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# INSTALLATION INSTRUCTIONS

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## LOW VOLTAGE CONTROL CIRCUIT WIRING

### MODELS

**W\*\*H**

**W\*\*H\*D**

**S\*\*H**

**S\*\*H\*D**



Bard Manufacturing Company, Inc.  
Bryan, Ohio 43506

*Since 1914...Moving ahead just as planned.*

Manual : 2100-516C  
Supersedes: 2100-516B  
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**TABLE 1  
DIAGRAM TO USE WITH UNIT AND VENTS**

System Type	Model Series	No Vents		MFAD, CRV or ERV		Economizer		CS2000A*
		Electronic	Programmable	Electronic	Programmable	Electronic	Programmable	All
Heat Pump	W**H S**H	1	1	3 & 4	2	N/A	5	11
Heat Pump w/Dehumidification Sequence	W**H*D S**H*D	7	6	9 & 10	8	N/A	12	N/A

**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**

TAP	RANGE
240V	253 – 216
208V	220 – 187

*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
Heat Pump Heating	Energize Y, G, B
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**

Part Number	Predominate Features
8403-058 (TH5220D1151)	2 stage Cool, 2 stage Heat - Conventional 1 stage Cool, 2 stage Heat - Heat Pump Electronic Non-Programmable Auto or Manual changeover
8403-060 (1120-445)	3 stage Cool; 3 stage Heat Programmable/Non-Programmable Electronic HP or Conventional Auto or Manual changeover Dehumidification Output

**TABLE 4  
HUMIDITY CONTROLS**

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

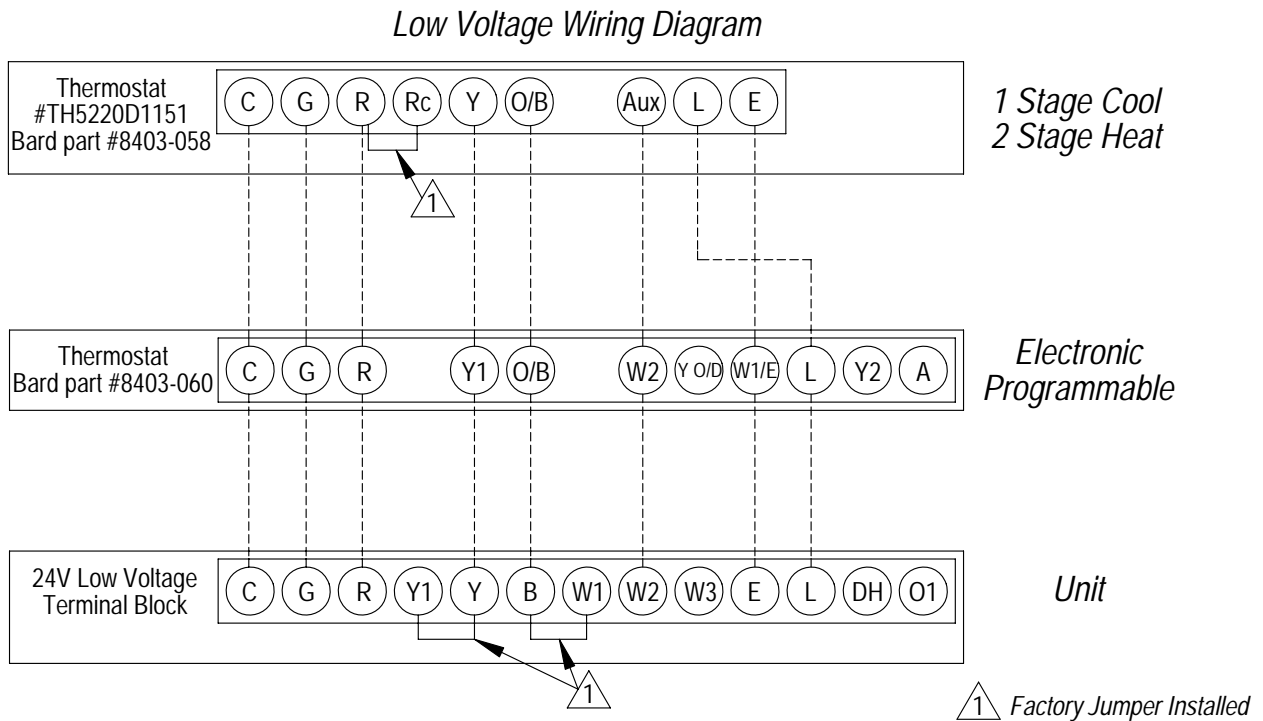
**TABLE 5  
CO2 CONTROLLER**

<b>Part Number</b>	<b>Predominate Features</b>
8403-056 (C7232A1008)	Normally Open SPST relay closes-on-rise 24V with automatic background calibration Default setting is 800ppm, adjustable to 1000 or 1200, on-off differential is 100ppm 0-2000ppm range, with display

**TABLE 6  
THERMOSTAT WIRE SIZE**

<b>Transformer VA</b>	<b>FLA</b>	<b>Wire Gauge</b>	<b>Maximum Distance In Feet</b>
55	2.3	20 gauge	45
		18 gauge	60
		16 gauge	100
		14 gauge	160
		12 gauge	250

