

Single Condenser Defrost Time Clock Board

P/N 604-3047

Overview

Copeland Single Condenser Defrost Time Clock Board (P/N 604-3047) is designed to physically replace the defrost clock in refrigeration condensing units. Control of the refrigeration solenoid, defrost heater contactor, and evaporator fans is done through the use of 24VAC Class 2 transformer. Low temperature systems such as a walk-in freezer will use all three relays on the defrost board to control the refrigeration solenoid, defrost heaters, and evaporator fans. Medium temperature systems like walk-in coolers use only one relay on the defrost board, switching the liquid line solenoid. In a typical W-I Cooler, fans are controlled so they can be turned OFF when a door is open.

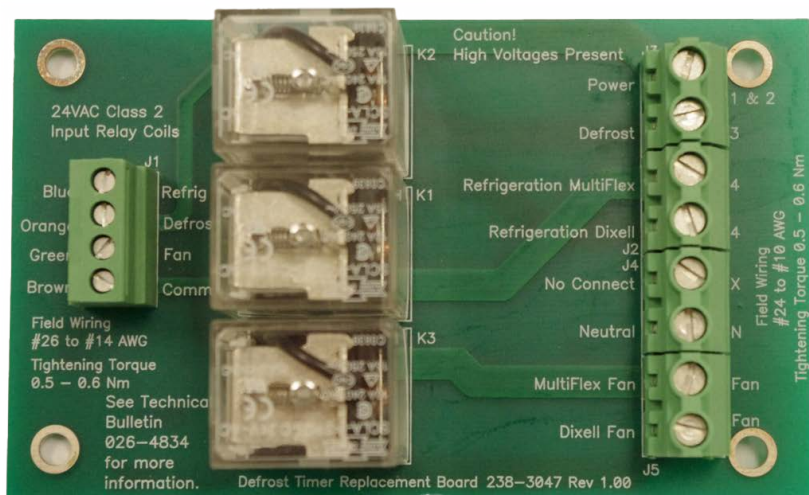


Figure 1 - Defrost Time Clock Board (P/N 604-3047)

Original Time Clock Operation

1. Time Clock enters defrost. Terminal 4 on the clock is deactivated. Terminal 4 shuts off L1 of the fans. Fans are OFF. It also shuts off L1 of the liquid line solenoid. Solenoid is OFF and the system pumps down. L1 is now active to the defrost heaters from Terminal 3 of the time clock, so the heaters are ON.
2. During the defrost cycle, the Fan Klixon opens due to temperature increase. L2 for the fan circuit is now OFF. The defrost heaters remain ON.
3. When the defrost heater Klixon senses enough heat, it closes, sending voltage back to the time clock to Terminal X. This activates an internal plunger that forces the time clock out of defrost and back into refrigeration mode.
4. Terminal 4 is now active again, supplying voltage to L1 of the solenoid and fans. Because the thermostat is closed due to the box temperature being above setpoint, the solenoid opens starting the refrigeration cycle. The fans do not start because the Klixon on L2 is still open. When the Klixon closes, allowing the fans to start. This prevents a blast of hot air from the built-up heat of the defrost heaters.

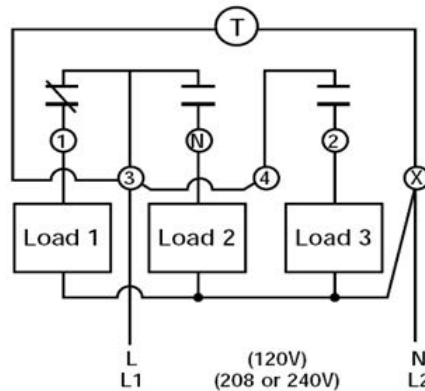


Figure 2 - Time Clock Operation Diagram

Electrical Ratings

Table 1: Electrical Ratings

Type of Operation	Electrical Rating
Refrigeration Solenoid Operation	120/240 V ac 240 VA 30,000 cycles 65°C ambient temperature (NO/NC) contacts
Defrost Heater Operation	120/240 V ac 15 A 30,000 cycles 65°C ambient temperature
Evaporator Fan Operation	120/240 V ac 1/2 HP 30,000 cycles 65°C ambient temperature

Defrost Timer Board Installation

The Defrost Time Clock Board (P/N 604-3047) is installed in the old time clock location. To simplify the installation, the defrost timer board includes snap track.

