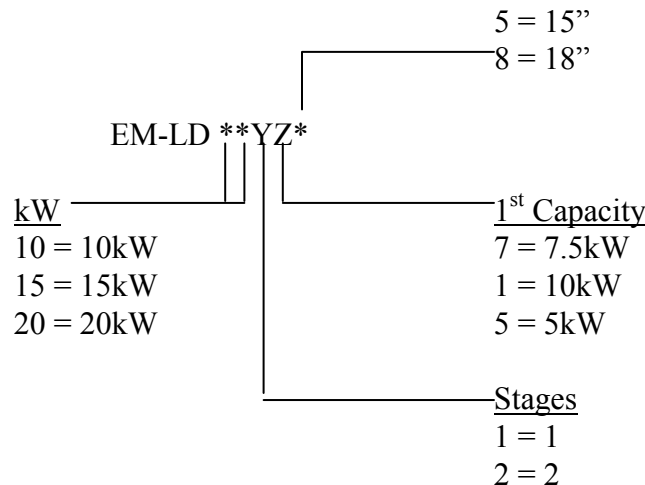




# OFF-PEAK FURNACE CONVERSION KIT

## DOWNFLOW/HORIZONTAL

### INSTALLATION AND OPERATING INSTRUCTIONS



U.S. and Canadian patent apply  
No. 4,593,176 and No. 1,177,512.

Note: This model now includes 250°F manual hi-limit reset, located behind the hinged controller board door.

Drawings: EA111  
EC001  
EH001  
ES006  
EW101  
ED105  
XX017



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### **Drawings:**

EA111, EC001, EH001, ES006, EW101, ED105, UAI012

## DESCRIPTION

This is a prewired package for converting your existing oil or gas furnace to a dual heating system. When installed according to this instruction manual and inspected by your local power company representative, your dual heating system will qualify for the special off-peak electric or Dual Fuel Kwh rates.

This unit can also be used for converting existing fossil furnace to "total electric" operation. Do not attempt to modify internal wiring or delete controls. Simply wire nut the Load Management remote control blue and blue/white wires ("ELECTRICAL HOOKUP") and install according to this manual.

This unit can be used in a DOWNFLOW or HORIZONTAL application. The horizontal can be right or left discharge. This model shall not be used for UPFLOW application. Electro Industries has a similar unit especially designed for UPFLOW.

Generally, a base adapter or raised plenum is required for installation of this DOWNFLOW Electro-Mate. The instructions on page 6 for the field design and fabrication of this base adapter must be followed in detail.

This unit is not recommended for mobile or premanufactured home application, model EM-DL\*\*\*\*M should apply.

The local installer and customer must assume total warranty and product liability responsibility for the installation requiring the repositioning of the existing oil or gas furnace chimney or vent pipe stack.

Since this is an addition to your existing furnace system, the existing fossil fuel furnace must be in good working condition.

This Electro-Mate unit contains several patented mechanical, airflow, and electrical control features. Since these patented features cause this unit to be unique compared to other electric heating products, this installation manual must be studied and followed in detail.

During operation, a high frequency warning buzzer indicates a problem with the blower motor or insufficient airflow across the heating elements.

Certain accessories may be required to complete this installation. See appropriate section of this manual.

This manual also contains a Limited Warranty Statement. Please read and understand conditions associated with proper installation, unauthorized changes, and POWER ON procedures.

**Note:** Using a 2ØKW unit for all installations is not necessarily a correct decision. The unit must be sized according to the actual heat requirements of the building. Over sizing could result in reduced element life, false hi-limit buzzer, increased wiring costs, unnecessary airflow problems with existing furnace, etc.

For information, all units are rated at 240 volt. When operating at lower source voltage, the output will be reduced.

Example:                    20KW unit, assuming normal element tolerances  
                                  220 volt source - 16.8KW, 76.4 Amps  
                                  208 volt source - 15.1KW, 72.3 Amps

## **Notice to Homeowner And Installer**

1. This model now contains a 4 minute POWER ON DELAY.
2. As a counterflow or downflow unit, this product and these models must not be used with a wood or coal counterflow or downflow furnace.
3. Hi-limit cycling and a warning buzzer 2 to 5 minutes after initial turn-on usually means improper deflector or baffle installation or insufficient airflow - carefully study and follow installation suggestions.

## **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](http://electromn.com) for upcoming service schools.**
2. All electrical wiring must be in accordance with National Electric Codes and local electric codes, ordinances, and regulations.
3. Observe electric polarity and wiring colors. Failure to observe could cause electric shock and/or damage to the equipment.
4. This unit can only be used for its intended design as described in this manual. Any internal wiring changes, modifications to the circuit board, modifications or bypass of any controls, or installation practices not according to the details of this manual will void the product warranty, the ARL certification label, and manufacturer product liability. Electro Industries, Inc., cannot be held responsible for field modifications, incorrect installation, and conditions which may bypass or compromise the built-in safety features and controls.
5. This installation manual and Electro-Mate products relate only to the addition of the Electro-Mate plenum heater to the furnace ducting system EXTERNAL to the gas or oil forced air furnace. The owner/installer assumes all responsibility and/or liability associated with any desired or needed installation modification 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.

