GE
Digital Energy

339
Motor Protection System
Motor protection and control

Instruction manual

GE Digital Energy
650 Markland Street
Markham, Ontario
Canada L6C 0M1
TELEPHONE: Worldwide +1 905 927 7070
Europe/Middle East Africa +34 94 485 88 54
North America toll-free 1 800 547 8629
FAX: +1 905 927 5098
E-MAIL: Worldwide multilin.tech@ge.com
Europe multilin.tech.euro@ge.com
HOME PAGE: Internet: http://www.gedigitalenergy.com/multilin

339 revision: 1.5x
Manual P/N: 1601-9103-AC
GE publication code: GEK-113562L

WORLDWIDE 10 YEAR WARRANTY

REGISTERED ISO 9001 GE MULTILIN

GE Multilin 339 Motor Protection System instruction manual for revision 1.5x.

Part number: 1601-9103-AC (February 2015)

⚠CAUTION

GENERAL SAFETY PRECAUTIONS - 339

- Failure to observe and follow the instructions provided in the equipment manual(s) could cause irreversible damage to the equipment and could lead to property damage, personal injury and/or death.
- Before attempting to use the equipment, it is important that all danger and caution indicators are reviewed.
- If the equipment is used in a manner not specified by the manufacturer or functions abnormally, proceed with caution. Otherwise, the protection provided by the equipment may be impaired and can result in Impaired operation and injury.
- Caution: Hazardous voltages can cause shock, burns or death.
- Installation/service personnel must be familiar with general device test practices, electrical awareness and safety precautions must be followed.
- Before performing visual inspections, tests, or periodic maintenance on this device or associated circuits, isolate or disconnect all hazardous live circuits and sources of electric power.
- Failure to shut equipment off prior to removing the power connections could expose you to dangerous voltages causing injury or death.
- All recommended equipment that should be grounded and must have a reliable and un-compromised grounding path for safety purposes, protection against electromagnetic interference and proper device operation.
- Equipment grounds should be bonded together and connected to the facility's main ground system for primary power.
- Keep all ground leads as short as possible.
- At all times, equipment ground terminal must be grounded during device operation and service.
- In addition to the safety precautions mentioned all electrical connections made must respect the applicable local jurisdiction electrical code.
- Before working on CTs, they must be short-circuited.

This product cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling return this product to your supplier or a designated collection point. For more information go to www.recyclethis.info.

Safety words and definitions

The following symbols used in this document indicate the following conditions

⚠DANGER	**Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
⚠WARNING	**Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
⚠CAUTION	**Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**Indicates practices not related to personal injury.**

Table of Contents

GE
Digital Energy

339 Motor Protection System

Chapter 1: Introduction

Overview

The 339 Motor Protection System is a microprocessor based relay providing suitable protection of medium voltage motors. The small footprint and the withdrawable option make the 339 relay ideal for panel mounting on either new or retrofit installations. The combination of proven hardware, a variety of protection and control features, and communications, makes the relay ideal for total motor protection and control. Equipped with serial (RS485), USB, and Ethernet ports, and a wide selection of protocols such as Modbus, DNP3.0, IEC 60870-5-103, 60870-5-104, GOOSE, the 339 relay is the best-in-class for MCCs, SCADA and inter-relay communications. The 339 relay provides excellent transparency with respect to power system conditions and events, through its four-line 20-character display, as well as the EnerVista SR3 Setup EnerVista SR3 Setup program. Conveniently located LEDs provide indication of overall relay operation, as well as alarm, pickup, and motor status.

The 339 relay provides the following key benefits:

- Withdrawable small footprint – saves on rewiring and space.
- Fast setup (Quick Setup) menu provided, to guide users through a wide range of motor management applications.
- Large four-line LCD display, LEDs, and an easy-to-navigate keypad.
- Multiple communication protocols for simultaneous access when integrated into monitoring and control systems.

Description of the 339 Motor Protection System

CPU

Relay functions are controlled by two processors: a Freescale MPC5554 32-bit microprocessor measures all analog signals and digital inputs and controls all output relays; a Freescale MPC520B 32-bit microprocessor controls all the Ethernet communication protocols.

Analog Input Waveform Capture

Magnetic transformers are used to scale-down the incoming analog signals from the source instrument transformers. The analog signals are then passed through a 960 Hz low pass anti-aliasing filter. All signals are then simultaneously captured by sample and hold buffers to ensure there are no phase shifts. The signals are converted to digital values by a 12-bit A/D converter before finally being passed on to the CPU for analysis.

Both current and voltage are sampled thirty-two times per power frequency cycle. These ‘raw’ samples are scaled in software, then placed into the waveform capture buffer, thus emulating a fault recorder. The waveforms can be retrieved from the relay via the EnerVista SR3 Setup software for display and diagnostics.

Frequency

Frequency measurement is accomplished by measuring the time between zero crossings of the Bus VT phase A voltage . The signals are passed through a low pass filter to prevent false zero crossings. Sampling is synchronized to the Va-x voltage zero crossing which results in better co-ordination for multiple 339 relays on the same bus.

Phasors, Transients, and Harmonics

Current waveforms are processed twice every cycle with a DC Offset Filter and a Discrete Fourier Transform (DFT). The resulting phasors have fault current transients and all harmonics removed. This results in a motor that is extremely secure and reliable; one that will not overreach.

Processing of AC Current Inputs

The DC Offset Filter is an infinite impulse response (IIR) digital filter, which removes the DC component from the asymmetrical current present at the moment a fault occurs. This is done for all current signals used for overcurrent protection; voltage signals bypass the DC Offset Filter. This filter ensures no overreach of the overcurrent protection.

The Discrete Fourier Transform (DFT) uses exactly one sample cycle to calculate a phasor quantity which represents the signal at the fundamental frequency; all harmonic components are removed. All subsequent calculations (e.g. RMS, power, etc.) are based upon the current and voltage phasors, such that the resulting values have no harmonic components.

Protection Elements

All protection elements are processed twice every cycle to determine if a pickup has occurred or a timer has expired. The protection elements use RMS current/voltage, based on the magnitude of the phasor. Hence, protection is impervious to both harmonics and DC transients.

Figure 1-1: Line Diagram

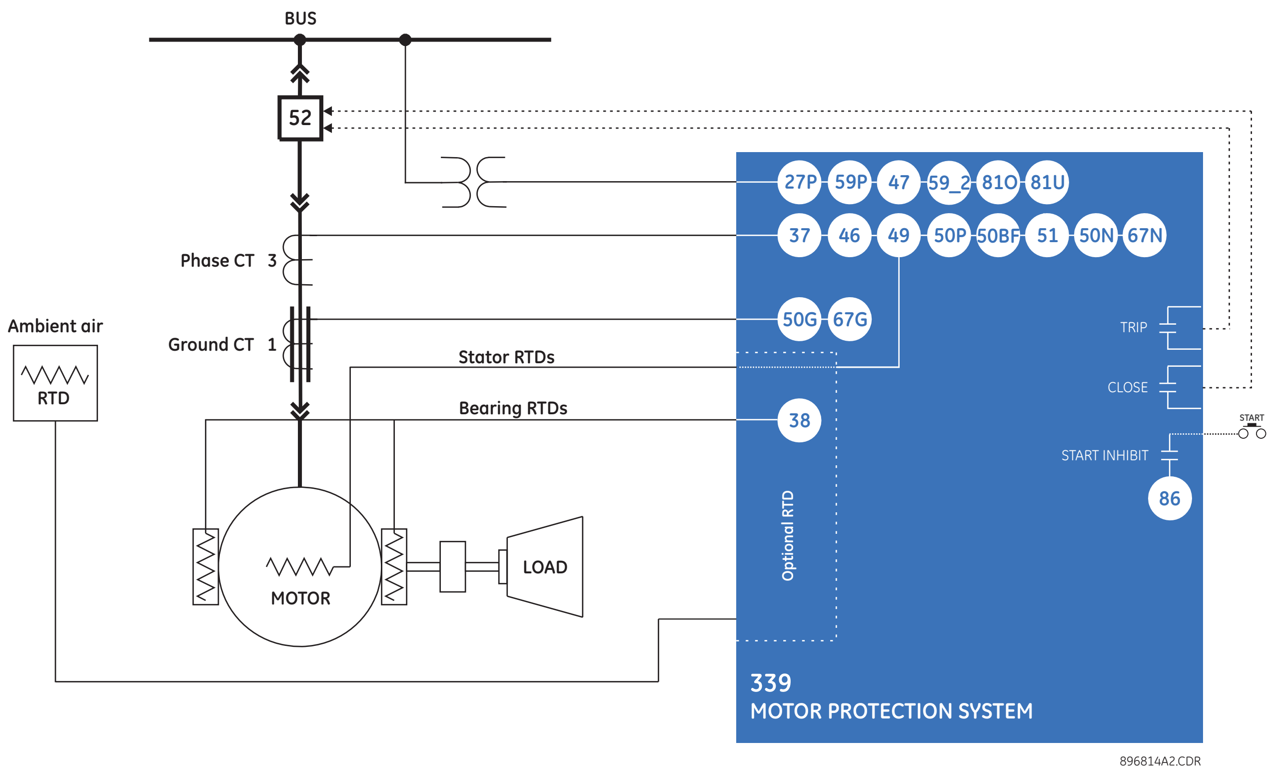
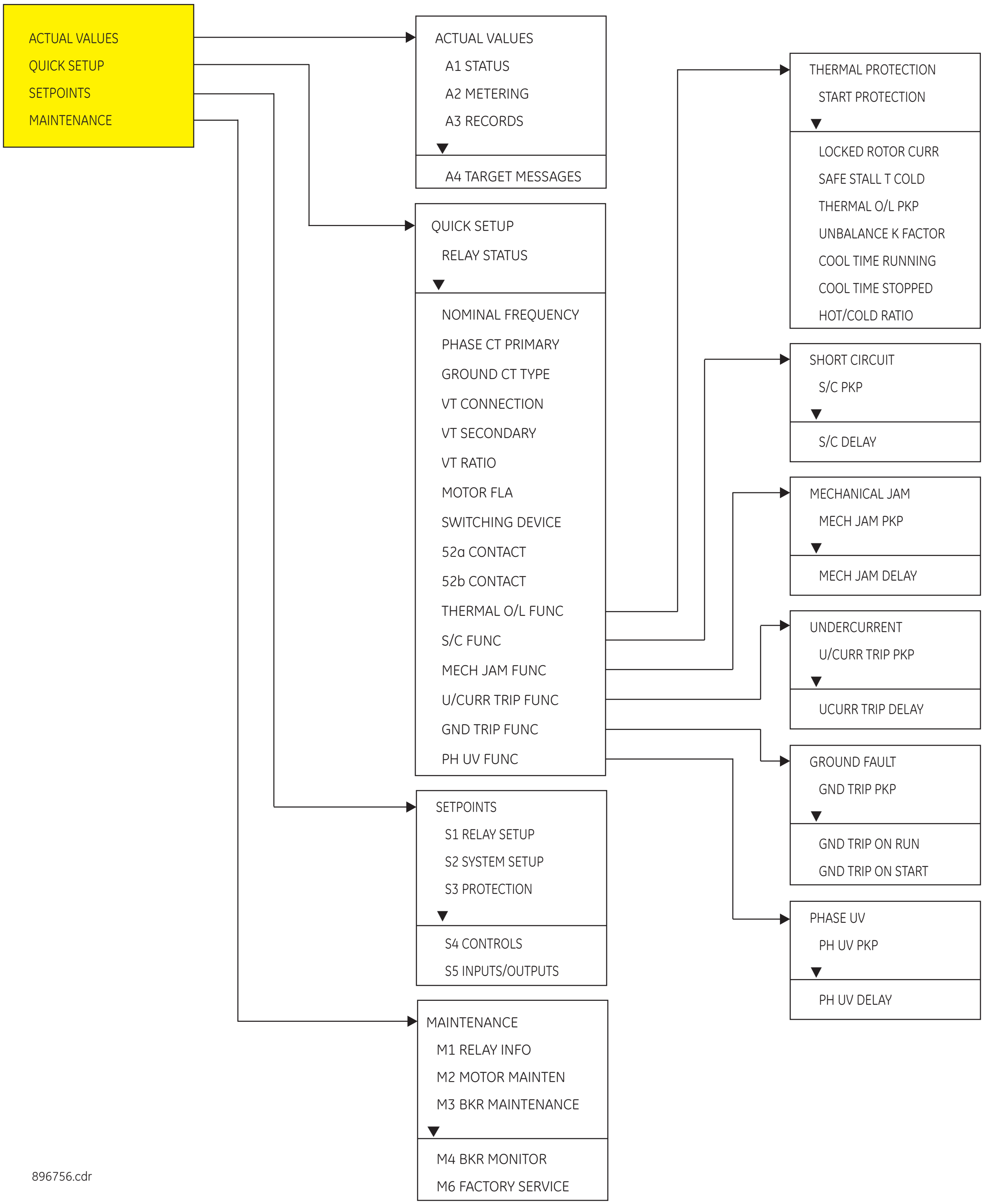


Table 1-1: 339 Protection functions

ANSI device	Description
27P	Phase UV
37	Undercurrent
	Underpower
38	Bearing RTD
	Stator/Ambient/Other
	RTD Trouble Alarm
46	Current Unbalance
47	Voltage Phase Reversal
48	Acceleration Time
49	Thermal Protection/Stall Protection
50BF	Breaker Failure / Welded Contactor
50G	Ground Fault
50P	Short Circuit
51P	Mechanical Jam
50N	Neutral Instantaneous Overcurrent
59_2	Negative Sequence OV
59P	Phase OV
66	Starts per Hour & Time Between Starts
	Restart Block
	Thermal Inhibit
81O	Overfrequency

ANSI device	Description
81U	Underfrequency
86	Lockout
VTFF	VT Fuse Failure

Figure 1-2: Main Menu structure



339 order codes

The information to specify a 339 339 relay is provided in the following order code table.

Figure 1-3: Order Codes

	339	–	*	*	*	*	*	S	N	*	*	*	*	*	
Interface	339														339 Motor Protection System
Language			C												339 Motor Protection System- Chinese
			E												339 Motor Protection System - English
Phase Currents				P1											1 A 3-phase current inputs
				P5											5 A 3-phase current inputs
Ground Currents					G1										1 A ground current input
					G5										5 A ground current input
Power Supply						L									24 to 48 V DC
						H									110 to 250 V DC/110 to 230 V AC
Input/Output							E								10 Contact Inputs, 7 Outputs (2 Form A, 5 Form C)
							R								10 Contact Inputs, 4 Outputs (1 Form A, 3 Form C), 3 100 Ohm Platinum RTD Inputs
Other Options										N					No Selection
										M					Voltage Metering
										P					Voltage Protection: 27P(1), 27P(2), VTFF(1), 59P(2), 81O(2), 81U(2), 59_2(1), 67N(1)
Communications											S	N			Standard: Front USB, Rear RS485: Modbus RTU, DNP3.0, IEC60870-5-103
											1	E			Standard + Ethernet (10/100 RJ45 Copper + MTRJ Fiber), Modbus TCP/IP, DNP3.0, IEC 60870-5-104
											2	E			Standard + Ethernet (10/100 RJ45 Copper + MTRJ Fiber), Modbus TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE
											3	E			Standard + Ethernet (10/100 RJ45 Copper + MTRJ Fiber), Modbus TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850
Case Design													D		Protection Relay with drawout design
													N		Protection Relay with non-drawout design
Harsh Environment														N	None
														H	Harsh Environment Conformal Coating

896800A3.fm

Specifications

NOTE

Specifications are subject to change without notice.

NOTE

To obtain the total element operating time, i.e. from the presence of a trip condition to initiation of a trip, add 8 ms output relay time to the operate times listed below.

Password security

PASSWORD SECURITY

Master Reset Password: .... 8 to 10 alpha-numeric characters
Settings Password:.. 3 to 10 alpha-numeric characters for local and remote access
Control Password:.. 3 to 10 alpha-numeric characters for local and remote access

Protection

NEUTRAL INSTANTANEOUS OVERCURRENT

Pickup Level:... 0.05 to 20 × CT in steps of 0.01 × CT
Dropout Level: .... 96 to 99% of Pickup @ I > 1 × CT
Pickup - 0.02 × CT @ I <1 × CT
Time Delay:.. 0.00 to 300.00 sec in steps of 0.01
Operate Time:.. <30 ms @ 60Hz (I > 2.0 x PKP), 0 ms time delay
<35 ms @ 50Hz (I > 2.0 x PKP), 0 ms time delay
Timer Accuracy:... 0 to 1 cycle
Level Accuracy:.. per CT input
Elements: .... Trip or Alarm

NEUTRAL DIRECTIONAL OVERCURRENT

Directionality:.. Co-existing forward and reverse
Polarizing: .... Voltage, Current, Dual
Polarizing Voltage:.. $-V_0$ calculated using phase voltages (VTs must be connected in "Wye")
Polarizing Current:.. I_G
MTA:... From 0^o to 359^o in steps of 1^o
Angle Accuracy:.. $\pm 4^o$
Operation Delay: .... 20 to 30 ms

NOTE

The selection of "P" option from "339 OTHER OPTIONS" in the Order Code table, will enable the Neutral Directional element with voltage polarizing V0 computed from the measured phase voltage inputs.

UNDERCURRENT

Pickup Level:... 0.1 to 0.95 × FLA in steps of 0.01 × FLA
Dropout Level: .... 101 to 104% of Pickup
Time Delay:.. 1.00 to 60.00 s in steps of 0.01 s
Block from Start:.. 0 to 600 s in steps of 1 s
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: .... See table below
Unbalance Pickup Level: .... 4 to 40% in steps of 1%
Unbalance Time Delay: .... 1.00 to 60.00 s in steps of 0.01 s
Single Phasing Pickup Level: .... unbalance level > 40% or when I_{avg} ≥25%FLA and current in any phase is less than the cutoff current
Single Phasing Time Delay: .... 2 sec
Dropout Level: .... 96 to 99% of pickup
Pickup Accuracy: .... ±2%
Timing Accuracy: .... ±0.5 s or ± 0.5% of total time
Unbalance Elements: .... Trip and Alarm
Single Phasing Elements: .... Trip

Table 1-2: Current Unbalance equations

$$\frac{I_2}{I_1} \times 100\% \text{ if } I_{avg} \geq \text{FLA}$$

$$\frac{I_2}{I_1} \times \frac{I_{avg}}{FLA} \times 100\% \text{ if } I_{avg} < \text{FLA}$$

RTD

Pickup: .... 1 to 250°C in steps of 1°C
Pickup Hysteresis: .... 2°C
Time Delay: .... 3 sec
Elements: .... Trip and Alarm

RTD TROUBLE ALARM

RTD Trouble Alarm: .... <-50°C or >250°C

LOAD INCREASE ALARM

Pickup Level: .... 50 to 150%FLA in steps of 1%FLA
Dropout Level: .... 96 to 99% of Pickup
Alarm Time Delay: .... 1.00 to 60.00 s in steps of 0.01 s
Pickup Accuracy: .... as per phase current inputs
Timing Accuracy: .... ±0.5 s or ±0.5% of total time

SHORT CIRCUIT

Pickup Level: .... 1.00 to 20.00 × CT in steps of 0.01 × CT
Dropout Level: .... 96 to 99% of Pickup @ I > 1 × CT
Pickup - 0.02 × CT @ I < 1 × CT
Alarm Time Delay: .... 0.00 to 60.00 s in steps of 0.01 s
Pickup Accuracy: .... as per phase current inputs
Operate Time: .... <30 ms @ 60Hz (I > 2.0 × PKP), 0 ms time delay
<35 ms @ 50Hz (I > 2.0 × PKP), 0 ms time delay
Timer Accuracy: .... 0 to 1 cycle
Elements: .... Trip or Alarm

MECHANICAL JAM TRIP

Pickup Level: .... 1.01 to 4.50 × FLA in steps of 0.01 × FLA, blocked from start
Dropout Level: .... 96 to 99% of Pickup
Trip Time Delay: .... 0.10 to 30.00 s in steps of 0.01 s
Pickup Accuracy: .... as per phase current inputs
Timing Accuracy: .... ±0.5 s or ±0.5% of total time

GROUND FAULT

Pickup Level:	0.03 to 1.00 × CT in steps of 0.01 × CT 0.50 to 15.00 A in steps of 0.01 A (CBCT)
Dropout Level:	Pickup - 0.02 × CT 96 to 99% of Pickup (CBCT)
Alarm Time Delay on Run:	0.00 to 60.00 s in steps of 0.01 s
Alarm Time Delay on Start:	0.00 to 60.00 s in steps of 0.01 s
Trip Time Delay on Run:	0.00 to 5.00 s in steps of 0.01 s
Trip Time Delay on Start:	0.00 to 10.00 s in steps of 0.01 s
Pickup Accuracy:	as per ground current inputs
Operate Time:	<30 ms @ 60Hz (I > 2.0 × PKP), 0 ms time delay <35 ms @ 50Hz (I > 2.0 × PKP), 0 ms time delay
Timing Accuracy:	0 to 1 cycle
Elements:	Trip and Alarm

THERMAL PROTECTION

Locked Rotor Current:	2.0 to 11.0 × FLA in steps of 0.1 × FLA
Safe Stall Time:	1.0 to 600.0 s in steps of 0.1 s
Curve Multiplier:	1 to 15 in steps of 1
Pickup Level:	1.01 to 1.25 × FLA in steps of 0.01 × FLA
Curve Biasing:	Phase unbalance Hot/cold biasing Stator RTD biasing Exponential Running and Stopped Cooling Rates
TCU Update Rate:	3 cycles
Pickup Accuracy:	per phase current inputs
Timing Accuracy:	±200 ms or ±2% of total time
Elements:	Trip and Alarm

PHASE/AUXILIARY UNDERVOLTAGE

Minimum Voltage:	Programmable from 0.00 to 1.25 × VT in steps of 0.01
Pickup Level:	0.00 to 1.25 × VT in steps of 0.01
Dropout Level:	101 to 104% of pickup
Curve:	Definite Time, Inverse Time
Time Delay:	0.1 to 600.0 s in steps of 0.1
Operate Time:	Time delay ±30 ms @ 60 Hz (V < 0.85 × PKP) Time delay ±40 ms @ 50 Hz (V < 0.85 × PKP)
Time Delay Accuracy:	±3% of expected time, or 1 cycle, whichever is greater
Level Accuracy:	Per voltage input

UNDERPOWER

Pickup Level:	1 to 100% Hz MNR 1%
Dropout Level:	101% to 104% of Pickup
Time Delay:	1.0 to 60.0 s in steps of 0.1
Pickup Accuracy:	as per power monitoring specification
Timing Accuracy:	±0.5 s or ±0.5% of total time
Elements:	Trip and Alarm

NEGATIVE SEQUENCE/PHASE OVERVOLTAGE

Pickup Level:	0.00 to 1.25 × VT in steps of 0.01
Dropout Level:	96 to 99% of pickup
Time Delay:	0.1 to 600.0 s in steps of 0.1
Operate Time:	Time delay ±30 ms @ 60 Hz (V < 0.85 × PKP) Time delay ±40 ms @ 50 Hz (V < 0.85 × PKP)
Timing Accuracy:	±0.5 s or ±0.3% of total time
Level Accuracy:	Per voltage input

PHASE REVERSAL

Configuration: ABC or ACB phase rotation
Time Delay: 100 ms
Timing Accuracy: ±0.5 s
Elements: Trip or Alarm

UNDERFREQUENCY

Minimum Voltage: 0.00 to 1.25 x VT in steps of 0.01
Pickup Level: 40.00 to 70.00 Hz in steps of 0.01
Dropout Level: Pickup +0.03 Hz
Time Delay: 0.1 to 600.0 s in steps of 0.1
Timing Accuracy: ±0.5 s or ±0.5% of total time
Level Accuracy: ±0.01 Hz
Elements: Trip and Alarm

OVERFREQUENCY

Minimum Voltage: 0.3 x VT
Pickup Level: 40.00 to 70.00 Hz in steps of 0.01
Dropout Level: Pickup - 0.03 Hz
Time Delay: 0.1 to 600.0 s in steps of 0.1
Timing Accuracy: ±0.5 s or ±0.5% of total time
Level Accuracy: ±0.01 Hz
Elements: Trip and Alarm

FUSE FAIL

Time Delay: 1 s
Timing Accuracy: ±0.5 s
Elements: Trip or Alarm

ACCELERATION TIME TRIP

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

Metering

PARAMETER	ACCURACY	RESOLUTION	RANGE
3-Phase Real Power (kW)	±1% of full scale	0.1 kW	±100000.0 kW
3-Phase Reactive Power (kvar)	±1% of full scale	0.1 kvar	±100000.0 kvar
3-Phase Apparent Power (kVA)	±1% of full scale	0.1 kVA	100000.0 kVA
3-Phase Positive Watthour (MWh)	±1% of full scale	±0.001 MWh	50000.0 MWh
3-Phase Negative Watthour (MWh)	±1% of full scale	±0.001 MWh	50000.0 MWh
3-Phase Positive Varhour (Mvarh)	±1% of full scale	±0.001 Mvarh	50000.0 Mvarh
3-Phase Negative Varhour (Mvarh)	±1% of full scale	±0.001 Mvarh	50000.0 Mvarh
Power Factor	±0.05	0.01	-0.99 to 1.00
Frequency	±0.05 Hz	0.01 Hz	40.00 to 70.00 Hz

NOTE

Full scale for CT Input is 3 x CT

Data capture

DATA LOGGER

Number of Channels:	10
Parameters:	Any available analog actual value
Sampling Rate:	1 cycle, 1 second, 1 minute, 1 hour
Trigger Source:	All logic elements, Logic operand: Any Trip PKP/OP/DPO, Any Alarm PKP/OP/DPO
Mode:	Continuous or triggered

MOTOR START DATA LOGGER

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

TRANSIENT RECORDER

Buffer size:	3 s
No. of buffers:	1x192 cycles, 3x64 cycles, 6x32 cycles
Sampling rate:	32 samples per cycle
Triggers:	Manual Command Contact Input Virtual Input Logic Element Element Pickup/Trip/Dropout/Alarm
Data:	AC input channels Contact input state Contact output state Virtual input state Logic element state
Data storage:	RAM - battery backed-up

EVENT RECORDER

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

LEARNED DATA RECORDER

Number of events:	250
Header:	Date, number of records
Content:	learned acceleration time , learned starting current, learned starting capacity, last starting current, last starting capacity, last acceleration time , average motor load learned, average run time after start (days), average run time after start (minutes)
Data Storage:	Non-volatile memory

CLOCK

Setup:	Date and time Daylight Saving Time RTC Accuracy: ± 1 min / month at 25°C
IRIG-B:	Auto-detect (DC shift or Amplitude Modulated) Amplitude modulated: 1 to 10 V pk-pk DC shift: 1 to 10 V DC Input impedance: 40 kOhm ± 10% at 25°C

Control

LOGIC ELEMENTS

Number of logic elements: 16
Trigger source inputs per element: 3
Block inputs per element: 3
Supported operations: OR, AND, NOT, Pickup / Dropout timers
Pickup timer: 0 to 60000 ms in steps of 1 ms
Dropout timer: 0 to 60000 ms in steps of 1 ms

BREAKER CONTROL

Operation: Asserted Contact Input, Logic Element, Virtual Input, Manual Command, Remote Input
Function: Opens/closes the motor breaker

START INHIBIT

Thermal Start Inhibit: Thermal Inhibit Margin: 0 to 25 % in steps of 1%
Starts per Hour Inhibit: Maximum: 1 to 5 starts in steps of 1
Time Between Starts Inhibit: Time Between Starts: 1 to 3600 s in steps of 1 s
Restart Inhibit: Restart Inhibit Delay: 1 to 50000 s in steps of 1 s

BREAKER FAILURE/WELDED CONTACTOR

Current Supervision: Phase Current
Current Supervision Pickup: 0.05 to 20.00 × CT in steps of 0.01 × CT
Time Delay 1: 0.03 to 1.00 s in steps of 0.01 s
Time Delay 2: 0.00 to 1.00 s in steps of 0.01 s
Current Supervision Dropout: 97 to 98% of pickup
Current Supervision Accuracy: per CT input
Timing Accuracy: 0 to 1 cycle (Timer 1, Timer 2)

BREAKER TRIP COUNTER

Trip Counter Limit (Pickup): 1 to 10000 in steps of 1

EMERGENCY RESTART

Function: Defeats all motor start inhibit features, resets all trips and alarms, and discharges the thermal capacity to zero so that a hot motor can be restarted in the event of an emergency
Operation: Contact Input 1 to 10, Virtual Input 1 to 32, Logic Element 1 to 16, Remote Input 1 to 32

LOCKOUT RESET

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

RESET

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

AMBIENT TEMPERATURE

High Temperature Pickup: 20°C to 80°C in steps of 1°C
Low Temperature Pickup: -40°C to 20°C in steps of 1°C
Time Delay: 1 to 60 min in steps of 1 mins
Temperature Dropout: Configurable 90 to 98% of pickup
Temperature Accuracy: ±10°C
Timing Accuracy: ±1 second

Inputs

CONTACT INPUTS

Inputs:	10
Selectable thresholds:	17, 33, 84, 166 VDC
Tolerance:	±10%
Recognition time:	1/2 cycle
Debounce time:	1 to 64 ms, selectable, in steps of 1 ms
Maximum input voltage & continuous current draw:	300 VDC, 2 mA, connected to Class 2 source
Type:	opto-isolated inputs
External switch:	wet contact

PHASE & GROUND CURRENT INPUTS

CT Primary:	30 to 1500 A
Range:	0.05 to 20 × CT
Input type:	1 A or 5 A (must be specified with order)
Nominal frequency:	50/60 Hz
Burden:	<0.1 VA at rated load
Accuracy:	±1% of reading at 1× CT ±3% of reading from 0.2 to 20 × CT ±20% of reading from 0.05 to 0.19 × CT
CT withstand:	1 second at 100 × rated current 2 seconds at 40 × rated current continuous at 3 × rated current

CBCT INPUT (50:0.025)

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

FREQUENCY

Accuracy:	±0.05 Hz
Resolution:	0.01 Hz
Range:	40.00 to 70.00 Hz

PHASE VOLTAGE INPUTS

Source VT:	100 to 20000 V
VT secondary range:	50 to 240 V
VT ratio:	1 to 300 in steps of 1
Nominal frequency:	50/60 Hz
Relay burden:	<0.25 VA at 120 V
Accuracy:	±1.0% throughout range
Voltage withstand:	260 VAC continuous

RTD INPUTS

RTD Type:	100 Ohm platinum (DIN.43760)
RTD Sensing Current:	5 mA
Isolation:	2 kV from base unit (RMIO only)
Distance:	250 m maximum
Range:	-50 to +250°C
Accuracy:	±3°C
Lead Resistance:	25 Ohm max per lead
RTD Trouble Alarm:	<-50 or >250°C
RTD Inputs Available:	3 with INPUT/OUTPUT option 'R' installed OR 12 maximum with the RMIO option connected

Outputs

FORM-A RELAYS

Configuration:	2 (two) electromechanical
Contact material:	silver-alloy
Operate time:	<8 ms
Continuous current:	10 A
Make and carry for 0.2s:	30 A per ANSI C37.90
Break (DC inductive, L/R=40 ms):	24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A 250 V / 0.2 A
Break (DC resistive):	24 V / 10 A 48 V / 6 A 125 V / 0.5 A 250 V / 0.3 A
Break (AC inductive):	720 VA @ 250 VAC Pilot duty A300
Break (AC resistive):	277 VAC / 10 A

FORM-A VOLTAGE MONITOR

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

FORM-C RELAYS

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

TRIP / CLOSE SEAL-IN

Relay 1 trip seal-in:	0.00 to 9.99 s in steps of 0.01
Relay 2 close seal-in:	0.00 to 9.99 s in steps of 0.01

Power supply

HIGH RANGE POWER SUPPLY

Nominal:	120 to 240 VAC 125 to 250 VDC
Range:	60 to 300 VAC (50 and 60 Hz) 84 to 250 VDC
Ride-through time:	35 ms

LOW RANGE POWER SUPPLY

Nominal:	24 to 48 VDC
Range:	20 to 60 VDC

ALL RANGES

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

Communications

SERIAL

RS485 port:	Opto-coupled
Baud rates:	up to 115 kbps
Response time:	1 ms typical
Parity:	None, Odd, Even
Protocol:	Modbus RTU, DNP 3.0, IEC 60870-5-103
Maximum distance:	1200 m (4000 feet)
Isolation:	2 kV

ETHERNET (COPPER)

Modes:.. 10/100 MB (auto-detect)
Connector:.. RJ-45
Protocol: .... Modbus TCP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE

ETHERNET (FIBER)

Fiber type:... 100 MB Multi-mode
Wavelength: .... 1300 nm
Connector:.. MTRJ
Protocol: .... Modbus TCP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE
Transmit power:... -20 dBm
Receiver sensitivity:..................................... -31 dBm
Power budget: .... 9 dB
Maximum input power:...................................... -11.8 dBm
Typical distance:... 2 km (1.25 miles)
Duplex: .... half/full

USB

Standard specification:................................... Compliant with USB 2.0
Data transfer rate:....................................... 115 kbps

CAN (RMIO)

Maximum distance: .... 250 m (820 feet)
Cable type: .... Shielded or unshielded twisted pair
Cable gauge: .... Belden 9841 or similar 24 AWG for distances up to 100 m; 22 AWG for distances up to 250 m

Testing and certification

CERTIFICATION

	Applicable Council Directive	**According to**:
	Low voltage directive	EN60255-5, EN60947-1, EN60947-6-1
CE compliance	EMC Directive	EN61000-6-2, EN61000-6-4
ISO	Manufactured under a registered quality program	ISO9001

TYPE TESTS

TEST	REFERENCE STANDARD	TEST LEVEL
Dielectric voltage withstand	IEC60255-5	
(high voltage power supply)		2.3KV
(low voltage power supply)		500V
Impulse voltage withstand	IEC60255-5	5KV
Insulation resistance		500VDC >100mohm
Damped Oscillatory	IEC61000-4-18/IEC60255-22-1	2.5KV CM, 1KV DM
Electrostatic Discharge	EN61000-4-2/IEC60255-22-2	Level 4
Radiated RF immunity	EN61000-4-3/IEC60255-22-3	Level 3
Fast Transient Disturbance	EN61000-4-4/IEC60255-22-4	Level 4
Surge Immunity	EN61000-4-5/IEC60255-22-5	Level 3 & 4

TEST	REFERENCE STANDARD	TEST LEVEL
Conducted RF Immunity	EN61000-4-6/IEC60255-22-6	Level 3
Power Frequency Magnetic Field Immunity	IEC61000-4-8	Level 4
Voltage Dip & Interruption	IEC61000-4-11	0,40,70% dips, 250/300cycle interrupts
Radiated & Conducted Emissions	CISPR11 /CISPR22/ IEC60255-25	Class A
Sinusoidal Vibration	IEC60255-21-1	Class 1
Shock & Bump	IEC60255-21-2	Class 1
Ingress Protection	IEC60529	IP40 (front) , IP10 (back)
Environmental (Cold)	IEC60068-2-1	-20^{o}C 16 hrs
Environmental (Dry heat)	IEC60068-2-2	85^{o}C 16hrs
Relative Humidity Cyclic	IEC60068-2-30	6 day variant 2
Fast Transient Disturbance	IEEE C37.90.1	4KV CM & DM
SWC Damped Oscillatory	IEEE C37.90.1	2.5KV CM & DM
RF Immunity	IEEE C37.90.2	20V/m 80-1Ghz 35V/m max at 80% modulation
Electrostatic Discharge	IEEE C37.90.3	8KV CD, 15KV AD

Physical

DIMENSIONS

Size: .... *Refer to Chapter 2*
Weight: .... 4.1 kg [9.0 lb]

Environmental

OPERATING ENVIRONMENT

Ambient temperatures:	
Storage/Shipping:	- 40^{o}C to 85^{o}C
Operating:	-40^{o}C to 60^{o}C
Humidity:	Operating up to 95% (non condensing) @ 55^{o}C (As per IEC60068-2-30 Variant 2, 6 days)
Altitude:	2000 m (max)
Pollution Degree:	II
Overvoltage Category:	III
Ingress Protection:	IP40 Front , IP10 Back

GE
Digital Energy

339 Motor Protection System

Chapter 2: Installation

Mechanical installation

This section describes the mechanical installation of the 339 system, including dimensions for mounting and information on module withdrawal and insertion.

Dimensions

The dimensions of the 339 are shown below. Additional dimensions for mounting and panel cutouts are shown in the following sections.

Figure 2-1: 339 dimensions - Drawout unit

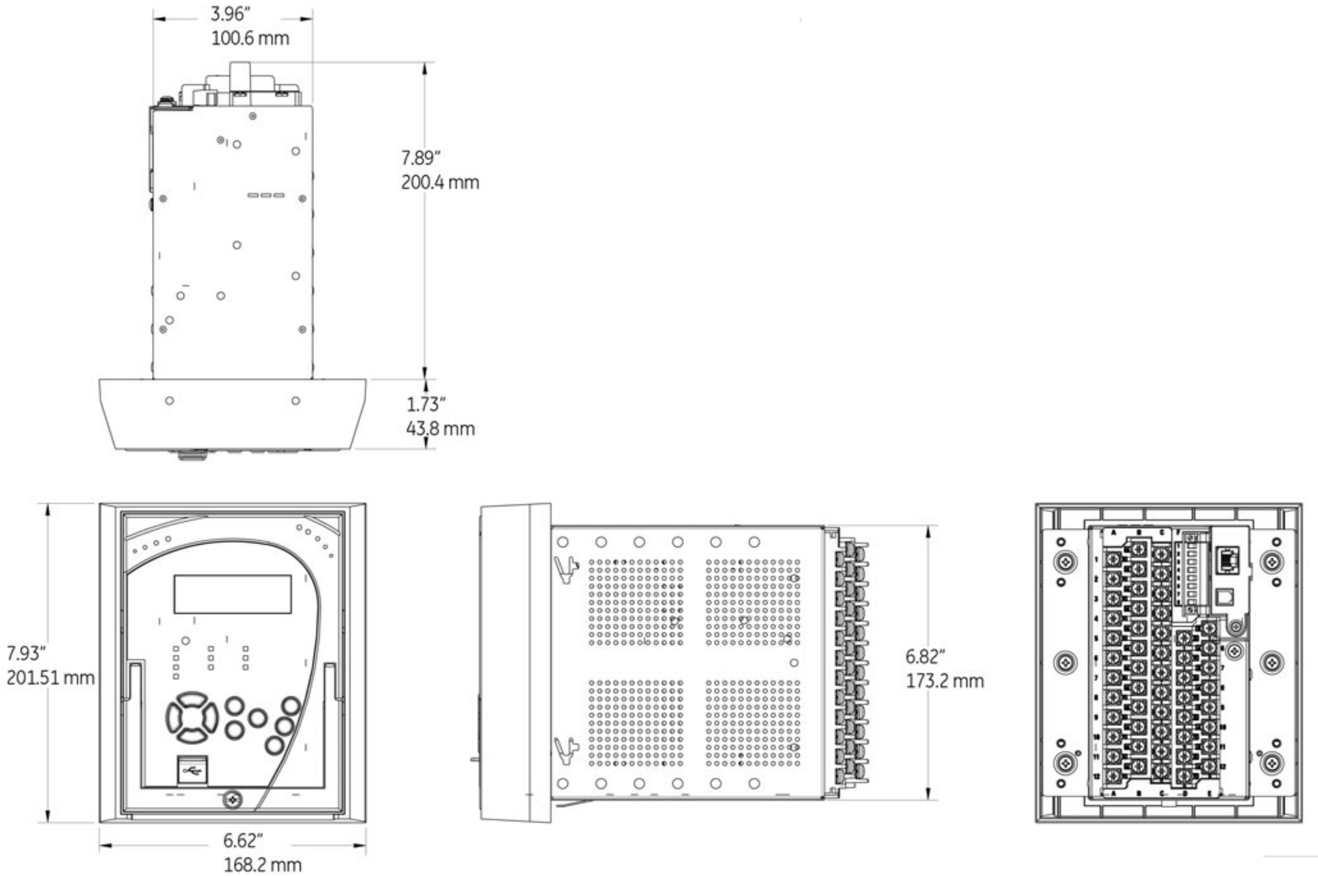
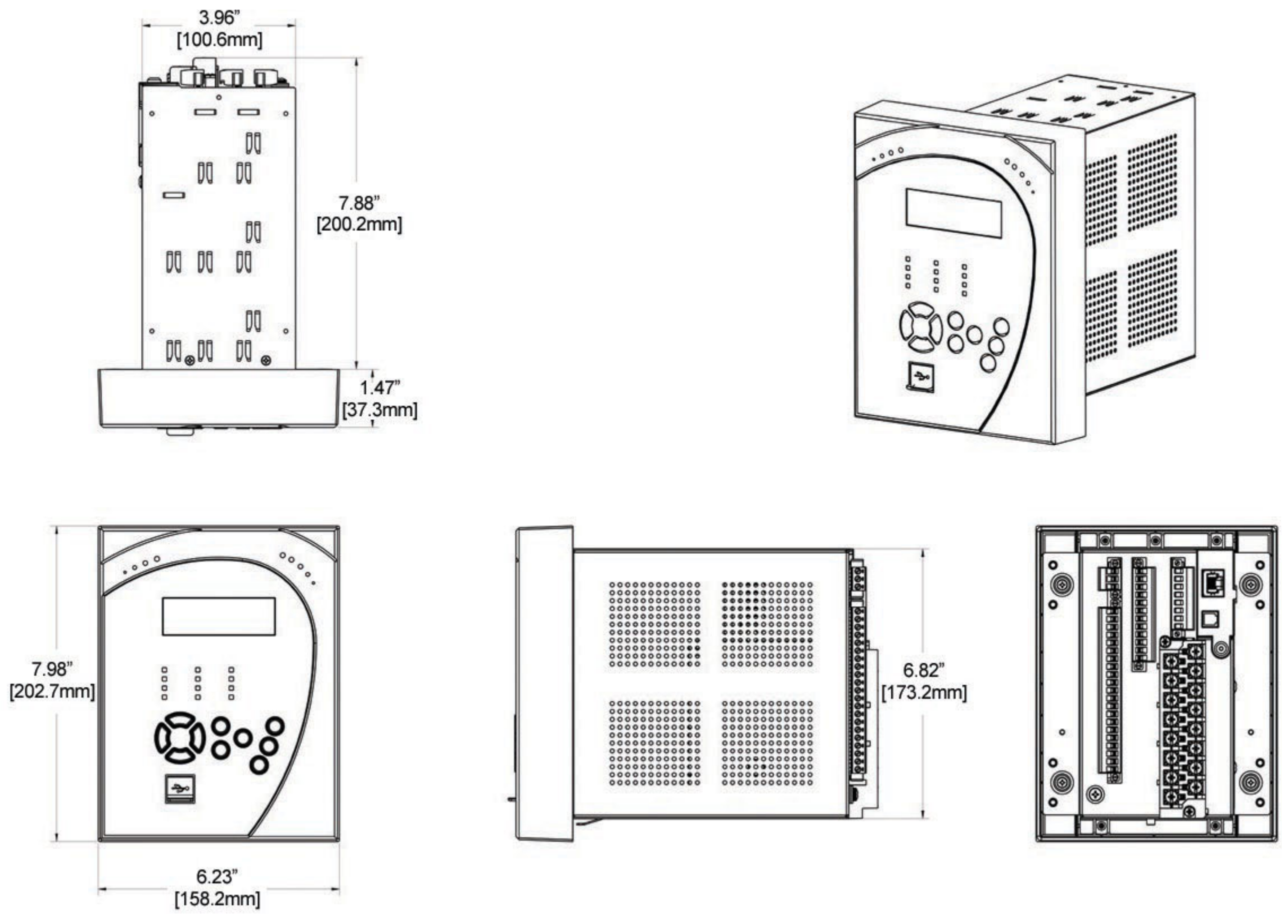


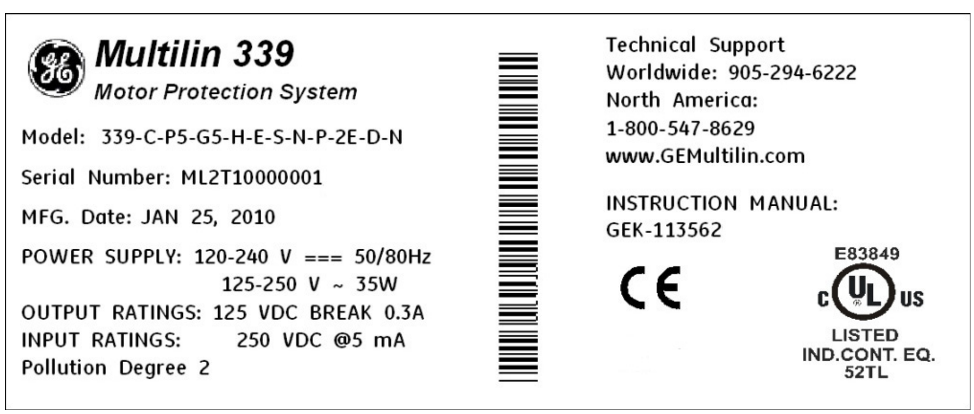
Figure 2-2: 339 339 dimensions - Non-drawout unit



Product identification

The product identification label is located on the side panel of the 339 . This label indicates the product model, serial number, and date of manufacture.

Figure 2-3: 339 Product Identification label



Mounting

Standard panel mount

The standard panel mount and cutout dimensions are illustrated below.

CAUTION

To avoid the potential for personal injury due to fire hazards, ensure the unit is mounted in a safe location and/or within an appropriate enclosure.

Figure 2-4: Standard Panel mounting - Drawout

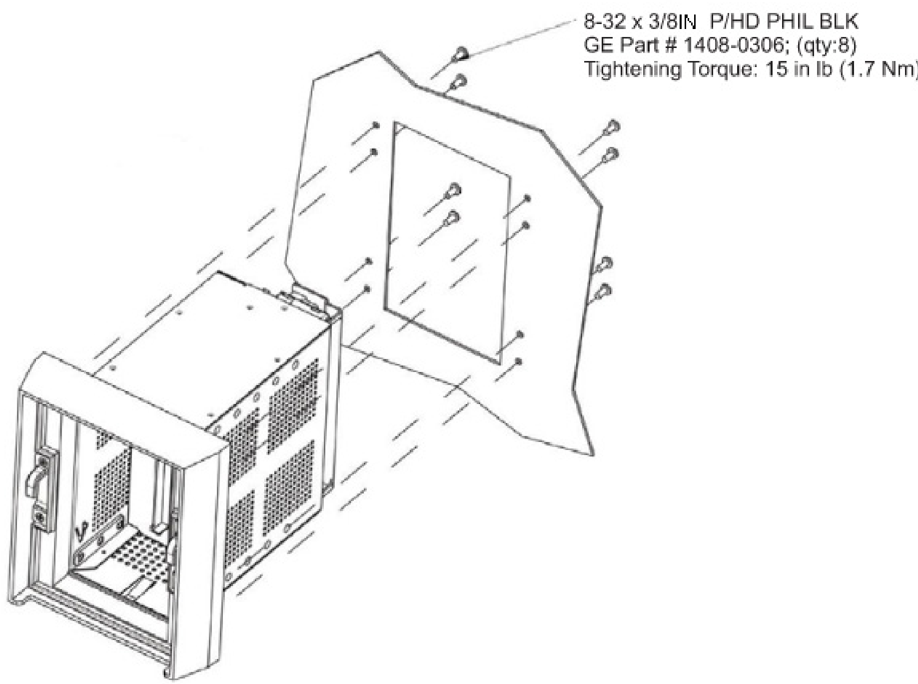


Figure 2-5: Standard Panel mounting - Non-drawout

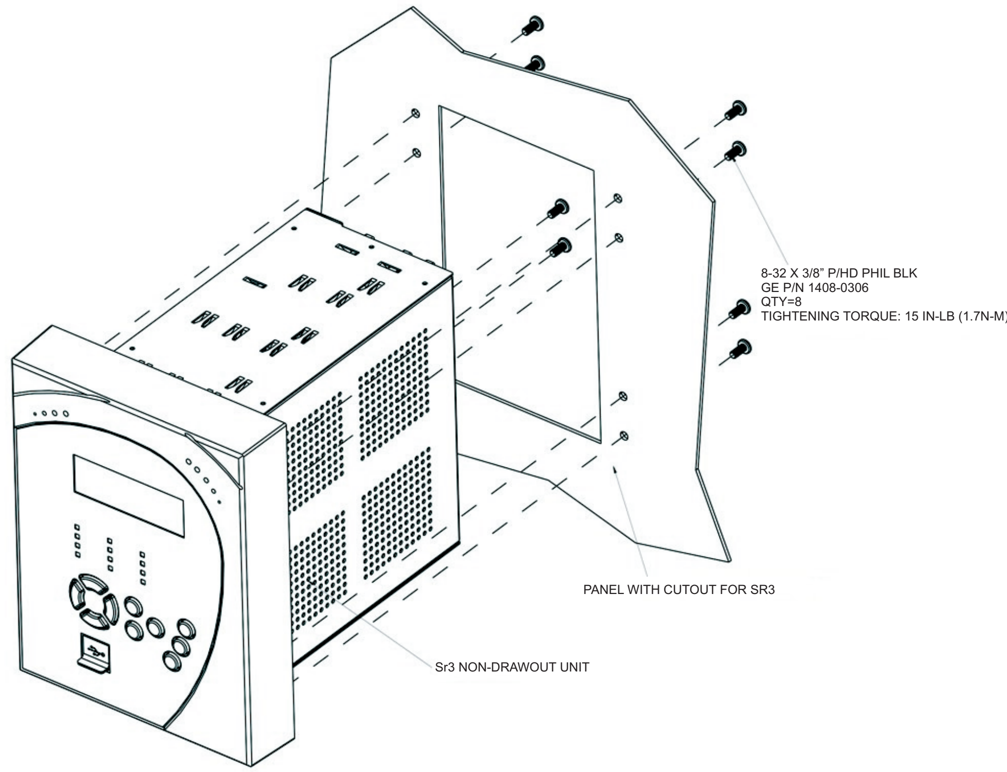
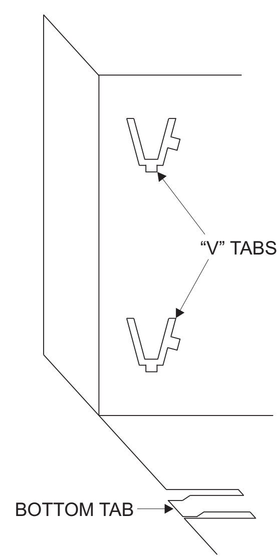


Figure 2-6: Mounting tabs (optional)



1. From the front of the panel, slide the empty case into the cutout until the bottom tab clicks into place (see above).
2. From the rear of the panel screw the case into the panel at the 8 screw positions shown above.
3. If added security is required, bend the retaining "V"tabs outward, to about 90°. These tabs are located on the sides of the case and appear as shown above.

The relay can now be inserted and can be panel wired.

Figure 2-7: Panel cutout dimensions

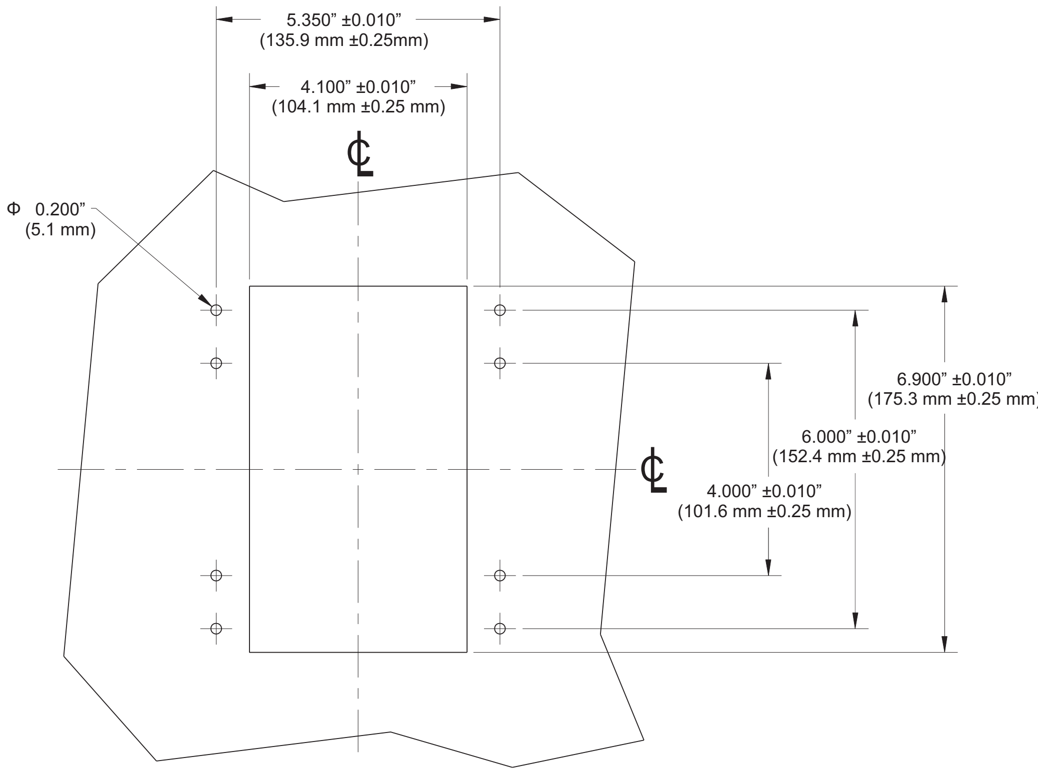


Figure 2-8: RMIO - DIN rail mounting - Base & Expansion units

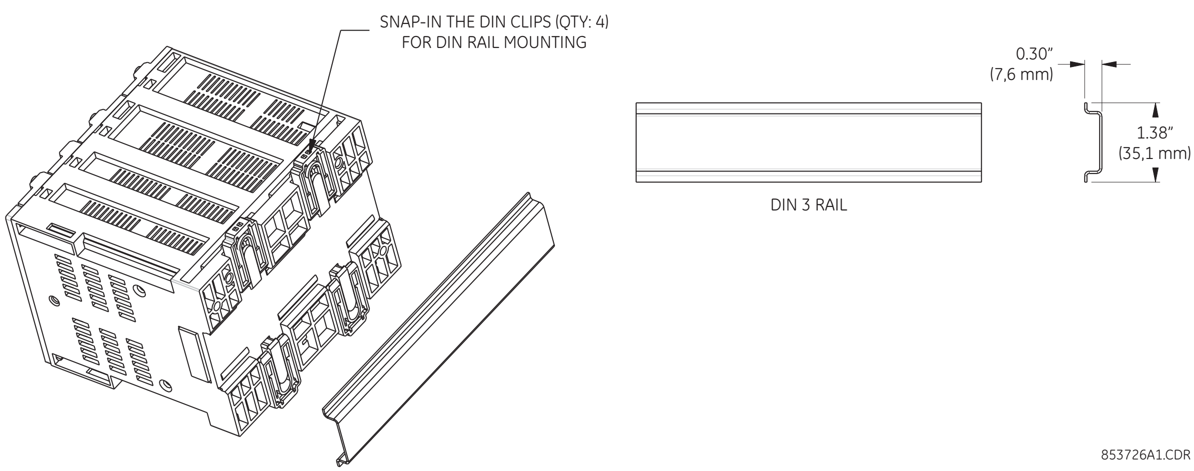


Figure 2-9: RMIO - Base Unit screw mounting

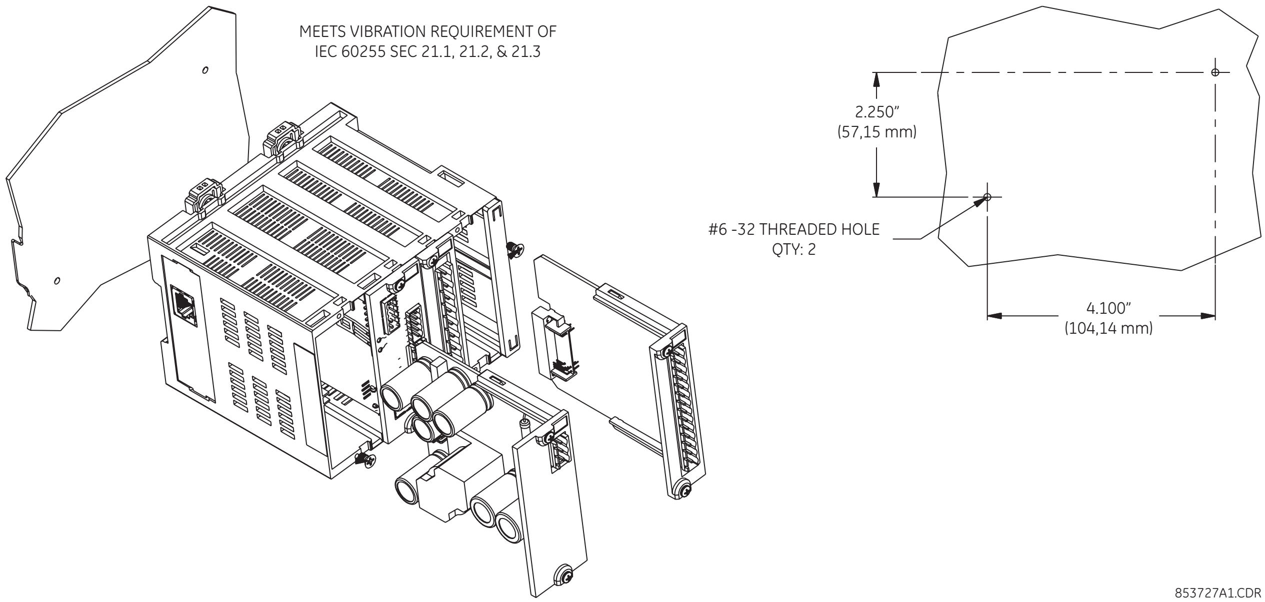
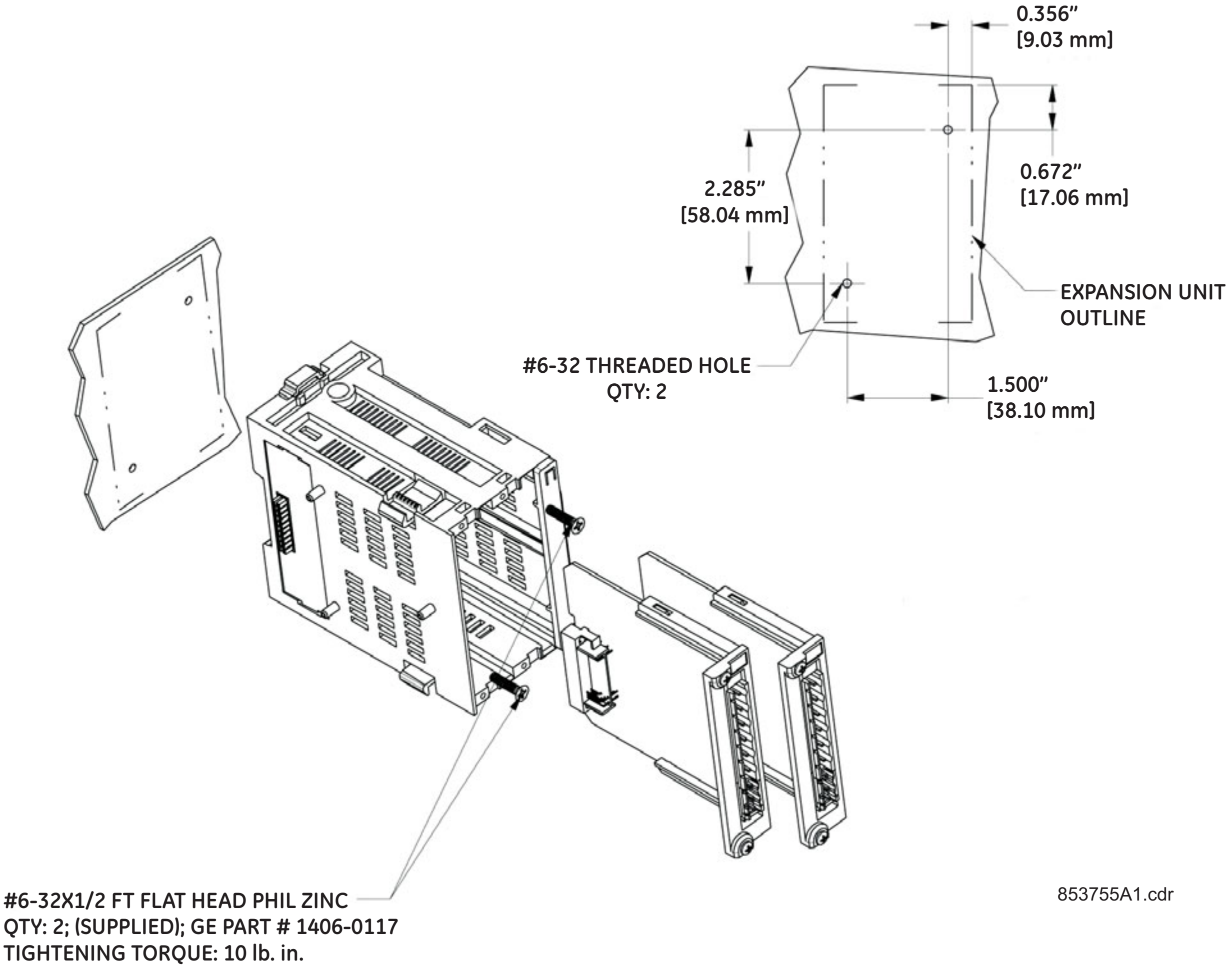
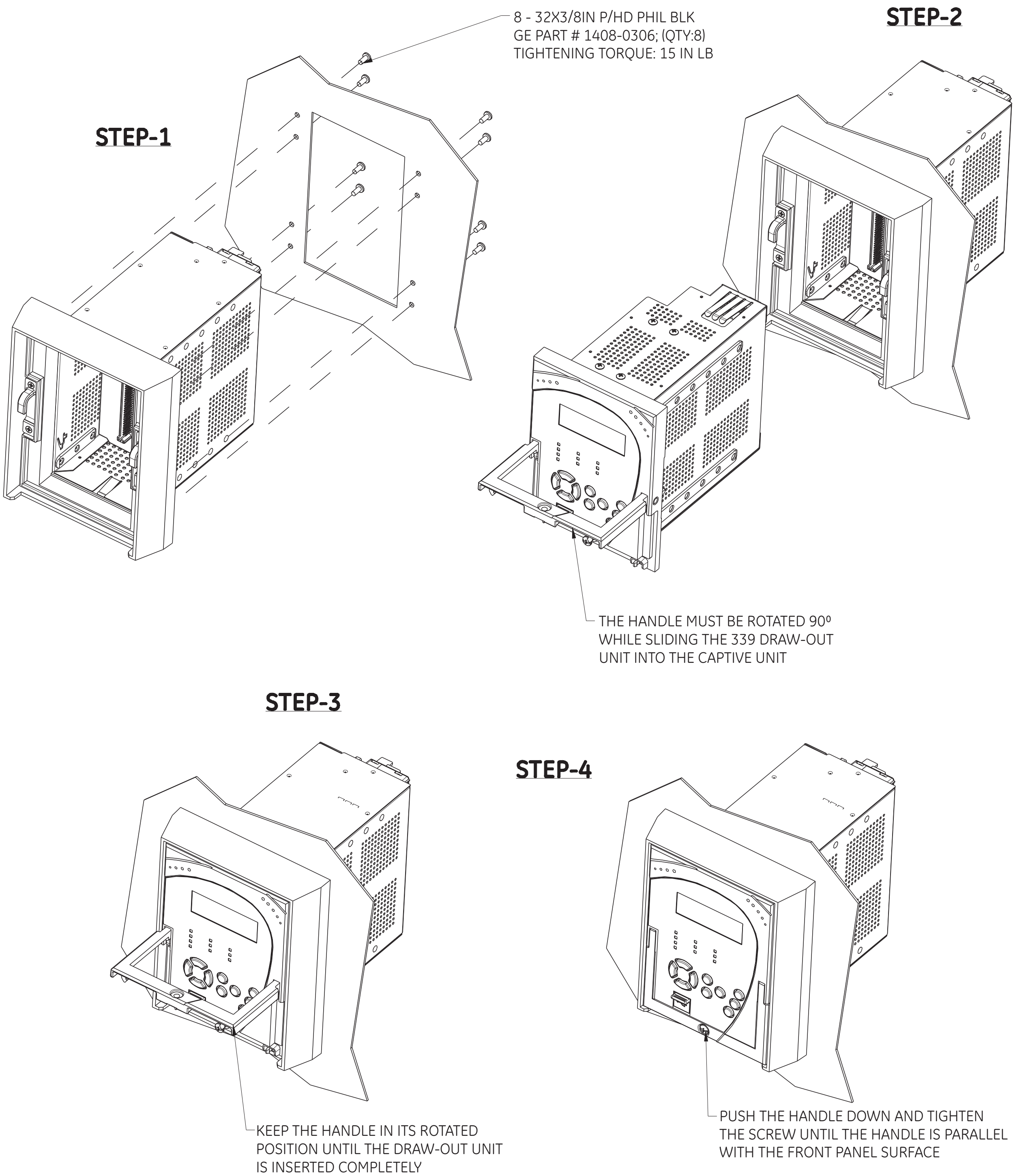


Figure 2-10: RMIO - Expansion Unit screw mounting



Drawout unit withdrawal and insertion

Figure 2-11: Standard unit withdrawal and insertion diagram



Electrical installation

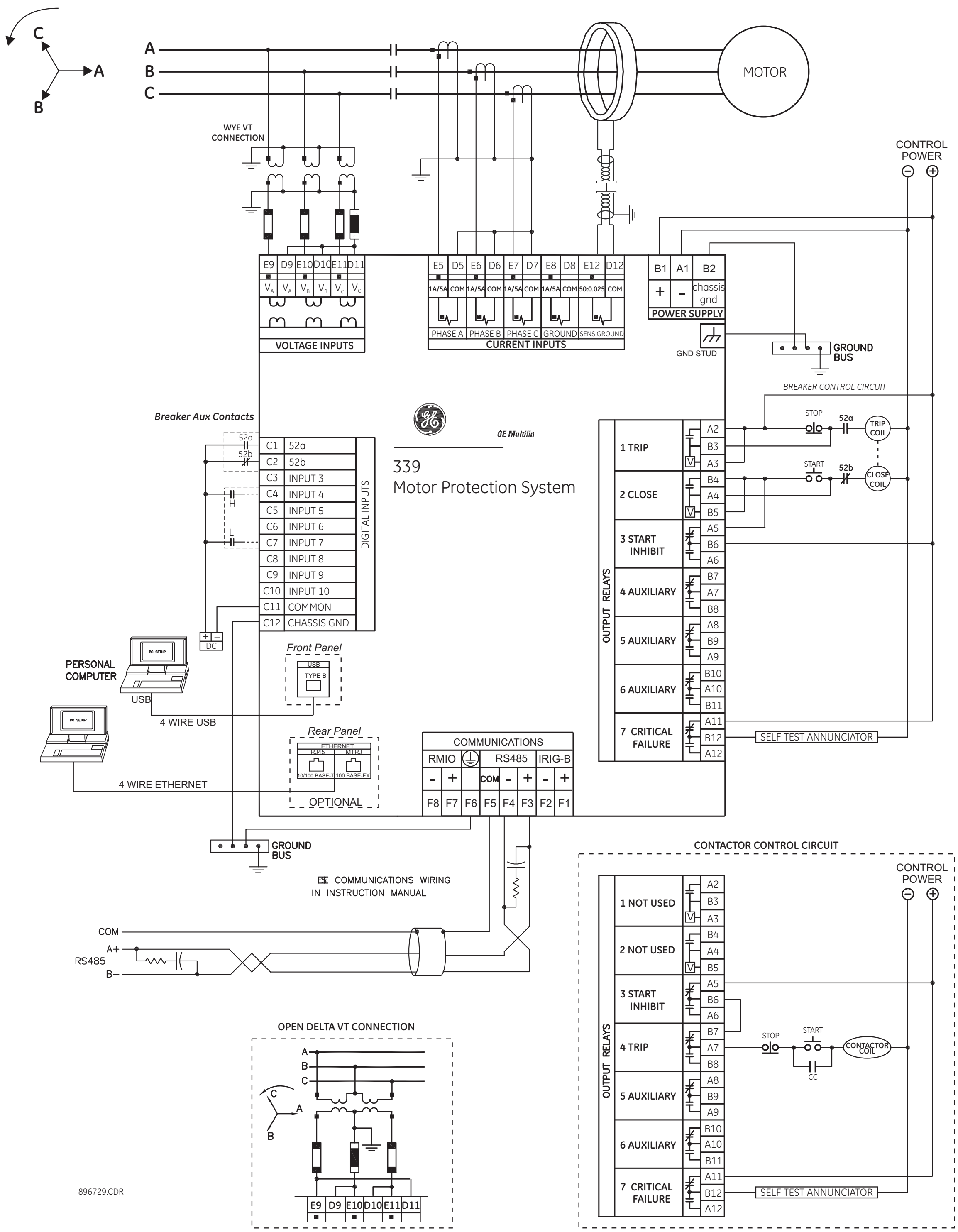


Figure 2-12: Typical Wiring Diagram - Drawout - Input/Output Option “E”

Figure 2-13: Typical Wiring Diagram - Non-drawout - Input/Output Option "E"

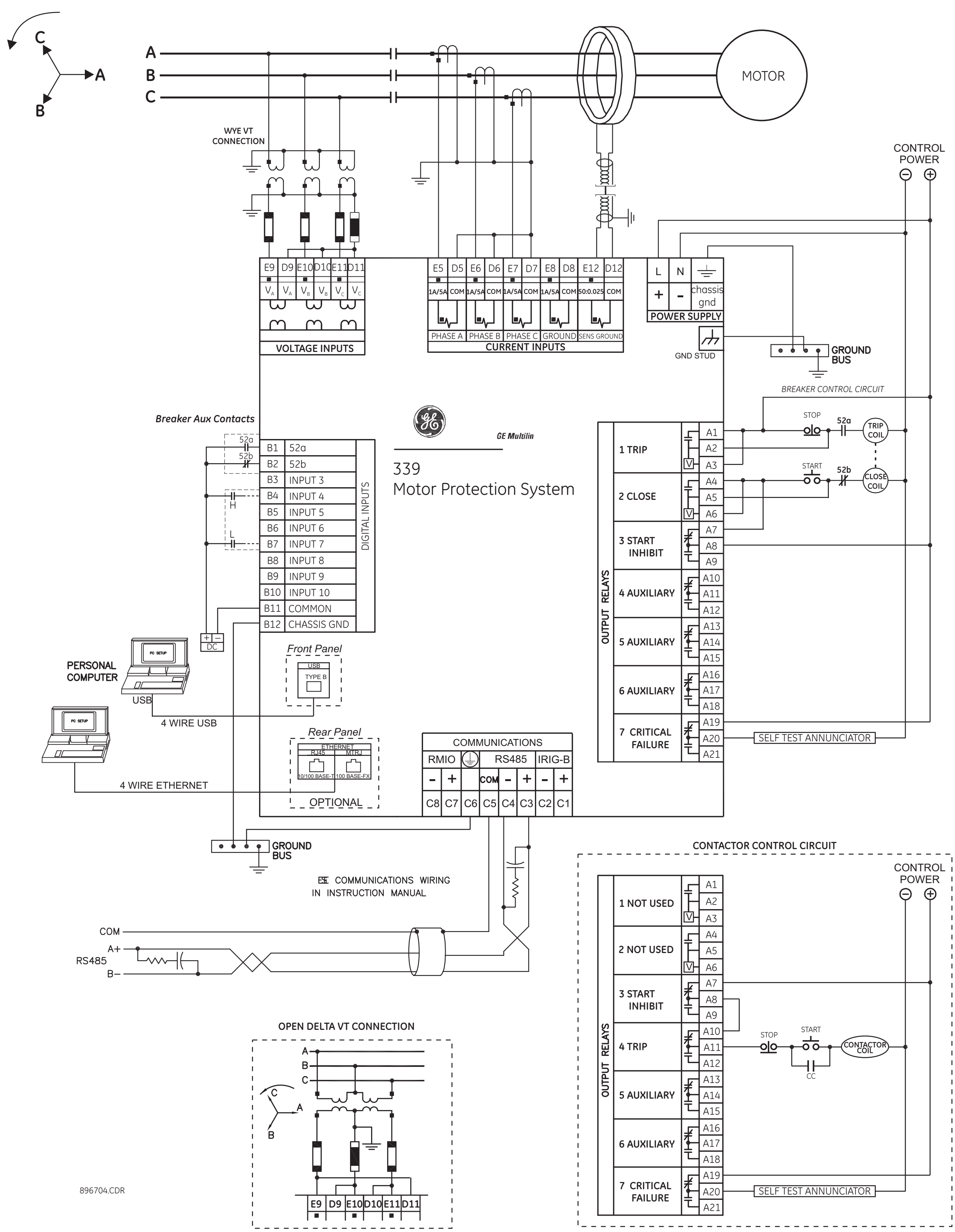
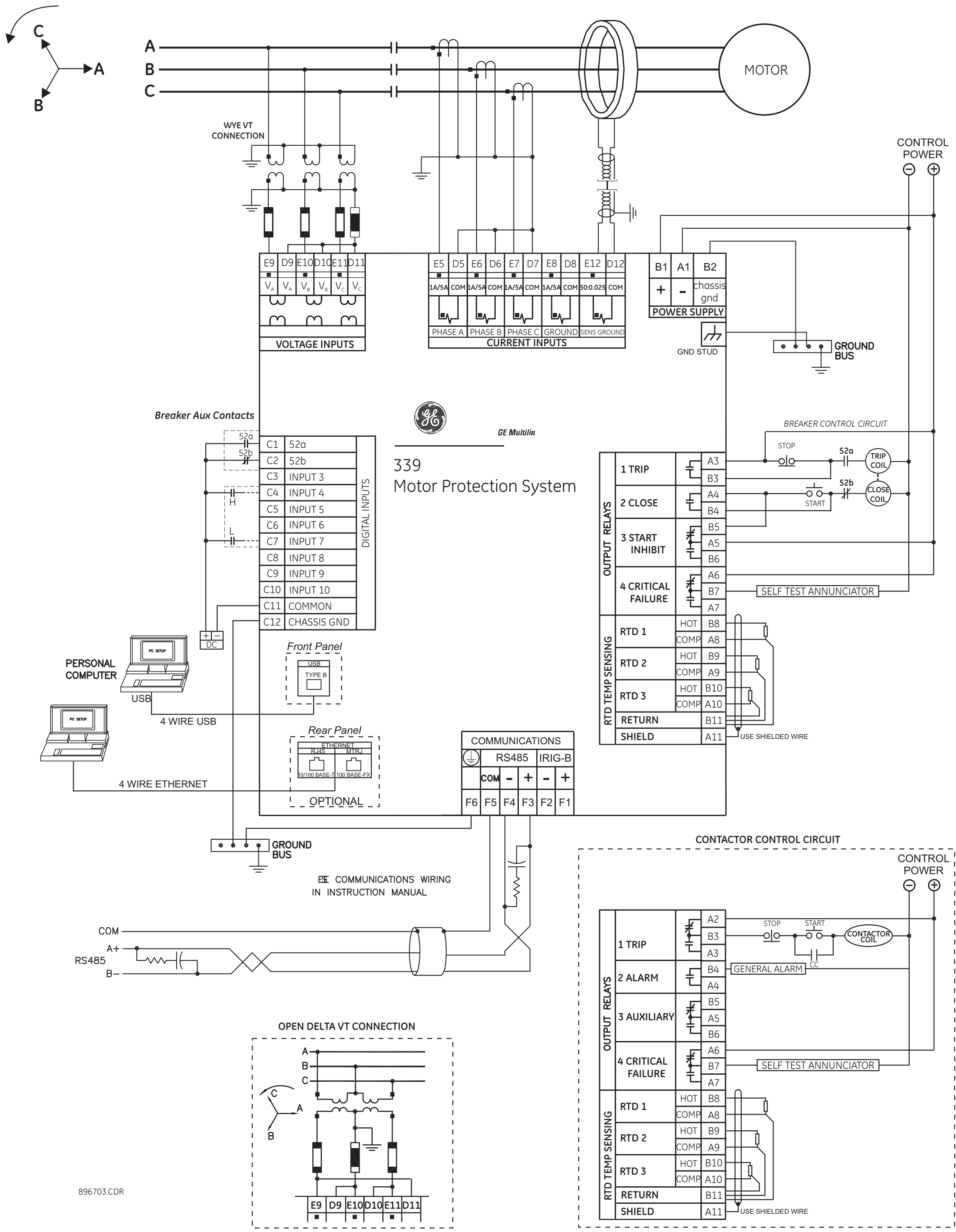


Figure 2-14: Typical Wiring Diagram - Input/Output Option “R”



339 terminals

NOTE

When installing two lugs on one terminal, both lugs should be "right side up" as shown in the pictures below. This is to ensure the adjacent lower terminal block does not interfere with the lug body.

Figure 2-15: Orient the Lugs correctly...

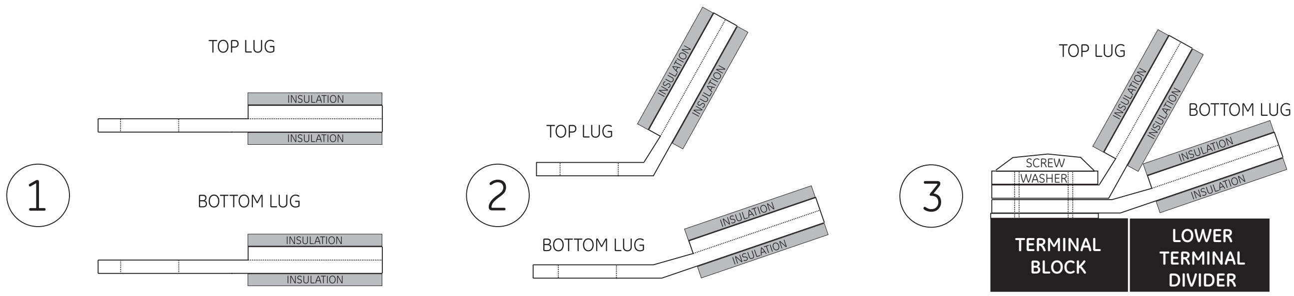


Figure 2-16: CORRECT INSTALLATION METHOD

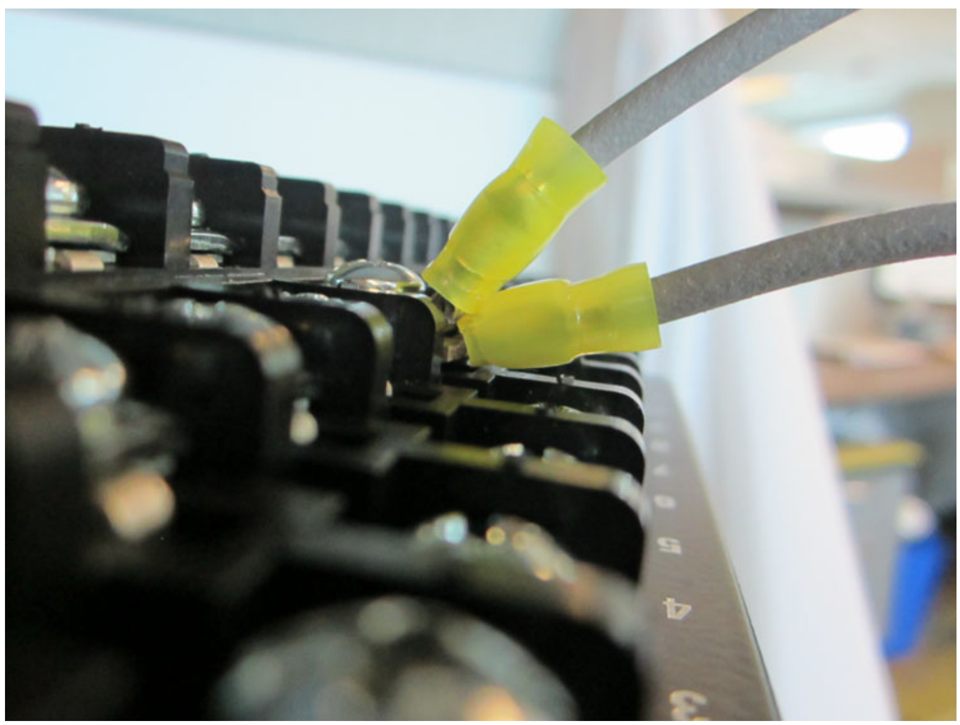
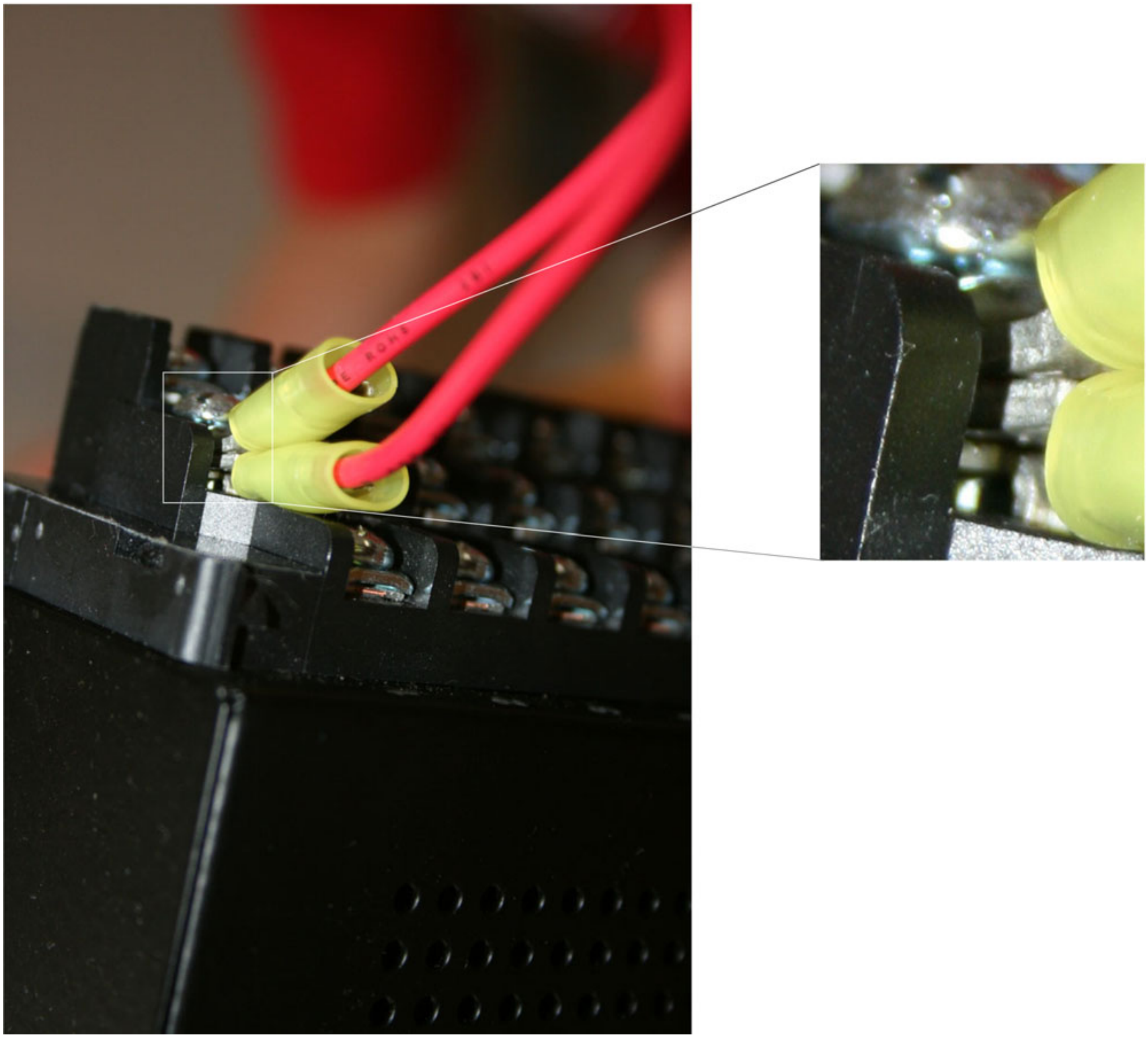


Figure 2-17: INCORRECT INSTALLATION METHOD (lower lug reversed)



Terminal identification - Input/ Output “E”

Figure 2-18: 339 Terminal identification with switching device as BREAKER - Drawout

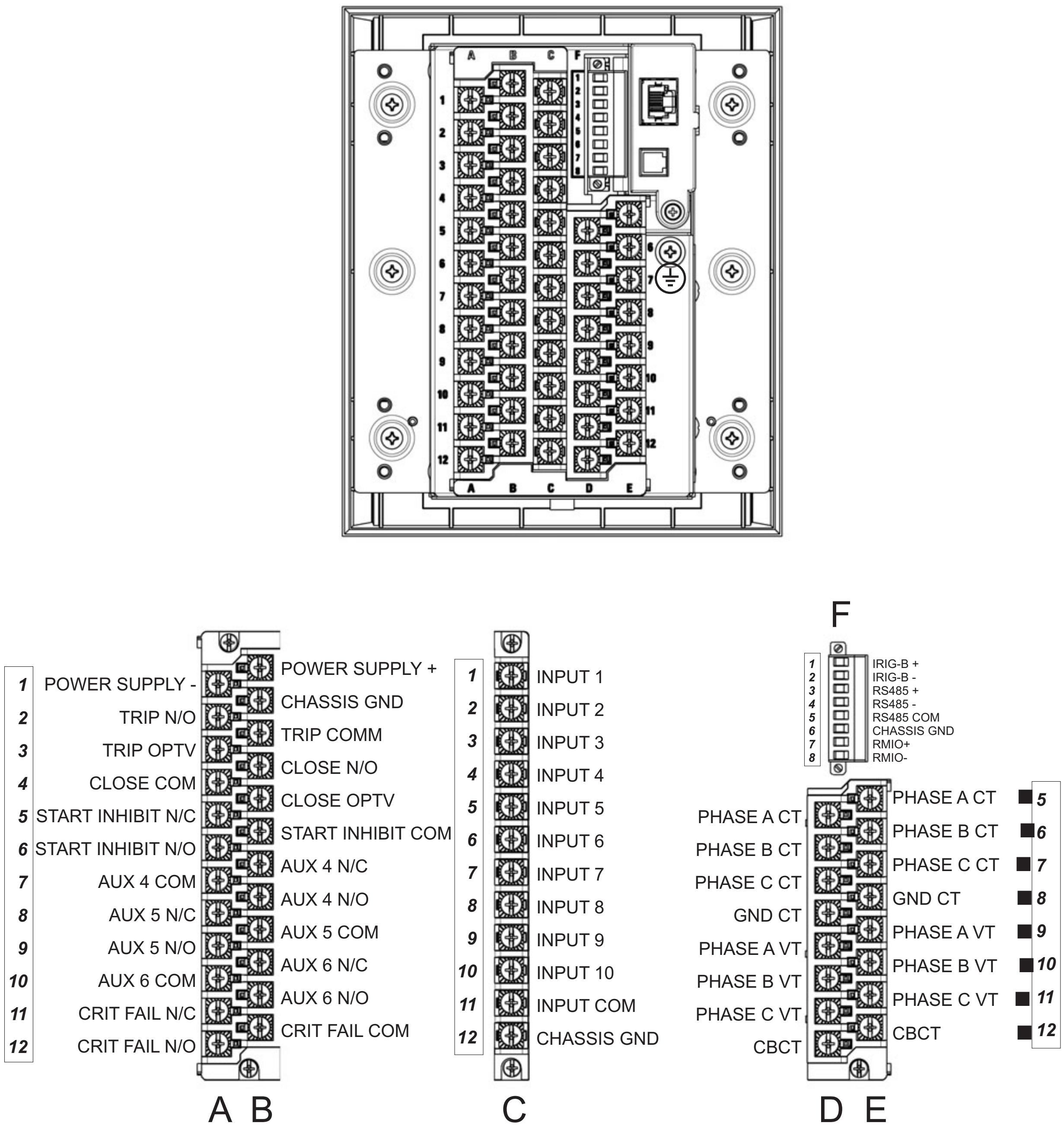


Figure 2-19: Terminal identification with switching device as BREAKER - Non-drawout

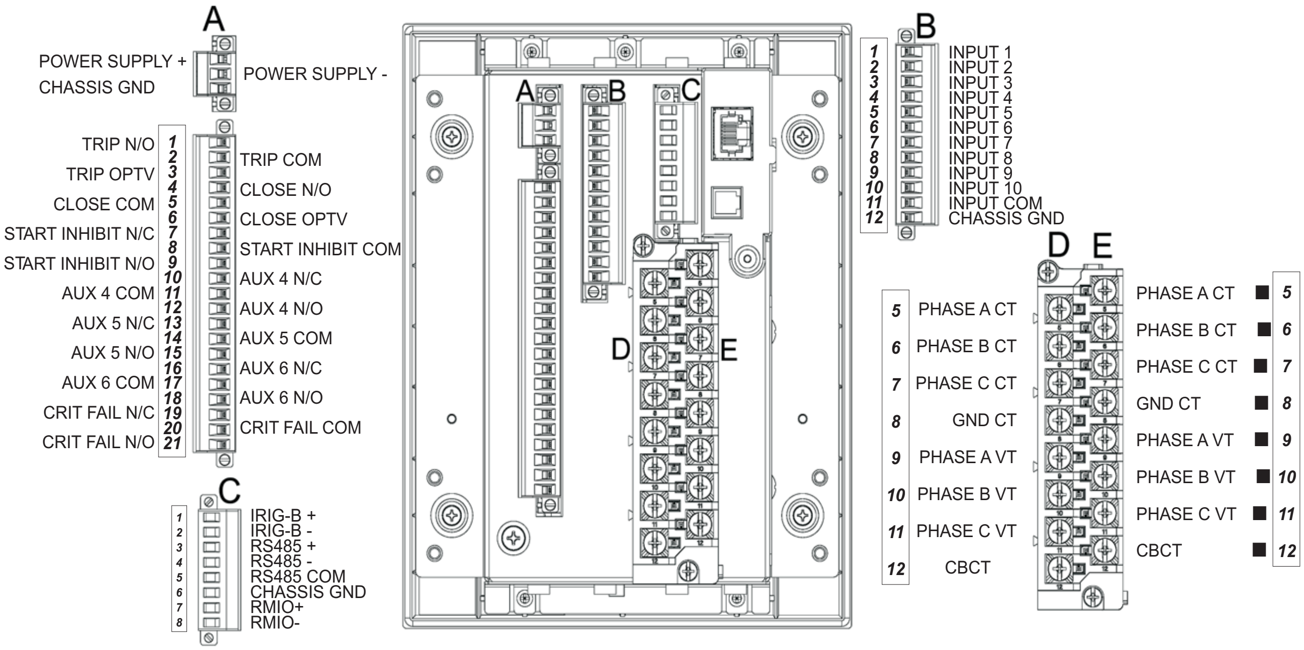
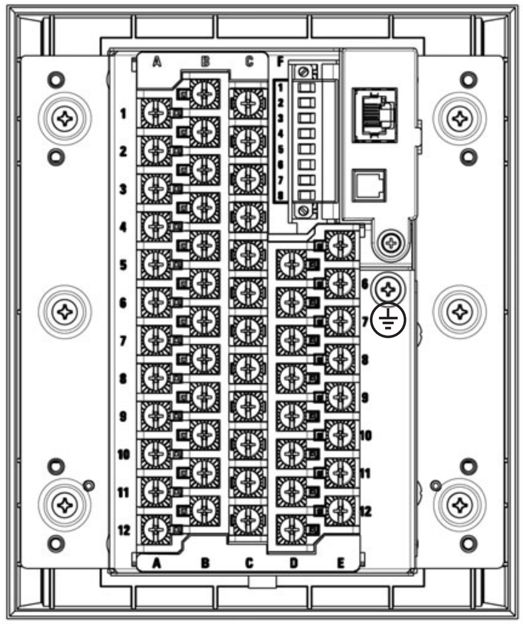


Figure 2-20: Terminal identification with switching device as CONTACTOR - Drawout



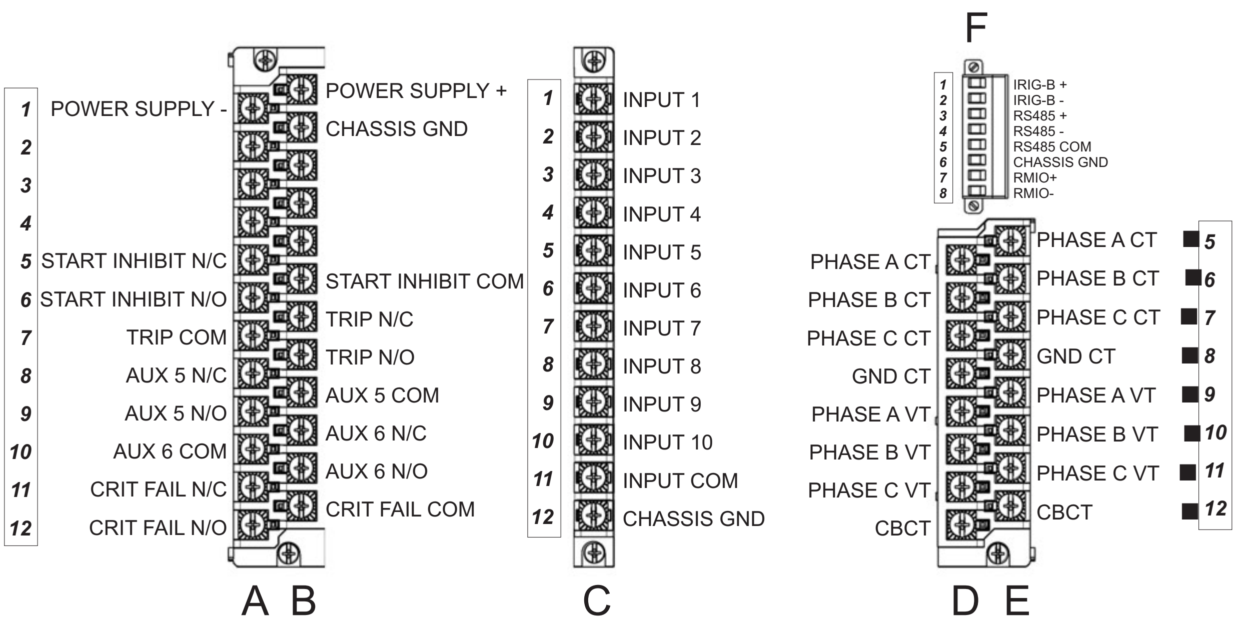
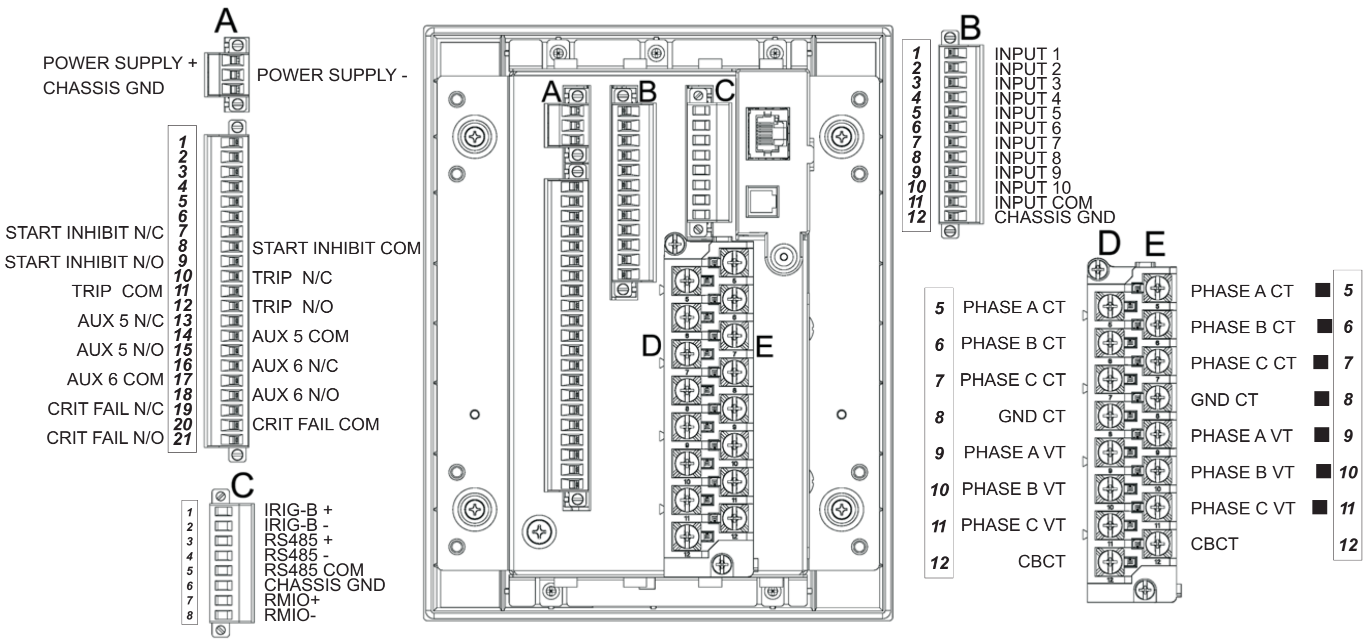


Figure 2-21: Terminal identification with switching device as CONTACTOR - Non-drawout



Terminal identification - Input/ Output "R"

Figure 2-22: 339 Terminal identification with switching device as BREAKER

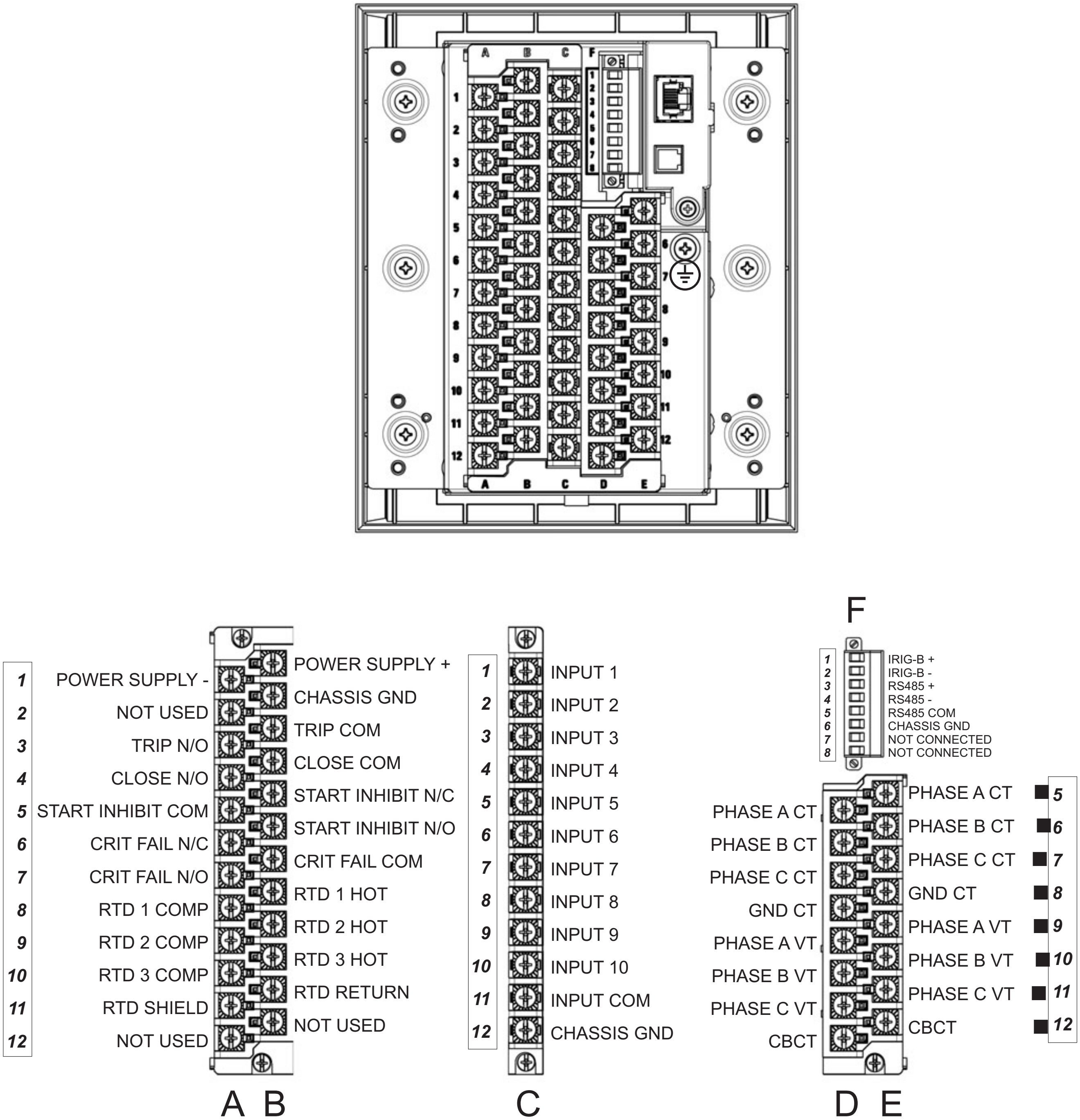
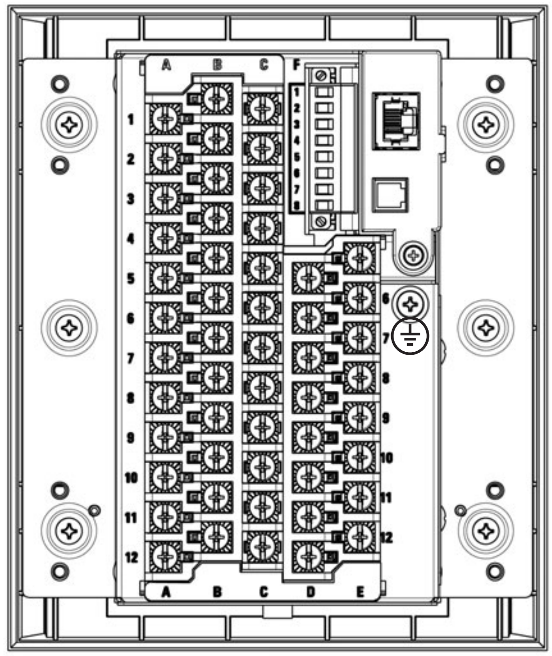
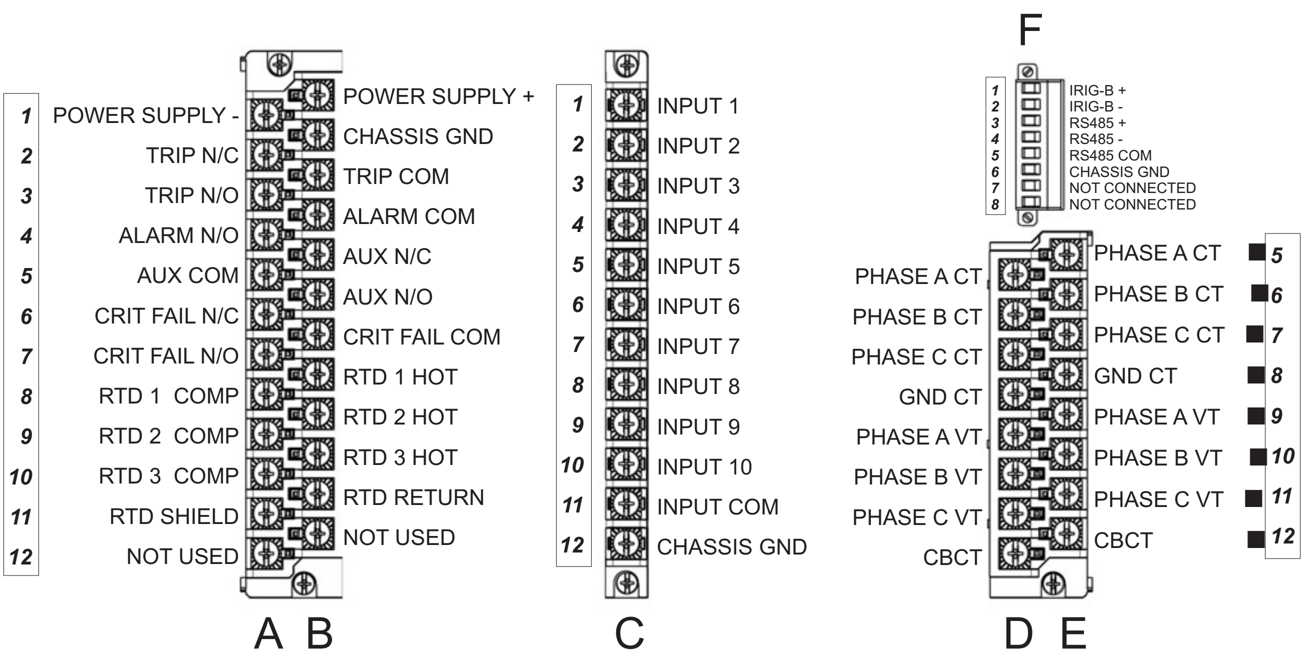


Figure 2-23: Terminal identification with switching device as CONTACTOR





Wire range

Use the following guideline when selecting wires or lugs to connect to terminal blocks A, B, C, D, E (Drawout case design), and terminal blocks D, E (Non-drawout case design):

- 12 AWG to 22 AWG (3.3 mm^2 to 0.3 mm^2): Single wire termination with/without 9.53 mm (0.375”) maximum diameter ring terminals.

