

Electro-HELPS VI

Control Board – Connector Definitions

This is an attempt to describe each Electro main control board connector point, pin by pin, by wire color, and function description. The referenced drawings are listed for typical application. There are other drawings but this list represents the majority and most common usage. The **last drawing number** typically is the electronic schematic of the board itself.

The primary intent of this document is hardware and troubleshooting information relating to all connector or access hardware points. The intent of this document is not to provide detailed functioning information for each control, but at times to describe the various tabs and points there is function information herein. Also the majority of the functional sequence relates to the software chip code. This document does not deal with the software or any sequence of events.

Comment: Connector pin 1 is always next to the control board engraved J number. The pins listed below are in the order of importance and diagnostics priority, **not** 1, 2, 3, etc. order on the physical connector itself.

Contents

	<u>Page</u>
<u>Forced Air Equipment</u>	
A. WarmFlo II Main Board (production – 3/01 through 6/04) – 3” x 5-1/4”, 4-stage, larger program chip, 4-pin connector, <i>Analyzer plugs in next to the 4-pin.</i>	3
B. WarmFlo II Main Board (production – 6/04 through present) – 3” x 5-1/4”, 4-stage, larger program chip, 10-pin connector, <i>Analyzer plugs in at the bottom corner.</i>	4
C. WarmFlo Interface Module, 4-wire stat, Heat Pump – WF-EZ3	5
D. WarmFlo Interface Module, 4-wire stat, non-Heat Pump – WF-EM3	7
E. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR3	8
F. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR4 (production 10/05 through 8/06)	10
G. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR4 Rev. A (production 8/06 through present)	12
H. WarmFlo Interface Module, 2-speed Heat Pump – WF-HP2	13
I. WarmFlo+ (WF+) EZ-Mate board – 4-stage, includes EZ3 and EM3 interface functions, must use program chip version 10.**.	16
J. WarmFlo+ (WF+) combo board – 4-stage, includes EZ3 and EM3 interface functions, physically the same as above but must use program chip 12.**.	18
K. WarmFlo+ HP/Gas only – WF-DFHP1	18
L. Power Supply, AC to DC, 5127 Relay	21
M. Relay Board – standard WarmFlo Electro-Mate and older EB-W boilers.	21
N. Electro-Mate DFC – EM-LV, EM-LU, or EM-DU Series	22
O. Electro-Mate Blower Board – EE-5626-*	23
P. HeatChoice Board (production before 3/07) – EH Model Series (or EM-EU or EM-ED)	24
Q. Dual Energy Furnace Board (DEC) – HD-D-** Series, non-WarmFlo.	25

Contents (continued)

R. Dual Energy Furnace Board (WF II) – HD-W-** Series, same as basic WarmFlo main board (WF II) and WF-EZ3 interface module, packaged as one unit within the furnace top panel.	27
S. WarmFlo, Comfort Module, Make-Up Air – EM-WC-** Series, warm air (ST) sensing only, one stage applications.	27
T. WarmFlo, Comfort Module, Make-Up Air – EM-WC-** Series, warm air (ST) sensing only, two stage applications.	28
U. Electro-Duct, strip heat (DI) – EM-DI***** Series	28

Electro-Boiler Products

A. Electro-Boiler, original (DFC) (product discontinued 09-98) – EB-** OR EB-L-**	29
B. Electro-Boiler, R Series (production discontinued 07-03) – EB-R-**	29
C. Electro-Boiler, original WarmFlo (production discontinued 11-03) – EB-W-**	30
D. Mini-Boiler, Non-WarmFlo – EMB-5 or EMB-9	30
E. Mini-Boiler, WarmFlo, single sensor – EMB-W-9	31
F. Electro-Boiler, staging – EB-MS-** and EB-S-** Series	32
G. Electro-Boiler, modulating/full WarmFlo – EB-MA-** or EB-WA-** Series	34
H. Electro-Boiler, modulating/full WarmFlo – EB-MO-** or EB-WO-** Series	34
I. Electro-Boiler, large, commercial – EB-C-(54-48, 40-20, 40-24)	35
J. Electro-Boiler, large, commercial – EB-C-(31, 36)	35

Forced Air Equipment

- A. WarmFlo II Main Board** (production – 3/01 through 6/04) – 3” x 5-1/4”, 4-stage, larger program chip, 4-pin connector, *Analyzer plugs in next to the 4-pin.*

Board part numbers – WF2EM (WFCOE5615), WF2EB (WFCOA5615)

Reference drawing – ES716, ES718, ES719, ES721, ES722, ES723, ES724, ES725, ES728, ES732, HS320

J1 – 8-pin going to inside relay board

- 7 – red/wht – 24VAC during T-stat call. This comes through K1 contact, K1 is energized directly from the Y (or E) tab or yellow wire input.
- 6 – gray – common
- 1 – orange – stage 1, triac. These go low or 0.7VDC when triac is on or relay is on. Because the DC for the inside relay board is made from pin 7 24VAC, the DC on these staging wires is only present during a heat call. Thus you will measure approximately 35VDC just prior to the board turning on the stage (red LED goes on), and then it goes low to approximately 0.7VDC.
- 2 – wht/blu – stage 2, same as above.
- 3 – org/blk – stage 3, same as above.
- 5 – violet – stage 4, same as above.
- 4 – not used (if there is a yellow wire has no value).
- 8 – not used.

J2 – connection to an appropriate interface module (see section C and following) – WF-EZ3, -EM3, -LGR3.

- 1 – red – 24VAC power or R to this board.
- 3 – gray – common
- 4 – blue – information wire telling WarmFlo to go to standby. Normally at 0 volts, when the external interface module is in standby mode, this blue wire goes to approximately 30VDC.
- 2 – brown – controls gas furnace turn-on (W) relay within interface module. This wire also goes through K1 and does not have voltage or information unless there is a heat call. In the normal or electric mode this will be approximately 30 VDC, when WarmFlo logic (not necessarily only standby mode) desires to send a W call to the gas furnace, this brown wire goes low to 0.7VDC.

Tabs – other connection points.

- Y – T1 – typically yellow wire from interface module, 24VAC or VDC conditions WarmFlo to a heat active, turn-on mode.
- HP-ODT – T4 – output signal to interrupt the compressor Y or yellow wire below the setup ODT temperature, blower purge cycles, in some cases standby, etc. Normally at approximately 30VDC, during interrupt goes low or 0.7VDC.
- R – T3 – 24VAC, from J2-1. This can be used as a monitor point or can be used as a 24VAC source for other plug-in. If this board is being used without J2 connector, 24VAC would be fed into this tab. If this board has a fuse or a small brown automatic reset fuse type component, it is between J2-1 and this tab.
- C – T2 – common. Same as J2-3 or other common points. The best place to connect voltmeter common lead.
- Comment – there may be a green wire plugged into C, this is available to make sure C becomes the static ground for the WarmFlo board and all other control boards. If the installer knows the furnace 24-volt common is tied to a good ground, this wire can be pulled off and discarded. However, it is very important all common points are indeed tied to a good static or earth ground.
- E – T6 – considered emergency function input, all stages step in, temperature calculation functions are typically bypassed.

Comment: Also see WarmFlo terminology document XC015 for definition of flat DT and an understanding why you do not necessarily always get all 4 stages on.

A1 – T5 – auxiliary terminal allows for an external method of forcing standby. Whenever this tab is raised to 24VAC or 24VDC, the board is forced into a standby mode (amber LED off). This is the same as the J2-4 blue wire mentioned above.

Temperature sensor plug-in block:

RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.

COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any “COM” tab on the control board.

ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.

OT – black – same as above except outdoor sensor. Typically this is the longest cable sensor and has a bracket for mounting on the outside of the building. The tip should be up in order to prevent water from getting in at the cable.

J3 – Analyzer plug-in (this will be the same for all Electro Industries’ boards or PC download boards and applications.

1 – +5 logic voltage or power to the Analyzer/special PC cable.

2 – TX or transmit logic or line.

3 – RCV or receive logic or line.

4 – common or ground.

6 – common or ground.

5 – keying pin, has been clipped off (female connector has plug in this position).

B. WarmFlo II Main Board (production – 6/04 through present) – 3” x 5-1/4”, 4-stage, larger program chip, 10-pin connector, *Analyzer plugs in at the bottom corner.*

Board part numbers – WF2EM (WFCOE5615), WF2EB (WFCOA5615)

Reference drawing – ES716, ES718, ES719, ES721, ES722, ES723, ES724, ES725, ES728, ES732, HS320

J1 – 8-pin going to inside relay board

Same as **A**, previous page.

J2 – connection to an appropriate interface module – WF-EZ3, -EM3, -LGR4, -HP2.

Note: This updated board uses this connector two different ways. For the basic WF-EZ3 and WF-EM3 the cable is still a 4-pin with the EZ3 or EM3 individual wires plug into the tabs. The 4-pin plugs into the **top** 4 pins. For the new WF-LGR4 and WF-HP2, these units come with a full 10-pin cable. In this case there are no separate wires for plugging into the tabs.

1 – red – 24VAC power or R to this board.

3 – gray – common

4 – blue – information wire telling WarmFlo to go to standby. Normally at 0 volts, when the external interface module is in standby mode, this blue wire goes to approximately 30VDC.

2 – brown – controls gas furnace turn-on (W) relay within interface module. This wire also goes through K1 and does not have voltage or information unless there is a heat call. In the normal or electric mode this will be approximately 30 VDC, when WarmFlo logic (not necessarily only standby mode) desires to send a W call to the gas furnace, this brown wire goes low to 0.7VDC.

5 – violet – same as HP-ODT tab, see below.

6 – yellow – same as Y tab, see below.

7 – yel/grn – same as E tab, see below.

