

**INSTALLATION INSTRUCTIONS FOR SYMCOM'S
MODEL 777-HVR-SP ELECTRONIC OVERLOAD RELAY**

**BE SURE POWER IS DISCONNECTED PRIOR TO INSTALLATION!!
FOLLOW NATIONAL, STATE AND LOCAL CODES!
READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION.**

CONNECTIONS

1. Using the four corner tabs OR the DIN rail mounting bracket, mount the Model 777-HVR-SP directly above or below the magnetic contactor. To use the DIN rail bracket, hook the top clip first, then apply downward pressure until the lower clip "clicks" onto the rail, then stop applying downward pressure.
2. Insert the motor conductors through the round holes marked "A" and "B." Terminate the conductors at the line or load side of the magnetic contactor. **Note: For motors with full load amps less than 25 Amps,** loop the conductors through the holes marked "A" and "B" according to Table No. 1 below. The rectangular holes behind the holes marked "A" and "B" are provided for wire looping. (see Figure No. 1).
3. **For motors with full load current above 90 A,** an external Current Transformer must be used (see Figure No. 2). SymCom recommends that the external CT have terminals for installation convenience. When using an external CT, five passes must be made through the holes in the Model 777-HVR-SP.

Table No.1: Wiring Configuration Based on Motor Amps

Full Load Amps	# of Loops (Required on B Phase only)	# of Conductors through B	MULT to Program (CT ratio)
2 - 2.5	9	10	10
2.5 - 3	8	9	9
3 - 3.5	7	8	8
3.5 - 4	6	7	7
4 - 5	5	6	6
5 - 6	4	5	5
6 - 8	3	4	4
8 - 12	2	3	3
12 - 25	1	2	2
25 - 90	0	1	1
↓ EXTERNAL CTs REQUIRED. SEE WIRING DIAGRAM FOR EXTERNAL CTs. ↓			
80 - 110	4	5	100 (100:5)
110 - 160	4	5	150 (150:5)
160 - 220	4	5	200 (200:5)
220 - 320	4	5	300 (300:5)
320 - 420	4	5	400 (400:5)
400 - 520	4	5	500 (500:5)
480 - 620	4	5	600 (600:5)
600 - 800	4	5	800 (800:5)

4. Connect the single-phase power from the line side of the contactor to "L1" and "L2." First insert a #12 - #18 AWG wire into the top of the terminal marked "L1" and tighten the screw on the front of the overload relay. Then, connect the other end of the wire to the line side of the contactor. Repeat these two steps for "L2." (see Figure No. 1).

II-777-HVR-SP-B



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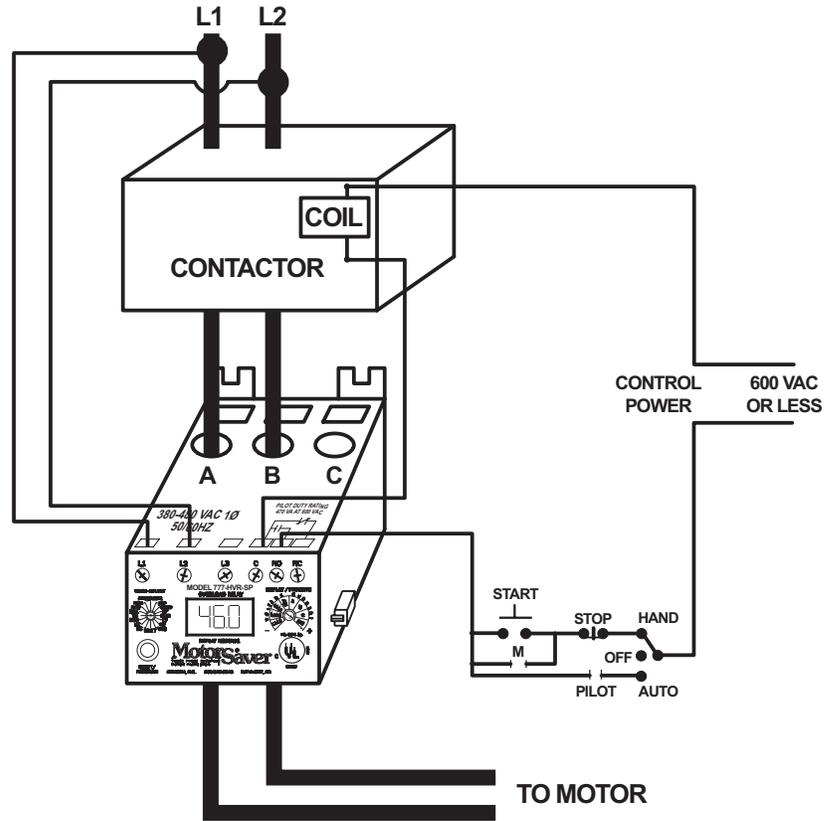


