REPAIR PART INSTALLATION INSTRUCTIONS

CONTROL REPAIR KIT FOR (S1-37323870001)
MODELS E*FH / E*EB / E*CS

GENERAL

The YorkGuard VI Demand Defrost control is a replacement part for prior versions of the YorkGuard control (YorkGuard IV).

⚠ CAUTION

Following the detailed instructions for modifications of both the indoor and outdoor units is critical.

NOTE: For direct replacement of YorkGuard VI, replace the control only.

Service replacement kit consists of:

1. YorkGuard "VI" Defrost Control and Mounting Plate
2. Mounting plates and hardware (10 - #6 screws)
3. 2-wire harnesses, terminals (1/4" and 3/16")
4. Wiring diagrams for both electric heat connections and fossil fuel connections.

CONTROL CONFIGURATION FOR ALL APPLICATIONS

Remove control from packaging and configure the control as follows:

1. Specify the desired Low Temperature Cut Out (LTCO) using the jumper on the control.
2. Specify the desired Balance Point (BP) using the jumper on the control.
3. Specify Defrost Curve **3** using the jumper on the control.
4. Verify that the Y2 LOCK jumper is in the OFF position. This jumper is not applicable to a single stage compressor system.
5. Specify if the Heat Pump is installed with a fossil fuel furnace using the FFUEL jumper. The jumper should be ON for a fossil fuel furnace installation and OFF for an air handler installation.
6. The Switch Point jumper is not applicable to a single stage compressor system.
7. Verify that the HOT HEAT PUMP is in the OFF position.

E*FH, E*EB & E*CS CONTROL REPLACEMENT

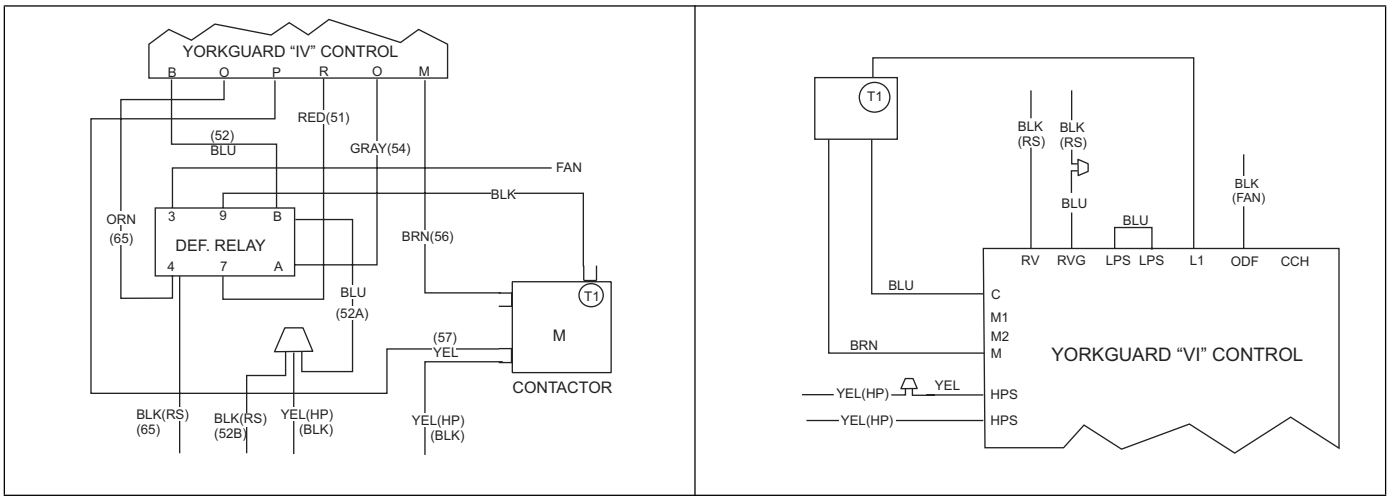

FIGURE 1: Wiring Connections for E*FH and E*EB

OUTDOOR UNIT MODIFICATIONS

1. Disconnect all high and 24V voltage power to the unit and the control circuit.
2. Mark and disconnect all thermostat, sensor and low voltage control connections from the YorkGuard IV control.
3. Remove the two #10 screws holding the control and remove the control.
4. Using the two #10 screws removed in step 3, secure the mounting plate supplied in the kit in the same location as the control that was removed.
5. Using the 4 screws supplied in the kit, secure the YorkGuard VI control and mounting plate to the previously installed mounting plate. The control should be oriented with the thermostat connections to the left side.
6. Remove the screws mounting the defrost relay and replace the screws in the two empty holes to seal the control box.

NOTE: Move the relay to the side but do not disconnect.

7. Re-wire per Figure 1 for E*FH and E*EB.

NOTE: All E*EB wires are number coded versus color coded. All E*EB wires are noted in [ ].

a. Remove wire nut holding Yellow (HP) [BLK], Black (RS) [52B] and Blue wire. Terminate the black (RS) [52] wire with an insulated 1/4" terminal and plug into RVG terminal on control.

b. Remove the Black (RS) [65A] wire from the defrost relay and plug into the control at RV terminal on control.

c. Remove the two fan leads (Black) from the defrost relay and plug into the L1 & ODF terminals on the new control for the condenser fan. Power supply should be connected to L1.

d. Remove the following wires from the defrost relay and dispose of the wires: (per Figure 2)

1. Blue [52] @ B
2. Orange [65] @ 4
3. Red [51] @ 7
4. Gray [54] @ A

e. Remove Yellow [57] wire from contactor and strip end with plug (previously connected to the control.) Wire nut to Yellow (HP) [BLK] wire from (a) above. Plug into control at HPS.

f. Remove Yellow (HP) [BLK] wire from contactor and plug into control at HPS.

g. Install the new Blue wire (from kit) from the common side of the contactor to “C” on the new control by M1.

h. Remove Brown [56] wire from contactor and install the new Brown wire (from kit) from the contactor to “M” on the control. Note the connection at the control is with a 3/16" terminal. Strip terminal with insulated 1/4” terminal and connect to M terminal on control.

8. Re-wire per Figure 2 for E*CS.

a. Remove the 65A (RS) and 52A wire from the defrost relay and plug into the control at RV and RVG.

b. Remove the two fan leads (Black) from the defrost relay and plug into the L1 & ODF terminals on the new control for the condenser fan. Power supply should be connected to L1.

c. Remove the following wires from the defrost relay and dispose of the wires:

1. 52 @ B
2. 65 @ 4
3. 51 @ 7
4. 54 @ A

d. Remove 57 wire from contactor and strip end with plug (previously connected to the control.) Disconnect 52B @ Rev. Valve Sol, Strip and wire nut to 57. The wire length may need to be extended.

e. Remove 57A (HP) wire from contactor and plug into control at HPS. The wire length may need to be extended or a new wire fabricated.

f. Install the new Blue wire (from kit) from the common side of the contactor to “C” on the new control by M1.

g. Remove 56 wire from contactor and install the new Brown wire (from kit) from the contactor to “M” on the control. Note the connection at the control is with a 3/16” terminal. Strip and terminate with insulated 1/4” terminal.

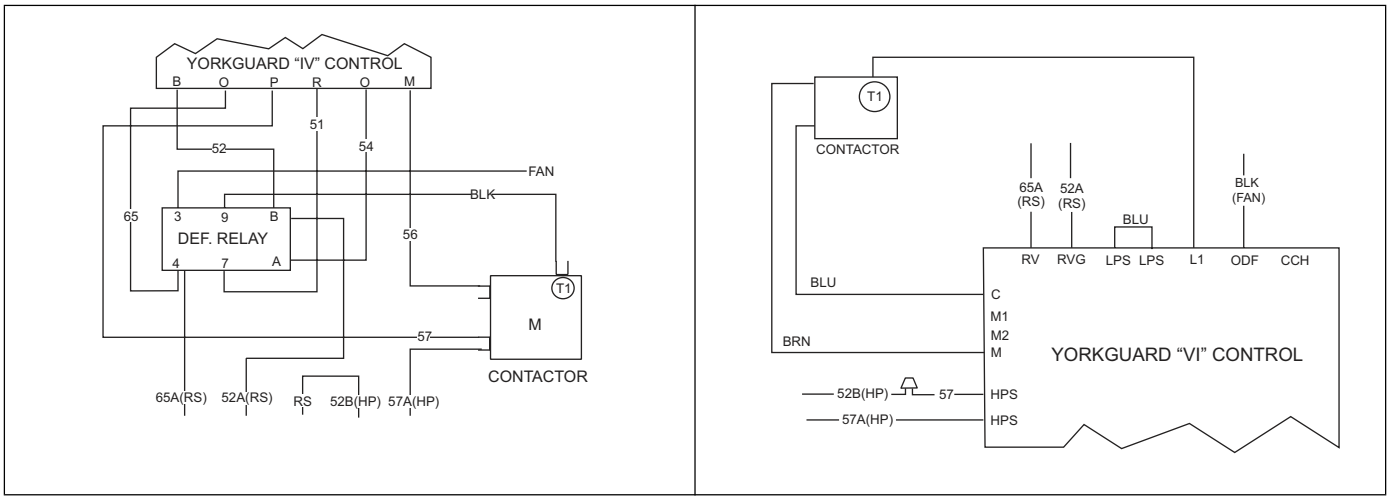

FIGURE 2: Wiring Connections for E*CS

9. Rewire sensor leads as follows.
   a. Liquid line sensor leads (blue) - cut and strip and reterminate with 1/4" terminals. Connect to the control at LL & LLG.
   b. Ambient sensor leads (white) - cut and strip and reterminate with one 1/4" and one 3/16" terminal. Connect to control at AMB & AMBG.
   c. Discharge sensor leads (red) - cut and strip and reterminate with 3/16" terminals. Connect to control at DIS & DISG.
10. Apply a new wiring diagram for either electric heat installations (278019) or fossil fuel installations (278020) supplied in the kit to the inside of the control box of the outdoor unit. Note: The wiring diagram notes colored wires.
11. Verify the settings for the balance point and low temperature cut-out. The settings are found at the top left of the control and are set using the supplied jumpers.