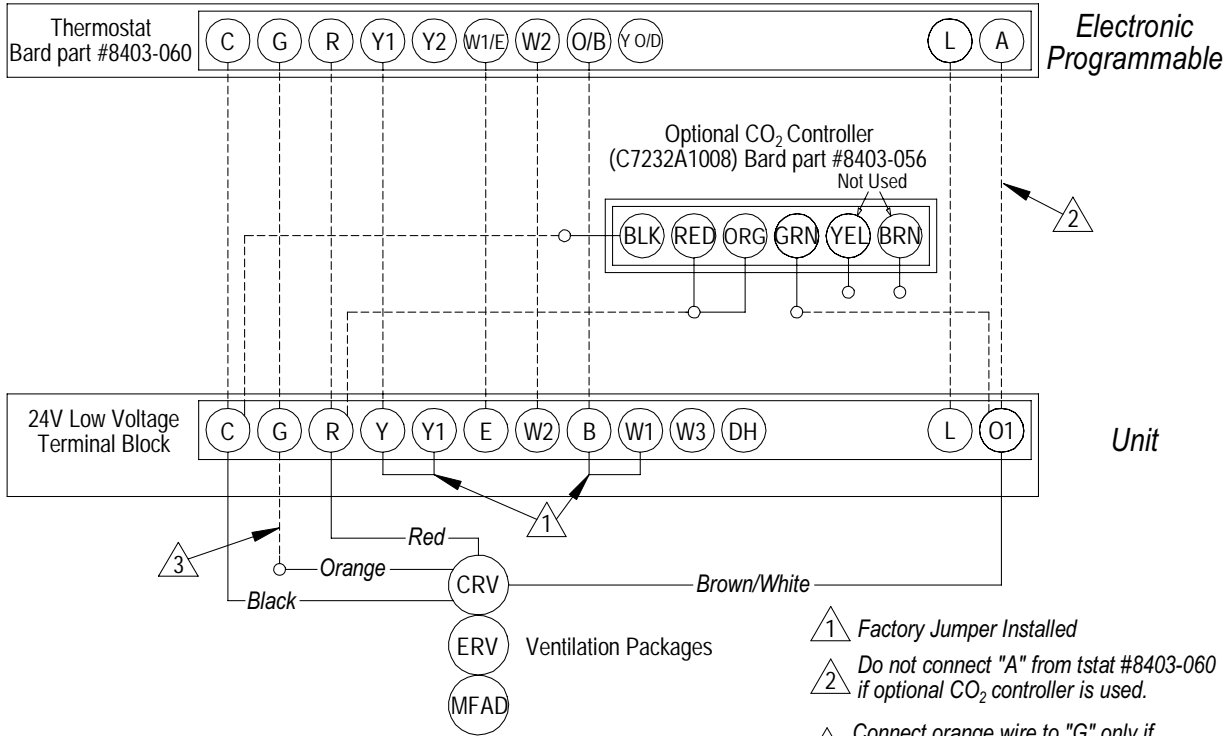
**FIGURE 1**  
**BASIC HEAT PUMP WITH OPTIONAL ELECTRIC HEAT**  
**NO ECONOMIZER or VENTILATION PACKAGES**



MIS-2645 B

**FIGURE 2**  
**HEAT PUMP WITH OPTIONAL MFAD, CRV & ERV**  
**VENTILATION PACKAGING WITH PROGRAMMABLE THERMOSTAT (RECOMMENDED)**

*Low Voltage Wiring Diagram*

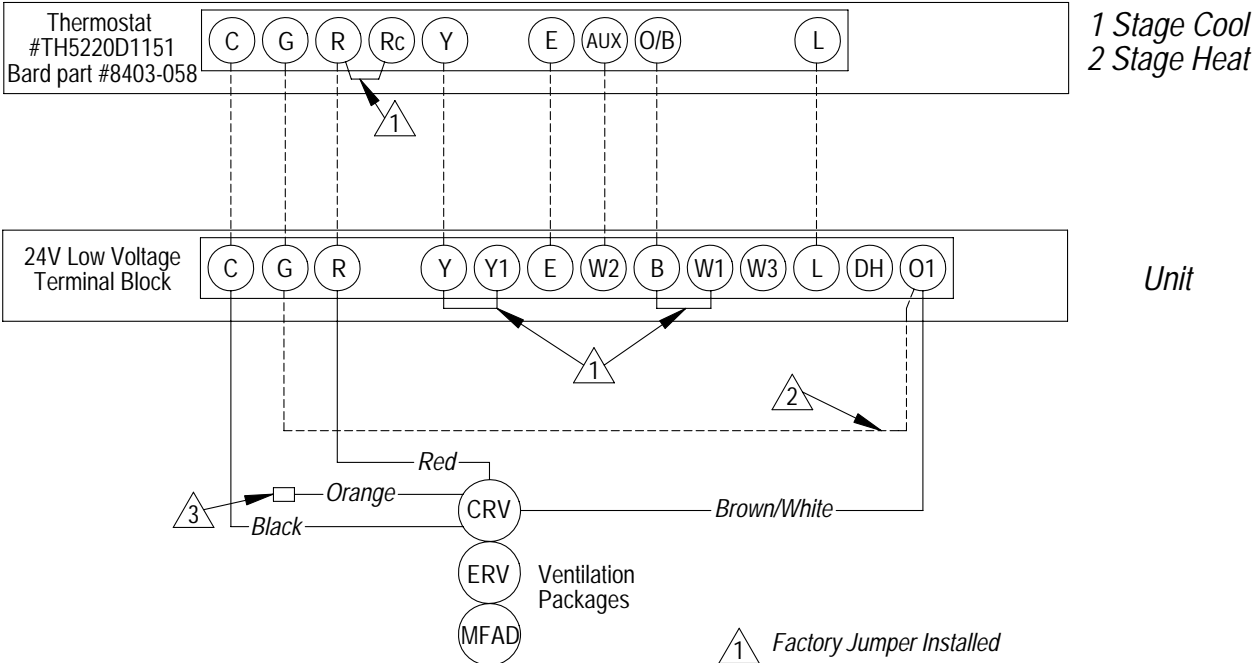


MIS-2633

- △1 Factory Jumper Installed
- △2 Do not connect "A" from tstat #8403-060 if optional CO<sub>2</sub> controller is used.
- △3 Connect orange wire to "G" only if optional CO<sub>2</sub> controller is used.




