WarmFlo® Electric Furnace

Installation & Operating Instructions

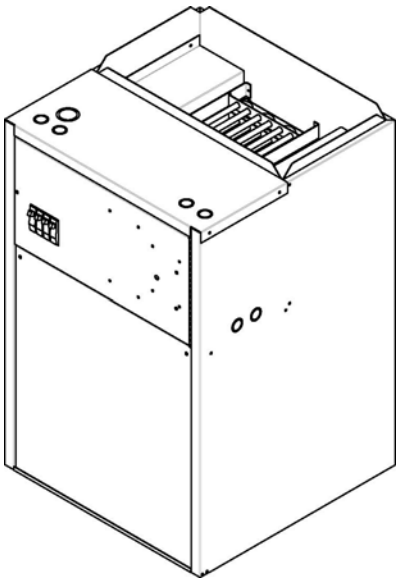
HE-H-**-21 Series

All HE-H-**-21 Electric Furnaces must use an AH chip code. If you have a chip code other than AH, please call factory for assistance.

Application

Full WarmFlo capability with outdoor sensor. This provides warm air outlet temperature dial selection and supply air ramp up with the decrease of outdoor temperature. This WarmFlo feature definitely applies to heat pumps, but it is also the top of the line comfort for straight electric, with air conditioning. The warm air dial suggested setting is 96° or 100° and the front dial selects the rate of ramp up or temperature increase based upon outdoor. The "C" setting will provide 114° warm air at 0° or 125° at -20° F outside. The ECM™ blower also ramps up in speed with an increase in supply temperature or decrease in outdoor temperature. Depending upon setup selection, the moderate heating blower speed could be as low as 50% of full capacity and full capacity blower is only used below 15° outdoor.

Heat/cool conventional or basic heat pump room thermostat can apply.



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

Drawings: **HD320**
NC805
NH803
NH804
NH805
NS802
EC001

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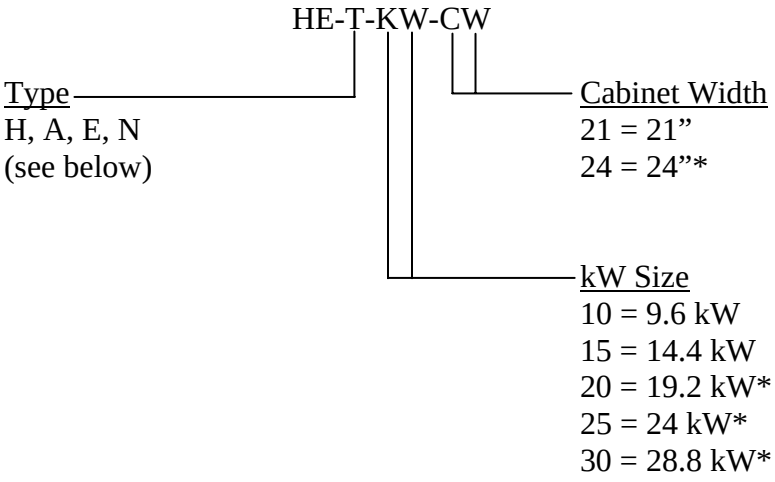
Configurator



Type

All models – ECM™ blower motor, setup selection of four cooling sizes, 50% continuous air (fan – on setting). High efficient air circulation at about 50-watt.

H = Full WarmFlo capability with outdoor sensor. This provides warm air outlet temperature dial selection and supply air ramp up with the decrease of outdoor temperature. This WarmFlo feature definitely applies to heat pumps, but it is also the top of the line comfort for straight electric, with air conditioning. The warm air dial suggested setting is 96° or 100° and the front dial selects the rate of ramp up or temperature increase based upon outdoor. The “C” setting will provide 114° warm air at 0° or 125° at -20° F outside. The ECM™ blower also ramps up in speed as there is an increase in supply temperature or decrease in outdoor temperature. Depending upon setup selection, the moderate heating blower speed could be as low as 60% of full capacity and full capacity blower is only used below 15° outdoor.

Heat/cool conventional or basic heat pump room thermostat can apply.

A = WarmFlo element modulation based upon a warm air set point and duct sensor. Heating blower speed is installation setup per kW size. A higher CFM selection can be made if there is a desire to “work” WarmFlo harder.

Heat/cool conventional thermostat applies.

E = Non-WarmFlo, 10, 15, or 20 kW built-in strip heat, direct function of roomstat W. Setup selection determines nominal ECM™ motor speed. A thermostat “E” type function could be used to jump to full speed.

N = Cabinet only, no electric elements or WarmFlo. This could typically be associated with an inlet hydronics water coil. Control board includes a relay for pump, initiated with input W. Setup selection determines heating blower speed. Cooling speeds and air conditioning interface are the same as mentioned above.

Note: Two-speed and multi-function room thermostat can also be configured with this system by adding WF-HP2 interface controller.

General Comments

Upflow/Downflow/Horizontal
The arrangement of refrigerant coil, hydronics coil, and built-in electric elements need to follow specific air direction or airflow rules, but the orientation of this Electric Furnace is not critical.

For upflow and horizontal standard **air conditioning** applications, the A-coil is mounted at the blower outlet with field provided plenum or AC manufacturer's case coil.

For upflow heat pump or hydronics applications, factory provided stackable modules are available for return air filter, hydronics water coil, or **heat pump** refrigerant coil compartment.

> **Note:** For heat pump the coil must be at the blower inlet.

All models contain GE ECM™ Series 2.3 blower motors. The special Electro Industries interface board allows hookup for heat/cool conventional or basic heat pump room thermostat. Blower speed setup and WarmFlo sensor control are separate for cooling and heating (unique).

The ECM™ motor provided in this unit has many features not available in a standard motor.

- Improved efficiency
- Constant CFM
- Soft start and stop
- Better humidity control

The provided ECM™ motor contains permanently sealed bearings and does not require oiling.

Utility Load Control
Provisions are included for the Utility Receiver to interrupt compressor and WarmFlo or strip heat. No provisions for dual heat, add HP-5046.

Two-Speed Heat Pump
Add WF-HP2 interface controller.

Zone Controller/Dampers
When using models HE-A or HE-H Series there are no adverse electrical heat concerns associated with a zone damper system. However, there may be an effect on the heat pump compressor due to potential reduced airflow. The zone dampers themselves must be in the horizontal ducts after the WarmFlo duct sensor and at least 12" downstream of the WarmFlo sensor.

The zone controller "HVAC equipment" terminal block simply connects to this unit's control board as if it was a room thermostat to this unit. If the various zone sizes produce high static pressure and reduced airflow, the WarmFlo temperature sensing technology will reduce the electric elements automatically.

If the zone damper action has an adverse effect on the heat pump compressor, Electro has zone controller staging interface for 2-speed heat pump application (WF-HP2, etc.).

Side by Side, with Gas Furnace or Other Dual Heat Arrangements
Add-on dual heat controller HP-5046 can simplify the wiring for dual heat.

For side by side ducting, a motor operated damper is required to isolate the return air between two blowers. The operation of this motor damper can be controlled from the HP-5046.

Installation Setup
There are specific peg jumpers relating to cooling tons, heating kW, heat pump reversing valve logic, and thermostat type. These must be properly evaluated and selected to match **each** installation.

The "setup or programming" section has all the detailed instructions and selection tables.

The WarmFlo controller also has various dial switch selections relating to duct temperature set point, minimum warm air set point, HP compressor ODT shutoff temperature, and ramp up efficiency dial. These are standard WarmFlo technology and setup requirements, if you're not familiar with WarmFlo controller study the HD320 WarmFlo information document, also in this package.

NOTICE: When changing any setup jumpers, power down and up. ECM™ motor needs 240V power and control power removed to **reset** and reread specific control lines. Open CB number 1 for 10 seconds.

Operation Instructions
The "Operation Indicators" section contains information relating to LED monitor lights, thermostat sequences, etc.

Installation Checkout
Attached to this manual is a warranty certification and checkout procedure. This must be completed and returned for warranty coverage. This is the responsibility of the contractor or company which "sold the job" and is assuming responsibility to the end customer.

Warranty Statement
See the last page of this manual for detailed limited warranty coverage explanation.

Application

General
The configurator, previous page, details several product types. Re-verify nameplate on your received unit to make sure it properly represents the product type you need for your installation/application.

The setup control board jumpers provide ECM™ blower motor speed flexibility to match the model and your heat/cool size requirements.

When using with heat pump, must use HE-H Series. Because of WarmFlo's sensor action and control, the heat pump coil must be at the inlet side of the blower.

This specific model series, HE-H--****
Full WarmFlo capability with outdoor sensor. This provides warm air outlet temperature dial selection and supply air ramp up with the decrease of outdoor temperature. This WarmFlo feature definitely applies to heat pumps, but it is also the top of the line comfort for straight electric, with air conditioning. The warm air dial suggested setting is 96° or 100° and the front dial selects the rate of ramp up or temperature increase based upon outdoor. The "C" setting will provide 114° warm air at 0° or 125° at -20° F outside. The ECM™ blower also ramps up in speed as there is an increase in supply temperature or decrease in outdoor temperature. Depending upon setup selection, the moderate heating blower speed could be as low as 50% of full capacity and full capacity blower is only used below 15° outdoor.

Backup or Assist Wood Heating
This WarmFlo Electric Furnace is ideal for accompanying a wood heating system. The WarmFlo technology and sensors will determine the Btu/h heating requirement of the building. If the wood warm air is below the requirement, a small portion (or as required) of the electric elements will come on automatically supplementing the wood heat.