INDOOR UNIT MODIFICATIONS

NOTE: Indoor transformer should be rated for a minimum of 40VA. Replace transformer if necessary.

FOSSIL FUEL APPLICATION - The YorkGuard VI control does not require an add-on fossil fuel kit. Remove existing fossil fuel kit if present. An optional bonnet sensor may be used if desired. See System Operation section for details of functionality with and without bonnet sensor installed.

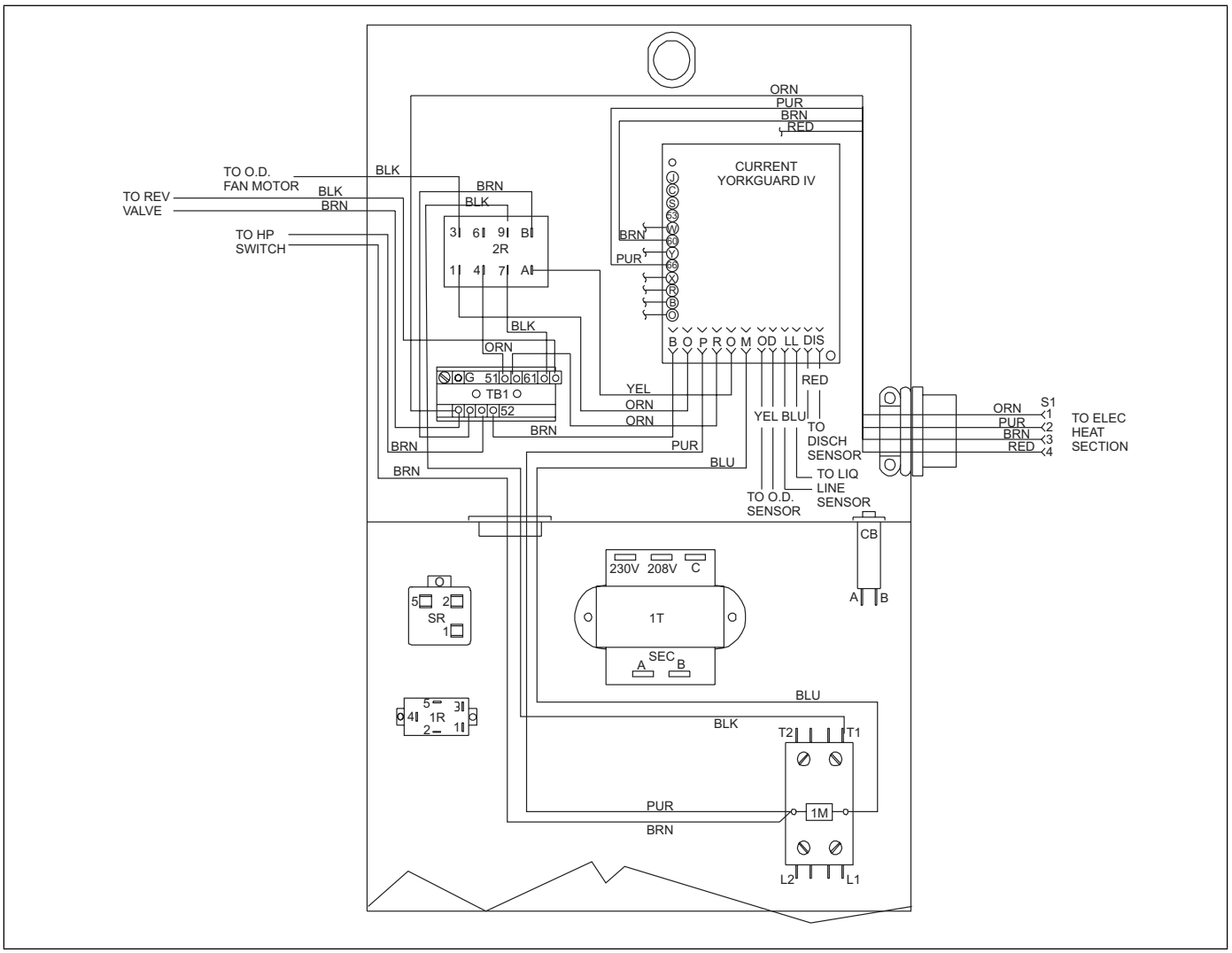

FIGURE 3: B1PH Control Wiring (Before)

B1PH CONTROL REPLACEMENT

YORKGUARD IV REMOVAL

Remove YorkGuard IV from B1PH units as follows:

1. Disconnect the unit power supply.

Mark and disconnect all thermostat, sensor, and low voltage wires at the YorkGuard IV control.

2. Remove the two #10 screws holding the old YorkGuard IV control and remove the control.
3. Remove the two screws mounting the defrost relay 2R and move the relay to the side but do not disconnect the wires.

YORKGUARD VI INSTALLATION

Use the two #10 screws removed in step 3 above, to attach the mounting plate to the control box. Install YorkGuard VI control and mounting plate oriented with the thermostat connections to the left, to the mounting plate with #6 screws supplied.

RE-WIRING B1PH CONTROL BOX

See Figure 4 (Before) and the enclosed wiring diagram 278191 to re-wire the B1PH control box, or follow the step by step procedure below:

1. Disconnect the black OD fan motor wire from relay 2R-3 and connect to YorkGuard VI - ODF.
2. Disconnect the black wire from relay 2R-9 and connect to the other terminal at YorkGuard VI - L1.
3. Disconnect the black wire from relay 2R-7 and connect to YorkGuard VI - RV.
4. Disconnect the orange wire from relay 2R-4 and TB1-51 and connect between TB1-52 and YorkGuard VI - RVG.
5. Remove relay 2R and discard the remaining attached wires and the relay.
6. Disconnect the two brown high pressure switch wires (one at TB1-51 and one at 1M coil) and connect them to YorkGuard VI-HPS.

NOTE: There are several brown wires at TB1-51. The wire connected to the high pressure switch can be easily confused with the wire connected to the reversing valve. You may want to use an meter to check continuity through the high pressure switch to find the correct wire.

7. Cut the purple and blue wires at the low voltage plug that was connected to the old YorkGuard IV. Terminate the cut end of the blue wire with a 1/4" push-on terminal and connect to YorkGuard VI - M. Terminate the cut end of the purple wire with a 1/4" push-on terminal and connect to YorkGuard VI - C by M1.
8. Move the brown circuit breaker (CB) wire from TB1-52 to TB1-51.
9. Move the black transformer wire from TB1-51 to TB1-52.
10. Cut the orange wire from TB1-51 to the low voltage plug at the plug and strip the end about 1/2". Terminate this wire and the red low voltage wire with one 1/4” push-on terminal and connect to YorkGuard VI - R terminal.
11. Terminate the remaining low voltage wires with 1/4” push-on terminals and connect to the YorkGuard VI low voltage terminals.
12. Remove and discard the low voltage plug and the wires still attached to it.
13. Rewire the sensor leads as follows:
    a. Liquid line sensor leads (blue) - cut at plug, strip end, and re-terminate with 1/4" terminals. Connect to the YorkGuard VI - LL & LLG.
    b. Ambient sensor leads (yellow) - cut at plug, strip end, and re-terminate with one 1/4" terminal and one 3/16" terminal. Connect to the YorkGuard VI - AMB & AMBG.
    c. Discharge sensor leads (red) - cut at plug, strip end, and re-terminate with 3/16" terminals. Connect to the YorkGuard VI - DIS & DISG.
14. Apply a new B1PH wiring diagram (278191) supplied with the kit to the inside of the control box cover.
15. Use the jumper pins supplied on the control to set the balance point (BAL PT) and low temperature cut-out (LTCO) settings to the same settings that were on the control.

