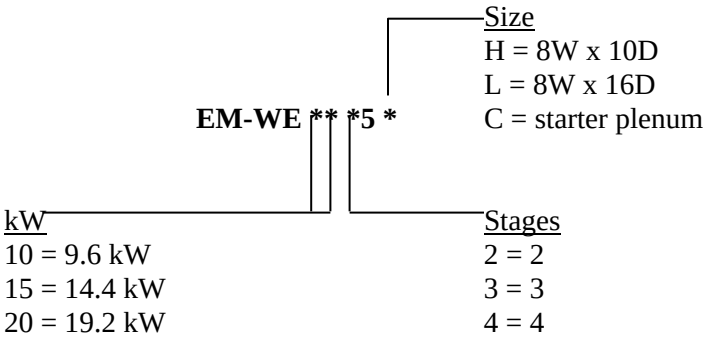
WarmFlo Equipped

Electric Duct Heater



Application – total electric systems.

- Air or water source heat pumps
- Air handler includes refrigerant coil, blower inlet
- No standby or gas furnace provisions

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 electrical hookup section suggests wiring for load control receiver connection. If installation also requires switchover to automatic standby furnace, call factory for necessary furnace interface module (WF-EM3, WF-LGR3, or WF-EZ3).

To meet the above application, this WarmFlo system comes with a multi-coded chip. If factory default does not match your application, reference HD320 for other setup parameters.

ELECTRO INDUSTRIES
Monticello, Minnesota
800.922.4138
www.electromn.com

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INTRODUCTION

Prior to installation we recommend that the installer verify the product intended application is applicable to your current installation needs.

This product provides generic forced air electric resistance heater designed for air handler, heat pump, or blower cabinet outlet duct installation. The relationship of the blower outlet to this insert heater must be according to the specific mechanical installation or instruction in detail of this manual.

First-time or non-routine user – before attempting installation or setup, suggest studying the last section of this manual, operational information and terminology definitions.

Basically the minimum airflow through the element rack is 100 CFM per KW (assumes 100°F inlet from heat pump). Any air volume which passes around or outside of the element rack insert must be discounted or added to the minimum 100 CFM per KW requirement. This manual provides the necessary details for duct/plenum deflectors and/or duct heater element rack position in relationship to the blower wheel to assure correct airflow through the elements.

NOTE: The maximum inlet air temperature is 100°F. For inlet temperatures greater than 100°, contact the factory for special assistance.

This product is assembled complete with the WarmFlo II controller configured for a total electric application as defined on the cover page. Various field or installation settings and decisions are required, see the "Controller Setup" section.

For information, all units are rated at 240 volts AC. When operating at lower source voltage, the output may be reduced.

Example: 9.6KW unit, assuming normal element tolerances

220 volt source – 8 kW
208 volt source - 7.3 kW

****Installation Notice**** – the WarmFlo controller is designed to operate in conjunction with the complete heating system – heat pump, strip heat, roomstat, WarmFlo sensors, etc. If one of these components is missing or not initially installed, improper performance of the WarmFlo and the heating system may be experienced. Suggest electrically this unit and the WarmFlo controller not be installed or used until all the components of the heating system are in place and functional.

Warranty/Checkout – Attached to this manual is a warranty certification and checkout procedure. This must be completed and returned for warranty coverage.

Failure to follow the mechanical installation details of this manual may shorten element life and may void limited warranty provisions.

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 electromn.com for upcoming service schools.**
2. All electrical wiring must be in accordance with national electric codes and local electric codes, ordinances, and regulations.
3. Observe electric polarity and wiring colors. Failure to observe could cause electric shock and/or damage to the equipment.
4. 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, the ARL certification label, and manufacturer product liability. Electro Industries, Inc., cannot be held responsible for field modifications, incorrect installation, and conditions which may bypass or compromise the built-in safety features and controls.

SPECIFICATIONS - TABLE 1

Model	Nominal kW	Current+	Min. CFM	Element Cross Section	Source CB	Internal Fuse	Shipping Weight
EM-WE1025H	9.6	40	1000	8 W x 10 D	50	N/A	12
EM-WE1535H	14.4	60	1500	8 W x 10 D	75	30 & 50	16
EM-WE2035H	19.2	80	2000	8 W x 10 D	100	50 & 50	19
EM-WE1025L	9.6	40	1000	8 W x 16 D	50	N/A	15
EM-WE1535L	14.4	60	1500	8 W x 16 D	75	30 & 50	19
EM-WE2035L	19.2	80	2000	8 W x 16 D	100	50 & 50	21

NOTE: Model series EM-WE****C is the same element and control box assembly as model EM-WE****L except prepackaged in a 16”w x 16”d plenum.

* Assumes 100°F inlet and all air passes through element rack. If duct/plenum is larger than element rack (without factory deflector kit), the air volume external (passing around) to the element rack must be added to this CFM requirement.

+ At 240 volt, single phase.

MECHANICAL INSTALLATION

NOTE: When installing or mounting this duct heater within four feet of the blower outlet, the following steps **must** be followed as detailed and shown in the appropriate drawing. This is necessary because the airflow from the blower outlet, A-coil, T-Duct, elbows, etc., is very non-uniform. The elements themselves must be centered over the blower opening width (wheel width) and the element rack must be in line with the blower outlet outer edge, see Figure 2.

MODELS: EM-WE**H&L**

Depending upon access and blower size, there are three possible insert locations. All reference is viewing the blower wheel end as shown on Figure 3.

These blower arrangements are detailed and shown for UPFLOW and horizontal installations.

1. Blower End, Reference Figure 3 – only use model number last digit "H". As shown on the drawing, the element rack right edge must line up with the blower outlet right edge. There shall be no opportunity for air to pass by the element rack on the right. Basically the blower opening or plenum width (area to the left of the element rack) is of little or no concern. All of the air coming off of the blower wheel is in the first 4 to 6 inches on the outer scroll of the blower.

   The control box back edge must line up with the blower opening edge. This is shown on Figure 3 with the reference "in line". If the plenum section in which the Electro-Duct is inserted is larger than the blower opening so that this "in line" cannot take place, do not use this method of installation.

   If the plenum depth (area behind the elements) is larger than about 11 inches, a V deflector will be required in the back of the plenum. See Figure 1 for examples of field constructed V deflector.

2. Insertion Over Blower, Reference Figure 2 – this is the preferred installation method if the blower width (wheel width) is 8 to 10 inches for the "H" model or 14 to 16 inches for the "L" model. Of greater concern is the opening depth (element rack length). The element rack must touch the back of the plenum when inserted.

   Again, if the plenum is larger than the blower opening, this method may not work without V deflectors as shown on Figure 1.

3. Insertion from the Blower Back – this is opposite from Figure 2 where the control box edge would line up with the blower back outlet edge. Also with this method, the elements are centered on the wheel width and the hi-limit panel must be in line with the blower edge. Typically the blower opening depth (element rack length) is of little concern because all the air coming off of the blower wheel is at the scroll outer edge.

Plenums Larger Than Element Rack – whenever the plenum or duct is larger than the element rack, field constructed or factory optional starter plenum is available or V deflectors are required to force the air through the element rack. Figure 1 is to be considered an example. This internal deflector must be complete and installed as shown. Do not simply use "an angled piece of tin". You must have the top section carried back to the side of the plenum to prevent eddy currents. Basically the installer is simply providing an internal scoop with the outer edge lined up with the bottom element. This will direct the air properly through the element rack.

NOTE: The airflow must be in the direction of the decal airflow.

MODEL: EM-WE**C**

This model includes starter plenum. Position over the blower outlet with the blower discharge at the plenum right (facing Electro-Duct control box). In other words, when facing the control box, you will also be looking at the blower motor end.

ELECTRICAL HOOKUP

High Voltage

240 VOLT SOURCE - Locate correct model number and KW size in Table 1 to determine operating current and minimum source circuit breaker size. According to local codes, building type, wiring run distance, etc., use the appropriate electric conductor size for the 240-volt source power. Connect to fuse block/input terminals (10KW is terminal block only).

GROUNDING - Route and install the appropriate size ground conductor between the ground lug labeled "GROUND" and building service entrance panel ground bus. This must be a conductor sized according to the total amp rating of the appropriate model. Conduit is not an adequate ground conductor.

Low Voltage

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. This WarmFlo controller has **no control** over the heat pump, blower, room thermostat, or other parts of the heating system. In its simplest form, consider this product as an "add-to" electrical connection.

> **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.

WarmFlo II Sensors

Located within each WarmFlo control are two sensing probes, **OT (outdoor sensing)** and **ST (supply sensing)** necessary for proper operation and installation of the WarmFlo systems. **Without proper installation of these probes the WarmFlo system will not operate correctly.**

Outdoor Sensor (OT) is identified by the longer cable and the metal mounting bracket.

- Determine best location for the OT sensor using the following ground rules.
  - Locate on the outside of the house to sample outside temperature least affected by sun.
  - Locate sensor away from other objects that produce a heat or cool effect such as heat pump Freon line sets, drier vents, and other miscellaneous objects that affect the air temperature.
  - Do not install sensor in an enclosure which may have a "heat build up" or insulation effect.
- Disconnect OT and ST sensor cable from WarmFlo Controller noting the screw locations for future re-hookup.
- The factory supplied OT cable is approximately 25'. Determine necessary length of cable to route to the predetermined outside location. If the sensor wire cable is too short, you must use the following rules for extending the cable.
  - Use unshielded (low capacitance, prefer twisted) 3 or 4 wire low voltage cable, **35 foot** maximum.
  - Do not under any circumstances use leftover wires within the thermostat cable going to the outdoor unit.
  - Consider approximately 50' as the maximum total length.
- Mount OT sensor with sensor tip up (cable downward)
- Drill ¼" hole near the outside sensor location.
- Route wire from outside making sure not to crimp, cut, staple, or damage cable in any way.
- Keep the sensor cables at least 12" away from any line voltage wiring, Romex, etc. Do not, under any circumstances, use part of existing thermostat cable, leftover wires, for the sensor cable.
- Do not reconnect sensor wires to the 4-screw terminal block until both sensors are properly installed.

Warm Air Supply Sensor (ST)

- Locate the ST sensor directly above the electric elements. Requirement is about 24" above the elements, approximately centered. If there is not 24" height before take-off ducts, locate in the major distribution duct approximately 3" into distribution duct and approximately 2" from the top.
- Drill ½" hole for insertion of the ST sensor tube and the appropriate holes for sheet metal screw mounting.
- Mount ST tube using two mounting holes.

OT & ST Sensor Reconnection

- A plug-in terminal block is provided for wiring convenience.
- Both red wires are terminated in the same single screw (+), and both white wires are terminated in the single common screw (COM). Each appropriate black wire is terminated in the appropriate OT and ST screw.

⚠ WARNING

IF THE BLACK AND RED SENSOR WIRES ARE CROSSED OR INCORRECTLY INSTALLED AT THE TERMINAL BLOCK AND POWER IS TURNED ON, BURNOUT DAMAGE CAN RESULT WITHIN THE SENSOR PROBE.

WarmFlo Controller Thermostat Connections (reference hookup drawing HH310)

24-Volt Power Source – this controller will receive its operating power from the heat pump main and only 24-volt transformer. This is the same as the "R and C" terminals between the roomstat and outdoor unit. Simply tap the 24-volt transformer and route to WarmFlo controller upper right "R" and "C".

Grounding – the installer must determine whether the heat pump 24-volt common has a good ground bond (not simply air handled cabinet skin). If 24-volt common is not grounded, ground the "C" tab (in addition to its normal hookup) for proper static ground protection.

Room thermostat first stage, Y – the roomstat yellow wire should go directly to the outdoor unit yellow. This stays intact, but simply add or "tap" a connection from this yellow wire and route to the WarmFlo "Y" tab. This is the basic "turn-on" or the connection which causes WarmFlo "to do its thing".

Stage 2, typically W or W1 – WarmFlo does **not** incorporate a Stage 2 function, there is no termination or connection for this wire. Nor is Stage 2 an optional pickup point for any other function related outside of the WarmFlo control requirement. Simply leave this unterminated and unused.

Optional, emergency switch function – this wire can be connected to the WarmFlo controller left "E" tab. This will override all temperature and WarmFlo controller logic functions. When energizing "E" all stages come on to their full capacity.

⚠ CAUTION

Since WarmFlo is an "add-to" controller and since E terminal is a single wire from the stat simply being energized, all other functions associated with blower, terminating the compressor, etc. when energizing all electric elements must take place external to this controller.

Heat anticipator – the connection of the WarmFlo "Y" tab does not affect the roomstat heat anticipator setting. The heat anticipator setting should remain as specified by the manufacturer's instructions.