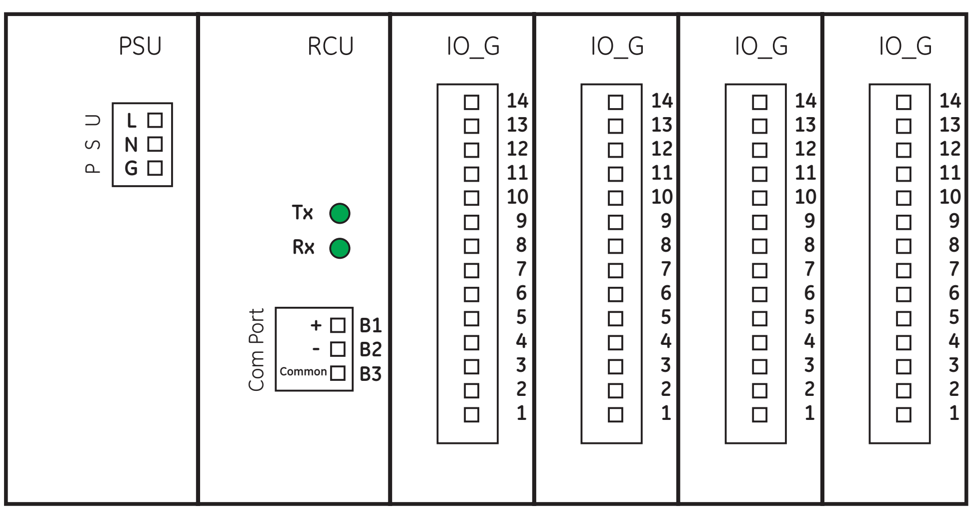
- 14 AWG to 22 AWG (2.1 mm^2 to 0.3 mm^2): Multiple wire termination with matching wire sizes and stranding. Two wires maximum per circuit.
- 14 AWG to 22 AWG (2.1 mm^2 to 0.3 mm^2): Multiple wire termination with 9.53 mm (0.375”) maximum diameter ring terminals. Two ring terminals maximum per circuit.
- Suggested wiring screw tightening torque, tighten to 12 in-lb (1.35 N-m).

RMIO module installation

The optional remote module (RMIO) is designed to be mounted near the motor. This eliminates the need for multiple RTD cables to run back from the motor, which may be in a remote location, to the switchgear. Although the RMIO is internally shielded to minimize noise pickup and interference, it should be mounted away from high current conductors or sources of strong magnetic fields.

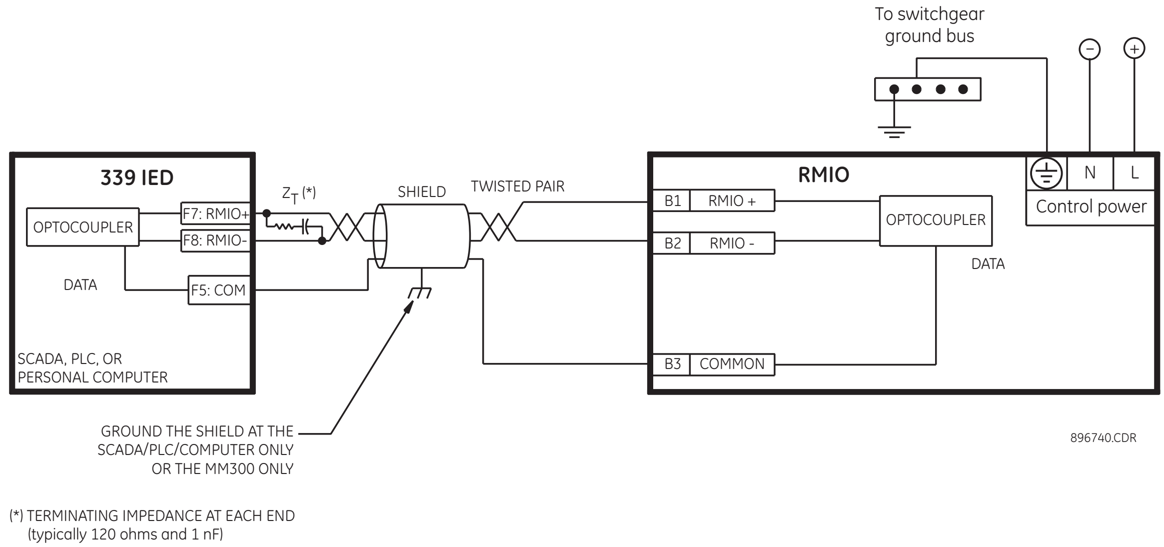
Figure 2-24: RMIO unit showing 2 IO_G modules

Figure 2-25: RMIO terminal identification with 4 IO_G modules



896750.cdr

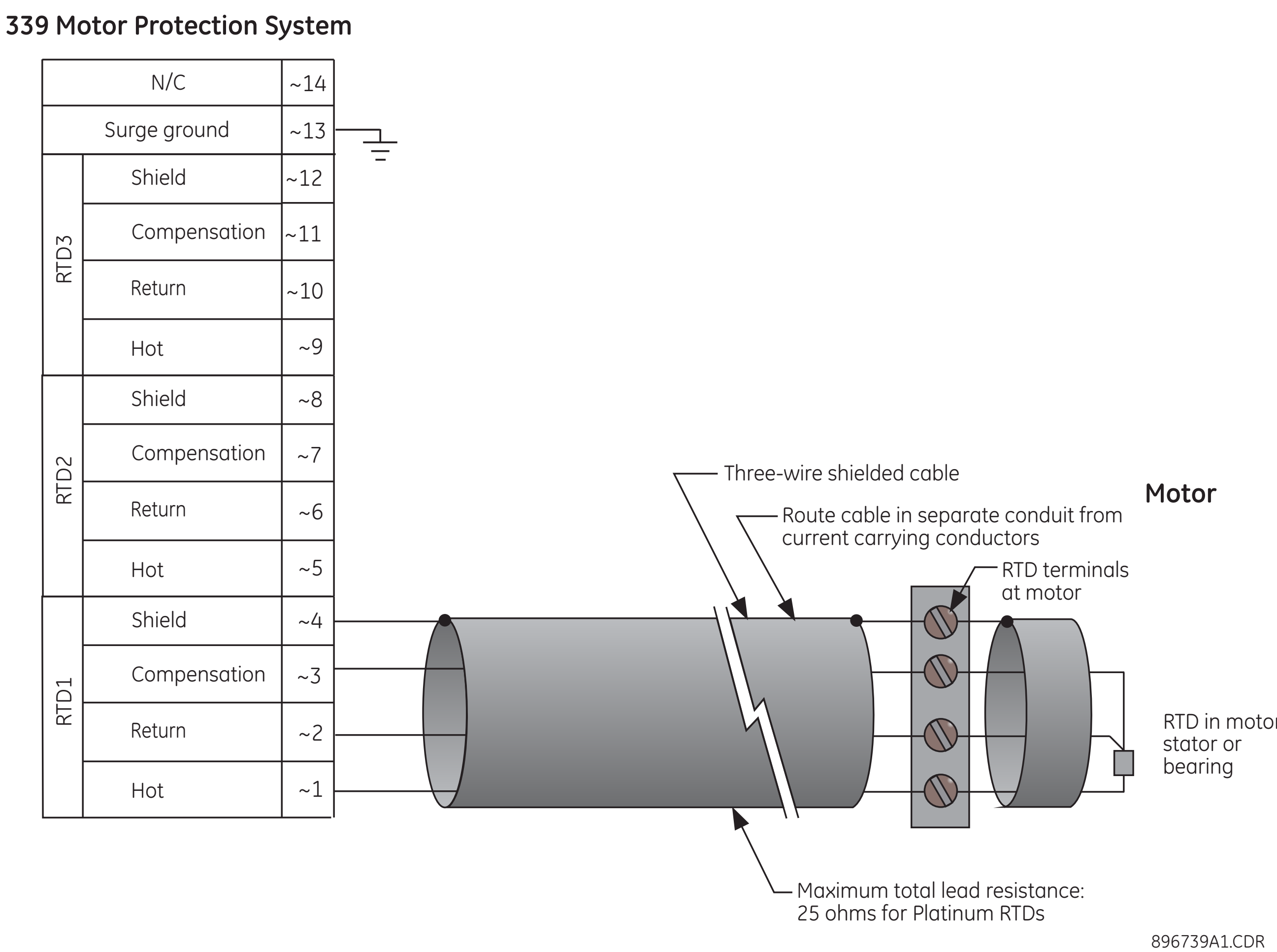
Figure 2-26: RMIO wiring diagram

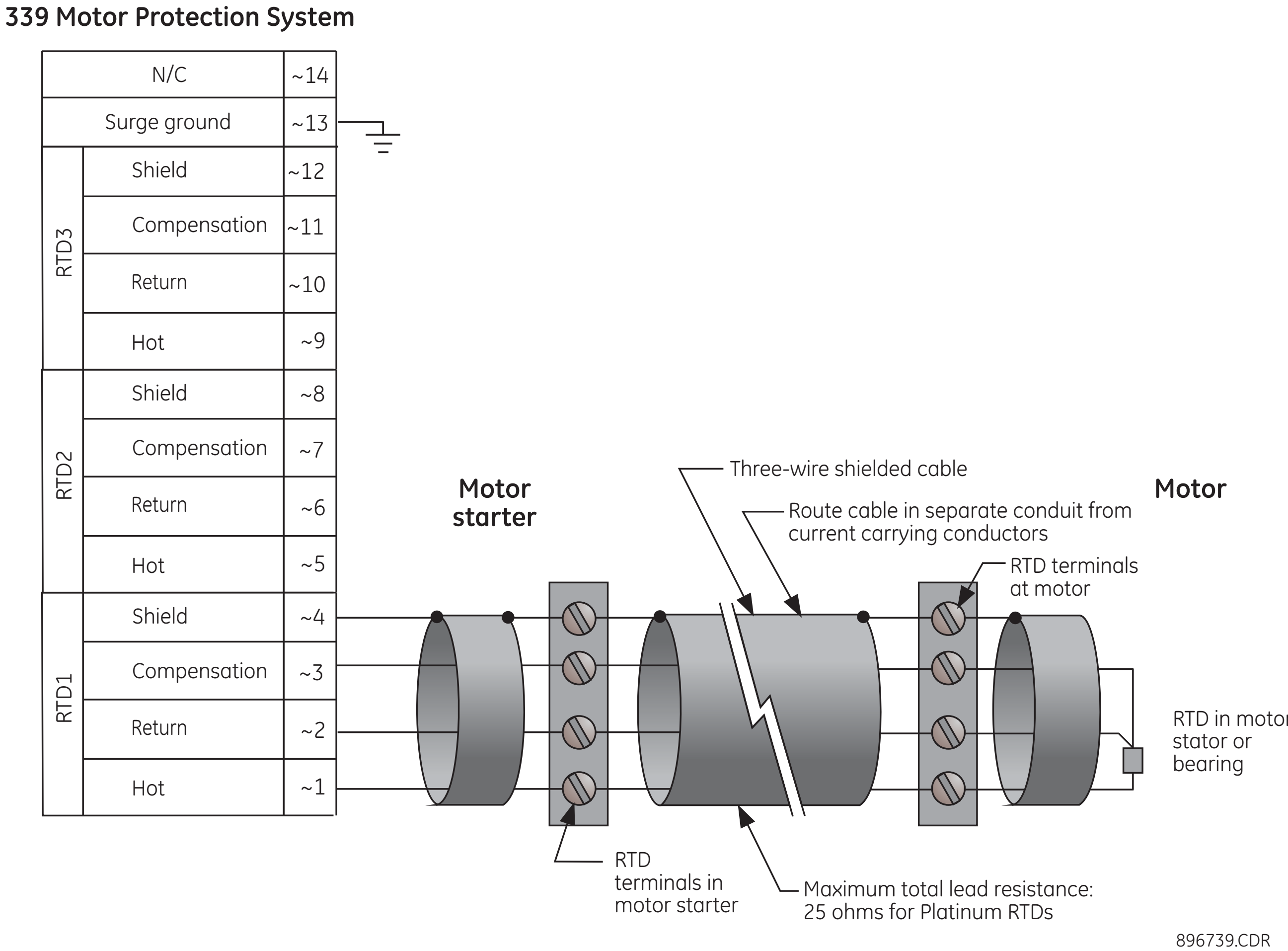


NOTE

F5, F7, and F8 refer to terminals shown on the above 339 Terminal Identification diagrams.

Figure 2-27: RTD wiring



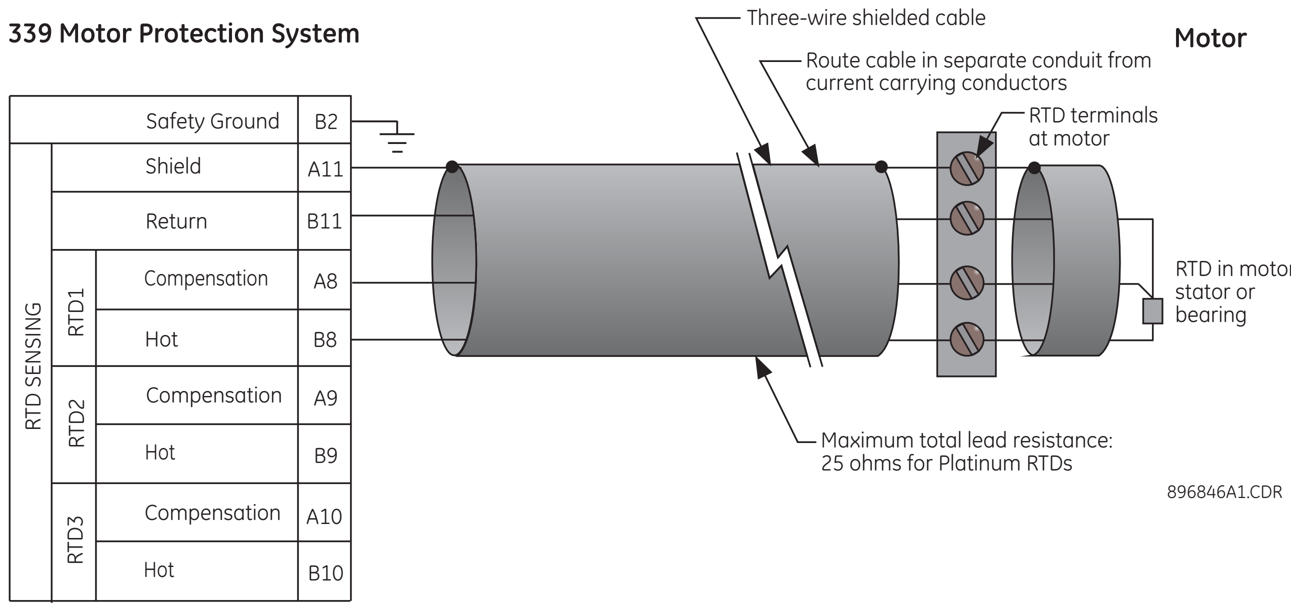


Internal RTD installation

Three resistance temperature detectors (RTDs) can be supplied internally with the 339 if the INPUT/OUTPUT option 'R' is installed (refer to Order Code). With the internal RTD option, the 100 ohm platinum DIN 43760 type is supported. Up to 3 RTDs may be used for motor stator and bearing temperature monitoring. All 3 RTDs share a common Return and Shield terminal.

The RTD circuitry compensates for lead resistance, provided that each of the three leads is the same length. Lead resistance should not exceed 25 ohms per lead. Shielded cable should be used to prevent noise pickup in the industrial environment. RTD cables should be kept close to grounded metal casings and away from 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.

The shield connection terminal of the RTDs is grounded in the 339 and should not be connected to ground at the motor or anywhere else to prevent noise pickup from circulating currents.



Phase sequence and transformer polarity

For correct operation of the relay features, the user must follow the instrument transformer polarities, shown in the Typical Wiring Diagram. Note the solid square markings shown with all instrument transformer connections. When the connections adhere to this drawing, the arrow shows the direction of power flow for positive watts and the positive direction of lagging vars. The phase sequence is user programmable for either ABC or ACB rotation.

Phase current inputs

The 339 relay has three (3) channels for phase current inputs, each with an isolating transformer. There are no internal ground connections on the current inputs. Current transformers with 30 to 1500 A primaries may be used.

⚠CAUTION **Verify that the relay's nominal input current of 1 A or 5 A matches the secondary rating of the connected CTs. Unmatched CTs may result in equipment damage or inadequate protection.**

⚠CAUTION **Before working on CTs, they MUST be short circuited.**

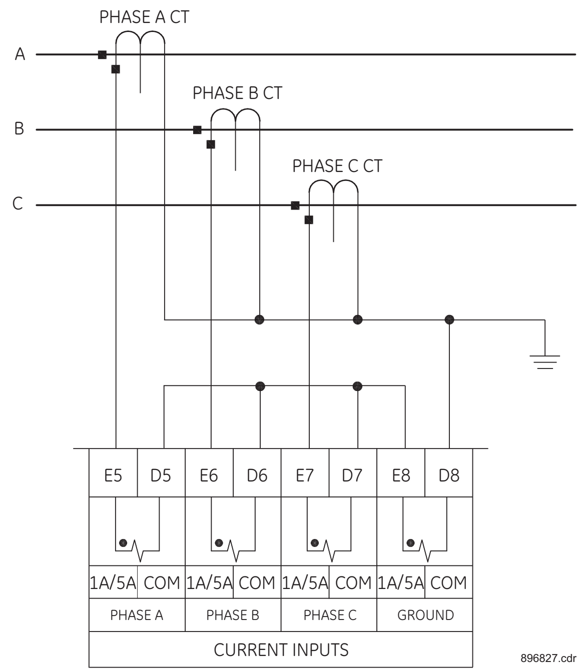
Ground and CBCT inputs

The 339 has two isolating transformers with separate terminals for the 1A/5A secondary and the CBCT (50:0.025). Only one ground terminal type can be used at a time. There are no internal ground connections on the ground current inputs.

The maximum ground CT primary for the 1 A and 5 A taps is 1500 A. Alternatively the sensitive ground input, 50:0.025, can be used to detect ground current on high resistance grounded systems.

The ground CT connection can either be a zero sequence (core balance) installation or a residual connection. Note that only 1 A and 5 A secondary CTs may be used for the residual connection. A typical residual connection is illustrated below. The zero-sequence connection is shown in the typical wiring diagram. The zero-sequence connection is recommended. Unequal saturation of CTs, CT mismatch, size and location of motor, resistance of the power system, motor core saturation density, etc. may cause false readings in the residually connected ground fault circuit.

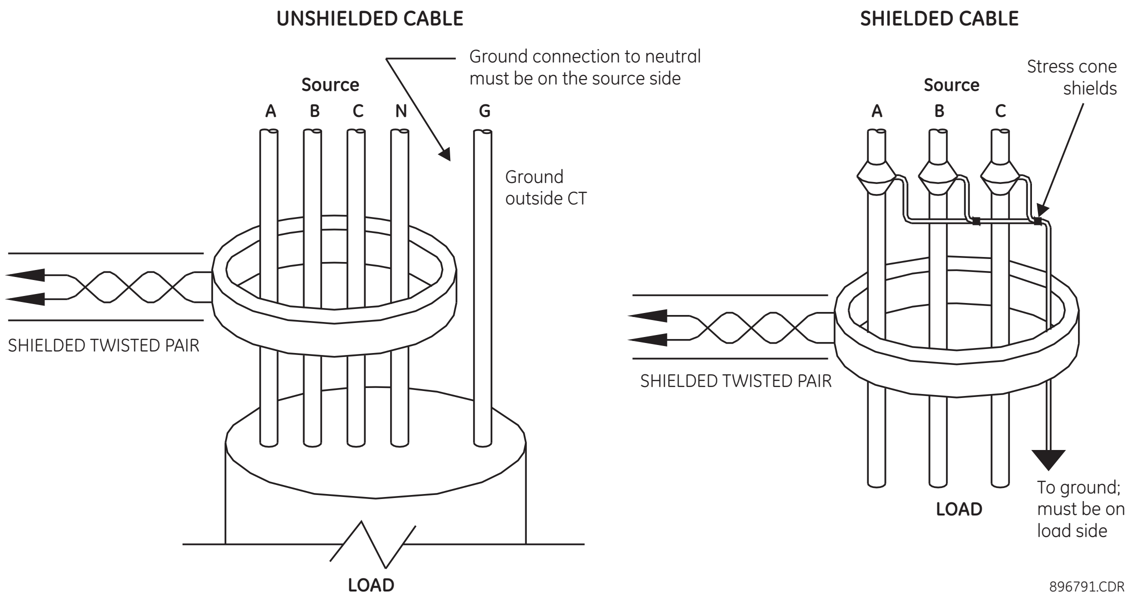
Figure 2-28: Residual ground CT connection



Zero sequence CBCT installation

The exact placement of a zero sequence CT to properly detect ground fault current is shown below. If the CT is placed over a 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 2-29: Zero sequence core balance (CT) installation



Voltage inputs

The 339 relay has three channels for AC voltage inputs, each with an isolating transformer. Voltage transformers up to a maximum 300:1 ratio may be used. The nominal secondary voltage must be in the 50 to 240 V range. The three phase inputs are designated as the “bus voltage”. The Bus VT connections most commonly used, wye and delta (or open delta), are shown in the typical wiring diagram.

NOTE

If Delta VTs are used, the zero sequence voltage (V_0) will be zero. Also, with the Delta VT connection, the phase-neutral voltage cannot be measured and will not be displayed.

NOTE

The 339 relay can be applied to both metering and protection feeders with up to 20000 V phase-to-phase voltage. Please ensure that the selected VT ratio and VT secondary do not result in a primary voltage exceeding 20000 V.

Control power

⚠CAUTION

Control power supplied to the relay must match the installed power supply range. If the applied voltage does not match, damage to the unit may occur. All grounds MUST be connected for safe, normal operation regardless of control power supply type.

The label found on the relay specifies its order code or model number. The installed power supply’s operating range will be one of the following:

LO: 24 to 48 V DC (Nominal Range: 20 to 60 V DC)
HI: 125 to 250 V DC/120 to 240 V AC (Nominal Range: 84 to 250 V DC/60 to 300 V AC)

⚠CAUTION

The relay chassis ground terminals should be connected directly to the ground bus, using the shortest practical path. A tinned copper, braided, shielding and bonding cable should be used. As a minimum, 96 strands of number 34 AWG should be used. Belden catalog number 8660 is suitable.

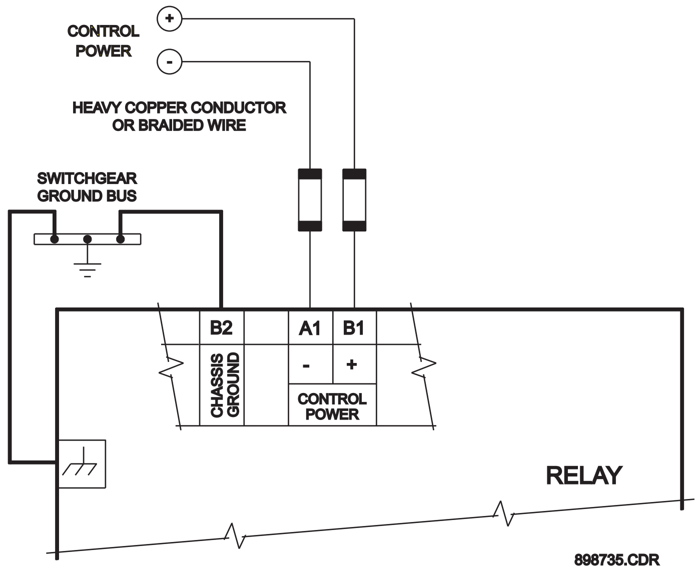
⚠CAUTION

Isolate power prior to servicing.

NOTE

An external switch, circuit breaker, or other protective device **must** be connected close to the equipment.

Figure 2-30: Control power connection



Contact inputs

External contacts can be connected to the relay's ten (10) digital inputs. These contacts are wet only.

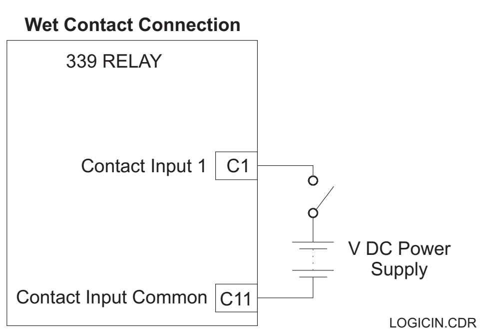
The inputs can be programmed to different thresholds depending on the DC voltage (17, 33, 84, 166).

CAUTION

Ensure correct polarity on contact input connections and do not connect any contact input circuits to ground or else relay hardware may be damaged.

A wet contact has one side connected to the positive terminal of an external DC power supply. The other side of this contact is connected to the required contact input terminal. In addition, the negative side of the external source must be connected to the relay's DC negative rail at Terminal C11. The maximum external source voltage for this arrangement is 300 V DC.

Figure 2-31: Wet contact connections



Trip and Close output relays

The 339 relay is equipped with seven electromechanical output relays: 2 Form A (Relay 1, Relay 2), and 5 Form C (Relays 3 to 7).

When SWITCHING DEVICE is selected as BREAKER:

Output Relays:

- For special purpose:
  - Output Relay 1 (non-failsafe, seal-in): Breaker Trip
  - Output Relay 2 (non-failsafe, seal-in): Breaker Close
  - Output Relay 3 (non-failsafe, self-reset): Start Inhibit
  - Output Relay 7 (fail-safe, self-reset): Critical Failure
- For general purpose:
  - Output Relays 4 to 6 - non-failsafe; can be programmed as self-reset or latched.

Operation of the Trip and Close output relays is designed to be controlled by the state of the circuit breaker as monitored by a 52a or 52b contact.

- The Trip and Close relays reset after the breaker is detected in a state corresponding to the command. When a relay feature sends a command to one of these special relays, it will remain operational until the requested change of breaker state is confirmed by a breaker auxiliary contact and the initiating condition has reset.
- If the initiating feature resets, but the breaker does not change state, the output relay will be reset after a default interval of 2 seconds.
- If neither of the breaker auxiliary contacts, 52a nor 52b, is programmed to a contact input, the Trip Relay is de-energized after either the delay programmed in the Breaker Failure feature, or a default interval of 100 ms after the initiating input resets. The Close Relay is de-energized after 200 ms.
- If a delay is programmed for the Trip or Close contact seal-in time, then this delay is added to the reset time. Note that the default setting for the seal-in time is 40 ms.

52a Contact Configured	52b Contact Configured	Relay Operation
Yes	Yes	Trip Relay remains operational until 52b indicates an open breaker. Close Relay remains operational until 52a indicates a closed breaker.
Yes	No	Trip Relay remains operational until 52a indicates an open breaker. Close Relay remains operational until 52a indicates a closed breaker.
No	Yes	Trip Relay remains operational until 52b indicates an open breaker. Close Relay remains operational until 52b indicates a closed breaker.
No	No	Trip Relay operates until either the Breaker Failure delay expires (if the Breaker Failure element is enabled), or 100 ms after the feature causing the trip resets. Close Relay operates for 200 ms.

Breaker monitoring (Trip and Close coil monitoring) is performed by a built-in voltage monitor on Form A output relays: #1 Trip, and #2 Close. The voltage monitor is connected across each of the two Form A contacts, and the relay effectively detects healthy current through the circuit. In order to do this, an external jumper must be connected between terminals A2 and A3 for Trip coil monitoring, or/and B4, and B5 for Close coil monitoring.

As long as the current through the Voltage Monitor is above the threshold of the trickle currents (see Technical Specification for Form A output relays), the circuit integrity for the Trip (Close) coil is effectively normal. If the Trip (Close) coil circuit gets disconnected, or if in general a high resistance is detected in the circuitry, a Trip (Close) alarm will be set and the “ALARM” and “MAINTENANCE” LEDs will be on provided the corresponding Coil Monitor feature is enabled.

Example: The figures below show the two different connections of the breaker trip (close) coil to the relay’s trip output #1 terminals (close output #2 terminals) for both no voltage monitoring and voltage monitoring of the trip (close) circuit integrity.

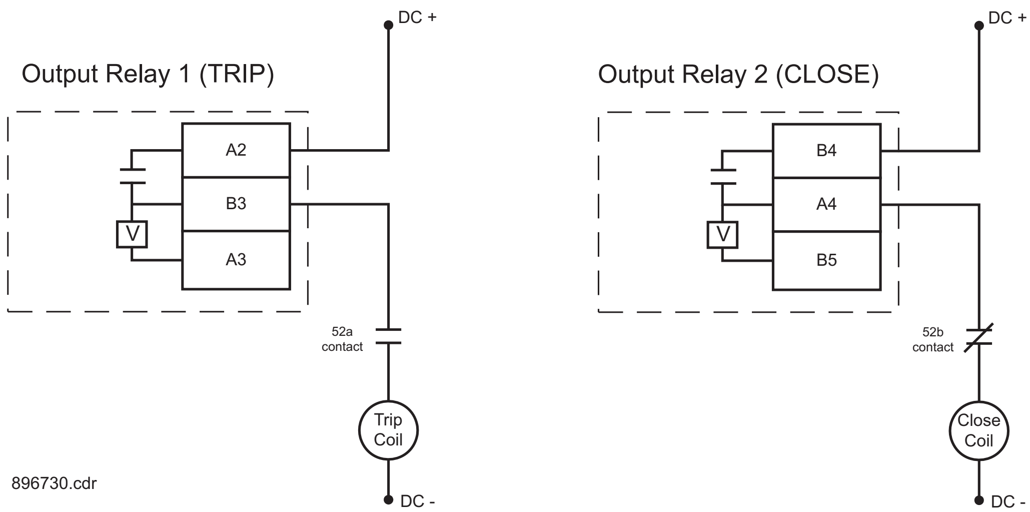
NOTE

To monitor the trip coil circuit integrity, use the relay terminals A2 and B3 to connect the Trip coil, and provide a jumper between terminals A2 and A3 (optional voltage).

NOTE

To monitor the close coil circuit integrity, use the relay terminals B4 and A4 to connect the Close coil, and provide a jumper between terminals B4 and B5 (optional voltage).

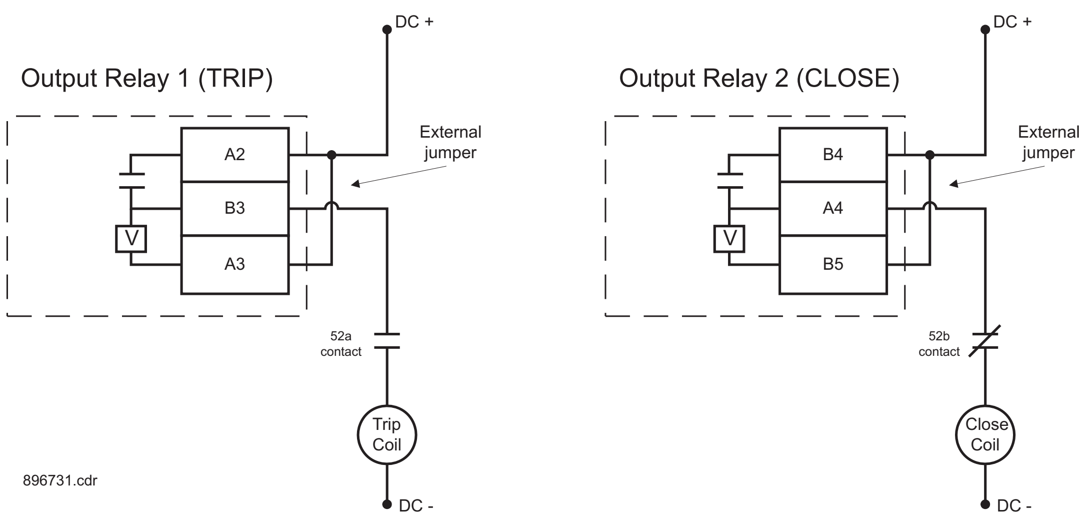
Figure 2-32: Trip and Close Coil circuits with no voltage monitoring



NOTE

All AUX contacts are shown when the breaker is open.

Figure 2-33: Trip and Close Coil circuits with voltage monitoring



When SWITCHING DEVICE is selected as CONTACTOR

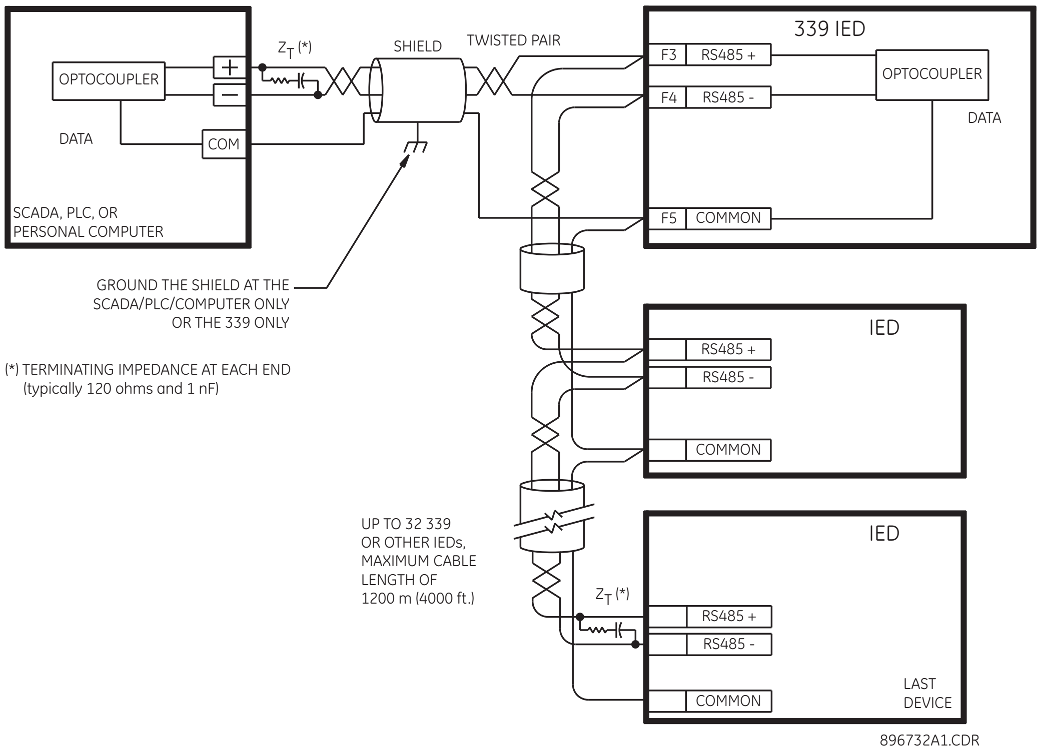
Output Relays:

- Not Used:
  - Output Relay 1
  - Output Relay 2
- For special purpose:
  - Output Relay 3 (self-reset): Start Inhibit
  - Output Relay 4 (fail-safe, non-fail-safe): Trip

- Output Relay 7 (fail-safe, self-reset): Critical Failure
- For general purpose:
  - Output Relays 5 to 6: Can be programmed as fail-safe or non-failsafe, as well as self-reset or latched.

Serial communications

Figure 2-34: RS485 wiring diagram



One two-wire RS485 port is provided. Up to 32 339 IEDs can be daisy-chained together on a communication channel without exceeding the driver capability. For larger systems, additional serial channels must be added. Commercially available repeaters can also be used to add more than 32 relays on a single channel. Suitable cable should have a characteristic impedance of 120 ohms (for example, Belden #9841) and total wire length should not exceed 1200 meters (4000 ft.). Commercially available repeaters will allow for transmission distances greater than 1200 meters.

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.

⚠CAUTION

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 or at the slave339 . Failure to do so may result in intermittent or failed communications.

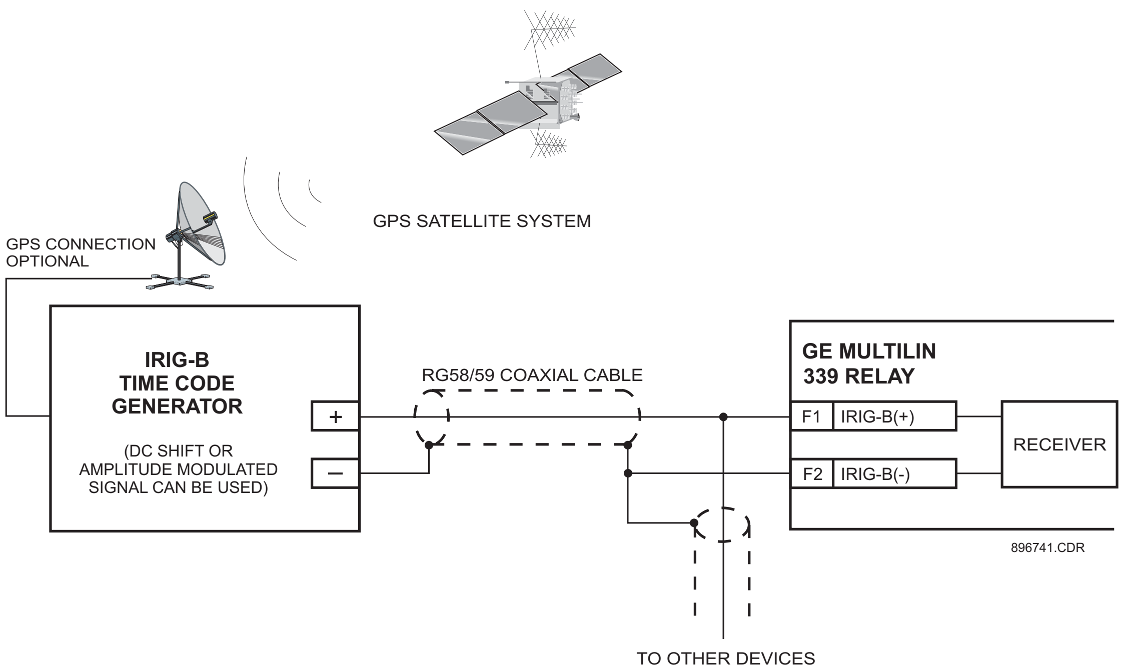
The source computer/PLC/SCADA system should have similar transient protection devices installed, either internally or externally. Ground the shield at one point only, as shown in the figure above, to avoid ground loops.

Correct polarity is also essential. The 339 IEDs must be wired with all the positive (+) terminals connected together and all the negative (–) 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 ¼ watt resistor in series with a 1 nF capacitor across the positive and negative terminals. Observing these guidelines will ensure a reliable communication system immune to system transients.

IRIG-B

IRIG-B is a standard time code format that allows time stamping of events to be synchronized among connected devices within 1 millisecond. The IRIG time code formats are serial, width-modulated codes which can be either DC level shift or amplitude modulated (AM) form. The type of form is auto-detected by the 339 relay. Third party equipment is available for generating the IRIG-B signal; this equipment may use a GPS satellite system to obtain the time reference so that devices at different geographic locations can also be synchronized.

Figure 2-35: IRIG-B connection



GE
Digital Energy

339 Motor Protection System

Chapter 3: Interfaces

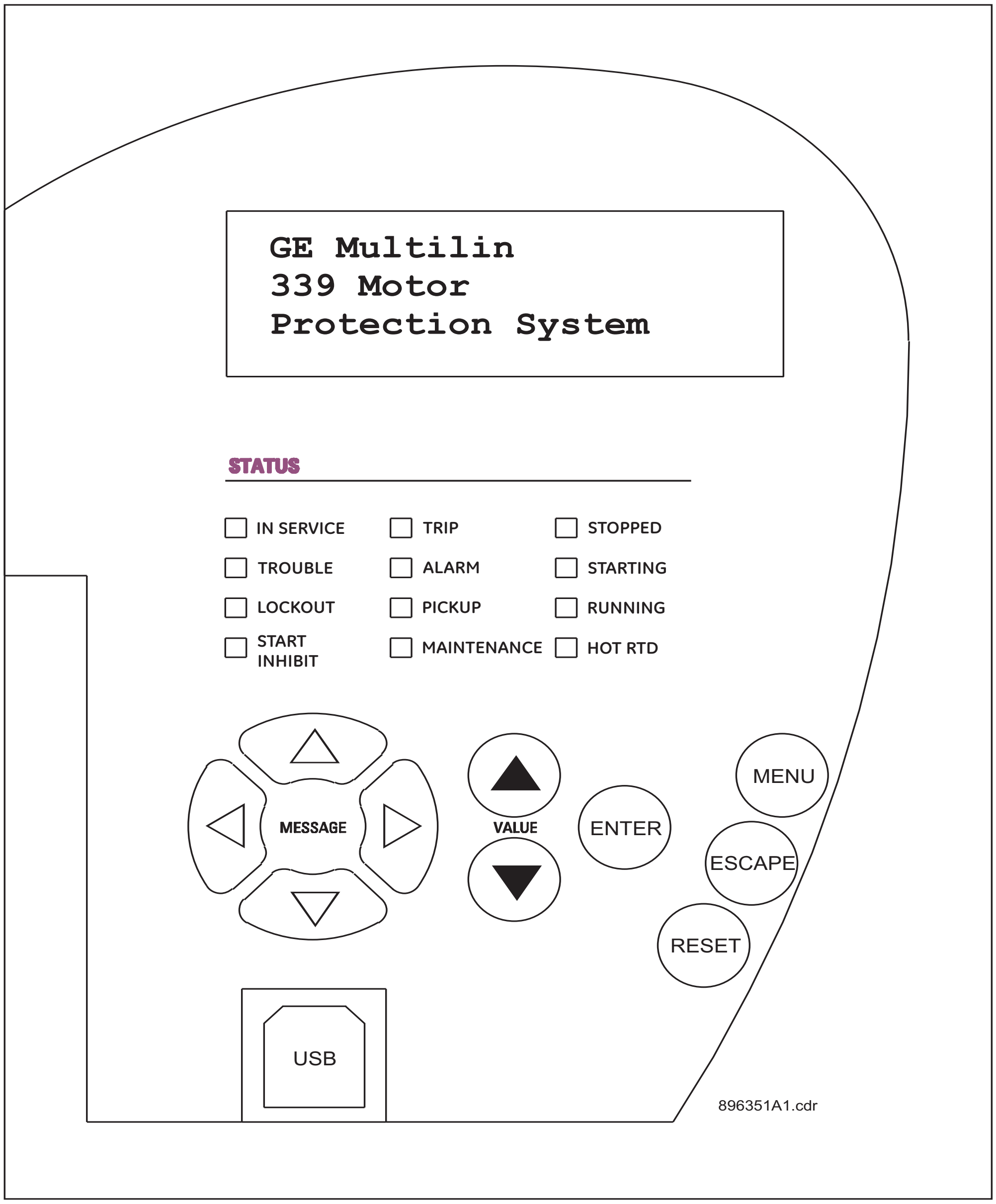
There are two methods of interfacing with the 339 Motor Protection System .

- Interfacing via the relay keypad and display.
- Interfacing via the EnerVista SR3 Setup software.

This section provides an overview of the interfacing methods available with the 339 using the relay control panel and EnerVista SR3 Setup software. For additional details on interface parameters (for example, settings, actual values, etc.), refer to the individual chapters.

Front control panel interface

Figure 3-1: 339 Motor Protection System front panel



Description

The relay front panel provides an interface with a liquid crystal display, LED status indicators, control keys, and a USB program port. The display and status indicators show the relay information automatically. The control keys are used to select the appropriate message for entering setpoints or displaying measured values. The USB program port is also provided for connection with a computer running the EnerVista SR3 Setup software.

Display

The 80-character liquid crystal display (LCD) allows visibility under varied lighting conditions. When the keypad and display are not being used, system information is displayed after a user-defined period of inactivity. Pressing the Menu key during the display of the default message returns the display to the last message shown before the default message appeared. Any trip, alarm, or pickup is displayed immediately, automatically overriding the default message.

Working with the Keypad

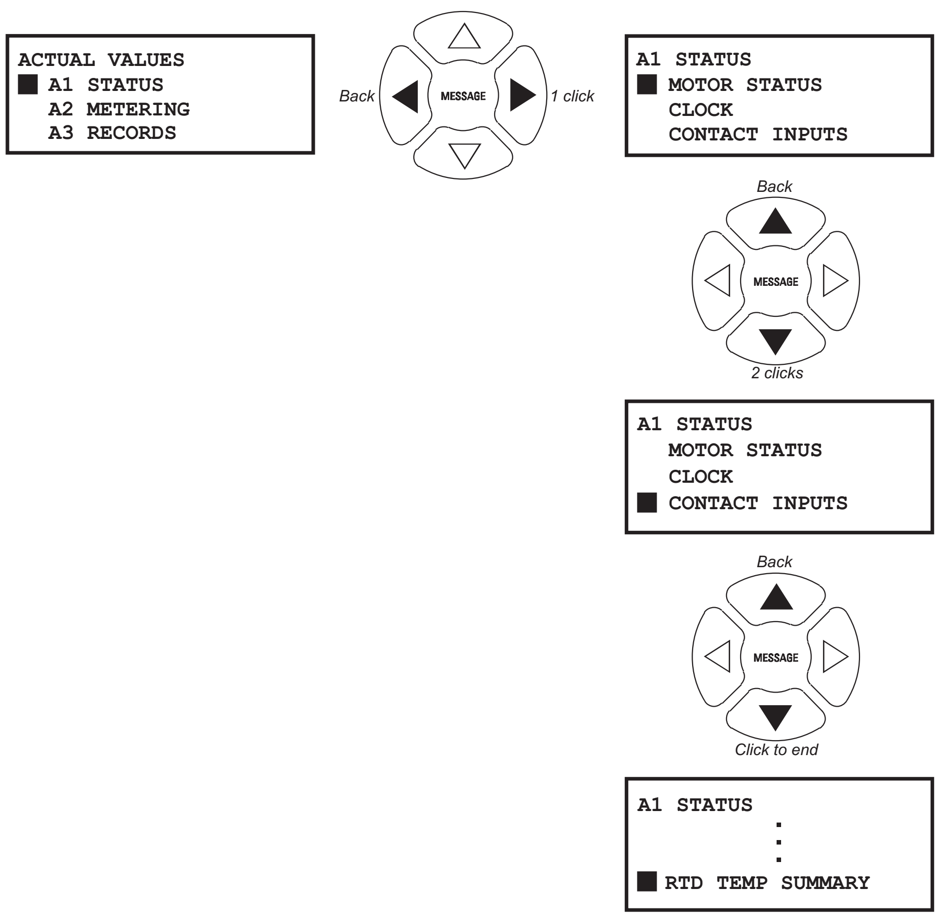
The 339 display messages are organized into a Main Menu, pages, and sub-pages. There are four main menus labeled Actual Values, Quick Setup, Setpoints, and Maintenance. Pressing the MENU key followed by the MESSAGE key scrolls through the four Main Menu headers, which appear in sequence as follows:

Figure 3-2: The four Main Menu headers

```
■ ACTUAL VALUES
  QUICK SETUP
  SETPOINTS
  MAINTENANCE
```

Pressing the **MESSAGE** ► key or the **ENTER** key from these Main Menu pages will display the corresponding menu Page. Use the MESSAGE ▲ and MESSAGE ▼ keys to scroll through the Page headers.

Figure 3-3: Typical paging operation from Main Menu selection



When the display shows **SETPOINTS**, pressing the **MESSAGE** ► key or the **ENTER** key will display the page headers of programmable parameters (referred to as setpoints in the manual). When the display shows **ACTUAL VALUES**, pressing the **MESSAGE** ► key or the **ENTER** key displays the page headers of measured parameters (referred to as actual values in the manual).

Each page is broken down further into logical sub-pages of messages. The **MESSAGE** ▲ and **MESSAGE** ▼ keys are used to navigate through the sub-pages. A summary of the setpoints and actual values pages can be found in the Chapters : Setpoints and Actual Values, respectively.

The **ENTER** key is dual purpose. It is used to enter the sub-pages and to store altered setpoint values into memory to complete the change. The **MESSAGE** ► key can also be used to enter sub-pages but not to store altered setpoints.

The **ESCAPE** key or the **MESSAGE** key can be used to exit the sub-pages.

The **VALUE** keys are used to scroll through the possible choices of an enumerated setpoint. They also decrement and increment numerical setpoints.

The **RESET** key resets any latched conditions that are not currently active. This includes resetting latched output relays, latched Trip LEDs, breaker operation failure, and trip / close coil failures.

The **MESSAGE** ▲ and **MESSAGE** ▼ keys scroll through any active conditions in the relay. Diagnostic messages are displayed indicating the state of protection and monitoring elements that are picked up, operating, or latched.

LED status indicators

- **IN SERVICE: Green**
  - Turns "ON" when the relay does not have any major self-test error.
  - Minor self-test targets will not de-activate the LED.
- **TROUBLE: Amber**
  - Turns "ON" when either a major or minor self-test error has occurred.
  - Will be latched "ON" for major self-test errors, except for "RELAY NOT READY".
  - Will be self-resetting for minor self-test errors.
- **TRIP: Red**
  - Turns "ON" when a protection element has been assigned to trip and the element has been activated.
  - Will be latched "ON" until a reset command occurs.
  - Turns "OFF" when a reset has been initiated through the front panel, communications, or digital inputs, and the fault has been cleared.
- **ALARM: Amber**
  - Flashes "ON" and "OFF" when a protection, control, or maintenance element has been assigned to alarm and the element has been activated.
  - Will be latched "ON" if "Latched Alarm" is set and the fault has been cleared.
  - Will be self-resetting if "Alarm" is set and the fault has been cleared.
  - Turns "OFF" when a reset has been initiated through the front panel or communications, and the fault has been cleared, if "Latched Alarm" is set.
- **PICKUP: Amber**
  - Turns "ON" when a protection element setting threshold has been exceeded. LED will turn "OFF" when the values go below the threshold.
- **MAINTENANCE: Amber**
  - Turns "ON" when either the Trip or the Close Coil Monitor element is activated, or the Trip Counter has exceeded the programmed value.

- **LOCKOUT: Red**
  - Turns "ON" when the following elements are activated:

  Thermal Overload
  Short Circuit
  Mechanical Jam
  Ground Fault.
  - Can be reset only by emergency restart or lockout reset, if they are enabled.
  - If the above are not enabled, a normal reset will turn the LED "OFF".
- **START INHIBIT: Red**
  - Turns "ON" when the Start Inhibit element is activated.
  - Self-resetting when the inhibit is no longer present.
- **STOPPED: Default to Red**
  - LED color is programmable. Turns "ON" when the motor status is "Stopped".
- **STARTING: Default to Amber**
  - LED color is programmable. Turns "ON" when the motor status is "Starting".
- **RUNNING: Default to Green**
  - LED color is programmable. Turns "ON" when the motor status is "Running".
- **HOT RTD: Amber**
  - Turns "ON" when either a RTD Alarm or Trip has been activated.
  - Self-resetting when the fault is no longer present.

Relay messages

Default message

Figure 3-4: Relay default messages

VT is connected as Wye	VT is connected as Delta
MOTOR LOAD 0.00xFLA TCU 0 % CURR UNBAL 0 % AVG PH CURR 0 A	MOTOR LOAD 0.00xFLA TCU 0 % CURR UNBAL 0 % AVG PH CURR 0 A
Ia 0.0 A Van 0 V Ib 0.0 A Vbn 0 V Ic 0.0 A Vcn 0 V Ig 0.00A Vav 0 V	Ia 0.0 A Vab 0 V Ib 0.0 A Vbc 0 V Ic 0.0 A Vca 0 V Ig 0.00A Vav 0 V
3ϕ REAL POWER: 0.0 kW 3ϕ REACTIVE POWER: 0.0 kvar	3ϕ REAL POWER: 0.00 kW 3ϕ REACTIVE POWER: 0.00 kvar
3ϕ APPARENT POWER: 0.0 kVA 3ϕ POWER FACTOR: 0.00 Lag	3ϕ APPARENT POWER: 0.00 kVA 3ϕ POWER FACTOR: 0.00 Lag
FREQUENCY 0.00 Hz HOTTEST RTD 0°C	FREQUENCY 0.00 Hz HOTTEST RTD 0°C

Target messages

Target messages are automatically displayed for any active condition on the relay such as pickups, trips, or alarms.

The relay displays and rolls up target messages until the conditions clear and/or the RESET command is initiated. The Target Messages can be reviewed by pressing either the MESSAGE UP or MESSAGE DOWN key. If a RESET command is not performed but any of the other faceplate pushbuttons is pressed, the display will not show the target messages unless the user navigates to **ACTUAL VALUES > A4 TARGET MESSAGES**, where they can be reviewed. If the target messages have not been cleared before the user presses a pushbutton different from "RESET", they will reappear on the screen after the time specified under the **SETPOINTS > S1 RELAY SETUP > S1 FRONT PANEL > MESSAGE TIMEOUT** setting, that will start timing out from the last pressed pushbutton. The following shows the format of a typical Target Message:

Figure 3-5: Typical target message

```
A4 TARGET MESSAGES
  Cause <function>
  State: Operate
  Phase:
```

Figure 3-6: Example of Trip on Phase A

```
A4 TARGET MESSAGES
  Ph IOC1 Trip
  State: Operate
▼  Phase:A
```

Cause <Function>

This line contains information of the cause of operation (the name of the operated element), and the element function.

State: Operate

This line from the display shows the state of the element: Pickup, Operate, Alarm.

Phase: A

The last line from the display shows the phase that picked up or operated.

Self-test errors

The relay performs self diagnostics at initialization (after power up), and continuously as a background task to ensure that the hardware and software are functioning correctly. There are two types of self-test warnings indicating either a minor or major problem. Minor problems indicate a problem with the relay that does not compromise protection of the power system. Major errors indicate a problem with the relay which takes it out of service.

⚠CAUTION

Self-Test Warnings may indicate a serious problem with the relay hardware!

Upon detection of a **minor** problem, the relay will:

- Turn on the "TROUBLE" LED at the same time as the "IN SERVICE" LED is on.
- Display the error on the relay display.
- Record the minor self-test error in the Event Recorder.

Upon detection of a **major** problem, the relay will:

- De-energize critical failure relay (Output Relay 7).
- Inhibit operation of all other output relays (1 to 6).
- Turn off the "IN SERVICE" LED.
- Turn on the "TROUBLE" LED.
- Flash the "ALARM" LED.
- Display the cause of major self-test failure.
- Record the major self-test failure in the Event Recorder.

Figure 3-7: Typical Self-test warning

```
A4 TARGET MESSAGES
  UNIT FAILURE:
  Contact Factory:
  Error code:1
```

Table 3-1: Minor Self-test Errors

Self-test Error Message	Latched Target Message?	Description of Problem	How Often the Test is Performed	What to do
MAINTENANCE ALERT: IRIG-B Failure	No	A bad IRIG-B input signal has been detected.	Every 5 seconds*	Ensure IRIG-B cable is connected, check cable functionality (i.e. physical damage or perform continuity test), ensure IRIG-B receiver is functioning, and check input signal level (it may be less than specification). If none of these apply, contact the factory.
MAINTENANCE ALERT: Clock Not Set	No	Clock time is the same as the default time.	Every 5 seconds*	Set the date and time in S1 RELAY SETUP.
MAINTENANCE ALERT: Comm Alert 1, 2, or 3	No	Communication error between CPU and Comms board.	Every 5 seconds*	If alert doesn't self-reset, then contact factory. Otherwise monitor recurrences as errors are detected and self-reset.
MAINTENANCE ALERT : Ethernet Link Fail	No	Communication error between 339 339 and Network.	Detected Instantaneously	Check Ethernet cable and Ethernet connection. Check health of the network. Check status of external routers and switches.
MAINTENANCE ALERT: High Ethernet Traffic	No		Every 5 seconds*	
MAINTENANCE ALERT: High Ambient Temperature	No	The ambient temperature is above 80^{o}C.	Every 1 hour	Increase ventillation to the surroundings.
MAINTENANCE ALERT : RMIO Mismatch	No	RMIO Module is not validated; communications with the RMIO module are lost or interrupted.	Every 5 seconds*	Validate the RMIO Module; check CANBUS communication.

Table 3-2: Major Self-test Errors

Self-test Error Message	Latched Target Message?	Description of Problem	How Often the Test is Performed	What to do
UNIT FAILURE: `Contact Factory (XXXX)`	Yes	This warning is caused by a unit hardware failure. Failure code (XXXX) is shown.	Every 5 seconds[1]	Contact the factory and provide the failure code.
RELAY NOT READY: Check Settings	No	S1 RELAY SETUP > INSTALLATION > RELAY STATUS is set to "Not Ready".	On power up and whenever the RELAY STATUS setting is altered.	Program all required settings then set the S1 RELAY SETUP > INSTALLATION > RELAY STATUS setting to "Ready".

1.Failure is logged after the detection of 5 consecutive failures - that is, after 25 seconds.

Flash messages

Flash messages are warning, error, or general information messages displayed in response to pressing certain keys.

Figure 3-8: Typical Flash message

```
S3 SHORT CIRCUIT
  BLOCK 1
  Logic Element 8
  <SETPOINT STORED>
```

SETPOINT STORED

This flash message is displayed in response to the **ENTER** key while on any setpoint message (see example above). The edited value was stored as entered.

COMMAND EXECUTED

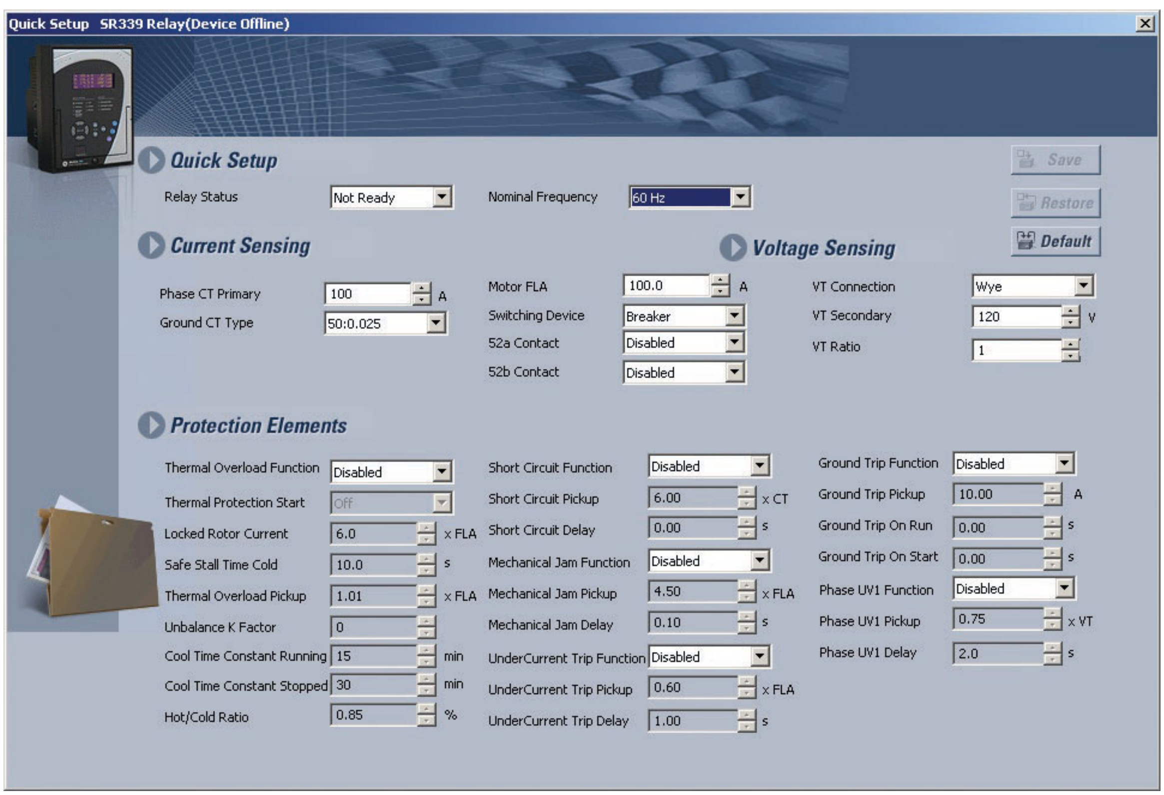
This flash message is displayed in response to executing a command: ON, OFF, YES, NO, etc.

INVALID PASSWORD

This flash message appears upon an attempt to enter an incorrect password, as part of password security.

Software setup

Quick setup - Software interface



- **The Quick Setup** window allows you to configure important settings from different screens in the relay by adding them to a common window.

- **The Quick Setup** window options are available for online devices or setpoint files.
- **The Quick Setup** Window option is accessed from the "Tree" which launches on clicking.

EnerVista SR3 Setup Software

Although settings can be entered manually using the control panel keys, a PC can be used to download setpoints through the communications port. The EnerVista SR3 Setup software is available from GE Digital Energy to make this as convenient as possible. With theEnerVista SR3 Setup 339 relay running, it is possible to:

- Program and modify settings
- Load and save setting files to and from a disk
- Read actual values
- Monitor status
- Read pre-trip data and event records
- Get help on any topic
- Upgrade the 339 firmware

The EnerVista SR3 Setup software allows immediate access to all 339 features with easy to use pull down menus in the familiar Windows environment. This section provides the necessary information to install the 339 EnerVista SR3 Setup , upgrade the relay firmware, and write and edit setting files.

The EnerVista SR3 Setup software can run without a 339 connected to the computer. In this case, settings may be saved to a file for future use. If a 339 is connected to a PC and communications are enabled, the 339 can be programmed from the setting screens. In addition, measured values, status and trip messages can be displayed with the actual value screens.

Hardware and software requirements

The following requirements must be met for the EnerVista SR3 Setup software.

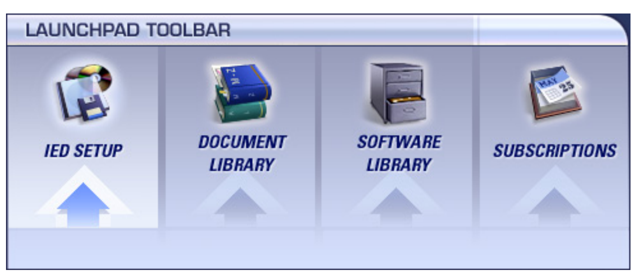
- Windows 7 (32-bit or 64-bit) or Windows 8.1 (32-bit or 64-bit)

The EnerVista SR3 Setup software can be installed from either the GE EnerVista CD or the GE Multilin website at http://www.gedigitalenergy.com/multilin.

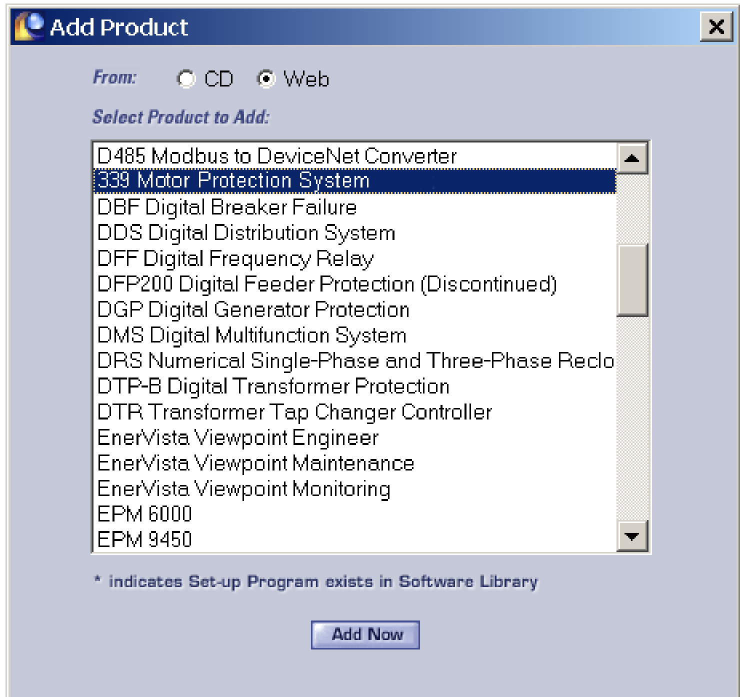
Installing the EnerVista SR3 Setup software

After ensuring the minimum requirements indicated earlier, use the following procedure to install the EnerVista SR3 Setup software from the enclosed GE EnerVista CD.

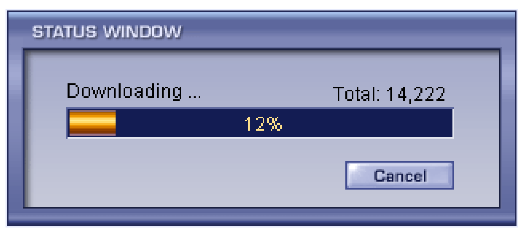
1. Insert the GE EnerVista CD into your CD-ROM drive.
2. Follow the installation instructions to install the no-charge EnerVista software on the local PC.
3. When installation is complete, start the EnerVista Launchpad application.
4. Click the **IED Setup** section of the LaunchPad toolbar.



5. In the EnerVista Launchpad window, click the **Add Product** button and select the 339 Feeder Protection System as shown below. Select the Web option to ensure the most recent software release, or select CD if you do not have a web connection, then click the **Add Now** button to list software items for the relay339 .



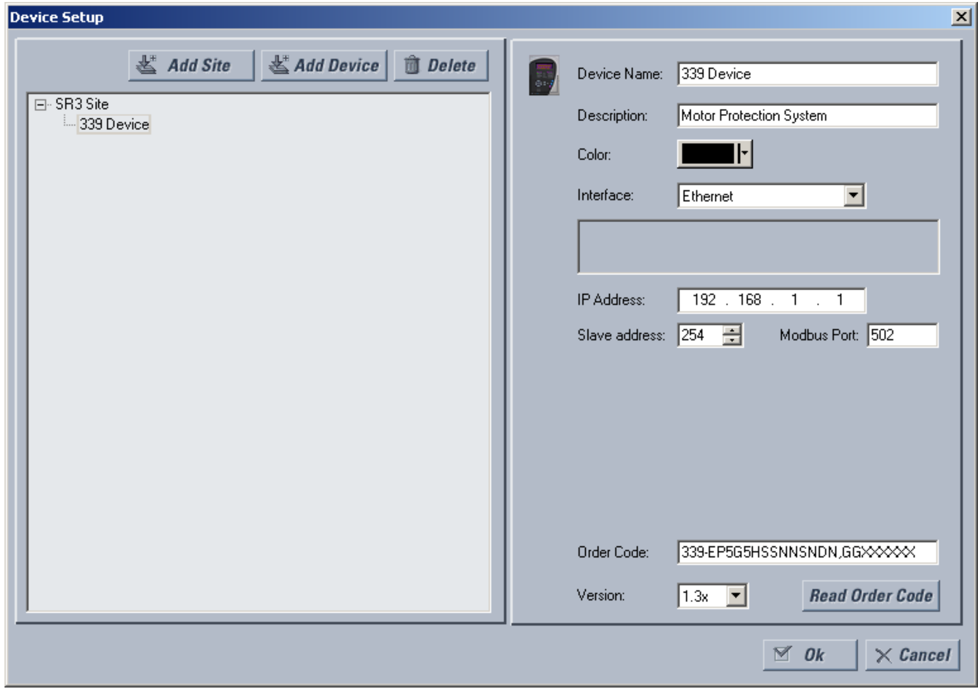
6. EnerVista Launchpad will obtain the latest installation software from the Web or CD and automatically start the installation process. A status window with a progress bar will be shown during the downloading process.



7. Select the complete path, including the new directory name, where the EnerVista SR3 Setup software will be installed.
8. Click on **Next** to begin the installation. The files will be installed in the directory indicated, the USB driver will be loaded into the computer, and the installation program will automatically create icons and add EnerVista SR3 Setup software to the Windows start menu.
9. The 339 device will be added to the list of installed IEDs in the EnerVista Launchpad window, as shown below.

If you are going to communicate from your computer to the 339 Relay using the USB port:

10. Plug the USB cable into the USB port on the 339 Relay then into the USB port on your computer.
11. Launch EnerVista SR3 Setup from LaunchPad.
12. In **EnerVista > Device Setup**:



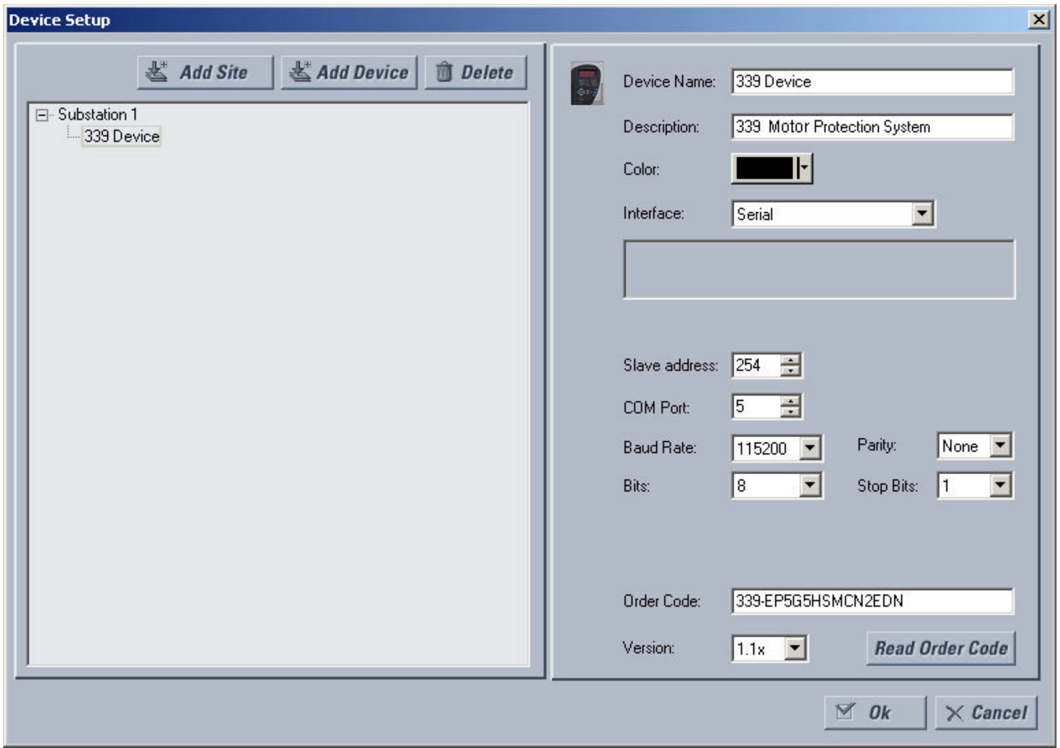
13. Select **USB** as the Interface type.
14. Select **339 Relay** as the USB device.

Connecting EnerVista SR3 Setup to the relay

Configuring serial communications

Before starting, verify that the cable is properly connected to either the USB port on the front panel of the device (for USB communications) or to the RS485 terminals on the back of the device (for RS485 communications). This example demonstrates an USB connection. For RS485 communications, the GE Digital Energy F485 converter will be required. Refer to the F485 manual for additional details. To configure the relay for Ethernet communications, see *Configuring Ethernet Communications* below.

1. Install and start the latest version of the EnerVista SR3 Setup software (available from the GE Digital Energy web site). See the previous section for the installation procedure.
2. Click on the **Device Setup** button to open the Device Setup window and click the **Add Site** button to define a new site.
3. Enter the desired site name in the "Site Name" field. If desired, a short description of the site can also be entered. In this example, we will use “Substation 1” as the site name.
4. The new site will appear in the upper-left list in the EnerVista SR3 Setup window.
5. Click the **Add Device** button to define the new device.
6. Enter the desired name in the "Device Name" field and a description (optional) of the device.
7. Select “Serial” from the Interface drop-down list.

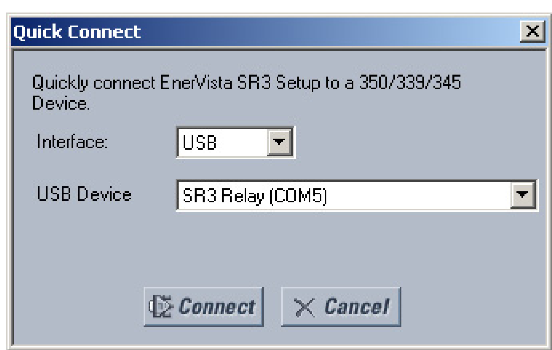


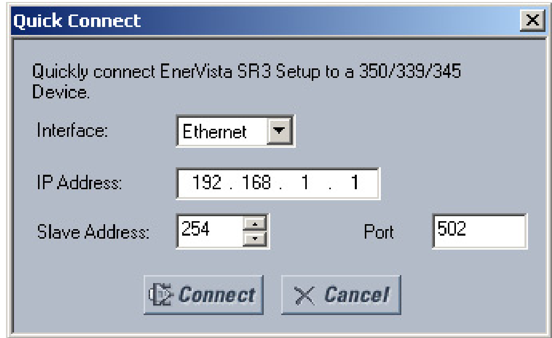
8. Click the **Read Order Code** button to connect to the 339 device and upload the order code.
9. Click **OK** when the relay order code has been received. The new device will be added to the Site List window (or Online window) located in the top left corner of the main EnerVista SR3 Setup window.

The 339 Site Device has now been configured for USB communications. Proceed to *Connecting to the Relay* below, to begin communications.

Using the Quick Connect feature

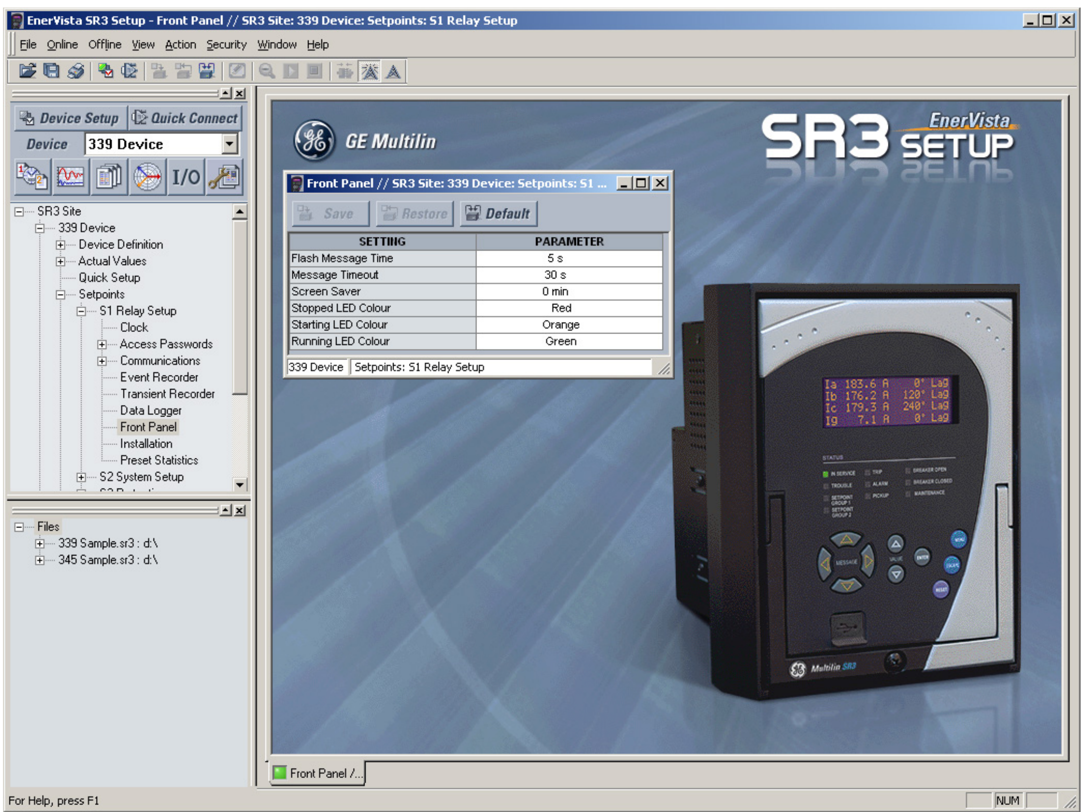
The **Quick Connect** button can be used to establish a fast connection through the front panel USB port of a 339 relay, or through the Ethernet port. The following window will appear when the **QuickConnect** button is pressed:





As indicated by the window, the "Quick Connect" feature can quickly connect the EnerVista SR3 Setup software to a 339 front port if the USB is selected in the interface drop-down list. Select "339 Relay" and press the **Connect** button. Ethernet can also be used as the interface for Quick Connect as shown above.

When connected, a new Site called “Quick Connect” will appear in the Site List window.



The 339 Site Device has now been configured via the Quick Connect feature for either USB or Ethernet communications. Proceed to *Connecting to the Relay* below, to begin communications.

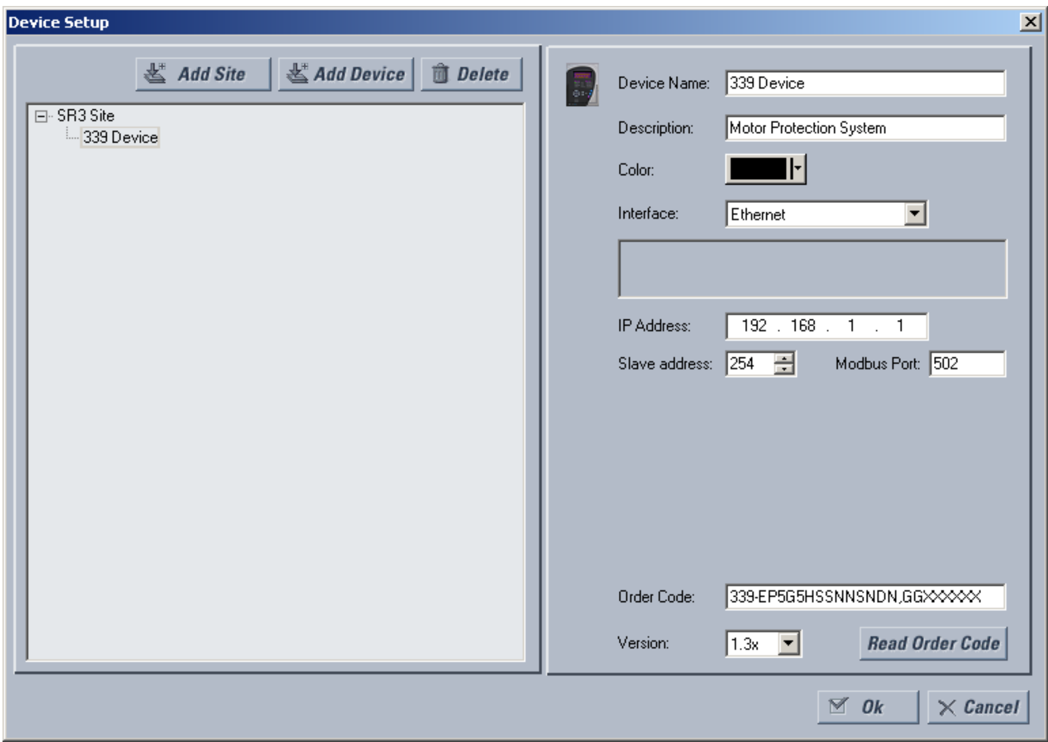
Configuring Ethernet communications

Before starting, verify that the Ethernet cable is properly connected to the RJ-45 Ethernet port.

NOTE

339 The 339 relay supports a maximum of 3 TCP/IP sessions.

1. Install and start the latest version of the EnerVista SR3 Setup Setup software (available from the GE EnerVista CD). See the previous section for the installation procedure.
2. Click on the **Device Setup** button to open the Device Setup window and click the **Add Site** button to define a new site.
3. Enter the desired site name in the "Site Name" field. If desired, a short description of the site can also be entered. In this example, we will use "Substation 1" as the site name.
4. The new site will appear in the upper-left list.
5. Click the **Add Device** button to define the new device.
6. Enter the desired name in the "Device Name" field, and a description (optional).
7. Select "Ethernet" from the Interface drop-down list. This will display a number of interface parameters that must be entered for proper Ethernet functionality.



8. Enter the IP address, slave address, and Modbus port values assigned to the 339 relay (from the S1 RELAY SETUP > COMMUNICATIONS > ETHERNET menu).
9. Click the **Read Order Code** button to connect to the 339 and upload the order code. If a communications error occurs, ensure that the Ethernet communication values correspond to the relay setting values.
10. Click **OK** when the relay order code has been received. The new device will be added to the Site List window (or Online window) located in the top left corner of the main EnerVista SR3 Setup window.

The 339 Site Device has now been configured for Ethernet communications. Proceed to the following section to begin communications.

Connecting to the relay

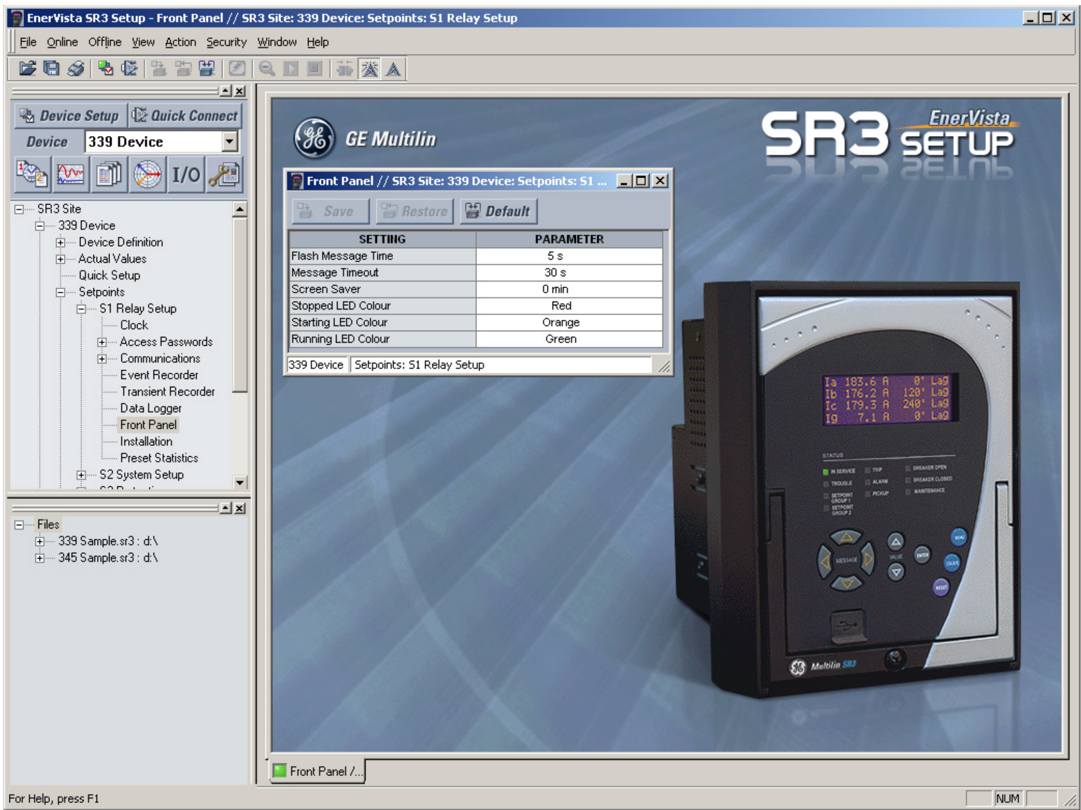
Now that the communications parameters have been properly configured, the user can easily communicate with the relay.

1. Expand the Site list by double clicking on the site name or clicking on the «**+**» box to list the available devices for the given site.

2. Desired device trees can be expanded by clicking the «+» box. The following list of headers is shown for each device:

   Device Definition
   Actual Values
   Quick Setup
   Setpoints
   Maintenance.

3. Expand the SETTINGS > RELAY SETUP list item and double click on **Front Panel** to open the "Front Panel" settings window as shown below:



4. The "Front Panel" settings window will open with a corresponding status indicator on the lower left of the EnerVista SR3 Setup window.

5. If the status indicator is red, verify that the serial, USB, or Ethernet cable is properly connected to the relay, and that the relay has been properly configured for communications (steps described earlier).

The "Front Panel" settings can now be edited, printed, or changed. Other setpoint and command windows can be displayed and edited in a similar manner. "Actual Values" windows are also available for display. These windows can be arranged, and resized at will.

Working with setpoints and setpoint files

Engaging a device

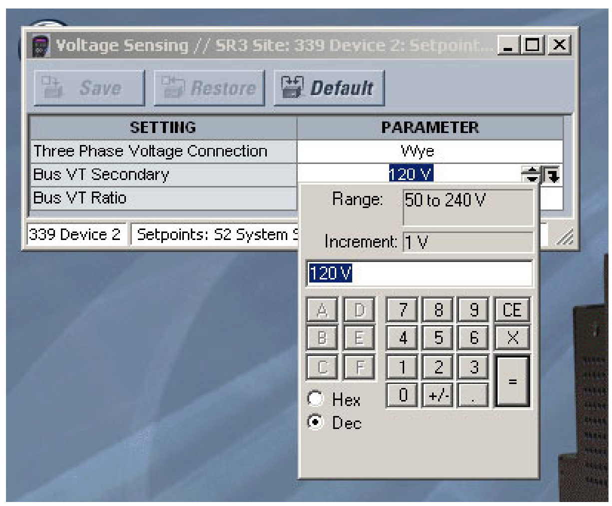
The EnerVista SR3 Setup software may be used in on-line mode (relay connected) to directly communicate with a relay. Communicating relays are organized and grouped by communication interfaces and into sites. Sites may contain any number of relays selected from the product series.

Entering setpoints

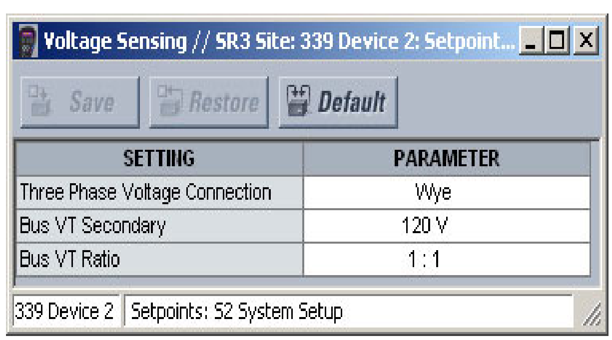
The System Setup page will be used as an example to illustrate the entering of setpoints. In this example, we will be changing the voltage sensing setpoints.

1. Establish communications with the relay.
2. Select the **Setpoint > System Setup > Voltage Sensing** menu item.
3. Select the Bus VT Secondary setpoint by clicking anywhere in the parameter box. This will display three arrows: two to increment/decrement the value and another to launch the numerical keypad.

4. Clicking the arrow at the end of the box displays a numerical keypad interface that allows the user to enter a value within the setpoint range displayed near the top of the keypad: Click **=** to exit from the keypad and keep the new value. Click on **X** to exit from the keypad and retain the old value.



5. For setpoints requiring non-numerical pre-set values (e.g. **3-Phase voltage connection** below), clicking anywhere within the setpoint value box displays a drop-down selection menu arrow. Select the desired value from this list.



6. For setpoints requiring an alphanumeric text string (e.g. "relay name"), the value may be entered directly within the setpoint value box.

7. In the **Setpoint > System Setup > Voltage Sensing** dialog box, click on **Save** to save the values into the relay 339 . Click **YES** to accept any changes and exit the window. Click **Restore** to retain previous values. Click **Default** to restore Default values.

File support

Opening any EnerVista SR3 Setup file will automatically launch the application or provide focus to the already opened application. If the file is a settings file (has a 'SR3' extension) which had been removed from the Settings List tree menu, it will be added back to the Settings List tree.

New files will be automatically added to the tree.

Using setpoints files

The EnerVista SR3 Setup software interface supports three ways of handling changes to relay settings:

- In off-line mode (relay disconnected) to create or edit relay settings files for later download to communicating relays.
- Directly modifying relay settings while connected to a communicating relay, then saving the settings when complete.
- Creating/editing settings files while connected to a communicating relay, then saving them to the relay when complete.

Settings files are organized on the basis of file names assigned by the user. A settings file contains data pertaining to the following types of relay settings:

- Device Definition
- Relay Setup
- System Setup
- Protection
- Control
- Inputs/Outputs

Factory default values are supplied and can be restored after any changes.

The EnerVista SR3 Setup displays relay setpoints with the same hierarchy as the front panel display.

Downloading and saving setpoints files

Setpoints must be saved to a file on the local PC before performing any firmware upgrades. Saving setpoints is also highly recommended before making any setpoint changes or creating new setpoint files.

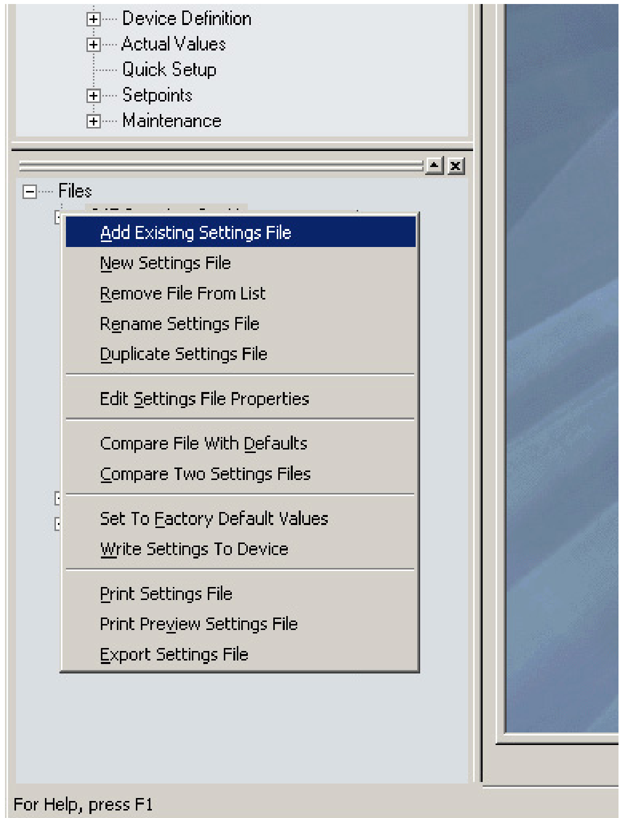
The setpoint files in the EnerVista SR3 Setup window are accessed in the Files Window. Use the following procedure to download and save setpoint files to a local PC.

1. Ensure that the site and corresponding device(s) have been properly defined and configured as shown in *Connecting EnerVista SR3 Setup to the Relay*, above.
2. Select the desired device from the site list.
3. Select the **Online > Read Device Settings** from Device menu item, or right-click on the device and select **Read Device Settings** to obtain settings information from the device.
4. After a few seconds of data retrieval, the software will request the name and destination path of the setpoint file. The corresponding file extension will be automatically assigned. Press **Receive** to complete the process. A new entry will be added to the tree, in the File pane, showing path and file name for the setpoint file.

Adding setpoints files to the environment

The EnerVista SR3 Setup software provides the capability to review and manage a large group of setpoint files. Use the following procedure to add an existing file to the list.

1. In the files pane, right-click on **Files** and select the **Add Existing Setting File** item as shown:

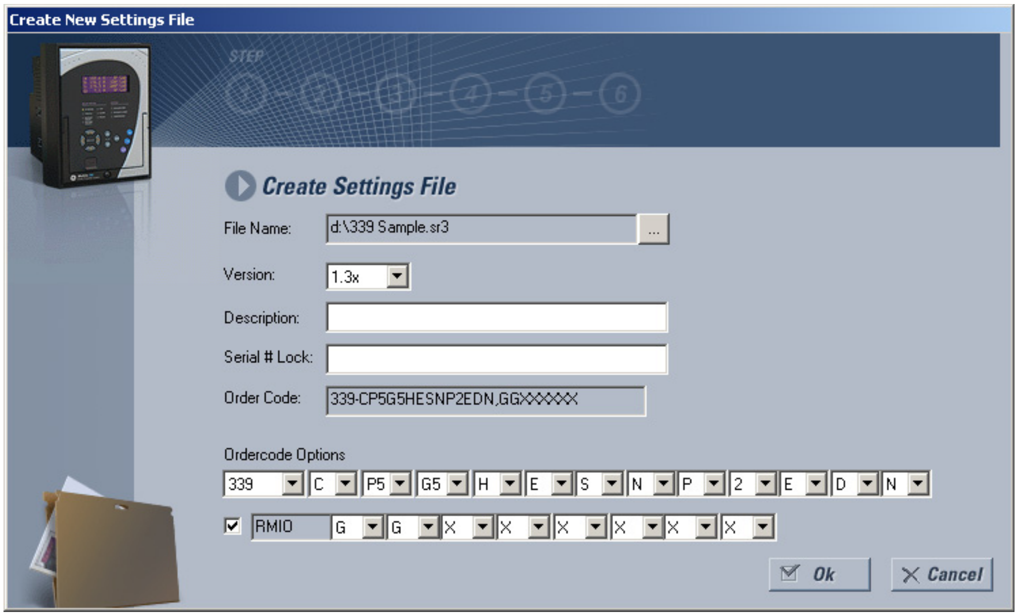


2. The Open dialog box will appear, prompting the user to select a previously saved setpoint file. As for any other MS Windows® application, browse for the file to be added then click **Open**. The new file and complete path will be added to the file list.

Creating a new setpoint file

The EnerVista SR3 Setup software allows the user to create new setpoint files independent of a connected device. These can be uploaded to a relay at a later date. The following procedure illustrates how to create new setpoint files.

1. In the File pane, right click on **File** and select the **New Settings File** item. The following box will appear, allowing for the configuration of the setpoint file for the correct firmware version. It is important to define the correct firmware version to ensure that setpoints not available in a particular version are not downloaded into the relay.



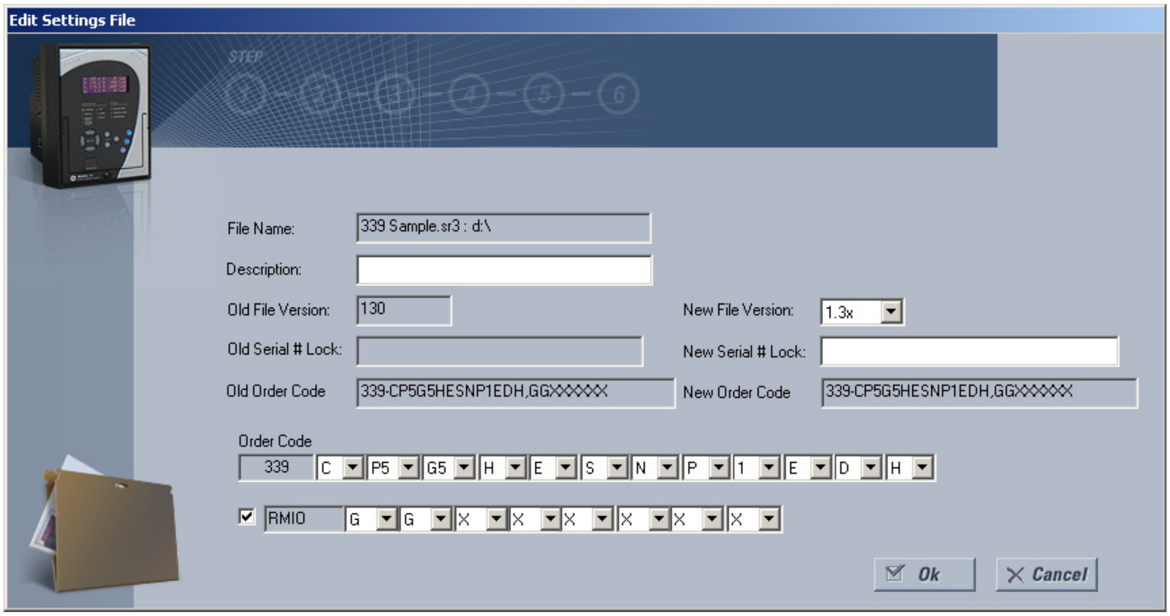
2. Select the Firmware Version, and Order Code options for the new setpoint file.
3. For future reference, enter some useful information in the **Description** box to facilitate the identification of the device and the purpose of the file.
4. To select a file name and path for the new file, click the button beside the File Name box.
5. Select the file name and path to store the file, or select any displayed file name to replace an existing file. All 339 setpoint files should have the extension 'SR3' (for example, 'feeder1.SR3').
6. Click **OK** to complete the process. Once this step is completed, the new file, with a complete path, will be added to the EnerVista SR3 Setup software environment.