## SPECIFICATIONS - TABLE 1

Model Number	EM-LD1Ø***	EM-LD15***	EM-LD2Ø***
KW Rating	1Ø	15	2Ø
Voltage/Phase	24Ø/1	24Ø/1	24Ø/1
Control Voltage	24 volt	24 volt	24 volt
Circuit Breaker	1-6Ø	1-45,1-45	2-6Ø
Source Feed	1	2	2
Elements	4	6	8
Min. CFM	65Ø	1ØØØ	12ØØ
Max. Temp. Rise	5Ø°F	5Ø°F	5Ø°F
Shipping Weight	31#	36#	38#

## **MECHANICAL**

The Electro-Mate is designed to control or compensate for certain airflow problems inherent with tight spacing residential forced air furnace systems. However, the Electro-Mate cannot produce airflow and cannot correct airflow problems inherent within the existing furnace system. The following 9 items must be carefully considered and properly followed for all installations:

1. **EXAMINATION OF EXISTING FORCED AIR FURNACE** - Prior to starting this installation or furnace modification, examine the total furnace system and make necessary comments or recommendations to the homeowner. Remember, if a marginal condition exists within the existing forced air system, the installation of an Electro-Mate will not necessarily cure PRE-EXISTING conditions. Consider such items as proper fossil fuel ignition, is the furnace cycling on hi-limit, filter, adequate cold air return, adequate supply duct and room register (1 register per 100 CFM) etc.
2. **FURNACE TYPE** - This unit must be installed in as DOWNFLOW application only. Do not turn the Electro-Mate upside down or install this unit in the cold air return.
3. **HEATING CAPACITY** - Size the Electro-Mate according to the normal heating requirements as the building exists today. Do not necessarily match to the existing furnace because it may be oversized. Do not oversize the Electro-Mate.
4. **SUPPLY PLENUM** - On a downflow, this is typically an extension to the A-Coil cabinet (between A-coil and furnace bottom) or a built up section as shown on drawing EA111.

Verify that all transition s have angles less then 30°, the Electro-Mate is centered within the plenum, and there are no odd shaped angles or odd shaped transitions within the plenum.

If the width or depth is greater than approximately 1” of the Electro-Mate element pattern, side and back deflectors may be required. Use the same general deflector requirements and techniques normally described in the Electro-Mate upflow manual. If you are not familiar with this, request drawing EH101.

**Note:** Do not use a 15" model in plenums larger than 18"x18". This is especially true when installing over an A-coil. The elements must be located at and close to the sides of the plenum.

5. PLENUM ACCESS, HOT OBJECTS - Electro-Mate control box must be at least 8" from flue pipe or other hot objects.
6. OTHER PLENUM EQUIPMENT - Auxiliary equipment such as humidifiers, plenum dampers, etc., located within the plenum which may cause a non-uniform airflow will have to be removed. Zone dampers within the trunk line at least 12" from the Electro-Mate typically are no problem. Verify that when the dampers are opened and closed, they do not result in an unbalanced airflow across the Electro-Mate or a turbulence effect at the Electro-Mate elements. When horizontal duct dampers are involved, perform all check-out functions with smallest zone open first.
7. Depending upon model, reference drawing EA111. This is non-heat pump Electro-Mate positioning.

**Caution, Heat Pump Application:** Depending upon mechanical positioning and airflow, in all cases (heat pump) the electric element, Electro-Mate, unit must be on the supply or warm side of the HP refrigerant coil.

This drawing shows placement in relationship to the A-coil (air conditioning only). It is difficult to configure this arrangement for heat pump. If you can arrange the heat pump with a "V" coil then the Electro-Mate unit can go below as required by heat pump airflow. Another possibility is to consult factory and request procedure HC004 suggesting ways of installing an EM-WE series duct insert unit under the A-coil drip pan.

FURNACE TYPE - This unit must be installed in as DOWNFLOW application only. Do not turn the Electro-Mate upside down or install this unit in the cold air return.

SUPPLY PLENUM - On a downflow, this is typically an extension to the A-Coil cabinet (between A-coil and furnace bottom) or a built up section as shown on drawing EA111.

8. INSUFFICIENT COLD AIR RETURN CAPACITY - Installation experience indicates this is a major concern. In fact, it could represent a problem in as many as 60% of the installations, especially if there is a requirement to increase airflow with the existing blower and the existing cold air return capacity is already undersized or restricted. Check the static pressure within the return cabinet or the suction at the filter cabinet door. Do not assume because there is a register on the wall, the hole behind the register or the passageways are equal to this register. Sharp offsets and transitions in the cold air return system often cause severe restrictions. Expect to add additional registers or a relief register in the main cold air return duct. See the "POWER ON START-UP" section to assist in identifying this concern.
9. BLOWER CFM CAPACITY - The furnace forced air system must have an airflow capacity larger than the minimum requirement on an Electro-Mate specification sheet (see "SPECIFICATIONS - TABLE 1") or the Electro-Mate nameplate. It is near impossible to correctly measure CFM airflow in an existing residential installation. Experience and rule of thumb indicators will have to be followed to determine the existing furnace CFM capacity. The following may be helpful:
  - A. Existing furnace nameplate - Typically represents a high or optimistic rating and is a function of the systems static pressure. What changes have been made to the furnace since it left the manufacturing plant?
  - B. Blower motor size - Used only as a minimal guide.

1ØKW unit - 1/5 HP or larger  
15KW unit - 1/4 HP or larger  
2ØKW unit - 1/3 HP or larger

- C. Observe/examine airflow ducting system and design - Use duct sizing table (ECØØ1), or industry equivalent duct capacity airflow charts and determine if the system is capable of delivery the CFM required on the nameplate. Especially check the number of registers and the number of “6 inch rounds”. The same would apply to cold air return duct capacity.
- D. Equipped or designed for air conditioning - Airflow systems updated or designed for three ton or larger air conditioning should have sufficient airflow.
- E. Calculated CFM - By measuring the temperature rise across the existing furnace (or this electric unit), the CFM can be approximated. The accuracy of this formula will depend upon the estimated or determined Btu output (actual heat energy across the furnace). You cannot use nameplate Btu values. You must use a realistic estimated or measured true OUTPUT Btu.

$$\text{CFM} = \frac{\text{Btu (output)}}{\text{Temp. Rise} \times 1.1}$$

### **Special Hi-Limit Probe Installation**

Shipped loose with this unit is a hi-limit probe which must be installed under the electric elements (counterflow). This is shown on drawing EA111. This hi-limit probe must receive direct heated air from the electric elements. It is wired into the red/white hi-limit loop as detailed in the “ELECTRICAL HOOK-UP” section of this manual.

