						
	...							
	1D8F	Reserved						
TEST ANALOG OUTPUTS	1D90	Force Analog Outputs	0	1	1	-	FC126	0
	1D91	Analog Output 1 Forced Value	0	100	1	% range	F1	0
	1D92	Analog Output 2 Forced Value	0	100	1	% range	F1	0
	1D93	Analog Output 3 Forced Value	0	100	1	% range	F1	0
	1D94	Analog Output 4 Forced Value	0	100	1	% range	F1	0
	1D95	Reserved						
	...							

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1DFE	Reserved						
SPEED2 O/L SETUP	1DFF	Speed2 Standard Overload Curve Number	1	15	1	-	F1	4
	1E00	Speed2 Time to Trip at 1.01 x FLA	5	999999	1	s	F10	174145
	1E02	Speed2 Time to Trip at 1.05 x FLA	5	999999	1	s	F10	34149
	1E04	Speed2 Time to Trip at 1.10 x FLA	5	999999	1	s	F10	16667
	1E06	Speed2 Time to Trip at 1.20 x FLA	5	999999	1	s	F10	7954
	1E08	Speed2 Time to Trip at 1.30 x FLA	5	999999	1	s	F10	5072
	1E0A	Speed2 Time to Trip at 1.40 x FLA	5	999999	1	s	F10	3646
	1E0C	Speed2 Time to Trip at 1.50 x FLA	5	999999	1	s	F10	2800
	1E0E	Speed2 Time to Trip at 1.75 x FLA	5	999999	1	s	F10	1697
	1E10	Speed2 Time to Trip at 2.00 x FLA	5	999999	1	s	F10	1166
	1E12	Speed2 Time to Trip at 2.25 x FLA	5	999999	1	s	F10	861
	1E14	Speed2 Time to Trip at 2.50 x FLA	5	999999	1	s	F10	666
	1E16	Speed2 Time to Trip at 2.75 x FLA	5	999999	1	s	F10	533
	1E18	Speed2 Time to Trip at 3.00 x FLA	5	999999	1	s	F10	437
	1E1A	Speed2 Time to Trip at 3.25 x FLA	5	999999	1	s	F10	366
	1E1C	Speed2 Time to Trip at 3.50 x FLA	5	999999	1	s	F10	311
	1E1E	Speed2 Time to Trip at 3.75 x FLA	5	999999	1	s	F10	268
	1E20	Speed2 Time to Trip at 4.00 x FLA	5	999999	1	s	F10	233
	1E22	Speed2 Time to Trip at 4.25 x FLA	5	999999	1	s	F10	205
	1E24	Speed2 Time to Trip at 4.50 x FLA	5	999999	1	s	F10	182
	1E26	Speed2 Time to Trip at 4.75 x FLA	5	999999	1	s	F10	162
	1E28	Speed2 Time to Trip at 5.00 x FLA	5	999999	1	s	F10	146
	1E2A	Speed2 Time to Trip at 5.50 x FLA	5	999999	1	s	F10	120
	1E2C	Speed2 Time to Trip at 6.00 x FLA	5	999999	1	s	F10	100
	1E2E	Speed2 Time to Trip at 6.50 x FLA	5	999999	1	s	F10	85
	1E30	Speed2 Time to Trip at 7.00 x FLA	5	999999	1	s	F10	73
	1E32	Speed2 Time to Trip at 7.50 x FLA	5	999999	1	s	F10	63
	1E34	Speed2 Time to Trip at 8.00 x FLA	5	999999	1	s	F10	56
	1E36	Speed2 Time to Trip at 10.0 x FLA	5	999999	1	s	F10	56
	1E38	Speed2 Time to Trip at 15.0 x FLA	5	999999	1	s	F10	56
	1E3A	Speed2 Time to Trip at 20.0 x FLA	5	999999	1	s	F10	56
	1E3C	Reserved						
	...							
	1E4F	Reserved						
	1E50	Speed2 Minimum Allowable Line Voltage	70	95	1	% Rated	F1	80
	1E51	Speed2 Stall Current at Min Vline	200	1500	1	x FLA	F3	480
	1E52	Speed2 Safe Stall Time at Min Vline	5	9999	1	s	F2	200
	1E53	Speed2 Accel. Intersect at Min Vline	200	1500	1	x FLA	F3	380
	1E54	Speed2 Stall Current at 100 % Vline	200	1500	1	x FLA	F3	600
	1E55	Speed2 Safe Stall Time at 100 % Vline	5	9999	1	s	F2	100
	1E56	Speed2 Accel. Intersect at 100 % Vline	200	1500	1	x FLA	F3	500

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1E57	Reserved						
	...							
	1E8F	Reserved						
SPEED2 UNDER-CURRENT	1E90	Block Speed2 Undercurrent from Start	0	15000	1	s	F1	0
	1E91	Speed2 Undercurrent Alarm	0	2	1	-	FC115	0
	1E92	Reserved						
	1E93	Speed2 Undercurrent Alarm Pickup	10	95	1	x FLA	F3	70
	1E94	Speed2 Undercurrent Alarm Delay	1	60	1	s	F1	1
	1E95	Speed2 Undercurrent Alarm Events	0	1	1	-	FC103	0
	1E96	Speed2 Undercurrent Trip	0	2	1	-	FC115	0
	1E97	Reserved						
	1E98	Speed2 Undercurrent Trip Pickup	10	99	1	x FLA	F3	70
	1E99	Speed2 Undercurrent Trip Delay	1	60	1	s	F1	1
	1E9A	Reserved						
	...							
	1EAF	Reserved						
SPEED2 ACCELERATIO N	1EB0	Speed2 Acceleration Timer From Start	10	2500	1	s	F2	100
	1EB1	Acceleration Timer From Speed One to Two	10	2500	1	s	F2	100
	1EB2	Speed Switch Trip Speed2 Delay	10	2500	1	s	F2	50
	1EB3	Speed2 Rated Speed	100	7200	1	R.P.M.	F1	3600
	1EB4	Reserved						
	...							
	1EFF	Reserved						
ANALOG INPUT 1-2 DIFF	1F00	Analog In Differential 1-2 Enable	0	1	1	-	FC126	0
	1F01	1st and 2nd char of Analog In Diff 1-2 Name	0	65535	1	-	F22	'An'
	...							
	1F06	11th and 12th char of Analog In Diff 1-2 Name	0	65535	1	-	F22	' '
.	1F07	Analog In Differential 1-2 Comparison	0	1	1	-	FC145	0
	1F08	Analog In Differential 1-2 Logic	0	2	1	-	FC146	0
	1F09	Analog In Differential 1-2 Active When	0	1	1	-	FC147	0
	1F0A	Analog In Differential 1-2 Block from Start	0	5000	1	s	F1	0
	1F0B	Analog In Differential 1-2 Alarm	0	2	1	-	FC115	0
	1F0C	Analog In Differential 1-2 Alarm Relays	0	6	1	-	FC113	0
	1F0D	Analog In Differential 1-2 Percent Alarm	0	500	1	%	F1	10
	1F0E	Analog In Differential 1-2 Absolute Alarm	0	50000	1	Units	F1	10
	1F0F	Analog In Differential 1-2 Alarm Delay	1	3000	1	s	F2	1
	1F10	Analog In Differential 1-2 Alarm Events	0	1	1	-	FC103	0
	1F11	Analog In Differential 1-2 Trip	0	2	1	-	FC115	0
	1F12	Analog In Differential 1-2 Trip Relays	0	6	1	-	FC111	0
	1F13	Analog In Differential 1-2 Percent Trip	0	500	1	%	F1	10
	1F14	Analog In Differential 1-2 Absolute Trip	0	50000	1	Units	F1	10

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	1F15	Analog In Differential 1-2 Trip Delay	1	3000	1	s	F2	1
	1F16	Reserved						
	...	...						
	1F1F	Reserved						
ANALOG INPUT 3-4 DIFF	1F20	Analog In Differential 3-4 Enable	0	1	1	-	FC126	0
	1F21	1st and 2nd char of Analog In Diff. 3-4 Name	0	65535	1	-	F22	‘An’
	...							
	1F26	11th and 12th char of Analog In Diff 3-4 Name	0	65535	1	-	F22	‘ ‘
.	1F27	Analog In Differential 3-4 Comparison	0	1	1	-	FC145	0
	1F28	Analog In Differential 3-4 Logic	0	2	1	-	FC146	0
	1F29	Analog In Differential 3-4 Active When	0	1	1	-	FC147	0
	1F2A	Analog In Differential 3-4 Block from Start	0	5000	1	s	F1	0
	1F2B	Analog In Differential 3-4 Alarm	0	2	1	-	FC115	0
	1F2C	Analog In Differential 3-4 Alarm Relays	0	6	1	-	FC113	0
	1F2D	Analog In Differential 3-4 Percent Alarm	0	500	1	%	F1	10
	1F2E	Analog In Differential 3-4 Absolute Alarm	0	50000	1	Units	F1	10
	1F2F	Analog In Differential 3-4 Alarm Delay	1	3000	1	s	F2	1
	1F30	Analog In Differential 3-4 Alarm Events	0	1	1	-	FC103	0
	1F31	Analog In Differential 3-4 Trip	0	2	1	-	FC115	0
	1F32	Analog In Differential 3-4 Trip Relays	0	6	1	-	FC111	0
	1F33	Analog In Differential 3-4 Percent Trip	0	500	1	%	F1	10
	1F34	Analog In Differential 3-4 Absolute Trip	0	50000	1	Units	F1	10
	1F35	Analog In Differential 3-4 Trip Delay	1	3000	1	s	F2	1
	1F36	Reserved						
	...	...						
	2FFF	Reserved						

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
Event Recorder / Trace Memory (Addresses 3000 -3FFF)								
EVENT RECORDER	3000	Event Recorder Last Reset (2 words)	N/A	N/A	N/A	N/A	F18	N/A
	3002	Total Number of Events Since Last Clear	0	65535	1	N/A	F1	0
	3003	Event Record Selector (1=newest, 40=oldest)	1	40	1	N/A	F1	1
	3004	Cause of Event	0	131	1	-	FC134	0
	3005	Time of Event (2 words)	N/A	N/A	N/A	N/A	F19	N/A
	3007	Date of Event (2 words)	N/A	N/A	N/A	N/A	F18	N/A
	3009	Motor Speed During Event	0	1	1	-	FC135	0
	300A	Event Tachometer RPM	0	3600	1	R.P.M.	F1	0
	300B	Event Phase A Current	0	100000	1	A	F9	0
	300D	Event Phase B Current	0	100000	1	A	F9	0
	300F	Event Phase C Current	0	100000	1	A	F9	0
	3011	Event Motor Load	0	2000	1	FLA	F3	0
	3012	Event Current Unbalance	0	100	1	%	F1	0
	3013	Event Ground Current	0	500000	1	A	F11	0
	3015	Event Phase A Differential Current	0	5000	1	A	F1	0
	3016	Event Phase B Differential Current	0	5000	1	A	F1	0
	3017	Event Phase C Differential Current	0	5000	1	A	F1	0
	3018	Event Hottest Stator RTD	0	12	1	-	F1	0
	3019	Event Temperature of Hottest Stator RTD	-50	250	1	°C	F4	0
	301A	Event Hottest Bearing RTD	0	12	1	-	F1	0
	301B	Event Temperature of Hottest Bearing RTD	-50	250	1	°C	F4	0
	301C	Event Hottest Other RTD	0	12	1	-	F1	0
	301D	Event Temperature of Hottest Other RTD	-50	250	1	°C	F4	0
	301E	Event Hottest Ambient RTD	0	12	1	-	F1	0
	301F	Event Ambient RTD Temperature	-50	250	1	°C	F4	0
	3020	Event Voltage Vab	0	20000	1	V	F1	0
	3021	Event Voltage Vbc	0	20000	1	V	F1	0
	3022	Event Voltage Vca	0	20000	1	V	F1	0
	3023	Event Voltage Van	0	20000	1	V	F1	0
	3024	Event Voltage Vbn	0	20000	1	V	F1	0
	3025	Event Voltage Vcn	0	20000	1	V	F1	0
	3026	Event System Frequency	0	12000	1	Hz	F3	0
	3027	Event Real Power	-50000	50000	1	kW	F12	0
	3029	Event Reactive Power	-50000	50000	1	kvar	F12	0
	302B	Event Apparent Power	0	50000	1	kVA	F1	0
	302C	Event Power Factor	-99	100	1	-	F21	0
	302D	Event Analog Input #1	-50000	50000	1	-	F12	0
	302F	Event Analog Input #2	-50000	50000	1	-	F12	0
	3031	Event Analog Input #3	-50000	50000	1	-	F12	0
	3033	Event Analog Input #4	-50000	50000	1	-	F12	0

GROUP	ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
	3035	Event Torque	0	9999999	1	Nm/ftlb	F2	0
	3037	Reserved						
	…							
	30DF	Reserved						
	30E0	Event Temp. of Hottest Stator RTD (in Fahr,)	-58	482	1	°F	F4	32
	30E1	Event Temp. of Hottest Bearing RTD (in Fahr,)	-58	482	1	°F	F4	32
	30E2	Event Temp. of Hottest Other RTD (in Fahr,)	-58	482	1	°F	F4	32
	30E3	Event Ambient RTD Temperature (in Fahr,)	-58	482	1	°F	F4	32
TRACE MEMORY	30E4	Reserved						
		...						
	30EF	Reserved						
	30F0	Trace Number Selector	1	65535	1	-	F1	0
	30F1	Trace Memory Channel Selector	0	9	1	-	F1	0
	30F2	Trace Memory Date	N/A	N/A	N/A	N/A	F18	N/A
	30F4	Trace Memory Time	N/A	N/A	N/A	N/A	F19	N/A
	30F6	Trace Trigger Cause	0	131	1	-	FC134	N/A
	30F7	Number of Samples per Trace	1	768	1	-	F1	N/A
	30F8	Number of Traces Taken	0	65535	1	-	F1	N/A
	30F9	Reserved						
	30FF	Reserved						
	3100	First Trace Memory Sample	-32767	32767	1	-	F4	0
	...	...						
	3400	Last Trace Memory Sample	-32767	32767	1	-	F4	0
	3401	Reserved						
	...	...						
	3FFF	Reserved						

SR 469 MEMORY MAP DATA FORMATS

FORMAT CODE	TYPE	DEFINITION
F1	16 bits	UNSIGNED VALUE
		Example: 1234 stored as 1234
F2	16 bits	UNSIGNED VALUE, 1 DECIMAL PLACE
		Example: 123.4 stored as 1234
F3	16 bits	UNSIGNED VALUE, 2 DECIMAL PLACES
		Example: 12.34 stored as 1234
F4	16 bits	2’s COMPLEMENT SIGNED VALUE
		Example: -1234 stored as -1234 (ie. 64302)
F5	16 bits	2’s COMPLEMENT SIGNED VALUE, 1 DECIMAL PLACES
		Example: -123.4 stored as -1234 (ie. 64302)
F6	16 bits	2’s COMPLEMENT SIGNED VALUE, 2 DECIMAL PLACES
		Example: -12.34 stored as -1234 (ie. 64302)
F7	16 bits	2’s COMPLEMENT SIGNED VALUE, 3 DECIMAL PLACES
		Example: -1.234 stored as -1234 (ie. 64302)
F8	16 bits	2’s COMPLEMENT SIGNED VALUE, 4 DECIMAL PLACES
		Example: -0.1234 stored as -1234 (ie. 64302)
F9	32 bits	UNSIGNED LONG VALUE
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: 123456 stored as 123456 (ie. 1st word: 0001 hex, 2nd word: E240 hex)
F10	32 bits	UNSIGNED LONG VALUE, 1 DECIMAL PLACE
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: 12345.6 stored as 123456 (ie. 1st word: 0001 hex, 2nd word: E240 hex)
F11	32 bits	UNSIGNED LONG VALUE, 2 DECIMAL PLACES
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: 1234.56 stored as 123456 (ie. 1st word: 0001 hex, 2nd word: E240 hex)
F12	32 bits	2’s COMPLEMENT SIGNED LONG VALUE
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: -123456 stored as -123456 (ie. 1st word: FFFE hex, 2nd word: 1DC0 hex)
F13	32 bits	2’s COMPLEMENT SIGNED LONG VALUE, 1 DECIMAL PLACE
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: -12345.6 stored as -123456 (ie. 1st word: FFFE hex, 2nd word: 1DC0 hex)
F14	32 bits	2’s COMPLEMENT SIGNED LONG VALUE, 2 DECIMAL PLACES