Upgrading setpoint files to a new revision

It is often necessary to upgrade the revision for a previously saved setpoint file after the 339 firmware has been upgraded. This is illustrated in the following procedure:

1. Establish communications with the 339 relay.
2. Select the **Maintenance > M1 Relay Info** menu item and record the Firmware Revision.
3. Load the setpoint file to be upgraded into the EnerVista SR3 Setup environment as described in the section, *Adding Setpoints Files to the Environment.*
4. In the File pane, select the saved setpoint file.
5. From the main window menu bar, select the **Offline > Edit Settings File Properties** menu item and note the File Version of the setpoint file. If this version is different from the Firmware Revision noted in step 2, select a New File Version that matches the Firmware Revision from the pull-down menu.

6. For example, if the firmware revision is L2L01MA120.000 (Firmware Revision 1.20) and the current setpoint file revision is 1.10, change the setpoint file revision to “1.2x”.



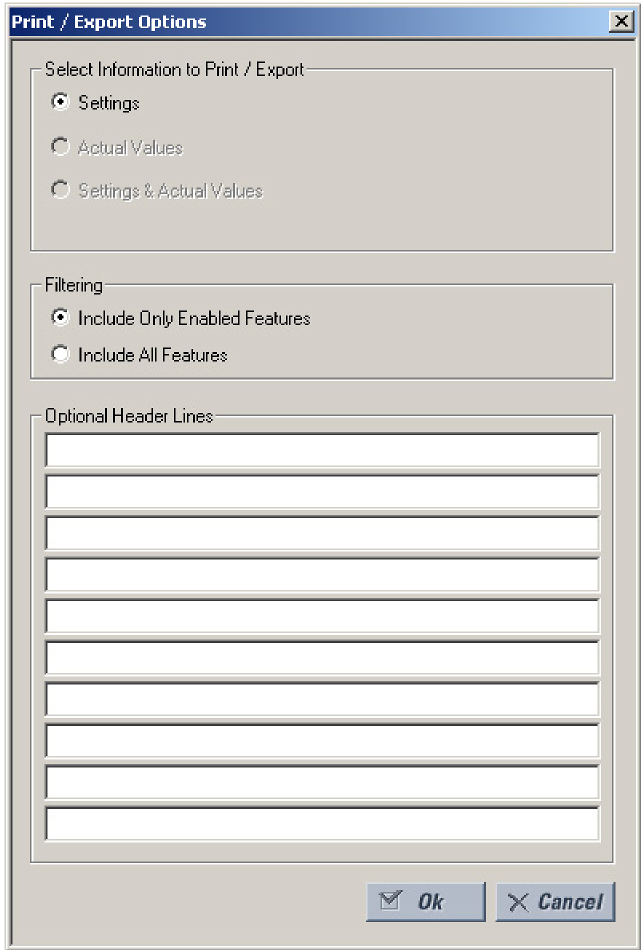
7. Enter any special comments about the setpoint file in the "Description" field.
8. Select the desired firmware version from the "New File Version" field.
9. When complete, click **OK** to convert the setpoint file to the desired revision. See *Loading Setpoints from a File* below, for instructions on loading this setpoint file into the 339 339 .

Printing setpoints and actual values

The EnerVista SR3 Setup software allows the user to print partial or complete lists of setpoints and actual values. Use the following procedure to print a list of setpoints:

1. Select a previously saved setpoints file in the File pane or establish communications with a 339 device.
2. From the main window, select the **Offline > Export Settings File** menu item.

3. The Print/Export Options dialog box will appear. Select **Settings** in the upper section and select either **Include All Features** (for a complete list) or **Include Only Enabled Features** (for a list of only those features which are currently used) in the filtering section and click **OK**.



4. The process for **Offline > Print Preview Settings File** is identical to the steps above.
5. Setpoint lists can be printed in the same manner by right clicking on the desired file (in the file list) or device (in the device list) and selecting the **Print Device Information** or **Print Settings File** options.

Printing actual values from a connected device

A complete list of actual values can also be printed from a connected device with the following procedure:

1. Establish communications with the desired 339 device.
2. From the main window, select the **Online > Print Device Information** menu item
3. The Print/Export Options dialog box will appear. Select **Actual Values** in the upper section and select either **Include All Features** (for a complete list) or **Include Only Enabled Features** (for a list of only those features which are currently used) in the filtering section and click **OK**.

Actual values lists can be printed in the same manner by right clicking on the desired device (in the device list) and selecting the **Print Device Information** option

Loading setpoints from a file

CAUTION

An error message will occur when attempting to download a setpoint file with a revision number that does not match the relay firmware. If the firmware has been upgraded since saving the setpoint file, see *Upgrading Setpoint Files to a New Revision*, above, for instructions on changing the revision number of a setpoint file.

The following procedure illustrates how to load setpoints from a file. Before loading a setpoints file, it must first be added to the EnerVista SR3 Setup environment as described in the section, *Adding Setpoints Files to the Environment*.

1. Select the previously saved setpoints file from the File pane of the EnerVista SR3 Setup software main window.
2. Select the **Offline > Edit Settings File Properties** menu item and verify that the corresponding file is fully compatible with the hardware and firmware version of the target relay. If the versions are not identical, see *Upgrading Setpoint Files to a New Revision*, above, for details on changing the setpoints file version.
3. Right-click on the selected file and select the **Write Settings File to Device** item.
4. Select the target relay from the list of devices shown and click **Send**. If there is an incompatibility, an "Incompatible Device" error message will occur:

If there are no incompatibilities between the target device and the settings file, the data will be transferred to the relay. An indication of the percentage completed will be shown in the bottom of the main window.

Upgrading relay firmware

To upgrade the 339 firmware, follow the procedures listed in this section. Upon successful completion of this procedure, the 339 will have new firmware installed with the factory default setpoints.The latest firmware files are available from the GE Digital Energy website at
http:// www.gedigitalenergy.com.

NOTE

EnerVista SR3 Setup EnerVista SR3 Setup software prevents incompatible firmware from being loaded into a 339 relay.

NOTE

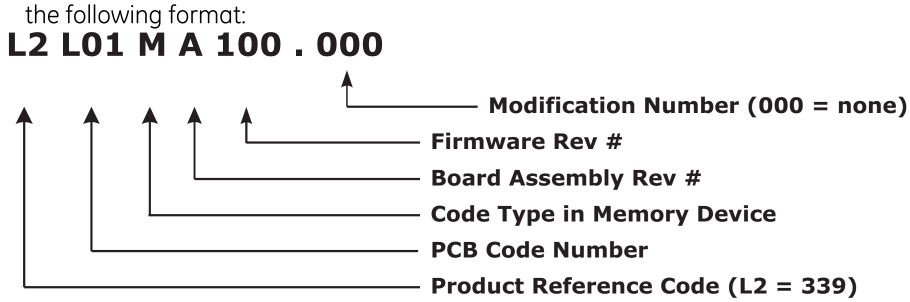
Before upgrading firmware, it is very important to save the current 339 settings to a file on your PC. After the firmware has been upgraded, it will be necessary to load this file back into the 339 . Refer to *Downloading and Saving Setpoints Files* for details on saving relay setpoints to a file.

Loading new relay firmware

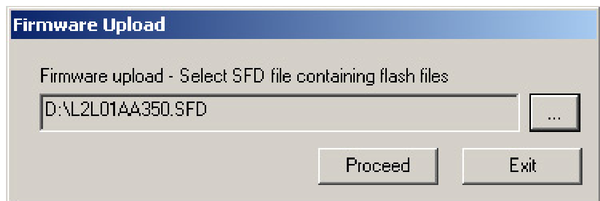
Loading new firmware into the 339 flash memory is accomplished as follows:

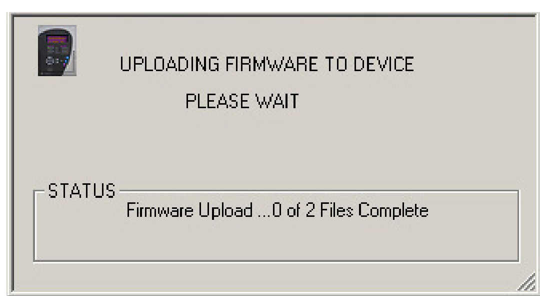
1. Connect the relay to the local PC and save the setpoints to a file as shown in *Downloading and Saving Setpoints Files*.
2. Select the **Maintenance > Update Firmware** menu item.

3. The EnerVista SR3 Setup software will request the new firmware file. Locate the folder that contains the firmware files to load into the relay339 . The firmware filename has the following format:



4. EnerVista SR3 Setup EnerVista SR3 Setup software now prepares the 339 to receive the new firmware file. The 339 front panel will momentarily display "SR BOOT PROGRAM Waiting for Message," indicating that it is in upload mode.
5. While the file is being loaded into the relay339 , a status box appears showing how much of the new firmware file has been transferred and the upgrade status. The entire transfer process takes approximately 10 minutes.





6. The EnerVista SR3 Setup software will notify the user when the 339 has finished loading the file. Carefully read any displayed messages and click **OK** to return the main screen. **Cycling power to the relay is recommended after a firmware upgrade.**

After successfully updating the 339 firmware, the relay will not be operational and will require setpoint programming. To communicate with the relay, the communication settings may have to be manually reprogrammed.

When communications are established, the saved setpoints must be reloaded back into the relay. See *Loading Setpoints from a File* for details.

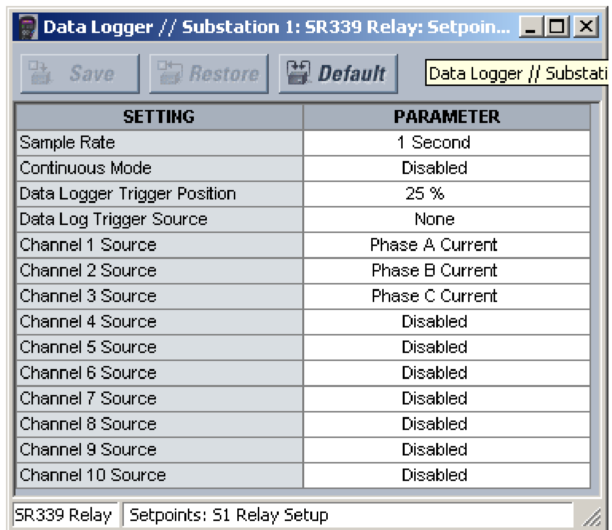
Modbus addresses assigned to firmware modules, features, settings, and corresponding data items (i.e. default values, min/max values, data type, and item size) may change slightly from version to version of the firmware. Addresses are rearranged when new features are added or existing features are enhanced or modified.

Advanced EnerVista SR3 Setup features

Data logger

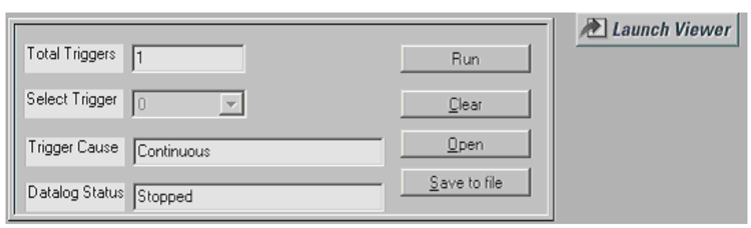
The data logger feature is used to sample and record up to ten actual values at a selectable interval. The datalogger can be run with Continuous mode Enabled, which will continuously record samples until stopped by the user; or with Continuous mode Disabled, which will trigger the datalog once without overwriting previous data.

Select the **Setpoints > S1RelaySetup > Datalogger** menu item to open the Datalogger Setup window.

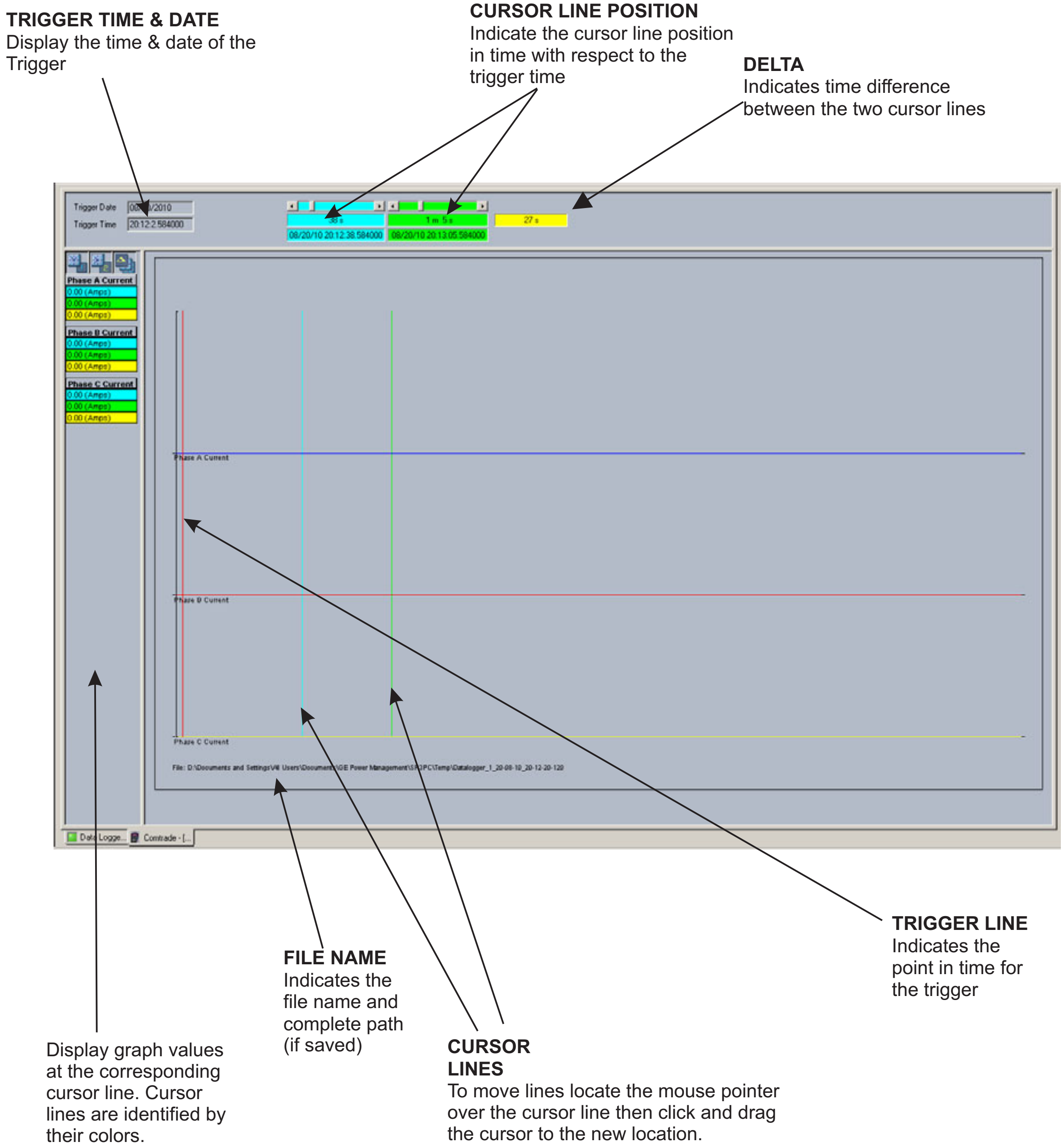


Viewing and saving of the Datalogger is performed as follows:

1. With EnerVista SR3 Setup running and communications established, select the **A3 Records > Datalogger** menu item to open the Datalogger Actual Values window:



2. If Continuous mode is enabled, click on **Stop** to stop the datalog
3. Click on the **Save to File** button to save the datalog to the local PC. A new window will appear requesting for file name and path.
4. One file is saved as a COMTRADE file, with the extension 'CFG'. The other file is a DAT file, required by the COMTRADE file for proper display of data.
5. To view a previously saved COMTRADE file, click the **Open** button and select the corresponding COMTRADE file.
6. To view the datalog, click the **Launch Viewer** button. A detailed Datalog window will appear as shown below.



7. The method of customizing the datalog view is the same as the Waveform Capture described below.
8. The datalog can be set to capture another buffer by clicking on **Run** (when Continuous mode is enabled), or by clicking on **Release** (when Continuous mode is disabled).

Motor start data logger

When a motor start status is detected by the 339 relay, a start data logger is triggered and begins to sample and record the following parameters at a rate of 1 sample every 200ms:

- True RMS values of the Phase A, B and C Currents (Ia, Ib, and Ic).
- True RMS value of the Ground current (Ig).
- Current Unbalance (%).

- True RMS values of the Phase A-N, B-N, and C-N voltages (Van, Vbn, and Vcn) if VT CONNECTION TYPE is set to Wye.
- True RMS values of the Phase A-B, B-C and C-A voltages (Vab, Vbc, and Vca) if VT CONNECTION TYPE is set to Delta.
- Thermal Capacity Used (%).
- Frequency.
- Breaker/Contactor Contact Input Status.

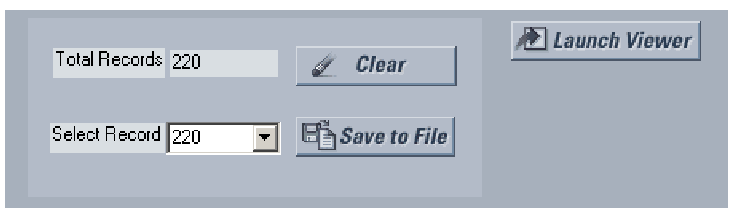
1-second pre-trigger data and 29-second post-trigger data are recorded. The data logger ignores all subsequent triggers and continues to record data until the active record is finished.

A total of 6 logs are stored in the relay. Log # 1 is the baseline log; it is written to only by the first start that occurs after the user clears the motor start data logger. Logs #2 to 6 are a rolling buffer of the last 5 motor starts. A new log automatically shifts the rolling buffer and overwrites the oldest log, #2.

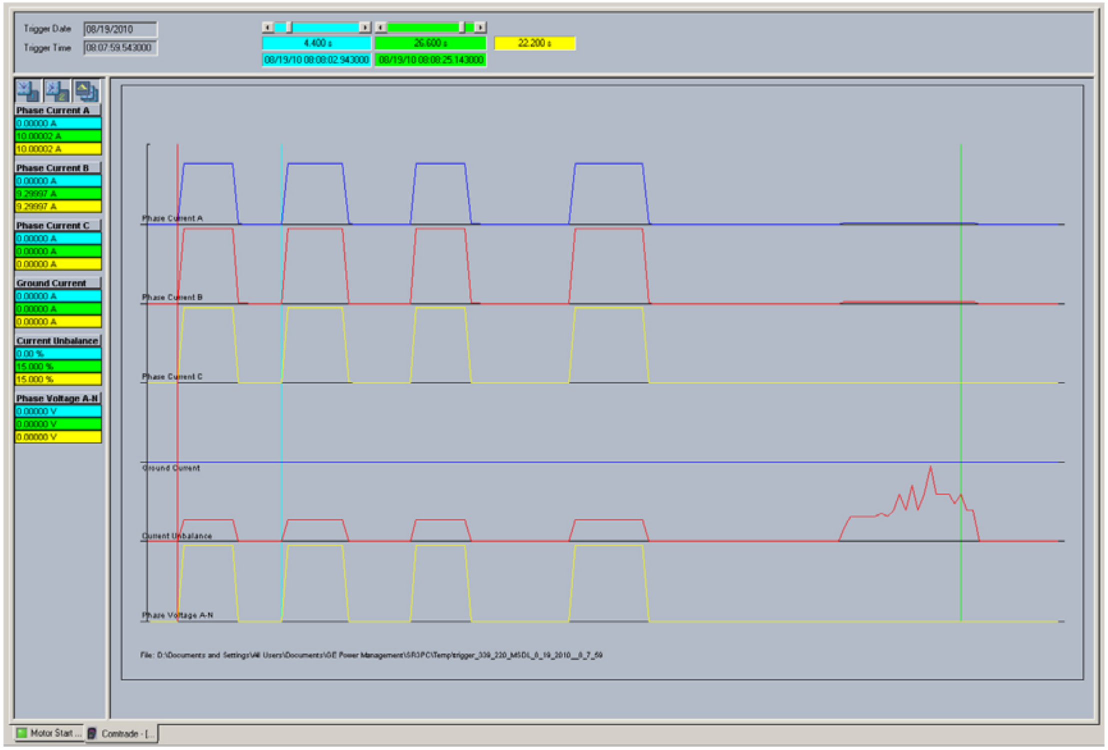
The log files are formatted using CSV (comma delimited values) and the COMTRADE file format per IEEE PC37.111 Draft 7C (02 September 1997). [Please see the details in the user interfaces section.] The files can be downloaded and displayed via EnerVista SR3 Setup software. All the files are stored in non-volatile memory, so that information is retained when power to the relay is lost.

Viewing and saving of the Motor Start Datalogger is performed as follows:

1. With EnerVista SR3 Setup running and communications established, select the **A3 Records > Motor Start Data Logger** menu item to open the Motor Start datalog setup window:



2. Click on the **Save to File** button to save the datalog to the local PC. A new window will appear requesting for file name and path.
3. One file is saved as a COMTRADE file, with the extension 'CFG'. The other file is a DAT file, required by the COMTRADE file for proper display of data.
4. To view a previously saved COMTRADE file, click the **Open** button and select the corresponding COMTRADE file.
5. To view the datalog, click the **Launch Viewer** button. A detailed Datalog window will appear as shown below. For an explanation of the components of this screen, please refer to the Data Logger section above.

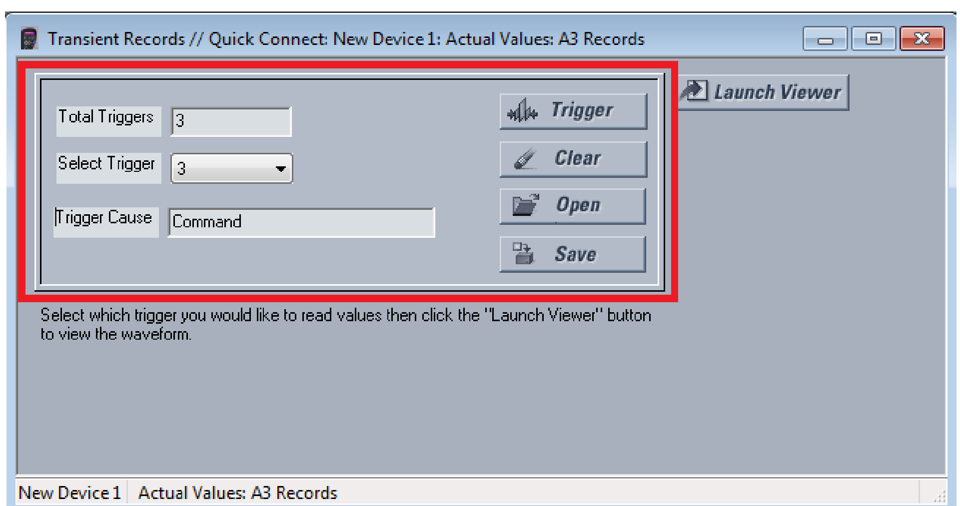


6. The method of customizing the datalog view is the same as the Waveform Capture described below.

Transient recorder (Waveform capture)

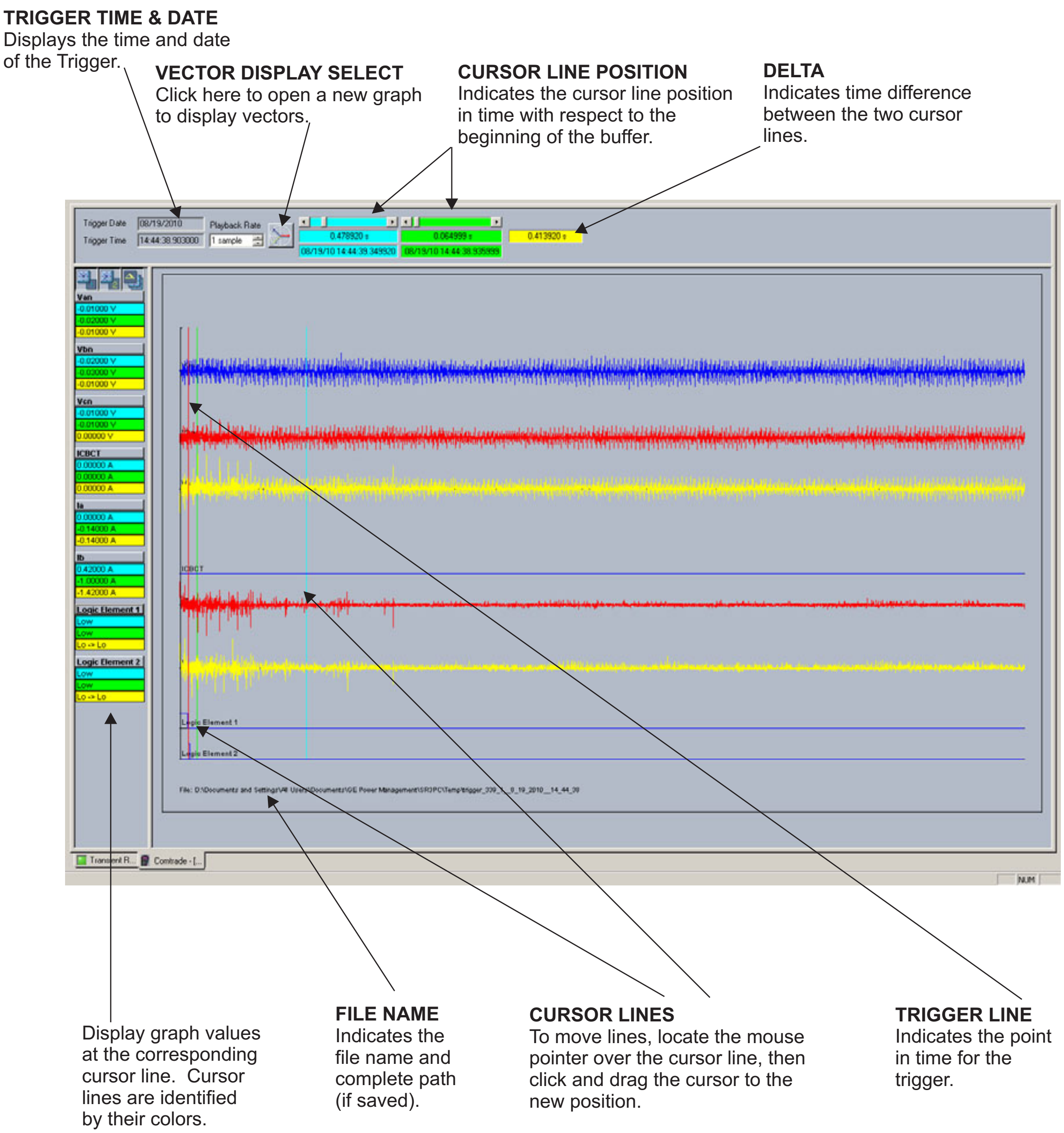
The EnerVista SR3 Setup EnerVista SR3 Setup software can be used to capture waveforms (or view trace memory) from the relay at the instance of a pickup, trip, alarm, or other condition.

- With EnerVista SR3 Setup software running and communications established, select the **Actual Values > A3 Records > Transient Records** menu item to open the Transient Recorder Viewer window.



- Click on **Trigger Waveform** to trigger a waveform capture. Waveform file numbering starts with the number zero in the 339 , so that the maximum trigger number will always be one less than the total number of triggers available.

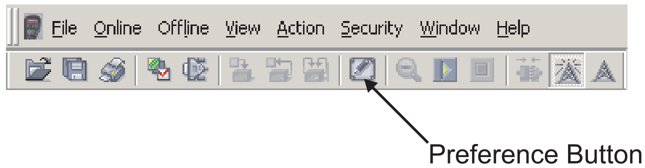
- Click on the **Save to File** button to save the selected waveform to the local PC. A new window will appear, requesting the file name and path. One file is saved as a COMTRADE file, with the extension "CFG." The other file is a "DAT" file, required by the COMTRADE file for proper display of waveforms.
- To view a previously saved COMTRADE file, click the **Open** button and select the corresponding COMTRADE file.
- To view the captured waveforms, click on the **Launch Viewer** button. A detailed Waveform Capture window will appear as shown below.



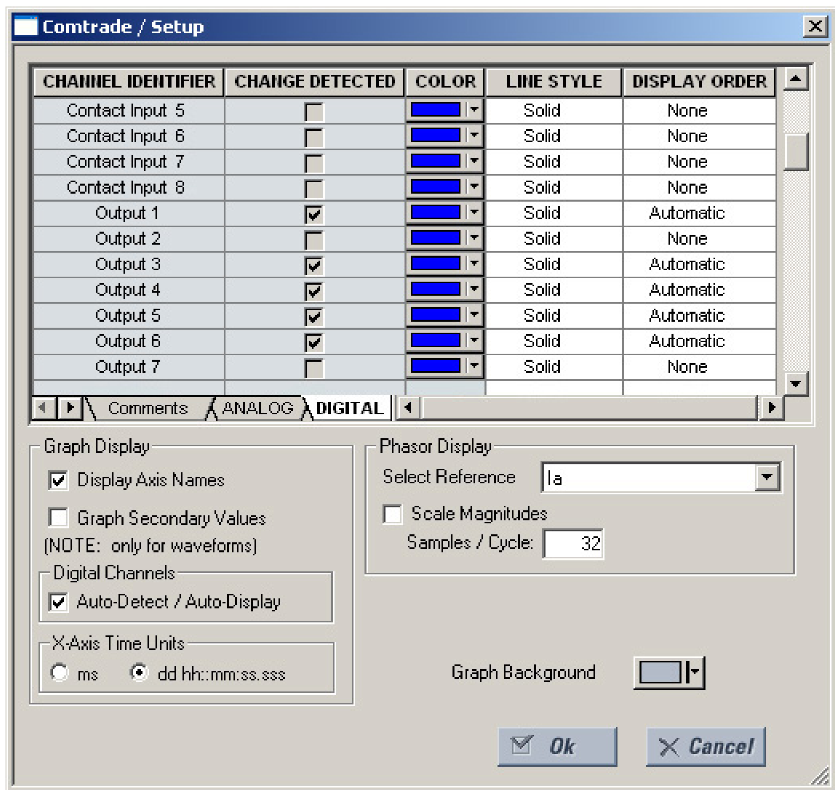
- The red vertical line indicates the trigger point.
- The date and time of the trigger are displayed at the top left corner of the window. To match the captured waveform with the event that triggered it, make note of the time and date shown in the graph, then find the event that matches the same time in the

event recorder. The event record will provide additional information on the cause and system conditions at the time of the event.

- From the window main menu bar, press the **Preference** button to open the COMTRADE Setup page, in order to change the graph attributes.



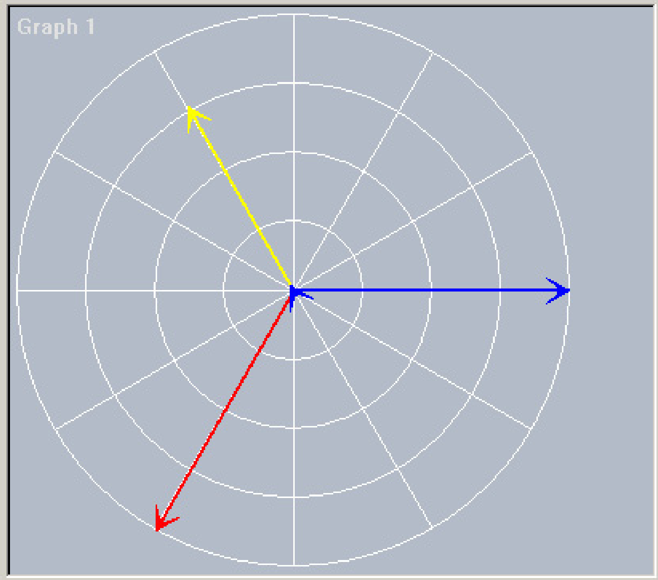
The following window will appear:



Change the color of each graph as desired, and select other options as required, by checking the appropriate boxes. Click **OK** to store these graph attributes, and to close the window. The Waveform Capture window will reappear based on the selected graph attributes.

To view a vector graph of the quantities contained in the waveform capture, press the **Vector Display** button to display the following window:

CHANNEL IDENTIFIER	COLOR	GRAPH	MAGNITUDE / ANGLE
Ia		Graph 1	502.01 A 0.00 deg
Ib		Graph 1	502.05 A -119.85 deg
Ic		Graph 1	385.60 A -240.01 deg
Ig		Graph 1	11.64 A -239.41 deg



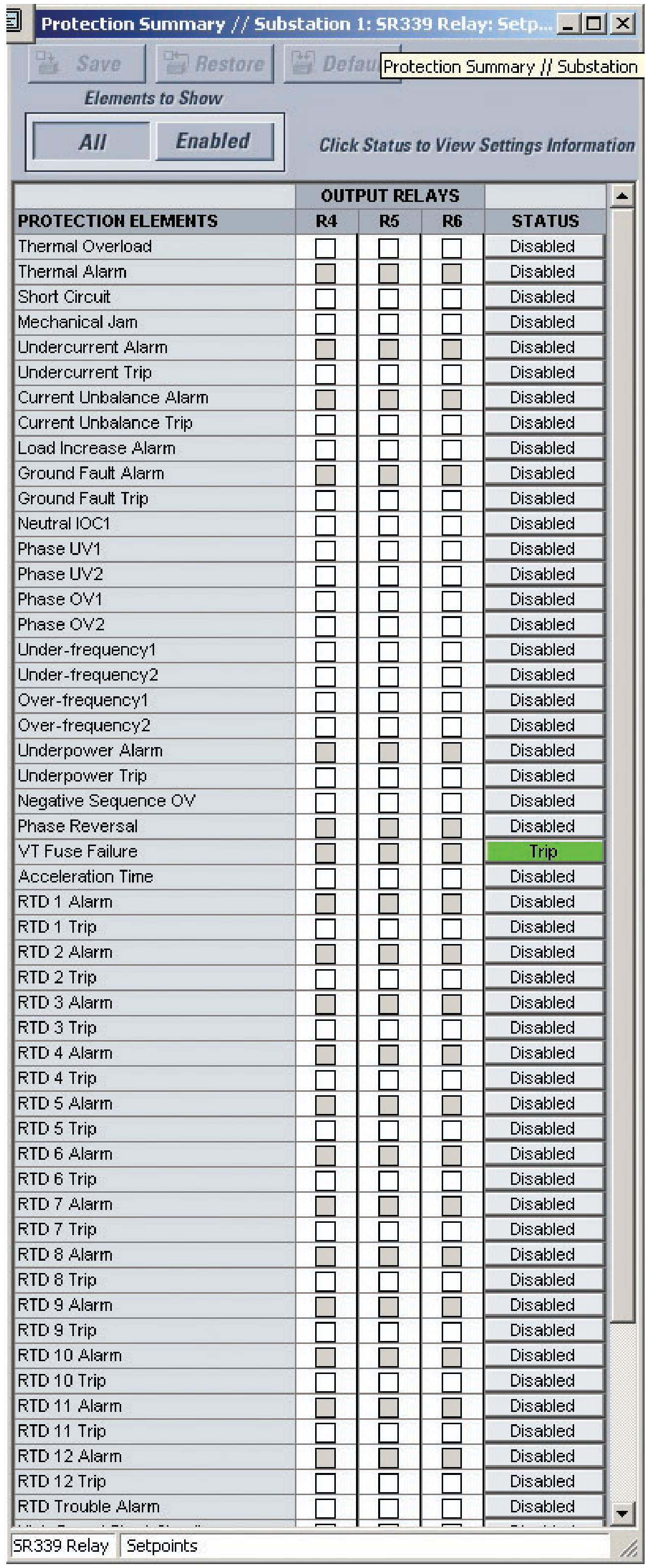
Protection summary

Protection Summary is a single screen which holds the summarized information of different settings from Grouped Elements, Control Elements and Maintenance screens.

Protection Summary Screen allows the User to:

- view the output relay assignments for the elements
- modify the output relay assignments for the elements
- view the enable/disable status of Control Elements
- navigate to the respected Protection Element screen on a button click.

The Protection Summary screen is as follows:



	OUTPUT RELAYS			
PROTECTION ELEMENTS	R4	R5	R6	STATUS
Thermal Overload				Disabled
Thermal Alarm				Disabled
Short Circuit				Disabled
Mechanical Jam				Disabled
Undercurrent Alarm				Disabled
Undercurrent Trip				Disabled
Current Unbalance Alarm				Disabled
Current Unbalance Trip				Disabled
Load Increase Alarm				Disabled
Ground Fault Alarm				Disabled
Ground Fault Trip				Disabled
Neutral IOC1				Disabled
Phase UV1				Disabled
Phase UV2				Disabled
Phase OV1				Disabled
Phase OV2				Disabled
Under-frequency1				Disabled
Under-frequency2				Disabled
Over-frequency1				Disabled
Over-frequency2				Disabled
Underpower Alarm				Disabled
Underpower Trip				Disabled
Negative Sequence OV				Disabled
Phase Reversal				Disabled
VT Fuse Failure				Trip
Acceleration Time				Disabled
RTD 1 Alarm				Disabled
RTD 1 Trip				Disabled
RTD 2 Alarm				Disabled
RTD 2 Trip				Disabled
RTD 3 Alarm				Disabled
RTD 3 Trip				Disabled
RTD 4 Alarm				Disabled
RTD 4 Trip				Disabled
RTD 5 Alarm				Disabled
RTD 5 Trip				Disabled
RTD 6 Alarm				Disabled
RTD 6 Trip				Disabled
RTD 7 Alarm				Disabled
RTD 7 Trip				Disabled
RTD 8 Alarm				Disabled
RTD 8 Trip				Disabled
RTD 9 Alarm				Disabled
RTD 9 Trip				Disabled
RTD 10 Alarm				Disabled
RTD 10 Trip				Disabled
RTD 11 Alarm				Disabled
RTD 11 Trip				Disabled
RTD 12 Alarm				Disabled
RTD 12 Trip				Disabled
RTD Trouble Alarm				Disabled

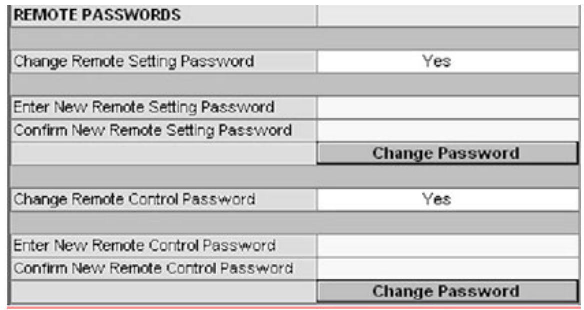
Password security

Password security is an optional feature of the 339 which can be setup using the SR3 EnerVista Setup software. The password system has been designed to facilitate a hierarchy for centralized management. This is accomplished through a Master level access password which can be used for resetting lower level access passwords and higher level privileged operations. In cases where operational security is required as well as a central administrative authority then the use of the password system is highly encouraged. The feature robustness of this system requires it to be managed exclusively through the EnerVista setup software. This section describes how to perform the initial setup. For more details on the password security feature, refer to *Chapter 6 - Password Security*.

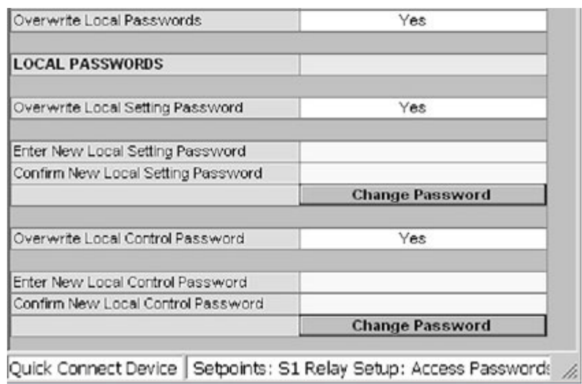
1. 339 339 devices shipped from the factory are initially set with security disabled. If the password security feature is to be used, the user must first change the Master Reset Password from the initial Null setting, this can only be done over communications, not from the front panel keypad. The new Master Reset Password must be 8 to 10 characters in length, and must have minimum 2 letters and 2 numbers. The letters are case sensitive. After entering a valid Master Reset Password, enter the new Master Reset Password again to confirm, then select **Change Password**.

2. Now that the Master Reset Password has been programmed, enter it again to log in to the Master Access level. The Master Level permits setup of the Remote and Local Passwords. If the Master Reset Password has been lost, record the Encrypted Key and contact the factory to have it decrypted.

3. With Master Level access, the user may disable password security altogether, or change the Master Reset Password.
4. The Master Access level allows programming of the Remote Setpoint and Remote Control passwords. These passwords are initially set to a Null value, and can only be set or changed from a remote user over RS485 or Ethernet communications. Remote Passwords must be 3 to 10 characters in length.



5. Initial setup of the Local Setpoint and Local Control passwords requires the Master Access level. If Overwrite Local Passwords is set to YES, Local passwords can be changed remotely only (over RS485 or Ethernet). If Overwrite Local Passwords is set to NO, Local passwords can be changed locally only (over USB or keypad). If changing Local Passwords is permitted locally, the keypad user can only change the Local Passwords if they have been changed from the initial NULL value to a valid one. Local Passwords must be 3 to 10 characters in length.



6. If any Remote password has never been set, that level will not be attainable except when logged in as the Master Level. The same logic applies to the Local passwords.
7. When passwords have been set, the user will be prompted to enter the appropriate password depending on the interface being used (remote or local), and the nature of the change being made (setpoint or control). If the correct password is entered, the user is now logged into that access level over that interface only. The access level turns off after a period of 5 minutes of inactivity, if control power is cycled, or if the user enters an incorrect password.

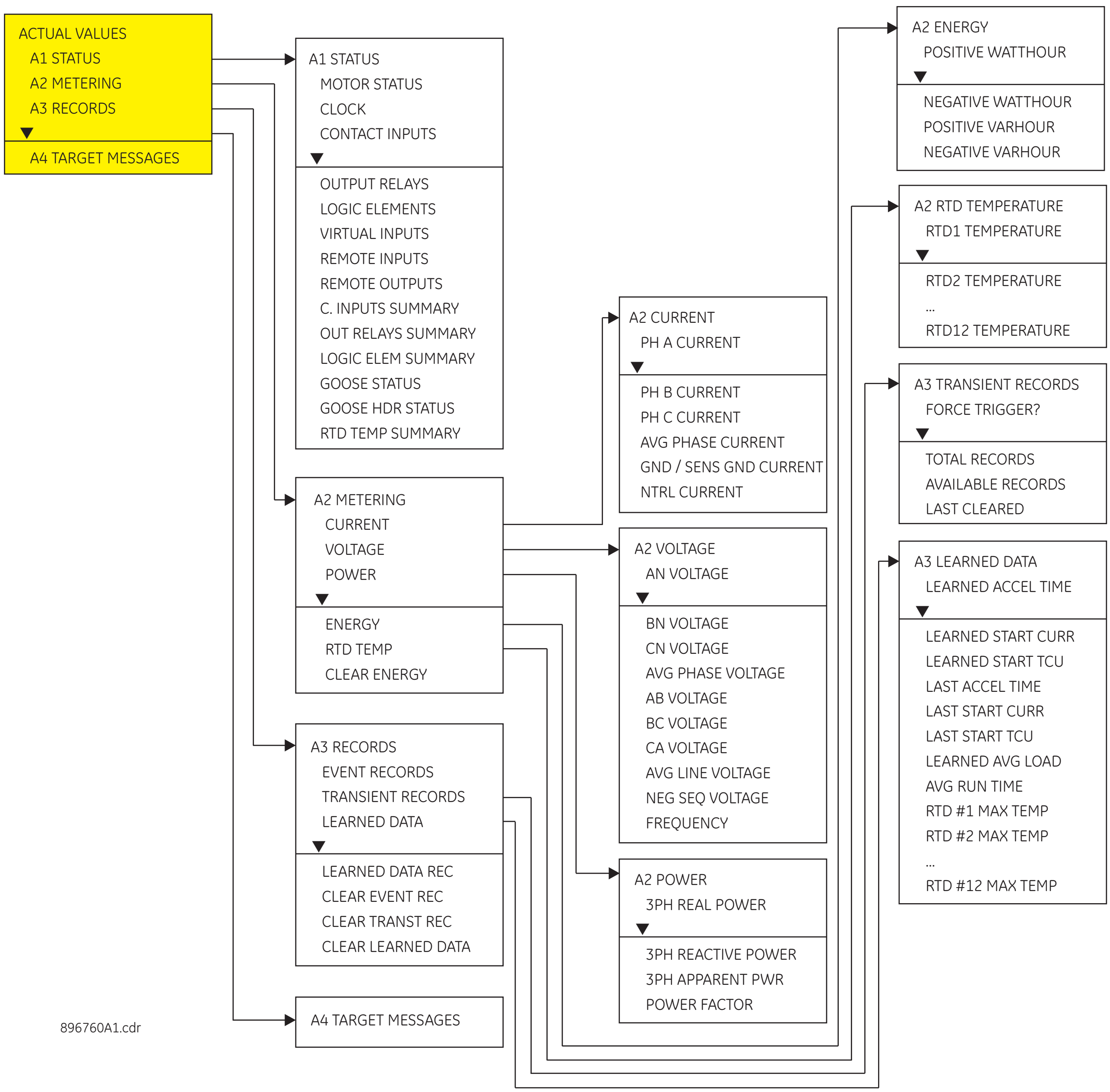
339 Motor Protection System

Chapter 4: Actual values

Actual values overview

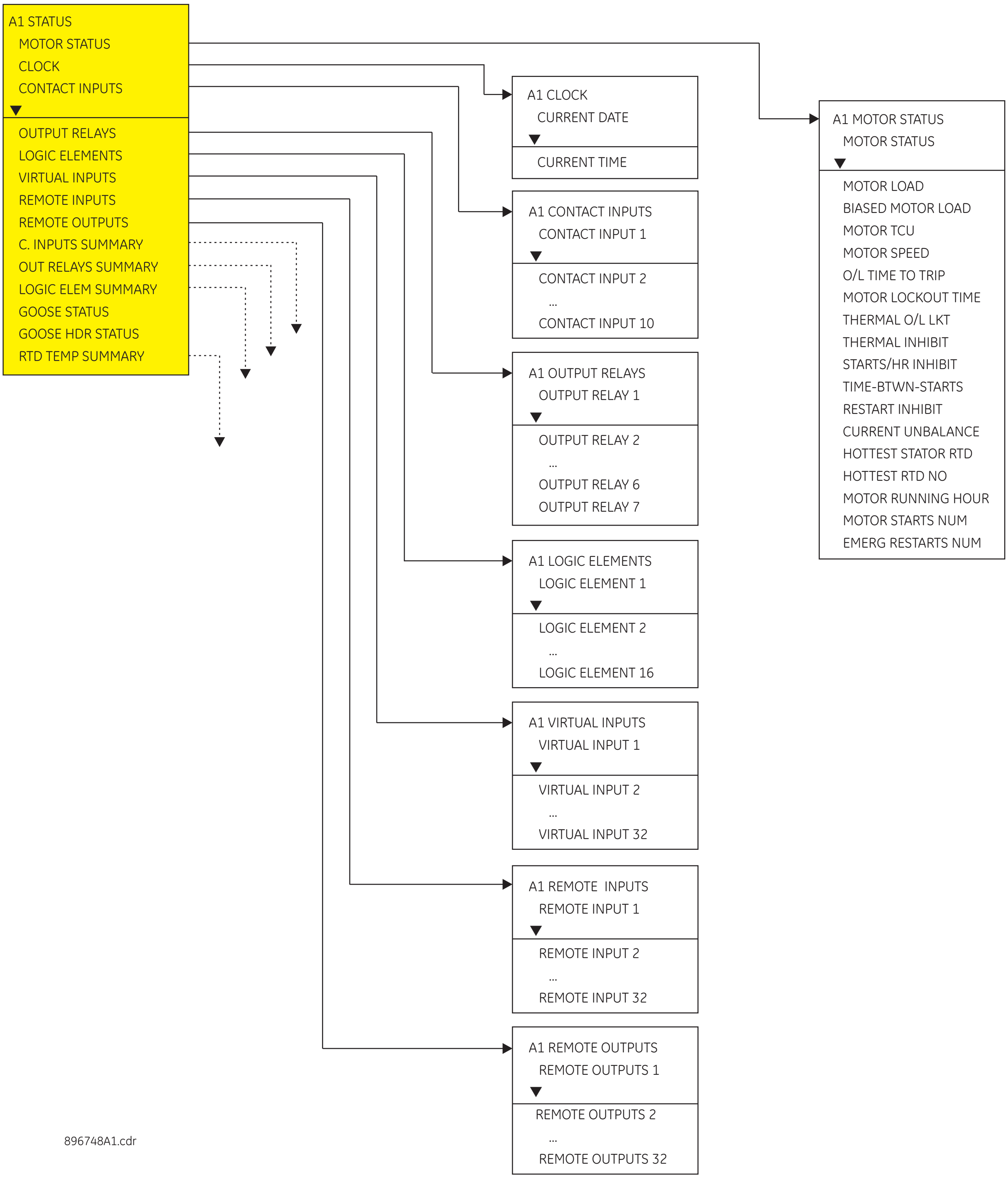
All measured values, the status of digital inputs and outputs, and fault analysis information are accessed in Actual Values mode. Actual value messages are organized into logical groups for easy reference as shown below.

Figure 4-1: Main Actual Values menu



A1 Status

Figure 4-2: Status menu



Motor status

MOTOR STATUS

Range: Tripped, Stopped, Starting, Running, Overload

The motor status is tripped following any protection trip operation or lockout. After all protection trips and lockout have cleared, the tripped motor status can be reset from the front panel reset key, by closure of the reset or lockout reset contact input, or via communications. The emergency restart function also resets tripped status.

When the motor status is stopped, detection of phase current above the FLA changes the status to starting. Running status follows starting when the current then drops below FLA. Running status continues as long as phase current greater than 5% of CT is detected. To accommodate applications where current does not rise above the thermal overload pickup setting on start, running status is also declared when the contact inputs indicate the motor is online. When phase current falls below 5% of CT the status changes to stopped. To accommodate applications where motor idle current is less than 5% CT, a further requirement to change status to stopped is that the contact inputs do not indicate the motor is online.

For single speed applications, an enabled 52a contact input closed or an enabled 52b contact input open is taken as indication of motor online. If both are enabled, the relay assumes the motor is online if the 52a contact is closed and the 52b contact is open.

For two speed applications, closure either of the High Speed Switch contact input or of the Low Speed Switch contact input is indication of motor online. If either 52a or 52b contact input is enabled, a further requirement is that these indicate the breaker is closed.

Use of these contact inputs (52a Contact, 52b Contact, High Speed Switch, Low Speed Switch) for motor online detection is optional, but is recommended to ensure proper detection of motor running, especially in cases where the starting current is less than the thermal overload pickup setting or motor idle current is less than 5% of CT.

MOTOR LOAD

Displays the average 3-phase motor current (I_{avg}) per-unit on an FLA base.

BIASED MOTOR LOAD

Displays the equivalent motor heating current (I_{eq}) per-unit on an FLA base. Refer to *Thermal Protection* section.

MOTOR TCU

Displays the Thermal Capacity Used.

MOTOR SPEED

Indicates the motor running speed per the speed switch input. This value is seen only when the setting "Enable 2-SPD Motor" is enabled.

O/L TIME TO TRIP

Displays the remainder of the thermal overload trip time when the current is above the thermal overload pick-up setting.

THERMAL INHIBIT

Time in seconds left until the Thermal Start Inhibit expires. Has a value of zero if this feature is set to OFF, or if the time has expired.

STARTS/HR INHIBIT

Time in seconds left until the Starts per Hour feature’s inhibit expires. Has a value of zero if this feature is set to OFF, or if the time has expired.

TIME-BTWN-START

Time in seconds left until the Time Between Starts feature's inhibit expires. Has a value of zero if this feature is set to OFF, or if the time has expired.

RESTART INHIBIT

Time in seconds left until the Restart Timer feature's inhibit expires. Has a value of zero if this feature is set to OFF, or if the time has expired.

MOTOR LOCKOUT TIME

Displays the longest lockout time among the following 5 timers: THERMAL INHIBIT, STARTS/HOUR INHIBIT, TIME-BETWEEN-STARTS INHIBIT, RESTART INHIBIT and THREMAL O/L LOCKOUT.

THERMAL O/L LKT

A thermal overload lockout will occur after a thermal overload trip so that the user cannot start the motor until the TCU drops to 15%. Following a thermal overload trip, this value indicates how long it will take for the 339 relay TCU to decrease from the current value to 15%.

CURRENT UNBALANCE

Displays the current unbalance level as a percentage. Refer to the *Current Unbalance* section.

HOTTEST STATOR RTD

Displays the temperature of the hottest Stator RTD.

HOTTEST RTD NO.

Indicates the hottest Stator RTD.

MOTOR RUNNING HOUR

Displays the actual motor running time in hours.

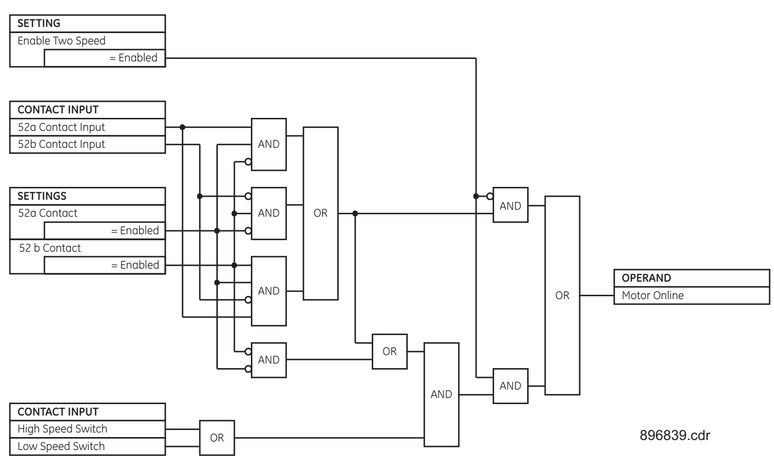
MOTOR STARTS NUM

Displays the actual number of motor starts.

EMERG RESTARTS NUM

Displays the actual number of motor Emergency Restarts.

Figure 4-3: Motor Status logic diagram



Clock

PATH: ACTUAL VALUES > A1 STATUS > CLOCK

CURRENT DATE
Feb 12 2009

Range: Date in format shown

Indicates today's date.

CURRENT TIME
09:17:12

Range: Time in format shown

Indicates the current time of day.

Contact inputs

PATH: ACTUAL VALUES > A1 STATUS > CONTACT INPUTS

52a (CI #1)
OFF

Range: Off, On

Shows the input status when connected to a 52a breaker auxiliary contact.

52b (CI #2)
OFF

Range: Off, On

Shows the breaker status when connected to a 52b breaker auxiliary contact.

CONTACT INPUT 3 to 10
OFF

Range: Off, On

Message displays the state of the contact input. The message "ON" indicates that the contact input is energized, and message "OFF" indicates a de-energized contact.

Output relays

PATH: ACTUAL VALUES > A1 STATUS > OUTPUT RELAYS

Output relays - Breaker

Output Relay #1 (TRIP)
OFF

Range: Off, On

The "ON" state of Output Relay #1 (Breaker TRIP) shows that a TRIP command has been sent to the breaker.

Output Relay #2 (CLOSE)
OFF

Range: Off, On

The "ON" state of Output Relay #2 (Breaker CLOSE) shows that a CLOSE command has been sent to the breaker.

Output Relay #3 (START INHIBIT)
OFF

Range: Off, On

Output Relay #4 to #6 (AUXILIARY OUTPUT RELAYS)
OFF

Range: Off, On

Output Relay #7 (CRITICAL FAILURE)

Range: Off, On

The "ON" state indicates that the relay is in-service.

Output relays - Contactor

Output Relay #1 (Not Used)
Output Relay #2 (Not Used)
Output Relay #3 (START INHIBIT)
OFF

Range: Off, On

The "ON" state of Output Relay #3 (Start Inhibit) shows that a "block motor start" command has been sent to the contactor.

Output Relay #4 (Contactor TRIP)

Range: Off, On

The "OFF" state of Output Relay #4 (Contactor TRIP) shows that a "TRIP" command has been sent to the contactor.

Output Relay #5 to #6 (AUXILIARY OUTPUT RELAYS)

Range: Off, On

Output Relay #7 (CRITICAL FAILURE RELAY)

Range: Off, On

The "ON" state indicates that the relay is in service.

Logic elements

PATH: ACTUAL VALUES > A1 STATUS > LOGIC ELEMENTS

LOGIC ELEMENT 1 to 16
OFF

Range: Off, On

The state “ON” or “OFF” for each logic element depends on its programmed logic: triggering inputs, blocking inputs, plus any pickup, and/or reset time delay.

Virtual inputs

The state of all virtual inputs is displayed here.

PATH: ACTUAL VALUES > A1 STATUS > VIRTUAL INPUTS

VIRTUAL INPUTS 1 to 32
OFF

Range: Off, On

Remote inputs

The state of all remote inputs is displayed here.

PATH: ACTUAL VALUES > A1 STATUS > REMOTE INPUTS

REMOTE INPUTS 1 to 32
OFF

Range: Off, On

Remote outputs

The state of all active remote outputs is displayed here.

PATH: ACTUAL VALUES > A1 STATUS > REMOTE OUTPUTS

REMOTE OUTPUTS 1 to 32
OFF

Range: Off, On

Contact inputs summary

PATH: ACTUAL VALUES > A1 STATUS > C. INPUTS SUMMARY

C. INPUTS SUMMARY

52a	OFF	CI#5	OFF
52b	OFF	CI#6	OFF
CI#3	OFF	CI#7	OFF
CI#4	OFF	CI#8	OFF
CI#9	OFF	CI#10	OFF

The display shows a summary of the states of all contact inputs.

Output relays summary

PATH: ACTUAL VALUES > A1 STATUS > OUT RELAYS SUMMARY

OUTPUT RELAYS SUMMARY

RLY #1	OFF	RLY#5	OFF
RLY #2	OFF	RLY#6	OFF
RLY#3	OFF	RLY#7	ON
RLY#4	OFF		

This display shows a summary of the states of all output relays.

NOTE

Output relay #7 is the Critical Failure relay, used to indicate the correct functioning of the 339 339 relay. This output relay shows the status "ON" when the 339 relay is powered up and set to "Ready" under **SETPOINTS > S1 RELAY SETUP > S1 INSTALLATION > RELAY STATUS** and no self-test alarms are active.

Logic elements summary

PATH: ACTUAL VALUES > A1 STATUS > LOGIC ELEM SUMMARY

LOGIC ELEM SUMMARY

LE#1	OFF	LE#9	OFF
LE#2	OFF	LE#10	OFF
LE#3	OFF	LE#11	OFF
LE#4	OFF	LE#12	OFF
LE#5	OFF	LE#13	OFF
LE#6	OFF	LE#14	OFF
LE#7	OFF	LE#15	OFF
LE#8	OFF	LE#16	OFF

This display shows a summary of the states of all logic elements.

GOOSE status

PATH: ACTUAL VALUES > A1 STATUS > GOOSE STATUS

GOOSE 1 to 8 STATUS

Range: OFF, ON

Default: OFF

GOOSE HDR status

PATH: ACTUAL VALUES > A1 STATUS > GOOSE HDR STATUS

GOOSE 1 to 8 H.STATUS

Range: OFF, ON

Default: OFF

RTD temp summary

PATH: ACTUAL VALUES > A1 STATUS > RTD TEMP SUMMARY

RTD TEMP SUMMARY

#1	40°C	#7	40°C
#2	40°C	#8	40°C
#3	40°C	#9	40°C
#4	40°C	#10	40°C
#5	40°C	#11	40°C
#6	40°C	#12	40°C

This display shows a summary of the states of all RTDs.

A2 Metering

The relay measures all RMS currents and voltages, frequency, and RTD inputs. Other values like neutral current, symmetrical components, power factor, power (real, reactive, apparent), are derived. All quantities are recalculated every power system cycle and perform protection and monitoring functions. Displayed metered quantities are updated approximately three (3) times a second for readability. All phasors and symmetrical components are referenced to the A-N voltage phasor for wye-connected VTs; to the A-B voltage phasor for delta connected VTs; or to the phase A current phasor when no voltage signals are present.

By scrolling the Message Up/Down keys the relay shows the following metered values:

- Current
- Voltage
- Power
- Energy
- RTD Temperature

Current

PH A CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

PH B CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

PH C CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

NTRL CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

GND CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

GND CURRENT is shown when the GROUND CT TYPE is set to "1A Secondary" or "5A Secondary".

SENS GND CURRENT
0.00 A 0° lag

Range: 0.00 to 15.00 A, 0 to 359° lag

SENS GND CURRENT is shown when the GROUND CT TYPE is set to "50:0.025".

NEG SEQ CURRENT
0.0 A 0° lag

Range: 0.0 to 30000 A, 0 to 359° lag

Voltage

AN VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

BN VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

CN VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

AVG VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

AB VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

BC VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

CA VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

NTRL VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

NEG SEQ VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

ZERO SEQ VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

AUX VOLTAGE
0 V 0° lag
Range: 0 to 65535 V

FREQUENCY
0.00 Hz
Range: 40 to 70 Hz

Power

3 ph REAL POWER
0.0 kV
Range: -100000.0 to 100000.0 kW

3 ph REACTIVE POWER
0.0 kVAR
Range: -100000.0 to 100000.0 kVAR

3 ph APPARENT POWER
0.0 kVA

Range: 0 to 3000 kVA

POWER FACTOR
0.00

Range: -0.99 to 1.00

Energy

POSITIVE WATTHOUR
0.000 MWh

Range: 0.000 to 50000.000 MWh

NEGATIVE WATTHOUR
0.000 MWh

Range: 0.000 to 50000.000 MWh

POSITIVE VARHOUR
0.000 MVarh

Range: 0.000 to 50000.000 MVarh

NEGATIVE VARHOUR
0.000 MVarh

Range: 0.000 to 50000.000 MVarh

RTD temperature

RTD1 TEMPERATURE
0°C

Range: -50°C to 250°C

RTD2 TEMPERATURE
0°C

Range: -50°C to 250°C

...
RTD12 TEMPERATURE
0°C

Range: -50°C to 250°C

Clear energy

CLEAR ENERGY
NO

Range: No, Yes

When set to "YES," pressing the ENTER key will clear all energy data.

A3 Records

Datalogger

Refer to *Advanced EnerVista SR3 Setup features* in Chapter 3.

Motor start data logger

Refer to *Advanced EnerVista SR3 Setup features* in Chapter 3.

Event records

The 339 339 has an event recorder which runs continuously. All event records are stored in memory such that information is maintained for up to 3 days even after losing relay control power. The events are displayed from newest to oldest event. Each event has a header message containing a summary of the event that occurred, and is assigned an event number equal to the number of events that have occured since the recorder was cleared. The event number is incremented for each new event.

The Event Recorder captures and stores the last 256 events. All events are stored in non-volatile memory where the information is maintained, even in the case where relay control power is lost.

Shown below is an example of an event record caused by a Breaker Open operation, and the recorded information at the time of this record.

PATH: **ACTUAL VALUES > A3 RECORDS > EVENT RECORDS**

Table 4-1: Example of Event Record

A3 EVENT REC T:778 E778 Jan 30,2009 BKR Stat Open 16:30:23.324	►	E778, CONTROL BKR Stat Open PHASE A CURRENT: 0.0 A 0° Lag ▼ E778, CONTROL BKR Stat Open PHASE B CURRENT: 0.0 A 0° Lag ▼ E778, CONTROL BKR Stat Open PHASE C CURRENT: 0.0 A 0° Lag ▼ E778, CONTROL BKR Stat Open GROUND CURRENT: 0.0 A 0° Lag ▼ E778, CONTROL BKR Stat Open NTRL GND CURRENT: 0.0 A ▼ E778, CONTROL BKR Stat Open PHASE A-B VOLTAGE 0 V 0° ▼ E778, CONTROL BKR Stat Open PHASE B-C VOLTAGE 0 V 0° ▼ E778, CONTROL BKR Stat Open PHASE C-A VOLTAGE 0 V 0° ▼ E778, CONTROL BKR Stat Open FREQUENCY 0.00 Hz ▼ E778, CONTROL BKR Stat Open 3ph REAL POWER 0.0 kW ▼

	E778, CONTROL BKR Stat Open 3ph REACTIVE POWER 0.0 kvar ▼ E778, CONTROL BKR Stat Open 3ph APPARENT POWER 0.0 kVA ▼ E778, CONTROL BKR Stat Open POWER FACTOR 0.00 ▼ E778, CONTROL BKR Stat Open THERM CAP PH A 0.0% ▼ E778, CONTROL BKR Stat Open THERM CAP PH B 0.0% ▼ E778, CONTROL BKR Stat Open THERM CAP PH C 0.0%

Each event is saved with event number, date and time, and contains information such as per phase current, ground current, either phase-phase voltages (VTs connected in Delta), or phase-neutral voltages (VTs connected in Wye), and system frequency. The Event Recorder can be cleared from **ACTUAL VALUES > A3 RECORDS > CLEAR EVENT REC** setpoint. The following tables provide lists of the event types and event causes:

Table 4-2: Event type

Event Type	Display	Description
General Events	None	Events that occur when specific operation takes place
Pickup Events	PICKUP:	These are events that occur when a protection element picks up
Trip Events	TRIP:	These are events that occur when a breaker trip is initiated
Alarm and Latched Alarm Events	ALARM:	These are events that occur when an alarm is initiated
Control Events	CONTROL:	These are events that occur when a control element is activated
Dropout Events	DROPOUT:	These are events that occur when a protection element drops out after a corresponding pickup event
Contact Input Events	C. INPUT:	These are events that occur when a contact input changes its state
Virtual Input Events	V. INPUT	These are events that occur when a virtual input changes its state
Remote Input Events	R. INPUT	These are events that occur when a remote input changes its state
Logic Element Events	L. ELEMENT	These are events that occur when a logic element changes its state
Self-Test Warning Events	SELF-TEST WARNING	These are events that occur when a self-test warning is detected.

The following table, from the *339 Communications Guide*, shows the list of Event Causes.

Code	Type	Definition
FC134	unsigned 16 bits	Cause of Event
0		No Evnt/Trp ToDate
1		Ctrl. Pwr Lost
2		Ctrl. Pwr Applied
3		Date or Time Set
4		Reset
5		Lockout Rst Closed
6		Factory Reload
7		Clock Not Set
8		IRIG-B Failure
9		Reset Trip Counter
10		BKR Status Unknown
11		Clear Event Rec
12		Clear Transt Rec
14		Comm. Alert 1
15		Comm. Alert 2
16		Comm. Alert 3
17		Ethernet Link Fail
18		High ENET Traffic
19		Ambient Temp. >80C
20		RMIO Mismatch
22		Emergency Restart
23		Trace Mem. Trigger
24		Rx Goose 1 ON
25		Rx Goose 1 OFF
26		Rx Goose 2 ON
27		Rx Goose 2 OFF
28		Rx Goose 3 ON
29		Rx Goose 3 OFF
30		Rx Goose 4 ON
31		Rx Goose 4 OFF
32		Rx Goose 5 ON
33		Rx Goose 5 OFF
34		Rx Goose 6 ON
35		Rx Goose 6 OFF
36		Rx Goose 7 ON
37		Rx Goose 7 OFF
38		Rx Goose 8 ON
39		Rx Goose 8 OFF
0x0040		Contact IN 1 On
0x0041		Contact IN 2 On
0x0042		Contact IN 3 On
0x0043		Contact IN 4 On
0x0044		Contact IN 5 On
0x0045		Contact IN 6 On
0x0046		Contact IN 7 On

Code	Type	Definition
0x0047		Contact IN 8 On
0x0048		Contact IN 9 On
0x0049		Contact IN 10 On
0x0060		Contact IN 1 Off
0x0061		Contact IN 2 Off
0x0062		Contact IN 3 Off
0x0063		Contact IN 4 Off
0x0064		Contact IN 5 Off
0x0065		Contact IN 6 Off
0x0066		Contact IN 7 Off
0x0067		Contact IN 8 Off
0x0068		Contact IN 9 Off
0x0069		Contact IN 10 Off
0x0080		Virtual IN 1 On
0x0081		Virtual IN 2 On
0x0082		Virtual IN 3 On
0x0083		Virtual IN 4 On
0x0084		Virtual IN 5 On
0x0085		Virtual IN 6 On
0x0086		Virtual IN 7 On
0x0087		Virtual IN 8 On
0x0088		Virtual IN 9 On
0x0089		Virtual IN 10 On
0x008A		Virtual IN 11 On
0x008B		Virtual IN 12 On
0x008C		Virtual IN 13 On
0x008D		Virtual IN 14 On
0x008E		Virtual IN 15 On
0x008F		Virtual IN 16 On
0x0090		Virtual IN 17 On
0x0091		Virtual IN 18 On
0x0092		Virtual IN 19 On
0x0093		Virtual IN 20 On
0x0094		Virtual IN 21 On
0x0095		Virtual IN 22 On
0x0096		Virtual IN 23 On
0x0097		Virtual IN 24 On
0x0098		Virtual IN 25 On
0x0099		Virtual IN 26 On
0x009A		Virtual IN 27 On
0x009B		Virtual IN 28 On
0x009C		Virtual IN 29 On
0x009D		Virtual IN 30 On
0x009E		Virtual IN 31 On
0x009F		Virtual IN 32 On
0x00A0		Virtual IN 1 Off
0x00A1		Virtual IN 2 Off

Code	Type	Definition
0x00A2		Virtual IN 3 Off
0x00A3		Virtual IN 4 Off
0x00A4		Virtual IN 5 Off
0x00A5		Virtual IN 6 Off
0x00A6		Virtual IN 7 Off
0x00A7		Virtual IN 8 Off
0x00A8		Virtual IN 9 Off
0x00A9		Virtual IN 10 Off
0x00AA		Virtual IN 11 Off
0x00AB		Virtual IN 12 Off
0x00AC		Virtual IN 13 Off
0x00AD		Virtual IN 14 Off
0x00AE		Virtual IN 15 Off
0x00AF		Virtual IN 16 Off
0x00B0		Virtual IN 17 Off
0x00B1		Virtual IN 18 Off
0x00B2		Virtual IN 19 Off
0x00B3		Virtual IN 20 Off
0x00B4		Virtual IN 21 Off
0x00B5		Virtual IN 22 Off
0x00B6		Virtual IN 23 Off
0x00B7		Virtual IN 24 Off
0x00B8		Virtual IN 25 Off
0x00B9		Virtual IN 26 Off
0x00BA		Virtual IN 27 Off
0x00BB		Virtual IN 28 Off
0x00BC		Virtual IN 29 Off
0x00BD		Virtual IN 30 Off
0x00BE		Virtual IN 31 Off
0x00BF		Virtual IN 32 Off
0x01C0		Remote IN 1 On
0x01C1		Remote IN 2 On
0x01C2		Remote IN 3 On
0x01C3		Remote IN 4 On
0x01C4		Remote IN 5 On
0x01C5		Remote IN 6 On
0x01C6		Remote IN 7 On
0x01C7		Remote IN 8 On
0x01C8		Remote IN 9 On
0x01C9		Remote IN 10 On
0x01CA		Remote IN 11 On
0x01CB		Remote IN 12 On
0x01CC		Remote IN 13 On
0x01CD		Remote IN 14 On
0x01CE		Remote IN 15 On
0x01CF		Remote IN 16 On
0x01D0		Remote IN 17 On

Code	Type	Definition
0x01D1		Remote IN 18 On
0x01D2		Remote IN 19 On
0x01D3		Remote IN 20 On
0x01D4		Remote IN 21 On
0x01D5		Remote IN 22 On
0x01D6		Remote IN 23 On
0x01D7		Remote IN 24 On
0x01D8		Remote IN 25 On
0x01D9		Remote IN 26 On
0x01DA		Remote IN 27 On
0x01DB		Remote IN 28 On
0x01DC		Remote IN 29 On
0x01DD		Remote IN 30 On
0x01DE		Remote IN 31 On
0x01DF		Remote IN 32 On
0x01E0		Remote IN 1 Off
0x01E1		Remote IN 2 Off
0x01E2		Remote IN 3 Off
0x01E3		Remote IN 4 Off
0x01E4		Remote IN 5 Off
0x01E5		Remote IN 6 Off
0x01E6		Remote IN 7 Off
0x01E7		Remote IN 8 Off
0x01E8		Remote IN 9 Off
0x01E9		Remote IN 10 Off
0x01EA		Remote IN 11 Off
0x01EB		Remote IN 12 Off
0x01EC		Remote IN 13 Off
0x01ED		Remote IN 14 Off
0x01EE		Remote IN 15 Off
0x01EF		Remote IN 16 Off
0x01F0		Remote IN 17 Off
0x01F1		Remote IN 18 Off
0x01F2		Remote IN 19 Off
0x01F3		Remote IN 20 Off
0x01F4		Remote IN 21 Off
0x01F5		Remote IN 22 Off
0x01F6		Remote IN 23 Off
0x01F7		Remote IN 24 Off
0x01F8		Remote IN 25 Off
0x01F9		Remote IN 26 Off
0x01FA		Remote IN 27 Off
0x01FB		Remote IN 28 Off
0x01FC		Remote IN 29 Off
0x01FD		Remote IN 30 Off
0x01FE		Remote IN 31 Off
0x01FF		Remote IN 32 Off

Code	Type	Definition
0x8041		Therm O/L Trip PKP
0x8042		Therm O/L Trip OP
0x8044		Therm O/L Trip DPO
0x8081		GF Trip PKP
0x8082		GF Trip OP
0x8084		GF Trip DPO
0x80C2		Accel Trip OP
0x8102		Phase Rev. Trp OP
0x8141		Under Pwr Trip PKP
0x8142		Under Pwr Trip OP
0x8144		Under Pwr Trip DPO
0x8181		Single PH Trip PKP
0x8182		Single PH Trip OP
0x8184		Single PH Trip DPO
0x8201		Mech Jam Trip PKP
0x8202		Mech Jam Trip OP
0x8204		Mech Jam Trip DPO
0x8241		U/CURR Trip PKP
0x8242		U/CURR Trip OP
0x8244		U/CURR Trip DPO
0x8281		UNBAL Trip PKP
0x8282		UNBAL Trip OP
0x8284		UNBAL Trip DPO
0x82C2		RTD 1 Trip OP
0x82C4		RTD 1 Trip DPO
0x8302		RTD 2 Trip OP
0x8304		RTD 2 Trip DPO
0x8342		RTD 3 Trip OP
0x8344		RTD 3 Trip DPO
0x8382		RTD 4 Trip OP
0x8384		RTD 4 Trip DPO
0x83C2		RTD 5 Trip OP
0x83C4		RTD 5 Trip DPO
0x8402		RTD 6 Trip OP
0x8404		RTD 6 Trip DPO
0x84C1		LE 1 Trip PKP
0x84C2		LE 1 Trip OP
0x84C4		LE 1 Trip DPO
0x8501		LE 2 Trip PKP
0x8502		LE 2 Trip OP
0x8504		LE 2 Trip DPO
0x8541		LE 3 Trip PKP
0x8542		LE 3 Trip OP
0x8544		LE 3 Trip DPO
0x8581		LE 4 Trip PKP
0x8582		LE 4 Trip OP
0x8584		LE 4 Trip DPO

Code	Type	Definition
0x85C1		LE 5 Trip PKP
0x85C2		LE 5 Trip OP
0x85C4		LE 5 Trip DPO
0x8601		LE 6 Trip PKP
0x8602		LE 6 Trip OP
0x8604		LE 6 Trip DPO
0x8641		LE 7 Trip PKP
0x8642		LE 7 Trip OP
0x8644		LE 7 Trip DPO
0x8681		LE 8 Trip PKP
0x8682		LE 8 Trip OP
0x8684		LE 8 Trip DPO
0x86C2		RTD 7 Trip OP
0x86C4		RTD 7 Trip DPO
0x8702		RTD 8 Trip OP
0x8704		RTD 8 Trip DPO
0x8742		RTD 9 Trip OP
0x8744		RTD 9 Trip DPO
0x8782		RTD 10 Trip OP
0x8784		RTD 10 Trip DPO
0x87C2		RTD 11 Trip OP
0x87C4		RTD 11 Trip DPO
0x8802		RTD 12 Trip OP
0x8804		RTD 12 Trip DPO
0x8F81		Fuse Fail Trip PKP
0x8F82		Fuse Fail Trip OP
0x8F84		Fuse Fail Trip DPO
0x8FC2		Ph Revrsl Trip OP
0x8FC4		Ph Revrsl Trip DPO
0x9041		Ntrl IOC1 Trip PKP
0x9042		Ntrl IOC1 Trip OP
0x9044		Ntrl IOC1 Trip DPO
0x93C1		NegSeq OV Trp PKP
0x93C2		NegSeq OV Trp OP
0x93C4		NegSeq OV Trp DPO
0x9441		Ph OV1 Trip PKP
0x9442		Ph OV1 Trip OP
0x9444		Ph OV1 Trip DPO
0x9449		Ph A OV1 Trip PKP
0x944A		Ph A OV1 Trip OP
0x944C		Ph A OV1 Trip DPO
0x9451		Ph B OV1 Trip PKP
0x9452		Ph B OV1 Trip OP
0x9454		Ph B OV1 Trip DPO
0x9461		Ph C OV1 Trip PKP
0x9462		Ph C OV1 Trip OP
0x9464		Ph C OV1 Trip DPO

Code	Type	Definition
0x9481		Ph UV1 Trip PKP
0x9482		Ph UV1 Trip OP
0x9484		Ph UV1 Trip DPO
0x9489		Ph A UV1 Trip PKP
0x948A		Ph A UV1 Trip OP
0x948C		Ph A UV1 Trip DPO
0x9491		Ph B UV1 Trip PKP
0x9492		Ph B UV1 Trip OP
0x9494		Ph B UV1 Trip DPO
0x94A1		Ph C UV1 Trip PKP
0x94A2		Ph C UV1 Trip OP
0x94A4		Ph C UV1 Trip DPO
0x9541		UndrFreq1 Trip PKP
0x9542		UndrFreq1 Trip OP
0x9544		UndrFreq1 Trip DPO
0x9581		UndrFreq2 Trip PKP
0x9582		UndrFreq2 Trip OP
0x9584		UndrFreq2 Trip DPO
0x95C1		OverFreq1 Trip PKP
0x95C2		OverFreq1 Trip OP
0x95C4		OverFreq1 Trip DPO
0x9601		OverFreq2 Trip PKP
0x9602		OverFreq2 Trip OP
0x9604		OverFreq2 Trip DPO
0x9881		Ph OV2 Trip PKP
0x9882		Ph OV2 Trip OP
0x9884		Ph OV2 Trip DPO
0x9889		Ph A OV2 Trip PKP
0x988A		Ph A OV2 Trip OP
0x988C		Ph A OV2 Trip DPO
0x9891		Ph B OV2 Trip PKP
0x9892		Ph B OV2 Trip OP
0x9894		Ph B OV2 Trip DPO
0x98A1		Ph C OV2 Trip PKP
0x98A2		Ph C OV2 Trip OP
0x98A4		Ph C OV2 Trip DPO
0x98C1		Ph UV2 Trip PKP
0x98C2		Ph UV2 Trip OP
0x98C4		Ph UV2 Trip DPO
0x98C9		Ph A UV2 Trip PKP
0x98CA		Ph A UV2 Trip Op
0x98CC		Ph A UV2 Trip DPO
0x98D1		Ph B UV2 Trip PKP
0x98D2		Ph B UV2 Trip Op
0x98D4		Ph B UV2 Trip DPO
0x98E1		Ph C UV2 Trip PKP
0x98E2		Ph C UV2 Trip Op

Code	Type	Definition
0x98E4		Ph C UV2 Trip DPO
0x9901		S/C Trip PKP
0x9902		S/C Trip OP
0x9904		S/C Trip DPO
0x9941		SPD2 S/C Trip PKP
0x9942		SPD2 S/C Trip OP
0x9944		SPD2 S/C Trip DPO
0x9981		SPD2 U/C Trip PKP
0x9982		SPD2 U/C Trip OP
0x9984		SPD2 U/C Trip DPO
0x9C01		LE 9 Trip PKP
0x9C02		LE 9 Trip OP
0x9C04		LE 9 Trip DPO
0x9C41		LE 10 Trip PKP
0x9C42		LE 10 Trip OP
0x9C44		LE 10 Trip DPO
0x9C81		LE 11 Trip PKP
0x9C82		LE 11 Trip OP
0x9C84		LE 11 Trip DPO
0x9CC1		LE 12 Trip PKP
0x9CC2		LE 12 Trip OP
0x9CC4		LE 12 Trip DPO
0x9D01		LE 13 Trip PKP
0x9D02		LE 13 Trip OP
0x9D04		LE 13 Trip DPO
0x9D41		LE 14 Trip PKP
0x9D42		LE 14 Trip OP
0x9D44		LE 14 Trip DPO
0x9D81		LE 15 Trip PKP
0x9D82		LE 15 Trip OP
0x9D84		LE 15 Trip DPO
0x9DC1		LE 16 Trip PKP
0x9DC2		LE 16 Trip OP
0x9DC4		LE 16 Trip DPO
0xA042		Therm Lvl Alrm OP
0xA044		Therm Lvl Alrm DPO
0xA081		Gnd Fault Alrm PKP
0xA082		Gnd Fault Alrm OP
0xA084		Gnd Fault Alrm DPO
0xA102		Phase Rev. Alm OP
0xA141		Under Pwr Alrm PKP
0xA142		Under Pwr Alrm OP
0xA144		Under Pwr Alrm DPO
0xA241		U/CURR Alarm PKP
0xA242		U/CURR Alarm OP
0xA244		U/CURR Alarm DPO
0xA281		UNBAL Alarm PKP

Code	Type	Definition
0xA282		UNBAL Alarm OP
0xA284		UNBAL Alarm DPO
0xA2C2		RTD 1 Alarm OP
0xA2C4		RTD 1 Alarm DPO
0xA302		RTD 2 Alarm OP
0xA304		RTD 2 Alarm DPO
0xA342		RTD 3 Alarm OP
0xA344		RTD 3 Alarm DPO
0xA382		RTD 4 Alarm OP
0xA384		RTD 4 Alarm DPO
0xA3C2		RTD 5 Alarm OP
0xA3C4		RTD 5 Alarm DPO
0xA402		RTD 6 Alarm OP
0xA404		RTD 6 Alarm DPO
0xA442		RTD Trouble OP
0xA482		Relay Not Ready
0xA4C1		LE 1 Alarm PKP
0xA4C2		LE 1 Alarm OP
0xA4C4		LE 1 Alarm DPO
0xA501		LE 2 Alarm PKP
0xA502		LE 2 Alarm OP
0xA504		LE 2 Alarm DPO
0xA541		LE 3 Alarm PKP
0xA542		LE 3 Alarm OP
0xA544		LE 3 Alarm DPO
0xA581		LE 4 Alarm PKP
0xA582		LE 4 Alarm OP
0xA584		LE 4 Alarm DPO
0xA5C1		LE 5 Alarm PKP
0xA5C2		LE 5 Alarm OP
0xA5C4		LE 5 Alarm DPO
0xA601		LE 6 Alarm PKP
0xA602		LE 6 Alarm OP
0xA604		LE 6 Alarm DPO
0xA641		LE 7 Alarm PKP
0xA642		LE 7 Alarm OP
0xA644		LE 7 Alarm DPO
0xA681		LE 8 Alarm PKP
0xA682		LE 8 Alarm OP
0xA684		LE 8 Alarm DPO
0xA6C2		RTD 7 Alarm OP
0xA6C4		RTD 7 Alarm DPO
0xA702		RTD 8 Alarm OP
0xA704		RTD 8 Alarm DPO
0xA742		RTD 9 Alarm OP
0xA744		RTD 9 Alarm DPO
0xA782		RTD 10 Alarm OP

Code	Type	Definition
0xA784		RTD 10 Alarm DPO
0xA7C2		RTD 11 Alarm OP
0xA7C4		RTD 11 Alarm DPO
0xA802		RTD 12 Alarm OP
0xA804		RTD 12 Alarm DPO
0xA982		Motor Run Hrs OP
0xA984		Motor Run Hrs DPO
0xAA01		Welded ContactrPKP
0xAA02		Welded Contactr OP
0xAA04		Welded ContactrDPO
0xAA42		SPD SW Not Cnfg OP
0xAA82		SPD SW Fail OP
0xAB01		Load Incr Alrm PKP
0xAB02		Load Incr Alrm OP
0xAB04		Load Incr Alrm DPO
0xABC1		HI Amb Temp PKP
0xABC2		HI Amb Temp OP
0xABC4		HI Amb Temp DPO
0xAC01		LO Amb Temp PKP
0xAC02		LO Amb Temp OP
0xAC04		LO Amb Temp DPO
0xAC42		Self Test Alarm OP
0xACC2		BKRTrpCntrAlrm OP
0xAD01		R1 CoilMonAlrm PKP
0xAD02		R1 CoilMonAlrm OP
0xAD04		R1 CoilMonAlrm DPO
0xAD41		R2 CoilMonAlrm PKP
0xAD42		R2 CoilMonAlrm OP
0xAD44		R2 CoilMonAlrm DPO
0xAD81		BKR1 Fail Alrm PKP
0xAD82		BKR1 Fail Alrm OP
0xADC2		BKR Stat Fail OP
0xAF81		Fuse Fail Alrm PKP
0xAF82		Fuse Fail Alrm OP
0xAF84		Fuse Fail Alrm DPO
0xAFC2		Ph Revrsl Alarm OP
0xAFC4		Ph Revrsl Alarm DPO
0xB041		Ntrl IOC1 Alrm PKP
0xB042		Ntrl IOC1 Alrm OP
0xB044		Ntrl IOC1 Alrm DPO
0xB3C1		NegSeq OV Alrm PKP
0xB3C2		NegSeq OV Alrm OP
0xB3C4		NegSeq OV Alrm DPO
0xB441		Ph OV1 Alarm PKP
0xB442		Ph OV1 Alarm OP
0xB444		Ph OV1 Alarm DPO
0xB449		Ph A OV1 Alarm PKP

Code	Type	Definition
0xB44A		Ph A OV1 Alarm OP
0xB44C		Ph A OV1 Alarm DPO
0xB451		Ph B OV1 Alarm PKP
0xB452		Ph B OV1 Alarm OP
0xB454		Ph B OV1 Alarm DPO
0xB461		Ph C OV1 Alarm PKP
0xB462		Ph C OV1 Alarm OP
0xB464		Ph C OV1 Alarm DPO
0xB481		Ph UV1 Alarm PKP
0xB482		Ph UV1 Alarm OP
0xB484		Ph UV1 Alarm DPO
0xB489		Ph A UV1 Alarm PKP
0xB48A		Ph A UV1 Alarm OP
0xB48C		Ph A UV1 Alarm DPO
0xB491		Ph B UV1 Alarm PKP
0xB492		Ph B UV1 Alarm OP
0xB494		Ph B UV1 Alarm DPO
0xB4A1		Ph C UV1 Alarm PKP
0xB4A2		Ph C UV1 Alarm OP
0xB4A4		Ph C UV1 Alarm DPO
0xB541		UndrFreq1 Alrm PKP
0xB542		UndrFreq1 Alrm OP
0xB544		UndrFreq1 Alrm DPO
0xB581		UndrFreq2 Alrm PKP
0xB582		UndrFreq2 Alrm OP
0xB584		UndrFreq2 Alrm DPO
0xB5C1		OverFreq1 Alrm PKP
0xB5C2		OverFreq1 Alrm OP
0xB5C4		OverFreq1 Alrm DPO
0xB601		OverFreq2 Alrm PKP
0xB602		OverFreq2 Alrm OP
0xB604		OverFreq2 Alrm DPO
0xB881		Ph OV2 Alarm PKP
0xB882		Ph OV2 Alarm OP
0xB884		Ph OV2 Alarm DPO
0xB889		Ph A OV2 Alarm PKP
0xB88A		Ph A OV2 Alarm OP
0xB88C		Ph A OV2 Alarm DPO
0xB891		Ph B OV2 Alarm PKP
0xB892		Ph B OV2 Alarm OP
0xB894		Ph B OV2 Alarm DPO
0xB8A1		Ph C OV2 Alarm PKP
0xB8A2		Ph C OV2 Alarm OP
0xB8A4		Ph C OV2 Alarm DPO
0xB8C1		Ph UV2 Alarm PKP
0xB8C2		Ph UV2 Alarm OP
0xB8C4		Ph UV2 Alarm DPO

Code	Type	Definition
0xB8C9		Ph A UV2 Alarm PKP
0xB8CA		Ph A UV2 Alarm OP
0xB8CC		Ph A UV2 Alarm DPO
0xB8D1		Ph B UV2 Alarm PKP
0xB8D2		Ph B UV2 Alarm OP
0xB8D4		Ph B UV2 Alarm DPO
0xB8E1		Ph C UV2 Alarm PKP
0xB8E2		Ph C UV2 Alarm OP
0xB8E4		Ph C UV2 Alarm DPO
0xB901		S/C Alarm PKP
0xB902		S/C Alarm OP
0xB904		S/C Alarm DPO
0xB941		SPD2 S/C Alarm PKP
0xB942		SPD2 S/C Alarm OP
0xB944		SPD2 S/C Alarm DPO
0xB981		SPD2 U/C Alarm PKP
0xB982		SPD2 U/C Alarm OP
0xB984		SPD2 U/C Alarm DPO
0xBC01		LE 9 Alarm PKP
0xBC02		LE 9 Alarm OP
0xBC04		LE 9 Alarm DPO
0xBC41		LE 10 Alarm PKP
0xBC42		LE 10 Alarm OP
0xBC44		LE 10 Alarm DPO
0xBC81		LE 11 Alarm PKP
0xBC82		LE 11 Alarm OP
0xBC84		LE 11 Alarm DPO
0xBCC1		LE 12 Alarm PKP
0xBCC2		LE 12 Alarm OP
0xBCC4		LE 12 Alarm DPO
0xBD01		LE 13 Alarm PKP
0xBD02		LE 13 Alarm OP
0xBD04		LE 13 Alarm DPO
0xBD41		LE 14 Alarm PKP
0xBD42		LE 14 Alarm OP
0xBD44		LE 14 Alarm DPO
0xBD81		LE 15 Alarm PKP
0xBD82		LE 15 Alarm OP
0xBD84		LE 15 Alarm DPO
0xBDC1		LE 16 Alarm PKP
0xBDC2		LE 16 Alarm OP
0xBDC4		LE 16 Alarm DPO
0xC042		Output Relay 3 On
0xC082		Output Relay 4 On
0xC0C2		Output Relay 5 On
0xC102		Output Relay 6 On
0xC142		Self-Test Rly 7 On

Code	Type	Definition
0xC182		Output Relay 1 On
0xC184		Output Relay 1 Off
0xC1C2		Output Relay 2 On
0xC1C4		Output Relay 2 Off
0xC242		High Speed OP
0xC282		Low Speed OP
0xC3C2		Motor Online
0xC402		Emergency Restart
0xC442		Hot RTD OP
0xC444		Hot RTD DPO
0xC481		Lockout PKP
0xC482		Lockout OP
0xC484		Lockout DPO
0xC4C1		LE 1 PKP
0xC4C2		LE 1 OP
0xC4C4		LE 1 DPO
0xC501		LE 2 PKP
0xC502		LE 2 OP
0xC504		LE 2 DPO
0xC541		LE 3 PKP
0xC542		LE 3 OP
0xC544		LE 3 DPO
0xC581		LE 4 PKP
0xC582		LE 4 OP
0xC584		LE 4 DPO
0xC5C1		LE 5 PKP
0xC5C2		LE 5 OP
0xC5C4		LE 5 DPO
0xC601		LE 6 PKP
0xC602		LE 6 OP
0xC604		LE 6 DPO
0xC641		LE 7 PKP
0xC642		LE 7 OP
0xC644		LE 7 DPO
0xC681		LE 8 PKP
0xC682		LE 8 OP
0xC684		LE 8 DPO
0xC902		Open Breaker
0xC942		Close Breaker
0xCA02		52a Contact OP
0xCA42		52b Contact OP
0xCA82		Reset OK
0xCAC2		L/O Rst Closed
0xCCC2		BKR Stat Open
0xCD02		BKR Stat Clsd
0xCE82		Therm Inhibit OP
0xCEC2		Rstrt Inhibit OP

Code	Type	Definition
0xCF02		Start/Hr Inhib OP
0xCF42		T-BT-Strt Inhib OP
0xCF81		Fuse Fail InhibPKP
0xCF82		Fuse Fail Inhib OP
0xCFC2		Ph Rev Inhibit OP
0xCFC4		Ph Rev Inhibit DPO
0xD984		SPD2 U/C DPO
0xDC01		LE 9 PKP
0xDC02		LE 9 OP
0xDC04		LE 9 DPO
0xDC41		LE 10 PKP
0xDC42		LE 10 OP
0xDC44		LE 10 DPO
0xDC81		LE 11 PKP
0xDC82		LE 11 OP
0xDC84		LE 11 DPO
0xDCC1		LE 12 PKP
0xDCC2		LE 12 OP
0xDCC4		LE 12 DPO
0xDD01		LE 13 PKP
0xDD02		LE 13 OP
0xDD04		LE 13 DPO
0xDD41		LE 14 PKP
0xDD42		LE 14 OP
0xDD44		LE 14 DPO
0xDD81		LE 15 PKP
0xDD82		LE 15 OP
0xDD84		LE 15 DPO
0xDDC1		LE 16 PKP
0xDDC2		LE 16 OP
0xDDC4		LE 16 DPO
0xE042		Therm O/L Blck OP
0xE044		Therm O/L Blck Off
0xE082		Gnd Fault BLK
0xE084		Gnd Fault BLK DPO
0xE0C2		Accel BLK
0xE0C4		Accel Block DPO
0xE142		UndrPower BLK
0xE144		UndrPower BLK DPO
0xE182		Output Relay 1 BLK
0xE184		Relay 1 BLK Off
0xE1C2		Output Relay 2 BLK
0xE1C4		Relay 2 BLK Off
0xE202		Mech Jam BLK
0xE204		Mech Jam BLK DPO
0xE242		U/CURR BLK
0xE244		U/CURR BLK DPO

Code	Type	Definition
0xE282		UNBAL BLK
0xE284		UNBAL BLK DPO
0xE2C2		RTD1 BLK OP
0xE2C4		RTD1 BLK DPO
0xE302		RTD2 BLK OP
0xE304		RTD2 BLK DPO
0xE342		RTD3 BLK OP
0xE344		RTD3 BLK DPO
0xE382		RTD4 BLK OP
0xE384		RTD4 BLK DPO
0xE3C2		RTD5 BLK OP
0xE3C4		RTD5 BLK DPO
0xE402		RTD6 BLK OP
0xE404		RTD6 BLK DPO
0xE442		RTDTrouble BLK OP
0xE6C2		RTD7 BLK OP
0xE6C4		RTD7 BLK DPO
0xE702		RTD8 BLK OP
0xE704		RTD8 BLK DPO
0xE742		RTD9 BLK OP
0xE744		RTD9 BLK DPO
0xE782		RTD10 BLK OP
0xE784		RTD10 BLK DPO
0xE7C2		RTD11 BLK OP
0xE7C4		RTD11 BLK DPO
0xE802		RTD12 BLK OP
0xE804		RTD12 BLK DPO
0xF042		Ntrl IOC1 Block
0xF044		Ntrl IOC1 Blk DPO
0xF3C2		NegSeq OV Block
0xF3C4		NSeq OV Blk DPO
0xF442		Ph OV1 Block
0xF444		Ph OV1 Block DPO
0xF482		Ph UV1 Block
0xF484		Ph UV1 Block DPO
0xF542		UndrFreq1 Block
0xF544		UndrFreq1 BlockDPO
0xF582		UndrFreq2 Block
0xF584		UndrFreq2 BlockDPO
0xF5C2		OverFreq1 Block
0xF5C4		OverFreq1 Blk DPO
0xF602		OverFreq2 Block
0xF604		OverFreq2 BlockDPO
0xF882		Ph OV2 Block
0xF884		Ph OV2 Block DPO
0xF8C2		Ph UV2 Block
0xF8C4		Ph UV2 Block DPO

Code	Type	Definition
0xF902		S/C BLK
0xF904		S/C BLK DPO
0xF942		SPD2 S/C BLK
0xF944		SPD2 S/C BLK DPO
0xF982		SPD2 U/C OP
0xF984		SPD2 U/C BLK DPO

Transient records

PATH: ACTUAL VALUES > A3 RECORDS > TRANSIENT RECORDS

FORCE TRIGGER?
No

Range: No, Yes

TOTAL RECORDS
1

Range: N/A

AVAILABLE RECORDS
1

Range: N/A

LAST CLEARED
Feb 08 2009

Range: N/A

Learned data

The 339 measures and records individual data records, as indicated below, all from actual motor operation. The latest individual data record "set" can be viewed using the Learned Data feature on the relay. The data, when input cumulatively to the Learned Data Recorder (see below) can be used to evaluate changes/trends over time. Note that learned values are calculated even when features requiring them are turned off.

Clearing motor data (ACTUAL VALUES > A3 RECORDS > CLEAR LEARNED DATA) resets all these values to their default settings.

NOTE

Each of the learned features discussed below should not be used until at least five (5) successful motor starts and stops have occurred.

LEARNED ACCEL TIME

Range: 0.0 to 250.0 s in steps of 0.1 s

The learned acceleration time is the Learned Acceleration Time measured at the time the record was saved. Acceleration time is the amount of time the motor takes to reach the running state from stopped. A successful motor start is one in which the motor reaches the running state.

If acceleration time is relatively consistent, the learned acceleration time plus suitable margin may be used to manually fine-tune the acceleration protection setting.

LEARNED START CURR

Range: 0.0 to 10000.0 A in steps of 0.1 A

The learned starting current is the Learned Starting Current measured at the time the record was saved. Starting current is measured 200 ms after the transition of motor status from stopped to starting, which should ensure that the measured current is symmetrical. A successful motor start is one in which the motor reaches the running state.

LEARNED START TCU

Range: 0 to 100% in steps of 1

The learned start thermal capacity is the Learned Thermal Capacity Used at the time the record was saved. Start thermal capacity used is the amount of thermal capacity used during starting. A successful motor start is one in which the motor reaches the running state.

If the thermal capacity used during starting is relatively consistent, the learned start thermal capacity used value plus suitable margin may be used to manually fine-tune the thermal start inhibit margin. See the Start Inhibit section of this manual for a description of how the learned start thermal capacity used is calculated.

LAST ACCEL TIME

Range: 0.0 to 250.0 s in steps of 0.1 s

The last acceleration time is the Last Acceleration Time measured at the time the record was saved.

LAST START CURR

Range: 0.0 to 10000.0 A in steps of 0.1 A

The last starting current is the Last Starting Current measured at the time the record was saved.

LAST START TCU

Range: 0 to 100% in steps of 1

The last start thermal capacity used is the Last Thermal Capacity Used at the time the record was saved.

LEARNED AVG LOAD

Range: 0.00 to 20.00 x FLA in steps of 0.01 x FLA

Learned average load is the Average Motor Current, expressed as a multiple of FLA, experienced over the last 15 running minutes. Samples are taken once a second. In the case of two-speed motors with different FLA values for the two speeds, the FLA used for each current sample is the one in effect at the time that sample was taken.

AVG RUN TIME

Range: Hours, Minutes

The average Run Time of the last five starts at the time the record was saved.

RTD 1 to 12 MAX TEMPERATURE

Range: -50 to 250°C

The maximum temperature experienced by each of the RTDs.

Once a second each of the RTD temperature values is captured. For each RTD, if the captured RTD temperature value is greater than the RDT maximum temperature already stored, the RDT maximum temperature is set to this latest captured RTD temperature value. The RTD maximum temperature values are maintained in non-volatile memory to carry over a relay power interruption.

Learned data recorder

The Learned Data Recorder measures and records up to 250 data record "sets," as indicated in the Learned Data section above, all from actual motor operation. This data can be used to evaluate changes/trends over time. Note that learned values are calculated even when features requiring them are turned off.

Clearing motor data (ACTUAL VALUES > A3 RECORDS > CLEAR LEARNED DATA) resets all these values to their default settings.

LEARNED DATA REC

Range: #xxxx1 of xx250 in steps of 1

This value indicates the number of learned data records saved to date. Only the latest 250 records can be viewed.