Utility load control – no direct provisions are made within this product for dual heat or normal utility load management. In the normal WarmFlo dual heat arrangement load control happens within the furnace interface module (fossil fuel kit). However, if there is a requirement to control this strip heat product (electric elements) only, this can be accomplished with a simple connection. Also there is no provision in this product for compressor load control.

Built-in compressor ODT – if using the built-in ODT function, there must be an added relay to open the yellow wire going to the outside unit, dotted insert diagram on HH310. This must be a small, low current, 24-volt DC relay as shown or order EE-5053 part from Electro Industries.

CONTROLLER SETUP OR PROGRAMMING

Important - Located on the WF II board is a firmware chip that determines a specific set of defaults. This can also be programmed (altered) with optional PC software (ET-SOFT-WF) or a plug-in WarmFlo analyzer (WF-ANZ*). As part of the WF II system this chip represents critical defaults and settings that make your system operate correctly.

This application, as outlined on the cover page, is supplied with "HPEL". Other chip codes are available, or can be field reprogrammed, see Handheld Analyzer section.

The factory default setup of the WarmFlo II module is detailed below:

- Electric staging enable – Stage 1 = 50°F, 2 = 38°F, 3 = 36°F, 4 = 34°F
- MU time – set as disable
- ODT mode – HP ODT
- SOT S time – disabled
- SOT E time – disabled
- OT sensor function – DT cal.

NOTE: If these factory defaults do not meet your application, reference HD320 for more options.

Dial Settings

Left dial switch – min. warm air – The yellow screwdriver adjustment dial sets a "floor" or level minimum operating temperature. The supply temperature will never go below this point independent of outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve. Reference later section "heat loss curve".

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

Right dial switch - built-in compressor ODT – The yellow screwdriver adjustment dial can be set to terminate the heat pump (reference manual WF-ANZ*).

NOTE: Requires added relay to open yellow wire, see Electrical Hookup section.

The temperature settings related to the "ODT dial" are:

Ø = Disabled, no ODT switch-over		Factory set on #3.
1 = -15°F	5 = 10°F	
2 = -10°F	6 = 20°F	
3 = 0°F	7 = 30°F	
4 = 5°F		

COMMENT: If you are using outdoor compressor built-in ODT, set the dial to "0".

Center dial switch – temperature (efficiency dial) vs. outside – see later section "Heat Loss Curve", the numbers below set a duct or supply temperature point at 0° degree outside. This allows the installer or user to determine the WarmFlo controller heat loss slope or how fast the supply temperature rises based upon a decrease in outside temperature. The lower the selected value (flatter the heat loss curve) the higher the operating efficiency (longer compressor run cycles). The higher the selected value, more electric resistance is used to provide a higher comfort warmer air at the room register. If set on #7, the elements will be full on at each thermostat heat call.

Ø = 100	4 = 122	Factory set on #2.
1 = 110	5 = 125	
2 = 114	6 = 130	
3 = 118	7 = Full EL	

See Operational Information section for further explanation.

OPERATION INDICATORS

WarmFlo II Controller

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 controller disables or locks out strip heat elements based upon outdoor temperature.

Stage 1 - 5Ø°F
Stage 2 - 38°F
Stage 3 - 36°F
Stage 4 - 34°

Monitor LED's on WF II Controller

Green LED - When illuminated the WarmFlo II controller is receiving 24v power. Under all normal operating modes, this should be solid green.

- As a secondary function this green LED provides status of the two remote sensors. If a sensor is inoperative, incorrectly wired, or malfunctioning; this monitor light is in a blinking or pulsing mode. By checking the pulsing pattern, the appropriate sensor can be identified.
    - OT sensor - 1ØØ ms blink every second.
    - ST sensor - two, 1ØØ ms blinks every second.
    - Both bad - ½ second on, ½ second off, alternating.

Amber LED – When illuminated the WarmFlo II controller is in the electric heat operating mode.

Red LED's - The four red LED's next to the output connector, indicate Stage 1, 2, 3, and 4 operation (Stage 1 is on the right).

Inside Relay Board Monitor Light

COMMENT: The relay board activates from the WarmFlo II controller as the WarmFlo II controller interprets the "Y" input voltage in relationship to both temperature sensor requirements. However, the "Y" input also directly controls the Stage 1 triac and the staging relays. Whenever the "Y" input goes to 0 volts (at the end of the cycle) the relay output immediately goes off and strip heat is turned off and not necessarily stepped down as shown by the WarmFlo II monitor Red LED's. This is a safety feature; strip heat cannot be on accidentally by the WarmFlo II controller internal logic if there is no "Y" input.

Red LED - Illuminates when the low voltage hi-limit sensor probe (135°) opens. This applies only after thermostat heat call and WarmFlo II controller is activating various element stages. If there is a hi-limit condition, red LED is illuminated. As soon as the hi-limit cools and snaps back in, red LED extinguishes.

Triac Relay Module (mounted next to relay board)

This module has its own built-in LED. When the LED is on, the triac switch is closed, elements will be heating. This LED shall operate coincident with Stage 1 on the WarmFlo board.

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 center dial switch to #7. Return to previous setting at the end.
- For this test the ODT dial 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:
    - 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:
    - Plenum temperature _____
    - 240 heating power, voltage _____
    - Measured 240 amps, current _____
    - Measured transformer control, voltage _____
- As you perform this test monitor the red LED on the relay board. 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.
    - Verify all airflow is through the electric elements (proper baffling, electric element positioning, etc.)
    - Increase airflow or determine ducting distribution problem loading the system.
    - Perhaps it can be assumed full electric element heat is not required when the compressor is running. If this is the decision, change the center dial switch to #4. If this improves the air delivery situation, provide informational technique to make sure the user never sets the center 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.

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.

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, there are two field calibration techniques. Proceed with extreme caution.

- The outdoor sensor can be calibrated with ice (32°F). This is not a temperature checking situation. If you proceed with this function, the sensor automatically goes to 32°F. Notice a small push button next to the sensor terminal block, with the sensor at 32°F, push and hold for approximately ten seconds. When green LED "blinks" at you, release and now the outdoor sensor is set at 32°F.

- Use WarmFlo II 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 II 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 for either test set device

Troubleshooting/Repair Helps

- This WarmFlo II 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 II 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.

- 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.

- 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.

- 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.

- Acquiring the WarmFlo II 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 II controller. Either test set device can display all temperatures, real time evaluation of WarmFlo II functions, provide temperature offsets for assimilating winter conditions, and reprogram the control chip (program stays with the actual WarmFlo circuit board, not with the plug-in chip).

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 there will be an attempt to cause the electric heat output to go "DT flat".

- 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

OPERATIONAL INFORMATION

In order for the installer to completely understand the WF II functions and operational sequence it is recommended to thoroughly read and understand the information below. This knowledge can help in determining settings that can be set according to the end customers needs.

Normal Heating Operation – Whenever the WarmFlo II Y tab is at 24 volt (with reference to "C"), the WarmFlo II controller begins turning on the Electro-Mate elements (assume outdoor temp. is below disable value) and automatically controls the warm air temperature as sampled by the warm air sensor (ST). However, if added heat is **not** required, no element power is used.

Depending upon Electro-Mate model, the heating section may have one, two, three, or four stages. Stage 1 is pulse modulated (approximate 10-second cycle) based upon the WarmFlo II controller automatic requirement. Stages 2, 3, and 4 are turned on and off with a relay. However, Stage 2 is only used when needed by the WarmFlo II supply air temperature calculations. When the warm air sensor is calling for more than the heat pump and Stage 1 100% output, Stage 2 turns on. Stage 1 may not necessarily remain at 100%, but is modulated downward to meet the requirements of the warm air sensor.
Also on the next call for heat, the WarmFlo II controller remembers what stages were on and starts at that point. A clamp-on amp meter at the service input can be used to "visualize" the Stage 1 modulation and/or Stages 2, 3, and 4 functions.

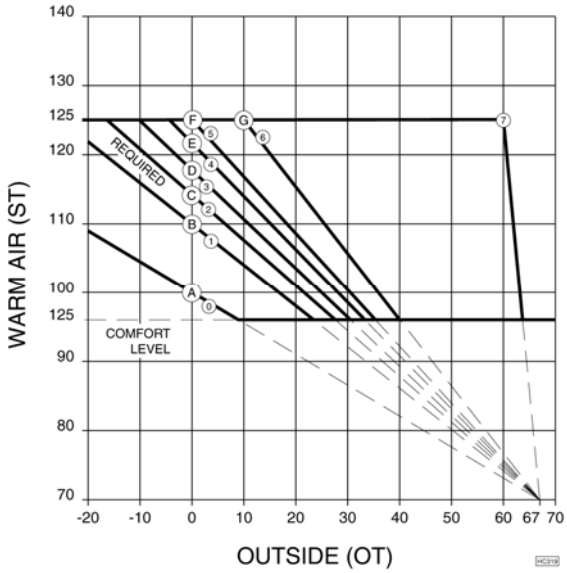
Efficiency – the characteristic of a heat pump dual heat system is the heat pump's ability to deliver warm air at efficiencies greater than 100%. Gas and oil systems are always less than 100% (60% through 90%), resistance electric (Electro-Mate) is always exactly 100%, but the heat pump is always at least 100% (-20°F) or greater, up to about 200% for air source.

Realizing it is to the user's advantage to run the heat pump either continuously or at the longest possible thermostat call cycles. This is contrary to the basic understanding of most users. However, realizing again the heat pump is a device that delivers greater than 100%, this system can only deliver greater than 100% if it's running, let it run. Because of the WarmFlo design concept and its internal "brain" the heat loss curve (diagonal lines, above) allows the compressor to operate with a minimal amount of electric resistance supplement or temperature boost.

Where should I set the efficiency (center) dial? – As you can visualize from the heat loss curve (Figure 1), the lower the setting, the flatter the curve, the less electric resistance is added to the heat pump compressor warm air. Therefore, the efficiency knob setting is based upon comfort and efficiency. The lower the setting the higher the overall operating annual efficiency, the higher the setting the warmer the air at the register.

Heat loss curve – within the "brain" of the WarmFlo controller is a relationship of supply temperature to outdoor temperature 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 65° outdoor and maximum Btu/h (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.

Figure 1



Factory set per table and chip on order sheet.

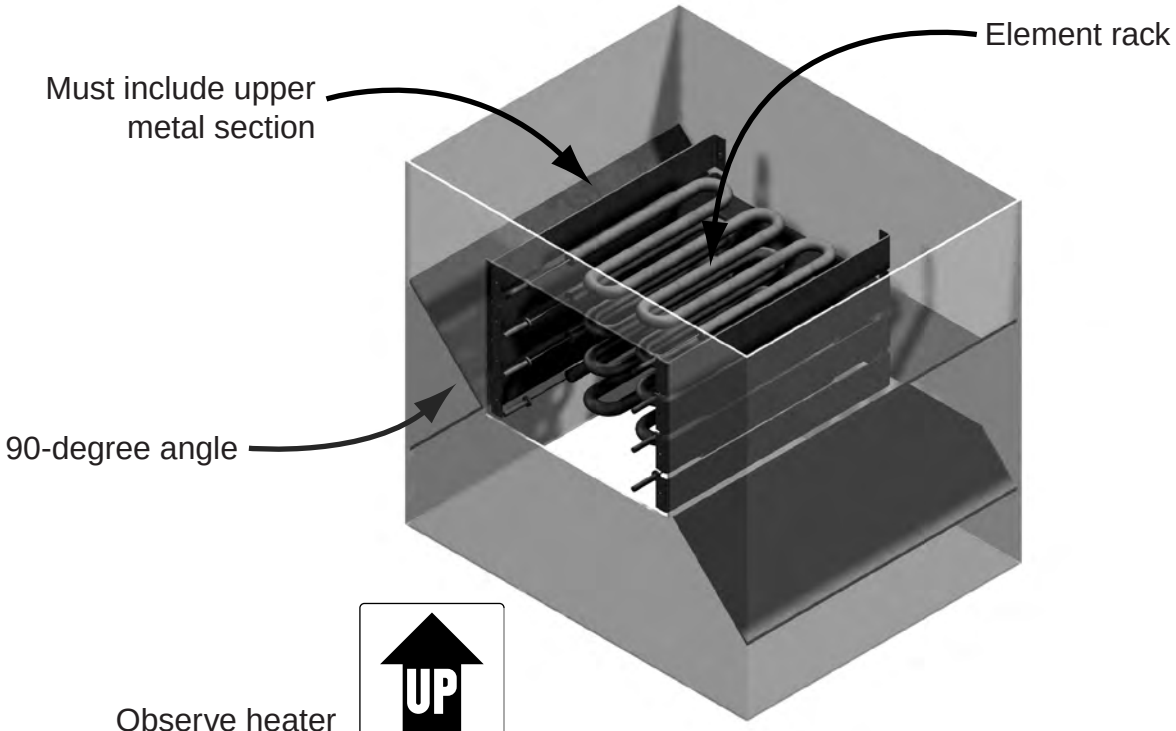
Outdoor sensor reference or heating requirement level – the outdoor digital sensor "tells" the WarmFlo "brain" its desired (DT) value or decision making capability. This is for desired or required supply temperatures greater than the "min. warm air" horizontal line setting. At each internal calculation cycle a DT is determined by reading the outdoor temperature and then finding the appropriate warm air point on the appropriate or selected diagonal line. See Figure 1 for the various diagonal lines associated with the A through G "temperature" selection knob.