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

*Low Voltage Wiring Diagram*



*1 Stage Cool  
2 Stage Heat*

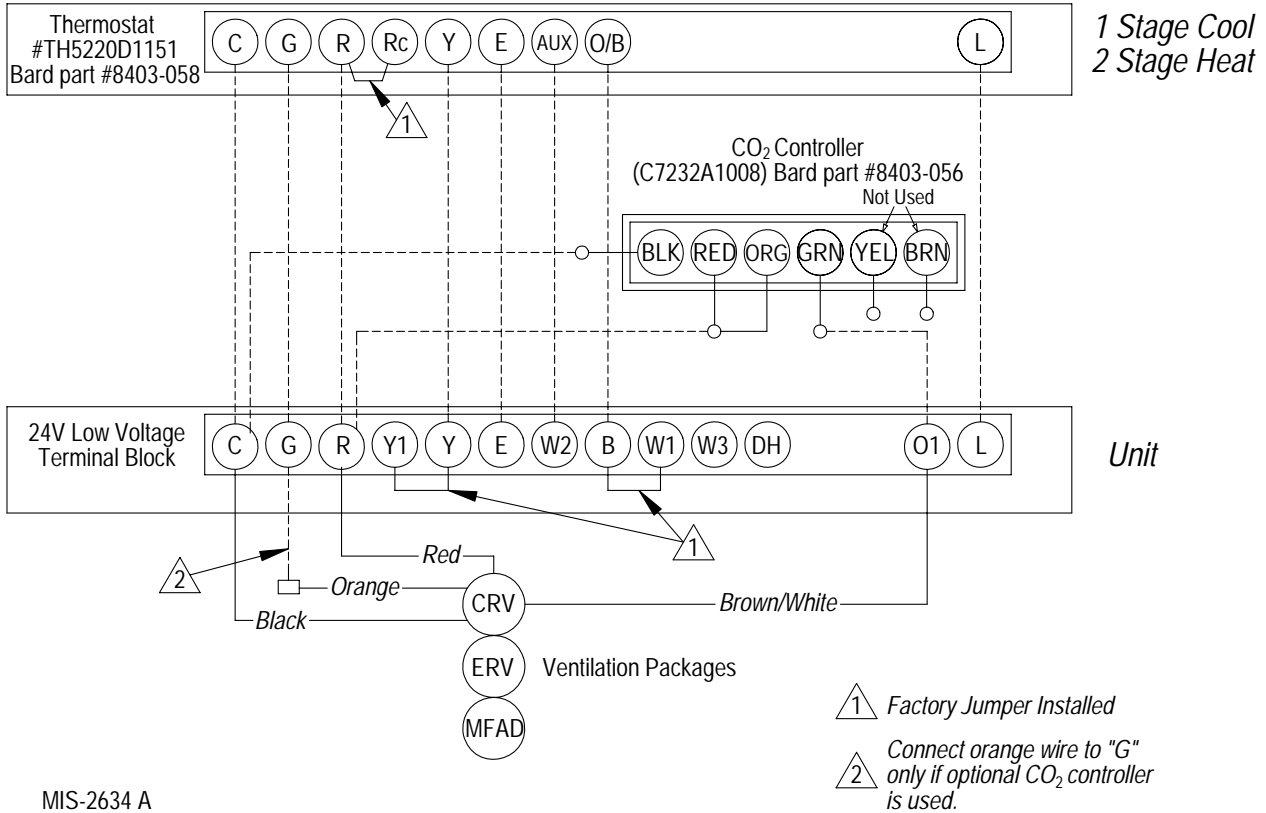
*Unit*

-  *Factory Jumper Installed*
-  *Add jumper, ventilation will be active whenever blower operates.*
-  *Do not connect orange wire.*

MIS-2646 A

**FIGURE 4**  
**HEAT PUMP WITH OPTIONAL MFAD, CRV and ERV VENTILATION**  
**PACKAGING WITH NON-PROGRAMMABLE THERMOSTAT WITH CO2 CONTROLLER**

