MotorSaver®
THREE-PHASE ELECTRIC MOTOR PROTECTOR

INSTALLATION INSTRUCTIONS FOR SYMCOM'S MODEL 77C-LR-KW/HP ELECTRONIC OVERLOAD RELAY

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

DANGER!

HAZARDOUS VOLTAGES MAY BE PRESENT DURING INSTALLATION.
Electrical shock can cause death or serious injury.
Installation should be done by qualified personnel following all national, state and local electrical codes.

CONNECTIONS

1. Mount the Model 77C-LR-KW/HP directly above or below the magnetic contactor using the four corner tabs or the DIN rail mounting bracket. To use the DIN rail bracket, hook the top clip first and apply downward pressure until the lower clip snaps onto the rail.

2. Insert the motor contactors through the A and B round windows (see Figure 1). **For motors with full load amps less than 2.1 Amps**, loop the conductors through window B according to Table 1 below. The rectangular window behind B is provided for wire looping.

3. 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 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 Figure1).

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

Full Load Amps	# of Conductors through Window B	MULT
1.0–2.0	2	2
2.1–9.0	1	1

Table 1. Wiring Configuration Based on Motor Amps

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MULTI-FUNCTION SYSTEM DISPLAY

The output display can show various system operating parameters: line voltage, current, kW and hp. The measurement shown is controlled by the DISPLAY/PROGRAM knob.

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 knob to the desired position as shown on the label.

The multi-function 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 that occurred. The following table shows the possible messages.

Displayed Message	Meaning
OC	Tripped on Overcurrent
LPr	Tripped on Low Power
HI	Tripped on High Voltage
Lo	Tripped on Low Voltage
oFF	A stop command was issued from a remote source

Table 2. Multi-Function Display Fault Messages

PROGRAMMING

1. 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 LV first. Then move clockwise through the positions to complete the process.

2. Push and hold the RESET/PROGRAM button.

3. Rotate the DISPLAY/PROGRAM knob to the desired setting of the feature as shown in the display.

4. Release the RESET/PROGRAM button. The Model 77C-LR-KW/HP is programmed when the button is released.

5. Continue steps 1-4 until all features are programmed.

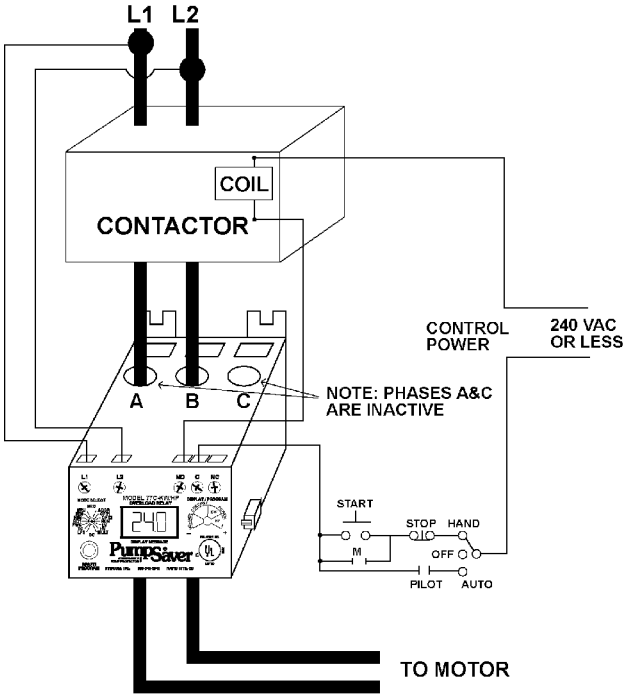
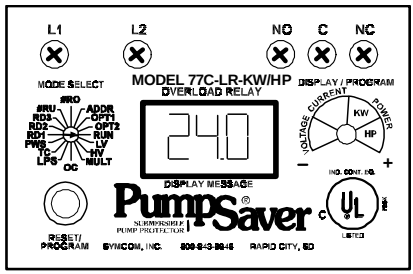


Figure 1. Typical Wiring Diagram

SUGGESTED SETTINGS

Consult the motor manufacturer for recommendations of the following settings. See the programming example on page 7 for further assistance.