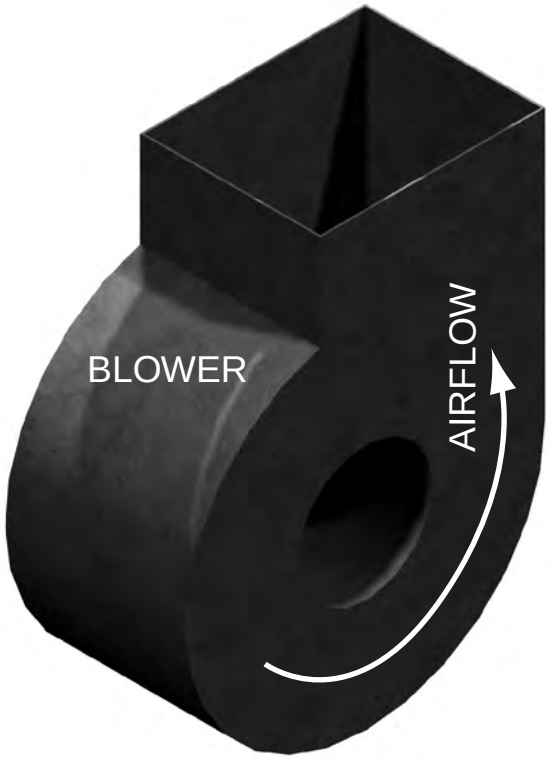
> **Example** – if the temperature knob is set on Position C, at 20° outside the DT or the supply delivery temperature is 100°. The WarmFlo controller now automatically adjusts and maintains electric element power to keep the supply temperature at 100°. Likewise if it -10° outside the DT or supply delivery temperature is 120°. The elements are re-adjusted to provide a constant 120° temperature.

Chip code/field programming – your unit was supplied with a "multi-coded" program chip, one of the selections shown in each Chip Code Reference Table for your application. These tables show the various defaults associated with that particular code. With WarmFlo II version a number of field re-programming possibilities and options exist using either PC software or WarmFlo analyzer, reference "WarmFlo Handheld Analyzer/Laptop Software" section. Chip code is located on the WarmFlo II controller board white label.

> **Note:** There are certain things such as SOT's, MU time, etc. which are only field programmable. If the item is not shown in the chip code table, that feature or item is default set as disable.

Delay, transfer from standby to electric – if the unit was operating in SB for more than 1 minute, the follow-up transfer back to electric engages a 2-minute delay before the HP compressor relay is activated and any of the electric stages are activated. The blower will react to the call for heat, but the elements will stay off for 2 minutes in order for the blower to cool down the furnace heat exchanger.



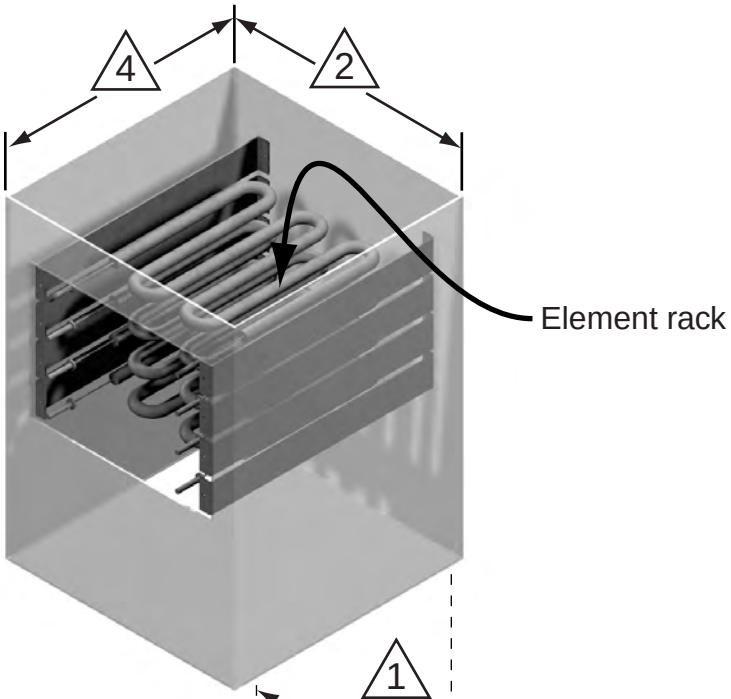


Notes:

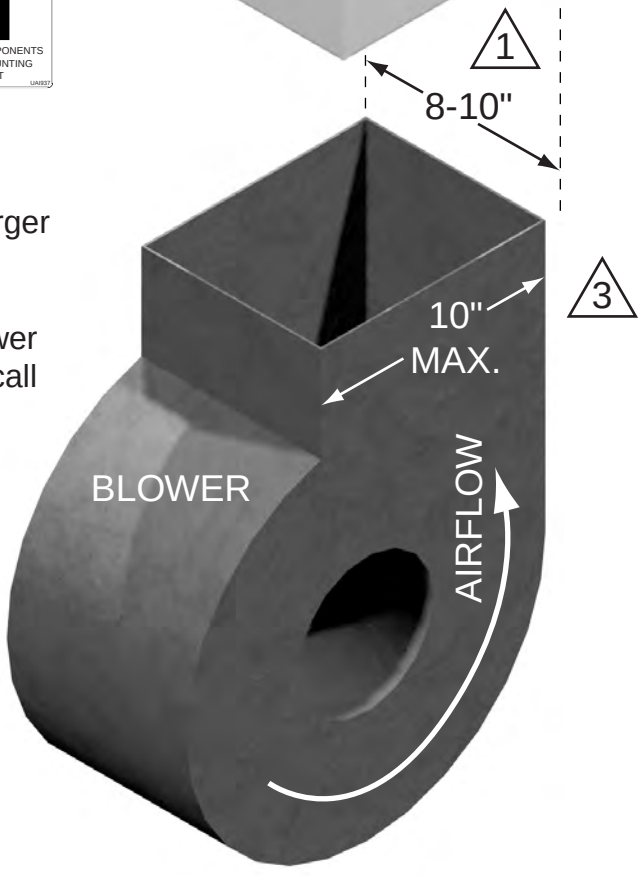
1. Center heater elements over blower outlet.
2. To maintain warranty, deflectors must be installed as shown.

IMPORTANT NOTE: When mounting Duct Heater within four (4) feet of blower and plenum is larger than blower opening, you MUST follow this drawing in detail!

ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION: DUCT HEATER LARGE PLENUM	
DRAWN: MEF	SOURCE DOCUMENT: 4383			
CHECKED: -	VIEW/DRAWING TYPE: DECAL LAYOUT		SCALE: 1:1	PART/ASSY/MODEL NUMBER: -
APPROVED: -	DRAWING STATUS: RELEASED	DOCUMENT DATE: 07-16-02	SHEET: 1/1	DOCUMENT NUMBER: EI503-F1



Observe heater air flow label



Notes:

1. Blower width range is 8" to 10". If larger than 10", must use side "V" deflectors.

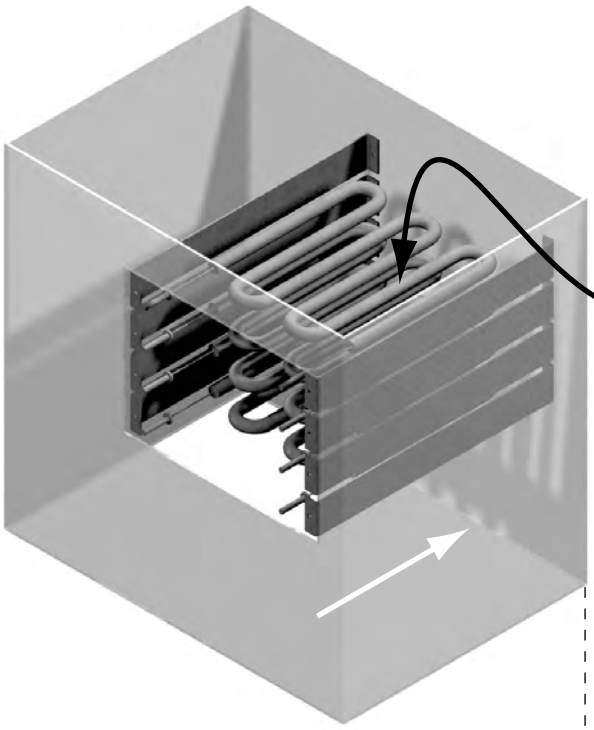
2. If the plenum/duct is wider than blower opening, must use side "V" deflector, call factory for assistance.

3. If smaller than 10", plenum can center over blower outlet. Cannot be larger than 10"

4. Max depth is 10". DO NOT use this insertion method unless element rack completely fills plenum.

IMPORTANT NOTE: When mounting Duct Heater within four (4) feet of blower and plenum is larger than blower opening, you MUST follow this drawing in detail!

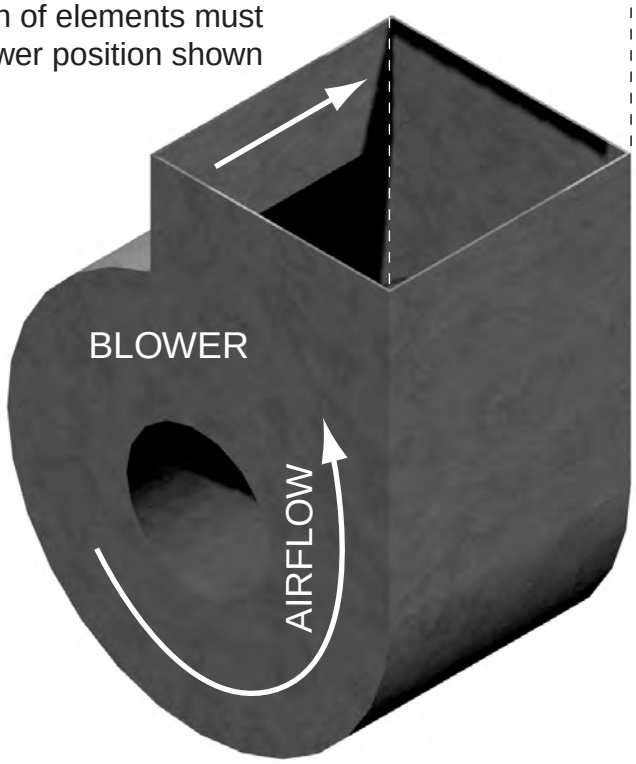
ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION DUCT HEATER MECHANICAL INSTALLATION - FRONT	
DRAWN MEF	SOURCE DOCUMENT 4384			
CHECKED -	VIEW/DRAWING TYPE DECAL LAYOUT		SCALE 1:1	PART/ASSY/MODEL NUMBER -
APPROVED -	DRAWING STATUS RELEASED	DOCUMENT DATE 07-24-02	SHEET 1/1	DOCUMENT NUMBER EI503-F2



Observe heater air flow label

FOR PROPER AIR FLOW:
Right edge of element duct heat heater MUST line up with right edge of blower