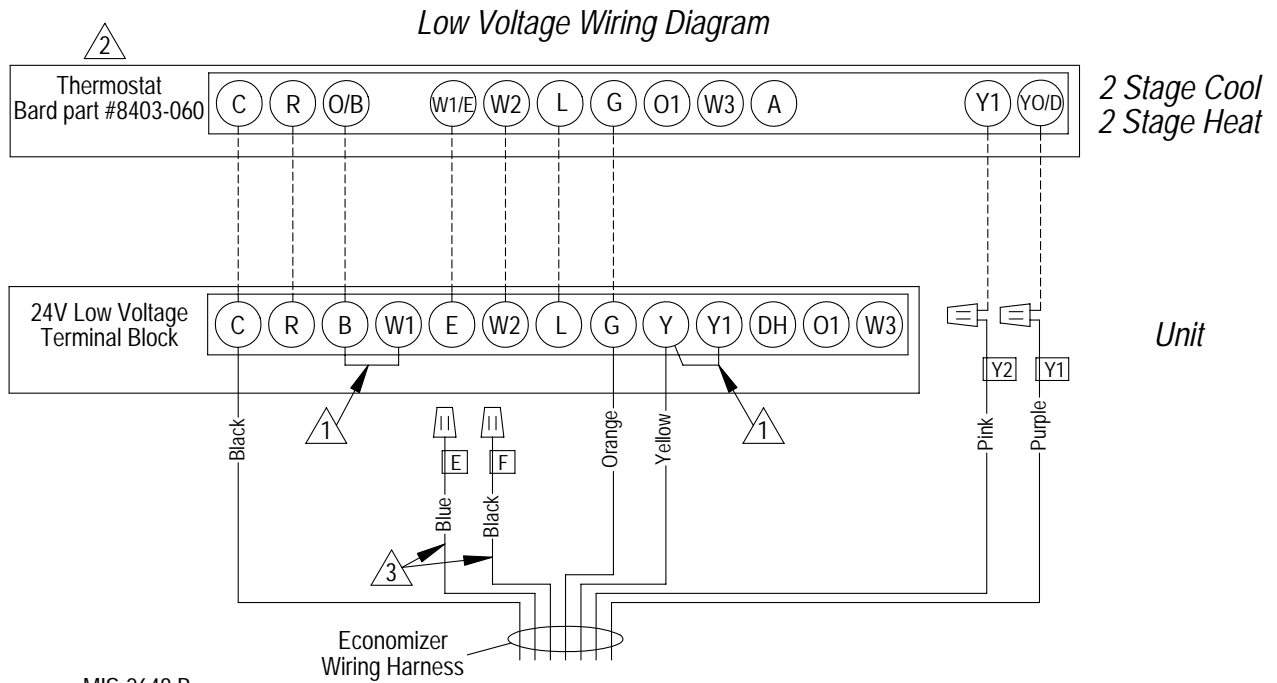
*Low Voltage Wiring Diagram*



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**FIGURE 5  
HEAT PUMP WITH OPTIONAL ECONOMIZER**

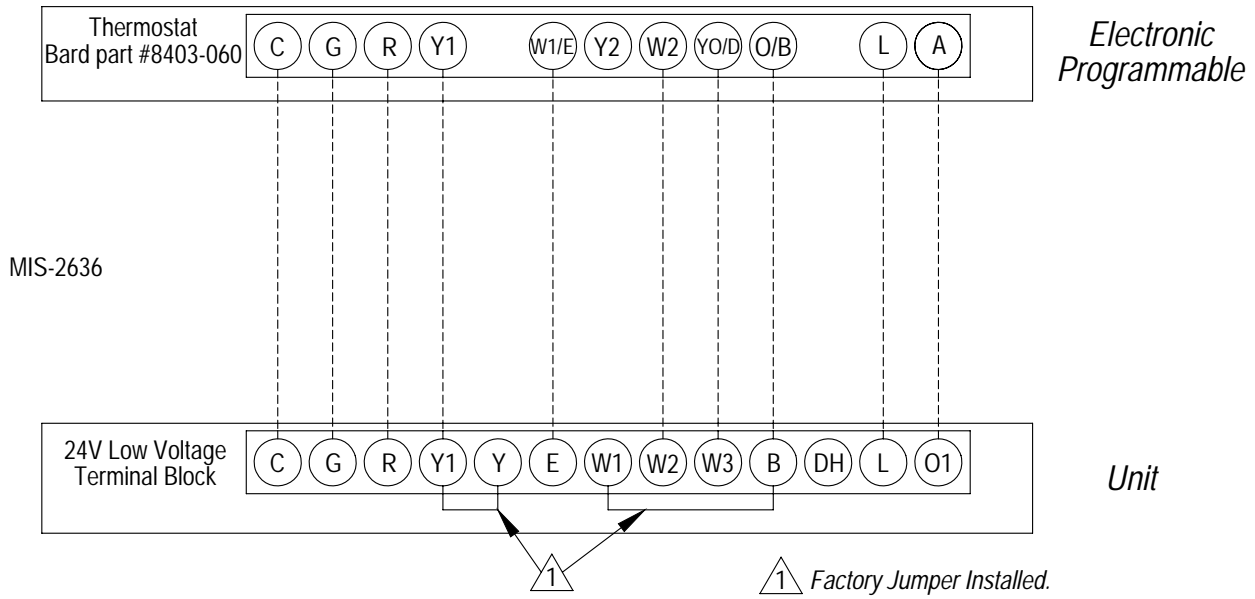


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- 1 Factory Jumper Installed.
- 2 Must be configured for economizer with YO/D output to be active as first stage cooling.
- 3 These wires are used in special control applications only.