FORMAT CODE	TYPE	DEFINITION
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: -1234.56 stored as -123456 (ie. 1st word: FFFE hex, 2nd word: 1DC0 hex)
F15	16 bits	HARDWARE REVISION
	0000 0000 0000 0001	1 = A
	0000 0000 0000 0010	2 = B
	...	...
	0000 0000 0001 1010	26 = Z
F16	16 bits	SOFTWARE REVISION
	1111 1111 xxxx xxxx	Major Revision Number
		0 to 9 in steps of 1
	xxxx xxxx 1111 1111	Minor Revision Number (two BCD digits)
		00 to 99 in steps of 1
		Example: Revision 2.30 stored as 0230 hex
F17	32 bits	UNSIGNED LONG VALUE, 3 DECIMAL PLACES
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Example: 123.456 stored as 123456 (ie. 1st word: 0001 hex, 2nd word: E240 hex)
F18	32 bits	DATE (MM/DD/YYYY)
	1st byte	Month (1 to 12)
	2nd byte	Day (1 to 31)
	3rd and 4th byte	Year (1995 to 2094)
		Example: Feb 20, 1995 stored as 34867142 (ie. 1st word: 0214, 2nd word 07C6)
F19	32 bits	TIME (HH:MM:SS:hh)
	1st byte	Hours (0 to 23)
	2nd byte	Minutes (0 to 59)
	3rd byte	Seconds (0 to 59)
	4th byte	Hundreds of seconds (0 to 99)
		Example: 2:05pm stored as 235208704 (ie. 1st word: 0E05, 2nd word 0000)
F20	32 bits	2's COMPLEMENT SIGNED LONG VALUE
	1st 16 bits	High Order Word of Long Value
	2nd 16 bits	Low Order Word of Long Value
		Note: -1 means "Never"
F21	16 bits	2's COMPLEMENT SIGNED VALUE, 2 DECIMAL PLACES (Power Factor)
	< 0	Leading Power Factor - Negative
	> 0	Lagging Power Factor - Positive
		Example: Power Factor of 0.87 lag is used as 87 (ie. 0057)
F22	16 bits	TWO 8-BIT CHARACTERS PACKED INTO 16-BIT UNSIGNED
	MSB	First Character
	LSB	Second Character
		Example: String 'AB' stored as 4142 hex.
F24	32 bits	Time Format for Broadcast
	1st byte	Hours (0 to 23)
	2nd byte	Minutes (0 to 59)
	3rd and 4th bytes	Milliseconds (0 to 59999). Note: Clock resolution limited to 0.01 sec
	Example:	1:15:48:572 stored as 17808828 (ie, 1st word 010F, 2nd word BDBC)
F25	16 bits	UNSIGNED VALUE, 4 DECIMAL PLACES
		Example: 0.1234 stored as 1234

FORMAT CODE	TYPE	DEFINITION
FC100	Unsigned 16 bit integer	Temperature Display Units
	0	Celsius
	1	Fahrenheit
FC101	Unsigned 16 bit integer	RS 485 Baud Rate
	0	300 baud
	1	1200 baud
	2	2400 baud
	3	4800 baud
	4	9600 baud
	5	19200 baud
FC102	Unsigned 16 bit integer	RS 485 Parity
	0	None
	1	Odd
	2	Even
FC103	Unsigned 16 bit integer	Off / On or No / Yes Selection
	0	Off / No
	1	On / Yes
FC104	Unsigned 16 bit integer	Ground CT Type
	0	None
	1	1 A Secondary
	2	5 A Secondary
	3	Multilin CT 50/0.025
FC105	Unsigned 16 bit integer	Differential CT Type
	0	None
	1	1 A Secondary
	2	5 A Secondary
FC106	Unsigned 16 bit integer	Voltage Transformer Connection Type
	0	None
	1	Open Delta
	2	Wye
FC107	Unsigned 16 bit integer	Nominal Frequency
	0	60 Hz
	1	50 Hz
	2	Variable
FC108	Unsigned 16 bit integer	Reduced Voltage Starting Transition On
	0	Current Only
	1	Current or Timer
	2	Current and Timer
FC109	Unsigned 16 bit integer	Starter Status Switch
	0	Starter Aux a
	1	Starter Aux b
FC110	Unsigned 16 bit integer	Assignable Input Function
	0	Off
	1	Remote Alarm
	2	Remote Trip
	3	Speed Switch Trip
	4	Load Shed Trip
	5	Pressure Sw. Alarm
	6	Pressure Switch Trip

FORMAT CODE	TYPE	DEFINITION
	7	Vibration Sw. Alarm
	8	Vibration Sw. Trip
	9	Digital Counter
	10	Tachometer
	11	General Sw. A
	12	General Sw. B
	13	General Sw. C
	14	General Sw. D
	15	Capture Trace
	16	Simulate Pre-Fault
	17	Simulate Fault
	18	Simulate Pre-Fault...Fault
FC111	Unsigned 16 bit integer	Trip Relays
	0	Trip
	1	Trip & Aux2
	2	Trip & Aux2 & Aux3
	3	Trip & Aux3
FC112	Unsigned 16 bit integer	Not Defined
	0	
	1	
FC113	Unsigned 16 bit integer	Alarm Relays
	0	Alarm
	1	Alarm & Aux2
	2	Alarm & Aux2 & Aux3
	3	Alarm & Aux3
	4	Aux2
	5	Aux2 & Aux3
	6	Aux3
FC114	Unsigned 16 bit integer	Counter Type
	0	Increment
	1	Decrement
FC115	Unsigned 16 bit integer	Alarm/Trip Type Selection
	0	Off
	1	Latched
	2	Unlatched
FC116	Unsigned 16 bit integer	Switch Type
	0	Normally Open
	1	Normally Closed
FC117	Unsigned 16 bit integer	Reset Mode
	0	All Resets
	1	Remote Reset Only
	2	Keypad Reset Only
FC118	Unsigned 16 bit integer	Short Circuit Relays
	0	Trip
	1	Trip & Aux2
	2	Trip & Aux2 & Aux3
	3	Trip & Aux3
	4	Aux2
	5	Aux2 & Aux3
	6	Aux3
FC119	Unsigned 16 bit integer	Backup Relays

FORMAT CODE	TYPE	DEFINITION
	0	Aux2
	1	Aux2 & Aux3
	2	Aux3
FC120	Unsigned 16 bit integer	RTD Type
	0	100 Ohm Platinum
	1	120 Ohm Nickel
	2	100 Ohm Nickel
	3	10 Ohm Copper
FC121	Unsigned 16 bit integer	RTD Application
	0	None
	1	Stator
	2	Bearing
	3	Ambient
	4	Other
FC122	Unsigned 16 bit integer	RTD Voting Selection
	1	RTD #1
	2	RTD #2
	3	RTD #3
	4	RTD #4
	5	RTD #5
	6	RTD #6
	7	RTD #7
	8	RTD #8
	9	RTD #9
	10	RTD #10
	11	RTD #11
	12	RTD #12
FC123	Unsigned 16 bit integer	Alarm Status
	0	Off
	1	Not Active
	2	Timing Out
	3	Active
	4	Latched
FC124	Unsigned 16 bit integer	Phase Rotation at Motor Terminals
	0	ABC
	1	BAC
FC125	Unsigned 16 bit integer	Starter Type
	0	Breaker
	1	Contactor
FC126	Unsigned 16 bit integer	Disabled / Enabled Selection
	0	Disabled
	1	Enabled
FC127	Unsigned 16 bit integer	Analog Output Parameter Selection
	0	None
	1	Phase A Current
	2	Phase B Current
	3	Phase C Current
	4	Average Phase Current
	5	AB Line Voltage
	6	BC Line Voltage
	7	CA Line Voltage

FORMAT CODE	TYPE	DEFINITION
	8	Average Line Voltage
	9	Phase AN Voltage
	10	Phase BN Voltage
	11	Phase CN Voltage
	12	Average Phase Voltage
	13	Hottest Stator RTD
	14	Hottest Bearing RTD
	15	Ambient RTD
	16	RTD #1
	17	RTD #2
	18	RTD #3
	19	RTD #4
	20	RTD #5
	21	RTD #6
	22	RTD #7
	23	RTD #8
	24	RTD #9
	25	RTD #10
	26	RTD #11
	27	RTD #12
	28	Power Factor
	29	Reactive Power
	30	Real Power (kW)
	31	Apparent Power
	32	Thermal Capacity Used
	33	Relay Lockout Time
	34	Current Demand
	35	kvar Demand
	36	kW Demand
	37	kVA Demand
	38	Motor Load
	39	Analog Input 1
	40	Analog Input 2
	41	Analog Input 3
	42	Analog Input 4
	43	Tachometer
	44	MWhrs
	45	Analog In Diff 1-2
	46	Analog In Diff 3-4
FC128	Unsigned 16 bit integer	Protection Curve Style Selection
	0	Standard
	1	Custom
	2	Voltage Dependent
FC129	Unsigned 16 bit integer	Analog Input Selection
	0	Disabled
	1	4-20 mA
	2	0-20 mA
	3	0-1 mA
FC130	Unsigned 16 bit integer	Pickup Type
	0	Over
	1	Under
FC131	Unsigned 16 bit integer	Input Switch Status
	0	Open
	1	Shorted
FC132	Unsigned 16 bit integer	Trip Coil Supervision Status

FORMAT CODE	TYPE	DEFINITION
	0	No Coil
	1	Coil
FC133	Unsigned 16 bit integer	Motor Status
	0	Stopped
	1	Starting
	2	Running
	3	Overloaded
	4	Tripped
FC134	Unsigned 16 bit integer	Cause of Event / Cause of Last Trip (up to 45)
	0	No Event / No Trip To Date
	1	Incomplete Sequence Trip
	2	Remote Trip
	3	Speed Switch Trip
	4	Load Shed Trip
	5	Pressure Sw. Trip
	6	Vibration Sw. Trip
	7	Tachometer Trip
	8	General Sw. A Trip
	9	General Sw. B Trip
	10	General Sw. C Trip
	11	General Sw. D Trip
	12	Overload Trip
	13	Short Circuit Trip
	14	Short Circuit Backup
	15	Mechanical Jam Trip
	16	Undercurrent Trip
	17	Current U/B Trip
	18	Ground Fault Trip
	19	Ground Fault Backup
	20	Differential Trip
	21	Acceleration Trip
	22	RTD 1 Trip
	23	RTD 2 Trip
	24	RTD 3 Trip
	25	RTD 4 Trip
	26	RTD 5 Trip
	27	RTD 6 Trip
	28	RTD 7 Trip
	29	RTD 8 Trip
	30	RTD 9 Trip
	31	RTD 10 Trip
	32	RTD 11 Trip
	33	RTD 12 Trip
	34	Undervoltage Trip
	35	Overvoltage Trip
	36	Phase Reversal Trip
	37	Volt. Frequency Trip
	38	Power Factor Trip
	39	Reactive Power Trip
	40	Underpower Trip
	41	Analog I/P 1 Trip
	42	Analog I/P 2 Trip
	43	Analog I/P 3 Trip
	44	Analog I/P 4 Trip
	45	Single Phasing Trip
	48	Analog Differential 1-2 Trip

FORMAT CODE	TYPE	DEFINITION
	49	Analog Differential 3-4 Trip
	51	Remote Alarm
	52	Pressure Sw. Alarm
	53	Vibration Sw. Alarm
	54	Counter Alarm
	55	Tachometer Alarm
	56	General Sw. A Alarm
	57	General Sw. B Alarm
	58	General Sw. C Alarm
	59	General Sw. D Alarm
	60	Thermal Model Alarm
	61	Overload Alarm
	62	Undercurrent Alarm
	63	Current U/B Alarm
	64	Ground Fault Alarm
	65	RTD 1 Alarm
	66	RTD 2 Alarm
	67	RTD 3 Alarm
	68	RTD 4 Alarm
	69	RTD 5 Alarm
	70	RTD 6 Alarm
	71	RTD 7 Alarm
	72	RTD 8 Alarm
	73	RTD 9 Alarm
	74	RTD 10 Alarm
	75	RTD 11 Alarm
	76	RTD 12 Alarm
	77	Open RTD Alarm
	78	Short/Low RTD Alarm
	79	Undervoltage Alarm
	80	Overvoltage Alarm
	81	Volt. Frequency Alarm
	82	Power Factor Alarm
	83	Reactive Power Alarm
	84	Underpower Alarm
	85	Trip Counter Alarm
	86	Starter Failed Alarm
	87	Current Demand Alarm
	88	kW Demand Alarm
	89	kvar Demand Alarm
	90	kVA Demand Alarm
	91	Broken Rotor Bar
	92	Analog I/P 1 Alarm
	93	Analog I/P 2 Alarm
	94	Analog I/P 3 Alarm
	95	Analog I/P 4 Alarm
	98	Analog Differential 1-2 Alarm
	99	Analog Differential 3-4 Alarm
	101	Service Alarm
	102	Control Power Lost
	103	Cont. Power Applied
	104	Emergency Rst. Close
	105	Emergency Rst. Open
	106	Start While Blocked
	107	Relay Not Inserted
	108	Trip Coil Super.
	109	Breaker Failure

FORMAT CODE	TYPE	DEFINITION
	110	Welded Contactor
	111	Simulation Started
	112	Simulation Stopped
	118	Digital Trace Trigger
	119	Serial Trace Trigger
	120	RTD 1 High Alarm
	121	RTD 2 High Alarm
	122	RTD 3 High Alarm
	123	RTD 4 High Alarm
	124	RTD 5 High Alarm
	125	RTD 6 High Alarm
	126	RTD 7 High Alarm
	127	RTD 8 High Alarm
	128	RTD 9 High Alarm
	129	RTD 10 High Alarm
	130	RTD 11 High Alarm
	131	RTD 12 High Alarm
FC135	Unsigned 16 bit integer	Motor Speed
	0	Low Speed (Speed 1)
	1	High Speed (Speed 2)
FC136	Unsigned 16 bit integer	Order Code
	Bit 0	0 - Code P5 (5A phase CT), 1 - Code P1 (1A phase CT)
	Bit 1	0 - Code HI (High Voltage Power Supply), 1 - Code LO (Low Voltage Power Supply)
	Bit 2	0 - Code A20 (4-20 mA Analog Outputs), 1 - Code A1 (0-1 mA Analog Outputs)
FC137	Unsigned 16 bit integer	Control Relays for Reduced Voltage Starting
	0	Auxiliary 2
	1	Auxiliary 2 & Auxiliary 3
	2	Auxiliary 3
FC138	Unsigned 16 bit integer	Simulation Mode
	0	Off
	1	Simulate Pre-Fault
	2	Simulate Fault
	3	Pre-Fault to Fault
FC139	Unsigned 16 bit integer	Force Operation of Relays
	0	Disabled
	1	R1 Trip
	2	R2 Auxiliary
	3	R3 Auxiliary
	4	R4 Alarm
	5	R5 Block Start
	6	R6 Service
	7	All Relays
	8	No Relays
FC140	Unsigned 16 bit integer	General Status
	bit 0	Relay in Service
	bit 1	Active Trip Condition
	bit 2	Active Alarm Condition
	bit 3	Reserved
	bit 4	Reserved
	bit 5	Reserved
	bit 6	Reserved

FORMAT CODE	TYPE	DEFINITION
	bit 7	Reserved
	bit 8	Motor Stopped
	bit 9	Motor Starting
	bit 10	Motor Running
	bit 11	Overload Pickup
	bit 12	Unbalance Pickup
	bit 13	Ground Pickup
	bit 14	Hot RTD
	bit 15	Loss of Load
FC141	Unsigned 16 bit integer	Output Relay Status
	bit 0	R1 Trip
	bit 1	R2 Auxiliary
	bit 2	R3 Auxiliary
	bit 3	R4 Alarm
	bit 4	R5 Block Start
	bit 5	R6 Service
	bit 6 – bit 15	Not Used
FC142	Unsigned 16 bit integer	Trip Coil Supervision Selection
	0	Disabled
	1	S2 Close
	2	S2 Open/Close
FC143	Unsigned 16 bit integer	Single VT Selection
	0	Off
	1	AN (Wye) AB (Delta)
	2	BN (Wye) BC (Delta)
	3	CN (Wye) N/A (Delta)
FC144	Unsigned 16 bit integer	Pulsed Output Relay Selection
	0	Off
	1	Auxiliary2
	2	Auxiliary3
	3	Alarm
FC145	Unsigned 16 bit integer	Analog In Differential Comparison
	0	% Difference
	1	Absolute Difference
FC146	Unsigned 16 bit integer	Analog In Differential Logic
	0	1>2 (or 3>4)
	1	2>1 (or 4>3)
	2	1<>2 (or 3<>4)
FC147	Unsigned 16 bit integer	Analog In Differential Active When
	0	Always
	1	Start/Run
FC148	Unsigned 16 bit integer	Torque Display Units
	0	Newton-meter
	1	Foot-pound

The purpose of this testing description is to demonstrate the procedures necessary to perform a complete functional test of all the SR469 hardware while also testing firmware/hardware interaction in the process. Since the SR469 is packaged in a drawout case, a demo case (metal carry case in which an SR469 may be mounted) may be useful for creating a portable test set. Testing of the relay during commissioning using a primary injection test set will ensure that CTs and wiring are correct and complete.

