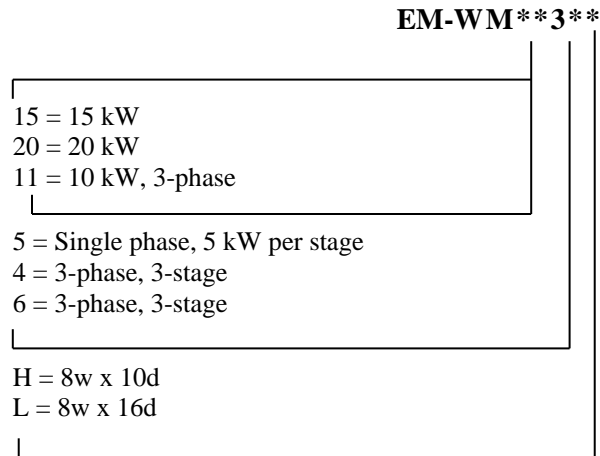


ELECTRIC MAKE-UP AIR

WITH WARMFLO CONTROLLER



Specific Application – forced air duct requiring a temperature rise with a fixed temperature outlet.

Reference: **EH902**
 ES502
 HD320
 XX017

NOTE: This manual revision and date pertains to controller chip version 5.00. The controller chip is the plug-in integrated circuit on the PC board with the printed label.



Description

This is more than a traditional duct heater. The control box and electric elements may appear to be a standard duct heater, but the internal WarmFlo controller and its companion solid state temperature sensor modulate the duct heater elements to produce a constant outlet temperature at the sensor.

This unit applies to forced air ducts (blower within system). Do not install in a fresh air duct which depends upon gravity or building pressure differential flow. See Table 1 for min. CFM.

240-Volt Rating – Single Phase – Models

When operating at a lower source voltage the output may be reduced.

Example: 10 kW unit assuming normal element tolerances.

- 220-volt source – 16.8 kW, 76 amps
- 208-volt source – 15.1 kW, 72 amps

208-Volt Rating – Three Phase – Models

When all elements are on, it is a three phase balance load. Measure current in each leg and apply three phase formula to determine kW.

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.
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.

Mechanical Installation

WARNING

IN ORDER TO PROVIDE MAXIMUM ELECTRIC ELEMENT LIFE, THE AIRFLOW THROUGH ALL ELECTRIC ELEMENTS MUST BE UNIFORM.

Typical installation is within a horizontal forced air duct. The element rack for these models is 8x16" deep.

Observe airflow arrow decal and orientate the unit so the airflow is through the elements as represented by the airflow decal arrow.

Using correct placement and deflectors, make every effort to make sure at least 90% of the air passes through the element rack.

If installation is within 4 feet of any elbow, plenum or tee; turning veins will be required to make sure there is uniform airflow through the element rack.

Secure control box to duct.

Clearance – Duct Surface Areas, Duct Installation, Etc.

When installed within air handler plenum or furnace/A-coil plenum, the codes and rules relating to clearance apply.

When installed in an “inline” duct or round pipe adapter for a general distribution boost heater or air make-up application, observe the following guidelines:

1. This product must be installed in a metal duct, size of the element rack.
2. There shall be no insulation on the inside of this sheet metal duct section.
3. Any flex-pipe or other insulated pipe must be at least 24” from the electric element.
4. Mounting – there must be at least 2” air clearance around all sides of this sheet metal duct section.
5. If there is a need to insulate this duct section for moisture condensation or in an unheated compartment, it is permissible to wrap insulation around the exterior of this metal duct section.
6. The control box must be positioned so it will not receive water dripping or collection of moisture.
7. See next section on duct sensor installation.

Specification – Table 1

Model	Nor. Kw	Phase	Current +	MIN CFM	Internal Fuse	Ship Weight
1535L	14.4	1	60	900	30 & 50	19
2035L	19.2	1	80	1200	50 & 50	21
1134H	10.8	3	30	600	40 (3)	20
1536L	15	3	42	900	50 (3)	21

+ At full rated voltage.

CFM Chart – Table 2

Temp. Rise Needed	80	70	60	50	40	30
<u>Model Number</u>	<u>CFM</u>	<u>CFM</u>	<u>CFM</u>	<u>CFM</u>	<u>CFM</u>	<u>CFM</u>
1535L	600	700	790	950	1180	1600
2035L	800	900	1050	1260	1600	2100
1134H	425	500	570	680	850	1140
1536L	600	700	790	950	1180	1600

Temperature Rise Comments

Typically the maximum temperature rise for this product is 40°F for room air inlet or 20°F for elevated supply temperature from a typical heat pump.

If it is air make-up, outside air, larger temperature rises are permissible, see table above.

