# ELECTRO DUCT ™

# Installation & Operating Instructions

# WF-DHKIT/WF-DHKIT2

## WarmFlo+ Controller

## Conversion Kit, Pre-wired Enclosure

<u>WARNING:</u> **Conventional H/C Roomstat Only**

## Application

Convert heat pump with electric strip or electric furnace to WarmFlo technology.

- Existing strip heat or electric element package
- During installation, disable existing sequencer, relays, etc.
- Use only existing strip heat package electric elements, wired in hi-limits, and fusing/240 power
- No standby or gas furnace provisions

**Note:** This kit is equipped to operate a maximum of 5 kW per individual heating element and a total system of 20 kW maximum. For units over 20 kW contact the factory for assistance.

Utility load control – as a total electric application, we assume no utility control or switchover to automatic standby. However, if this is not the case the low voltage hookup section suggests wiring for load control receiver connection.

**Built-In ODT Switchover** (Dual Setting) – When using this kit in a heat pump and electric strip heat backup application it must be realized that upon ODT cut off only the heat pump is terminated. The electric strip continues on at this point. See page 7 for further details.

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DO NOT DESTROY THIS MANUAL. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICE TECHNICIAN.

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Drawings:  **HH344**
**HS334**
**EH812**
**EH813**
**XX017**

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# Introduction

This manual defines the wiring modifications to an existing strip heat package, control wiring/low voltage connections, and interface for the WarmFlo controller.

This pre-wired enclosure has power wiring pigtails which connect in place of the existing sequencer or relay contacts.

**Important-Safety** – the existing strip heat power wiring terminal block, fusing, and hi-limits must remain unmodified.  This is a very important safety statement, it is the installer's responsibility to make sure these pigtail wires are only connected in place of the sequencer contact or relay contact point.  All other items within the existing strip heat package relating to power wiring, temperature sensing, and safety control must **remain unmodified**.

# Kit, Enclosure Installation

Mount the pre-wired box on the side of or some convenient location near the air handler strip heat panel allowing the 4-foot #12 pigtails to properly enter the strip heat wiring box for termination.  Use National Electric Code approved conduit or enclosure coupling techniques for routing of these power wires.

**Hi-limit sensor, EM5729** – this is required to make sure the WarmFlo controller has proper airflow.  Install in any cabinet or plenum location, 2" to 3" above the existing electric element.  The tip of the sensor must be over the electric element rack.  Connect the two wires from the hi-limit to the two provided red/white wires connected to the internal power supply circuit board tabs marked "HL" (Reference system schematic HS334).

# Installation Requirements

1. All installation work must be performed by trained, qualified contractors or technicians.  Electro Industries, Inc., sponsors installation and service schools to assist the installer.  **Visit our web site at www.electromn.com for upcoming service schools.**

   ## ⚠ WARNING
   | ALL ELECTRICAL WIRING MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE AND LOCAL ELECTRIC CODES, ORDINANCES, AND REGULATIONS. |
   | --- |

   ## ⚠ WARNING
   | OBSERVE ELECTRIC POLARITY AND WIRING COLORS.  FAILURE TO OBSERVE COULD CAUSE ELECTRIC SHOCK AND/OR DAMAGE TO THE EQUIPMENT. |
   | --- |

   ## ⚠ CAUTION
   | This unit can only be used for its intended design as described in this manual.  Any internal wiring changes, modifications to the circuit board, modifications or bypass of any controls, or installation practices not according to the details of this manual will void the product warranty, and manufacturer product liability.  Electro Industries, Inc., cannot be held responsible for field modifications, incorrect installations, and conditions which may bypass or compromise the built-in safety features and controls. |
   | --- |

2. This installation guide relates only to the addition of this upgrade kit to an existing strip heat unit.  The owner/installer assumes all responsibility and/or liability associated with any needed installation of the gas/oil furnace, fuel system, flue, chimney, etc.  Any instructions or comments made within this manual (or factory phone assistance) relating to the gas/oil furnace are provided as comments of assistance and "helps" only.

## ⚠ CAUTION

Hazards or unsafe practices could result in property damage, product damage, severe personal injury and/or death.

Remember, safety is the installer's responsibility and the installer must know this product well enough to instruct the end user on its safe use.

Safety is a matter of common sense - - a matter of thinking before acting.  Professional installers have training and experienced practices for handling electrical, sheet metal, and material handling processes. Use them.

## ⚠ WARNING

DISCONNECT ALL ELECTRICAL POWER BEFORE ELECTRICALLY CONNECTING OR SERVICING THE UNIT.  FAILURE TO DISCONNECT THE ELECTRICAL POWER BEFORE WORKING ON THIS PRODUCT CAN CREATE A HAZARD LEADING TO PERSONAL INJURY OR DEATH.

# Electrical Hookup

**High Voltage**

(Reference system schematic HS334)

Existing sequencers/relays – very carefully study the strip heat unit internal wiring and determine a successful method of removing the sequencer/relays.  In doing so realize that each pair of #10 pigtail wires will be connected in place of a specific staging sequencer **contact**.

See important CAUTION note previous page, specifically all individual element limits within the sequencer must remain intact and operational.

Each pair of 10AWG wires has a number relating to the electric stage number. **Example:** wires marked number one are connected to the first stage heating element, wires marked number two are connected to the second stage heating element, number three wires to stage three, and number four wires to stage four.

If you do not have four stages or four sets of sequencer contacts, the highest numbered wires are simply capped off and unused.

# Low Voltage Hookup

The WarmFlo+ controller within this strip heat product only operates the electric elements based upon the thermostat Stage 1 call for heat and the outdoor/warm air temperature sensors.

> **Assumption** – this manual does not attempt to define the heat pump manufacturer's installation, and assumes the heat pump is functional and has not been altered from the factory. Also, the installing technician must have basic knowledge and understanding of heat pump control logic and/or wire colors/functions. The basic heat pump installation, checkout, troubleshooting, repair of its factory standard components is not covered in this manual.

**Remote Sensors**
(Reference hookup drawing HH344)

**Duct Sensor (ST)** Install the duct sensor according to HH344. The duct sensor (ST) needs to be installed 12" to 16" above the control box.

If there is not adequate plenum distance, pick the largest distribution duct and install towards the top of the horizontal duct. Locate, common sense, in the maximum warm air stream.

> **Note**: The black tip inside of the white tube is the sensor itself. It must be positioned slightly sticking out of the white tube. The only purpose of the white tube is physical protection, once it is installed it is okay to push out the sensor ¼" to ½" to make it more sensitive and faster responding to the warm air stream.

**Outdoor sensor –** extend sensor to an outdoor location properly sampling the outdoor temperature. The north side may pick up too much shading and winds, but the south side should be avoided unless there is a position which will shade the sun. Install bracket with the sensor tip up (cable downward).

Use care in selecting location so the sensor does not pick up false temperature from the heat pump outdoor unit, from refrigerant line sets, dryer vent, reflection off of steel siding, etc. Also do not install the sensor in a plastic box because it will falsely trap and pick up radiant sun temperature.

**Other Sensor Related Comments**
The factory supplied OT cable is 25 feet. If additional cable length is required, you must use the following rules for extending the cable.

- Use unshielded (low capacitance, preferred twisted) 3 or 4-wire low voltage cable.
- 50 feet is maximum.
- Do not, under any circumstances, use leftover wires within the thermostat cable going out to the outdoor unit.
- Route the sensor cable making sure you do not crimp, cut, staple, or damage the cable in any way.
- Keep sensor cables at least 12" away from any line voltage wiring, romex, etc.

For easy sensor cable disconnect and reconnect, the control board has a plug-in 4-place terminal block. Before disconnecting, you will notice two red wires are under the screw marked RED and two white wires are under the COM screw. The black wire represents the data information from each sensor and must be connected to the appropriate OT or ST screw.

The sensor has polarity, is sensitive to wrong voltage, must be protected from static voltage, etc. Do not cross connect or inadvertently short out sensor wires with power on. Permanent destructive damage may result.

**Load Control**
(Reference hookup drawing HH344)

The Warmflo+ is factory shipped with the blue jumper wire shorting the load control contact. If load control is used in this application, remove the blue jumper wire and connect the control wires from the utility load control receiver.

**Variable Speed, ECM Motor, Blower**
Standard within this controller, the furnace Y connection will always have voltage relating to heating and cooling speed requirement.  This Y function voltage is not present during standby.  With this provided feature the ECM motor basically has two speeds – continuous air (G only) or G and Y combination for full heating and cooling speed.  If the furnace being installed has additional intermediate blower speeds (Y1, Y2, BK, O, etc.).

**Variable Speed Blower, Operate at Low Speed During Low Heat Requirements**
The WF-DHKIT allows selecting an outdoor temperature to change furnace blower speed.  The control board has a programmable temperature which can trigger one or two additional relays for activating these additional furnace blower speed functions.  Drawing EH813 provides the hookup details for this feature. The factory temperature defaults are:

| ST | OT |
|---|---|
| SPD B – 104° | SPD B – 30° |

**Zone Damper Systems**
Because of WarmFlo temperature sensing, this unit works very well with zone dampers.  However, the dampers need to be in the horizontal ducts and at least 24" away from these electric elements.  Since this unit uses 4-wire, heat/cool, thermostat connections; the zone damper must be a basic 4-wire thermostat device with an HVAC equipment terminal block simply labeled R, W, G, Y.  This terminal block is connected to the control board upper left same nomenclature terminal block.

> **Note**: Strongly suggest wiring damper motors as normally open (NO).

**Load Control, Other Products or Hardware**
If there is a need to "pass on" the utility load control receiver function to other heating equipment, radiant floor boiler, peak interrupter, etc; there is an isolated contact on this control board.  Locate tabs COM/EL/SB.  In the electric mode there is an isolated contact between COM and EL.  This contact is for low voltage only, 1-amp maximum.

> **Note**: There may be a 1 or 2 minute delay between this relay contact action and the actual load control receiver.  This delay coincides with various blower purge functions.

**Remotely Located Standby Override Switch**
On the bottom of the board is an "SBSW" tab.  Using an external switch between this "SBSW" tab and a common tab provides the same function as the front override switch.  Whichever switch is in the up or override position takes priority.  In other words, they **both** need to be in the down position during **cooling**.

> **Note**: All override switches (front panel and any options) must be in normal or electric position during cooling.

# WF-DHKIT Specific

### Room Thermostat
Use conventional (not heat pump with O and compressor Y) heat/cool, 1H/1C.  It can be mechanical, digital, power-robbing, battery operated, setback, etc.  If required, set heat anticipator to 0.2.

> **Note**: Do not, even with heat pump, use a heat pump thermostat.

Connect the standard R, W, G, Y stat terminals to the control board upper left terminal block.  If the specific roomstat requires common or C, this can be picked up from a tab on the board bottom left.

### Outdoor HP Unit (Single Speed)
This system is setup for the primary four wires – R, Y, O, C.  Connect to the control board upper right four terminal block points marked HP.

## Field Setup or Programming

It is extremely important the installer properly goes through this section and sets up the various switches to match the installation.

### ⚠ WARNING
POWER-DOWN RESET REQUIRED WHENEVER CHANGING ANY OF THE SWITCH POSITIONS ON THE BACK SIDE OF THE BOARD.

### HP Reversing Valve Logic
Since this control board creates the reversing valve control wire for the heat pump, it is important the installer select the required logic for the heat pump installed.  The control board top has a peg jumper and three pins.  When the jumper is in the "C" position the heat pump O wire is high during cooling.  If there is a requirement for high during heating, move jumper to the H position.

### Select Configuration or Hardware Mode
For this upgrade kit only one of the four positions are legal and should be used. It is assumed that this is an electric only application, therefore set the dial to HEAT PUMP No Gas.

**Heat Pump – no gas furnace, max. electric**
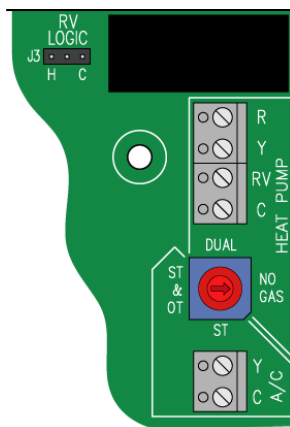


### Important
Located on the WF+ board is a firmware chip that, along with the position of the application selection dial, determines a specific set of defaults.  However, this can be programmed (altered) with optional plug-in WarmFlo Analyzer (WF-ANZ7).