The snap track should be secured using the appropriate mounting hardware. Then, install the installation paper inside the snap track. The defrost timer board can then be mounted inside the snap track. The defrost timer board is wired to an 8RO board (or the XM, XR controller outputs - labeled "Dixell Fan") as shown in the following wiring diagram:

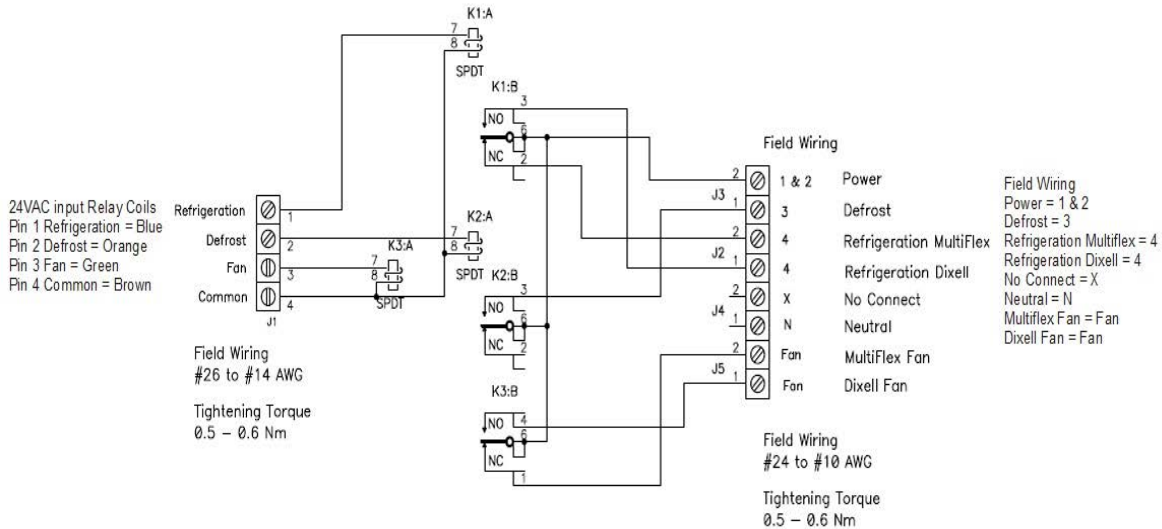


Figure 3 - Wiring Diagram

The Copeland system controls the solenoid, fans, and defrost heat separately. The controller has the ability to adjust the fan delay and defrost duration through programming. Defrost termination is accomplished with the use of an evaporator-mounted temperature sensor. As a result, you must eliminate both coil-mounted Klixon's.

During the retrofit, you may find that you are lacking one wire between the time clock and evaporator to accomplish independent control of the fans and solenoid. Because you no longer need the defrost termination Klixon (wired to Terminal X), you can reuse this wire to separate the fans from the refrigeration solenoid.

1. Power-down the condensing unit. Remove the time clock and install the Defrost Timer Replacement Board as illustrated previously in the figure. Connect the wire from Terminal X of the time clock to Fan on the replacement board.
1. Remove the existing mechanical thermostat. Install a weatherproof junction box in its place and wire the two leads together.
2. In the evaporator, remove the defrost termination Klixon and rewire in accordance with NEC guidelines for wet locations. Install the defrost termination sensor (Copeland Part # 501-1127).
3. At the point on the terminal block where the wire from Terminal 4 from the original time clock is attached, trace the wires leaving that terminal to determine which control the fans and which go to the solenoid. Leave the solenoid attached, but remove the fan connection and attach it to the wire that was originally connected to the defrost termination Klixon (Terminal X on the original time clock).
4. Locate the fan Klixon installed in series with L2 of the fan circuit. Remove the Klixon and rewire in accordance with NEC guidelines for wet locations.
5. Confirm all wiring connections, re-power the unit, and check all modes of operation. In freezer applications, the fans should shut off immediately upon defrost initiation, and should delay coming back on for the fan delay duration programmed in the controller, following expiration of the drip time. In Cooling applications, the fans should remain running during the defrost cycle. Make sure the fans remain running when the system reaches setpoint and the refrigeration solenoid cycles off. If they do not, confirm in the circuit application of the controller that the fan strategy is set to ON during off-cycle. If this is correct, re-check your wiring of the evaporator.