7.1.1 SECONDARY INJECTION TEST SETUP

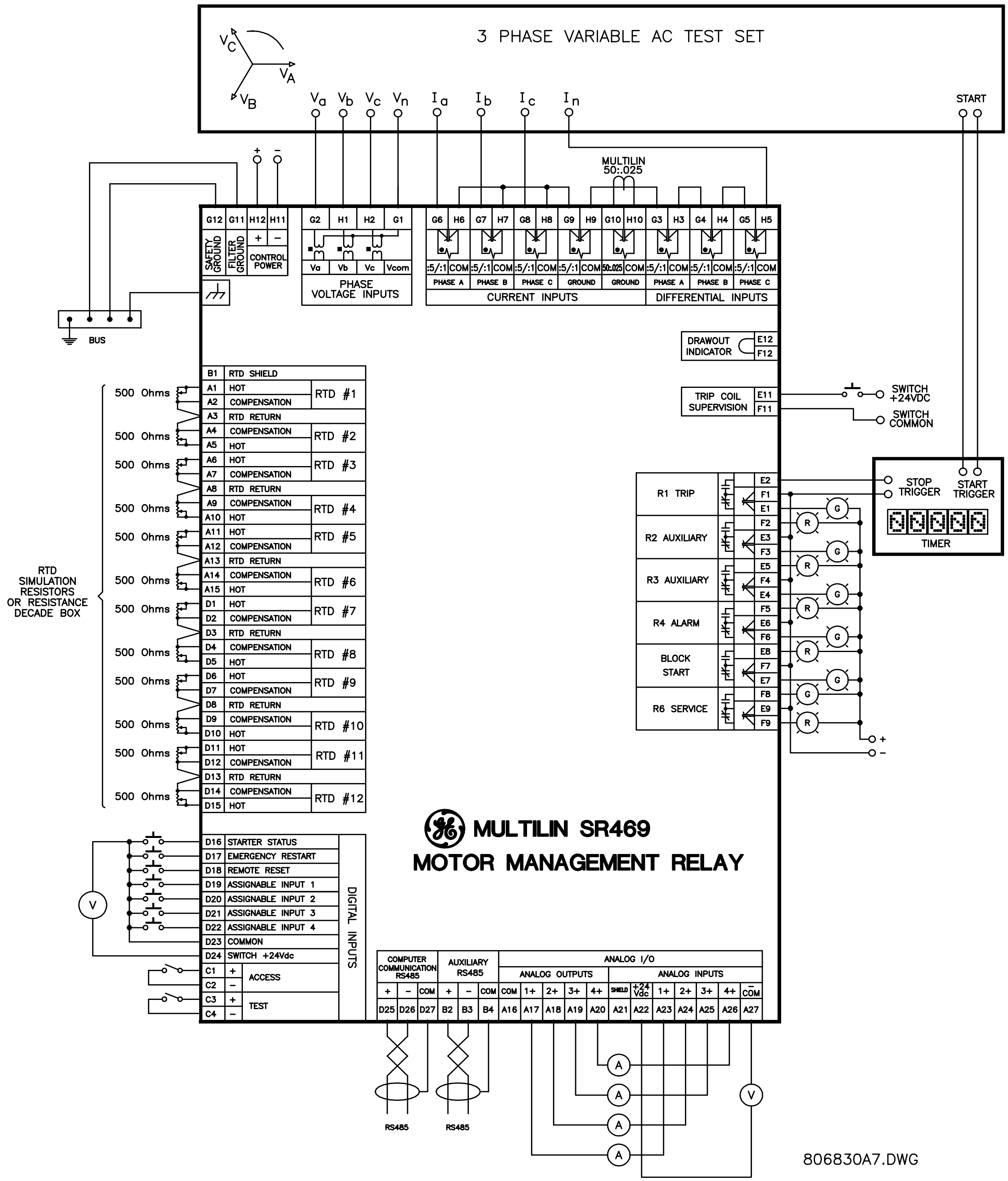


Figure 7-1 SECONDARY INJECTION TEST SETUP

7.2.1 PHASE CURRENT ACCURACY TEST

The SR469 specification for phase current accuracy is ±0.5% of 2xCT when the injected current is < 2xCT. Perform the steps below to verify accuracy.

1. Alter the following setpoint:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE CT PRIMARY: 1000A

2. Measured values should be ±10A. Inject the values shown in the table below and verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING

Table 7-1 PHASE CURRENT TEST

INJECTED CURRENT 1 A UNIT (A)	INJECTED CURRENT 5 A UNIT (A)	EXPECTED CURRENT READING (A)	MEASURED CURRENT PHASE A (A)	MEASURED CURRENT PHASE B (A)	MEASURED CURRENT PHASE C (A)
0.1	0.5	100			
0.2	1.0	200			
0.5	2.5	500			
1	5	1000			
1.5	7.5	1500			
2	10	2000			

7.2.2 VOLTAGE INPUT ACCURACY TEST

The SR469 specification for voltage input accuracy is ±0.5% of full scale(273V). Perform the steps below to verify accuracy.

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\VOLTAGE SENSING\VT CONNECTION TYPE: Wye
   SETPOINT S2:SYSTEM SETUP\VOLTAGE SENSING\VOLTAGE TRANSFORMER RATIO: 10.00:1

2. Measured values should be ±13.65V. Apply the voltage values shown in the table and verify accuracy of the measured values. View the measured values in:
3.
   ACTUAL VALUES A2:\METERING DATA\VOLTAGE METERING

Table 7-2 VOLTAGE INPUT TEST

APPLIED LINE-NEUTRAL VOLTAGE (V)	EXPECTED VOLTAGE READING (V)	MEASURED VOLTAGE A-N (V)	MEASURED VOLTAGE B-N (V)	MEASURED VOLTAGE C-N (V)
30	300			
50	500			
100	1000			
150	1500			
200	2000			
270	2700			

7.2.3 GROUND (1A/5A) AND DIFFERENTIAL ACCURACY TEST

The SR469 specification for differential current and 1A/5A ground current input accuracy is ±0.5% of 1xCT for the 5A input and 0.5% of 5xCT for the 1A input. Perform the steps below to verify accuracy.

5A INPUT

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\GROUND CT: 5A Secondary
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\GROUND CT PRIMARY: 1000 A
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE DIFFERENTIAL CT: 5A Secondary
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE DIFFERENTIAL CT PRIMARY: 1000 A

2. Measured values should be ±5A. Inject the values shown in the table below into one phase only and verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING

Table 7-3 DIFFERENTIAL AND GROUND CURRENT TEST (5A)

INJECTED CURRENT 5 A UNIT (A)	EXPECTED CURRENT READING (A)	MEASURED GROUND CURRENT (A)	MEASURED DIFFERENTIAL CURRENT PHASE A (A)	MEASURED DIFFERENTIAL CURRENT PHASE B (A)	MEASURED DIFFERENTIAL CURRENT PHASE C (A)
0.5	100				
1.0	200				
2.5	500				
5	1000				

1A INPUT

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\GROUND CT: 1A Secondary
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\GROUND CT PRIMARY: 1000 A
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE DIFFERENTIAL CT: 1A Secondary
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE DIFFERENTIAL CT PRIMARY: 1000 A

2. Measured values should be ±25A. Inject the values shown in the table below into one phase only and verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING

Table 7-4 DIFFERENTIAL AND GROUND CURRENT TEST (1A)

INJECTED CURRENT 1 A UNIT (A)	EXPECTED CURRENT READING (A)	MEASURED GROUND CURRENT (A)	MEASURED DIFFERENTIAL CURRENT PHASE A (A)	MEASURED DIFFERENTIAL CURRENT PHASE B (A)	MEASURED DIFFERENTIAL CURRENT PHASE C (A)
0.1	100				
0.2	200				
0.5	500				
1	1000				

7.2.4 MULTILIN 50:0.025 GROUND ACCURACY TEST

The SR469 specification for Multilin 50:0.025 ground current input accuracy is ±0.5% of CT rated primary (25A). Perform the steps below to verify accuracy.

1. Alter the following setpoint:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\GROUND CT: MULTILIN 50:0.025

2. Measured values should be ±0.125A. Inject the values shown in the table below either as primary values into a Multilin 50:0.025 Core Balance CT or as secondary values that simulate the core balance CT. Verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING

Table 7-5 MULTILIN 50:0.025 GROUND CURRENT TEST

PRIMARY INJECTED CURRENT 50:0.025 CT (A)	SECONDARY INJECTED CURRENT (mA)	EXPECTED CURRENT READING (A)	MEASURED GROUND CURRENT (A)
0.25	0.125	0.25	
1	0.5	1.00	
10	5	10.00	
25	12.5	25.00	

7.2.5 RTD ACCURACY TEST

The SR469 specification for RTD input accuracy is ±2°. Perform the steps below to verify accuracy.

1. alter the following setpoints:
   SETPOINT S8:RTD TEMPERATURE\RTD TYPE\STATOR RTD TYPE: 100 ohm Platinum
   (select desired type)
   SETPOINT S8:RTD TEMPERATURE\RTD #1\RTD #1 APPLICATION: Stator
   (repeat for RTDs 2-12)

2. Measured values should be ±2° C or ±4° F. Alter the resistances applied to the RTD inputs as per the table below to simulate RTDs and verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\TEMPERATURE

Table 7-6 RTD 100 OHM PLATINUM TEST

APPLIED RESISTANCE 100 OHM PLATINUM (ohm)	EXPECTED RTD TEMPERATURE READING (°C)	EXPECTED RTD TEMPERATURE READING (°F)	MEASURED RTD TEMPERATURE 4 SELECT ONE ____(°C) ____(°F)											
			1	2	3	4	5	6	7	8	9	10	11	12
80.31	-50	-58												
100.00	0	32												
119.39	50	122												
138.50	100	212												
157.32	150	302												
175.84	200	392												
194.08	250	482												

Table 7-7 RTD 120 OHM NICKEL TEST

APPLIED RESISTANCE 120 OHM NICKEL (ohm)	EXPECTED RTD TEMPERATURE READING (°C)	EXPECTED RTD TEMPERATURE READING (°F)	MEASURED RTD TEMPERATURE 4 SELECT ONE ____(°C) ____(°F)											
			1	2	3	4	5	6	7	8	9	10	11	12
86.17	-50	-58												
120.00	0	32												
157.74	50	122												
200.64	100	212												
248.95	150	302												
303.46	200	392												
366.53	250	482												

Table 7-8 RTD 100 OHM NICKEL TEST

APPLIED RESISTANCE 100 OHM NICKEL (ohm)	EXPECTED RTD TEMPERATURE READING (°C)	EXPECTED RTD TEMPERATURE READING (°F)	MEASURED RTD TEMPERATURE 4 SELECT ONE ____(°C) ____(°F)											
			1	2	3	4	5	6	7	8	9	10	11	12
71.81	-50	-58												
100.00	0	32												
131.45	50	122												
167.20	100	212												
207.45	150	302												
252.88	200	392												
305.44	250	482												

Table 7-9 RTD 10 OHM COPPER TEST

APPLIED RESISTANCE 10 OHM COPPER (ohm)	EXPECTED RTD TEMPERATURE READING (°C)	EXPECTED RTD TEMPERATURE READING (°F)	MEASURED RTD TEMPERATURE 4 SELECT ONE ____(°C) ____(°F)											
			1	2	3	4	5	6	7	8	9	10	11	12
7.10	-50	-58												
9.04	0	32												
10.97	50	122												
12.90	100	212												
14.83	150	302												
16.78	200	392												
18.73	250	482												

7.2.6 DIGITAL INPUTS AND TRIP COIL SUPERVISION

The digital inputs and trip coil supervision can be verified easily with a simple switch or pushbutton. Verify the SWITCH +24Vdc with a voltmeter. Perform the steps below to verify functionality of the digital inputs.

1. Open switches of all of the digital inputs and the trip coil supervision circuit.

2. View the status of the digital inputs and trip coil supervision in:
   ACTUAL VALUES A1:\STATUS\DIGITAL INPUTS

3. Close switches of all of the digital inputs and the trip coil supervision circuit.

4. View the status of the digital inputs and trip coil supervision in:
   ACTUAL VALUES A1:\STATUS\DIGITAL INPUTS

Table 7-10 DIGITAL INPUTS

INPUT	EXPECTED STATUS (SWITCH OPEN)	4 PASS 8 FAIL	EXPECTED STATUS (SWITCH CLOSED)	4 PASS 8 FAIL
ACCESS	Open		Shorted	
TEST	Open		Shorted	
STARTER STATUS	Open		Shorted	
EMERGENCY RESTART	Open		Shorted	
REMOTE RESET	Open		Shorted	
ASSIGNABLE INPUT 1	Open		Shorted	
ASSIGNABLE INPUT 2	Open		Shorted	
ASSIGNABLE INPUT 3	Open		Shorted	
ASSIGNABLE INPUT 4	Open		Shorted	
TRIP COIL SUPERVISION	No Coil		Coil	

7.2.7 ANALOG INPUTS AND OUTPUTS

The SR469 specification for analog input and analog output accuracy is ±1% of full scale. Perform the steps below to verify accuracy. Verify the Analog Input +24Vdc with a voltmeter.

4-20mA

1. alter the following setpoints:
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1: 4-20 mA
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1 MINIMUM:0
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1 MAXIMUM:1000
   (repeat for analog inputs 2-4)

2. Analog output values should be ±0.2mA on the ammeter. Measured analog input values should be ±10 units. Force the analog outputs using the following setpoints:
   SETPOINT S13:TESTING\TEST ANALOG OUTPUT\FORCE ANALOG OUTPUTS FUNCTION: Enabled
   SETPOINT S13:TESTING\TEST ANALOG OUTPUT\ANALOG OUTPUT 1 FORCED VALUE: 0 %
   (enter desired percent, repeat for analog outputs 2-4)

3. Verify the ammeter readings as well as the measured analog input readings. For the purposes of testing, the analog input is fed in from the analog output (see Figure 7-1). View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\ANALOG INPUTS

Table 7-11 ANALOG I/O TEST 4-20mA

ANALOG OUTPUT FORCE VALUE (%)	EXPECTED AMMETER READING (mA)	MEASURED AMMETER READING (mA)				EXPECTED ANALOG INPUT READING (Units)	MEASURED ANALOG INPUT READING (units)			
		1	2	3	4		1	2	3	4
0	4					0				
25	8					250				
50	12					500				
75	16					750				
100	20					1000				

0-1mA

1. alter the following setpoints:
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1: 0-1 mA
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1 MINIMUM:0
   SETPOINT S12:ANALOG I/O\ANALOG INPUT1\ANALOG INPUT1 MAXIMUM:1000
   (repeat for analog inputs 2-4)

2. Analog output values should be ±0.01mA on the ammeter. Measured analog input values should be ±10 units. Force the analog outputs using the following setpoints:
   SETPOINT S13:TESTING\TEST ANALOG OUTPUT\FORCE ANALOG OUTPUTS FUNCTION: Enabled
   SETPOINT S13:TESTING\TEST ANALOG OUTPUT\ANALOG OUTPUT 1 FORCED VALUE: 0 %
   (enter desired percent, repeats for analog output 2-4)

3. Verify the ammeter readings as well as the measured analog input readings. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\ANALOG INPUTS

Table 7-12 ANALOG I/O TEST 0-1mA

ANALOG OUTPUT FORCE VALUE (%)	EXPECTED AMMETER READING (mA)	MEASURED AMMETER READING (mA)				EXPECTED ANALOG INPUT READING (mA)	MEASURED ANALOG INPUT READING (units)			
		1	2	3	4		1	2	3	4
0	0					0				
25	0.25					250				
50	0.50					500				
75	0.75					750				
100	1.00					1000				

7.2.8 OUTPUT RELAYS

To verify the functionality of the output relays, perform the following steps:

1. Using the setpoint:
   SETPOINT S13:TESTING\TEST OUTPUT RELAYS\FORCE OPERATION OF RELAYS: R1 TRIP
   select and store values as per the table below, verifying operation

Table 7-13 OUTPUT RELAYS

FORCE OPERATION SETPOINT	EXPECTED MEASUREMENT 4 for SHORT												ACTUAL MEASUREMENT 4 for SHORT											
	R1		R2		R3		R4		R5		R6		R1		R2		R3		R4		R5		R6	
	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc
R1 Trip	4			4		4		4		4	4													
R2 Auxiliary		4	4			4		4		4	4													
R3 Auxiliary		4		4	4			4		4	4													
R4 Alarm		4		4		4	4			4	4													
R5 Block Start		4		4		4		4	4		4													
R6 Service		4		4		4		4		4		4												
All Relays	4		4		4		4		4			4												
No Relays		4		4		4		4		4	4													

NOTE: R6 Service relay is failsafe or energized normally, operating R6 causes it to de-energize.

7.3.1 OVERLOAD CURVE TEST

The SR469 specification for overload curve timing accuracy is ±100ms or ±2% of time to trip. Pickup accuracy is as per the current inputs (±0.5% of 2xCT when the injected current is < 2xCT and ±1% of 20xCT when the injected current is ≥ 2xCT). Perform the steps below to verify accuracy.

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE CT PRIMARY: 1000
   SETPOINT S2:SYSTEM SETUP\ CURRENT SENSING \MOTOR FULL LOAD AMPS FLA: 1000
   SETPOINT S5 THERMAL MODEL\THERMAL MODEL\SELECT CURVE STYLE: Standard
   SETPOINT S5 THERMAL MODEL\THERMAL MODEL\OVERLOAD PICKUP LEVEL: 1.10
   SETPOINT S5 THERMAL MODEL\THERMAL MODEL\UNBALANCE BIAS K FACTOR: 0
   SETPOINT S5 THERMAL MODEL\THERMAL MODEL\HOT/COLD SAFE STALL RATIO: 1.00
   SETPOINT S5 THERMAL MODEL\THERMAL MODEL\ENABLE RTD BIASING: No
   SETPOINT S5 THERMAL MODEL\O/L CURVE SETUP\STANDARD OVERLOAD CURVE NUMBER: 4

2. Any trip must be reset prior to each test. Short the emergency restart terminals momentarily immediately prior to each overload curve test to ensure that the thermal capacity used is zero. Failure to do so will result in shorter trip times. Inject the current of the proper amplitude to obtain the values as shown and verify the trip times. Motor load may be viewed in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING
   Thermal capacity used and estimated time to trip may be viewed in:
   ACTUAL VALUES A1:\STATUS\MOTOR STATUS

Table 7-14 OVERLOAD TEST (STANDARD CURVE #4)

AVERAGE PHASE CURRENT DISPLAYED (A)	PICKUP LEVEL	EXPECTED TIME TO TRIP (s)	TOLERANCE RANGE (s)	MEASURED TIME TO TRIP (s)
1050	1.05	never	n/a	
1200	1.20	795.44	779.53-811.35	
1750	1.75	169.66	166.27-173.05	
3000	3.00	43.73	42.86-44.60	
6000	6.00	9.99	9.79-10.19	
10000	10.00	5.55	5.44-5.66	

7.3.2 POWER MEASUREMENT TEST

The SR469 specification for reactive and apparent power is ± 1% of √3x2xCTxVTxVT full scale @ Iavg <2xCT. Perform the steps below to verify accuracy.