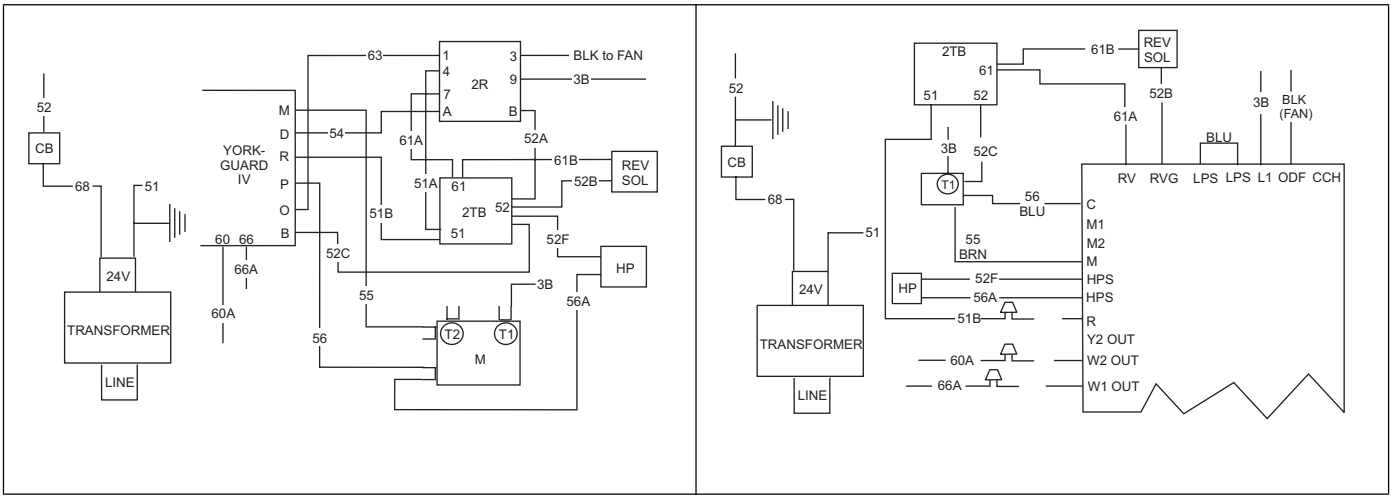

FIGURE 4: Wiring Connections for B1PS

START-UP OPERATION

1. Reapply power to the unit and the control voltage circuit.
2. The LED on the defrost control will flash on and off when there is power to the control and it is working properly.
3. Verify unit operation.

SYSTEM OPERATION

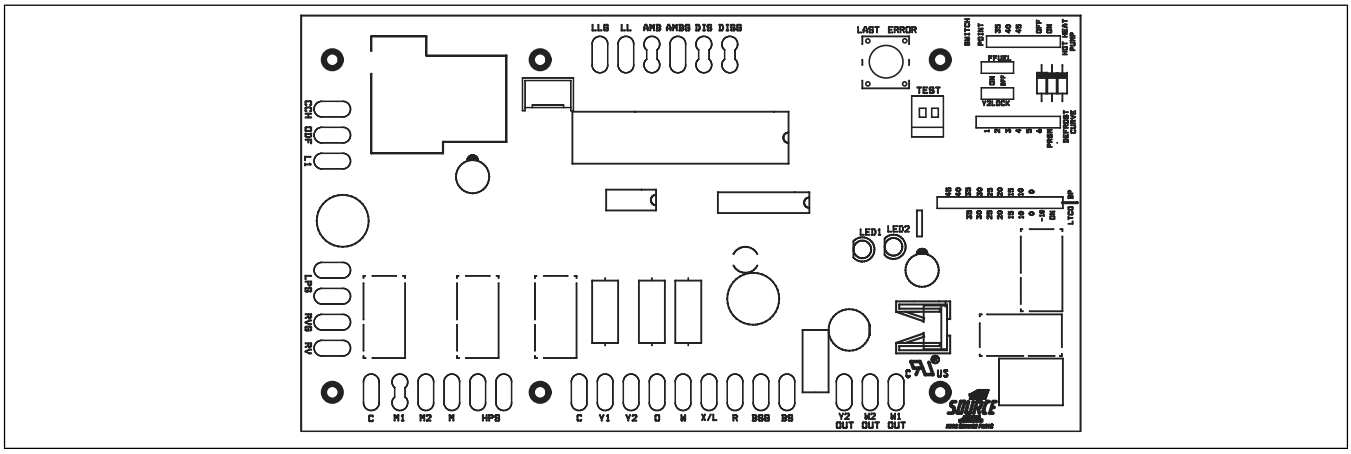

FIGURE 5: Demand Defrost Control Module

ANTI-SHORT CYCLE DELAY

The control includes a five-minute anti-short cycle delay (ASCD) timer to prevent the compressor from short cycling after a power or thermostat signal interruption. The ASCD timer is applied when the control is first powered from the indoor unit thermostat and immediately following the completion of a compressor run cycle. The compressor and the outdoor fan will not operate during the five minutes that the timer is active.

The ASCD timer can be bypassed by connecting the TEST terminals for three seconds while the thermostat is calling for compressor operation (Y1 input signal energized).

LOW VOLTAGE DETECTION

The control monitors the transformer secondary (24 VAC) voltage and provides low voltage protection for the heat pump and its components. In particular, the control prevents contactor chatter during low voltage conditions. If the voltage drops below approximately 19 VAC, the control will continue to energize any relays that are already energized but will not energize any additional relays until the voltage level increases. If the voltage drops below approximately 16 VAC, the control will immediately de-energize the relay outputs and will not energize any relays until the voltage level increases. The control will store and display the appropriate fault codes when low voltage conditions occur.

CRANKCASE HEATER

The control energizes the crankcase heater terminal (CCH) whenever line voltage is applied to the control and the outdoor fan is not on. If the compressor is equipped with a crankcase heater, it will be energized from the CCH terminal of the control.

TEST INPUT

The control includes a TEST input connector that can be used for various testing functions during installation and service. The TEST input connector is shown in Figures 1 and 4. The following table summarizes the behavior of the control when the two TEST pins are connected. More detailed descriptions of the various functions are included in other sections of this document.

TABLE 1:TEST Input Functionality

Duration of connection (seconds)	Control behavior with no thermostat signals present	Control behavior with thermostat signals present
Less than 2	No response	No response
2-6	Display operational mode	Bypass ASCD. If Y1 is present and high-pressure switch is closed, contactors will be energized.
	Clear soft lockout	Clear soft lockout
	Clear hard lockout	Clear hard lockout
More than 6	Display operational mode. Energize X/L with active defrost curve flash code.	Initiate defrost cycle ignoring the liquid line and outdoor ambient temp. Energize X/L with active defrost curve flash code
Connection removed	Resume normal LED display	Terminate defrost as normal or until O signal is energized.
Connection not removed	Display operational mode. Energize X/L with active defrost curve flash code.	Continue defrost cycle and X/L flash code until TEST connection removed.

LED DIAGNOSTIC INDICATORS

The control includes two LED's that display various types of diagnostic information. LED1 is red and LED2 is green. The location of the LED's is shown in Figures 1 and 4. These LED's are used to display operational mode, status, and fault information.

OPERATIONAL MODE DETECTION

The control can be used in a variety of applications including heat pumps and air conditioners with modulating compressors. The control uses various inputs to determine the proper mode of operation.

It looks for the presence of a reversing valve connected to the RV and RVG terminals to determine if it should operate as a heat pump or an air conditioner. If the reversing valve is not connected, the control will not operate in the heat pump mode. The control senses the reversing valve loads and determines the operational mode each time power to the control is cycled.

The control also senses the connections that are made to the M, M1, and M2 terminals and determines the correct operational mode for the control. This is done each time power to the control is cycled.

OPERATIONAL MODE DISPLAY

The control will display its active operational mode using the onboard LED's when the TEST pins are connected while no thermostat signals are energized. See Table 5. The control will display the operational mode as long as the TEST pins are shorted and no thermostat signals are energized. When the TEST pin short is removed, the control will return to normal LED displays. The X/L output will be energized (with the number of flashes corresponding to the active defrost curve) while the operational mode is displayed. For example, if defrost curve 2 is active, the X/L output will be energized with two flashes while the operational mode is being displayed on the LED's.

TABLE 2: Operational Mode Display

Operational Mode	LED1 (Red)	LED2 (Green)
Heat Pump		ON
Air Conditioner		OFF
Single-Stage Compressor	1	
Reciprocating Two-Stage Compressor	2	
Scroll Two-Stage Compressor	3	

STATUS MODE DISPLAY

The control also provides status codes using the LED's. Status codes indicate the state of operation of the unit but do not represent a fault. Table 6 describes the LED displays during status codes. Status codes will not be displayed when a fault code is present.

During the following conditions, the control will not energize the X/L output.

TABLE 3: Status Code Display

Description	LED1 (Red)	LED2 (Green)
No power to control	OFF	OFF
First-stage compressor operation – not applicable to single stage compressor	OFF	ON
Second-stage or full capacity compressor operation	ON	ON
Control normal operation – no call for compressor	OFF	2 sec ON 2 sec OFF
Control normal operation – call for compressor and ASCD timer (5 min.) is active	OFF	Rapid Flash
No fault codes in memory – Initiated by LAST ERROR push button	2	2
Fault code memory cleared – Initiated by LAST ERROR push button	3	3

FAULT CODE DISPLAY

X/L Output

The X/L terminal of the heat pump control is typically connected to the X/L input of the room thermostat. The thermostat uses this signal to notify the homeowner of a problem with the heat pump using an LED or LCD display. When the control energizes the X/L terminal, the thermostat displays the flash code so the homeowner can see it.

The heat pump control informs the homeowner of the type of condition that is present using flash codes. Table 7 shows the condition categories and the corresponding X/L flash codes.

The control will continue to energize the X/L output for fault codes having an X/L code of 4 flashes even after the thermostat calls are removed. The control does this to notify the installer or homeowner that a significant problem with the wiring or system configuration is present and needs to be corrected.

The control will continue to energize the X/L output until the condition that caused the fault condition no longer exists.