Electrical Hookup

Reference: Drawing HH316, the electrical requirements are quite straight forward – element power, 240 or 208 and very basic 24-volt control. The following should give you the necessary information.

1. **ELEMENT POWER 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 to bring over the source power. Connect to fuse block/input terminals.
2. **GROUNDING** - Route and install the appropriate size ground conductor between the ground lug labeled "GROUND" and building service entrance panel ground buss. This must be a conductor sized according to the total amp rating of the appropriate model. Conduit is not an adequate ground conductor.
3. **24 VOLT SOURCE** – Connect the system 24v transformer to “R” and “C”. Typically this is from the Fan Center. If this is tied in with an existing thermostat system and furnace air handler, do not add a separate transformer for this unit. If this is a stand alone makeup air unit, you will need a 24-volt transformer to operate this unit.
4. **THERMOSTAT OR TURN-ON CONTROL** - This unit is activated (elements turn on and off) when a contact is applied to the terminal block “Y” and “R”. Using either a roomstat thermostat W connection, or an external relay contact (relating to blower operation); close “Y” to “R” for basic on/off operation.
Comment: Electro Industries stocks pressure differential (set at 0.2 static) airflow detecting turn-on switch (P/N 5009) or current sensing switch with adjustable detection (P/N WF-ISW). If these “turn-on” devices would be a help in your installation, call factory.

Duct Sensor

This unit is equipped with a remote temperature-sensing probe. This is a solid state probe (actually mini-micro computer chip at the end of the probe), handle with care.

Suggested installation is in the main warm air stream approximately 20 to 24 airflow inches away from the electric element. Simply drill a ½” hole in the duct, insert probe, and screw in place.

Comment: The sensor tip within the tube should be at the end of the tube or slightly extending beyond the tube. If this is not the case, very carefully push the cable (do not grab the sensor tip with pliers) until the sensor tip can effectively sample the warm air.

This duct sensor has a 6-wire cable. It should be connected to the Red, ST, and COM screw terminals. The “OT” screw terminal is **not** used for this product application.

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.

Temperature Set Point

Built into this unit is a WarmFlo II control module with a multitude of setup parameters allowing detailed product configuration. This allows the installing contractor the ability to customize the unit to better meet this installation application.

The most common configuration (Mode Dial Setting #7, factory default) for this product is detailed below. Mode dial #7 allows for very basic space heating applications (non-dual fuel, non-outdoor reset) as well as make-up air applications. Use the “TEMP. RANGE jumper to select the desired set-point range (determined by application).

Example: Space heating application use the “HI” setting.

Example: Make-up air application use the “LO” setting.

The “Minimum Warm Air” dial sets the fixed target set point during heating on operation.

MODE DIAL SETTING #7		
Minimum Warm Air	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

NOTE: With “MODE” dial set to #7, the “TEMPERATURE” and “ODT” dials are not used. See HD320 for more information on WarmFlo operation and various setup parameters pertaining to the module in this unit (WarmFlo II board).

Operational Tips

Monitor Lights

Main Control Board (WarmFlo)

Green Monitor LED – when illuminated the WarmFlo controller is receiving 24 volts at the R and C terminals. Under all normal operating modes, this should be solid green.

As a secondary function this green LED provides status of the remote sensors. If a sensor is inoperative, incorrectly wired, or malfunctioning; this monitor light is in a blinking or pulsing mode.

Upper Left Monitor LED – the three red LED's next to the output connector indicate stage 1, 2, and 3 operation (stage 1 is on the right).

Fuse – the WarmFlo board itself does not contain a traditional fuse, but at the “R” input terminal is an automatic reset, short current protection device. If there has been a short circuit condition, and the green LED is off, at least 2 to 3 minutes “cool off time” is required for this “fuse” to reset.

Electric Power Module (EPM)