### ⚠ WARNING
ADJUSTING THE APPLICATION SELECTION DIAL WILL ERASE ALL SPECIAL PROGRAMMING CHANGES.

**Switchover Temperature (SW OVER)**
Select the temperature where the unit will terminate the heat pump. The electric section will continue to be used below the selected temperature. The table relating to heat loss house size and location may help.

    Ø = Disabled, no ODT switch-over

| | | |
|---|---|---|
| 1 = -15°F | 5 = 10°F | Factory set on #3. |
| 2 = -10°F | 6 = 20°F | |
| 3 = 0°F | 7 = 30°F | |
| 4 = 5°F | | |

| Heat Loss | Minneapolis | | Bismarck | | Denver | | DesMoines | | Akron | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HP | Non-HP | HP | Non-HP | HP | Non-HP | HP | Non-HP | HP | Non-HP |
| 65,000 | +5 | ③ | +10 | ③ | +10 | ③ | +5 | ③ | +10 | ③ |
| 55,000 | 0 | +15 | 0 | +10 | +5 | +20 | 0 | +15 | +5 | +20 |
| 45,000 | -10 | +5 | -10 | 0 | 0 | +10 | -10 | +5 | 0 | +10 |
| 35,000 | -15 | -10 | -15 | -15 | -15 | 0 | -15 | -10 | -15 | 0 |

**Minimum Warm Air**
This dial switch sets a "floor" or minimum operating temperature level. The supply temperature will never go below this point independent of outdoor temperature, heat pump output, etc.

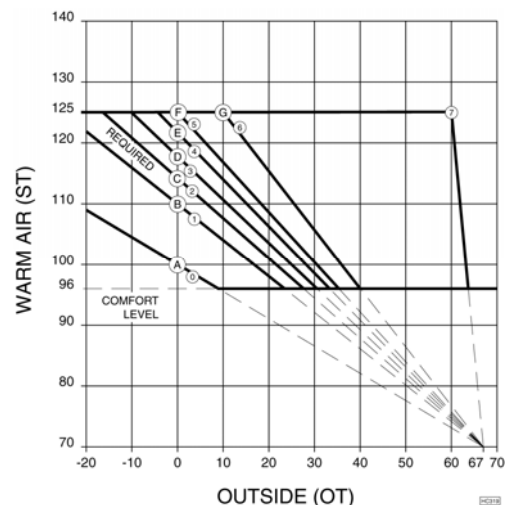| | | |
|---|---|---|
| 0 = 90 | 4 = 98 | Factory set on #3. |
| 1 = 92 | 5 = 100 | |
| 2 = 94 | 6 = 102 | |
| 3 = 96 | 7 = 104 | |

    **Comment**: Suggest 94 or 96 for heat pump but probably 102 for non-heat pump.

**Temperature (Efficiency Dial)**
Located on the front cover is a red screwdriver adjustment dial with selection A through G. These A through G selections represent a supply temperature point at 0° outdoor. The closer the user or installer selection is to A, the flatter the heat loss curve or the higher the operating efficiency. The closer a selected setting is to G, the steeper the heat loss curve or the lower overall heat pump system efficiency. If the knob is turned to "full", the controller DT is set at its maximum or 125°. It will bring in stages or electric elements as required to run at the "flat" or 125° point. This does **not** necessarily mean all stages are on or this is not the same as the "E" input tab. If there is not adequate airflow for the capacity of the unit and the 125° is reached before all stages or all modulation is on, it will simply operate at that point (see E input staging override paragraph under Troubleshooting section).



**Heat loss curve** – within the "brain" of the WarmFlo+ controller is a relationship of supply temperature (ST) to outdoor temperature (OT) measurement. As it gets colder outside, the higher the supply temperature in order to properly overcome the heat loss within the structure. This is the diagonal line between 67° outdoor and maximum Btuh (heat loss) at the coldest outdoor temperature. The slope of this line or the exact warm air position at the coldest temperature is established by the "efficiency" adjustment knob or dial.

# Operation Indicators

**Front Panel LED's**

- **Hi-limit** – when the hi-limit probe (automatic reset or manual reset) opens this top red LED is on. The electric elements will be interrupted via a safety relay circuit whenever this HL LED is illuminated.
- **PWR ON** – indicates good fuse and 24-volt power source from the furnace terminal block.
- **EL mode** – this illuminates during electric heat function. In some ways this can be a utility load control indicator, but there are additional programmable functions which cause this unit to go to standby (see list in the Troubleshooting section).
- **HP/AC call** – the output "Y" screw terminal is active at 24 volts high. The outdoor unit should be on and running. This LED will be off when the OT sensor is below the setup ODT value.
- **T-stat call** – the room thermostat Y or E is active or 24 volts high.
- **Gas call** – the furnace "W" or terminal block feeding fan center W is 24 volts high.

**Override Switch** – the front panel slide switch (very similar to standard Electro-Mate DFC) is a direct hardware disabling of any WarmFlo and electric elements functions. The room thermostat heat call wire or function is directly controlling the fossil fuel or gas furnace. This function can also be on a remote switch, see previous statement for "SBSW" tab.

> **Note**: This switch must be in the normal position during cooling.

**Strip Heat Disable** – To maximize heat pump system energy efficiency and preventing "accidental" unnecessary resistant strip heat when it is not required, this WarmFlo II disables or locks out strip heat elements based upon outdoor temperature.

| Heat Pump |
|---|
| Stage 1 - 50°F |
| Stage 2 - 38°F |
| Stage 3 - 36°F |
| Stage 4 - 34° |

**Sensor Monitor Indicators** – in addition to using WarmFlo Analyzer or WarmFlo PC software to readout the temperature sensors, there is a built-in go/no-go type monitor visible on the green PWR ON second from the top LED.
- If there is detection of miss-wired or totally inoperative sensor, this LED has a blinking or pulse mode. By checking the pulsing pattern, the appropriate sensor can be identified.
- OT sensor - 100 ms blink every second
- ST sensor - two, 100 ms blinks every second
- Both bad - ½ second on, ½ second off, alternating.

**Inside Power Supply Converter Board (top center inside cabinet)** – the LED is illuminated whenever there is a T-call and the power supply is in correct, working order.

# Stat Override Timer (SOT)

This is a field option internal timer which can be field programmed with WF analyzer to select a roomstat cycle run time.  If this downloaded run time is exceeded before the thermostat is satisfied, the system automatically switches to either (DT flat) or standby.

- SOT S – this is the longer set timer which allows transfer to standby if something might have happened to the electric system unmonitored.
- SOT E – this must be shorter time than above, is typically used to overcome morning setback pickup issues.  In other words, if you would field download 20 minutes and you program the setback stat to begin bringing up the temperature 20 minutes prior to the wakeup time; and the system is not at the new higher temperature at the 20-minute point it will automatically add stages (DT flat) in order to more rapidly raise the building temperature.  However, this also means you will be "short cycling" the HP compressor during other heat calls.  The maximum run time for the compressor is then about 20 minutes at any time of the day or at any particular heat call.

# Handheld Analyzer/Laptop Software

This test tool and/or software is available for temperature offset, field altering the program chip parameters and setup, and general assistance for troubleshooting.

See the enclosed "WarmFlo Information" document (HD320) for functional details.

# Installation Checkout

Insert plenum thermometer 6" to 8" above the electric element section, position to measure the warm air from the electric elements.  Proceed with the following procedure, observing the various staging action, element power current, and the outlet temperature.

- Verify controller setup dial switch settings per previous section.  For this test, set the minimum warm air switch to #7.  Return to previous setting at the end.
- For this test the SW OVER switch needs to be at 0 or #3.  Again return to previous setting.
- Using WF Analyzer (or software) set the outside temperature (OT) to 5°F.
- Initiate thermostat call for heat:
    o Verify heat pump is operational and producing heat, not cooling.
- Verify red LED's are staging in, the system should go to all four stages.
- Verify electric element heating and plenum thermometer temperature is rising.
- With full heat output, wait 5 to 10 minutes to stabilize temperature and take the following readings:
    o Plenum temperature _____
    o 240 heating power, voltage _____
    o Measured 240 amps, current _____
    o Measured transformer control, voltage _____
- As you perform this test monitor the Hi-Limit LED on the front of the door of the control box.  This LED determines hi-limit cycling.  If the red LED came on and you observed hi-limit cycling, corrective action will be required to make sure hi-limiting does not occur during normal operation.
    o Verify all airflow is through the electric elements (proper baffling, electric element positioning, etc.)
    o Increase airflow or determine ducting distribution problem loading the system.
    o Perhaps it can be assumed full electric element heat is not required when the compressor is running.  If this is the decision, change the minimum warm air switch to #4.  If this improves the air delivery situation, provide informational technique to make sure the user

never sets the minimum warm air switch to #5, #6, or #7.  If #4 still produced hi-limit, try #3.  For proper heating comfort #3 would probably be the lowest acceptable number.  Again if you cannot sustain non-hi-limiting operation with #3, a serious evaluation of the basic airflow, blower, ducting system will be required to match your specific kW electric unit sizing.

# Troubleshooting

**Sensor Temperature Calibration** – both remote sensors are digital electronic and factory calibrated.  Normally these do not require field calibration or verification.  However, if sensor temperature error is determined, use WarmFlo Analyzer test set or purchase special PC software disc and PC serial port cable.  These plug-in devices allow direct readout of both temperatures, allows a visual determination of WarmFlo internal temperature settings, and can be used to offset either temperature sensor for troubleshooting and demonstration purposes.  This is especially valuable during summer installation.  Call factory and order test set device.

**Override Staging, "E" Tab Input** – during a normal roomstat heat call and E is jumpered to W, it brings on all four stages and essentially bypasses any temperature sensing or stage modulation functions.  In other words, with an E input (still need the normal W stat input) this is simply a turn-on/turn-off device.

**Heat pump application** – with the E input the heat pump is still on and the user must have concern for adequate airflow when energizing all elements.  E jumpered to W should never be considered a normal usage.  This can be used during defrost, see previous hookup paragraph.

**Operational Conditions, Forcing Standby** – these conditions are also monitored by the front panel EL mode light being off.
1. Utility Load Control
2. SOT S timeout
3. MU timeout
4. OT below switchover set point - configuration mode setup dial switch also defines switchover function
5. Front override switch
6. Option WF-HP2 or WF-LGR4 interface has setup a standby condition

**Operational Conditions Which May Prevent Standby**
1. No call for heat - T-call LED is off
2. LED EL ON mode- utility is not controlling or front panel is not in override
3. Somehow stat terminal block Y is also energized or at 24 volts
4. Board K1 or K2 open/inoperative
5. Hang-up - power down, 10 seconds, power up

**Operational Conditions Which May Prevent EL Stages On (No Stage LED's)**
1. No call for heat - T-call LED is off
2. In standby mode, see previous section
3. Hang-up - power down, 10 seconds, power up
4. Above stage disable temperatures

**Conditions Which May Prevent Electric Elements On, With Staging LED's On**
1. Mechanical hi-limit, front panel top LED on
2. Board K1 or K2 open/inoperative
3. Inoperative element relays
4. Inside AC to DC power supply board bad
5. Circuit breakers off
6. Burn 240 inside wires
7. Building power panel fusing or breakers

**Outdoor Sensor (OT) Location** – direct sunlight has a definite affect on sensor temperature reading. The sensor white tube must be "shadowed" from direct sun rays.

**Troubleshooting/Repair Helps**
1.  This WarmFlo+ controller contains several interference suppression components, but as an electronic logic product, unpredictable and unusual transients or interferences may sometimes cause strange results. If the WarmFlo+ controller is "acting strange", one immediate step would be power down reset. Simply turn off the 24-volt source power (probably furnace or air handler circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.
2.  The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.
3.  Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.
4.  The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor "hang in conditioned space" and attempt to run this system.
5.  Acquiring the WarmFlo Analyzer test set or the PC software and serial port hook-up cable (see previous page) is a positive tool for understanding and troubleshooting the WarmFlo controller. Either test set device can display all temperatures, real time evaluation of WarmFlo functions, provide temperature offsets for assimilating winter conditions, and reprogram the control chip (program stays with the actual controller board).