TABLE 4:X/L Output Categories

Condition Category	X/L
Soft Lockout – Reset with interruption of thermostat call following correction of fault condition	2 flashes
Hard Lockout – Reset by cycling power to system	3 flashes
Wiring, sensor or control setting related error	4 flashes

LED Display

The control will display any fault code that is currently active using the LED's. The control will display the fault code, pause two seconds, and display the fault again. The control will continue the fault code display until the condition that caused the fault code no longer exists. If multiple fault codes are present at the same time, the control will display only the most recent fault. The other active errors may be accessed from memory using the LAST ERROR pushbutton.

Operational Fault Codes

Table 8 shows the operational faults that the control can detect. The control displays this type of error by flashing LED1 (Red) only. LED1 (Green) is not energized. These faults typically occur when the heat pump has been operating and a problem occurs.

TABLE 5: Operational Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
Operational Faults			
Control Failure that still allows fault code output	ON	OFF	4 if possible
High-pressure switch fault (not in lockout yet)	1	OFF	OFF
High-pressure switch lockout (last mode of operation was heat pump)	2	OFF	2 (soft) 3 (hard)
High-pressure switch lockout (last mode of operation was defrost)	3	OFF	2 (soft) 3 (hard)
Low-pressure switch lockout	4	OFF	2 (soft) 3 (hard)
Low Voltage (< 19 VAC) preventing further relay outputs	5	OFF	OFF
Low Voltage (< 16 VAC) stopped current relay outputs	6	OFF	OFF
Pipe Freeze Protection Timer expiration	7	OFF	4

Sensor or Switch Fault Codes

Table 9 shows the faults that the control can detect when a problem is present with a sensor or switch. The control displays this type of error by energizing LED1 (Red) constantly and flashing LED2 (Green). These faults typically occur when the heat pump has been operating and a problem occurs with a sensor or its wiring. These faults could also occur during installation as the heat pump is configured.

TABLE 6: Sensor or Switch Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
Required Sensor or Switch Faults			
Outdoor ambient sensor failure (short)	ON	1	2 (soft)
Outdoor ambient sensor failure (open)	ON	2	2 (soft)
Liquid line sensor failure (short)	ON	3	2 (soft)
Liquid line sensor failure (open)	ON	4	2 (soft)
Optional Discharge Line Sensor Faults			
High discharge line temperature	ON	5	2 (soft) 3 (hard)
Low discharge line temperature	ON	6	2 (soft) 3 (hard)
Discharge line sensor failure (short)	ON	7	2 (soft)
Optional Bonnet Sensor Faults			
Bonnet sensor failure (short)	ON	8	4
Fossil Fuel Mode setting error (FFUEL jumper in OFF position but bonnet sensor present)	ON	9	4

Wiring Related Fault Codes

Table 10 shows the faults that the control can detect when a problem is present with the system wiring or jumper configurations. The control displays this type of error by flashing LED1 (Red) and energizing LED2 (Green) constantly. These faults typically occur when the heat pump is first installed or when a system component such as the room thermostat or indoor unit is replaced or rewired.

TABLE 7: Wiring Related Fault Codes

Description	LED1 (Red)	LED2 (Green)	X/L
Wiring Related Faults			
Compressor Contactor Miswire	1	ON	4
Y2 present without Y1	2	ON	4
Y1 and W present without Y2 in two stage mode	3	ON	4
O signal received in AC mode	4	ON	4
W signal received in AC mode	5	ON	4
W and O signal received in AC mode	6	ON	4
W and O signal received in HP mode	7	ON	4
Defrost Curve Jumper Error (Invalid jumper setting preventing compressor operation)	8	ON	4

FAULT CODE MEMORY

Displaying Stored Fault Codes

The control will store up to five fault codes in memory. If more than five faults occur, the five most recent fault codes will remain in memory. The stored faults can be displayed by depressing the LAST ERROR push button for one to five seconds while no thermostat inputs to the control are energized. See Figures 1 and 4 for the location of the push button. Since some room thermostats energize the O signal even when not calling for compressor operation, turn the room thermostat to the SYSTEM OFF setting when displaying fault codes.

When the LAST ERROR push button is depressed and released, the control will display the stored fault codes beginning with the most recent. The control will display the most recent fault code, pause two seconds, and display the next fault code. The control will display the stored error codes and then return to the normal LED status display mode. The stored fault codes can be displayed again by depressing the push button again. When the control displays the fault codes with the onboard LED's, it will also energize the X/L output with the corresponding flash code. The X/L output signal can be observed at the room thermostat or at the control using a 24VAC LED test device connected to the X/L terminal.

If the control has no fault codes stored in memory, it will flash both LED's twice simultaneously. If a thermostat signal is energized while the control is displaying the stored error codes, the control will stop displaying the stored error codes and resume normal operation.

Clearing Fault Code Memory

Once the stored fault codes have been displayed and recorded, the installer should clear the stored fault codes from the control's memory. This practice will enable better troubleshooting and diagnosis of system problems. If the stored fault codes are not cleared after the cause of the problem has been resolved, a service technician doing a later service call may not know that the fault codes in the memory were caused by a problem that has already been fixed. The technician may waste time trying to fix a condition that no longer exists. Therefore, it is very important to always clear the fault code memory after the unit is installed and running properly following a service call.

IMPORTANT - Always clear the fault code memory after resolving the condition that caused the fault code.

To clear the fault code memory, depress the LAST ERROR push button for longer than 5 seconds. The control will flash both LED's three times to indicate that the memory has been cleared. To confirm that the memory has been cleared, depress the LAST ERROR push button for one to five seconds. The control will flash both LED's twice to indicate that no faults are stored in memory.

LOCKOUT MODES

Soft Lockout

The control will cause a soft lockout during the following conditions. Detailed descriptions of the conditions required for the control to enter the soft lockout mode are contained in other sections of this document.

1. High-pressure switch
   a. Two openings within six hours
2. Low-pressure switch
   a. One opening of the switch for more than five seconds except under certain conditions.
3. High discharge temperature (with optional discharge sensor)
   a. Temperature reading exceeds 263°F
4. Low discharge temperature (with optional discharge sensor)
   a. Temperature reading does not reach 90°F following timer expiration under certain conditions.

During the soft lockout mode, the control will do the following.

1. De-energize the compressor
2. If in heating mode, the control will energize auxiliary heat as if the outdoor ambient temperature was below the LTCO setting.
3. Energize the LED and X/L outputs with the appropriate flash codes
4. Store the appropriate fault code in memory.

The control will reset the soft lockout condition when any of the following occur following removal of the fault condition.

1. Power is cycled to the R or Y1 inputs of the control. This will cause the soft lockout condition to be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode.
2. The TEST terminals are shorted for more than two seconds.

When the soft lockout condition is reset, the control will stop displaying the fault code and will respond to thermostat inputs normally.

Hard Lockout

If four soft lockouts occur within a twelve-hour period, the control shall cause a hard lockout condition. These soft lockouts can be caused by the same or different conditions. The control will function in the same way during soft and hard lockout conditions. The difference is in the requirements for resetting the lockout condition. The control will reset the hard lockout condition when any of the following occur following removal of the fault condition.

1. Power is removed from the R input of the control.
2. The TEST terminals are shorted for more than two seconds.

A hard lockout condition will not be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode. Power (24 VAC) to the control must be removed and reapplied.

When the hard lockout condition is reset, the control will de-energize the LED and X/L outputs and respond to thermostat inputs normally.

Wiring or Setting Related Lockouts

The control will not operate the compressor when the following faults occur. These faults can be reset using the same methods used to reset a soft lockout. However, two occurrences of these faults will not cause a hard lockout condition.

1. Presence of Y2 thermostat signal without Y1.
2. Shorted discharge sensor input
3. Shorted bonnet sensor
4. Shorted or open liquid line or outdoor ambient sensor
5. Defrost curve jumper error

If a compressor wiring error is detected, the control will not operate the compressor. Once the compressor wiring error has been detected, power (24 VAC) must be cycled to the control for the control to sense the wiring change and clear the lockout condition.

DEFROST OPERATION

General

The control maintains proper airflow through the outdoor coil during heating operation by melting frost and ice that may form on the coil. Frost may accumulate unevenly in different sections of the coil because of the arrangement of the refrigeration circuit within the coil. The control may initiate a defrost cycle even when the coil is not completely covered with frost. This is normal operation.

The control regulates the defrost operation of the heat pump based on accumulated compressor run time, outdoor coil temperature, and outdoor ambient temperature. The control will cause the unit to operate in the normal heating mode until it determines that a defrost cycle is needed.

All defrost timings are based on accumulated compressor run time.

Operation

The defrost mode is equivalent to the cooling mode except that the outdoor fan motor is de-energized. The control shall do the following to initiate a defrost cycle.

- De-energize the outdoor fan
- Energize the crankcase heater
- Energize the reversing valve
- Energize the auxiliary heat outputs based on the system configuration
- Energize Y2 OUT terminal if not already energized
- Begin the maximum defrost cycle length timer

If the call for heating (Y1) is removed from the control during the defrost cycle, it will terminate the defrost cycle and de-energize the compressor. The control will also stop the defrost cycle length timer but not reset it. When the control receives another call for heating, it will restart the defrost cycle and the timer at the point at which the call for heating was removed. This will happen only if the liquid line temperature conditions allow defrost to occur.

