INSTALLATION INSTRUCTIONS FOR SYMCOM'S MODEL 777-LR ELECTRONIC OVERLOAD RELAY, 2 - 10 AMPS

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. Using the four corner tabs OR the DIN rail mounting bracket, mount the Model 777-LR 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", "B", and "C." Terminate the conductors at the line or load side of the magnetic contactor. **Note: For motors with full load amps less than 2.0 Amps,** loop the conductors through the holes marked "A", "B", and "C" according to Table No. 1 below. The rectangular holes behind the holes marked "A", "B" and "C" are provided for wire looping (see Figure No. 1).

3. Connect the three-phase power from the line side of the contactor to "L1", "L2" and "L3". First insert a #14 - #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 and L3 (see Figure No. 1).

4. 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).

Full Load Amps	# of Loops	# of Conductors through A, B and C	MULT to Program (CT ratio)
1.0 - 2.5	1	2	2
2.0 - 9.0	0	1	1

TABLE NO. 1: Wiring Configuration Based on Motor Amps

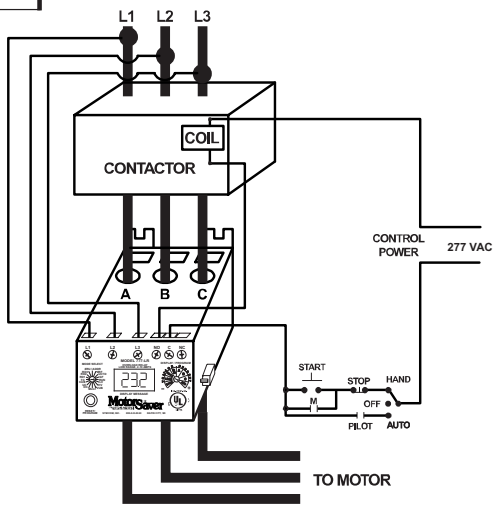


FIGURE NO. 1: Typical Wiring Diagram

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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 the "LV" setting first, then move clockwise through the postions to complete the process.

2. Push and hold the "RESET / PROGRAM" button.

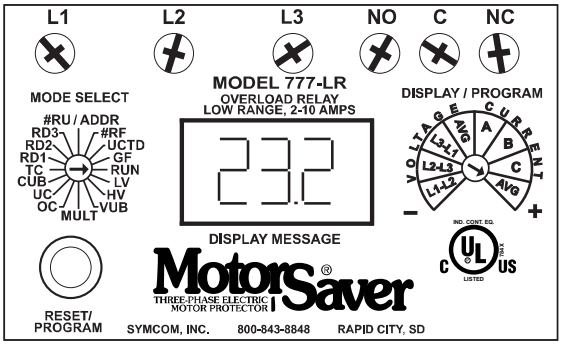


FIGURE NO. 2: Unit Face and Display

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

4. Release the "RESET/PROGRAM" button. The Model 777-LR is programmed when the button is released.

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

NOTE: Some "MODE SELECT" positions are dual function such as the "#RU / ADDR" position. When the "MODE SELECT" switch is pointed at "#RU / ADDR," you may view and program "#RU" and "ADDR." To view the two settings, rotate the "DISPLAY / PROGRAM" adjustment across its entire range. You will see the "#RU" setting when the "DISPLAY / PROGRAM" adjustment is between approximately 7 o'clock and 11 o'clock. You will see the "ADDR" setting when the "DISPLAY / PROGRAM" adjustment is between approximately 11 o'clock and 5 o'clock.

To program "#RU" or "ADDR,# follow the programming instructions above. The "#RU" setting will only be progrrammed when the "DISPLAY / PROGRAM" adjustment is between approximately 7 o'clock and 11 o'clock. Likewise, the "ADDR" setting will only be programmed when the "DISPLAY / PROGRAM" adjustment is between approximately 11 o'clock and 5 o'clock. "ADDR" settings will be an "A" followed by a number between 1 and 99.

SUGGESTED SETTINGS (Consult the Motor Manufacturer for their recommendations.)

[Be sure to read 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 ±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 230 V, set "LV" to 0.9x230=207, set "HV" to 1.10x230=253) "LV" can not be set higher than "HV", so "HV" may have to be adjusted higher before the proper "LV" setting can be programmed.