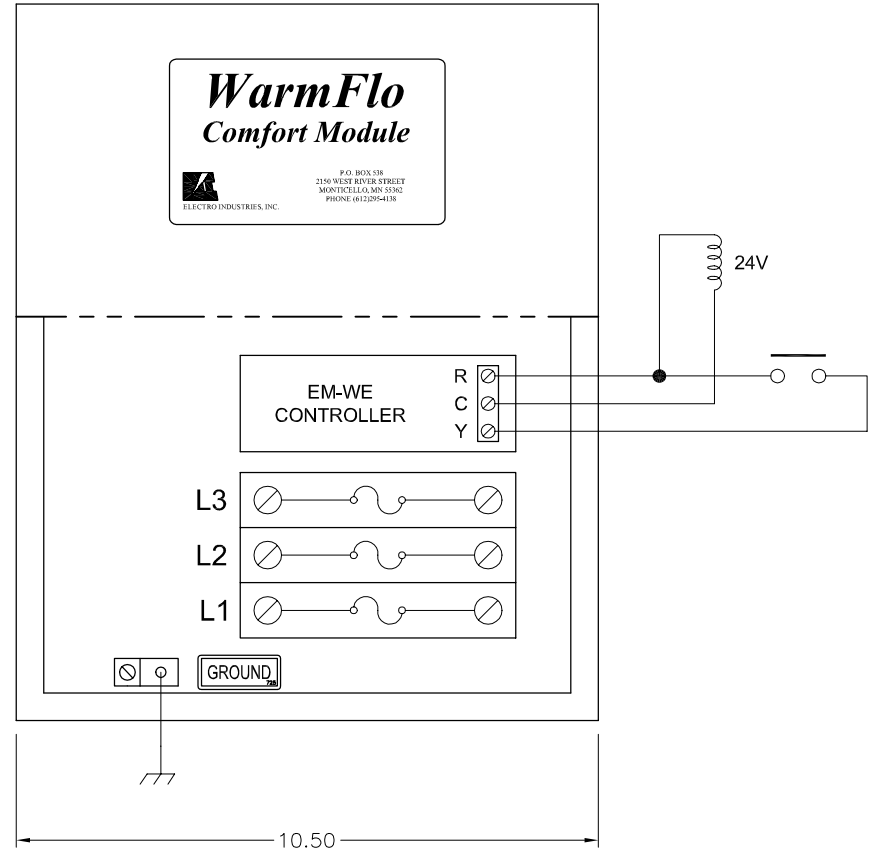
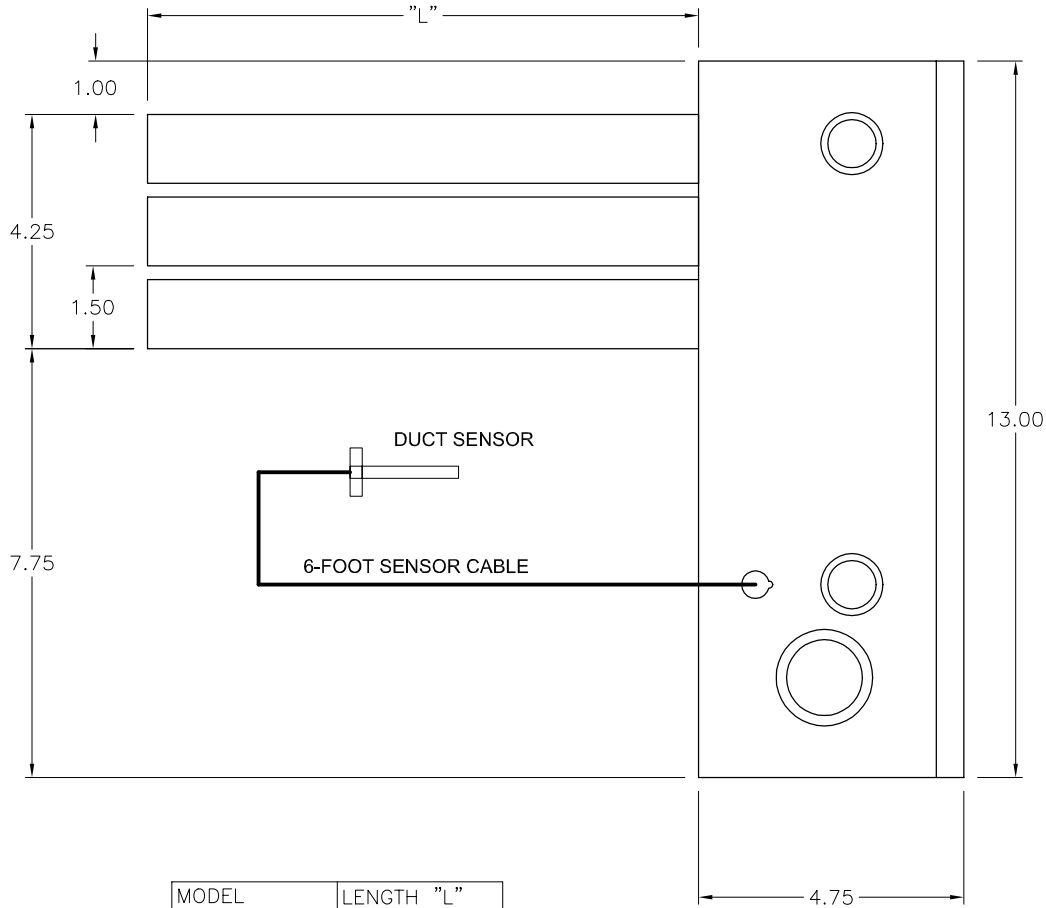
Red LED – on relay board – illuminates when the low voltage hi-limit sensor probe opens. This applies only after thermostat heat call and WarmFlo controller is stepping on the various element stages. If there is a hi-limit condition, red LED is illuminated. As soon as the hi-limit cools and snaps back in, red LED extinguishes.