Defrost Curve Selection

The control will display the proper fault code when a defrost curve jumper error is present. If the jumper is missing, the control will behave as if the jumper was in the PRGM position. The control will display the active defrost curve using the X/L terminal when the heat pump is operating in a defrost cycle that has been forced using the TEST inputs. It will also display the active defrost curve using the X/L terminal when the operational mode is being displayed using the LED's. For instance, the X/L output will be energized with two flashes when defrost curve 2 is active. The control will lock out the compressor if the defrost curve selection jumper is not properly set.

Defrost Cycle Initiation

The control will allow the heat pump to operate in the heating mode until the combination of outdoor ambient and outdoor coil temperatures indicate that a defrost cycle is necessary.

The control will initiate a defrost cycle when the liquid line temperature is below the initiate point for the measured ambient temperature (see Figure 2) continuously for 4-1/2 minutes. This delay eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

The control will initiate a defrost cycle every 6 hours (accumulated compressor run time) to recirculate refrigerant lubricants. This forced defrost timer will be reset and restarted following the completion or termination of a defrost cycle.

The control will also initiate a defrost cycle when the TEST terminals are shorted. This feature allows an installer or service technician to start a defrost cycle immediately as required. When the TEST terminals are shorted for more than six seconds with a Y1 input energized and the high-pressure switch closed, the ASCD will be bypassed and the compressor will be energized. If an O signal is present, the control will not initiate a defrost cycle. If the defrost cycle is initiated using the TEST terminals, the control will bypass the normal auxiliary heat timings and will energize the W1 Out and W2 Out terminals immediately when it begins the defrost cycle.

When the TEST inputs are used to force a defrost cycle, the control will ignore the state of the liquid line temperature and outdoor ambient temperature inputs. The coil does not have to be cold and the outdoor temperature does not have to be within a certain range for the heat pump to be forced into a defrost cycle. After the TEST input jumper is removed, the defrost mode will be terminated as normal. The defrost cycle length timer will not be started until the TEST input is removed. If the TEST terminals remain shorted, the control will keep the unit in defrost mode.

Defrost Inhibition

The control will not initiate a defrost cycle if the liquid line temperature is above 40°F unless the defrost cycle is forced using the TEST input.

The control will not initiate a defrost cycle when the outdoor ambient temperature is below –25°F or above 55°F unless the defrost cycle is forced using the TEST input.

The control will also prevent a defrost cycle from being initiated too soon after the initiation of the previous defrost cycle. When power is applied to the control and after the completion or termination of each defrost cycle, the control will start a 40-minute timer. When this timer expires, the control will allow another defrost cycle when needed. The timer is based on accumulated compressor run time.

Defrost Termination

The control will terminate the defrost cycle immediately after the liquid line temperature reaches 80°F or after eight minutes of defrost operation.

The control will also terminate a defrost cycle that has been forced using the TEST input when the O input is energized. The control will not terminate a normal defrost cycle when it receives an O input.

The control will do the following to terminate a defrost cycle.

- Energize the outdoor fan
- De-energize the crankcase heater
- De-energize the reversing valve
- De-energize the auxiliary heat outputs
- Control the Y2 Out terminal based on operating conditions
- Reset and restart the 40-minute defrost inhibit timer

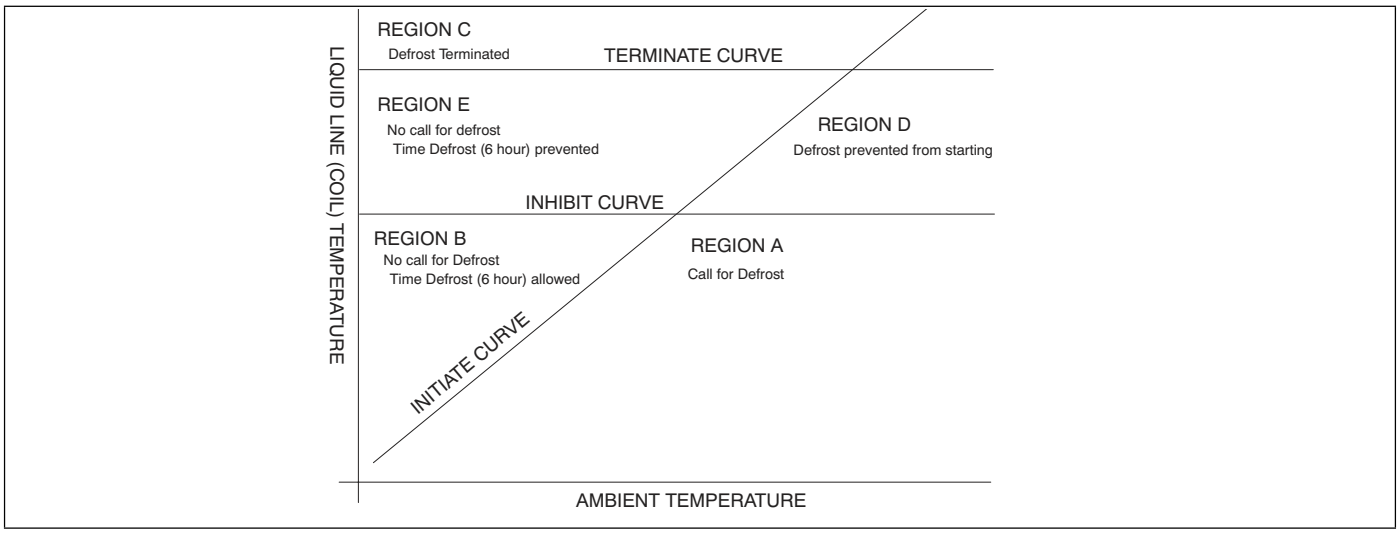

FIGURE 6: Defrost Operation Curves

COOLING OPERATION

During cooling operation, the control will receive thermostat signals at the Y1 and O input terminals. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also closes the outdoor fan relay delivering power to the ODF terminal causing the outdoor fan to operate. The control energizes the RV terminal with 24VAC to switch the reversing valve. Additionally, the Y2 OUT terminal is energized with 24VAC. This signal can be used to signal the indoor unit to deliver high air flow.

HEATING OPERATION

During first-stage heating operation, the control will receive a thermostat signal at the Y1 input terminal. The control will energize the M compressor output terminal. This signal energizes the coil of the compressor contactor causing the compressor to run. The control also closes the outdoor fan relay delivering power to the ODF terminal causing the outdoor fan to operate. The reversing valve is not energized in heating mode.

Conventional Heat Pump Mode

The recommended setting of the HOT HEAT PUMP jumper on the control is the OFF position. In this configuration the heat pump operates in conventional heat pump mode. If the jumper is not in place, the control will act as if the jumper is in the OFF position.

If the HOT HEAT PUMP jumper is in the OFF position, the control will energize the Y2 OUT terminal whenever the compressor is running in second-stage.

The location of the hot heat pump jumper is shown in Figures 1 and 4.

Hot Heat Pump Enable (HOT HEAT PUMP) Settings

The Hot Heat Pump Enable (HOT HEAT PUMP) jumper input does not affect the Forced Second Stage Feature.

Hot Heat Pump Mode

The hot heat pump mode is not recommended for E4FH models.

The control will operate in Hot Heat Pump Mode only if the HOT HEAT PUMP jumper on the control is placed in the ON position. The Y2 OUT signal must also be connected to the indoor unit.

Hot Heat Pump Mode only affects the indoor blower motor speed when the unit is operating in heating mode.

The control implements the Hot Heat Pump Mode by controlling the indoor airflow level during heating operation only. Cooling operation is not affected. By reducing the indoor airflow level, the heat pump system will operate with increased indoor discharge air temperatures. The control changes the indoor airflow level using the Y2 OUT signal. This terminal is connected to the high speed cooling input of a variable speed indoor unit. When the heat pump control energizes the Y2 OUT terminal, the indoor blower runs at high speed delivering high airflow. When the control de-energizes the Y2 OUT terminal, the indoor blower runs at a lower speed delivering lower airflow.

If the HOT HP jumper is in the ON position and the control receives a call for heating, the control will energize the compressor and measure the outdoor ambient temperature.

This section of the instructions is provided for general information regarding the operation of the control.

If the outdoor ambient temperature is equal to or greater than 50°F, the control will energize Y2 OUT and keep it energized until the thermostat is satisfied (Y1 signal removed). The higher airflow is required to keep the operating pressures low when the outdoor ambient temperature is 50°F or greater.

If the outdoor ambient temperature is less than 50°F, the control will start a ten-minute timer and keep Y2 OUT de-energized. Therefore, the compressor will be operating and the indoor unit will be operating with reduced airflow. **If the HOT HP jumper is in the ON position and if the outdoor ambient temperature is less than 50°F, the indoor airflow at the beginning of a heating cycle will always be low.**

When the ten-minute timer expires, the control will measure the liquid line temperature and determine whether to energize Y2 OUT and increase the indoor airflow or keep Y2 OUT de-energized and maintain reduced indoor airflow. The control compares the measured liquid line temperature to a pre-programmed indoor airflow curve. It continues to keep Y2 OUT de-energized until the liquid line temperature exceeds the curve for the given outdoor ambient temperature continually for 30 seconds. If the liquid line temperature drops below the curve, the control will reset the 30-second timer and restart it when the liquid line temperature again exceeds the curve. When the liquid line temperature exceeds the indoor airflow control curve continually for 30 seconds, the control will energize Y2 OUT, i.e. cause high indoor airflow, until the thermostat demand is satisfied and the thermostat signal inputs are removed. Figure 3 describes the required behavior.