Figure No. 1: Typical Wiring Diagram

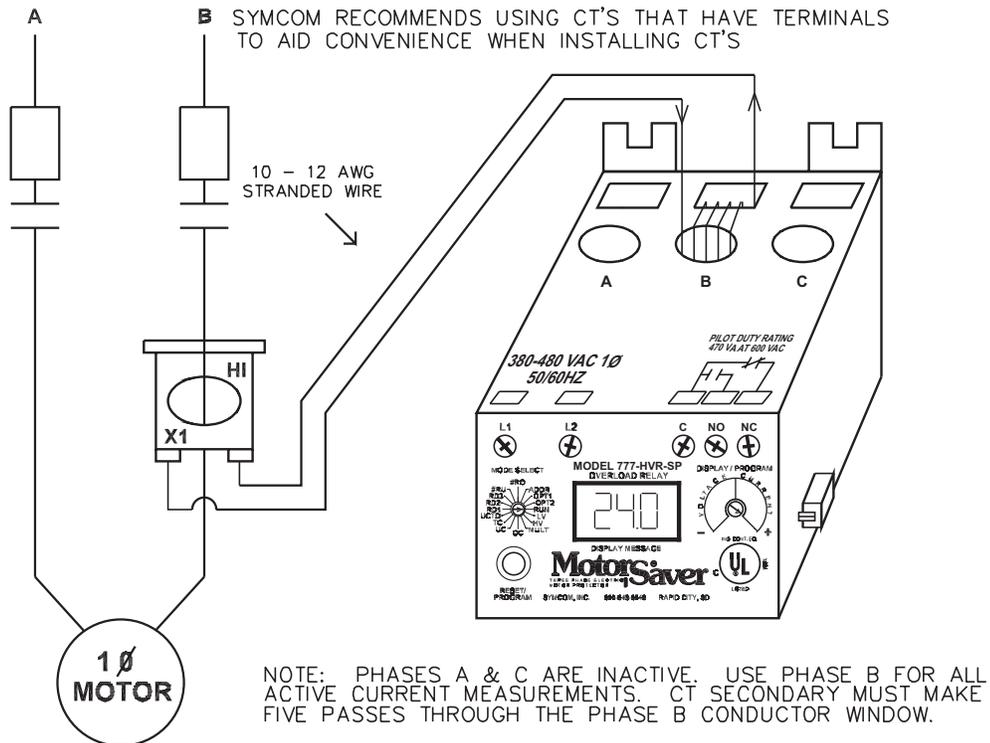
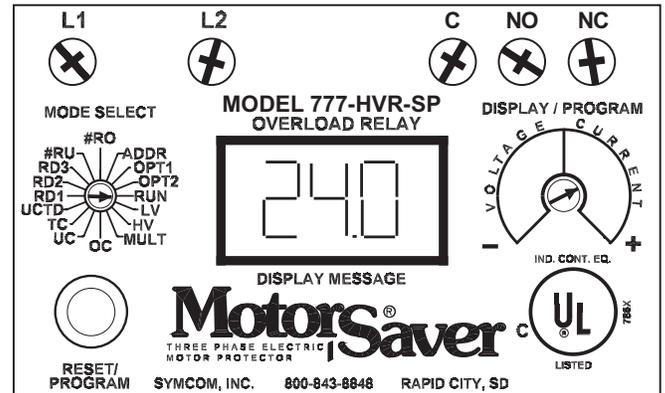


Figure No. 2: Typical wiring diagram when CT is used.