Using a wood boiler with the water coil inlet option is an ideal arrangement.

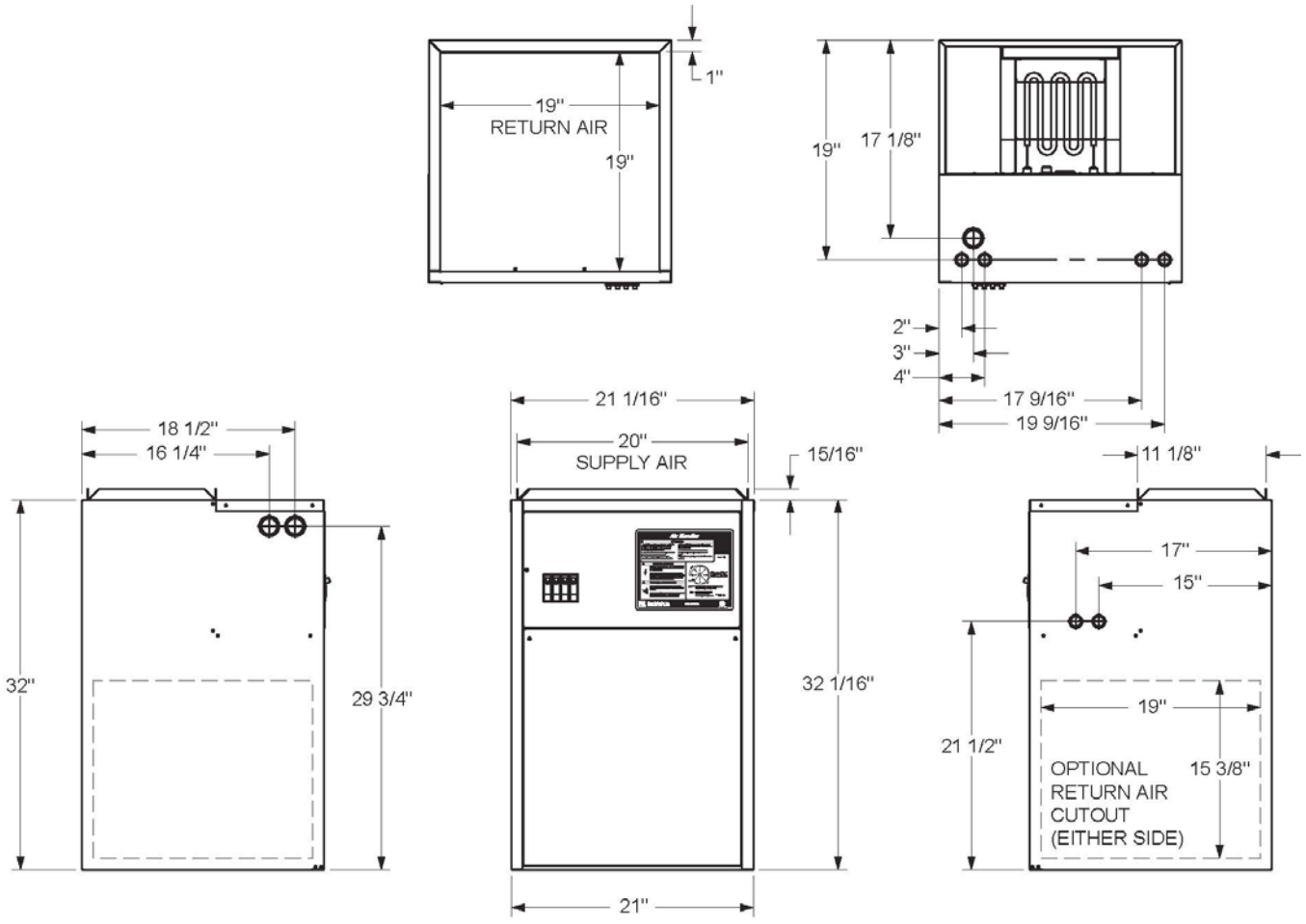
If using a forced wood system, caution must be used when allowing the wood warm air to enter through the ECM™ motor blower. The maximum temperature for the ECM™ motor is approximately 120° F.

Specification Chart

Model Number	HE-H-10-21	HE-H-15-21	HE-H-20-21
Cabinet Width	21”	21”	21”
kW rating	10	15	20
Btu/h	34000	51000	68000
Voltage/Phase	240/1	240/1	240/1
Circuit Breaker	60	1-60, 1-30	2-60
Amps per CB	42	42, 21	42, 42
Source Feed	1	2	2
Elements	4	6	8
Relays	2	4	6
Heat CFM*	765 (LO)	900 (M)	1035 (HI)
Max. Temp. Rise	45° F	45° F	45° F
Shipping Weight			

*WarmFlo sensing will override this to 1200 CFM.

Product Dimensions



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.**

⚠ WARNING

ALL ELECTRICAL WIRING MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE AND LOCAL ELECTRIC CODES, ORDINANCES, AND REGULATIONS.

⚠ WARNING

OBSERVE ELECTRIC POLARITY AND WIRING COLORS. FAILURE TO OBSERVE COULD CAUSE ELECTRIC SHOCK AND/OR DAMAGE TO THE EQUIPMENT.

⚠ CAUTION

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

2. If this is a Dual Heat system, this product relates only to the addition to the furnace ducting system external to the gas or oil force air furnace. The owner/ installer assumes all responsibility and/or liability associated with any needed installation of the gas/oil furnace, fuel system, flue, chimney, etc. Any instructions or comments made within this manual (or factory phone assistance) relating to the gas/oil furnace are provided as comments of assistance and "helps" only.

⚠ CAUTION

This unit shall not be operated (either heating section or blower) until the interior of the structure is completed and cleaned. This also means all duct work must be complete with filter, etc. Both manufacturers' warranties are void if this unit is operated during structure construction.

⚠ CAUTION

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

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

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

Mechanical Installation

Clearances and Accessibility
Zero clearance is allowed on all sides for combustible materials. However, 36" should be allowed at the front for operation, maintenance, and service.

To reduce the risk of rusting and appearance, do not install the unit directly on the ground or on a floor that is likely to be wet. In such environments the unit must be elevated by use of a sturdy non-porous material.

General Ductwork and Airflow Requirement
Design the airflow ductwork to meet the maximum operating airflow (CFM) for the kW **and** cooling ton requirements (whichever is larger). This document does not provide installation and design information for the ductwork external to this product. It is assumed this is being accomplished by a professional and trained installer understanding ductwork design, airflow/static pressure resistance, and forced air distribution systems. Key requirements information:

- Heating and cooling blower speed or minimum CFM is setup independently. See the "Blower Speed Selection" to match the airflow capacity with the ducting design.
- The airflow distribution system shall be designed for a maximum of 0.5" SP. Ideally the design should be set at 0.3" to 0.4" SP.
- The variable speed, ECM™ motor, is sensitive to inlet static pressure. In order for the motor to arrive at the setup CFM (motor RPM adjust according to static pressure) the inlet must have a minimum resistance of about 0.15 to 0.2. If you do not have return air ducting and you're simply allowing free return air circulation through a filter at this Electric Furnace inlet, you may need to have a slight restriction in order for the blower motor to arrive at its setup speed.
- All transitions must have a slope of 30° to 45°. There shall be no 90° bends or surfaces causing airflow bounce/eddy current.
- The manufacturer strongly recommends the return air entering the bottom (under the blower) of the cabinet. For smaller kW and smaller cooling (10 kW or 2-ton) it is permissible to bring the air in on either side of the 32" cabinet.
- Previous Specification Chart shows the minimum CFM associated with the kW. Again this is setup as detailed in the "Setup or Programming" section.
- The cooling CFM is also selected but is **not** shown on the Specification Chart. In many cases the airflow distribution system is probably designed to meet the **cooling** requirement.
- The room registers and individual 5" or 6 " runs must also match the total setup or planned CFM for this installation. Typically a 6" round and a typical room register is rated at 100 CFM.
- All distribution ducts (supply **and** return) must be sized for the setup or planned total CFM requirement. The attached duct sizing chart shows various distribution duct sizes relating to their ability to properly handle the stated CFM.
- Seal connections between this unit and ductwork, all ductwork connections, etc. as required to reduce or eliminate air leakage. Sealing all connections will also reduce air noise.

Comment: The ECM™ motor efficiently relates to system static pressure. On one hand a minimum of about 0.2" SP is required for the motor to adjust itself, but above 0.3" it begins to drain high current. For information, consider (at 240):

1.0" SP – 3.4A
0.8" SP – 2.5A
0.5" SP – 0.9A
0.2" SP – 0.4A
Continuous Air – 0.25A

Whether this unit is sitting on or attached to an inlet cabinet, field designed inlet cabinet, or horizontal supports; verify proper support and mechanical strength is provided within the system installation. Rubber isolation pads should be used where possible to reduce sound and vibration transmission.

⚠ WARNING

WHEN HANGING THIS UNIT, THERE MUST BE UNDER SUPPORTS WHICH DISTRIBUTE THE HANGING CHAINS ACROSS THE SURFACE OF THIS UNIT, DO NOT SIMPLY DRILL A HOLE AND USE A COUPLE OF HANGING BOLTS.

For information, factory optional inlet cabinets can reduce cost and simplify installation, see NC805.