Once the control energizes Y2 OUT to create high airflow, it will keep Y2 OUT energized until the thermostat is satisfied and the call for heating is removed. It will do this regardless of a change in outdoor ambient or liquid line temperature. Therefore, if the control energizes Y2 OUT because the outdoor ambient temperature is greater than or equal to 50°F or because the liquid line temperature exceeds the curve for the given outdoor ambient temperature (point within region B), it will keep Y2 OUT energized until the thermostat is satisfied even if the liquid line or outdoor ambient temperature falls below the curve (point within region A).

The control of Y2 OUT to generate high indoor airflow as required will prevent the heat pump system pressures and temperatures from becoming too great when the compressor is running at full capacity with low indoor airflow.

As an example, assume that the HOT HP jumper is in the ON position. When the control receives a call for heating (Y1), it checks the outdoor ambient temperature. If the outdoor ambient temperature is 52°F, the control will energize Y2 OUT immediately causing high indoor airflow and keep it energized until the thermostat signal is removed. If the outdoor ambient temperature is 48°F, the control will maintain Y2 OUT in a de-energized state and begin a ten-minute timer. The indoor unit will be running at low airflow because of the thermostat signal being delivered to the Y1 input of the indoor unit.

When the ten-minute timer expires, the control will compare the liquid line temperature to the indoor airflow control curve for the measured outdoor ambient temperature. If the point is within region A (See Figure 3), the control shall maintain Y2 OUT in the de-energized state until the liquid line temperature rises so that region B is entered. While in region A, the indoor unit will continue to run at low airflow. When the liquid line temperature point enters region B, the control will start a 30 second timer. When the timer expires, the control will immediately energize Y2 OUT. If the liquid line temperature drops back into region A before the timer expires, the control will reset the timer and restart it when the liquid line temperature again enters region B. When the liquid line temperature is in region B continually for thirty seconds, the Y2 OUT signal will be delivered to the indoor unit and cause high airflow.

During defrost operation, the control will ignore the HOT HP jumper setting and energize the Y2 OUT signal to create high indoor airflow. Additionally, if at any point the conditions require a defrost cycle, the control will override the reduced indoor airflow feature and function based on the defrost requirements and conditions.

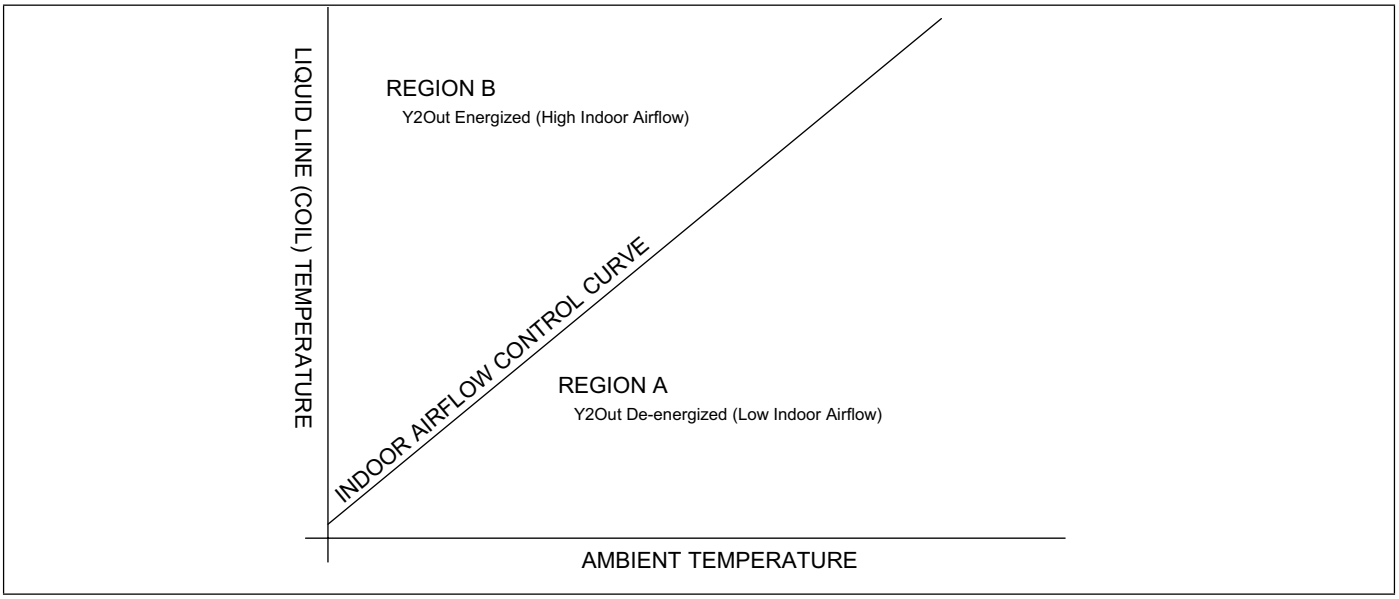

FIGURE 7: Hot Heat Pump Indoor Airflow Control

EMERGENCY HEAT

When the control receives a W signal without a Y signal (emergency heat), the control will de-energize the compressor and energize the W1 OUT and W2 OUT terminals immediately. The balance point setting is ignored during a call for emergency heat. Therefore, W1 OUT and W2 OUT will be energized regardless of the outdoor ambient temperature.

JUMPER INPUTS

The control uses seven jumpers to determine how the heat pump should operate. These jumpers are shown in Figures 1 and 4 and below. Y2 LOCK and SWITCH POINT jumpers do not apply to single-stage heat pump operation. The effects of these jumper settings on the operation of the heat pump are described in other sections of this document.

- LTCO – Low Temperature Cutout
- BP – Balance Point
- Defrost Curve
- FFUEL – Specifies fossil fuel furnace application
- HOT HEAT PUMP – Enables indoor airflow control for hot heat pump application
- Y2 LOCK – Determines compressor staging
- SWITCH POINT – Specifies liquid temperature at which second-stage compressor operation is forced.

The control only reads the jumper inputs when the Y1, Y2, and W thermostat inputs are de-energized. If a jumper position is changed while any of these inputs are energized, the control will not act upon the jumper changes until all three of these thermostat calls are de-energized or power (24 VAC) to the control is cycled.

IMPORTANT - Changes to the jumper inputs do not take affect until Y1, Y2, and W thermostat signals are de-energized.

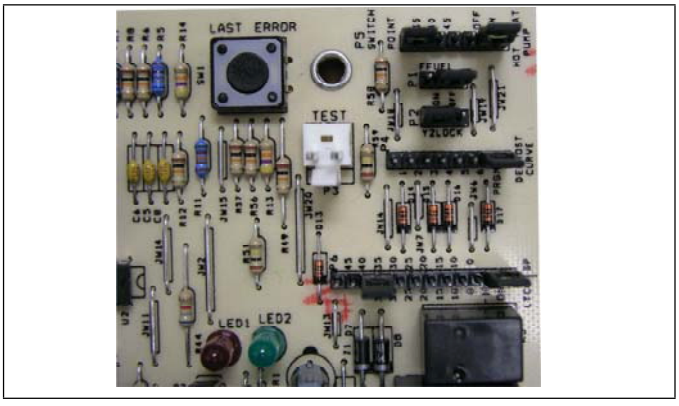

FIGURE 8: Jumper Inputs

LOW TEMPERATURE CUTOUT (LTCO) AND BALANCE POINT (BP)

The control includes a low temperature cutout (LTCO) feature that prevents compressor operation below a specified temperature during heat pump heating operation only. The LTCO setting does not apply to compressor operation during cooling or defrost operation.

The control also includes a balance point feature that prevents the operation of auxiliary heat above a specified temperature.

Setting

The LTCO and BP jumpers on the control are shown in Figures 1 and 4. Both jumpers are placed on the same connector. The control will consider the lowest jumper pin setting to be the LTCO and the highest jumper pin setting to be the BP. The use of the same connector forces the BP and the LTCO to always be separated by at least 10 degrees.

The temperatures shown on the side of the connector labeled LTCO are the LTCO temperature options. The values shown are in degrees F. The control allows the LTCO to be set to any of the following temperatures: -10, 0, 10, 15, 20, 25, 30, 35 degrees F or ON. Placing the jumper in the ON position will allow the control to operate the compressor at any temperature during heating operation.

The factory places the LTCO jumper in the ON position. The jumper must be changed in the field to implement the LTCO feature. If the jumper is removed, the control will behave as if the jumper is in the ON position.

The temperatures shown on the side of the connector labeled BP are the BP temperature options. The values are shown in degrees F. The control allows the balance point to be set to any of the following temperatures: 0, 10, 15, 20, 25, 30, 35, 40, or 45 degrees F.

The factory places the BP jumper in the 35 F position. The jumper may be changed in the field as desired. If the jumper is removed, the control will behave as if the jumper is in the 35 position.

If only one jumper is in place, the control will set the balance point based on the jumper position and will set the LTCO to ON. If only one jumper is in place and it is below the valid BP settings (in the –10 or ON position), the control will set the BP to the default value for no jumper in place (35F) and set the LTCO based on the jumper position (-10 or ON).