# MECHANICAL INSTALLATION

## WARNING

AN AIRFLOW DECAL IS INSTALLED ON THE VOLTAGE BARRIER BEHIND THE RIGHT HAND DOOR OF THE ELECTRO-MATE UNITS. IT IS IMPERATIVE THE DIRECTION OF THE SYSTEM AIRFLOW AND THE DIRECTION OF THE AIRFLOW DECAL MATCH.

If the DOWNFLOW furnace is setting directly on the floor, the furnace will have to be raised for insertion of the Electro-Mate unit. This will require a field designed and constructed plenum. This plenum must have sufficient strength to carry the weight of the existing furnace.

The ideal plenum size for the Electro-Mate is 18"x18". The maximum size allowable is 19"x19". Therefore, this base plenum should be sized according to the Electro-Mate and the hot air discharge hole on the bottom of the furnace. It should NOT be sized according to the outer dimensions of the furnace (see drawing EA111).

Examine the hot air discharge hole in the bottom of the downflow furnace. If it ranges between 18"x18" to 19"x19" (assuming standard 18" model, if 15" model adjust accordingly) the Electro-Mate unit can be installed directly beneath the furnace and this plenum need only be about 11" high. If the bottom hot air discharge hole is less than 18"x18", allow at least 6" between the bottom of the furnace and the top of the Electro-Mate unit (see drawing EA111).

The Electro-Mate is designed with a special double plate at the element mounting. Cool air from the blower must blow between these two plates. Therefore, the Electro-Mate must be inserted into the base plenum such that the mounting plate is even with the edge of the hot air outlet hole. Do not necessarily line up the Electro-Mate control box with the furnace cabinet front. The concern is the hole in the bottom of the furnace mating with Electro-Mate elements.

Cutting the correct hole size in the plenum – locate the supplied cutout template marked "UAI012". Once placement of the Electro-Mate is determined, tape all four corners of the template to the plenum. **Make sure that the template is squared off to the plenum before proceeding to the next step.** Using a utility knife cut out the appropriate dashed line on the template. Then use a marker to trace around the area cut out of the template. Remove the template from the plenum and proceed to cut the hole into the plenum.

Extend the "V" channel to butt against the plenum surface opposite the 8"x18" hole. After Electro-Mate insertion, a sheet metal screw may be installed to attach the back plate of this "V" deflector channel.

Insert the Electro-Mate and properly screw to base plenum. If the base plenum is 18" wide, side supports will be needed on the side for proper attachment to the Electro-Mate.

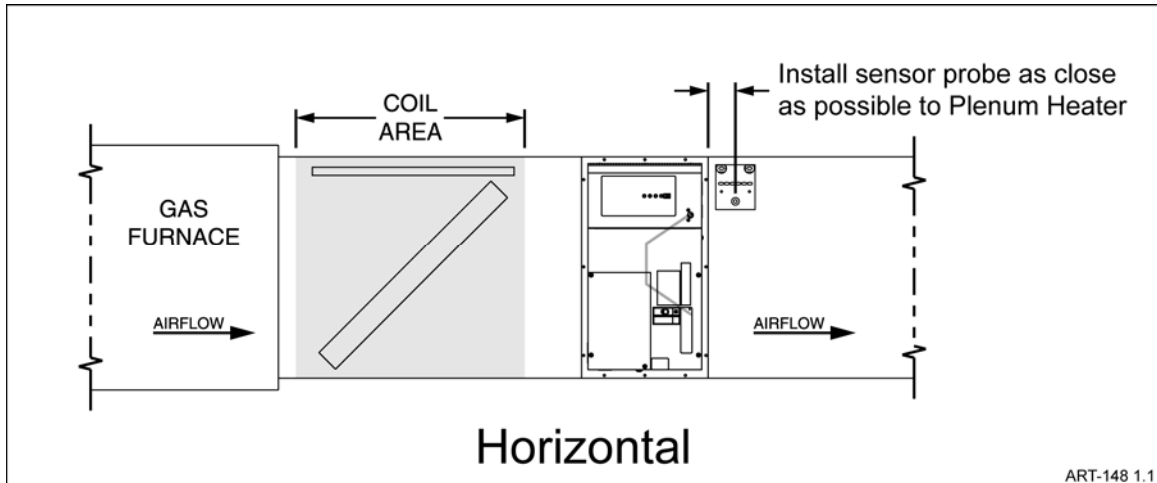
The Dual Fuel Control (DFC) panel can be mounted remote from the main unit if interference exists. Order extension cable part number EM571Ø.



## Horizontal Installation

Basically this involves a downflow unit (EM-LD\*\*\*\*\*) rotated 90° with the plenum instruction and rules common to the upflow unit and/or manual. Advise installing a honeycomb air straightener at the Electro-Mate entrance.

The key is to observe the “AIRFLOW” arrow and allowing for gravity temperature rise; make sure there is a probability of the hi-limits sensing at an upper point in case of airflow failure. Also, all airflow must pass uniformly through the elements. Feel free to call the factory for additional assistance with horizontal applications.



The hot air plenum must be 18”x18” or larger. If the hot air plenum exceeds 19”x19”, an air deflector kit must be installed with this unit.

Air Deflector Kit A, P/N 5750 - Hot air plenum size 19” to 20½”

Air Deflector Kit B, P/N 5751 - Hot air plenum size 21” - 22½”

For plenums larger than 23”, a special deflector is required (same rules normally used for proper upflow Electro-Mate deflector installation).

Air conditioning coil, typically we are aware of three physical coil types – flat (90° to horizontal duct), slant coil, and A-coil turned 90° (with an extended drip pan at the bottom). With these three types, the Electro-Mate® is always installed after the coil or on the “warm” side. Again top and bottom and backside deflectors may be required depending upon plenum size.