VUB- "VUB" is the voltage unbalance trip point. The NEMA MG1 standard does not recommend operating a motor above a 1% voltage unbalance without derating the motor. Voltage unbalance is determined from the following formula:

% Voltage Unbalance = [(Maximum Deviation from the Average) / Average] x 100%

The NEMA MG1 standard also recommends against operating a motor above a 5% voltage unbalance under any circumstances. Therefore, a setting of "5" is a good place to start but SymCom recommends consulting the motor manufacturer for specific tolerances.

Note: A setting of "999" in this position will eliminate voltage unbalance and single phase protection.

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", "B" and "C," 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 manufacturer'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" (undercurrent) 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 undercurrent (loss of load) protection.

CUB- "CUB" is the current unbalance trip point. Most motor manufacturers recommend operating under no more than 5% current unbalance, therefore, a setting of "5" is a good place to start. However, your motor manufacturer should be contacted for exact settings.

Note: A setting of "999" in this position will eliminate current unbalance and single phase 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.

RD2- "RD2" is the restart delay after the overload relay trips on current unbalance, single phasing and overload (if "oc" is programmed in "#RF"). This delay allows the motor to cool down after experiencing the above faults. 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.

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 provides a 2-second trip time for motors exceeding 400% SFA, regardless of trip class.

TABLE NO. 2: Trip Class Descriptions

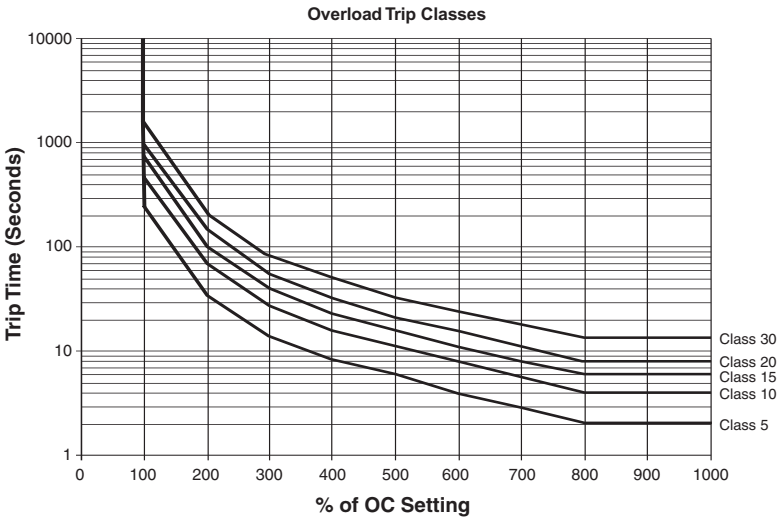


FIGURE NO. 3: Overload Trip Classes

#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. This setting is programmed on the right half of the PROGRAM/DISPLAY adjustment (see programming instruction note for explanation of dual function settings). You may ignore this setting if RS485 communications are not used.

#RF- "#RF" is the number of successive restart attempts allowed after a current unbalance, single phasing or overload fault. The following settings are available: "0", "1", "oc1", "2", "oc2", "3", "oc3", "4", "oc4", "A", and "ocA". A setting which includes "oc" will allow the overload relay to automatically reset after an overload fault (eg., a setting of "oc2" will allow the overload relay to reset 2 times after an overload condition before locking out if an overload condition is detected immediately after each of those two times.) A setting which does not include "oc" requires a manual reset for all overload faults. 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-LR will tolerate an under current condition. Typically, UCTD is set to 2 - 4 seconds.

GF- "GF" is the ground fault protection amperage threshold. This setting detects a leakage current to ground and signals an insulation breakdown in the system. The "GF" setting should be some where between 10% and 20% of the full load motor current. Short circuit protection is provided by separate branch protective devices such as circuit breakers or fuses.

Ground fault protection is a Class II ground fault protector and should not be used for personnel safety, but can be used to indicate motor degradation for maintenance purposes.

PROGRAMMING EXAMPLE

#1 - Motor To Be Protected: 3Ø, 460 Volt, 1/2 Hp submersible pump with a full load amperage of 1.2 A and maximum service factor amps of 1.6.

Use the following calculations and reasoning to determine the appropriate settings for this application.