DATE OF RECORD

Range: Month, Day, Year

This value is the date on which the record was saved.

Clear learned data

CLEAR LEARNED DATA
No

Range: No, Yes

When set to "Yes," pressing the ENTER key will clear all learned data.

Clear transient record

PATH: ACTUAL VALUES > A3 RECORDS > CLEAR TRANST REC

CLEAR TRANST RECORD
No

Range: No, Yes

When set to "Yes," pressing the ENTER key will clear all transient records.

Clear event record

PATH: ACTUAL VALUES > A3 RECORDS > CLEAR EVENT REC

CLEAR EVENT RECORD
No

Range: No, Yes

When set to "Yes," pressing the ENTER key will clear all event records.

A4 Target messages

Target messages are automatically displayed for any active condition on the relay such as pickups, trips, alarms, or asserted input. The target messages shown in the table below are displayed as required.

The relay displays the most recent event first, and after 5 seconds starts rolling up the other target messages, until the Reset command is initiated. If the Reset command is not performed, but any of the other faceplate pushbuttons is pressed, the display will not show the target messages, unless the user navigates to **ACTUAL VALUES > A4 TARGET MESSAGES**, where they can be reviewed.

The target messages can be reviewed by pressing **Up** and **Down** message pushbuttons from the relay keypad.

The following table from the *339 Communication Guide* shows the list of Target Messages.

Code	Type	Definition
FC134A	unsigned 16 bits	Active Targets
0		No Active Targets
7		Clock Not Set
8		IRIG-B Failure
14		Comm. Alert 1
15		Comm. Alert 2
16		Comm. Alert 3
17		Ethernet Link Fail
18		High ENET Traffic
19		Ambient Temp. >80C
20		RMIO Mismatch
0x8040		Therm O/L Trip
0x8080		Gnd Fault Trip
0x80C0		Accel Trip
0x8100		Ph Revrsl Trip
0x8140		UndrPower Trip
0x8180		Single Ph Trip
0x8200		Mech Jam Trip
0x8240		U/Curr Trip
0x8280		UNBAL Trip
0x82C0		RTD 1 Trip
0x8300		RTD 2 Trip
0x8340		RTD 3 Trip
0x8380		RTD 4 Trip
0x83C0		RTD 5 Trip
0x8400		RTD 6 Trip
0x8480		Relay Not Config
0x84C0		LE 1 Trip
0x8500		LE 2 Trip
0x8540		LE 3 Trip
0x8580		LE 4 Trip
0x85C0		LE 5 Trip
0x8600		LE 6 Trip
0x8640		LE 7 Trip
0x8680		LE 8 Trip
0x86C0		RTD 7 Trip
0x8700		RTD 8 Trip
0x8740		RTD 9 Trip
0x8780		RTD 10 Trip
0x87C0		RTD 11 Trip
0x8800		RTD 12 Trip
0x8F80		Fuse Fail Trip
0x8FC0		Ph Revrsl Trip

Code	Type	Definition
0x9040		Ntrl IOC1 Trip
0x93C0		NegSeq OV Trip
0x9440		Ph OV1 Trip
0x9480		Ph UV1 Trip
0x9540		UndrFreq1 Trip
0x9580		UndrFreq2 Trip
0x95C0		OverFreq1 Trip
0x9600		OverFreq2 Trip
0x9880		Ph OV2 Trip
0x98C0		Ph UV2 Trip
0x9900		S/C Trip
0x9940		SPD2 S/C Trip
0x9980		SPD2 U/C Trip
0x9C00		LE 9 Trip
0x9C40		LE 10 Trip
0x9C80		LE 11 Trip
0x9CC0		LE 12 Trip
0x9D00		LE 13 Trip
0x9D40		LE 14 Trip
0x9D80		LE 15 Trip
0x9DC0		LE 16 Trip
0xA040		Therm Lvl Alrm
0xA080		Gnd Fault Alarm
0xA140		UndrPower Alarm
0xA240		U/Curr Alarm
0xA280		UNBAL Alarm
0xA2C0		RTD 1 Alarm
0xA300		RTD 2 Alarm
0xA340		RTD 3 Alarm
0xA380		RTD 4 Alarm
0xA3C0		RTD 5 Alarm
0xA400		RTD 6 Alarm
0xA440		RTD Trouble
0xA480		Not Configured
0xA4C0		LE 1 Alarm
0xA500		LE 2 Alarm
0xA540		LE 3 Alarm
0xA580		LE 4 Alarm
0xA5C0		LE 5 Alarm
0xA600		LE 6 Alarm
0xA640		LE 7 Alarm
0xA680		LE 8 Alarm
0xA6C0		RTD 7 Alarm
0xA700		RTD 8 Alarm
0xA740		RTD 9 Alarm
0xA780		RTD 10 Alarm
0xA7C0		RTD 11 Alarm

Code	Type	Definition
0xA800		RTD 12 Alarm
0xA980		Motor Running Hrs
0xAA00		Welded Contactr
0xAA40		SPD SW Not Config
0xAA80		SPD SW Fail
0xAB00		Load Incr Alarm
0xABC0		HI Ambient Temp
0xAC00		LO Ambient Temp
0xAC40		Self Test Alarm
0xACC0		BKRTrpCntrAlrm
0xAD00		Rly1 Coil Mn Alrm
0xAD40		Rly2 Coil Mn Alrm
0xAD80		BKR Fail Alrm
0xADC0		BKRStatus Fail
0xAF80		Fuse Fail Alrm
0xAFC0		Ph Revrsl Alrm
0xB040		Ntrl IOC1 Alarm
0xB3C0		NegSeq OV Alarm
0xB440		Ph OV1 Alarm
0xB480		Ph UV1 Alarm
0xB540		UndrFreq1 Alarm
0xB580		UndrFreq2 Alarm
0xB5C0		OverFreq1 Alrm
0xB600		OverFreq2 Alrm
0xB880		Ph OV2 Alarm
0xB8C0		Ph UV2 Alarm
0xB900		S/C Alarm
0xB940		SPD2 S/C Alarm
0xB980		SPD2 U/C Alarm
0xBC00		LE 9 Alarm
0xBC40		LE 10 Alarm
0xBC80		LE 11 Alarm
0xBCC0		LE 12 Alarm
0xBD00		LE 13 Alarm
0xBD40		LE 14 Alarm
0xBD80		LE 15 Alarm
0xBDC0		LE 16 Alarm
0xC240		High Speed
0xC280		Low Speed
0xC3C0		Motor Online
0xC400		Emergency Restart
0xC440		Hot RTD
0xC480		Lockout
0xC4C0		LE 1
0xC500		LE 2
0xC540		LE 3
0xC580		LE 4

Code	Type	Definition
0xC5C0		LE 5
0xC600		LE 6
0xC640		LE 7
0xC680		LE 8
0xC900		Open Breaker
0xC940		Close Breaker
0xCCC0		BKR Stat Open
0xCD00		BKR Stat Clsd
0xCE80		Therm Inhibit
0xCEC0		Rstrt Inhibit
0xCF00		Start/Hr Inhib
0xCF40		T-BT-Strt Inhib
0xCF80		Fuse Fail Inhib
0xCFC0		Ph Revrsl Inhib
0xD340		Ntrl Dir Rev
0xDC00		LE 9
0xDC40		LE 10
0xDC80		LE 11
0xDCC0		LE 12
0xDD00		LE 13
0xDD40		LE 14
0xDD80		LE 15
0xDDC0		LE 16
0xE040		Therm O/L Blck
0xE080		Gnd Fault BLK
0xE0C0		Accel Block
0xE140		UndrPower BLK
0xE180		Output Relay 1 BLK
0xE1C0		Output Relay 2 BLK
0xE200		Mech Jam Block
0xE240		U/Curr Block
0xE280		UNBAL Block
0xE2C0		RTD1 BLK
0xE300		RTD2 BLK
0xE340		RTD3 BLK
0xE380		RTD4 BLK
0xE3C0		RTD5 BLK
0xE400		RTD6 BLK
0xE440		RTD Trouble BLK
0xE6C0		RTD7 BLK
0xE700		RTD8 BLK
0xE740		RTD9 BLK
0xE780		RTD10 BLK
0xE7C0		RTD11 BLK
0xE800		RTD12 BLK
0xF040		Ntrl IOC1 Block
0xF340		NTRL DIR Rev Block

Code	Type	Definition
0xF3C0		NegSeq OV Block
0xF440		Ph OV1 Block
0xF480		Ph UV1 Block
0xF540		UndrFreq1 Block
0xF580		UndrFreq2 Block
0xF5C0		OverFreq1 Block
0xF600		OverFreq2 Block
0xF880		Ph OV2 Block
0xF8C0		Ph UV2 Block
0xF900		S/C BLK
0xF940		SPD2 S/C BLK
0xF980		SPD2 U/C Block

- The PKP messages will appear on the relay display as long as their respective flags are active. The messages will disappear from the display, when either the protection element drops out before operation, such as when the condition clears before reaching operation, or when the protection element operates.
- The OP and BKR Status messages will appear on the relay display, when the respective element operates, with the element function set to "TRIP", or "LATCHED ALARM". The message will stay on the display after the condition clears, and will disappear upon Reset command. If the element function is selected to "ALARM", or "CONTROL", the message will disappear from the display, when the condition causing operation clears.
- The Breaker Open and Breaker Close messages will appear on the display and stay for 5 seconds only, unless the reset command is initiated, or the element changes its state. For example, if the breaker is detected "Open", the message "Breaker Open OK" will appear on the display and will stay for 5 seconds, unless the breaker status changes to "Close". If the breaker status changes to "Close" within 5 seconds after the breaker has been detected open, the message "Breaker Open OK" will disappear, and the message "Breaker Close OK" will appear and stay for 5 seconds.
- The Contact Input ON/OFF, Virtual Input ON/OFF, and Remote Input ON/OFF messages will not appear as target messages upon change of state. The state change, however, will be logged in the Event recorder.

Examples of how the messages appear on the display:

Example 1:

Short Circuit Settings:

- SHORT CIRCUIT FUNCTION = Trip
- SHORT CIRCUIT PICKUP = 1.00 x CT
- SHORT CIRCUIT DELAY = 0.20 s

When current greater than the SHORT CIRCUIT pickup level is applied, the 3339 50 display shows the following target message:

A4 TARGET MESSAGES
Short Circuit Trip
STATE: PKP

After the 200 ms time delay expires, the display shows the following message only:

A4 TARGET MESSAGES
Short Circuit Trip
STATE: OP

Example 2:

Phase Short Circuit Settings:

- SHORT CIRCUIT FUNCTION = Latched Alarm
- SHORT CIRCUIT PICKUP = 1.00 x CT
- SHORT CIRCUIT DELAY = 0.20 s

When current greater than the Short Circuit pickup level is applied, the 339 display shows the following target message:

A4 TARGET MESSAGES
Ph Short Circuit Alarm
STATE: PKP

After the 200 ms time delay expires, the display shows the following message only:

A4 TARGET MESSAGES
Ph Short Circuit Alarm
STATE: OP

Example 3:

Phase Short Circuit Settings:

- SHORT CIRCUIT FUNCTION = Alarm
- SHORT CIRCUIT PICKUP = 1.00 x CT
- SHORT CIRCUIT DELAY = 0.20 s

When current greater than the Short Circuit pickup level is applied, the 339 display shows the following target message:

A4 TARGET MESSAGES
Ph Short Circuit Alarm
STATE: PKP

After the 200 ms time delay expires, the display shows the following message only:

A4 TARGET MESSAGES
Ph Short Circuit Alarm
STATE: OP

NOTE

Once the condition clears, the target message will disappear.

339 Motor Protection System

Chapter 5: Quick setup - Front control panel

The “Quick Setup” utility is part of the 339 relay main menu, and can be used for quick and easy programming. Power system parameters, and settings for some simple over-current elements can be easily set. Use the “Quick Setup” utility to program the following:

Relay Status

- Relay Status

Power System Data:

- Nominal Frequency
- Phase CT Primary
- Ground CT Type
- VT Connection
- VT Secondary
- VT Ratio

Protection:

- Thermal Overload
- Short Circuit
- Mechanical Jam
- Undercurrent
- Ground Fault
- Phase Undervoltage

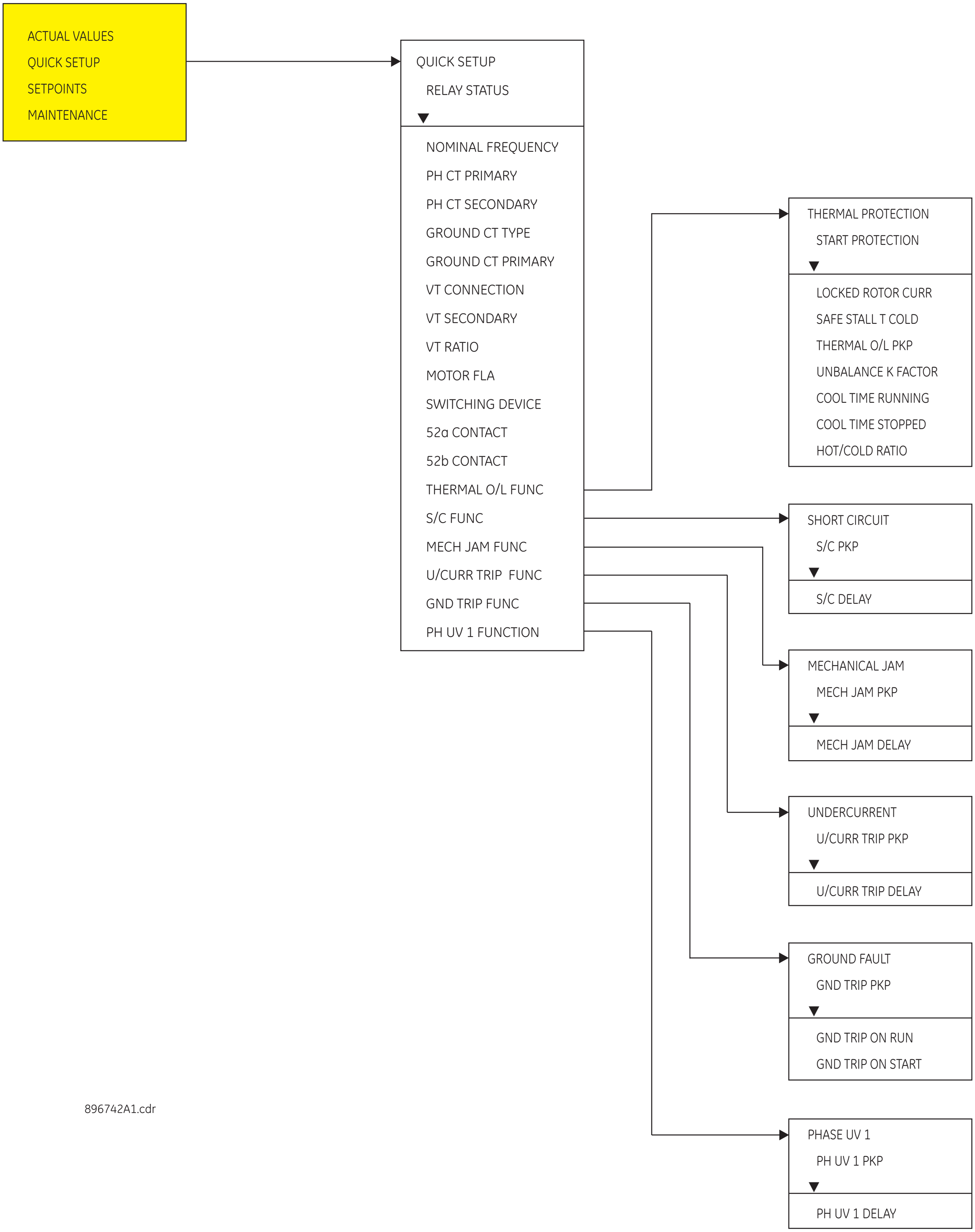
Motor Data:

- Motor FLA
- Switching Device
- 52a Contact
- 52b Contact

NOTE

Ensure the relay is in "Relay Ready" state before using Quick Setup.

Figure 5-1: Quick Setup menu



Quick Setup settings

The setpoints below can be programmed under the "Quick Setup" menu.

Note that monitoring of Breaker Status via 52a, 52b, or both of these contacts, should be programmed under **SETPOINTS > SYSTEM SETUP > BREAKER**.

PATH: **QUICK SETUP >**

RELAY STATUS
Range: Ready, Not Ready
Default: Not Ready

NOMINAL FREQUENCY
Range: 50 Hz, 60 Hz
Default: 60 Hz

PH CT PRIMARY
Range: 1 A to 6000 A in steps of 1
Default: 500 A

GND CT TYPE
Range: None, 1 A Secondary, 5A Secondary, 50:0.025
Default: 50:0.025

VT CONNECTION
Range: Wye, Delta
Default: Wye

VT SECONDARY
Range: 50 V to 240 V in steps of 1
Default: 120 V

VT RATIO
Range: 1:1 to 300:1 in steps of 1
Default: 1:1

THERMAL O/L FUNC
Range: Disabled, Enabled
Default: Disabled

SHORT CIRCUIT FUNC
Range: Disabled, Trip, Latched Alarm, Alarm
Default: Disabled

MECHANICAL JAM FUNC
Range: Disabled, Trip, Latched Alarm, Alarm
Default: Disabled

U/CURR TRIP FUNC
Range: Disabled, Enabled
Default: Disabled

GROUND TRIP FUNC
Range: Disabled, Enabled
Default: Disabled

PH UV1 FUNCTION
Range: Disabled, Enabled
Default: Disabled

NOTE

The settings changed using the Quick Setup menu, are available for review and modification by navigating through **S2 SYSTEM SETUP** and **S3 PROTECTION > SETPOINT GROUP 1** in the **SETPOINTS** main menu.

GE
Digital Energy

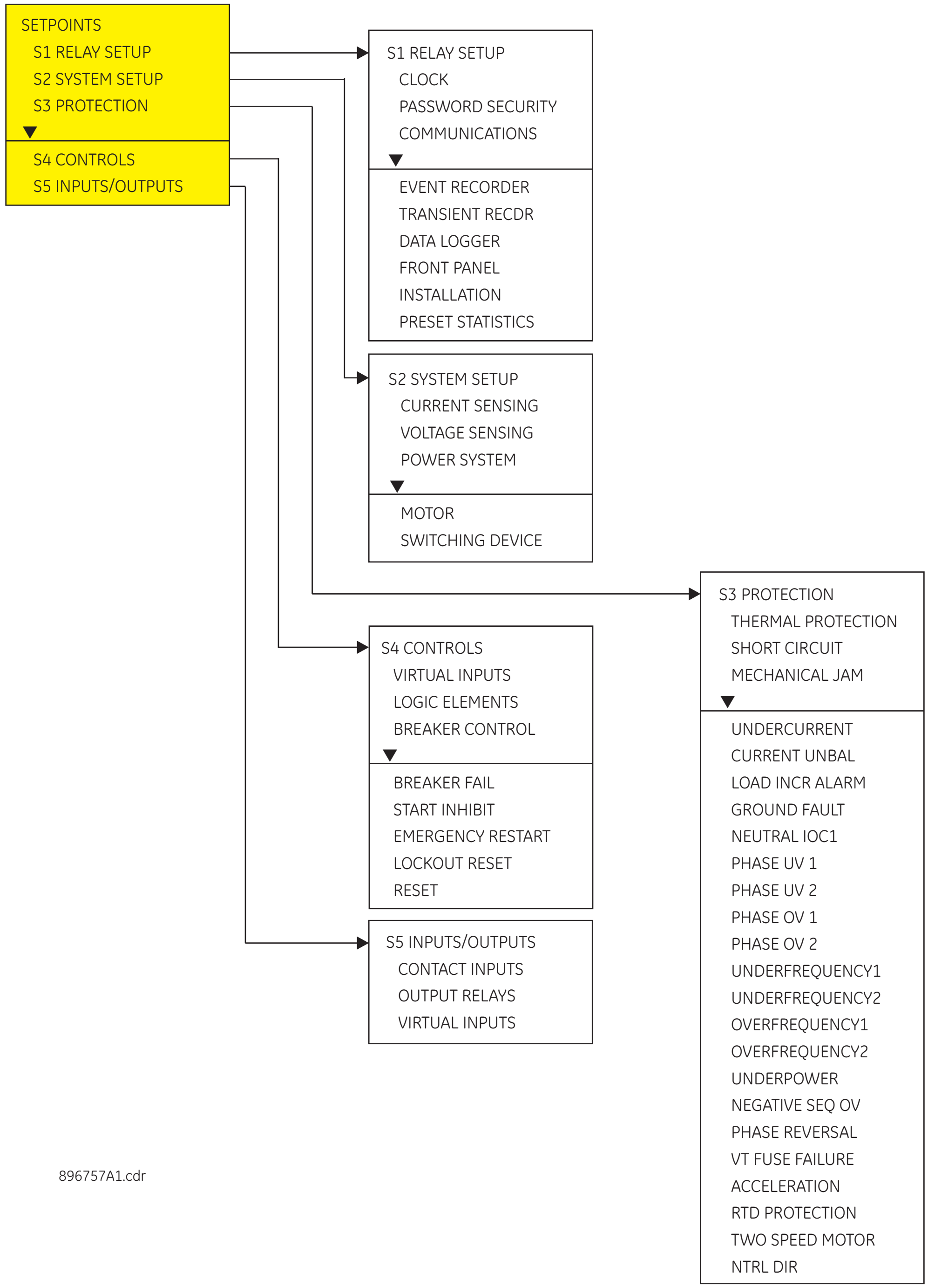
339 Motor Protection System

Chapter 6: Setpoints

Setpoints

The 339 has a considerable number of programmable setpoints, all of which make the relay extremely flexible. These setpoints have been grouped into a variety of pages and subpages as shown below. Each Setpoints menu has a section that describes in detail the setpoints found on that menu.

Figure 6-1: Main Setpoints menu



Setpoint entry methods

Before placing the relay into "**IN SERVICE**" mode, setpoints defining system characteristics, inputs, relay outputs, and protection settings must be entered using one of the following methods:

- Front panel, using the keypad and the display.
- Front USB port, or rear RS485, Ethernet 100 FX, Ethernet 10/100 BaseT (optional) port, and a computer running the EnerVista SR3 Setup software supplied with the relay.

- Rear serial RS485, and a SCADA system running user-written software.

Any of these methods can be used to enter the same information. A computer, however, makes entry much easier. Files can be stored and downloaded for fast, error free entry when a computer is used. To facilitate this process, the GE EnerVista CD with the EnerVista SR3 Setup software is supplied with the relay.

The relay leaves the factory with setpoints programmed to default values, and these values are shown throughout the setpoint message illustrations. Some of these factory default values can be left unchanged whenever they satisfy the application.

At a minimum, the **S2 SYSTEM SETUP** setpoints must be entered for the system to function correctly. To safeguard against the installation of a relay into which setpoints have not been entered, the **Relay Not Ready** self-test warning is displayed. In addition, the critical failure relay will be de-energized. Once the relay has been programmed for the intended application, the **S1 RELAY SETUP/ INSTALLATION/ RELAY STATUS** setpoint should be changed from "**Not Ready**" (the default) to "**Ready**".

Common setpoints

To make the application of this device as simple as possible, similar methods of operation and similar types of setpoints are incorporated in various features. Rather than repeat operation descriptions for this class of setpoint throughout the manual, a general description is presented in this overview. Details that are specific to a particular feature are included in the discussion of the feature. The form and nature of these setpoints is described below.

- **FUNCTION setpoint**: The **<ELEMENT_NAME> FUNCTION** setpoint determines the operational characteristic of each feature. The range for these setpoints is two or more of: "Disabled", "Enabled", "Trip", "Alarm", "Latched Alarm", and "Control".

  If **<ELEMENT_NAME > FUNCTION**: "Disabled", the feature is not operational.

  If **<ELEMENT_NAME > FUNCTION**: "Enabled", the feature is operational.

  If **<ELEMENT_NAME > FUNCTION**: "Trip", then the feature is operational. When an output is generated, the feature declares a Trip condition, and operates the Trip relay (output relay 1), any other selected aux. output relays, and displays the appropriate trip message.

  If **<ELEMENT_NAME> FUNCTION**: "Alarm" or "Latched Alarm", then the feature is operational. When an output is generated, the feature declares an "Alarm" condition which operates any selected aux.output relays and displays the appropriate alarm message.
- **Output Relay * setpoint**: The **<ELEMENT_NAME> OUTPUT RELAY *** setpoint selects the relays required to operate when the feature generates an output. The range is any combination of the assignable Auxiliary relays.
- **PICKUP setpoint**: The **<ELEMENT_NAME> PICKUP** setpoint selects the threshold above which the measured parameter causes an output from the measuring element.
- **DELAY setpoint**: The **<ELEMENT_NAME> DELAY** setpoint selects a fixed time interval to delay an input signal from appearing at the output. The time from a contact input change of state or an AC parameter input level change to a contact closure of the 1 Trip relay, is the time selected as time delay in this setpoint plus approximately up to 2 power frequency periods.

Logic diagrams

The logic diagrams provide a complete comprehensive understanding of the operation of each feature. These sequential logic diagrams illustrate how each setpoint, input parameter, and internal logic is used in the feature to obtain an output. In addition to these logic diagrams, written descriptions are provided in the setpoints chapter which includes each feature.

- **Settings**: Shown as a block with a heading labeled '**SETTING**'. The exact wording of the displayed setpoint message identifies the setpoint. Major functional setpoint selections are listed below the name and are incorporated in the logic.
- **Compensator Blocks**: Shown as a block with an inset box labeled '**RUN**' with the associated pickup/dropout setpoint shown directly above. Element operation of the detector is controlled by the signal entering the 'RUN' inset. The measurement/ comparison can only be performed if a logic '1' is provided at the '**RUN**' input. The relationship between setpoint and input parameter is indicated by the following symbols: "**<**" (less than) " **>**" (greater than), etc.
- **Time Delays**: Shown as a block with either pickup, drop-out, or both; times in milliseconds or seconds. If the delay is adjustable, associated delay setpoint is shown with block **SETPOINT** on the top of the delay block.
- **LED Indicators**: Shown as the following schematic symbol, □. The exact wording of the front panel label identifies the indicator.
- **Logic**: Described with basic logic gates (**AND, OR, XOR, NAND, NOR**). The inverter (**logical NOT**), is shown as a circle: ○.

Settings text abbreviations

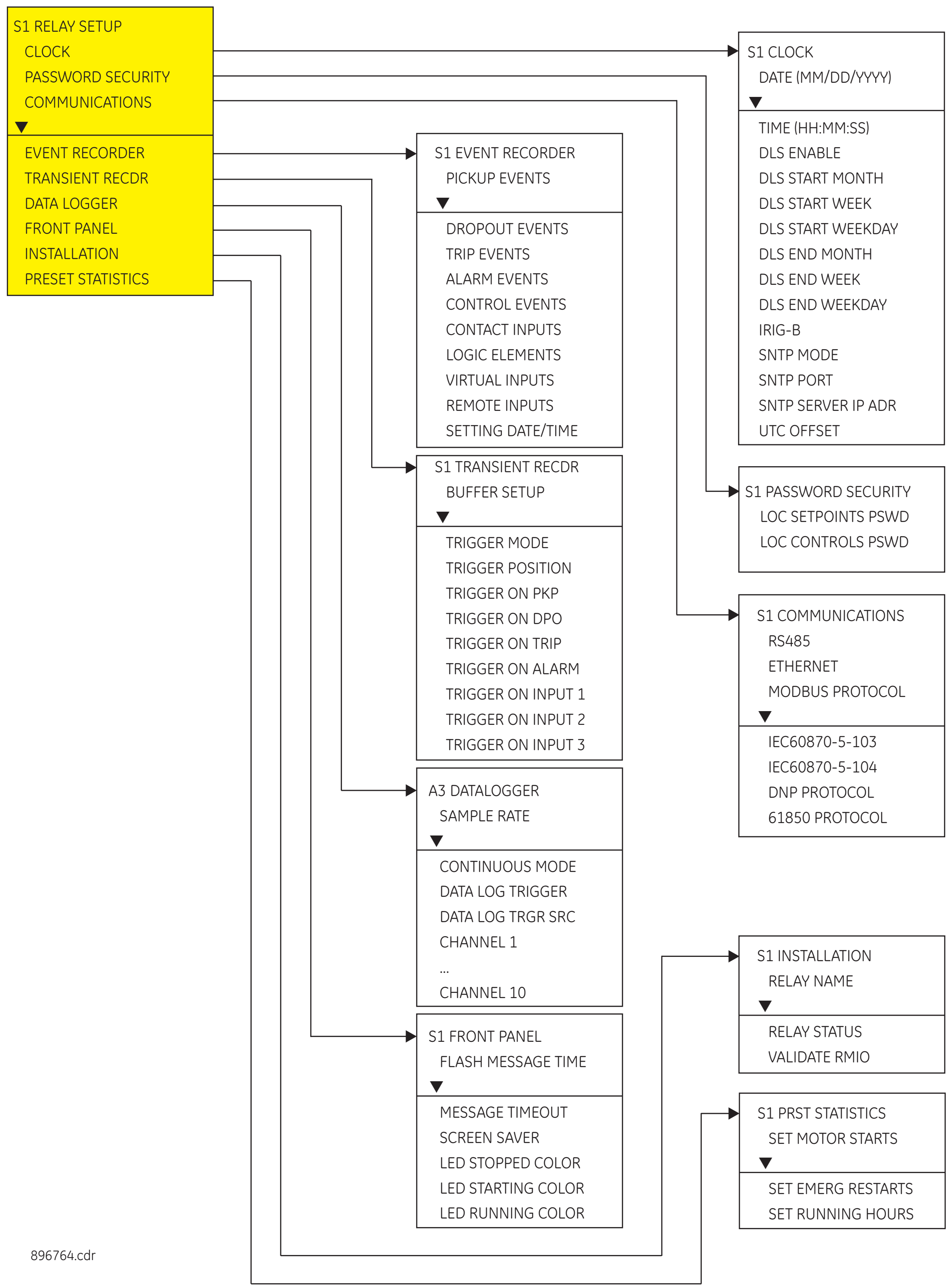
The following abbreviations are used in the setpoints pages.

- Acceleration time: ACCEL TIME; ACCEL T
- Alarm: ALM, ALRM
- ASDU: ASD
- Auxiliary: AUX
- Average: AVG
- Average Line Voltage: Vav
- Block: BLK, BLCK
- Contactor: CONT
- Control: Ctrl
- CT Secondary: CT SEC
- Current: CURR
- Current Unbalance: CURR UNBAL
- Delay: DLY
- Emergency Restarts: EMERG RESTARTS
- Function: FUNC, FUNCTN
- Ground: GND
- High Speed: SPD2
- Hour: Hr
- Initiate: INILoad Increase: LOAD INCRLogic Element: LE; LOGIC E
- Maintenance: MAINTEN, MAINT
- Mechanical Jam: MECH JAM
- Neutral: NTRL

- O/L: overload
- Password: PSWD, PSW
- Preset: PRST
- Protection: PROT
- POWER: PWR
- Primary: PRIM
- Protection: PROT
- Recorder: RECDR
- Relay: RLY
- Reset: RST
- Short Circuit: S/C
- High Speed: HIGH SPD
- Speed2: SPD2
- START: STAT
- Temperature: TEMP
- Thermal Capacity Used: TCU
- Thermal Overload: THERMAL O/L
- Time Constant: TIME CONS
- Transient Recorder: TRANSIENT RECDR
- Two-speed Motor: 2-SPD MOTOR
- Undercurrent: U/CURR; U/C
- Underfrequency: UNDRFREQ
- Undervoltage: UV
- Overvoltage: OV
- Underpower: U/POWER; U/P
- Voltage: VOLT
- Welded Contactor: WELDED CONT

S1 Relay setup

Figure 6-2: Relay Setup menu



Clock

The 339 relay has an internal real time clock that performs time stamping via IRIG-B for various features such as the event and transient recorders. This time stamping is available with the IRIG-B signal connected to the relay terminals and set to “Enabled”. When an IRIG-B device is connected to the relay terminals, the relay detects the DC shift or the Amplitude Modulated signal automatically. Time stamping on multiple relays can be synchronized to ± 1.0 ms with the use of IRIG-B input. Time stamping is also optionally available using SNTP.

Time synchronization priority uses the IRIG-B and SNTP protocols - via Modbus, IEC60870-5-103, IEC60870-5-104, or DNP commands - as follows:

IRIG-B has the highest priority, so any other source of synchronization should be rejected if IRIG-B is the synchronization source and an IRIG-B signal is available.

SNTP has the second highest priority, so if IRIG-B is not the synchronization source but SNTP is, then any other source of synchronization should be rejected.

Synchronization commands are all eventually translated into a MODBUS function, and as such are blocked from the MODBUS layer as required.

Any synchronization commands other than Modbus, IEC60870-5-103, IEC60870-5-104, or DNP will be accepted only if IRIG-B and SNTP are not the synchronization sources. There is no prioritization amongst synchronization commands. A synchronization command issued from DNP for example, can be directly followed by another from MODBUS, for example.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S1 RELAY SETUP > CLOCK**

DATE: (MM/DD/YYYY)

Range: Month: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec Day: 1 to 31 Year: 2009 to 2099
Default: Jan 15 2009

This setting sets the date in the specified format.

TIME: (HH:MM:SS)

Range: 0 to 23: 0 to 59: 0 to59
Default: 03:15:50

This setting sets the time in the specified format.

DLS ENABLE

Range: Disabled, Enabled
Default: Disabled

With DLS Enabled, the main CPU has to maintain the information regarding AV.m_DaylightSavingsActive, because it is necessary in the comms CPU to translate from localtime to UTC in 61850 protocol. In addition, if SNTP is enabled, the main CPU will receive UTC time from comms CPU and it needs to apply this in order to pass it to localtime.

Without any other synchronization, DLS correction is applied only at 0200 hours on daylight saving months.

PATH: **SETPOINTS > S1 RELAY SETUP > CLOCK > DLS ENABLE [ENABLED]**

DLS START MONTH:

Range: Not Set, January, February, March, April, May, June, July, August, September, October, November, December
Default: Not Set

This setting sets the month for the DLS start time.

DLS START WEEK:

Range: Not Set, 1st, 2nd, 3rd, 4th, Last
Default: Not Set

This setting sets the week of the month for the DLS start time.

DLS START WEEKDAY:

Range: Not Set, Mon, Tue, Wed, Thu, Fri, Sat, Sun
Default: Not Set

This setting sets the weekday for the DLS start time.

DLS END MONTH:

Range: Not Set, January, February, March, April, May, June, July, August, September, October, November, December
Default: Not Set

This setting sets the month for the end of the DLS time.

DLS END WEEK:

Range: Not Set, 1st, 2nd, 3rd, 4th, Last
Default: Not Set

This setting sets the week of the month for the end of the DLS time.

DLS END WEEKDAY:

Range: Not Set, Mon, Tue, Wed, Thu, Fri, Sat, Sun
Default: Not Set

This setting sets the weekday for the end of the DLS time.

PATH: **SETPOINTS > S1 RELAY SETUP > CLOCK**

IRIG-B:

Range: Disabled, Enabled
Default: Disabled

This setting enables the IRIG-B signal for time stamp synchronization.

When the IRIG-B setting is enabled, the time received is directly stamped as local date and time. If there is no signal, one event and alarm is generated. Any other attempted synchronization commands should be ignored in the main CPU. Since the user has the capability to enable both SNTP and IRIG-B via the HMI, the system will synchronize to SNTP, provided SNTP packets are received, when an IRIG-B signal is unavailable.

1. Set the IRIG-B to “Enabled” if the IRIG-B device is connected to the relay IRIG-B terminals. The relay will display the message “IRIG-B failure” in the case of either no IRIG-B signal from the connected IRIG-B device, or when the signal cannot be decoded.
2. Set the date and time per the specified date and time format.
3. Set the start time of the Daylight Saving (DLS) time, by selecting the Month, the Week of the month, and the Weekday defining the beginning of the Daylight Saving time.
4. Set the end of the Daylight Saving time, by selecting the Month, the Week of the month, and the Weekday defining the end of the Daylight Saving time.

The clock has a super-capacitor back-up, so that time, date, and events will be kept for up to 3 days in cases of loss of relay control power.

SNTP MODE

Range: Disabled, Broadcast, Anycast, Unicast
Default: Disabled

SNTP PORT

Range: 0 to 65535 in steps of 1
Default: Disabled

SNTP SERVER IP ADR
Range: Standard IP Address Format
Default: 000.000.000.000

UTC OFFSET
Range: -24.00 hours to 24.00 hours in steps of 0.01 hours
Default: 00.00 hours

NOTE

Refer to the *339 Communications Guide* for details on SNTP MODE, SNTP PORT, and SNTP SERVER IP ADR.

Password security

Password security features are designed into the relay to provide protection against unauthorized setpoint changes and control. The relay has programmable passwords for both Local and Remote access, which can be used to allow setpoint changes and command execution from both the front panel and the communications ports. These passwords consist of 3 to 10 alphanumeric characters. The Local and the Remote passwords are initially set after entering in a Master Reset Password (MRP). The Master Reset Password (MRP) is set to “NULL” when the relay is shipped from the factory. When the MRP is programmed to “NULL” all password security is disabled.. The remote user may choose to allow the local user to change the local passwords.

Each interface (RS485, Ethernet, USB, and front panel keypad) is independent of one another, meaning that enabling setpoint access on one interface does not enable access for any of the other interfaces (i.e., the password must be explicitly entered via the interface from which access is desired).

The EnerVista SR3 Setup software incorporates a facility for programming the relay’s passwords as well as enabling/disabling setpoint access. For example, when an attempt is made to modify a setpoint but access is restricted, the program will prompt the user to enter the password and send it to the relay before the setpoint can actually be written to the relay. If a SCADA system is used for relay programming, it is up to the programmer to incorporate appropriate security for the application.

Aside from being logged out of security, which allows the user to read setpoints and actual values only, three levels of security access are provided: Setpoint Level, Control Level, and Master Level. The Setpoint and Control Levels can be attained either locally using the Local passwords (USB port and keypad), or remotely using the Remote passwords (RS485 and Ethernet ports). The user can have either Setpoint or Control Level active, but not both simultaneously from the same interface. The Master Level is used for setting and resetting of passwords, and includes all Setpoint and Control Level access rights. The Master Level cannot be attained from the keypad. The Master Reset Password must be 8 to 10 characters in length, and must contain at least 2 letters and 2 numbers. The Master Level can define whether the local user is permitted to change Local Passwords without having to enter the Master Level. The Master Reset Password is encrypted, and is not viewable from the keypad. If the Master Reset Password is lost, the user should contact the factory to decrypt the Master Reset Password.

After password entry, the access level is maintained until a period of 5 minutes of inactivity has elapsed, after which the password must be re-entered. A power-loss or entering in the wrong password will log the user out of security.

Further definition of the access levels is described as follows:

SETPOINT LEVEL

- Changing settings under QUICK SETUP menu
- Changing settings under the SETPOINTS menu except the features requiring control access listed below

- Changing any setting under MAINTENANCE such as trip and close coil monitoring and breaker maintenance settings, except the features requiring control access listed below
- Changing the Local or Remote Setpoint Password, depending on the interface being accessed

CONTROL LEVEL

- Reset command
- Open and Close Breaker commands
- Virtual Input commands
- Clearing of event records, transient records, and other data
- Uploading new firmware
- Changing the Local or Remote Control Password, depending on the interface being accessed

MASTER LEVEL

- Setting and changing of all passwords including the Master Reset Password
- Disabling password security
- All Setpoint and Control Level access rights

For details on Password Security setup and handling using the EnerVista Setup software, refer to *Chapter 3*.

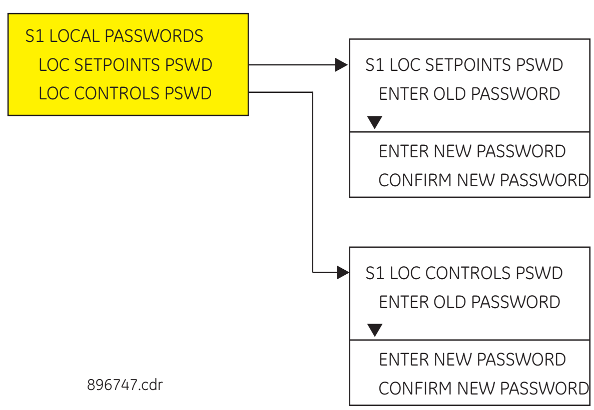
Access passwords

This section allows the user to change the Local Setpoint and Local Control Passwords. The local user may change a local password from the keypad if all of the following are true:

- Security is enabled
- A valid local setpoint (or local control) password has initially been set
- The remote user has the Overwrite Local Passwords setpoint set to **NO**
- The local user knows the current local password.

For more details on the Password Security feature, refer to *Chapter 3*.

Figure 6-3: Menu for handling password security using 339 keypad



The following steps describe how to change the Local Setpoints Password from the keypad. Similar steps are followed to change the Local Control Password.

ENTER OLD PASSWORD

The user is prompted to enter the current Local Setpoints Password. User the value up/down keys to select characters, and use the message left/right keys to move the cursor. Press the Enter key when done. An INVALID PASSWORD message will appear if a wrong password is entered, security is disabled, the password has not been originally set, or the local user does not have the rights to change the password. In addition, the user will be automatically logged out of security from the keypad. If the correct password was entered, the user is now logged in to the Setpoints Level from the keypad, and will be prompted to enter a new password.

ENTER NEW PASSWORD

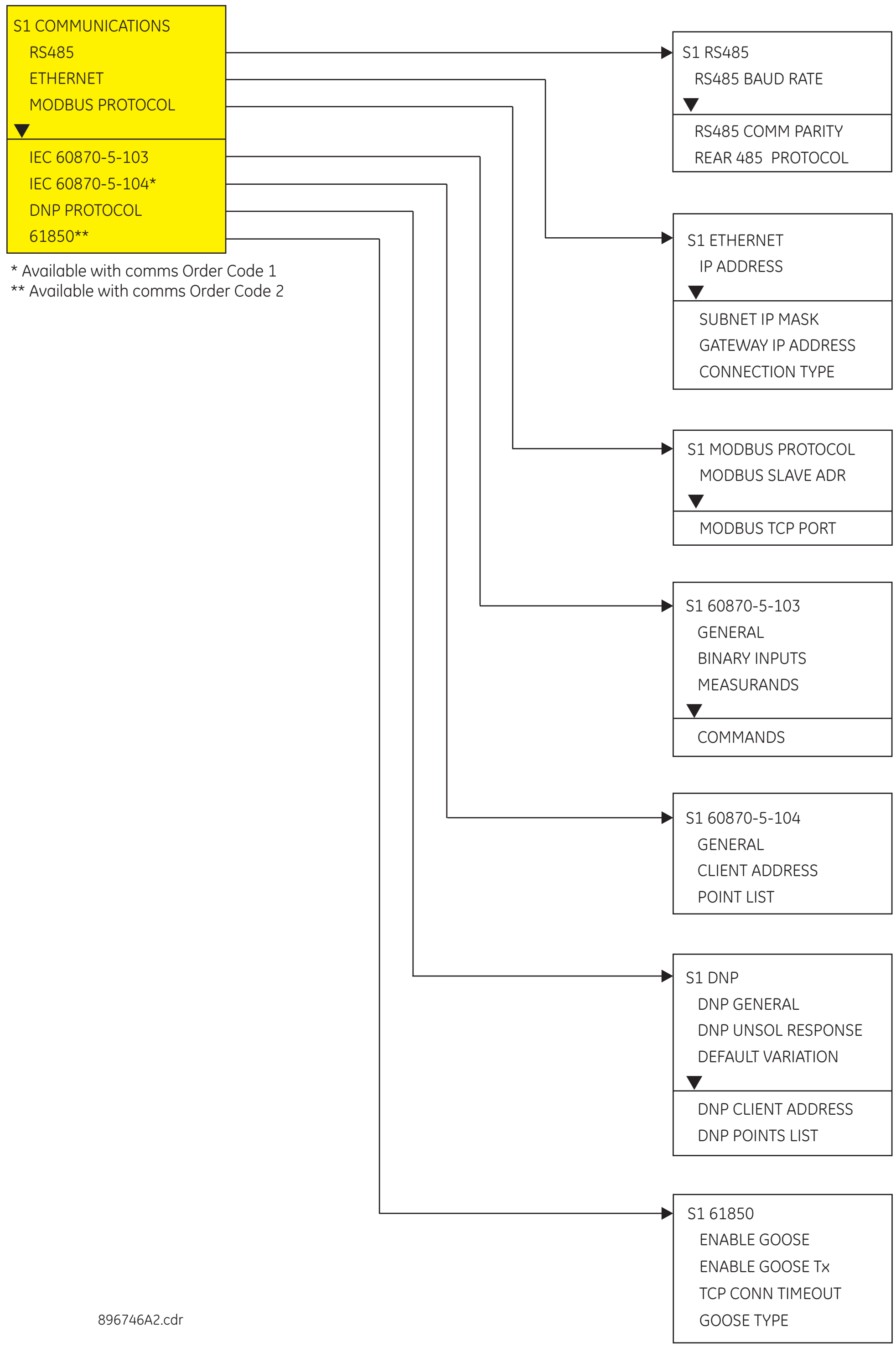
The user is prompted to enter a new Local Setpoints Password. A valid password is alphanumeric, and is 3 to 10 characters in length. An INVALID PASSWORD message will appear if the new password does not meet the password requirements. If a valid password was entered, the user will be prompted to re-enter the new password.

CONFIRM PASSWORD

The user is prompted to re-enter the new Local Setpoints Password. If the passwords do not match, an ENTRY MISMATCH message will appear, the password will remain unchanged, and the user will be returned to the Enter New Password page. If the passwords match, a PASSWORD CHANGED message will appear indicating the Local Setpoints Password has successfully been updated.

Communications

Figure 6-4: Main Communications menu

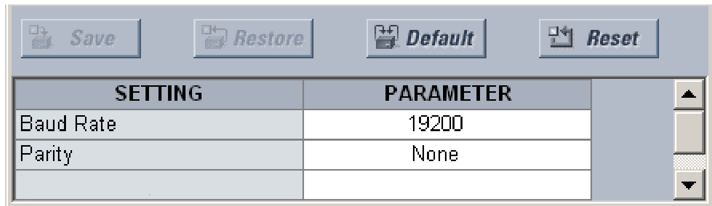


RS485 interface

The 339 is equipped with one serial RS485 communication port. The RS485 port has settings for baud rate and parity. It is important that these parameters agree with the settings used on the computer or other equipment that is connected to these ports. This port may be connected to a computer running the EnerVista SR3 Setup software. This software can download and upload setting files, view measured parameters, and upgrade the device firmware. A maximum of 32 339 -series devices can be daisy-chained and connected to a DCS, PLC, or PC using the RS485 port.

Select the **Settings > Communications > Serial Ports** menu item in the EnerVista SR3 Setup program, or the SETPOINTS > S1 RELAY SETUP > COMMUNICATIONS > RS485 path on the display, to configure the serial port.

Figure 6-5: Serial port configuration settings



The following settings are available to configure the RS485 port.

BAUD RATE

Range: 9600, 19200, 38400, 57600, 115200
Default: 115200

This setting specifies the baud rate (bits per second) for the RS485 port.

PARITY

Range: None, Odd, Even
Default: None

This setting specifies the parity for the RS485 port.

Ethernet

Select the **Setpoints > S1 Relay Setup > Communications > Ethernet** menu item in the EnerVista SR3 Setup program, or the SETPOINTS > S1 RELAY SETUP > COMMUNICATIONS > ETHERNET path on the display, to configure the Ethernet port.

The following settings are available to configure the Ethernet port.

IP Address

Range: Standard IP Address format
Default: 000.000.000.000

This setting specifies the IP Address for the Ethernet port.

Subnet IP Mask

Range: Standard IP Address format
Default: 255.255.255.000

This setting specifies the Subnet IP Mask setting for the Ethernet port.

Gateway IP Address

Range: Standard IP Address format
Default: 000.000.000.000

This setting specifies the Gateway IP Address for the Ethernet port.

Connection Type

Range: Copper, fiber
Default: Copper

This setting specifies the connection type (Copper or Fiber) used for Ethernet communication.

NOTE

When changing Ethernet settings, power to the relay must be cycled in order for the new settings to become active.

Modbus

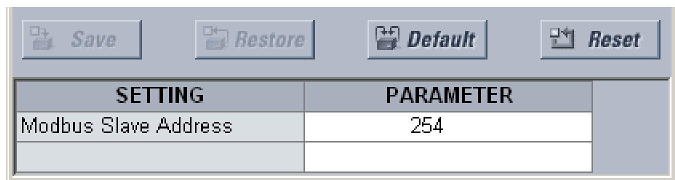
The Modicon Modbus protocol is supported by the 339 . Modbus is available via the RS485 serial link (Modbus RTU). The 339 always acts as a slave device, meaning that it never initiates communications; it only listens and responds to requests issued by a master device. A subset of the Modbus protocol format is supported that allows extensive monitoring, programming, and control functions using read and write register commands.Refer to the *339 Feeder Protection System Communications Guide* for additional details on the Modbus protocol and the Modbus memory map.

The Modbus server can simultaneously support two clients over serial RS485. The server is capable of reporting any indication or measurement and operating any output present in the device. A user-configurable input and output map is also implemented.

The 339 operates as a Modbus slave device only

Select the **Settings > Communications > Modbus > Protocol** menu item in EnerVista SR3 Setup software, or the **SETPOINTS > S1 RELAY SETUP > COMMUNICATIONS > MODBUS PROTOCOL** path to set up the modbus protocol as shown below.

Figure 6-6: Modbus protocol configuration settings



The following Modbus settings are available:

MODBUS SLAVE ADDRESS

Range: 1 to 254 in steps of 1

Default: 254

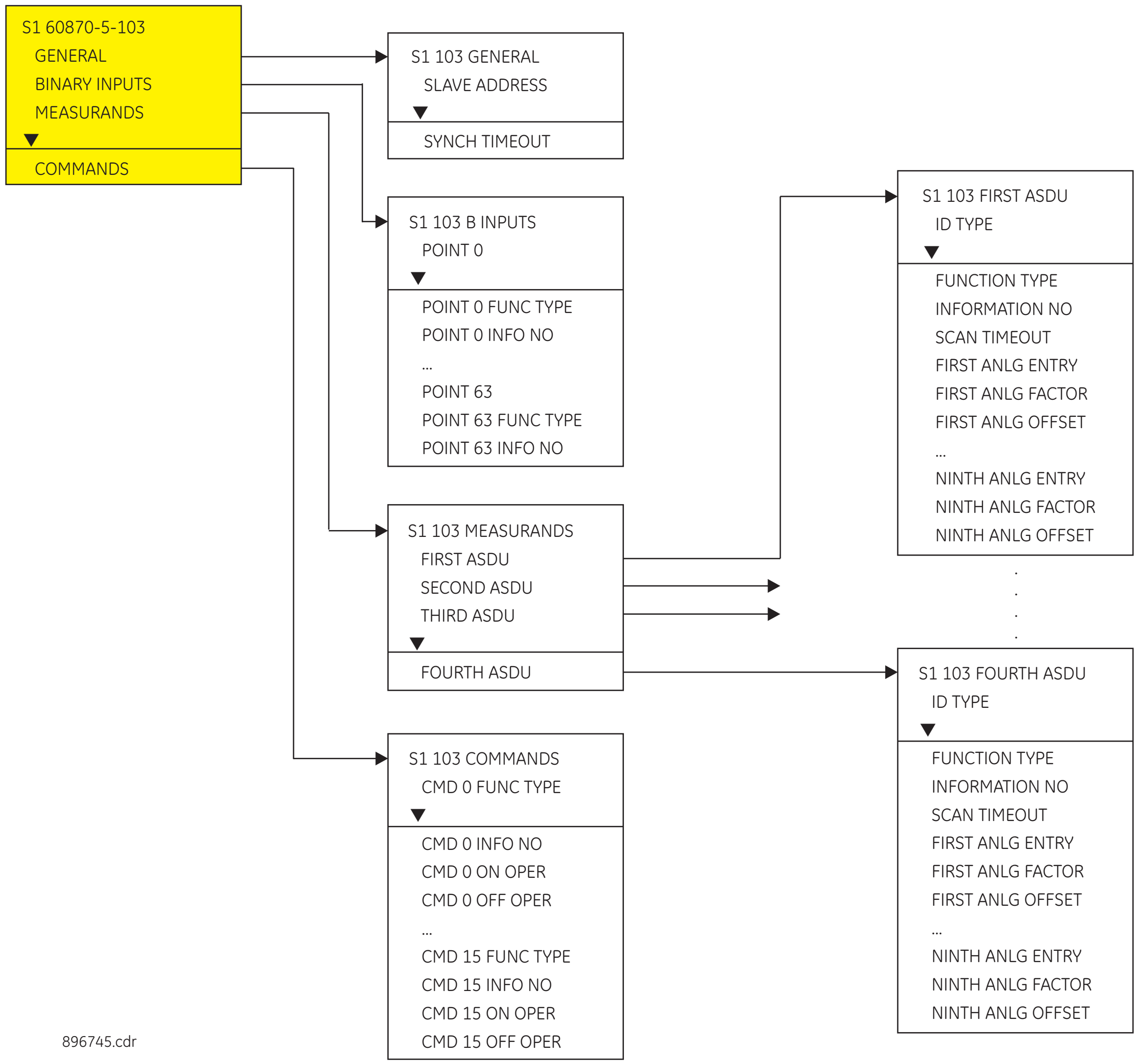
This setting specifies the Modbus slave address . Each device must have a unique address from 1 to 254. Address 0 is the broadcast address to which all Modbus slave devices listen. Addresses do not have to be sequential, but no two devices can have the same address or conflicts resulting in errors will occur. Generally, each device added to the link should use the next higher address starting at 1.

Please refer to the *339 Communications Guide* for details on how to set up the Modbus communications protocol.

IEC60870-5-103 serial communication settings

PATH: **SETPOINTS > S1 RELAY SETUP > COMMUNICATIONS > IEC61870-5-103**

Figure 6-7: IEC 60870-5-103 communication settings menu



The following table, from the *339 339 Communications Guide*, shows the list of Binary Inputs.

Code	Type	Definition
FC134B	unsigned 16 bits	DNP Binary Inputs
0		Off
0x0040		Contact IN 1 On
0x0041		Contact IN 2 On
0x0042		Contact IN 3 On
0x0043		Contact IN 4 On
0x0044		Contact IN 5 On
0x0045		Contact IN 6 On
0x0046		Contact IN 7 On
0x0047		Contact IN 8 On
0x0048		Contact IN 9 On
0x0049		Contact IN 10 On

Code	Type	Definition
0x0060		Contact IN 1 Off
0x0061		Contact IN 2 Off
0x0062		Contact IN 3 Off
0x0063		Contact IN 4 Off
0x0064		Contact IN 5 Off
0x0065		Contact IN 6 Off
0x0066		Contact IN 7 Off
0x0067		Contact IN 8 Off
0x0068		Contact IN 9 Off
0x0069		Contact IN 10 Off
0x0080		Virtual IN 1 On
0x0081		Virtual IN 2 On
0x0082		Virtual IN 3 On
0x0083		Virtual IN 4 On
0x0084		Virtual IN 5 On
0x0085		Virtual IN 6 On
0x0086		Virtual IN 7 On
0x0087		Virtual IN 8 On
0x0088		Virtual IN 9 On
0x0089		Virtual IN 10 On
0x008A		Virtual IN 11 On
0x008B		Virtual IN 12 On
0x008C		Virtual IN 13 On
0x008D		Virtual IN 14 On
0x008E		Virtual IN 15 On
0x008F		Virtual IN 16 On
0x0090		Virtual IN 17 On
0x0091		Virtual IN 18 On
0x0092		Virtual IN 19 On
0x0093		Virtual IN 20 On
0x0094		Virtual IN 21 On
0x0095		Virtual IN 22 On
0x0096		Virtual IN 23 On
0x0097		Virtual IN 24 On
0x0098		Virtual IN 25 On
0x0099		Virtual IN 26 On
0x009A		Virtual IN 27 On
0x009B		Virtual IN 28 On
0x009C		Virtual IN 29 On
0x009D		Virtual IN 30 On
0x009E		Virtual IN 31 On
0x009F		Virtual IN 32 On
0x01C0		Remote IN 1 On
0x01C1		Remote IN 2 On
0x01C2		Remote IN 3 On
0x01C3		Remote IN 4 On
0x01C4		Remote IN 5 On

Code	Type	Definition
0x01C5		Remote IN 6 On
0x01C6		Remote IN 7 On
0x01C7		Remote IN 8 On
0x01C8		Remote IN 9 On
0x01C9		Remote IN 10 On
0x01CA		Remote IN 11 On
0x01CB		Remote IN 12 On
0x01CC		Remote IN 13 On
0x01CD		Remote IN 14 On
0x01CE		Remote IN 15 On
0x01CF		Remote IN 16 On
0x01D0		Remote IN 17 On
0x01D1		Remote IN 18 On
0x01D2		Remote IN 19 On
0x01D3		Remote IN 20 On
0x01D4		Remote IN 21 On
0x01D5		Remote IN 22 On
0x01D6		Remote IN 23 On
0x01D7		Remote IN 24 On
0x01D8		Remote IN 25 On
0x01D9		Remote IN 26 On
0x01DA		Remote IN 27 On
0x01DB		Remote IN 28 On
0x01DC		Remote IN 29 On
0x01DD		Remote IN 30 On
0x01DE		Remote IN 31 On
0x01DF		Remote IN 32 On
0x01E0		Remote IN 1 Off
0x01E1		Remote IN 2 Off
0x01E2		Remote IN 3 Off
0x01E3		Remote IN 4 Off
0x01E4		Remote IN 5 Off
0x01E5		Remote IN 6 Off
0x01E6		Remote IN 7 Off
0x01E7		Remote IN 8 Off
0x01E8		Remote IN 9 Off
0x01E9		Remote IN 10 Off
0x01EA		Remote IN 11 Off
0x01EB		Remote IN 12 Off
0x01EC		Remote IN 13 Off
0x01ED		Remote IN 14 Off
0x01EE		Remote IN 15 Off
0x01EF		Remote IN 16 Off
0x01F0		Remote IN 17 Off
0x01F1		Remote IN 18 Off
0x01F2		Remote IN 19 Off
0x01F3		Remote IN 20 Off

Code	Type	Definition
0x01F4		Remote IN 21 Off
0x01F5		Remote IN 22 Off
0x01F6		Remote IN 23 Off
0x01F7		Remote IN 24 Off
0x01F8		Remote IN 25 Off
0x01F9		Remote IN 26 Off
0x01FA		Remote IN 27 Off
0x01FB		Remote IN 28 Off
0x01FC		Remote IN 29 Off
0x01FD		Remote IN 30 Off
0x01FE		Remote IN 31 Off
0x01FF		Remote IN 32 Off
0x8002		Any Trip
0x8041		Therm O/L Trip PKP
0x8042		Therm O/L Trip OP
0x8044		Therm O/L Trip DPO
0x8081		GF Trip PKP
0x8082		GF Trip OP
0x8084		GF Trip DPO
0x80C2		Accel Trip OP
0x8102		Phase Rev. Trp OP
0x8141		Under Pwr Trip PKP
0x8142		Under Pwr Trip OP
0x8144		Under Pwr Trip DPO
0x8181		Single PH Trip PKP
0x8182		Single PH Trip OP
0x8184		Single PH Trip DPO
0x8201		Mech Jam Trip PKP
0x8202		Mech Jam Trip OP
0x8204		Mech Jam Trip DPO
0x8241		U/CURR Trip PKP
0x8242		U/CURR Trip OP
0x8244		U/CURR Trip DPO
0x8281		UNBAL Trip PKP
0x8282		UNBAL Trip OP
0x8284		UNBAL Trip DPO
0x82C2		RTD 1 Trip OP
0x82C4		RTD 1 Trip DPO
0x8302		RTD 2 Trip OP
0x8304		RTD 2 Trip DPO
0x8342		RTD 3 Trip OP
0x8344		RTD 3 Trip DPO
0x8382		RTD 4 Trip OP
0x8384		RTD 4 Trip DPO
0x83C2		RTD 5 Trip OP
0x83C4		RTD 5 Trip DPO
0x8402		RTD 6 Trip OP

Code	Type	Definition
0x8404		RTD 6 Trip DPO
0x84C1		LE 1 Trip PKP
0x84C2		LE 1 Trip OP
0x84C4		LE 1 Trip DPO
0x8501		LE 2 Trip PKP
0x8502		LE 2 Trip OP
0x8504		LE 2 Trip DPO
0x8541		LE 3 Trip PKP
0x8542		LE 3 Trip OP
0x8544		LE 3 Trip DPO
0x8581		LE 4 Trip PKP
0x8582		LE 4 Trip OP
0x8584		LE 4 Trip DPO
0x85C1		LE 5 Trip PKP
0x85C2		LE 5 Trip OP
0x85C4		LE 5 Trip DPO
0x8601		LE 6 Trip PKP
0x8602		LE 6 Trip OP
0x8604		LE 6 Trip DPO
0x8641		LE 7 Trip PKP
0x8642		LE 7 Trip OP
0x8644		LE 7 Trip DPO
0x8681		LE 8 Trip PKP
0x8682		LE 8 Trip OP
0x8684		LE 8 Trip DPO
0x86C2		RTD 7 Trip OP
0x86C4		RTD 7 Trip DPO
0x8702		RTD 8 Trip OP
0x8704		RTD 8 Trip DPO
0x8742		RTD 9 Trip OP
0x8744		RTD 9 Trip DPO
0x8782		RTD 10 Trip OP
0x8784		RTD 10 Trip DPO
0x87C2		RTD 11 Trip OP
0x87C4		RTD 11 Trip DPO
0x8802		RTD 12 Trip OP
0x8804		RTD 12 Trip DPO
0x8F82		Fuse Fail Trip OP
0x8F84		Fuse Fail Trip DPO
0x8FC2		Ph Revrsl Trip OP
0x8FC4		Ph Revrsl Trip DPO
0x9041		Ntrl IOC1 Trip PKP
0x9042		Ntrl IOC1 Trip OP
0x9044		Ntrl IOC1 Trip DPO
0x93C1		NegSeq OV Trp PKP
0x93C2		NegSeq OV Trp OP
0x93C4		NegSeq OV Trp DPO

Code	Type	Definition
0x9441		Ph OV1 Trip PKP
0x9442		Ph OV1 Trip OP
0x9444		Ph OV1 Trip DPO
0x9449		Ph A OV1 Trip PKP
0x944A		Ph A OV1 Trip OP
0x944C		Ph A OV1 Trip DPO
0x9451		Ph B OV1 Trip PKP
0x9452		Ph B OV1 Trip OP
0x9454		Ph B OV1 Trip DPO
0x9461		Ph C OV1 Trip PKP
0x9462		Ph C OV1 Trip OP
0x9464		Ph C OV1 Trip DPO
0x9481		Ph UV1 Trip PKP
0x9482		Ph UV1 Trip OP
0x9484		Ph UV1 Trip DPO
0x9489		Ph A UV1 Trip PKP
0x948A		Ph A UV1 Trip OP
0x948C		Ph A UV1 Trip DPO
0x9491		Ph B UV1 Trip PKP
0x9492		Ph B UV1 Trip OP
0x9494		Ph B UV1 Trip DPO
0x94A1		Ph C UV1 Trip PKP
0x94A2		Ph C UV1 Trip OP
0x94A4		Ph C UV1 Trip DPO
0x9541		UndrFreq1 Trip PKP
0x9542		UndrFreq1 Trip OP
0x9544		UndrFreq1 Trip DPO
0x9581		UndrFreq2 Trip PKP
0x9582		UndrFreq2 Trip OP
0x9584		UndrFreq2 Trip DPO
0x95C1		OverFreq1 Trip PKP
0x95C2		OverFreq1 Trip OP
0x95C4		OverFreq1 Trip DPO
0x9601		OverFreq2 Trip PKP
0x9602		OverFreq2 Trip OP
0x9604		OverFreq2 Trip DPO
0x9881		Ph OV2 Trip PKP
0x9882		Ph OV2 Trip OP
0x9884		Ph OV2 Trip DPO
0x9889		Ph A OV2 Trip PKP
0x988A		Ph A OV2 Trip OP
0x988C		Ph A OV2 Trip DPO
0x9891		Ph B OV2 Trip PKP
0x9892		Ph B OV2 Trip OP
0x9894		Ph B OV2 Trip DPO
0x98A1		Ph C OV2 Trip PKP
0x98A2		Ph C OV2 Trip OP

Code	Type	Definition
0x98A4		Ph C OV2 Trip DPO
0x98C1		Ph UV2 Trip PKP
0x98C2		Ph UV2 Trip OP
0x98C4		Ph UV2 Trip DPO
0x98C9		Ph A UV2 Trip PKP
0x98CA		Ph A UV2 Trip OP
0x98CC		Ph A UV2 Trip DPO
0x98D1		Ph B UV2 Trip PKP
0x98D2		Ph B UV2 Trip OP
0x98D4		Ph B UV2 Trip DPO
0x98E1		Ph C UV2 Trip PKP
0x98E2		Ph C UV2 Trip OP
0x98E4		Ph C UV2 Trip DPO
0x9901		S/C Trip PKP
0x9902		S/C Trip OP
0x9904		S/C Trip DPO
0x9941		SPD2 S/C Trip PKP
0x9942		SPD2 S/C Trip OP
0x9944		SPD2 S/C Trip DPO
0x9981		SPD2 U/C Trip PKP
0x9982		SPD2 U/C Trip OP
0x9984		SPD2 U/C Trip DPO
0x9C01		LE 9 Trip PKP
0x9C02		LE 9 Trip OP
0x9C04		LE 9 Trip DPO
0x9C41		LE 10 Trip PKP
0x9C42		LE 10 Trip OP
0x9C44		LE 10 Trip DPO
0x9C81		LE 11 Trip PKP
0x9C82		LE 11 Trip OP
0x9C84		LE 11 Trip DPO
0x9CC1		LE 12 Trip PKP
0x9CC2		LE 12 Trip OP
0x9CC4		LE 12 Trip DPO
0x9D01		LE 13 Trip PKP
0x9D02		LE 13 Trip OP
0x9D04		LE 13 Trip DPO
0x9D41		LE 14 Trip PKP
0x9D42		LE 14 Trip OP
0x9D44		LE 14 Trip DPO
0x9D81		LE 15 Trip PKP
0x9D82		LE 15 Trip OP
0x9D84		LE 15 Trip DPO
0x9DC1		LE 16 Trip PKP
0x9DC2		LE 16 Trip OP
0x9DC4		LE 16 Trip DPO
0xA002		Any Alarm

Code	Type	Definition
0xA042		Therm Lvl Alrm OP
0xA044		Therm Lvl Alrm DPO
0xA081		Gnd Fault Alrm PKP
0xA082		Gnd Fault Alrm OP
0xA084		Gnd Fault Alrm DPO
0xA141		Under Pwr Alrm PKP
0xA142		Under Pwr Alrm OP
0xA144		Under Pwr Alrm DPO
0xA241		U/CURR Alarm PKP
0xA242		U/CURR Alarm OP
0xA244		U/CURR Alarm DPO
0xA281		UNBAL Alarm PKP
0xA282		UNBAL Alarm OP
0xA284		UNBAL Alarm DPO
0xA2C2		RTD 1 Alarm OP
0xA2C4		RTD 1 Alarm DPO
0xA302		RTD 2 Alarm OP
0xA304		RTD 2 Alarm DPO
0xA342		RTD 3 Alarm OP
0xA344		RTD 3 Alarm DPO
0xA382		RTD 4 Alarm OP
0xA384		RTD 4 Alarm DPO
0xA3C2		RTD 5 Alarm OP
0xA3C4		RTD 5 Alarm DPO
0xA402		RTD 6 Alarm OP
0xA404		RTD 6 Alarm DPO
0xA442		RTD Trouble OP
0xA4C1		LE 1 Alarm PKP
0xA4C2		LE 1 Alarm OP
0xA4C4		LE 1 Alarm DPO
0xA501		LE 2 Alarm PKP
0xA502		LE 2 Alarm OP
0xA504		LE 2 Alarm DPO
0xA541		LE 3 Alarm PKP
0xA542		LE 3 Alarm OP
0xA544		LE 3 Alarm DPO
0xA581		LE 4 Alarm PKP
0xA582		LE 4 Alarm OP
0xA584		LE 4 Alarm DPO
0xA5C1		LE 5 Alarm PKP
0xA5C2		LE 5 Alarm OP
0xA5C4		LE 5 Alarm DPO
0xA601		LE 6 Alarm PKP
0xA602		LE 6 Alarm OP
0xA604		LE 6 Alarm DPO
0xA641		LE 7 Alarm PKP
0xA642		LE 7 Alarm OP

Code	Type	Definition
0xA644		LE 7 Alarm DPO
0xA681		LE 8 Alarm PKP
0xA682		LE 8 Alarm OP
0xA684		LE 8 Alarm DPO
0xA6C2		RTD 7 Alarm OP
0xA6C4		RTD 7 Alarm DPO
0xA702		RTD 8 Alarm OP
0xA704		RTD 8 Alarm DPO
0xA742		RTD 9 Alarm OP
0xA744		RTD 9 Alarm DPO
0xA782		RTD 10 Alarm OP
0xA784		RTD 10 Alarm DPO
0xA7C2		RTD 11 Alarm OP
0xA7C4		RTD 11 Alarm DPO
0xA802		RTD 12 Alarm OP
0xA804		RTD 12 Alarm DPO
0xA982		Motor Run Hrs OP
0xAA01		Welded ContactrPKP
0xAA02		Welded Contactr OP
0xAA04		Welded ContactrDPO
0xAA42		SPD SW Not Cnfg OP
0xAA82		SPD SW Fail OP
0xAB01		Load Incr AlarmPKP
0xAB02		Load Incr Alarm OP
0xAB04		Load Incr Alrm DPO
0xABC1		HI Amb Temp PKP
0xABC2		HI Amb Temp OP
0xABC4		HI Amb Temp DPO
0xAC01		LO Amb Temp PKP
0xAC02		LO Amb Temp OP
0xAC04		LO Amb Temp DPO
0xAC42		Self Test Alarm OP
0xACC2		BKRTrpCntrAlrm OP
0xAD02		R1 CoilMonAlrm OP
0xAD42		R2 CoilMonAlrm OP
0xAD81		BKR1 Fail Alrm PKP
0xAD82		BKR1 Fail Alrm OP
0xADC2		BKR Stat Fail OP
0xAF81		Fuse Fail Alrm PKP
0xAF82		Fuse Fail Alrm OP
0xAF84		Fuse Fail Alrm DPO
0xAFC2		Ph Revrsl Alarm OP
0xAFC4		Ph Revrsl Alarm DPO
0xB041		Ntrl IOC1 Alrm PKP
0xB042		Ntrl IOC1 Alrm OP
0xB044		Ntrl IOC1 Alrm DPO
0xB342		NtrlDir RevAlm OP

Code	Type	Definition
0xB344		NtrlDir RevAlmDPO
0xB3C1		NegSeq OV Alrm PKP
0xB3C2		NegSeq OV Alrm OP
0xB3C4		NegSeq OV Alrm DPO
0xB441		Ph OV1 Alarm PKP
0xB442		Ph OV1 Alarm OP
0xB444		Ph OV1 Alarm DPO
0xB449		Ph A OV1 Alarm PKP
0xB44A		Ph A OV1 Alarm OP
0xB44C		Ph A OV1 Alarm DPO
0xB451		Ph B OV1 Alarm PKP
0xB452		Ph B OV1 Alarm OP
0xB454		Ph B OV1 Alarm DPO
0xB461		Ph C OV1 Alarm PKP
0xB462		Ph C OV1 Alarm OP
0xB464		Ph C OV1 Alarm DPO
0xB481		Ph UV1 Alarm PKP
0xB482		Ph UV1 Alarm OP
0xB484		Ph UV1 Alarm DPO
0xB489		Ph A UV1 Alarm PKP
0xB48A		Ph A UV1 Alarm OP
0xB48C		Ph A UV1 Alarm DPO
0xB491		Ph B UV1 Alarm PKP
0xB492		Ph B UV1 Alarm OP
0xB494		Ph B UV1 Alarm DPO
0xB4A1		Ph C UV1 Alarm PKP
0xB4A2		Ph C UV1 Alarm OP
0xB4A4		Ph C UV1 Alarm DPO
0xB541		UndrFreq1 Alrm PKP
0xB542		UndrFreq1 Alrm OP
0xB544		UndrFreq1 Alrm DPO
0xB581		UndrFreq2 Alrm PKP
0xB582		UndrFreq2 Alrm OP
0xB584		UndrFreq2 Alrm DPO
0xB5C1		OverFreq1 Alrm PKP
0xB5C2		OverFreq1 Alrm OP
0xB5C4		OverFreq1 Alrm DPO
0xB601		OverFreq2 Alrm PKP
0xB602		OverFreq2 Alrm OP
0xB604		OverFreq2 Alrm DPO
0xB881		Ph OV2 Alarm PKP
0xB882		Ph OV2 Alarm OP
0xB884		Ph OV2 Alarm DPO
0xB889		Ph A OV2 Alarm PKP
0xB88A		Ph A OV2 Alarm OP
0xB88C		Ph A OV2 Alarm DPO
0xB891		Ph B OV2 Alarm PKP

Code	Type	Definition
0xB892		Ph B OV2 Alarm OP
0xB894		Ph B OV2 Alarm DPO
0xB8A1		Ph C OV2 Alarm PKP
0xB8A2		Ph C OV2 Alarm OP
0xB8A4		Ph C OV2 Alarm DPO
0xB8C1		Ph UV2 Alarm PKP
0xB8C2		Ph UV2 Alarm OP
0xB8C4		Ph UV2 Alarm DPO
0xB8C9		Ph A UV2 Alarm PKP
0xB8CA		Ph A UV2 Alarm OP
0xB8CC		Ph A UV2 Alarm DPO
0xB8D1		Ph B UV2 Alarm PKP
0xB8D2		Ph B UV2 Alarm OP
0xB8D4		Ph B UV2 Alarm DPO
0xB8E1		Ph C UV2 Alarm PKP
0xB8E2		Ph C UV2 Alarm OP
0xB8E4		Ph C UV2 Alarm DPO
0xB901		S/C Alarm PKP
0xB902		S/C Alarm OP
0xB904		S/C Alarm DPO
0xB941		SPD2 S/C Alarm PKP
0xB942		SPD2 S/C Alarm OP
0xB944		SPD2 S/C Alarm DPO
0xB981		SPD2 U/C Alarm PKP
0xB982		SPD2 U/C Alarm OP
0xB984		SPD2 U/C Alarm DPO
0xBC01		LE 9 Alarm PKP
0xBC02		LE 9 Alarm OP
0xBC04		LE 9 Alarm DPO
0xBC41		LE 10 Alarm PKP
0xBC42		LE 10 Alarm OP
0xBC44		LE 10 Alarm DPO
0xBC81		LE 11 Alarm PKP
0xBC82		LE 11 Alarm OP
0xBC84		LE 11 Alarm DPO
0xBCC1		LE 12 Alarm PKP
0xBCC2		LE 12 Alarm OP
0xBCC4		LE 12 Alarm DPO
0xBD01		LE 13 Alarm PKP
0xBD02		LE 13 Alarm OP
0xBD04		LE 13 Alarm DPO
0xBD41		LE 14 Alarm PKP
0xBD42		LE 14 Alarm OP
0xBD44		LE 14 Alarm DPO
0xBD81		LE 15 Alarm PKP
0xBD82		LE 15 Alarm OP
0xBD84		LE 15 Alarm DPO

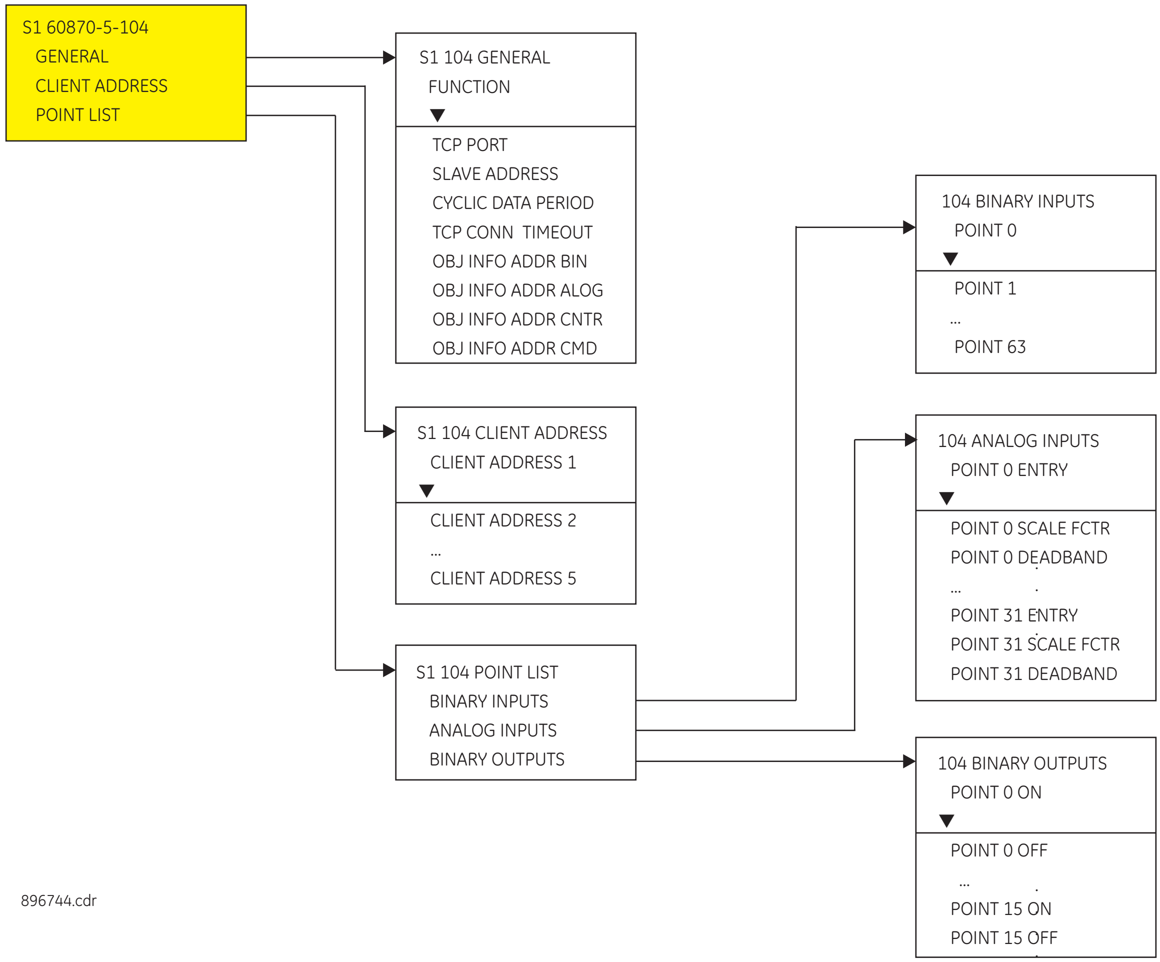
Code	Type	Definition
0xBDC1		LE 16 Alarm PKP
0xBDC2		LE 16 Alarm OP
0xBDC4		LE 16 Alarm DPO
0xC002		Any Inhibit
0xC042		Output Relay 3 On
0xC082		Output Relay 4 On
0xC0C2		Output Relay 5 On
0xC102		Output Relay 6 On
0xC142		Self-Test Rly 7 On
0xC182		Output Relay 1 On
0xC1C2		Output Relay 2 On
0xC242		High Speed OP
0xC282		Low Speed OP
0xC3C2		Motor Online
0xC402		Emergency Restart
0xC442		Hot RTD OP
0xC444		Hot RTD DPO
0xC482		Lockout OP
0xC484		Lockout DPO
0xC4C1		LE 1 PKP
0xC4C2		LE 1 OP
0xC4C4		LE 1 DPO
0xC501		LE 2 PKP
0xC502		LE 2 OP
0xC504		LE 2 DPO
0xC541		LE 3 PKP
0xC542		LE 3 OP
0xC544		LE 3 DPO
0xC581		LE 4 PKP
0xC582		LE 4 OP
0xC584		LE 4 DPO
0xC5C1		LE 5 PKP
0xC5C2		LE 5 OP
0xC5C4		LE 5 DPO
0xC601		LE 6 PKP
0xC602		LE 6 OP
0xC604		LE 6 DPO
0xC641		LE 7 PKP
0xC642		LE 7 OP
0xC644		LE 7 DPO
0xC681		LE 8 PKP
0xC682		LE 8 OP
0xC684		LE 8 DPO
0xC902		Open Breaker
0xC942		Close Breaker
0xCA02		52a Contact OP
0xCA42		52b Contact OP

Code	Type	Definition
0xCAC2		L/O Rst Closed
0xCCC2		BKR Stat Open
0xCD02		BKR Stat Clsd
0xCE82		Therm Inhibit OP
0xCEC2		Rstrt Inhibit OP
0xCF02		Start/Hr Inhib OP
0xCF42		T-BT-Strt Inhib OP
0xCF81		Fuse Fail InhibPKP
0xCF82		Fuse Fail Inhib OP
0xCFC2		Ph Rev Inhibit OP
0xCFC4		Ph Rev Inhibit DPO
0xD342		Ntrl Dir Rev OP
0xD344		Ntrl Dir Rev DPO
0xDC01		LE 9 PKP
0xDC02		LE 9 OP
0xDC04		LE 9 DPO
0xDC41		LE 10 PKP
0xDC42		LE 10 OP
0xDC44		LE 10 DPO
0xDC81		LE 11 PKP
0xDC82		LE 11 OP
0xDC84		LE 11 DPO
0xDCC1		LE 12 PKP
0xDCC2		LE 12 OP
0xDCC4		LE 12 DPO
0xDD01		LE 13 PKP
0xDD02		LE 13 OP
0xDD04		LE 13 DPO
0xDD41		LE 14 PKP
0xDD42		LE 14 OP
0xDD44		LE 14 DPO
0xDD81		LE 15 PKP
0xDD82		LE 15 OP
0xDD84		LE 15 DPO
0xDDC1		LE 16 PKP
0xDDC2		LE 16 OP
0xDDC4		LE 16 DPO
0xE002		Any Block
0xE042		Therm O/L Blck
0xE082		Gnd Fault BLK
0xE0C2		Accel BLK
0xE142		UndrPower BLK
0xE182		Output Relay 1 BLK
0xE1C2		Output Relay 2 BLK
0xE202		Mech Jam BLK
0xE242		U/CURR BLK
0xE282		UNBAL BLK

Code	Type	Definition
0xE2C2		RTD1 BLK OP
0xE302		RTD2 BLK OP
0xE342		RTD3 BLK OP
0xE382		RTD4 BLK OP
0xE3C2		RTD5 BLK OP
0xE402		RTD6 BLK OP
0xE442		RTDTrouble BLK OP
0xE6C2		RTD7 BLK OP
0xE702		RTD8 BLK OP
0xE742		RTD9 BLK OP
0xE782		RTD10 BLK OP
0xE7C2		RTD11 BLK OP
0xE802		RTD12 BLK OP
0xF042		Ntrl IOC1 Block
0xF342		NTRL DIR Rev Block
0xF3C2		NegSeq OV Block
0xF442		Ph OV1 Block
0xF482		Ph UV1 Block
0xF542		UndrFreq1 Block
0xF582		UndrFreq2 Block
0xF5C2		OverFreq1 Block
0xF602		OverFreq2 Block
0xF882		Ph OV2 Block
0xF8C2		Ph UV2 Block
0xF902		S/C BLK
0xF942		SPD2 S/C BLK
0xF982		SPD2 U/C OP

IEC60870-5-104 protocol

Figure 6-8: IEC 60870-5-104 protocol settings menu

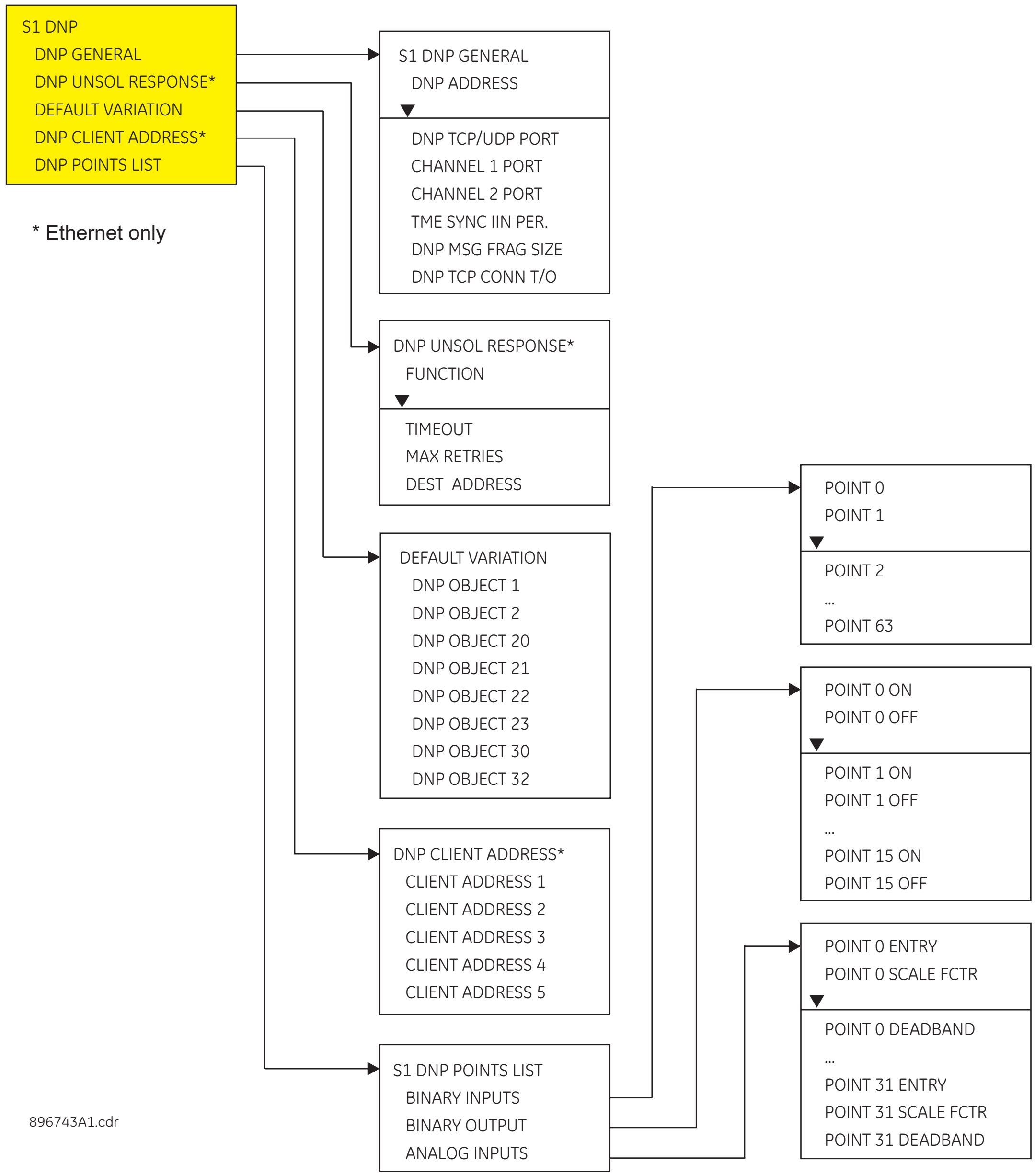


DNP communication

The menu structure for the DNP protocol is shown below.

PATH: SETPOINTS > RELAY SETUP > COMMUNICATIONS > DNP PROTOCOL

Figure 6-9: DNP communication settings menu



The following path is available using the keypad. For instructions on how to use the keypad, please refer to the *Chapter 3 - Working with the Keypad*.

The following table, from the *339 339 Communications Guide*, shows the list of DNP Binary Inputs.