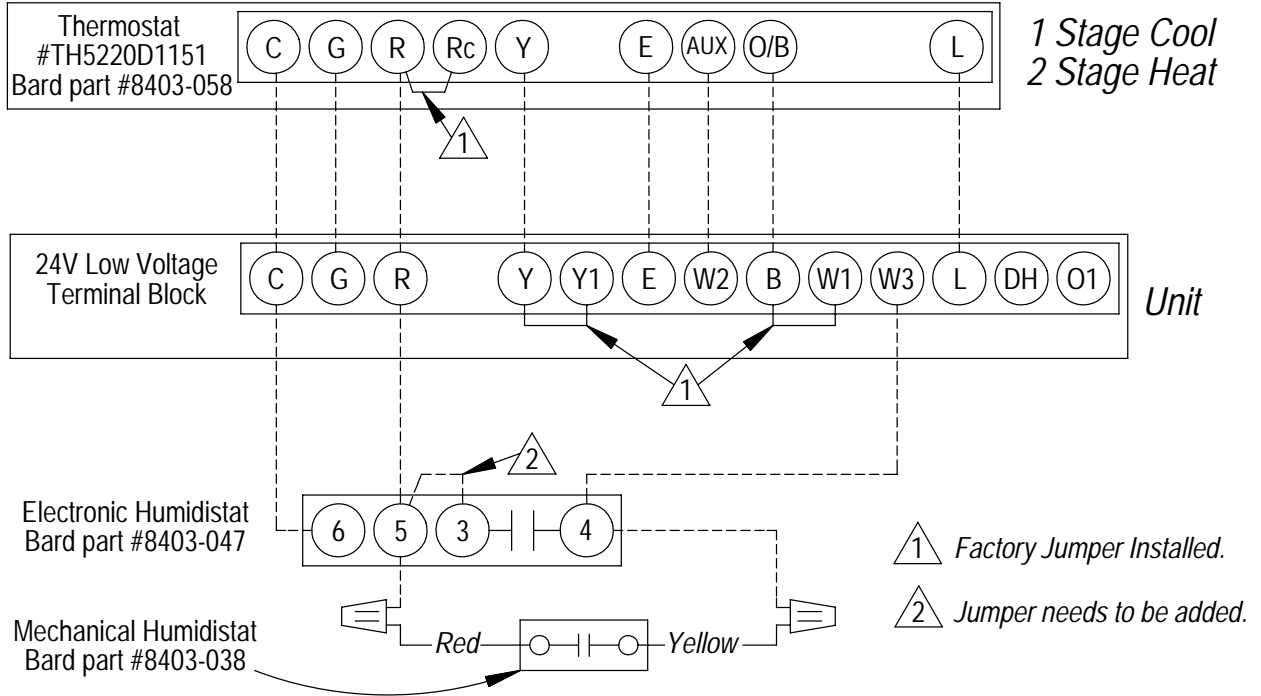
**FIGURE 6**  
**HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE AND NO VENTILATION PACKAGE**  
**USING THERMOSTAT #8403-060 COMBINATION TEMPERATURE & HUMIDITY CONTROLLER**

*Low Voltage Wiring Diagram*



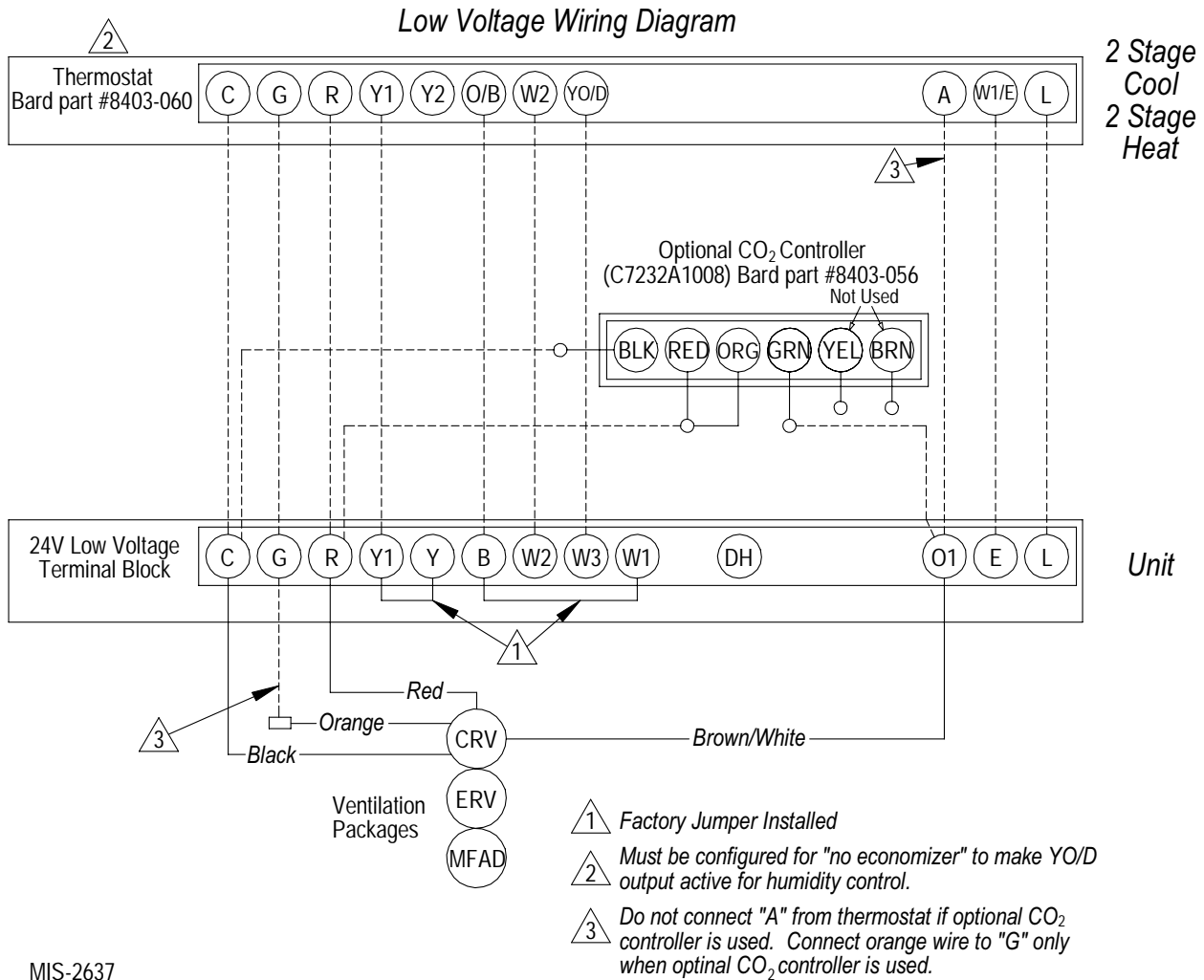
**FIGURE 7  
HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE  
WITH NON-PROGRAMMABLE THERMOSTAT**