**Bad sensor, safety** – if the internal logic detects open sensor wire, incorrectly wired sensor, or some bad sensor transmitted value conditions; the green LED reverts to a pulsing mode. Basically the appropriate sensor is set internally to a 0° value and the WarmFlo+ main board only allows stage 1 and stage 2 on.
- OT sensor – approximately 1/10 second blip every ½ second
- ST sensor – two, 1/10 second blips every ½ second
- Both bad – ½ second on and ½ second off, alternating

**Bad sensor, operating default condition** – the detection of bad sensor forces the controller to a fixed stage operation.
- OT sensor
  - Stages 1 and 2 on, stages 3 and 4 off (5 kW maximum)
  - If the switchover set point is 0° or less, will go directly to standby
  - The WF-ANZ screen reads "254"
- ST sensor
  - Stages 1 and 2 on, stages 3 and 4 off (5 kW maximum)
  - The WF-ANZ screen reads "254"

**Bad sensor, could disable cooling** – depending upon the ODT setting a bad sensor, even during cooling, can affect the ODT of the compressor and the compressor will be off. Temporary fix is to set the ODT dial to "0" position and get the sensor fixed. Verify with plug-in Analyzer and/or no blinking green LED.

**Analyzer readout, sensor temperature constant 32° or 0°** – these two values represent digital bit patterns that are hard to predict an error function. A blinking green light may or may not be experienced. Typically the cable is too long, wrong type of sensor wire, or some electrical interference on the sensor cable.

# WF-DHKIT2 Specific

**Room Thermostat**
Use conventional (not heat pump with O and compressor Y) heat/cool.  This can be a 1H/1C or 2H/2C, see special Field Setup instructions for 1H/1C.

It can be mechanical, digital, power robbing, battery operated, setback, etc.  If required, set heat anticipator to 0.2.

> **Note 1:** Do not (even with heat pump) use a heat pump thermostat.
>
> **Note 2:** If programmable roomstat has external sensors, make sure these are display monitor only and any programming for these sensors that has to do with interrupting any output functions, ODT, auxiliary, setback, etc. are not active or program disabled.

Connect the standard R, W, G, Y1, Y2 stat terminals to the control board upper left terminal block.  If 2-stage furnace burner and it is necessary to use a stat W2 (in place of furnace W1 to W2 jumper or timer) add wire to the W2 tab.  If the specific roomstat requires common or C, this can be picked up from a tab on the board bottom right.

**Outdoor HP Unit**
Connect the primary five wires to the control board upper right terminal block – R, Y, RV, C, Y2.

**Defrost**
If the installer/user desires faster plenum heat during defrost, the outdoor unit W1 (W2 or anything else) can be connected to the WF-E tab.  **Caution:** This is not necessarily universal with all heat pumps, this should and must be tested by the installer if so connected.
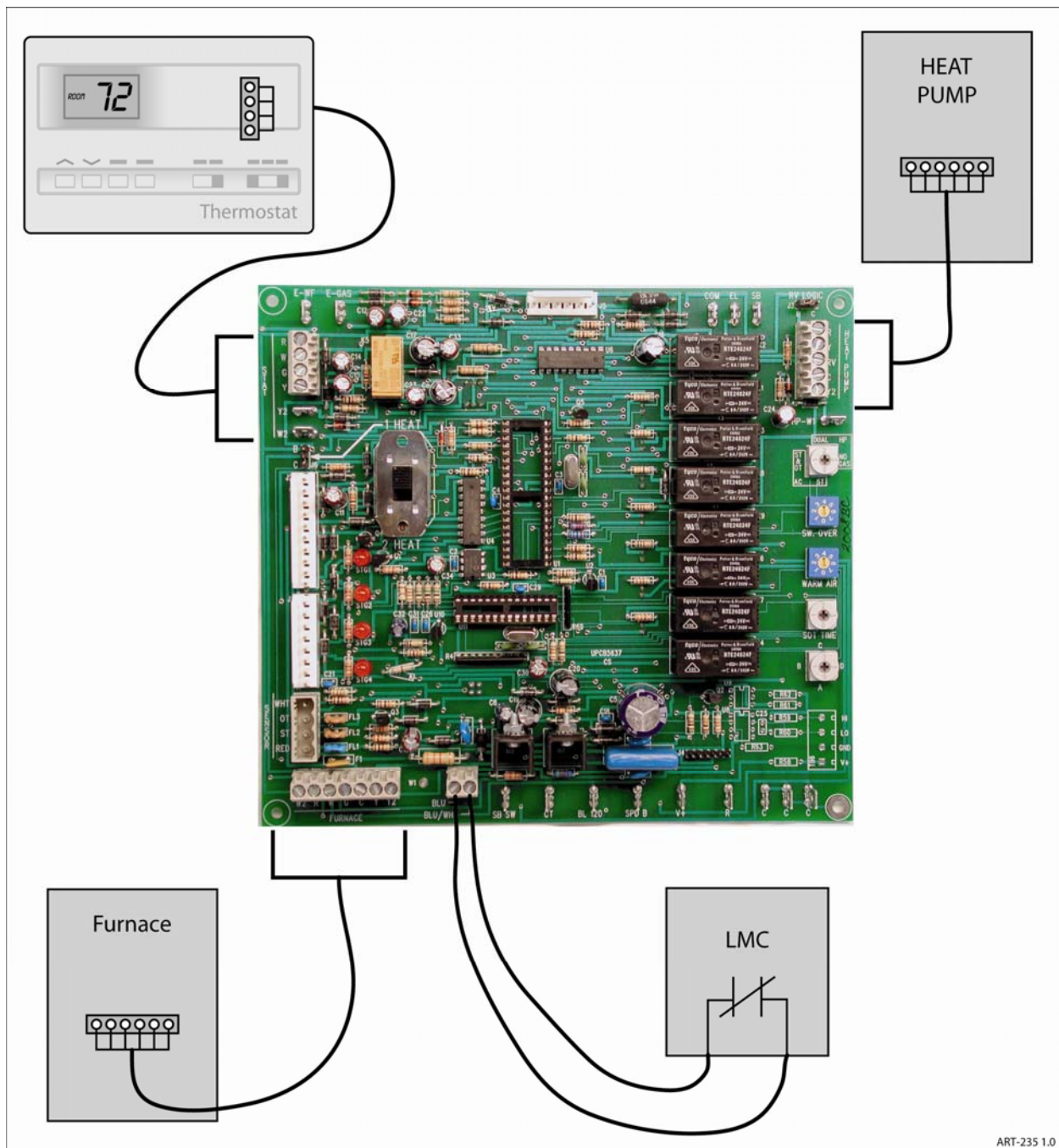
**Gas Furnace (or Oil with Fan Center Terminal Wiring Strip)**
The control board lower left 7 terminal screw points are used for the furnace interface. However, all 7 are not necessarily used, based on type of furnace, blower, burner, etc.

**24-volt power** – this unit receives its power from furnace R and C.

**Basic furnace, PSC blower motor** – in addition to R and C above, add W and G.

**Variable speed blower, ECM motor, single Y** – in addition to the above add Y to Y.

**Variable speed blower, ECM motor, available Y1 and Y2 speeds** – in addition to the above, the control board Y goes to furnace Y1 and control board Y2 goes to furnace Y2.

**2-stage burner** – if there is a desire to control W2 from the roomstat (if not using furnace jumper or built-in timeout) add wires from stat W2 to control board upper left W2 and control board furnace W2 to furnace wiring strip W2.

**Utility Load Control**
Bottom 2-screw terminal block marked blue and blu/wht. Remove the jumper and extend the two wires to the utility furnished control device. For electric energy operation (off-peak) the two blue wires represent contact closure as shipped. **Do not apply external voltage or external power to the blue wires**, they are simply looking for a closed contact during off-peak.
- The maximum "AC noise" on the blue wire is 5 volts, peak to peak. The blue/white wire is actually common and if grounding is proper as suggested in the next paragraph, this should dampen any effect. But it is always good practice to run these wires separate from any current carrying line voltage Romex or other conductors.
- One load control wire pair handles both winter and summer interrupt. Please attach enclosed tag to the power company or utility end of the provided two wires.
- If load control reverse logic is required, consult factory for interposing relay – or a closed to interrupt contact can be connected to SB SW to COM (see page 14).
- If load management interrupt does not apply, simply leave the blue wires jumpered.

**Grounding**

> **Caution – 24 volts common grounding –** the installer must determine whether the furnace fan center COM screw terminal has a good ground bond (not simply furnace skin). If the fan center COM is not adequately grounded, use the pigtail green wire (WarmFlo board, upper, C tab) for a ground bond to the Electro-Mate cabinet power source ground lug. The upper right circuit board mounting screw is a static ground protection point.

**Other Furnace Situations or Special Wiring Requirements**
See next page for a variety of items which may or may not relate to your specific installation.

**Staging Load Shed**
This controller and its internal software contains certain functions which allow a remote "CT" to monitor a specific low demand/usage load and drop 1 or 2 WarmFlo Select stages when this load is active. This model or product as shipped (factory defaults) does **not** include this function, but in special application cases it is possible to activate this function and provide this feature.

Electro Industries does not recommend this staging load shed option for larger kW units and applications where this WarmFlo Select is sized for the complete heating load.

If this option is used, as a minimum these items apply:
1. The CT must be order separately, part #3629.
2. The applicable load shed stage must be field selected and activated with WF-ANZ Handheld.
3. The following warnings apply.

# Additional Hookup or Special System Equipment Concerns

**Special Oil Furnace Comment**
This controller is designed to interface directly with a furnace fan center containing 24-volt transformer (40VA or larger), blower relay, and a "W" function to operate the furnace. If this installation is for an **oil furnace** with only oil control "T and T" terminals, a special fan center will need to be added with an isolation relay at the "W" terminal so only isolated contacts are connected to the oil burner master control "T and T". Another choice is to order EE-5053 relay with accompanying HD001 instruction sheet.

**Wood Furnace or Other Non-Automatic Standby Furnace**
WarmFlo **works well** with a wood furnace because it modulates (or adds to) the electric element to maintain a fixed temperature output. Thus the wood fire can "die down" and the supply sensor (ST) will make up electric element heat to keep the building comfortable. The other operating extreme is a "hot" wood fire where it is adequate to heat the building. In this case the supply sensor will be measuring temperature greater than required and turn off all elements automatically. However, there must be adequate controls on the wood furnace so that the discharge temperature does not exceed 180°F.

**Forced Air Zone Controller**
Because of WarmFlo temperature sensing, zone systems **work very well** and can be effective with this WarmFlo Select. Basic suggestions:

1. Dampers must be in the distribution duct, not in the plenum with this WarmFlo Select.
2. Strongly suggest the damper motors be wired normally open (NO).
3. The zone controller terminal block typically marked "furnace or heating equipment" is connected directly to this unit's control board "roomstat" terminal block.
4. Configure or program zone controller for conventional thermostats (not heat pump).
5. See previous page "Room Thermostat", use the same concept for the zone controller.

**Remotely Located Standby Override Switch**
On the bottom of the board is an "SB SW" tab. Using an external switch between this "SB SW" tab and a common tab provides the same function as the front override switch. Whichever switch is in the up or override position takes priority. In other words, they **both** need to be in the down position during **cooling**.

> **Note**: All override switches (front panel and any options) must be in normal or electric position during cooling.

**Load Control, Other Products or Hardware**
If there is a need to "pass on" the utility load control receiver function to other heating equipment, radiant floor boiler, peak interrupter, etc; there is an isolated contact on this control board. Locate tabs COM/EL/SB. In the electric mode there is an isolated contact between COM and EL. This contact is for low voltage only, 1-amp maximum.

> **Note**: There may be a 1 or 2 minute delay between this relay contact action and the actual load control receiver. This delay coincides with various blower purge functions.

> **Note**: This contact **also** follows front panel standby switch and all other standby functions such as SOT-S, etc.

# Field Setup or Programming

It is extremely important the installer properly goes through this section and sets up the various switches to match the installation.