Summer Operation


Provisions will need to be made to make sure these elements cannot come on (interrupting Y input) during cooling season.

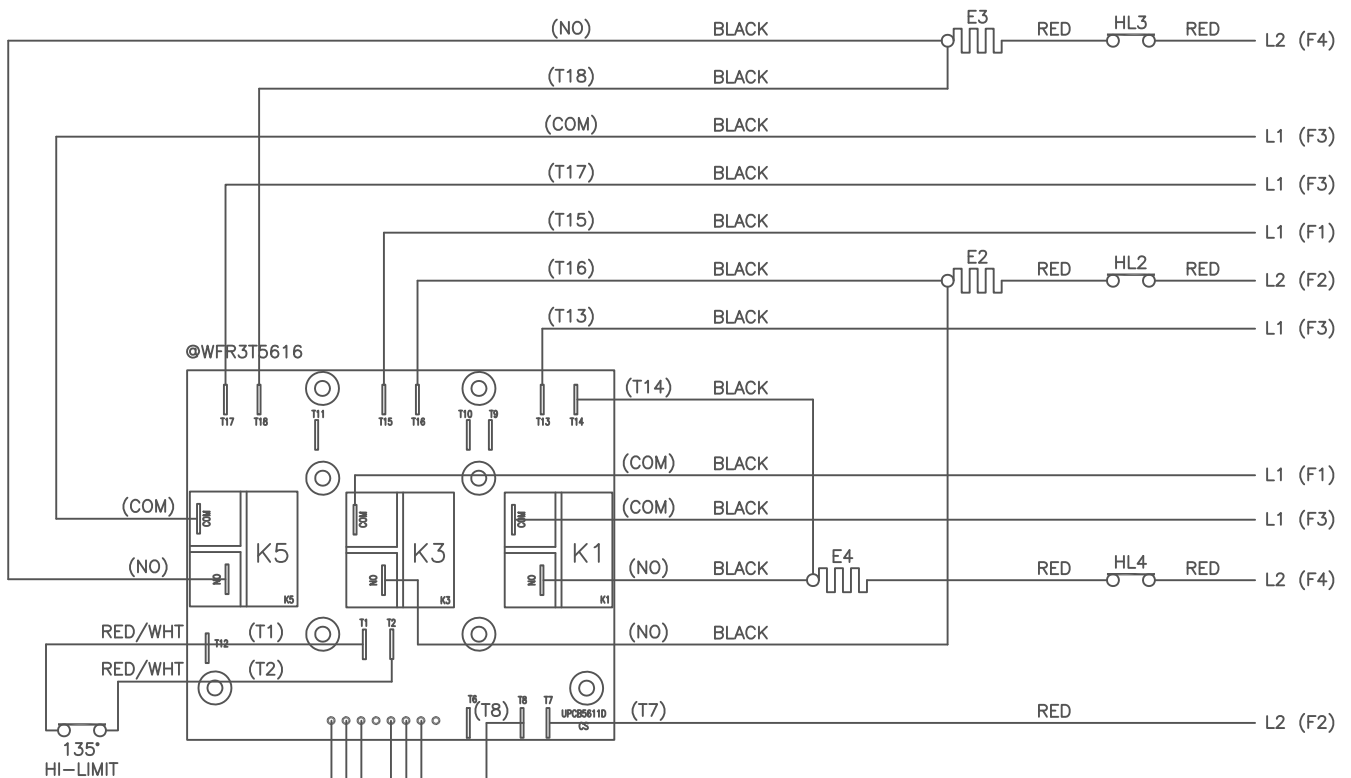
Sequence

- A. Contact applied to “Y” and “R” terminals.
- B. Stage 1 (5KW) turns on for at least 10 seconds.
- C. Based upon temperature at the duct sensor, the electric elements begin modulating or remain full on if temperature is 3° below set point.
- D. As the temperature rises, the Stage 1 (5KW) begins modulating (full on and then full off during a 10-second interval).
- E. If temperature does not reach set point, Stage 2 and/or Stage 3 comes on (Approximate 3 min. spacing).
- F. If the warm air temperature goes 3° above set point, Stage 3 and/or Stage 2 again turn off.
- G. Stage 1 will modulate $\pm 2^\circ$ around the set point.
- H. With the absence of the “Y” and “R” contact, all elements are off.
- I. At the next “Y” to “R” contact closure, the modulation rate and stage 2 or 3 activity returns to the same state.