*Low Voltage Wiring Diagram*



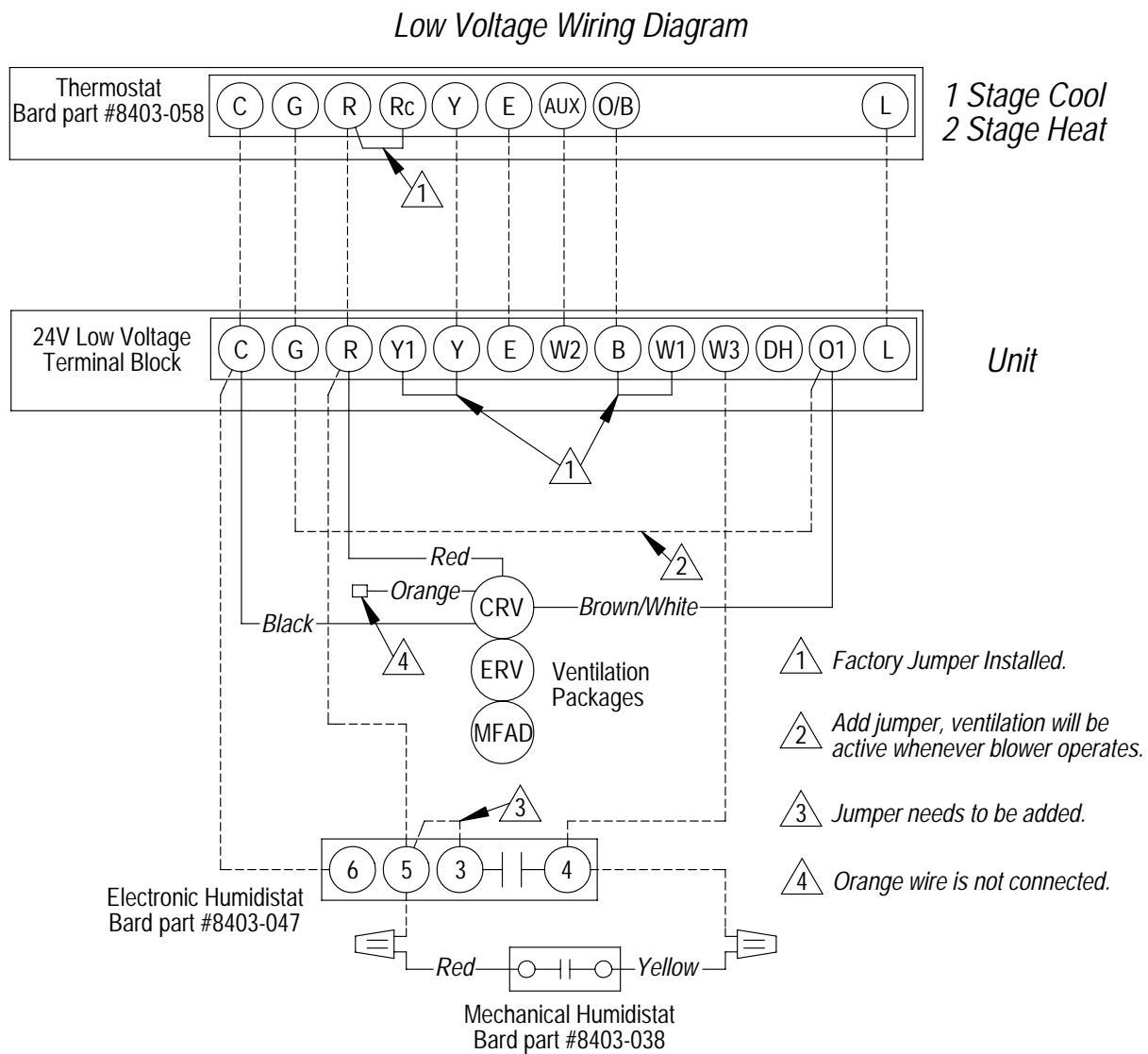
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**FIGURE 8**  
**HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION**  
**PACKAGING USING ELECTRONIC THERMOSTAT WITH COMBINATION TEMPERATURE &**  
**HUMIDITY CONTROL WITH OPTIONAL CO<sub>2</sub> CONTROLLER**