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 ±10% of the motor's nameplate voltage. The setting can be determined by multiplying the motor's nameplate voltage by the recommended percent over/undervoltage (e.g. the motor nameplate voltage is 230V, set LV to .9x230=207 and HV to 1.1x230=253).

NOTE: LV cannot 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 window. The appropriate number can be determined from Table 1. MULT must be correctly programmed in order to accurately program the current settings.

OC- 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 the OC setting. However, OC is typically between 110% and 125% of full load amperage (FLA).

LP- LP (low power) is used to shut down the motor or pump on an underload condition. Setting LP to 0 disables the underload trip feature. LP is set in either kilowatts (kW) or horsepower (hp) depending on the PWS setting.

NOTE: PWS must be set before setting LP.

TC- Trip class is defined as the maximum trip delay in seconds when there is a 600% overload. The type of motor and application determines the trip class; the motor manufacturer should be consulted for the proper setting. See Table 5 for trip class descriptions and Figure 2 for overload trip class curves.

PWS- PWS (power scale) is the range setting for the LP setting in either kW or hp.

PWS Setting	LP Range
1	0.01 – 0.99 kW
2	1.00 – 9.95 kW
3	10.0 – 99.5 kW
4	100 – 650 kW
5	0.01 – 1.30 hp
6	1.34 – 13.3 hp
7	13.4 – 133.0 hp
8	134 – 871 hp

Table 3. PWS Settings

RD1- RD1 is the rapid-cycle timer (in seconds). 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.

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. The motor manufacturer should be contacted to determine this setting. Under normal circumstances, a setting of 5–10 minutes should give the motor enough time to cool down between faults.
See OPT2 for setting RD2 to seconds or minutes.

RD3- RD3 is the restart timer, in minutes, used after an underload (LP) trip. It is also known as a dry-well recovery timer in pumping applications. This would be the time it takes a well to recharge after pumping dry. This setting varies widely from application to application; there is no typical setting. RD3 can be set from 2–500 or to A to enable the automatic Dry-Well Recovery Calculator. **See OPT2 for setting RD3 to seconds or minutes.**

The Automatic Dry-Well Recovery Calculator allows the 77C-LR-KW/HP to automatically select a restart delay based on the run time of the last run cycle. Table 2 shows the next restart delay vs. run time. In general a longer run time produces a shorter restart delay. This feature allows the 77C-LR-KW/HP to optimize running and rest times automatically.

Run Time	Next Restart Delay (minutes)	Starts/Hr
> 1Hr	6	10
30 min.– 59.99 min.	15	4
15 min.– 29.99 min.	30	2
< 15 min.	60	1

Table 2. Automatic Dry-Well Recovery Timer

#RU- #RU is the number of successive restart attempts allowed after an underload fault before the overload relay requires manual resetting. A setting of 0 is manual reset and A is automatic reset.

#RO- #RO is the number of successive restart attempts allowed after an overcurrent fault. Available settings are 0, 1, 2, 3, 4, and A. 0 is manual reset and A is automatic reset.

ADDR- ADDR is the address setting for RS-485 communications. Available addresses are A01-A99. Ignore this setting if RS-485 communications are not used.

OPT1- OPT1 is the linear overcurrent trip delay (2–60 seconds). This programming position is used only if the TC 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.

OPT2- OPT2 sets the time units used by the RD2 and RD3 timers. (e.g. if RD2 = 10, RD3 = 20 and OPT2 = 2. From the table below: RD2 = 10 seconds and RD3 = 20 minutes)

OPT2	RD2	RD3
0	Minutes	Minutes
1	Minutes	Seconds
2	Seconds	Minutes
3	Seconds	Seconds

Table 4. OPT2 Settings

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) This setting will protect most NEMA-rated, general-purpose motors.
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 provides a 2-second trip time for motors exceeding 400% OC, 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 at program position OPT1.

