

Troubleshooting the Current Sensing Lock Out

CLO stands for **C**urrent Sensing **L**ock **O**ut. It is also commonly referred to as a **C**ompressor **L**ock **O**ut. A CLO board provides a lockout function in the event of a safety switch trip. Its main function is to prevent the restart of the compressor or unit if the safety devices themselves are not manual reset. The CLO will keep the compressor or the device it is protecting locked out until power is momentarily interrupted to the CLO.

With 24 VAC applied between common terminal 1 & terminal 2, and approximately 2.5 amps applied simultaneously through the current sensor loop, the control relay on the CLO must remain de-energized, applying a voltage through the series string of safety switches to the contactor. When the current sensed by the sensor loop is reduced to 0.5 amps, the control relay will energize within 1 second and open a normally-closed contact between Terminals 2 & 3 opens, removing voltage from the safety switches and the contactor. A normally-open contact between Terminals 2 & X closes, applying the voltage from terminal 2 to terminal X. (voltage at the terminal X is to provide a signal of an alarm condition). Not all applications use the X terminal, but measuring the voltage between common and the X terminal and no voltage from common to terminal 3 proves a lockout condition. This circuit board can also be used to protect devices other than compressors. Some older commercial split systems used one CLO for compressor protection, and a second CLO to monitor the crankcase heater. If the heater does not draw current while the compressor is not running, it prevents possible compressor damage caused by starting with liquid refrigerant in a cold compressor. In this case, the heater does not draw the required 2.5 amps required to prevent a lockout, so the heater wire is looped several times through the current sensor loop, increasing current sensed by the sensor to above the minimum 2.5 amps required to prevent a lockout.

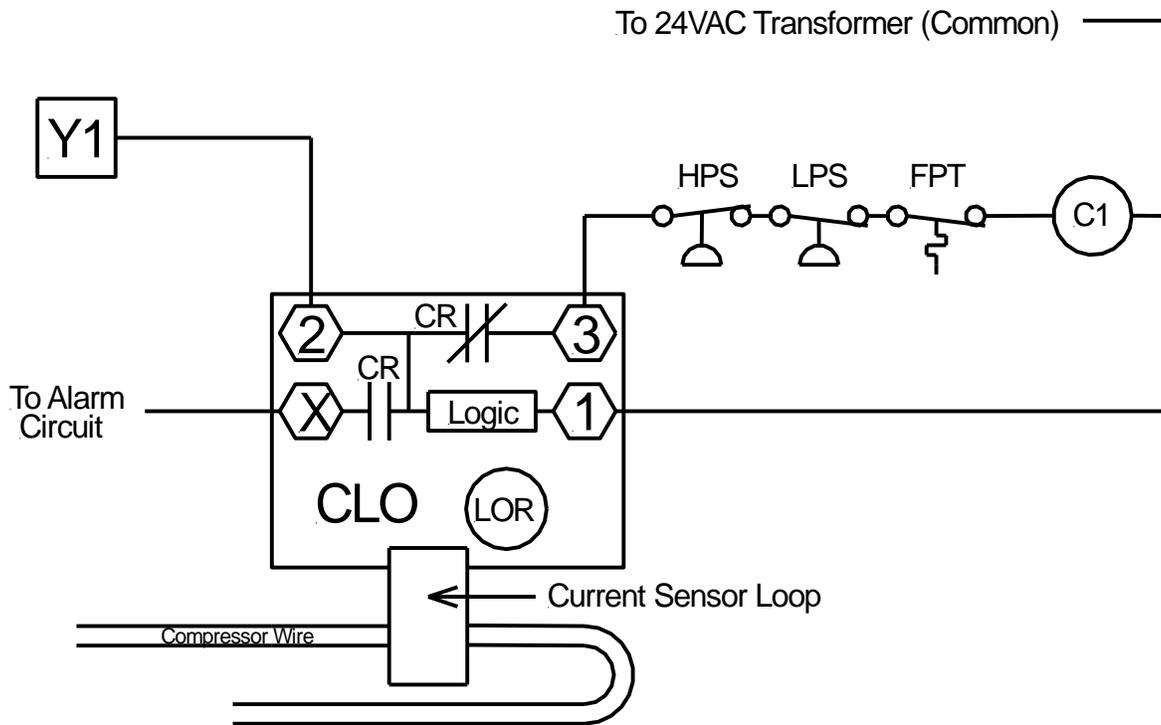
The CLO is very reliable and is usually doing its job when it locks out. It is also easy to troubleshoot. Cycling power to terminal 2 resets the CLO if a safety switch is not open. You now need to troubleshoot the reason for a safety switch opening and causing the CLO to do what is supposed to do, prevent the compressor from running when a system problem may cause compressor damage. If cycling power does not reset the board and voltage is still read at the X terminal, turn the power off to the unit and use an ohmmeter to check continuity from terminal 3 to the contactor. If an open circuit exists, hopscotch through the safeties and wiring to find the problem.

There is also another simple way to test the CLO. Using safe practices working with power on the unit, while measuring voltage from common to terminal 3, manually close the contactor. When the compressor starts, if you now measure control voltage at terminal 3 and no voltage measured at terminal X, the CLO is working correctly. Troubleshoot and find the root cause.

Possibilities include:

1. Low charge or possible low airflow causing the low pressure switch to open.
2. Dirty coil, overcharge, non-condensables, condenser fan not running, or other possible causes of head pressure reaching the trip limit.
3. Oil pressure trip on semi-hermetic compressors using an oil pressure switch. Pressure can drop as the compressor warms up.
4. A worn main compressor bearing is usually the cause of low oil pressure.
5. Most of these things can be very intermittent. If the troubleshooting methods above prove the CLO is working, a thorough checkout should lead you to the root cause.

Below is the typical control circuit to which a CLO is applied:



In the above diagram, if the HPS (High Pressure Switch), LPS (Low Pressure Switch), or FPT (Freeze Protection Thermostat) should open, Compressor Contactor (C1) will be locked out.

Below is a more accurate representation of the CLO printed circuit board.

