INSTALLATION INSTRUCTIONS

SINGLE STAGE HEAT PUMPS
LOW VOLTAGE
CONTROL CIRCUIT WIRING

MODELS

W**H  W**H*D
S**H  S**H*D
T**H  T**H*D
**TABLE 1**
**DIAGRAM TO USE WITH UNIT AND VENTS**

<table>
<thead>
<tr>
<th>System</th>
<th>Vent</th>
<th>None</th>
<th>CRV, ERV, MFAD</th>
<th>CRVMWH-3</th>
<th>EIFM Economizer</th>
<th>ECONWM*</th>
<th>CS2000A*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vent Code</td>
<td>X</td>
<td>R, M, V, P</td>
<td>C</td>
<td>E</td>
<td>T, W, S</td>
<td></td>
</tr>
<tr>
<td>Thermostat</td>
<td>Programmable</td>
<td>Programmable</td>
<td>Programmable</td>
<td>Programmable</td>
<td>Programmable</td>
<td>Programmable</td>
<td>All</td>
</tr>
<tr>
<td>Model Series</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Heat Pump S<strong>H</strong></td>
<td>T<strong>H</strong></td>
<td>W<strong>H</strong></td>
<td>1</td>
<td>1</td>
<td>3 &amp; 4</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Heat Pump with Dehumidification S**H*D</td>
<td>T**H*D</td>
<td>W**H*D</td>
<td>7</td>
<td>6</td>
<td>9 &amp; 10</td>
<td>8</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**WIRING – LOW VOLTAGE WIRING**

230/208V, 1 phase and 3 phase equipment dual primary voltage transformers. All equipment leaves the factory wired on 240V tap. For 208V operation, reconnect from 240V to 208V tap. The acceptable operating voltage range for the 240V and 208V taps are:

**TABLE 2**
**OPERATING VOLTAGE RANGE**

<table>
<thead>
<tr>
<th>TAP</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>240V</td>
<td>253 – 216</td>
</tr>
<tr>
<td>208V</td>
<td>220 – 187</td>
</tr>
</tbody>
</table>

**NOTE:** The voltage should be measured at the field power connection point in the unit and while the unit is operating at full load (maximum amperage operating condition).

An 18 gauge copper, color-coded thermostat cable is recommended. The connection points are shown in this Manual. See Table above.

**Low Voltage Connection**

These units use a grounded 24-volt AC low voltage circuit.

The “R” terminal is the **hot** terminal and the “C” terminal is **grounded**.

“G” terminal is the **fan input**.

“Y” terminal is the **compressor input**.

“B” terminal is the **reversing valve input**. The reversing valve must be energized for heating mode.

“R” terminal is the **24 VAC hot**.

“C” terminal is the **24 VAC grounded**.

“L” terminal is **compressor lockout output**. This terminal is activated on a high or low pressure trip by the electronic heat pump control. This is a 24 VAC output.

“W2” terminal is **second stage heat** (if equipped).

“O1” terminal is the **ventilation input**. This terminal energizes any factory installed ventilation option.

“E” terminal is the **emergency heat input**. This terminal energizes the emergency heat relay.

“W3” terminal is the **dehumidification input**. This terminal energizes compressor, blower and three-way valve.

**LOW VOLTAGE CONNECTIONS**
**FOR DDC CONTROL**

- Fan Only: Energize G
- Cooling Mode: Energize Y, G
- 2nd Stage Heating w/Heat Pump (if employed): Energize G, W2, Y, B
- Ventilation: Energize G, O1
- Emergency Heat: Energize B, W2, E, G
- Dehumidification: Energize W3

**TABLE 3**
**WALL THERMOSTAT**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Predominate Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>8403-058 (TH5220D1151)</td>
<td>2 stage Cool, 2 stage Heat - Conventional, Electronic Non- Programmable Auto or Manual changeover</td>
</tr>
<tr>
<td>8403-060 (1120-445)</td>
<td>3 stage Cool; 3 stage Heat Programmable/Non-Programmable Electronic HP or Conventional Auto or Manual changeover Dehumidification Output</td>
</tr>
</tbody>
</table>
### TABLE 4
**HUMIDITY CONTROLS**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Predominate Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>8403-038</td>
<td>SPDT switching, pilot duty 50VA @ 24V</td>
</tr>
<tr>
<td>(H600A1014)</td>
<td>Humidity range 20-80% RH</td>
</tr>
<tr>
<td>8403-047</td>
<td>Electronic dehumidistat SPST closes-on-rise</td>
</tr>
<tr>
<td>(H200-10-21-10)</td>
<td>Humidity range 10-90% with adjustable stops</td>
</tr>
</tbody>
</table>

### TABLE 5
**CO2 CONTROLLER**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Predominate Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>8403-067</td>
<td>Normally Open SPST relay closes-on-rise</td>
</tr>
<tr>
<td></td>
<td>24V dual wave length sensor. Default setting 950ppm, adjustable to 0-2000ppm</td>
</tr>
<tr>
<td></td>
<td>Default off setting 1000ppm., adjustable to 0-200 ppm can be calibrated</td>
</tr>
</tbody>
</table>