Table 5. Trip Class Descriptions

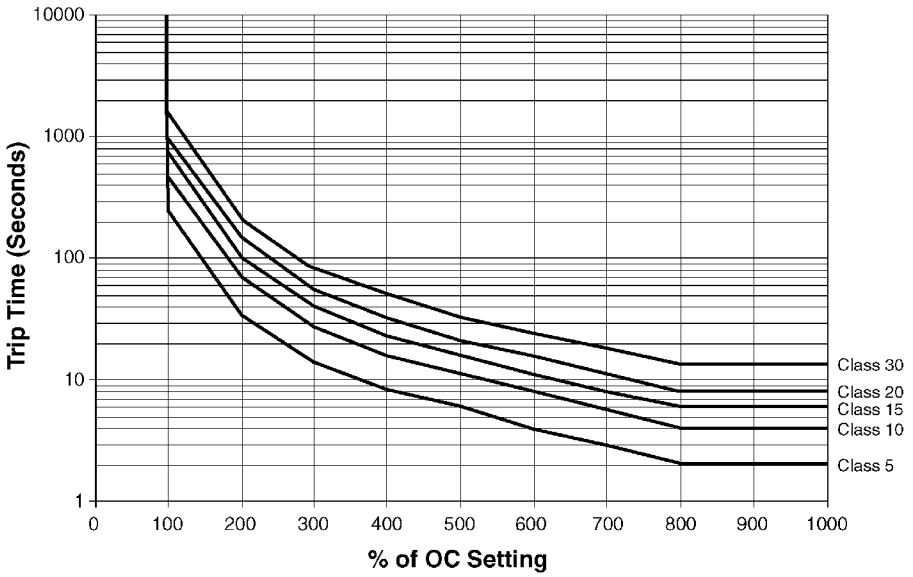


Figure 2. Overload Trip Class Curves

PROGRAMMING EXAMPLE

Motor to be protected: Single-phase, 230V, ½ hp raw material transfer auger. This auger moves material from a delivery pit to the production area main storage hopper. The motor has a full load amperage rating of 5.0 Amps and a maximum service factor of 6.0 Amps. Use the following calculations and reasoning to determine the appropriate settings for this application.

LV-	230 x 0.90 = 207
HV-	230 x 1.10 = 253
MULT-	From Table 1, MULT = 1
OC-	Usually set to service factor amps = 6.0 Amps
LP-	Use rated output power x % load/motor efficiency to calculate approximate underload trip point. LP = 0.5 hp x 0.80/0.85 = 0.47 hp = 0.35 kW
TC-	Because the motor is a general purpose motor and the motor should be protected from being jammed by a foreign object, TC = J20
PWS-	See page 4. For LP in kW, set to 1; for hp, set to 5
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 an underload trip. 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
OTP2-	N/A

COMMUNICATIONS PORT/REMOTE RESET

The Model 77C-LR-KW/HP comes standard with a 9-pin, sub-D connector for remote communications. The Model 77C-LR-KW/HP supports RS-485 communication standard. This standard allows up to 99 Model 77C-LR-KW/HPs to be controlled and monitored from a single remote personal computer.

NOTE: An RS485MS-2W module and software are required to operate the communications bus. Refer to RS485MS-2W installation instructions for more information.

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

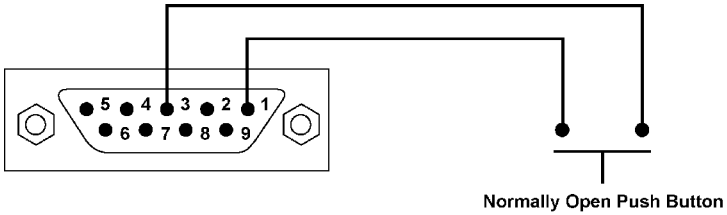


Figure 3. Remote Reset Connections

TROUBLESHOOTING

Problem	Solution
The unit will not start. Display alternates “HI” or “Lo” with the DISPLAY/PROGRAM knob parameter value.	The incoming voltage is not within the limits programmed in the HV and LV settings. Adjust the DISPLAY/PROGRAM knob 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 underload and is timing down RD3 before restarting. If underload 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 a manual reset is required because of the programmed setting in #RO. Check the system for problems that would produce the overload fault, for example, a jam.
Display is showing a solid “uc.”	The unit has tripped on underload 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.
Unable to change setpoint/setpoint bounces back to previous setting.	Unlock tamper guard. See page 10.
Motor starts and stops a short time later but doesn’t have a fault indicator.	Control is wired to NC relay rather than NO relay. (See Figure 1)
Current readings are incorrect.	Check MULT, CT ratio and/or number of wraps through the B current window.