- 10 – wht/blk – WarmFlo speed B. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to high or Y2 speed. This pin function or wire itself cannot go to the ECM blower motor, either must be a function within the interface module or a DC relay coil connected to this pin.
- 9 – blk/wht – WarmFlo speed A. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to medium or Y1 speed. This pin function or wire itself cannot go to the ECM blower motor, either must be a function within the interface module or a DC relay coil connected to this pin.
- Comment – in addition to equipment where this 10-pin connector uses pin 10 or pin 9, it is possible to add EE-5053 relays for a direct connection or operation of a furnace Y1 and Y2 blower speed function. The easiest way to do this is to purchase Electro cable WFCBSPD (same wire color as J2 above) and drawing HH332, pages 3 and 4.
- 8 – spare, not used.

Tabs – other connection points.

- Y – T1 – typically yellow wire from interface module, 24VAC or VDC conditions WarmFlo to a heat active, turn-on mode.
- HP-ODT – T4 – output signal to interrupt the compressor Y or yellow wire below the setup ODT temperature, blower purge cycles, in some cases standby, etc. Normally at approximately 30VDC, during interrupt goes low or 0.7VDC.
- R – T3 – 24VAC, from J2-1. This can be used as a monitor point or can be used as a 24VAC source for other plug-in. If this board is being used without J2 connector, 24VAC would be fed into this tab. If this board has a fuse or a small brown automatic reset fuse type component, it is between J2-1 and this tab.
- C – T2 – common. Same as J2-3 or other common points. The best place to connect voltmeter common lead.
- Comment – there may be a green wire plugged into C, this is available to make sure C becomes the static ground for the WarmFlo board and all other control boards. If the installer knows the furnace 24-volt common is tied to a good ground, this wire can be pulled off and discarded. However, it is very important all common points are indeed tied to a good static or earth ground.
- E – T6 – considered emergency function input, all stages step in, temperature calculation functions are typically bypassed.
 Comment: Also see WarmFlo terminology document XC015 for definition of flat DT and an understanding why you do not necessarily always get all 4 stages on.
- A1 – T5 – auxiliary terminal allows for an external method of forcing standby. Whenever this tab is raised to 24VAC or 24VDC, the board is forced into a standby mode (amber LED off). This is the same as the J2-4 blue wire mentioned above.

Temperature sensor plug-in block:

Same as previous, reference **A**, page 3.

C. WarmFlo Interface Module, 4-wire stat, Heat Pump – WF-EZ3

Board part number – @WFIZ36704

Reference drawing – HH317, HH329, HS321

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

Interface connector cable – plugs into WarmFlo II main board, J2, reference **A** or **B**.

- 1 – red – 24VAC power or R to this board, after fuse.
- 3 – gray – common
- 4 – blue – information wire telling WarmFlo to go to standby. Normally at 0 volts, when the external interface module is in standby mode, this blue wire goes to approximately 30VDC.

- 2 – brown – controls gas furnace turn-on (W) relay within interface module. This wire also goes through K1 and does not have voltage or information unless there is a heat call. In the normal or electric mode this will be approximately 30 VDC, when WarmFlo logic (not necessarily only standby mode) desires to send a W call to the gas furnace, this brown wire goes low to 0.7VDC.
 - 5 – yellow – signal to WarmFlo indicating heat call. Same as thermostat W, 24VAC when stat W is high. Plugs into WarmFlo main board Y tab.
 - 6 – violet – plugs into WarmFlo main board HP-ODT tab. Signal from WarmFlo board for ODT compressor interrupt. Normally at 30 volts VDC, NPN collector, below ODT wire goes to low or 0.7 volts VDC.
 - 8 – Blu/wht – Load Control – same as common.
 - 7 – Blu – Load Control – pull down logic from 24VAC (R). This is power resistors so that the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.
- Comment – there may or may not be a brown/yellow wire within the cable housing. This is simply a spare wire allowing any special or additional needs or communication between this interface module and the main board WarmFlo board.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

- R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.
- W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.
- G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.
- Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace terminal block:

- R – typically red – furnace transformer 24-volt AC source.
 - W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.
 - G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.
 - C – typically blue or black – furnace and transformer common. This must be same as **static or system ground** either at the furnace or at the WarmFlo C terminal at the C tab.
 - Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.
- Comment – within WarmFlo logic there are various blower purge functions. The furnace W and G may have delays allowing the furnace blower to purge the heat out of the furnace heat exchanger or the heat off of the electric elements. Typically this is 1 minute before gas furnace on or 2 to 3 minutes before allowing electric elements on (electric mode and various other LED indicators).

Heat pump, outdoor unit, terminal block:

- R – typically red – 24VAC source to the heat pump unit, fuse is between this point and furnace R.
- Y – typically yellow – 24VAC to the heat pump to turn on the compressor, generally the main contactor coil.
- RV (O) – typically orange – 24VAC level telling the heat pump whether it should be in heat or cool. This is commonly referred to as heat pump reversing valve logic. Depending upon the heat pump manufacturer this could be 24 (high) for cooling **or** heating. This unit has a peg jumper (J1) setup, the installer selects high for cool or high for heat. The majority of the manufacturers are high for cool; therefore, the factory default has the peg jumper above the “C”.
- C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.

Heat pump, RV logic pin jumper, J1:

Since this controller creates the heat pump reversing valve (commonly referred to as O or RV) and since various heat pump manufacturers have different logic levels for this control wire, the RV logic must be field selected. This is a pin jumper with three pegs and a slide-on shorting block.

The center pin is common. The outer two pins are marked H or C.

C – the outdoor unit requires 24VAC (R) on the O wire during cooling.

H – the outdoor unit requires 24VAC (R) on the O wire during heating.

Tabs – follows blower relay, special variable speed connection:

Special – T1 (lower left side) – internal tap point basically representing **either** roomstat W or Y.

NO – T4 – typically yellow – if installed with variable speed blower, jumper this tab to tab T1.

BL – T3 – the added wire required for variable speed furnace, extend this tab to the furnace Y terminal.

NC – T5 – typically not used, the other contact of the BL relay.

Tabs – LMC AUX contact:

COM – T7 – isolated relay contact, follows the standby function (includes front panel switch) “relay arm”.

EL – T9 – COM tab to this point during non-standby.

SB – T8 – COM tab to this point during standby.

Tabs – other:

G1 – T6 – another method of getting at the furnace G terminal block screw, in this case bypasses the internal blower relay function. Basically this puts the roomstat G directly to furnace G.

L – T14 – a logic point which also follows the LMC “blue wires” function. This is not for field connection without an EE-5053 isolation relay.

R – T12 – same as furnace terminal block screw R (before face).

C – T13 – same as furnace screw C.

X1 – T16 – special connection for N/O LMC logic. Typically leave the blue and blu/wht wire-nutted, X1 goes through a load control normally open contact and the other side of the load control contact goes to R voltage.

SB – T17 – option to add an external standby switch. Using a switch contact, simply pull this tab to common to create a standby identical to the front panel switch.

T2 – internally 0 ohm shorted to T1. If there is a desire to use a 100° temperature sensor between gas furnace and heat pump A-coil, R37 would be cut and this open at rise sensor would connect to T1 and T2.

D. WarmFlo Interface Module, 4-wire stat, non-Heat Pump – WF-EM3

Board part number – @WFIE36704

Reference drawing – HH318, HS323

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

Interface connector cable – plugs into WarmFlo II main board, J2, reference **A** or **B**.

Same as previous, reference **C**, EZ3, page 5.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

W – typically white – the roomstat switch contact (from R) back to this controller indicating a heat call.

G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.

Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace terminal block:

R – typically red – furnace transformer 24-volt AC source.

W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.

G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.

C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.

Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.

Air conditioning outdoor unit terminal block:

Y – typically yellow – voltage for compressor contactor.

C – typically blue or black – common for compressor contactor.

Tabs – follows blower relay, special variable speed connection:

BL – T3 – the added wire required for variable speed furnace, extend this tab to the furnace Y terminal.

NO – T4 – typically yellow – add jumper wire to AC Y.

NC – T5 – add jumper wire to stat W screw (this would be a second wire under this screw).

Tabs – LMC AUX contact:

L – T14 – a logic point which also follows the LMC “blue wires” function. This is not for field connection without an EE-5053 isolation relay. For the EM3 there is no AUX LMC isolated contact. You must use the EE-5053 isolation relay connected to this L terminal (request document HH339).

Tabs – other:

G1 – T6 – another method of getting at the furnace G terminal block screw, in this case bypasses the internal blower relay function. Basically this puts the roomstat G directly to furnace G.

R – T12 – same as furnace terminal block screw R (before face).

C – T13 – same as furnace screw C.

X1 – T16 – special connection for N/O LMC logic. Typically you leave the blue and blu/wht wire-nutted, X1 goes through a load control normally open contact and the other side of the load control contact goes to R voltage.

SB – T17 – option to add an external standby switch. Using a switch contact, simply pull this tab to common to create a standby identical to the front panel switch.

T2 – internally 0 ohm shorted to T1. If there is a desire to use a 100° temperature sensor between gas furnace and heat pump A-coil, R37 would be cut and this open at rise sensor would connect to T1 and T2.

E. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR3

Board part number – @WFIH36704

Reference drawing – HH316, HS322

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

Interface connector cable – plugs into WarmFlo II main board, J2, reference **A** or **B**.

Same as previous, reference **C**, EZ3, page 4.

Roomstat terminal block – must be **multi-wire, HP** arrangement with O (B) and constant Y

Y – typically yellow – stat stage 1, active for heat or cool.

G – typically green – the thermostat switch contact to this controller indicating that sub-base “fan on” or blower on during cooling.

Emergency screw – only if desire by customer, can be used either for full electric staging or standby gas.

Full electric – connect this E wire (typically via the extra brown/yel wire) to the WarmFlo main board E tab.

Standby gas – this will require a relay coil to stat point and the contact of this extra relay is tied to SB tab and common (see Tabs – Other below).

O – typically orange – reversing valve, this goes directly to the heat pump unit, does not go through the LGR3.

Furnace terminal block:

R – typically red – furnace transformer 24-volt AC source.

W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.

G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.

C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.

Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.

Heat pump, outdoor unit, terminal block:

R – typically red – 24 volt source to the heat pump unit, fuse is between this point and furnace R.