Code	Type	Definition
FC134B	unsigned 16 bits	DNP Binary Inputs
0		Off
0x0040		Contact IN 1 On
0x0041		Contact IN 2 On
0x0042		Contact IN 3 On
0x0043		Contact IN 4 On

Code	Type	Definition
0x0044		Contact IN 5 On
0x0045		Contact IN 6 On
0x0046		Contact IN 7 On
0x0047		Contact IN 8 On
0x0048		Contact IN 9 On
0x0049		Contact IN 10 On
0x0060		Contact IN 1 Off
0x0061		Contact IN 2 Off
0x0062		Contact IN 3 Off
0x0063		Contact IN 4 Off
0x0064		Contact IN 5 Off
0x0065		Contact IN 6 Off
0x0066		Contact IN 7 Off
0x0067		Contact IN 8 Off
0x0068		Contact IN 9 Off
0x0069		Contact IN 10 Off
0x0080		Virtual IN 1 On
0x0081		Virtual IN 2 On
0x0082		Virtual IN 3 On
0x0083		Virtual IN 4 On
0x0084		Virtual IN 5 On
0x0085		Virtual IN 6 On
0x0086		Virtual IN 7 On
0x0087		Virtual IN 8 On
0x0088		Virtual IN 9 On
0x0089		Virtual IN 10 On
0x008A		Virtual IN 11 On
0x008B		Virtual IN 12 On
0x008C		Virtual IN 13 On
0x008D		Virtual IN 14 On
0x008E		Virtual IN 15 On
0x008F		Virtual IN 16 On
0x0090		Virtual IN 17 On
0x0091		Virtual IN 18 On
0x0092		Virtual IN 19 On
0x0093		Virtual IN 20 On
0x0094		Virtual IN 21 On
0x0095		Virtual IN 22 On
0x0096		Virtual IN 23 On
0x0097		Virtual IN 24 On
0x0098		Virtual IN 25 On
0x0099		Virtual IN 26 On
0x009A		Virtual IN 27 On
0x009B		Virtual IN 28 On
0x009C		Virtual IN 29 On
0x009D		Virtual IN 30 On
0x009E		Virtual IN 31 On

Code	Type	Definition
0x009F		Virtual IN 32 On
0x01C0		Remote IN 1 On
0x01C1		Remote IN 2 On
0x01C2		Remote IN 3 On
0x01C3		Remote IN 4 On
0x01C4		Remote IN 5 On
0x01C5		Remote IN 6 On
0x01C6		Remote IN 7 On
0x01C7		Remote IN 8 On
0x01C8		Remote IN 9 On
0x01C9		Remote IN 10 On
0x01CA		Remote IN 11 On
0x01CB		Remote IN 12 On
0x01CC		Remote IN 13 On
0x01CD		Remote IN 14 On
0x01CE		Remote IN 15 On
0x01CF		Remote IN 16 On
0x01D0		Remote IN 17 On
0x01D1		Remote IN 18 On
0x01D2		Remote IN 19 On
0x01D3		Remote IN 20 On
0x01D4		Remote IN 21 On
0x01D5		Remote IN 22 On
0x01D6		Remote IN 23 On
0x01D7		Remote IN 24 On
0x01D8		Remote IN 25 On
0x01D9		Remote IN 26 On
0x01DA		Remote IN 27 On
0x01DB		Remote IN 28 On
0x01DC		Remote IN 29 On
0x01DD		Remote IN 30 On
0x01DE		Remote IN 31 On
0x01DF		Remote IN 32 On
0x01E0		Remote IN 1 Off
0x01E1		Remote IN 2 Off
0x01E2		Remote IN 3 Off
0x01E3		Remote IN 4 Off
0x01E4		Remote IN 5 Off
0x01E5		Remote IN 6 Off
0x01E6		Remote IN 7 Off
0x01E7		Remote IN 8 Off
0x01E8		Remote IN 9 Off
0x01E9		Remote IN 10 Off
0x01EA		Remote IN 11 Off
0x01EB		Remote IN 12 Off
0x01EC		Remote IN 13 Off
0x01ED		Remote IN 14 Off

Code	Type	Definition
0x01EE		Remote IN 15 Off
0x01EF		Remote IN 16 Off
0x01F0		Remote IN 17 Off
0x01F1		Remote IN 18 Off
0x01F2		Remote IN 19 Off
0x01F3		Remote IN 20 Off
0x01F4		Remote IN 21 Off
0x01F5		Remote IN 22 Off
0x01F6		Remote IN 23 Off
0x01F7		Remote IN 24 Off
0x01F8		Remote IN 25 Off
0x01F9		Remote IN 26 Off
0x01FA		Remote IN 27 Off
0x01FB		Remote IN 28 Off
0x01FC		Remote IN 29 Off
0x01FD		Remote IN 30 Off
0x01FE		Remote IN 31 Off
0x01FF		Remote IN 32 Off
0x8002		Any Trip
0x8041		Therm O/L Trip PKP
0x8042		Therm O/L Trip OP
0x8044		Therm O/L Trip DPO
0x8081		GF Trip PKP
0x8082		GF Trip OP
0x8084		GF Trip DPO
0x80C2		Accel Trip OP
0x8102		Phase Rev. Trp OP
0x8141		Under Pwr Trip PKP
0x8142		Under Pwr Trip OP
0x8144		Under Pwr Trip DPO
0x8181		Single PH Trip PKP
0x8182		Single PH Trip OP
0x8184		Single PH Trip DPO
0x8201		Mech Jam Trip PKP
0x8202		Mech Jam Trip OP
0x8204		Mech Jam Trip DPO
0x8241		U/CURR Trip PKP
0x8242		U/CURR Trip OP
0x8244		U/CURR Trip DPO
0x8281		UNBAL Trip PKP
0x8282		UNBAL Trip OP
0x8284		UNBAL Trip DPO
0x82C2		RTD 1 Trip OP
0x82C4		RTD 1 Trip DPO
0x8302		RTD 2 Trip OP
0x8304		RTD 2 Trip DPO
0x8342		RTD 3 Trip OP

Code	Type	Definition
0x8344		RTD 3 Trip DPO
0x8382		RTD 4 Trip OP
0x8384		RTD 4 Trip DPO
0x83C2		RTD 5 Trip OP
0x83C4		RTD 5 Trip DPO
0x8402		RTD 6 Trip OP
0x8404		RTD 6 Trip DPO
0x84C1		LE 1 Trip PKP
0x84C2		LE 1 Trip OP
0x84C4		LE 1 Trip DPO
0x8501		LE 2 Trip PKP
0x8502		LE 2 Trip OP
0x8504		LE 2 Trip DPO
0x8541		LE 3 Trip PKP
0x8542		LE 3 Trip OP
0x8544		LE 3 Trip DPO
0x8581		LE 4 Trip PKP
0x8582		LE 4 Trip OP
0x8584		LE 4 Trip DPO
0x85C1		LE 5 Trip PKP
0x85C2		LE 5 Trip OP
0x85C4		LE 5 Trip DPO
0x8601		LE 6 Trip PKP
0x8602		LE 6 Trip OP
0x8604		LE 6 Trip DPO
0x8641		LE 7 Trip PKP
0x8642		LE 7 Trip OP
0x8644		LE 7 Trip DPO
0x8681		LE 8 Trip PKP
0x8682		LE 8 Trip OP
0x8684		LE 8 Trip DPO
0x86C2		RTD 7 Trip OP
0x86C4		RTD 7 Trip DPO
0x8702		RTD 8 Trip OP
0x8704		RTD 8 Trip DPO
0x8742		RTD 9 Trip OP
0x8744		RTD 9 Trip DPO
0x8782		RTD 10 Trip OP
0x8784		RTD 10 Trip DPO
0x87C2		RTD 11 Trip OP
0x87C4		RTD 11 Trip DPO
0x8802		RTD 12 Trip OP
0x8804		RTD 12 Trip DPO
0x8F82		Fuse Fail Trip OP
0x8F84		Fuse Fail Trip DPO
0x8FC2		Ph Revrsl Trip OP
0x8FC4		Ph Revrsl Trip DPO

Code	Type	Definition
0x9041		Ntrl IOC1 Trip PKP
0x9042		Ntrl IOC1 Trip OP
0x9044		Ntrl IOC1 Trip DPO
0x93C1		NegSeq OV Trp PKP
0x93C2		NegSeq OV Trp OP
0x93C4		NegSeq OV Trp DPO
0x9441		Ph OV1 Trip PKP
0x9442		Ph OV1 Trip OP
0x9444		Ph OV1 Trip DPO
0x9449		Ph A OV1 Trip PKP
0x944A		Ph A OV1 Trip OP
0x944C		Ph A OV1 Trip DPO
0x9451		Ph B OV1 Trip PKP
0x9452		Ph B OV1 Trip OP
0x9454		Ph B OV1 Trip DPO
0x9461		Ph C OV1 Trip PKP
0x9462		Ph C OV1 Trip OP
0x9464		Ph C OV1 Trip DPO
0x9481		Ph UV1 Trip PKP
0x9482		Ph UV1 Trip OP
0x9484		Ph UV1 Trip DPO
0x9489		Ph A UV1 Trip PKP
0x948A		Ph A UV1 Trip OP
0x948C		Ph A UV1 Trip DPO
0x9491		Ph B UV1 Trip PKP
0x9492		Ph B UV1 Trip OP
0x9494		Ph B UV1 Trip DPO
0x94A1		Ph C UV1 Trip PKP
0x94A2		Ph C UV1 Trip OP
0x94A4		Ph C UV1 Trip DPO
0x9541		UndrFreq1 Trip PKP
0x9542		UndrFreq1 Trip OP
0x9544		UndrFreq1 Trip DPO
0x9581		UndrFreq2 Trip PKP
0x9582		UndrFreq2 Trip OP
0x9584		UndrFreq2 Trip DPO
0x95C1		OverFreq1 Trip PKP
0x95C2		OverFreq1 Trip OP
0x95C4		OverFreq1 Trip DPO
0x9601		OverFreq2 Trip PKP
0x9602		OverFreq2 Trip OP
0x9604		OverFreq2 Trip DPO
0x9881		Ph OV2 Trip PKP
0x9882		Ph OV2 Trip OP
0x9884		Ph OV2 Trip DPO
0x9889		Ph A OV2 Trip PKP
0x988A		Ph A OV2 Trip OP

Code	Type	Definition
0x988C		Ph A OV2 Trip DPO
0x9891		Ph B OV2 Trip PKP
0x9892		Ph B OV2 Trip OP
0x9894		Ph B OV2 Trip DPO
0x98A1		Ph C OV2 Trip PKP
0x98A2		Ph C OV2 Trip OP
0x98A4		Ph C OV2 Trip DPO
0x98C1		Ph UV2 Trip PKP
0x98C2		Ph UV2 Trip OP
0x98C4		Ph UV2 Trip DPO
0x98C9		Ph A UV2 Trip PKP
0x98CA		Ph A UV2 Trip OP
0x98CC		Ph A UV2 Trip DPO
0x98D1		Ph B UV2 Trip PKP
0x98D2		Ph B UV2 Trip OP
0x98D4		Ph B UV2 Trip DPO
0x98E1		Ph C UV2 Trip PKP
0x98E2		Ph C UV2 Trip OP
0x98E4		Ph C UV2 Trip DPO
0x9901		S/C Trip PKP
0x9902		S/C Trip OP
0x9904		S/C Trip DPO
0x9941		SPD2 S/C Trip PKP
0x9942		SPD2 S/C Trip OP
0x9944		SPD2 S/C Trip DPO
0x9981		SPD2 U/C Trip PKP
0x9982		SPD2 U/C Trip OP
0x9984		SPD2 U/C Trip DPO
0x9C01		LE 9 Trip PKP
0x9C02		LE 9 Trip OP
0x9C04		LE 9 Trip DPO
0x9C41		LE 10 Trip PKP
0x9C42		LE 10 Trip OP
0x9C44		LE 10 Trip DPO
0x9C81		LE 11 Trip PKP
0x9C82		LE 11 Trip OP
0x9C84		LE 11 Trip DPO
0x9CC1		LE 12 Trip PKP
0x9CC2		LE 12 Trip OP
0x9CC4		LE 12 Trip DPO
0x9D01		LE 13 Trip PKP
0x9D02		LE 13 Trip OP
0x9D04		LE 13 Trip DPO
0x9D41		LE 14 Trip PKP
0x9D42		LE 14 Trip OP
0x9D44		LE 14 Trip DPO
0x9D81		LE 15 Trip PKP

Code	Type	Definition
0x9D82		LE 15 Trip OP
0x9D84		LE 15 Trip DPO
0x9DC1		LE 16 Trip PKP
0x9DC2		LE 16 Trip OP
0x9DC4		LE 16 Trip DPO
0xA002		Any Alarm
0xA042		Therm Lvl Alrm OP
0xA044		Therm Lvl Alrm DPO
0xA081		Gnd Fault Alrm PKP
0xA082		Gnd Fault Alrm OP
0xA084		Gnd Fault Alrm DPO
0xA141		Under Pwr Alrm PKP
0xA142		Under Pwr Alrm OP
0xA144		Under Pwr Alrm DPO
0xA241		U/CURR Alarm PKP
0xA242		U/CURR Alarm OP
0xA244		U/CURR Alarm DPO
0xA281		UNBAL Alarm PKP
0xA282		UNBAL Alarm OP
0xA284		UNBAL Alarm DPO
0xA2C2		RTD 1 Alarm OP
0xA2C4		RTD 1 Alarm DPO
0xA302		RTD 2 Alarm OP
0xA304		RTD 2 Alarm DPO
0xA342		RTD 3 Alarm OP
0xA344		RTD 3 Alarm DPO
0xA382		RTD 4 Alarm OP
0xA384		RTD 4 Alarm DPO
0xA3C2		RTD 5 Alarm OP
0xA3C4		RTD 5 Alarm DPO
0xA402		RTD 6 Alarm OP
0xA404		RTD 6 Alarm DPO
0xA442		RTD Trouble OP
0xA4C1		LE 1 Alarm PKP
0xA4C2		LE 1 Alarm OP
0xA4C4		LE 1 Alarm DPO
0xA501		LE 2 Alarm PKP
0xA502		LE 2 Alarm OP
0xA504		LE 2 Alarm DPO
0xA541		LE 3 Alarm PKP
0xA542		LE 3 Alarm OP
0xA544		LE 3 Alarm DPO
0xA581		LE 4 Alarm PKP
0xA582		LE 4 Alarm OP
0xA584		LE 4 Alarm DPO
0xA5C1		LE 5 Alarm PKP
0xA5C2		LE 5 Alarm OP

Code	Type	Definition
0xA5C4		LE 5 Alarm DPO
0xA601		LE 6 Alarm PKP
0xA602		LE 6 Alarm OP
0xA604		LE 6 Alarm DPO
0xA641		LE 7 Alarm PKP
0xA642		LE 7 Alarm OP
0xA644		LE 7 Alarm DPO
0xA681		LE 8 Alarm PKP
0xA682		LE 8 Alarm OP
0xA684		LE 8 Alarm DPO
0xA6C2		RTD 7 Alarm OP
0xA6C4		RTD 7 Alarm DPO
0xA702		RTD 8 Alarm OP
0xA704		RTD 8 Alarm DPO
0xA742		RTD 9 Alarm OP
0xA744		RTD 9 Alarm DPO
0xA782		RTD 10 Alarm OP
0xA784		RTD 10 Alarm DPO
0xA7C2		RTD 11 Alarm OP
0xA7C4		RTD 11 Alarm DPO
0xA802		RTD 12 Alarm OP
0xA804		RTD 12 Alarm DPO
0xA982		Motor Run Hrs OP
0xAA01		Welded ContactrPKP
0xAA02		Welded Contactr OP
0xAA04		Welded ContactrDPO
0xAA42		SPD SW Not Cnfg OP
0xAA82		SPD SW Fail OP
0xAB01		Load Incr AlarmPKP
0xAB02		Load Incr Alarm OP
0xAB04		Load Incr Alrm DPO
0xABC1		HI Amb Temp PKP
0xABC2		HI Amb Temp OP
0xABC4		HI Amb Temp DPO
0xAC01		LO Amb Temp PKP
0xAC02		LO Amb Temp OP
0xAC04		LO Amb Temp DPO
0xAC42		Self Test Alarm OP
0xACC2		BKRTrpCntrAlrm OP
0xAD02		R1 CoilMonAlrm OP
0xAD42		R2 CoilMonAlrm OP
0xAD81		BKR1 Fail Alrm PKP
0xAD82		BKR1 Fail Alrm OP
0xADC2		BKR Stat Fail OP
0xAF81		Fuse Fail Alrm PKP
0xAF82		Fuse Fail Alrm OP
0xAF84		Fuse Fail Alrm DPO

Code	Type	Definition
0xAFC2		Ph Revrsl Alarm OP
0xAFC4		Ph Revrsl Alarm DPO
0xB041		Ntrl IOC1 Alrm PKP
0xB042		Ntrl IOC1 Alrm OP
0xB044		Ntrl IOC1 Alrm DPO
0xB342		NtrlDir RevAlm OP
0xB344		NtrlDir RevAlmDPO
0xB3C1		NegSeq OV Alrm PKP
0xB3C2		NegSeq OV Alrm OP
0xB3C4		NegSeq OV Alrm DPO
0xB441		Ph OV1 Alarm PKP
0xB442		Ph OV1 Alarm OP
0xB444		Ph OV1 Alarm DPO
0xB449		Ph A OV1 Alarm PKP
0xB44A		Ph A OV1 Alarm OP
0xB44C		Ph A OV1 Alarm DPO
0xB451		Ph B OV1 Alarm PKP
0xB452		Ph B OV1 Alarm OP
0xB454		Ph B OV1 Alarm DPO
0xB461		Ph C OV1 Alarm PKP
0xB462		Ph C OV1 Alarm OP
0xB464		Ph C OV1 Alarm DPO
0xB481		Ph UV1 Alarm PKP
0xB482		Ph UV1 Alarm OP
0xB484		Ph UV1 Alarm DPO
0xB489		Ph A UV1 Alarm PKP
0xB48A		Ph A UV1 Alarm OP
0xB48C		Ph A UV1 Alarm DPO
0xB491		Ph B UV1 Alarm PKP
0xB492		Ph B UV1 Alarm OP
0xB494		Ph B UV1 Alarm DPO
0xB4A1		Ph C UV1 Alarm PKP
0xB4A2		Ph C UV1 Alarm OP
0xB4A4		Ph C UV1 Alarm DPO
0xB541		UndrFreq1 Alrm PKP
0xB542		UndrFreq1 Alrm OP
0xB544		UndrFreq1 Alrm DPO
0xB581		UndrFreq2 Alrm PKP
0xB582		UndrFreq2 Alrm OP
0xB584		UndrFreq2 Alrm DPO
0xB5C1		OverFreq1 Alrm PKP
0xB5C2		OverFreq1 Alrm OP
0xB5C4		OverFreq1 Alrm DPO
0xB601		OverFreq2 Alrm PKP
0xB602		OverFreq2 Alrm OP
0xB604		OverFreq2 Alrm DPO
0xB881		Ph OV2 Alarm PKP

Code	Type	Definition
0xB882		Ph OV2 Alarm OP
0xB884		Ph OV2 Alarm DPO
0xB889		Ph A OV2 Alarm PKP
0xB88A		Ph A OV2 Alarm OP
0xB88C		Ph A OV2 Alarm DPO
0xB891		Ph B OV2 Alarm PKP
0xB892		Ph B OV2 Alarm OP
0xB894		Ph B OV2 Alarm DPO
0xB8A1		Ph C OV2 Alarm PKP
0xB8A2		Ph C OV2 Alarm OP
0xB8A4		Ph C OV2 Alarm DPO
0xB8C1		Ph UV2 Alarm PKP
0xB8C2		Ph UV2 Alarm OP
0xB8C4		Ph UV2 Alarm DPO
0xB8C9		Ph A UV2 Alarm PKP
0xB8CA		Ph A UV2 Alarm OP
0xB8CC		Ph A UV2 Alarm DPO
0xB8D1		Ph B UV2 Alarm PKP
0xB8D2		Ph B UV2 Alarm OP
0xB8D4		Ph B UV2 Alarm DPO
0xB8E1		Ph C UV2 Alarm PKP
0xB8E2		Ph C UV2 Alarm OP
0xB8E4		Ph C UV2 Alarm DPO
0xB901		S/C Alarm PKP
0xB902		S/C Alarm OP
0xB904		S/C Alarm DPO
0xB941		SPD2 S/C Alarm PKP
0xB942		SPD2 S/C Alarm OP
0xB944		SPD2 S/C Alarm DPO
0xB981		SPD2 U/C Alarm PKP
0xB982		SPD2 U/C Alarm OP
0xB984		SPD2 U/C Alarm DPO
0xBC01		LE 9 Alarm PKP
0xBC02		LE 9 Alarm OP
0xBC04		LE 9 Alarm DPO
0xBC41		LE 10 Alarm PKP
0xBC42		LE 10 Alarm OP
0xBC44		LE 10 Alarm DPO
0xBC81		LE 11 Alarm PKP
0xBC82		LE 11 Alarm OP
0xBC84		LE 11 Alarm DPO
0xBCC1		LE 12 Alarm PKP
0xBCC2		LE 12 Alarm OP
0xBCC4		LE 12 Alarm DPO
0xBD01		LE 13 Alarm PKP
0xBD02		LE 13 Alarm OP
0xBD04		LE 13 Alarm DPO

Code	Type	Definition
0xBD41		LE 14 Alarm PKP
0xBD42		LE 14 Alarm OP
0xBD44		LE 14 Alarm DPO
0xBD81		LE 15 Alarm PKP
0xBD82		LE 15 Alarm OP
0xBD84		LE 15 Alarm DPO
0xBDC1		LE 16 Alarm PKP
0xBDC2		LE 16 Alarm OP
0xBDC4		LE 16 Alarm DPO
0xC002		Any Inhibit
0xC042		Output Relay 3 On
0xC082		Output Relay 4 On
0xC0C2		Output Relay 5 On
0xC102		Output Relay 6 On
0xC142		Self-Test Rly 7 On
0xC182		Output Relay 1 On
0xC1C2		Output Relay 2 On
0xC242		High Speed OP
0xC282		Low Speed OP
0xC3C2		Motor Online
0xC402		Emergency Restart
0xC442		Hot RTD OP
0xC444		Hot RTD DPO
0xC482		Lockout OP
0xC484		Lockout DPO
0xC4C1		LE 1 PKP
0xC4C2		LE 1 OP
0xC4C4		LE 1 DPO
0xC501		LE 2 PKP
0xC502		LE 2 OP
0xC504		LE 2 DPO
0xC541		LE 3 PKP
0xC542		LE 3 OP
0xC544		LE 3 DPO
0xC581		LE 4 PKP
0xC582		LE 4 OP
0xC584		LE 4 DPO
0xC5C1		LE 5 PKP
0xC5C2		LE 5 OP
0xC5C4		LE 5 DPO
0xC601		LE 6 PKP
0xC602		LE 6 OP
0xC604		LE 6 DPO
0xC641		LE 7 PKP
0xC642		LE 7 OP
0xC644		LE 7 DPO
0xC681		LE 8 PKP

Code	Type	Definition
0xC682		LE 8 OP
0xC684		LE 8 DPO
0xC902		Open Breaker
0xC942		Close Breaker
0xCA02		52a Contact OP
0xCA42		52b Contact OP
0xCAC2		L/O Rst Closed
0xCCC2		BKR Stat Open
0xCD02		BKR Stat Clsd
0xCE82		Therm Inhibit OP
0xCEC2		Rstrt Inhibit OP
0xCF02		Start/Hr Inhib OP
0xCF42		T-BT-Strt Inhib OP
0xCF81		Fuse Fail InhibPKP
0xCF82		Fuse Fail Inhib OP
0xCFC2		Ph Rev Inhibit OP
0xCFC4		Ph Rev Inhibit DPO
0xD342		Ntrl Dir Rev OP
0xD344		Ntrl Dir Rev DPO
0xDC01		LE 9 PKP
0xDC02		LE 9 OP
0xDC04		LE 9 DPO
0xDC41		LE 10 PKP
0xDC42		LE 10 OP
0xDC44		LE 10 DPO
0xDC81		LE 11 PKP
0xDC82		LE 11 OP
0xDC84		LE 11 DPO
0xDCC1		LE 12 PKP
0xDCC2		LE 12 OP
0xDCC4		LE 12 DPO
0xDD01		LE 13 PKP
0xDD02		LE 13 OP
0xDD04		LE 13 DPO
0xDD41		LE 14 PKP
0xDD42		LE 14 OP
0xDD44		LE 14 DPO
0xDD81		LE 15 PKP
0xDD82		LE 15 OP
0xDD84		LE 15 DPO
0xDDC1		LE 16 PKP
0xDDC2		LE 16 OP
0xDDC4		LE 16 DPO
0xE002		Any Block
0xE042		Therm O/L Blck
0xE082		Gnd Fault BLK
0xE0C2		Accel BLK

Code	Type	Definition
0xE142		UndrPower BLK
0xE182		Output Relay 1 BLK
0xE1C2		Output Relay 2 BLK
0xE202		Mech Jam BLK
0xE242		U/CURR BLK
0xE282		UNBAL BLK
0xE2C2		RTD1 BLK OP
0xE302		RTD2 BLK OP
0xE342		RTD3 BLK OP
0xE382		RTD4 BLK OP
0xE3C2		RTD5 BLK OP
0xE402		RTD6 BLK OP
0xE442		RTDTrouble BLK OP
0xE6C2		RTD7 BLK OP
0xE702		RTD8 BLK OP
0xE742		RTD9 BLK OP
0xE782		RTD10 BLK OP
0xE7C2		RTD11 BLK OP
0xE802		RTD12 BLK OP
0xF042		Ntrl IOC1 Block
0xF342		NTRL DIR Rev Block
0xF3C2		NegSeq OV Block
0xF442		Ph OV1 Block
0xF482		Ph UV1 Block
0xF542		UndrFreq1 Block
0xF582		UndrFreq2 Block
0xF5C2		OverFreq1 Block
0xF602		OverFreq2 Block
0xF882		Ph OV2 Block
0xF8C2		Ph UV2 Block
0xF902		S/C BLK
0xF942		SPD2 S/C BLK
0xF982		SPD2 U/C OP

SR3 IEC 61850 GOOSE details

The 339 firmware supports IEC61850 GOOSE communications.

Portions of the IEC61850 standard not pertaining to GOOSE, are not implemented in the 339 relay.

The 339 relay does not support:

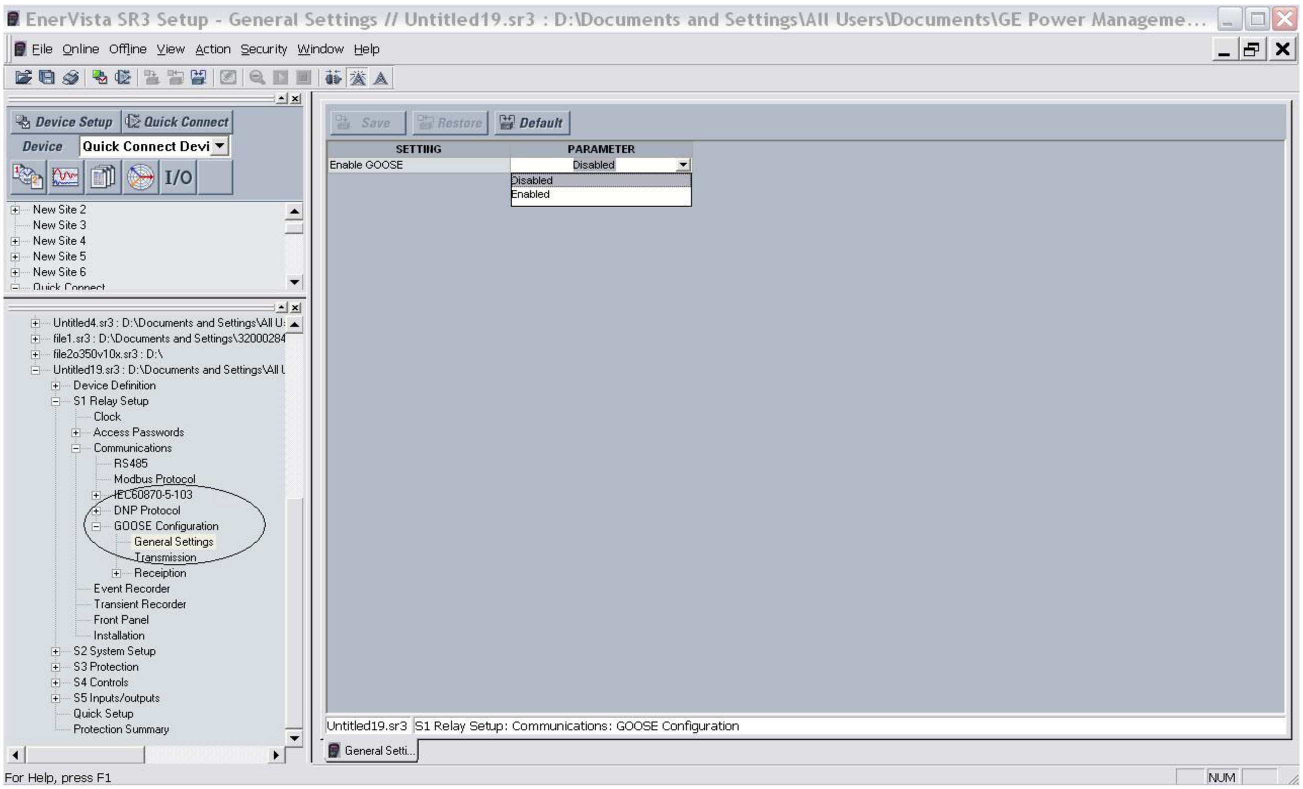
- Manufacturing Message Specification (MMS) standard ISO/IEC 9506
- the mapping of analogue values to data points in data sets in either the transmit or receive direction
- a file system to maintain SCL, ICD or CID files, for IEC61850 GOOSE. As such the implementation stores GOOSE configuration using MODBUS set points.

Configuration of transmission and reception settings for the GOOSE feature are performed using EnerVista SR3 Setup Software.

The 339 firmware accepts GOOSE messages from UR, F650 and UR Plus. The interoperability with other manufacturers will be guaranteed in almost all cases, by implementing the reception side with nested structures (one level of nesting) and all the standard data types.

GOOSE settings changes will take effect only after the 339 relay is re-booted. One setting is available to Enable/Disable both Transmission and Reception. It is possible to change these settings from the Front Panel of the relay.

Figure 6-10: EnerVista SR3 GOOSE General Settings



Event recorder

The Event Recorder runs continuously, capturing and storing the last 256 events. All events are stored in a non-volatile memory where the information is maintained for up to 3 days in case of lost relay control power.

PATH: **SETPOINTS > S1 RELAY SETUP > EVENT RECORDER**

PICKUP EVENTS

Range: Disabled, Enabled

Default: Disabled

When set to "Enabled", the event recorder records the events that occur when a protection element picks up.

DROPOUT EVENTS

Range: Disabled, Enabled

Default: Disabled

When set to "Enabled" the event recorder records the dropout state of a protection element.

TRIP EVENTS

Range: Disabled, Enabled
Default: Enabled

The trip events include all programmed relay elements set to trip the breaker. The text "TRIP" followed by the name of the operated element is recorded.

ALARM EVENTS

Range: Disabled, Enabled
Default: Enabled

These events include the elements programmed as an "ALARM" or "LATCHED ALARM" function, which detect power system conditions considered as an alarm.

CONTROL EVENTS

Range: Disabled, Enabled
Default: Enabled

If set to "Enabled", the event recorder records events caused by the performance of the programmed control elements.

CONTACT INPUTS

Range: Disabled, Enabled
Default: Enabled

When set to "Enabled", the event recorder will record the event, when a contact input changes its state.

LOGIC ELEMENT

Range: Disabled, Enabled
Default: Enabled

When set to "Enabled", the event recorder records the events, which occur upon state change of any programmed logic element.

VIRTUAL INPUTS

Range: Disabled, Enabled
Default: Enabled

When set to "Enabled", the event recorder records the events, which occur upon state changes of any virtual input.

REMOTE INPUTS

Range: Disabled, Enabled
Default: Enabled

When set to "Enabled", the event recorder records the events, which occur upon state change of any programmed remote input.

Transient recorder

The Transient Recorder contains waveforms captured at the same sampling rate as the other relay data at the point of trigger. By default, data is captured for the analog current and voltage inputs - Ia, Ib, Ic, Ig, Va, Vb, Vc, and Vx when relay is ordered with CTs and VTs, or only analog current inputs Ia, Ib, Ic, and Ig when relay is ordered without VTs. Triggering of the transient recorder occurs, when an event is detected, causing a pickup, trip, dropout, or alarm, any one of which has been "Enabled" to activate the trigger. The transient recorder trigger may also be activated when any of the selected trigger inputs 1 to 3 is detected as having "On" status.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S1 RELAY SETUP > TRANSIENT RECDR**

BUFFER SETUP

Range: 1 x 192, 3 x 64, 6 x 32

Default: 3 x 64

Each selection from the range is expressed by two numbers; the first identifies the number of records, whereas the second stands for the number of cycles per record.

TRIGGER MODE

Range: Overwrite, Protected

Default: Overwrite

When the “Overwrite” setting is selected, the new records overwrite the old ones, meaning the relay will always keep the newest records. In “Protected” mode, the relay will keep the number of records corresponding to the selected number, only without overwriting.

TRIGGER POSITION

Range: 0 to 100% in steps of 1%

Default: 0%

This setting indicates the location of the trigger with respect to the selected length of record. For example at 20% selected trigger position, the length of each record will be split on 20% pre-trigger data, and 80% post-trigger data.

TRIGGER ON PKP

Range: Off, On

Default: Off

Selection of “Yes” setting enables triggering for the recorder upon Pickup condition detected from any protection or control element.

TRIGGER ON DPO

Range: Off, On

Default: Off

Selection of “Yes” setting enables triggering for the recorder upon a Dropout condition detected from any protection or control element.

TRIGGER ON TRIP

Range: Off, On

Default: Off

Selection of “Yes” setting enables triggering for the recorder upon Trip condition detected from any protection or control element.

TRIGGER ON ALARM

Range: Off, On

Default: Off

Selection of “Yes” setting enables triggering for the recorder upon Alarm condition detected from any protection or control element.

TRIGGER ON INPUT 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Selection of input or logic element from the settings range enables triggering input for the recorder. A record will be triggered if the status of the selected input changes to “On”.

Datalogger

The following setpoints are available:

SAMPLE RATE

Range: 1 cycle, 1 second, 1 minute, 1 hour

Default: 1 second

Determines how often data is stored in the data log.

CONTINUOUS MODE

Range: Disabled, Enabled

Default: Disabled

Determines whether or not the trigger data is overwritten with new data. Enabled will overwrite the previous trigger data with new trigger data. When Disabled, the data log will run until filled with 256 samples. Continuous Mode should be used when the data is stored externally by a polling system. The sample rate should be chosen to match the poll rate of the external program.

TRIGGER POSITION

Range: 0 to 100% steps of 1%

Default: 25%

Percentage of the sample buffer used for pretrigger samples.

TRIGGER SOURCE

Range: Command, Logic Element 1 to 8, Any Trip Pickup, Any Trip, Any Trip Dropout, Any Alarm Pickup, Any Alarm, Any Alarm Dropout, Any Inhibit

Default: Command

Selects a trigger source. Command is always active. Logic Elements can be used to create combinations of trigger sources.

CHANNEL 1 SOURCE

Range: Disabled, Phase A Current, Phase B Current, Phase C Current, Average Phase Current, Motor Load, Current Unbalance, Ground Current, System Frequency, Vab, Vbc, Vca, Van, Vbn, Vcn, Power Factor, Real Power (kW), Reactive Power (kvar), Apparent Power (kVA), Positive Watthours, Positive Varhours, Hottest Stator RTD, Thermal Capacity Used, RTD #1, RTD #2, RTD #3, RTD #4, RTD #5, RTD #6, RTD #7, RTD #8, RTD #9, RTD #10, RTD #11, RTD #12

Default: Disabled

Selects the data to be stored for each sample of the data log channel.

NOTE

Sources and Defaults for Channels 2 to 10 are the same as those for Channel 1.

Front panel

The user can send a message to the display, that will override any normal message by sending text through Modbus. Refer to the *339 Feeder Protection System Communications Guide* for register details.

PATH: **SETPOINTS > S1 RELAY SETUP > FRONT PANEL**

FLASH MESSAGE TIME

Range: 1 s to 65535 s

Default: 5 s

Flash messages are status, warning, error, or information messages displayed for several seconds in response to certain key presses during setting programming. These messages override any normal messages. The duration of a flash message on the display can be changed to accommodate different reading rates.

MESSAGE TIMEOUT

Range: 1 s to 65535 s

Default: 30 s

If the keypad is inactive for a period of time, the relay automatically reverts to a default message. The inactivity time is modified via this setting to ensure messages remain on the screen long enough during programming or reading of actual values.

SCREEN SAVER

Range: Off, 1 min to 10000 min

Default: Off

The life of the LCD backlight can be prolonged by enabling the Screen Saver mode.

If the keypad is inactive for the selected period of time, the relay automatically shuts off the LCD screen. Any activity (keypress, alarm, trip, or target message) will restore screen messages.

LED STOPPED COLOR

Range: None, Red, Green, Orange

Default: Red

Allows the user to select the color of the LED indicator for Motor Stopped status.

LED STARTING COLOR

Range: None, Red, Green, Orange

Default: Orange

Allows the user to select the color of the LED indicator for Motor Starting status.

LED RUNNING COLOR

Range: None, Red, Green, Orange

Default: Green

Allows the user to select the color of the LED indicator for Motor Running status.

Installation

PATH: **SETPOINTS > S1 RELAY SETUP > INSTALLATION**

RELAY NAME

Range: Motor Name, Alpha-numeric (18 characters)

Default: Motor Name

The RELAY NAME setting allows the user to uniquely identify a relay. This name will appear on generated reports. This name is also used to identify specific devices which are engaged in automatically sending/receiving data over the communications channel.

RELAY STATUS

Range: Not Ready, Ready

Default: Not Ready

Allows the user to activate/deactivate the relay. The relay is not operational when set to "Not Ready."

VALIDATE RMIO

Range: Yes, No

Default: No

The 339 relay allows remote metering and programming for up to 12 RTDs via a .CANBUS-based RMIO module. Refer to *Chapter 2 - RMIO Installation* for details. The 339 will automatically detect the installed RMIO cards when the relay is booted, at which time the user must send a YES command to validate the RMIO. Otherwise the 339 relay will issue a RMIO MISMATCH self-test error. It is recommended to power cycle the 339 after validating the RMIO module.

Preset statistics

These commands can be used to preset the motor statistic data on new installations or existing installations where new equipment has been installed.

PATH: **SETPOINTS > S1 RELAY SETUP > PRESET STATISTICS**

SET MOTOR STARTS

Range: 0 to 50000 in steps of 1

Default: 0

This command presets the number of motor starts.

SET EMERG RESTARTS

Range: 0 to 50000 in steps of 1

Default: 0

This command presets the number of motor emergency restarts.

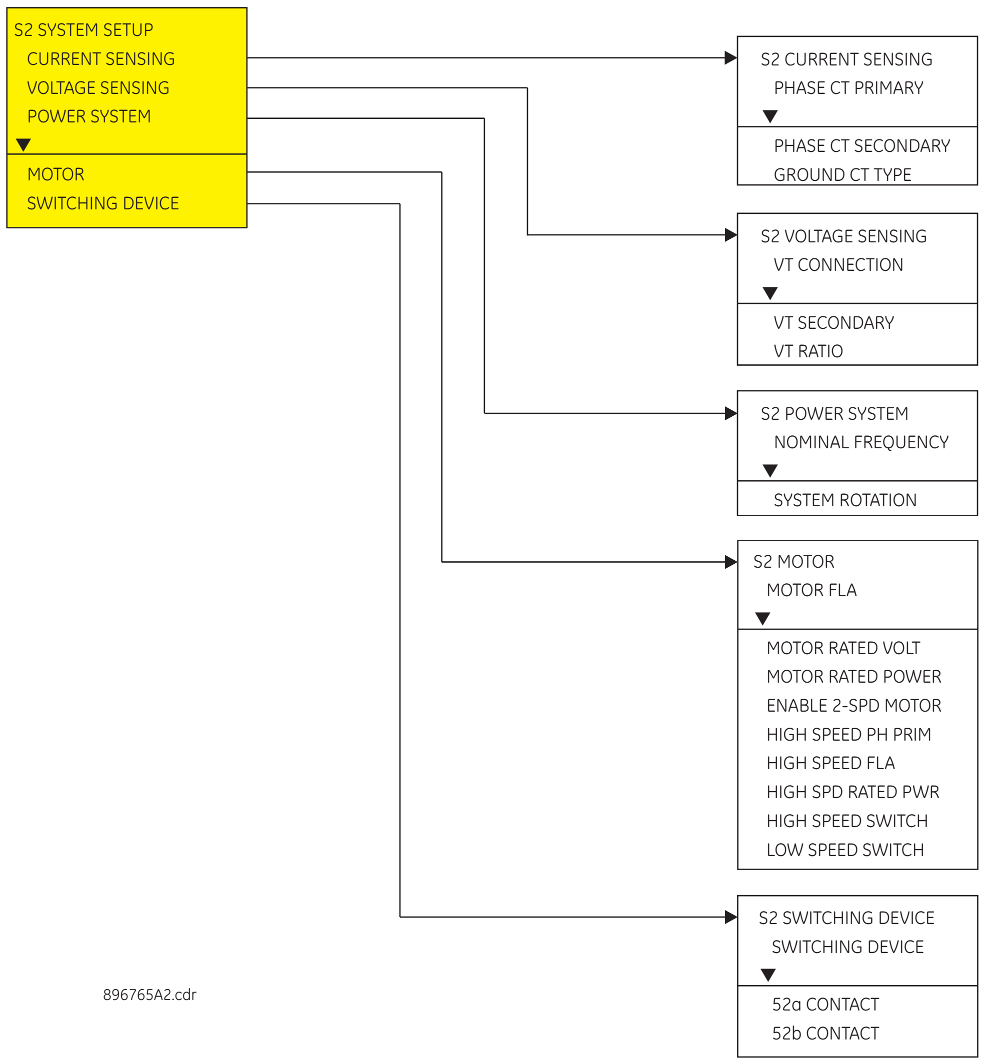
SET RUNNING HOURS

Range: 0 to 65535 in steps of 1

Default: 0

This command presets the value of motor running hours.

S2 System Setup



Current sensing

NOTE

The CT secondary value of 1 or 5 A must be specified at the time of order so that the proper hardware is installed.

NOTE

The setting GROUND CT PRIMARY is seen only if the GROUND CT TYPE is set to “1A Secondary” or “5A Secondary”.

PATH: SETPOINTS > S2 SYSTEM SETUP > CURRENT SENSING

PHASE CT PRIMARY

Range: 30 to 1500 A in steps of 1 A

Default: 100 A

The phase CT should be chosen so that the FLA is no less than 50% of the rated phase CT primary. Ideally, the phase CT primary should be chosen so that the FLA is 100% of the phase CT primary or slightly less; never more.

PHASE CT SECONDARY

Range: 1 A or 5 A

Default: 5 A

Configurable 1 A or 5 A secondary, available with Phase Current option 'P0' installed. Enter the rated phase CT secondary current of the three-phase current transformers.

GROUND CT TYPE

Range: 50:0.025, 1A Secondary, 5A Secondary, None

Default: 50:0.025

Depending on this setting, the current measured by the Ground Fault Protection element can be either the Core Balance CT current or the fourth CT input current.

The 339 has an isolating transformer with 1A or 5A Ground CT terminals and CBCT 50:0.025 terminals. Only one ground CT input tap should be used on a given unit. There are no internal ground connections on the ground current inputs.

For high-resistance grounded systems, sensitive ground current detection is possible if the Core Balance CT (CBCT) 50:0.025 is used. For example, in mining applications where earth leakage current must be measured for personnel safety, primary ground current as low as 0.25A may be detected with the GE Multilin 50:0.025 CT. For these applications, select the setting GROUND CT TYPE as "50:0.025".

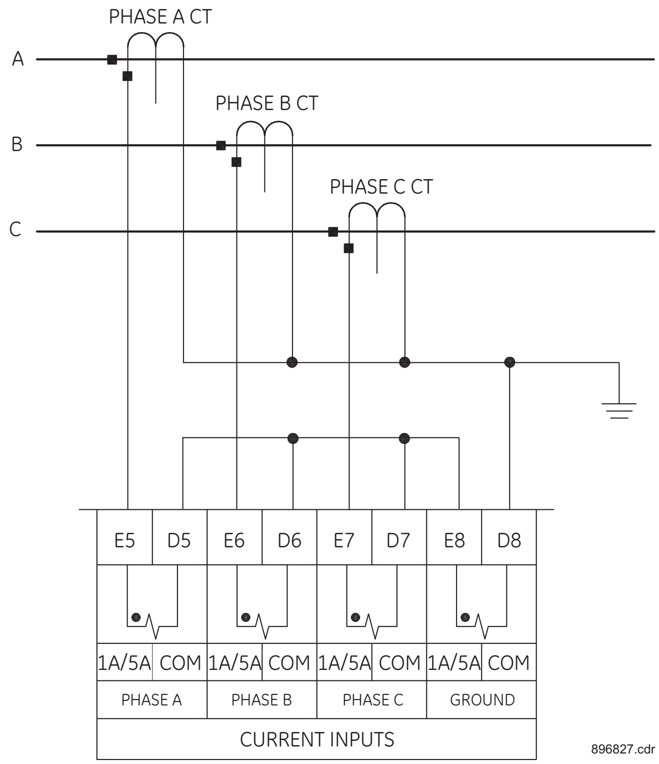
For solid or low-resistance grounded systems where fault currents may be quite large, ground sensing is possible with a zero-sequence CT or residually connected phase CTs as shown in the figure below. For these applications, select the setting GROUND CT TYPE as "1A secondary" or "5A secondary". If the connection is residual, the Ground CT secondary and primary values should be set the same as those of the Phase CT. If however, the connection is zero-sequence CT, the Ground CT secondary and primary values must be entered as per the selected CT. The Ground CT should be selected such that the 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.

GROUND CT PRIMARY

Range: 30 TO 1500 A in steps of 1 A

Default: 100 A

Set the Ground CT primary when the setting GROUND CT TYPE is selected as "1A secondary" or "5A secondary".



Voltage sensing

PATH: SETPOINTS > S2 SYSTEM SETUP > VOLTAGE SENSING

VT CONNECTION

Range: Wye, Delta

Default: Wye

The 339 339 provides three-phase VT inputs. Select "Wye" connection, if phase-neutral voltages are wired to the relay VT terminals. Select "Delta" connection, if phase-phase voltages from Delta VT are connected to the three-phase VT terminals. See the VT connections per the *Typical Wiring Diagram* in *Chapter 2*.

VT SECONDARY

Range: 50 V to 240 V

Default: 120 V

This setting defines the voltage across the VT secondary winding when nominal voltage is applied to the primary. On a source of 13.8kV line-line voltage, with a VT ratio of 14400:120 V delta connection, the voltage to be entered is "115 V". For a Wye connection, the voltage to be entered is $115/\sqrt{3} = 66$ V.

VT RATIO

Range: 1:1 to 300:1

Default: 1:1

This setting defines the VT primary to secondary turns ratio. For a 14400: 120 VT, the entry would be "120:1" (14400/120 = 120).

Power system

PATH: **SETPOINTS > S2 SYSTEM SETUP > POWER SYSTEM**

NOMINAL FREQUENCY

Range: 60 Hz, 50 Hz

Default: 60 Hz

Enter the nominal power system frequency. This value is used as a default to set the optimal digital sampling rate.

SYSTEM ROTATION

Range: ABC, ACB,

Default: ABC

Enter the phase sequence of the power system.

Motor

MOTOR FLA

Range: 15.0 to 1500.0 A in steps of 0.1 A

Default: 100 A

This setting is used to specify the Full Load Amp for normal (Low) Speed.

MOTOR RATED VOLT

Range: 100 to 20000 VAC in steps of 1 V

Default: 3000 V

This setting is used to specify the Rated Voltage of the motor.

MOTOR RATED POWER

Range: 100 to 10000 kW in steps of 1 kW

Default: 3000 kW

This setting is used to specify the Rated Power of the motor at normal (Low) speed.

ENABLE 2-SPD MOTOR

Range: Disabled, Enabled

Default: Disabled

This setting is used to enable two-speed motor functionality. When this setting is selected as Disabled, all two-speed motor functionalities will be disabled, and all other two-speed motor related settings are hidden.

HI SPEED PRIM

30 to 1500 A in steps of 1 A

Default: 100 A

This setting is used to specify the Phase CT primary for High Speed.

HIGH SPEED FLA

Range: 15.0 to 1500.0 A in steps of 0.1 A

Default: 100.0 A

This setting is used to specify the Full Load Amp for High Speed.

HIGH SPEED RATED PWR

Range: 100 to 10000 kW in steps of 1 kW

Default: 3000 kW

This setting is used to specify the rated power for High Speed.

HIGH SPEED SWITCH

Range: Off, Contact Input 1 to 10, Virtual Input 1 through 32, Logic element 1 through 16, Remote Input 1 to 32

Default: Off

For use in two speed motor applications only, to monitor the high speed contactor position. The status of this switch is used by the relay to select between the normal settings used for low speed operation and the high speed settings, and to ensure that in high speed operation the relay maintains running status when current draw is very low. Use a form-a (normally open) auxiliary contact of the high speed (speed 2) contactor.

LOW SPEED SWITCH

Range: Off, Contact Input 1 to 10, Virtual Input 1 through 32, Logic element 1 through 16, Remote Input 1 to 32

Default: Off

For use in two speed motor applications only, to monitor the low speed contactor position. The status of this switch is used by the relay to ensure that in low speed operation the relay maintains running status when current draw is very low. Use a form-a (normally open) auxiliary contact of the low speed (speed 1) contactor.

Switching device

52a CONTACT

Range: Disabled, Enabled

Default: Disabled

The 52a contact function is permanently assigned to contact input number 1. It in single-speed applications, when enabled, closure of this contact informs the relay that the motor is connected to the line (online) and therefore the motor is running. It is recommended that this contact be connected to a form-a (normally open) auxiliary contact of the breaker/contactor, to ensure the relay maintains running status when motor current draw is very low. The 52b contact (see below) has the same function, and is for use when only a form-b (normally closed) auxiliary contact is available.

In two-speed applications, this contact is intended for monitoring the circuit breaker where there is a circuit breaker as well as a high speed contactor and a low speed contactor. When enabled and closed, and when one of the contactors is closed, the relay maintains running status even when the motor current is very small.

52b CONTACT

Range: Disabled, Enabled

Default: Disabled

The 52b contact function is permanently assigned to contact input 2. It performs the same function as the 52a contact, but with a form-b (normally closed) rather than a form-a (normally) auxiliary contact of the breaker/contactor.

If both 52a contact and 52b contact are enabled, the relay assumes the motor online if the 52a contact is closed and the 52b contact is open.

S3 Protection

339 protection functions include:

- Thermal Protection
- Short Circuit
- Ground Fault
- Mechanical Jam
- Undercurrent
- Current Unbalance
- Load Increase
- Neutral IOC
- Neutral Directional OC
- RTD Protection
- Phase Undervoltage
- Phase Overvoltage
- Overfrequency
- Underfrequency
- Underpower
- Voltage Phase Reversal
- VT Fuse Fail
- Negative Sequence Overvoltage

Figure 6-11: Main Protection menu - 1 of 2

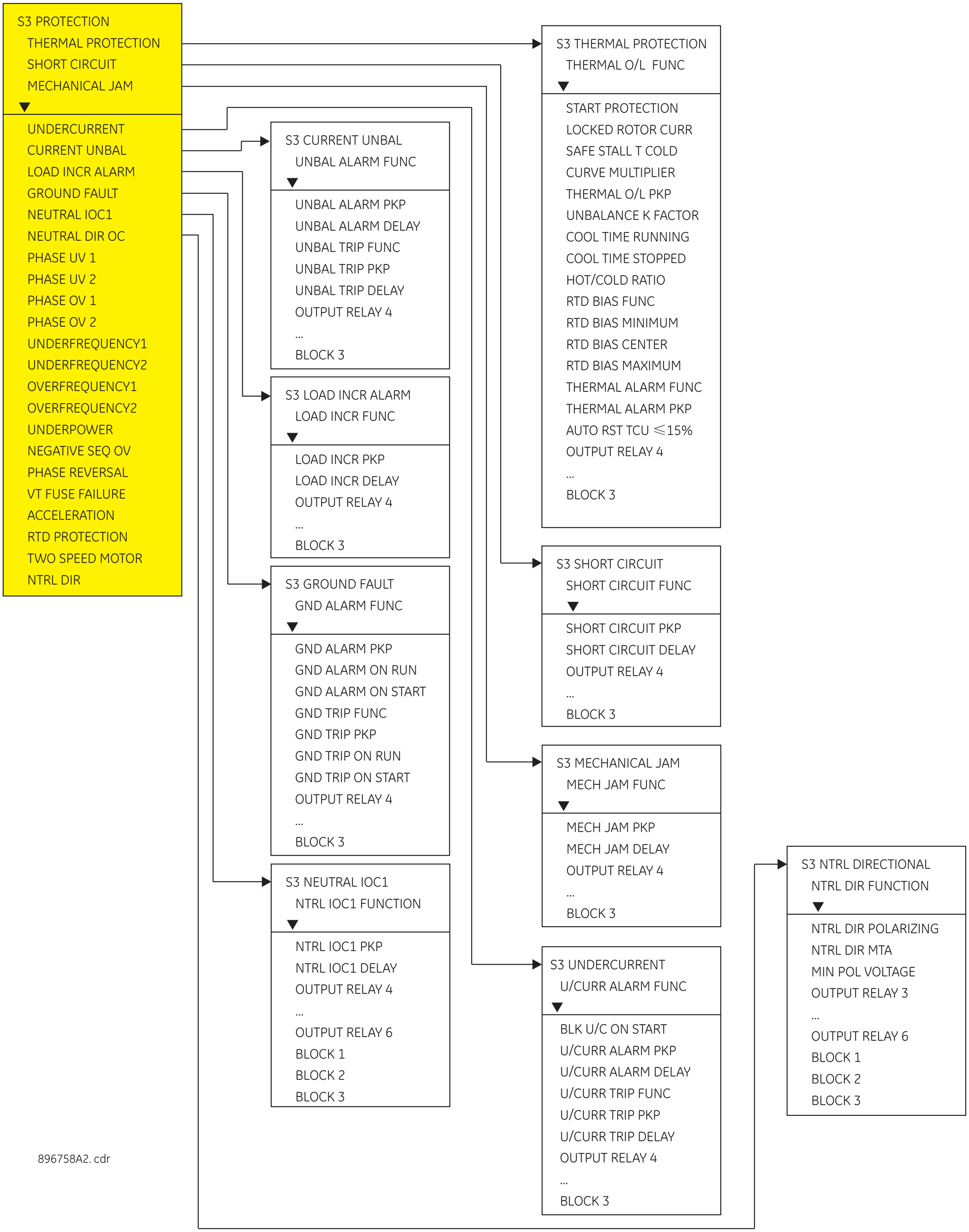
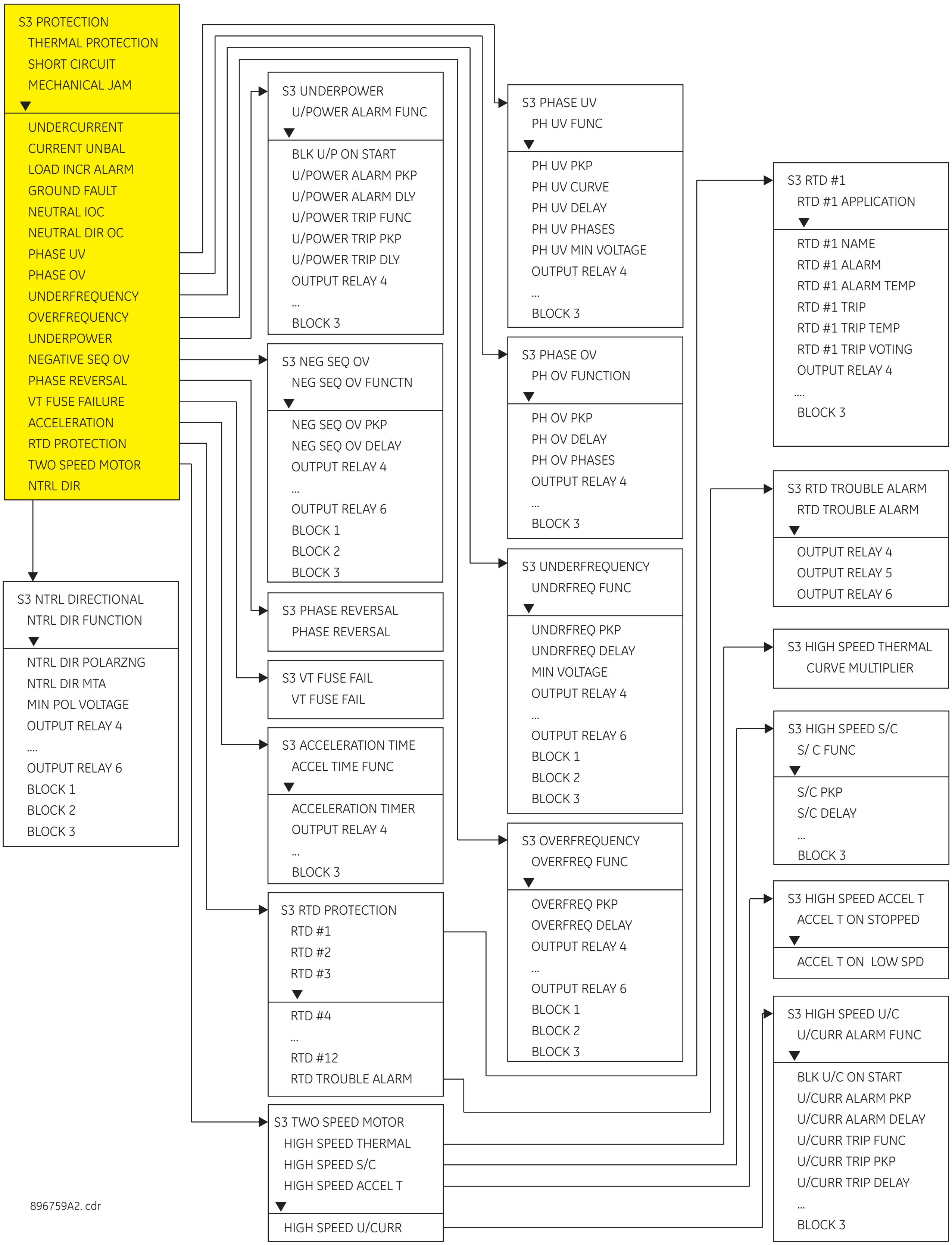


Figure 6-12: Main Protection menu - 2 of 2



Thermal Model

The primary protective function of the 339 motor relay is motor thermal protection.

The 339 thermal protection consists of seven key elements:

- **Start Protection** - accounts for the rapid heating that occurs during starting
- **Unbalance Current Biasing** - accounts for negative sequence heating
- **Hot/Cold Biasing** - accounts for normal temperature rise
- **RTD Biasing** - accounts for ambient variation and cooling problems
- **Cooling Rate** - accounts for heat dissipation
- **Thermal Protection Reset** - controls recovery from thermal trips/lockouts.

Each of these elements is described in detail in the sections that follow.

Total Capacity Used register (TCU)

339 thermal protection integrates stator and rotor heating into one model. The rate of motor heating is gauged primarily by measuring the terminal currents. The present value of the accumulated motor heating is maintained in the Thermal Capacity Used actual value register.

While the motor's equivalent current is greater than the thermal overload pickup setting, the TCU register is updated every 3 cycles using the following equation:

$$TCU_i = TCU_{i-1} + \frac{3 \cdot T_{system}}{Time\ to\ Trip} \times 100\% \qquad \textbf{Eq. 1}$$

where:

Time to Trip = Thermal Overload Trip Time in seconds, calculated from the thermal overload curve when running, or from the start protection when starting. The thermal overload curve and the start protection are described in the corresponding sections below.

T_{system} = the period in seconds corresponding to the nominal power system frequency.

The 339 thermal protection addresses the two distinct parts of the thermal limit curve: the motor starting limit, and the running limit. The start protection determines Time to Trip during motor starting, and the thermal overload curve determines Time to Trip during motor running.

When the motor is in overload, the motor's temperature and the Thermal Capacity Used will be rising. When the thermal capacity used reaches 100%, a trip will occur. The thermal overload curve and start protection 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.

When the motor is stopped and is cooling to ambient, the Thermal Capacity Used decays to zero. If the motor is running normally, the motor temperature will eventually stabilize at some steady state temperature, and the Thermal Capacity Used moves up or down to some corresponding intermediate value TCU_{SS}, which accounts for the reduced amount of thermal capacity left to accommodate transient overloads. While the motor's equivalent current is less than the thermal overload pickup setting, the TCU register is updated every 3 cycles using the following equation:

$$TCU_i = TCU_{i-1} + (TCU_{SS} - TCU_{i-1}) \frac{3 \cdot T_{system}}{Cooling\ Time\ Constant} \qquad \textbf{Eq. 2}$$

where:

TCU_{SS} = Steady state TCU corresponding to the running terminal current; zero when stopped, or when running as described in the hot/cold biasing section below.

Cooling Time Constant = The value of the Cool Time Running setting when running, or the value of the Cool Time Stopped setting when stopped, expressed in seconds.

T_{system} = the period in seconds corresponding to the nominal power system frequency

The TCU register value can also be forced to at least equal the RTD bias value as described in the RTD Biasing section below.

In the event of a loss of control power to the relay, the thermal capacity will decay for the duration of the loss of control power based on the stopped motor cooling rate.

$$TCU_{on\ powerup} = TCU_{saved\ on\ power\ down} \times e^{-\frac{\text{Interruption Duration}}{\text{Cool Time Stopped}}} \quad \textbf{Eq. 3}$$

Start protection

If enabled, Start Protection is used to determine the Time to Trip value while the motor status is "starting," using the formula:

$$t(I_{eq}) = t_{LRcold} \times \frac{I_{LR}^{\ 2}}{I_{eq}^{\ 2}} \quad \textbf{Eq. 4}$$

where:

I_{eq} is the equivalent motor heating current in per-unit on an FLA base, which will be discussed in the unbalance biasing section.

I_{LR} is the Locked rotor current in per-unit on an FLA base.

t_{LRCold} is the Safe Stall Time Cold in seconds.

In some applications where the characteristics of the starting thermal damage curve (locked rotor) and the running thermal damage curves fit together very smoothly, the thermal overload curve can in these cases provide both starting and running protection, so start protection is not required. Therefore, the start protection can be disabled or enabled as required. When start protection is disabled, the thermal overload curve determines time to trip during both starting and running.

The start protection is disabled by setting setpoint START PROTECTION to OFF or to any assignable contact input that is off when start protection is not required.

Thermal overload curves

The thermal overload curves can be either standard or customized. The standard overload curves are a series of 15 curves with a common curve shape based on typical motor thermal limit curves. The customized curve (FlexCurve) is used to more closely tailor motor protection to the thermal limits so the motor may be started successfully and used to its full potential without compromising protection.

THERMAL OVERLOAD STANDARD CURVE

If the motor starting times are well within the safe stall times, it is recommended that the 339 standard overload curve be used. The standard overload curves are a series of 15 curves, each a multiple from 1 to 15 of a common curve shape based on typical motor thermal limit curves. The curve gives a **Time to Trip** for the equivalent motor heating current, and incorporates hot/cold biasing, and unbalance biasing.

The standard curve is defined by the following equation, which is graphed and tabulated below. The curve reflects the fact that under overload conditions, heating largely swamps cooling, and that the heating is due primarily to resistive losses in the stator and rotor windings, said losses being proportional to the square of the current.

$$Time\ to\ Trip = \frac{Curve\ Multiplier \times 87.4}{I_{eq}^2 - 1} \quad \textbf{Eq. 5}$$

where:

Time to Trip is the amount of time, in seconds, the relay will take to trip, given that the motor starts cold and the current is constant.

Curve Multiplier is the value of the Curve Multiplier setpoint.

I_{eq} is the equivalent motor heating current per-unit on an FLA base. However, the value of I_{eq} is limited in this equation, to 8.0, in order to prevent the overload from acting as an instantaneous element, and responding to short circuits.

For example, a motor with a stall current (also known as locked rotor current) of 8 times its FLA, with a Curve Multiplier of 7, if stalled from a cold state, would trip in:

$$Time\ to\ Trip = \frac{7 \times 87.4}{8^2 - 1} = 9.71\ \ seconds \qquad \textbf{Eq. 6}$$

This would respect a Safe Stall Time Cold of 10 seconds.

Figure 6-13: Standard Overload Curve Trip Times

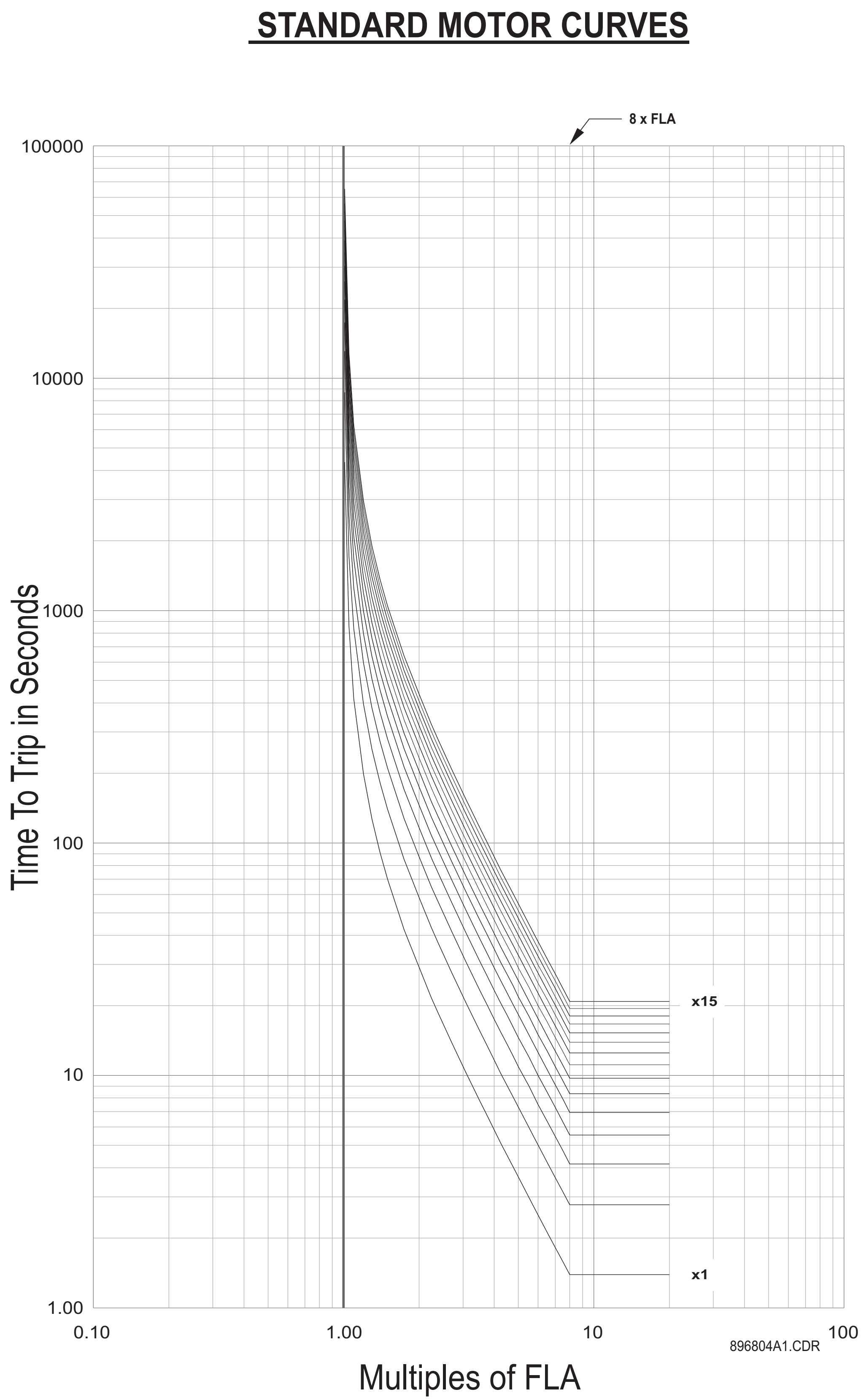


Table 6-1: Standard overload curve trip times (in seconds)

MOTOR CURRENT (× FLA)	STANDARD CURVE MULTIPLIERS														
	× 1	× 2	× 3	× 4	× 5	× 6	× 7	× 8	× 9	× 10	× 11	× 12	× 13	× 14	× 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

MOTOR CURRENT (× FLA)	STANDARD CURVE MULTIPLIERS														
	× 1	× 2	× 3	× 4	× 5	× 6	× 7	× 8	× 9	× 10	× 11	× 12	× 13	× 14	× 15
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
20.00	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

Table 6-2: Conversion Between NEMA Curves and 339 Curve Multiplier

NEMA Curve	Class 10	Class 15	Class 20	Class 30
339 Curve Multiplier	4	6	8	12

UNBALANCE BIASING

Unbalanced phase currents, that is to say negative sequence currents, cause rotor heating in addition to the normal heating caused by positive sequence currents. When the motor is running, the rotor rotates in the direction of the positive-sequence Magnetomotive Force (MMF) wave at near synchronous speed. The induced rotor currents are at a frequency determined by the difference between synchronous speed and rotor speed, typically 2 to 4 Hertz. At these low frequencies the current flows equally in all parts of the rotor bars, right down to the inside portion of the bars at the bottom of the slots. Negative-sequence stator current on the other hand causes an MMF wave with a rotation opposite to rotor rotation, which induces rotor current with a frequency approximately 2 times the line frequency: 100 Hz for a 50 Hz system or 120 Hz for a 60 Hz system. The skin effect at this frequency restricts the rotor current to the outside portion of the bars at the top of the slots, causing a significant increase in rotor resistance and therefore significant additional rotor heating. This extra heating is not accounted for in the thermal limit curves supplied by the motor manufacturer, as these curves assume only positive sequence currents from a perfectly balanced supply and balanced motor construction.

To account for this additional heating, the relay allows for the thermal overload curve to be biased with negative sequence current. This biasing is accomplished by using an equivalent motor heating current rather than the simple motor terminal current (I_{avg}). This equivalent current is calculated according to the equation:

$$I_{eq} = I_{avg}\sqrt{1 + k \cdot \left(I_2 / I_1 \right)^2}$$

Eq. 7

where:

I_{eq} = equivalent motor heating current in per-unit on an FLA base

I_{avg} = average of each motor terminal's RMS current in per-unit on an FLA base I_2 / I_1 = negative sequence to positive sequence current ratio k = value of the Unbalance K Factor setpoint, which is used to adjust the degree of unbalance biasing.

k may be estimated as:

$$k = \frac{175}{I_{LR}^2} \text{ (typical estimate);} \qquad k = \frac{230}{I_{LR}^2} \text{ (conservative estimate)}$$

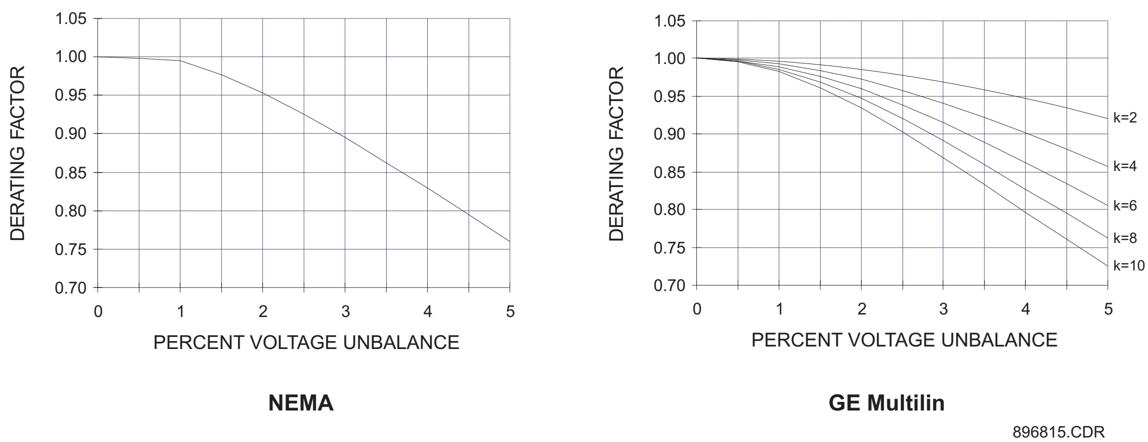
Eq. 8

where I_{LR} is the locked rotor current in per-unit on an FLA base.

If a k value of 0 is entered, the unbalance biasing is defeated and the overload curve will time out against the average per-unit motor current.

The figure below shows the recommended motor derating as a function of voltage unbalance recommended by NEMA (the National Electrical Manufacturers Association). To illustrate this relay's unbalance biasing, assume a typical induction motor with an inrush of 6 x FLA and a negative sequence impedance of 0.167. With this impedance, voltage unbalances of 1, 2, 3, 4, and 5% on the motor terminals will result in current unbalances of 6, 12, 18, 24, and 30% respectively. Based on these assumptions, the derating resulting from this relay's unbalance biasing for different values of k is as illustrated in the GE Multilin curve below. Note that the curve for k = 8 is almost identical to the NEMA derating curve.

Figure 6-14: Motor Derating Factor due to Unbalanced Voltage



HOT/COLD BIASING

When the motor is running with a constant load below the overload level, the motor will eventually reach a steady state temperature, which corresponds to a particular steady state Thermal Capacity Used. As some thermal capacity is used, there is less thermal capacity left in the motor to cover transient overloads than is available when the motor is cold. Typically, the extent of this effect is calculated by taking the ratio of the motor's rated Safe Stall Time Hot to its rated Safe Stall Time Cold. Safe Stall Time (also known as Locked Rotor Time) is the time taken with the rotor not turning, for the motor to heat, at an unacceptable rate, to a temperature beyond which motor damage occurs. "Cold" refers to starting off with the motor at ambient temperature, "Hot" refers to starting off with the motor at the temperature reached when running at rated load. The method used by the thermal overload curve to account for the pre-overload state, is thus known as hot/cold biasing.

The Hot/Cold Ratio setpoint is determined by the equation shown below:

$$HCR = \frac{Safe\ Stall\ Time\ Hot}{Safe\ Stall\ Time\ Cold} \quad \textbf{Eq. 9}$$

where: HCR is the value of the Hot/Cold Ratio setpoint expressed as a fraction of 1.00.

The steady state Thermal Capacity Used is calculated according to the equation:

$$TCU_{ss} = I_{eq} \times (1 - HCR) \times 100\% \quad \textbf{Eq. 10}$$

where: TCU_{SS} is the steady state Thermal Capacity Used expressed as a percentage. I_{eq} is the equivalent motor heating current in per-unit on an FLA base, which was discussed in the unbalance biasing section above.

For example, a motor with a Safe Stall Time Hot of 7 seconds, and a Safe Stall Time Cold of 10 seconds would typically have the Hot/Cold Ratio set to 7/10= 0.70. If the motor current is 0.8 pu, the steady state Thermal Capacity Used is:

$$TCU_{ss} = 0.8 \times (1 - 0.70) \times 100\% = 24\% \quad \textbf{Eq. 11}$$

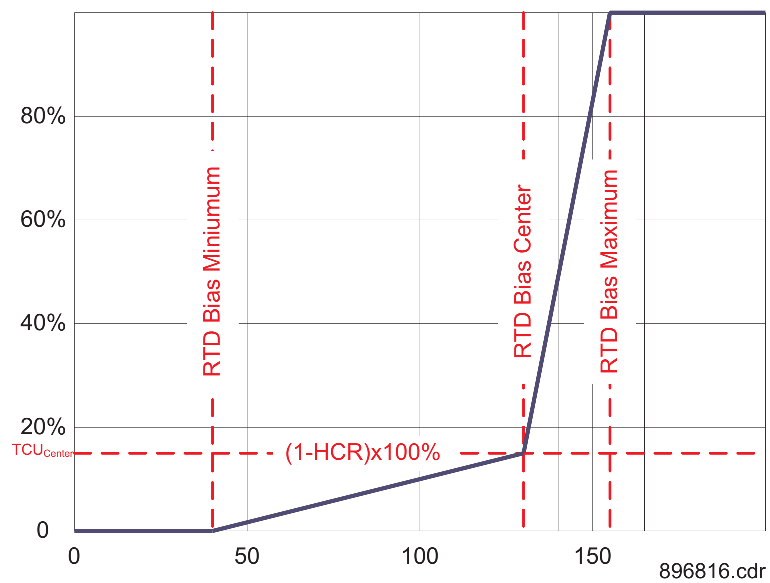
If a Hot/Cold Ratio value of 1 is entered, hot/cold biasing is defeated, and unless RTD biasing is deployed, the thermal overload curve will operate as if the motor was cold pre-overload.

RTD BIASING

The thermal overload curves can operate based solely on measured current and the assumption of rated ambient and normal motor cooling, as described above. However, if the ambient temperature is unusually high, or motor cooling is blocked, the motor will have an un-modelled temperature increase. The RTD biasing feature can correct for this by forcing the Thermal Capacity Used register up to the value appropriate to the temperature of the hottest stator RTD. Since RTDs are relatively slow, the rest of the thermal overload is still required during starting and heavy overload conditions when motor heating is relatively fast. Thus the RTD bias feature does not prevent the Thermal Capacity Used value from rising above the value appropriate to the RTD temperature.

The value of the Thermal Capacity Used register appropriate to the RTD temperature is determined by the straight line segmented curve shown in the figure below. This curve is characterized by minimum, center and maximum temperature setpoints, and by the hot/cold ratio setpoint.

Figure 6-15: RTD bias curve



NOTE

RDT Bias Minimum, RTD Bias Center, RTD Bias Maximum and HCR are setpoints.

If the maximum stator RTD temperature is below the RTD BIAS MINIMUM setting, no biasing occurs. If the maximum stator RTD temperature is above the RTD BIAS MAXIMUM, then the thermal memory is fully biased and THERMAL CAPACITY USED is forced to 100%. At values between the maximum and minimum, the THERMAL CAPACITY USED created by the overload curve is compared to the RTD Bias Thermal Capacity Used determined by the hottest stator RTD temperature.

If the RTD Biased Thermal Capacity Used value is higher than the Thermal Overload Thermal Capacity Used, then that value is used to replace the Thermal Overload Thermal Capacity Used. If the RTD Biased Thermal Capacity is lower than the Thermal Overload Thermal Capacity Used, the Thermal Overload curve does not need to be biased by stator RTD temperature.

Typically, the RTD BIAS MINIMUM is set as 40°C, the RTD BIAS CENTER POINT is set at the rated motor running temperature, and the RTD BIAS MAXIMUM is set at the stator insulation rating or slightly higher.

Eq. 12

$$TCU_{RTDbias} = \begin{cases} 0.00, & \text{RTD Bias Function is OFF} \\ 0.00, & T_{Hottest\ Stator} < T_{Min} \\ TCU_{Center} = (1-HCR)\times 100\%, & T_{Hottest\ Stator} = T_{center} \\ \dfrac{\mathrm{T_{Hottest\ Stator}} - \mathrm{T_{Min}}}{\mathrm{T_{Center}} - \mathrm{T_{Min}}} \times TCU_{Center}, & T_{Min} \le T_{Hottest\ Stator} \le T_{center} \\ \dfrac{\mathrm{T_{Hottest\ Stator}} - \mathrm{T_{Center}}}{\mathrm{T_{Max}} - \mathrm{T_{Center}}} \times (100 - TCU_{Center}) + TCU_{Center}, & T_{Center} \le T_{Hottest\ Stator} \le T_{Max} \\ 1.00, & T_{Hottest\ Stator} > T_{Max} \end{cases}$$

where:

TCU_{Center} – the value of the Thermal Capacity Used register when the hottest stator RTD temperature is equal to the setpoint, RTD Bias – Center T.

$T_{HottestStator}$ – the temperature in degrees Celsius of the hottest RTD that is neither open nor short and is declared to be a stator RTD. If there is no such RTD, use a value of zero.

T_{Min} – the value of the setpoint, RTD Bias – Minimum T.

T_{Center} – the value of the setpoint, RTD Bias – Center T.

T_{Max} – the value of the setpoint, RTD Bias – Maximum T.

$TCU_{RTDbias}$ – the RTD Biased Thermal Capacity determined by the hottest stator RTD temperature.

HCR – the setting HOT/COLD SAFE STALL RATIO

Note that the RTD bias feature alone cannot create a trip. If the RTD bias forces Thermal Capacity Used to 100%, the motor current must be above the overload pickup before an overload trip occurs.

COOLING RATE

The Thermal Capacity Used value decreases exponentially when the motor equivalent current (I_{eq}) is less than the Thermal Overload Pickup setting. This reduction simulates motor cooling. As a stopped motor normally cools significantly slower than a running motor, the relay has two cooling time constant setpoints, one is used when the motor is not in service (stopped, tripped, locked out, etc.), the other is used when the motor is in service (starting, running). The time constant is, in each case, the time in minutes for the motor's temperature to cool by 63% of the difference between the initial temperature and ambient temperature.

Motor cooling is calculated as:

$$TCU = (TCU_{used\_start} - TCU_{used\_end})(e^{-t/\tau}) + TCU_{used\_end}$$

$$TCU_{used-end} = \left(\frac{I_{eq}}{O/L_{\_PKP}}\right)(1-HCR)\times 100\%$$

Eq. 13

where:

TCU_{used_start}: the TCU caused by an overload condition

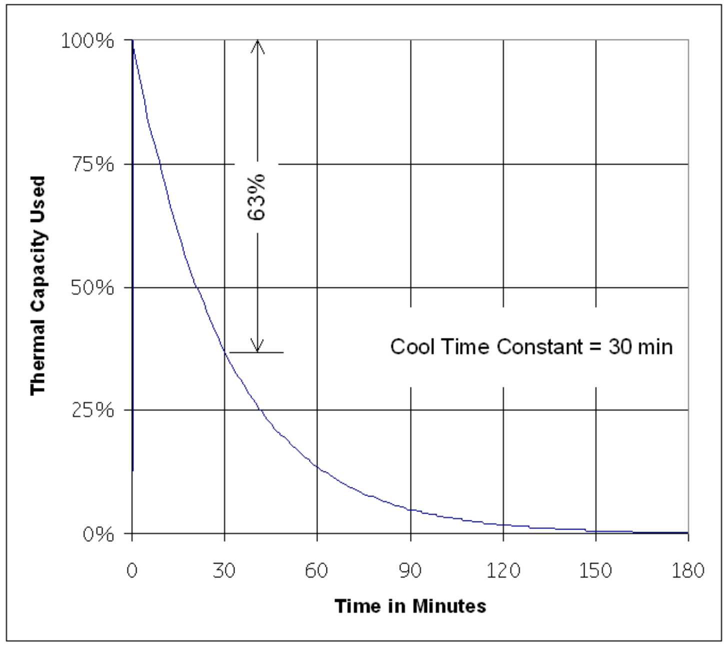
TCU_{used_end}: the TCU dictated by the hot/cold safe stall ratio when the motor is running (=0 when the motor is stopped)

t: time in minutes

τ: Cool Time Constant (running or stopped)

I_{eq}: equivalent motor heating current
$O/L_{\_PKP}$: overload pickup setting as a multiple of FLA
HCR: hot/cold safe stall ratio

Figure 6-16: Thermal Protection Cooling Following a Trip at t = 0



THERMAL PROTECTION RESET

Thermal Protection operation is a serious event, and it consequently results in a lockout that cannot be reset until the motor has cooled, unless an Emergency Restart or a Lockout Reset is used. An Emergency Restart will reset the motor Thermal Capacity Used from its current value to 0% so that a hot motor may be restarted. Note that a Lockout Reset does not reset the Thermal Capacity Used register; if the motor is re-started it may re-trip quickly. Should process interruption concerns overweigh the probable damage to the motor that early starting would create, an Emergency Restart can be issued.

A setpoint AUTO RESET TCU≤15% is available to control whether once the motor has cooled until the Thermal Capacity Used reaches 15% (approximately twice the Cool Time Constant Stopped setting), the lockout is replaced with a trip that can be manually reset, or alternatively the condition is fully reset, allowing immediate re-start.

THERMAL CAPACITY ALARM

A Thermal Capacity Alarm will occur when the Thermal Capacity rises above the programmed THERMAL ALARM PKP level.

Thermal protection setpoints

PATH: SETPOINTS > S3 PROTECTION > THERMAL PROTECTION

THERMAL O/L FUNC

Range: Disabled, Latched Alarm, Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Thermal Overload function. If the operating condition is satisfied when **Trip** is selected as the function, the TRIP output relay will operate, and the “TRIP” LED will be turned on. If **Alarm** is selected, the “ALARM” LED will flash upon Thermal Overload operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the “ALARM” LED will flash upon Thermal Overload operation, and will stay “ON” after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the

Latched Alarm or **Alarm** function is selected. Any assignable output relays can be selected to operate when the Thermal Overload Function is selected as **Latched Alarm**, **Alarm**, or **Trip**.

START PROTECTION

Range: Off, On, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

By setting the START PROTECTION setpoint to OFF, Start Protection can be disabled. Thermal protection will therefore go directly to the running condition and the Thermal Overload Curve will be employed to protect the connected load.

LOCKED ROTOR CURRENT

Range: 2 to 11xFLA in steps of 0.1xFLA

Default: 6xFLA

This is the steady state motor current with the rotor locked, when supplied from a source at rated voltage and frequency.

SAFE STALL T COLD

Range: 1.0 to 600.0 sec in steps of 0.1 sec

Default: 10.0 sec

This setting is given as the Safe Stall Time Cold.

THERMAL O/L CURVE

Range: Standard, FlexCurve

Default: Standard

When FlexCurve is selected, the 339 relay uses motor speed indication to apply FlexCurve A or FlexCurve B. Flex curve A is active when the motor is running at low speed. Flex curve B is active when the motor is running at high speed. If two-speed function is not deployed, only FlexCurve A is active.

CURVE MULTIPLIER

Range: 1 to 15 in steps of 1

Default: 4

Fits the Standard Overload Curve to the thermal characteristics of the protected motor.

THERMAL O/L PKP

Range: 1.01 to 1.25xFLA in steps of 0.01xFLA

Default: 1.01xFLA

The Thermal Overload Pickup setting defines the current level at which the motor is considered to be overloaded. The Overload Curve is cut off at current values below this pickup value. Normally, the Thermal Overload Pickup Setting is set slightly above the motor Service Factor, to account for inherent load measuring errors (CTs and limited relay accuracy). The typical total inaccuracy factor is 8 to 10%; as such, for motors with a thermal capability at rated service factor of 1 or 1.15, the Thermal Overload Pickup level should be set as 1.10 or 1.25, respectively.

The Thermal Capacity Used value decreases exponentially when the motor equivalent current (I_{eq}) is less than the Thermal Overload Pickup setting.

UNBALANCE K FACTOR

Range: 0 to 19 in steps of 1

Default: 0

Sets the degree of unbalance biasing used by the Thermal Overload Curve. Zero disables the unbalance bias.

COOL TIME RUNNING

Range: 1 to 1000 min in steps of 1 min

Default: 15 min

Sets the Cooling Time Constant used by the Thermal Overload Curve when the motor is in service. Enter the time in minutes for the motor to cool by 63% of the difference between the initial and ambient temperature when the motor is running at rated speed.

COOL TIME STOPPED

Range: 1 to 1000 min in steps of 1 min

Default: 30 min

Sets the Cooling Time Constant used by the Thermal Overload Curve when the motor is not in service. Enter the time in minutes for the motor to cool by 63% of the difference between the initial and ambient temperature when the motor is stopped.

HOT/COLD RATIO

Range: 0.01 to 1.00 in steps of 0.01

Default: 0.85

This setpoint controls the Hot/Cold Bias and RTD Bias features. If the safe stall time hot/cold cannot be determined from the motor specification, a typical value of 0.85 is suggested. If a HCR value of 1 is programmed, Hot/Cold Biasing is defeated.

RTD BIAS FUNC

Range: Disabled, Enabled

Default: Disabled

Sets to disable or enable RTD Bias function.

RTD BIAS MINIMUM

Range: 0 to 130°C in steps of 1°C

Default: 40°C

Sets the stator RTD temperature appropriate for a Thermal Capacity Used value of zero. If RTD Bias is to be deployed, enter the rated ambient temperature.

RTD BIAS CENTER

Range: 40 to 155°C in steps of 1°C

Default: 110°C

Sets the stator RTD temperature appropriate for the steady state Thermal Capacity Used at rated full load motor current. If RTD Bias is to be deployed, enter the rated full load motor running temperature.

RTD BIAS MAXIMUM

Range: 130 to 250°C in steps of 1°C

Default: 130°C

Sets the stator RTD temperature appropriate for a Thermal Capacity Used value of 100%. If RTD Bias is to be deployed, enter the stator insulation temperature rating.

THERMAL ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

Sets to enable or disable the Thermal Capacity Alarm function.

THERMAL ALARM PKP

Range: 10% to 100% in steps of 1%

Default: 75%

Sets the amount of the Thermal Capacity Used where the Thermal Capacity Alarm will be issued.

AUTORESET TCU≤15%

Range: Auto, Manual

Default: Manual

If this Setpoint is set to AUTO, an automatic reset of an overload lockout occurs after the Thermal Capacity Used has dropped to 15%. When set to MANUAL, the lockout is replaced with a trip when the motor cools. This trip must be reset by the control panel, a remote contact, or a communication command, before the motor can be restarted.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon Thermal Protection (Start Protection and Thermal Overload Curve) operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4~6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5~6.

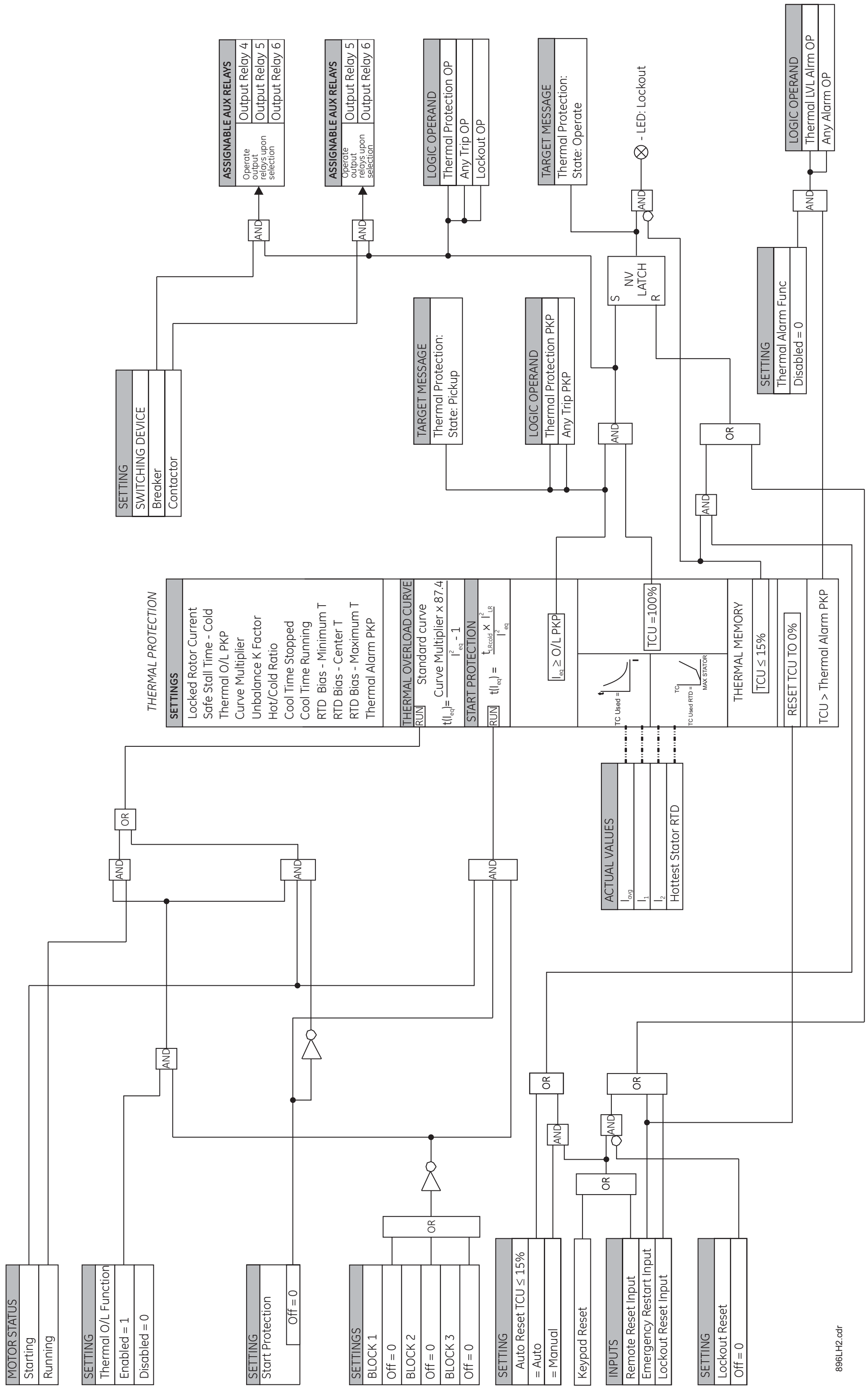
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for Thermal Protection. When any of the selected blocking inputs turns ON, Thermal Protection will be blocked.

Figure 6-17: Thermal Protection logic diagram



Short circuit

If Short Circuit is enabled, a trip or alarm occurs once the magnitude of any phase current exceeds the setting S/C PKP for the time specified by the setting S/C DELAY.

A second independent Short Circuit protection element is provided for High Speed. If two-speed functionality is enabled, the 339 relay relies on the motor speed indication to switch the Short Circuit settings as per the motor running speed, so the main Short Circuit is only active when the motor is running at low speed, and the High Speed Short Circuit is only active when the motor is running at high speed. If two-speed functionality is not deployed, only the main Short Circuit is active, and the High Speed Short Circuit is disabled.

Short Circuit operation is a serious event, and therefore results in a lockout that cannot be reset unless an Emergency Restart or a Lockout Reset is issued.

NOTE

Warning: 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, the function of this feature should not be programmed as TRIP. Alternatively, this feature may be programmed as ALARM or LATCHED ALARM and assigned to an auxiliary relay connected to an upstream device which is capable of breaking the fault current.

PATH: SETPOINTS > S3 PROTECTION > SHORT CIRCUIT

S/C FUNC

Range: Disabled, Latched Alarm, Alarm, Trip
Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Short Circuit function. If the operating condition is satisfied when **Trip** is selected as the function, the "LOCKOUT" LED will be turned on, and the logic operand ANY TRIP OP will be asserted, which in turn will operate the "TRIP" LED and trip output relay. If **Alarm** is selected, the "ALARM" LED will flash upon Short Circuit operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon Short Circuit operation, and will stay "ON" after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting S/C FUNC is selected as **Latched Alarm**, **Alarm**, or **Trip**.

S/C PKP

Range: 1.00 to 20.00xCT in steps of 0.01xCT
Default: 6.00xCT

This setting specifies a pickup threshold for the Short Circuit.

S/C DELAY

Range: 0.00 to 60.00 s in steps of 0.01 s
Default: 0.00 s

This setting specifies a time delay for the Short Circuit.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate
Default: Do not operate

Any assignable output relay can be selected to operate upon Short Circuit operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

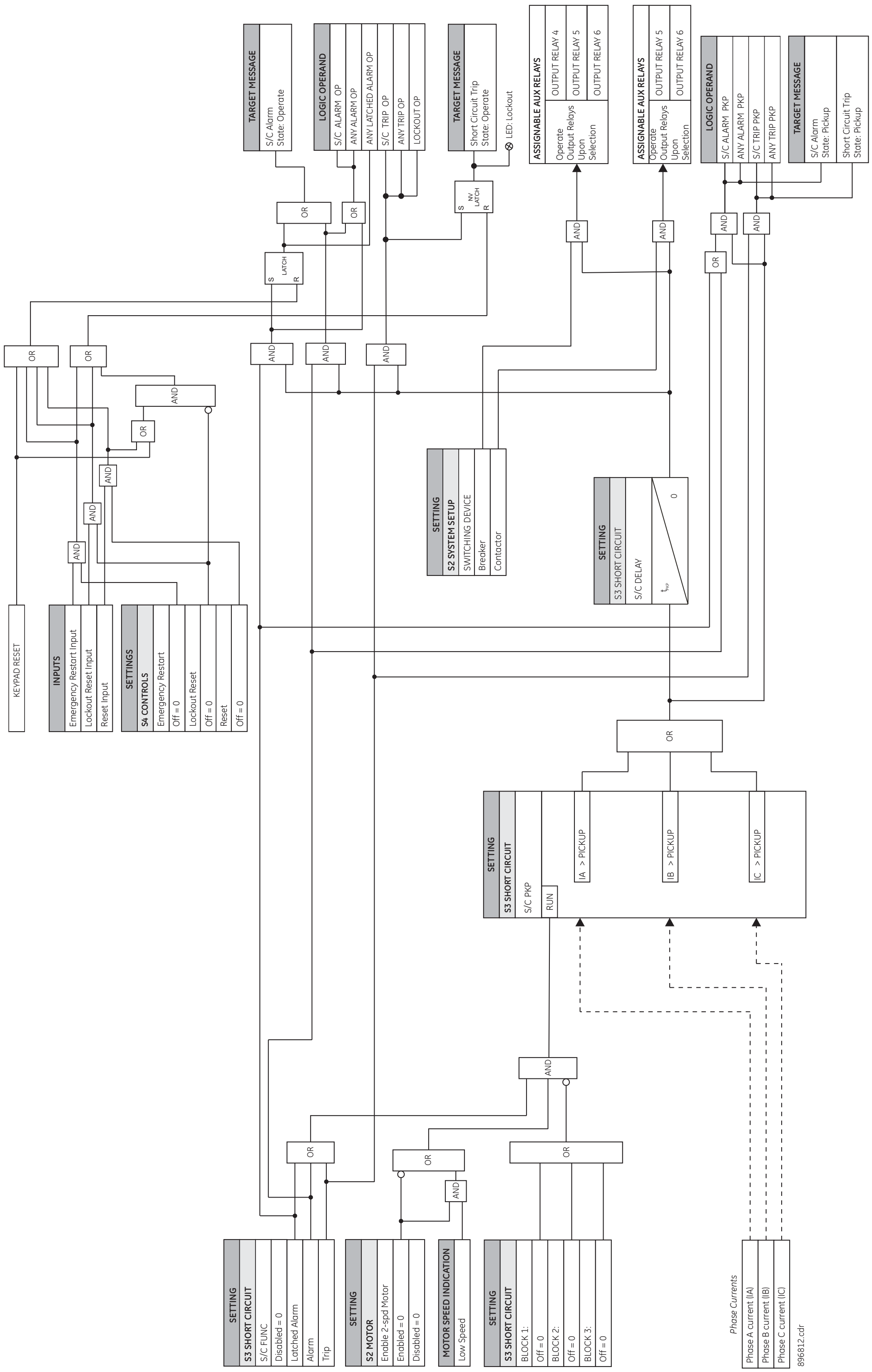
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Short Circuit feature. When any of the selected blocking inputs is on, the Short Circuit function is blocked.

Figure 6-18: Short Circuit logic diagram



Mechanical Jam

A motor load can become constrained (mechanical jam) during starting or running. The starting current magnitude alone cannot provide a definitive indication of a mechanical jam, so the starting load jams are detected by monitoring acceleration time and speed. However, the running current magnitude can indicate load jams. Therefore, the Mechanical Jam element is specially designed to operate for running load jams. After a motor has started and reached the running state, a trip or alarm occurs should the magnitude of any phase current exceed the setting MECH JAM PKP for a period of time specified by the setting MECH JAM DELAY. The thermal protection element will also operate during mechanical jams but after a delay when the thermal capacity reaches 100%. Not only does the Mechanical Jam protect the motor by taking it off-line quicker than the thermal protection, it may also prevent or limit damage to the driven equipment in the event of a locked rotor during running.

The Mechanical Jam is armed as long as the motor status is not STARTING. When two-speed functionality is deployed, the 339 will block Mechanical Jam Protection during the acceleration time from Low Speed to High Speed until the motor current has dropped below overload pickup level. At that point of time when the motor reached the high speed running stage, the Mechanical Jam will be enabled with the High Speed FLA.

The MECH JAM PKP level should be set higher than motor loading during normal operation, but lower than the motor stall level. Normally the delay is set to the minimum time delay or set so that no nuisance trips occur due to momentary load fluctuations.

Mechanical Jam operation is a serious event, and therefore results in a lockout that cannot be reset unless an Emergency Restart or a Lockout Reset is issued.

PATH: **SETPOINTS > S3 PROTECTION > MECHANICAL JAM**

MECH JAM FUNC

Range: Disabled, Latched Alarm, Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Mechanical Jam function. If the operating condition is satisfied when **Trip** is selected as the function, the "LOCKOUT" LED will be turned on, and the logic operand ANY TRIP OP will be asserted, which in turn will activate the "TRIP" LED and operate the "Trip" output relay. If **Alarm** is selected, the "ALARM" LED will flash upon Mechanical Jam operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon Mechanical Jam operation, and will stay "ON" after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting MECH JAM FUNC is selected as **Latched Alarm**, **Alarm**, or **Trip**.

MECH JAM PKP

Range: 1.01 to 4.50xFLA in steps of 0.01xFLA

Default: 4.00xFLA

This setting defines the excessive current condition that identifies a mechanical jam. As the element is not armed during motor starting, this threshold can be set below the starting current.

MECH JAM DELAY

Range: 0.00 to 30.00 s in steps of 0.01 s

Default: 0.00 s

This setting specifies the pickup delay for the Mechanical Jam.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Mechanical Jam operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

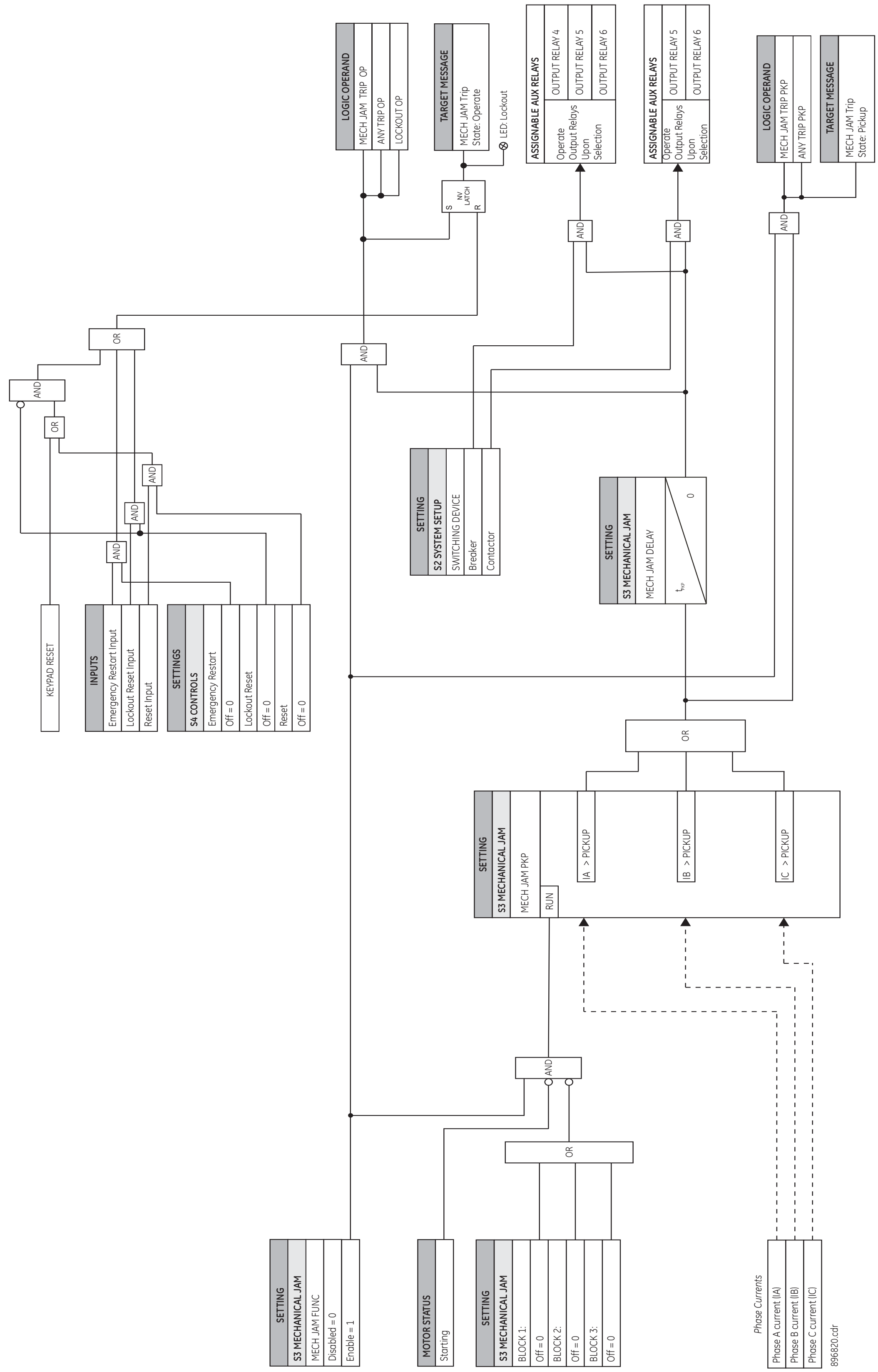
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Mechanical Jam feature. When any of the selected blocking inputs is on, the Mechanical Jam function is blocked.

Figure 6-19: Mechanical Jam logic diagram



Undercurrent

When the motor is in the running state, an alarm will occur if the magnitude of any phase current falls below the undercurrent alarm pickup level for the time specified by the undercurrent alarm delay. Furthermore, a trip will occur if the magnitude of any phase current falls below the undercurrent trip pickup level for the time specified by the undercurrent trip delay. The alarm and trip pickup levels should be set lower than the lowest motor loading during normal operations.

For example, if a pump is cooled by the liquid it pumps, loss of load may mean that the pump overheats. In this case, enable the undercurrent feature. If the motor loading should never fall below 75% FLA, even for short durations, the Undercurrent Trip Pickup could be set to “70% FLA” and the Undercurrent Alarm Pickup be set to “75% FLA”. The Undercurrent Trip Delay and Undercurrent Alarm Delay settings are typically set as quick as possible, i.e. 1.00 second.

The Undercurrent element is active only when the motor is running and is blocked upon the initiation of a motor start for a period of time defined by the setting BLK U/C ON START. This block may be used to allow pumps to build up head before the undercurrent element trips or alarms.

A second independent Undercurrent Protection element is provided for High Speed. If two-speed functionality is enabled, the 339 relay relies on the motor speed indication to switch the undercurrent settings as per the motor running speed, so the main Undercurrent Protection element is only active when the motor is running at low speed, and the High Speed Undercurrent Protection element is only active when the motor is running at high speed. If two-speed functionality is not deployed, only the main Undercurrent is active, and the High Speed Undercurrent is disabled.

PATH:SETPOINTS > S3 PROTECTION > UNDERCURRENT

U/CURR ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Undercurrent alarm functionality.

BLK U/C ON START

Range: 0 to 600 s in steps of 1 s

Default: 0 s

This setting specifies the length of time to block the undercurrent function when the motor is starting. The undercurrent element is active only when the motor is running and is blocked for a period of time specified by this setting, upon the initiation of a motor start. A value of 0 s specifies that the feature is not blocked from start.

U/CURR ALARM PKP

Range: 1% to 100% FLA in steps of 1% FLA

Default: 70% FLA

This setting specifies a pickup threshold for the alarm stage. The alarm pickup threshold should be less than the motor load current during normal operation.

U/CURR ALARM DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s

Default: 1.00 s

This setting specifies a time delay for the alarm stage. The time delay should be long enough to overcome any short lowering of the current (e.g. during system faults).

U/CURR TRIP FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Undercurrent trip functionality.

U/CURR TRIP PKP

Range: 1% to 100% FLA in steps of 1% FLA
Default: 60% FLA

This setting specifies a pickup threshold for the trip stage. This setting is typically set at a level less than the corresponding setting for the alarm stage.

U/CURR TRIP DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s
Default: 1.00 s

This setting specifies a time delay for the trip stage. The time delay should be long enough to overcome any short lowering of the current (e.g. during system faults).

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate
Default: Do not operate

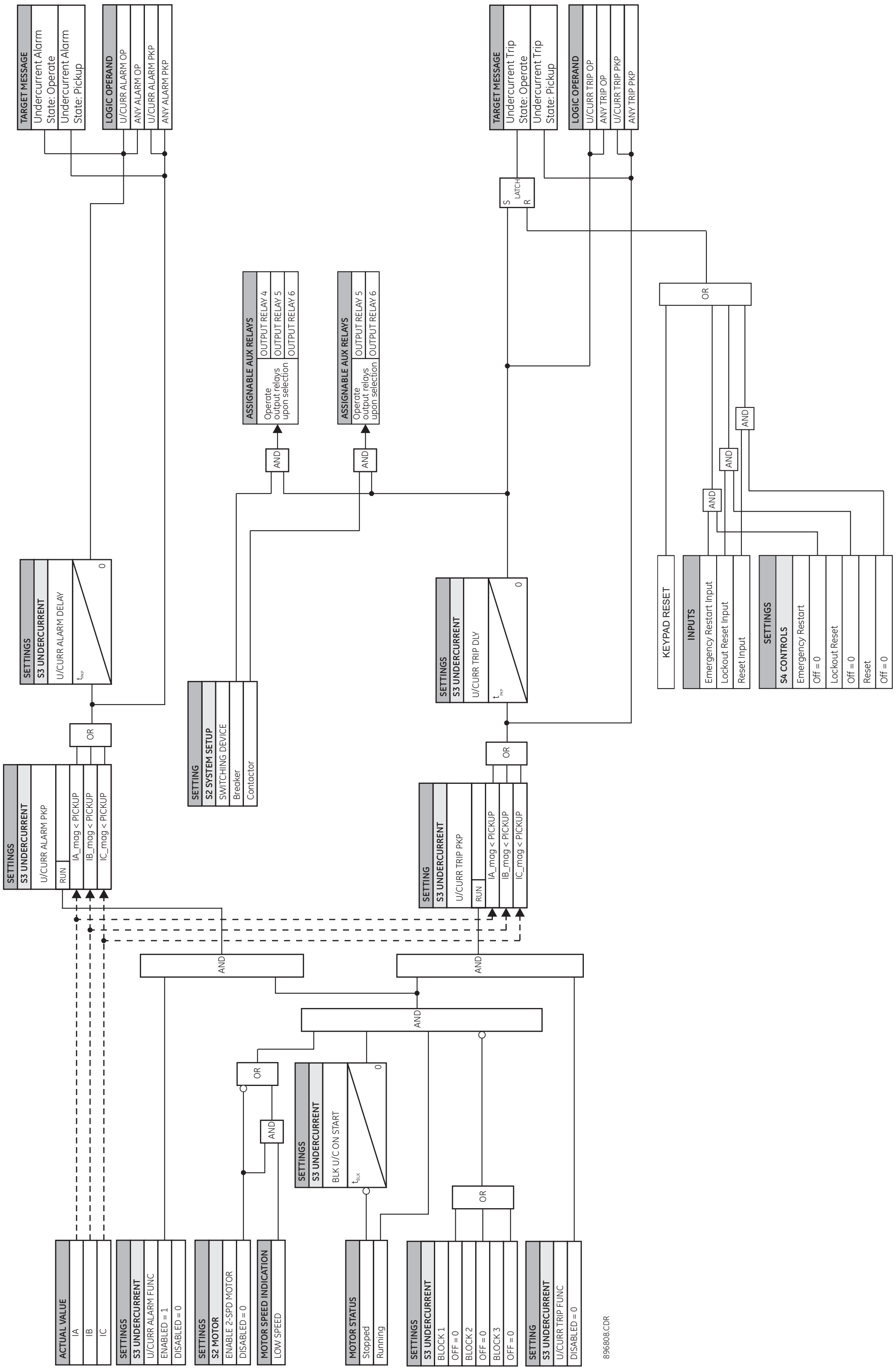
Any assignable output relay can be selected to operate upon Undercurrent operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16
Default: Off

Three blocking inputs are provided for the Undercurrent feature. When any of the selected blocking inputs is on, the Undercurrent function is blocked.

Figure 6-20: Undercurrent logic diagram



Current unbalance

Unbalance current, also known as negative sequence current or I2, results in disproportionate rotor heating. If the thermal overload protection's unbalance bias feature has been enabled, the thermal overload protection will protect the motor against unbalance by tripping when the motor's thermal capacity is exhausted. However, the current unbalance protection can detect this condition and alarm or trip before the motor has heated substantially.