When installing the unit maintain a minimum clearance of 36" in front of the unit for service accessibility.

Upflow, Air Conditioning
The return air should enter the bottom of this cabinet. Suggest using Electro bottom filter cabinet (NC805) or field constructed equivalent. The A-coil will be mounted above the blower in either a case coil or field constructed plenum.

Upflow, Heat Pump
In this case the HP refrigerant coil must be at the bottom of the blower in order for WarmFlo to properly add temperature to the heat pump output. Electro inlet cabinet is ideal for using a heat pump A-coil (NC805). This factory available inlet cabinet provides space for standard A-coil and is installed between the filter/inlet cabinet and the Electric Furnace unit itself.

The cabinet is designed for 20"H A-coil, but for larger A-coils the top can be above this cabinet approximately 3" (24").

The outlet of the blower will enter into a plenum and directly into distribution duct.

Downflow, Air Conditioning
Similar to upflow above, the air conditioning coil is positioned at the blower outlet. Depending upon the coil type and drip pan it is positioned in a field constructed plenum as required.

A typical packaged 20" x 20" filter cabinet could easily be installed at the blower inlet opening.

Downflow, Heat Pump

With the WarmFlo elements down and airflow direction down, the A-coil must be at the top of this unit. This is assuming the heat pump and associated refrigerant coil you are using is designed to drive air "backwards" through the A-coil and drip pan. Use heat pump manufacturer's recommendation; however, refrigerant coil must be on the inlet side of the elements.

Horizontal, Air Conditioning

Similar to upflow above, the air conditioning coil is positioned at the blower outlet. Depending upon the coil type and drip pan it is positioned in a field constructed plenum as required.

As horizontal, the return air would enter the blower end of the cabinet with a typical packaged 20" x 20" filter cabinet.

Horizontal, Heat Pump
As emphasized above, the heat pump coil must be at the blower inlet. Depending upon the coil physical arrangements and drip pan, it is installed in a field constructed plenum at the blower inlet.

Typically a package filter cabinet is installed at the entrance (or ahead of) of the HP coil.

The blower outlet goes directly into the distribution duct system.

Blower Motor Orientation
If the installation is not upflow, the blower motor shall be positioned so the power and control connectors are down. This will prevent water from entering the blower motor through the connector housing opening.

Loosen motor mount clamp and rotate motor accordingly.

Before tightening motor mount clamp be sure the blower wheel is properly centered inside the blower housing.

Electrical Installation

⚠ WARNING

TO AVOID THE RISK OF ELECTRIC SHOCK OR DEATH, WIRING TO THE UNIT MUST BE PROPERLY GROUNDED. FAILURE TO PROPERLY GROUND THE UNIT CAN RESULT IN A HAZARD LEADING TO PERSONAL INJURY OR DEATH.

Line Voltage
The nameplate and/or Installation and Operating Manual specification page provides kW rating and operating current requirements for each specific model. Select the proper wire size to comply with your type of wire routing and NEC field wiring requirements.

Field connection is at this product's furnished circuit breaker. This integrated circuit breaker is a proper local disconnect.

⚠ WARNING

USE ONLY COPPER WIRE FOR CONNECTION TO THE CIRCUIT BREAKER TERMINALS AND INSIDE THIS PRODUCT'S CABINET.

If the 240 power service is to be wired as single feed, order option circuit breaker single feed bus bar, part number 5701.

⚠ WARNING

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

WarmFlo Controller – Inside View, Left Board

Remote Sensor

Duct sensor, A-coil not in supply plenum – the duct sensor (shorter cable, black wire on ST terminal) is installed approximately 24" above (or airflow distance from element) the Electric Furnace or electric elements. Drill a ½" hole, approximately plenum center.

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

Duct sensor, A-coil in supply plenum – the duct sensor (shorter cable, black wire on ST terminal) is installed on the warm side of the coil and 4" to 6" after the coil. Pick the side which appears to have the most airflow distribution (facing A-coil) and drill a ½" hole approximately 2" from the side edge.

Again the key is getting this sensor in the maximum warm air stream, the air coming through the A-coil fins will all be on the edge of the plenum.

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

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

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

Other Sensor Related Comments

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

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

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

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

Electric Furnace Control – Inside View, Right Board

There are several room thermostat and outdoor unit possibilities. **Pick** the following paragraph which relates to your installation.

Room Thermostat, Air Conditioning
Use conventional heat/cool, 1H/1C, thermostat. It can be mechanical, digital, power robbing, battery operated, setback, etc. If mechanical, set the heat anticipator to 0.2.

Connect the standard R, W, G, Y stat terminals to the control board **HEAT/COOL** terminal block with the same letters.

Room Thermostat, 2-Speed Air Conditioning
Use conventional heat/cool, 2H/2C, thermostat. It can be mechanical, digital, power robbing, battery operated, setback, etc. If mechanical, set the heat anticipator to 0.2.

Connect the R, W, G stat terminals to the control board **HEAT/COOL** terminal block with the same letters.

Connect the Y1 stat terminal to the control board Y1 tab. Connect the Y2 stat terminal to the control board Y/Y2 screw terminal.

The room thermostat W2 is not used or connected.

Outdoor Unit, Air Conditioning
Connect the outdoor unit 2 wires to the control board Y/Y2 and C. If 2-speed A/C, there will be a third wire connected to the tab Y1.

Room Thermostat, Heat Pump Single Stage
You must use a basic HP stat with built-in reversing valve function. Typically this will be 6 wires. A conventional heat/cool (4-wire) thermostat will not work when using a heat pump.

The R and C for the HP thermostat is picked up at the bottom spare 24VAC and COM tabs. The O, G, E, Y connections are made on the left side bracketed area "HP".

Outdoor HP Unit (Single Stage)
Typically this unit will have either 4 or 5 wires. The main 4 wires are connected to the screw terminal block R, Y/2, RV, C. The RV can either be the O or the B wire within the outdoor unit.

If the HP outdoor unit has a 5th wire for defrost auxiliary heating, connect this 5th wire to the WF (W1) tab.

Two-Speed Heat Pump and/or Multi-Wire Heat Pump Thermostat
Add optional interface controller WF-HP2. In this case all room thermostat and outdoor unit hookup is from the WF-HP2. The HP2 furnace TB connects to this unit stat TB. Use H/C TB and pin jumpers and R, C, Y1, Y2.

Cooling, Special Dehumidification
The BK tab and the BK peg jumper provide the industry standard 12% blower speed reduction to "pull out" additional moisture from the air. Provide an external humidistat between BK and R and pull or permanently disconnect the BK jumper. With the BK terminal at 0 volts the 12% blower speed reduction is activated.

Utility Load Control
If applicable for your installation and your utility authorized electric rate, at the bottom of the control board is a blue wire jumper. Simply remove this jumper and extend the two tabs to the power company receiver having N.C. logic.

- If opposite control logic is required contact factory for other wiring instructions.

Setup or Programming

It is extremely important the installer properly sets the peg jumpers for all of the following requirements.

WarmFlo Controller – Inside View, Left Board

Program Control Chip
This unit is provided with a control chip (version 2.36 or higher) which can relate to heat pump or non-heat pump, but must have both the OT and ST sensors installed. The key information programmed within this "AH" chip is:

Stg. Enable	MU Time	ODT Mode	OT Function	SB Reset
90°, 38°, 36°, 34°	00	HP	DT cal.	Disabled

Electric Heat Staging Disable
At OT temperatures above the following the electric elements are held off. The outside temperature (as measured by the OT sensor) must be below these values before the appropriate stage will come on. This is independent of the supply sensor requirement.

Stage	OT Temp.
1	90° F
2	38° F
3	36° F
4	34° F

WarmFlo Dial Settings
Lower right dial switch – min. warm air – The yellow dial switch 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.

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

Top right dial switch - Built-in ODT – The yellow dial switch can be set to **terminate the heat pump** below ODT temp.

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".

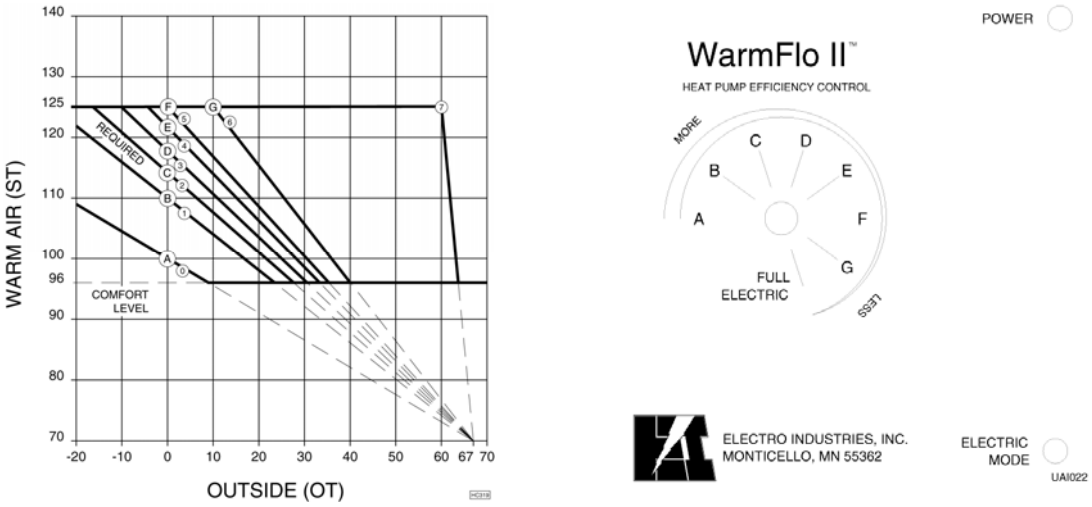
Temperature (Efficiency Dial) – Located on the front cover of the WF II Electro-Mate, the red center screwdriver adjustment dial has a selection of A through G. These A through G selections represent a supply temperature point at 0° outdoor. The closer the user or installer selection is to A, the flatter 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 knob is turned to "full" the WF II will automatically put all stages of electric to full capacity.