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE CT PRIMARY: 1000
   SETPOINT S2:SYSTEM SETUP\VOLTAGE SENSING\VT CONNECTION TYPE: Wye
   SETPOINT S2:SYSTEM SETUP\VOLTAGE SENSING\VOLTAGE TRANSFORMER RATIO: 10.00:1

2. Inject current and apply voltage as per the table below. Verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\POWER METERING

Table 7-15 POWER MEASUREMENT TEST

INJECTED CURRENT 1A UNIT, APPLIED VOLTAGE (Ia is reference vector)	INJECTED CURRENT 5A UNIT, APPLIED VOLTAGE (Ia is reference vector)	EXPECTED LEVEL OF POWER QUANTITY	TOLERANCE RANGE OF POWER QUANTITY	MEASURED POWER QUANTITY	EXPECTED POWER FACTOR	MEASURED POWER FACTOR
Ia=1A ∠0° Ib=1A ∠120° Ic=1A ∠240° Va=120V ∠342° Vb=120V ∠102° Vc=120V ∠222°	Ia=5A ∠0° Ib=5A ∠120° Ic=5A ∠240° Va=120V ∠342° Vb=120V ∠102° Vc=120V ∠222°	+ 3424 kW	3329-3519 kW		0.95 lag	
Ia=1A ∠0° Ib=1A ∠120° Ic=1A ∠240° Va=120V ∠288° Vb=120V ∠48° Vc=120V ∠168°	Ia=5A ∠0° Ib=5A ∠120° Ic=5A ∠240° Va=120V ∠288° Vb=120V ∠48° Vc=120V ∠168°	+ 3424 kvar	3329-3519 kvar		0.31 lag	

7.3.3 UNBALANCE TEST

The SR469 measures the ratio of negative sequence current (I_2) to positive sequence current (I_1). This value as a percent is used as the unbalance level when motor load exceeds FLA. When the average phase current is below FLA, the unbalance value is derated to prevent nuisance tripping as positive sequence current is much smaller and negative sequence current remains relatively constant. A sample calculation is given below.

The derating formula is: $\left|\frac{I_2}{I_1}\right| \times \frac{\text{Iavg}}{\text{FLA}}\ \text{x}100\%$

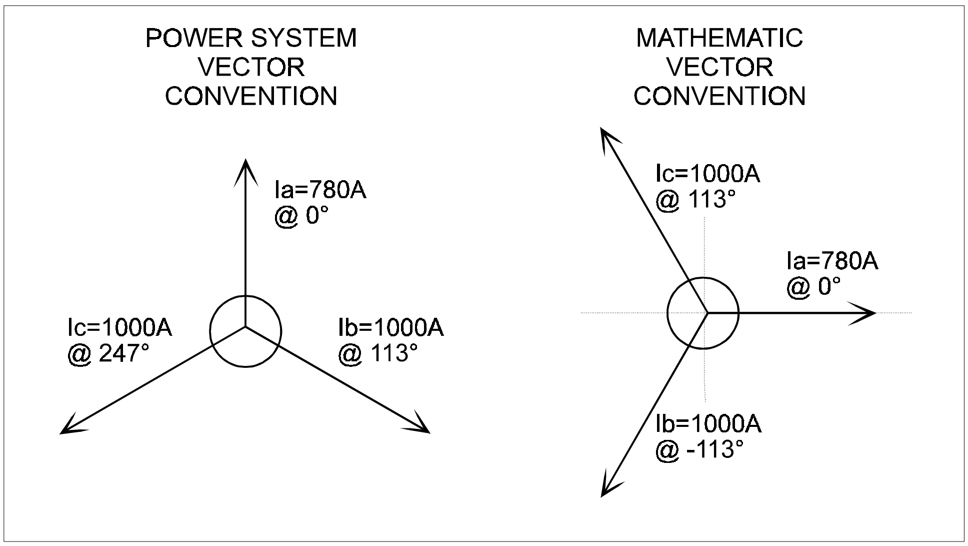


Figure 7-2 THREE PHASE EXAMPLE FOR UNBALANCE CALCULATION

Symmetrical component analysis of vectors using the mathematic vector convention yields a ratio of negative sequence current to positive sequence current as shown:

$$\frac{I_2}{I_1} = \frac{\frac{1}{3}(I_a + a^2 I_b + aI_c)}{\frac{1}{3}(I_a + aI_b + a^2 I_c)} \quad \text{where } a = 1\angle 120° = -0.5 + j0.866$$

$$\frac{I_2}{I_1} = \frac{780\angle 0° + (1\angle 120°)^2(1000\angle -113°) + (1\angle 120°)(1000\angle 113°)}{780\angle 0° + (1\angle 120°)(1000\angle -113°) + (1\angle 120°)^2(1000\angle 113°)}$$

$$\frac{I_2}{I_1} = \frac{780\angle 0° + 1000\angle 127° + 1000\angle 233°}{780\angle 0° + 1000\angle 7° + 1000\angle 353°)}$$

$$\frac{I_2}{I_1} = \frac{780 - 6018 + j798.6 + -6018 - j798.6}{780 + 992.5 + j1219 + 992.5 - j1219}$$

$$\frac{I_2}{I_1} = \frac{-423.6}{2765}$$

$$\frac{I_2}{I_1} = -0.1532$$

if, FLA=1000

$$\text{Iavg} = \frac{780\text{A} + 1000\text{A} + 1000\text{A}}{3} = 926.7\text{A}$$

and since, (Iavg =926.7A) < (FLA=1000)

$$\text{SR469 UNBALANCE} = \left|-0.1532\right| \times \frac{926.7}{1000}\ \text{x}100\% = 14.2\%$$

The SR469 specification for unbalance accuracy is ±2%. Perform the steps below to verify accuracy.

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE CT PRIMARY: 1000A
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\MOTOR FULL LOAD AMPS FLA: 1000A

2. Inject the values shown in the table below and verify accuracy of the measured values. View the measured values in:
   ACTUAL VALUES A2:\METERING DATA\CURRENT METERING

Table 7-16 CURRENT UNBALANCE TEST

INJECTED CURRENT 1A UNIT (A)	INJECTED CURRENT 5A UNIT (A)	EXPECTED UNBALANCE LEVEL (%)	MEASURED UNBALANCE LEVEL (%)
Ia= 0.78 ∠0° Ib=1 ∠247° Ic=1 ∠113°	Ia= 3.9 ∠0° Ib=5 ∠247° Ic=5 ∠113°	14	
Ia=1.56 ∠0° Ib=2 ∠247° Ic=2 ∠113°	Ia=7.8 ∠0° Ib=10 ∠247° Ic=10 ∠113°	15	
Ia= 0.39 ∠0° Ib=0.5 ∠247° Ic=0.5 ∠113°	Ia= 1.95 ∠0° Ib=2.5 ∠247° Ic=2.5 ∠113°	7	

7.3.4 VOLTAGE PHASE REVERSAL TEST

The SR469 can detect voltage phase rotation and protect against phase reversal. To test the phase reversal element, perform the following steps:

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\VOLTAGE SENSING\VT CONNECTION TYPE: Wye or Delta
   SETPOINT S2:SYSTEM SETUP\POWER SYSTEM\SYSTEM PHASE SEQUENCE: ABC
   SETPOINT S9:VOLTAGE ELEMENTS\PHASE REVERSAL\PHASE REVERSAL TRIP: Latched
   SETPOINT S9:VOLTAGE ELEMENTS\PHASE REVERSAL\ASSIGN TRIP RELAYS: Trip

2. Apply voltages as per the table below. Verify the SR469 operation on voltage phase reversal.

Table 7-17 VOLTAGE PHASE REVERSAL TEST

APPLIED VOLTAGE	EXPECTED RESULT 8 NO TRIP 4 PHASE REVERSAL TRIP	OBSERVED RESULT 8 NO TRIP 4 PHASE REVERSAL TRIP
Va=120V ∠0° Vb=120V ∠120° Vc=120V ∠240°	8	
Va=120V ∠0° Vb=120V ∠240° Vc=120V ∠120°	4	

7.3.5 SHORT CIRCUIT TEST

The SR469 specification for short circuit timing is +40ms or ±0.5% of total time. The pickup accuracy is as per the phase current inputs. Perform the steps below to verify the performance of the short circuit element.

1. Alter the following setpoints:
   SETPOINT S2:SYSTEM SETUP\CURRENT SENSING\PHASE CT PRIMARY: 1000
   SETPOINT S6:CURRENT ELEMENTS\SHORT CIRCUIT TRIP\SHORT CIRCUIT TRIP: On
   SETPOINT S6:CURRENT ELEMENTS\SHORT CIRCUIT TRIP\ASSIGN TRIP RELAYS: Trip
   SETPOINT S6:CURRENT ELEMENTS\SHORT CIRCUIT TRIP\SHORT CIRCUIT TRIP PICKUP: 5.0 x CT
   SETPOINT S6:CURRENT ELEMENTS\SHORT CIRCUIT TRIP\INTENTIONAL S/C DELAY: 0

2. Inject current as per the table below, resetting the unit after each trip by pressing the [RESET] key, and verify timing accuracy. Pre-trip values may be viewed by pressing the [NEXT] after each trip.

Table 7-18 SHORT CIRCUIT TIMING

INJECTED CURRENT 5A UNIT (A)	INJECTED CURRENT 1A UNIT (A)	EXPECTED TIME TO TRIP (ms)	MEASURED TIME TO TRIP (ms)
30	6	<40	
40	8	<40	
50	10	<40	

This document provides all the necessary information to install and/or upgrade a previous installation of the 469PC Program, upgrade the relay firmware and write/edit setpoint files. It should be noted that the 469PC program should only be used with firmware versions 30D**220**A4.000, 30D**220**A8.000, 30D251A8.000 or later releases.

The 469 PC Program is *not* compatible with Mods or any firmware versions prior to 220, and could cause errors if setpoints are edited. It can however be used to upgrade older versions of relay firmware. When doing this however all previously programmed setpoints will be erased and should be saved to a file for reprogramming with the new Firmware.

The following sections are included in this document:

- System requirements
- 469PC program version for previous installation check
- 469PC program installation/upgrade procedure
- 469PC program system configuration
- Relay firmware upgrade procedure
- Creating/Editing/Upgrading/Downloading Setpoint Files
- Printing Setpoints and Actual Values
- Using Trending and Waveform Capture
- Viewing Phasors and Event Record
- Troubleshooting

8.1 INSTALLATION/UPGRADE

The following minimum requirements must be met for the 469PC Program to properly operate on a computer.

Processor:	minimum 486, Pentium recommended
Memory:	minimum 4 Mb, 16 Mb recommended minimum 540 K of conventional memory
Hard Drive:	20 Mb free space required before installation of PC program.
O/S:	Windows 3.1, Windows 3.11 for Workgroup, Windows NT, or Windows 95

Windows 3.1 Users must ensure that **SHARE.EXE** is installed.

If a version of the 469PC Program is currently installed, note the path and directory name as this information will be needed when upgrading.

How to check if a currently installed version of 469PC program needs upgrading:

1. Run 469PC program
2. Select **Help**
3. Select **About 469PC**
4. Compare version number located here with one on installation disks.
5. If number here is lower, program needs upgrading.

Figure 8-1 CHECKING PROGRAM VERSION

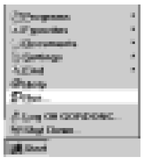
Installation/Upgrading the 469PC program:

START WINDOWS™

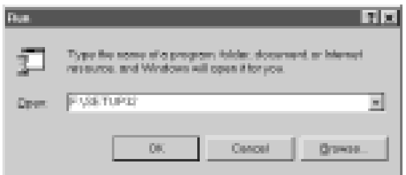
1.

INSERT PRODUCT CD INTO CD-ROM DRIVE

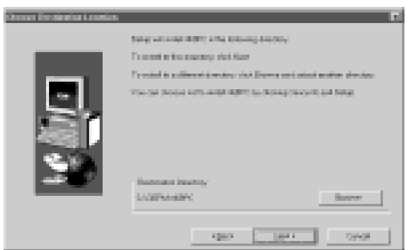
2. Under Windows 95, when the CD is inserted in the drive, it should launch automatically. If not, or if you are running Windows 3.x, continue with step 3. Otherwise, skip to step 6.



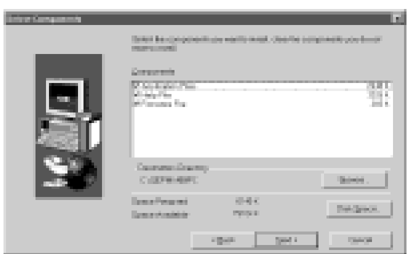
3. From **Program Manager** (Win 3.x) or **Start Menu** (Win 95), select **Run**.



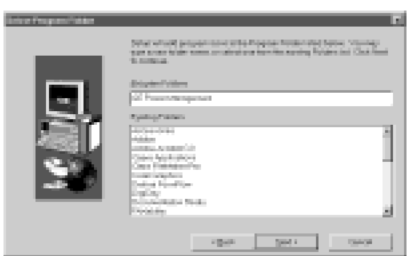
4. Type in the CD-ROM drive letter (usually D or E) and the filename as shown, e.g. *D:\SETUP32* (or *D:\SETUP16* for Windows 3.x).
5. Select **OK** to begin installation.
6. From the Product CD Main Menu that appears, select "**Install PC Software**", then select "**469PC**".
7. A dialog box will prompt for confirmation. Click on **Yes** if you wish to continue with the installation of **469PC**.



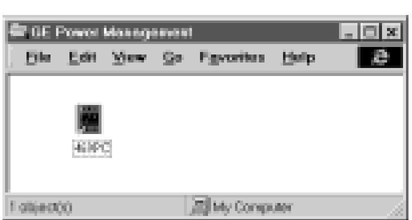
8. After a few seconds of initializing the Setup program, a Welcome screen will appear. Click on the "**Next >**" button. If the program is not to be located in the default directory (C:\GEPM\469PC), click on the **Browse** button to locate the path where you wish to install the program.
9. If the program already exists and is to be upgraded, choose the path of the current installation if not the same as the default path.
10. Select "**Next >**" to continue to the next step.
11. Choose your installation preference, Typical, Compact, or Custom. If you choose Custom, the following screen will appear:



12. Select the option(s) you wish to install, then click "**Next >**" to continue.



13. Choose the name of the program group where 469PC is to be installed. By default this is set to "GE Power Management". Select "**Next >**". When installation is complete a group will be created in the **Program Manager** or **Explorer** if not already present containing the 469PC icon.



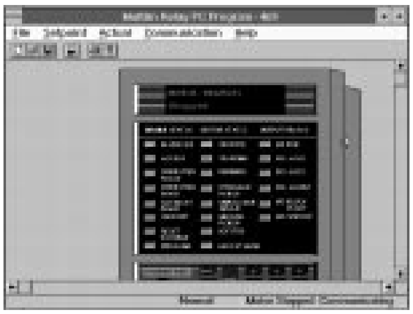
14. **GE Power Management** group located in **Program Manager/Explorer** containing all PC program icons.

Figure 8-2 INSTALLATION/UPGRADE

8.2 CONFIGURATION

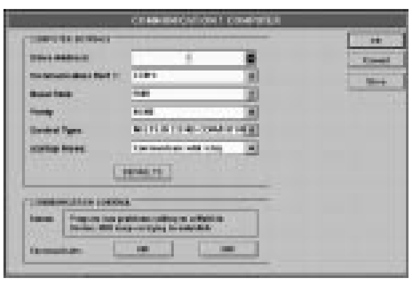
Connect the computer running the 469PC program to the relay via one of the RS485 ports (see manual section 2.2.13) or directly via the RS232 front port.

- Double click on the SR469 icon inside the Multilin group.



- Once the 469PC program starts to operate it will attempt to communicate with the relay. If communications are established the relay shown on the display will display the same information as displayed by the actual relay.
- LED status and display message shown will match actual relays if communications is established.

- If the 469PC program cannot establish communications with the relay, this message will appear.
- Select **Yes** to edit the communication settings for the 469PC program.

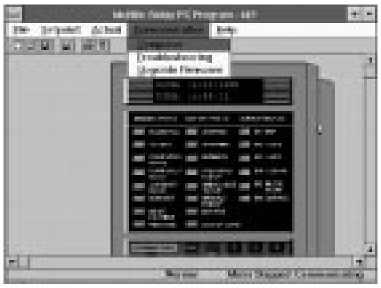


- Set **Slave Address** to match that programmed into relay.
- Set **Communication Port#** to the computer port connected to the relay.
- Set **Baud Rate** and **Parity** to match that programmed into relay.
- Set **Control Type** to type used.
- Select **ON** to enable communications with new settings.