- Flat coil – allow at least 8 inches between coil and Electro-Mate®
- Slant coil – installing the Electro-Mate® at the same angle as the coil is preferred, or insert the Electro-Mate® as close as possible to the horizontal plenum bottom (assuming this is the furthest distance between coil and Electro-Mate®).
- Turned A-coil – similar to an upflow, the Electro-Mate® must be inserted in line with the A-coil, with the Electro-Mate® deflector centered on the inverted “A” and as close as possible to the coil inverted A “top”.

Cut the Electro-Mate insert hole into the plenum at the predetermined location. The size of this hole will depend upon the Electro-Mate model. The last digit of the model number indicates the width.

A. 15” model - 8”x15 ¼” hole

B. 18” model - 8”x18 ¼” hole

When handling or inserting the actual Electro-Mate unit, verify the element or the element fins do not become bent and the sensor probe is parallel with the top element. **These probes must be approximately 1½” from element fin.**

Extend the “V” channel to butt against the plenum surface opposite the 8”x18” hole.

Insert the Electro-Mate unit making sure the center deflector has its point toward the furnace. Verify that the unit is completely inserted so the air will flow between the element mounting plate and the front panel. Mount the unit to the plenum.

Where required, “S” clips should be placed on the INSIDE surface of the plenum to act as a supporting brace when mounting the unit to the plenum.

Verify that there is a tight air seal around the Electro-Mate off-peak conversion unit and the plenum. Verify that the unit is rigidly supported and there is no vibration when the blower motor is operating.

**Note:** If the mechanical contractor has responsibility for this job (sold the unit), he must return to perform the POWER ON start-up test and fill out the certification data sheet. The job is not complete until there is a thorough verification of proper operation.

# ELECTRICAL

Prior to starting the electric wiring, evaluate the following items:

1. **QUALITY AND TYPE OF ROOM THERMOSTAT** - The room thermostat can be any 24 volt, adjustable heat anticipator, single stage unit. Set the heat anticipator to  $\emptyset$ .2. Do not use a 2 stage roomstat or 2 thermostats for this Dual Heat system. The DFC module takes care of all switch over, Load Management interrupt, and matching of 1 thermostat to both heating sources. If you feel you need to use 2 stage stat or 2 thermostats, call the factory for special instructions.
2. **AIR CONDITIONING SUB-BASE THERMOSTAT** - If the existing furnace has a 4 wire thermostat for controlling the air conditioner and fan switch, wiring colors or polarity of the 24 volt control system must be observed. Reference must be made to the 24 volt system **COMMON**. This common must be at the bottom right terminal (viewed from the back) of the Dual Fuel Control (DFC) module.
3. **FURNACE FAN CENTER OR 24 VOLT SOURCE** - Since fan center (transformer and blower relay) are now quite universal among all furnaces, this manual has been rewritten assuming the standby furnace has a traditional fan center and low voltage wiring matches drawing EH001. If this is not the case, call the factory for assistance. The primary low voltage rules within this dual heat system are:
  - a. **One** 24 volt transformer for the entire heating/cooling system.
  - b. Electro-Mate requires 40 VA minimum.
  - c. **One** 24 volt "common" throughout the system.
  - d. Brown wires represent an isolated contact circuit, low voltage only, pilot duty.
  - e. Orange wires represent an isolated contact circuit. Orange wires can be used to drive the blower motor if the fan center relay does not exist.
4. **PLENUM OR DUCT DAMPERS** - If the installation has multi thermostat duct dampers, control wiring should remain the same. The Electro-Mate should be able to interface at the two wires now connected to the furnace "T&T" ("R" & "W") terminals. In addition, zone dampers may result in reduced airflow. This can be overcome by automatically staging the Electro-Mate with multi-zone interface control model EB-5415A.
5. **ELECTRO-MATE AND HEAT PUMP** - This Electro-Mate plenum heater can be added to an oil/gas furnace, add-on heat pump combination. In many cases this will enhance the system by additional hot air comfort plus savings due to lower electric rates. When installing this combination the standard DFC is **not** adequate to meet the 6 to 8 wire roomstat requirements. In place of the standard DFC use DFC-HP, **order HP5739**.
6. **DUAL FUEL CONTROL (DFC) MODULE RELOCATION** - If it is desirable to remotely mount this module, order extension cable EM571 $\emptyset$ .
7. **ELECTRO-MATE CIRCUIT BREAKER OPERATION** - The left-most breaker (#1) is the highest priority circuit. It must always remain "on". The right breaker can be turned off in fall and spring.

8. DISCONNECTION OF HEATING ELEMENTS - If after installation the Electro-Mate unit is determined to be oversized, it may be desirable to disconnect one or more elements. This can be accomplished in 2.5 kW element steps.

Disconnecting an element can be accomplished by simply pulling wire from the element end spade connector. Tape and stow the disconnected wire and it may be desirable to also tape the element open spade.

Facing the control box (door is opened to the right), disconnect elements in the following order. This order starts with a 20 kW unit:

1. Left top element
  2. Right top element
  3. Left second element from the top
  4. Right second element from the top
9. POWER COMPANY SECURITY REQUIREMENTS - The location of the power company Load Management receiver, the control wire routing to the Electro-Mate, the protection of this control wiring, and power for the actual remote receiver must be handled as specified by your local power company policy. Each power company has different requirements. Electro Industries, Inc., can supply supporting installation diagrams for these requirements.
  10. POWER COMPANY CONTROLLING 24Ø SOURCE AT SERVICE ENTRANCE - This presents some problem with the Electro-Mate because the Electro-Mate remote control blue wires must still be switched. Add relay EE5Ø56 to detect loss of 24Ø and properly switch the blue wires.
  11. DUAL VOLTAGE SOURCE - When servicing, verify all sources are disconnected at the service entrance panel. This will include 24Ø volt off-peak service and 12Ø volt main furnace.