## ⚠ WARNING

POWER-DOWN RESET REQUIRED WHENEVER CHANGING ANY OF THE SWITCH POSITIONS ON THE BACK SIDE OF THE BOARD.

### HP Reversing Valve Logic

Since this control board creates the reversing valve control wire for the heat pump, it is important the installer select the required logic for the heat pump installed. The control board top has a peg jumper and three pins. When the jumper is in the "C" position the heat pump O wire is high during cooling. If there is a requirement for high during heating, move jumper to the H position.

### Select Configuration or Hardware Mode

**Heat Pump – Dual (HPDH)**
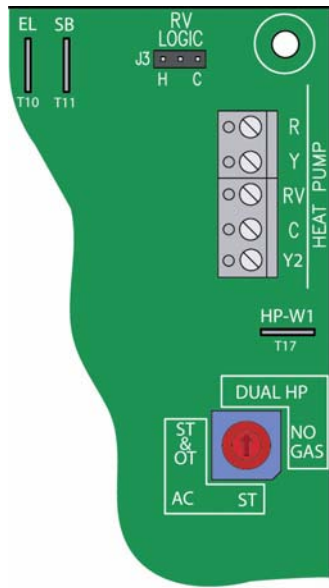
**Heat Pump – No gas furnace, max. electric (HPEL)**
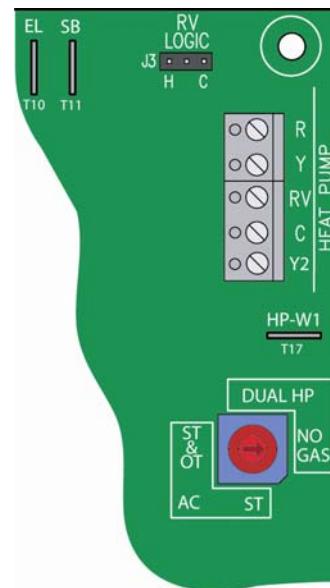


### Notes:

1.  Mode switch positions ST and ST&OT must not be used with this model series. This heat pump 2-stage control (SL2) must only be used with a heat pump.
2.  If the furnace is used as a blower only with no intent of using gas or no gas in the tank, use "no gas" mode switch position.

**Important**
Located on the WF+ board is a firmware chip that, along with the position of the application selection dial, determines a specific set of defaults. However, this can be programmed (altered) with optional plug-in WarmFlo Analyzer (WF-ANZ).

## ⚠ WARNING

ADJUSTING THE APPLICATION SELECTION DIAL WILL ERASE ALL SPECIAL PROGRAMMING CHANGES.

**Switchover Temperature (SW OVER)**
Select the temperature to ODT or interrupt the heat pump outdoor unit. With this WarmFlo Select the electric elements continue below this SW OVER set point. If the installer/user desires to also terminate the electric elements at this SW OVER point, this can only be setup using WF-ANZ* Handheld and selecting EL to SB.

Ø = Disabled, no ODT switch-over

| | | |
|---|---|---|
| 1 = -15°F | 5 = 10°F | Factory set on #3. |
| 2 = -10°F | 6 = 20°F | |
| 3 = 0°F | 7 = 30°F | |
| 4 = 5°F | | |

**Minimum Warm Air**
This dial switch sets a "floor" or minimum operating temperature level. The supply temperature will never go below this point independent of outdoor temperature, heat pump output, etc.

| | | |
|---|---|---|
| 0 = 90 | 4 = 98 | Factory set on #3. |
| 1 = 92 | 5 = 100 | |
| 2 = 94 | 6 = 102 | |
| 3 = 96 | 7 = 104 | |

   **Comment**: Suggest 94 or 96 for heat pump.

**Temperature (Efficiency Dial)**
Located on the front cover is a red screwdriver adjustment dial with selection A through G. These A through G selections represent a supply temperature point at 0° outdoor. The closer the user or installer selection is to A, the flatter the heat loss curve or the higher the operating efficiency. The closer a selected setting is to G, the steeper the heat loss curve or the lower overall heat pump system efficiency. If the knob is turned to "full", the controller DT is set at its maximum or 125°. It will bring in stages or electric elements as required to run at the "flat" or 125° point. This does **not** necessarily mean all stages are on or this is not the same as the "E" input tab. If there is not adequate airflow for the capacity of the unit and the 125° is reached before all stages or all modulation is on, it will simply operate at that point (see E input staging override paragraph under Troubleshooting section).



**Heat loss curve** – within the "brain" of the WarmFlo Select controller is a relationship of supply temperature (ST) to outdoor temperature (OT) measurement. As it gets colder outside, the higher the supply temperature needs to be in order to properly overcome the heat loss within the structure. This is the diagonal line between 67° outdoor and maximum Btuh (heat loss) at the coldest outdoor temperature. The slope of this line or the exact warm air position at the coldest temperature is established by the "efficiency" adjustment knob or dial.

**1HEAT/2HEAT Switch – Two Stage Equipment Only**

One of the first functional decisions and somewhat controversial issue is whether or not the Electro-Mate/WarmFlo should be activated with roomstat/heat pump stage 1. The first reaction may be that stage 1 should be heat pump only to use higher efficient section of the heat pump. However, since the first stage is approximately 60% heat pump capacity there is a strong possibility of heat pump blowing cool air every time the room thermostat is "waiting" for stage 2 to kick in (room temperature will also be reduced). This certainly is not what WarmFlo comfort is all about. On the other side of the coin, if WarmFlo is activated on stage 1, WarmFlo temperature sensing will simply take over and the heat pump may never be used as stage 2 heating. This is not good because the full benefit of the HP heating is not used.

Electro Industries suggests the **heating** be one stage (full heat pump at all times, maximum heat pump comfort heat) and standard manufacturer supplied 2-stage **cooling**. In this case, **use 1 HEAT**. This seems to be the best of both worlds.

Also the 2 HEAT selection requires some additional compromise conditions.
1. Roomstat W1 gives only HP-Y1 and furnace Y1.
2. Roomstat W2 gives HP-Y2 and furnace Y2 and causes or triggers the WarmFlo active.
3. Roomstat W1 does not activate WarmFlo; therefore, there is no electric element heat during defrost if HP is in stage 1 during a defrost cycle.
4. SOT-S timeout begins with the roomstat W2 input.
5. Blower speed directly relates to roomstat, W1 is furnace Y1 and roomstat W2 is furnace Y2 (no Spd. B).
6. The SOT dial in the next paragraph (cooling) only applies to 1HEAT position.
7. Do not use or connect the stat emergency wire to E-WF tab. Using roomstat emergency wire for E-GAS is okay.
8. Below ODU (HP is off) WarmFlo may be off when roomstat is W1 only, WarmFlo is activated with roomstat W2.

**Conventional 1H/1C room thermostat** – when using 1HEAT mode, it is very feasible to use simple 4-wire, RWGY, roomstat. But, in addition, set the SOT dial switch for a delay or run time to enable **cooling** compressor stage 2 or full speed.

> 0 = 30-minute          Factory set on #3.
> 1 = 60-minute
> 2 = 90-minute
> 3 = 120-minute

**Blower Speed Y1 and Y2 Sequence**

**1HEAT** – the initial turn-on and basic run condition is blower Y1. Blower Y2 speed is controlled by WarmFlo temperature sensors. These are the Spd. B settings within factory defaults or can be changed with the WF-ANZ*.
- Factory defaults (Spd. B for Y2 speed)
  - ST – 105° F
  - OT – 20° F

**2HEAT** – in addition to Y2 speed controlled by Spd. WarmFlo sensors detailed above, the stat W2 and Y2 are direct control for furnace Y2. In other words, heating works just like cooling – Y1 direct F-Y1, Y2 direct F-Y2, W1 direct F-Y1, W2 direct F-Y2.

**Emergency, Remote Switch**

If there is a need and the desire to have additional override switch or operation, use this information.

> **Comment:** The front panel normal/standby switch allows direct override to gas furnace independent of any other setup or load control condition. Note the front panel statement about cooling.

**E-GAS tab** – externally supplying 24 volts from roomstat W is a direct standby function, but same as front panel switch and/or SB SW tab (see previous paragraph).

**E-tab or E-WF tab** – supplying a remote switch from stat W to this tab activates all electric stages on. In essence, this is a WarmFlo logic and WarmFlo sensor bypass. It is often used for testing, installation verification of full capacity, emergency full electric, etc.

**Load Shed Option**
This controller and its internal software contains certain functions which allow a remote "CT" to monitor a specific low demand/usage load and drop 1 or 2 WarmFlo Select stages when this load is active. This model or product as shipped does **not** include this function, but in special application cases it is possible to activate this function and provide this feature.

Electro Industries does not recommend this staging load shed option for larger kW units and applications where this WarmFlo Select is sized for the complete heating load.

If this option is used, as a minimum these items apply:
1.  The CT must be order separately, part #3629.
2.  The applicable load shed stage must be field selected and activated with WF-ANZ Handheld.
3.  The following warnings apply.

## ⚠ WARNING

Current Transformers (**CT**) with unterminated wires can overheat and burn up their internal winding.

Do not plug in or install the CT to the WF+ board if there is current through the CT monitor wire.

## ⚠ SAFETY WARNING

CT UNTERMINATED WIRES CAN PRODUCE VERY HIGH VOLTAGE AND COULD BE A SAFETY SHOCK HAZARD.

**WarmFlo – Stat Override Timer (SOT)**
Activated with T-stat call and can be programmed for switchover to standby or full electric.
- SOT S – this is the longer set timer which allows transfer to standby if something might have happened to the electric system unmonitored. To prevent Electro-Mate manual reset possibility of house freeze-ups, SOT S is set at 90 minutes. Warning: this must apply to mode switch "dual" only, not good if there is no functional gas furnace.
- SOT E – this must be shorter time than above, is typically used to overcome morning setback pickup issues. In other words, if you would field download 30 minutes and you program the **setback stat** to begin bringing up the temperature 30 minutes prior to the wakeup time; and the system is not at the new higher temperature at the 30-minute point it will automatically jump to all stages full on (DT flat) in order to more rapidly raise the building temperature. **However**, this also means you will be "short cycling" the HP compressor during **other** heat calls. The maximum run time for the compressor is then about 30 minutes at any time of the day or at any particular heat call. Factory default setting is disabled.

**Optional, gas furnace outlet temperature HP safety** – an optional 100° gas furnace temperature sensor probe, protects HP compressor, can be added. Order part EM5713 and connect in series with the Y or yellow wire going to the HP outdoor unit.

# Operation Indicators

**Front Panel LED's**

- **Hi-limit** – when the hi-limit probe (automatic reset or manual reset) opens this top red LED is on. The electric elements will be interrupted via a safety relay circuit whenever this HL LED is illuminated.
- **PWR ON** – indicates good fuse and 24-volt power source from the furnace terminal block.
- **EL mode** – this illuminates during electric heat function. In some ways this can be a utility load control indicator, but there are additional programmable functions which cause this unit to go to standby (see list in the Troubleshooting section).
- **HP-Y1** – the output "Y" screw terminal is active at 24 volts high. The outdoor unit should be on and running. This LED will be off when the OT sensor is below the setup ODT value.
- **HP-Y2** – the output "Y2" screw terminal is active at 24 volts high.
- **T-stat call** – the room thermostat Y or E is active or 24 volts high.
- **Gas call** – the furnace "W" or terminal block feeding fan center W is 24 volts high.

Two speed equipment – the HP first stage LED is HP1 and the second stage HP2.

**Override Switch** – the front panel slide switch (very similar to standard Electro-Mate DFC) is a direct hardware disabling of any WarmFlo and electric elements functions. The room thermostat heat call wire or function is directly controlling the fossil fuel or gas furnace. This function can also be on a remote switch, see previous statement for "SBSW" tab.

## ⚠ WARNING

THIS FRONT PANEL MANUAL OVERRIDE SWITCH IS A HARDWARE DIRECT TO GAS FURNACE FUNCTION. THUS THERE ARE NO BLOWER PURGE CYCLES. IF THE ELECTRIC ELEMENTS ARE ON AND HOT WHEN SWITCHING TO OVERRIDE AND IMMEDIATELY ALLOWING THE GAS FURNACE, OVERHEAT ON THE ELECTRIC ELEMENTS AND POTENTIAL ELECTRO-MATE MANUAL RESET IS POSSIBLE. THIS FRONT PANEL OVERRIDE SWITCH SHOULD ONLY BE ACTIVATED WHEN THERE IS NOT A ROOMSTAT HEAT CALL.