Low Temperature Cutout (LTCO) Operation

The control will not operate the compressor in heating mode when the outdoor ambient temperature is below the selected LTCO. The LTCO applies only to air handler mode operation. In fossil fuel mode the balance point (BP) restricts the operation of the compressor so the LTCO setting has no effect.

Balance Point (BP) Operation

If the measured outdoor ambient temperature is greater than the balance point setting, the control will not energize the auxiliary heat outputs. However, the control shall ignore the balance point setting and energize auxiliary heat under some conditions as described in the auxiliary heat sections of this document.

FOSSIL FUEL JUMPER (FFUEL)

Setting

The control includes a FFUEL jumper to specify whether the control is installed with a fossil fuel furnace or an air handler (electric heat). This jumper is shown in Figures 1 and 4. The factory places the FFUEL jumper in the OFF position which is the correct position for an air handler installation. The jumper must be changed to the ON position in the field if the heat pump is installed with a fossil fuel furnace. If the jumper is removed, the control will behave as if the jumper is in the OFF position.

IMPORTANT - If the heat pump is being installed with a fossil fuel furnace, the FUEL jumper must be placed in the ON position during installation for proper system operation.

Operation

The control operates the auxiliary heat outputs, W1 OUT and W2 OUT, based on the position of the FFUEL jumper. If the FFUEL jumper is in the ON position, the control will function in fossil fuel mode. If the jumper is in the OFF position, the control will function in air handler mode. The FFUEL jumper has no effect on cooling operation.

AUXILIARY HEAT - AIR HANDLER MODE

The heat pump control energizes the auxiliary electric heat in air handler mode using the W1 OUT and W2 OUT signals. The control receives the room thermostat call for auxiliary heat at the W input terminal.

Standard Operation

If the outdoor ambient temperature is less than ten degrees F below the balance point setting and a W input is received with a Y1 or Y1 + Y2 input, the control will energize the M compressor contactor output based on the Y1 input and will energize the W1 OUT immediately when the W input is received. When the W input is received, the control will start a fifteen-minute timer. If the call for Y1 + W or Y1 + Y2 + W is still present after the fifteen-minute timer expires, the control will then energize W2 OUT along with W1 OUT. If the W input is removed but the Y1 or Y1 + Y2 signal remains, the control will de-energize W1 OUT and W2 OUT (if energized) and reset and restart the timer. If the W input is received again without a loss of the Y1 or Y1 + Y2, the same functionality will be repeated.

If the outdoor ambient temperature is ten degrees F or more below the balance point setting and a W input is received with a Y1 or Y1 + Y2 input, the control will energize W1 OUT and W2 OUT immediately.

If the outdoor ambient temperature is below the low temperature cutout (LTCO) setting, the control will de-energize the compressor and energize W1 Out immediately when a Y1 input is received and W2 out immediately when the Y2 input is received. If the outdoor ambient temperature rises above the LTCO setting before the thermostat is satisfied, the control will continue to keep the compressor outputs de-energized until the thermostat is satisfied. In other words, the control will use auxiliary heat to satisfy the thermostat demand and not turn the compressor back on even if the outdoor ambient temperature rises above the LTCO setting during a call for heating.

TABLE 8: Air Handler Auxiliary Heat Functionality

Outdoor Ambient Temperature	**CONTROL INPUTS**			
	Y1	**Y1 + Y2**	**Y1 + W OR Y1 + Y2 + W**	**OR**
Ambient above BP	Heat Pump Operation		Heat Pump Operation (then + W1 OUT + W2 OUT after pipe freeze protection timer expires)	W1 OUT + W2 OUT
Ambient below BP and above BP-10F	Heat Pump Operation		Heat Pump Operation + W1 OUT (immediate) + W2 OUT (after 15 minutes)	W1 OUT + W2 OUT
Ambient below BP-10F and above LTCO	Heat Pump Operation		Heat Pump Operation + W1 OUT (immediate) + W2 OUT (immediate)	W1 OUT + W2 OUT
Ambient below LTCO	W1 OUT	W1 OUT + W2 OUT	W1 OUT + W2 OUT	W1 OUT + W2 OUT

Auxiliary Heat Defrost Operation – Air Handler Mode

The control will energize W1 OUT and W2 OUT 45 seconds prior to and during defrost operation. If a call for heating (Y1 or Y1 + Y2) is still present after the defrost cycle has terminated, the control will continue to energize W1 OUT and W2 OUT for 180 seconds after the defrost cycle has been terminated. The control will begin normal heat pump heating mode operation upon termination of the defrost cycle.

Pipe Freeze Protection Timer – Air Handler Mode Operation

The control starts a four-hour timer when a call for compressor operation and auxiliary heat (Y1 + W or Y1 + Y2 + W) is received. If the call for compressor operation and auxiliary heat is still present after the timer expires, the control will energize W1 OUT and W2 OUT in addition to the compressor output regardless of the balance point setting. If the call for auxiliary heat (W) is removed but the call for compressor operation (Y1 or Y1 + Y2) remains, the control will de-energize auxiliary heat (W1 OUT and W2 OUT) and reset and restart the timer. If the timer expires again, the same functionality will be repeated indefinitely. The purpose of this feature is to prevent the pipes in a home from freezing if the balance point is set too low and the heat pump cannot heat the home using compressor operation only. This will be a benefit if a home is not occupied and a compressor problem occurs. The control shall also store and display a fault flash code when the pipe freeze timer has expired.

AUXILIARY HEAT - FOSSIL FUEL MODE

Standard Operation

The LTCO does not have any impact on the operation of auxiliary heat when the control is in fossil fuel mode. Since the compressor is not allowed to come on below the balance point and the balance point is always above the LTCO, the balance point setting effectively becomes the LTCO setting. This is done intentionally to allow the balance point to function as an economic balance point based on the cost of heating with electricity (above the balance point) versus heating with fossil fuel (below the balance point).

If the measured outdoor ambient temperature is below the balance point setting, the control will de-energize compressor outputs and energize W1 OUT immediately when the Y1 input is received and W2 OUT immediately when a Y2 input is received. If the outdoor ambient temperature rises above the balance point setting before the thermostat is satisfied, the control will continue to keep the compressor outputs de-energized until the thermostat is satisfied. In other words, the control will use furnace to satisfy the thermostat demand and not turn the compressor back on even if the outdoor ambient temperature rises above the LTCO setting during the call for heating.

If a W input is received with or without a Y1or Y1 + Y2 input, the control will de-energize the compressor outputs and energize W1 OUT and W2 OUT immediately.

Table 12 describes the auxiliary heat operation for fossil fuel mode.

TABLE 9: Fossil Fuel Furnace Auxiliary Heat Functionality

Outdoor Ambient Temperature	CONTROL INPUTS			
	Y1	Y1 + Y2	Y1 + W OR Y1 + Y2 + W	W
Ambient above BP	Heat Pump Operation		Heat Pump Operation (then W1 OUT + W2 OUT after pipe freeze protection timer expires)	W1 OUT + W2 OUT
Ambient below BP	W1 OUT	W1 OUT + W2 OUT	W1 OUT + W2 OUT	W1 OUT + W2 OUT

Bonnet Sensor – Fossil Fuel Mode

The heat pump may be equipped in the field with an optional indoor air discharge temperature or bonnet sensor. The control does not allow the heat pump and the furnace to operate simultaneously even with a bonnet sensor installed except surrounding a defrost cycle. The control cycles the fossil fuel furnace differently surrounding a defrost cycle depending on whether a bonnet sensor is installed.

The bonnet sensor is installed in the indoor unit and is mounted so that it measures the indoor air temperature after the air exits the furnace. The bonnet sensor is connected to the heat pump control using the BS and BSG terminals. Refer to the bonnet sensor accessory kit for complete installation instructions.

The bonnet sensor only applies to fossil fuel furnace applications and should not be installed with air handlers. If the bonnet sensor is present and the control is set to air handler mode, the indoor unit might be a furnace and the operation mode is incorrectly specified. The control will operate in fossil fuel mode instead of air handler mode so that the furnace and heat pump are not operated simultaneously.

Since the bonnet sensor is an optional accessory, the control cannot detect a bonnet sensor that fails in the open position. If the control senses that the bonnet sensor thermistor is open, it will assume that a bonnet sensor thermistor is not connected and will function without implementing the optional bonnet sensor features. If the control senses that the bonnet sensor thermistor is shorted, it will cause a lockout condition and store and display the appropriate error code.

If the control is in air handler mode and detects that a bonnet sensor input is present, it will control W1 OUT and W2 OUT as required by the fossil fuel mode. It will also cause a fault code to be displayed on the thermostat via the X/L output to notify the homeowner that there is a problem even though the system is operating.

Auxiliary Heat Defrost Operation – Fossil Fuel Mode with Bonnet Sensor

With a bonnet sensor present the control will energize W1 OUT and W2 OUT 45 seconds prior to the initiation of the defrost cycle.

During defrost operation, if the bonnet sensor input reaches 109°F, the control will de-energize W1 OUT and W2 OUT. The control will re-energize W1 OUT and W2 OUT when the bonnet sensor input drops below 90°F again and the defrost cycle is still in process.