Y – typically yellow – signal to the heat pump to turn on the compressor, generally the main contactor coil.

RV (O) – not used within LGR3, is wired direct from HP thermostat to outdoor unit.

Note: If there is a need and desire (good idea) to force a WarmFlo electric element interrupt during cooling, this can be accomplished with an additional relay as outlined in HD304.

C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.

Tabs – follows blower relay, special variable speed connection:

Special – T1 (lower left side) – internal tap point basically representing **either** roomstat W or Y.

NO – T4 – typically yellow – if installed with variable speed blower, jumper this tab to tab T1.

BL – T3 – the second wire required for variable speed furnace, extend this tab to the furnace Y terminal.

NC – T5 – typically not used, the other contact of the BL relay.

Tabs – LMC AUX contact:

COM – T7 – isolated relay contact, follows the standby function (includes front panel switch) common or “relay wiper”.

EL – T9 – COM tab to this point during non-standby.

SB – T8 – COM tab to this point during standby.

Tabs – other:

G1 – T6 – another method of getting at the furnace G terminal block screw, in this case bypasses the internal blower relay function.

L – T14 – a logic point which also follows the LMC “blue wires” function. This is not for field connection without an EE-5053 isolation relay.

R – T12 – same as furnace terminal block screw R.

C – T13 – same as furnace screw C.

X1 – T16 – special connection for N/O LMC logic. Typically you leave the blue and blu/wht wire-nutted, X1 goes through a load control normally open contact and the other side of the load control contact goes to R voltage.

SB – T17 – option to add an external standby switch. Using a switch contact, simply pull this tab to common to create a standby identical to the front panel switch.

F. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR4 (production 10/05 through 8/06)

Board part number – @WFIH46708

Reference drawing – HH340, HS329

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

J2 – this is a pin to pin cable to the expanded J2 on the WarmFlo II main board after 6/04 production.

1 – red – 24VAC power or R to this board, after fuse.

3 – gray – common

4 – blue – information wire telling WarmFlo to go to standby. Normally at 0 volts, when the external interface module is in standby mode, this blue wire goes to approximately 30VDC.

2 – brown – controls gas furnace turn-on (W) relay within interface module. This wire also goes through K1 and does not have voltage or information unless there is a heat call. In the normal or electric mode this will be approximately 30 VDC, when WarmFlo logic (not necessarily only standby mode) desires to send a W call to the gas furnace, this brown wire goes low to 0.7VDC.

5 – violet – same as HP-ODT tab, see previous section B.

6 – yellow – same as Y tab, see previous section B.

7 – yel/grn – same as E tab, see previous section B.

10 – wht/blk – WarmFlo speed B. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to high or Y2 speed. This pin function or wire itself cannot go to the ECM blower motor, this controller simply provides this wire at SPD B tab – T9. Drawing HH341 shows the addition of EE-5053 relay in order to properly use variable speed furnace Y2.

9 – blk/wht – WarmFlo speed A. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to high or Y1 speed. This pin function or wire itself cannot go to the ECM blower motor, this controller simply provides this wire at SPD A tab – T7. Drawing HH341 shows the addition of EE-5053 relay in order to properly use variable speed furnace Y1.

8 – spare, not used.

Roomstat terminal block – must be **multi-wire, HP** arrangement with O (B) and constant Y.

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

Y – typically yellow – stage 1, active for heat or cool.

G – typically green – the thermostat switch contact to this controller indicating that sub-base “fan on” or blower on during cooling. See next section concerning variable speed or ECM motor.

O – typically orange – reversing valve, this feeds through to the heat pump RV (O) terminal screw.

But in addition it is monitored within this controller to determine heat or cool. Thus the manufacturer’s RV logic must be known in order to properly set the J1 RV logic pin jumper.

The controller front COOL LED follows this controller’s interpretation of the cooling mode. In other words, if the COOL LED is on there will be no electric heat and if the technician thinks it supposed to be in heating, there is a problem between RV logic from the stat/heat pump and this pin jumper arrangement.

C – typically blue or black – same as furnace or transformer common, if specific multi-wire roomstat requires common this would be a place to attach.

Furnace terminal block:

- R – typically red – furnace transformer 24-volt AC source.
- W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.
- G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.
- C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.
- Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.
- Variable speed – this controller has a built-in arrangement where the furnace Y is energized at 24 volts when it either interprets a heat mode or cool mode. This is a single Y and will be used depending upon whether the variable speed furnace has a Y1 or Y2. If you use speed B (reference above J2-10 – T9) with the extra EE-5053 relay, you can use this as the low speed Y1. If you are not using speed B, suggest this go to furnace Y2 or its highest speed.

Heat pump, outdoor unit, terminal block:

- R – typically red – 24 volt source to the heat pump unit, fuse is between this point and furnace R.
- Y – typically yellow – signal to the heat pump to turn on the compressor, generally the main contactor coil.
- RV (O) – typically orange – 24VAC level telling the heat pump whether it should be in heat or cool. This comes directly from the HP type roomstat and is wired per heat pump manufacturer's requirement. Thus the logic within the thermostat should line up with the logic required within the outdoor unit.
- C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.
- DF (W1) – T10 – this **must** be connected to the heat pump outdoor unit wire goes high (24VAC) during defrost. This sets up the correct logic within this controller and forces the WarmFlo main board to all four stages immediate on.

Heat pump, RV logic pin jumper, J1:

- Since this controller creates the heat pump reversing valve (commonly referred to as O or RV) and since various heat pump manufacturers have different logic levels for this control wire, the RV logic must be field selected. This is a pin jumper with three pegs and a slide-on shorting block. The center pin is common. The outer two pins are marked H or C.
- C – the outdoor unit requires 24VAC (R) on the O wire during cooling.
- H – the outdoor unit requires 24VAC (R) on the O wire during heating.

LMC terminal block – two wires which go to the utility load control receiver commonly referred to as “blue wires”.

- Blu/wht – Load Control – same as common.
- Blu – Load Control – pull down logic from 24VAC (R). This has a power resistor so that the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.

Tabs – roomstat emergency screw/function:

- E WF – T4 – the HP stat E screw could go to this terminal if you desire full electric.
- E GAS – T5 – the HP stat E screw could go to this terminal if you desire gas furnace.

Tabs – LMC AUX contact:

- L – T14 – a logic point which also follows the LMC “blue wires” function. This is not for field connection without an EE-5053 isolation relay. For the EM3 there is no AUX LMC isolated

contact. You must use the EE-5053 isolation relay connected to this L terminal (request document HH339).

Tabs – other connections:

SPD B – T9 – see above J2 connector comments.

SPD A – T7 – see above J2 connector comments.

L – T8 – a logic point which also follows the LMC “blue wires” function. This is not for field connection without an EE-5053 isolation relay.

R – T1 – same as furnace terminal block screw R, after fuse.

C – T2 and T3 – same as furnace screw C.

X1 – T16 – special connection for N/O LMC logic. Typically you leave the blue and blu/wht wire-nutted, X1 goes through a load control normally open contact and the other side of the load control contact goes to R voltage.

SB – T6 – COM tab to this point during standby.

G. WarmFlo Interface Module, HP (multi-wire) stat, Heat Pump – WF-LGR4 Rev. A (production 8/06 through present)

Note – this is an REV A update to the previous WF-LGR4, and specifically relates to improvements required for manufacturers’ heat pump with RV logic high for heat. It eventually replaces the “non-A” but the non-A will perform all its correct functions for a manufacturer’s heat pump that is RV logic high for cool.

Board part number – @WFIH46708A

Reference drawing – HH340, ECM blower options HH341, HS332

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

J2 – this is a pin to pin cable to the expanded J2 on the WarmFlo II main board after 6/04 production.

Reference section **F**, above.

Roomstat terminal block – must be **multi-wire, HP** arrangement with O (B) and constant Y.

Reference section **F**, above.

Additional comments – pertains to manufacturers systems with RV logic high during heating. “Stat-B” jumper is open for all other applications.

O (B) – option color – typically for RV logic high during heat, roomstat is a “B” screw. In this case there is an additional pin jumper which must be in the B position for proper control or operation. In addition the heat pump DF (W1) function further isolates the roomstat option plug-in E WF tab from WarmFlo main board E tab.

Furnace terminal block:

Reference section **F**, above.

Heat pump, outdoor unit, terminal block:

Reference section **F**, above.

LMC terminal block – two wires which go to the utility load control receiver commonly referred to as “blue wires”.

Reference section **F**, above.

Tabs – roomstat emergency screw/function:

Reference section **F**, above.

Tabs – other connections:
Reference section **F**, above.

H. WarmFlo Interface Module, 2-speed Heat Pump – WF-HP2

Board part number – HP26700

Reference drawing – HI210B or HI211B, HS213

Fuse – replace only with fast blow, low voltage – typically 3-amp, 5-amp maximum.

J2 – this is a pin to pin cable to the expanded J2 on the WarmFlo II main board after 6/04 production.

- 1 – red – 24VAC power or R to this board, after fuse.
- 3 – gray – common
- 4 – blue – information wire telling WarmFlo to go to standby. Normally at 0 volts, when the external interface module is in standby mode, this blue wire goes to approximately 30VDC.
- 2 – brown – controls gas furnace turn-on (W) relay within interface module. This wire also goes through K1 and does not have voltage or information unless there is a heat call. In the normal or electric mode this will be approximately 30 VDC, when WarmFlo logic (not necessarily only standby mode) desires to send a W call to the gas furnace, this brown wire goes low to 0.7VDC.
- 5 – violet – same as HP-ODT tab, see previous section B.
- 6 – yellow – same as Y tab, see previous section B.
- 7 – yel/grn – same as E tab, see previous section B.
- 10 – wht/blk – WarmFlo speed B. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to high or Y2 speed. This pin function or wire itself cannot go to the ECM blower motor, this controller provides automatic Y2 speed control, see comment.
- 9 – blk/wht – WarmFlo speed A. The control chip and its sequence condition this point low (NPN emitter) when it desires the variable speed blower to go to high or Y1 speed. This pin function or wire itself cannot go to the ECM blower motor, this controller provides automatic Y1 speed control, see comment.
- 8 – spare, not used.