OPERATION

Once the overload relay has been programmed, turn the MODE SELECT switch to the RUN position. The LED display will flash “run” alternating with a number representing the parameter indicated by the DISPLAY/PROGRAM knob. After the period of time programmed into RD1, the output contacts will close and the value of the parameter indicated by the DISPLAY/PROGRAM knob will appear on the LED display. If a message other than this is shown on the LED display, see the TROUBLESHOOTING section to diagnose the problem.

77C-LR-KW/HP SPECIFICATIONS	
Input voltage	100–240VAC (single-phase)
Frequency	50/60Hz
Motor full load amp range	1–9 Amps (single-phase)
Programmable Operating Points	**Range**
LV - Low voltage threshold	85V– HV setting
HV - High voltage threshold	LV setting – 264V
MULT - Number of conductors	1 or 2
OC - Overcurrent threshold	(2.0–10.0A) / MULT
LP - Low power threshold	See PWS below, 0 = OFF
TC - Overcurrent trip class *	5, J5, 10, J10, 15, J15, 20, J20, 30, J30 or LIn
RD1 - Rapid-cycle timer	0, 2–500 seconds
RD2 - Restart delay after all faults except underload (motor cool-down timer) **	2–500 (minutes/seconds)
RD3 - Restart delay after underload (dry-well recovery timer) **	2–500 (minutes/seconds)
#RU - Number of restarts after underload	0, 1, 2, 3, 4, A (automatic)
ADDR - RS-485 address	A01–A99
#RO - Number of restarts after overcurrent	0, 1, 2, 3, 4, A (automatic)
PWS - Power setpoint range	1 = 0.01–0.99 kW 2 = 1.00–9.95 kW 3 = 10.0–99.5 kW 4 = 100–650 kW 5 = 0.01–1.30 hp 6 = 1.34–13.3 hp 7 = 13.4–133 hp 8 = 134–871 hp
OPT1-Linear overcurrent trip delay	2–60 seconds
OPT2-RD2 and RD3 timer units	See description on page 5
Physical Specifications	
Output contact rating (Pilot Duty) SPDT	480VA @ 240VAC
Transient protection (internal)	2500V for 10ms
Accuracy	
Voltage	±1%
Current	±3%
Timing	5% ±1 second
Repeatability	
Voltage	±0.5%
Current	±1% (<10.0 Amps Direct)
Dimensions	3.0” H x 5.1” D x 3.6” W
Power consumption	5 Watts (max.)
Weight	1.2 lbs.
Maximum conductor diameter	.650”

* If J prefix is displayed in the Trip Class setting, jam protection is enabled. If programmed to LIn, overcurrent trip delays are fixed linear time delays set in OPT1.
****** RD2 and RD3 can be set in minutes or seconds in OPT2.

CLEARING LAST FAULT

The last fault stored can be cleared on the PumpSaver®:

1. Rotate MODE SELECT to OPT2.
2. Press and hold the RESET/PROGRAM button.
3. Adjust DISPLAY/PROGRAM until “cLr” appears on the display.
4. Release the RESET/PROGRAM button.

To verify the last fault was cleared, turn MODE SELECT to RUN. Press and hold RESET/PROGRAM; “cLr” should be on the display.

TAMPER GUARD

The PumpSaver can be protected from unauthorized program changes by locking in the setpoints.

1. Rotate MODE SELECT to OPT2
2. Press and hold the RESET/PROGRAM button. Adjust DISPLAY/PROGRAM until ”Loc” appears on the display.
3. Release the RESET/PROGRAM button.
4. Turn MODE SELECT to RUN.

The program is now locked, but all settings can be viewed. The unit can be unlocked by following the procedure above except step three; adjust DISPLAY/PROGRAM until “unL” appears.

NOTES:

1) If a setting jumps back to its previous setpoint when changed, the 77C-LR-KW/HP has its tamper guard locked.
2) The state of the tamper guard cannot be viewed directly.

NOTES

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