The rewiring of the evaporator will vary based on the type of evaporator. The typical rewiring sequence is shown in the following diagrams:

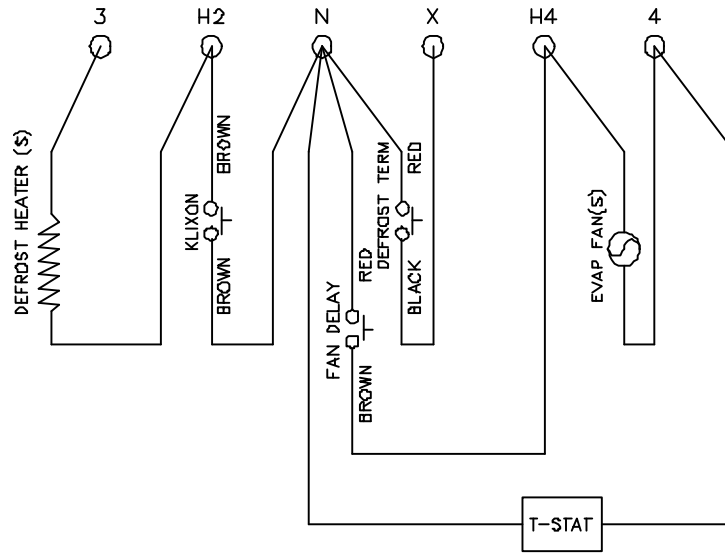


Figure 4 - Typical Evaporator Wiring Diagram Before Installation

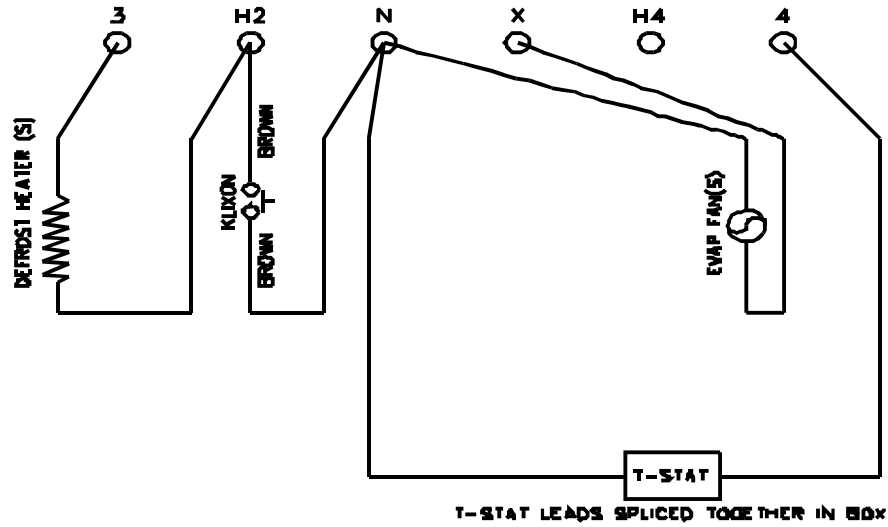


Figure 5 - Typical Evaporator Wiring Diagram After Installation

Proper Operation, Confirmation and Troubleshooting

For 8RO board connections, the refrigeration and fan relays are normally closed, while the defrost relay is normally open. In the event of a system failure, refrigeration and fan relays will remain closed, and the defrost will be open. When activating the relays in this configuration, 24VAC is sent to the terminal on the left-hand side of the board for each load. For refrigeration and fans, this voltage is sent to turn the load OFF. We send the voltage to the defrost relay to turn the heaters ON. When using a voltmeter to troubleshoot this board, measuring AC voltage on the low voltage connection, you will see the following values:

Table 2: 8RO Defrost Time Clock Board Voltage Values

Present Condition	Terminals Tested	Voltage
Refrigeration ON	24V Common to Refrigeration	0V
Refrigeration OFF	24V Common to Refrigeration	24V
Defrost ON	24V Common to Defrost	24V
Defrost OFF	24V Common to Defrost	0V
Fan ON	24V Common to Fan	0V
Fan OFF	24V Common to Fan	24V

For XR and XM controller connections, the refrigeration, fan and defrost relays are normally open. In the event of a system failure, refrigeration, fan and defrost relays will remain open.