Comment – when this controller’s upper center dial switch (SW1) is in the “A” position, the furnace ECM motor speeds are under full WarmFlo main board ST and OT temperature control:

- Between ST 105° and OT 50°, G speed only.
- Between ST 115° and OT 30°, furnace Y1.
- >ST 115° or OT 30°, Y2 speed.

This controller’s upper dial switch has two other active positions:

- “B” – constant (after thermostat call) Y1 and Y2 speed.
- “C” – constant (after thermostat call) Y1 speed and Y2 is still controlled as speed B.

Note – the above and the ST/OT blower speed function only applies to **heating**. Blower speeds relating to **cooling** are a direct function of stat Y1 or Y2 and likewise heat pump Y1 and Y2. In other words, the furnace terminal block Y1 and Y2 have a direct tie to the other Y1 and Y2’s (cooling only).

Room thermostat and overall controller function options – must select conventional 1H/1C, conventional 2H/2C, or heat pump stat function

Conventional, 1H/1C – peg jumper must be set in H/C, and 1HEAT

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

- W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.
- G – typically green – the thermostat switch contact to this controller indicating that sub-base “fan on” or blower on during cooling.
- Y1 – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Conventional, 2H/2C – peg jumper must be set in H/C, and 1HEAT

- R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.
- W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.
- G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.
- Y1 – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.
- Y2 – option – provides roomstat second stage cooling direct to heat pump Y2 and furnace Y2.
- W2 – option – convenience point, same as W2 tab next to furnace block. If setting up furnace for a thermostat W2, use these tabs or run the roomstat W2 directly to the furnace.
- Note** – O terminal is not used, reversing valve is generated within this controller.

Comment – if the specific room thermostat setup as conventional has an emergency function screw active, it could be connected to E WF or E GAS, see the end of the next paragraph section.

Heat pump stat functions – peg jumper must be set in HP, select 1HEAT or 2HEAT, Electro suggests 1HEAT for best WarmFlo operation and comfort/economy.

- R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.
- Y – typically yellow – stage 1, active for heat or cool.
- G – typically green – the thermostat switch contact to this controller indicating that sub-base “fan on” or blower on during cooling. See next section concerning variable speed or ECM motor.
- O – typically orange – reversing valve, this feeds through to the heat pump RV (O) terminal screw. **But** in addition it is monitored within this controller to determine heat or cool. Thus the manufacturer’s RV logic must be known in order to properly set the J1 RV logic pin jumper. The controller front COOL LED follows this controller’s interpretation of the cooling mode. In other words, if the COOL LED is on there will be no electric heat and if the technician thinks it supposed to be in heating, there is a problem between RV logic from the stat/heat pump and this pin jumper arrangement.
- C – typically blue or black – same as furnace or transformer common, if specific multi-wire roomstat requires common this would be a place to attach.
- Y2 – option – provides roomstat second stage cooling direct to heat pump Y2 and furnace Y2.
- W2 – option – convenience point, same as W2 tab next to furnace block. If setting up furnace for a thermostat W2, use these tabs or run the roomstat W2 directly to the furnace.

Stat emergency wire:

- E WF – T4 – the HP stat E screw could go to this terminal if you desire full electric during emergency.
- E GAS – T5 – the HP stat E screw could go to this terminal if you desire gas furnace during emergency.
- Note** – W screw is not used, this is extremely important, controller goes into a hold/default mode.

Furnace terminal block:

- R – typically red – furnace transformer 24-volt AC source.
- W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.
- G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.

- C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.
- Y1 – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.
- Y2 – option – if variable speed and the furnace has a Y2 this 24-volt high will be the blower top speed. If the furnace does not have a Y2 connect this Y2 to the furnace Y or highest speed.
- O – orange – if the furnace reduces heating speed during heat (or increase during cooling), this tab is the same as the heat pump RV (O) screw.
- W2 – option – see above stat W2 comment, above.
- Variable speed – see previous J2 “comment” paragraph.

Heat pump, outdoor unit, terminal block:

- R – typically red – 24 volt source to the heat pump unit, fuse is between this point and furnace R.
- Y1 – typically yellow – signal to the heat pump to turn on the compressor, generally the main contactor coil.
- Y2 – option – 24VAC signal to the heat pump for high stage or high speed compressor.
- RV (O) – typically orange – 24VAC level telling the heat pump whether it should be in heat or cool. Depending upon thermostat type and setup, this is either generated within this controller (H/C) or comes directly from the HP type roomstat (HP) and is wired per heat pump manufacturer’s requirement. Hold/default mode may appear if this is not selected correctly and taken care of correctly with the RV logic jumper selection.
- C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.
- W1 – option – must be connected to outdoor unit W1 (or sometimes W2) function which goes to 24 volts during defrost. This controller uses this input to disable any internal function which is normally interpreted as cooling if the (O) terminal happens to go high during defrost. It is imperative and required that this W1 terminal go to 24 volts some milliseconds prior to the outdoor unit (O) terminal going to cooling. There are manufacturers where this function lags, thus causing a hold/default mode. Suggest using conventional thermostat setup and allow this controller to create the (O) function going to the outdoor unit.
- L – option – if desire fault light, when this terminal is at 24V, front panel fault light illuminates. If roomstat has an L terminal, tap from this point directly to roomstat L.
- W GAS – option – special input relating to SYS MOD peg jumper when in the HP-GAS position. Call factory for use.
- SP – T7 – special program function, currently not used.
- Note – most all applications, SYS MOD peg jumper is always in HP-WF.

LMC screw terminal block – two wires which go to the utility load control receiver commonly referred to as “blue wires”.

- Blu/wht – Load Control – same as common.
- Blu – Load Control – pull down logic from 24VAC (R). This has a power resistor so that the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.

Tabs – LMC AUX contact:

- COM – T9 – isolated relay contact, follows the standby function (includes front panel switch) “relay arm”.
- EL – T10 – COM tab to this point during non-standby.
- SB – T11 – COM tab to this point during standby.

Tabs – other connections:

- R – T1 – same as furnace terminal block screw R, before fuse.
- C – T2 – same as furnace screw C.

SB – T8 – option to add an external standby switch. Using a switch contact, simply pull this tab to ground to create a standby identical to the front panel switch.

Remote – special 4-wire terminal block, future option remote display or Electro communication bus connections.

Option wires – W1, W2, W3

This is an isolated contact following the program chip cool output (K3). Could be used for any remote special need during cooling.

I. WarmFlo+ (WF+) EZ-Mate board – 4-stage, includes EZ3 and EM3 interface functions, must use program chip version 10.**.

Board part number – @WFCIE5630

Reference drawing – ES815, HS334, HH344, BL option HH342, HS331

Fuse – automatic reset, 3-amp, must cool for 5 minutes after opening.

J1 – 8-pin going to inside relay board

7 – red/wht – 24VAC during T-stat call. Must be in EL mode, and a non-Y input (cooling). The voltage path is from K2 (non-standby mode) through K1 (stat W) and through K6 (non-cooling).

6 – gray – common

1 – orange – stage 1, triac. These go low or 0.7VDC when triac is on or relay is on. Because the DC for the inside relay board is made from pin 7 24VAC, the DC on these staging wires is only present during a heat call. Thus you will measure approximately 35VDC just prior to the board turning on the stage (red LED goes on), and then it goes low to approximately 0.7VDC.

2 – wht/blu – stage 2, same as above.

3 – org/blk – stage 3, same as above.

5 – violet – stage 4, same as above.

4 – 24VDC from relay, external, AC to DC power supply.

8 – the relay side or the other side of the external hi-limit probe. When this point goes low (hi-limit open) front HL LED illuminates.

Note – the onboard staging LED's are also powered from pin 4. Thus they will not illuminate if the AC to DC power supply is not plugged in.

J2 – connection to WF-HP2 interface module.

Same as previous, reference **H**, except provides speed B only, J2-9 has no connection.

Variable speed comment – in this case the upper center dial switch must be set in position C.

Comment – typically WF-HP2 should be used with the WarmFlo main board (section B, page 4).

This provision is only provided where there is a field situation with this controller already in place.

The installer AND USER must be very familiar with the installation manual conditions for this combination. Specifically the front panel lights of this controller should not be monitored, monitor HP2 controller and additional jumpers or hookup between modules, also see installation addendum HD206.

Temperature sensor plug-in block:

RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.

COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any "COM" tab on the control board.

ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can

detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.

OT – black – same as above except outdoor sensor. Typically this is the longest cable sensor and has a bracket for mounting on the outside of the building. The tip should be up in order to prevent water from getting in at the cable.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.

G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.

Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace terminal block:

R – typically red – furnace transformer 24-volt AC source.

W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.

G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.

C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.

Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.

Variable speed – this controller has a built-in arrangement where the furnace Y is energized at 24 volts when it either interprets a heat mode or cool mode. This is a single Y and will be used depending upon whether the variable speed furnace has a Y1 or Y2. If you use speed B with the extra EE-5053 relay, you can use this as the low speed Y1. The speed B, extra EE-5053 relay, is detailed on drawing HH342. If you are not using speed B, suggest this go to furnace Y2 or its highest speed.

Heat pump, outdoor unit, terminal block:

R – typically red – 24VAC source to the heat pump unit, fuse is between this point and furnace R.

Y – typically yellow – 24VAC to the heat pump to turn on the compressor, generally the main contactor coil.

RV (O) – typically orange – 24VAC level telling the heat pump whether it should be in heat or cool. This is commonly referred to as heat pump reversing valve logic. Depending upon the heat pump manufacturer this could be 24 (high) for cooling or heating. This unit has a peg jumper (J3) setup, the installer selects high for cool or high for heat. The majority of the manufacturers are high for cool; therefore, the factory default has the peg jumper above the “C”.