If a call for heating (Y1) is still present after the defrost cycle has terminated, the control will continue to energize W1 OUT and W2 OUT after the defrost cycle has been terminated until the bonnet sensor reaches 109°F. When the bonnet sensor reaches 109°F after the defrost cycle has terminated, the control will de-energize W1 OUT and W2 OUT and will not re-energize them during this call for heat. That is, once the defrost cycle has terminated, the control will not cycle W1 OUT and W2 OUT with the bonnet sensor.

The control will begin normal heat pump heating mode operation upon termination of the defrost cycle.

Auxiliary Heat Defrost Operation – Fossil Fuel Mode without Bonnet Sensor

If the control is in fossil fuel mode and senses that no bonnet sensor is present, it will energize W1 OUT and W2 OUT immediately when the defrost cycle is initiated. If a call for heating (Y1) is still present after the defrost cycle has terminated, the control will de-energize W1 OUT and W2 OUT immediately and return to normal heat pump mode operation.

In this mode the control will energize the fossil fuel furnace only during defrost and not provide any comfort enhancements during the transition. The heat pump and furnace will not operate at the same time if the bonnet sensor is not in place.

Pipe Freeze Protection Timer – Fossil Fuel Mode Operation

The control starts a four-hour timer when a call for compressor operation and auxiliary heat (Y1 + W) is received. If the outdoor temperature is above the balance point, the control will energize the compressor instead of the auxiliary heat outputs. If the call for compressor operation and auxiliary heat is still present after the timer expires, the control will energize W1 OUT and W2 OUT and de-energize the compressor regardless of the balance point setting. The control will keep the W1 OUT and W2 OUT signals energized until the Y1 signal is removed. That is, the control will lock into auxiliary heat furnace operation until the room thermostat is satisfied. The purpose of this feature is to prevent the pipes in a home from freezing if the balance point is set too low and the heat pump cannot heat the home using compressor operation only. This will be a benefit if a home is not occupied and a compressor problem occurs. The control will also store and display a fault flash code when the pipe freeze timer has expired.

Y2 LOCK

The Y2 LOCK jumper does not apply to single-stage units.

SWITCH POINT

The SWITCH POINT jumper does not apply to single-stage units.

HIGH-PRESSURE SWITCH FAULT

The heat pump is equipped with a high-pressure switch that is connected to the control at the HPS terminals. If the high-pressure switch opens for more than 40 milliseconds, the control will de-energize the compressor and store and display the appropriate fault code. If the pressure switch closes and a thermostat call for compressor operation is present, the control will apply the five-minute anti-short cycle delay timer and start the compressor when the timer expires.

When the compressor is started following a high-pressure switch fault, the control will start a six-hour timer based on accumulated compressor run time. If the control senses another opening of the high-pressure switch before the timer expires, it will cause a soft lockout condition. The second opening of the high-pressure switch must be greater than 160 milliseconds for the lockout to occur. If the second opening is between 40 and 160 milliseconds, the control will de-energize the compressor but not cause a soft lockout condition. If the control does not sense a second high-pressure switch opening before the six-hour timer expires, the timer and counter will be reset.

LOW-PRESSURE SWITCH

If the heat pump is equipped with a low-pressure switch, it is connected to the control at the LPS terminals. If the low-pressure switch opens for more than five seconds, the control will cause a soft lockout condition and display the appropriate fault codes. However, the control will ignore the low pressure switch input and not cause a soft lockout condition if it opens during the following conditions.

- Defrost operation
- First two minutes of compressor operation
- Two minutes following the completion of a defrost cycle
- TEST input shorted with Y1 input energized

DISCHARGE LINE TEMPERATURE SENSOR

The heat pump may be equipped with an optional discharge line temperature sensor. If a discharge sensor is present, the control will provide the following features.

High Discharge Line Temperature

If the control senses a discharge line temperature reading of 263°F for 30 seconds continually, it will cause a soft lockout condition. If the discharge line temperature drops below 263°F during the 30-second timer, the control will reset the 30-second timer and restart the timer if the discharge line temperature again exceeds 263°F.

Low Discharge Line Temperature

The control will begin a sixty-minute timer when either of the following conditions are met.

- The discharge line temperature has not reached 90°F after eight minutes of accumulated compressor run time.
- The discharge temperature has not reached 90°F after fifteen minutes of accumulated compressor run time following the exit of a defrost cycle.

If the discharge line temperature has not reached 90°F after the sixty-minute timer has expired, the control will cause a soft lockout condition. The control will reset the sixty-minute timer upon expiration and when the compressor starts. The timer is reset when the compressor starts and is only restarted if one of the two conditions shown above are met.

The low discharge temperature fault indicates that the outdoor coil is too cold during heating operation. The lockout is intended to prevent refrigerant flooding back to the compressor.

IMPORTANT - The discharge sensor must be well insulated and installed properly to prevent nuisance lockouts from occurring.

INDICATIONS OF PROPER OPERATION

Cooling

Cooling operation is the same as any conventional air conditioning unit.

1. The outdoor fan should be running, with warm air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging cool air from the ducts. Coils or other parts in the air circuit should be cleaned as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
3. The vapor line at the outdoor unit will feel cool to the touch.
4. The liquid line at the outdoor unit will feel warm to the touch.

Heating

Indications of proper Heating operation is as follows:

1. The outdoor fan should be running, with cool air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging warm air from the ducts.
3. The vapor line at the outdoor unit will feel warm to the touch.
4. The liquid line at the outdoor unit will feel cool to the touch.

TEMPLATE

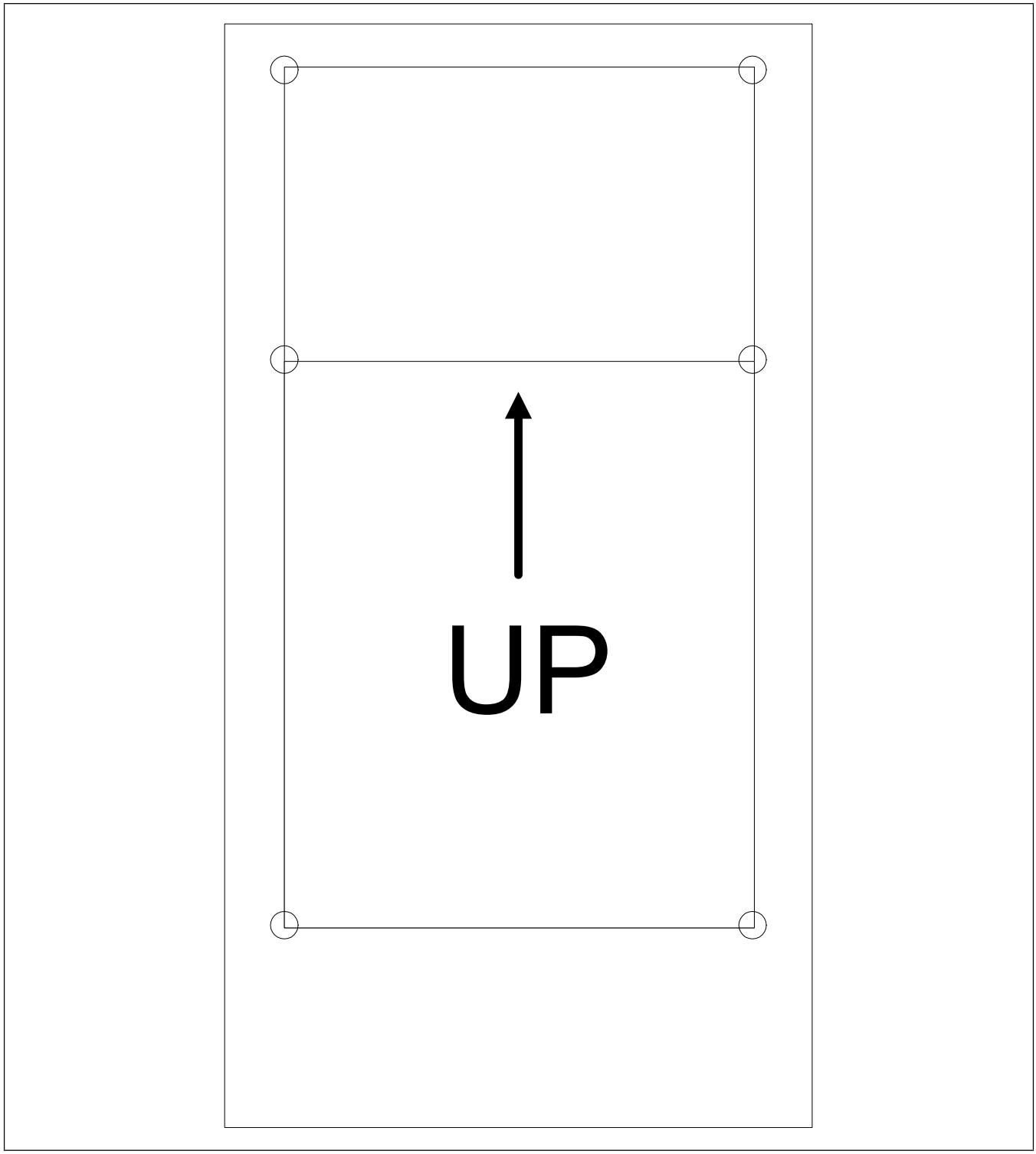

FIGURE 9: Control Mounting Template

NOTES

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