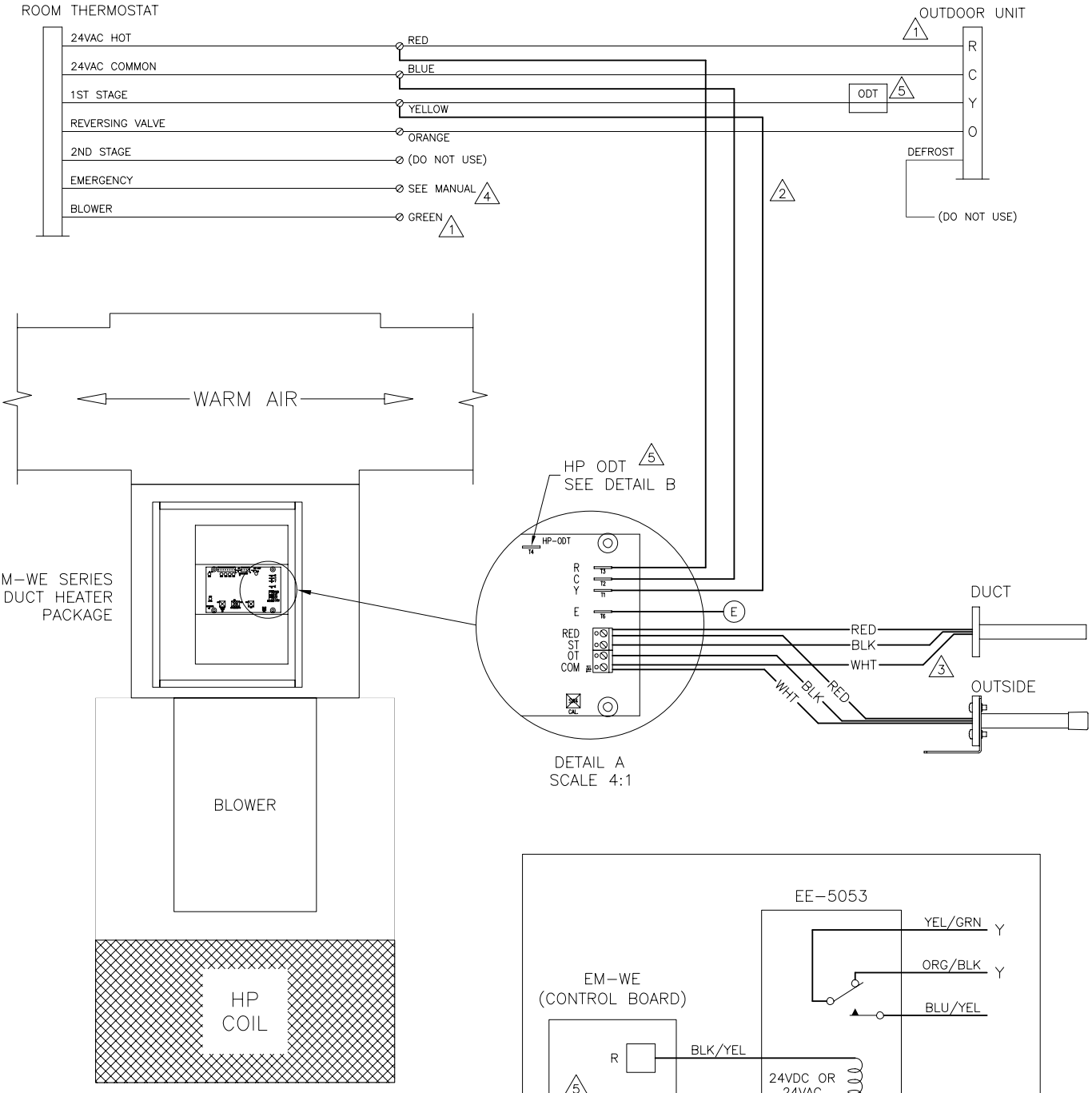
Direction of elements must match blower position shown



IMPORTANT NOTE: When mounting Duct Heater within four (4) feet of blower and plenum is larger than blower opening, you MUST follow this drawing in detail!

ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION DUCT HEATER MECHANICAL INSTALLATION - SIDE	
DRAWN MEF	SOURCE DOCUMENT 4385			
CHECKED -	VIEW/DRAWING TYPE DECAL LAYOUT		SCALE 1:1	PART/ASSY/MODEL NUMBER -
APPROVED -	DRAWING STATUS RELEASED	DOCUMENT DATE 07-24-02	SHEET 1/1	DOCUMENT NUMBER EI503-F3

WARMFLO SYSTEM
HP W/ EM-WE



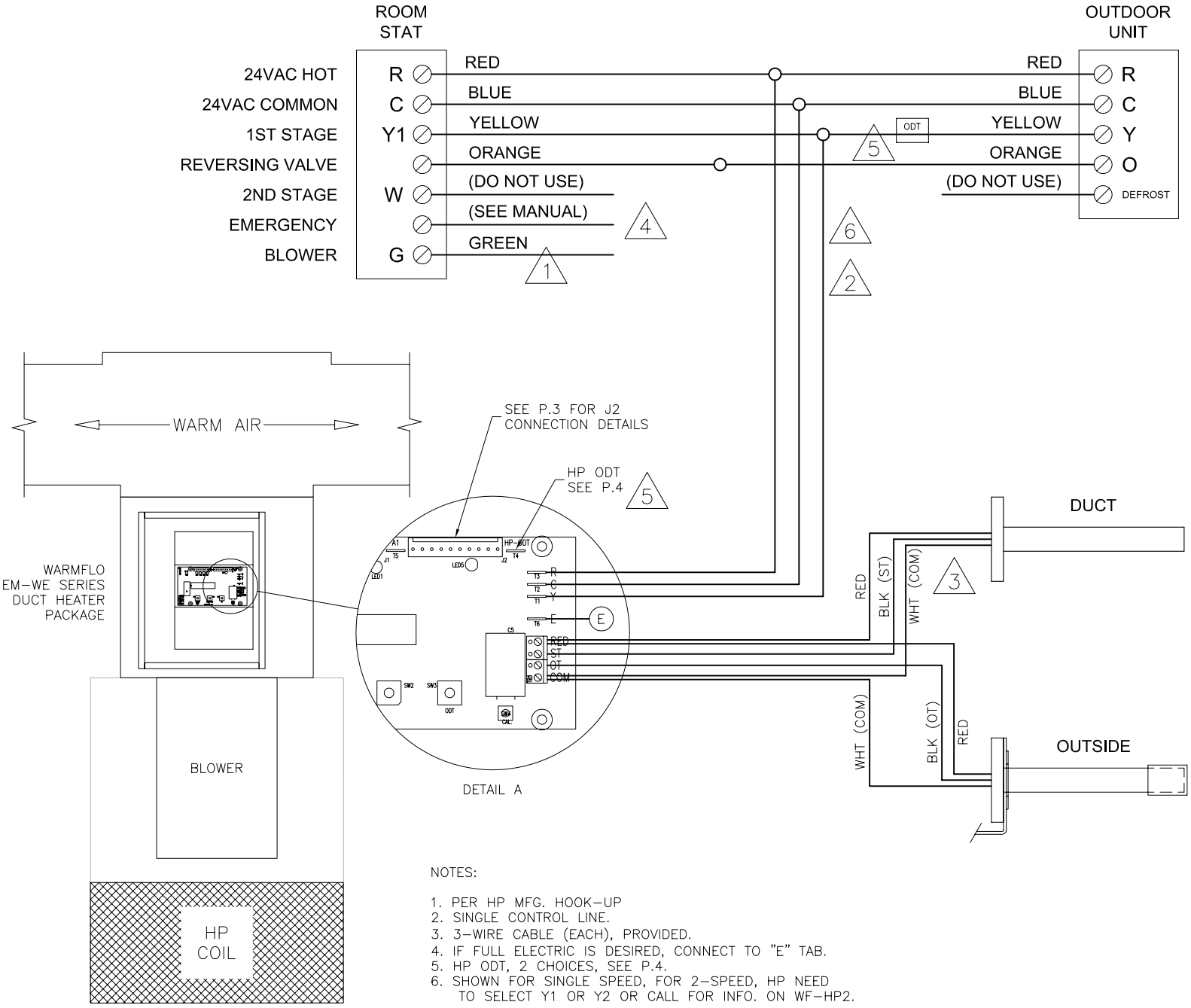
DETAIL B

NOTES:

1. PER HP MFG. HOOK-UP
2. SINGLE CONTROL LINE.
3. 3-WIRE CABLE (EACH), PROVIDED.
4. IF FULL ELECTRIC IS DESIRED, CONNECT TO "E" TAB.
5. HP ODT, 2 CHOICES:

- USE MFG. PROVIDED WITHIN OUTDOOR UNIT
- USE WARMFLO SENSOR & CONTROLLER, ADD RELAY (SEE DETAILS A, B)

HEAT PUMP, NON-DUAL HEAT, TOTAL ELECTRIC

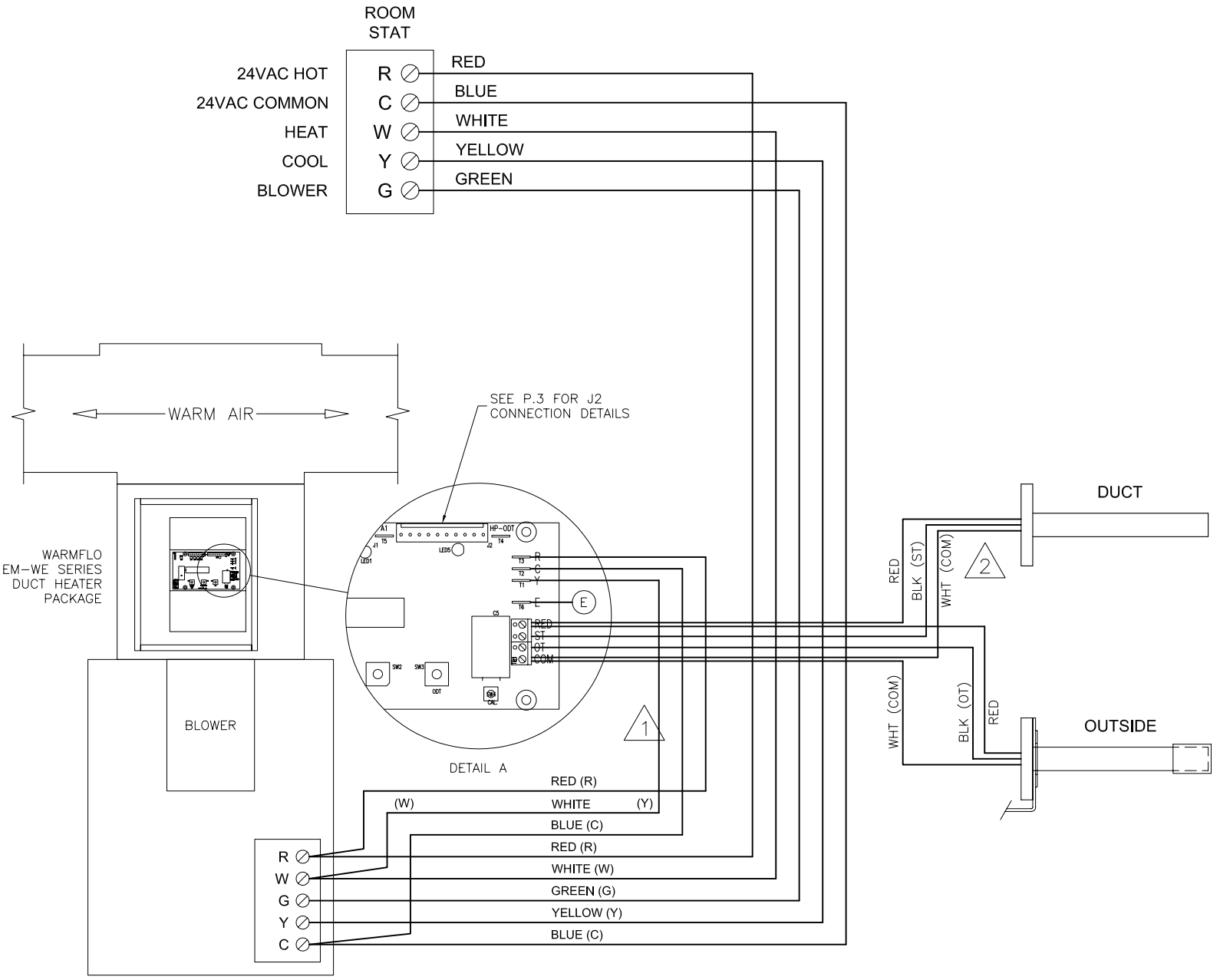


NOTES:

1. PER HP MFG. HOOK–UP
2. SINGLE CONTROL LINE.
3. 3–WIRE CABLE (EACH), PROVIDED.
4. IF FULL ELECTRIC IS DESIRED, CONNECT TO "E" TAB.
5. HP ODT, 2 CHOICES, SEE P.4.
6. SHOWN FOR SINGLE SPEED, FOR 2–SPEED, HP NEED TO SELECT Y1 OR Y2 OR CALL FOR INFO. ON WF–HP2.

ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

AIR HANDLER, NON-HP, WITH A/C



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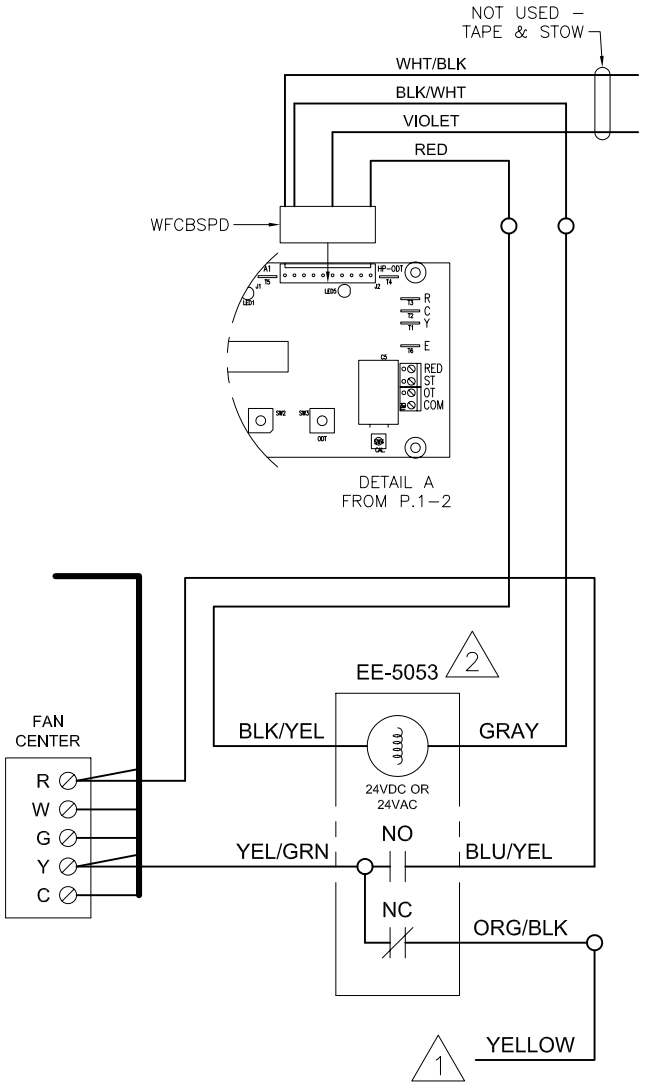
ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

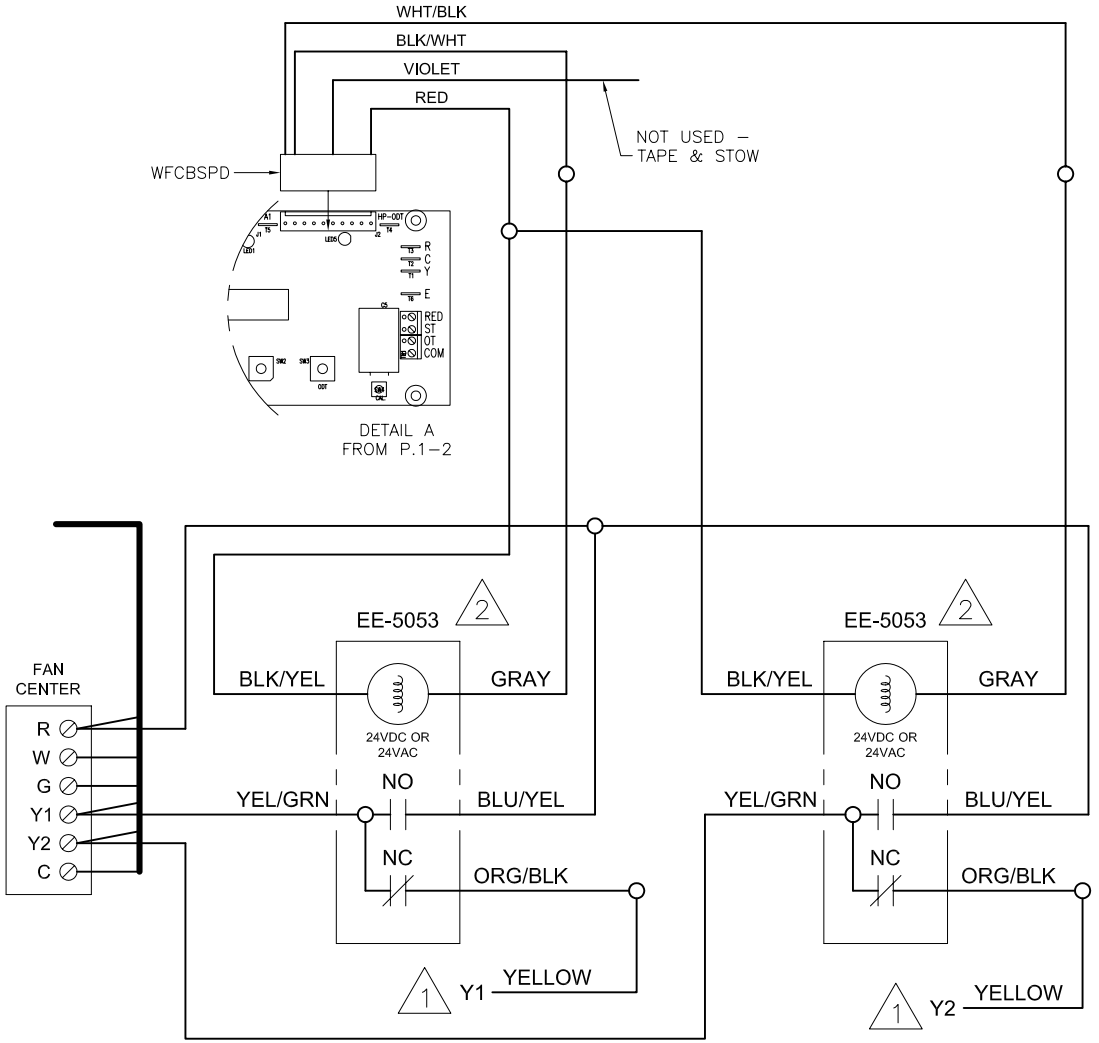
HH332 P2
07-29-04

WARMFLO, EM-WE, OPTIONS

VARIABLE-SPEED - FULL BLOWER
40° OUTDOOR TEMP.



THREE-SPEED BLOWER
40° & 30° OUTDOOR TEMP.



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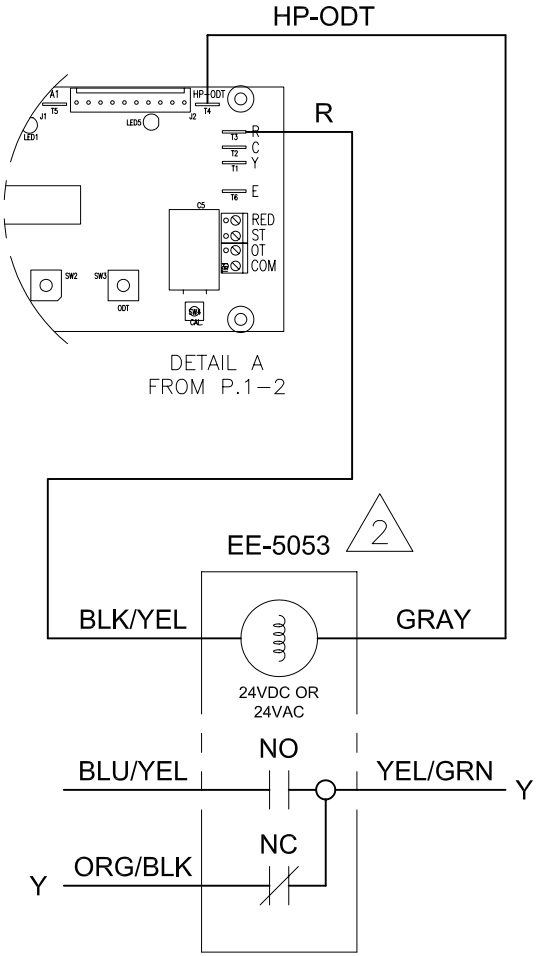
NOTES:

1. FROM ROOMSTAT, COOLING HIGH SPEED.
2. SPECIAL DC RELAY WITH FILTER, DO NOT USE STOCK RELAY.
3. ORDER BOTH EE–5053 RELAY AND WFCBSPD CABLE.

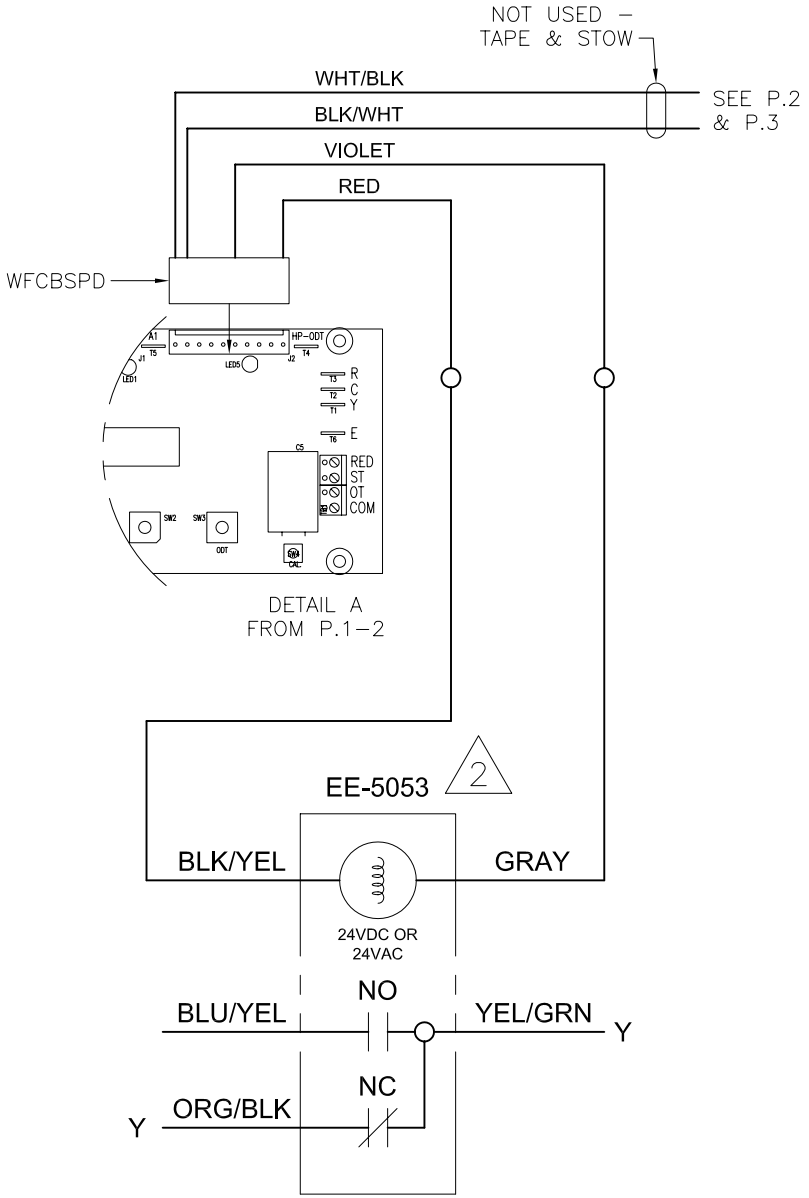
ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