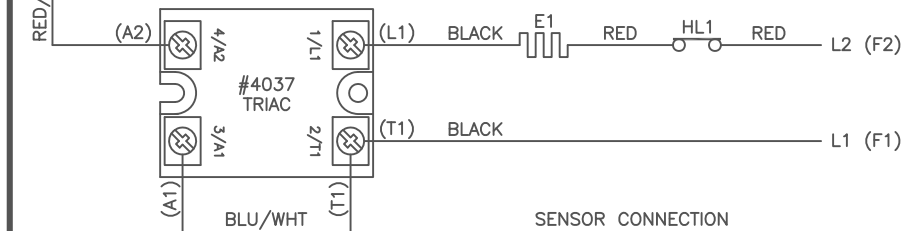
MODEL	LENGTH "L"
EM-WM1134H	10.00"
EM-WM1535L	16.00"
EM-WM1536L	16.00"
EM-WM2035L	16.00"

A11-13-01 REVISED	 ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362		DESCRIPTION	
	DRAWN	REFERENCE DOCUMENT	WARMFLO MAKE-UP AIR OUTLINE	
	MEF	--	EM-WM(1,2)(0,1,5)3(4,5,6)(H,L)	
	CHECKED	VIEW/DRAWING TYPE	SCALE	PART/ASSY/MODEL NUMBER
	HOOKUP	NTS	EM-WM**3**	
APPROVED	DRAWING STATUS	DOCUMENT DATE	SHEET	DOCUMENT NUMBER
	RELEASED	05-04-00	1/1	EH902



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

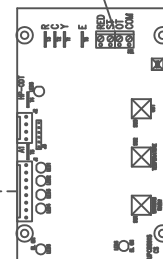
EM-WE2035C
 EM-WE2035H
 EM-WE2035L
 EM-WM2035L



STAGES 1-4 ARE AT 24VAC WHEN INACTIVE.

TO J1	WIRE COLOR
1	ORANGE
2	WHT/BLU
3	ORG/BLK
4	VIOLET
5	GRAY
6	RED/WHT
7	RED/WHT

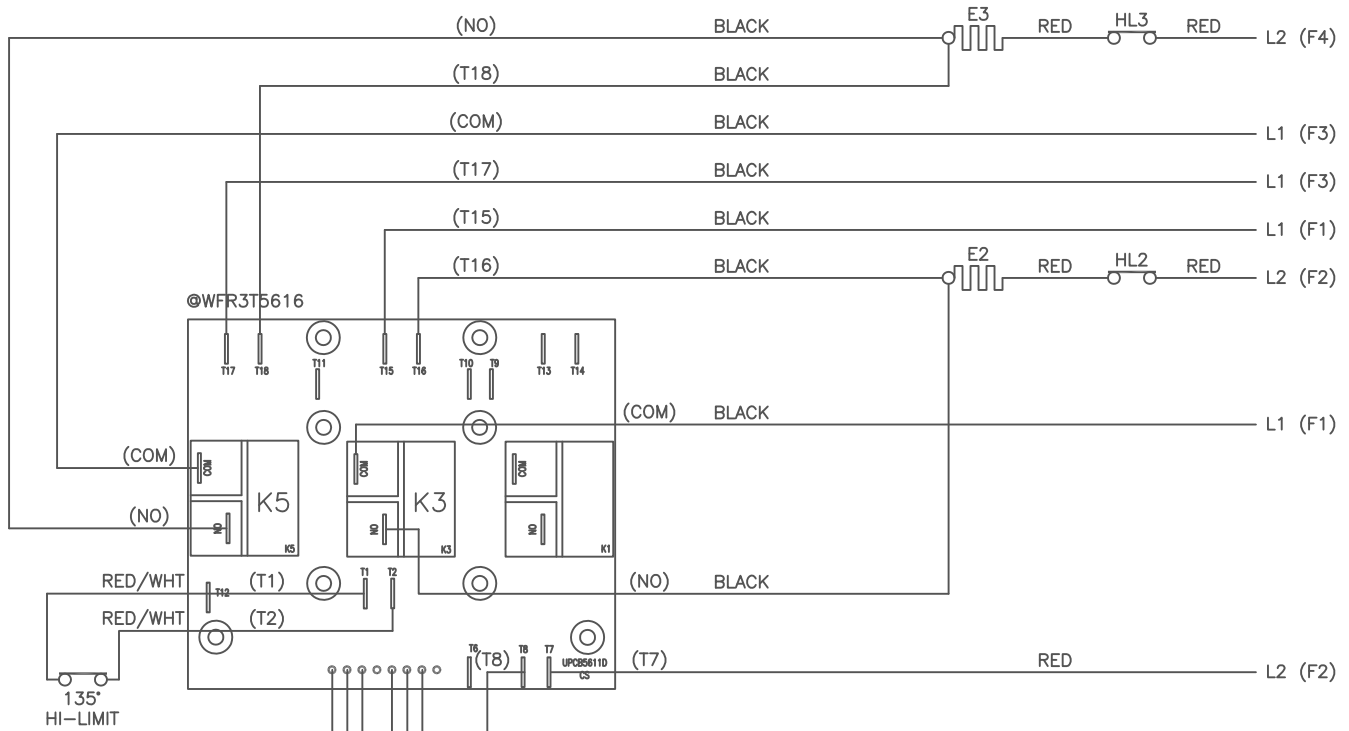
SENSOR CONNECTION
(CABLES NOT SHOWN)