C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.

Heat pump, RV logic pin jumper, J3:

Since this controller creates the heat pump reversing valve (commonly referred to as O or RV) and since various heat pump manufacturers have different logic levels for this control wire, the RV logic must be field selected. This is a pin jumper with three pegs and a slide-on shorting block. The center pin is common. The outer two pins are marked H or C.

C – the outdoor unit requires 24VAC (R) on the O wire during cooling.

H – the outdoor unit requires 24VAC (R) on the O wire during heating.

Air conditioner, outdoor unit, terminal block:

Y – typically yellow – voltage for compressor contactor.

C – typically blue or black – common for compressor contactor.

LMC screw terminal block – two wires which go to the utility load control receiver commonly referred to as “blue wires”.

Blu/wht – Load Control – same as common.

Blu – Load Control – pull down logic from 24VAC (R). This has a power resistor so that the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.

Tabs – LMC AUX contact:

Basically, this provision is not provided. Suggest field 2-pole relay addition and use the second pole for the AUX and the first pole for the blue wires of this product.

Tabs – other:

E – T6 – considered emergency function input, all stages step in, temperature calculation functions are typically bypassed.

Comment: Also see WarmFlo terminology document XC015 for definition of flat DT and an understanding why you do not necessarily always get all 4 stages on.

R – T3 – same as furnace terminal block screw R after fuse.

C – T2, T14, T15 – same as furnace screw C.

BL 120 – T13 – this tab allows the connection of a blower sensor (EM5724). Normally pulled to 24VDC. When remote blower sensor is tied to this tab and C tab, bringing the tab to common, the blower G function is energized (and possible related to blower Y, see previous page – variable speed).

V+ – T8 – not used, can be used check 24VDC with voltmeter.

CT – T5 – when using staging interrupt CT, CT is attached to this tab and C. Comment – when all stages are on, this tab must be at 0 volts. When the CT provides an AC source greater than 2.3 volts, stages 3 and 4 are inhibited.

Warning – whenever a CT is not being used the leads must be wire-nutted, only connect the CT leads to this tab when there is no current flowing through the CT. Voltages greater than approximately 20 volts at this tab can cause damage.

SB – T9 – option to add an external standby switch. Using a switch contact, simply pull this tab to ground to create a standby identical to the front panel switch.

SPD B – T7 – this can also be the tie point for the added EE-5053 outlined in the speed B hookup drawing HH342.

BL-Y – T1 – gas furnace variable speed, high speed required for cooling, connect to gas furnace Y.

BL-W – T4 – special Electro Industries’ type relay connection for speed B, see drawing HH342 for special application information when active at 24VAC.

J. WarmFlo+ (WF+) combo board – 4-stage, includes EZ3 and EM3 interface functions, physically the same as above but must use program chip 12.**.

Board part number – @WFCIE5630

Reference drawing – HS331

Comment – this is the same section I, EZ-Mate, except for more general application relating to upgrade kits and next generation Electro-Mate, etc.

K. WarmFlo+ HP/Gas only – WF-DFHP1

Board part number – @HPIGT5630

Reference drawing – HH113, HH114, HS115

Fuse – automatic reset, 3-amp, must cool for 5 minutes after opening.

Temperature sensor plug-in block:

RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.

COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any “COM” tab on the control board.

ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.

OT – black – same as above except outdoor sensor. Typically this is the longest cable sensor and has a bracket for mounting on the outside of the building. The tip should be up in order to prevent water from getting in at the cable.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.

G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.

Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace terminal block:

R – typically red – furnace transformer 24-volt AC source.

W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.

G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.

C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.

Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.

Variable speed – this controller has a built-in arrangement where the furnace Y is energized at 24 volts when it either interprets a heat mode or cool mode. This is a single Y and will be used depending upon whether the variable speed furnace has a Y1 or Y2. If you use speed B with the extra EE-5053 relay, you can use this as the low speed Y1. The speed B, extra EE-5053 relay, is detailed on drawing HH342. If you are not using speed B, suggest this go to furnace Y2 or its highest speed.

Heat pump, outdoor unit, terminal block:

R – typically red – 24VAC source to the heat pump unit, fuse is between this point and furnace R.

Y – typically yellow – 24VAC to the heat pump to turn on the compressor, generally the main contactor coil.

RV (O) – typically orange – 24VAC level telling the heat pump whether it should be in heat or cool. This is commonly referred to as heat pump reversing valve logic. Depending upon the heat pump manufacturer this could be 24 (high) for cooling or heating. This unit has a peg jumper setup, the installer selects high for cool or high for heat. The majority of the manufacturers are high for cool; therefore, the factory default has the peg jumper above the “H”.

C – typically blue or black – control common for the heat pump unit, as a minimum this is the other side of the main contactor coil and the RV voltage level reference.

Heat pump, RV logic pin jumper, J3:

Since this controller creates the heat pump reversing valve (commonly referred to as O or RV) and since various heat pump manufacturers have different logic levels for this control wire, the RV logic must be field selected. This is a pin jumper with three pegs and a slide-on shorting block. The center pin is common. The outer two pins are marked H or C.

C – the outdoor unit requires 24VAC (R) on the O wire during cooling.

H – the outdoor unit requires 24VAC (R) on the O wire during heating.

LMC terminal block – two wires which go to the utility load control receiver commonly referred to as “blue wires”.

Blu/wht – Load Control – same as common.

Blu – Load Control – pull down logic from 24VAC (R). This has a power resistor so that the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.

Tabs – LMC AUX contact:

COM – T12 – isolated relay contact, follows the standby function (includes front panel switch) “relay arm”.

EL – T10 – COM tab to this point during non-standby.

SB – T11 – COM tab to this point during standby.

Tabs – other:

E – T6 – considered emergency function input, all stages step in, temperature calculation functions are typically bypassed.

Comment: Also see WarmFlo terminology document XC015 for definition of flat DT and an understanding why you do not necessarily always get all 4 stages on.

R – T3 – same as furnace terminal block screw R after fuse.

C – T2, T14, T15 – same as furnace screw C.

Defrost – T5 – this tab would typically be connected to the outdoor unit W1 (or W2 if there is a desire to start the gas furnace during outdoor unit triggered defrost). However, since there is a slow heat build-up and a slow dispersment of the heat exchanger heat within the gas furnace, this may or may not be a very good idea. If used, investigate the need for a 100° sensor probe above the gas furnace heat exchanger to terminate this function when the gas furnace begins to heat up, see Field Service Bulletin 1102.

V+ – T8 – not used, can be used check 24VDC with voltmeter.

SB – T9 – option to add an external standby switch. Using a switch contact, simply pull this tab to ground to create a standby identical to the front panel switch.

SPD B – T7 – this can also be the tie point for the added EE-5053 outlined in the speed B hookup drawing HH342.

BL-Y – T1 – gas furnace variable speed, high speed required for cooling, connect to gas furnace Y.

BL-W – T4 – special Electro Industries’ type relay connection for speed B, see drawing HH342 for special application information when active at 24VAC.

J1 – available for special application relating to using ODT setting for other combination installation control. Typical might be dual fuel heat pump/gas furnace/Electro-Boiler and the boiler used below ODT. Reference procedure document HC108 (effective after 02-07).

1 – follows processor ODT output, pulls low via diode.

5 – V+, via diode, for remote EB-5053 relay coil.

7 – 24VAC output follows heating, stat-W call.

L. Power Supply, AC to DC, 5127 Relay

Board part number – @WFPDC5632

Reference drawing – ES815, HS330

J1 – AC power and HL LED monitor signals from WarmFlo board J1.

2 – yellow – 24VAC, from J1-7. Example – see section I, J1-7.

1 – gray – common.

4 – blue/white – 24VDC, representing this power supply output and the source side of hi-limit probe.

3 – red/wht – the contact side of the hi-limit probe and the J2 source for all power element relays or triac.

Comment – J1-4 also supplies voltage for the WF+ board staging LED's.

J2 – all six pins are tied together, simple a convenience wiring source for all element power relays.

1 through 6 – yellow/green – the high side or 24VDC power for triac and all power relays.

Tabs – normal connection points:

HL – T3 – the source or input side of hi-limit probe, 24VDC whenever there is a call for heat and this power supply is active.

HL – T5 – the hi-limit wire providing power to J2 and all power relays. Thus if the hi-limit probe opens all element power relays lose their source and must drop out.

SAF – T6 (same as T5) – wired to a safety relay in series with triac. The other coil side of this relay is typically connected to T4-common.

Tabs – normally not used connection points:

24VAC – T1 – meter check, same as WarmFlo board J1-7 output.

Common – T2 – available.

Comment – there are two triac modules within the WarmFlo system. The 24VDC activated is part number 4038 which applies to this power supply arrangement.

M. Relay Board – standard WarmFlo Electro-Mate and older EB-W boilers.

Board part number – @WFRFT5616

Reference drawing – ES717

Pigtail connector – typically this plugs into main WarmFlo board (section A or B) J1.

Red/wht – goes to 24VAC during t-stat call, comes through WarmFlo board K1. Realize this is only active and this board is only active when K1 is pulled which is the WarmFlo board Y input.

Gray – common for this board and same as tab T6.

Orange – stage 1 input, goes to 0.7VDC when the main board outputs stage 1. Again, this voltage will not be there if there is not 24VAC on the above red/wht. This activates the U1 triac driver for T7 and T8.

Wht/blu – stage 2, similar to above except activates K3 and K4.

Org/blk – stage 3, similar to above except activates K5 and K6.

Violet – stage 4, similar to above except activates K1 and K2.

Tabs – hi-limit:

T2 – same as red/wht wire, above.

T1 – provides the N.C. hi-limit probe to bring voltage back to the power supply on this board which provides DC power for all the electric element power relays and the U1 triac driver.

Comment – the red LED is across T1 and T2. Therefore, if the hi-limit opens there is voltage across T1 and T2, the power supply or the power relays are “dead” and the LED is illuminated.

Remote triac module, element 1 – internal triac driver module, U1, provides drive contact for this component.

