

The Following Sequence of operation is used **IF** 2 stage cooling compressor is selected in the setup menu selections.

Sequence of operation (2.1) Main control buttons set to **Fan AUTO/ON** and **System COOL**. (This is 1<sup>st</sup> Stage cooling)

The thermostat monitors the actual temp inside the space and compares it to the set point selected by the user. Should the actual temperature rise above the set point by .5deg F, the 1<sup>st</sup> Stage Y1 compressor contacts, the G fan contacts, and the O/B reversing valve contacts will be energized allowing the system to cool. When the actual temp falls below the set point by .5deg F then the 1<sup>st</sup> Stage Y1 and G contacts will be de-energized, and system will go back to idle. (Assuming humidity is in range). O/B reversing valve contacts remain energized anytime the System Select button is set to COOL. This small temp offset from set point prevents the system from short cycling while still maintaining close control of the desired temp. Once the contacts are de-energized a short minimum off timer begins a countdown to prevent mechanical short cycling. (Timer is set in Setup Menu).

Two conditions will cause the system to energize the 2<sup>nd</sup> Stage Cooling. The first is if the actual Temperature is >1deg F above the set point. The other is if the 1<sup>st</sup> stage runs >15minutes without reaching set point.

Sequence of operation (2.2) Main control buttons set to **Fan AUTO/ON** and **System COOL**. (This is 2<sup>nd</sup> Stage Cooling).

The thermostat monitors the actual temp inside the space and compares it to the set point selected by the user. Should the actual temperature rise above the set point >1deg F, the 1<sup>st</sup> Stage Y1 compressor contacts, the O/B reversing valve and the G fan contacts will remain energized. Additionally, the 2<sup>nd</sup> Stage Y/Y2 contacts energize, allowing the system to cool in 2<sup>nd</sup> Stage. When the actual temp falls below the set point by .5deg F, only then will the 1<sup>st</sup> Stage Y1, the 2<sup>nd</sup> Stage Y/Y2 and G contacts be de-energized, and system will go back to idle. (Assuming humidity is in range). O/B reversing valve contacts remain energized anytime the System Select button is set to COOL.

Note. There needs to be a minimum run time (2 Minutes) on Stage 1 before stage 2 can be energized. Even if the temperature is >1deg F. This prevents air mixing in the space from energizing stage 2 prematurely.

If "DEHUMIDIFIER" was chosen from the installer setup menu, humidity is controlled in this mode as well. If the actual humidity rises more than 5% above the humidity set point, The *AUX1 DEHUM* contacts, and the *G* fan contacts will be energized allowing a stand-alone dehumidifier to reduce the space humidity. Once the humidity is 5% below the humidity set point, the *AUX1 DEHUM* contacts and the *G* fan contacts are de-energized.

If "ALLOW DE-HUMIDIFICATION WITH ELECTRIC HEAT" was chosen from the installer setup menu, humidity is controlled by the system and uses Stage 2 cooling along with *W1* Electric heat to do it. If the actual humidity rises more than 5% above the humidity set point, The *Y/Y2* compressor contacts, the *G* fan contacts and the *W1* electric heating contacts will be energized. This will command the system to cool while reheat is introduced by electric heat to allow the space to dehumidify while not over cooling. Temperature must not go out of range while dehumidifying. Therefore, the *W1* electric heat contacts are energized when the actual temp reaches the temp set point  $-.75^{\circ}\text{F}$  and are de-energized when the actual temp reaches the set point  $+.75^{\circ}\text{F}$ . This modulation will continue until the humidity reaches the humidity set point  $-5\%$  AND the temperature is within  $.5^{\circ}\text{F}$  of the temperature set point.

Hard parameters need to keep the system from "Running away" in the event of a mechanical failure or lack of heating capacity provided by the electric heat. When/if the actual temp reaches the set point  $-1^{\circ}\text{F}$ , the system will de-energize the *Y/Y2* compressor contacts while maintaining the *W1* electric heat and *G* fan contacts. Once the actual temp reaches the set point temp  $+.5^{\circ}\text{F}$  then the *Y/Y2* compressor contacts can be energized again to commence the modulation.

If the temperature is within  $.5^{\circ}\text{F}$  above or below set point AND the humidity is within 5% above or below set point, the system simply cycles to "idle". The *Y/Y2* compressor contacts, the *G* fan contacts and the *W1* electric heat contacts are all de-energized.

In all operations listed above, the *G* fan contacts will remain energized if the fan control button is in the ON position.

Carbon Dioxide and Carbon Monoxide detection are always active and operate independently/simultaneously with the above sequence.

If the  $\text{CO}_2$  rises above 600ppm the *AUX3 CO2* contacts and the *G* fan contacts are energized to allow for an outside air damper to open, introducing fresh air into the space. Once the  $\text{CO}_2$  reaches 500ppm the *AUX3 CO2* contacts and the *G* fan contacts are de-energized. The *G* fan contacts simply remain energized if the Fan control button is in the ON position.

If the  $\text{CO}$  rises above 70ppm, a HIGH CARBON MONOXIDE WARNING alarm event will de-energize all contacts and put the system in idle mode including

the G fan contacts. This should command a "Push Notification" to the user and will present an on-screen alarm warning. Once CO falls below 40ppm, the system may return to the modes required to maintain space comfort as outlined above while indicating an alarm event has taken place. A record of alarm events should be available in a diagnostic screen.