## ELECTRICAL HOOKUP

1. 24Ø volt OFF-PEAK SOURCE - Route and wire from the off-peak meter and the service entrance safety disconnect directly to the Electro-Mate circuit breakers, use only **copper** connected to breakers. The service entrance disconnect and 24Ø volt wires should be sized according to the Electro-Mate nameplate rating. The circuit breakers within the unit qualify as the appropriate disconnect device. No other disconnect or switches are required. Note: On TOD or TOU installations, this may still be the general service panel, request drawing EH110 which amplifies TOD connection of drawing EH106.
  - If wiring from single source, order and install single feed bus, EM5716.
2. GROUNDING - Route and install the appropriate size conductor wire between the Electro-Mate lug labeled "ground" and the building service entrance panel ground bus. This must be a conductor wire sized according to the total amp rating of the Electro-Mate. The conduit is not a sufficient ground conductor.
3. LOW VOLTAGE CONTROL WIRING – Upon opening the hinged door of the plenum heater you will see the Dual Fuel Control (DFC) is now located within the Electro-Mate.
  - 24-volt source – typically the transformer for the complete system resides within the gas/oil fan center. Extend the fan center R and C to the bottom of the DFC terminals marked “24-volt” and “common”. Note: There are 4 spades, the second 24VAC tab powers the blower relay and the second COM is extra.
  - Room thermostat – the t-stat sub-base wires go directly to the DFC top terminals. This is a straight point-to-point connection, the wires from the roomstat shall only be connected to the DFC top 2 or 4 terminals.
  - Existing furnace burner control – route the two brown wires rolled up within the Electro-Mate, through an appropriate knockout, to the existing furnace thermostat connection plate (fan center). Terminate the two brown wires on R and W. If it is an oil furnace with “T and T”, it is okay to use these two brown wires directly to the oil controller. The brown wires do represent an isolated contact closure.
4. WIRE HARNESS - Within the Electro-Mate control box, locate the circuit board connector wire harness. If you have elected to mount the Dual Fuel Control (DFC) module on the right, remove knockout, and use the nylon strip as a grommet. If mounting on the door, simply remove the hole plug and use the nylon strip as a grommet. Insert the connector through the hole and attach to module. Mount the module with the screws provided.
5. HI-LIMIT PROBE EM5714 (shipped loose in control box cabinet) – Install probe as close as possible below Electro-Mate on the right side, see drawing EA111. Within the upper right portion of the main control box locate one of the two wire nuts that join a red wire from the right hi-limit probe to a red/white wire from the DFC wire harness, see drawing EW1Ø1. Remove wire nut, route, and connect in series to this additional hi-limit probe’s red wires.
6. BLOWER CONTROL – Within the Electro-Mate control box, bottom center, is the blower relay with two orange wires. This represents a contact closure for turning on the blower. Extend and route these two orange wires to the furnace fan center R and G. Note: The G connection on the fan center shall only have one wire, this orange wire.

**Multi-speed blower** – if the furnace has multi-speed or variable speed blower arrangements, wiring will be needed to make sure the blower switches to a higher speed for cooling and Electro-Mate operation. Refer to drawing EH001 showing the 3 added wires on the back of the DFC, upper right spades. This means there is another wire needed to go from the DFC to the fan center “Y” screw.

7. AIR CONDITIONING – Assuming utility load control for cooling, the A/C condenser relay is connected to the DFC top “Y2” and the bottom common tab. See hookup drawing EH001.
  - 2-speed hookup is shown on EH001, page 2.
8. POWER COMPANY LOAD MANAGEMENT RECEIVER CONTROL - Locate the two blue wires (with tag) within the Electro-Mate control box. Route these two wires to the power company remote receiver or time clock. Method of routing the connection at the remote receiver shall be according to the local power company.

**Warning:** These two blue wires require a switch closure only. If voltage (24Ø volt, 12Ø volt, or 24 volt) is externally applied to these two wires, immediate burnout of the Dual Fuel Control (DFC) module will result.
9. NON-STANDARD, LOAD MANAGEMENT LOGIC - If the power company device is **not** NC=EL remote logic, contact the factory for method of connecting to DFC module blue wires. The DFC module has built-in provisions for various other Load Management device logic or voltage levels.

**Verify:** Before POWER ON, check that all screw and terminations (field and factory installed) are tight and all line parts have proper clearance.

## POWER ON START-UP

To assure future trouble-free performance and warranty coverage, a thorough check-out of the installation is required. We believe the following is a result of several years experience and, when followed in detail, will reduce call backs.

**Note:** The warranty certification sheet must be completed (including temperature measurements) and returned to the factory to maintain the warranty coverage.

### Initial Conditions

1. Room thermostat heat anticipator is set at Ø.2 or lower
2. With initial POWER ON (24 volt), a built-in 3 minute delay will exist before the electric elements come on (new DFC’s have eliminated the 3-minute power-up).
3. Prior or during conversion, the following were recorded and verified:
  - A. Oil/gas furnace outlet plenum temperature.
  - B. If the existing furnace outlet temperature was greater than about 15Ø°F, anticipate blower or air problems.
  - C. Determination whether existing furnace capacity should be decreased.
  - D. Check for return air restriction and starved blower.
  - E. A-coil inspected and cleaned for dirt/lint.

- F. Electro-Mate position and furnace cabinet examined for no air blockage under each element.
  - G. Air moving in direction of the red arrow decal.
  - H. Plenum size evaluated for necessary deflectors or plenum build-in.
  - I. Blower wheel fins checked and cleaned for dirt, foreign material build up, or coating.
4. Inspect each room register (including return) and verify each is open and clean.
  5. The power company remote receiver or time clock is in the primary mode and the room thermostat is not calling for heat.
  6. The 24Ø volt off-peak source, main furnace 12Ø volt, and the 24 volt transformer source are energized. The Dual Fuel Control (DFC) module "POWER ON" (green) and "ELECTRIC MODE" (amber) lights are illuminated.