T8 – one leg of 240 incoming source.

T7 – connected to external triac module A2 screw terminal. The triac module A1 screw terminal goes to the other 240 leg.

Comment – for this product the 240 AC triggering triac module (4037) must be used. The CB black leg is connected to T7 which is the source to this onboard “switch”. T8 provides 240 leg (black) to the remote triac module and the remote triac module has the other 240 (red) hard connected. When the triac module green LED is on and when element 1 is expected to be on, there will be 0 volts across T8 and T7 because it will act as a closed AC switch. This is a live, high voltage, AC switch and will not respond to an ohmmeter check.

N. **Electro-Mate DFC** – EM-LV, EM-LU, or EM-DU Series

Board part number – after 11-01 date, EM5845 – hinged door

- Prior to 11-01 date, EM5735C – U bracket

Reference drawing – ES105, ES010, ED105, ES003, ES010

J1 – the traditional and long-term used rectangular Electro-Mate connector.

2 – orange – 24VAC, stage 1 output to activate relay coil.

10 – white/blue – 24VAC, stage 2 output to activate relay coil.

5 – orange/blk – 24VAC, 3-stage output relay coil. There is no delay between stages 2 and 3, this is simply a convenience wire for third relay which may or may not be used in the application product.

12 – gray – common and common side of above relay coils.

7 – red/wht – source or power side of HL probe loop. Same as R when in the electric mode.

4 – red/wht – the other side of HL loop, this is the power source for pin 2, 10, and 5 staging relays.

Also the HL audible is across the pin 7 and pin 4, when the hi-limit opens there is voltage across 7 and 4 thus the audible can active and provide the alert.

3 – blue/wht – same as common, goes to LMC or utility load control receiver.

9 – blue – Load Control – pull down logic from 24VAC (R). This has a power resistor so the load control receiver contact has operating or acceptable current (0.02 amps). When this controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.

1 – brown – isolated relay contact loop for gas or oil furnace. There are two contacts in this loop, K1 responds to stat W and K2 responds to off-peak or electric mode.

6 – brown – other end of brown wire standby loop.

11 – violet – 24VAC when this controller expects blower on. This controller provides no delays, it is simply an output for all heat calls and a transfer of the roomstat G to this point.

Comment – within WarmFlo logic there are various blower purge functions. The furnace W and G may have delays allowing the furnace blower to purge the heat out of the furnace heat exchanger or the heat off of the electric elements. Typically this is 1 minute before gas furnace on or 2 to 3 minutes before allowing electric elements on (electric mode and various other LED indicators).

8 – black/yel – normally vacant, used for N.O. LMC logic. When pin 8 is inserted and used, blues remain wire-nutted, one side of utility load control device is tied to this pin 8 wire and the other side to R voltage.

J2 – AUX connector, previously used for load shed, extra relay, extra standby relay, etc.

6 – yellow – 24VAC source, same as R.

1 – gray – common.

3 – brown – 24VAC during standby only.

4 – orange – available to externally deactivate or disable stage 2 or 3. Grounding this point inhibits stage 2 or 3 relay.

5 – option – 30VDC source.

2 – option – available to externally deactivate or disable stage 4. Grounding this point inhibits stage 4 relay.

White/blue jumper – T7 and T8 – cutting or opening and extending to some external contact device controls or interrupts the stage 2 power relay, J1-10.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.

W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.

G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.

Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

W (T25) – extra, typically used for variable speed blower contact, NO, T19.

Air conditioning, outdoor unit terminal block:

Y2 – typically yellow – voltage to compressor contactor.

C – typically blue or black – common for compressor contactor.

Comment – the top Y2 tab is the same as roomstat Y except going through a load control contact in order to allow easy utility summertime control of air conditioners. The front panel standby switch **does** affect this Y2. For air conditioning front switch must be down or normal.

Tabs – LMC AUX contact:

COM – T10 – isolated relay contact, follows the standby function (includes front panel switch) “relay arm”.

EL – T11 – COM tab to this point during non-standby.

SB – T12 – COM tab to this point during standby.

Variable speed – additional jumpers required if furnace has ECM motor.

BL – T17 – extend this tab to the furnace Y terminal.

NC – T18 – jumper this tab to the Y2 or yellow wire going to the air conditioner contactor.

NO – T19 – jumper this tab to the W tab (later DFC boards have a second W making this easier).

Power source, input from furnace transformer:

R – T13 and T14 – 24VAC, input side of fuse, for this controller and all other wiring.

C – T15 and T16 – common.

Tabs – other connections:

X1 – T9 – same as J1-8, relates to an externally forced standby. Option devices such as SOT are often connected to this tab.

A – T6 – same as J2-3, 24VAC high during standby.

STG4 – T21 – NPN emitter output, can represent another staging delay, must use EE-5053 or equivalent high impedance DC relay coil.

V+ – T20 – the source for the above external relay coil, also a good point to measure 20 volts DC.

J3 pins – factory test only, do not use.

O. Electro-Mate Blower Board – EE-5626-*

Board part number – @EMBRC5608B

Reference drawing – ES012

Electro-Mate unit connection:

12-pin connector:

- Gray – tab T2
- Violet – tab T3

Power:

- Yellow – pigtail wire plugs into DFC bottom 24VAC

Blower limit probe, EM5719:

- Black – T4
- Black – T5

P. HeatChoice Board (production before 3/07) – EH Model Series (or EM-EU or EM-ED)

Board part number – @EMDHC5626

Reference drawing – ES201, ES202

J1 – 6-pin going to inside relays and load control.

- 1 – orange – 24VAC, stage 1 output to activate relay coil.
- 2 – white/blue – 24VAC, stage 2 output to activate relay coil.
- 3 – gray – common.
- 4 – violet – 24VAC when this controller expects blower on. This controller provides no delays, it is simply an output for all heat calls. This pin is not necessarily used in all applications.
- 6 – blue/wht – Load Control – 24VAC through a 100-ohm resistor. This means it is a soft voltage, if shorted to ground for over a few seconds, the 100-ohm resistor could burn out and open.
- 5 – blue – Load Control – high side of an internal relay, when the load control receiver has a closed contact (typically off-peak) the soft voltage from the blu/wht wire tied to this wire pulls or operates the internal relay K2. The rear panel amber, off-peak, LED is a representation of this closed load control contact.

Roomstat terminal block – must be **conventional**, 4-wire, as follows:

- R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.
- W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.
- G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.
- Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace (fan center) terminal block:

- R – typically red – furnace transformer 24-volt AC source.
 - W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.
 - G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.
 - C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.
 - Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.
- Comment – within WarmFlo logic there are various blower purge functions. The furnace W and G may have delays allowing the furnace blower to purge the heat out of the furnace heat exchanger or the heat off of the electric elements. Typically this is 1 minute before gas furnace on or 2 to 3 minutes before allowing electric elements on (electric mode and various other LED indicators).

Air conditioning, outdoor unit terminal block:

- Y2 – typically yellow – voltage to compressor contactor.

C – typically blue or black – common for compressor contactor.

Comment – the top Y2 tab is the same as roomstat Y except going through a load control contact in order to allow easy utility summertime control of air conditioners. The front panel standby switch **does** affect this Y2. For air conditioning front switch must be down or normal.

HL tabs – the hi-limit probe plugs into these two tabs.

T3 – red/wht – source from K1 and electric mode K3.

T4 – hi-limit return, provides 24VAC power to J1-1, J1-2, and T10 tab.

Comment – the inside board HL red LED is illuminated when this hi-limit probe is open, must also have call for heat (K1) and in the EL mode.

Tabs – LMC AUX contact:

COM – T20 – isolated relay contact, follows the standby function (includes front panel switch) common or “relay wiper”.

EL – T22 – COM tab to this point during non-standby.

SB – T21 – COM tab to this point during standby.

Variable speed – additional jumpers required if furnace has ECM motor.

BL – T16 – extend this tab to the furnace Y terminal.

NC – T15 – jumper this tab to the Y2 or yellow wire going to the air conditioner contactor.

NO – T17 – jumper this tab to the W tab (later DFC boards have a second W making this easier).

Tabs – other connections:

A – T19 – 24VAC high during standby. For this controller, this does not depend upon the front panel switch being in normal.

T18 – blower relay K4 low side tap, an external switch (this could be EM5724 blower low limit probe) to ground can activate the K4 logic blower relay.

Stg 3 – T10 – can be used to add another relay coil, internal contact K2 (same as J12, 24VAC output).

Q. Dual Energy Furnace Board (DEC) – HD-D- Series, non-WarmFlo.**

Board part number – @EMDEC5628

Reference drawing – DS101, DS102, ES020

J1 – 12-pin going to inside element power relays.

11 and 12 – gray and gray – approximate +35VDC source for the DC relay coils. Two pins or two DC sources, provides redundancy and allows splitting to an approximate equal number of staging relays. This is active or high in electric mode, thermostat call (K1) and a closed hi-limit probe.

1 and 2 – org and org – stage 1, two pins or possibly two element power relays per stage.

3 and 4 – wht/blu and wht/blu – stage 2, same provision for two element power relays.

5 and 6 – org/blk and org/blk – stage 3, same as above.

7 and 8 – violet and violet – stage 4, same as above.

9 and 10 – yel/grn and yel/grn – stage 5, same as above.

Note – assuming the conditions for active stated above (pins 11 and 12), the remaining points are at 35VDC prior to this active stage. When the stage pulls in, these points are pulled down to 0.7VDC.

J3 – LMC connections, utility load control:

3 – blu/wht – Load Control – same as common.

2 – blu – Load Control – pull down logic from 24VAC (R). This has a power resistor so that the load control receiver contact has operating or acceptable current (0.02 amps). When this

controller is conditioned for standby, this wire would be at R voltage. At off-peak or electric mode this wire is typically switched to Blu/wht meaning this point is at 0 volts or common.
1 – special connection for N/O LMC logic. Typically leave the blue and blu/wht wire-nutted, this pin goes through a load control normally open contact and the other side of the load control contact goes to R voltage. This is also the same as X1, below.