### TABLE 6
**THERMOSTAT WIRE SIZE**

<table>
<thead>
<tr>
<th>Transformer VA</th>
<th>FLA</th>
<th>Wire Gauge</th>
<th>Maximum Distance In Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>2.3</td>
<td>20 gauge</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 gauge</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 gauge</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 gauge</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 gauge</td>
<td>250</td>
</tr>
</tbody>
</table>
FIGURE 1
BASIC HEAT PUMP WITH OPTIONAL ELECTRIC HEAT
NO ECONOMIZER or VENTILATION PACKAGES

Low Voltage Wiring Diagram

Thermostat
#TH5220D1151
Bard part #8403-058

Thermostat
Bard part #8403-060

24V Low Voltage
Terminal Block

C G R Y W1 W2 W3 E L DH O1

1 Stage Cool
2 Stage Heat

L" is constant 24V output when
thermostat is in Em Heat mode

Electronic
Programmable

MIS-2645 C

Factory Jumper Installed

Manual 2100-516H
Page 5 of 19
FIGURE 2
HEAT PUMP WITH OPTIONAL MFAD, CRV & ERV
VENTILATION PACKAGING WITH PROGRAMMABLE THERMOSTAT (RECOMMENDED)

Low Voltage Wiring Diagram

Thermostat
Bard part #8403-060

Electronic Programmable

Optional CO₂ Controller
Bard part #8403-067

24V Low Voltage Terminal Block

1. Factory Jumper Installed
2. Do not connect “A” from tstat #8403-060 if optional CO₂ controller is used.
3. Connect orange wire to “G” only if optional CO₂ controller is used.
4. Must be configured to programmable and fan set to programmed for the “A” output to function during scheduled occupied periods

Red
Orange
Black
Brown/White
Red

MFAD
CRV
ERV
Ventilation Packages

MIS-2633 C
FIGURE 3
HEAT PUMP WITH OPTIONAL MFAD, CRV and ERV VENTILATION
PACKAGING WITH NON-PROGRAMMABLE THERMOSTAT (NO OCCUPIED SIGNAL)

Low Voltage Wiring Diagram

Thermostat
#TH5220D1151
Bard part #8403-058

1 Stage Cool
2 Stage Heat

"L" is constant 24V output when thermostat is in Em Heat mode

24V Low Voltage Terminal Block

MIS-2646 C

Add jumper, ventilation will be active whenever blower operates.

Do not connect orange wire.
FIGURE 4
HEAT PUMP WITH OPTIONAL MFAD, CRV and ERV VENTILATION PACKAGING WITH NON-PROGRAMMABLE THERMOSTAT WITH CO₂ CONTROLLER

Low Voltage Wiring Diagram

- Factory Jumper Installed
- Connect orange wire to "G" only if optional CO₂ controller is used.

Thermostat
#TH5220D1151
Bard part #8403-058

24V Low Voltage Terminal Block

1 Stage Cool
2 Stage Heat

Optional CO₂ Controller
Bard part #8403-067

"L" is constant 24V output when thermostat is in Em Heat mode

MIS-2634 E
FIGURE 5
HEAT PUMP WITH OPTIONAL EIFM ECONOMIZER
“E” VENT OPTION

Low Voltage Wiring Diagram

- Thermostat
  Bard part #8403-060

- 2 Stage Cool
- 2 Stage Heat

24V Low Voltage Terminal Block


- Unit

- Wiring Harness
  MIS-2648 C

- Industrial Jumper Installed.
- Must be configured for economizer with YO/D output to be active as first stage cooling.
- These wires are used in special control applications only.
FIGURE 6
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE AND NO VENTILATION PACKAGE
USING THERMOSTAT #8403-060 COMBINATION TEMPERATURE & HUMIDITY CONTROLLER

Low Voltage Wiring Diagram

Thermostat
Bard part #8403-060

MIS-2636 A

24V Low Voltage Terminal Block

Unit

Electronic Programmable

Factory Jumper Installed.

Must be configured for "No economizer" for YO/D to be active for humidity control

Manual  2100-516H
Page  10 of 19
FIGURE 7
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE
WITH NON-PROGRAMMABLE THERMOSTAT

Low Voltage Wiring Diagram

1 Stage Cool
2 Stage Heat

"L" is constant 24V output when thermostat is in Em Heat mode

1 Factory Jumper Installed.
2 Jumper needs to be added.
FIGURE 8
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION PACKAGING USING ELECTRONIC THERMOSTAT WITH COMBINATION TEMPERATURE & HUMIDITY CONTROL WITH OPTIONAL CO2 CONTROLLER

Low Voltage Wiring Diagram

Thermostat
Bard part #8403-060

2 Stage
Cool
2 Stage
Heat

Optional CO2 Controller
Bard part #8403-067

Unit

24V Low Voltage Terminal Block

Factory Jumper Installed
MIS-2637 C

Must be configured to "no economizer" to make YO/D output active for humidity control. Must be configured to programmable and fan set to programmed fan for the "A" output to function during scheduled occupied periods.