WF-ODT OPTIONS

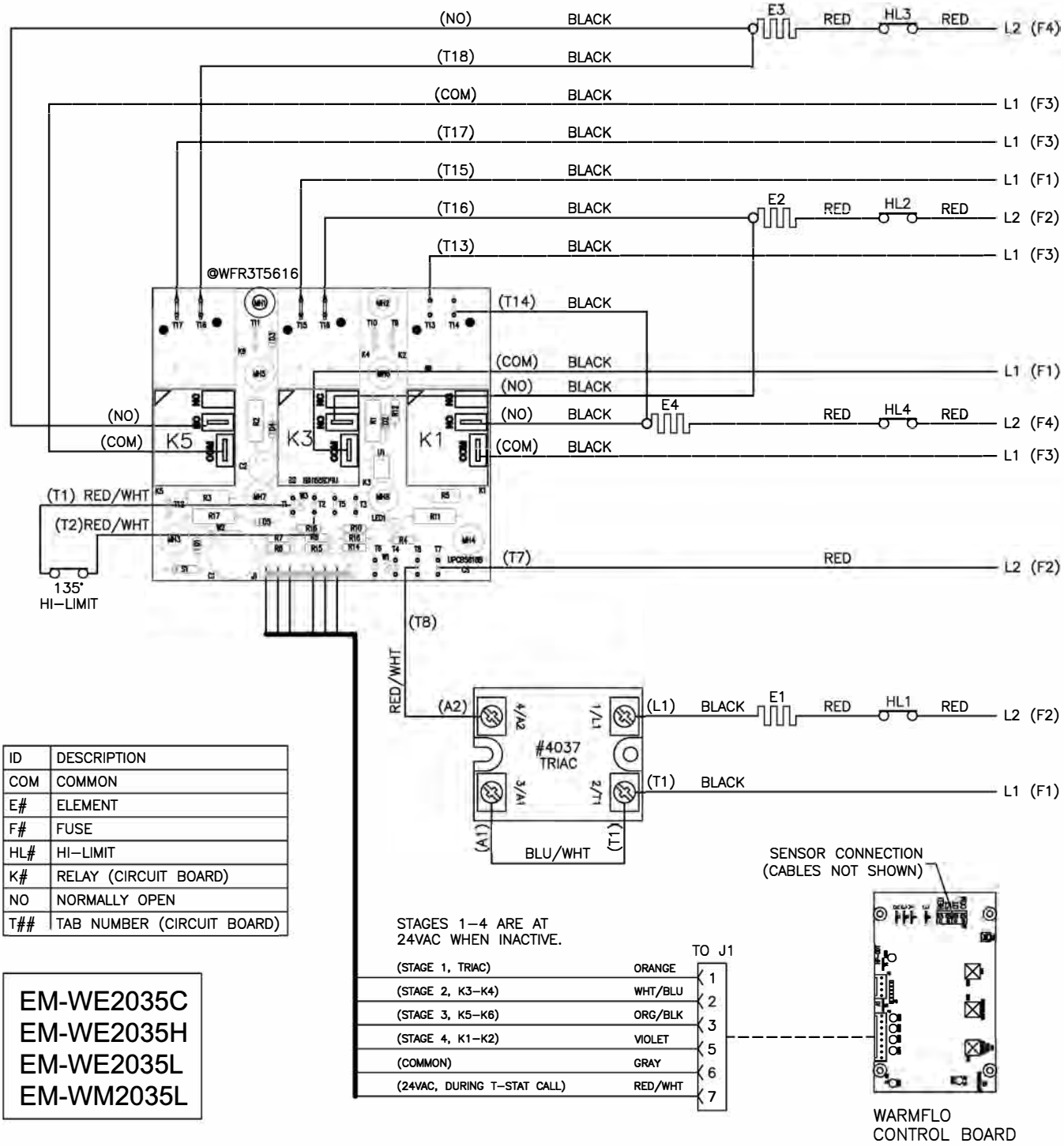
WF-ODT, WITHOUT CABLE



WF-ODT, WITH CABLE



ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

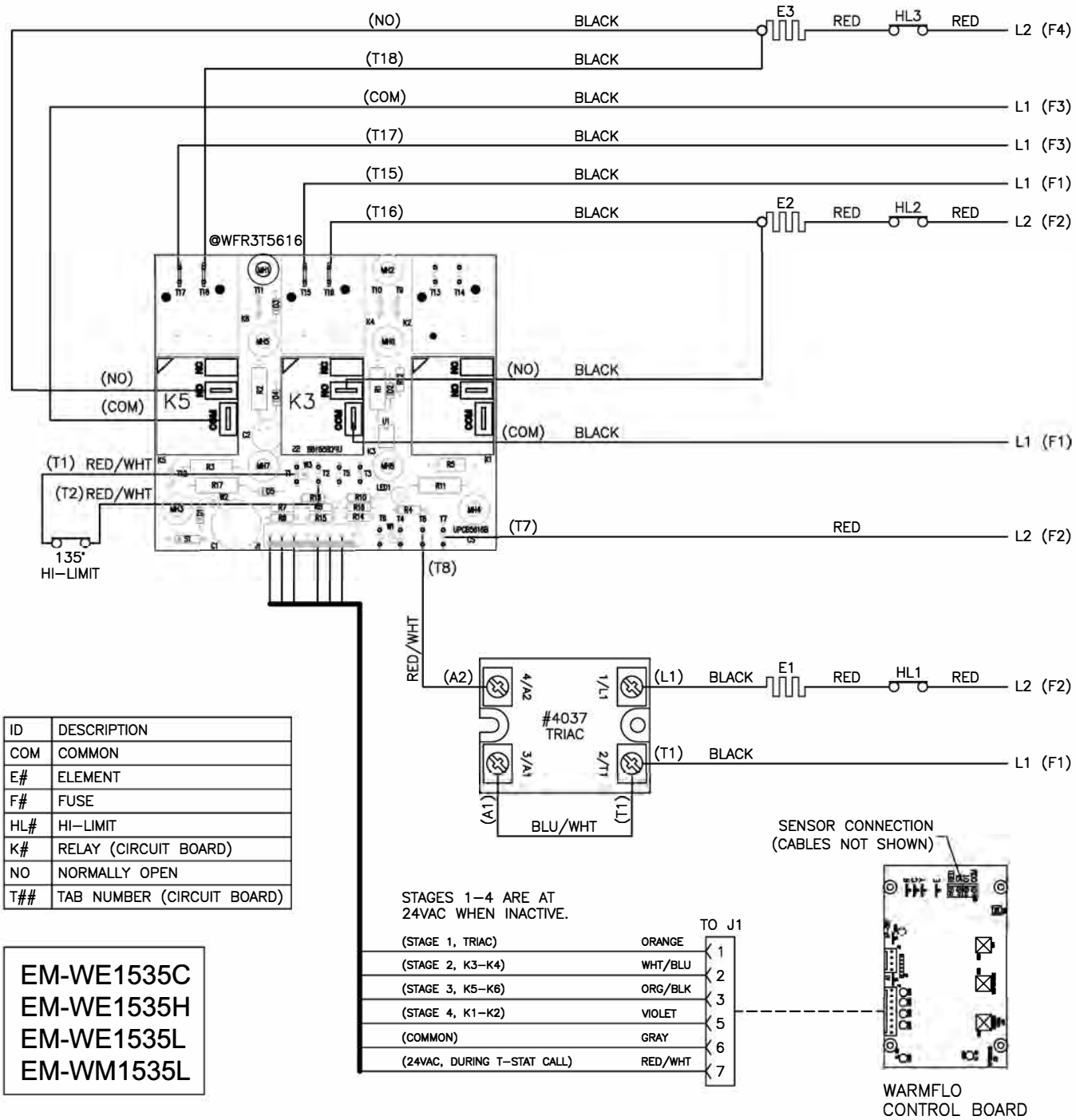


ID	DESCRIPTION
COM	COMMON
E#	ELEMENT
F#	FUSE
HL#	HI–LIMIT
K#	RELAY (CIRCUIT BOARD)
NO	NORMALLY OPEN
T##	TAB NUMBER (CIRCUIT BOARD)

EM-WE2035C
EM-WE2035H
EM-WE2035L
EM-WM2035L

F 9/25/17 – REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION: DIAGRAM, EM–WE***5* WIRING SCHEMATIC	
	DRAWN: MEF	REFERENCE DOCUMENT: BS705			
	CHECKED	VIEW/DRAWING TYPE: SCHEMATIC		SCALE: NTS	PART/ASSY/MODEL NUMBER: EM–WE***5*
	APPROVED	DRAWING STATUS: RELEASED	DOCUMENT DATE: 1–17–13	SHEET: 1/4	DOCUMENT NUMBER: ES502

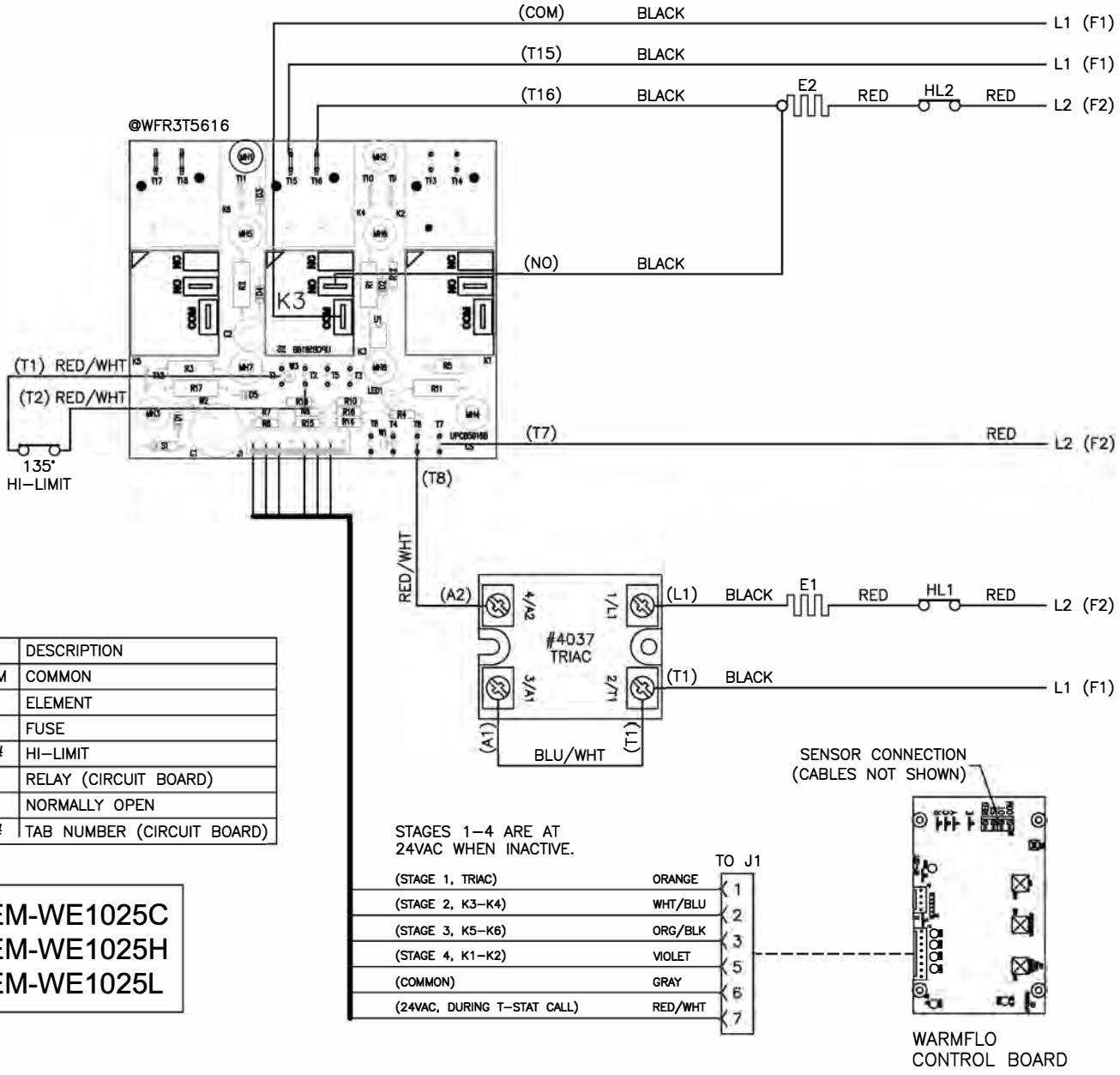
Rev. F 9–25–17: Revise PCB views with J11F2 Relays



ID	DESCRIPTION
COM	COMMON
E#	ELEMENT
F#	FUSE
HL#	HI-LIMIT
K#	RELAY (CIRCUIT BOARD)
NO	NORMALLY OPEN
T##	TAB NUMBER (CIRCUIT BOARD)

EM-WE1535C
EM-WE1535H
EM-WE1535L
EM-WM1535L

F 9-25-17 - REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION: DIAGRAM, EM-WE***5* WIRING SCHEMATIC	
	DRAWN: MEF	REFERENCE DOCUMENT: BS705			
	CHECKED	VIEW/DRAWING TYPE: SCHEMATIC		SCALE: NTS	PART/ASSY/MODEL NUMBER: EM-WE***5*
	APPROVED	DRAWING STATUS: RELEASED	DOCUMENT DATE: 1-17-13	SHEET: 2/4	DOCUMENT NUMBER: ES502



ID	DESCRIPTION
COM	COMMON
E#	ELEMENT
F#	FUSE
HL#	HI-LIMIT
K#	RELAY (CIRCUIT BOARD)
NO	NORMALLY OPEN
T##	TAB NUMBER (CIRCUIT BOARD)