When activating the relays in this configuration, 24VAC is sent to the terminal on the left-hand side of the board for each load. For refrigeration, fans, and defrost this voltage is sent to turn the load ON. When using a voltmeter to troubleshoot this board, measuring AC voltage on the low voltage connection, you will see the following values:

Table 3: XR and XM Controller Defrost Time Clock Board Voltage Values

Present Condition	Terminals Tested	Voltage
Refrigeration ON	24V Common to Refrigeration	24V
Refrigeration OFF	24V Common to Refrigeration	0V
Defrost ON	24V Common to Defrost	24V
Defrost OFF	24V Common to Defrost	0V
Fan ON	24V Common to Fan	24V
Fan OFF	24V Common to Fan	0V

When using this board for a walk-in freezer, or a multi-deck case with electric defrost heat, all 24V control points will be used. Eliminate the fan Klixon located on the evaporator. The E2 Controller will then assume all operation of the fan delay following defrost.

In some instances, the condensing-unit to evaporator wiring will not include a wire dedicated for fan control. These units use Terminal 4 from the existing time clock to power L1 of the refrigeration solenoid and L1 of the fan circuit. Because the E2 Controller activates defrost termination based on coil temperature, you must remove the defrost termination Klixon from the evaporator. The wire that was previously connected to the defrost Klixon—X on the existing time clock—is rewired to L1 of the fan circuit and connected to the fan relay of the Defrost Timer Replacement Board.

When this board is used in a walk-in cooler application where fan control and defrost heat are not needed, the 24V control will consist of the refrigeration solenoid only. The two remaining control relays on the Defrost Timer Replacement Board will not be used.

Terminals N and X on the Defrost Timer Replacement Board are passive in that they do not connect to anything control related. They are simply there to land the unused wires from the time clock during conversion to Copeland control.

Because the voltages to the Defrost Timer Replacement Board low-voltage inputs originate at the outputs of the Form C relays of 8RO boards, or at the outputs of Copeland XM and XR controllers. You may need to check voltages there as well if the readings listed above are incorrect. Follow these guidelines to confirm proper operation of the outputs.

Testing the voltages here will be the same as checking them at the Defrost Timer Replacement Board. If no voltages are present regardless of the state of the output, check the 2-amp fuse located on the 8RO board or XM and XR controllers. If the fuse is not blown, trace the control circuit back to the control transformer, making sure all connections are sound. If all connections are good, disconnect the quick-connect spade connectors located near the secondary output of the control transformer and check the voltage. If 24VAC is not present, check the 120V primary voltage to the transformer. If the 120V supply is present, replace the control transformer with a Class 2, non-center-tapped, 120V primary, minimum 50VA rated transformer. For XM and XR controllers, if the problem persists, the XM and XR controllers must be replaced.

For 8RO board connections, if some or all of the voltages between **Terminals Tested** and **Voltage** in the chart above appear to be reversed (for example, that Refrigeration ON shows 24V, and Refrigeration OFF shows 0V, etc.) then the problem can be resolved by checking the failsafe dip switches on the 8RO board. Printed on the board near the failsafe dip switches you will see markings indicating the correct position of the switches for ON or OFF. Follow these rules to confirm the correct positions. If the output is for refrigeration or evaporator Fans, the switch should be in the ON position.

If the output is for defrost or HVAC Heat/Cool/Fan stages, the switch should be in the OFF position. If you make changes to the network dip switches, you must power the board down for five seconds by pulling the 24VAC plug. When you restore power to the board, it will re-read the switch settings.

Visit our website at copeland.com/en-us/products/controls-monitoring-systems for the latest technical documentation and updates.

For Technical Support call **833-409-7505** or email ColdChain.TechnicalServices@Copeland.com