**Note**: This switch must be in the normal position during cooling.

**Strip Heat Disable** – To maximize heat pump system energy efficiency and preventing "accidental" unnecessary resistant strip heat when it is not required, this WarmFlo disables or locks out strip heat elements based upon outdoor temperature.

| Non-Heat Pump | Heat Pump |
|---|---|
| Stage 1 - 90°F | Stage 1 - 50°F |
| Stage 2 - 50°F | Stage 2 - 38°F |
| Stage 3 - 36°F | Stage 3 - 36°F |
| Stage 4 - 34°F | Stage 4 - 34°F |

**Sensor Monitor Indicators** – in addition to using WarmFlo Analyzer or WarmFlo PC software to readout the temperature sensors, there is a built-in go/no-go type monitor visible on the green PWR ON second from the top LED.

- If there is detection of miswired or totally inoperative sensor, this LED has a blinking or pulse mode. By checking the pulsing pattern, the appropriate sensor can be identified.
- OT sensor - 100 ms blink every second
- ST sensor - two, 100 ms blinks every second
- Both bad - ½ second on, ½ second off, alternating.

## ⚠ WARNING

THE OT IS REQUIRED FOR HP. YOU CANNOT DISCONNECT TO ATTEMPT A SENSOR BYPASS.

**Inside Power Supply Converter Board (top center inside cabinet)** – the LED is illuminated whenever there is a heat call and the power supply is in correct, working order.

# Stat Override Timer (SOT)

This is a field option internal timer which can be field programmed with WF analyzer to select a roomstat cycle run time. If this downloaded run time (typically 30 minutes) is exceeded before the thermostat is satisfied, the system automatically switches to either full electric elements or standby.

- SOT S – this is the longer set timer which allows transfer to standby if something might have happened to the electric system unmonitored. Warning: this must apply to mode switch "dual" only, not good if there is no functional gas furnace.
- SOT E – this must be shorter time than above, is typically used to overcome morning setback pickup issues. In other words, if you would field download 20 minutes and you program the setback stat to begin bringing up the temperature 20 minutes prior to the wakeup time; and the system is not at the new higher temperature at the 20-minute point it will automatically add stages (DT flat) in order to more rapidly raise the building temperature. However, this also means you will be "short cycling" the HP compressor during other heat calls. The maximum run time for the compressor is then about 20 minutes at any time of the day or at any particular heat call.

# Handheld Analyzer/Laptop Software

This test tool and/or software is available for temperature offset, field altering the program chip parameters and setup, and general assistance for troubleshooting.

The WF-ANZ*, version 4.12 update, now can be used to real time calculate CFM.

See the enclosed "WarmFlo Information" document (HD320) for functional details.

# Troubleshooting

**Comment**: Also see the "WarmFlo Information" document (HD320) included with this manual.

**Sensor Temperature Calibration** – both remote sensors are digital electronic and factory calibrated. Normally these do not require field calibration or verification. However, if sensor temperature error is determined, use WarmFlo Analyzer test set or purchase special PC software disc and PC serial port cable. These plug-in devices allow direct readout of both temperatures, allows a visual determination of WarmFlo internal temperature settings, and can be used to offset either temperature sensor for troubleshooting and demonstration purposes. This is especially valuable during summer installation. Call local distributor and order WarmFlo Analyzer.

**Override Staging, "E" Tab Input** – during a normal roomstat heat call and E is jumpered to W, it brings on all four stages and essentially bypasses any temperature sensing or stage modulation functions. In other words, with an E input (still need the normal W stat input) this is simply a turn-on/turn-off device.

**Operational Conditions, Forcing Standby** – these conditions are also monitored by the front panel EL mode light being off.
1. Utility Load Control
2. SOT S timeout
3. MU timeout
4. OT below switchover set point - configuration mode setup dial switch also defines switchover function
5. Front override switch

**Operational Conditions Which May Prevent Standby or Gas On**
1. No call for heat - T-call LED is off
2. LED EL ON mode- utility is not controlling or front panel is not in override
3. Somehow stat terminal block Y is also energized or at 24 volts
4. Board K1 or K2 open/inoperative
5. Hang-up - power down, 10 seconds, power up

**Operational Conditions Which May Prevent EL Stages On (No Stage LED's)**
1. No call for heat - T-call LED is off
2. In standby mode, see previous section
3. Hang-up - power down, 10 seconds, power up

**Conditions Which May Prevent Electric Elements On, With Staging LED's On**
1. Mechanical hi-limit, front panel top LED on
2. Board K1 or K2 open/inoperative
3. Inoperative element relays
4. Inside AC to DC power supply board bad
5. Circuit breakers off
6. Burn 240 inside wires
7. Building power panel fusing or breakers

**Outdoor Sensor (OT) Location** – direct sunlight has a definite affect on sensor temperature reading. The sensor white tube must be "shadowed" from direct sun rays.

**Troubleshooting/Repair Helps**
1. This WarmFlo controller contains several interference suppression components, but as an electronic logic product, unpredictable and unusual transients or interferences may sometimes cause strange results. If the WarmFlo controller is "acting strange", one immediate step would be power down reset. Simply turn off the 24-volt source power (probably furnace or air handler circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.
2. The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.
3. Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.
4. The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor "hanging in conditioned space" and attempt to run this system.
5. Acquiring the WarmFlo Analyzer test set or the PC software and serial port hook-up cable (see previous page) is a positive tool for understanding and troubleshooting the WarmFlo controller. Either test set device can display all temperatures, real time evaluation of WarmFlo functions, provide temperature offsets for assimilating winter conditions, and reprogram the control chip (program stays with the actual controller board).

**Bad sensor, safety** – if the internal logic detects open sensor wire, incorrectly wired sensor, or some bad sensor transmitted value conditions; the green LED reverts to a pulsing mode. Basically the appropriate sensor is set internally to a 0° value and the WarmFlo main board only allows stage 1 and stage 2 on.
- OT sensor – approximately 1/10 second blip every ½ second
- ST sensor – two, 1/10 second blips every ½ second
- Both bad – ½ second on and ½ second off, alternating

**Bad sensor, operating default condition** – the detection of bad sensor forces the controller to a fixed stage operation.
- OT sensor
  - Stages 1 and 2 on, stages 3 and 4 off (5 kW maximum)
  - If the switchover set point is 0° or less, will go directly to standby
  - The WF-ANZ screen reads "254" or "BAD"
- ST sensor
  - Stages 1 and 2 on, stages 3 and 4 off (5 kW maximum)
  - The WF-ANZ screen reads "254"

**Bad sensor, could disable cooling** – depending upon the ODT setting a bad sensor, even during cooling, can affect the ODT of the compressor and the compressor will be off.  Temporary fix is to set the ODT dial to "0" position and get the sensor fixed.  Verify with plug-in Analyzer and/or no blinking green LED.

**Analyzer readout, sensor temperature constant 32° or 0°** – these two values represent digital bit patterns that are hard to predict an error function.  A blinking green light may or may not be experienced.  Typically the cable is too long, wrong type of sensor wire, or some electrical interference on the sensor cable.

# WARMFLO+ CONVERSION KIT WF-DHKIT
# HEAT PUMP HOOKUP

NOTES:

⚠1 REMOVE BLUE JUMPER AND CONNECT TO UTLITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.

⚠2 DO NOT CONNECT TO A/C BLOCK.

⚠3 WF-DHKIT MODULE MUST BE INSTALLED IN PLACE OF EXISTING SEQUENCERS.

⚠4 PACKAGED STRIP HEAT WITH WF INSTALLED CAN BE ORDERED AS EM-WE*****.

OUTSIDE SENSOR
WHITE (COM)
BLACK (OT)
RED (RED)

DUCT SENSOR
WHITE (COM)
BLACK (ST)
RED (RED)

ROOM T-STAT
R ⊘ 24VAC HOT
W ⊘ HEAT
G ⊘ BLOWER
Y ⊘ COOL

COM  EL  SB

LOGIC J3  H  C

K3

R — R — RED — ⊘ R
Y — Y — YELLOW — ⊘ Y
RV — RV — ORANGE — ⊘ O
C — C — BLUE — ⊘ C

HEAT PUMP

HP UNIT

DUAL
ST & OT   SW5 +   NO GAS
ST
Y   A/C
C

← WARM AIR →

MOUNT DUCT SENSOR (ST) WITHIN 18–24" OF TOP ELEMENT

MOUNT HIGH LIMIT SENSOR TUBE WITHIN 2–4" OF TOP ELEMENT

SENSOR TUBE

RED/WHT WIRES

5KW
5KW
5KW

⚠2

⚠3 ⚠4

J2

LED1
LED2
LED3
LED4

SENSOR
WHT
OT
ST
RED
TB1

U1

SW. OVER

WARM AIR

E
V+
SPD B
BL 120
R

UTILITY LOAD CONTROL

BLOWER

FAN CENTER
R ⊘ — RED (R)
W ⊘ — WHITE (W)
C ⊘ — BLUE (C)
G ⊘ — GREEN (G)
Y ⊘ — YELLOW (Y)

RED (R) — R ⊘
WHITE (W) — W ⊘
GREEN (G) — C ⊘
BLUE (C) — C ⊘
YELLOW (Y) — Y ⊘

FURNACE

CABLE

BL-W
BL-Y

⚠1

BLU
BLU/WHT

SB SW   CT   C   C   C

BLU/WHT   BLUE

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# WARMFLO+ CONVERSION KIT WF-DHKIT2
# HEAT PUMP HOOKUP

NOTES:
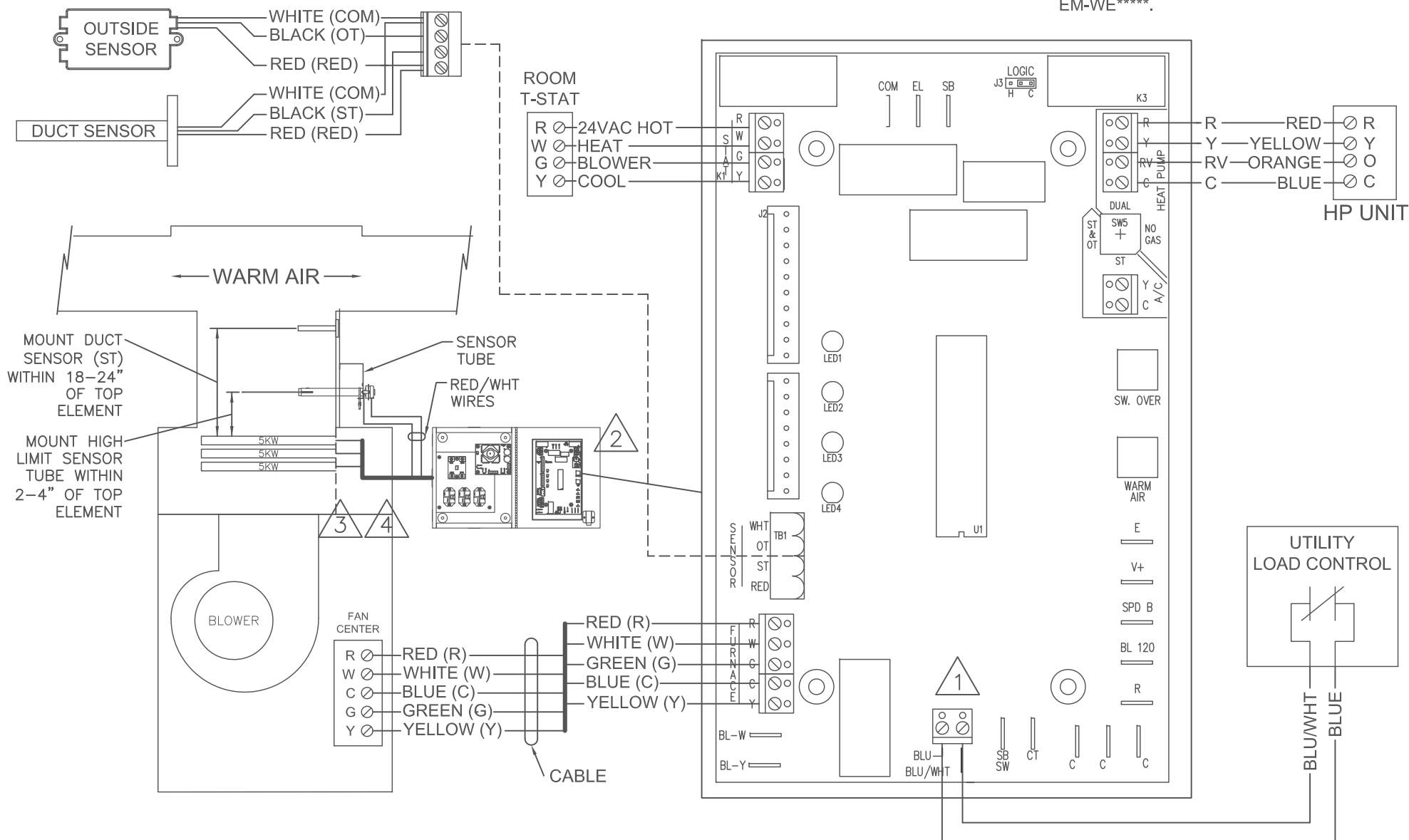1. REMOVE BLUE JUMPER AND CONNECT TO UTLITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.