- Connect the output relay to the circuitry to be controlled (see Figure No. 1). To control a motor, connect the normally open contact in series with the magnetic coil of the motor starter as shown. To sound an alarm, connect the normally closed contact in series with the alarm (not shown).

PROGRAMMING

- Select the feature to program by rotating the "MODE SELECT" switch to the desired position. The "MULT" setting must be programmed before any of the current settings to ensure proper display of actual current setpoints. Therefore, SymCom recommends programming the "LV" setting first, then move clockwise through the positions to complete the process.
- Push and hold the "RESET / PROGRAM" button.
- Rotate the "DISPLAY / PROGRAM" adjustment to the desired setting of the feature as shown in the LED display.
- Release the "RESET/PROGRAM" button. The Model 777-HVR-SP is programmed when the button is released.
- Continue steps 1-4 until all features are programmed.



SUGGESTED SETTINGS (Consult the Motor Manufacturer for their recommendations.)
 [Don't forget to read the programming examples on page 5.]

LV/HV- The recommended settings for "LV" (low voltage) and "HV" (high voltage) depend on many factors such as motor usage, motor size, environmental factors and tolerance of the motor. The motor manufacturer should be consulted for "HV" and "LV" settings. However, the NEMA MG1 standard recommends that "LV" and "HV" be set to no more than $\pm 10\%$ of the motor's nameplate voltage. The setting can be determined by multiplying the motor's nameplate voltage by the recommended percent over and under voltage. (eg., The motor nameplate voltage is 460 V, set "LV" to $0.9 \times 460 = 414$, set "HV" to $1.1 \times 460 = 506$) "LV" can not be set higher than "HV", so "HV" may have to be adjusted higher before the proper "LV" setting can be programmed.

MULT- "MULT" is the multiplication factor for determining true current settings and represents the number of conductors passing through the main current windows marked "A" and "B," or current transformer ratio of external CTs. The appropriate number can be determined from Table No. 1 on page 1. "MULT" must be correctly programmed in order to accurately program the current settings.

OC- **Represents the motor's maximum service factor amperage.** The "OC" (overcurrent) setting depends on many factors such as motor usage, motor size, environmental factors and tolerance of the motor. The motor manufacturer should be consulted for "OC" settings. However, "OC" is typically between 110% and 125% of full load amperage (FLA).

UC- The "UC" (under current) setting is typically set to 80% of full load amperage (FLA). The overload relay with a "UC" setting of 80% of FLA will typically detect a loss of load for many pumps and motors such as a dry well condition for submersible pumps. The "UC" setting may be set to 0.00 to disable under current (loss of load) protection.

TC- "TC" designates the trip class for overload protection. The trip class defines the trip delay when an overload is detected (see Table No. 2). Trip class is determined by the type of motor and application. Your motor manufacturer should be consulted for the proper setting. The following table shows the trip class and a general description of the applications.

RD1- "RD1" is the rapid cycle timer. It will engage when the motor is first powered-up or after the motor controls shut down the motor. An "RD1" setting of 20-30 seconds will generally protect the motor from rapid, successive power outages or short cycling caused by the motor controls. A setting of 0 seconds will allow the motor to start immediately after power-up or after a normal shutdown.

Trip Class	Application Description
5	Small fractional horsepower motors where acceleration times are almost instantaneous or where extremely quick trip times are required.
10	(Fast Trip) Hermetic refrigerant motors, compressors, submersible pumps and general purpose motors that reach rated speed in less than 4 seconds.
15	Certain specialized applications.
20	(Standard Trip) Most NEMA-rated general purpose motors will be protected by this setting.
30	(Slow Trip) Motors with long acceleration times (>10 seconds) or high inertia loads.
J Prefix	Programming any of the trip classes with the J Prefix will enable jam protection. This additional protection is enabled 1 minute after the motor starts and will enable a 2-second trip time for motors exceeding 400% of OC setting, regardless of trip class.
LIn	Programming the trip class to LIn disables the normal trip classes shown above and enables a linear trip delay on overcurrent. The linear trip delay is set in program position OPT1.