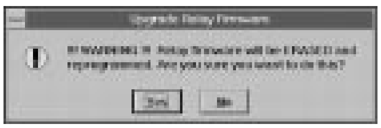
Figure 8-3 CONFIGURATION

8.3 UPGRADING RELAY FIRMWARE

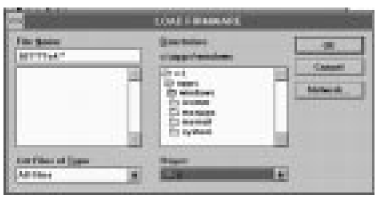
1. To upgrade relay firmware connect a computer to the SR469 ***via the front RS232 port***. Then run the 469PC program and establish communications with the relay. Next follow the steps listed below.



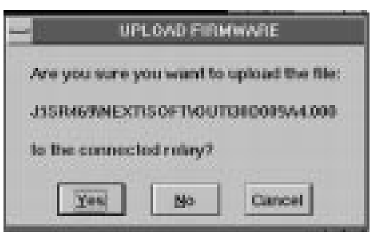
2. Select **Upgrade Firmware** from the **Communication** menu.



3. Select **Yes** to proceed or **No** to abort.
- Remember all previously programmed setpoints will be erased.

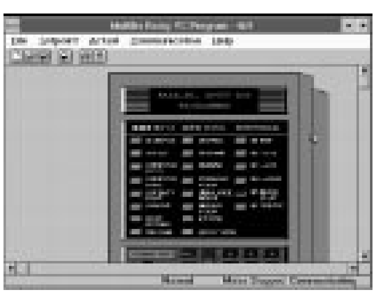


4. Locate the firmware file to load into the relay.
5. Select **OK** to proceed or **Cancel** to abort.



6. Select **Yes** to proceed, **No** to load a different file or **Cancel** to abort the process.

- The program will automatically put the relay into upload mode and then begin loading the file selected.



- When loading is complete the relay will not be in service and will require programming.
- To communicate with the relay via the RS485 ports, Slave Address, Baud Rate and Parity may have to be manually programmed.

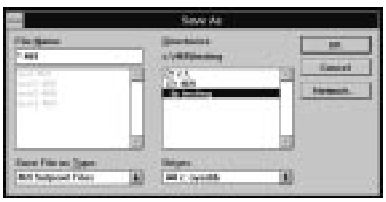
Figure 8-4 UPGRADING RELAY FIRMWARE

8.4 CREATING A NEW SETPOINT FILE

1. To create a new Setpoint file, run the 469PC Program. It is not necessary to have a SR469 connected to the computer. The 469PC status bar will indicate that the program is in “Polling Relay” mode and “Not Communicating”

2. Select **Setpoints** from the menu and choose the appropriate section of setpoints to program, e.g. **System Setup** and enter the new setpoints. When you are finished programming a page, select **OK** and store the information to the computer’s scratchpad memory (note: this action does store the information as a file on a disk)

3. Repeat step 2. until all the desired setpoints are programmed.



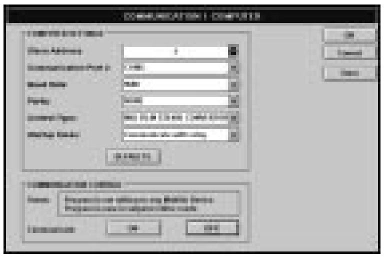
5. Select **File**, **Save As** to store this file to disk. Enter the location and file name of the setpoint file with a file extension of ‘**.469**’ and select **OK.**

- The file is now saved to disk. See section 8.6 for downloading this setpoint file to the SR469 relay.

Figure 8-5 CREATING A NEW SETPOINT FILE

8.5 EDITING A SETPOINT FILE

1. To edit an existing Setpoint file, run the 469 PC program and establish communications with the connected relay via the front panel RS232 port. The 469PC status bar should indicate "Communicating"



2. Select **Communication**, **Computer** from the menu, and select **Off** and **OK** to turn off computer communications with the relay and place the PC program in "Editing File" mode.

3. Select **Setpoints** from the menu and choose the appropriate section of setpoints to program, e.g. **SR469 Setup** and enter any new setpoints. When you are finished programming a page, select **OK** and store the information to the computer's scratchpad memory (note this action does store the information as a file on a disk).

4. Repeat step 3. until all the desired setpoints are programmed.

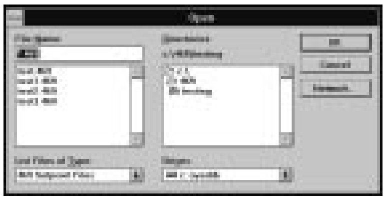
5. Select **File**, **Save As** to store this file to disk. Enter the location and file name of the setpoint file with a file extension of '**.469**'

- The file is now saved to disk, see section 8.6 for downloading this setpoint file to the SR469 relay.

Figure 8-6 Editing A Setpoint File

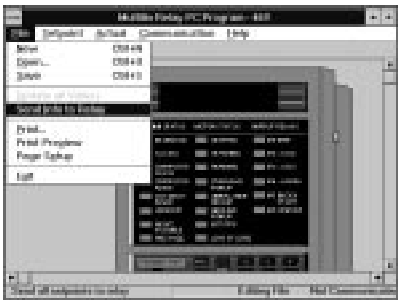
8.6 DOWNLOADING A SETPOINT FILE TO THE SR469

1. To download a preprogrammed setpoint file (See Section 8.4, 8.5) to the SR469 Relay, run the 469 PC program and establish communications with the connected relay via the front panel RS232 port.



2. Select **File**, **Open** from the menu on the 469PC program.
3. Locate the setpoint file to be loaded into the relay, and select **OK**.

4. When the file is completely loaded from disk, the PC program will break communications with the connected relay and change the Status bar to say "Editing File" , "Not Communicating".



5. Select **File**, **Send Info To Relay**, to download the setpoint file to the connected relay.

6. When the file is completely downloaded, the status bar will revert back to "Communicating"

- The relay now contains all the setpoints as programmed in the setpoint file.

NOTE: The following message will appear when attempting to download a setpoint file with a revision number that does not match the revision of the relay firmware. See section 8.7 for changing the revision number for the setpoint file.

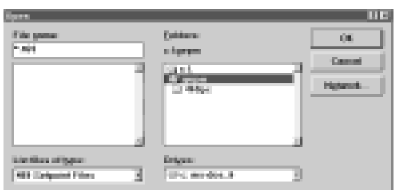
Figure 8-7 DOWNLOADING A SETPOINT FILE TO THE SR469

8.7 UPGRADING SETPOINT FILE TO NEW REVISION

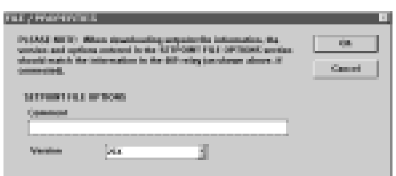
It may be necessary to upgrade the revision code for a previously saved Setpoint file when the firmware of the SR469 is upgraded.

1. To upgrade the revision of a previously saved Setpoint file, run the 469 PC program and establish communications with the SR469 through the front RS232 port.

2. Select **Actual**, **Product Information** from the menu and record the Main Revision number of the relay's firmware, e.g. 30D**251**A8.000, where **251** is the Main Revision identifier.



3. Select **File**, **Open** from the menu and enter the location and file name of the saved Setpoint File to be downloaded to the connected relay. When the file is open, the 469PC program will be in "File Editing" mode and "Not Communicating".



4. Select **File**, **Properties** from the menu and note the version code of the setpoint file. If the Main Revision code of the Setpoint File (e.g. **23X**) is different than the Main Revision code of the Firmware (as noted in step 2, as **251**), use the pull-down tab to expose the available revision codes and select the one which matches the Firmware
e.g. Firmware revision: 30D**251**A8.000
current setpoint file revision: **23X**
change Setpoint file revision to **25X**

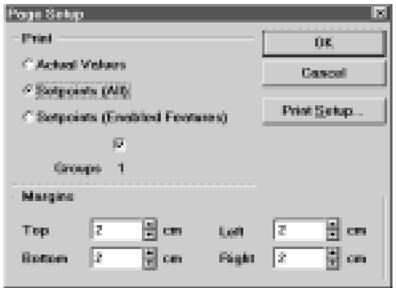
5. Select **File**, **Save** to save the Setpoint file to Disk.

6. See Section 8.6 for downloading this setpoint file to the connected SR469.

Figure 8-8 UPGRADING SETPOINT FILE TO NEW REVISION

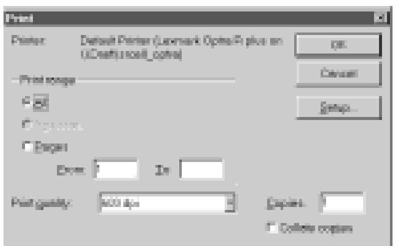
8.8 PRINTING

1. To print the Relay **Setpoints**, run the 469PC program, it is not necessry to establish communications with a connected SR469.



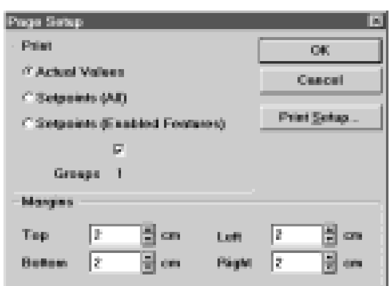
2. Select **File**, **Open** to open a previously saved Setpoint File
or
Establish communications with a SR469 connected to the computer to print the current Setpoints.

3. Select **File**, **Page Setup** and highlight one of the **Setpoints** bubbles. Select OK.



4. Select **File**, **Print** and OK to send the Setpoint file to the connected printer.

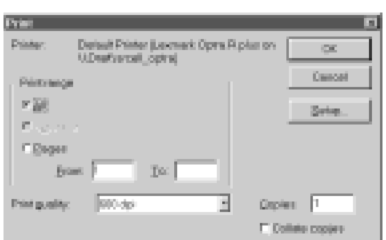
1. To print the Relay **Actual Values**, run the 469PC program and establish communications with a connected SR469.



2. Select **File**, **Page Setup** and highlight the **Actual Values** bubble.

3. Under **Print Setup**, ensure that your specific printer is setup to **Print True Types as Graphics.**

5. Select **OK** to close this window.



6. Select **File**, **Print** and **OK** to send the Setpoint file to the connected printer.

Figure 8-9 PRINTING

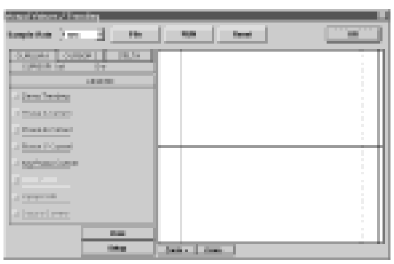
8.9 TRENDING

Trending from the SR469 can be accomplished via the 469PC program. Many different paramters can be trended and graphed at sampling periods ranging from 1 second up to 1 hour.

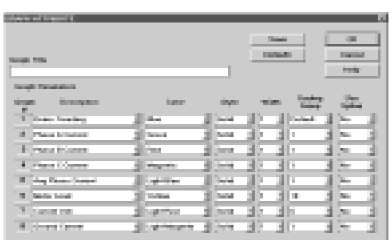
The parameters which can be **Trended** by the 469PC program are:

Currents/Voltages			
Phase Currents A,B&C	Avg. Phase Current	Motor Load	Current Unbalance
Ground Current	Differential Currents A,B & C		System Frequency
Voltages Vab, Vbc, Vca Van, Vbn & Vcn			
Power			
Power Factor	Real Power (kW)	Reactive Power (kvar)	Apparent Power (kVA)
Positive Watthours	Positive Varhours	Negative Varhours	
Temperature			
Hottest Stator RTD	Thermal Capacity Used	RTD's 1 through 12	
Demands			
Current	Peak Current	Reactive Power	Peak Reactive Power,
Apparent Power	Peak Apparent Power		
Others			
Analog Inputs 1,2 3 & 4	Tachometer		

1. To use the Trending function, run the **469PC** program and establish communications with a connected SR469 relay.



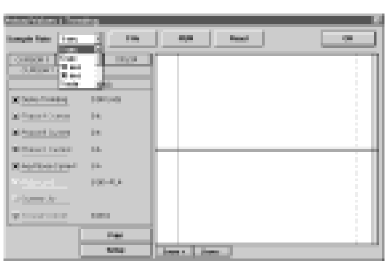
2. Select **Actual** , **Trending** from the main menu to open the **Trending** window.



3. Press the **Setup** button to enter the **Graph Attribute** page.

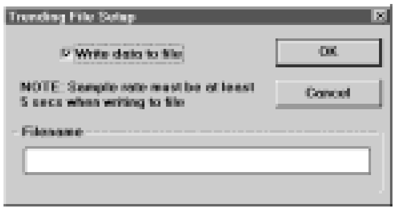
4. Program the **Graphs** which are to be displayed by selecting the pull down menu beside each **Graph Description**. Change the **Color**, **Style**, **Width**, **Group #**, and **Spline** selection as desired.
Select the same Group # for all paramaters to be scaled together.

5. Select Save to store these **Graph Attributes,** and **OK** to close this window.



7. Use the pulldown menu to select the **Sample Rate**, click the checkboxes of the **Graphs** to be displayed, and select **RUN** to begin the trending sampling.

8. **Print** will copy the window to the system printer. More information for navigating through Trending can be found under **Help**.



9. The **File** button can be used to write the graph data to a file in a standard spreadsheet format. Ensure that the **Write Data to File** box is checked, and that the **Sample Rate** is at a minimum of **5 seconds**.

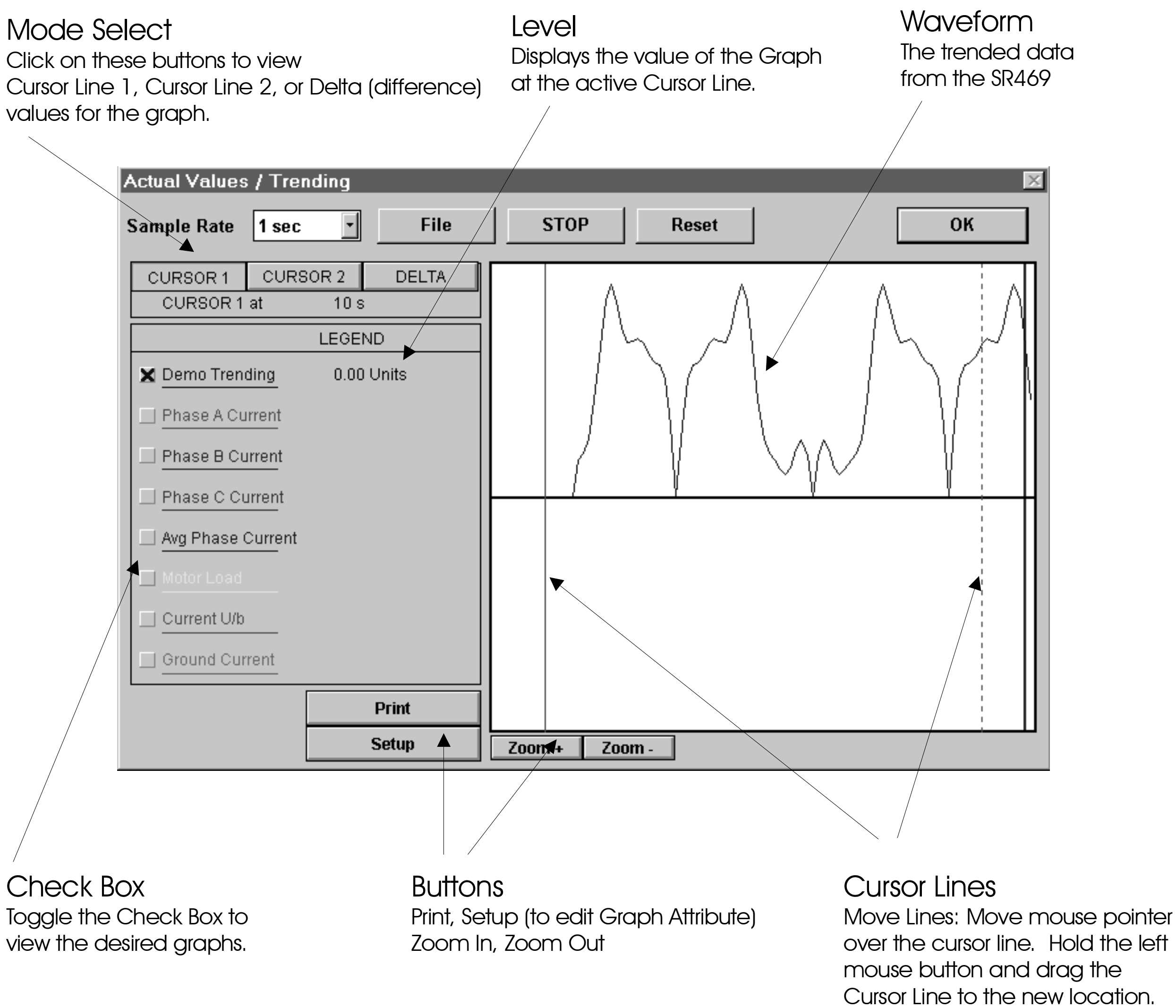


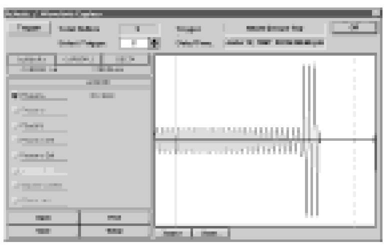
Figure 8-10 TRENDING

8.10 WAVEFORM CAPTURE

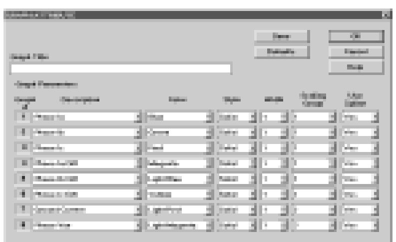
The 469PC program can be used to capture waveforms from the SR469 at the instant of a trip. Maximum of 64 cycles can be captured and the trigger point can be adjusted to anywhere within the set cycles. Maximum of 16 waveforms can be buffered (stored) with the buffer/cycle trade off.