> **COMMENT:** When using with non-heat pump and OT sensing, this dial is also involved with a temperature ramp-up function. In order to provide maximum electric heat efficiency it is still desirable to use a setting which provides ramp-up. However, instead of working with settings B and C common with heat pumps it may be okay to work with C or D for straight resistance.

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.



Factory set per table and chip on order sheet.

Electric Furnace Control – Inside View, Right Board

Room Thermostat Type
On the control board left side is a peg jumper which needs to point either to conventional heat/cool or heat pump thermostat.

Heat Minimal Blower Speed Selection
This is only used with H/C thermostat. With heat pump thermostat, heat jumper has no function. On the right side is a peg jumper for a LO/MED/HI selection. The WarmFlo technology and action of both of the remote sensors will determine the full speed or maximum CFM when required by the heating system. This selection is simply a first step blower speed and does not necessarily have to match the kW capacity. The suggestions are as following, but 20 kW will function just fine with the LO position.

- 10 kW LO 765 CFM
- 15 kW MED 900 CFM
- 20 kW HI 1035 CFM

Cool Blower Speed Selection
At the control board right side is A/B/C/D selection. It is very important that this selection be matched to the cooling ton installed within the system. When using a heat pump stat , cool jumper relates to heating and cooling. Heat jumper is non-active.

- A – 3-3.5 ton 1200 CFM
- B – 2.5-3 ton 1100 CFM
- C – 2-2.5 ton 1000 CFM
- D – 2 ton 900 CFM

Heat Pump
When using a heat pump thermostat select the COOL A/B/C/D jumper position relating to the heat pump size.

Operation Indicators

WarmFlo Controller – Inside View, Left Board

Monitor LED's on Front
Green LED
When illuminated WarmFlo II 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 WarmFlo II is in the electric heat operating mode (Utility Load Control).

Inside Warmflo Board, 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 top).

Electric Furnace Control – Inside View, Right Board

Green, next to Fuse
24-volt power connected and fuse good.

Red, next to W
Call for electric heat, also represents the input signal (yellow wire) to the WarmFlo control board.

Green, Cool
Conventional H/C stat has an active Y function or heat pump stat reversing valve is in the cool mode (will depend upon proper setup with RV logic jumper). For 2-speed AC this LED is illuminating during high speed.

Amber
Represents action within ECM™ blower motor. Factory technician troubleshooting only.

Additional Information

WarmFlo Elements Mechanical Hi-Limit
For this unit there is no LED's representing mechanical, automatic reset, hi-limit.

ECM™ Blower Motor
The "setup or programming" section outlined the peg jumper programming for selecting blower motor speed according to the nominal or low volume heat and cool installed tons.

WarmFlo Sensing Blower Speed Override
Both WarmFlo sensors will and can set the blower to maximum CFM (independent of the heat LO/MED/HI setup).

Whenever the duct sensor (ST) senses above 115° F **or** the outdoor (OT) is below 30°, the blower speeds up to full 1200 CFM (SPD B).

The full speed blower action continues to the end of the thermostat cycle, independent of any change at the ST or OT.

Room Thermostat "Fan On" Mode
This sets up continuous air at 50% of the pin jumper selected cool. The ECM™ motor is very economical at this speed.

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.

Note: This unit is designed to operate in a total electric application. Therefore, SOT-S and MU are not permitted and should always remain disabled.

Troubleshooting

CFM CALCULATION – By measuring the temperature rise across the Electro-Mate, the actual CFM can be quite accurately determined. The airflow and Electro-Mate unit must be operating in a stable condition for at least 10 minutes. If it is cycling on temperature limit, this calculation will be of no value. The accuracy of this formula will depend upon uniform and average temperature rise plenum thermometer readings and the accuracy of both the clamp-on amp meter and AC voltmeter. NOTE: The volts x amps x 3.4 value is the same as Btuh output.

$$\text{CFM} = \frac{\text{Volts x Amps x 3.4}}{\text{Temperature Rise x 1.08}}$$

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.

1. The outdoor sensor can be calibrated with ice (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.

   Caution: This is not a temperature checking situation. If you proceed with this function, the sensor automatically goes to 32°F.

2. 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 and order test set device.

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

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

Troubleshooting/Repair Helps

1. This WarmFlo 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 Electric Furnace circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.

2. The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.

3. Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.

4. The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor "hang in conditioned space" and attempt to run this system.

5. Acquiring the WarmFlo 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 controller board).

Bad sensor, safety – if the internal logic detects open sensor wire, incorrectly wired sensor, or some bad sensor transmitted value conditions; the green LED reverts to a pulsing mode. Basically the appropriate sensor is set internally to a 0° value and the WarmFlo main board only allows stage 1 and stage 2 on.

- OT sensor – approximately 1/10 second blip every ½ second
- ST sensor – two, 1/10 second blips every ½ second
- Both bad – ½ second on and ½ second off, alternating

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

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

24-Volt Fuse – the internal fuse is between the Electric Furnace transformer and all other WarmFlo II functions, including the "R" going to the outdoor unit. Use only two amp, fast blow.

Heat Pump Only, Reversing Valve Logic
Depending upon manufacturer's outdoor unit and room thermostat, the RV wire (O or B) can either be high for cool or high for heat. Set the jumper on the top of the board in the appropriate position for 24 volts/high.

Replacement Parts

@WFS55612	Sensor ST filter 5 ft.
@WFS255612	Sensor 25 ft. filter
@WFCOE5615	PCB WF2 PIC 74 Dual Heat
@HEIBG6707	PCB Electric Furnace ECM™ Motor H/C and HP Stat
@WFPDC5632	PCB Power Sup AC to DC
5850	Motor ½ HP ECM™ GE
5541	Transformer 120/240:24 40VA
4038	Triac SSR 50-amp 24VDC
5127	Relay NO 25A@277 24VDC Coil
6630	Limit O-150/O-180 25A@240V ST-CLSD
5636	Limit O-135/C-120 25A@240V DP-CLSD
6615	Element DI 4800W@240V
5652	Circuit Breaker SD 60A
5650	Circuit Breaker SD 30A
5651	Circuit Breaker SD 45A

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.

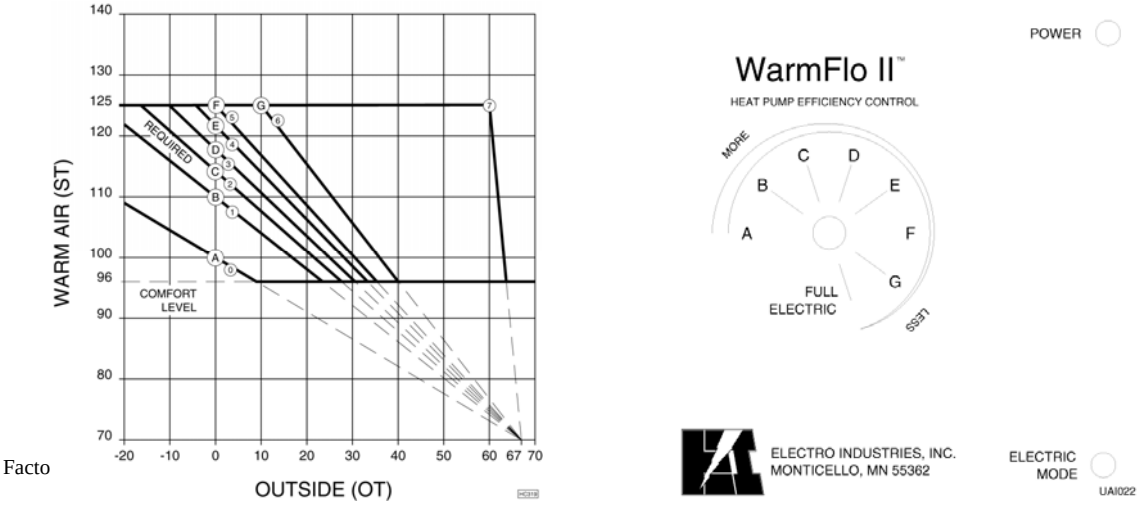
Also on the next call for heat, the WarmFlo II controller remembers what stages were on and starts at that point. A clamp-on amp meter at the service input can be used to "visualize" the Stage 1 modulation and/or Stages 2, 3, and 4 functions.

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.



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

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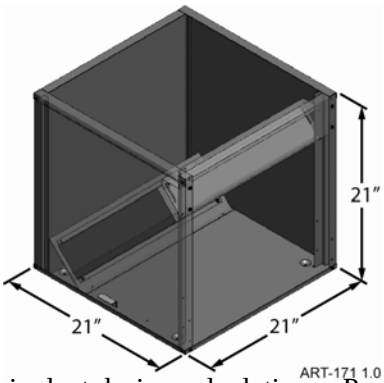
Electric Furnace/Air Handler – Inlet Cabinets

Factory available accessory cabinets can make the Electro Electric Furnace/Air Handler more effective and easier to install. Typically these are designed for **upflow** applications.