Roomstat terminal tabs – must be **conventional**, 4-wire, as follows:

- R – typically red – 24VAC source to roomstat, fuse between furnace R and this R.
- W – typically white – the roomstat switch contact (from R) back to this controller indicating a **heat** call.
- G – typically green – the thermostat switch contact back to this controller indicating that sub-base “fan on” or blower on during cooling.
- Y – typically yellow – this thermostat switch contact back to this controller indicating a **cool** call.

Furnace (fan center) terminal tabs:

- R – typically red – furnace transformer 24-volt AC source.
- W – typically white – this controller telling gas furnace to heat or operate. Goes to 24VAC to turn on furnace.
- G – typically green – this controller tells the furnace blower to operate. Goes to 24VAC for blower on. In the case of standard blower this would be the speed set by the PSC motor wires, in the case of ECM motor variable this may be continuous air only.
- C – typically blue or black – furnace and transformer common. This must be same as static or **system ground** either at the furnace or at the WarmFlo C terminal at the C tab.
- Y – typically yellow – this is only required for variable speed blower furnaces, when high or 24VAC tells the ECM motor to go to high cooling speed.
- Comment – within WarmFlo logic there are various blower purge functions. The furnace W and G may have delays allowing the furnace blower to purge the heat out of the furnace heat exchanger or the heat off of the electric elements. Typically this is 1 minute before gas furnace on or 2 to 3 minutes before allowing electric elements on (electric mode and various other LED indicators).

J2 – 6-pin convenience cable connector, same as furnace terminal tabs:

- 3 – R
- 4 – C
- 5 – W
- 1 – G
- 2 – Y2
- 6 – O – T26 – tab only.

Hi-limit probe:

- T23 and T24 – red/wht – source or power to N.C. hi-limit. Must be in electric mode and heat call.
- T22 – red/wht – return side of hi-limit, feeding DC power supply and J1-11 and J1-12.

Variable speed – additional jumpers required if furnace has ECM motor.

- BL – T10 – extend this tab to the furnace Y terminal.
- NC – T11 – jumper this tab to the Y2 or yellow wire going to the air conditioner contactor.
- NO – T9 – jumper this tab to the W tab (later DFC boards have a second W making this easier).

Tabs – LMC AUX isolated contact:

- At this time the provided contact does not correctly follow load control (follows t-stat action). Request drawing DH104, it details addition of relay EE-5053.

Tabs – other connections:

- A – T15 – 24VAC whenever LMC (J3) is conditioned for standby.
- W2 – T27 – same as LMC AUX, T12.

T8 – when this point is switched to common (could be EM5729 low limit blower probe) blower relay and fan center G are energized.
X1 – T25 – same as J3-1, above.
J5 – SOT – with jumper pulled, disables all the pre-setup SOT or switchover to gas/electric functions.
T7 – same as Y2 tab.
Wht/blu jumper – when cut or extended to a remote NC contact, this jumper can open stage 2 (J1-3 and J1-4).

R. Dual Energy Furnace Board (WF II) – HD-W-* Series, same as basic WarmFlo main board (WF II) and WF-EZ3 interface module, packaged as one unit within the furnace top panel.**

Board part number – WF2EM and @WFIZ36704

Reference drawing – DS102, HS320, HS321

Connectors and function information – same as reference A and reference C.

S. WarmFlo, Comfort Module, Make-Up Air – EM-WC-* Series, warm air (ST) sensing only, one stage applications.**

Board part number – @WFCDB5614

Reference drawing – HS317

Temperature sensor terminal block:

RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.

COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any “COM” tab on the control board.

ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.

Tabs – normal hookup:

C – T5 – black or blue – system common.

Y – T4 – yellow – primary input requiring heat or turn-on. This module does not have a 24-volt power input; it simply begins working when this point is at 24VAC. Thus it resets or begins at power-up for each new heat on input with this terminal.

W – T6 – white – when added to the input Y function, bypasses modulation and provides full output.

E – T7 – option – same as Y+ E, full output.

Tabs – output to triac:

G – T3 – wire goes to gate of triac or an input terminal at triac module.

T2 – T2 – source voltage for gate, 120 leg not associated with the other input terminal of the triac module.

Tabs – other:

RV – T1 – when raised to 24VAC disables all outputs, assumes to be in summer or cooling.

RV logic – orange jumper – with this jumper intact a high RV input is disable. If this jumper is cut a high RV input is heating or activation of this module.

T. WarmFlo, Comfort Module, Make-Up Air – EM-WC-* Series, warm air (ST) sensing only, two stage applications.**

Board part number – @WFCD25614

Reference drawing – HS318

Reference **S** above, all functions and contact points are the same.

Stage 2 relay contact:

COM – T9 – isolated relay arm, connects to a low voltage source in relationship to stage 2 power relay.

NO – T8 – relay contact to activate stage 2 power relay coil.

U. Electro-Duct, strip heat (DI) – EM-DI*** Series**

Board part number – 2-stage – @EMD2I6600, 3-stage – @EMD3I6600

Reference drawing – ES501, ES504, ES505

Roomstat/air handler cable tabs – field connections for control wiring:

R – T3 and T4 – typically red – 24VAC source, air handler or system transformer power to this controller. This controller had no fusing, it is assumed the fusing is prior to this connection.

C – T11 and T12 – system common, typically from air handler or system transformer common.

W – T9 and T10 – typically white – first stage turn-on, probably 5 kW.

W1 – T8 – option – second stage turn-on, probably 5 kW. In many applications T10 is jumpered to T8.

W2 – T7 – option – stage 3 turn-on, the remaining kW. This can be a third stage from HP roomstat or an ODT stat between T10 and this T7, or simply a jumper between T10 and this T7.

F – T1 – typically green – roomstat blower function, can be same as G at the air handler or an input to this controller where the F is passed on.

T – T2 – option – activated from F or R with an internal blower logic relay contact. With no heat input (W's) the F simply passes through a normally closed to this G. With any W input, R (24VAC) is sent out to the G tab, T2.

Y2 – T5 – option tie point – no internal function, simply goes to J4-7.

O – T6 – option tie point – no connection.

J4 – 10-pin for OEM applications where a connector/harness is used for permanent wiring within the heat pump/air handler, thus conveniently eliminating any of the left side tab hookups. These connection points basically are the same as a tab.

8 – T4 and R.

1 – T11 and T12, and C.

3 – T9 and W.

5 – T8 and W1.

6 – T7 and W2.

2 – T2 and G.

7 – T5 and Y2.

9 – the return side of HL probe, would only be used as a monitor, towards common or C.

10 – internal logic common, the other side of the HL probe, unless otherwise configured it is the same as J4-9.

Tabs – hi-limit probe:

T13 – the source side of HL, ground/common, T11 and T12.

T14 – return side of HL probe providing the common or return for all element power relays. The HL LED is across these two tabs.

Element power relays – 25-amp contact, 240 element circuit/inline hi-limit looped through these relay tabs.

K5 – stage 1.

K6 – stage 2.

K7 – stage 3.

Electro-Boiler Products

A. Electro-Boiler, original (DFC) (product discontinued __/02 – EB- OR EB-L-****

Board part number – EM5835C

Connector function description – same as Electro-Mate DFC – reference **N**, same point by point description.

B. Electro-Boiler, R Series (production discontinued 07-03) – EB-R-**

Board part number – @EMHCB5502A

Reference drawing – BS401, ES011

J1 – harness to boiler internals:

12 – gray – common for all relays.

2 – orange – stage 1 relay.

10 – wht/blu – stage 2 relay.

11 – violet – output to pump relay.

7 – red/wht – power for 160° limit.

4 – red/wht – 160° limit return wire.

J2 – typically not used, parallel to most J1 pins.

Blue jumper – between J1-12 and system or board common. Cut and extend to load control, removes common or return (gray) from each element power relay.

Transformer power – tab T10 and tab T12.

Tabs – other:

Common – T13 – system common.

R – T5 – thermostat source.

W – T6 – thermostat output.

Tabs – spare, not used:

R – T4 1 – T7

G – T3 2 – T8

G1 – T2 HL – T9

8 – T1

Wht/blu jumper – typical stage 2 interrupt cut-in point (same as typical DFC).

C. Electro-Boiler, original WarmFlo (production discontinued 11-03) – EB-W-**

Board part number – WF2EB and @EBCOA5615

Reference drawing – BS701, BS703, BS704

Interface board connector information – same as reference A.

D. Mini-Boiler, Non-WarmFlo – EMB-5 or EMB-9

Board part number – @EBR2M5620

Reference drawing – BS302, BS307

Power source – T5 and T6 – red and black – this controller has its built-in transformer, feed with 240VAC from input field connected power terminal.

Roomstat or end switch terminal block – field connections for boiler turn-on:

R – typically red – 24VAC source to the field connected turn-on device, fuse between internal transformer and this R.

W – typically white – the field connected turn-on switch contact (from R) back to this controller indicating a heat call.

Comment – this can be any 24VAC input as long as the reference is to “C”. It also can be AC or DC. The source could be a zone controller (W-OUT) or a totally separate 24-volt transformer where the above R terminal screw is not used. In this case remove the fuse.

C – typically blue or black – available for slab stats or other devices which require a common.

LMC or utility load control terminal block:

Blue/wht – Load Control – same as W from roomstat device, 24V with heat call.

Blue – Load Control – the return load control contact, feeding 24V to the T2 (HL) and illuminating EL mode LED.

Comment – if there is no utility load control, jumper these two terminals or leave the blue jumper in place.

Automatic reset hi-limit, 160° – the 160° LED illuminates when these two tabs are open. However, since this all feeds from the W screw, LED’s only have information during heat call.

T2 – red/wht – source for 160° HL.

T1 – red/wht – return from HL, provides 24V source to rectifier and element power relays.

J1 – pin jumper for selecting pump relay action.

1 to 2 – pump relay is only active during electric mode with heat call.