Table No. 2: Trip Class Descriptions

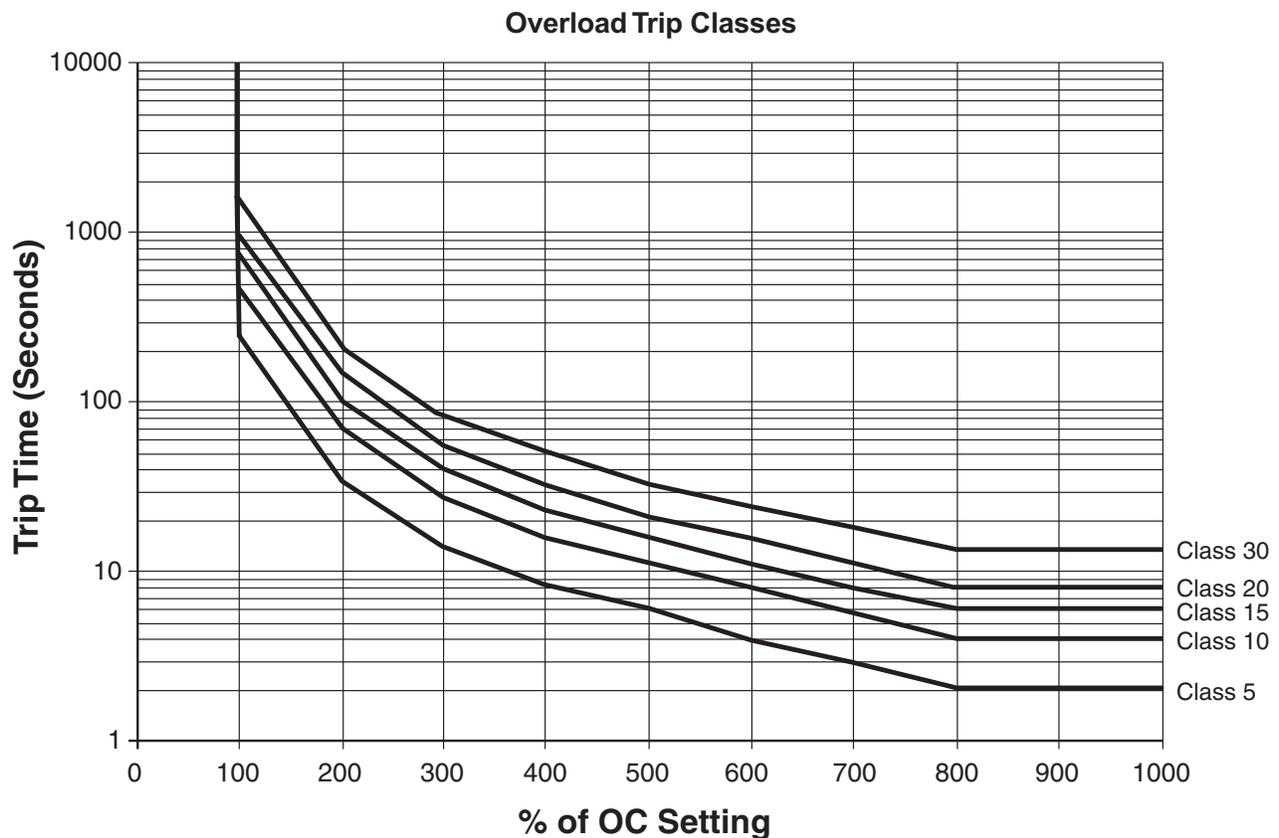


FIGURE #3: Overload Trip Classes

- RD2-** "RD2" is the restart delay after the overload relay trips on overload. This delay allows the motor to cool down after experiencing an overcurrent. It is also known as a motor cool down timer. Your motor manufacturer should be contacted to determine this setting. Under normal circumstances, a setting of 5-10 minutes will give the motor enough time to cool down between faults.
- RD3-** "RD3" is the restart delay after an undercurrent. It is also known as a dry well recovery timer and is usually used in submersible pumping applications. The setting of "RD3" depends on the recovery time of the water well and varies widely from application to application.
- #RU-** "#RU" is the number of successive restart attempts allowed after an undercurrent fault before the overload relay requires manual reset. A setting of "0" is manual reset and a setting of "A" is continuously automatic reset.
- ADDR-** "ADDR" is the address setting for RS485 communications. Available settings are from A01 - A99. You may ignore this setting if RS485 communications are not used.
- #RO-** "#RO" is the number of successive restart attempts allowed after an overcurrent fault. The following settings are available: 0, 1, 2, 3, 4 and A. A setting of "0" is manual reset and a setting of "A" is continuously automatic.
- UCTD-** "UCTD" is the undercurrent trip delay timer. This setting represents the maximum time that the Model 777-HVR-SP will tolerate an under current condition. Typically, UCTD is set to 2 - 4 seconds.
- OPT1-** Linear overcurrent trip delay (2-60 seconds). This programming position is used only if the TC position is set to LIn. This setting will determine the period of time that will expire before tripping on overcurrent, after the amperage exceeds the OC setting. (See Programming Example #2).