For the 339 relay, unbalance is defined as the ratio of negative-sequence to positive-sequence current,

$$\frac{I_2}{I_1} \times 100\% \quad \textbf{Eq. 14}$$

if the motor is operating at a load (Iavg) greater than or equal to FLA.

If the motor Iavg is less than FLA, unbalance is defined as

$$\frac{I_2}{I_1} \times \frac{I_{avg}}{FLA} \times 100\% \quad \textbf{Eq. 15}$$

This desensitizing is necessary to prevent nuisance alarms when a motor is lightly loaded.

If enabled, a trip and/or alarm occurs once the unbalance level equals or exceeds the set pickup for the set period of time. If the unbalance level exceeds 40%, or when Iavg ≥ 25% FLA and current in any one phase is less than the cutoff current, the motor is considered to be single phasing and a trip occurs within 2 seconds. Single phasing protection is disabled if the unbalance trip feature is turned "Off".

When setting the pickup level, note that a 1% voltage unbalance typically translates into a 6% current unbalance. 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.

NOTE

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

For example, if the supply voltage is normally unbalanced up to 2%, the current unbalance seen by a typical motor is 2 × 6 = 12%. In this case, set the current unbalance alarm pickup to "15%" and the current unbalance trip pickup to "20%" to prevent nuisance tripping; 5 or 10 seconds is a reasonable delay.

PATH: **SETPOINTS > S3 PROTECTION > CURRENT UNBALANCE**

UNBAL ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Current Unbalance Alarm functionality.

UNBAL ALARM PKP

Range: 4% to 40% in steps of 1%

Default: 15%

This setting specifies a pickup threshold for the current unbalance alarm stage.

UNBAL ALARM DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s

Default: 1.00 s

This setting specifies a time delay for the alarm stage.

UNBAL TRIP FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Current Unbalance Trip functionality.

UNBAL TRIP PKP

Range: 4% to 40% in steps of 1%

Default: 30%

This setting specifies a pickup threshold for the current unbalance trip stage. This setting should be greater than the corresponding setting for the alarm stage.

UNBAL TRIP DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s

Default: 1.00 s

This setting specifies a time delay for the trip stage.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Current Unbalance operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

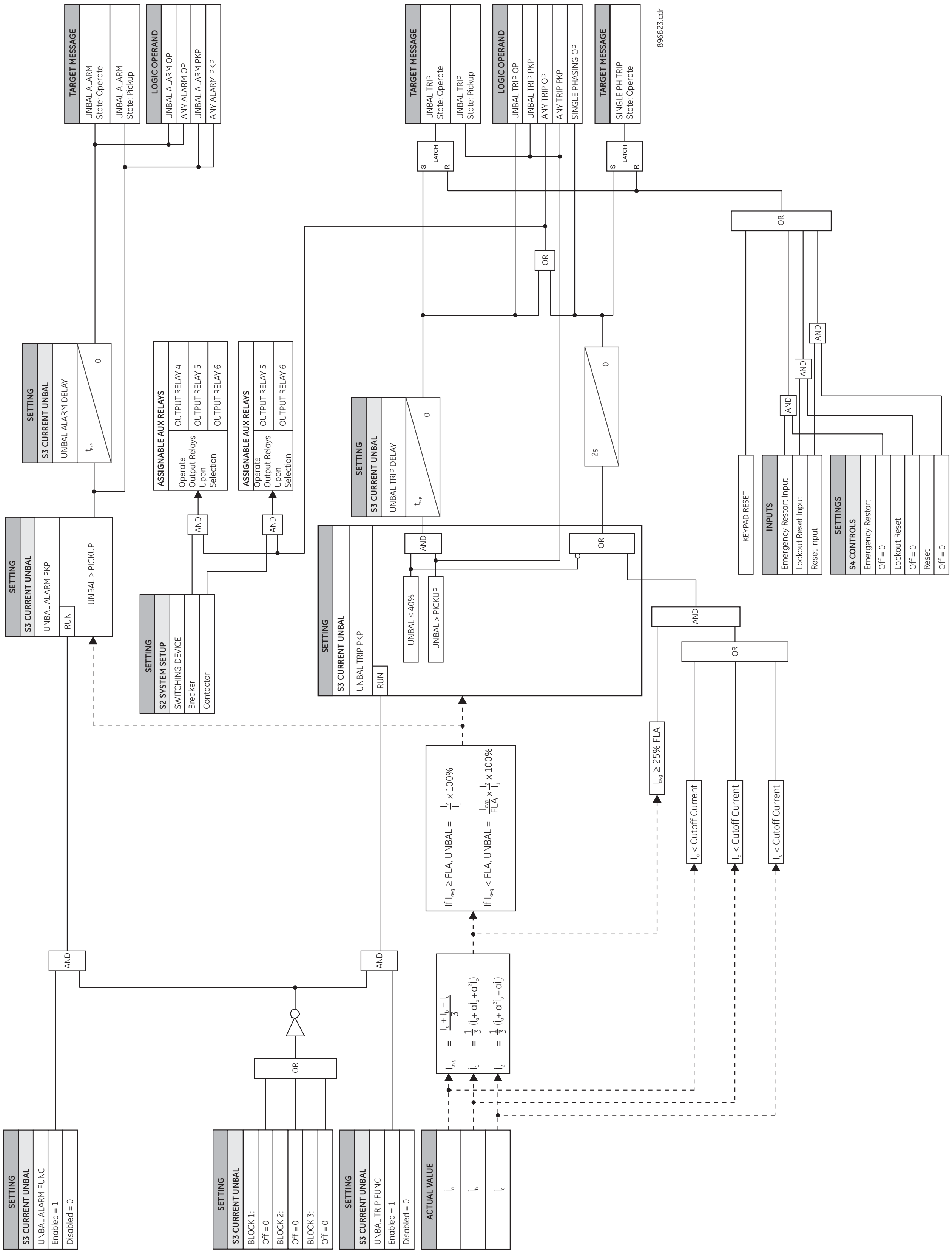
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Current Unbalance feature. When any of the selected blocking inputs is on, the Current Unbalance function is blocked.

Figure 6-21: Current Unbalance logic diagram



Load increase alarm

The Load Increase Alarm is used to alarm abnormal load increases that may indicate problems with the process. An alarm is enabled only after the acceleration stage is complete and the motor has entered the running stage. Once enabled, the alarm is generated when the motor load exceeds the setting LOAD INCR PKP for the time delay specified by the setting LOAD INCR DELAY, and automatically resets when the current has subsided.

PATH: SETPOINTS > S3 PROTECTION > LOAD INCR ALARM

LOAD INCR FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Load Increase Alarm functionality.

LOAD INCR PKP

Range: 50% to 150% FLA in steps of 1% FLA

Default: 150% FLA

This setting specifies the pickup threshold for the Load Increase Alarm.

LOAD INCR DELAY

Range: 0.00 to 60.00 s in steps of 0.01 s

Default: 1.50 s

This setting specifies the time delay for the Load Increase Alarm.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Load Increase Alarm operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

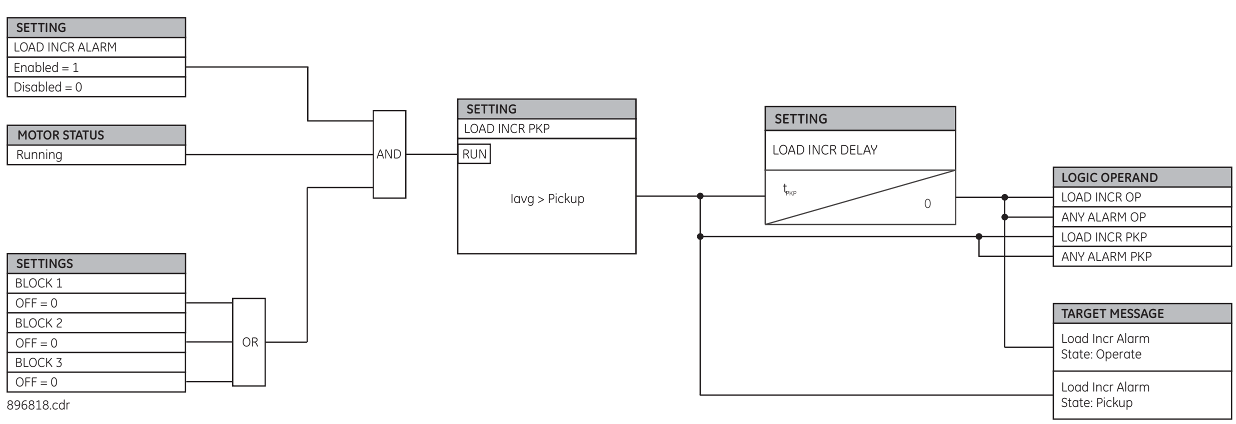
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Load Increase Alarm feature. When any of the selected blocking inputs is on, the Load Increase Alarm function is blocked.

Figure 6-22: Load Increase logic diagram



Ground fault

When motor stator windings become wet or otherwise suffer insulation deterioration, low magnitude leakage currents often precede complete failure and resultant destructive fault currents. Ground fault protection provides early detection of such leakage current, so that the motor can be taken off line in time to limit motor damage.

Depending on the setting **S2 SYSTEM SETUP > CURRENT SENSING > GROUND CT TYPE**, the current measured by this element is either the Core Balance CT (CBCT) current, the fourth CT input current, or the sum of the first three CT inputs' currents. For high resistance grounded systems, sensitive ground current detection is possible if the CBCT 50:0.025 input is used. To use the CBCT 50:0.025 input, select "50:0.025" for the Ground CT Type. On solidly grounded systems where fault currents may be quite large, the 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 Fault protection alarms or trips when the ground current magnitude exceeds the set pickup for the set time.

A ground fault trip is a serious event, and therefore results in a lockout that cannot be reset unless an Emergency Restart or a Lockout Reset is issued.

Various situations (e.g. contactor bounce) may cause transient ground currents during motor starting that may exceed the Ground Fault pickup levels for a very short period of time. The delay can be fine tuned to an application such that it still responds very quickly, but rides through normal operational disturbances. Normally, the Ground Fault time delays are set as short as possible, that is, 0.00 seconds. Time to trip 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 or DC component. This momentary DC component will cause each of the phase CTs to react differently, and cause a net current into the ground input of the relay. A 20 ms block of the ground fault elements when the motor starts normally enables the relay to ride through this momentary ground current signal.

NOTE

The settings GND ALARM PKP and GND TRIP PKP are entered in units of 'xCT' if the setting GROUND CT TYPE is programmed as "1A Secondary" or "5A Secondary," or in units of 'A' if the setting GROUND CT TYPE is programmed as "50:0.025".

PATH: SETPOINTS > S3 PROTECTION > GROUND FAULT

GND ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Ground Fault Alarm functionality.

GND ALARM PKP

Ground CT Type = 1A Secondary, 5A Secondary:

Range: 0.03 to 1.00xCT in steps of 0.01xCT

Default: 0.10xCT

Ground CT Type = 50:0.025:

Range: 0.50 to 15.00 A in steps of 0.01 A

Default: 10.00 A

This setting specifies the Pickup threshold for the Alarm stage.

GND ALARM ON RUN

Range: 0.00 to 60.00 s in steps of 0.01 s

Default: 0.00 s

This setting specifies the amount of time by which motor ground current must exceed pickup to generate an alarm when the motor is in running condition.

GND ALARM ON START

Range: 0.00 to 60.00 s in steps of 0.01 s

Default: 0.00 s

This setting specifies the amount of time by which motor ground current must exceed pickup to generate an alarm when the motor is in starting condition.

GND TRIP FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Ground Fault Trip functionality.

GND TRIP PKP

Ground CT Type = 1A Secondary, 5A Secondary:

Range: 0.03 to 1.00xCT in steps of 0.01xCT

Default: 0.10xCT

Ground CT Type = 50:0.025:

Range: 0.50 to 15.00 A in steps of 0.01 A

Default: 10.00 A

This setting specifies the Pickup threshold for the Trip stage.

GND TRIP ON RUN

Range: 0.00 to 5.00 s in steps of 0.01 s

Default: 0.00 s

This setting specifies the amount of time by which motor ground current must exceed pickup to generate a Trip when the motor is in running condition.

GND TRIP ON START

Range: 0.00 to 10.00 s in steps of 0.01 s

Default: 0.00 s

This setting specifies the amount of time by which motor ground current must exceed pickup to generate a Trip when the motor is in starting condition.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Ground Fault operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

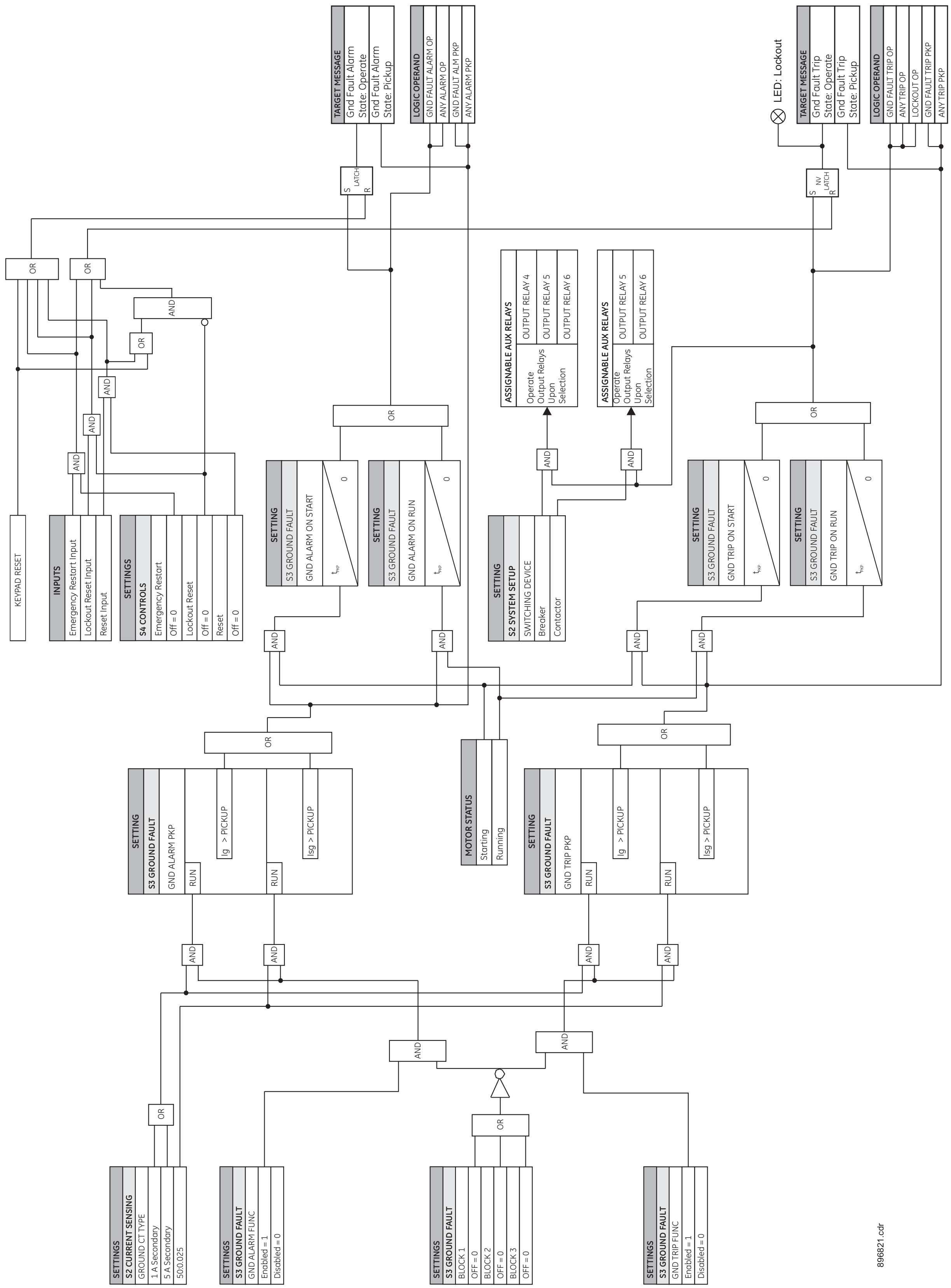
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Ground Fault feature. When any of the selected blocking inputs is on, the Ground Fault function is blocked.

Figure 6-23: Ground Fault logic diagram



Neutral instantaneous overcurrent

The relay has one Instantaneous Overcurrent protection. The settings of this function are applied to the calculated neutral current for producing pickup and trip flags. The Neutral IOC pickup flag is asserted, when the neutral current is above the PKP value. The Neutral IOC operate flag is asserted if the element stays picked up for the time defined by the Neutral IOC Delay setting. If the pickup time delay is set to 0.00 seconds, the pickup and operate flags will be asserted at the same time. The element drops from pickup without operation, if the neutral current drops below 96 to 99% of the pickup value.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > NEUTRAL IOC**

NTRL IOC1 FUNCTION

Range: Disabled, Latched Alarm, Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Neutral IOC function. The output relay #1 "Trip" will operate if the Neutral IOC function is selected as **Trip**, and the neutral current calculated by the relay satisfies the operating condition set by the settings. The "ALARM" LED will not turn on if the neutral IOC operates when set to function **Trip**. The "ALARM" LED will flash upon Neutral IOC operation with the IOC function selected as **Alarm** and will self-reset when this operation clears. If **Latched Alarm** is selected as an IOC function, the "ALARM" LED will flash during IOC operation and will stay "ON" after the operating condition clears, until the reset command is initiated. The output relay #1 "Trip" will not operate if the **Latched Alarm** or **Alarm** setting is selected. Any assignable output relay can be selected to operate when the Neutral IOC function - **Latched Alarm**, **Alarm**, or **Trip** - is selected.

NTRL IOC PKP

Range: 0.05 to 20 × CT in steps of 0.01 × CT

Default: 1.00 × CT

This setting sets the neutral instantaneous overcurrent pickup level specified as times CT.

NTRL IOC DELAY

Range: 0.00 to 300 s in steps of 0.01 s

Default: 0.00 s

This setting provides selection for the pickup time delay, used to delay the protection operation.

NTRL IOC DIRECTION

Range: Disabled, Forward, Reverse

Default: Disabled

This setting provides control to the Neutral IOC function in terms of permitting operation upon fault conditions in the selected current flow direction, and blocking it when faults occur in the opposite direction.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Neutral IOC operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

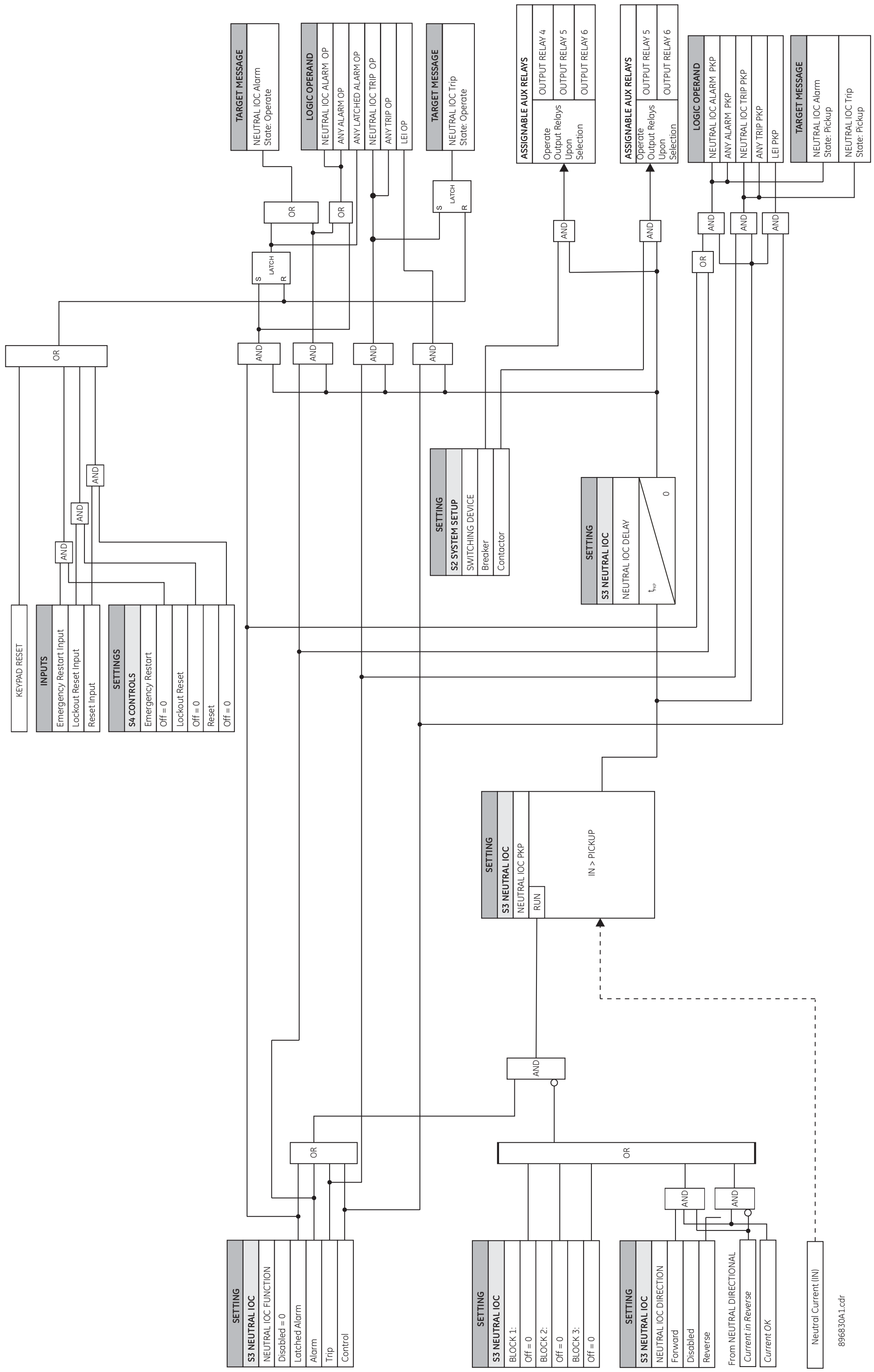
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Neutral IOC feature. When any of the selected blocking inputs is on, the Neutral IOC function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-24: Neutral Instantaneous Overcurrent logic diagram



Phase undervoltage

- **Undervoltage Protection**: For voltage sensitive loads, such as induction motors, a drop in voltage will result in an increase in the drawn current, which may cause dangerous overheating in the motor. The undervoltage protection feature can be used to either cause a trip or generate an alarm when the voltage drops below a specified voltage setting for a specified time delay.
- **Permissive Functions**: The undervoltage feature may be used to block the functioning of external devices by operating an output relay, when the voltage falls below the specified voltage setting. Note that all internal features that are inhibited by an undervoltage condition, such as underfrequency and overfrequency, have their own inhibit functions independent of the undervoltage protection features.
- **Source Transfer Schemes**: In the event of an undervoltage, a transfer signal may be generated to transfer a load from its normal source to a standby or emergency power source.

The undervoltage elements can be programmed to have an inverse time delay characteristic. The undervoltage delay setpoint defines a family of curves as shown below. The operating time is given by:

$$T = \frac{D}{1 - V/V_{pu}} \qquad \textbf{Eq. 16}$$

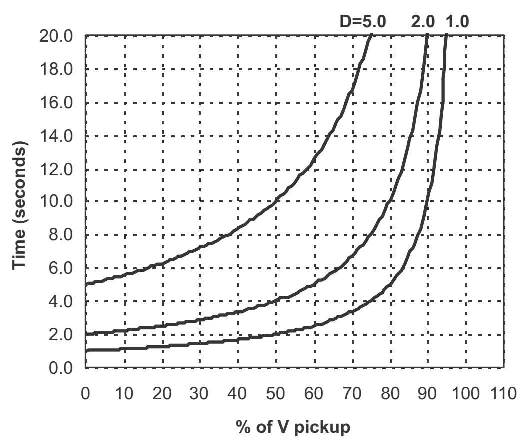
Where:

T = Operating Time
D = Undervoltage Delay setpoint
V = Voltage as a fraction of the nominal VT Secondary Voltage
V_{pu} = Pickup Level

NOTE

At 0% of pickup, the operating time equals the Undervoltage Delay setpoint.

Figure 6-25: Inverse time undervoltage curves



The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > PHASE UV1(2)**

PH UV FUNCTION

Range: Disabled, Alarm, Latched Alarm, Trip
Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Phase Undervoltage function. If the operating condition is satisfied when **Trip** is selected as the function, the logic operand ANY TRIP OP will be asserted, which in turn will activate the “TRIP” LED and operate the “Trip” output relay. If **Alarm** is selected, the “ALARM” LED will flash upon Phase Undervoltage operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon Phase Undervoltage operation, and will stay "ON" after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting PH UV FUNCTION is selected as **Latched Alarm**, **Alarm**, or **Trip**.

PH UV PKP

Range: 0.00 to 1.25 x VT in steps of 0.01

Default: 0.75 x VT

This setting defines the phase UV pickup level, and it is usually set to a level, below which the drawn current may cause dangerous motor overheating conditions.

PH UV CURVE

Range: Definite Time, Inverse Time

Default: Inverse Time

This setting selects the type of timing-inverse time/definite time to define the time of undervoltage operation based on the selected UV time delay, and the actual undervoltage condition with respect to the selected UV pickup.

PH UV DELAY

Range: 0.1 to 600.0 sec in steps of 0.1 sec

Default: 2.0 s

This setting specifies the time delay used by the selected "PHASE UV CURVE" type of timing, to calculate the time before UV operation.

PH UV PHASES

Range: Any One, Any Two, All Three

Default: Any One

This setting selects the combination of undervoltage conditions with respect to the number of phase voltages under the undervoltage pickup setting. Selection of "Any Two" or "All Three" would effectively rule out the case of single VT fuse failure.

PH UV MIN VOLTAGE

Range: 0.00 to 1.25 x VT in steps of 0.01

Default: 0.30 x VT

The minimum operating voltage level is programmable to prevent undesired UV operation before voltage becomes available.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Phase Undervoltage operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

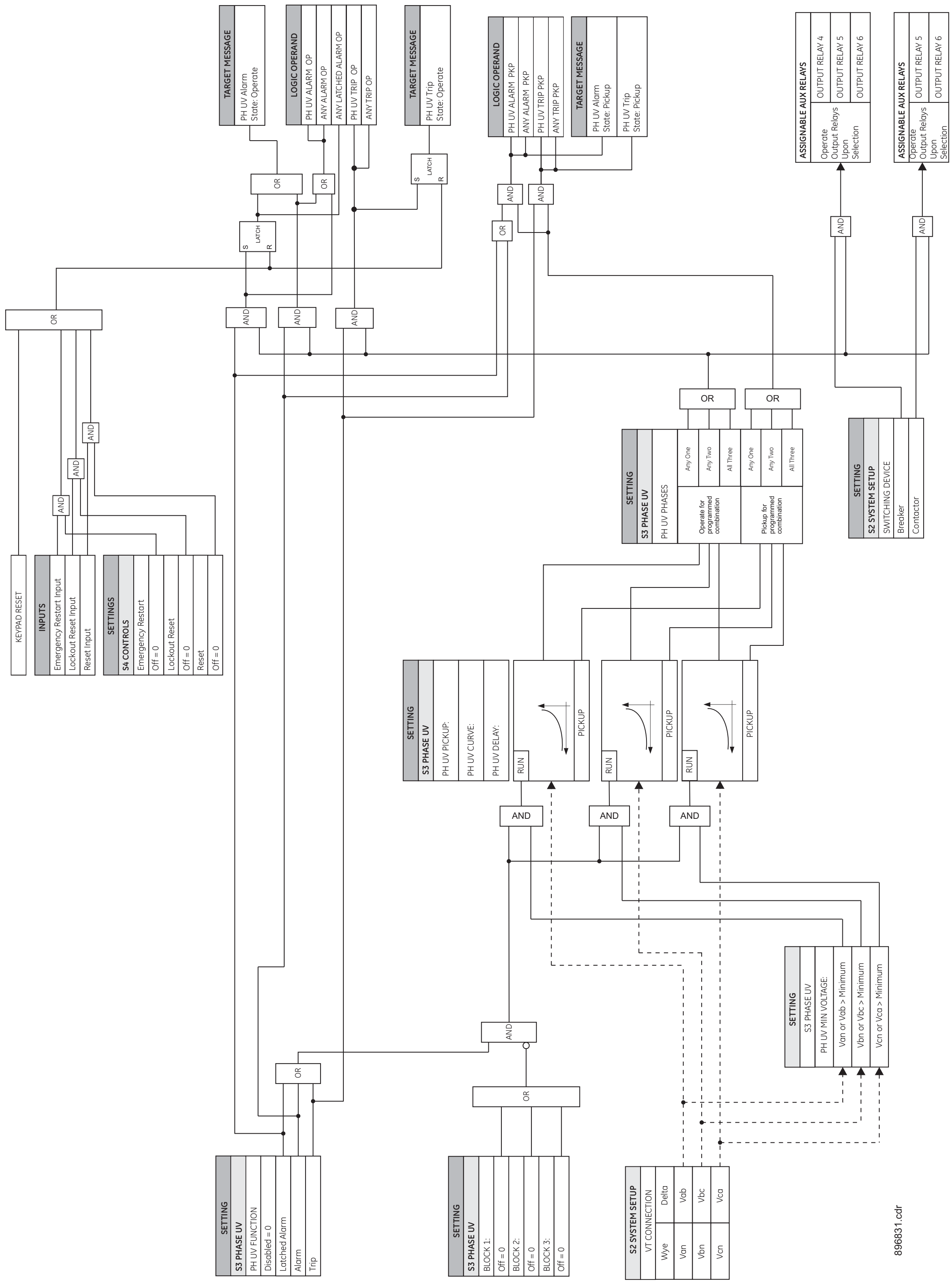
BLOCK 1/2/3

Range: Off, Contact Input 1 to 10, Virtual Input1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default:Off

Three blocking inputs are provided for Phase UV. When any of the selected blocking inputs is on, the Phase UV function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-26: Phase Undervoltage logic diagram



Phase overvoltage

An overvoltage on a running motor with a constant load results in decreased current. However, iron and copper losses increase, causing an increase in motor temperature. The current overload element 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. The 339 provides 2 Phase Overvoltage elements. Each element can be set to either cause a trip or generate an alarm when the input voltage exceeds the pickup level for a specified time delay. If it is desirable to have an alarm before a trip occurs, the user can set the function of one Phase Overvoltage element to ALARM, and the function of the other element to TRIP. For wye-connected VT, the input voltage is phase-to-ground voltage; for delta-connected VT, the input voltage is phase-to-phase voltage. The Phase Overvoltage operation can be set for phase combinations including "Any One", "Any Two" and "All Three". If overvoltage tripping is enabled, and the setting PH OV PHASES is set for "Any One", a trip will occur once the magnitude of any input voltage (wye-connected VT: phase-to-ground voltage; delta-connected VT: phase-to-phase voltage) exceeds the pickup level for a period of time specified by the time delay. On the other hand, if overvoltage trip is enabled, and the setting PH OV PHASES is set for "All Three", a trip will occur only when the magnitudes of all three input voltages exceed the pickup level for a period of time specified by the time delay.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > PHASE OV1(2)**

PH OV FUNCTION

Range: Disabled, Alarm, Latched Alarm, Trip
Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Phase Overvoltage function. If the operating condition is satisfied when **Trip** is selected as the function, the logic operand ANY TRIP OP will be asserted, which in turn will activate the "TRIP" LED and operate the "Trip" output relay. If **Alarm** is selected, the "ALARM" LED will flash upon Phase Overvoltage operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon Phase Overvoltage operation, and will stay "ON" after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting PH OV FUNCTION is selected as **Latched Alarm**, **Alarm**, or **Trip**.

PH OV PKP

Range: 0.00 to 1.25 x VT in steps of 0.01
Default: 1.25 x VT

This setting defines the Phase OV pickup level.

PH OV DELAY

Range: 0.1 to 600.0 sec in steps of 0.1
Default: 2.0 s

This setting specifies the time delay before Phase OV operation.

PH OV PHASES

Range: Any One, Any Two, All Three
Default: All Three

This setting selects the combination of overvoltage conditions with respect to the number of phase voltages over the overvoltage pickup setting.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Phase Overvoltage operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

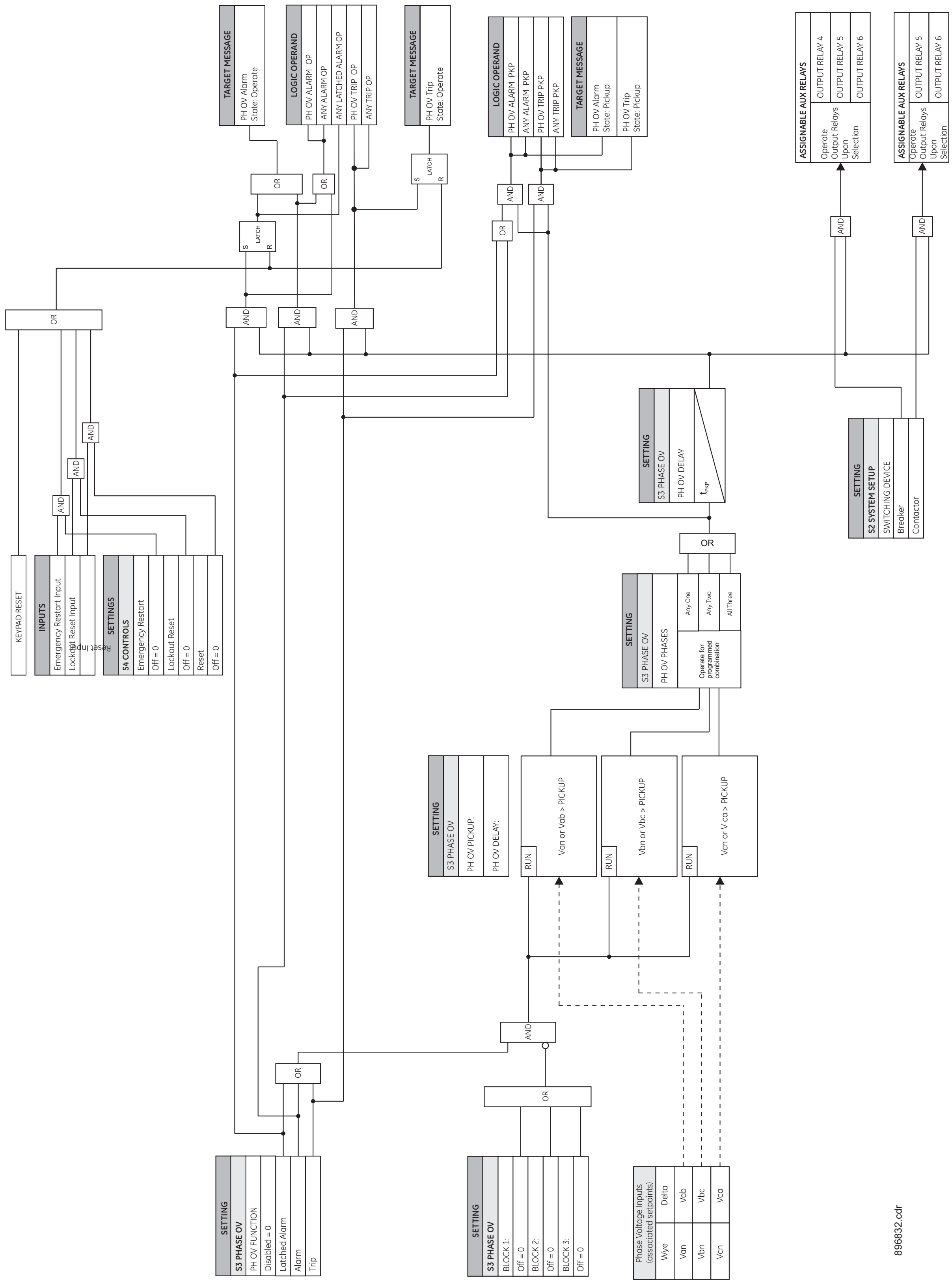
BLOCK 1/2/3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for Phase OV. When any of the selected blocking inputs is on, the Phase OV function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-27: Phase Overvoltage logic diagram



Underfrequency

The 339 provides 2 Underfrequency Protection elements. Each element can be set to either cause a trip or generate an alarm when the frequency of the input voltage (wye-connected VT: VAN; delta-connected VT: VAB) drops below the pickup level for a specified time delay. If it is desirable to have an alarm before a trip occurs, the user can set the function of one Underfrequency element to ALARM, and the function of another element to TRIP.

The Underfrequency element is blocked VAN is below the set MIN VOLTAGE. This setting may be used to prevent nuisance alarms or trips when the bus is not energized. If a dead source is desirable to be considered as a fault condition, set this setting to "0.00xVT".

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.

Underfrequency can also be used to detect loss of power to a synchronous motor. Due to motor generation, sustained voltage may prevent quick detection of power loss. Therefore, to quickly detect the loss of system power, the decaying frequency of the generated voltage as the motor slows can be used.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > UNDER-FREQUENCY1(2)**

UNDRFREQ 1(2) FUNC

Range: Disabled, Alarm, Latched Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Underfrequency function. If the operating condition is satisfied when **Trip** is selected as the function, the logic operand ANY TRIP OP will be asserted, which in turn will activate the "TRIP" LED and operate the "Trip" output relay. If **Alarm** is selected, the "ALARM" LED will flash upon Underfrequency operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon Underfrequency operation, and will stay "ON" after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting UNDRFREQ FUNC is selected as **Latched Alarm**, **Alarm**, or **Trip**.

UNDERFREQ PKP

Range: 40.00 to 70.00 Hz in steps of 0.01 Hz

Default: 59.00 Hz

This setting defines the Underfrequency pickup level; it is usually set to a frequency level considered dangerous for the stability of the system.

UNDRFREQ DELAY

Range: 0.1 to 600.0 sec in steps of 0.1 sec

Default: 2.0 s

This setting specifies the time delay before Underfrequency operation.

MIN VOLTAGE

Range: 0.00 to 1.25 x VT in steps of 0.01 x VT

Default: 0.70 x VT

The minimum operating voltage level is programmable to prevent undesired Underfrequency operation before voltage VAN becomes available, such as on faults cleared by downstream protection or fuses.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Underfrequency operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

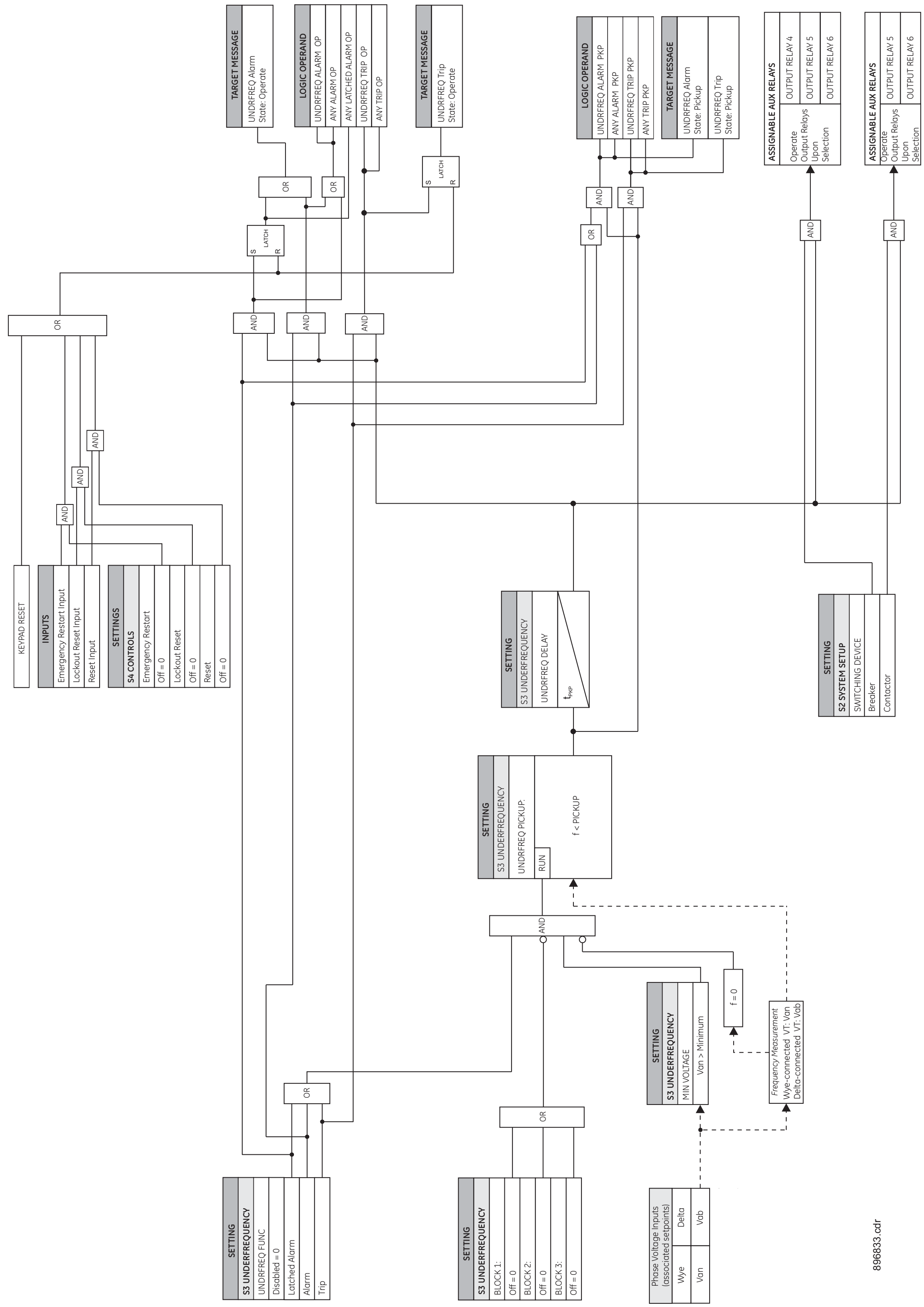
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Underfrequency feature. When any of the selected blocking inputs is on, the Underfrequency function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-28: Underfrequency logic diagram



Overfrequency

The 339 provides 2 Overfrequency Protection elements. Each element can be set to either cause a trip or generate an alarm when the frequency of the input voltage (wye-connected VT: Van; delta-connected VT: Vab) exceeds the pickup level for a specified time delay. If it is desirable to have an alarm before a trip occurs, the user can set the function of one Overfrequency element to ALARM, and the function of the other element to TRIP.

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.

The overfrequency feature is inhibited from operating unless the phase A voltage is above 30% of nominal. When the supply source is energized, the overfrequency delay timer will only be allowed to time when the 30% threshold is exceeded and the frequency is above the programmed pickup level. In the same way, when an overfrequency condition starts the overfrequency delay timer and the phase A voltage falls below the 30% threshold before the timer has expired, the element will reset without operating.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > OVER-FREQUENCY1(2)**

OVERFREQ FUNCTION

Range: Disabled, Alarm, Latched Alarm, Trip

Default: Disabled

The selection of **Latched Alarm**, **Alarm**, or **Trip** setting enables the Overfrequency Function. If the operating condition is satisfied when **Trip** is selected as the function, the logic operand ANY TRIP OP will be asserted, which in turn will activate the “TRIP” LED and operate the “Trip” output relay. If **Alarm** is selected, the “ALARM” LED will flash upon overfrequency operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the “ALARM” LED will flash upon overfrequency operation, and will stay “ON” after the condition clears, until a reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting OVERFREQ FUNC is selected as **Latched Alarm**, **Alarm**, or **Trip**.

OVERFREQ PKP

Range: 40.00 to 70.00 Hz in steps of 0.01

Default: 60.50 Hz

This setting defines the Overfrequency pickup level, and it is usually set to a frequency level considered dangerous for the stability of the system.

OVERFREQ DELAY

Range: 0.1 to 600.0 s in steps of 0.1

Default: 2.0 s

This setting specifies the time delay before overfrequency operation.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Overfrequency operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

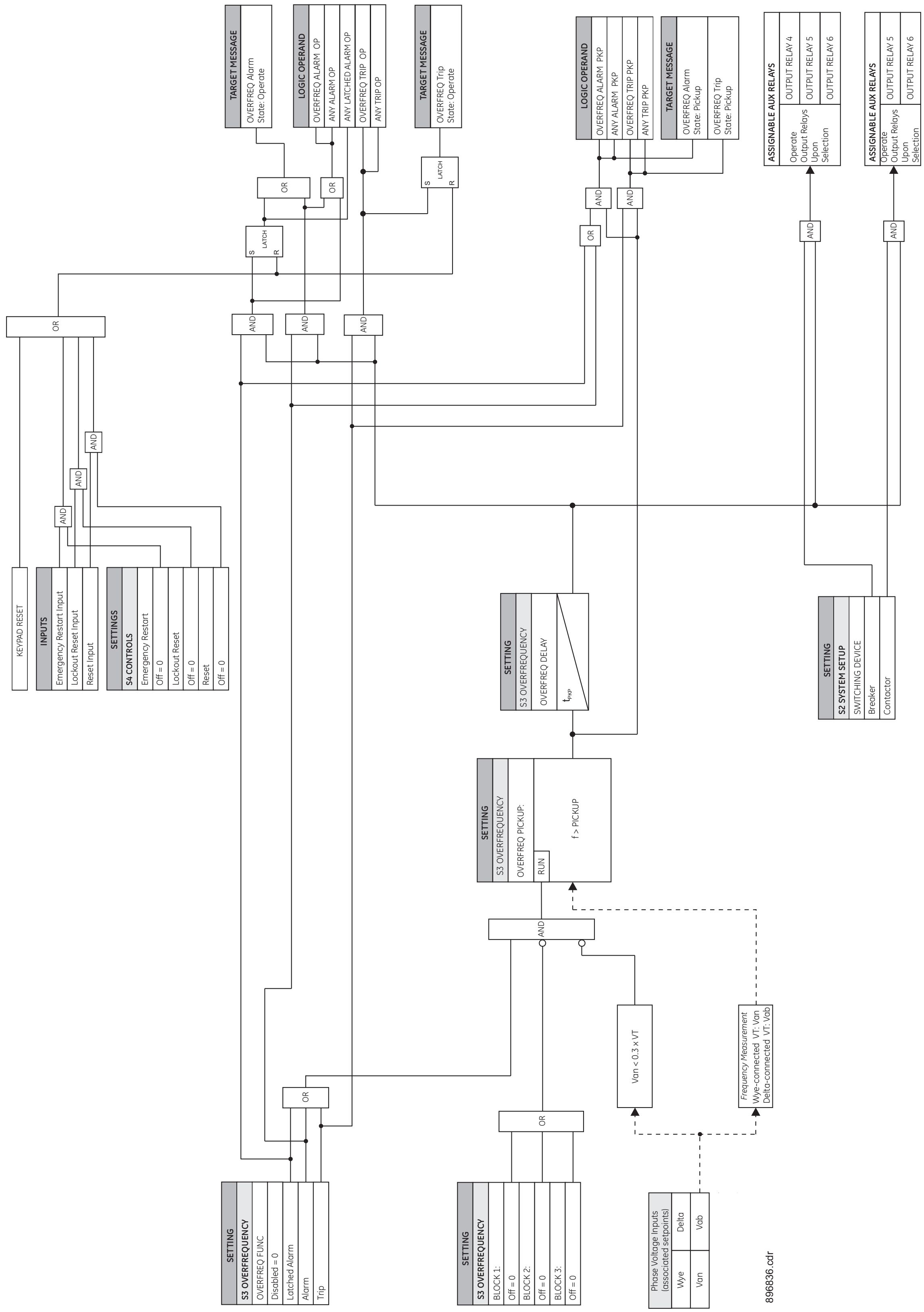
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Overfrequency feature. When any of the selected blocking inputs is on, the Overfrequency function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-29: Overfrequency logic diagram



Underpower

The Underpower element responds to total three-phase real power measured from the phase currents and voltages.

When the motor is in the running state, a trip or/and alarm will occur once the magnitude of three-phase real power falls below the pickup level for a period of time specified by the Delay. The pickup levels are based on Motor Nameplate Rated Power (MNR) and should be set lower than the lowest motor loading during normal operations.

For 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 cavitations. This may be especially useful for detecting process related problems.

NOTE

The Underpower element is blocked if the **VT Fuse Fail** element is active; indicating which valid voltage inputs are not available due to fuse failure.

NOTE

A **Block Underpower on Start** feature is available to the user. The Block Underpower element is active only when the motor is running and is blocked upon the initiation of a motor start for a period of time defined by the setting BLK U/P ON START. This block may be used to allow pumps to build up head before the underpower element trips or alarms.

PATH: SETPOINTS > S3 PROTECTION > UNDERPOWER

U/POWER ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Underpower Alarm functionality.

BLK U/P ON START

Range: 0.1 to 600 s in steps of 1 s

Default: 0 s

This setting specifies the length of time to block the underpower function when motor is starting. The underpower element is active only when the motor is running and is blocked upon the initiation of a motor start for a period of time specified by this setting. A value of 0 specifies that the feature is not blocked from start.

U/POWER ALARM PKP

Range: 1% to 100% MNR

Default: 70% MNR

This setting specifies a pickup threshold for the Alarm stage. The alarm pickup threshold should be less than the motor load during normal operation.

U/POWER ALARM DLY

Range: 0.1 to 60.0 s in steps of 0.1 s

Default: 0.1 s

This setting specifies a time delay for the alarm stage. The time delay should be long enough to overcome any short lowering of the load (e.g. during system faults).

U/POWER TRIP FUNC

Range: Disabled, Enabled

Default: Disabled

This setting enables the Underpower Trip functionality.

U/POWER TRIP PKP

Range: 1% to 100% MNR

Default: 60% MNR

This setting specifies a pickup threshold for the trip stage. This setting is typically set at a level less than the corresponding setting for the alarm stage.

U/POWER TRIP DLY

Range: 0.1 to 60.0 s in steps of 0.1 s

Default: 0.1 s

This setting specifies a time delay for the trip stage. The time delay should be long enough to overcome any short lowering of the load (e.g. during system faults).

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon underpower operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

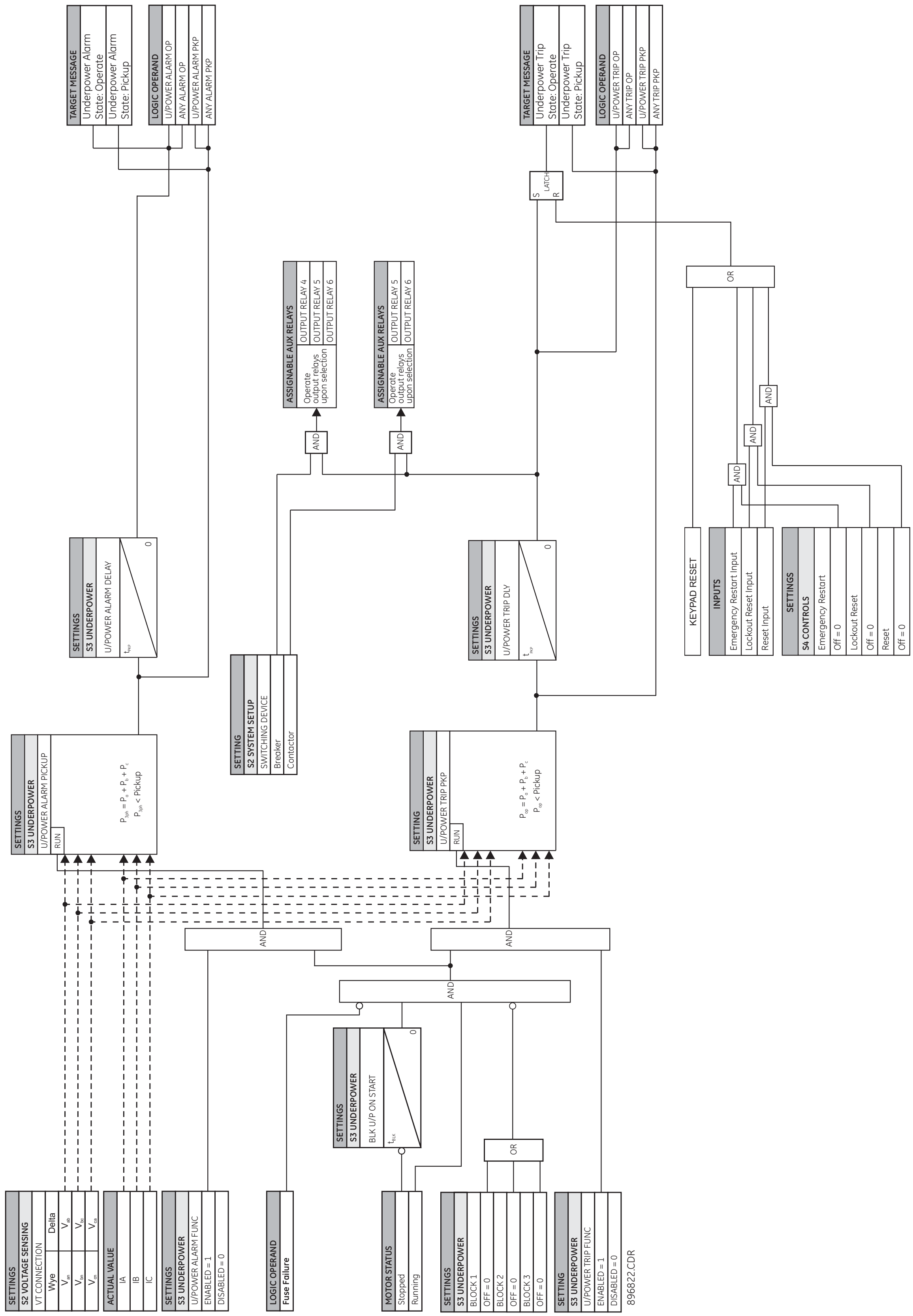
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

There are three blocking inputs provided for the underpower feature. When any of the selected blocking inputs is on, the underpower function is blocked.

Figure 6-30: Underpower logic diagram



Negative sequence overvoltage

The relay has one Negative Sequence Overvoltage element. The negative sequence overvoltage may be used to detect the loss of one, or two phases of the source, a reversed voltage phase sequence, or non-system voltage conditions.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: SETPOINTS > S3 PROTECTION > NEGATIVE SEQ OV

NEG SEQ OV FUNCTN

Range: Disabled, Alarm, Latched Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm**, or **Trip** setting enables the Negative Sequence OV function. The output relay #1 "Trip" will operate, if the function is selected as a **Trip** and the negative sequence voltage computed by the relay is above the NEG SEQ OV PKP setting for a time greater than the selected NEG SEQ OV DELAY time. The "ALARM" LED will not turn on if the neg. sequence OV function is set to **Trip**. The "ALARM" LED will flash upon an OV operating condition with the neg. sequence OV function selected as **Alarm**, and will self-reset, when the operating condition clears. If **Latched Alarm** is selected as a Neg. Seq. OV function, the "ALARM" LED will flash during the OV condition, and will stay "ON" after the condition clears, until the reset command is initiated. The output relay #1 "Trip" will not operate if the **Latched Alarm** or **Alarm** setting is selected. Any or all of the output relays 3 to 6 can be selected to operate when the NEG SEQ OV FUNCTN is selected as **Latched Alarm**, **Alarm**, or **Trip**.

NEG SEQ OV PKP

Range: 0.00 to 1.25 x VT in steps of 0.01

Default: 0.30 x VT

This setting defines the negative sequence OV pickup level.

NEG SEQ OV DELAY

Range: 0.1 to 600.0 sec in steps of 0.1 sec

Default: 2.0 s

This setting specifies the time delay before negative sequence OV operation.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Negative Sequence Overvoltage operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

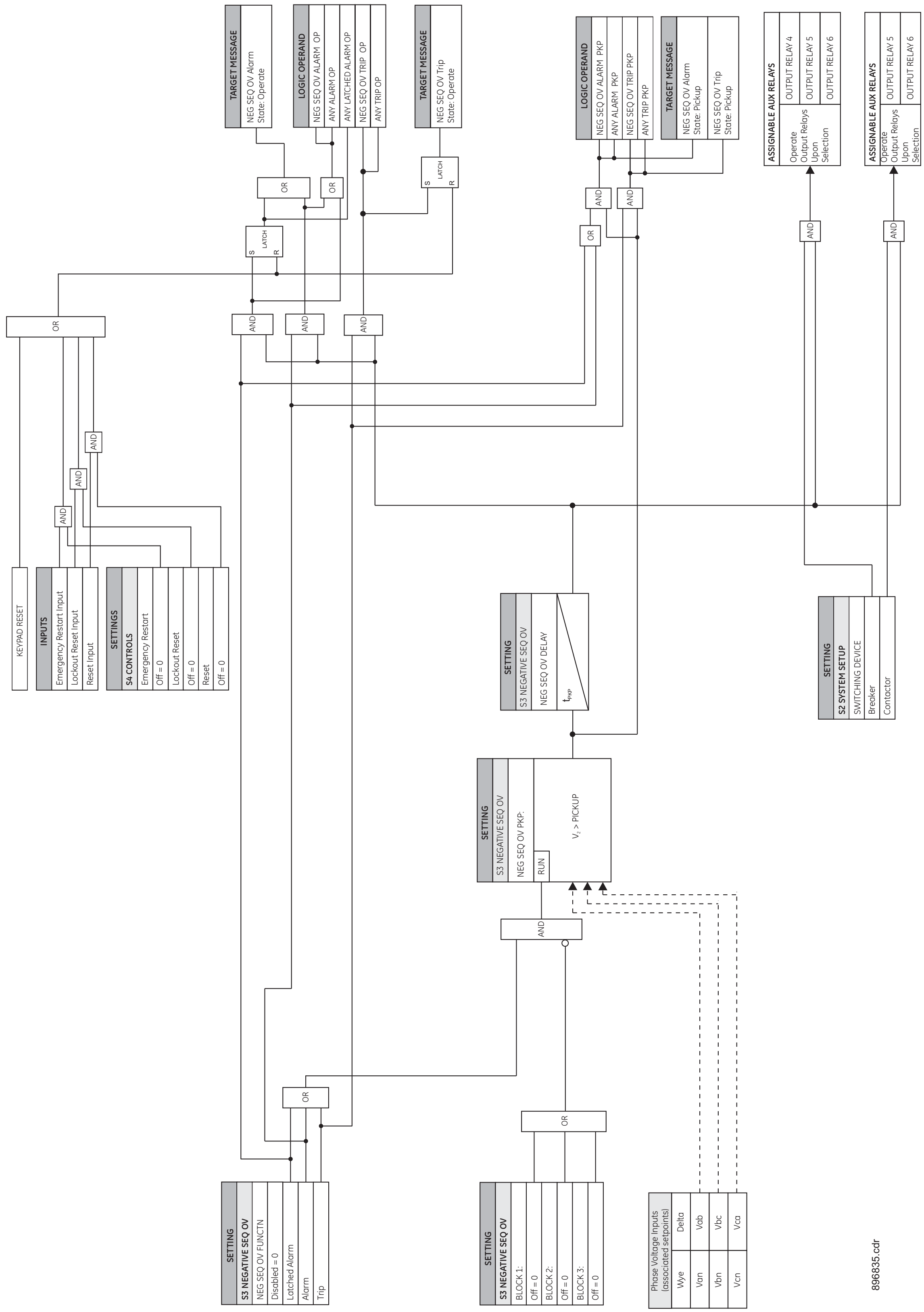
BLOCK 1/2/3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for Negative Sequence Overvoltage. When any of the selected blocking inputs is on, the NEG SEQ OV function is blocked. The available selections for each block can be any Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-31: Negative Sequence Overvoltage logic diagram



Phase reversal

The 339 can detect the phase rotation of the three phase voltages. When all three Phase to Phase Voltages (Vab, Vbc and Vca) are greater than 50% of the Motor Rated Voltage, if the phase rotation of the three phase voltages is not the same as the Supply Rotation setpoint, and there is no fuse failure, either an alarm or a trip and a Start Inhibit will occur within 100ms.

PATH: SETPOINTS > S3 PROTECTION > PHASE REVERSAL

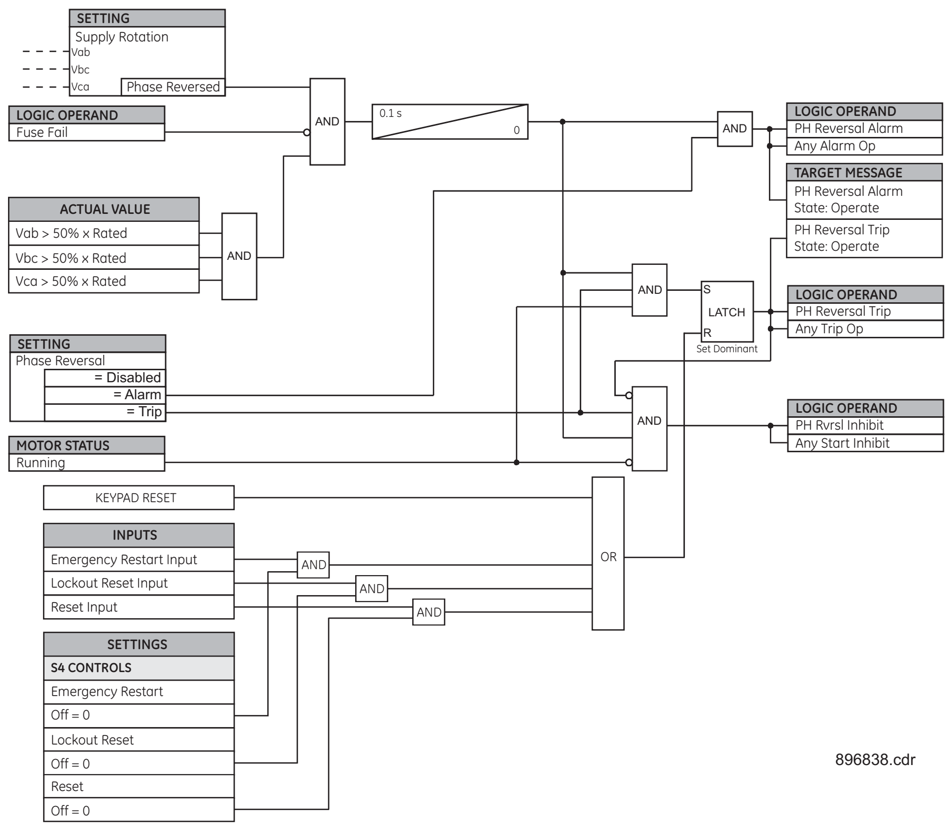
PHASE REVERSAL

Range: Disabled, Alarm, Trip

Default: Disabled

Sets the Phase Reversal action.

Figure 6-32: Phase Reversal Protection logic diagram



VT fuse fail

If one or two of the three phase to phase voltages drops to less than 70% of nominal, and at the same time any of the three voltages is greater than 85%, either an alarm or a trip and Start Inhibit will occur after a 1 second delay. The 70% threshold allows for the possibility that the voltage downstream from a blown fuse is pulled up above zero by devices connected between the open fuse and another phase.

PATH: SETPOINTS > S3 PROTECTION > VT FUSE FAILURE

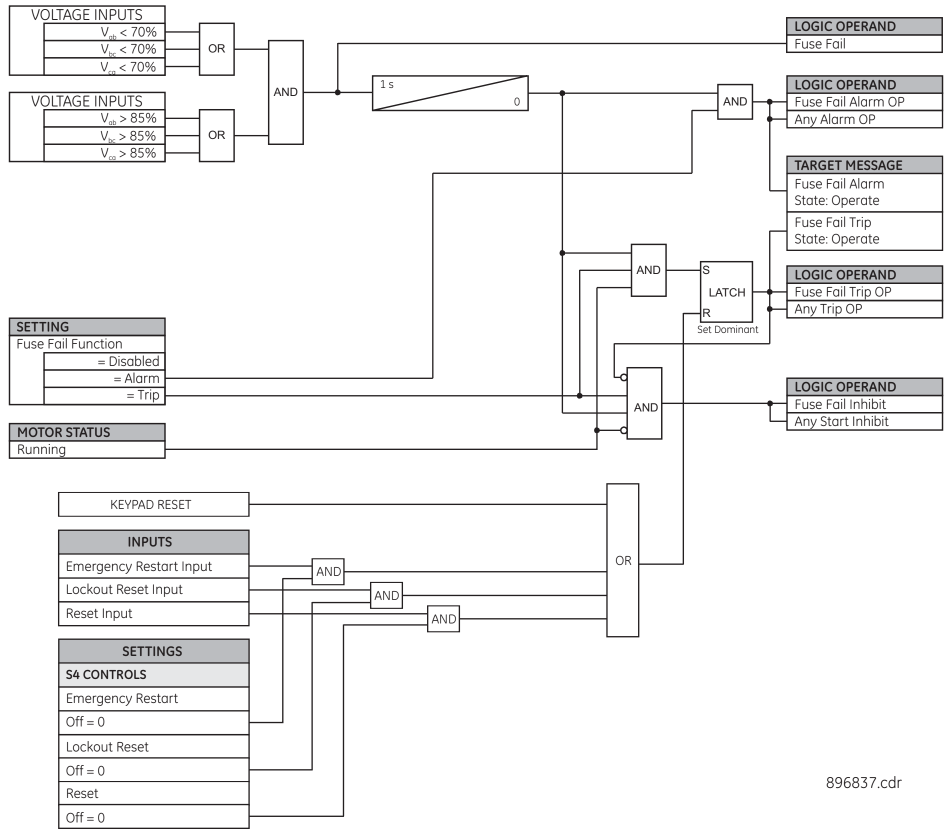
FUSE FAIL FUNCTION

Range: Disabled, Alarm, Trip

Default: Trip

Sets the Fuse Fail action.

Figure 6-33: Fuse Fail Protection logic diagram



Acceleration protection

The thermal model protects the motor under both starting and overload conditions. The acceleration timer trip may be used to complement this protection. For example, if the motor always starts in 2 seconds, but the safe stall time is 8 seconds, there is no point letting the motor remain in a stall condition for the 7 or 8 seconds it would take for the thermal model to operate. Furthermore, the starting torque applied to the driven equipment for that period of time could cause severe damage.

If enabled, the Acceleration Protection will trip if the motor stays in the starting state and does not reach the running state by the set acceleration time. Detection of starting and running is as described in the motor status section of this manual. For two speed motor applications, separate timer settings are provided for accelerating from stopped to low speed, for accelerating from stopped to high speed, and for accelerating from low speed to high speed.

If the acceleration time of the motor is variable, this feature should be set just beyond the longest acceleration time.

PATH: **SETPOINTS > S3 PROTECTION > ACCELERATION**

ACCEL TIME FUNC

Range: Disabled, Enabled

Default: Disabled

Enables Acceleration Protection tripping.

ACCELERATION TIMER

Range: 1.0 to 250.0 s in steps of 0.1 s

Default: 10 s

In single-speed motor applications, sets the maximum acceleration time before tripping. In two speed motor applications, sets the maximum acceleration time before tripping when low speed starting from a stopped condition.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon Acceleration Trip operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the Acceleration feature. When any of the selected blocking inputs is ON, the Acceleration function is blocked.

TWO-SPEED MOTOR APPLICATION

PATH: SETPOINTS > S3 PROTECTION > TWO SPEED MOTOR > HIGH SPEED ACCEL T

ACCEL T ON STOPPED

Range: 1.0 to 250.0 s in steps of 0.1 s

Default: 10.0 s

When a two-speed motor starts directly at high speed, this setting specifies the maximum acceleration time before tripping.

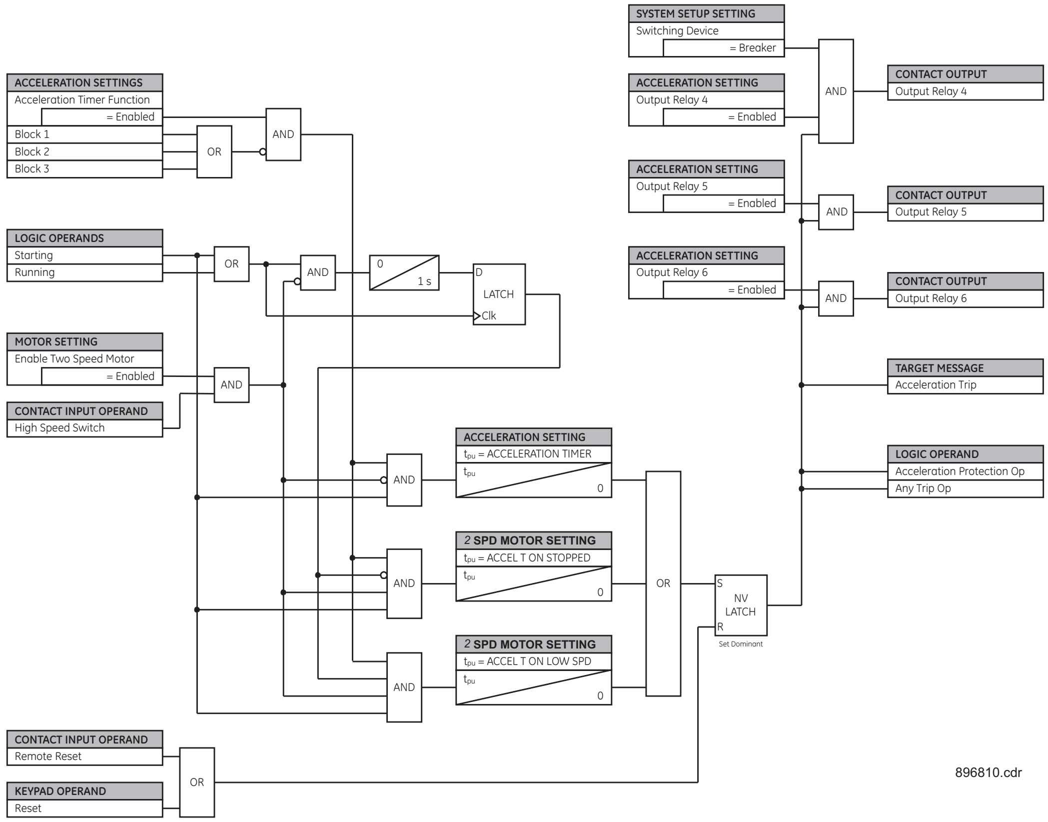
ACCEL T ON LOW SPD

Range: 1.0 to 250.0 s in steps of 0.1 s

Default: 10.0 s

When a two-speed motor is switched from a low-to-high speed, this setting specifies the maximum acceleration time before tripping.

Figure 6-34: Acceleration logic diagram



RTD protection

The 339 has two methods of supporting RTD inputs.

As an option, a CANBUS-based RMIO module can be installed on the 339, which can monitor up to 12 RTDs. With the RMIO option, the RTD protection setpoints can be seen only if the 339 has the RMIO module installed and validated. If, for some reason, communications with the RMIO module are lost or interrupted, the 339 will issue an RMIO MISMATCH self-test error indicating the failure. This feature is useful as it ensures that the remote RTDs are being continuously monitored.

Alternatively, the INPUT/OUTPUT option 'R' can be selected from the Order Codes, an option which provides 3 internal RTDs.The 339 does not support both Internal RTDs and RMIO RTDs simultaneously.

The RTD type supported is 100 Ohm Platinum. Each of these may be configured to have a trip temperature as well as an alarm temperature. The alarm temperature is normally set slightly above the normal running temperature. The trip temperature is normally set at the insulation rating. Trip Voting has been added for extra security 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 may also be configured as being of application type Stator, Bearing, Ambient or Other. The table below - *RTD Temperature vs Resistance* - lists RTD resistance versus temperature. RTDs configured as Stator type are also used by the thermal model for determining the RTD Bias.

If for some reason, communications with the RMIO module are lost or interrupted, the 339 will issue an RMIO MISMATCH self-test error indicating the failure. This feature is useful as it ensures that the remote RTDs are being continuously monitored.

PATH: **SETPOINTS > S3 PROTECTION > RTD PROTECTION > RTD #1(12)**

RTD #1 to 12 APPLICATION

Range: None, Stator, Bearing, Ambient, Other
Default: None

Sets the application type.

RTD #1 to 12 NAME

Range: 1 to 18 characters
Default: RTD 1(12)

Sets the RTD programmable name.

RTD #1 to 12 ALARM

Range: Disabled, Enabled
Default: Disabled

This setting enables the RTD #1 to 12 Alarm functionality.

RTD #1 to 12 ALARM TEMP

Range: $1^{o}C$ to $250^{o}C$ in steps of $1^{o}C$
Default: $130^{o}C$

Sets the Alarm temperature.

RTD #1 to 12 TRIP

Range: Disabled, Enabled
Default: Disabled

This setting enables the RTD #1 to 12 Trip functionality.

RTD #1 to 12 TRIP TEMP

Range: $1^{o}C$ to $250^{o}C$ in steps of $1^{o}C$
Default: $155^{o}C$

Sets the Trip temperature.

RTD #1 to 12 TRIP VOTING

Range: Off, RTD #1 to 12
Default: Off

Sets the redundant RTD that must also exceed this RTD’s trip temperature for a trip to occur.

OUTPUT RELAYS

Range: Do Not Operate, Operate
Default: Do Not Operate

NOTE

The availability of assignable Output Relay setpoints is dependent on the Order Code options and the SWITCHING DEVICE setpoint. Refer to section S5 INPUTS/OUTPUTS > OUTPUT RELAYS for more information.

Any assignable output relay can be selected to operate upon RTD Trip operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

To select any assignable output relays to operate upon the RTD #1 to 12 Alarm operation, assign the Logic Operand “RTD #1 to 12 ALARM OP” or “Any Alarm OP” to a Logic Element.

e.g. With the following setup, output relay 5 will operate upon the operation of any RTD or alarm.

S3 RTD #1
RTD #1 APPLICATION
Stator
RTD #1 NAME
RTD1
RTD #1 ALARM
Enabled
RTD #1 ALARM TEMP
130°C
RTD #1 TRIP
Disabled
RTD #1 TRIP TEMP
155°C
RTD #1 TRIP VOTING
Off
OUTPUT RELAY 4
Do Not Operate
OUTPUT RELAY 5
Do Not Operate
OUTPUT RELAY 6
Do Not Operate
BLOCK 1
Off
BLOCK 2
Off
BLOCK 3
Off

S4 LOGIC ELEMENT 1
LOGIC E 1 NAME
Alarm Operation
LOGIC E1 FUNCTION
Enabled
LOGIC E1 ASSERTED
On
TRIGGER SOURCE 1
Any Alarm OP
TRIGGER SOURCE 2
Off
TRIGGER SOURCE 3
Off
PICKUP TIME DELAY
0 ms
DROPOUT TIME DELAY
0 ms
OUTPUT RELAY 4
Do Not Operate
OUTPUT RELAY 5
Operate
OUTPUT RELAY 6
Do Not Operate
BLOCK 1
Off
BLOCK 2
Off
BLOCK 3
Off

896802.cdr

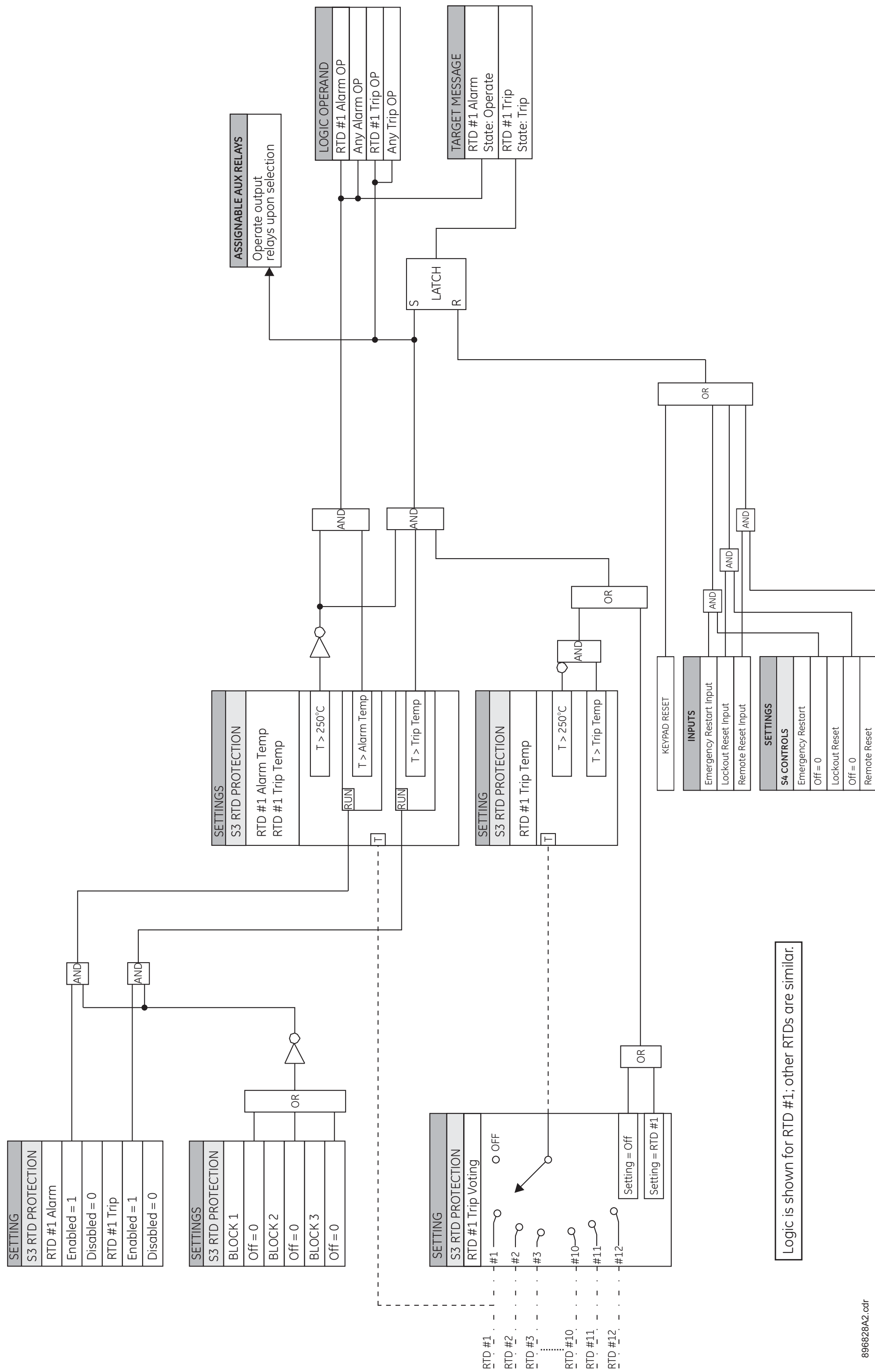
BLOCK 1 to 3

Range: Off, Any Contact Input, Virtual Input, Remote Input, or Logic Element

Default: Off

Three blocking inputs are provided for RTD Protection. When any of the selected blocking inputs is on, both RTD Alarm and Trip functionalities are blocked.

Figure 6-35: RTD Protection logic diagram



THE RTD TROUBLE ALARM

All RTDs that are programmed with either an alarm or a trip are monitored for sensor failure. When the measured temperature is greater than 300°C or less than -50°C, the RTD is declared failed and a common RTD trouble alarm is issued.

RTD TROUBLE ALARM

Range: Disable, Enable

Default: Disable

This setting enables the RTD Trouble Alarm functionality.

OUTPUT RELAYS

Range: Do Not Operate, Operate

Default: Do Not Operate

NOTE

The availability of assignable Output Relay setpoints is dependent on the Order Code options and the SWITCHING DEVICE setpoint. Refer to section S5 INPUTS/OUTPUTS > OUTPUT RELAYS for more information.

Any assignable output relay can be selected to operate upon RTD Trouble Alarm operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

BLOCK 1 to 3

Range: Off, Any Contact Input, Virtual Input, Remote Input, or Logic Element Element 1 to 16

Default: Off

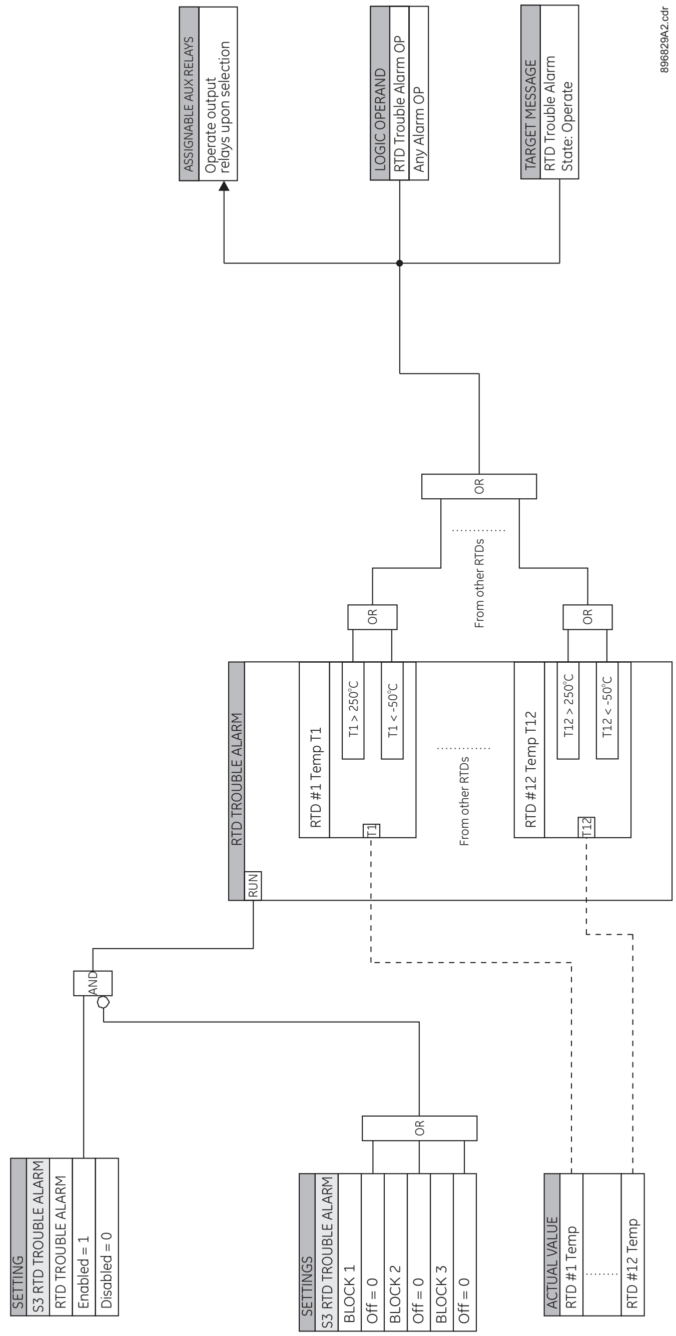
Three blocking inputs are provided for RTD Trouble Alarm. When any of the selected blocking inputs is on, both RTD Trouble Alarm functionality is blocked.

Table 6-3: RTD Temperature vs Resistance

Temperature		100 Ω Pt (DIN 43760)
°C	°F	
–50	–58	80.31
–40	–40	84.27
–30	–22	88.22
–20	–4	92.16
–10	14	96.09
0	32	100.00
10	50	103.90
20	68	107.79
30	86	111.67
40	104	115.54
50	122	119.39
60	140	123.24
70	158	127.07
80	176	130.89
90	194	134.70
100	212	138.50
110	230	142.29
120	248	146.06
130	266	149.82
140	284	153.58
150	302	157.32

Temperature		100 Ω Pt (DIN 43760)
°C	°F	
160	320	161.04
170	338	164.76
180	356	168.47
190	374	172.46
200	392	175.84
210	410	179.51
220	428	183.17
230	446	186.82
240	464	190.45
250	482	194.08

Figure 6-36: RTD Trouble Alarm logic diagram



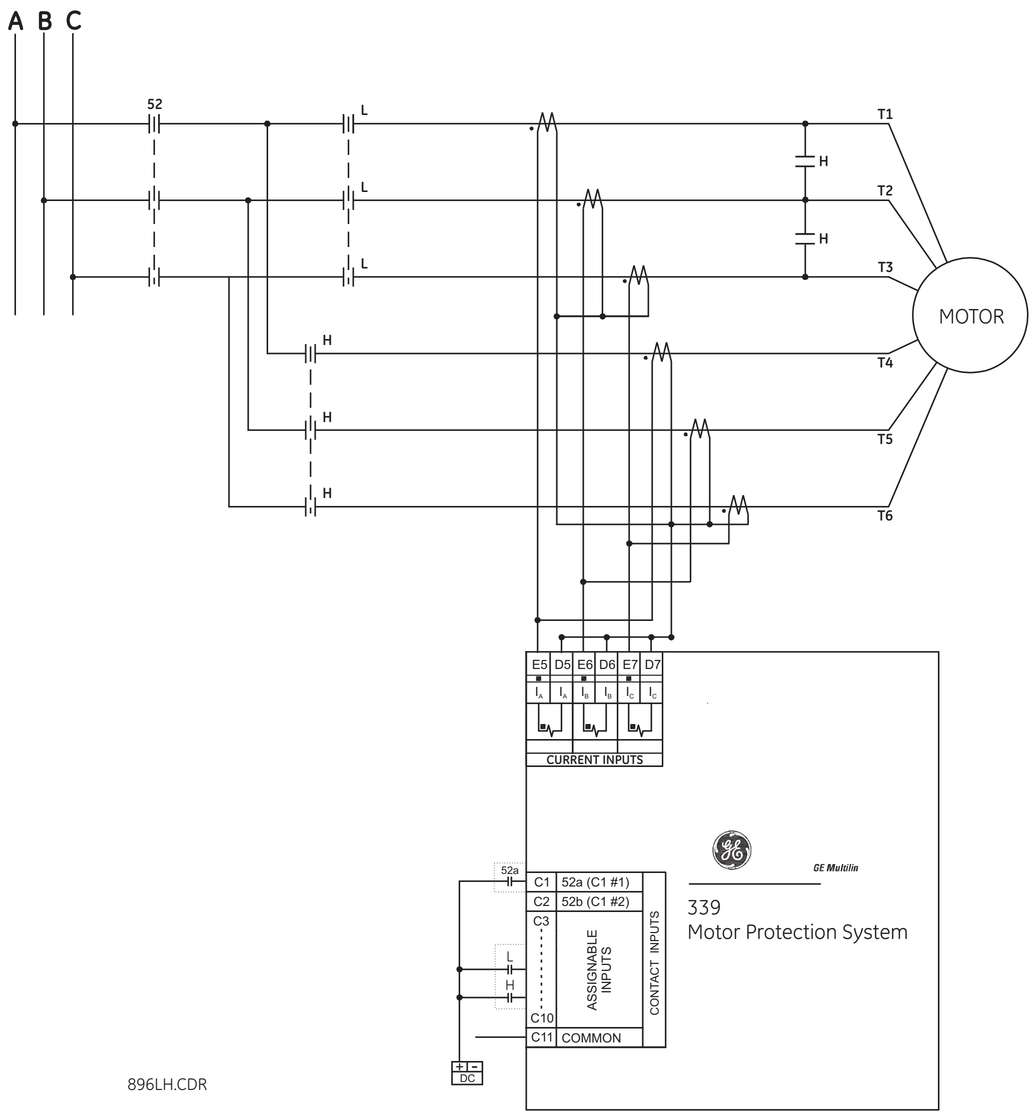
Two-speed motor

Two-speed motors have two windings wound into one stator. These motors rely on contactors to accomplish speed changes by altering the winding configurations. The 339 motor relay provides a complete set of protective functions for each speed.

The 339 motor relay provides proper protection for a two-speed motor where there are two different full-load values. The 339 algorithm integrates the heating at each speed into one thermal model using a common Thermal Capacity Used Register for both high and low speeds.

In the figure below, contactor L and H are interlocked so that only one contactor can be energized to select either low speed or high speed. This figure shows the AC connections for a two-speed motor where CTs connected to low and high speed are paralleled, such that the 339 relay can measure the motor current when the motor is running at either low or high speed, and it will switch CT Primary and motor FLA settings as per the motor running speed. This function is accomplished by detecting the input status from the motor speed switches.

Figure 6-37: Two-speed motor connections



If the two-speed motor feature is enabled, the setting HIGH SPEED SWITCH specifies a contact input to monitor the high speed contact position, and the setting LOW SPEED SWITCH specifies another contact input to monitor the low speed contact position. It is recommended to monitor both high and low speed switches, but using only one of them is also acceptable. When the motor speed is indicated as HIGH SPEED, the relay uses the high speed settings. When the motor speed is indicated as LOW SPEED, the relay uses the same settings as those used for single speed operation. The logic for motor speed indication is shown in the table below.

Setting			Speed Switch Inputs		Motor Speed Indication
ENABLE 2-SPD MOTOR	**High Speed Switch**	**Low Speed Switch**	**High Speed S2**	**Low Speed S1**	
Enable	Configured	Configured	Closed	Open	High Speed
			Open	Closed	Low Speed
			Open	Open	Alarm: SPD SW Fail
			Closed	Closed	
	Configured	Not Configured	Closed	N/A	High Speed
			Open	N/A	Low Speed
	Not Configured	Configured	N/A	Closed	Low Speed
			N/A	Open	High Speed
	Not Configured	Not Configured	N/A	N/A	Alarm: SPD SW Not Config
Disable	Two-speed functionality is not enabled.				

The two-speed motor feature is enabled with the setting **S2 SYSTEM SETUP > MOTOR > ENABLE 2-SPD MOTOR**. When the two-speed feature is enabled, the 339 provides the second independent Short Circuit and Undercurrent elements for High Speed, and adjusts the thermal overload curve and acceleration timer as per the high speed motor characteristics.

Two-speed motor setup

PATH: SETPOINTS > S2 SYSTEM SETUP > MOTOR

ENABLE 2-SPD MOTOR

Range: Disabled, Enabled

Default: Disabled

This setting is used to enable two-speed motor functionality. When this setting is selected as Disabled, all two-speed motor functionalities will be disabled, and all other two-speed motor-related settings are hidden.

HIGH-SPEED PH PRIM

Range: 30 to 1500 A in steps of 1 A

Default: 100 A

This setting is used to specify the Phase CT primary for High Speed.

HIGH-SPEED FLA

Range: 15.0 to 1500.0 A in steps of 0.1 A

Default: 100.0 A

This setting is used to specify the Full Load Amps for High Speed.

HIGH-SPEED RATED PWR

Range: 100 to 10000 KW in steps of 1 KW

Default: 3000 KW

This setting is used to specify the rated power for High Speed.

HIGH SPEED SWITCH

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

If the two-speed motor functionality is used, this setting specifies a contact input to indicate the motor high speed.

LOW SPEED SWITCH

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 8

Default: Off

If the two-speed motor functionality is used, this setting specifies a contact input to indicate the motor low speed.

High speed thermal protection

When the two-speed functionality is enabled, the 339 will switch settings between **S3 PROTECTION > THERMAL PROTECTION** and **S3 PROTECTION > TWO SPEED MOTOR > HIGH SPEED THERMAL** to ensure proper parameters are applied to each speed. The motor thermal characteristics for high and low speed can be different, so separate FLA and curve selections are provided for high speed operation. In applications where the motor has the same thermal characteristics for both low and high speed, set the high speed Thermal O/L Curve to be the same as the main settings.

For a single speed motor where the two-speed functionality is disabled, the 339 will apply **S3 PROTECTION > THERMAL PROTECTION** settings to protect the motor.

PATH: SETPOINTS > S3 PROTECTION > TWO SPEED MOTOR > HIGH SPEED THERMAL

CURVE MULTIPLIER

Range: 1 to 15 in steps of 1

Default: 4

This setting is used to fit a standard overload curve to the thermal characteristics of the protected motor when it is running at High Speed.

High speed short circuit settings

When two-speed functionality is enabled, a second independent Short Circuit element is provided for High Speed. When the motor is running at high speed and any phase current exceeds the high speed short circuit pickup level for the high speed short circuit time delay, the high speed short circuit protection will be activated. In cases where the switching device is a contactor, which is not designed to cut off fault current, the function of short circuit can be set as either **Latched Alarm** or **Alarm**, so the assigned auxiliary output relay will be activated and signal an upstream breaker to trip.

PATH: SETPOINTS > S3 PROTECTION > TWO SPEED MOTOR > HIGH SPEED S/C

S/C FUNC

Range: Disabled, Latched Alarm, Alarm, Trip

Default: Disabled

The selection of the **Latched Alarm**, **Alarm** or **Trip** setting enables the High Speed Short Circuit function. If the operating condition is satisfied when **Trip** is selected as the function, the "LOCKOUT" LED will be turned on, and the logic operand ANY TRIP OP will be asserted, which in turn will operate the "TRIP" LED and the trip output relay. If **Alarm** is selected, the "ALARM" LED will flash upon the short circuit protection operation, and will automatically reset when the activating condition clears. If **Latched Alarm** is selected, the "ALARM" LED will flash upon short circuit protection operation, and will stay "ON" after the condition clears, until a Reset command is initiated. The TRIP output relay will not operate if the **Latched Alarm** or **Alarm** function is selected. Any assignable output relays can be selected to operate when the setting S/C FUNC is selected as **Latched Alarm**, **Alarm**, or **Trip**.

S/C PKP

Range: 1.00 to 20.00xCT in steps of 0.01xCT

Default: 6.00xCT

This setting specifies a pickup threshold for the High Speed Short Circuit function.

S/C DELAY

Range: 0.00 to 60.00 s in steps of 0.01 s
Default: 0.00 s

This setting specifies a time delay for the High Speed Short Circuit function.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate
Default: Do Not Operate

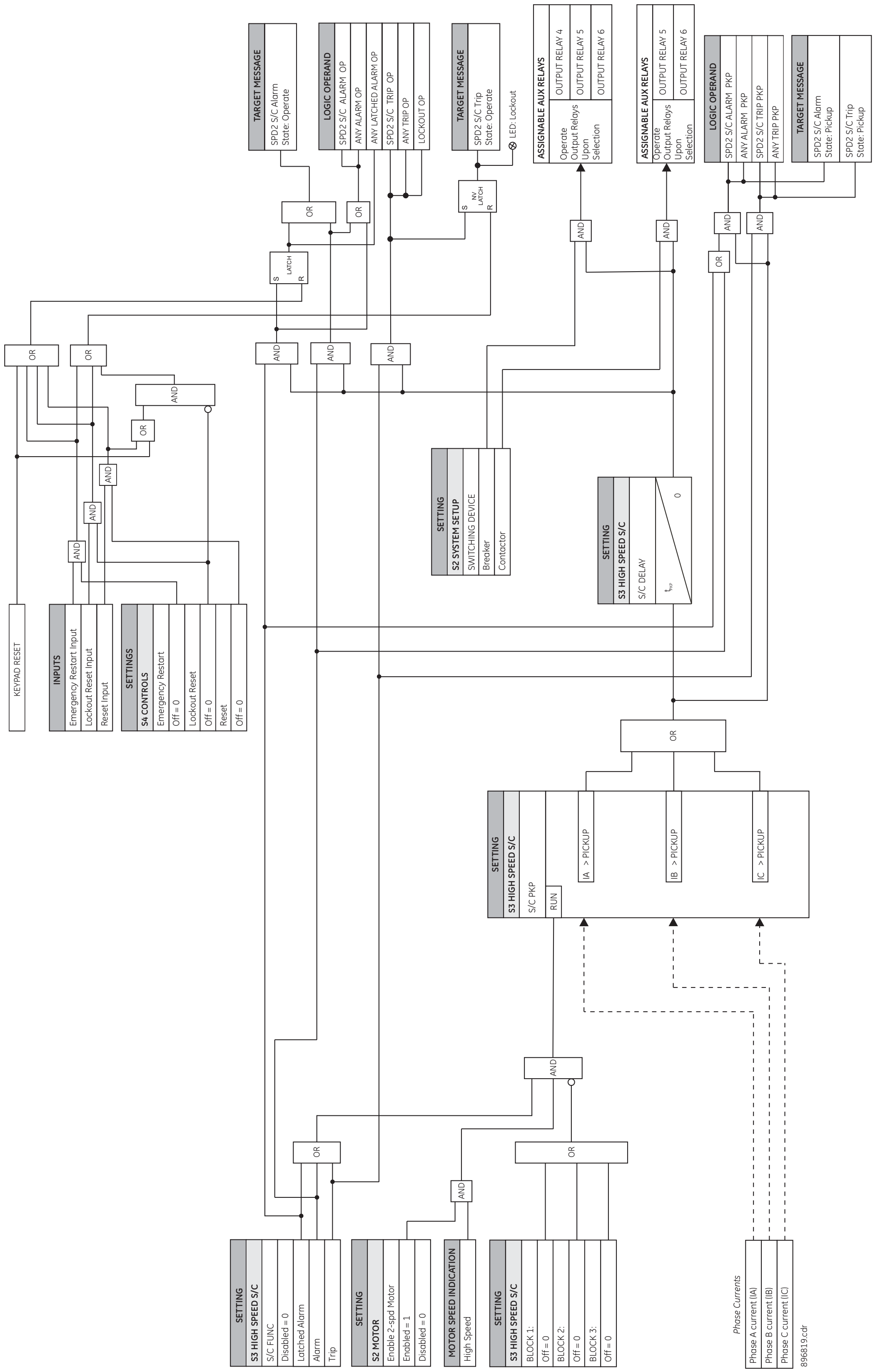
Any assignable output relay can be selected to operate upon High Speed Short Circuit operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16
Default: Off

Three blocking inputs are provided for the High Speed Short Circuit function. When any of the selected blocking inputs is on, the high speed Short Circuit is blocked.

Figure 6-38: High Speed Short Circuit logic diagram



High speed acceleration

When two-speed functionality is enabled, the main acceleration timer is used for low speed starting (a start in low speed from a stopped condition). Two additional acceleration timers are provided for high speed starting. One timer is for a start in high speed from a stopped condition, another timer is for the transition from low speed to high speed. Selection of acceleration timers is as described in the Acceleration section of this manual.

High speed undercurrent

If two-speed functionality is enabled, the 339C relay relies on the motor speed indication to switch the undercurrent settings as per the motor running speed, so the main Undercurrent Protection element is only active when the motor is running at low speed, and the High Speed Undercurrent Protection element is only active when the motor is running at high speed. If two-speed functionality is not deployed, only the main Short Circuit is active, and the High Speed Short Circuit is disabled.

PATH: **SETPOINTS > S3 PROTECTION > TWO SPEED MOTOR > HIGH SPEED U/CURR**

U/CURR ALARM FUNC

Range: Disabled, Enabled

Default: Disabled

This setting is used to enable the High Speed Undercurrent Alarm function.

BLK U/C ON START

Range: 0 to 600 s in steps of 1 s

Default: 0 s

This setting is used to specify a time delay to block undercurrent function when the motor is starting to High Speed. If this setting is programmed as 0, the undercurrent function will not be blocked from start.

U/CURR ALARM PKP

Range: 0.10 to 0.95xFLA in steps of 0.01xFLA

Default: 0.70xFLA

This setting specifies a pickup threshold for the Alarm stage. This threshold should be set lower than motor load current during normal operation.

U/CURR ALARM DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s

Default: 1.00 s

This setting specifies a time delay for the Alarm stage. This time delay should be set long enough to overcome short lowering of the current such as during system faults.

U/CURR TRIP FUNC

Range: Disabled, Enabled

Default: Disabled

This setting is used to enable the High Speed Undercurrent Trip function.

U/CURR TRIP PKP

Range: 0.10 to 0.95xFLA in steps of 0.01xFLA

Default: 0.60xFLA

This setting specifies a pickup threshold for the Trip stage. This threshold should be set lower than the threshold for the Alarm stage.