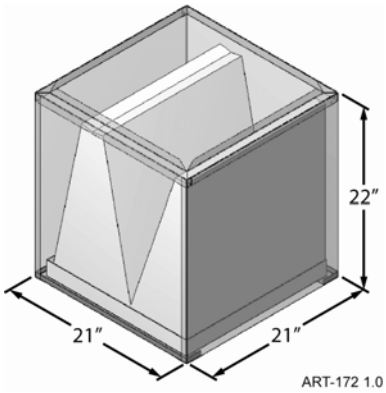


Side Entry, Filter Cabinet HE-IF-21
Return air duct connection opening is 16" x 19". There is an access door on both sides, thus this cabinet can be positioned in any direction or orientation to the Electric Furnace/Air Handler.

Adjustable rails are provided for standard 2" or 4" pleated filter.

The pleated filter is standard 20" x 20". Examples include Honeywell 203721, BestAir HW2020, or Grainger® 6B936.

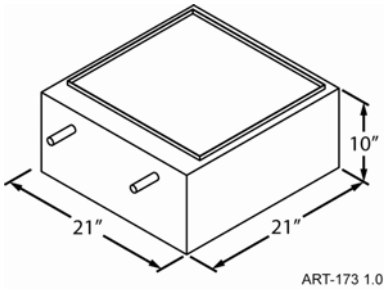
Comment – The 3M MERV filter airflow resistance needs to be considered in duct design calculations. Per specification information from 3M the static pressure drop across the 1", Series 1000, MERV 11 filter is 0.2" SP.



Heat Pump Coil Cabinet
This can be configured between the Electric Furnace inlet and the filter cabinet. This section allows for a field installed 20"W x 20-½"D x 20"H (24"H is possible) standard drip pan A-coil. For horizontal applications the installer furnished coil must have proper drip pan. Access holes for refrigerant lines need to be cut in as required.

- HE-ICC-21

Hydronics Coil and Cabinet
Depending upon capacity size and position, there are two designs available. If standard air conditioning is desired with this Electric Furnace/Air Handler, the air conditioning coil would be at the outlet of the blower. In this case the hydronics coil is at the inlet as draw-through. Suggest low or medium temperature applications, do not use as draw-through with 180° water. 140° to 150° water would be acceptable.



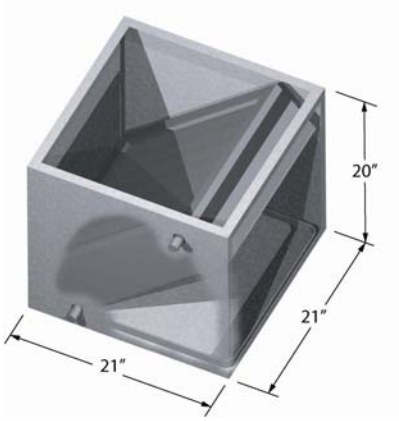
Flat coil – Typically this is used between the above filter cabinet and the Electric Furnace/Air Handler.

- Nominal Btu/h rating – 45,000
- Recommended CFM setup – 1000 min.
- Typical inlet water – 120° to 140°
- Nominal water flow – 8 GPM
- HE-WC-21 or assembly

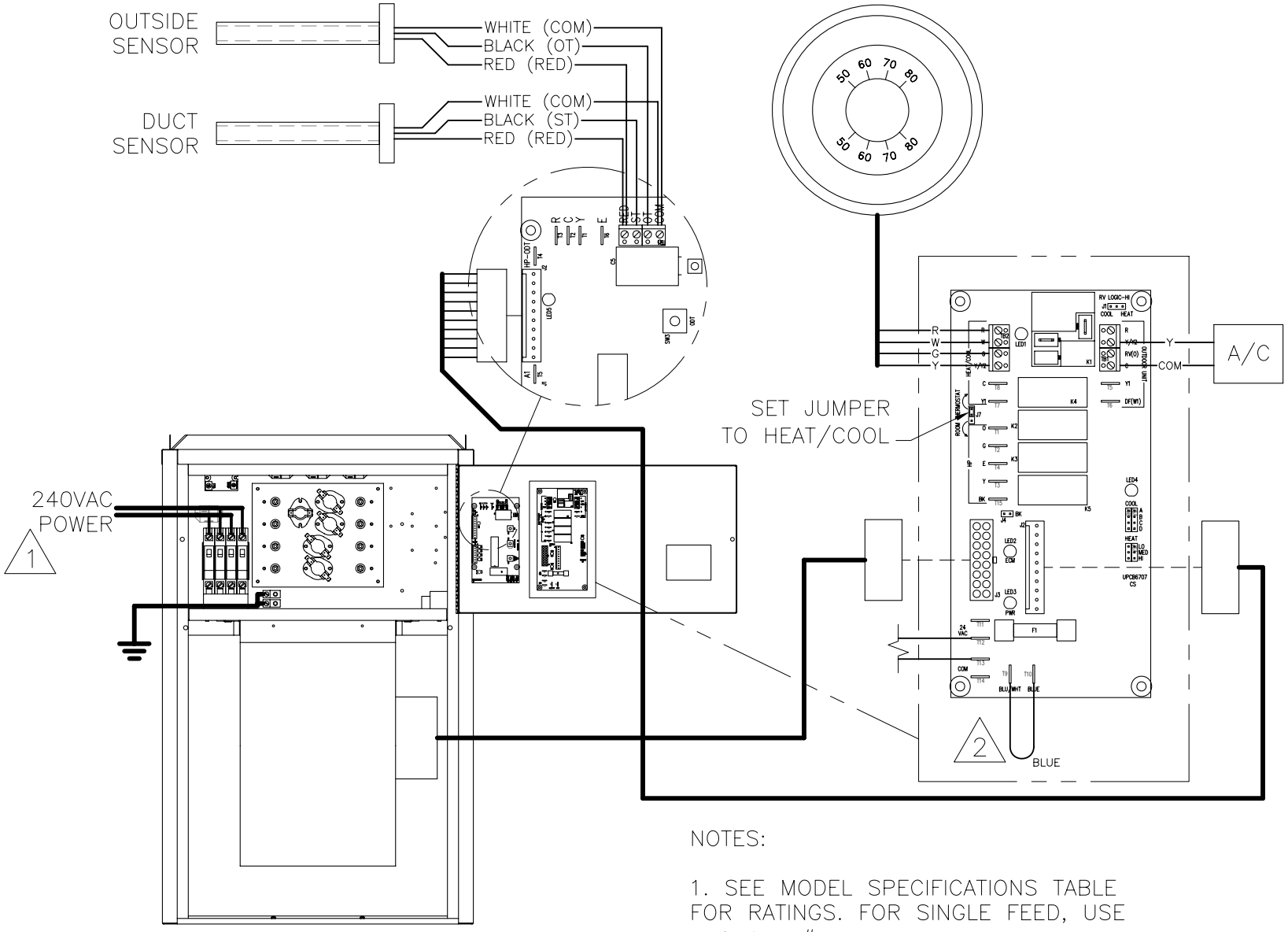
Larger, 4-row coil – This cabinet is arranged for side, direct, return air. The cabinet can be reversed for either left or right side entry. The inlet for this cabinet is sized for an externally installed packaged return air filter cabinet – typical 20" x 20" size.

- Nominal Btu/h rating – 75,000
- Recommended CFM setup – 1200
- Typical inlet water – 120° to 140°
- Nominal water flow – 12 GPM
- HE-IWC-21

Reduced CFM and/or inlet water temperature will reduce Btu/h rating.



WARMFLO (OT & ST), HEAT/COOL STAT, A/C (1 SPEED)
HE-H-**-** (CHIP CODE "AH")



NOTES:

1. SEE MODEL SPECIFICATIONS TABLE FOR RATINGS. FOR SINGLE FEED, USE LUG SET #5701.
2. FOR LOAD CONTROL INTERRUPT, REMOVE BLUE JUMPER & CONNECT N.C. CONTROL DEVICE.