WARMFLO CONTROL BOARD

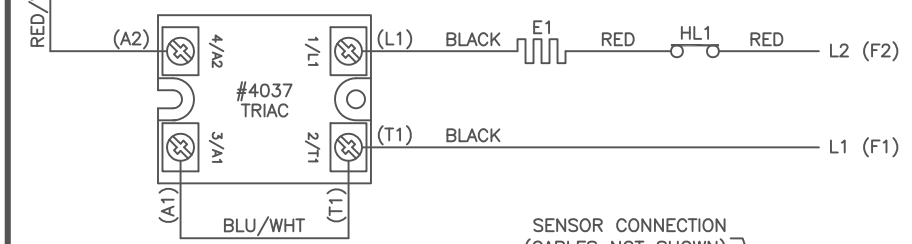
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CHECKED	VIEW/DRAWING TYPE	SCALE	PART/ASSY/MODEL NUMBER	
	SCHEMATIC	NTS	EM-WE***5*	
APPROVED	DRAWING STATUS	DOCUMENT DATE	SHEET	DOCUMENT NUMBER
	RELEASED	1-17-13	1/4	ES502

E1-17-13
REVISED



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

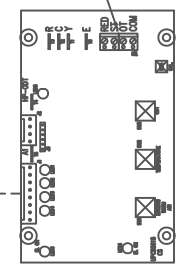
EM-WE1535C
 EM-WE1535H
 EM-WE1535L
 EM-WM1535L



STAGES 1-4 ARE AT 24VAC WHEN INACTIVE.

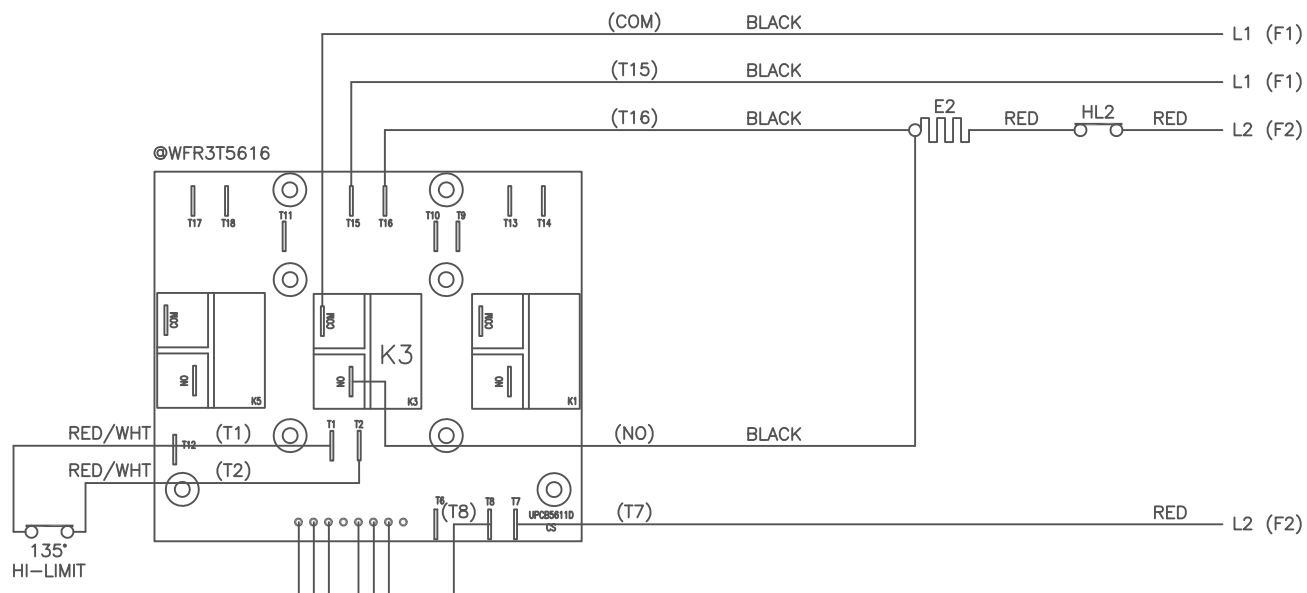
(STAGE 1, TRIAC)	ORANGE	1
(STAGE 2, K3-K4)	WHT/BLU	2
(STAGE 3, K5-K6)	ORG/BLK	3
(STAGE 4, K1-K2)	VIOLET	5
(COMMON)	GRAY	6
(24VAC, DURING T-STAT CALL)	RED/WHT	7