LV- 460 x 0.90 = 414
HV- 460 x 1.10 = 506
VUB- Manufacturer suggests 5
MULT- From Table No. 1, MULT = 2, 1 loop of main conductor
OC- Service Factor Amperage = 1.6
UC- FLA x 0.80 = 1.2 x 0.80 = .96
CUB- Manufacturer suggests 5
TC- From Figure No. 3, for this (and most) submersible pumps, TC = 10 (fast trip)
RD1- To protect the pump from rapid cycling, RD1 = 60
RD2- Since the motor is small and submerged in water, the motor will generally cool down quickly. RD2=5
RD3- The well history shows that it will fully recover in 2 hours. RD3 = 120
#RU- In this application, we know that the well will eventually recharge itself, #RU = A.
#RF- This well is known for sand to jam the impeller, therefore "oc" should be included so that the pump will attempt to automatically restart after an overloaded condition. History shows that 2 or 3 starts and stops usually clears the sand out of the impeller. #RF = oc2 or oc3.
UCTD- This well may become airlocked on startup, but will usually re-prime itself in 5 seconds or less. UCTD = 10
GF- Because it may take several days to get a new pump and schedule for a driller to remove and replace the pump, GF setting of 10% of full load amperage will give the well owner enough time to prepare for pump replacement. GF = 1.2 x 0.15 = 0.18

MULTI-FUNCTION SYSTEM DISPLAY

The output display can show various system operating parameters:

- Average Voltage
- L1-L2 Voltage
- L2-L3 Voltage
- L3-L1 Voltage
- Average Current
- L1 Current (A)
- L2 Current (B)
- L3 Current (C)

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, high voltage, single phasing, voltage unbalance, current unbalance, and reverse phasing errors. 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.

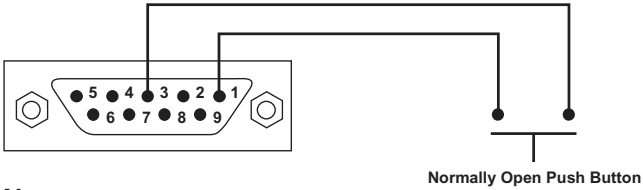
Displayed Message	Meaning
oc	Tripped on Overcurrent
SP	Tripped on Single Phasing
ub	Tripped on Voltage or Current Unbalance
uc	Tripped on Undercurrent
CF	Tripped on Contactor Failure (3ØVoltage Input Only)
GrF	Tripped on Ground Fault
H I	Tripped on High Voltage
Lo	Tripped on Low Voltage
rP	Incoming phases have been reversed. Your motor may run backward if started. (3ØVoltage Input Only)
oFF	A stop command was issued from a remote source.

TABLE NO. 3: Displayed Messages

COMMUNICATIONS PORT / REMOTE RESET

The Model 777-LR comes standard with a 9-pin sub-D connector for remote communications. The Model 777-LR supports RS-485 communication standard. This standard allows up to 99 Model 777-LR's to be controlled and monitored from a single remote personal computer. NOTE: An RS485MS-2W module and software is required to operate the communications bus. (Refer to RS485MS-2W Installation Instructions for more information on this subject.)

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



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 to diagnose the problem.

TROUBLESHOOTING

PROBLEM	SOLUTION
The unit will not start. Display alternates "rP" with the "DISPLAY / PROGRAM" switch parameter value.	The voltage inputs are reverse phased. If this is the initial start up, swap any two of the leads connected to "L1", "L2", or "L3" to correct the problem. If the overload relay has been previously running, the power system has been reverse phased. Check the phase sequence of the incoming power lines. Note: "L1" must be taped from conductor phaseA, "L2" from B, and "L3" from C fr correct power factor measurements on remote communications.
The unit will not start. Display alternates "SP", "uB", "HI", or "Lo" with the "DISPLAY / PROGRAM" switch parameter value.	The incoming voltage is not within the limits programmed in the "VUB", "HV", and "LV" settings. Adjust the "DISPLAY / PROGRAM" switch to read the incoming line voltage values. Correct the incoming power problem and check programmed limits to verify they are correct.
Display alternates "SP", "uB", or "oc" with "RUN."	The overload relay has tripped on the fault shown on the LED display 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 "SP", "uB", or "oc."	The unit has tripped on the fault shown and manual reset is required because of the programmed setting in "#RF". Check the system for problems that would produce the single phase, overload or current unbalance 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 setting in "#RU." Check the system for problems that would produce a loss of load like a broken belt or a pump is out of liquid.
Display is showing a solid "CF."	The unit has tripped on a single phasing of the current, but was not single phased by the incoming power. Check for damaged contacts or loose wiring.
Display is showing a solid "GrF."	A ground fault current greater than the programmed "GF" value has been detected. Check the motor for insulation breakdown.