## Procedure

1. Remove the filter cabinet door and the filter.
2. Turn up the room thermostat and verify that the blower starts within 4Ø seconds (after 3 minute turn-on delay).
3. Dual Fuel Control (DFC) module monitor lights illuminated for "HEAT ON" and "ELECTRIC MODE".
4. Using plenum thermometer, determine air temperature 2 to 4 inches above the elements and verify it does not rise above 125°F.
5. If it rises above 125°F and an airflow problem exists, immediately terminate the heat cycle:
  - Check the blower wheel fins for foreign material and required cleaning
  - Speed up the blower, maximum of one turn (adjustable pulley)
  - May require larger blower motor or blower itself.
  - Is Electro-Mate oversized? Disconnect element according to specified priority, see "ELECTRICAL" section, paragraph 8.
6. Again, turn up the room thermostat and watch the plenum thermometer. If after increasing the blower speed the temperature rise on the thermometer is identical to Step 4 above, there is no point in further increasing the blower speed. The blower will have to be reworked or the total hot air distribution system is too small for the blower. Additional airflow within the system is required.
7. With the Electro-Mate hot air between 11Ø°F to 125°F, proceed with general check and cycling of roomstat. The delay between stages is five to eight seconds.
8. Measure and record 24Ø volt voltage and total current at the Electro-Mate.
9. Measure and record 24 volt transformer voltage (22 volt minimum - 3Ø volt maximum during operation).

10. Install a new filter, close the filter cabinet door, and on new furnace installation the total air system must be complete.
11. Again observe the plenum thermometer. The temperature rise shall be no more than 10°F or 125°F. If the reading is greater than 125°F, a return air problem exists. This must be relieved or corrected prior to proceeding.
12. As a verification, move the plenum thermometer to the opposite side of the plenum. Again reading temperature approximately 3" above the element, the value should be approximately the same on both sides. If this is not the case, determine what is off balancing the air in the plenum. Correct as required or rework the total air system to verify the maximum of 125°F plenum temperature.
13. Check blower motor current, compare to nameplate reading and verify that the blower motor is not being overloaded.
14. With system operating in the electric mode, continue to monitor the thermometer and add a rag or towel over part of the filter to simulate a dirty filter condition. Always keep the filter cabinet door closed when monitoring this step. With a simulated dirty filter condition the hi-limit buzzer shall not trip (audible alarm). If it does, the airflow is still marginal.
15. Do not proceed to turn on the oil/gas furnace until all of the above have been completed and check-out.
16. Switch the Dual Fuel Control (DFC) module to the "STANDBY" position and verify proper operation of the oil or gas furnace as the room thermostat is cycled. Continue to monitor the plenum thermometer and verify less than approximately 75°F temperature rise.
17. Measure the furnace plenum temperature and compare to reading taken prior to modification ("INITIAL CONDITIONS", paragraph 4). If the temperature change is more than 10°F, the modification has caused an air restriction.
18. Return the Dual Fuel Control (DFC) module "STANDBY" switch to the "NORMAL" or down position. A delay of two to four minutes will exist before the electric section turns on. This delay is required so that the blower can properly cool off the oil/gas heat exchanger and not cause overheating on the electric coils and hi-limit sensors.
19. Remove the rags from the air filter, verify that the power company remote receiver or time clock is in the correct mode for the hour of the day or outside temperature, and close the Electro-Mate control box door with the securing screws.
20. Fill out and send in the warranty certification sheet.
21. Contact the power company stating the system is completely functional and ready for their inspection and security seals.

## **OPERATING TIPS**

1. **MANUAL HI-LIMIT RESET** – Located behind the hinged control board door is a 250°F manual reset. This breaks the circuit for all electric elements. However, connected in the



same circuit loop is the automatic reset 170°F hi-limit. Normally the automatic reset should always take care of any overheat condition prior to popping the manual reset. Therefore, you should not experience a manual reset condition unless there has been a true hardware failure.

**Two exceptions** – a standby furnace (or wood furnace) having an outlet temperature greater than 250°F or cold startup without blower. Because of the sensitivity of this capillary manual reset, anytime there is a blower failure when the elements come on you can expect a manual reset.

2. **DUAL FUEL CONTROL (DFC MODULE)** - This module contains several new operating features. Proper usage and troubleshooting can be simplified by a detailed understanding of the following:

**Initial Power On Delay** - When first turning on the 24 volt transformer power, there is a built-in 3-4 minute delay prior to energizing the electric elements.

**Mode Switching Delay** - When transferring from the standby (oil/gas) mode to the electric mode, there is a built-in 3-4 minute delay. This delay is required to allow the blower to cool off the fossil fuel furnace heat exchanger prior to energizing the electric elements.

**Power On Light** (Green) - Indicates 24 volt transformer power.

**Electric Mode Light** (Amber) - Illuminated when Load Management receiver is in the electric mode.

**Heat On Light** (Red) - Illuminated when the room thermostat is calling for heat.

**Note:** This red LED is off during the 3-4 minute delay.

**Override Switch** - With the switch in the override (up) position, the dual furnace system will be in the standby or gas/oil mode. This switch becomes useful and handy for furnace repair, for very cold days when possibly the electric section cannot keep up, or when operating with a standby generator.

**Control Fuse** - Type number AGC-2 (2A).

**Note:** This DFC module can be identified by the fuse being located to the left of the monitor lights.

3. **BLOWER ON/OFF** - Blower should start approximately 2Ø to 4Ø second after the thermostat calls for heat. Blower will continue to run as long as there is heat within the plenum. This turn off will be between 1 and 3 minutes after the thermostat is satisfied.
4. **AUDIBLE ALARM** - If during installation an audible alarm is experienced, it will be due to an airflow problem. Restudy the complete mechanical installation pages of this manual. There is no shortcut to increasing airflow except actual modification and improvements to the existing furnace ducting or blower system.
5. **AIR CONDITIONING/ROOMSTAT OPERATIONS** - The traditional 4 wire sub-base must go directly to the DFC top. **Do not** connect the thermostat “G” directly to the furnace fan center. This will set up a feedback loop and run the compressor during heating. Wire as shown on drawing EHØØ1.