2. SHOWN WITH 2H/2C CONVENTIONAL STAT, 1H/1C CAN BE USED, SEE INSTALL MANUAL.

OUTSIDE SENSOR
WHITE (COM)
BLACK (OT)
RED (RED)

DUCT SENSOR
WHITE (COM)
BLACK (ST)
RED (RED)

ROOM T-STAT
R — 24VAC HOT — R
W — HEAT-1 — W
G — BLOWER — G
Y — COOL-1 — Y
Y2 — COOL-2 — Y2 — T1
W2 — HEAT-2 — W2 — T4

E-WF   E-GAS
K5

RV LOGIC
J3

HP UNIT

HEAT PUMP
R — RED (R) — R
Y — YELLOW (Y) — Y1
RV — ORANGE (O) — O
C — BLUE (C) — C
Y2 — BLACK (Y2) — Y2
TB4

HP-W1 — BROWN (W1) — W1 (W2)

DUAL HP
SW5
ST OT   NO GAS
AC   ST

SW3
SW. OVER

SW1
WARM AIR

SW7
SOT TIME
C

SW8
B   D

SS

1 HEAT
B
C   J6

2 HEAT

J2

J1

STG1
STG2
STG3
STG4

WARM AIR →

MOUNT DUCT SENSOR (ST) WITHIN 18-24" OF TOP ELEMENT

MOUNT HIGH LIMIT SENSOR TUBE WITHIN 2-4" OF TOP ELEMENT

SENSOR TUBE
RED/WHT WIRES

SENSOR
WHT
OT
ST
RED
TB1

UTILITY LOAD CONTROL

HI
LO
GND
V+

TM4  TM5
C    C

BLOWER

FAN CENTER
R — RED (R)
W — WHITE (W)
C — BLUE (C)
G — GREEN (G)
Y — YELLOW (Y)
W2 — BROWN (W2)
Y2 — VIOLET (Y2)

CABLE

W2  R  W  G  C  Y  Y2

TB2
BLU
BLU/WHT

BROWN (W2)
RED (R)
WHITE (W)
GREEN (G)
BLUE (C)
YELLOW (Y)
VIOLET (Y2)

BLU/WHT
BLUE

# WarmFlo Conversion Kit
# WF—DHKIT/WF—DHKIT2

HL6
250°
HL5
170°

4

EM5729

UPCB5632 CS
LED1
U1
C2
C1

J1
4 — BLW
3 — RW
2 — Y
1 — GY

RW — T3
HL
RW — T5  T4  T6
SAF
J2
T1  T2  J1
24VAC

J2
1 2 3 4 5 6
EMCBW5209
(EW834)

SC1 L1        SC2 T1
TRIAC K1
SC4 A2        SC3 A1

OR WBL OBK VI
YG YG YG YG

EMCBW5210
(EW835)

J1
STAGE 1 — OR — 1
STAGE 2 — WBL — 2
STAGE 3 — OBK — 3
BLW — 4
STAGE 4 — VI — 5
COMMON — GY — 6
24VAC — Y — 7
RW — 8

NOTE: MAXIMUM INDIVIDUAL
ELEMENT KW = 5KW MAX.
SYSTEM TOTAL = 20KW MAX.

L2    L1

HL4 — E4
HL3 — E3
HL2 — E2
HL1 — E1

K2        K3        K4
K2        K3        K4
RED       RED       RED
RED       RED       RED

BRAND X
STRIP HEAT BOX

4 FOOT PIGTAILS
10AWG WIRE    6

NOTES:

1. CONNECTION POINT, REMOVED SEQUENCER OR HEATING RELAY CONTACT.
2. HIGH LIMIT MUST STAY IN PLACE.
3. START WITH TOP ELEMENT (E1), REMAINING WILL DEPEND UPON NUMBER OF ELEMENTS.
4. SHIPPED LOOSE, FIELD INSTALL 2—3" ABOVE ELEMENT RACK.
5. DRAWING SHOWS (4) ELEMENTS. IF LESS, CAP OFF SAFELY AND SECURELY.
6. USE NATONAL ELECTRIC CODE (NEC) APPROVED CONDUIT AND COUPLING TECHNIQUES.

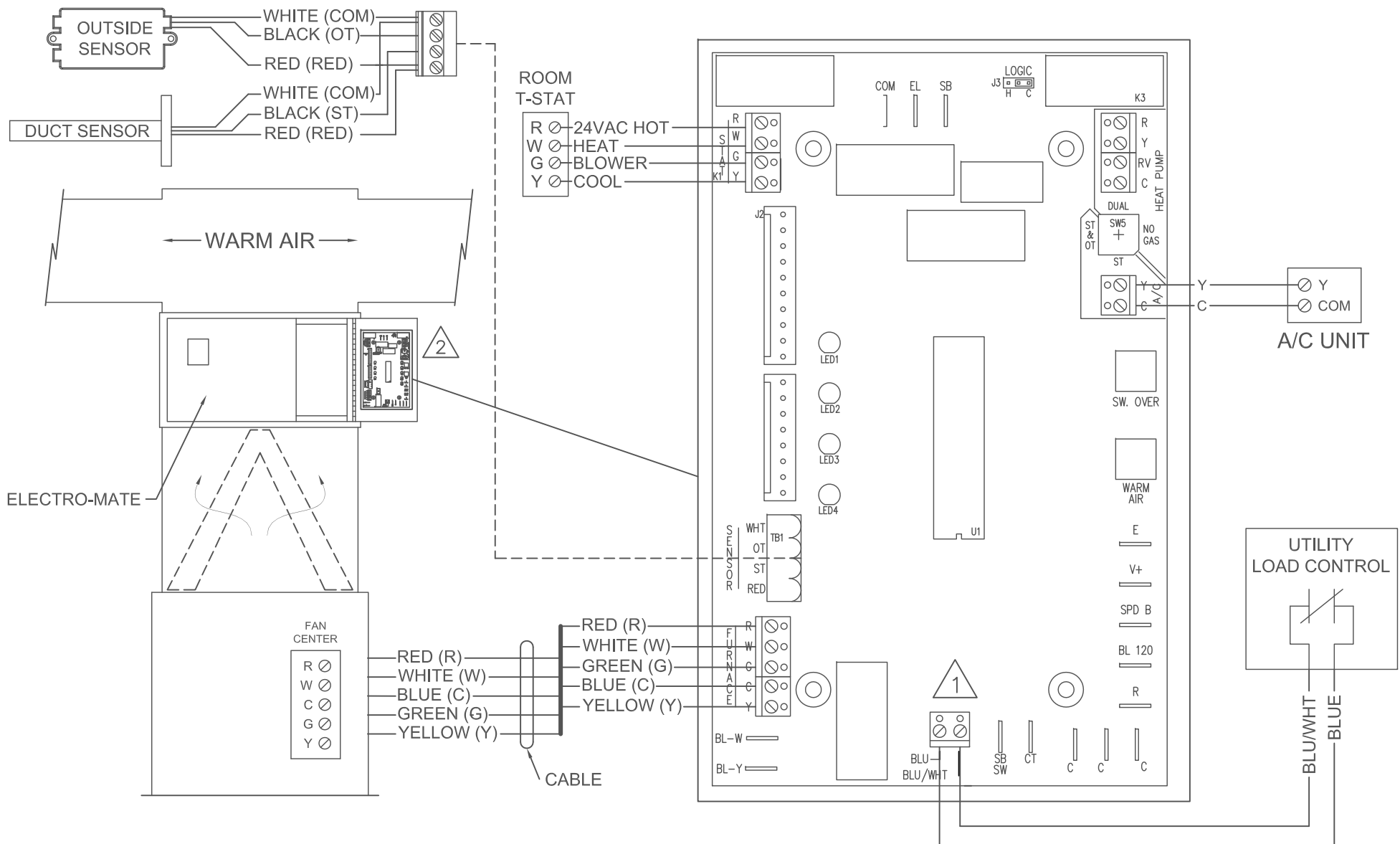| COMPONENT CODE | | WIRE COLOR CODE | | RELAY STAGING | |
|---|---|---|---|---|---|
| CB | CIRCUIT BREAKER | BLW | BLUE/WHITE | 1 | TRIAC (K1) |
| E | ELECTRIC ELEMENT | GY | GRAY | 2 | K2 |
| HL | HI—LIMIT | OR | ORANGE | 3 | K3 |
| K | RELAY | OBK | ORANGE/BLACK | 4 | K4 |
| PC | CIRCUIT BOARD | R | RED | | |
| T | TAB TERMINAL | RW | RED/WHT | DECAL | |
| | | VI | VIOLET | | N/A |
| | | WBL | WHITE/BLUE | | |
| | | Y | YELLOW | DRAWING | |
| | | YG | YELLOW/GREEN | | HS334 B |
| | | | | | 8—23—2012 |

# WARMFLO+ UPGRADE KIT-
# AIR CONDITIONER HOOKUP

NOTES:

⚠1 REMOVE BLUE JUMPER AND CONNECT TO UTLITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.

⚠2 DO NOT CONNECT TO HP BLOCK.