U/CURR TRIP DELAY

Range: 1.00 to 60.00 s in steps of 0.01 s

Default: 1.00 s

This setting specifies a time delay for the Trip stage. This time delay should be set long enough to overcome short lowering of the current such as during system faults.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon High Speed Undercurrent operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

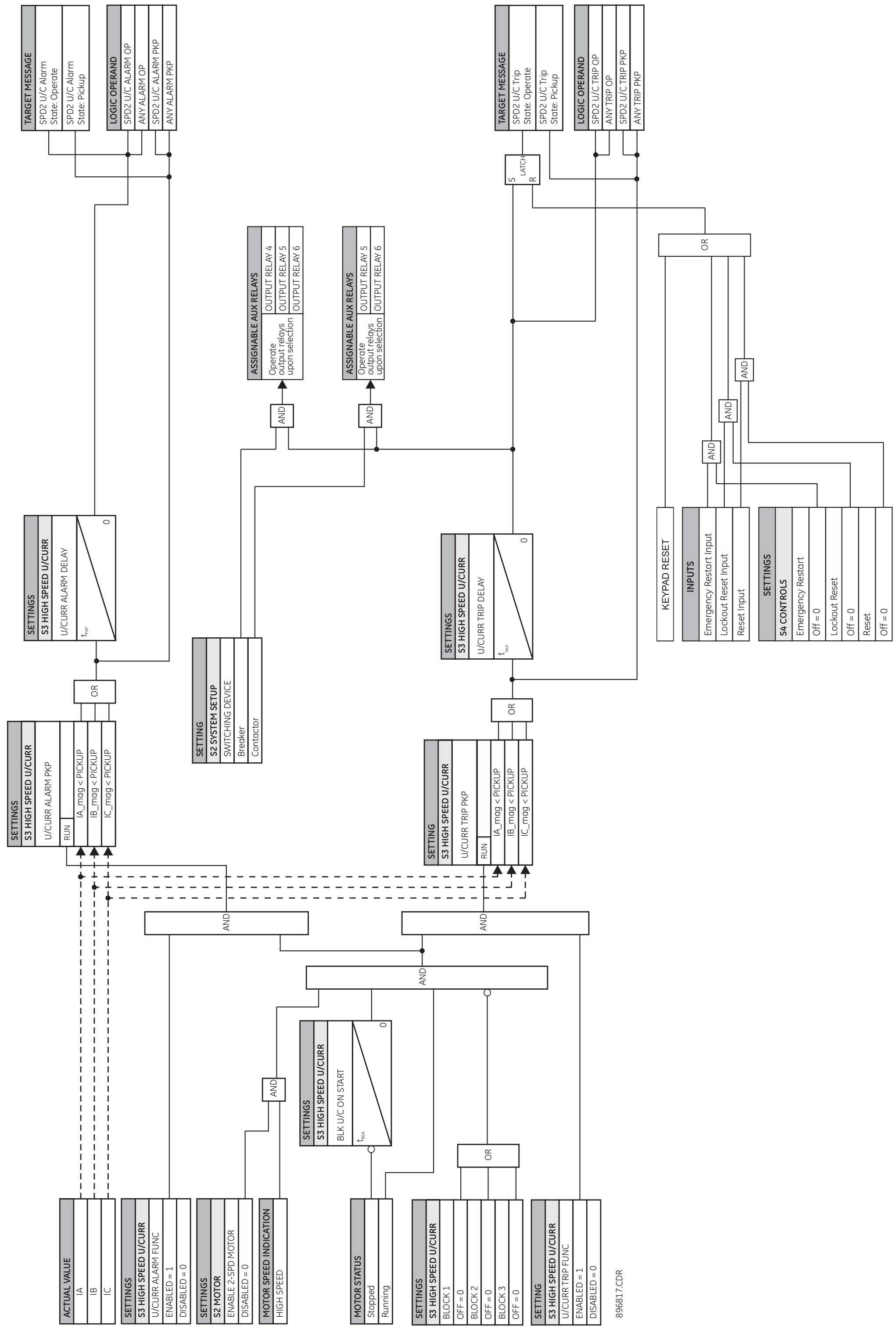
BLOCK 1 to 3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided for the High Speed Undercurrent function. When any of the selected blocking inputs is on, the High Speed Undercurrent is blocked.

Figure 6-39: High Speed Undercurrent logic diagram



Neutral directional overcurrent

The Neutral Directional element is used to discriminate between faults that occur in the forward direction, and faults that occur in the reverse direction. The Neutral Directional element can be used either individually for control or alarm by energizing the auxiliary output relays, or as a part of the Neutral Time, or Instantaneous, over-current elements to define the tripping direction. (See the setup for Neutral TOC, and Neutral IOC elements.)

The polarizing signal for the Neutral Directional element can be set to be either voltage (zero sequence voltage), current (measured ground current), or dual (both).

The polarizing voltage for the Neutral directional element is calculated as follows:

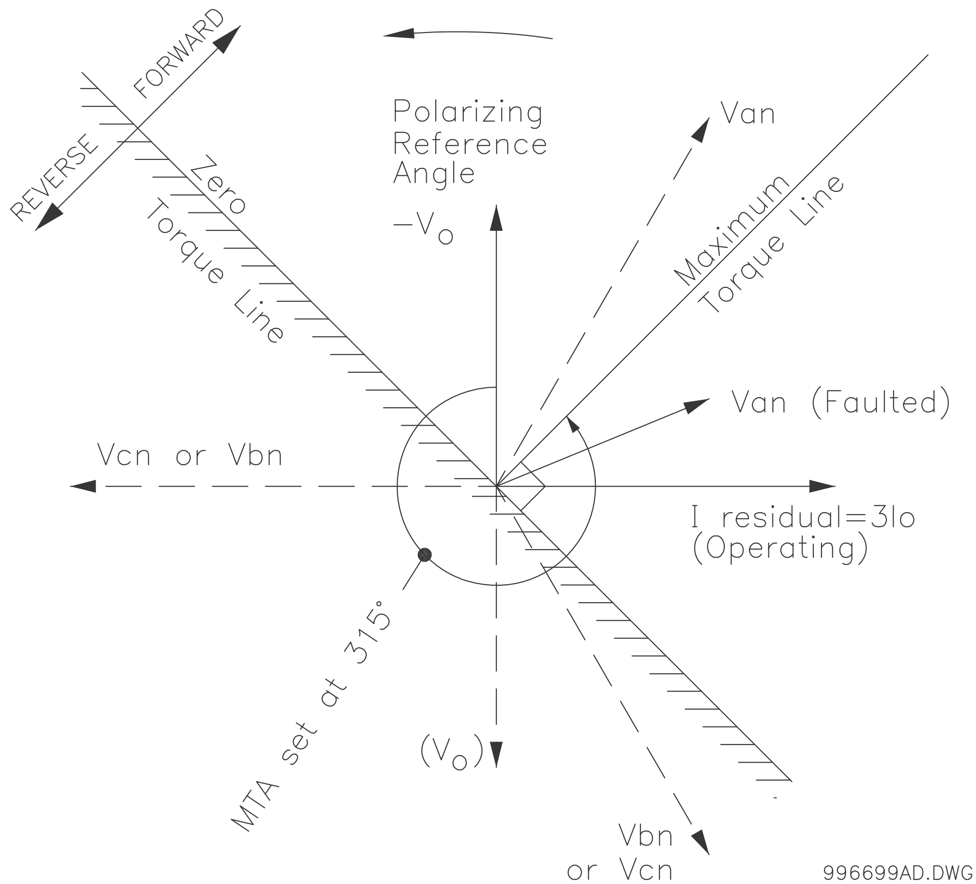
$$-V_0 = \frac{-(V_a + V_b + V_c)}{3} \quad \textbf{Eq. 17}$$

Please note that the phase VT inputs must be connected in Wye.

When “Voltage” polarization is selected, the direction is determined by comparing the angle between the operating current and the voltage, and the set MTA angle. In cases where the voltage drops below the setting of the minimum polarizing voltage, the neutral directional element defaults to the Forward direction.

When “Current” polarizing is selected, the direction of the neutral current is determined with reference to the direction of the measured ground current . The fault is detected in the Forward direction when the ground current typically flowing from the ground point into the neutral current is within ± 90° of the polarizing current. Otherwise the direction is detected as Reverse. The neutral direction defaults to Forward if the polarizing ground current drops below 5% of the ground CT.

The diagram below shows the regions for detection of neutral current Forward and Reverse directions with respect to the zero sequence voltage and the selected Maximum Torque Angle (MTA).



When "Dual" polarizing is selected, the Reverse direction is declared if both directional comparators - the one based on the zero sequence polarizing voltage, and the other based on measured ground polarizing current - declare Reverse direction. If the direction from one of the comparators declares Forward direction and the other declares Reverse direction, the element will declare Forward direction. If the polarizing voltage falls below the set minimum voltage, the direction declared depends on the polarizing ground current, assuming the measured ground current is above some 5% CTg. The same rule applies if the ground current falls below 5% CTg. In this case the direction is determined using the polarizing zero sequence voltage, assuming it is above the set minimum voltage from the settings menu.

The following table shows the operating current, and the polarizing signals, used for directional control:

Table 6-4: Neutral directional characteristics

Quantity	Operating Current	Polarizing Voltage (VT Connection: Wye)	Polarizing Current
Neutral	3Io = Ia + Ib + Ic	-Vo = -(Va + Vb + Vc)/3	Ig

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S3 PROTECTION > S3 SETPOINT GROUP 1(2) > NTRL DIR**

NTRL DIR FUNCTION

Range: Disabled, Latched Alarm, Alarm, Control

Default: Disabled

When an **Alarm** function is selected, the alarm LED will flash upon detection of Reverse direction, and will drop out when the direction changes to Forward. When **Latched Alarm** is selected, the alarm LED will flash upon detection of Reverse direction, and will stay lit (latched) after the direction changes to Forward. The alarm LED can be reset, by issuing a Reset command. Detection of Reverse direction when the **Control** function is selected, does not trigger the alarm LED.

NTRL DIR POLARIZING

Range: Voltage, Current, Dual

Default: Voltage

This setting specifies the voltage polarizing signal for the detection of Forward and Reverse directions.

NTRL DIR MTA

Range: 0° to 359° Lead in steps of 1°

Default: 315°

This setting sets the Maximum Torque Angle (MTA), for the Neutral Directional element to define the regions of Forward and Reverse directions. For Voltage polarizing, enter the maximum torque angle by which the operating current leads the polarizing voltage. This is the angle of maximum sensitivity.

MIN POL VOLTAGE

Range: 0.05 to 1.25 x VT in steps of 0.01

Default: 0.05 x VT

This setting affects only cases where voltage or dual polarizing is selected. The minimum zero sequence voltage level must be selected to prevent operation due to normal system unbalances, or voltage transformer errors. Set the minimum zero sequence voltage level to 2% of VT for well balanced systems, and 1% of VT accuracy. For systems with high resistance grounding or floating neutrals, this setting can be as high as 20%. The default of 5% of VT is appropriate for most solidly grounded systems.

OUTPUT RELAY 3 to 6

Range: Do not operate, Operate

Default: Do not operate

Any or all of the output relays 3 to 6 can be selected to operate upon Neutral Directional operation. The selection of relay outputs operation is available no matter whether Latched Alarm, Alarm, or Trip function is selected.

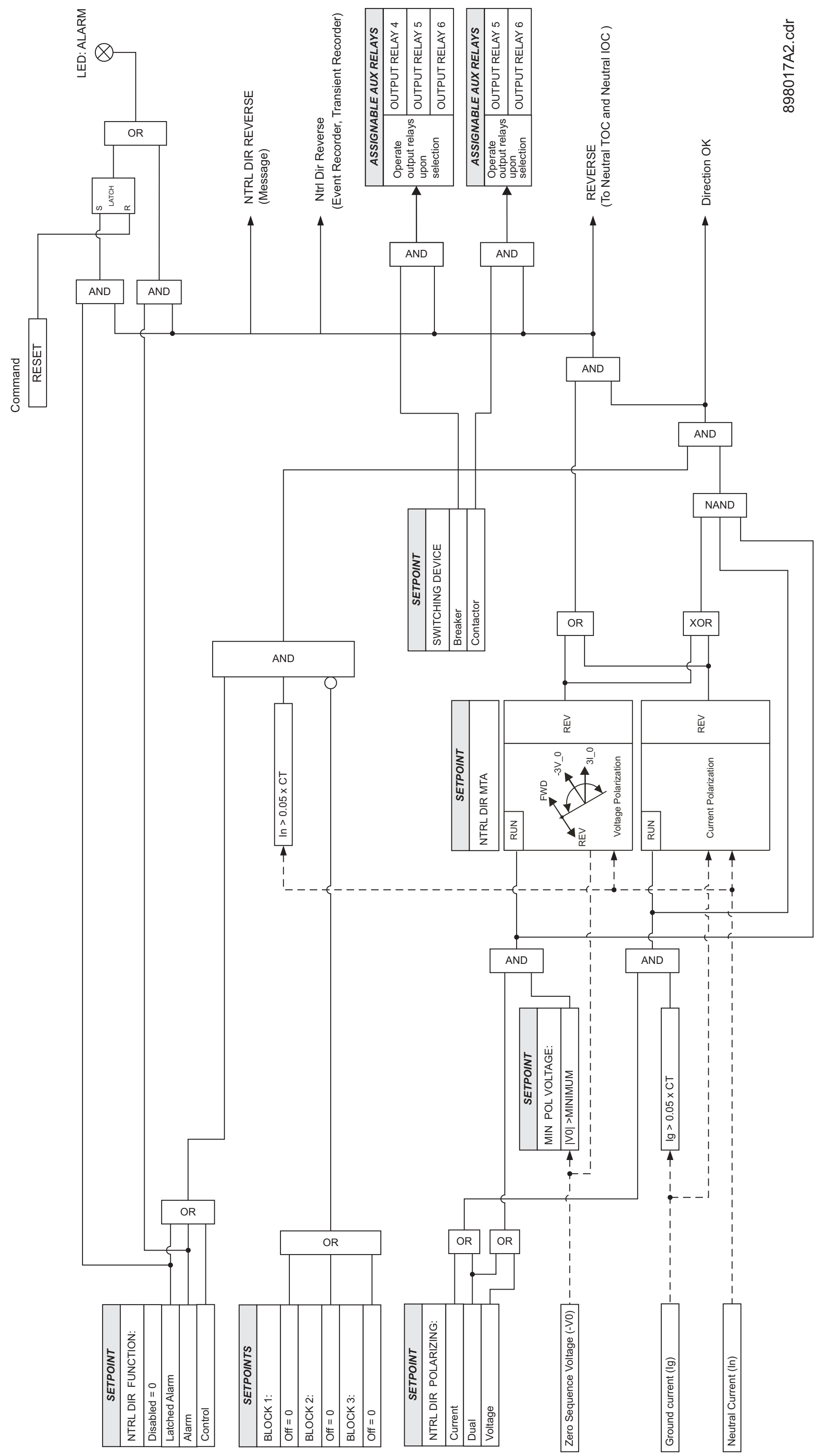
BLOCK 1/2/3

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

Three blocking inputs are provided in the Neutral Directional menu. One blocking input going “high” is enough to block the function. The selection for each block can be Contact input, Virtual Input, Remote Input, or Logic Element.

Figure 6-40: Neutral Directional logic diagram



S4 Control

Figure 6-41: Controls with BREAKER menu

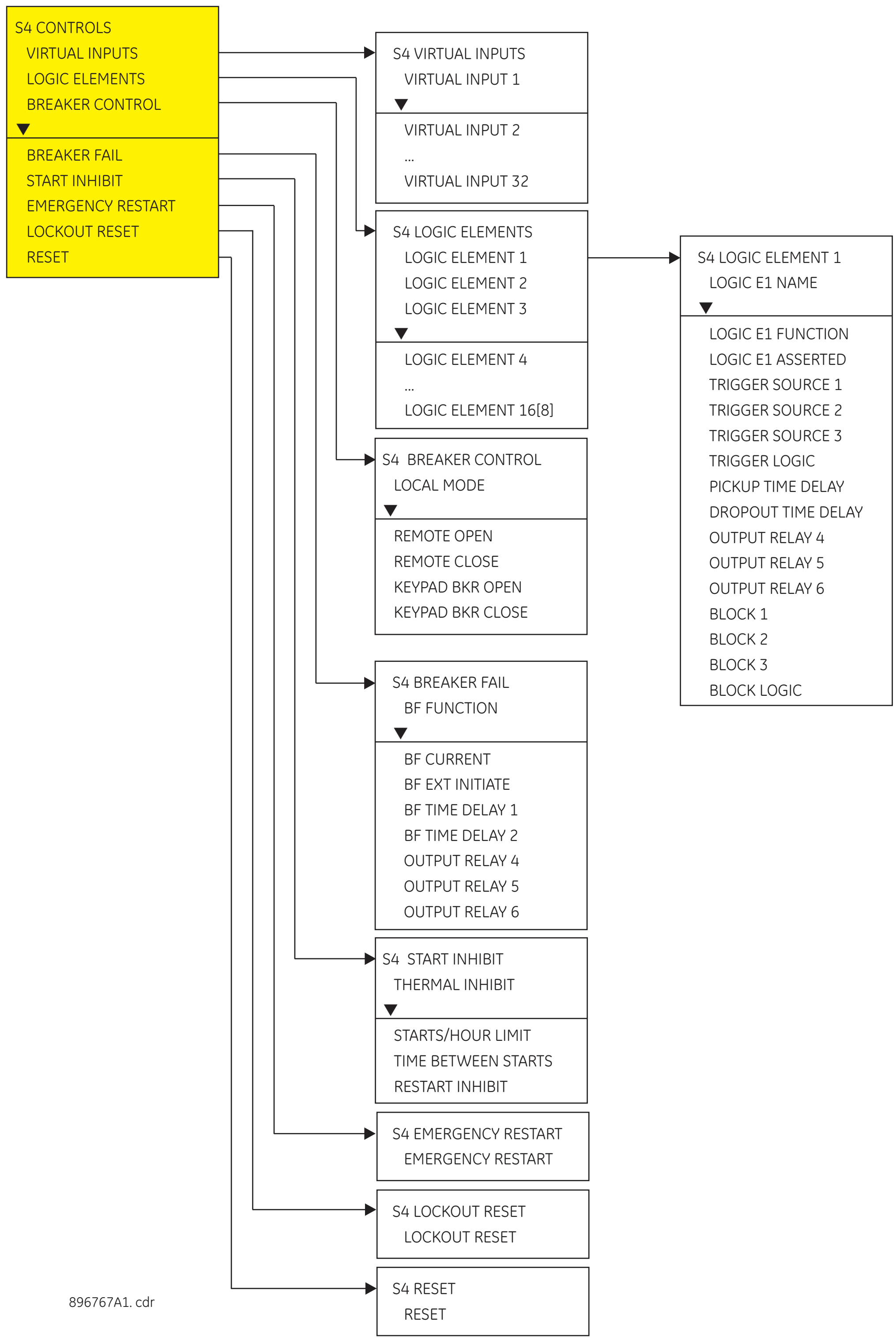
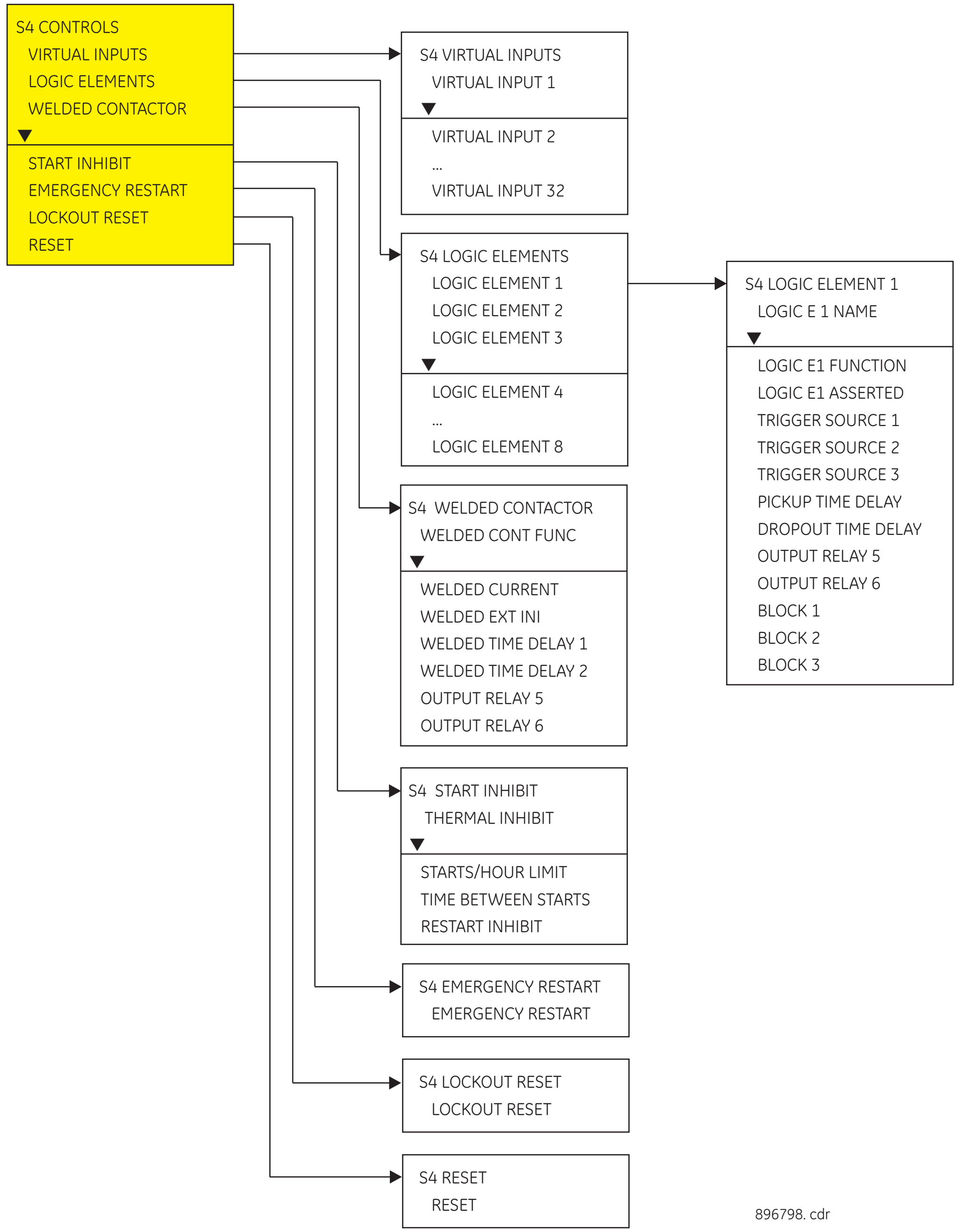


Figure 6-42: Controls with CONTACTOR menu



Virtual inputs

There are 32 virtual inputs that can be individually programmed to respond to input commands entered via the relay keypad, or by using communication protocols.

PATH: **SETPOINTS > S4 CONTROLS > VIRTUAL INPUTS**

VIRTUAL INPUT 1

Range: Off, On

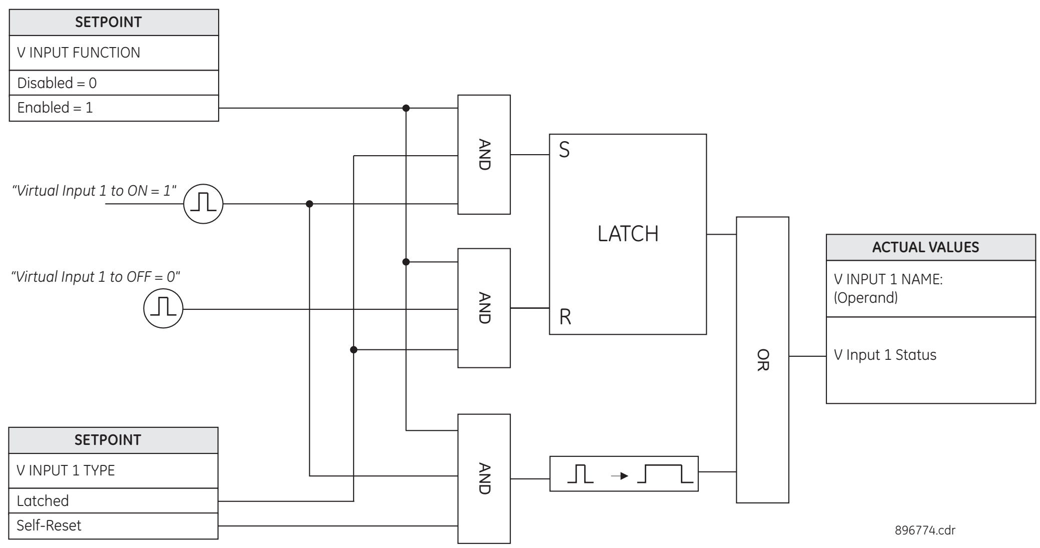
Default: Off

The state of each virtual input can be controlled under **SETPOINTS > S4 CONTROL > VIRTUAL INPUTS** menu. For this purpose, each of the virtual inputs selected for control need be “Enabled” under **SETPOINTS > S5 INPUTS/OUTPUTS > VIRTUAL INPUTS**, and its type “Self-Reset” or “Latched” specified.

If Self-Reset type was selected, entering “On” command will lead to a pulse of one protection pass. To prolong the time of the virtual input pulse, one can assign it as a trigger source to a Logic Element with a dropout timer set to the desired pulse time. If “Latched” type is selected, the state of the virtual input will be latched, upon entering “On” command.

Refer to the logic diagram below for more details.

Figure 6-43: Virtual inputs scheme logic



Logic elements

The 339 relay has 16 Logic Elements available to build simple logic using the state of any programmed contact, virtual, or remote input, or from the output operand of a protection, or control element. Changing the state of any of the assigned inputs used as trigger sources, will change the state of the Logic Element, unless a blocking input is present. The logic provides for assigning up to three triggering inputs in an “OR” gate for Logic Element operation, and up to three blocking inputs in an “OR” gate for defining the block signal. Pickup and dropout timers are available for delaying Logic Element operation and drop-out respectively. In addition, the user can define whether to use the “ON”, or “OFF” state of the programmed element by selecting ASSERTED: “On” or “Off”.

Referring to the Logic Element logic diagram below, the Logic Element can be set to one of four functions: **Control**, **Alarm**, **Latched Alarm**, or **Trip**. The Trip output relay will be triggered when **Trip** is selected as a function, and the Logic element operates. Output relay #1 (Trip) will not be triggered during Logic Element operation if **Alarm**, **Latched Alarm**, or **Control** is selected.

The “PICKUP” LED will turn on upon a Logic Element pickup condition except when the Logic Element function is selected as **Control**.

The “ALARM” LED will turn on upon Logic Element operation if the Logic Element function selected is either **Alarm**, or **Latched Alarm**.

The “TRIP” LED will turn on upon Logic Element operation if the Logic Element function is selected as **Trip**.

The option to trigger auxiliary output relays is provided for any of the selected Logic Element functions.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S4 CONTROLS > S4 LOGIC ELEMENTS**

LE1(16) FUNCTION

Range: Disabled, Control, Alarm, Latched Alarm, Trip

Default: Disabled

This setting defines the use of the Logic Element. When **Trip** is selected as a function, the Logic Element will trigger Output Relay # 1 (Trip) upon operation.

LE1(16) ASSERTED

Range: On, Off

Default: Off

This setting defines the Logic Element state “On” or “Off” to be used as an output. The asserted “On” selection provides an output “high” when the LE is "On". If asserted “Off” is selected, then the LE output will be “high”, when the LE is “Off”.

TRIGGER SOURCE 1, 2, 3

Range: Off, Any input from the list of inputs

Default: Off

Each of the three trigger sources is configurable by allowing the assigning of an input selected from a list of inputs. This input can be a contact input, a virtual input, a remote input, or an output flag from a protection, or control element.

TRIGGER LOGIC

Range: OR, AND

Default: OR

This setting defines trigger source operation as either “OR” or “AND”. When set to “OR” any of the inputs will trigger the Logic Element. When set to “AND” all three sources must be asserted before the Logic Element is triggered.

PKP TIME DELAY

Range: 0 to 60000 ms in steps of 1 ms

Default: 0 ms

This setting specifies the pickup time delay before Logic Element operation.

DPO TIME DELAY

Range: 0 to 60000 ms in steps of 1 ms

Default: 0 ms

This setting specifies the time delay from a reset timer that starts upon expiry of the pickup time delay and prolongs the operation of the Logic Element until this time expires.

BLOCK 1, 2, 3

Range: Off, Any input from the list of inputs

Default: Off

Each of the three blocks is configurable by allowing the assigning of an input selected from a list of inputs. This input can be a contact input, a virtual input, a remote input, or an output flag from a protection, or control element, as well as an input from any of the other seven logic inputs.

BLOCK LOGIC

Range: OR, AND

Default: OR

This setting defines block source operation as either “OR” or “AND”. When set to “OR” any of the inputs will block the Logic Element. When set to “AND” all three sources must be asserted before the Logic Element is blocked.

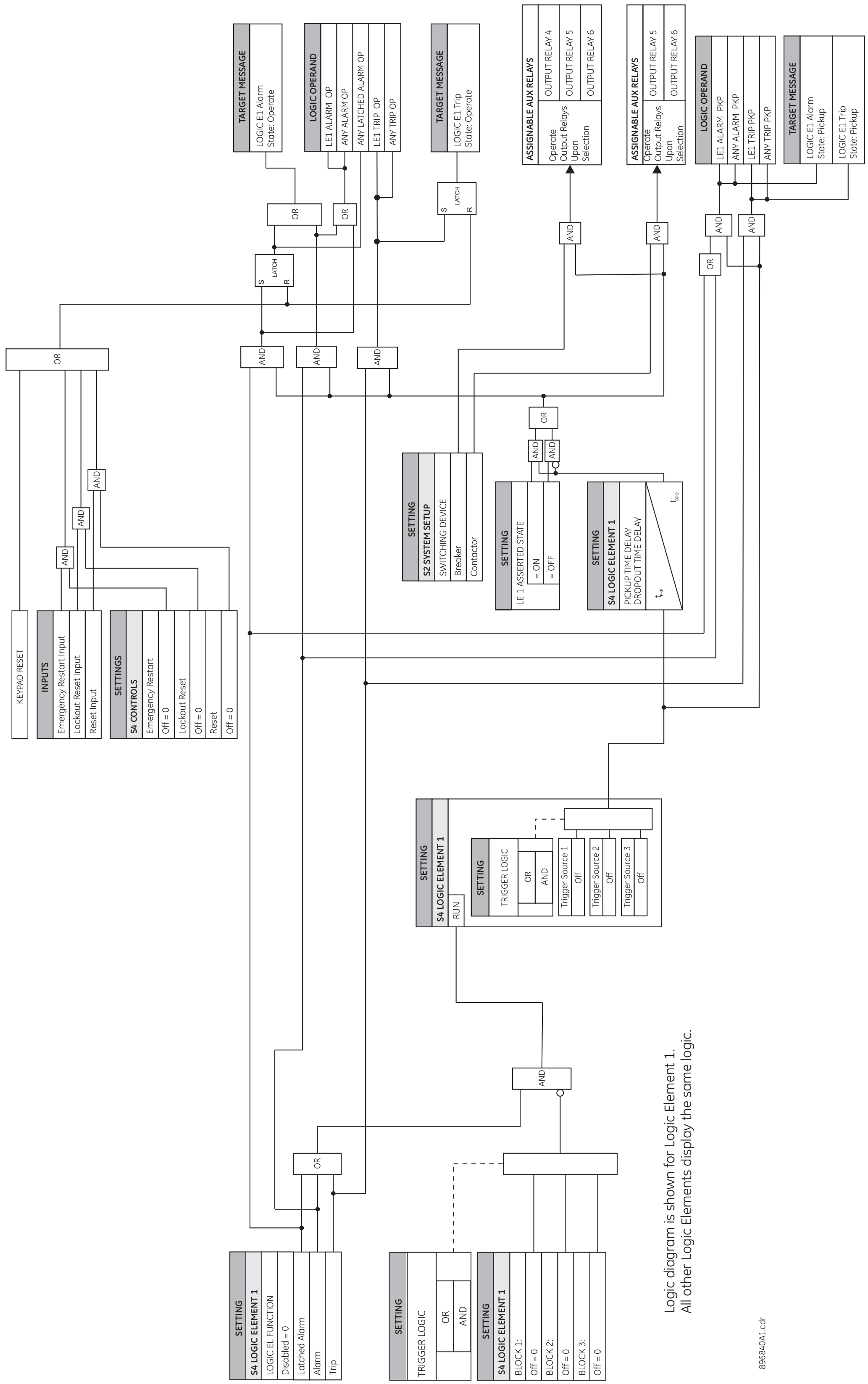
OUTPUT RELAYS 4 to 6 / OUTPUT RELAYS 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon a Logic Element operating condition. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relays 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relays 5 to 6. The selection of auxiliary relay outputs is available no matter whether the **Control**, **Alarm**, **Latched Alarm**, or **Trip** function is selected.

Figure 6-44: Logic Element logic diagram



The following table, from the *339 Communications Guide*, shows the list of available Logic Inputs.

Code	Type	Definition
FC134C	unsigned 16 bits	Logic Element Trigger
0		Off
0x0040		Contact IN 1 On
0x0041		Contact IN 2 On
0x0042		Contact IN 3 On
0x0043		Contact IN 4 On
0x0044		Contact IN 5 On
0x0045		Contact IN 6 On
0x0046		Contact IN 7 On
0x0047		Contact IN 8 On
0x0048		Contact IN 9 On
0x0049		Contact IN 10 On
0x0060		Contact IN 1 Off
0x0061		Contact IN 2 Off
0x0062		Contact IN 3 Off
0x0063		Contact IN 4 Off
0x0064		Contact IN 5 Off
0x0065		Contact IN 6 Off
0x0066		Contact IN 7 Off
0x0067		Contact IN 8 Off
0x0068		Contact IN 9 Off
0x0069		Contact IN 10 Off
0x0080		Virtual IN 1 On
0x0081		Virtual IN 2 On
0x0082		Virtual IN 3 On
0x0083		Virtual IN 4 On
0x0084		Virtual IN 5 On
0x0085		Virtual IN 6 On
0x0086		Virtual IN 7 On
0x0087		Virtual IN 8 On
0x0088		Virtual IN 9 On
0x0089		Virtual IN 10 On
0x008A		Virtual IN 11 On
0x008B		Virtual IN 12 On
0x008C		Virtual IN 13 On
0x008D		Virtual IN 14 On
0x008E		Virtual IN 15 On
0x008F		Virtual IN 16 On
0x0090		Virtual IN 17 On
0x0091		Virtual IN 18 On
0x0092		Virtual IN 19 On
0x0093		Virtual IN 20 On
0x0094		Virtual IN 21 On
0x0095		Virtual IN 22 On

Code	Type	Definition
0x0096		Virtual IN 23 On
0x0097		Virtual IN 24 On
0x0098		Virtual IN 25 On
0x0099		Virtual IN 26 On
0x009A		Virtual IN 27 On
0x009B		Virtual IN 28 On
0x009C		Virtual IN 29 On
0x009D		Virtual IN 30 On
0x009E		Virtual IN 31 On
0x009F		Virtual IN 32 On
0x00A0		Virtual IN 1 Off
0x00A1		Virtual IN 2 Off
0x00A2		Virtual IN 3 Off
0x00A3		Virtual IN 4 Off
0x00A4		Virtual IN 5 Off
0x00A5		Virtual IN 6 Off
0x00A6		Virtual IN 7 Off
0x00A7		Virtual IN 8 Off
0x00A8		Virtual IN 9 Off
0x00A9		Virtual IN 10 Off
0x00AA		Virtual IN 11 Off
0x00AB		Virtual IN 12 Off
0x00AC		Virtual IN 13 Off
0x00AD		Virtual IN 14 Off
0x00AE		Virtual IN 15 Off
0x00AF		Virtual IN 16 Off
0x00B0		Virtual IN 17 Off
0x00B1		Virtual IN 18 Off
0x00B2		Virtual IN 19 Off
0x00B3		Virtual IN 20 Off
0x00B4		Virtual IN 21 Off
0x00B5		Virtual IN 22 Off
0x00B6		Virtual IN 23 Off
0x00B7		Virtual IN 24 Off
0x00B8		Virtual IN 25 Off
0x00B9		Virtual IN 26 Off
0x00BA		Virtual IN 27 Off
0x00BB		Virtual IN 28 Off
0x00BC		Virtual IN 29 Off
0x00BD		Virtual IN 30 Off
0x00BE		Virtual IN 31 Off
0x00BF		Virtual IN 32 Off
0x01C0		Remote IN 1 On
0x01C1		Remote IN 2 On
0x01C2		Remote IN 3 On
0x01C3		Remote IN 4 On
0x01C4		Remote IN 5 On

Code	Type	Definition
0x01C5		Remote IN 6 On
0x01C6		Remote IN 7 On
0x01C7		Remote IN 8 On
0x01C8		Remote IN 9 On
0x01C9		Remote IN 10 On
0x01CA		Remote IN 11 On
0x01CB		Remote IN 12 On
0x01CC		Remote IN 13 On
0x01CD		Remote IN 14 On
0x01CE		Remote IN 15 On
0x01CF		Remote IN 16 On
0x01D0		Remote IN 17 On
0x01D1		Remote IN 18 On
0x01D2		Remote IN 19 On
0x01D3		Remote IN 20 On
0x01D4		Remote IN 21 On
0x01D5		Remote IN 22 On
0x01D6		Remote IN 23 On
0x01D7		Remote IN 24 On
0x01D8		Remote IN 25 On
0x01D9		Remote IN 26 On
0x01DA		Remote IN 27 On
0x01DB		Remote IN 28 On
0x01DC		Remote IN 29 On
0x01DD		Remote IN 30 On
0x01DE		Remote IN 31 On
0x01DF		Remote IN 32 On
0x01E0		Remote IN 1 Off
0x01E1		Remote IN 2 Off
0x01E2		Remote IN 3 Off
0x01E3		Remote IN 4 Off
0x01E4		Remote IN 5 Off
0x01E5		Remote IN 6 Off
0x01E6		Remote IN 7 Off
0x01E7		Remote IN 8 Off
0x01E8		Remote IN 9 Off
0x01E9		Remote IN 10 Off
0x01EA		Remote IN 11 Off
0x01EB		Remote IN 12 Off
0x01EC		Remote IN 13 Off
0x01ED		Remote IN 14 Off
0x01EE		Remote IN 15 Off
0x01EF		Remote IN 16 Off
0x01F0		Remote IN 17 Off
0x01F1		Remote IN 18 Off
0x01F2		Remote IN 19 Off
0x01F3		Remote IN 20 Off

Code	Type	Definition
0x01F4		Remote IN 21 Off
0x01F5		Remote IN 22 Off
0x01F6		Remote IN 23 Off
0x01F7		Remote IN 24 Off
0x01F8		Remote IN 25 Off
0x01F9		Remote IN 26 Off
0x01FA		Remote IN 27 Off
0x01FB		Remote IN 28 Off
0x01FC		Remote IN 29 Off
0x01FD		Remote IN 30 Off
0x01FE		Remote IN 31 Off
0x01FF		Remote IN 32 Off
0x8002		Any Trip
0x8041		Therm O/L Trip PKP
0x8042		Therm O/L Trip OP
0x8044		Therm O/L Trip DPO
0x8081		GF Trip PKP
0x8082		GF Trip OP
0x8084		GF Trip DPO
0x80C2		Accel Trip OP
0x8141		Under Pwr Trip PKP
0x8142		Under Pwr Trip OP
0x8144		Under Pwr Trip DPO
0x8181		Single PH Trip PKP
0x8182		Single PH Trip OP
0x8184		Single PH Trip DPO
0x8201		Mech Jam Trip PKP
0x8202		Mech Jam Trip OP
0x8204		Mech Jam Trip DPO
0x8241		U/CURR Trip PKP
0x8242		U/CURR Trip OP
0x8244		U/CURR Trip DPO
0x8281		UNBAL Trip PKP
0x8282		UNBAL Trip OP
0x8284		UNBAL Trip DPO
0x82C2		RTD 1 Trip OP
0x82C4		RTD 1 Trip DPO
0x8302		RTD 2 Trip OP
0x8304		RTD 2 Trip DPO
0x8342		RTD 3 Trip OP
0x8344		RTD 3 Trip DPO
0x8382		RTD 4 Trip OP
0x8384		RTD 4 Trip DPO
0x83C2		RTD 5 Trip OP
0x83C4		RTD 5 Trip DPO
0x8402		RTD 6 Trip OP
0x8404		RTD 6 Trip DPO

Code	Type	Definition
0x84C1		LE 1 Trip PKP
0x84C2		LE 1 Trip OP
0x84C4		LE 1 Trip DPO
0x8501		LE 2 Trip PKP
0x8502		LE 2 Trip OP
0x8504		LE 2 Trip DPO
0x8541		LE 3 Trip PKP
0x8542		LE 3 Trip OP
0x8544		LE 3 Trip DPO
0x8581		LE 4 Trip PKP
0x8582		LE 4 Trip OP
0x8584		LE 4 Trip DPO
0x85C1		LE 5 Trip PKP
0x85C2		LE 5 Trip OP
0x85C4		LE 5 Trip DPO
0x8601		LE 6 Trip PKP
0x8602		LE 6 Trip OP
0x8604		LE 6 Trip DPO
0x8641		LE 7 Trip PKP
0x8642		LE 7 Trip OP
0x8644		LE 7 Trip DPO
0x8681		LE 8 Trip PKP
0x8682		LE 8 Trip OP
0x8684		LE 8 Trip DPO
0x86C2		RTD 7 Trip OP
0x86C4		RTD 7 Trip DPO
0x8702		RTD 8 Trip OP
0x8704		RTD 8 Trip DPO
0x8742		RTD 9 Trip OP
0x8744		RTD 9 Trip DPO
0x8782		RTD 10 Trip OP
0x8784		RTD 10 Trip DPO
0x87C2		RTD 11 Trip OP
0x87C4		RTD 11 Trip DPO
0x8802		RTD 12 Trip OP
0x8804		RTD 12 Trip DPO
0x8F81		Fuse Fail Trip PKP
0x8F82		Fuse Fail Trip OP
0x8F84		Fuse Fail Trip DPO
0x8FC2		Ph Revrsl Trip OP
0x8FC4		Ph Revrsl Trip DPO
0x9041		Ntrl IOC1 Trip PKP
0x9042		Ntrl IOC1 Trip OP
0x9044		Ntrl IOC1 Trip DPO
0x93C1		NegSeq OV Trp PKP
0x93C2		NegSeq OV Trp OP
0x93C4		NegSeq OV Trp DPO

Code	Type	Definition
0x9441		Ph OV1 Trip PKP
0x9442		Ph OV1 Trip OP
0x9444		Ph OV1 Trip DPO
0x9481		Ph UV1 Trip PKP
0x9482		Ph UV1 Trip OP
0x9484		Ph UV1 Trip DPO
0x9541		UndrFreq1 Trip PKP
0x9542		UndrFreq1 Trip OP
0x9544		UndrFreq1 Trip DPO
0x9581		UndrFreq2 Trip PKP
0x9582		UndrFreq2 Trip OP
0x9584		UndrFreq2 Trip DPO
0x95C1		OverFreq1 Trip PKP
0x95C2		OverFreq1 Trip OP
0x95C4		OverFreq1 Trip DPO
0x9601		OverFreq2 Trip PKP
0x9602		OverFreq2 Trip OP
0x9604		OverFreq2 Trip DPO
0x9881		Ph OV2 Trip PKP
0x9882		Ph OV2 Trip OP
0x9884		Ph OV2 Trip DPO
0x98C1		Ph UV2 Trip PKP
0x98C2		Ph UV2 Trip OP
0x98C4		Ph UV2 Trip DPO
0x9901		S/C Trip PKP
0x9902		S/C Trip OP
0x9904		S/C Trip DPO
0x9941		SPD2 S/C Trip PKP
0x9942		SPD2 S/C Trip OP
0x9944		SPD2 S/C Trip DPO
0x9981		SPD2 U/C Trip PKP
0x9982		SPD2 U/C Trip OP
0x9984		SPD2 U/C Trip DPO
0x9C01		LE 9 Trip PKP
0x9C02		LE 9 Trip OP
0x9C04		LE 9 Trip DPO
0x9C41		LE 10 Trip PKP
0x9C42		LE 10 Trip OP
0x9C44		LE 10 Trip DPO
0x9C81		LE 11 Trip PKP
0x9C82		LE 11 Trip OP
0x9C84		LE 11 Trip DPO
0x9CC1		LE 12 Trip PKP
0x9CC2		LE 12 Trip OP
0x9CC4		LE 12 Trip DPO
0x9D01		LE 13 Trip PKP
0x9D02		LE 13 Trip OP

Code	Type	Definition
0x9D04		LE 13 Trip DPO
0x9D41		LE 14 Trip PKP
0x9D42		LE 14 Trip OP
0x9D44		LE 14 Trip DPO
0x9D81		LE 15 Trip PKP
0x9D82		LE 15 Trip OP
0x9D84		LE 15 Trip DPO
0x9DC1		LE 16 Trip PKP
0x9DC2		LE 16 Trip OP
0x9DC4		LE 16 Trip DPO
0xA002		Any Alarm
0xA042		Therm Lvl Alrm OP
0xA044		Therm Lvl Alrm DPO
0xA081		Gnd Fault Alrm PKP
0xA082		Gnd Fault Alrm OP
0xA084		Gnd Fault Alrm DPO
0xA141		Under Pwr Alrm PKP
0xA142		Under Pwr Alrm OP
0xA144		Under Pwr Alrm DPO
0xA241		U/CURR Alarm PKP
0xA242		U/CURR Alarm OP
0xA244		U/CURR Alarm DPO
0xA281		UNBAL Alarm PKP
0xA282		UNBAL Alarm OP
0xA284		UNBAL Alarm DPO
0xA2C2		RTD 1 Alarm OP
0xA2C4		RTD 1 Alarm DPO
0xA302		RTD 2 Alarm OP
0xA304		RTD 2 Alarm DPO
0xA342		RTD 3 Alarm OP
0xA344		RTD 3 Alarm DPO
0xA382		RTD 4 Alarm OP
0xA384		RTD 4 Alarm DPO
0xA3C2		RTD 5 Alarm OP
0xA3C4		RTD 5 Alarm DPO
0xA402		RTD 6 Alarm OP
0xA404		RTD 6 Alarm DPO
0xA442		RTD Trouble OP
0xA4C1		LE 1 Alarm PKP
0xA4C2		LE 1 Alarm OP
0xA4C4		LE 1 Alarm DPO
0xA501		LE 2 Alarm PKP
0xA502		LE 2 Alarm OP
0xA504		LE 2 Alarm DPO
0xA541		LE 3 Alarm PKP
0xA542		LE 3 Alarm OP
0xA544		LE 3 Alarm DPO

Code	Type	Definition
0xA581		LE 4 Alarm PKP
0xA582		LE 4 Alarm OP
0xA584		LE 4 Alarm DPO
0xA5C1		LE 5 Alarm PKP
0xA5C2		LE 5 Alarm OP
0xA5C4		LE 5 Alarm DPO
0xA601		LE 6 Alarm PKP
0xA602		LE 6 Alarm OP
0xA604		LE 6 Alarm DPO
0xA641		LE 7 Alarm PKP
0xA642		LE 7 Alarm OP
0xA644		LE 7 Alarm DPO
0xA681		LE 8 Alarm PKP
0xA682		LE 8 Alarm OP
0xA684		LE 8 Alarm DPO
0xA6C2		RTD 7 Alarm OP
0xA6C4		RTD 7 Alarm DPO
0xA702		RTD 8 Alarm OP
0xA704		RTD 8 Alarm DPO
0xA742		RTD 9 Alarm OP
0xA744		RTD 9 Alarm DPO
0xA782		RTD 10 Alarm OP
0xA784		RTD 10 Alarm DPO
0xA7C2		RTD 11 Alarm OP
0xA7C4		RTD 11 Alarm DPO
0xA802		RTD 12 Alarm OP
0xA804		RTD 12 Alarm DPO
0xA982		Motor Run Hrs OP
0xAA01		Welded ContactrPKP
0xAA02		Welded Contactr OP
0xAA04		Welded ContactrDPO
0xAA42		SPD SW Not Cnfg OP
0xAA82		SPD SW Fail OP
0xAB01		Load Incr Alrm PKP
0xAB02		Load Incr Alrm OP
0xAB04		Load Incr Alrm DPO
0xABC1		HI Amb Temp PKP
0xABC2		HI Amb Temp OP
0xABC4		HI Amb Temp DPO
0xAC01		LO Amb Temp PKP
0xAC02		LO Amb Temp OP
0xAC04		LO Amb Temp DPO
0xAC42		Self Test Alarm OP
0xACC2		BKRTrpCntrAlrm OP
0xAD02		R1 CoilMonAlrm OP
0xAD42		R2 CoilMonAlrm OP
0xAD81		BKR1 Fail Alrm PKP

Code	Type	Definition
0xAD82		BKR1 Fail Alrm OP
0xADC2		BKR Stat Fail OP
0xAF81		Fuse Fail Alrm PKP
0xAF82		Fuse Fail Alrm OP
0xAF84		Fuse Fail Alrm DPO
0xAFC2		Ph Revrsl Alarm OP
0xAFC4		Ph Revrsl Alarm DPO
0xB041		Ntrl IOC1 Alrm PKP
0xB042		Ntrl IOC1 Alrm OP
0xB044		Ntrl IOC1 Alrm DPO
0xB342		NtrlDir RevAlm OP
0xB344		NtrlDir RevAlmDPO
0xB3C1		NegSeq OV Alrm PKP
0xB3C2		NegSeq OV Alrm OP
0xB3C4		NegSeq OV Alrm DPO
0xB441		Ph OV1 Alarm PKP
0xB442		Ph OV1 Alarm OP
0xB444		Ph OV1 Alarm DPO
0xB481		Ph UV1 Alarm PKP
0xB482		Ph UV1 Alarm OP
0xB484		Ph UV1 Alarm DPO
0xB541		UndrFreq1 Alrm PKP
0xB542		UndrFreq1 Alrm OP
0xB544		UndrFreq1 Alrm DPO
0xB581		UndrFreq2 Alrm PKP
0xB582		UndrFreq2 Alrm OP
0xB584		UndrFreq2 Alrm DPO
0xB5C1		OverFreq1 Alrm PKP
0xB5C2		OverFreq1 Alrm OP
0xB5C4		OverFreq1 Alrm DPO
0xB601		OverFreq2 Alrm PKP
0xB602		OverFreq2 Alrm OP
0xB604		OverFreq2 Alrm DPO
0xB881		Ph OV2 Alarm PKP
0xB882		Ph OV2 Alarm OP
0xB884		Ph OV2 Alarm DPO
0xB8C1		Ph UV2 Alarm PKP
0xB8C2		Ph UV2 Alarm OP
0xB8C4		Ph UV2 Alarm DPO
0xB901		S/C Alarm PKP
0xB902		S/C Alarm OP
0xB904		S/C Alarm DPO
0xB941		SPD2 S/C Alarm PKP
0xB942		SPD2 S/C Alarm OP
0xB944		SPD2 S/C Alarm DPO
0xB981		SPD2 U/C Alarm PKP
0xB982		SPD2 U/C Alarm OP

Code	Type	Definition
0xB984		SPD2 U/C Alarm DPO
0xBC01		LE 9 Alarm PKP
0xBC02		LE 9 Alarm OP
0xBC04		LE 9 Alarm DPO
0xBC41		LE 10 Alarm PKP
0xBC42		LE 10 Alarm OP
0xBC44		LE 10 Alarm DPO
0xBC81		LE 11 Alarm PKP
0xBC82		LE 11 Alarm OP
0xBC84		LE 11 Alarm DPO
0xBCC1		LE 12 Alarm PKP
0xBCC2		LE 12 Alarm OP
0xBCC4		LE 12 Alarm DPO
0xBD01		LE 13 Alarm PKP
0xBD02		LE 13 Alarm OP
0xBD04		LE 13 Alarm DPO
0xBD41		LE 14 Alarm PKP
0xBD42		LE 14 Alarm OP
0xBD44		LE 14 Alarm DPO
0xBD81		LE 15 Alarm PKP
0xBD82		LE 15 Alarm OP
0xBD84		LE 15 Alarm DPO
0xBDC1		LE 16 Alarm PKP
0xBDC2		LE 16 Alarm OP
0xBDC4		LE 16 Alarm DPO
0xC002		Any Inhibit
0xC042		Output Relay 3 On
0xC082		Output Relay 4 On
0xC0C2		Output Relay 5 On
0xC102		Output Relay 6 On
0xC142		Self-Test Rly 7 On
0xC182		Output Relay 1 On
0xC1C2		Output Relay 2 On
0xC242		High Speed OP
0xC282		Low Speed OP
0xC3C2		Motor Online
0xC402		Emergency Restart
0xC442		Hot RTD OP
0xC444		Hot RTD DPO
0xC482		Lockout OP
0xC484		Lockout DPO
0xC4C1		LE 1 PKP
0xC4C2		LE 1 OP
0xC4C4		LE 1 DPO
0xC501		LE 2 PKP
0xC502		LE 2 OP
0xC504		LE 2 DPO

Code	Type	Definition
0xC541		LE 3 PKP
0xC542		LE 3 OP
0xC544		LE 3 DPO
0xC581		LE 4 PKP
0xC582		LE 4 OP
0xC584		LE 4 DPO
0xC5C1		LE 5 PKP
0xC5C2		LE 5 OP
0xC5C4		LE 5 DPO
0xC601		LE 6 PKP
0xC602		LE 6 OP
0xC604		LE 6 DPO
0xC641		LE 7 PKP
0xC642		LE 7 OP
0xC644		LE 7 DPO
0xC681		LE 8 PKP
0xC682		LE 8 OP
0xC684		LE 8 DPO
0xC902		Open Breaker
0xC942		Close Breaker
0xCA02		52a Contact OP
0xCA42		52b Contact OP
0xCAC2		L/O Rst Closed
0xCCC2		BKR Stat Open
0xCD02		BKR Stat Clsd
0xCE82		Therm Inhibit OP
0xCEC2		Rstrt Inhibit OP
0xCF02		Start/Hr Inhib OP
0xCF42		T-BT-Strt Inhib OP
0xCF81		Fuse Fail InhibPKP
0xCF82		Fuse Fail Inhib OP
0xCFC2		Ph Rev Inhibit OP
0xCFC4		Ph Rev Inhibit DPO
0xD342		Ntrl Dir Rev OP
0xD344		Ntrl Dir Rev DPO
0xDC01		LE 9 PKP
0xDC02		LE 9 OP
0xDC04		LE 9 DPO
0xDC41		LE 10 PKP
0xDC42		LE 10 OP
0xDC44		LE 10 DPO
0xDC81		LE 11 PKP
0xDC82		LE 11 OP
0xDC84		LE 11 DPO
0xDCC1		LE 12 PKP
0xDCC2		LE 12 OP
0xDCC4		LE 12 DPO

Code	Type	Definition
0xDD01		LE 13 PKP
0xDD02		LE 13 OP
0xDD04		LE 13 DPO
0xDD41		LE 14 PKP
0xDD42		LE 14 OP
0xDD44		LE 14 DPO
0xDD81		LE 15 PKP
0xDD82		LE 15 OP
0xDD84		LE 15 DPO
0xDDC1		LE 16 PKP
0xDDC2		LE 16 OP
0xDDC4		LE 16 DPO
0xE002		Any Block
0xE042		Therm O/L Blck OP
0xE082		Gnd Fault BLK
0xE0C2		Accel BLK
0xE142		UndrPower BLK
0xE182		Output Relay 1 BLK
0xE1C2		Output Relay 2 BLK
0xE202		Mech Jam BLK
0xE242		U/CURR BLK
0xE282		UNBAL BLK
0xE2C2		RTD1 BLK OP
0xE302		RTD2 BLK OP
0xE342		RTD3 BLK OP
0xE382		RTD4 BLK OP
0xE3C2		RTD5 BLK OP
0xE402		RTD6 BLK OP
0xE442		RTDTrouble BLK OP
0xE6C2		RTD7 BLK OP
0xE702		RTD8 BLK OP
0xE742		RTD9 BLK OP
0xE782		RTD10 BLK OP
0xE7C2		RTD11 BLK OP
0xE802		RTD12 BLK OP
0xF042		Ntrl IOC1 Block
0xF342		NTRL DIR Rev Block
0xF3C2		NegSeq OV Block
0xF442		Ph OV1 Block
0xF482		Ph UV1 Block
0xF542		UndrFreq1 Block
0xF582		UndrFreq2 Block
0xF5C2		OverFreq1 Block
0xF602		OverFreq2 Block
0xF882		Ph OV2 Block

Code	Type	Definition
0xF8C2		Ph UV2 Block
0xF902		S/C BLK
0xF942		SPD2 S/C BLK
0xF982		SPD2 U/C BLK OP

Breaker failure / Welded contactor

The Breaker Failure or Welded Contactor function monitors the phase currents, after a trip command from the protection elements is initiated, or a logic operand programmed as BF EXT INITIATE / WELDED EXT INI is asserted. The external initiating logic operand can be a Contact Input, a Virtual Input, a Remote Input, or an output from a Logic Element. If any phase current is above the set current level after the programmed time delay, a BREAKER FAILURE will be declared when BREAKER was chosen for SWITCHING DEVICE, or a WELDED CONTACTOR will be declared when CONTACTOR was chosen for SWITCHING DEVICE, and the selected output relays will be activated. The time delay should be set slightly longer than the breaker or contactor operating time.

To provide user flexibility, the 339 has included two programmable timers for the Breaker Failure / Welded Contactor function. The timers can be used singularly or in combination with each other. BF/Welded Time Delay 1 starts counting down once a trip condition is recognized or the programmed logic operand is asserted. BF/Welded Time Delay 2 does not begin counting down until BF/Welded Time Delay 1 has expired and one of the phase currents is above the setting BF/Welded Current. If one of the delays is not required, simply program the unwanted timer to its minimum value.

NOTE

When the switching device is selected as CONTACTOR, this feature is displayed as WELDED CONTACTOR.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: SETPOINTS > S4 CONTROLS > BREAKER FAIL (WELDED CONTACTOR)

BF FUNCTION / WELDED CONT FUNC

Range: Disabled, Alarm, Latched Alarm

Default: Disabled

This setting enables the Breaker failure or Welded Contactor functionality. If the operating condition is satisfied when ALARM is selected as the function, the LED "ALARM" will flash upon the activating condition, and will automatically reset when the condition clears. If Latched Alarm is selected, the LED "ALARM" will flash upon the activating condition, and will stay "ON" after the condition clears, until a reset command is initiated. Any assignable output relays can be selected to operate when this function is enabled.

BF CURRENT / WELDED CURRENT

Range: 0.05 to 20.00 x CT in steps of 0.01

Default: 1.00 x CT

This setting specifies the current level monitored by the Breaker Failure / Welded Contactor logic. Program this setting to a current level that can detect the lowest expected fault current on the protected breaker/contactor.

BF EXT INITIATE / WELDED EXT INI

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Element 1 to 16

Default: Off

This setting allows the user to select a logic operand to externally initiate the Breaker Failure / Welded Contactor logic.

BF TIME DELAY 1 / WELDED TIME DELAY 1

Range: 0.03 to 1.00 s in steps of 0.01 s

Default: 0.10 s

This timer starts when breaker trip command is issued from any of the protection elements, or a programmed external initiating logic operand is asserted.

BF TIME DELAY 2 / WELDED TIME DELAY 2

Range: 0.00 to 1.00 s in steps of 0.01 s

Default: 0.00 s

This timer does not start until a trip command is recognized, timer BF / WELDED TIME DELAY1 has expired, and at least one of the phase currents is above the setting BF / WELDED CURRENT.

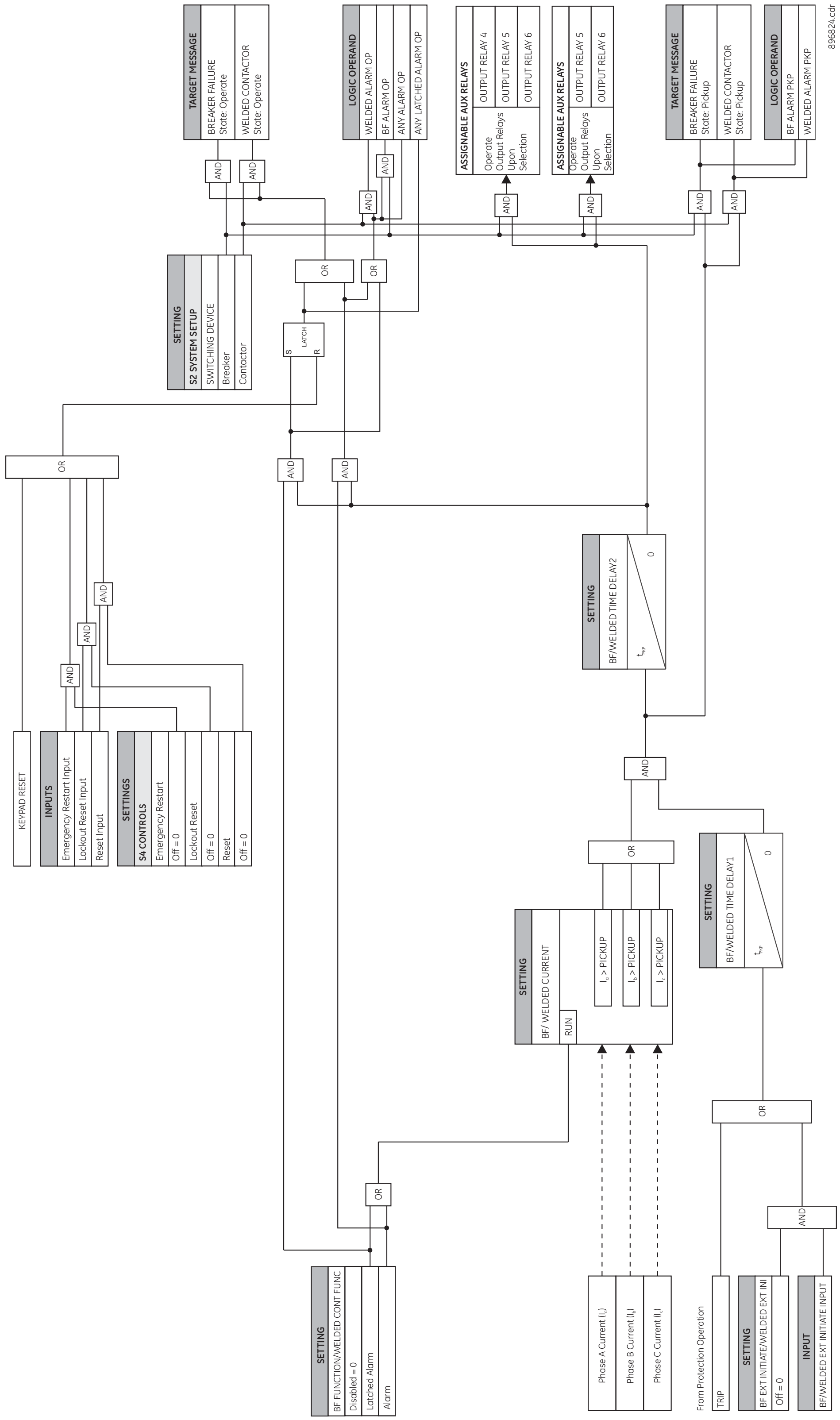
OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do not operate, Operate

Default: Do not operate

Any assignable output relay can be selected to operate upon Breaker Failure / Welded Contactor operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

Figure 6-45: Breaker Failure / Welded Contactor logic diagram



Start inhibit

Thermal Start Inhibit

This function is provided to inhibit starting of a motor if there is insufficient thermal capacity available for a successful start. The motor start inhibit logic algorithm is defined by the Thermal Inhibit setpoint. If this setpoint is set to “0”, starts are inhibited until thermal capacity used decays to a level of 15%. If this setpoint is set greater than zero, starts are inhibited while the available thermal capacity is less than the learned thermal capacity used at start.

NOTE

The margin should be set to zero if the load varies for different starts.

The learned thermal capacity used at start is the largest thermal capacity used value calculated by the thermal model from the last five successful starts, plus a settable margin. The margin is a percentage of this largest of five. A successful motor start is one in which the motor reaches the Running state. See the Start/Stop section of this manual for a description of Running state logic. When the motor information is reset, a value of 85% is used for the learned thermal capacity used until displaced by 5 subsequent successful starts. This 85% default requires the thermal capacity used to decay to the same 15% level required when the margin setting is zero.

For example, if the thermal capacity used for the last 5 starts is 24, 23, 27, 26 and 20% respectively, and the set margin is 25%, the learned starting capacity used at start is Maximum(24%+23%+27%+26%+20%) x (1+25%/100%) = 34%. If the motor stops with a thermal capacity used of 90%, a start inhibit will be issued until the motor cools to 100% - 34% = 66%. If the stopped cool time constant is set to 30 minutes, the inhibit time will be:

$$30 \times \ln\left(\frac{90\%}{66\%}\right) = 9.3 \text{ minutes} \quad \textbf{Eq. 18}$$

If instead the set margin is zero, the inhibit time will be:

$$30 \times \ln\left(\frac{90\%}{15\%}\right) = 54 \text{ minutes} \quad \textbf{Eq. 19}$$

Starts per Hour Inhibit

This element defines the number of start attempts allowed in any 60 minutes interval. Once the set number of starts has occurred in the last 60 minutes, start controls are inhibited until the oldest start contributing to the inhibit is more than 60 minutes old.

This element assumes a motor start is occurring when the relay 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, the Start Inhibit Output Relay will be activated to block the motor start. 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.

For example, if STARTS/HOUR LIMIT is programmed at “2”:

- One start occurs at T = 0 minutes
- A second start occurs at T = 17 minutes
- The motor is stopped at T = 33 minutes
- A block occurs
- The lockout time would be 1 hour – 33minutes = 27 minutes

Time Between Starts Inhibit

This function enforces a settable minimum time duration between two successive start attempts. A time delay is initiated with every start attempt, and a restart is not allowed until the specified interval has lapsed. This timer feature may be useful in enforcing the duty limits of starting resistors or starting autotransformers. It may also be used to restrict jogging.

This element assumes a motor start is occurring when the relay 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 START setting, the Start Inhibit Output Relay will be activated to block the motor start. If a block occurs, the lockout time will be equal to the time elapsed since the most recent start subtracted from the TIME BETWEEN START setting.

For example, if TIME BETWEEN START is programmed as 25 min:

- A start occurs at T = 0 minutes
- The motor is stopped at T = 12 minutes
- A block occurs
- The lockout time would be 25 minutes – 12 minutes = 13 minutes

Restart Inhibit

The Restart Inhibit feature may be used to ensure that a certain amount of time passes between the time a motor is stopped and the restarting of 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.

NOTE

This element assumes a motor stop is occurring when the relay measures the transition of some value of motor current to no motor current.

NOTE

For each of these features, non-volatile memory is used to make it behave as if it continues to operate while control power is lost.

THERMAL INHIBIT

Range: OFF, 0 to 25% in steps of 1%

Default: 10%

OFF disables thermal start inhibits. 0% causes starts to be inhibited until the value of thermal capacity used calculated by the thermal model drops to 15% or less. Setting values in the range of 1 to 25% specify the margin to be included in the calculation of the learned thermal capacity used at start, and cause starts to be inhibited until the value of thermal capacity used drops to the learned thermal capacity used at start or less.

STARTS/HOUR LIMIT

Range: OFF, 1 to 5 in steps of 1

Default: OFF

Sets the number of starts in the last 60 minutes at which count start control is inhibited. OFF defeats this feature.

TIME BETWEEN STARTS

Range: OFF, 1 to 3600 s in steps of 1 s

Default: OFF

Sets the amount of time following a start before the next start control is permitted to prevent restart attempts in quick succession (jogging). OFF defeats this feature.

RESTART INHIBIT

Range: OFF, 1 to 50000 s in steps of 1 s

Default: OFF

Sets the amount of time following a stop before a start control is permitted. OFF defeats this feature.

OUTPUT RELAY 3

Range: Operate, Do Not Operate

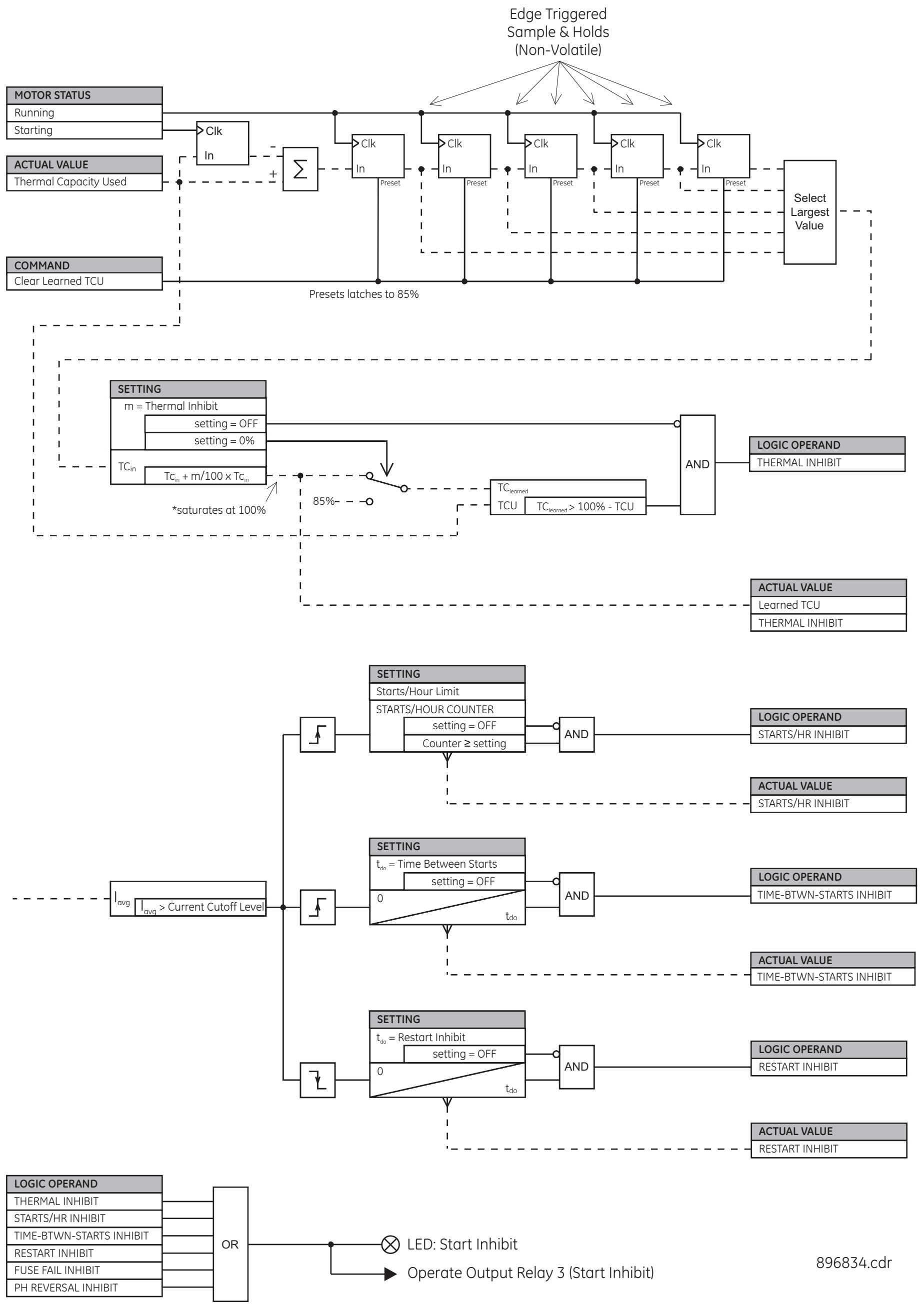
Default: Operate

Only shown if INPUT/OUTPUT option 'R' is installed and SWITCHING DEVICE is programmed as CONTACTOR.

This output relay can be selected to operate while any Start Inhibit is active. This setpoint is available only with 339 INPUT/OUTPUT option 'R', and when the SWITCHING DEVICE is selected as CONTACTOR, otherwise Output Relay 3 will be automatically assigned for Start Inhibits. If this output relay is programmed to OPERATE, it is recommended that the OUTPUT TYPE be programmed to SELF-RESET in S5 OUTPUT RELAYS > RLY3 AUXILIARY.

Refer to the S5 OUTPUT RELAYS section for details on Start Inhibit relay wiring and logic diagrams.

Figure 6-46: Start Inhibit, Starts per Hour, Time Between Starts, and Restart Inhibit logic diagram



Emergency restart

EMERGENCY RESTART

Range: Off, Contact Input 1 to 10, Virtual Input 1 through 32, Logic element 1 through 16, Remote Input 1 to 32

Default: Off

CAUTION

All relay protection is defeated while the Emergency Restart contact input is closed.

Emergency restart is for use in situations where continuation of the process driven by the motor is more important than protecting the motor itself. Closing this contact input discharges the thermal capacity used register to zero, resets the Starts/Hour Block count, resets the Time Between Starts Block timer, and resets all trips and alarms so that a hot motor may be restarted. Therefore, while the Emergency Restart contact input terminals are shorted, the trip output relay will remain in its normal non-trip state. As the name implies, this feature should only be used in an emergency – using it otherwise defeats the purpose of the relay, namely, protecting the motor.

Lockout reset

LOCKOUT RESET

Range: Off, Contact Input 1 to 10, Virtual Input 1 through 32, Logic element 1 through 16, Remote Input 1 to 32

Default: Off

Closing this contact input resets any lockouts, as well as any trips or latched alarms provided that the condition that caused the lockout, alarm or trip is no longer present. If there is a lockout time pending, the start inhibit output will not reset until the lockout time has expired.

Reset

RESET

Range: Off, Contact Input 1 to 10, Virtual Input 1 through 32, Logic element 1 through 16, Remote Input 1 to 32

Default: Off

Reset allows a pushbutton or other device located external to the relay to perform the same functions as the reset pushbutton on the relay faceplate. Closing this contact input resets any trips or latched alarms provided that the condition that caused the alarm or trip is no longer present. Lockouts and start inhibits are also reset if the lockout reset setting is Off.

Breaker control

The Breaker Control menu is designed to trip and close the breaker from the relay either remotely (LOCAL MODE setting set to "OFF," or the selected contact input deselected) or locally (the input from the LOCAL MODE setpoint asserted). While in LOCAL MODE, the REMOTE OPEN and CLOSE setpoints are not active.

NOTE

The Breaker Control feature is available only when the SWITCHING DEVICE is selected as BREAKER.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: SETPOINTS > S4 CONTROLS > BREAKER CONTROL

LOCAL MODE

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

The LOCAL MODE setting places the relay in local mode. The relay is in Remote Mode, if not forced into Local Mode by this setpoint (i.e. LOCAL MODE set to "OFF," or the selected input de-asserted).

REMOTE OPEN

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

This setting specifies the input which when asserted, initiates a trip (output relay #1 TRIP energized) and opens the breaker.

REMOTE CLOSE

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

This setting specifies the input which when asserted, initiates a close (output relay #2 CLOSE energized) and closes the breaker.

KEYPAD BKR OPEN

Range: Yes, No

Default: No

This setting provides flexibility to the user to open the breaker from the keypad. Selecting “Yes” will introduce a pulse of 100ms to the "trip" output relay. The setting is active, when the selected input under LOCAL MODE setpoint is asserted.

KEYPAD BKR CLOSE

Range: Yes, No

Default: No

This setting provides flexibility to the user to close the breaker from the keypad. Selecting “Yes” will introduce a pulse of 100ms to the "close" output relay. The setting is active, when the selected input under LOCAL MODE setpoint is asserted.

By default, the breaker control mode is set to "Remote" (LOCAL MODE set to "OFF"). In this mode, only the REMOTE OPEN and REMOTE CLOSE setpoints are active. The rest of the setpoints with exception of the RESET setpoint are deactivated, regardless of the status of their selected inputs.

Local Mode is set if the input for the LOCAL MODE setpoint is asserted. In this mode, the REMOTE OPEN and REMOTE CLOSE setpoints are deactivated, regardless of the status of their selected inputs. **Breaker Open** and **Breaker Close** commands from the KEYPAD BKR OPEN and KEYPAD BKR CLOSE setpoints will be active, if the breaker operation is set to Local Mode (i.e. the selected input under the LOCAL MODE setpoint asserted).

S5 Inputs/Outputs

Figure 6-47: Inputs/Outputs option “E” with BREAKER menu

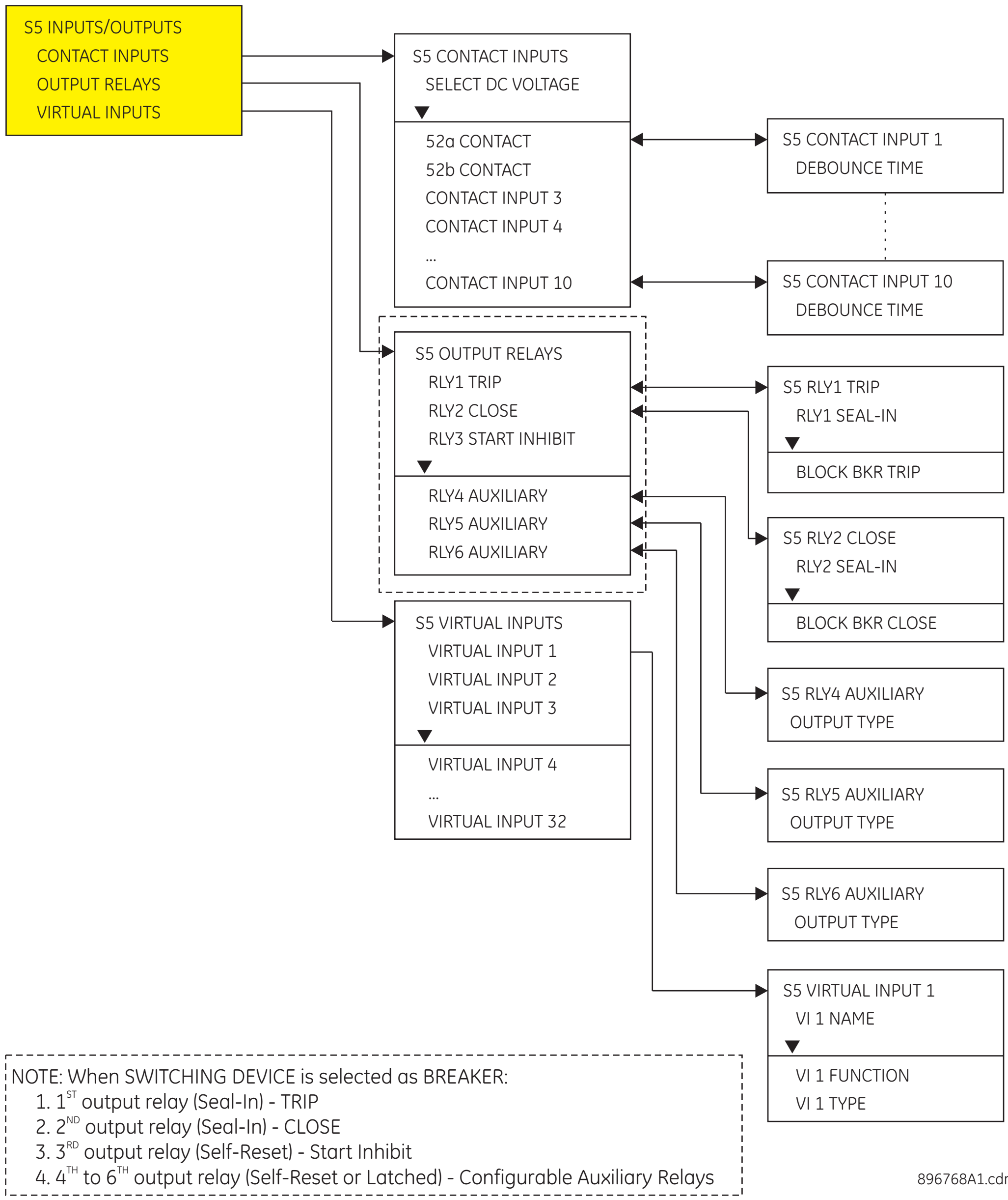


Figure 6-48: Inputs/Outputs with BREAKER & I/O option 'R' menu

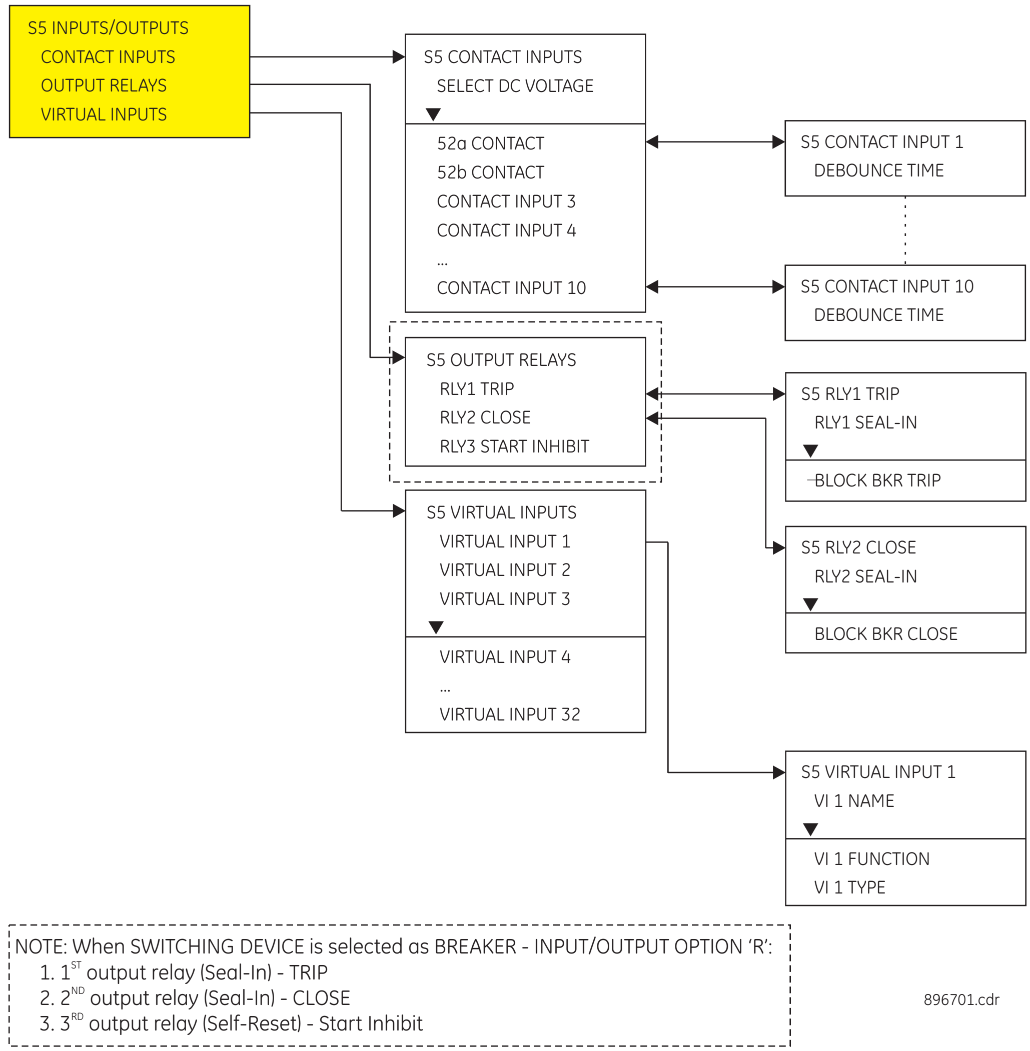
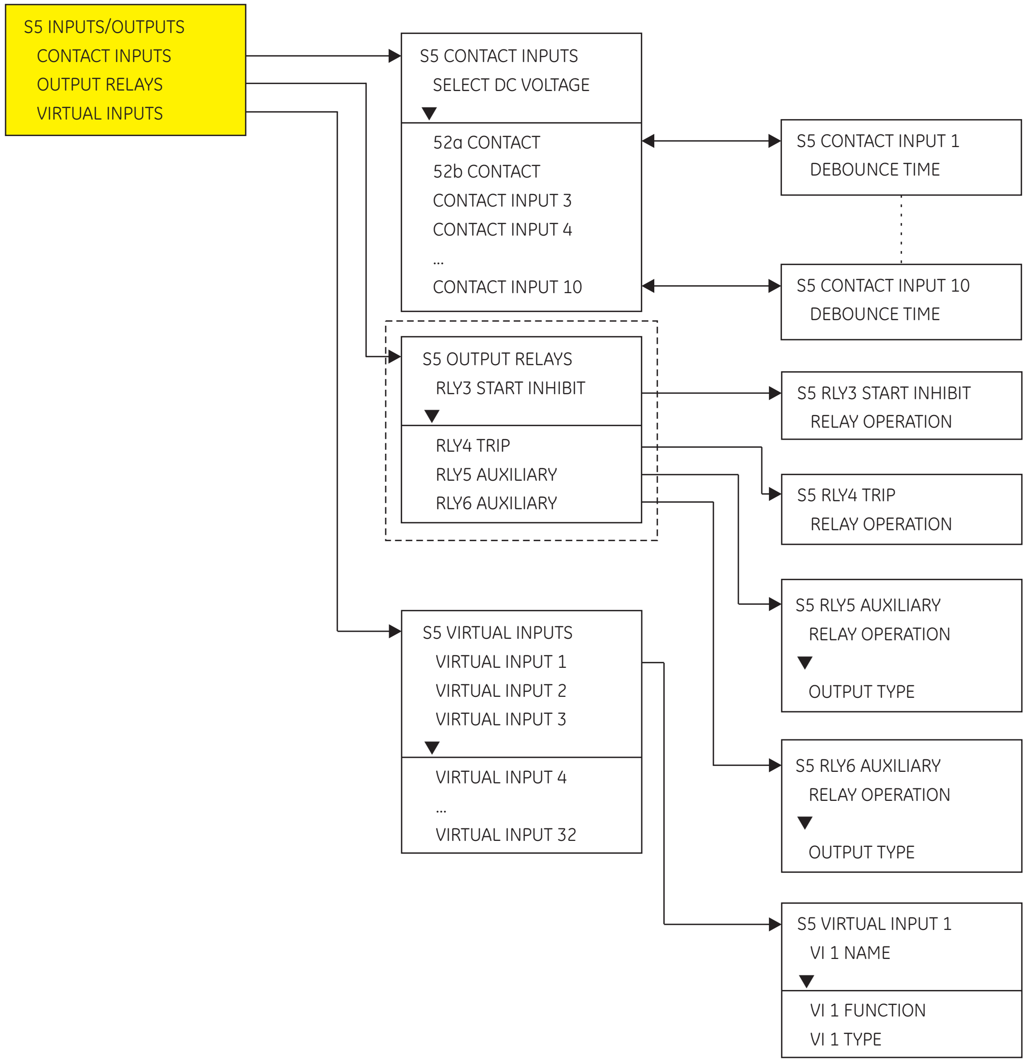


Figure 6-49: Inputs/Outputs option “E” with CONTACTOR menu

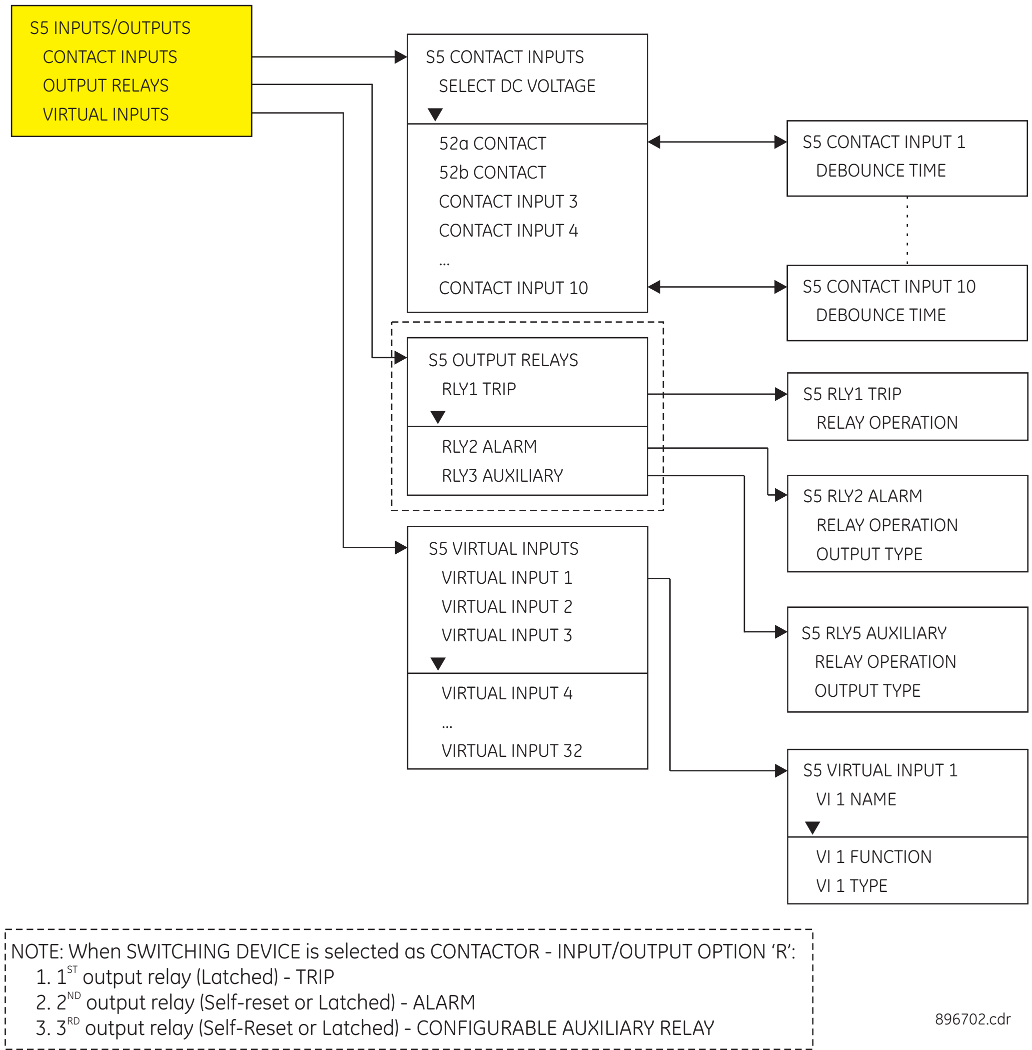


NOTE: When SWITCHING DEVICE is selected as CONTACTOR:

1. 1ST output relay (Seal-In) - Not Used
2. 2ND output relay (Seal-In) - Not Used
3. 3RD output relay (Self-Reset) - Start Inhibit
4. 4TH output relay (Latched) - TRIP
5. 5TH to 6TH output relay (Self-Reset or Latched) - Configurable Auxiliary Relays

896769.cdr

Figure 6-50: Inputs/Outputs with CONTACTOR & I/O option 'R' menu



Contact inputs

The 339 relay is equipped with ten (10) contact inputs, which can be used to provide a variety of functions such as for circuit breaker control, external trips, blocking of protection elements, etc. All contact inputs are wet type contacts (refer to the 339 typical wiring diagram) that require an external DC voltage source. The voltage threshold (17V, 33V, 84V, 166V) is selectable, and it applies for all ten contact inputs.

The contact inputs are either open or closed with a programmable debounce time to prevent false operation from induced voltage. Because of de-bouncing, momentary contacts must have a minimum dwell time greater than half power frequency cycle. The debounce time is adjustable by the user.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > CONTACT INPUTS**

SELECT DC VOLTAGE

Range: 17 V, 33 V, 84 V, 166 V

Default: 84 V

CONTACT INPUT 1

Range: Eighteen Characters

Default: 52a Contact

CONTACT INPUT 2

Range: Eighteen Characters
Default: 52b Contact

CONTACT INPUT X [3 to 10]

Range: Eighteen Characters
Default: Input X

DEBOUNCE TIME

↳

CONTACT INPUT X [1 TO 10]

Range: 1 to 64 ms in steps of 1 ms
Default: 2 ms

Each of the contact inputs can be named to reflect the function it represents within the application. Up to 18 alpha-numeric characters are available for names.

The debounce time is used to discriminate between oscillating inputs. The state will be recognized if the input is maintained for a period consisting of the protection pass plus the debounce setting.

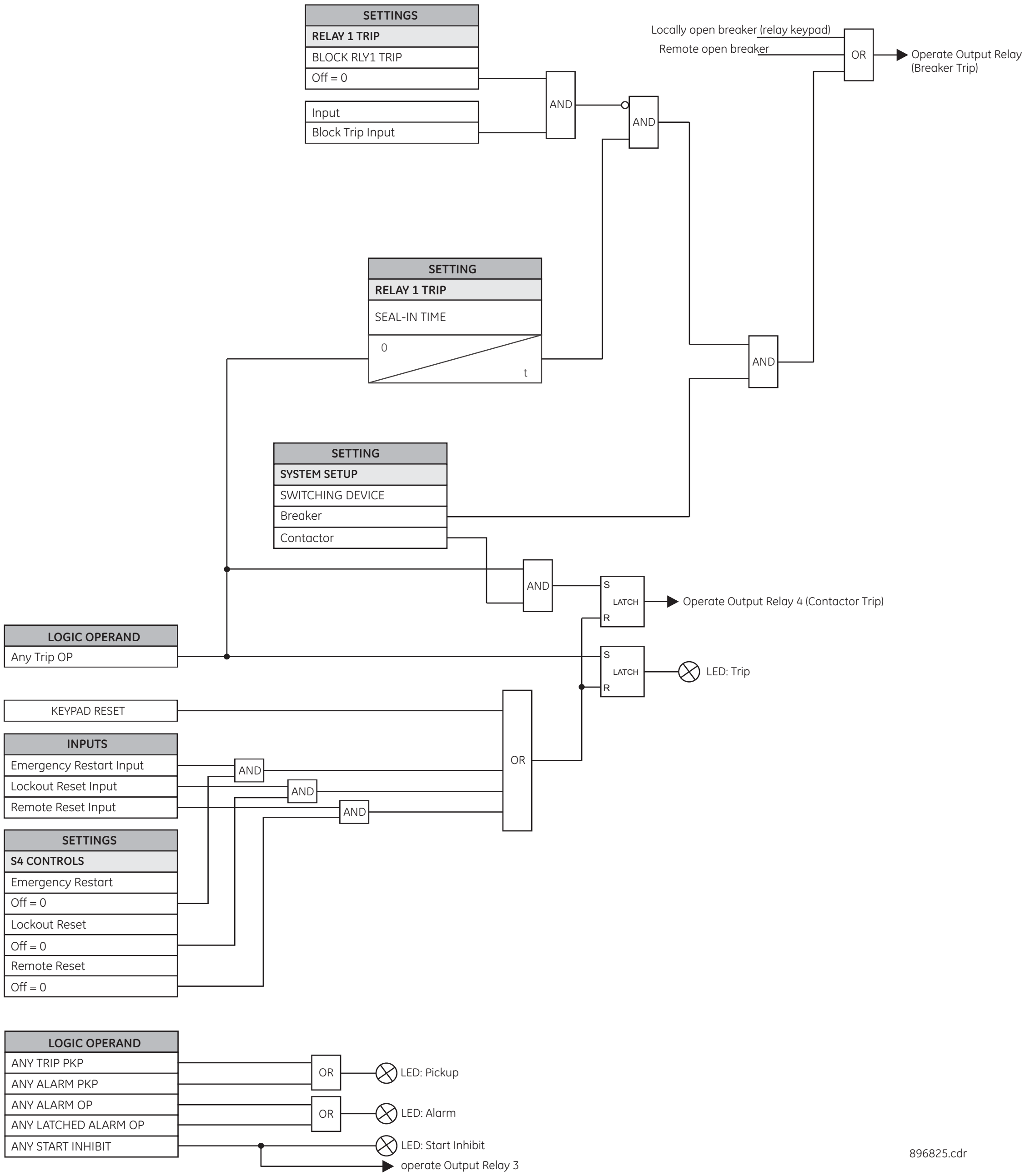
NOTE

Contact Input 1 and Contact Input 2 are named by the factory as 52a and 52b respectively and are used for monitoring the breaker open/close state when wired to the breakers auxiliary contacts 52a and 52b.

Output relays - Input/Output “E”

The 339 relay is equipped with seven electromechanical output relays: 2 form A relays (Relay 1 and Relay 2), and 5 form C relays (Relays 3 to 7). Depending on the setting **S2 SYSTEM SETUP > SWITCHING DEVICE**, these output relays function differently per the application of BREAKER and CONTACTOR.

Figure 6-51: Relay trip



Output Relays - Breaker - Input/ Output "E"

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected as BREAKER, the seven output relays function as:

Output Relay 1: Breaker Trip
Output Relay 2: Breaker Close
Output Relay 3: Start Inhibit
Output Relays 4 to 6: Auxiliary Relays
Output Relay 7: Critical Failure

There are four special purpose relays: Breaker Trip, Breaker Close, Start Inhibit, and Critical Failure. These relays have fixed operating characteristics:

Breaker Trip: Seal-in

Breaker Close: Seal-in
Start Inhibit: Self-reset
Critical Failure: Self-reset

The user can configure an Auxiliary Relay as either latched or self-reset. Logic diagrams for each Output Relay are provided for detailed explanation of their operation.

Operation of the BREAKER TRIP and BREAKER CLOSE relays is controlled by the state of the circuit breaker as monitored by a 52a or 52b contact.

- The Trip and Close relays reset after the breaker is detected in a state corresponding to the command. When a relay feature sends a command to one of these special relays, it will remain operational until the requested change of breaker state is confirmed by a breaker auxiliary contact and the initiating condition has reset.
- If the initiating feature resets, but the breaker does not change state, the output relay will be reset after a default interval of 2 seconds.
- If neither of the breaker auxiliary contacts, 52a nor 52b, is programmed to a logic input, the Trip Relay is de-energized after either the delay programmed in the Breaker Failure feature, or a default interval of 100 ms after the initiating input resets. The Close Relay is de-energized after 200 ms.
- If a delay is programmed for the Trip or Close contact seal-in time, then this delay is added to the reset time. Note that the default setting for the seal-in time is 40 ms.

52a Contact Configured	52b Contact Configured	Relay Operation
Yes	Yes	Trip Relay remains operational until 52b indicates an open breaker. Close Relay remains operational until 52a indicates a closed breaker.
Yes	No	Trip Relay remains operational until 52a indicates an open breaker. Close Relay remains operational until 52a indicates a closed breaker.
No	Yes	Trip Relay remains operational until 52b indicates an open breaker. Close Relay remains operational until 52b indicates a closed breaker.
No	No	Trip Relay operates until either the Breaker Failure delay expires (if the Breaker Failure element is enabled), or 100 ms after the feature causing the trip resets. Close Relay operates for 200 ms.

Output Relay 1 "Breaker Trip" - Input/Output “E”

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 1 TRIP**

SEAL IN TIME

Range: 0.00 to 9.99 s in steps of 0.01
Default: 0.04 s

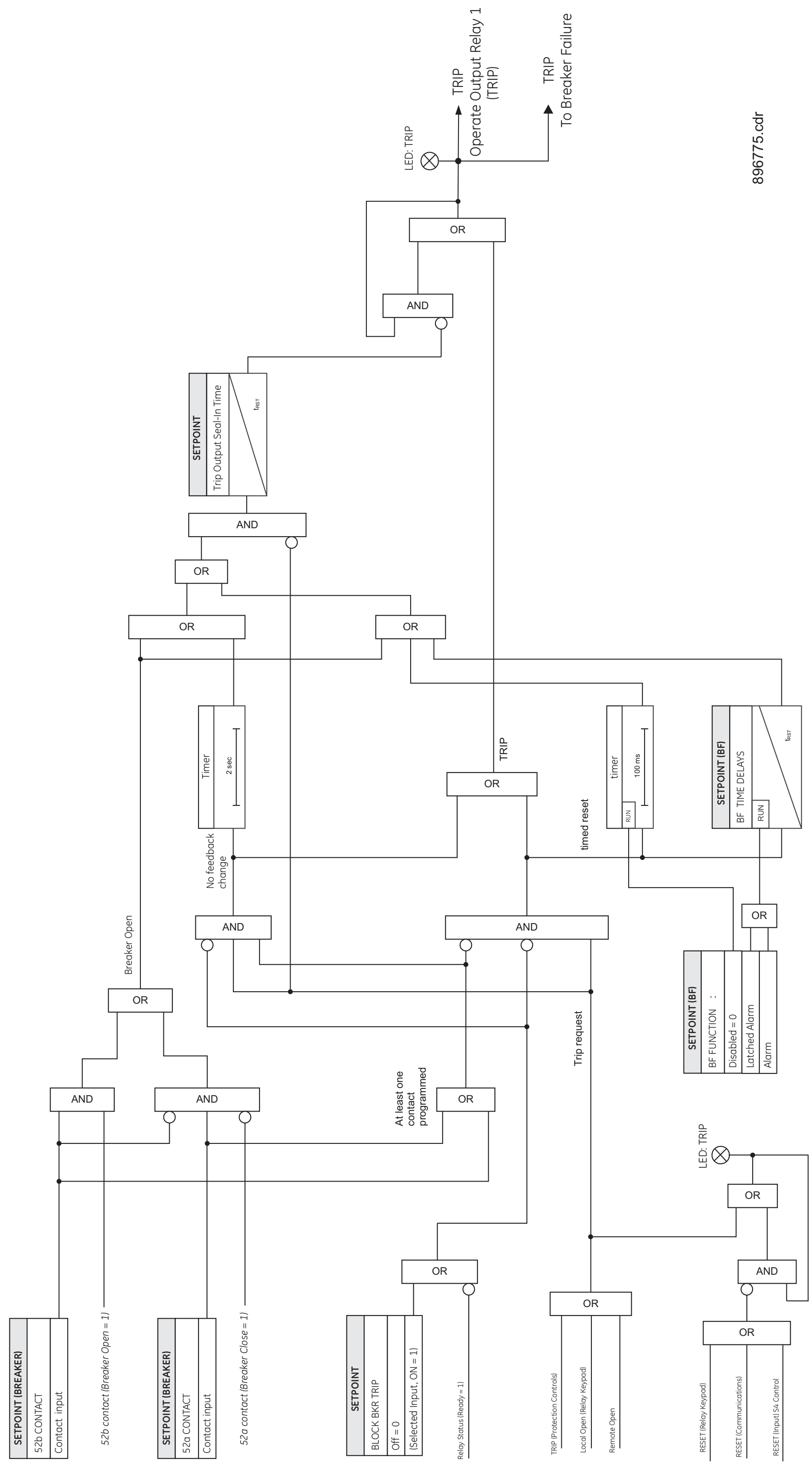
This setting defines the time to be added to the reset time of the Relay 1 Trip output, thus extending its pulse width. This is useful for those applications where the 52 contacts reporting the breaker state are faster than the 52 contacts that are responsible for interrupting the coil current.