Do not connect "A" from thermostat if optional CO2 controller is used. Connect orange wire to "G" only when optional CO2 controller is used.
FIGURE 9
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION PACKAGING USING A NON-PROGRAMMABLE THERMOSTAT (NO OCCUPIED SIGNAL)

Low Voltage Wiring Diagram

1 Stage Cool
2 Stage Heat

"L" is constant 24V output when thermostat is in Em Heat mode

Factory Jumper Installed.
Add jumper, ventilation will be active whenever blower operates.
Jumper needs to be added.
Orange wire is not connected.

终端

Thermostat
Bard part #8403-058

24V Low Voltage Terminal Block

Electronic Humidistat
Bard part #8403-047

Mechanical Humidistat
Bard part #8403-038

MIS-2638 C
FIGURE 10
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION PACKAGING USING A NON-PROGRAMMABLE THERMOSTAT WITH CO2 CONTROLLER

Low Voltage Wiring Diagram

1 Stage
Cool
2 Stage
Heat

Thermostat
#TH5220D1151
Bard part #8403-058

24V Low Voltage
Terminal Block

Electronic Humidistat
Bard part #8403-047

Mechanical Humidistat
Bard part #8403-038

1. Factory Jumper Installed.
2. Jumper needs to be added.
3. Connect Orange wire to "G".

"L" is constant 24V output when thermostat is in Em Heat mode

MIS-2639 E
FIGURE 11
HEAT PUMP WITH CS2000A2

WH/SH HEAT PUMP CONNECTION DIAGRAM

RECOMMENDED SWITCH SETTINGS SHOWN BELOW

<table>
<thead>
<tr>
<th>FUNCTION SWITCHES</th>
<th>TEMPERATURE SWITCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARN</td>
<td>90</td>
</tr>
<tr>
<td>PRE P</td>
<td>84</td>
</tr>
<tr>
<td>MODE</td>
<td>81</td>
</tr>
<tr>
<td>RATE</td>
<td>78</td>
</tr>
<tr>
<td>SEARCH-TIME</td>
<td>68</td>
</tr>
<tr>
<td>N/C</td>
<td>65</td>
</tr>
<tr>
<td>STAGE</td>
<td>62</td>
</tr>
<tr>
<td>AUX</td>
<td>58</td>
</tr>
<tr>
<td>DEMAND 2</td>
<td>54</td>
</tr>
<tr>
<td>DEMAND 1</td>
<td>48</td>
</tr>
</tbody>
</table>
**ELECTRICAL SHOCK HAZARD**
*DISCONNECT POWER BEFORE SERVICING.*

Thermostat Part #8403-060*

DANGER

*RELAYS AND ASSOCIATED WIRING ARE FIELD INSTALLED.*

*Thermostat Model Configuration Notes:
1.) Configured for "Heat Pump"
2.) Configured for "Multi-Stage"
3.) Configured for "No Economizer"
4.) Configured CS2000A Attached = NO

4200-001 B
FIGURE 13
1-STAGE HEAT PUMP WITH OPTIONAL ELECTRIC HEAT
WITH OR WITHOUT DEHUMIDIFICATION
WITH ECONWM* STYLE ECONOMIZER
“W” OR “T” VENT OPTION

Low Voltage Wiring Diagram

Thermostat
part #8403-060

24V Low Voltage Terminal Block

Economizer Wiring Harness

1. Must be energized to enable minimum position. NOTE: Economizer Control Default Setting is 10V (100%). Depending upon application may require setting to lower value.

2. Must be configured for heat pump / multistage/ no economizer/ to enable YO/D output to be active as dehumidification output

3. Factory Jumper Installed.

MIS-2981 B
FIGURE 14
HEAT PUMP WITH OPTIONAL CRVMWH-3 OR CHCRV-5
VENTILATION PACKAGING WITH PROGRAMMABLE THERMOSTAT (RECOMMENDED)

Low Voltage Wiring Diagram

- Thermostat: Bard part #8403-060
- Electronic Programmable
- Optional CO2 Controller: Bard part #8403-067
- Ventilation Package: CHCRV-5 OR CRVMWH-3

Wiring Instructions:
1. Factory Jumper Installed
2. Do not connect "A" from tstat #8403-060 if optional CO2 controller is used.
3. Wire only needed for dehumidification units
4. Must be configured to programmable and fan set to programmed for the "A" output to function during scheduled occupied periods

Manual 2100-516H
Page 18 of 19
FIGURE 15
HEAT PUMP WITH OPTIONAL CRVMWH-3 OR CHCRV-5 VENTILATION PACKAGING WITH NON-PROGRAMMABLE THERMOSTAT (NO OCCUPIED SIGNAL)

Low Voltage Wiring Diagram

Thermostat #TH5220D1151
Bard part #8403-058

1 Stage Cool
2 Stage Heat

24V Low Voltage Terminal Block
C G R Y E AUX O/B L

Unit

CHCRV-5 OR CRVMWH-3 Ventilation Package

Factory Jumper Installed
Add jumper, ventilation will be active whenever blower operates.