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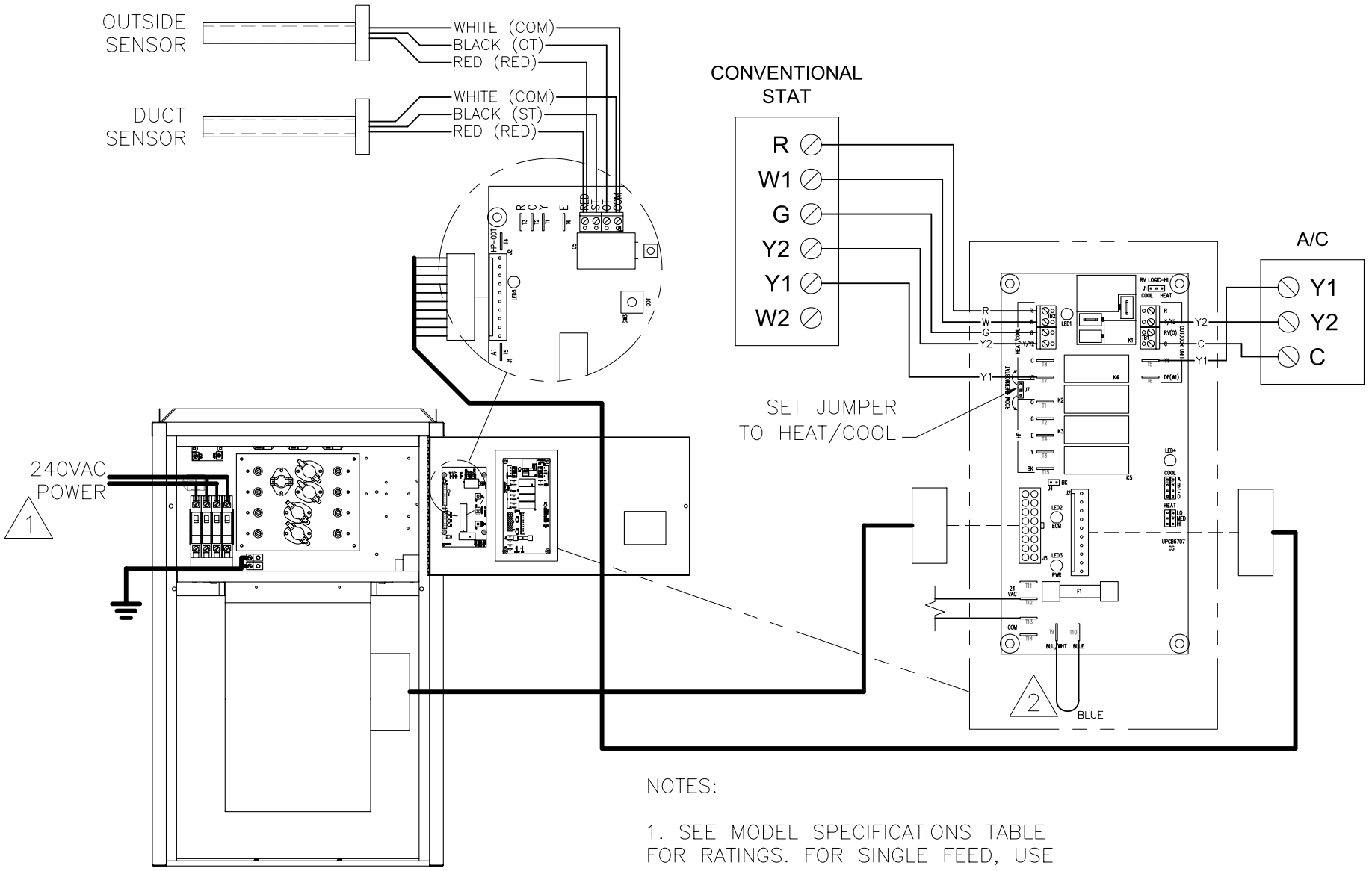
WARMFLO (OT & ST), HEAT/COOL STAT, A/C (2 SPEED)
HE-H-**-** (CHIP CODE "AH")



NOTES:

1. SEE MODEL SPECIFICATIONS TABLE FOR RATINGS. FOR SINGLE FEED, USE LUG SET #5701.
2. FOR LOAD CONTROL INTERRUPT, REMOVE BLUE JUMPER & CONNECT N.C. CONTROL DEVICE.

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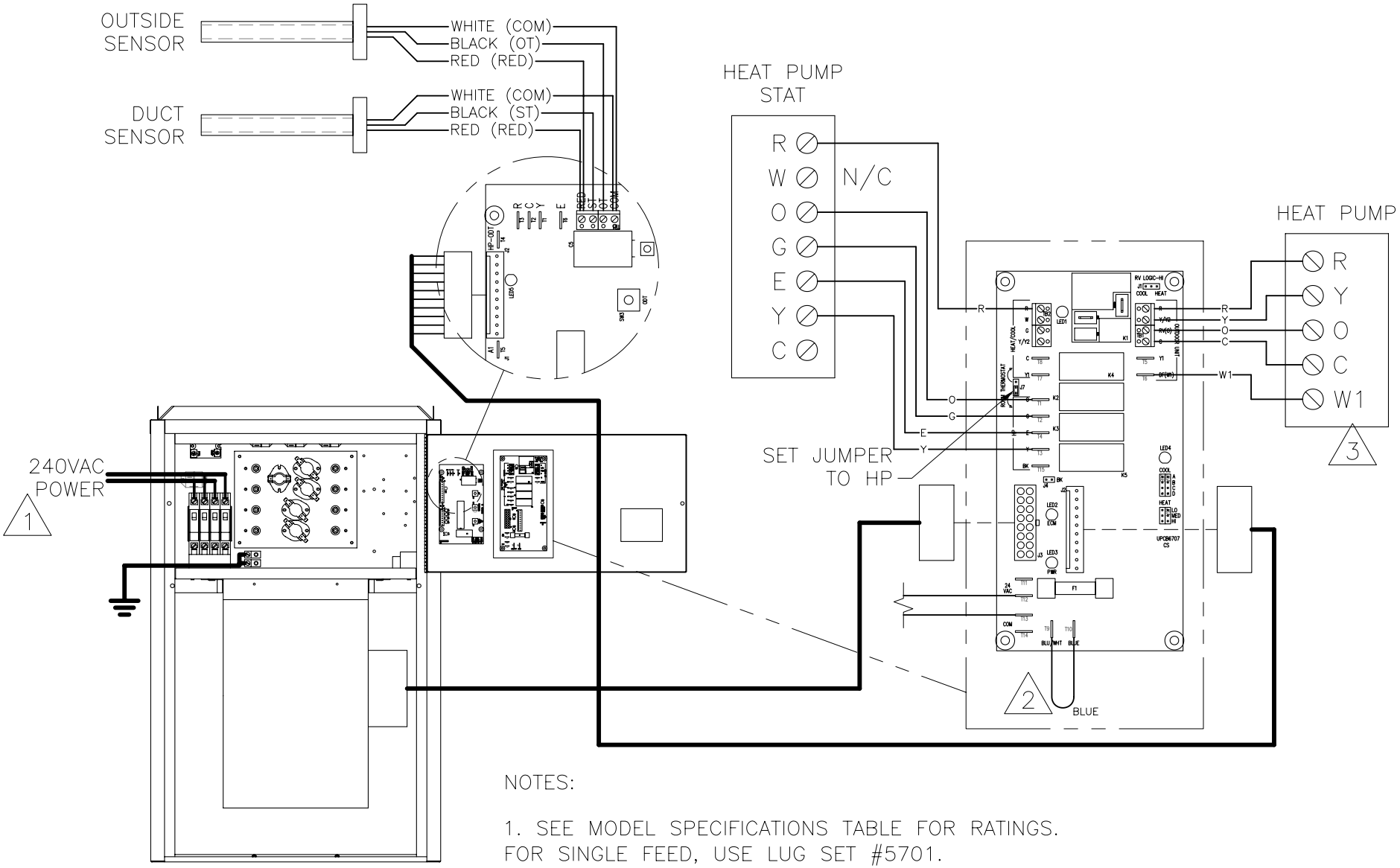
WARMFLO (OT & ST), HEAT PUMP STAT, HEAT PUMP (1 SPEED)
HE-H-**-** (CHIP CODE "AH")



NOTES:

1. SEE MODEL SPECIFICATIONS TABLE FOR RATINGS. FOR SINGLE FEED, USE LUG SET #5701.
2. FOR LOAD CONTROL INTERRUPT, REMOVE BLUE JUMPER & CONNECT N.C. CONTROL DEVICE.
3. OPTION – DEFROST OUTPUT, SAME AS STAT E.
4. FOR 2–SPEED HEAT PUMP, MUST ADD WF–HP2 AND ALL HOOKUP IS AT HP2 CONTROLLER.