EM-WE1025C
EM-WE1025H
EM-WE1025L

F | 9-25-17 - REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION: DIAGRAM, EM-WE***5* WIRING SCHEMATIC	
	DRAWN: MEF	REFERENCE DOCUMENT: BS705			
	CHECKED	VIEW/DRAWING TYPE: SCHEMATIC		SCALE: NTS	PART/ASSY/MODEL NUMBER: EM-WE***5*
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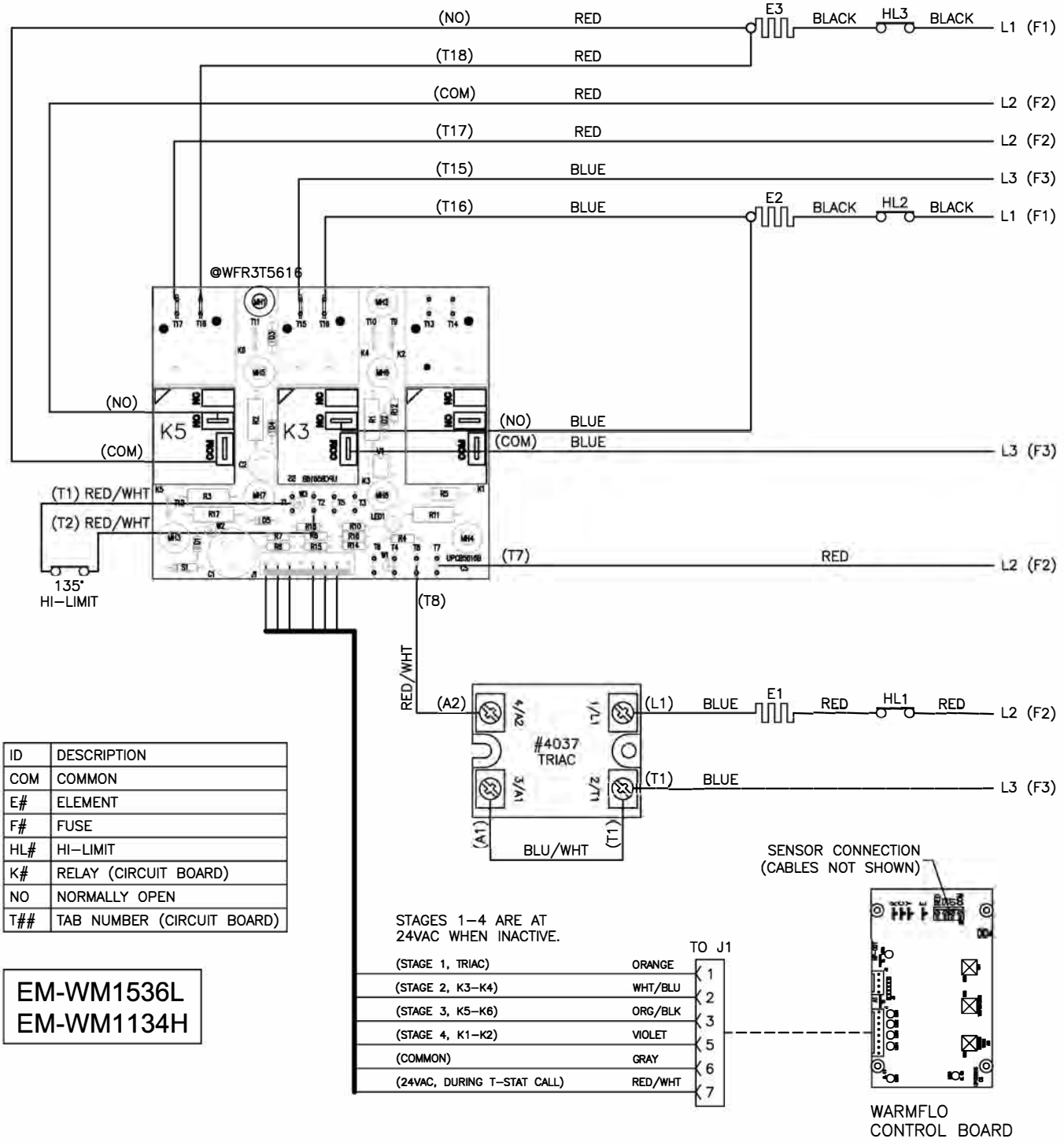


ID	DESCRIPTION
COM	COMMON
E#	ELEMENT
F#	FUSE
HL#	HI–LIMIT
K#	RELAY (CIRCUIT BOARD)
NO	NORMALLY OPEN
T##	TAB NUMBER (CIRCUIT BOARD)

EM-WM1536L
EM-WM1134H

F 9–25–17 – REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362			DESCRIPTION: DIAGRAM, EM–WE***5* WIRING SCHEMATIC	
	DRAWN: MEF	REFERENCE DOCUMENT: BS705			
	CHECKED	VIEW/DRAWING TYPE: SCHEMATIC		SCALE: NTS	PART/ASSY/MODEL NUMBER: EM–WE***5*
	APPROVED	DRAWING STATUS: RELEASED	DOCUMENT DATE: 1–17–13	SHEET: 4/4	DOCUMENT NUMBER: ES502

Electro-HELPS IV

2016 Update

In the spring of 2016, an update was made to the main WarmFlo II controller to encompass all chip codes into one single control module. There is now a dial labeled “MODE” (SW6) which allows the selection of the various chip codes.

NOTE: Upon changing of this dial, a power down reset is required.

All information detailed in this document is still accurate regarding control board functionality (various timers, sensor operation, stage disables, etc.), but now there is a dial which allows the selection of your desired chip code (no longer need to order a new chip when reconfiguring). WarmFlo Analyzer and PC software are still usable with this new, updated module.

The chart below details the new module as it pertains to the various chip codes.

Various Chip Codes	Mode dial (SW6)
HPDH	0
HPDF	1
HPEL	2
AH	2
EMA	3
EMW	4
EBA	5
EBW	6
AHS	7
A	7
B	7
C	7
D	7
E	7
H	7
WFMU	7

NOTE: If mode #7 is the required setting for your application, there is a temperature range option to allow for up to 16 temperature selections (space heating and make up air). See below:

MIN WARM AIR SETTING	TEMP RANGE SELECTION	
	HI °F	LO °F
0	70	20
1	80	30
2	90	35
3	100	40
4	110	50
5	115	55
6	120	60
7	125	65

WarmFlo Terminology, Key Terms

ST – supply temperature sensor. This is the warm air or duct sensor (boiler – supply outlet water).

OT – outdoor temperature sensor. Provides the WarmFlo board with outdoor temperature information.

DT – desired temperature to overcome building heat loss, the diagonal line on heat loss curve. The front panel efficiency knob selects one of 8 curves to determine DT at specific real time OT.

DT Flat – this is an internal reference point, as WarmFlo establishes this mode it in essence sets the operating point at 125° F. (Analyzer or software may have any value from 123 to 125). Electric element modulation and staging are still in effect. The staging will be based upon the ST sensor detecting and operating around the 125° point.

> **Note**: All four stages do not automatically go to full on.

HL – actually this is the same as "DT Flat". This perceived hi-limit temperature value (130°) within the control logic, measured by the ST. This is over and above the 155° probe or 170° mechanical hi-limits.

Full electric (or Full EL) – this setting causes the modulation and staging to operate at "DT Flat". When first selected or turned on, the WarmFlo logic may first go through a process of building up to the "DT Flat" value. Do not expect the outlet temperature to immediately jump up to this highest value. However, on consecutive thermostat calls it will immediately step to the "DT Flat" temperature value.

> **Note**: This is essentially the same as DT Flat and again all four stages do not automatically go to full on.

Staging Disable Temperature – in all OT active sensor applications (DT cal) there is a setup program temperature to "hold off" each stage for warmer heating conditions. In other words, the OT sensor must be reporting a temperature below these values before the stage is allowed to come on. In WarmFlo Analyzer or PC software terminology this is called – STG1 DIS, etc.

The stage-up situation relating to all of the above "DT Flat" operation is controlled by these stage enable temperature set points. This statement must be carefully related to all of the above.

- In other words, if the OT is reading 42° and the front panel is set to "full electric" the ST is looking to operate at 125°, but only stage 1 will be on.

If for heat pump applications Stg 1 is set at 50°, there will be no electric element or standby furnace above 50° OT.

> **Note**: For HP roomstat multi-wire thermostat application, the OT temp. set point must be below normal desired cooling.

E tab (board top center) – in most WarmFlo products and TS Series boiler products there is a troubleshooting tab marked "E". When applying 24-volt (or jumpered to "W" tab) this input function immediately forces all four stages on and bypasses all temperature sensing or element modulation sequences. If used verify blower also functions properly.

- A potential convenience or secondary usage for this upgraded E tab function is to provide an easy manual means for rapidly bringing up the building or room temperature if the system has been set for non-occupancy. By installing a pushbutton between W and E tab,

the homeowner can easily activate all stages on to the end of the thermostat cycle. **Warning:** This is all stages on, no temperature monitor. This should only be used in this manner when it is a very cold building from non-occupancy, the outdoor temperature is quite low with low temperature rise coming from the heat pump.

Stat override timer (SOT) – this is an option WarmFlo internal timer which can be programmed with WF analyzer to select a roomstat run time. If this downloaded run time (typically 90 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.
- SOT E – this must be shorter time, 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 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.

  Note: Beginning approximately 7-04 the SOT S has been factory default at 90 minutes for all dual heat chip codes.

MU – this is an internal timeout function which begins when **all stages** are on at 100%. Anytime the electric section is operating with all stages on at 100% for a continuous operating time greater than the programmed MU (3 initial minutes), the system automatically switches to standby. MU = 00 is a disable setting. The amber LED on the main WarmFlo board will correctly follow electric or standby. On the Interface module (EZ3, etc.) the "gas call" LED also will be on, but the "utility off-peak" LED remains on.

Electro-Mate or strip heat undersizing – there are provisions within WarmFlo and within Electro's various heating products to add partial resistance heating section to heat pumps. To provide optimum operation and comfort, the setup functions need to be activated accordingly. Default program code chip "HPDF" has been designed for this application. As a field setup, you probably want MU to be relatively short (30 minutes), the ODT mode will be "EL to SB" with an ODT dial switch temperature selection at about the combination heat pump and Electro-Mate output energy (probably 0°) or position #3.

Electro-Mate only, no heat pump – there are two default chip codes, EMW or EMA.

- EMW – all normal WarmFlo functions and modulation, front dial, etc.
  - Must be auto standby, no wood furnace.
- EMA – does not use an OT sensor, at each thermostat call outlet temperature goes to a preset value (commonly called electronic aquastat). This value is the "min. warm air" adjustment (inside main board).
  - The decal table shows the outlet temperature at the various "temperature" settings.
  - The plug-in Analyzer OT Function must be "disable" (no OT sensor).

Note: With an Electro-Mate it is assumed there is always standby or gas furnace. For non-automatic or wood, suggest using EMA and select the desired outlet temperature.

ODT dial switch mode – within the program chip default and Analyzer/software programming this function defines the use of the dial switch on the circuit board labeled "ODT". The dial switch selects the temperature, the setup function selects what the temperature does.

- EL to SB – interrupts all electric elements **and** the heat pump

- HP – interrupts only the outdoor compressor unit, electric energy continues without an OT temperature shut down reference

Note: "0" position does not disable outdoor sensor. This only disables the built-in heat pump ODT function. With the dial switch "0" position the heat pump becomes a direct function of the room thermostat and/or standby mode.

Standby (SB) – the WarmFlo control system has transferred the thermostat or heat active function to the standby furnace via the appropriate Furnace Interface module (WF-EZ3, etc.). These actions cause SB.

- SOT-S timeout – thermostat continuous run time.
- MU timeout.
- ODT dial switch value – EL to SB mode.
- A1 tab at 24 volts – any switching device which raises A1 tab to 24VAC.

In addition the Furnace Interface module (EZ3, EM3, etc.) sends a signal via J2-4 (blue, high DC)

- Load Control interrupt (open blues)
- Front panel switch
- Added remote switch, "SB" tab to common

Note: ***Electro-Helps V*** has additional troubleshooting conditions that will help evaluate standby.

SB (Gas) 5-Minute Safety – when in the standby mode (see previous section) there is a 5-minute timer which begins at each heat call. If after the 5 minutes the ST sensor is less than 80°, the logic board itself goes into an automatic reset and restart. This simply means it attempts to begin the heat cycle using electric in case the furnace did not ignite or "out of gas". However, if it is in the SB mode because of Load Control it will still remain SB and try the gas furnace again. The system will never go back to electric if Load Control is set for on-peak or A1 tab high.

- Typically this is disabled for boiler control applications.
- Analyzer or PC software can disable this function.
- As an added non-freeze safety feature, the program counts these 5-minute resets. If the count reaches 40 (200 minutes) and each time the ST is still less than 80°, the system will revert back to electric to bring up the temperature of the building, one thermostat cycle only.

Delay, transfer from electric to standby – because there are a multitude of gas furnaces which turn off the blower during their internal heat exchanger warm-up, there is a 1-minute delay before the gas furnace receives the W input. During this 1-minute the gas furnace G function remains high allowing the blower to purge out the heat on the Electro-Mate elements. After the 1-minute the G function drops and the gas furnace W function goes high.