6. LOAD MANAGEMENT AIR CONDITIONING CONTROL - When wiring the air conditioning compressor relay as shown on EH001 (Y2 tab) proper utility load control cycling of the air conditioner is automatic. IF TOU rate or other control techniques where AC cycling is not required, simply connect compressor relay to the roomstat "Y" terminal.
7. CALCULATED CFM, OIL/GAS FURNACE - By measuring the temperature rise across the existing furnace, the CFM can be approximated. The accuracy of this formula will depend upon the estimated or determined Btuh output (actual heat energy used across the furnace). You cannot use nameplate Btuh values. You must use a realistic estimated or measured true OUTPUT Btuh.

$$\text{CFM} = \frac{\text{Btuh (output)}}{\text{Temperature Rise} \times 1.08}$$

8. CFM CALCULATIONS, THIS FURNACE - By measuring the temperature rise across the electric furnace, the actual CFM can be quite accurately determined. If you are having difficulty sustaining hi-limit operation, it may be a good idea to calculate the CFM according to this formula. To arise at the stable output temperature, you can turn off CB #2 and operate only as stage one. This will allow you to verify or calculate the CFM without reaching hi-limit cycling. The accuracy of this formula will depend upon readings, and the accuracy of both the clamp-on amp meter and the AC volt meter. NOTE: The amps x volts x 3.4 value is the same as Btuh output.

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

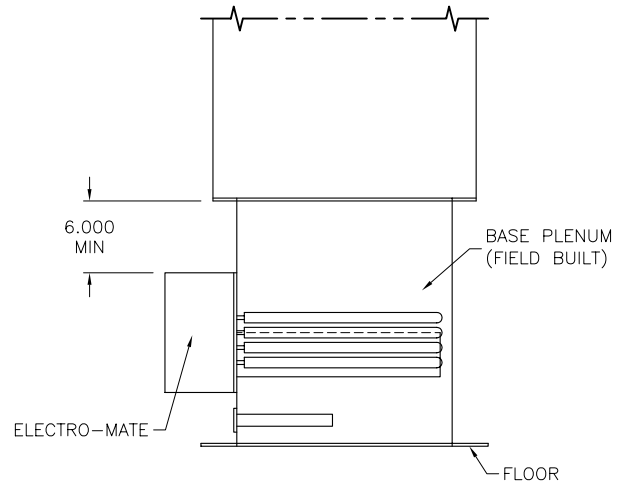
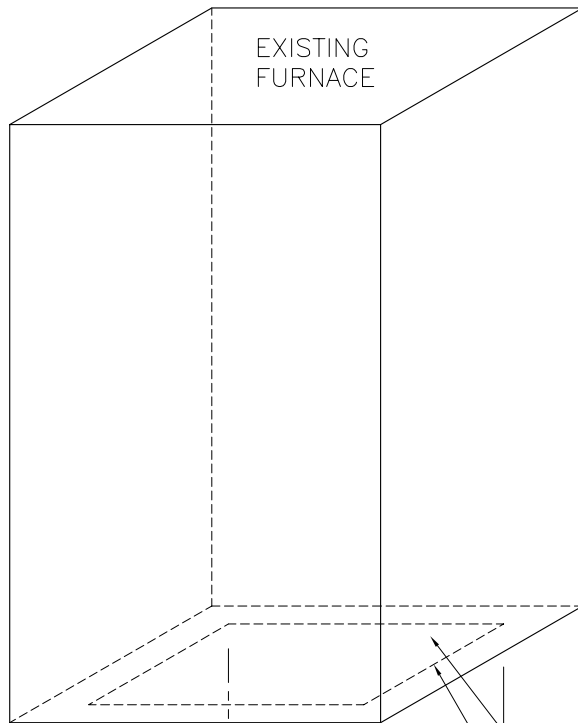
9. AUXILIARY CONTROL - Depending upon the complexity of the total heating system and the power company control policy, it may be desirable to plug various items into the DFC 6 pin connector:

- EM5709 – Interrupt 1 or 2 baseboard circuits
- HP5739 – Add-on heat pump
- SOT-EM-60 – Roomstat timer override
- IH-31 – DFC controller, any combination up to three heaters
- EM5713 – Wood plenum interlock
- EB-5415A – Multi-zone interlock
- 5701 – Square D single feed bus
- EM5716 – Single feed bus
- EM5750 – Plenum defector kit A
- EM5751 – Plenum defector kit B
- PI-0A1DYM0 – Load shed interlock, stage 2