MIS-2637

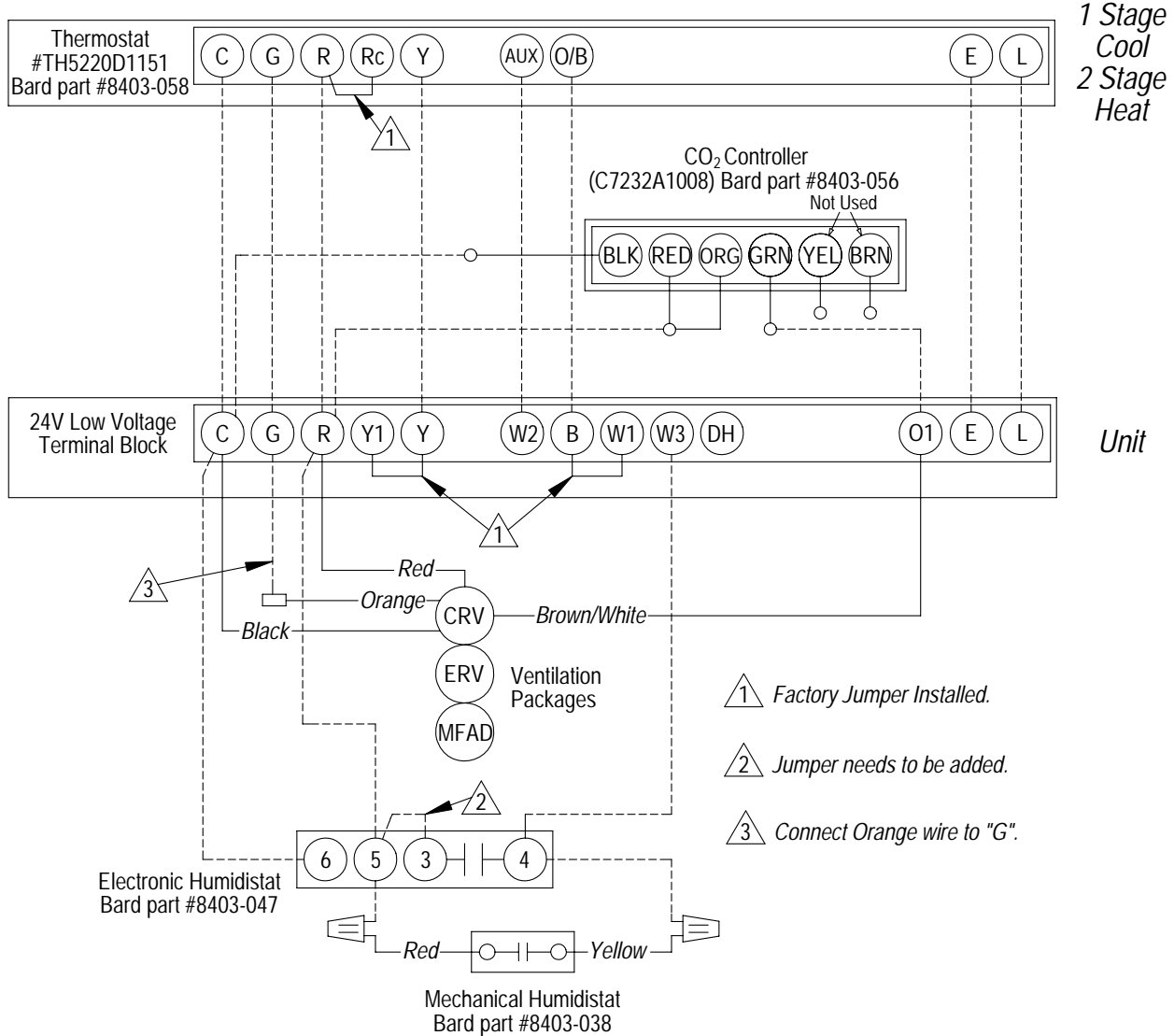
**FIGURE 9**  
**HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION**  
**PACKAGING USING A NON-PROGRAMMABLE THERMOSTAT (NO OCCUPIED SIGNAL)**



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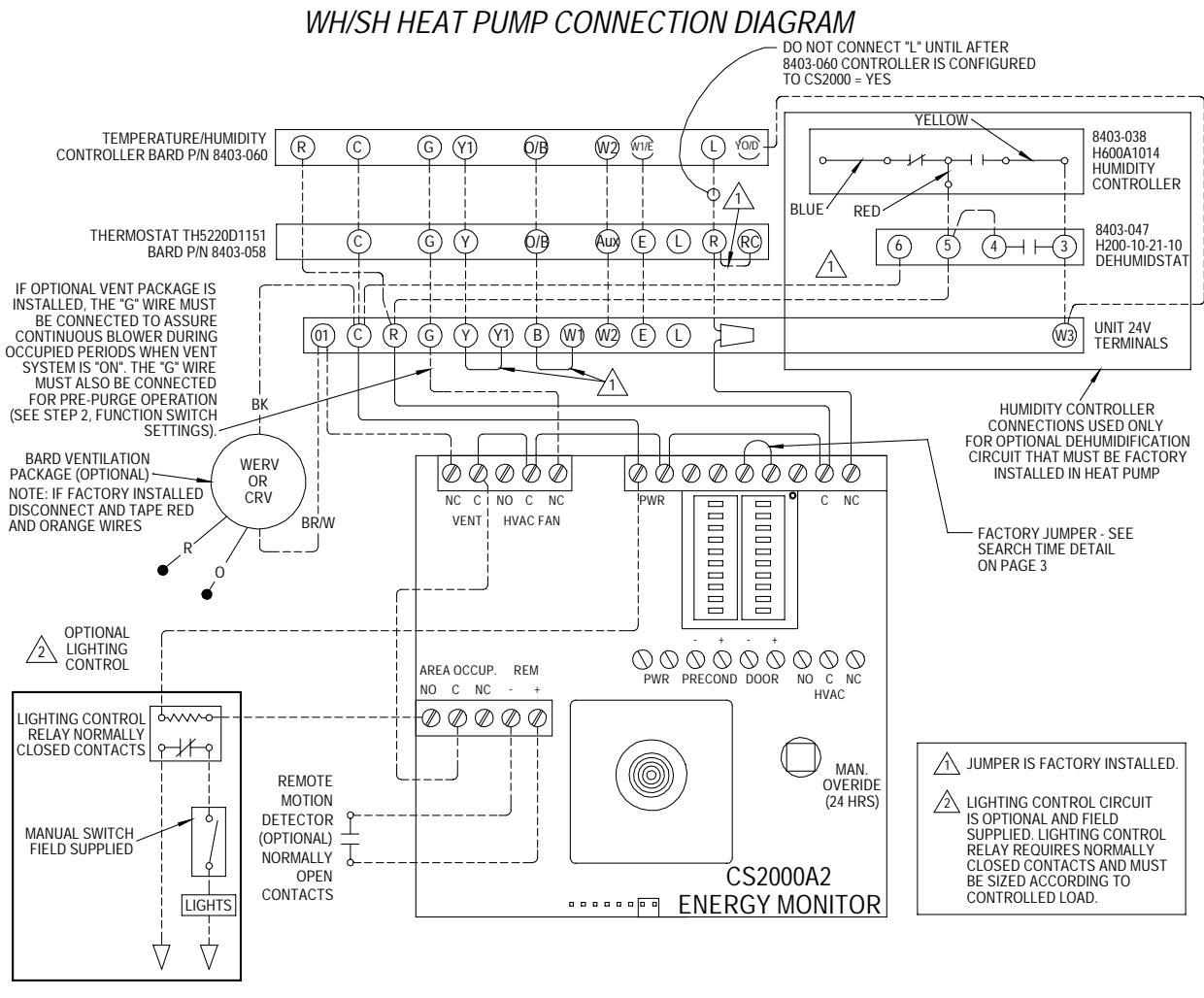
**FIGURE 10**  
**HEAT PUMP WITH DEHUMIDIFICATION SEQUENCE & OPTIONAL MFAD, CRV & ERV VENTILATION**  
**PACKAGING USING A NON-PROGRAMMABLE THERMOSTAT WITH CO2 CONTROLLER**