- OPT2-** RD2 & RD3 time units programming. This position sets the time units used by the RD2 and RD3 timers. (e.g., RD2 = 10, RD3 = 20, OPT2 = 2 from the table below; RD2 = 10 seconds and RD3 = 20 minutes.

SETTING	RD2	RD3
0	Minutes	Minutes
1	Minutes	Seconds
2	Seconds	Minutes
3	Seconds	Seconds

PROGRAMMING EXAMPLES

- #1** Motor To Be Protected: 1Ø, 460 Volt, 20 Hp raw material transfer auger. This auger moves material from a large bulk delivery pit to the production area main storage hopper. The motor has a full load amperage rating of 50 Amps and a maximum service factor of 57 Amps. Use the following calculations and reasoning to determine the appropriate settings for this application.

LV- $460 \times 0.90 = 414$

HV- $460 \times 1.10 = 506$

MULT - From Table No. 1; MULT = 1

OC- 57

- UC- Since the motor current will unload at least 20% if a shaft shear pin breaks or the auger runs out of material, $UC = 50A \times 0.80 = 40$
- TC- Because the motor is a general purpose motor and the motor should be protected from being jammed by a foreign object, $TC = J20$
- UCTD- 5-10 seconds
- RD1- To protect the motor from rapid successive power outages, $RD1 = 20$
- RD2- N/A, see #RO setting.
- RD3- N/A, see #RU setting.
- #RU- Setting #RU to 0 will require a manual reset after undercurrent. Therefore, RD3 has no affect in this application. This setting will allow the auger to be started, and left unattended, and will run until the delivery pit is empty. Pressing a remote reset button will start the auger for the next load.
- #RO- Setting #RO to 0 will require a manual reset after an overcurrent. Therefore, RD2 has no affect.
- ADDR- N/A.
- OPT1- N/A.
- OPT2- N/A.



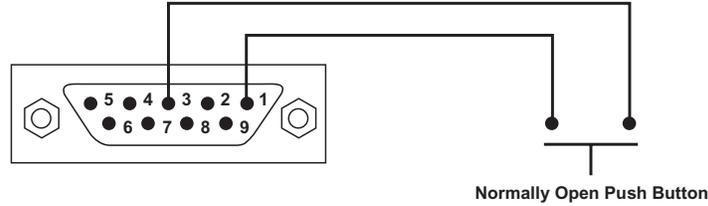
#2 - Application: A 3Ø, 460 Volt, 50 Hp motor with 65 FLA and 75 SFA is used to shred plastic for recycling. The shredder is fed by a conveyor. This example shows how the Model 777-HVR-SP is used to control the conveyor to prevent the 50 Hp shredder motor from being overloaded by excess material being fed by the conveyor.