The waveforms captured are:
Phase Currents A, B & C
Differential Currents A, B & C
Ground Current
Phase Voltages A-N, B-N & C-N

1. To use the **Waveform Capture** function, run the 469PC program and establish communications with a connected SR469 Relay.



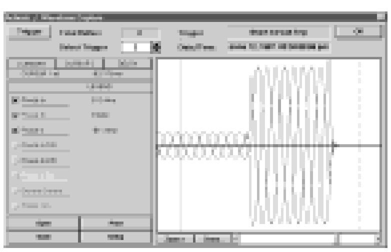
2. Select **Actual** , **Waveform Capture** from the main menu to open the **Waveform Capture** Window.
What will appear is the waveform of Phase A current of the last trip of the SR469. The date and time of this trip is displayed on the top of the window. The RED vertical line indicates the trigger point of the relay.



3. Press the **Setup** button to enter the **Graph Attribute** page.

4. Program the **Graphs** which are to be displayed by selecting the pull down menu beside each **Graph Description**. Change the **Color**, **Style**, **Width**, **Group #**, and **Spline** selection as desired.
Select the same **Group #** for all parameters to be scaled together.

5. Select **Save** to store these **Graph Attributes,** and **OK** to close this window.



6. Click the checkboxes of the **Graphs** to be displayed,

7. The **Save** button can be used to store the current image on the screen, and **Open** can be used to recall a saved image. **Print** will copy the window to the system printer. More information for navigating through Waveform Capture can be found under **Help**.

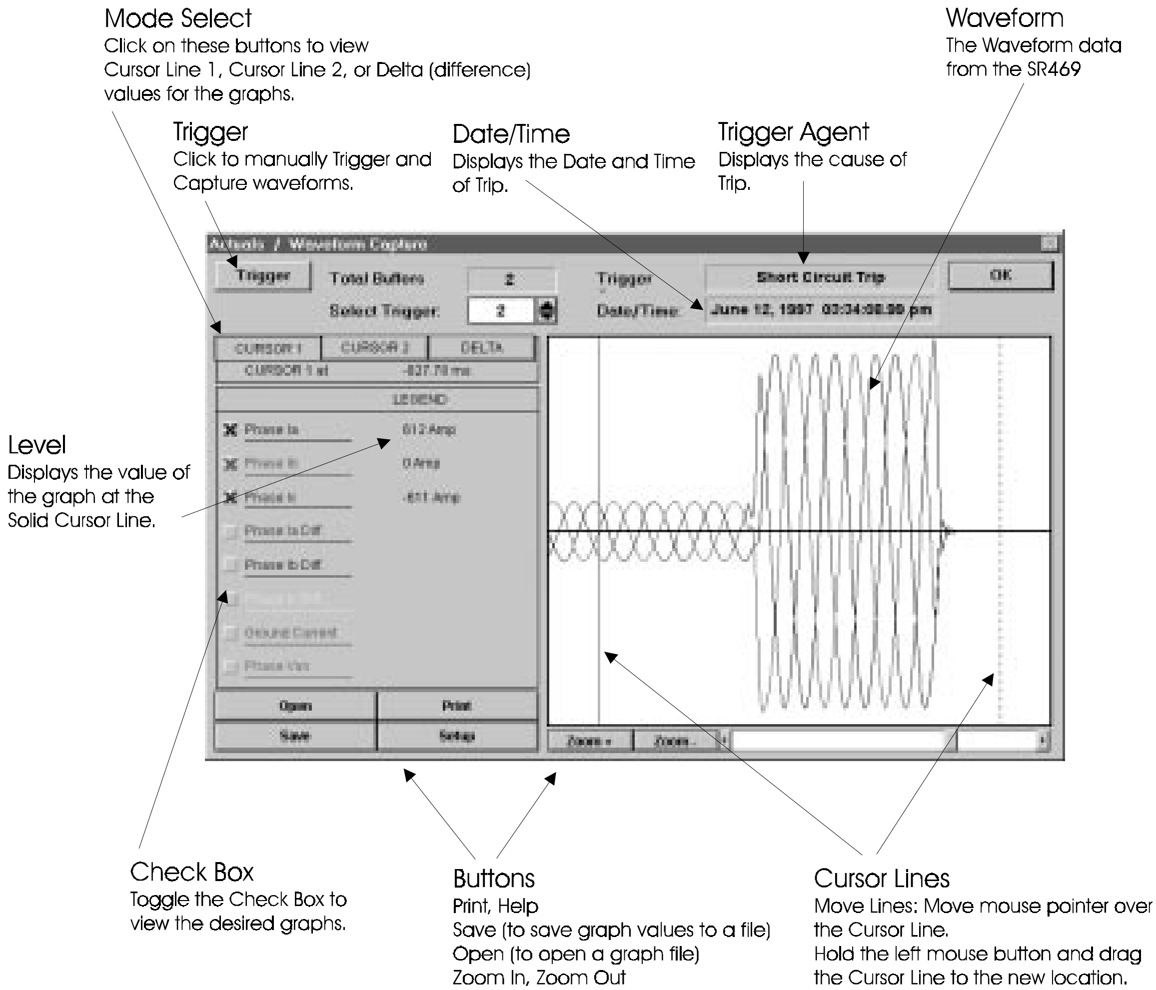


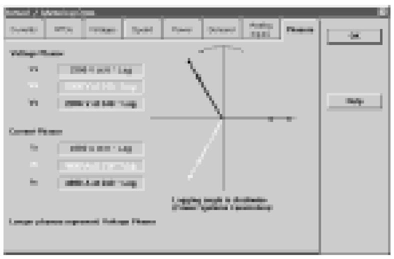
Figure 8-11 WAVEFORM CAPTURE

8.11 PHASORS

The 469PC program can be used to view the phasor diagram of three phase currents and voltages.

The phasors are for:
Phase Voltages A, B & C
Phase Currents A, B & C

1. To use the **Phasor Metering** function, run the 469PC program and establish communications with a connected SR469 Relay.



2. Select **Actual** , **Metering Data** from the main menu, then click on the **Phasors** tab on the **Metering Data** Window. The phasor diagram and the values of voltage phasors, and current phasors are displayed.
Note: Longer arrows are the voltage phasors, shorter arrows are the current phasors.
Va and Ia are the references (i.e. zero degree phase).
Lagging angle is clockwise.

3. More information for **Phasors** can be found under **Help**.

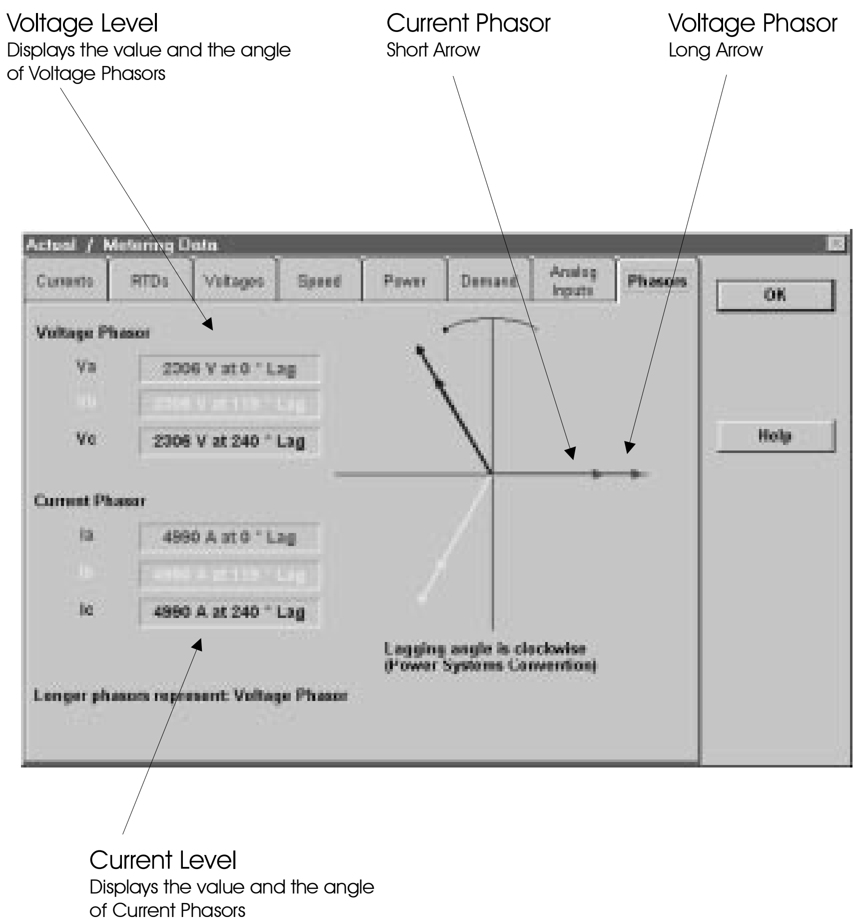
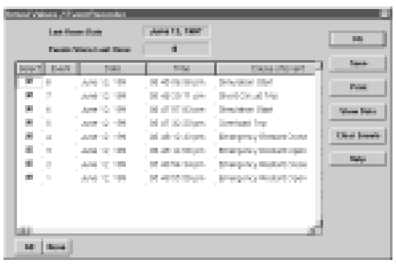


Figure 8-12 PHASORS

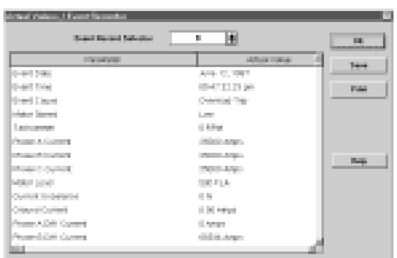
8.12 EVENT RECORDING

The 469PC program can be used to view the SR469 Event Recorder. The Event Recorder stores motor and system information each time an event occurs (i.e. motor trip). The Event Recorder stores upto 40 events, where EVENT01 is the most recent and EVENT40 is the oldest event. The EVENT40 is overwritten when a new event occurs.

1. To use the **Event Recording** function, run the 469PC program and establish communications with a connected SR469 Relay.



2. Select **Actual** , **Event Recording** from the main menu to open the **Event Recording** Window. The Event Recording Window displays the list of events with the most current event displayed on top.



3. Press the **View Data** button to view the details of selected events.
The **Event Record Selector** at the top of the **View Data** Window allows the user to scroll through different events.

4. Select **Save** to store the details of the selected events to a file.

5. Select **Print** to send the events to the system printer, and **OK** to close the window.

6. More information for **Event Recording** can be found under **Help**.

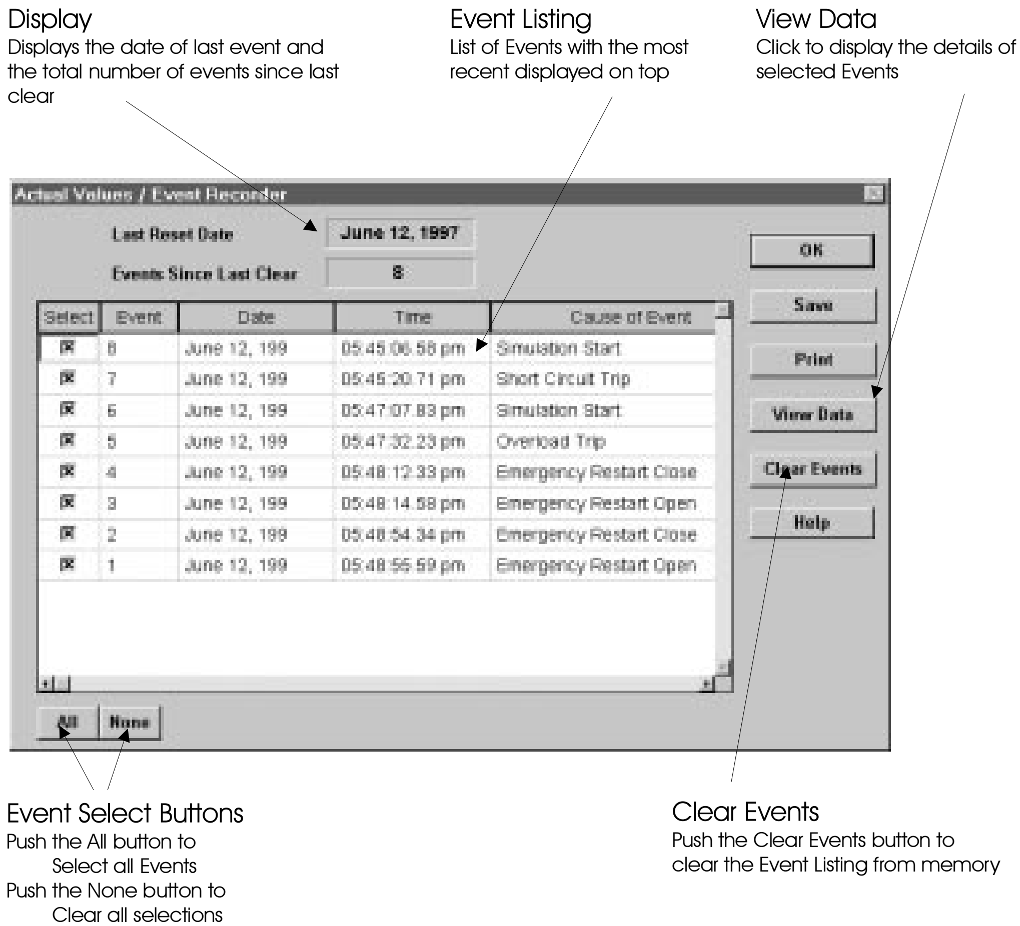


Figure 8-13 EVENT RECORDING

8.13 TROUBLESHOOTING

This section provides some procedures for troubleshooting the 469PC when troubles are encountered within the Windows™ Environment, e.g. **General Protection Fault (GPF), Missing Window, Problems in Opening/Saving Files, and Application Error**.

If the SR469 program causes Windows™ system errors:

1. Check system resources by selecting **Help, About Program Manager** from the Program Manager menu.
Verify that the available system resources are 60% or higher. If it is lower, close any other programs running concurrently in Windows™.

2. There exists a file in the Windows directory stucture which is used by the 469PC program and possibly other Windows™ programs, **threed.vbx**. Some older versions of this file are not compatible with the 469PC program and therefore it is required to update this file with the latest version which is supplied on the Setup disks of the 469PC program shipped with every new SR469 Relay. After installation of the 469PC, this file will be located in **\multilin\469PC\threed.vbx**.

Steps to Update the **threed.vbx** file.

1. Locate the currently used **threed.vbx** file and make a backup of it, e.g. **threed.bak.**
A **Find** or **Search** should be conducted to locate any threed.vbx files on the computer's hard drive. The file which will need replacing is the one located in the **\windows** or the **\windows\system** directory.

2. Replace the original **threed.vbx** with **\multilin\469pc\threed.vbx**. Ensure that the new **threed.vbx** is copied to the same directory where the original one was.

3. If Windows™ prevents the replacing of this file, restart windows and pertorm the replacing of **threed.vbx** before any programs are opened.