OUTSIDE SENSOR

WHITE (COM)
BLACK (OT)
RED (RED)

DUCT SENSOR

WHITE (COM)
BLACK (ST)
RED (RED)

ROOM T-STAT

R — 24VAC HOT
W — HEAT
G — BLOWER
Y — COOL

R W G Y
S W G Y
A
K1

COM EL SB

LOGIC J3 H C

K3

R Y RV C

HEAT PUMP

DUAL SW5 + NO GAS
ST & OT
ST

Y/C A/C — Y
C — C

A/C UNIT

⊘ Y
⊘ COM

J2

LED1
LED2
LED3
LED4

SENSOR
WHT TB1
OT
ST
RED

U1

SW. OVER

WARM AIR

E
V+
SPD B
BL 120
R

UTILITY LOAD CONTROL

WARM AIR

ELECTRO-MATE

⚠2

FAN CENTER

R ⊘
W ⊘
C ⊘
G ⊘
Y ⊘

RED (R)
WHITE (W)
BLUE (C)
GREEN (G)
YELLOW (Y)

CABLE

RED (R)
WHITE (W)
GREEN (G)
BLUE (C)
YELLOW (Y)

F U R N A C E
R
W
C
C
Y

BL-W
BL-Y

⚠1

BLU
BLU/WHT

SB SW   CT   C   C   C

BLU/WHT   BLUE

ELECTRO INDUSTRIES, INC.
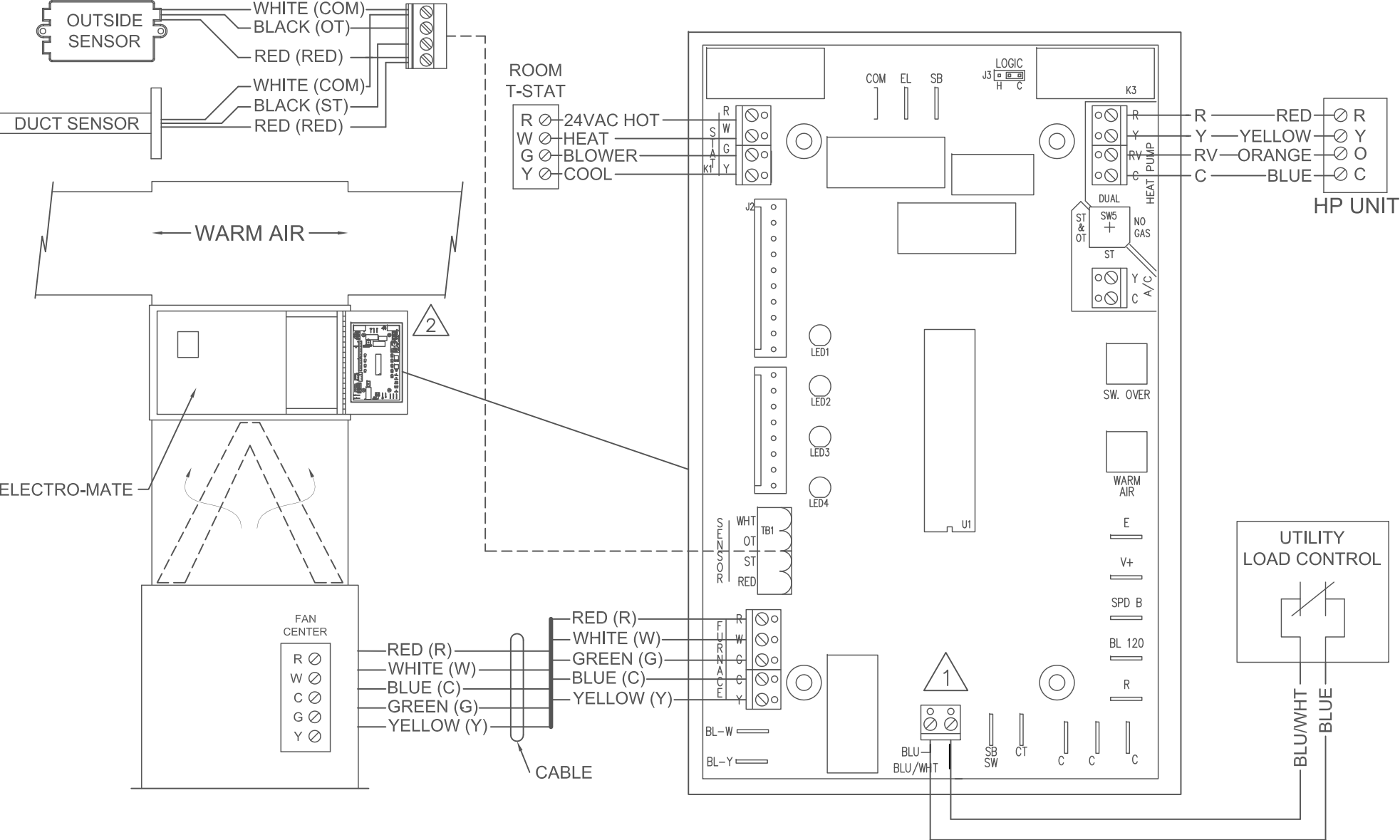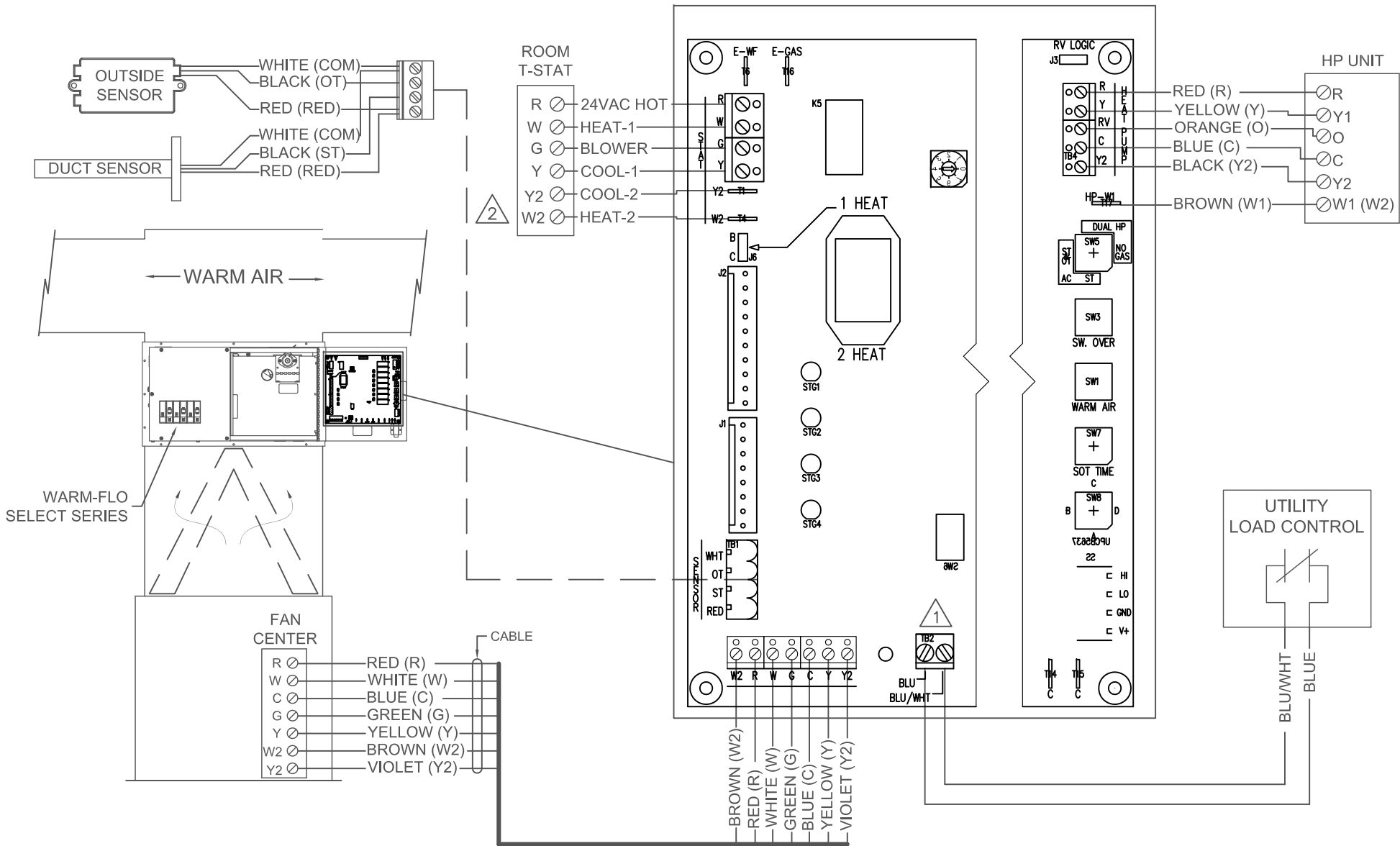MONTICELLO, MN 55362

EH812 P1
Rev A 8-23-2012

# WARMFLO+ UPGRADE KIT-
# HEAT PUMP HOOKUP

NOTES:
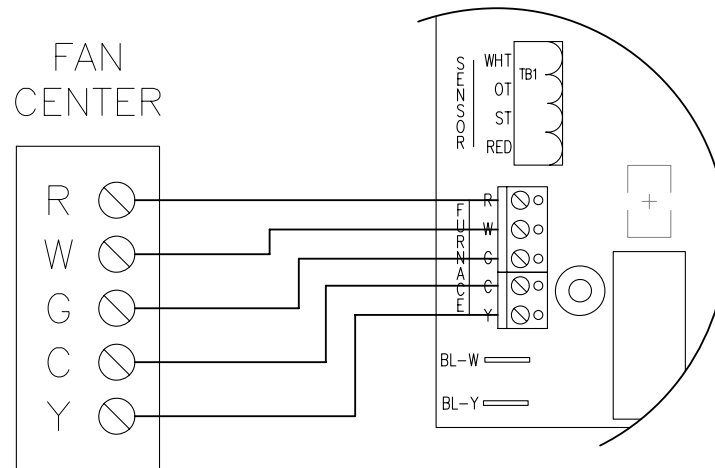1. REMOVE BLUE JUMPER AND CONNECT TO UTLITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.

2. DO NOT CONNECT TO A/C BLOCK.

OUTSIDE SENSOR
WHITE (COM)
BLACK (OT)
RED (RED)

DUCT SENSOR
WHITE (COM)
BLACK (ST)
RED (RED)

ROOM T-STAT
R — 24VAC HOT
W — HEAT
G — BLOWER
Y — COOL

R W G Y
S T A T
K1

WARM AIR

ELECTRO-MATE

FAN CENTER
R
W
C
G
Y

RED (R)
WHITE (W)
BLUE (C)
GREEN (G)
YELLOW (Y)

CABLE

RED (R)
WHITE (W)
GREEN (G)
BLUE (C)
YELLOW (Y)

FURNACE
R
W
G
C
Y

BL-W
BL-Y

SENSOR
WHT
OT
ST
RED
TB1

COM  EL  SB
LOGIC
J3  H  C

J2

LED1
LED2
LED3
LED4

U1

K3
R — R — RED — R
Y — Y — YELLOW — Y
RV — RV — ORANGE — O
C — C — BLUE — C

HEAT PUMP
DUAL

ST & OT
SW5
NO GAS
ST
Y C
A/C

HP UNIT

SW. OVER

WARM AIR

E
V+
SPD B
BL 120
R

1
BLU
BLU/WHT

SB SW    CT    C    C    C

UTILITY LOAD CONTROL

BLU/WHT
BLUE

ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

EH812 P2
Rev A 8-23-2012

# WARMFLO+ UPGRADE KIT-
# HEAT PUMP HOOKUP

⚠1 NOTES:
REMOVE BLUE JUMPER AND CONNECT TO UTLITY CONTROL RECEIVER. IF NOT USED, KEEP BLUE JUMPER IN PLACE.

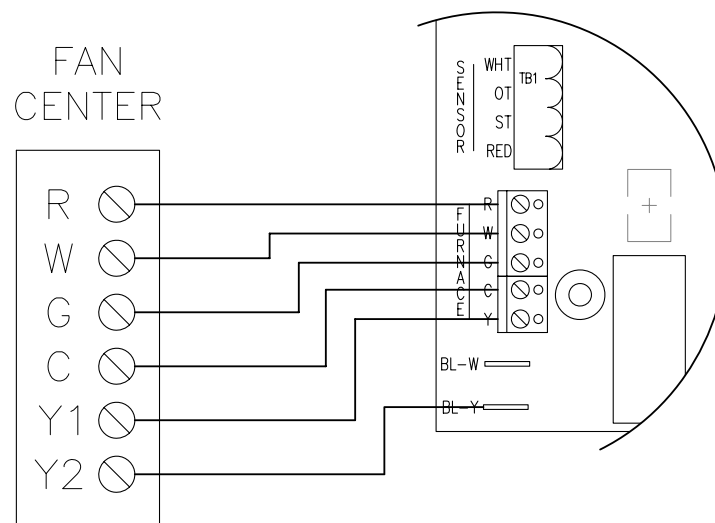⚠2 SHOWN WITH 2H/2C CONVENTIONAL STAT, 1H/1C CAN BE USED, SEE INSTALL MANUAL.