2 to 3 – pump relay follows W input.

J2 pins – front panel heat on LED.

J3 pins – front panel EL mode LED.

J4 pins – front panel 160 HL LED.

Comment – this board operates its intended functions with or without the remote LED connections. If the W input is AC (typical switch contact between R and W) there is no plug-in polarity for J2 and J3. But J4 must have correct plug-in polarity for proper red LED action. However, the J1 pin jumper must be in either position (L or W) before the pump relay will work. Note – L or W pin jumper must be in place.

Tabs – other connections:

Wht/blu jumper – T3 and T4 – with jumper in place normal operation, with jumper pulled, cut and/or extended this is a method of remotely controlling K2 or the 2nd element.

T12 and T13 – connections for 205° HL wires from manual reset hi-limit. **Warning** – this is 240-volt power and can be dangerous.

R – T16 – extra 24VAC, R voltage, source (after fuse).

C – T14 and T15 – extra common tab.

Y – T11 – normally not used, 24V after 160 HL, can activate other boards or other staging device going beyond the W call, load control interrupt, and 160 HL.

T7 and T8 – bottom side of K1 contact.

T9 and T10 – bottom side of K2 contact.

E. Mini-Boiler, WarmFlo, single sensor – EMB-W-9

Board part number – @EBR1M5621

Reference drawing – BS304 , BS308

Temperature sensor terminal block:

RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.

COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any “COM” tab on the control board.

ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.

Power source – T5 and T6 – red and black – this controller has its built-in transformer, feed with 240VAC from input field connected power terminal.

Roomstat or end switch terminal block – field connections for boiler turn-on:

R – typically red – 24VAC source to the field connected turn-on device, fuse between internal transformer and this R.

W – typically white – the field connected turn-on switch contact (from R) back to this controller indicating a heat call.

Comment – this can be any 24VAC input as long as the reference is to “C”. It also can be AC or DC. The source could be a zone controller (W-OUT) or a totally separate 24-volt transformer where the above R terminal screw is not used. In this case remove the fuse.

C – typically blue or black – available for slab stats or other devices which require a common.

LMC or utility load control terminal block:

Blue/wht – Load Control – same as W from roomstat device, 24V with heat call.

Blue – Load Control – the return load control contact, feeding 24V to the T2 (HL) and illuminating EL mode LED.

Comment – if there is no utility load control, jumper these two terminals or leave the blue jumper in place.

Automatic reset hi-limit, 160° – the 160° LED illuminates when these two tabs are open. However, since this all feeds from the W screw, LED’s only have information during heat call.

T2 – red/wht – source for 160° HL.

T1 – red/wht – return from HL, provides 24V source to rectifier and element power relays.

J1 – pin jumper for selecting pump relay action.

1 to 2 – pump relay is only active during electric mode with heat call.

2 to 3 – pump relay follows W input.

J2 pins – front panel heat on LED.

J3 pins – front panel EL mode LED.

J4 pins – front panel 160 HL LED.

Comment – this board operates its intended functions with or without the remote LED connections. If the W input is AC (typical switch contact between R and W) there is no plug-in polarity for J2 and J3. But J4 must have correct plug-in polarity for proper red LED action. However, the J1 pin jumper must be in either position (L or W) before the pump relay will work. Note – L or W pin jumper must be in place.

Tabs – output to triac:

G – T4 – wire goes to gate of triac or an input terminal at triac module.

T2 – T3 – source voltage for gate, 120 leg not associated with the other input terminal of the triac module.

Tabs – other connections:

Wht/blu jumper – T3 and T4 – with jumper in place normal operation, with jumper pulled, cut and/or extended this is a method of remotely controlling K2 or the 2nd element.

T12 and T13 – connections for 205° HL wires from manual reset hi-limit. **Warning** – this is 240-volt power and can be dangerous.

R – T16 – extra 24VAC, R voltage, source (after fuse).

C – T14 and T15 – extra common tab.

T7 and T8 – bottom side of K1 contact.

E – T9 – when raised to 24V, bypasses temp sensor and all modulation functions, full 2-stage output.

Comment: The following Electro-Boilers all use the same control board. Connector information and function is detailed in the first model, it is the same for all the following, it is not repeated.

F. Electro-Boiler, staging – EB-MS-** and EB-S-** Series

Board part number – @EBSTU5623

Reference drawing – BS509, BS803

Control power source – this controller does not have a transformer, external transformer wires plug in and the next components include two suppressor devices and the fuse. All voltage beyond this point goes through the fuse.

24VAC – T8 and T10 – input transformer high side.

COM – T9 and T11 – common for this controller and other functions. The factory provided green wire on the adjacent C tab will static ground this controller and all low voltage functions.

J4 – 10-pin connector to element power relays.

7 – red/wht – with W input heat active, 24VDC via K1 contact this is the source to HL.

8 – red/wht – return from HL, 24VDC to power all element power relay **drivers** and HL monitor within logic chip/software.

Comment – for this controller the relay drivers are “sink” devices which means they actually output power to the high side of various element power relays. This is opposite of all forced air product controllers which act like an NPN emitter and pull down the relay coil to 0.7 volts.

1 – orange – stage 1 power relay coil.

- 2 – wht/blu – stage 2 power relay coil.
- 3 – org/blk – stage 3 power relay coil.
- 4 – violet – stage 4 power relay coil.
- 5 – yel/grn – stage 5 power relay coil.
- 6 – brn/yel – stage 6 power relay coil.
- 9 and 10 – gray – the common side or return of all relay coils. This common side finds its way to COM via the load control (standby) K2 relay. In other words, all of the power relays simply go open when declared standby because their coils have no return path. Internally to the logic chip and software the drivers also open removing the high side of the power relay coil.

Temperature sensor plug-in block:

- RED – red – +5VDC required by the sensor. Since there typically are two sensors, there will be two red wires under this screw. This is an easy place to measure or verify the presence of +5VDC logic voltage for the complete board. It is critical that AC noise, transient voltage, misapplied higher voltage, do not affect this wire or this screw point.
- COM – white – common point for the sensors. Since there typically are two sensors there should be two wires under this screw. This is electrically the same as any “COM” tab on the control board.
- ST – black – the data wire for the supply temperature sensor. This could be duct sensor, boiler water outlet sensor, etc. This is digital logic at a much higher frequency than a standard meter can detect. Unless using a digital oscilloscope, there is no way to measure or verify this digital logic pulse train.
- OT – black – same as above except outdoor sensor. Typically this is the longest cable sensor and has a bracket for mounting on the outside of the building. The tip should be up in order to prevent water from getting in at the cable.

Roomstat or end switch terminal block – field connections for boiler turn-on:

- R – typically red – 24VAC source to the field connected turn-on device, fuse between input R and this R.
- W – typically white – the field connected turn-on switch contact (from R) back to this controller indicating a heat call.
- Comment – this can be any 24VAC input as long as the reference is to “C”. It also can be AC or DC. The source could be a zone controller (W-OUT) or a totally separate 24-volt transformer where the above R terminal screw is not used. In this case remove the fuse.
- C – typically blue or black – available for slab stats or other devices which require a common.

LMC or utility load control terminal block:

- Blu/wht – common.
- Blue – 24VAC, R, voltage through a 2K resistor. As an open contact measure 24VAC, when blues are closed, this is at 0 volts.

J5 – 8-pin miscellaneous connector, primary function is standby option.

- 8 – common.
- 2 – 24VDC with W input and heat call active (K1).
- 1 – common, but only in electric mode.
- 5 – live 24VDC source.
- 6 – remote standby switch, typically switch feeds pin 5 to this point during standby.
- 7 – 24VAC, R voltage.
- 3 and 4 – brown wire isolated contact loop, internal contacts include K1 (W heat call active) and K2 (standby mode).

Tabs – LMC AUX contact:

This feature can be provided with the addition of EB-5053 plug-in relay, request drawing BH024.

Tabs – other connections:

SB SW – T5 – external switch contact pulling this point to common or C activates a manual standby or electric element interrupt.

E – T1 – a jumper from input W to this point provides both elements on and bypasses the temperature modulating function. The internal logic power and temperature logic function is activated after the 160 HL, which means also from stat W and through LMC blues.

J3 pins – pin jumper for selecting pump relay action.

J1 – Analyzer plug-in (this will be the same for all Electro Industries' boards or PC download boards and applications.

1 – +5 logic voltage or power to the Analyzer/special PC cable.

2 – TX or transmit logic or line.

3 – RCV or receive logic or line.

4 – common or ground.

6 – common or ground.

5 – keying pin, has been clipped off (female connector has plug in this position).

J6 – 3-pin header connection for stage 5 or EB-SG5-SG option. Center pin is common, either outer pins are logic +5 volts and available for pull down with the remote plug-in option. If the outer pins are at 0 volts software activates the stage 5 sequence.

J7 – pin jumper to select dual temp 150 or 175 water setting. Jumper in = 150°.

Remote – TB4 – software communication port to other devices. The V+ and GRN screws are self explanatory. The LO and HI screws represent an RS485 format data transmit/receive. The primary immediate application is zone controllers. In order for the zone controller to correctly stage this board, the remote bus must be connected.

G. Electro-Boiler, modulating/full WarmFlo – EB-MA- or EB-WA-** Series**

Reference drawing – BS803, BS510

Connector/function – reference **F**.

All hardware functions and actions are the same. The software within the chip code determines other interaction relating to this series.

H. Electro-Boiler, modulating/full WarmFlo – EB-MO- or EB-WO-** Series**

Reference drawing – BS803, BS502

Connector/function – reference **F**.

All hardware functions and actions are the same. In this case the OT sensor is required. The software within the chip code determines other interaction relating to this series.

I. Electro-Boiler, large, commercial – EB-C-(54-48, 40-20, 40-24)

Reference drawing – BS803, BS505

Connector/function – reference **F**.

J. Electro-Boiler, large, commercial – EB-C-(31, 36)

Reference drawing – BS803, BS506

Connector/function – reference **F**.



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