4. Restart Windows™ for these changes to take full affect.

S1 SETPOINTS
SR469 SETUP

PASSCODE	
Passcode	

PREFERENCES	
Def. Msg. Cycle Time	
Def. Msg. Timeout	
Avg. Motor Load Calc Period	
Temperature Display	
Trace Memory Trigger Pos.	
Trace Memory Buffers	
Display Update Interval	
Cyclic Load	
Filter Interval	

SERIAL PORTS	
Slave Address	
Comp. RS485 Baud Rate	
Comp. RS485 Parity	
Aux. RS485 Baud Rate	
Aux. RS485 Parity	

MESSAGE SCRATCHPAD
Text 1
Text 2
Text 3
Text 4
Text 5

S2 SETPOINTS
SYSTEM SETUP

CURRENT SENSING	
Phase CT Primary	
Motor Full Load Amps	
Ground CT	
Ground CT Primary	
Phase Differential CT	
Phase Differential CT Pri.	
Enable 2-Speed Motor Prot.	
Speed 2 Phase CT Primary	
Speed 2 Motor FLA	

VOLTAGE SENSING	
VT Connection Type	
Enable Single VT Connection	
Voltage Transformer Ratio	
Motor Nameplate Voltage	

POWER SYSTEM	
Nominal System Frequency	
System Phase Sequence	
Speed2 Phase Sequence	

SERIAL COMMUNICATION CONTROL	
Serial Communication Ctrl	
Assign Start Control Relays	

REDUCED VOLTAGE	
Reduced Voltage Starting	
Assign Control Relays	
Transition On	
Assign Trip Relays	
Reduced Voltage Start Level	
Reduced Voltage Start Timer	

S3 SETPOINTS
DIGITAL INPUTS

Starter Status Switch:	Input 1 Function:	Input 2 Function:	Input 3 Function:	Input 4 Function:

REMOTE ALARM	
Remote Alarm Name	
Remote Alarm	
Assign Alarm Relays	
Remote Alarm Events	

REMOTE TRIP	
Remote Trip Name	
Assign Trip Relays	

SPEED SWITCH TRIP	
Assign Trip Relays	
Speed Switch Trip Delay	

LOAD SHED TRIP	
Assign Trip Relays	

PRESSURE SWITCH ALARM	
Block Alarm From Start	
Pressure Switch Alarm	
Assign Alarm Relays	
Pressure Switch Alarm Delay	
Pressure Switch Alarm Events	

PRESSURE SWITCH TRIP	
Block Trip From Start	
Assign Trip Relays	
Pressure Switch Trip Delay	

VIBRATION SWITCH ALARM	
Vibration Switch Alarm	
Assign Alarm Relays	
Vibration Switch Delay	
Vibration Switch Alarm Events	

VIBRATION SWITCH TRIP	
Assign Trip Relays	
Vibration Switch Trip Delay	

DIGITAL COUNTER	
Counter Units	
Counter Preset Value	
Counter Type	
Counter Alarm	
Assign Alarm Relays	
Counter Alarm Level	
Counter Alarm Pickup	
Counter Alarm Events	

TACHOMETER	
Rated Speed	
Tachometer Alarm	
Assign Alarm Relays	
Tachometer Alarm Speed	
Tachometer Alarm Delay	
Tachometer Alarm Events	
Tachometer Trip	
Assign Trip Relays	
Tachometer Trip Speed	
Tachometer Trip Delay	

GENERAL SWITCH A	
Switch Name	
General Switch State	
Block Input From Start	
General Switch Alarm	
Assign Alarm Relays	
General Switch Alarm Delay	
General Switch Events	
General Switch Trip	
Assign Trip Relays	
General Switch Trip Delay	

GENERAL SWITCH B	
Switch Name	
General Switch State	
Block Input From Start	
General Switch Alarm	
Assign Alarm Relays	
General Switch Alarm Delay	
General Switch Events	
General Switch Trip	
Assign Trip Relays	
General Switch Trip Delay	

GENERAL SWITCH C	
Switch Name	
General Switch State	
Block Input From Start	
General Switch Alarm	
Assign Alarm Relays	
General Switch Alarm Delay	
General Switch Events	
General Switch Trip	
Assign Trip Relays	
General Switch Trip Delay	

GENERAL SWITCH D	
Switch Name	
General Switch State	
Block Input From Start	
General Switch Alarm	
Assign Alarm Relays	
General Switch Alarm Delay	
General Switch Events	
General Switch Trip	
Assign Trip Relays	
General Switch Trip Delay	

S4 SETPOINTS
OUTPUT RELAYS

R1 Trip Reset Mode		R4 Alarm Reset Mode	
R2 Auxiliary Reset Mode		R5 Block Start Reset Mode	Auto-Reset
R3 Auxiliary Reset Mode		R6 Service Reset Mode	

Force Output Relay			
Force R1 Output Relay		Force R1 Operation Time	
Force R2 Output Relay		Force R2 Operation Time	
Force R3 Output Relay		Force R3 Operation Time	
Force R4 Output Relay		Force R4 Operation Time	
Force R5 Output Relay		Force R5 Operation Time	

S5 SETPOINTS PROTECTION	
THERMAL MODEL	
Select Curve Style	
Overload Pickup Level	
Assign Trip Relays	
Unbalance Bias K Factor	
Cool Time Constant Running	
Cool Time Constant Stopped	
Hot/Cold Safe Stall Ratio	
Enable RTD Biasing?	
RTD Bias Minimum	
RTD Bias Center	
RTD Bias Maximum	
Thermal Capacity Alarm	
Assign Alarm Relays	
Thermal Cap. Alarm Level	
Thermal Cap. Alarm Events	
O/L CURVE SETUP	
Standard O/L Curve No.	
Time to Trip @ 1.01 x FLA	
Time to Trip @ 1.05 x FLA	
Time to Trip @ 1.10 x FLA	
Time to Trip @ 1.20 x FLA	
Time to Trip @ 1.30 x FLA	
Time to Trip @ 1.40 x FLA	
Time to Trip @ 1.50 x FLA	
Time to Trip @ 1.75 x FLA	
Time to Trip @ 2.00 x FLA	
Time to Trip @ 2.25 x FLA	
Time to Trip @ 2.50 x FLA	
Time to Trip @ 2.75 x FLA	
Time to Trip @ 3.00 x FLA	
Time to Trip @ 3.25 x FLA	
Time to Trip @ 3.50 x FLA	
Time to Trip @ 3.75 x FLA	
Time to Trip @ 4.00 x FLA	
Time to Trip @ 4.25 x FLA	
Time to Trip @ 4.50 x FLA	
Time to Trip @ 4.75 x FLA	
Time to Trip @ 5.00 x FLA	
Time to Trip @ 5.50 x FLA	
Time to Trip @ 6.00 x FLA	
Time to Trip @ 6.50 x FLA	
Time to Trip @ 7.00 x FLA	
Time to Trip @ 7.50 x FLA	
Time to Trip @ 8.00 x FLA	
Time to Trip @ 10.00 x FLA	
Time to Trip @ 15.00 x FLA	
Time to Trip @ 20.00 x FLA	
Min Allowable Line Voltage	
Stall Current @ Min Vline	
Safe Stall Time @ Min Vline	
Accel. Intersect @ Min Vline	
Stall Current @ 100% Vline	
Safe Stall Time@100% Vline	
Accel. Intersect@100% Vline	

S6 SETPOINTS CURRENT ELEMENTS	
SHORT CIRCUIT	
Short Circuit Trip	
Assign Trip Relays	
Short Circuit Trip Pickup	
Intent. S/C Trip Delay	
S/C Trip Backup	
Assign Backup Relays	
S/C Trip Backup Delay	
OVERLOAD ALARM	
Overload Alarm	
Assign Alarm Relays	
Overload Alarm Delay	
Overload Alarm Events	
MECHANICAL JAM	
Mechanical Jam Trip	
Assign Trip Relays	
Mechanical Jam Delay	
Mechanical Jam Pickup	
UNDERCURRENT	
Block U/C from Start	
Undercurrent Alarm	
Assign Alarm Relays	
Undercurrent Alarm Pickup	
Undercurrent Alarm Delay	
Undercurrent Alarm Events	
Undercurrent Trip	
Assign Trip Relays	
Undercurrent Trip Pickup	
Undercurrent Trip Delay	
CURRENT UNBALANCE	
Current Unbalance Alarm	
Assign Alarm Relays	
Current U/B Alarm Pickup	
Current U/B Alarm Delay	
Current U/B Alarm Events	
Current Unbalance Trip	
Assign Trip Relays	
Current U/B Trip Pickup	
Current U/B Trip Delay	
GROUND FAULT	
Ground Fault Alarm	
Assign Alarm Relays	
Ground Fault Alarm Pickup	
Intentional GF Alarm Delay	
Ground Fault Alarm Events	
Ground Fault Trip	
Assign Trip Relays	
Ground Fault Trip Pickup	
Intentional GF Trip Delay	
Ground Fault Trip Backup	
Assign GF Trip B/U Relays	
GF Trip Backup Delay	
PHASE DIFFERENTIAL	
Phase Differential Trip	
Assign Trip Relays	
Starting Differential Trip PU	
Starting Diff. Trip Delay	
Running Diff. Trip PU	
Running Diff. Trip Delay	

S7 SETPOINTS
MOTOR STARTING

ACCELERATION TIMER	
Acceleration Timer Trip	
Assign Trip Relays	
Accel. Timer From Start	

START INHIBIT	
Start Inhibit Block	
TC Used Margin	

JOGGING BLOCK	
Jogging Block	
Max. Starts/Hr Permissible	
Time Between Starts Perm.	
RESTART BLOCK	
Restart Block	
Restart Block Time	

S8 SETPOINTS
RTD TEMPERATURE

Stator RTD Type	
Bearing RTD Type	

Ambient RTD Type	
Other RTD Type	

RTD	Application	Name	Alarm	Assign Alarm Relays	Alarm Temp.	Alarm Events
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

RTD	Trip	Trip Voting	Assign Trip Relays	Trip Temp.	High Alarm	High Alarm Relays	High Alarm Temperature
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

OPEN RTD SENSOR	
Open RTD Sensor Alarm	
Assign Alarm Relays	
Open RTD Sensor Alarm Events	

RTD SHORT/LOW TEMP.	
RTD Short/Low Temp. Alarm	
Assign Alarm Relays	
RTD Short/Low Tmp. Alrm Events	

S9 SETPOINTS VOLTAGE ELEMENTS

UNDERVOLTAGE	
U/V Active only if bus energized	
U/V Alarm	
Assign Alarm Relays	
U/V Alarm Pickup	
Starting U/V Alarm Pickup	
U/V Alarm Delay	
U/V Alarm Events	
U/V Trip	
Assign Trip Relays	
U/V Trip Pickup	
Starting U/V Trip Pickup	
U/V Trip Delay	

OVERVOLTAGE	
Overvoltage Alarm	
Assign Alarm Relays	
Alarm Pickup	
Alarm Delay	
Alarm Events	
Overvoltage Trip	
Assign Trip Relays	
Trip Pickup	
Trip Delay	

PHASE REVERSAL	
Phase Reversal Trip	
Assign Trip Relays	

FREQUENCY	
Frequency Alarm	
Assign Alarm Relays	
Overfreq. Alarm Level	
Underfreq. Alarm Level	
Alarm Delay	
Alarm Events	
Frequency Trip	
Assign Trip Relays	
Overfreq. Trip Level	
Underfreq. Trip Level	
Frequency Trip Delay	

S10 SETPOINTS POWER ELEMENTS

POWER FACTOR	
Block PF Element From Start	
PF Alarm	
Assign Alarm Relays	
PF Lead Alarm Level	
PF Lag Alarm Level	
PF Alarm Delay	
PF Alarm Events	
PF Trip	
Assign Trip Relays	
PF Lead Trip Level	
PF Lag Trip Level	
PF Trip Delay	

REACTIVE POWER	
Block kvar Element From Start	
Reactive Power Alarm	
Assign Alarm Relays	
Positive kvar Alarm Level	
Negative kvar Alarm Level	
Alarm Delay	
Alarm Events	
Reactive Power Trip	
Assign Trip Relays	
Positive kvar Trip Level	
Negative kvar Trip Level	
Trip Delay	

UNDERPOWER	
Block U/P From Start	
Underpower Alarm	
Assign Alarm Relays	
Alarm Level	
Alarm Delay	
Alarm Events	
Underpower Trip	
Assign Trip Relays	
Underpower Trip Level	
Underpower Trip Delay	

REVERSE POWER	
Block from start	
Reverse Power Alarm	
Assign Alarm Relays	
Alarm Level	
Alarm Delay	
Alarm Events	
Reverse Power Trip	
Assign Trip Relays	
Trip Level	
Trip Delay	

S10 SETPOINTS POWER ELEMENTS CONT.

TORQUE SETUP	
Stator Resistance	
Pole Pairs	
Torque Unit	

OVERTORQUE SETUP	
Overtorque	
Assign Alarm Relays	
Torque Alarm	
Torque Alarm	
Torque Alarm	

S11 SETPOINTS MONITORING

TRIP COUNTER	
Trip Counter Alarm	
Assign Alarm Relays	
Trip Counter Alarm	
Alarm Events	

STARTER FAILURE	
Starter Failure Alarm	
Starter Type	
Assign Alarm Relays	
Starter Failure Delay	
Supervision Of Trip Coil	
Alarm Events	

CURRENT DEMAND	
Current Demand Period	
Current Demand Alarm	
Assign Alarm Relays	
Current Demand Limit	
Alarm Events	

kW DEMAND	
kW Demand Period	
kW Demand Alarm	
Assign Alarm Relays	
kW Demand Limit	
Alarm Events	

kvar DEMAND	
kvar Demand Period	
kvar Demand Alarm	
Assign Alarm Relays	
kvar Demand Limit	
kvar Demand Alarm Events	

kVA DEMAND	
kVA Demand Period	
kVA Demand Alarm	
Assign Alarm Relays	
kVA Demand Limit	
Alarm Events	

PULSE OUTPUT	
+ kWh Pulse Out. Relay	
+ kWh Pulse Out. Int.	
+ kvarh Pulse Out. Relay	
+ kvarh Pulse Out. Int.	
– kvarh Pulse Out. Relay	
– kvarh Pulse Out Int.	
Running Time Pulse Relay	
Running Time Pulse Int.	

S12 SETPOINTS
ANALOG I/O

Analog Output 1	
Minimum	
Maximum	

Analog Output 2	
Minimum	
Maximum	

Analog Output 3	
Minimum	
Maximum	

Analog Output 4	
Minimum	
Maximum	

Setpoint	Analog Input 1	Analog Input 2	Analog Input 3	Analog Input 4
Enabled?				
Name				
Units				
Minimum				
Maximum				
Block From Start				
Alarm				
Assign Alarm Relays				
Alarm Level				
Alarm Pickup				
Alarm Delay				
Alarm Events				
Trip				
Assign Trip Relays				
Trip Level				
Trip Pickup				
Trip Delay				

Setpoint	Analog In Diff. 1-2	Analog In Diff. 3-4
Enabled?		
Name		
Comparison Type		
Logic		
Active When		
Block From Start		
Alarm		
Assign Alarm Relays		
Alarm Level		
Alarm Delay		
Alarm Events		
Trip		
Assign Trip Relays		
Trip Level		
Trip Delay		

S14 SETPOINTS
TWO-SPEED MOTOR

SPEED 2 O/L SETUP	
Speed2 Standard Curve #	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @	
Speed2 Trip @ 10.00xFLA	
Speed2 Trip @ 15.00xFLA	
Speed2 Trip @ 20.00xFLA	

Speed2 Min. Line Voltage	
Speed2 IStall @ Min.	
Speed2 Safe Stall@Min.Vline	
Speed2 Acl. ISect@Min. Vline	
Speed2 IStall@100% Vline	
Sp.2 Safe Stall@100% Vline	
Sp.2 Acl. ISect@100% Vline	

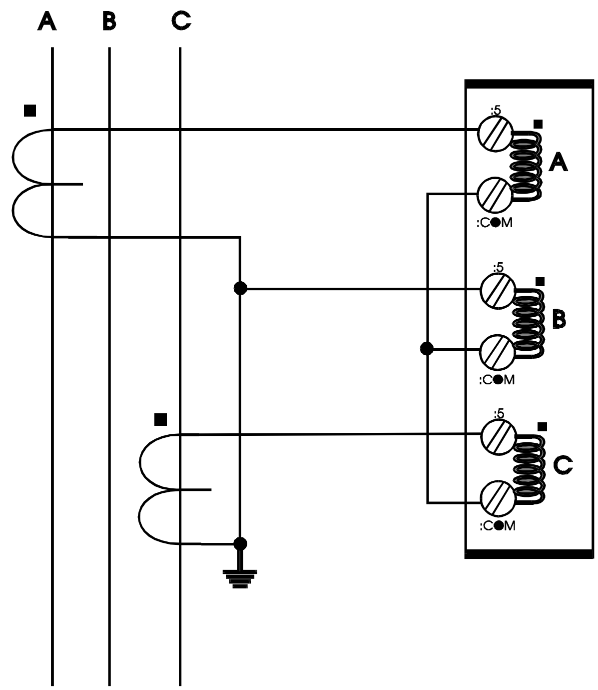
SPEED 2 U/C	
Speed2 U/C Blk. From Start	
Speed2 U/C Alarm	
Speed2 U/C Alarm	
Speed2 U/C Alarm Delay	
Speed2 U/C Alarm	
Speed2 U/C Trip	
Speed2 U/C Trip Pickup	
Speed2 U/C Trip Delay	

SPEED 2 ACCEL.	
Sp.2 Accel. Timer From Start	
Accel. Timer From Sp.1-2	
Speed Sw. Trip Sp.2 Delay	
Speed2 Rated Speed	

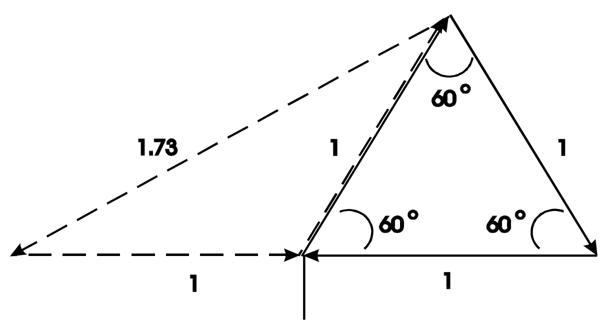
2ϕ CT Configuration

The purpose of this Appendix is to illustrate how two CT's may be used to sense three phase currents.

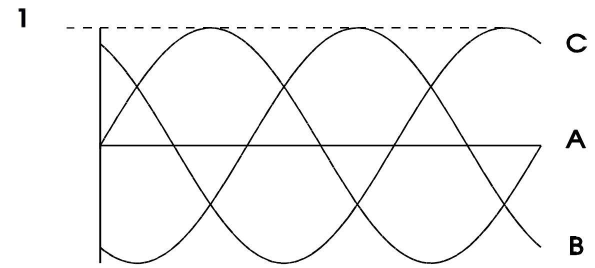
The proper configuration for the use of two CTs rather than three to detect phase current is shown. Each of the two CTs acts as a current source. The current that comes out of the CT on phase 'A' flows into the interposing CT on the relay marked 'A'. From there, the current sums with the current that is flowing from the CT on phase 'C' which has just passed through the interposing CT on the relay marked 'C'. This 'summed' current flows through the interposing CT marked 'B' and from there, the current splits up to return to its respective source (CT). **Polarity is very important since the value of phase 'B' must be the negative equivalent of 'A' + 'C' in order for the sum of all the vectors to equate to zero.** Note, there is only one ground connection as shown. If two ground connections are made, a parallel path for current has been created.