Delay, transfer from standby to electric – if the unit was operating in SB for more than 1 minute, the follow-up transfer back to electric engages a 2-minute delay before the HP compressor relay is activated and any of the electric stages are activated. The blower will react to the call for heat, but the elements will stay off for 2 minutes in order for the blower to cool down the furnace heat exchanger. In addition the WarmFlo logic stages up from stage 1 through the various temperature/delay staging sequences.

Blower operation – the air handler or fossil fuel furnace blower is operated from its own fan center (G screw). The activation of this "G" input is either directly from a heat pump (total electric system) roomstat "G" screw or in the case of dual heat from the Furnace Interface module (WF-EZ3, LGR4, EM3, etc.). The Interface module and its wiring or association with the room thermostat completely controls the blower. There is nothing on or within the WarmFlo control board itself which has anything to do with the blower function.

- Delay on/delay off – within all Interface modules there is an approximate 10 to 15 second blower on delay and a 1-minute blower off delay. In the case of a heat pump stat, this can be bypassed by taking the stat "G" screw directly to the interface module tab "G1" (multi-wire stat only).
- Multi-speed blower – newer furnaces having multi-speed blower functions can be stepped up to the proper high speed with an appropriate (special relay contact) jumper between the furnace fan center "G" and "Y". See the installation manual sketch and paragraph for adding the necessary wiring jumpers associated with the Interface module special terminals (BL, NO, NC). Also ***Electro-Helps VIII*** provides details on all the various wiring arrangements for ECM variable speed blower.
- Using E tab with HP stat emergency output – see previous "E-tab" section for blower operation caution.

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 default value and there will be an attempt to cause the electric heat output to go "DT Flat".

- 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 default heating – when above condition is detected electric unit has limited staging output.

WarmFlo Analyzer or Software Bad Sensor Indicators

- 255 or NA - OT function is disabled, EMA/EBA type operation
- 254 or BAD - controller cannot read a value from the temperature sensor
- 31° (assuming it is not 31°) - new software (2.3* and up chip) with previous sensor, "D" ring (DS2434)
- 0° (assuming it is not 0° F) - previous software (2.2* chip) with new sensor, "E" ring (DS18B20), green LED should also blink

Cal. pushbutton, on board upper right – function is unchanged, holding for 10 seconds forces the OT sensor to 32° value.

Power-Down Reset – there are some data entry or setup modes which require power-down reset - WF+ board configuration selection, cancelling pulsing bad sensor green LED, etc. If in doubt do a complete 24-volt system power-down reset after WarmFlo Analyzer save operations. Reset always verifies the proper handling of a software modification.

HANDHELD ANALYZER/LAPTOP SOFTWARE

PC software (ET-SOFT-WF) or Handheld (WF-ANZ*) – has provisions for the following setup or reprogramming functions. Caution – do not attempt to reprogram a forced air (Electro-Mate) chip for boiler application.

- Select proper product application – dial switch on the back
- MU time, or disable
- SB RESET – disable/enable
- SOT S time, or disable – switches to standby
- SOT E time, or disable – all stages on
- Stage disable temperature – 1, 2, 3, 4
- OT sensor function
    - DT cal.
    - Flat DT or HL (suggest not using)
    - Disable
- ODT dial switch mode
    - EL to SB – interrupt all electric energy (Electro-Mate and HP)
    - HP – Outdoor compressor interrupt only
- OT SPD A/B and ST SPD A/B – special temperature sensing speed settings, relates only to variable speed motor interface arrangements (WF-ANZ5 and up)
- WF-ANZ7 adds a EB-WO or EB-MO function for establishing the baseline or beginning point for modulation temperature ramp-on

Warning, field reprogramming – within WarmFlo II internal logic and non-volatile memory, it can detect whether it is operating from a pre-programmed chip (see table, following pages) or if it has been modified (reprogrammed) with PC software or Handheld. Once the user or field technician has downloaded (save), the WarmFlo II physical control board is no longer governed by the chip code written on the plug-in chip, etc. In other words, power up/power down or reset does not affect any altered reprogrammed functions. It is smart enough to know it is no longer the original chip and that **specific physical** board, from this time forward, must be under the control of the PC software/Handheld.

However, a new totally different coded chip with the same or different revision date will automatically wipe out any of the previous setups and can restart the same physical board based on the defaults within this newly added or different coded chip. After power-up reset the internal program reads the chip code and the version number. If either changes it begins new with the defaults and revision code of the specific replaced chip.

OPERATIONAL INFORMATION

In order for the installer to completely understand the WarmFlo II functions and operational sequence it is recommended to thoroughly read and understand the information below. This knowledge can help in determining settings that can be set according to the end customers needs.

Normal Heating Operation – Whenever the WarmFlo II Y tab is at 24 volt (with reference to "C"), the WarmFlo II controller begins turning on the Electro-Mate elements (assume outdoor temperature is below disable value) and automatically controls the warm air temperature as sampled by the warm air sensor (ST). However, if added heat is **not** required, no element power is used.

Depending upon Electro-Mate model, the heating section may have one, two, three, or four stages. Stage one is pulse modulated (approximate 10-second cycle) based upon the WarmFlo II controller automatic requirement. Stages 2, 3, and 4 are turned on and off with a relay. However, Stage 2, etc. is only used when needed by the WarmFlo II supply air temperature calculations.

When the warm air sensor is calling for more than the heat pump and Stage 1 100% output, Stage 2, etc. turns on. Stage 1 may not necessarily remain at 100%, but can be modulated downward to meet the requirements of the warm air sensor.

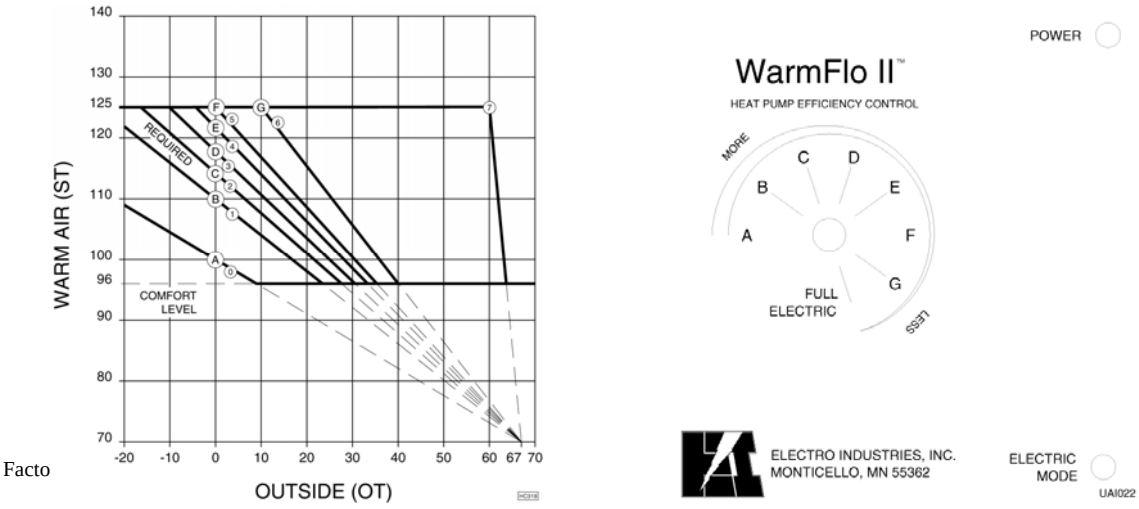
Also on the next call for heat, the WarmFlo II controller remembers what stages were on and starts at that point. A clamp-on amp meter at the service input can be used to "visualize" the Stage 1 modulation and/or Stages 2, 3, and 4 functions.

Note: Power-up reset or return from standby (SB) resets all staging memory and temperature cycling begins new.

Efficiency* – the characteristic of a heat pump dual heat system is the heat pump's ability to deliver warm air at efficiencies greater than 100%. Gas and oil systems are always less than 100% (60% through 90%), resistance electric (Electro-Mate) is always exactly 100%, but the heat pump is always at least 100% (-20°F) or greater, up to about 200% for air source.

The user needs to realize it is to his advantage to run the heat pump either continuously or at the longest possible thermostat call cycles. This is contrary to the basic understanding of most users. However, realizing again the heat pump is a device that delivers greater than 100%, this system can only deliver greater than 100% if it's running, let it run. Because of the WarmFlo design concept and its internal "brain" the heat loss curve (diagonal lines, below) allows the compressor to operate with a minimal amount of electric resistance supplement or temperature boost.

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 needed the supply temperature in order to properly overcome the heat loss within the structure. This is the diagonal line between 67° outdoor and maximum Btu/h (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.



Facto

Temperature (Efficiency Dial)* – the red center screwdriver adjustment dial has a selection of 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 dial is turned to "full electric" the WF II will automatically put all stages of electric to full capacity.

***Does not apply to chip codes such as EMA and EBA.**

Outdoor sensor reference or heating requirement level* – the outdoor digital sensor "tells" the WarmFlo "brain" its desired (DT) value or decision making capability. This is for desired or required supply temperatures greater than the "min. warm air" horizontal line setting. At each internal calculation cycle a DT is determined by reading the outdoor temperature (OT) and then finding the appropriate warm air point on the appropriate or selected diagonal line. See Figure 1 for the various diagonal lines associated with the A through G "temperature" selection knob.

> **Example** – if the temperature knob is set on Position C, at 20° outside the DT or the supply delivery temperature is 100°. The WarmFlo controller now automatically adjusts and maintains electric element power to keep the supply temperature at 100°. Likewise if it -10° outside the DT or supply delivery temperature is 120°. The elements are re-adjusted to provide a constant 120° temperature.

Where should I set the efficiency dial? – As you can visualize from the curves above, the lower the setting, the flatter the curve, the less electric resistance is added to the heat pump compressor warm air. Therefore, the efficiency knob setting is based upon comfort and efficiency. The lower the setting the higher the overall operating annual efficiency, the higher the setting the warmer the air at the register.

Chip code/field programming – your unit was ordered and supplied with a "coded" program chip, one of the selections shown in each Chip Code Reference Table for your application (within the various colored page sections). These tables show the various defaults associated with that particular code. With WarmFlo II a number of field re-programming possibilities and options exist using either PC software or WarmFlo analyzer, reference "WarmFlo Handheld Analyzer/Laptop Software" section. Chip code is located on the WarmFlo II controller board white label.

> **Note:** There are certain things such as SOT's, MU time, etc. which are only field programmable. If the item is not shown in the chip code table, that feature or item is default set as disable.

WarmFlo Select, WarmFlo+, EZ-Mate, WF II

Selection Dial	Code	Stg. Enable	MU Time	ODT Mode	OT Function	SOT-S
Dual	HPDH[2]	50°, 38°, 36°, 34°	90	HP	DT Cal.	90
ANZ-set	HPDF[2]	50°, 38°, 36°, 34°	30	EL to SB	DT Cal.	90
No Gas	HPEL	50°, 38°, 36°, 34°	00	HP	DT Cal.	00
ST & OT	EMW	90°, 50°, 36°, 34°	60	EL to SB[1]	DT Cal.	90
ST	EMA	-	00	EL to SB[1]	Disable	90
-	HPFU	50°, 38°, 36°, 34°	30	HP	DT Cal.	90

[1]ODT dial switch must be set on 0 = disable.
[2]EZ-Mate – dual is HPDF, not HPDH.

Other defaults, all Forced Air models.

SB RESET – enabled	ST SPD A – N/A
SOT-E – 000 (disabled)	ST SPD B – 105°
OT SPD A – N/A	CT STG DISABLE – all 0, except EZ-Mate = 3
OT SPD B – 30°	CT STG DISABLE – all 0, except EZ-Mate = 4

ELECTRO INDUSTRIES
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Electro Industries, Inc.

Limited Product Warranty

Effective February 5, 2009

Electro Industries, Inc. warrants to the original owner, at the original installation site, for a period of two (2) years from date of installation, that the product and product parts manufactured by Electro Industries 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. If any product or product parts manufactured by Electro Industries are found to have manufacturing defects in materials or workmanship, such will be repaired or replaced by Electro Industries. Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Electro Industries may request that the materials be returned to Electro Industries at the 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 or its authorized representative. Electro Industries will cover reasonable labor costs to repair defective product or product parts for ninety (90) days after installation.

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 installation. If any boiler elements or vessels are found to have a manufacturing defect in materials or workmanship, Electro Industries 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 installation. If any spin fin elements are found to have a manufacturing defect in materials or workmanship, Electro Industries 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 installation. If any open wire elements are found to have a manufacturing defect in materials or workmanship, Electro Industries will replace them.

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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.

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