BLOCK RLY 1 TRIP

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16
Default: Off

This setting defines a block to the Trip Output relay. When the selected input is asserted, the Trip Output relay will be blocked.

Figure 6-52: Relay 1 "TRIP" logic diagram



Output Relay 2 "Breaker Close" - Input/Output “E”

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 2 CLOSE**

SEAL IN TIME

Range: 0.00 to 9.99 s in steps of 0.01

Default: 0.04 s

This setting defines the time to be added to the reset time of the Relay 2 Close output, thus extending its pulse width. This is useful for those applications where the 52 contacts reporting the breaker state are faster than the 52 contacts that are responsible for interrupting the coil current.

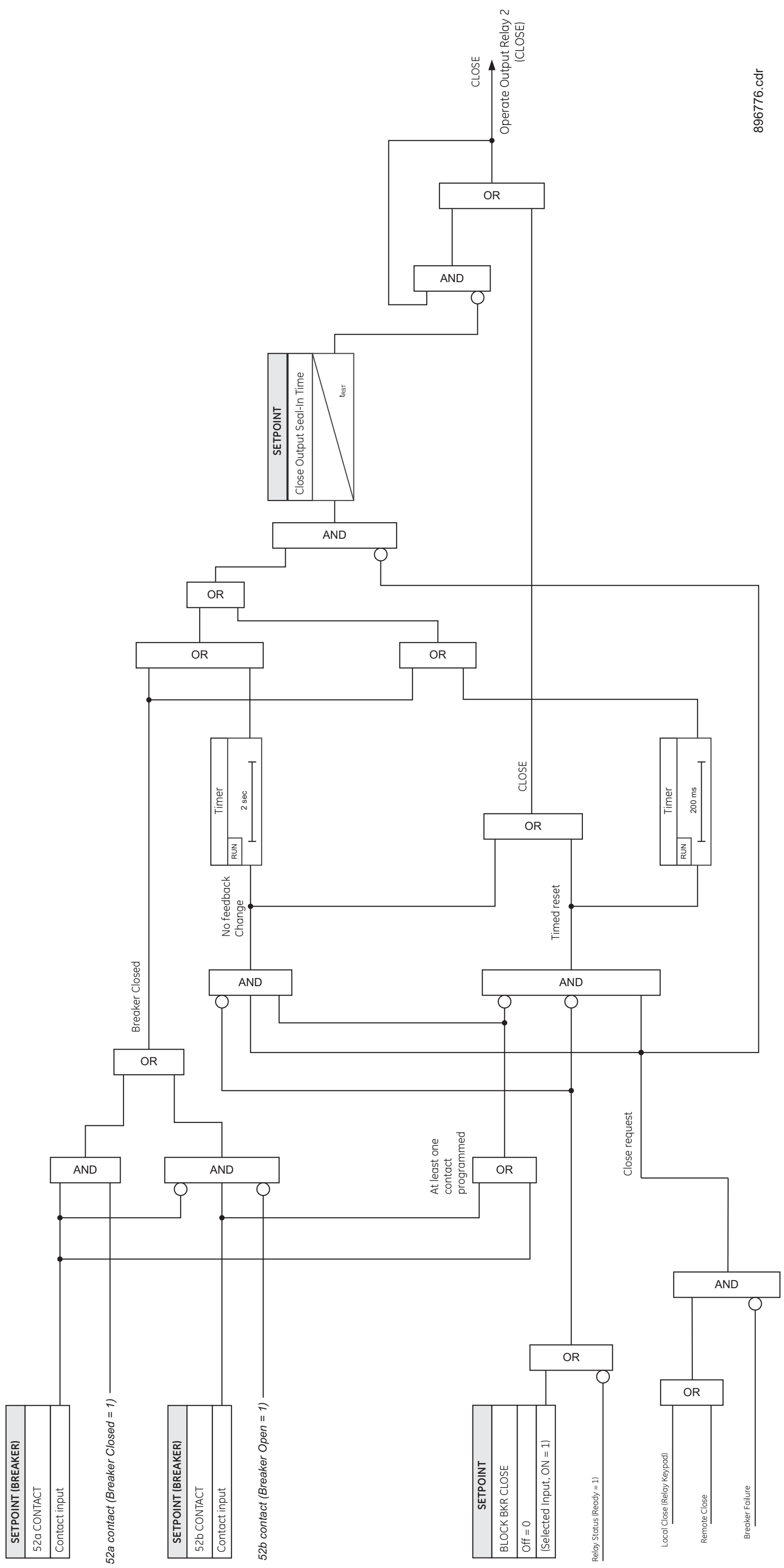
BLOCK RLY 2 CLOSE

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

This setting defines a block to the Close Output relay. When the selected input is asserted, the Close Output relay will be blocked. The block function can be useful for breaker maintenance purposes.

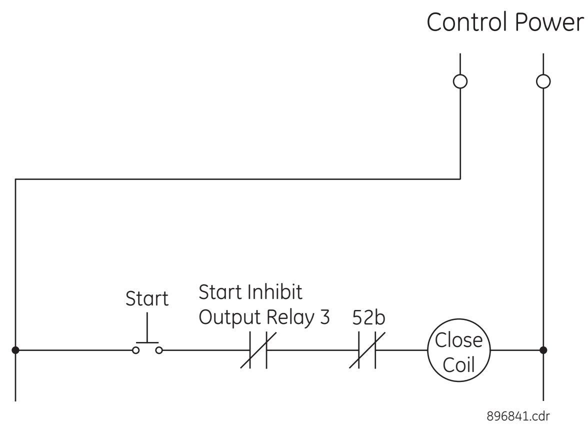
Figure 6-53: Relay 2 "CLOSE" logic diagram



Output Relay 3 Start Inhibit - Input/Output "E"

There are no user-programmable setpoints associated with the START INHIBIT relay. If there is a lockout time, the START INHIBIT relay prevents or inhibits the start of the motor based on the MOTOR LOCKOUT TIME. The operation of this output relay is always self-reset, so it will automatically reset when all lockout timers expire. This relay should be wired in series with the start pushbutton to prevent motor starting.

Figure 6-54: Breaker: Wiring for Start Inhibit



Auxiliary Output Relays 4 to 6 - Input/Output "E"

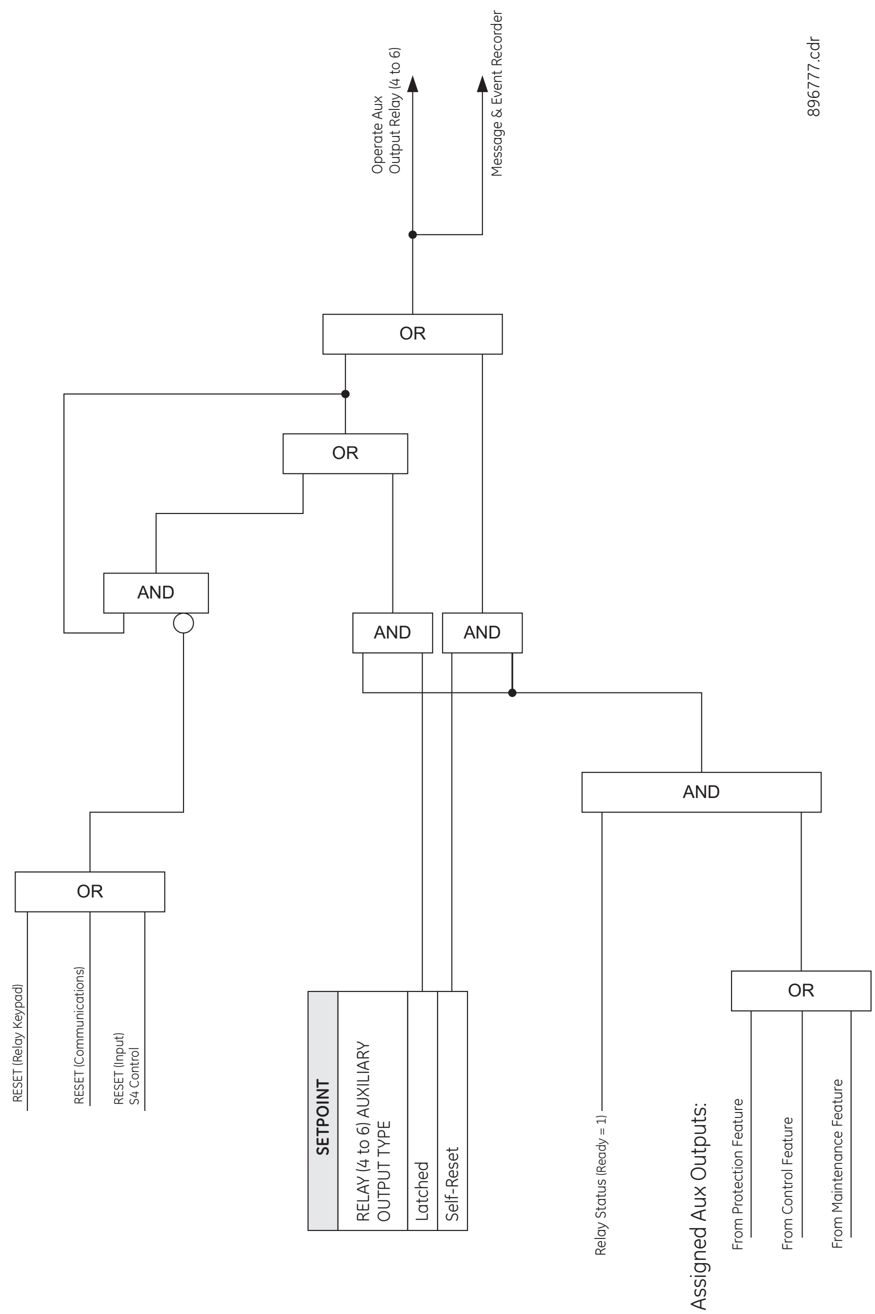
When the setting S2 SYSTEM SETUP\SWITCHING DEVICE is selected BREAKER, there are 3 auxiliary output relays (Output Relay 4 to 6) available for customer specific requirements. Each auxiliary relay can be selected as either **Self-reset**, or **Latched**. If the **Self-Reset** type is selected, the output relay will be energized as long as the element is in operating mode and will reset when the element drops out. If the **Latched** type is selected, the output relay will stay energized, after the element dropout, and will be de-energized upon the reset command. If an auxiliary output is only required while the activating condition is present, select **Self-Reset**. Once an activating condition disappears, the auxiliary relay returns to the non-active state and the associated message automatically clears. To ensure all auxiliary function conditions are acknowledged, select **Latched**.

PATH: SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 4(6) AUXILIARY

OUTPUT TYPE

Range: Self Reset, Latched
Default: Self Reset

Figure 6-55: Auxiliary relays



Critical Failure Relay #7 - Input/Output "E"

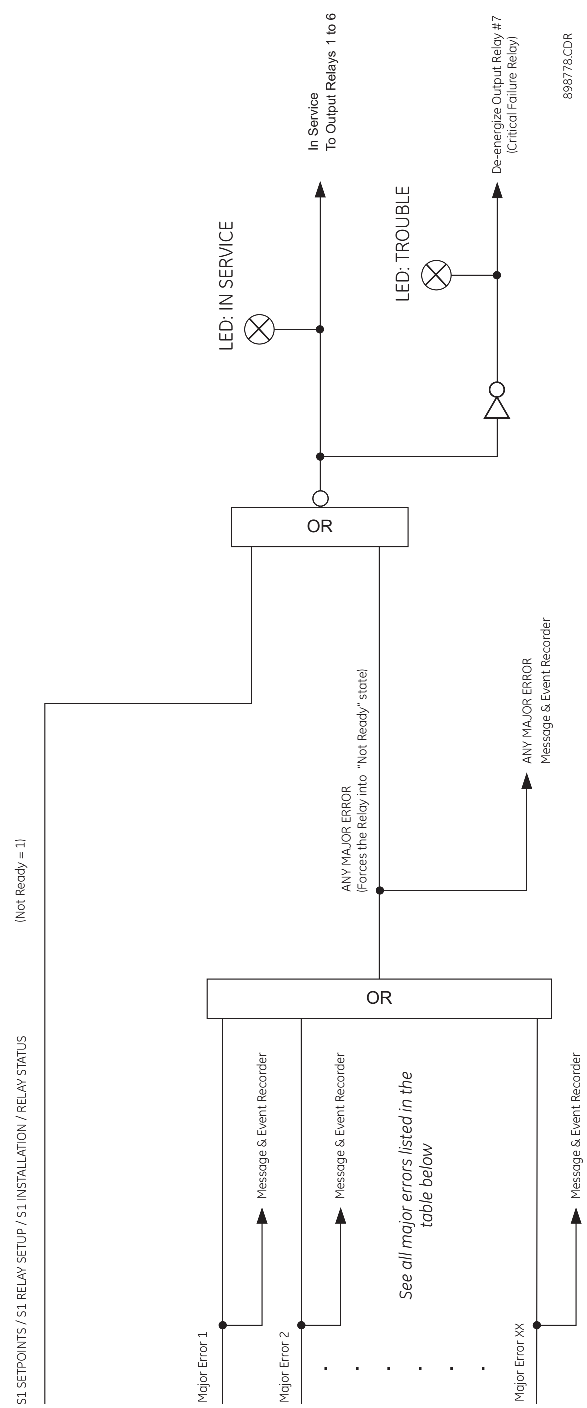
The 339 339 relay is also equipped with one output relay (# 7 - "Critical Failure Relay") for fail-safe indication. There are no user-programmable setpoints associated with this output relay. The logic for this relay is shown below.

The Critical Failure Relay (Output Relay 7) is a form C contact (refer to the Typical Wiring Diagram) with one Normally Open, and one Normally Closed contact (no control power). Output Relay 7 is energized or de-energized (state change) depending on the following conditions:

1. Output Relay 7 will be **de-energized**, if the relay is not in IN-SERVICE mode or the control power is not applied to the relay

2. Output Relay 7 will be **energized** when the control power is applied to the relay and the relay is in IN-SERVICE mode.
3. Output Relay 7 will stay **de-energized**, when the control power is applied, if the relay was not programmed as “Ready”, or upon major self-test failure during relay boot-up.
4. Output Relay 7 will change state from **energized** to **de-energized** if the 339 relay experiences any major self-test failure.

Figure 6-56: Output relay 7: Critical Failure Relay



Output Relays - Contactor - Input/Output "E"

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected as CONTACTOR, the seven output relays function as:

Output Relay 1: Not Used
Output Relay 2: Not Used
Output Relay 3: Start Inhibit
Output Relay 4: Contactor Trip
Output Relays 5 to 6: Auxiliary Relays
Output Relay 7: Critical Failure

There are three special purpose relays: Start Inhibit, Contactor Trip, and Critical Failure. These relays have fixed operating characteristics:

Start Inhibit: Self-reset
Contactor Trip: Latched
Critical Failure: Self-reset, Failsafe

The user can configure an Auxiliary Relay as either **Latched** or **Self-reset**.

Output Relays 1 to 6 can be programmed to be in either Non-failsafe or Failsafe operation mode.

Non-failsafe: the relay coil is not energized in its non-active state. Loss of control power will cause the relay to remain in the non-active state; i.e. a non-failsafe trip relay will not cause a trip on loss of control power.

Failsafe: the relay coil is energized in its non-active state. Loss of control power will cause the relay to go into its active state; i.e. a failsafe trip relay will cause a trip on loss of control power.

Output Relay 1 "Not Used" - Input/Output "E"

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected as CONTACTOR, this output relay is not used.

Output Relay 2 "Not Used" - Input/Output "E"

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected as CONTACTOR, this output relay is not used.

Output Relay 3 Start Inhibit - Input/Output "E"

The Start Inhibit relay (Output Relay 3) is a form C contact with one Normally Open and one Normally Close contacts. This relay can be programmed as either Non-failsafe or Failsafe operation mode. Wiring of the Start Inhibit relay contacts will depend on the user's selection of operation mode. If Non-failsafe operation is selected, wire the Normally Close contact of Start Inhibit output relay to the contactor control circuit; if Fail-safe operation is selected, wire the Normally Open contact to the control circuit.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 3 START INHIB**

RELAY OPERATION

Range: Non-Failsafe, Failsafe
Default: Non-failsafe

Output Relay 4 Contactor Trip - Input/Output "E"

When the setting **S2 SYSTEM > SWITCHING DEVICE** is selected as CONTACTOR, a protection trip is always issued as a latched operation. The Trip relay (Output Relay 4) can be programmed as either Non-failsafe or Failsafe operation mode. Wiring of the Trip relay contacts will depend on this configuration. For maximum motor protection, program the trip relay to be failsafe and wire the contactor to the Normally Open trip relay terminals, referring to Figure 40, below. When control power is lost to the 339 , the contactor will trip to ensure maximum protection. If process considerations are more important than protection, program non-failsafe and wire the contactor to the Normally Close trip relay terminals, referring to Figure 39 below. When control power to the 339 is lost, no protection is available and the motor will continue to run. This has the advantage that the process will not shut down, however the motor may be damaged if a fault develops under these conditions.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 3 START INHIB**

RELAY OPERATION

Range: Non-Failsafe, Failsafe

Default: Non-failsafe

Figure 6-57: Contactor: Wiring for Start Inhibit and Trip (Non-failsafe)

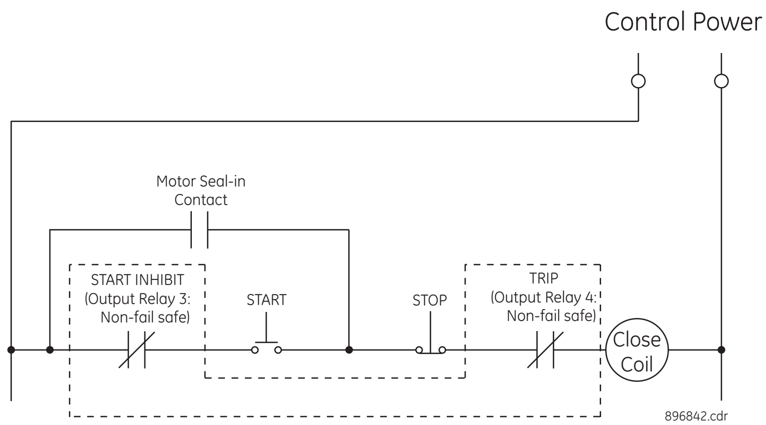
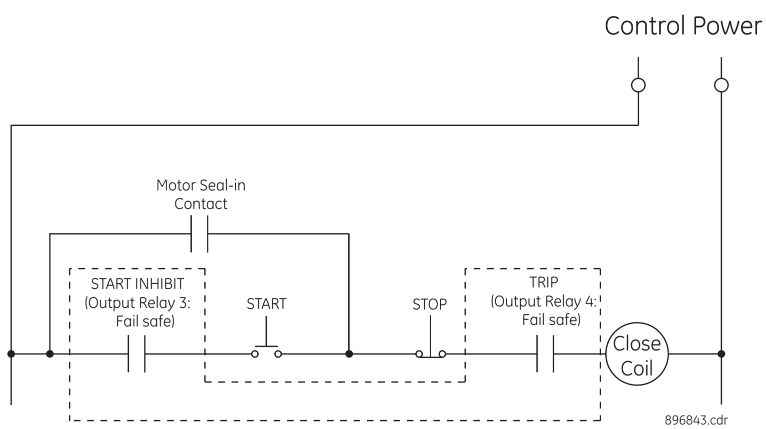


Figure 6-58: Contactor: Wiring for Start Inhibit and Trip (Failsafe)



Auxiliary Output Relays 5 to 6 - Input/Output “E”

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected CONTACTOR, there are 2 output relays (Output Relay 5 to 6) available for customer specific requirement. Each auxiliary relay can be selected as either Self-Reset or Latched. If the Self-Reset type is selected, the output relay will be energized as long as the element is in operating mode and will reset when the element drops out. If the Latched type is selected, the output relay will stay energized, after the element dropout, and will be de-energized upon the reset command. Each auxiliary relay can also be selected as either Non-Failsafe, or Failsafe. If an output is required when the 339 is not operational due to a loss of control power, select Failsafe auxiliary operation, otherwise, choose Non-Failsafe.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 5(6) AUXILIARY**

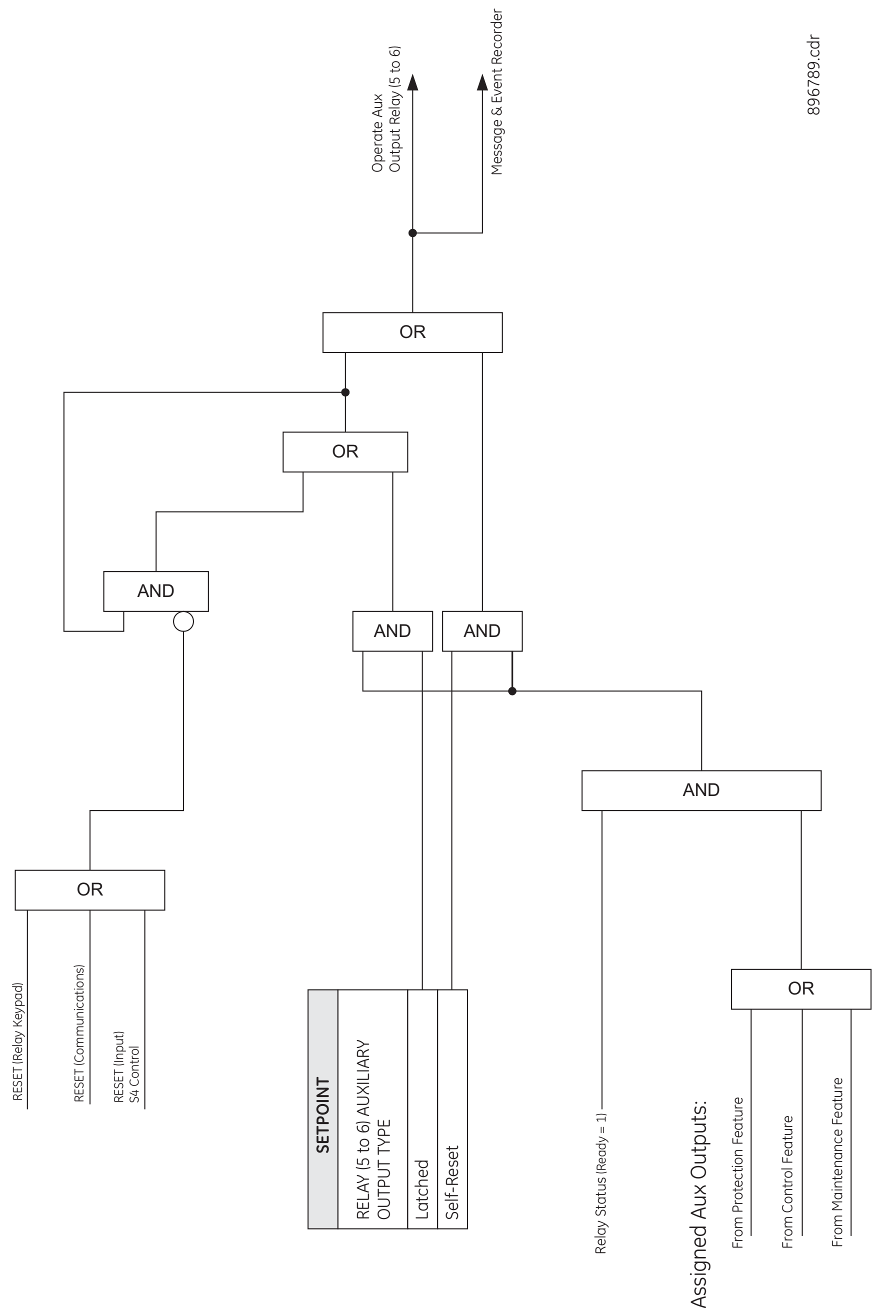
RELAY OPERATION

Range: Non-failsafe, Failsafe

Default: Non-failsafe

OUTPUT TYPE
Range: Self Reset, Latched
Default: Self Reset

Figure 6-59: Auxiliary relays



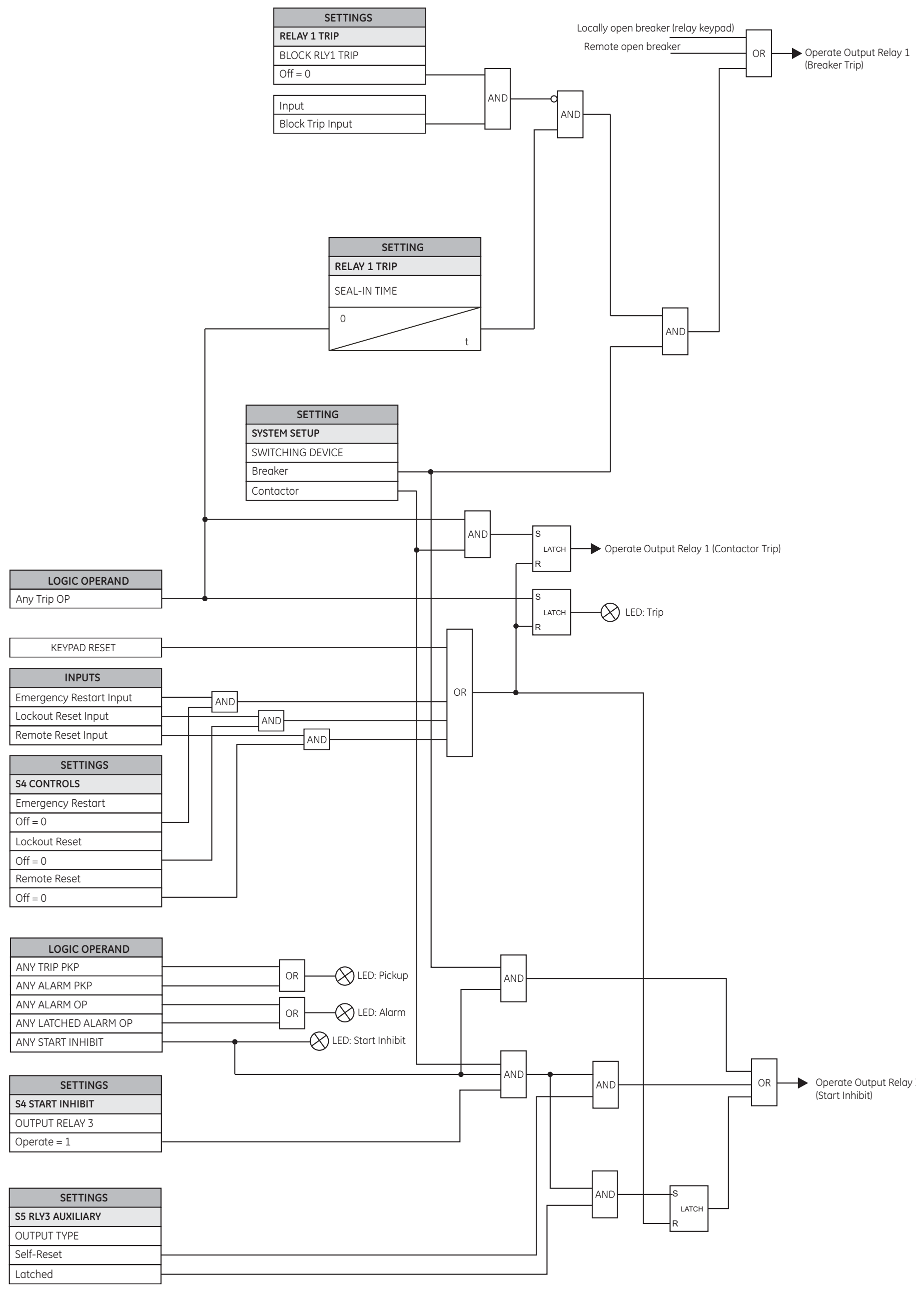
Critical Failure Relay #7 - Input/Output "E"

When the SWITCHING DEVICE is selected as contactor, the Critical Failure Relay behaves in the same way as when the SWITCHING DEVICE is selected as BREAKER.

Output relays Input/Output "R"

The 339 relay with INPUT/OUTPUT option 'R' is equipped with four electromechanical output relays: 3 form C relays (Relay 1, Relay 3, Relay 4), and 1 form A relay (Relay 2). Depending on the setting S2 SYSTEM SETUP > SWITCHING DEVICE, these output relays function differently with respect to the application of BREAKER and CONTACTOR.

Figure 6-60: Trip and Start Inhibit Output Relay Logic – INPUT/OUTPUT Option 'R'



Output Relays - Breaker - Input/ Output "R"

When the setting S2 SYSTEM SETUP > SWITCHING DEVICE is selected as BREAKER, the four output relays function as:

Output Relay 1: Breaker Trip
Output Relay 2: Breaker Close
Output Relay 3: Start Inhibit

Output Relay 4: Critical Failure

These four special purpose relays have fixed operating characteristics:

Breaker Trip: Seal-in

Breaker Close: Seal-in

Start Inhibit: Non-failsafe, Self-reset

Critical Failure: Failsafe, Self-reset

There are no configurable Auxiliary Relays in this case. Logic diagrams for each Output Relay are provided for detailed explanation of their operation.

The logic of the BREAKER TRIP, BREAKER CLOSE, START INHIBIT, and CRITICAL FAILURE relays with INPUT/OUTPUT Option 'R' is the same as for the other INPUT/OUTPUT options (Option 'E'), with the exception that the CRITICAL FAILURE relay is assigned to Output Relay 4 instead of Output Relay 7, as shown below.

Output Relay 1 "Breaker Trip" - Input/Output "R"

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 1 TRIP**

SEAL IN TIME

Range: 0.00 to 9.99 s in steps of 0.01

Default: 0.04 s

This setting defines the time to be added to the reset time of the Relay 1 Trip output, thus extending its pulse width. This is useful for those applications where the 52 contacts reporting the breaker state are faster than the 52 contacts that are responsible for interrupting the coil current.

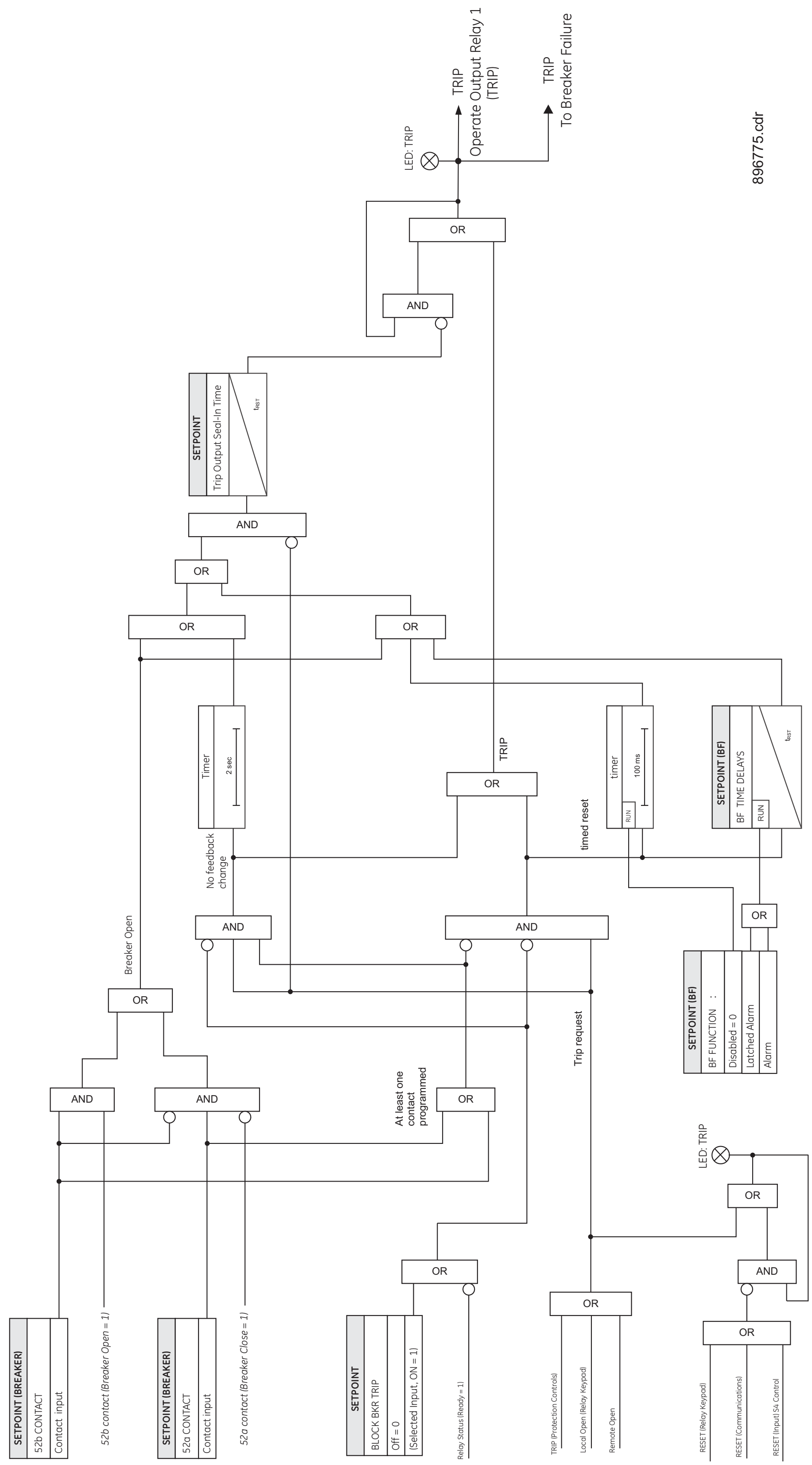
BLOCK RLY 1 TRIP

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

This setting defines a block to the Trip Output relay. When the selected input is asserted, the Trip Output relay will be blocked.

Figure 6-61: Relay 1 "TRIP" logic diagram



Output Relay 2 "Breaker Close" - Input/Output “R”

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 2 CLOSE**

SEAL IN TIME

Range: 0.00 to 9.99 s in steps of 0.01

Default: 0.04 s

This setting defines the time to be added to the reset time of the Relay 2 Close output, thus extending its pulse width. This is useful for those applications where the 52 contacts reporting the breaker state are faster than the 52 contacts that are responsible for interrupting the coil current.

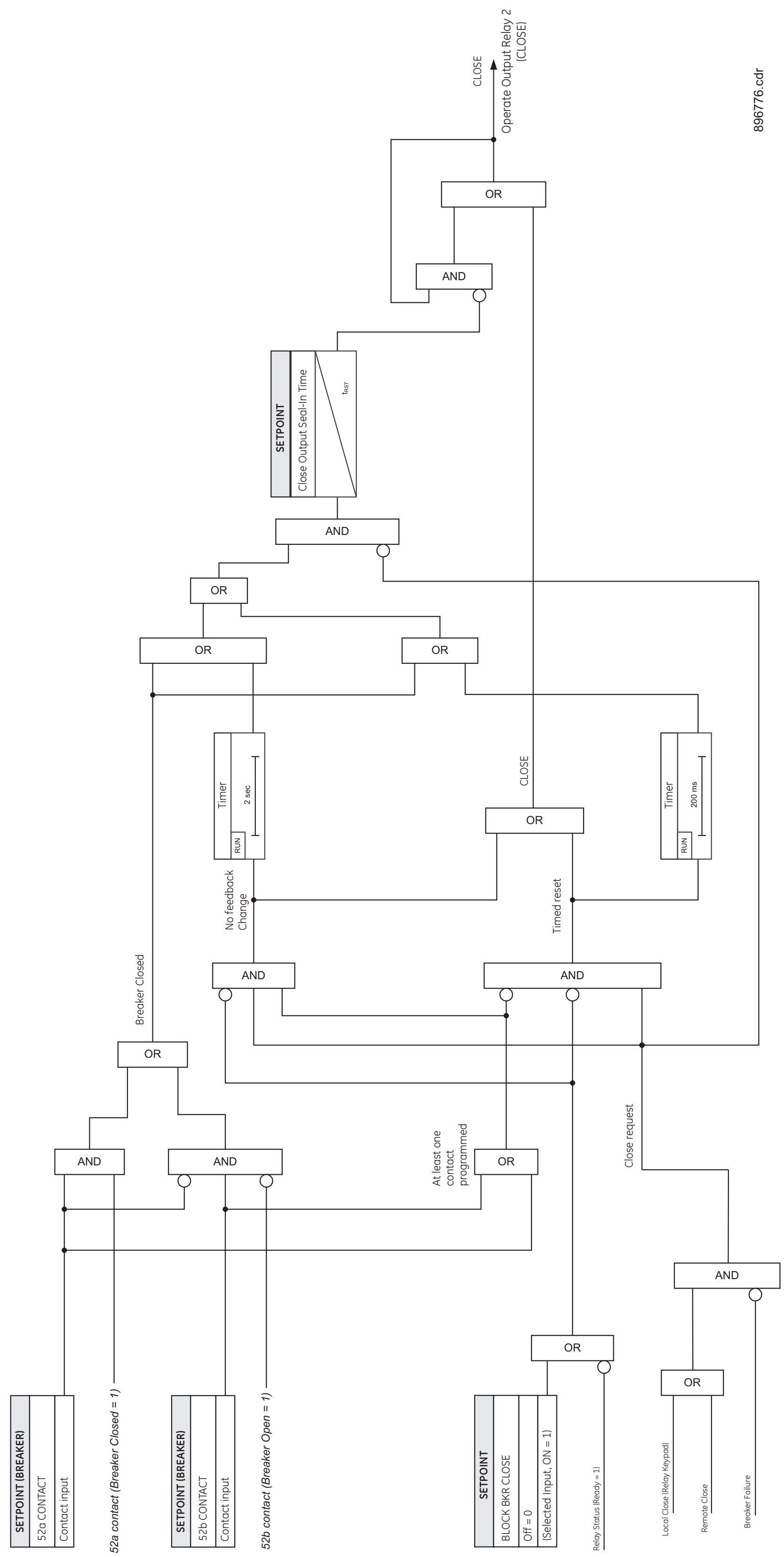
BLOCK RLY 2 CLOSE

Range: Off, Contact Input 1 to 10, Virtual Input 1 to 32, Remote Input 1 to 32, Logic Elements 1 to 16

Default: Off

This setting defines a block to the Close Output relay. When the selected input is asserted, the Close Output relay will be blocked. The block function can be useful for breaker maintenance purposes.

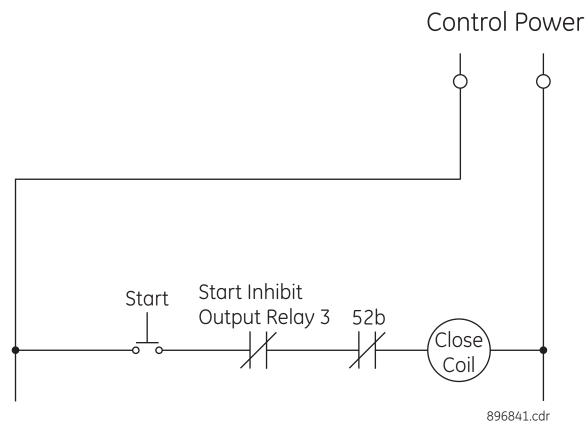
Figure 6-62: Relay 2 "CLOSE" logic diagram



Output Relay 3 Start Inhibit - Input/Output "R"

There are no user-programmable setpoints associated with the START INHIBIT relay. If there is a lockout time, the START INHIBIT relay prevents or inhibits the start of the motor based on the MOTOR LOCKOUT TIME. The operation of this output relay is always self-reset, so it will automatically reset when all lockout timers expire. This relay should be wired in series with the start pushbutton to prevent motor starting.

Figure 6-63: Breaker: Wiring for Start Inhibit



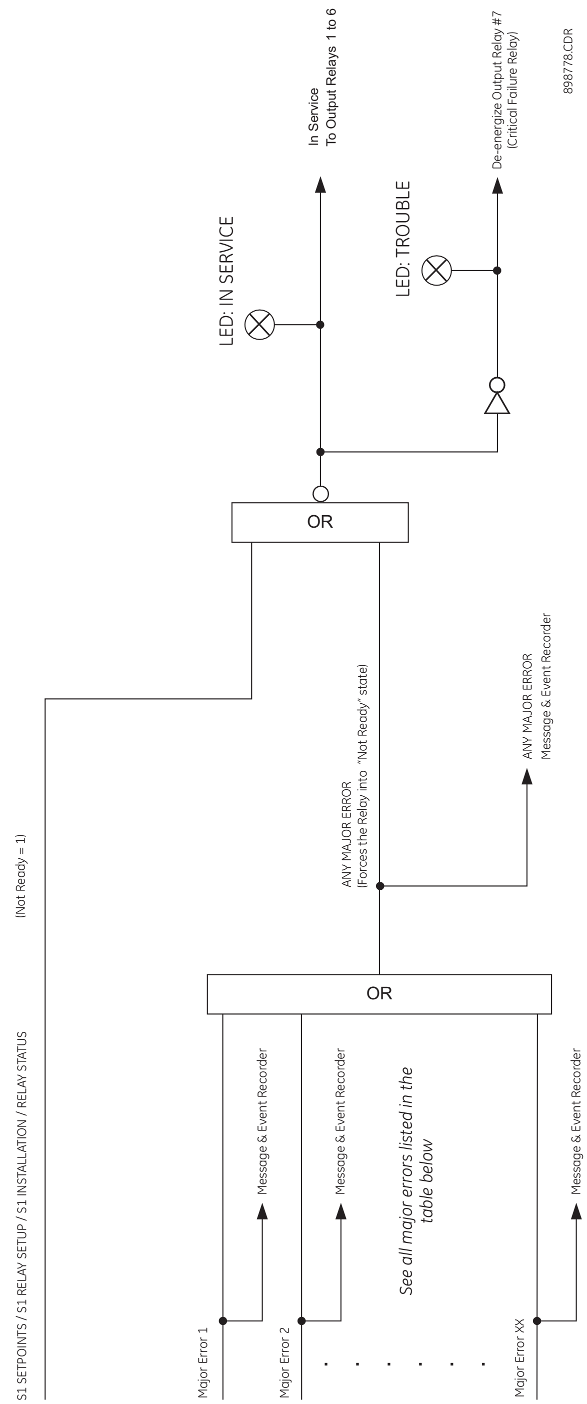
Critical Failure Relay 4 - Input/Output "R"

The 339 339 relay is also equipped with one output relay (#4 - "Critical Failure Relay") for fail-safe indication. There are no user-programmable setpoints associated with this output relay. The logic for this relay is shown below.

The Critical Failure Relay (Output Relay 4) is a form C contact (refer to the Typical Wiring Diagram) with one Normally Open, and one Normally Closed contact (no control power). Output Relay 4 is energized or de-energized (state change) depending on the following conditions:

1. Output Relay 4 will be **de-energized**, if the relay is not in IN-SERVICE mode or the control power is not applied to the relay
2. Output Relay 4 will be **energized** when the control power is applied to the relay and the relay is in IN-SERVICE mode.
3. Output Relay 4 will stay **de-energized**, when the control power is applied, if the relay was not programmed as "Ready", or upon major self-test failure during relay boot-up.
4. Output Relay 4 will change state from **energized** to **de-energized** if the 339 relay experiences any major self-test failure.

Figure 6-64: Output Relay 4: Critical Failure Relay



Output Relays - Contactor - Input/ Output "R"

When the setting **S2 SYSTEM SETUP > SWITCHING DEVICE** is selected as CONTACTOR, the four output relays function as:

Output Relay 1: Contactor Trip
Output Relay 2: Alarm
Output Relay 3: Auxiliary
Output Relay 4: Critical Failure

There are three special purpose relays: Contactor Trip, Alarm, and Critical Failure. These relays have fixed operating characteristics:

Contactor Trip: Failsafe or Non-Failsafe, Latched
Alarm: Failsafe or Non-Failsafe, Latched or Self-reset
Critical Failure: Failsafe, Self-reset

The user can configure the Auxiliary Relay as either Latched or Self-reset, and to be in either Non-failsafe or Failsafe operation mode. Note that the Auxiliary Relay is defaulted to operate when a Start Inhibit is active. This is selectable with setting S4 CONTROLS > START INHIBIT > OUTPUT RELAY 3.

Output Relay 1 Contactor Trip - Input/Output “R”

When the setting S2 SYSTEM SETUP > SWITCHING DEVICE is selected as CONTACTOR, a protection trip is always issued as a latched operation. The Trip Relay (Output Relay 1) can be programmed to operate in either **Non-failsafe** or **Failsafe** mode. Wiring of the Trip Relay contacts will depend on this configuration. For maximum motor protection, program the Trip Relay to be Failsafe and wire the contactor to the Normally Open trip relay terminals (see figure below). When control power is lost to the 339 , the contactor will trip to ensure maximum protection. If process considerations are more important than protection, program **Non-Failsafe** and wire the contactor to the Normally Closed trip relay terminals (see figure below). When control power to the 339 is lost, no protection is available and the motor will continue to run. Although this has the advantage that the process will not shut down, the motor may be damaged if a fault develops under these conditions.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 1 TRIP**

RELAY OPERATION

Range: Non-Failsafe, Failsafe
Default: Non-Failsafe

Figure 6-65: Contactor: Wiring for Start Inhibit and Trip (Non-failsafe) – INPUT/OUTPUT Option ‘R’

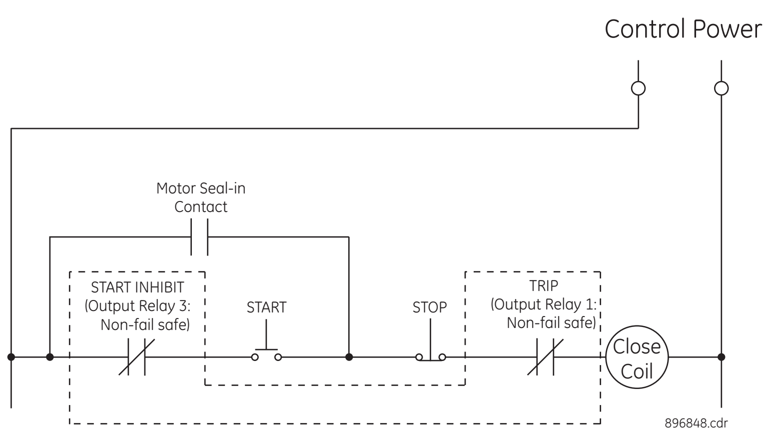
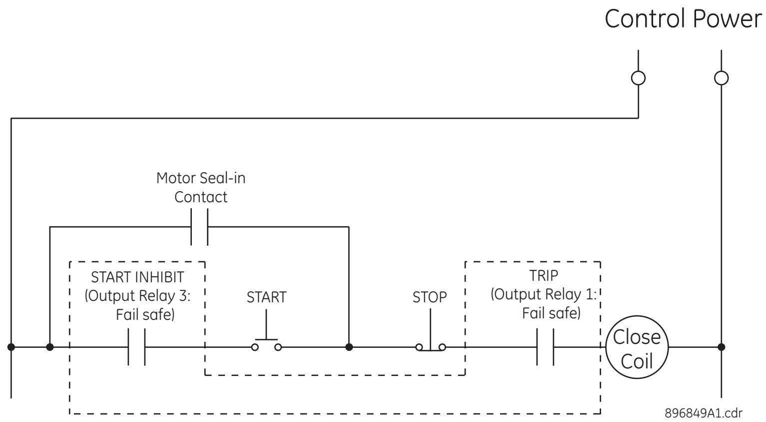


Figure 6-66: Contactor: Wiring for Start Inhibit and Trip (Failsafe) – INPUT/OUTPUT Option 'R'



Output Relay 2 Alarm - Input/Output "R"

Any Alarm condition will activate the Form-A ALARM relay. The ALARM relay is selectable for either **Non-Failsafe** or **Failsafe** operation. If an alarm indication is required only while an alarm is present, select **Unlatched**. With the **Unlatched** output type, once an alarm condition is cleared, the alarm and associated message automatically clear. To ensure all alarms are acknowledged, select **Latched**. If an alarm condition is no longer present, the Latched Alarm relay can be cleared only by a **Reset** command.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 2 ALARM**

RELAY OPERATION

Range: Non-Failsafe, Failsafe
Default: Non-Failsafe

OUTPUT TYPE

Range: Self-Reset, Latched
Default: Self-Reset

Auxiliary Output Relay 3 - Input/Output "R"

When the setting S2 SYSTEMS SETUP > SWITCHING DEVICE is selected as CONTACTOR, there is one output relay (Output Relay 3) available for customer-specific requirements. The Auxiliary relay can be selected as either **Self-Reset** or **Latched**. If the **Self-Reset** output type is selected, this relay will be energized as long as the element is in operating mode and will reset when the element drops out. If the **Latched** type is selected, the output relay will stay energized after the element dropout, and will be de-energized upon the **Reset** command. The Auxiliary relay can also be selected as either **Non-Failsafe** or **Failsafe**. If an output is required when the 339 is not operational due to a loss of control power, select **Failsafe** operation, otherwise choose **Non-Failsafe**. Note that the Auxiliary relay is defaulted to operate when a Start Inhibit is active, this is selectable with setting S4 CONTROLS > START INHIBIT > OUTPUT RELAY 3. If the Auxiliary relay is to be controlled by the Start Inhibit feature, it is recommended that the Output Type be set to **Self-Reset**.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > OUTPUT RELAYS > RLY 3 AUXILIARY**

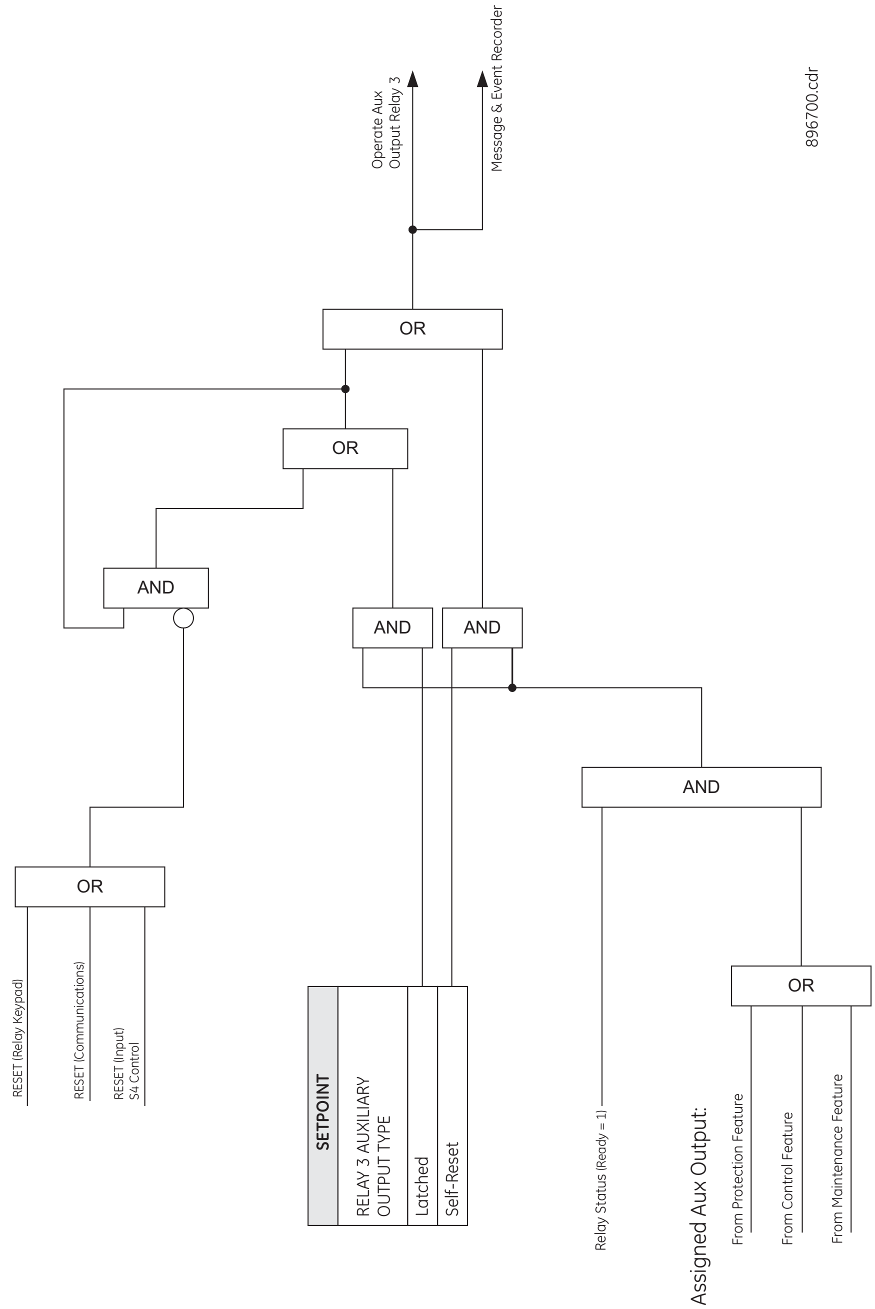
RELAY OPERATION

Range: Non-Failsafe, Failsafe
Default: Non-Failsafe

OUTPUT TYPE

Range: Self-Reset, Latched
Default: Self-Reset

Figure 6-67: Contactor: Auxiliary Relay Logic – INPUT/OUTPUT Option 'R'



Critical Failure Relay 4 - Input/Output "R"

When the SWITCHING DEVICE is selected as CONTACTOR, the Critical Failure Relay behaves in the same way as when the SWITCHING DEVICE is selected as BREAKER.

Virtual inputs

There are 32 virtual inputs that can be individually programmed to respond to input commands entered via the relay keypad, or by using communication protocols.

Virtual input programming begins with enabling the Virtual Input Function, and selecting the Virtual Input Type **Self-Reset** or **Latched** under **SETPOINTS > S5 INPUTS/OUTPUTS > VIRTUAL INPUTS**. Next, the user can assign a command **On/Off** to the enabled Virtual Input under **SETPOINTS > S4 CONTROLS > VIRTUAL INPUTS**. Referring to the Virtual Inputs logic diagram below, a Virtual Input type can be selected to be either **Self-Reset**, or **Latched**. When **Self-Reset** is selected and the “On” command is executed, the virtual input is evaluated as a pulse at a rate of one protection pass. To prolong the time of the virtual input pulse, one can assign it as a trigger source to a logic element with a dropout timer set to the desired pulse time. Selecting the **Latched** type, will latch the virtual input state, when the “On” command is executed.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **SETPOINTS > S5 INPUTS/OUTPUTS > VIRTUAL INPUTS**

VI x NAME

Range: 18 Characters

Default: Virtual IN x

This setting defines a programmable name for the Virtual Input.

VI x FUNCTION

Range: Disabled/Enabled

Default: Disabled

The Virtual Input is enabled and ready to be triggered when set to **Enabled**.

VI x TYPE

Range: Self-Reset, Latched

Default: Self-reset

When the **Self-Reset** type is selected, the Virtual Input will be evaluated for one protection pass only, upon “On” initiation and it will reset. When the **Latched** type is selected, the virtual input will keep the state “On” until reset command “Off” is initiated.

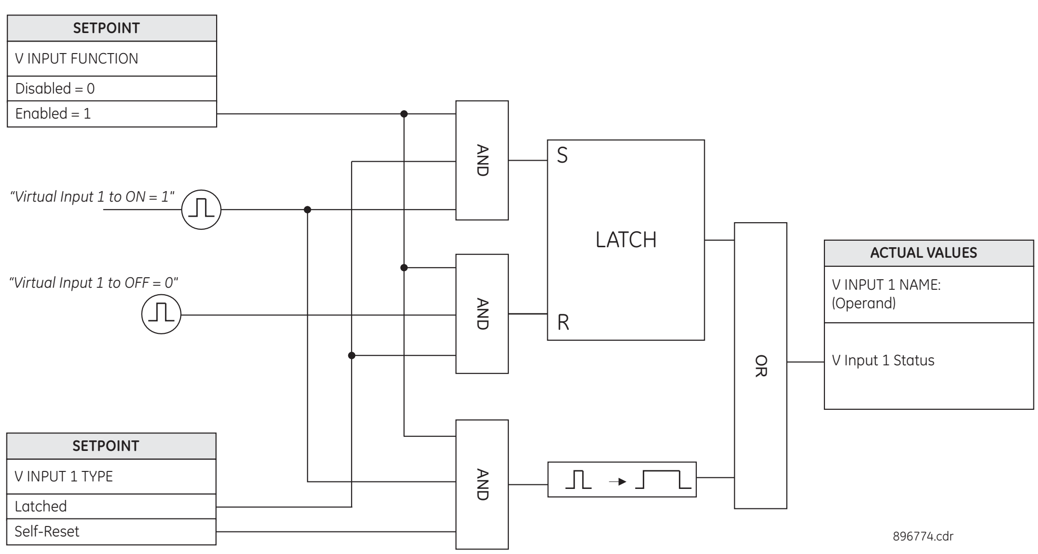
NOTE

See also the Virtual Inputs section under **S4 CONTROLS**, on how to trigger a virtual input signal state.

NOTE

The "On" state of the Virtual Input will not be retained in the case of cycling of the relay control power supply.

Figure 6-68: Virtual Inputs Scheme logic



339 Motor Protection System

Chapter 7: Maintenance

Information about the relay and the breaker can be obtained through the features included in the Maintenance page.

Figure 7-1: Main Maintenance menu - BREAKER condition

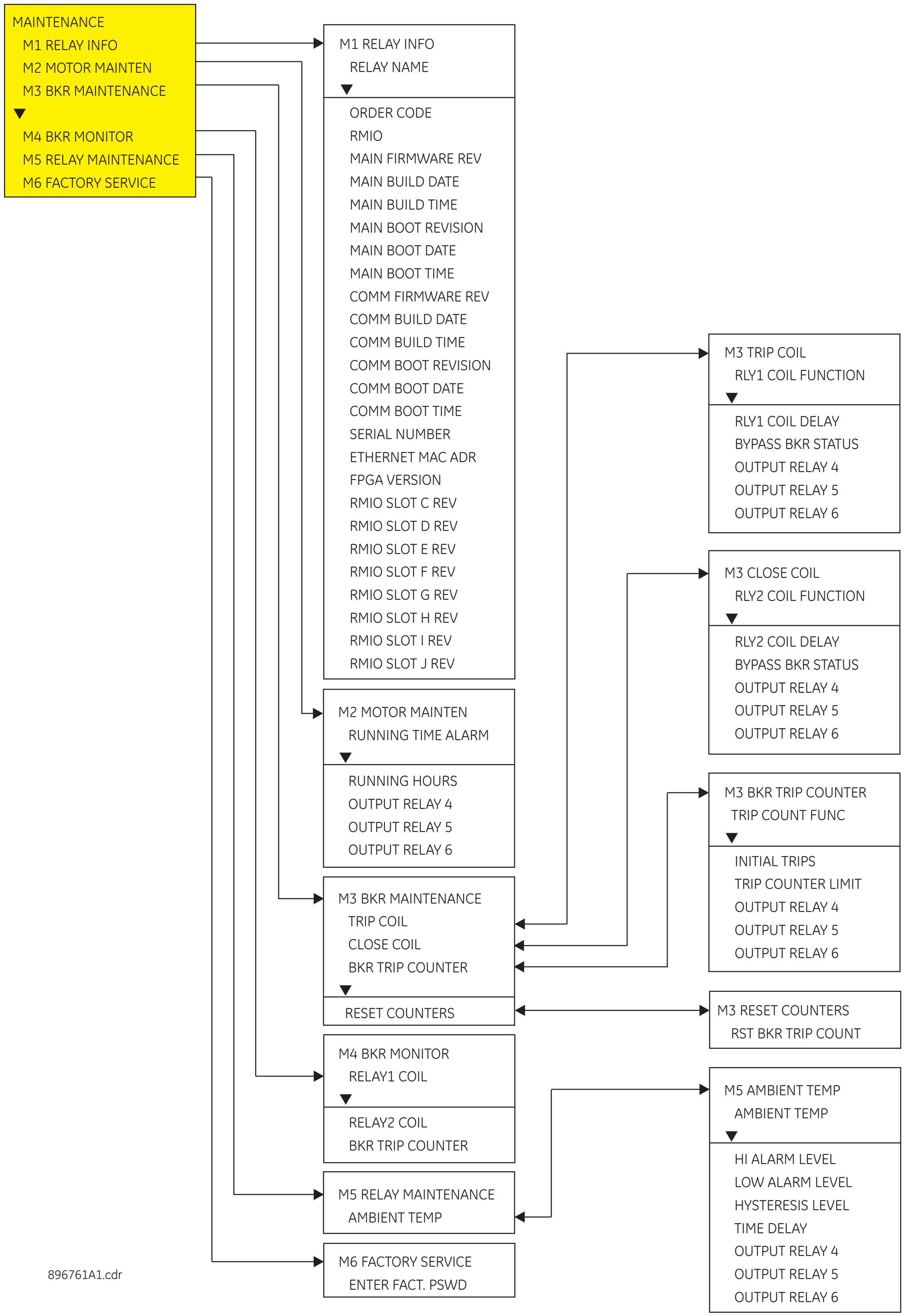
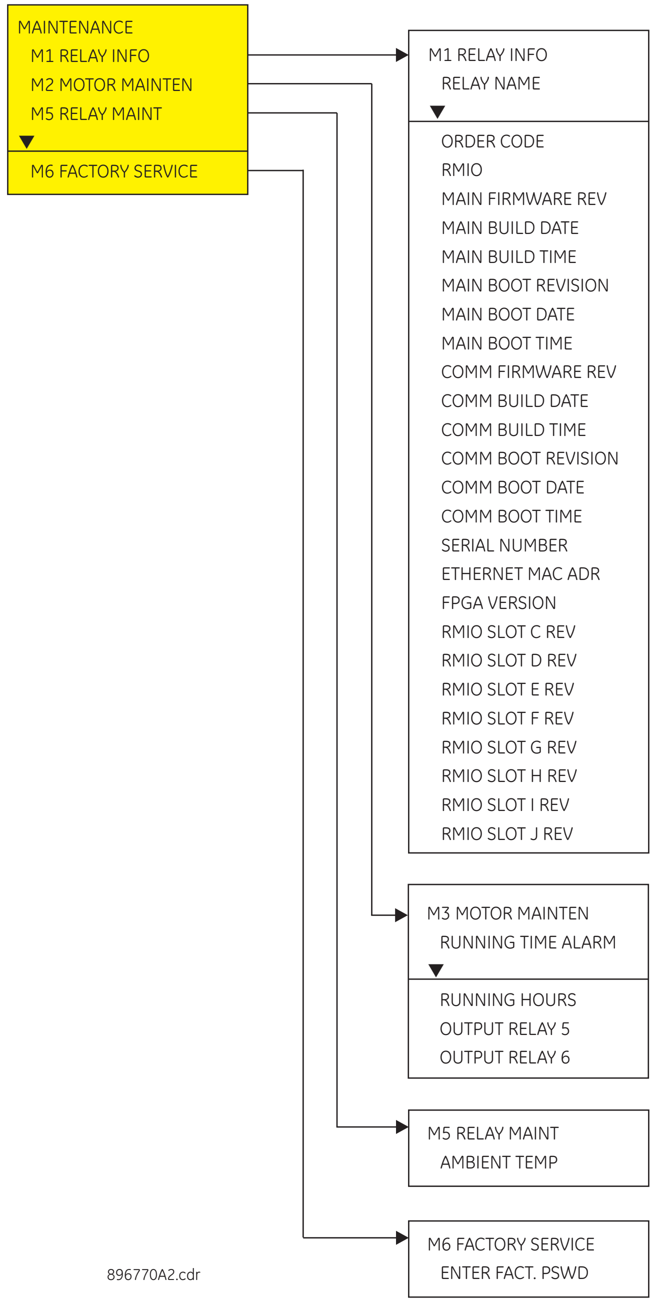


Figure 7-2: Main Maintenance menu - CONTACTOR condition



M1 Relay information

PATH: MAINTENANCE > M1 RELAY INFO

RELAY NAME

Range: alpha-numeric name of up to 18 characters

Default: Motor Name

ORDER CODE
339-EP5G5HESNP2EDN

This screen shows the relay Order Code.

RMIO

Range: G, GG, GGG

Displays the validated RMIO. This value will be seen only if the RMIO module is installed.

MAIN FIRMWARE REVISION
1.41

This screen shows the relay Main Firmware Revision.

MAIN BUILD DATE
Aug 16 2010

This screen shows the relay Main Firmware Build Date.

MAIN BUILD TIME
16:32:38

This screen shows the relay Main Firmware Build Time.

MAIN BOOT REVISION
1.20

This screen shows the relay Main Boot Code Revision.

MAIN BOOT DATE
Dec 11 2009

This screen shows the relay Main Boot Code Build Date.

MAIN BOOT TIME
10:44:54

This screen shows the relay Main Boot Code Build Time.

COMM FIRMWARE REVISION
1.41

This screen shows the relay Comm Code Revision.

COMM BUILD DATE
Aug 16 2010

This screen shows the relay Comm Code Build Date.

COMM BUILD TIME
17:51:38

This screen shows the relay Comm Code Build Time.

COMM BOOT REVISION
1.20

This screen shows the relay Comm Boot Code Revision.

COMM BOOT TIME
11:47:17

This screen shows the relay Comm Boot Code Build Time.

SERIAL NUMBER
ML0A08M00133

Each 339 relay has a unique serial number.

ETHERNET MAC ADR
00:A0F4:00:0B:78

This screen shows the Ethernet MAC Address of the relay.

FPGA VERSION
1.00

This screen shows the FPGA Version.

RMIO SLOT C REV
1.75

RMIO SLOT D REV
1.75

RMIO SLOT E REV
1.75

RMIO SLOT F REV
1.75

RMIO SLOT G REV
1.75

RMIO SLOT H REV
1.75

RMIO SLOT I REV
1.75

RMIO SLOT J REV
1.75

M2 Motor maintenance

PATH: MAINTENANCE > M2 MOTOR MAINTEN

When the motor running time exceeds the setting RUNNING HOURS, a "Motor Running Hrs Alarm" is generated, and this alarm can be assigned to any available auxiliary output relays. To clear the counter for "Motor Running Hours", use the command "S1 RELAY SETUP / PRESET STATISTICS / SET RUNNING HOURS" to preset this value to 0.

RUNNING TIME ALARM

Range: Disabled, Enabled

Default: Disabled

This setting enables the Motor Running Time Alarm functionality. If this feature is not required, set this setting to **Disabled**.

RUNNING HOURS

Range: 0 to 65535 hrs in steps of 1 hr

Default: 0 hrs

This setting specifies a motor running time above which an alarm should be issued.

OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon Motor Running Time Alarm operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

M3 Breaker maintenance

NOTE

M3 Breaker Maintenance and associated functions are available only when the switching device is set to BREAKER.

Trip coil

The Trip coil monitoring is performed by a built-in voltage monitor on the Form A output relay: #1 Trip. The voltage monitor is connected across the Form A contact, and effectively the relay detects healthy current through the circuit. To do that, an external jumper must be made between terminals "A2" and "A3" for Trip coil monitoring.

As long as the current through the Voltage Monitor is above the threshold of the trickle currents (see Technical Specification for Form A output relays), the circuit integrity for the Trip coil is effectively normal. If the Trip coil circuit gets disconnected, or if in general a high resistance is detected in the circuitry, a Relay 1 Coil Monitor alarm will be set and the "ALARM" and "MAINTENANCE" LEDs will be ON.

NOTE

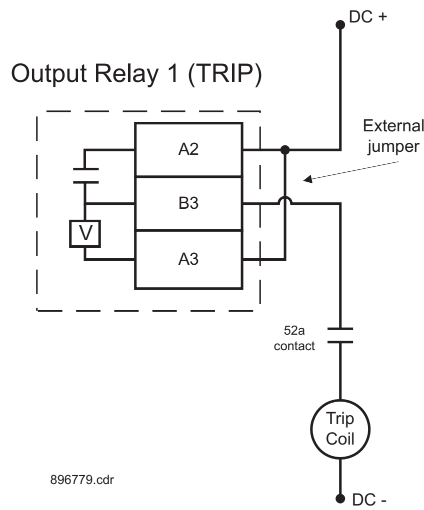
The Coil Monitor feature is not available with 339 INPUT/OUTPUT option 'R'. Refer to the Order Codes section to determine if this feature is supported.

Example 1: The figure below shows the connections of the breaker trip coil to the relay's trip output relay for voltage monitoring of the trip circuit.

NOTE

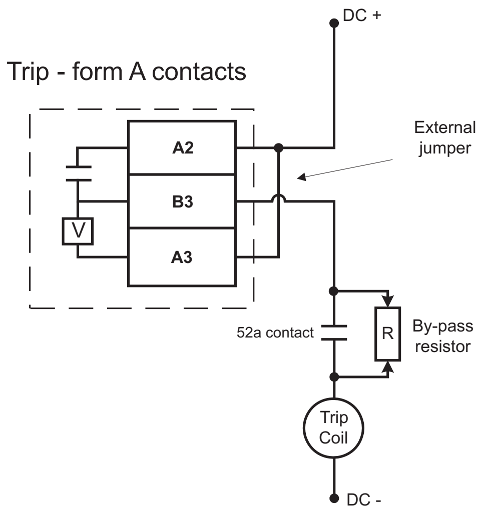
To monitor the trip coil circuit integrity, use the relay terminals "A2" and "B3" to connect the Trip coil, and provide a jumper between terminals "A2" and "A3" (voltage monitor).

Figure 7-3: Trip Coil circuit with voltage monitoring



Example 2: Some applications require that the Trip coil be monitored continuously, regardless of the breaker position (open or closed). This can be achieved by connecting a suitable resistor (see the table) across breaker auxiliary contact 52a in the trip circuit. With such connections, the trickle current will be maintained by the resistor when the breaker is open. For these applications the setting for “BYPASS BKR STATUS” should be set to ENABLED.

Figure 7-4: Trip circuit with continuous monitoring



VALUES OF RESISTOR ‘R’

POWER SUPPLY (V DC)	RESISTANCE (OHMS)	POWER (WATTS)
24	1000	2
30	5000	2
48	10000	2
110	25000	5
125	25000	5
250	50000	5

896780.cdr

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: MAINTENANCE > M3 BKR MAINTENANCE > TRIP COIL

RLY1 COIL FUNCTION

Range: Disabled, Alarm, Latched Alarm

Default: Disabled

Selecting Alarm, or Latched Alarm, enables the Trip Coil Monitor monitoring function. The “ALARM” and “MAINTENANCE” LEDs will light up upon detection of a trip coil circuitry problem. The “ALARM” LED will flash upon Trip Coil Monitor operating condition, with the Trip Coil Monitor function selected as Alarm, and will self-reset, when the condition clears. If Latched Alarm is selected, the “ALARM” LED will flash during the Trip Coil Monitor condition, and will stay “ON” after the condition clears, until the reset command is initiated. Any or all of output relays 4 to 6 can be selected to operate when the Trip Coil Monitor function is selected as Alarm, or Latched Alarm.

RLY1 COIL DELAY

Range: 1 to 10 sec in steps of 1 sec

Default: 5 s

This setting defines the Trip Coil Monitor Delay, before targets appear on the display, “ALARM” and “MAINTENANCE” LEDs light up on the front panel, and selected output relays operate.

BYPASS BKR STATUS

Range: Disabled, Enabled

Default: Disabled

Set the “BYPASS BKR STATUS” to Enabled when a by-pass resistor is connected across the breaker auxiliary contact for continuous Trip circuit integrity monitoring. The circuits will be monitored regardless of breaker position. When “BYPASS BKR STATUS” is set to Disabled, monitoring of the trip coil will be blocked when the breaker is open.

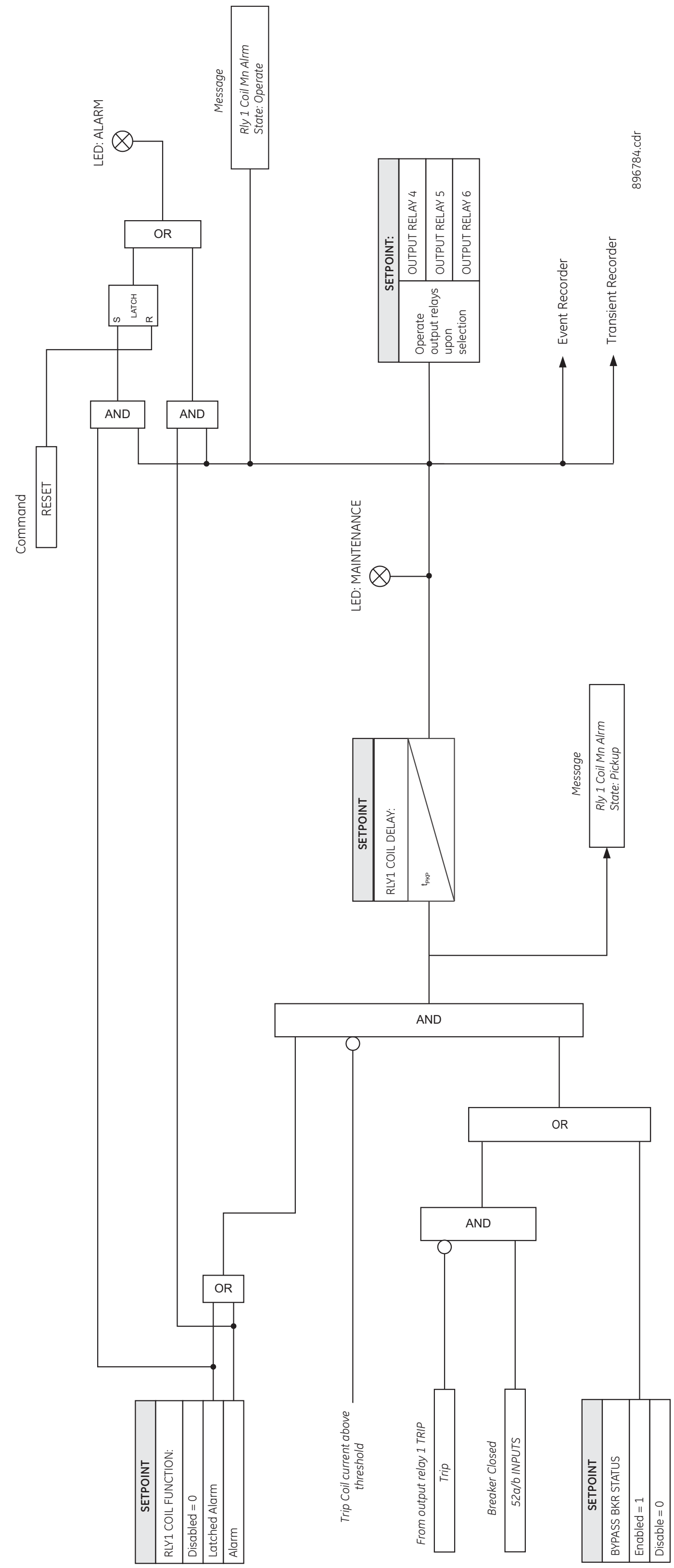
OUTPUT RELAY 4 to 6

Range: Do not operate, Operate

Default: Do not operate

Any, or all, of output relays 4 to 6 can be selected to operate upon detection of Trip Coil, or a Trip coil circuitry problem. The selection of the relay outputs operation is available no matter whether the Alarm, or Latched Alarm, function is selected.

Figure 7-5: Trip Coil Monitoring logic diagram



Close coil

Close coil monitoring is performed by a built-in voltage monitor on the Form A output relay: #2 Close. The voltage monitor is connected across the Form A contact, and effectively the relay detects healthy current through the circuit. To do that, an external jumper should be made between terminals “B4”, and “B5” for Close coil monitoring.

As long as the current through the Voltage Monitor is above the threshold of the trickle currents (see Technical Specification for Form A output relays), the circuit integrity for the Close coil is effectively normal. If the Close coil circuit gets disconnected, or if in general a high resistance is detected in the circuitry, a Relay 2 Coil Monitor Alarm will be set and the “ALARM” and “MAINTENANCE” LEDs will be on.

NOTE

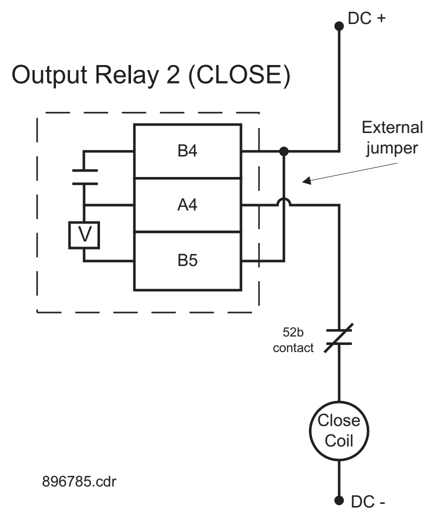
The Coil Monitor feature is not available with 339 INPUT/OUTPUT option ‘R’. Refer to the Order Code section to determine if this feature is supported

Example 1: The figure below shows the connection of the breaker close coil to the relay’s close output relay for voltage monitoring of the close circuit.

NOTE

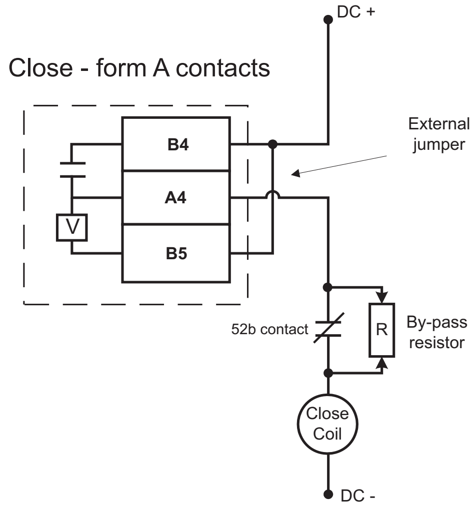
To monitor the close coil circuit integrity, use the relay terminals “B4” and “A4” to connect the Close coil, and provide a jumper between terminals “B4” and “B5” (voltage monitor).

Figure 7-6: Close Coil circuit with voltage monitoring



Example 2: Some applications require that the Close Coil be monitored continuously, regardless of the breaker position (open or closed). This can be achieved by connecting a suitable resistor (see the table) across breaker auxiliary contact 52b in the Close circuit. With such connections, the trickle current will be maintained by the resistor when the breaker is closed. For these applications the setting for “BYPASS BKR STATUS” should be set to ENABLED.

Figure 7-7: Close Coil circuit with continuous monitoring



VALUES OF RESISTOR 'R'

POWER SUPPLY (V DC)	RESISTANCE (OHMS)	POWER (WATTS)
24	1000	2
30	5000	2
48	10000	2
110	25000	5
125	25000	5
250	50000	5

896786.cdr

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **MAINTENANCE > M3 BKR MAINTENANCE > CLOSE COIL**

RLY2 COIL FUNCTION

Range: Disabled, Alarm, Latched Alarm

Default: Disabled

Selecting Alarm, or Latched Alarm, enables the Close Coil Monitor monitoring function. The "ALARM" and "MAINTENANCE" LEDs will light up upon detection of a close coil circuitry problem. The "ALARM" LED will flash upon a Close Coil Monitor operating condition, with the Close Coil Monitor function selected as Alarm, and will self-reset, when the condition clears. If Latched Alarm is selected, the "ALARM" LED will flash during the Close Coil Monitor condition, and will stay "ON" after the condition clears, until the reset command is initiated. Any or all of output relays 4 to 6 can be selected to operate when the Close Coil Monitor function is selected as Alarm, or Latched Alarm.

RLY2 COIL DELAY

Range: 1 to 10 sec in steps of 1 sec

Default: 5 s

This setting defines the Close Coil Monitor Delay, before targets appear on the display, "ALARM" and "MAINTENANCE" LEDs light up on the front panel, and selected output relays operate.

BYPASS BKR STATUS

Range: Disabled, Enabled

Default: Disabled

Set the "BYPASS BKR STATUS" to Enabled when a by-pass resistor is connected across the breaker auxiliary contact for continuous Close circuit integrity monitoring. The circuits will be monitored regardless of breaker position. When "BYPASS BKR STATUS" is set to Disabled, monitoring of the close coil will be blocked when the breaker is closed.

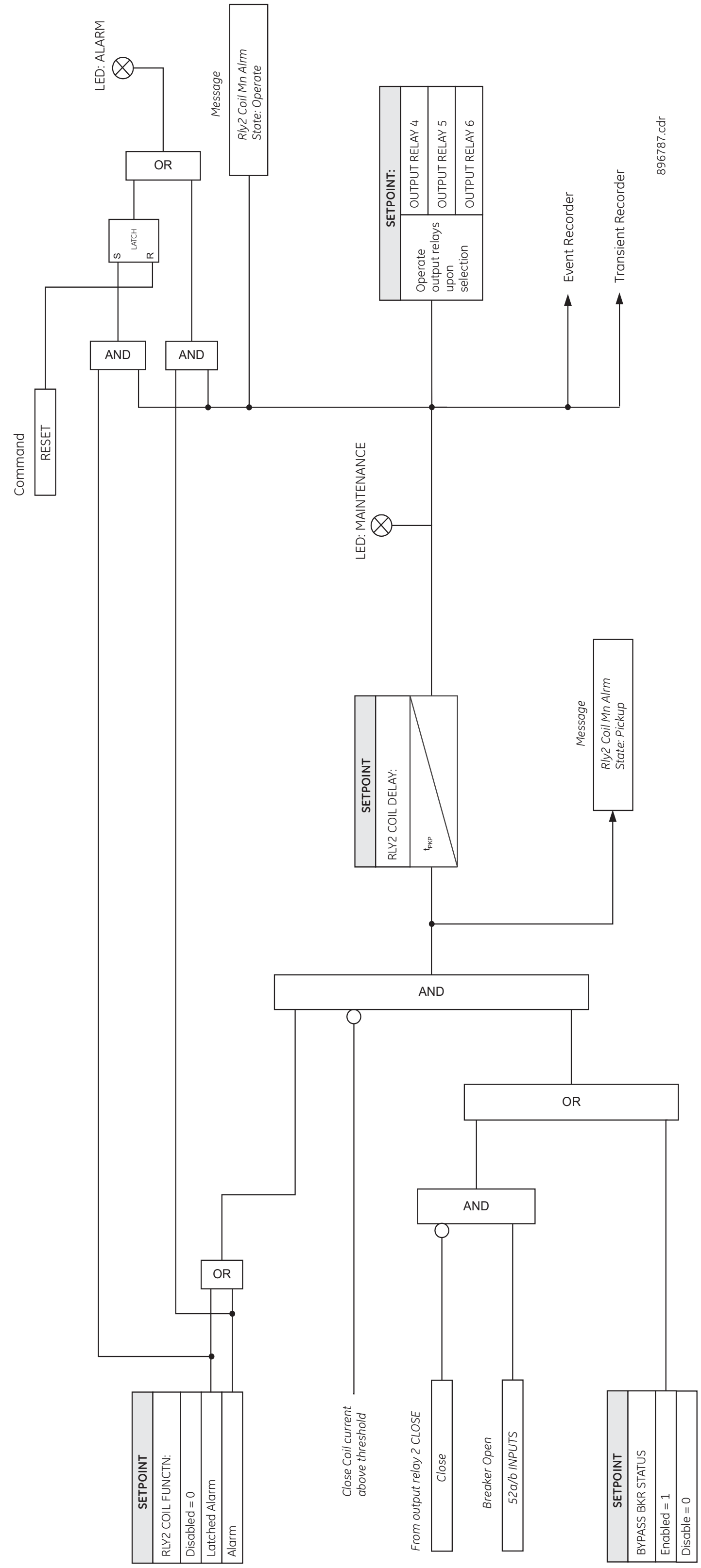
OUTPUT RELAY 4 to 6

Range: Do not operate, Operate

Default: Do not operate

Any, or all, of output relays 4 to 6 can be selected to operate upon detection of a Close coil circuitry problem. The selection of the relay outputs operation is available no matter whether the Alarm, or Latched Alarm, function is selected.

Figure 7-8: Close coil monitoring logic diagram



Breaker trip counter

When the total number of breaker trips detected reaches the TRIP COUNTER LIMIT setpoint, an output will occur.

The following path is available using the keypad. For instructions on how to use the keypad, please refer to *Chapter 3 - Working with the Keypad*.

PATH: **MAINTENANCE > M3 BKR MAINTENANCE > BKR TRIP COUNTER**

TRIP COUNT FUNC

Range: Disabled, Alarm, Latched Alarm

Default: Disabled

The selection of the **Latched Alarm**, or **Alarm** setting enables the BKR Trip Counter function. The "ALARM" LED will turn on when the Total breaker trips reaches the TRIP COUNTER LIMIT setting. The "ALARM" LED will flash when the BKR Trip Counter reaches the TRIP COUNTER LIMIT setting with function selected as **Alarm**, and will reset, when the trip counter is reset. The "ALARM" LED will latch when **Latched Alarm** is selected, until the counter is reset, and the **Reset** command is initiated.

Any or all of output relays 4 to 6 can be selected to operate when the number of breaker trips reaches the "TRIP COUNTER LIMIT," regardless of the selected trip counter function.

INITIAL TRIPS

Range: 0 to 10000 in steps of 1

Default: 0

This setting defines the number of breaker trips, that occurred before enabling the breaker trip counter for breaker monitoring.

TRIP COUNTER LIMIT

Range: 1 to 10000 trips in steps of 1

Default: 1 trip

This setting defines the limit number for breaker trips. The BKR TRIP COUNTER will operate and produce an output if the number of breaker trips reaches the set limit.

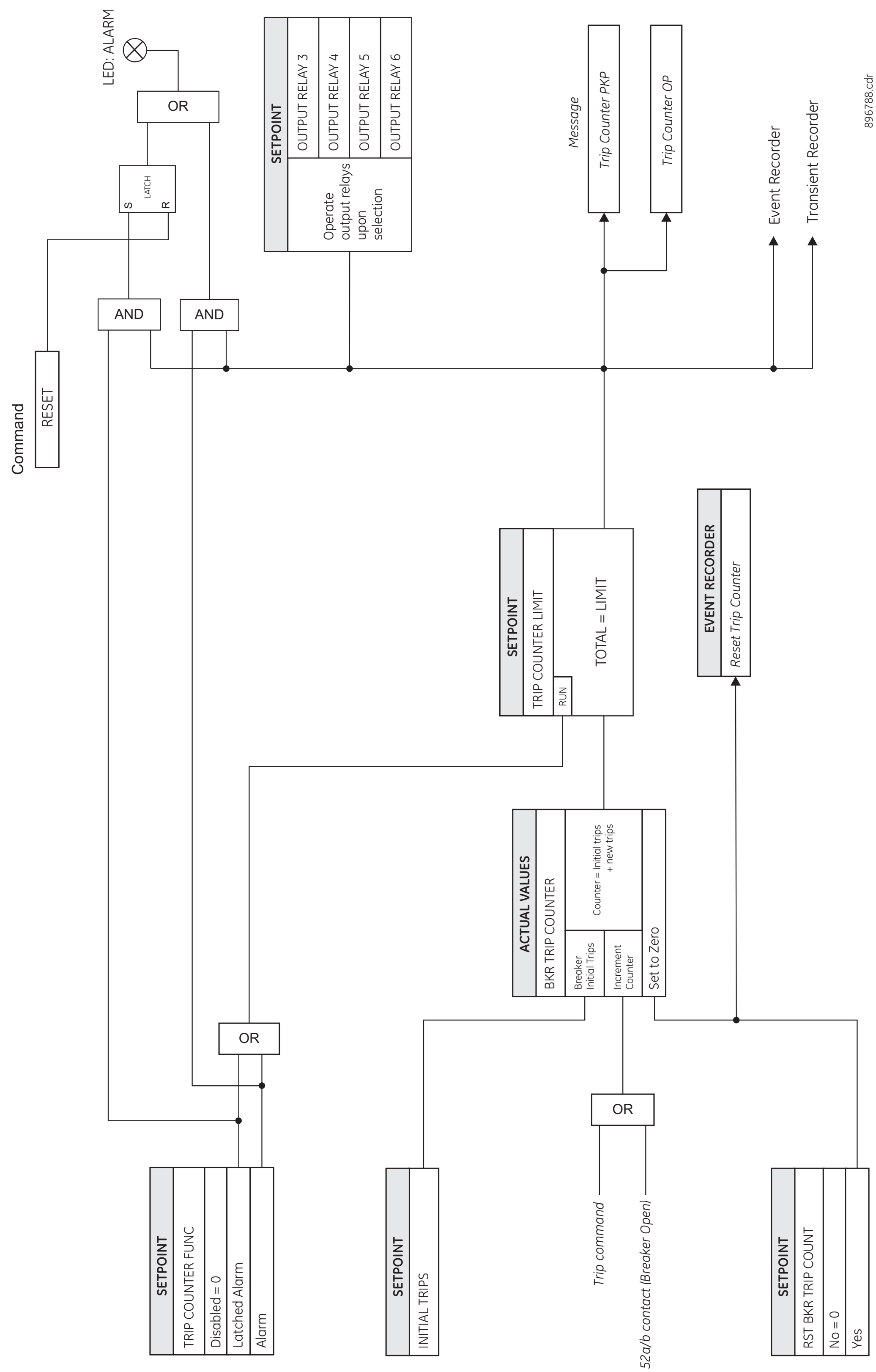
OUTPUT RELAY 4 to 6

Range: Do not operate, Operate

Default: Do not operate

Any, or all, of output relays 4 to 6 can be selected to operate, upon the BKR TRIP COUNTER condition.

Figure 7-9: BKR Trip Counter logic diagram



Reset counters

This command clears the Trip Counters.

PATH: **MAINTENANCE > M3 RESET COUNTERS > RESET BKR TRIP COUNT**

RST BKR TRIP COUNT

Range: No, Yes

Default: No

Entering a "Yes" command will clear the Trip Counters, and an event - "Reset Trip Counter" - will be recorded

M4 Breaker monitor

The status of the breaker trip and close coils, as well as the trip and close circuits, can be monitored under **MAINTENANCE > M4 BKR MONITOR**. In the case where a breaker coil or circuit fails, the relay will display the message "Unhealthy" for the corresponding coil.

Further information on the breaker is provided under **BKR TRIP COUNTER**, which displays the number of trips. The counter can be reset under **M3 RESET COUNTERS > RST BKR TRIP COUNT** set to "Yes".

PATH: **MAINTENANCE > M4 BKR MONITOR**

RELAY1 COIL
Healthy

Range: Healthy, Unhealthy

RELAY2 COIL
Healthy

Range: Healthy, Unhealthy

BKR TRIP COUNTER
5

Range: 0 to 50000 trips

M5 Relay maintenance

Ambient temperature

The SR3 has a temperature monitor feature that measures the ambient temperature around the chassis of the relay. The relay extrapolates the ambient temperature from an internal temperature sensor inside the product. This feature can be used to signal the customer that the product is being subjected to temperatures that can degrade the product life and proper action should be initiated. For example the air conditioning, heating or ventilation system should be checked.

The purpose of the feature is to measure the immediate temperature around the product. There are several factors that can alter the measurement that need to be considered for the application of this feature.

- Any forced air flow or obstructions that can interrupt even distribution of the ambient temperature.
- Installation of the relay should be for normal operation (CT, VT, inputs, outputs).

PATH: **MAINTENANCE > M5 RELAY MAINTENANCE > AMBIENT TEMP**

AMBIENT TEMPERATURE

Range: Disabled, Alarm, Latched Alarm

Default: Disabled

This setting enables the ambient temperature functionality. If the operating condition is satisfied when **Alarm** is selected as the function, the “ALARM” LED will flash upon the activating condition, and will automatically reset when the condition clears. If **Latched Alarm** is selected, the LED “ALARM” will flash upon the activating condition, and will stay “ON” after the condition clears, until a reset command is initiated. Any assignable output relays can be selected to operate when this function is enabled.

HI ALARM LEVEL

Range: 20°C to 80°C in steps of 1°C

Default: 60°C

This setting specifies the temperature level monitored by the Ambient Temperature Alarm high logic. The alarm will occur when the temperature remains above this level.

LOW ALARM LEVEL

Range: -40°C to 20°C in steps of 1°C

Default: 10°C

This setting specifies the temperature level monitored by the Ambient Temperature Alarm low logic. The alarm will occur when the temperature remains below this level.

HYSTERESIS LEVEL

Range: 2°C to 10°C in steps of 1°C

Default: 2°C

This setting allows the user to select the dropout level for the feature.

TIME DELAY

Range: 1 to 60 min in steps of 1 min

Default: 1 sec

This timer starts when either the high or low level thresholds have exceeded their respective levels.

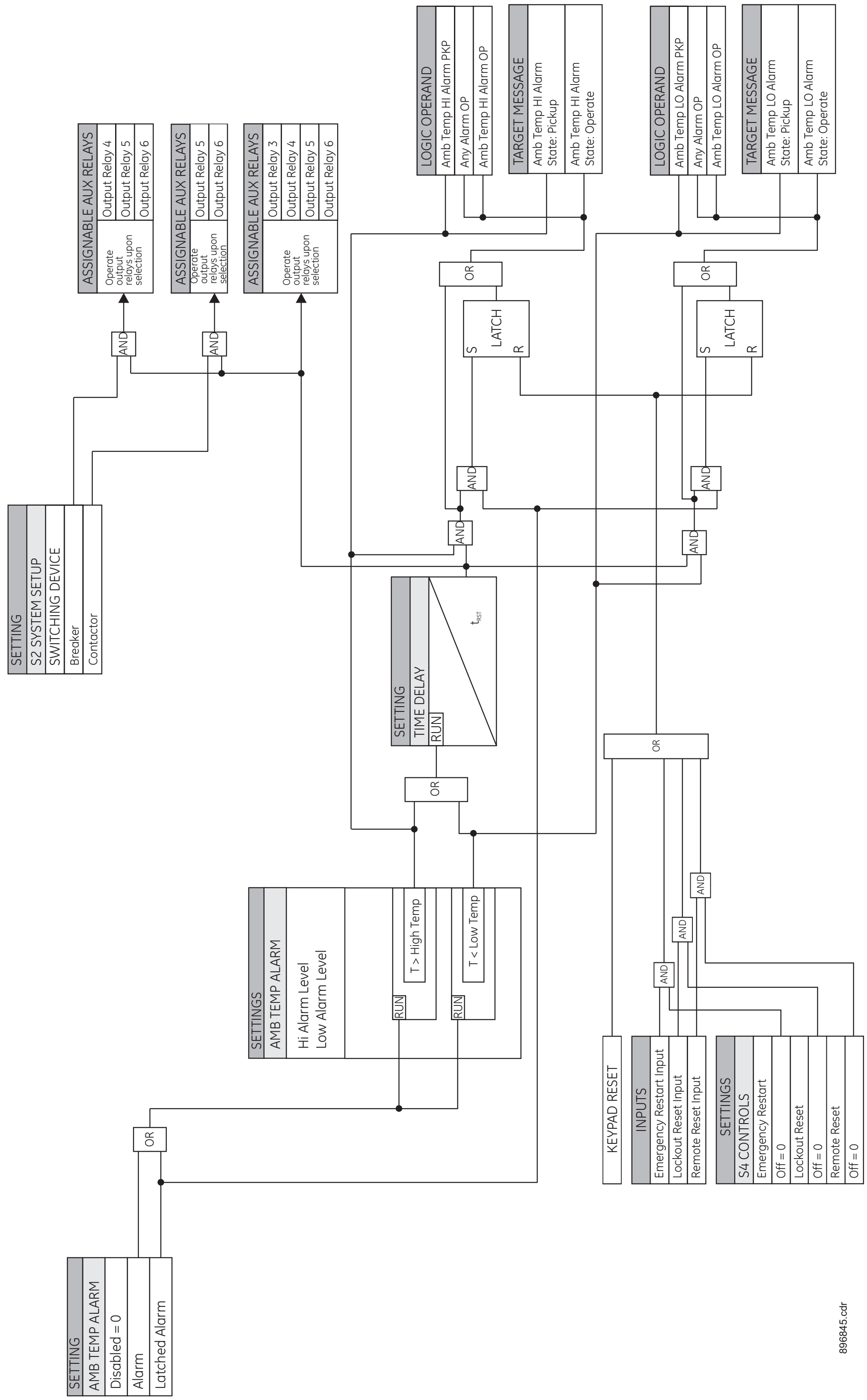
OUTPUT RELAY 4 to 6 / OUTPUT RELAY 5 to 6

Range: Do Not Operate, Operate

Default: Do Not Operate

Any assignable output relay can be selected to operate upon Ambient Temperature Alarm operation. When the SWITCHING DEVICE is selected as BREAKER, the assignable output relays will be Output Relay 4 to 6. When the SWITCHING DEVICE is selected as CONTACTOR, the assignable output relays will be Output Relay 5 to 6.

Figure 7-10: Ambient Temperature Alarm logic diagram



M6 Factory service

This feature is reserved for use by GE Multilin personnel for testing and calibration purposes.

Digital Energy

339 Motor Protection System

Appendix

Warranty

For products shipped as of 1 October 2013, GE Digital Energy warrants most of its GE manufactured products for 10 years. For warranty details including any limitations and disclaimers, see the GE Digital Energy Terms and Conditions at https://www.gedigitalenergy.com/multilin/warranty.htm

For products shipped before 1 October 2013, the standard 24-month warranty applies.

Change notes

Manual Revision history

Table 1: Revision History

MANUAL P/N	RELEASE DATE
1601-9103-A1	12 February 2010
1601-9103-A2	16 February 2010
1601-9103-A3	6 December 2010
1601-9103-A6	9 December 2011
1601-9103-A7	29 February 2012
1601-9103-A8	18 September 2012
1601-9103-A9	13 June 2013
1601-9103-AA	10 July 2013
1601-9103-AB	26 August 2014
1601-9103-AC	26 February 2015

Table 2: Major Updates for 339-AC

Page Number	CHANGES
	Manual revision number to AC
Chapter 6	Added desription to specify which curve the relay uses in the Thermal O/L Curve setting
General	Minor Corrections

Table 3: Major Updates for 339-AB

Page Number	CHANGES
	Manual revision number to AB and 339 revision number to 1.5x
Chapter 1	Added note to specifications
Chapter 3	Updated hardware and software requirements.
Chapter 3	Replaced image for Transient Recorder Viewer window with updated image.
General	Minor Corrections

Table 4: Major Updates for 339-AA

Page Number	CHANGES
	Manual revision number to AA
Chapter 2	Update RTD wiring and Motor protection system figures
Chapter 6	Update Main communications menu figure
Chapter 6	Clarify SR3 IEC 61850 GOOSE details
General	Minor Corrections

Table 5: Major Updates for 339-A9

Page Number	CHANGES
	Manual revision number to A9
Chapter 1	Update Type Tests table
General	Minor Corrections

Table 6: Major Updates for 339-A8

Page Number	CHANGES
	Manual revision number to A8
Chapter 1	Add Case design option N (relay with non-drawout design)
Chapter 2	Add dimensions, mounting and wiring for non-drawout unit
General	Minor Corrections

Table 7: Major Updates for 339-A7

Page Number	CHANGES
	Manual revision number to A7
Chapter 2	Change Control Power parameters

Table 8: Major Updates for 339-A6

Page Number	CHANGES
	Manual revision number to A6
General	Add support for Input/Output option "R"
General	Add support for additional safety/protection elements

Table 9: Major Updates for 339-A4 and A5

Page Number	CHANGES
	Incremental changes and revisions

Table 10: Major Updates for 339-A3

Page Number	CHANGES
	Manual revision number from A2 to A3
Chapter 1	Add Comm Option 3E to Order Code Table
Chapter 7	Add Ambient Temp section (Ch 7 - Maintenance)
General	Increase number of Logic Elements to 16
General	Minor Corrections

Table 11: Major Updates for 339-A2

Page Number	CHANGES
	Manual revision number from A1 to A2
General	Minor Corrections