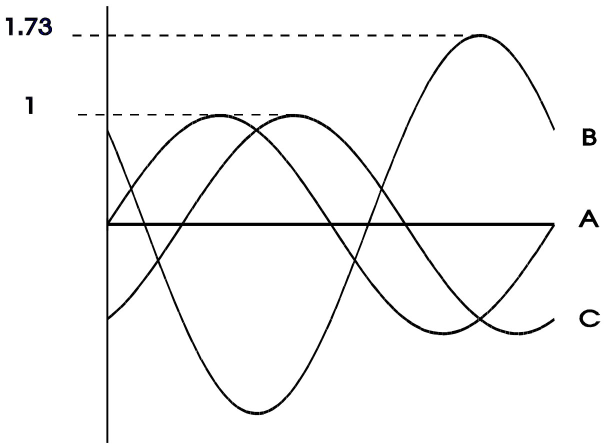
In the two CT configuration, the currents will sum vectorially at the common point of the two CTs. The diagram illustrates the two possible configurations. If one phase is reading high by a factor of 1.73 on a system that is known to be balanced, simply reverse the polarity of the leads at one of the two phase CTs (taking care that the CTs are still tied to ground at some point). **Polarity is important.**



To illustrate the point further, the diagram here shows how the current in phases 'A' and 'C' sum up to create phase 'B'.



Once again, if the polarity of one of the phases is out by 180°, the magnitude of the resulting vector on a balanced system will be out by a factor of 1.73.



On a three wire supply, this configuration will always work and unbalance will be detected properly. In the event of a single phase, there will always be a large unbalance present at the interposing CTs of the relay. If for example phase 'A' was lost, phase 'A' would read zero while phases 'B' and 'C' would both read the magnitude of phase 'C'. If on the other hand, phase 'B' was lost, at the supply, 'A' would be 180° out of phase with phase 'C' and the vector addition would equal zero at phase 'B'.

Selection of Cool Time Constants

Thermal limits are not a black and white science and there is some art to setting a protective relay thermal model. The definition of thermal limits mean different things to different manufacturers and quite often, information is not available. Therefore, it is important to remember what the goal of the motor protection thermal modeling is: to thermally protect the motor (rotor and stator) without impeding the normal and expected operating conditions that the motor will be subject to.

The thermal model of the SR469 provides integrated rotor and stator heating protection. If cooling time constants are supplied with the motor data they should be used. Since the rotor and stator heating and cooling is integrated into a single model, use the longer of the cooling time constants (rotor or stator).

If however, no cooling time constants are provided, settings will have to be determined. Before determining the cool time constant settings, the duty cycle of the motor should be considered. If the motor is typically started up and run continuously for very long periods of time with no overload duty requirements, the cooling time constants can be large. This would make the thermal model conservative. If the normal duty cycle of the motor involves frequent starts and stops with a periodic overload duty requirement, the cooling time constants will need to be shorter and closer to the actual *thermal limit* of the motor.

Normally motors are rotor limited during starting. Thus RTDs in the stator do not provide the best method of determining cool times. Determination of reasonable settings for the running and stopped cool time constants can be accomplished in one of the following manners listed in order of preference.

1. The motor running and stopped cool times or constants may be provided on the motor data sheets or by the manufacturer if requested. Remember that the cooling is exponential and the time constants are one fifth the total time to go from 100% thermal capacity used to 0%.

2. Attempt to determine a conservative value from available data on the motor. See the following example for details.

3. If no data is available an educated guess must be made. Perhaps the motor data could be estimated from other motors of a similar size or use. Note that conservative protection is better as a first choice until a better understanding of the motor requirements is developed. Remember that the goal is to protect the motor without impeding the operating duty that is desired.

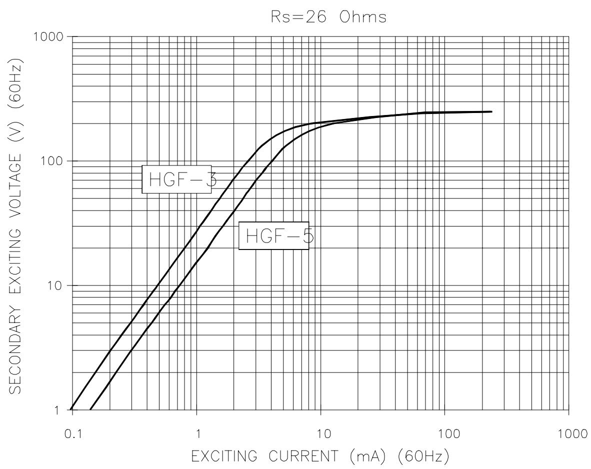
<u>Example:</u>

1) Motor data sheets state that the starting sequence allowed is 2 cold or 1 hot after which you must wait 5 hours before attempting another start.
   - This implies that under a normal start condition the motor is using between 34 and 50% thermal capacity. Hence, two consecutive starts are allowed, but not three.
   - If the hot and cold curves or a hot/cold safe stall ratio are not available program 0.5 (1hot/2cold starts) in as the hot/cold ratio.
   - Programming *Start Inhibit* ‘On’ makes a restart possible as soon as 62.5% (50x1.25) thermal capacity is available.
   - After 2 cold or 1 hot start, close to 100% thermal capacity will be used. Thermal capacity used decays exponentially (see SR469 manual section on motor cooling for calculation). There will be only 37% thermal capacity used after 1 time constant which means there is enough thermal capacity available for another start. Program 300 minutes (5 hours) as the *stopped cool time constant*. Thus after 2 cold or 1 hot start, a stopped motor will be blocked from starting for 5 hours.
   - Since the rotor cools faster when the motor is running, a reasonable setting for the running cool time constant might be half the stopped cool time constant or 150 minutes.

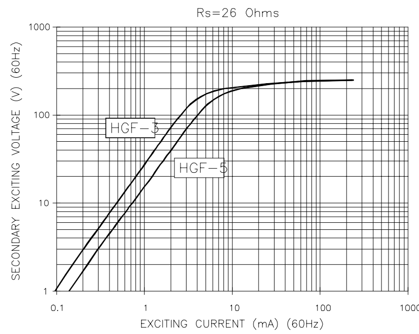
GROUND FAULT CTS FOR 50:0.025 A CT

CTs that are specially designed to match the ground fault input of GE Multilin motor protection relays should be used to ensure correct performance. These CTs have a 50:0.025A (2000:1 ratio) and can sense low leakage currents over the relay setting range with minimum error. Three sizes are available with 3½", 5½", or 8" diameter windows.

HGF3 / HGF5



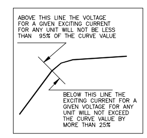
HGF8



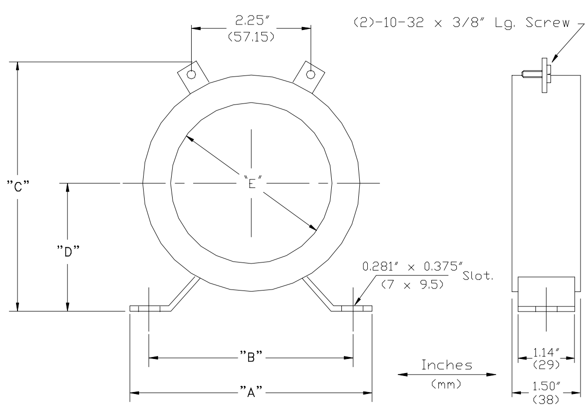
CURRENT RATIO	TURNS RATIO	SEC RES.*
50:0.025	2000:1	24.85

* OHMS AT 75° C.

This test report is in accordance with ANSI/IEEE C57.13 1993

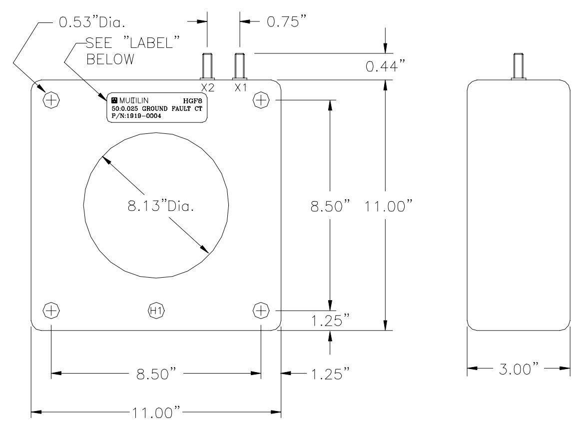


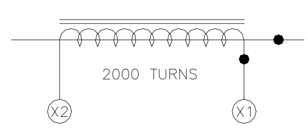
DIMENSIONS



PART NO.	DIMENSIONS																	
	A		B		C						D		E					
					Min.		Nom.		Max.				Min.		Nom.		Max.	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
CT-HGF5	7.80	198	7.00	178	8.40	213	8.50	216	8.60	218	4.50	114	5.50	140	5.70	145	5.90	150
CT-HGF3	6.00	152	5.25	133	5.65	144	5.75	146	5.85	149	2.90	74	3.50	89	3.70	94	3.90	99

DIMENSIONS

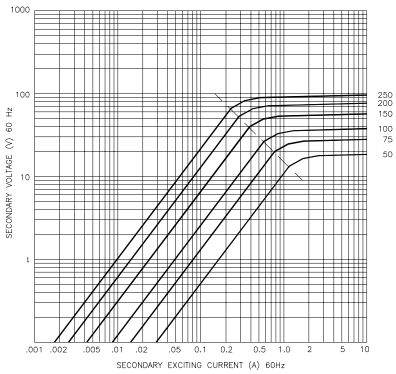




GROUND FAULT CTS FOR 5A SECONDARY CT

For low resistance or solidly grounded systems, a 5 A secondary CT should be used. Two sizes are available with 5½" or 13"x16" windows. Various Primary amp CTs can be chosen (50 to 250).

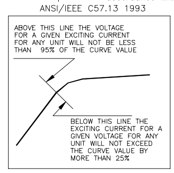
GCT5



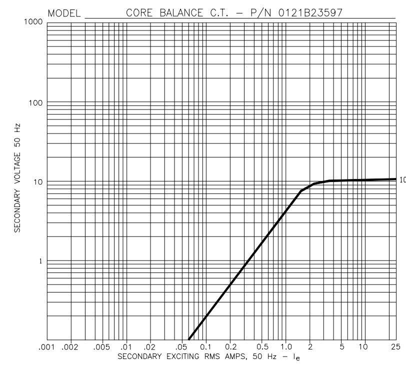
MULTILIN NO.	CURRENT RATIO	TURNS RATIO	SEC RES.*
X021–0251	250:5	50:1	0.097
X021–0201	200:5	40:1	0.078
X021–0151	150:5	30:1	0.058
X021–0101	100:5	20:1	0.039
X021–0076	75:5	15:1	0.029
X021–0051	50:5	10:1	0.019

* OHMS AT 75° C.

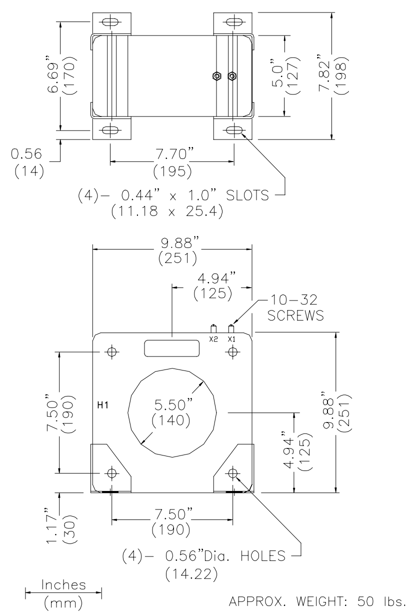
This test report is in accordance with ANSI/IEEE C57.13 1993



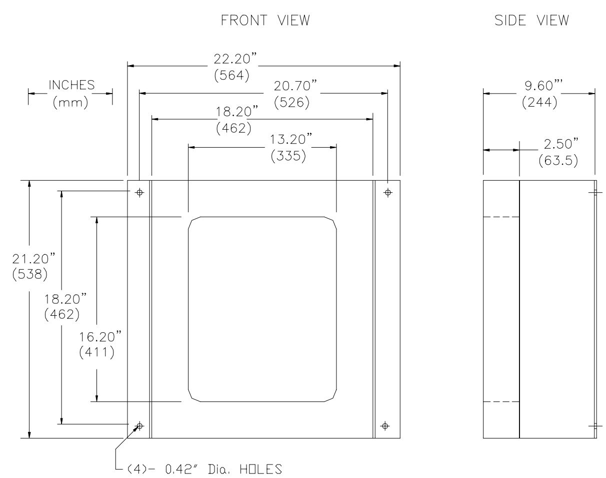
GCT16



DIMENSIONS

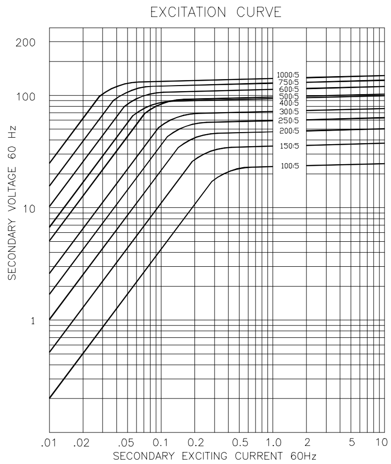


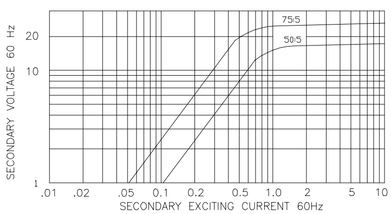
DIMENSIONS



PHASE CTS

Current transformers in most common ratios from 50:5 to 1000:5 are available for use as phase current inputs with motor protection relays. These come with mounting hardware and are also available with 1 A secondaries. Voltage class - 600V BIL 10 KV.





DIMENSIONS

CURRENT TRANSFORMER SPECIFICATIONS

CURRENT RATIO	WINDOW SIZE	CT CLASS	MULTILIN No.	CT Dims.
50:5	2.75"	C10	X911–0010	A
75:5	2.75"	C10	X911–0011	A
100:5	3.00"	C10	X911–0012	B
150:5	3.00"	C10	X911–0013	B
200:5	3.00"	C20	X911–0014	B
250:5	3.00"	C20	X911–0015	B
300:5	3.00"	C20	X911–0016	B
400:5	3.00"	C20	X911–0017	B
500:5	3.00"	C50	X911–0018	B
600:5	3.00"	C50	X911–0019	B
750:5	3.00"	C50	X911–0020	B
1000:5	3.75"	C50	X911–0021	B

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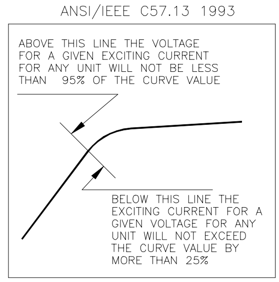
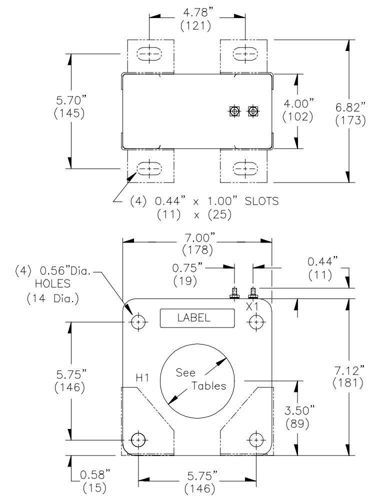
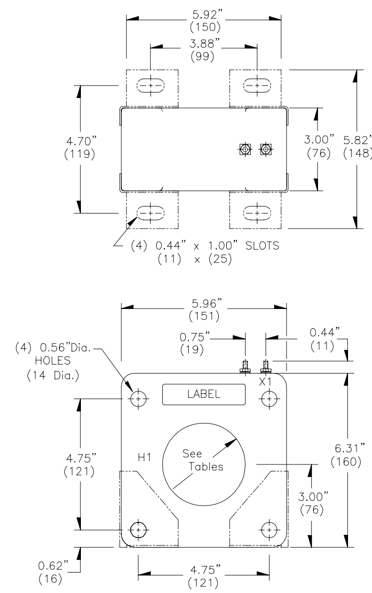
This test report is in accordance with ANSI/IEEE C57.13 1993





CT DIMENSIONS "A"



CT DIMENSIONS "B"

FIGURE 4-20 THERMAL MODEL COOLING MOTOR STOPPED 4-38
FIGURE 4-21 THERMAL MODEL COOLING MOTOR TRIPPED 4-38

GE MULTILIN RELAY WARRANTY

General Electric Multilin Inc. (GE Multilin) warrants each relay it manufactures to be free from defects in material and workmanship under normal use and service for a period of 24 months from date of shipment from factory.

In the event of a failure covered by warranty, GE Multilin will undertake to repair or replace the relay providing the warrantor determined that it is defective and it is returned with all transportation charges prepaid to an authorized service centre or the factory. Repairs or replacement under warranty will be made without charge.

Warranty shall not apply to any relay which has been subject to misuse, negligence, accident, incorrect installation or use not in accordance with instructions nor any unit that has been altered outside a GE Multilin authorized factory outlet.

GE Multilin is not liable for special, indirect or consequential damages or for loss of profit or for expenses sustained as a result of a relay malfunction, incorrect application or adjustment.

For complete text of Warranty (including limitations and disclaimers) refer to GE Multilin Standard Conditions of Sale.