The Following Sequence of operation is used **IF** 2 stage heating compressor is selected in the setup menu selections.

Sequence of operation (3.1) Main control buttons set to **Fan AUTO/ON** and **System HEAT**. (This is 1<sup>st</sup> Stage Compressor Heating).

The thermostat monitors the actual temp inside the space and compares it to the set point selected by the user. Should the actual temperature fall below the set point by .5deg F, the Y1 compressor contacts and the G fan contacts, will be energized allowing the system to Heat. When the actual temp rises above the set point by .5deg F then both contacts will be de-energized, and system will go back to idle. (Assuming humidity is in range). This small temp offset from set point prevents the system from short cycling while still maintaining close control of the desired temp. Once the contacts are de-energized a short minimum off timer begins a countdown to prevent mechanical short cycling. (Timer set in Setup menu)

Two conditions will cause the system to energize the 2<sup>nd</sup> Stage Heating. The first is if the actual Temperature is >1deg F below the set point. The other is if the 1<sup>st</sup> stage runs >10minutes without reaching set point.

Sequence of operation (3.2) Main control buttons set to **Fan AUTO/ON** and **System HEAT**. (This is 2<sup>nd</sup> Stage Compressor Heating).

The thermostat monitors the actual temp inside the space and compares it to the set point selected by the user. Should the actual temperature fall below the set point by >1deg F, the 1<sup>st</sup> Stage Y1 compressor and the G fan contacts, will remain energized. Additionally, the 2<sup>nd</sup> Stage Y/Y2 contacts will be energized allowing the system to Heat in Stage 2. When the actual temp rises above the set point by .5deg F, only then will the 1<sup>st</sup> Stage Y1, the 2<sup>nd</sup> Stage Y/Y2 and G Fan contacts be de-energized, and system will go back to idle. (Assuming humidity is in range). This small temp offset from set point

prevents the system from short cycling while still maintaining close control of the desired temp. Once the contacts are de-energized a short minimum off timer begins a countdown to prevent mechanical short cycling. (Timer set in Setup menu)

There are two conditions that would require the addition of the *W1* electric heat while heating with the heat pump. First, if the actual temp is > 1.5 deg below the set point. And the other is extended heating run time. In either case the *Y/Y2* Contacts, the *G* fan Contacts and the *W1* electric heat contacts are energized to allow for 2<sup>nd</sup> Stage heat pump AND supplemental electric heat to operate simultaneously. If the 2<sup>nd</sup> Stage heating run time duration exceeds 10 minutes, this sequence would be initiated. System would return to idle once the actual temp reached the set point +.5deg F.

If "ALLOW DE-HUMIDIFICATION WHILE HEATING" was chosen from the installer setup menu, humidity is controlled in this mode as well. If the actual humidity rises more than 10% above the humidity set point, The *Y/Y2* compressor contacts, the *G* fan contacts, the *O/B* reversing valve contacts, and the *W1* electric heating contacts will be energized. This will command the system to cool while reheat is introduced by electric heat to allow the space to dehumidify. Temperature must not go out of range while dehumidifying. Therefore, the *W1* electric heat contacts are energized when the actual temp reaches the temp set point -.75deg F and are de-energized when the actual temp reaches the set point +.75deg F. This modulation will continue until the humidity reaches the humidity set point -5% AND the temperature is within .5 deg F of the temperature set point.

Hard parameters need to keep the system from "Running away" in the event of a mechanical failure or lack of heating capacity. When/if the actual temp reaches the set point -1deg F, the system will de-energize the *O/B* reversing valve contacts while maintaining the *W1* electric heat and *G* fan contacts. Once the actual temp reaches the set point temp +.75deg F then the *O/B* reversing valve contacts can be energized again to commence the modulation.

If the temperature is within .5deg F above or below set point AND the humidity is within 5% set point, the system simply cycles to "idle".

The *Y/Y2* compressor contacts, the *G* fan contacts, the *O/B* reversing valve contacts and the *W1* electric heat contacts are all de-energized. The *G* fan contacts will remain energized if the fan control button is in the ON position. If "HUMIDIFIER" was chosen from installer setup menu, a humidifier can be turned on from this mode. If the actual humidity is 8% below the humidity set point, the *G* fan contacts and the *AUX1* Hum contacts are energized to allow a humidifier to increase space humidity. Once Actual humidity is 5%

above humidity set point, the *AUX1* Hum contacts and the *G* fan contacts are de-energized. The *G* fan contacts will remain energized if the fan control button is in the ON position.

Carbon Dioxide and Carbon Monoxide detection are always active and operate independently/simultaneously with the above sequence.

If the CO<sub>2</sub> rises above 600ppm the *AUX1* CO<sub>2</sub> contacts and the *G* fan contacts are energized to allow for an outside air damper to open, introducing fresh air into the space. Once the CO<sub>2</sub> reaches 500ppm the *AUX1* CO<sub>2</sub> contacts and the *G* fan contacts are de-energized. The *G* fan contacts simply remain energized if one of the above conditions are driving the fan contacts to the energized position.

If the CO rises above 70 ppm, a HIGH CARBON MONOXIDE WARNING alarm event will de-energize all contacts and put the system in idle mode including the *G* fan contacts. This should command a "Push Notification" to the user and will present an on-screen alarm warning. Once CO falls below 40 ppm, the system may return to the modes required to maintain space comfort as outlined above.