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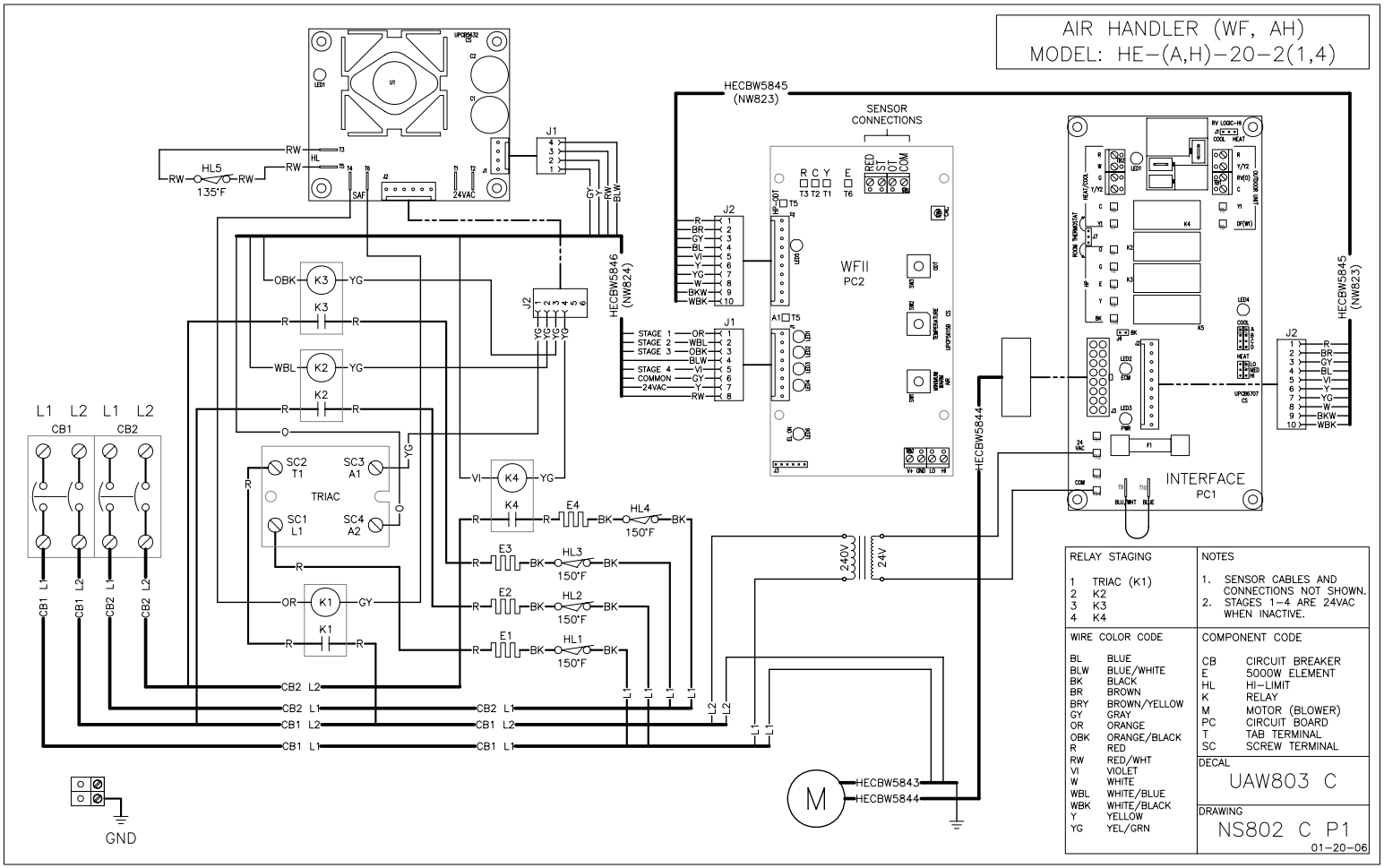
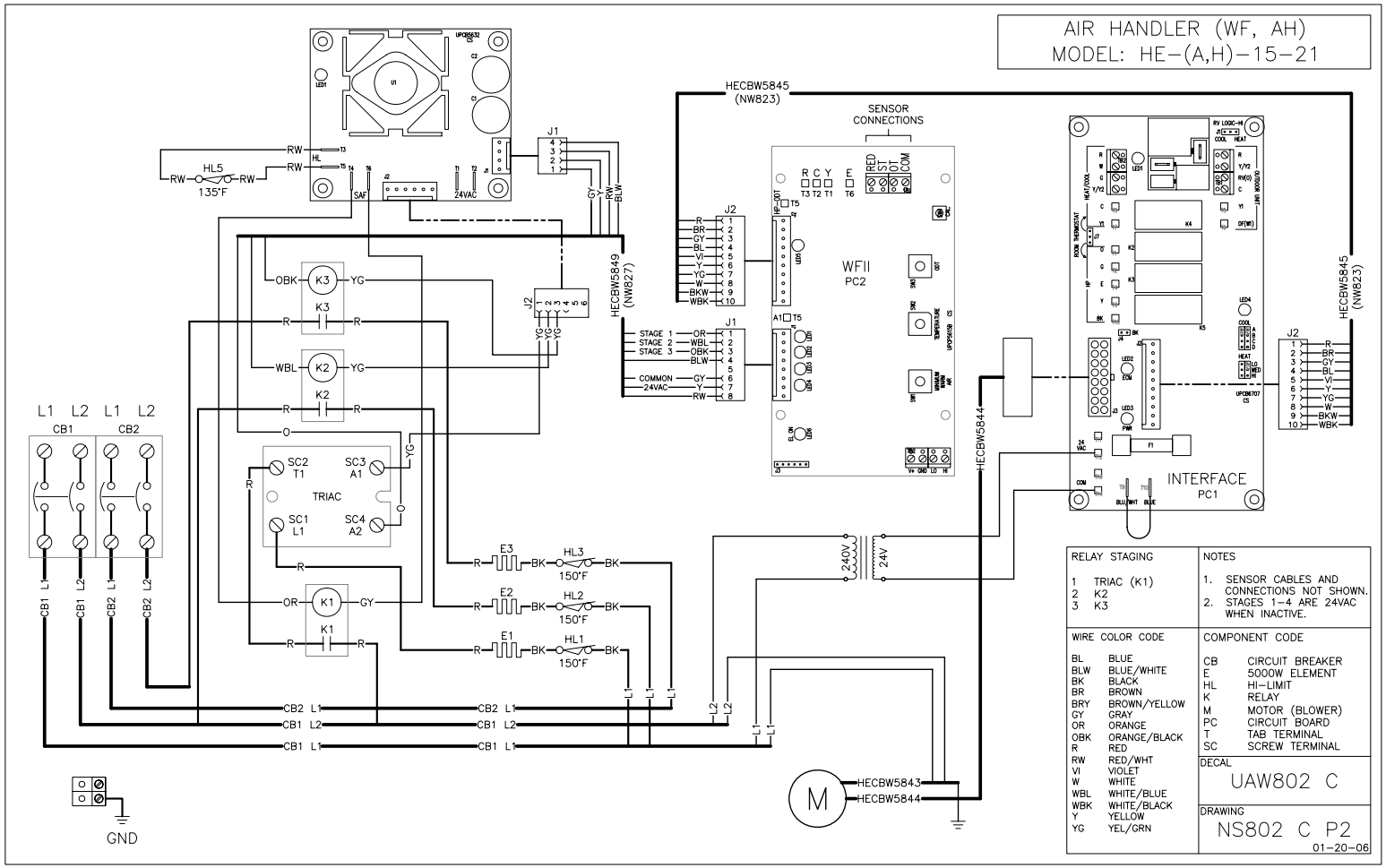
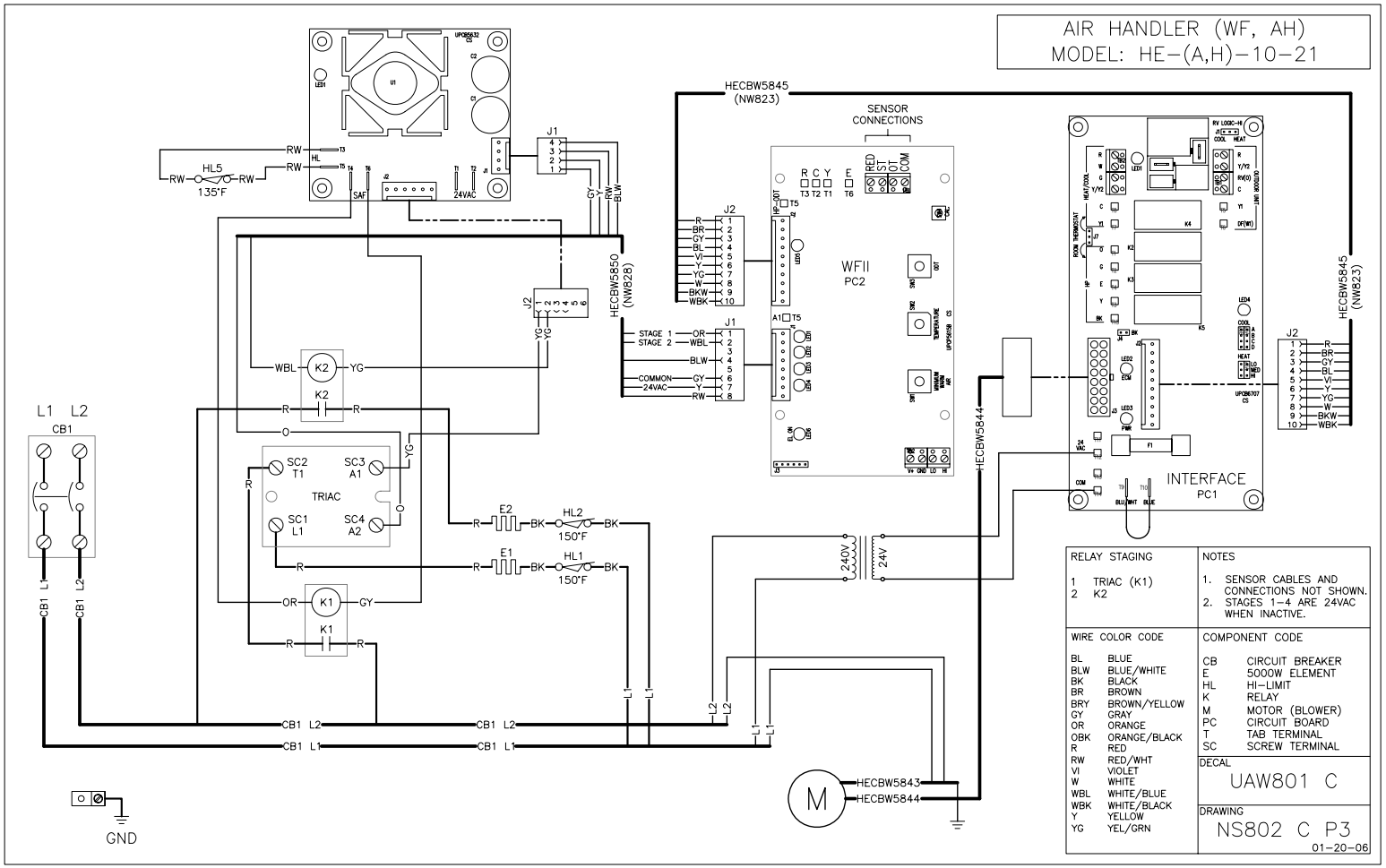
WarmFlo Air Handler (HE-(A,H)-20-2(1,4)), Individual relays
WIRING SCHEMATIC