OUTSIDE SENSOR
WHITE (COM)
BLACK (OT)
RED (RED)

DUCT SENSOR
WHITE (COM)
BLACK (ST)
RED (RED)

ROOM T-STAT
R — 24VAC HOT — R
W — HEAT-1 — W
G — BLOWER — G
Y — COOL-1 — Y
Y2 — COOL-2 — Y2
W2 — HEAT-2 — W2
⚠2

E-WF  E-GAS
K5
1 HEAT
2 HEAT
B C J6
J2
STG1
STG2
J1
STG3
STG4
SW8

RV LOGIC
J3

HEAT PUMP
R — RED (R) — R
Y — YELLOW (Y) — Y1
RV — ORANGE (O) — O
C — BLUE (C) — C
Y2 — BLACK (Y2) — Y2
TB4
HP W1
— BROWN (W1) — W1 (W2)

HP UNIT

DUAL HP
SW5
NO GAS
ST OT
AC  ST
SW3
SW. OVER
SW1
WARM AIR
SW7
SOT TIME
SW8
B  D
SS
upgsst21
HI
LO
GND
V+

WARM AIR

WARM-FLO SELECT SERIES

WHT
OT
ST
RED

FAN CENTER
R — RED (R)
W — WHITE (W)
C — BLUE (C)
G — GREEN (G)
Y — YELLOW (Y)
W2 — BROWN (W2)
Y2 — VIOLET (Y2)

CABLE

W2 R W G C Y Y2
BROWN (W2)
RED (R)
WHITE (W)
GREEN (G)
BLUE (C)
YELLOW (Y)
VIOLET (Y2)

TB2
BLU
BLU/WHT
⚠1

TH4  TH5
C     C

UTILITY LOAD CONTROL
BLU/WHT
BLUE

# WARMFLO+ UPGRADE KIT
## VARIABLE-SPEED BLOWER OPTIONS

### FURNACE — G & Y ONLY.

FAN CENTER

- R
- W
- G
- C
- Y

SENSOR

TB1
- WHT
- OT
- ST
- RED

FURNACE
- R
- W
- C
- C
- Y

BL-W
BL-Y

+

### FURNACE — G, Y1, Y2
### Y1 FOR HEAT, Y2 FOR COOL

FAN CENTER

- R
- W
- G
- C
- Y1
- Y2

SENSOR

TB1
- WHT
- OT
- ST
- RED

FURNACE
- R
- W
- C
- C
- Y

BL-W
BL-Y

+

# WARMFLO+ UPGRADE KIT
# VARIABLE-SPEED BLOWER OPTIONS

FURNACE — G, Y1, Y2
ALWAYS RUN IN HIGH SPEED

FAN CENTER

SENSOR
WHT
OT
ST
RED
TB1

FURNACE
R
W
C
C
Y

BL-W
BL-Y

R
W
G
C
Y1
Y2
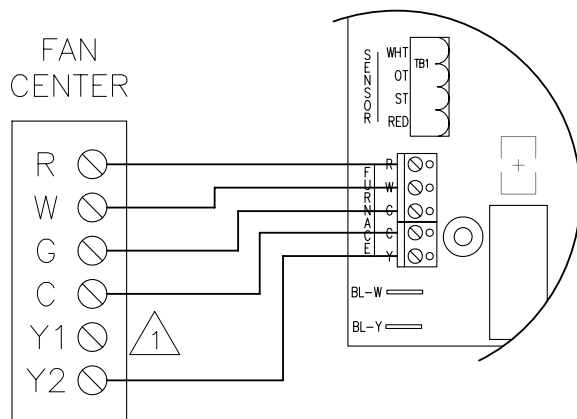
NOTES:

1. SOME FURNACES REQUIRE Y1 WITH Y2. IF THIS IS YOUR CASE, JUMPER AS REQUIRED.

1 FURNACE — G, Y1, Y2
Y1 LOW HEAT
Y2 WF ST>105 OT<30
Y2 HIGH COOL

FAN CENTER

R
W
G
C
Y1
Y2

SENSOR
WHT
OT
ST
RED
TB1

FURNACE
R
W
C
C
Y

BL-W
BL-Y

LED3
LED4
LED8
LED9
U1

E
V+
SPD B
BL 120
R

K4

BLU
BLU/WHT

SB
SW
CT
C
C
C

ADD EE-5053

ORG/BLK ——— NC

BLU/YEL ——— NO ——— YEL/GRN

BLK/YEL ——— (24VDC OR 24VAC) ——— GRAY
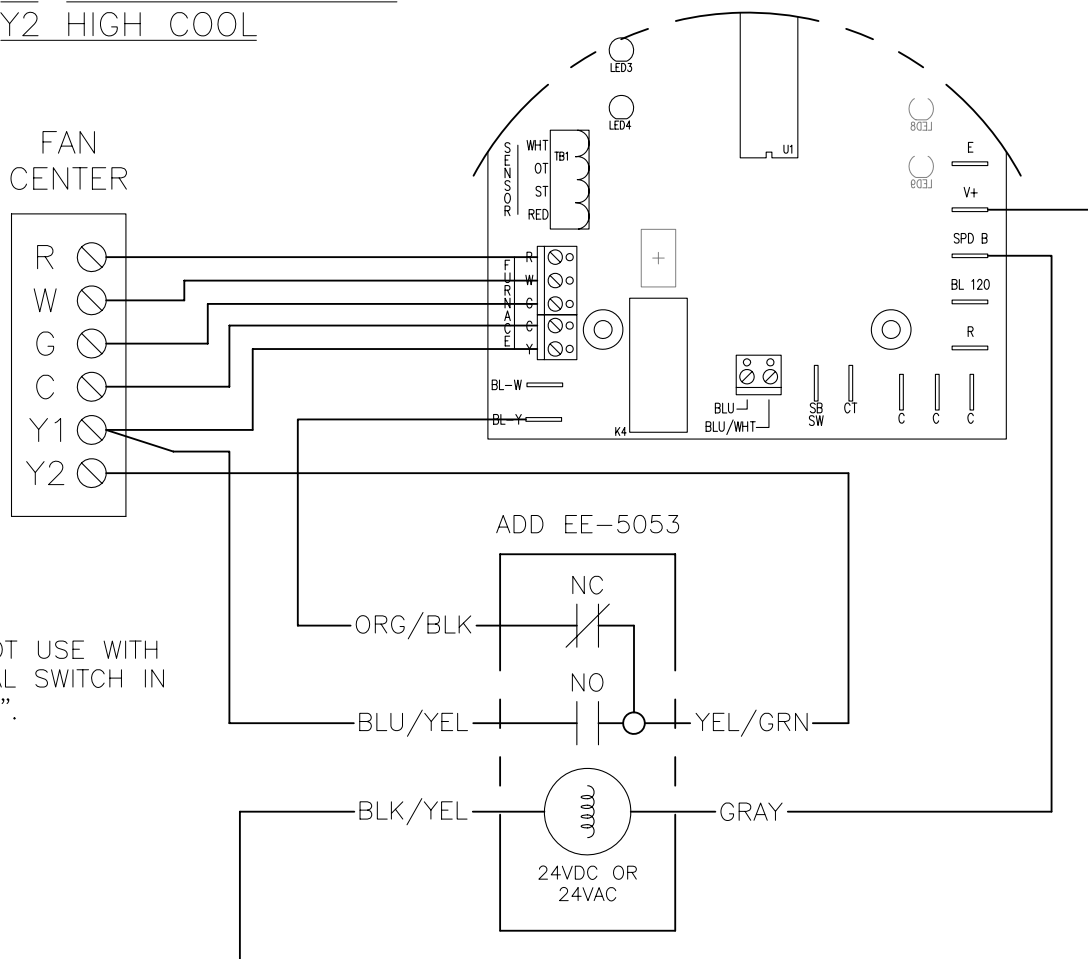
NOTES:

1. DO NOT USE WITH MODE DIAL SWITCH IN "ST ONLY".

ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

# Electro Industries, Inc. Residential
# Limited Product Warranty
### Effective November 1, 2009

Electro Industries, Inc. warrants to the original owner, at the original installation site, for a period of two (2) years from date of original purchase, that the product and product parts manufactured by Electro Industries, Inc. are free from manufacturing defects in materials and workmanship, when used under normal conditions and when such product has not been modified or changed in any manner after leaving the plant of Electro Industries, Inc.  If any product or product parts manufactured by Electro Industries, Inc. are found to have manufacturing defects in materials or workmanship, such will be repaired or replaced by Electro Industries, Inc.  Electro Industries, Inc., shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Electro Industries, Inc. may request that the materials be returned to Electro Industries, Inc. at owner's expense for factory inspection.  The determination as to whether product or product parts shall be repaired, or in the alternative, replaced, shall be made by Electro Industries, Inc. or its authorized representative.

Electro Industries, Inc. will cover labor costs according to the Repair / Replacement Labor Allowance Schedule for a period of ninety (90) days from the date of original purchase, to the original owner, at the original installation site.  The Repair / Replacement Labor Allowance is designed to reduce the cost of repairs.  This Repair / Replacement Labor Allowance may not cover the entire labor fee charged by your dealer / contractor.

### TWENTY YEAR (20) LIMITED WARRANTY ON BOILER ELEMENTS AND VESSELS
Electro Industries, Inc. warrants that the boiler elements and vessels of its products are free from defects in materials and workmanship through the twentieth year following date of original purchase.  If any boiler elements or vessels are found to have a manufacturing defect in materials or workmanship, Electro Industries, Inc. will replace them.

### TWENTY YEAR (20) LIMITED WARRANTY ON SPIN FIN ELEMENTS
Electro Industries, Inc. warrants that the spin fin elements of its products are free from defects in materials and workmanship through the twentieth year following date of original purchase.  If any spin fin elements are found to have a manufacturing defect in materials or workmanship, Electro Industries, Inc. will replace them.

### FIVE YEAR (5) LIMITED WARRANTY ON OPEN WIRE ELEMENTS

Electro Industries, Inc. warrants that the open wire elements of its products are free from defects in materials and workmanship through the fifth year following date of original purchase.  If any open wire elements are found to have a manufacturing defect in materials or workmanship, Electro Industries, Inc. will replace them.

**ELECTRO INDUSTRIES**
Monticello, Minnesota
800.922.4138
www.electromn.com

## THESE WARRANTIES DO NOT COVER:

1. Costs for labor for removal and reinstallation of an alleged defective product or product parts, transportation to Electro Industries, and any other materials necessary to perform the exchange, except as stated in this warranty. Replacement material will be invoiced to the distributor in the usual manner and will be subject to adjustment upon verification of defect.

2. Any product that has been damaged as a result of being improperly serviced or operated, including, but not limited to, the following: operated with insufficient water or airflow, allowed to freeze, subjected to flood conditions, subjected to improper voltages or power supplies, operated with airflow or water conditions and/or fuels or additives which cause unusual deposits or corrosion in or on the product, chemical or galvanic erosion, improper maintenance or subject to any other abuse or negligence.

3. Any product that has been damaged as a result of natural disasters, including, but not limited to, the following: lightning, fire, earthquake, hurricanes, tornadoes or floods.

4. Any product that has been damaged as a result of shipment or handling by the freight carrier. It is the receiver's responsibility to claim and process freight damage with the carrier.

5. Any product that has been defaced, abused, or suffered unusual wear and tear as determined by Electro Industries or its authorized representative.

6. Workmanship of any installer of the product. This warranty does not assume any liability of any nature for unsatisfactory performance caused by improper installation.

7. Transportation charges for any replacement part or component, service calls, normal maintenance; replacement of fuses, filters, refrigerant, etc.

## CONDITIONS AND LIMITATIONS:

1. If at the time of a request for service the original owner cannot provide an original sales receipt or a warranty card registration then the warranty period for the product will have deemed to begin thirty (30) days after the date of manufacture and **NOT** the date of installation.

2. The product must have been sold and installed by a licensed electrical contractor, a licensed plumbing contractor, or a licensed heating contractor.

3. The application and installation of the product must be in compliance with Electro Industries' specifications as stated in the installation and instruction manual, and all state and federal codes and statutes. If not, the warranty will be null and void.

4. The purchaser shall have maintained the product in accordance with the manual that accompanies the unit. Annually, a qualified and licensed contractor must inspect the product to assure it is in proper working condition.

5. All related heating components must be maintained in good operating condition.

6. All lines must be checked to confirm that all condensation drains properly from the unit.

7. Replacement of a product or product part under this limited warranty does not extend the warranty term or period.

8. Replacement product parts are warranted to be free from defects in material and workmanship for ninety (90) days from the date of installation. All exclusions, conditions, and limitations expressed in this warranty apply.

9. Before warranty claims will be honored, Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Remedies under this warranty are limited to repairing or replacing alleged defective product or product parts. The decision whether to repair or, in the alternative replace, products or product parts shall be made by Electro Industries or its authorized representative.