*Low Voltage Wiring Diagram*



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**FIGURE 11  
HEAT PUMP WITH CS2000A2**

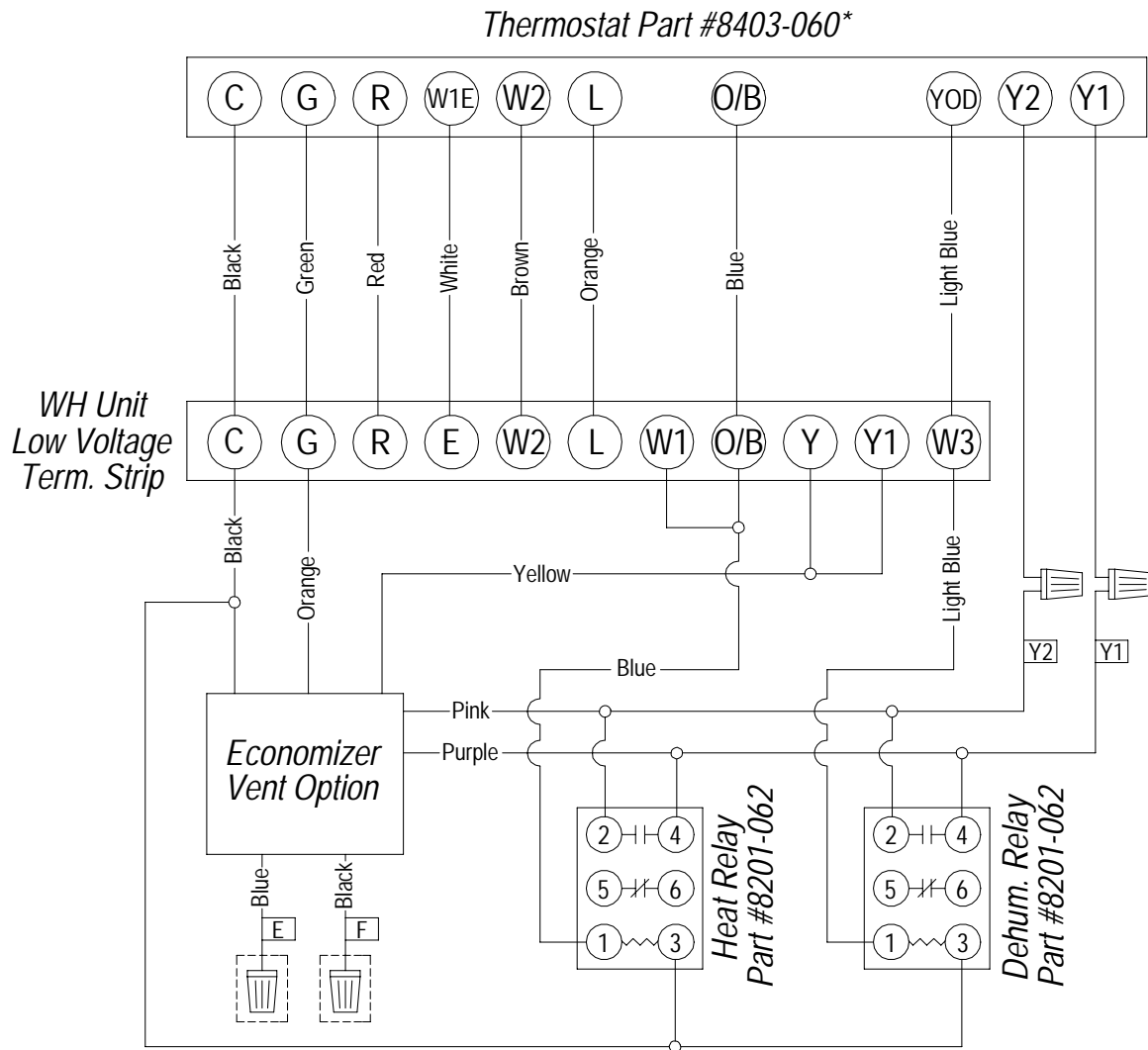


**RECOMMENDED SWITCH SETTINGS SHOWN BELOW**

FUNCTION SWITCHES		TEMPERATURE SWITCHES	
LEARN			90
PRE P			84
MODE			81
RATE			78
SEARCH-TIME			68
N/C			65
STAGE			62
AUX			58
DEMAND 2			54
DEMAND 1			48

4093-140 L

**FIGURE 12**  
**W\*\*H1 DEHUM. WITH ECONOMIZER**  
**& #8403-060 THERMOSTAT**



**⚠ DANGER**  
 \*ELECTRICAL SHOCK HAZARD  
 \*DISCONNECT POWER BEFORE  
 SERVICING.

**\*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 A