SENSOR CONNECTION
(CABLES NOT SHOWN)



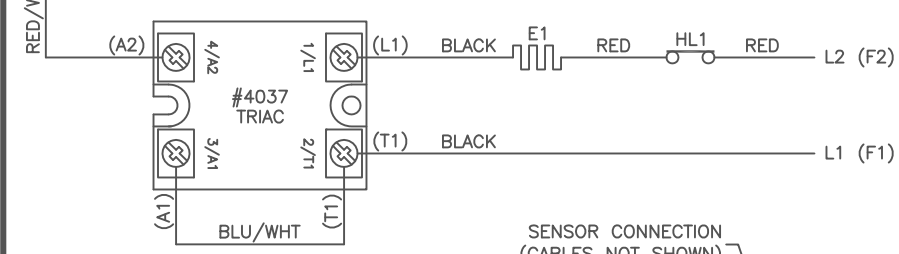
WARMFLO CONTROL BOARD

E1-17-13 REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362		DESCRIPTION	
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CHECKED	VIEW/DRAWING TYPE	SCALE	PART/ASSY/MODEL NUMBER	
	SCHEMATIC	NTS	EM-WE***5*	
APPROVED	DRAWING STATUS	DOCUMENT DATE	DOCUMENT NUMBER	
	RELEASED	1-17-13	ES502	
		SHEET		
		2/4		



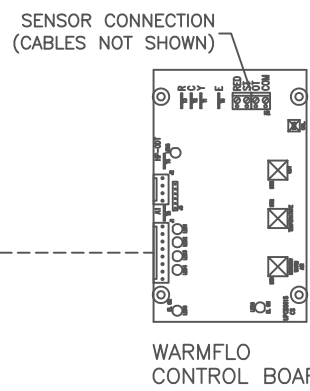
ID	DESCRIPTION
COM	COMMON
E#	ELEMENT
F#	FUSE
HL#	HI-LIMIT
K#	RELAY (CIRCUIT BOARD)
NO	NORMALLY OPEN
T##	TAB NUMBER (CIRCUIT BOARD)