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

SPECIFICATIONS	777-LR
Input Voltage	200 - 480 VAC, 3Ø (Standard) (500-600 VAC, 3Ø Available)
Frequency	50 - 60 Hz
Motor Full Load Amp Range	1 - 9 Amps, 3Ø
Programmable Operating Points	**Range**
LV - Low Voltage Threshold	170V (450V*) - HV Setting
HV - High Voltage Threshold	LV Setting - 528V (660V*)
VUB - Voltage Unbalance Threshold	2 - 15% or 999%
MULT - # of Loops	1 or 2 Loops
OC - Overcurrent Threshold	(2.0 - 10.0A) / MULT
UC - Undercurrent Threshold	(0, 1.0 - 9.8A) / MULT
CUB - Current Unbalance Threshold	2 - 25% or 999%
TC - Overcurrent Trip Class **	5, J5, 10, J10, 15, J15, 20, J20, 30, J30
RD1 - Rapid Cycle Timer	0, 2 - 500 Seconds
RD2 - Restart Delay After All Faults Except Undercurrent (Motor Cool Down Timer)	2 - 500 Minutes
RD3 - Restart Delay After Under Current (Dry Well Recovery Timer)	2 - 500 Minutes
#RU - Number of Restarts After Undercurrent	0, 1, 2, 3, 4, A (Automatic)
ADDR - RS485 Address	A01 - A99
#RF - Number of Restarts After All Faults Except Undercurrent ***	0, 1, oc1, 2, oc2, 3, oc3, 4, oc4, A, ocA
UCTD - Undercurrent Trip Delay	2 - 60 Seconds
GF - Ground Fault Current Threshold	(0.3 - 2.0A) / MULT or OFF
Physical Specifications	
Output Contact Rating (Pilot Duty) SPDT	480 VA @ 240 VAC
Transient Protection (Internal)	2500 V for 10 mSeconds
Accuracy	
Voltage	±1%
Current	±3% (<10.0 Amps Direct)
Timing	5% ± 1 Second
Repeatability	
Voltage	±0.5%
Current	±1% (<10.0 Amps Direct)
Temperature Range	0 - 70 ℃
Dimensions	3.0" H x 5.1" D x 3.6" W
Power Consumption	5 Watts (Max.)
Weight	1.2 lbs.

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

*575 Volt Model.

**If J Prefix is displayed in trip class setting, jam protection is enabled.

***If "oc" is displayed in the #RF setting, then overcurrent will be included as a normal fault and the relay will automatically restart after RD2 expires, otherwise, manual reset is required after an overcurrent fault.

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Clearing Last Fault

The last fault stored can be cleared on the MotorSaver.
This procedure is outline as follows:

1. Rotate the Mode Select Switch to 'GF'.
2. Press and hold the Reset/Program Button. Adjust the Display/Program adjustment until cLr appears on the display. Release the Reset/Program Button.

To verify the last fault was cleared, place the Mode Select switch in the Run position. Then press and hold the Reset/Program Button, cLr should be on the display.

Tamper Guard

The MotorSaver can be protected from unauthorized program changes by locking in the setpoints.
This procedure is outlines as follows:

1. Rotate the Mode Select switch to 'GF'.
2. Rotate Display/Program adjustment fully clockwise.
3. Press and hold the Reset Button. Adjust the Display/Program adjustment until 'Loc' appears in the display.
4. Release the Reset Button.
5. Turn Mode Select switch 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. This step should say: Press and hold the Reset Button. Adjust the Display/Program adjustment until 'unL' appears in the display.

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SymCom Warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, returns, and cancellations, please refer to the SymCom Terms and Conditions of Sale document.

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