- LV- $0.90 \times 460 = 414$
- HV- $1.10 \times 460 = 506$
- MULT - From Table No. 1, $MULT = 1$
- OC- 70 Amps, keeps motor from reaching service factor Amps during normal operation.
- UC- The conveyor should be stopped only on severe undercurrent conditions; i.e., broken shear pin on shredder. $UC = 65 \times 0.50 = 32$
- TC- Because the shredder can become quickly overloaded by excessive material feed, $TC = LIn$.
- UCTD- 5-10
- RD1- Rapid cycling is not a concern in this application, $RD1 = 0$.
- RD2- The motor will quickly regain its speed after the conveyor stops feeding material, $RD2 = 5$. This will allow the conveyor to start feeding material 5 seconds after tripping on overcurrent.
- RD3- N/A, see #RU.
- #RU- Because an undercurrent would indicate a serious problem, $\#RU = 0$.
- #RO- This sytem will potentially overload many times, $\#RO = A$.
- ADDR- N/A.
- OPT1- Linear overcurrent trip delay = 2 seconds. This will stop the conveyor 2 seconds after it starts to overload and exceeds 70 amps.
- OPT2- RD2 must be in seconds. Therefore, a setting of 2 in OPT2 should be used in this application.

COMMUNICATIONS PORT / REMOTE RESET

The Model 777-HVR-SP comes standard with a 9-pin Sub D connector for remote communications. The Model 777-HVR-SP supports RS-485 communication standard. This standard allows up to 99 Model 777-HVR-SPs to be controlled and monitored from a single remote personal computer. NOTE: An RS-485 module and software is required to operate the communications bus. (Refer to RS-485 Installation Instructions for more information on this subject.)

The communications port also provides connections for remote reset as shown below.



MULTI-FUNCTION SYSTEM DISPLAY

The output display can show various system operating parameters: L1-L2 Voltage, L2 Current (B).

When the "MODE SELECT" switch is in the "RUN" position, the LED will display one of the above operating parameters. To select or change the displayed parameter, turn the "DISPLAY / PROGRAM" adjustment to the desired position as shown on its label.

The multifunction display also announces system faults such as low voltage and high voltage. Any time the "MODE SELECT" switch is in the "RUN" position, the "RESET/PROGRAM" button may be pushed to view the last fault which occurred. The table below shows the possible messages.

Displayed Message	Meaning
oc	Tripped on Overcurrent
uc	Tripped on Undercurrent
H I	Tripped on High Voltage
Lo	Tripped on Low Voltage
oFF	A stop command was issued from a remote source.

TROUBLESHOOTING

PROBLEM	SOLUTION
The unit will not start. Display alternates "HI" or "Lo" with the "DISPLAY / PROGRAM" switch parameter value.	The incoming voltage is not within the limits programmed in the "HV" and "LV" settings. Adjust the "DISPLAY / PROGRAM" switch to read the incoming line voltage value. Correct the incoming power problem and check programmed limits to verify they are correct.
Display alternates "oc" with "RUN."	The overload relay has tripped on overcurrent and is timing down "RD2" before restarting.
Display alternates "uc" with "RUN."	The overload relay has tripped on undercurrent and is timing down "RD3" before restarting. If undercurrent is not a normal condition for this installation, check for broken shafts, broken belts, etc.
Display is showing a solid "oc."	The unit has tripped on overcurrent and manual reset is required because of the programmed setting in "#RO." Check the system for problems that would produce the overload fault like a jam.
Display is showing a solid "uc."	The unit has tripped on undercurrent and a manual reset is required because of the programmed setting in "#RU." Check the system for problems that would produce an underload condition like a broken belt or shear pin.

If you need further assistance, call us at 1-800-843-8848 . . . we'd be happy to help!!!!

OPERATION

Once the overload relay has been programmed, turn the "MODE SELECT" switch to the "RUN" position.

The LED display will flash "RUN" alternatively with a number representing the parameter indicated by the "DISPLAY / PROGRAM" adjustment. After the period of time programmed into RD1, the output contacts will close and the value of the parameter indicated by the "DISPLAY / PROGRAM" adjustment will appear on the LED display.