EM-WE1025C
EM-WE1025H
EM-WE1025L

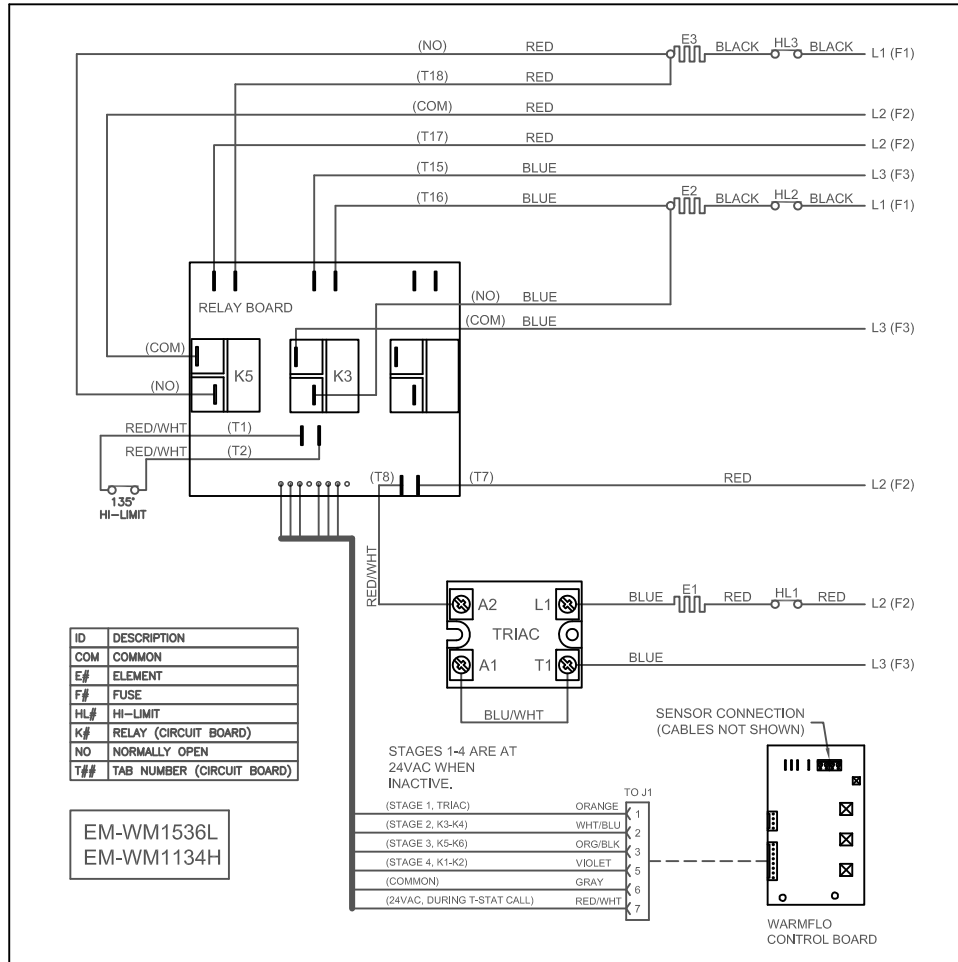


STAGES 1-4 ARE AT 24VAC WHEN INACTIVE.

STAGE	WIRE COLOR	TO J1
(STAGE 1, TRIAC)	ORANGE	1
(STAGE 2, K3-K4)	WHT/BLU	2
(STAGE 3, K5-K6)	ORG/BLK	3
(STAGE 4, K1-K2)	VIOLET	5
(COMMON)	GRAY	6
(24VAC, DURING T-STAT CALL)	RED/WHT	7



E1-17-13 REVISED	ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362		DESCRIPTION	
	DRAWN	REFERENCE DOCUMENT	DIAGRAM, EM-WE***5* WIRING SCHEMATIC	
	CHECKED	VIEW/DRAWING TYPE		
	APPROVED	DRAWING STATUS	DOCUMENT DATE	SHEET
	RELEASED	1-17-13	3/4	EM-WE***5* ES502



E1-17-13 REVISED		ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362	DESCRIPTION		
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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

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.

- New 2008 – version 2.38, 10.03, 12.04, 15.03, etc. – once activated, it remains for the completion of the heat call. Thus it only needs to be a temporary jumper (5 seconds or more) to step on all stages. User needs to remember to cycle the roomstat to cancel this E tab function.
- 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*) – now 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 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 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.

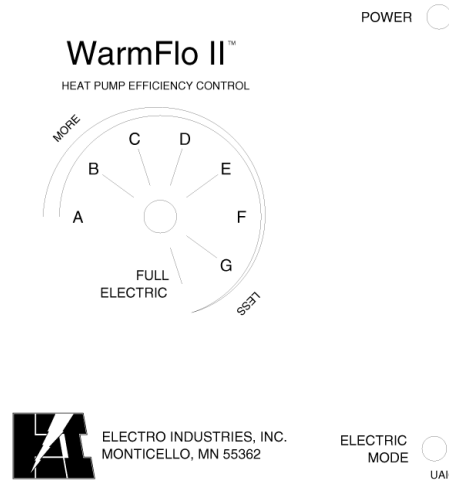
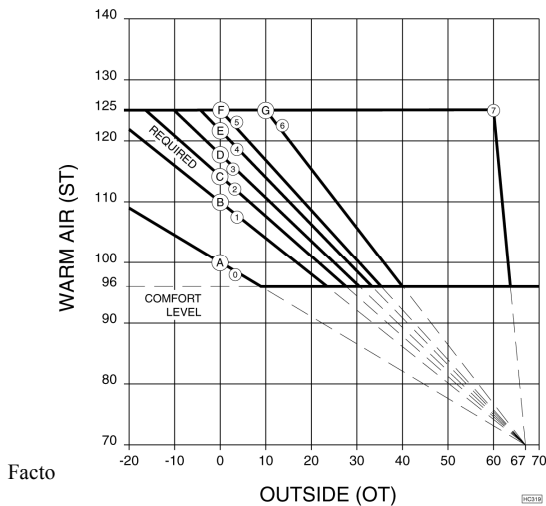
Also on the next call for heat, the WarmFlo II controller remembers what stages were on and starts at that point. A clamp-on amp meter at the service input can be used to “visualize” the Stage 1 modulation and/or Stages 2, 3, and 4 functions.

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 WarmFlo’s 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 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.



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

¹ODT dial switch must be set on 0 = disable.

²EZ-Mate – dual is HPDF, not HPDH.

Other defaults, all Forced Air models.

SB RESET – enabled
 SOT-E – 000 (disabled)
 OT SPD A – N/A
 OT SPD B – 30°

ST SPD A – N/A
 ST SPD B – 105°
 CT STG DISABLE – all 0, except EZ-Mate = 3
 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

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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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