WarmFlo Air Handler (HE-(A,H)-15-21), Individual relays
WIRING SCHEMATIC



WarmFlo Air Handler (HE-(A,H)-10-21), Individual relays
WIRING SCHEMATIC



DUCT SIZING TABLE

DUCT CAP. CFM	DUCT DIAM IN.	Equivalent Friction Rectangular Ducts (In.)								
1	2	3	4	5	6	7	8	9	10	11
80	5.3	5x5	6x4	9x3						
100	5.8	6x5	7x4	10x3						
125	6.3	6x6	7x5	9x4	12x3					
150	6.8	7x6	8x5	10x4	15x3					
175	7.2	7x6	9x5	11x4	17x3					
200	7.5	7x7	8x6	10x5	13x4	19x3				
225	7.9	8x7	9x6	11x5	14x4	21x3				
250	8.2	8x7	10x6	12x5	16x4	23x3				
275	8.5	8x8	9x7	10x6	13x6	17x4	25x3			
300	8.8	8x8	9x7	11x6	14x5	18x4	27x3			
350	9.3	9x8	11x7	13x6	16x5	21x4	32x3			
400	9.8	9x9	10x8	12x7	14x6	18x5	24x4	36x3		
450	10.2	10x9	11x8	13x7	15x6	19x5	26x4	40x3		
500	10.7	10x10	11x9	12x8	14x7	17x6	21x5	28x4	44x3	
550	11.0	10x10	11x9	13x8	15x7	18x6	23x5	32x4	48x3	
600	11.4	11x10	12x9	14x8	16x7	20x6	25x5	35x4	52x3	
650	11.8	11x11	12x10	13x9	15x8	17x7	21x6	27x5	37x4	
700	12.1	11x11	12x10	14x9	16x8	18x7	22x6	29x5	40x4	
750	12.3	12x11	13x10	15x9	17x8	20x7	24x6	30x5	42x4	
800	12.7	12x11	14x10	15x9	18x8	21x7	25x6	32x5	45x4	
850	13.0	12x12	13x11	14x10	16x9	18x8	21x7	26x6	35x5	
900	13.2	12x12	14x11	15x10	17x9	19x8	23x7	28x6	36x5	
950	13.6	13x12	14x11	16x10	18x9	20x8	24x7	30x6	38x5	
1000	13.9	13x12	15x11	16x10	18x9	21x8	25x7	31x6	40x5	
1100	14.3	13x13	14x12	16x11	18x10	20x9	23x8	27x7	33x6	43x5
1200	14.8	14x13	15x12	17x11	19x10	21x9	25x8	29x7	36x6	47x5
1300	15.2	14x14	15x13	16x12	18x11	20x10	23x9	26x8	31x7	39x6
1400	15.7	15x14	16x13	17x12	19x11	21x10	24x9	28x8	34x7	41x6

NOTE:

If sizing is in question, always go to the larger duct for CFM in question.

Grilles and registers shall be sized according to manufacturers performance data capable of handling the CFM of the duct at a throw based on room dimensions. Return air registers should be selected to provide for 450 FPM face velocity.

The above capacities assume individual duct static pressures of less than about 0.1. If the static pressure is higher, assume considerably reduced CFM.

EVALUATING AND SIZING DUCT WORK SYSTEMS

Quickie Method

- The trunkline duct work off of the plenum should have 70 square inches per ton for the supply side
- The return air plenum should have 80 square inches per ton

Standards Used

- Heat pumps require 400 CFM to 450 CFM per ton to operate
- Use a friction per 100 ft. of duct of .08 when sizing or evaluating supply duct work
- Use a friction per 100 ft. of duct of .06 when sizing or evaluating return air duct work
- Duct work is manufactured in 8 ft. lengths
- Rectangular duct work is normally 8 inches tall
- Return air grills are normally 8 inches high and the width of one or two joist spaces
- 7 inch round pipe will handle approximately 150 CFM
- 6 inch round pipe will handle approximately 100 CFM

Tips

- Never go larger than a 3 to 1 ratio on rectangular duct work width to height when figuring a duct work system
- Common branch duct round pipe is either 6 inch or 7 inch
- Never use branch duct piping smaller than 6 inch round pipe when using a heat pump system
- Normal practice when sizing new duct work is to use a friction per 100 ft. of duct of .08 for the supply line duct work and .06 for the return line duct work
- When doing a retrofit job you will more likely have problems with the distribution of air to the rooms than the size of the duct work

Evaluating Existing Duct Work

1. Perform a heat loss/gain calculation on the structure and obtain the size system needed and the CFM needed per room.

2. Figure the total CFM needed for the system room by room or: 400 CFM minimum to 450 CFM maximum x heat pump system tonnage.

3. Figure the CFM that can be supplied with each trunkline leaving the plenum using the duct calculator with a friction per 100 ft. of duct of .08.

4. The total CFM that the trunkline(s) can handle must equal or exceed the CFM required by the heat pump system. If it is not, the duct work will have to be replaced or changed.

5. If the trunkline is large enough, subtract the heat loss/gain CFM (whichever is larger) needed per room, fed by the first section of trunkline from the total provided. Then figure the size of the next piece of trunkline for the remaining CFM.

6. The return air duct work must handle the CFM put out by the supply side of the system. Using the duct calculator, figure the amount of air that can be handled by the existing system. Use a friction per 100 ft. of duct of .06. Figure the trunklines first, then branch ducts.

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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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sales@electromn.com • www.electromn.com

THESE WARRANTIES DO NOT COVER:

1. Costs for labor for removal and reinstallation of an alleged defective product or product parts, transportation to Electro Industries, and any other materials necessary to perform the exchange, except as stated in this warranty. Replacement material will be invoiced to the distributor in the usual manner and will be subject to adjustment upon verification of defect.
2. Any product that has been damaged as a result of being improperly serviced or operated, including, but not limited to, the following: operated with insufficient water or airflow, allowed to freeze, subjected to flood conditions, subjected to improper voltages or power supplies, operated with airflow or water conditions and/or fuels or additives which cause unusual deposits or corrosion in or on the product, chemical or galvanic erosion, improper maintenance or subject to any other abuse or negligence.
3. Any product that has been damaged as a result of natural disasters, including, but not limited to, the following: lightning, fire, earthquake, hurricanes, tornadoes or floods.
4. Any product that has been damaged as a result of shipment or handling by the freight carrier. It is the receiver's responsibility to claim and process freight damage with the carrier.
5. Any product that has been defaced, abused, or suffered unusual wear and tear as determined by Electro Industries or its authorized representative.
6. Workmanship of any installer of the product. This warranty does not assume any liability of any nature for unsatisfactory performance caused by improper installation.
7. Transportation charges for any replacement part or component, service calls, normal maintenance; replacement of fuses, filters, refrigerant, etc.

CONDITIONS AND LIMITATIONS:

1. If at the time of a request for service the original owner cannot provide an original sales receipt or a warranty card registration then the warranty period for the product will have deemed to begin thirty (30) days after the date of manufacture and **NOT** the date of installation.
2. The product must have been sold and installed by a licensed electrical contractor, a licensed plumbing contractor, or a licensed heating contractor.
3. The application and installation of the product must be in compliance with Electro Industries' specifications as stated in the installation and instruction manual, and all state and federal codes and statutes. If not, the warranty will be null and void.
4. The purchaser shall have maintained the product in accordance with the manual that accompanies the unit. Annually, a qualified and licensed contractor must inspect the product to assure it is in proper working condition.
5. All related heating components must be maintained in good operating condition.
6. All lines must be checked to confirm that all condensation drains properly from the unit.
7. Replacement of a product or product part under this limited warranty does not extend the warranty term or period.
8. Replacement product parts are warranted to be free from defects in material and workmanship for ninety (90) days from the date of installation. All exclusions, conditions, and limitations expressed in this warranty apply.
9. Before warranty claims will be honored, Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Remedies under this warranty are limited to repairing or replacing alleged defective product or product parts. The decision whether to repair or, in the alternative replace, products or product parts shall be made by Electro Industries or its authorized representative.

THESE WARRANTIES DO NOT EXTEND TO ANYONE EXCEPT THE ORIGINAL PURCHASER AT RETAIL AND ONLY WHEN THE PRODUCT IS IN THE ORIGINAL INSTALLATION SITE. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

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ALL EXPRESS WARRANTIES SHALL BE LIMITED TO THE DURATION OF THIS EXPRESS LIMITED WARRANTIES SET FORTH HEREIN AND EXCLUDE ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM THE BREACH THEREOF. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. PRODUCTS OR PARTS OF OTHER MANUFACTURERS ATTACHED ARE SPECIFICALLY EXCLUDED FROM THE WARRANTY.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS WHICH VARY UNDER THE LAWS OF EACH STATE. IF ANY PROVISION OF THIS WARRANTY IS PROHIBITED OR INVALID UNDER APPLICABLE STATE LAW, THAT PROVISION SHALL BE INEFFECTIVE TO THE EXTENT OF THE PROHIBITION OR INVALIDITY WITHOUT INVALIDATING THE REMAINDER OF THE AFFECTED PROVISION OR THE OTHER PROVISIONS OF THIS WARRANTY.