If a message other than those indicated above is shown on the LED display, see the TROUBLESHOOTING section on page 7 to diagnose the problem.

SPECIFICATIONS	OVERLOAD RELAY
Electrical	
Input Voltage	380 - 480 VAC, 1Ø
Frequency	50-60 Hz
Motor Full Load Amp Range - 77C	2-25 Amps, 3Ø(Loops Required) 26-90 Amps, 3Ø(Direct) 91-800 Amps, 3Ø(External CTs)
Motor Full Load Amp Range - 77LR	1.0 Amps - 2.5 Amps (Loops Required) 2.0 Amps - 9.0 Amps (Direct)
Short Circuit	10kA
Power Consumption	10W (Maximum)
Output Contact Rating SPDT (Form C)	Pilot duty rating: 470 VA @ 600 VAC
Mechanical	
Expected Life	
Mechanical	1 x 10 ⁸ operations
Electrical	1 x 10 ⁸ operations at rated load
Accuracy at 25° C (77° F)	
Voltage	±1%
Current	±3% (Direct, No External CTs)
Timing	5% ± 1 second
Repeatability	
Voltage	± 0.5% of nominal voltage
Current	± 1% (Direct, No External CTs)
Safety Marks	
UL	UL508
CE	IEC 60947-1, IEC 60947-5-1
Standards Passed	
Electrostatic Discharge (ESD)	IEC 1000-4-2, Level 3, 6kV contact, 8kV air
Radio Frequency Immunity (RFI)	IEC 1000-4-6 Level 3, 10V/m
Fast Transient Burst	IEC 1000-4-4 Level 3, 3.5kV input power, 1kV control bus
Surge	
IEC	1000-4-5 Level 2, 2kV line-to-line, 4kV line-to-ground
ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Vibration	IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis
Shock	IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse
Mechanical	
Dimensions	3.0"H x 5.1" D x 3.6"W
Terminal Torque	7 inch*lb
Enclosure Material	polycarbonate
Weight	1.2 lbs
Maximum Conductor Size Through 777	0.65" with insulation
Environmental	
Temperature Range	Ambient Operating: -20° - 70° C (-40° - 158°F) Ambient Storage: -40° - 80° C (-40° - 176°F)
Pollution Degree	3
Class of Protection	IP20, NEMA 1
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Programmable Operating Points	
Range	
LV- Low Voltage Threshold	340V - HV Setting
HV- High Voltage Threshold	LV Setting - 528V
MULT- # of Loops or CT Ratio (XXX:5)	77C, 1-10 Loops or 100-800 Ratio 77C-LR 1 or 2
OC- Over Current Threshold	(20-100A) ÷ MULT or 80-120% of CT Primary
UC- Under Current Threshold	(0, 10-98A) ÷ MULT or 40-100% of CT Primary
CUB- Current Unbalance Threshold	2 - 25% or 999%
TC- Over Current Trip Class *	5, J5, 10, J10, 15, J15, 20, J20, 30, J30, or lin (linear)
RD1- Rapid Cycle Timer	0, 2 - 500 Seconds
RD2- Restart Delay After All Faults Except Under Current (motor cool down timer)**	2 - 500 Minutes/Seconds
RD3- Restart Delay After Under Current (dry well recovery timer)	2 - 500 Minutes/Seconds
#RU- Number of Restarts After Under Current	0, 1, 2, 3, 4, A(Automatic)
ADDR- RS485 Address	A01- A99
#RO-Number of Restarts After Over Current ***	0, 1, 2, 3, 4, A(Automatic)
UCTD- Under Current Trip Delay	2 - 60 Seconds

NOTES: SymCom's Overload Relay can be preprogrammed prior to installation by applying 120 VAC between the L1 and L2 terminals.

* If J Prefix is displayed in trip class setting, jam protection is enabled. If programmed to LIn position, overcurrent trip delays are fixed linear time delays set in OPT1 position.

** RD2 & RD3 can be changed from minutes to seconds under program position OPT2.