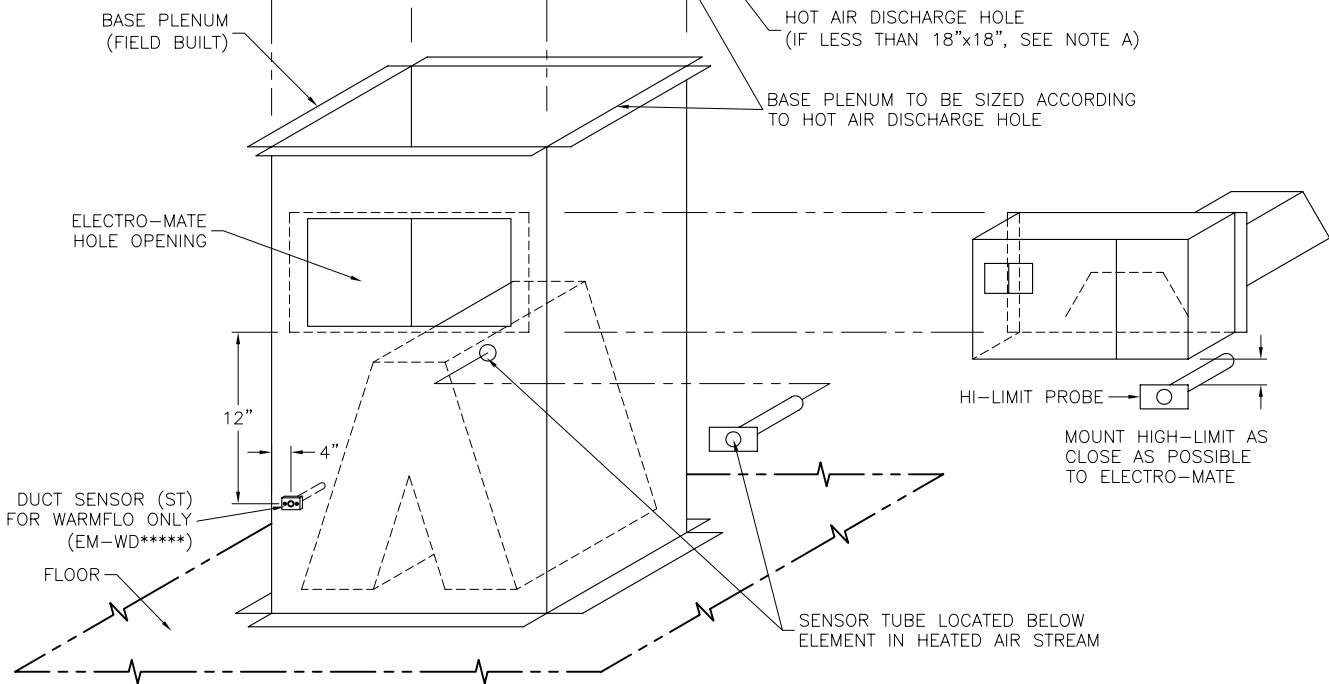
10. STANDARD UPFLOW MANUAL - The EM upflow installation manual contains other general items which can also apply to the downflow models.

We assume the installer has previous experience with basic Electro-Mate upflow installations.

# ELECTRO-MATE DOWNFLOW INSTALLATION (NON - HEAT PUMP)



NOTE A:  
IF HOT AIR DISCHARGE HOLE IS LESS THAN 18"x18"  
ALLOW A MINIMUM OF 6" BETWEEN ELECTRO-MATE TOP  
& BOTTOM OF FURNACE



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**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

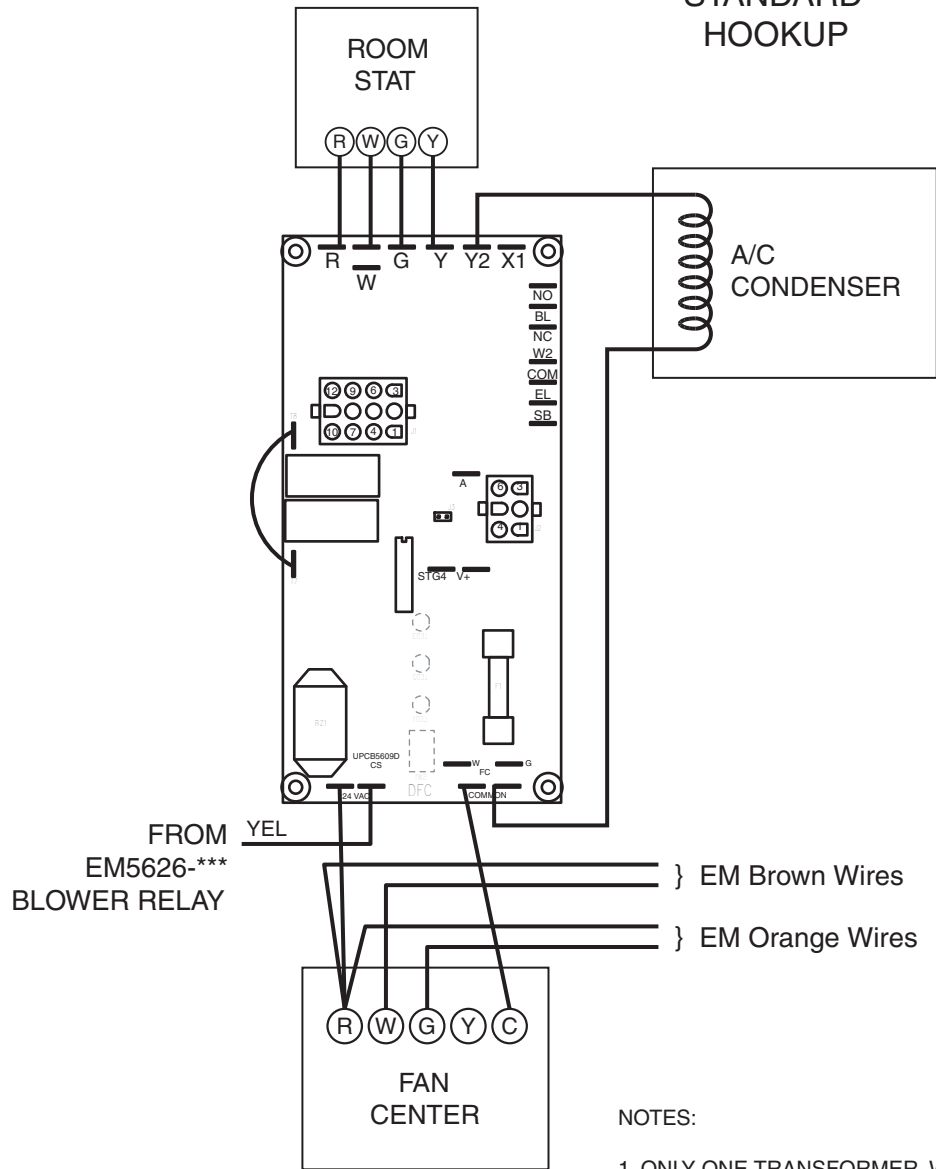
### Evaluating Existing Duct Work

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.

ELECTRO INDUSTRIES, INC.  
2150 WEST RIVER STREET, P.O. BOX 538  
MONTICELLO, MN 55362  
(763) 295-4138

# DFC / AIR CONDITIONING HOOKUP

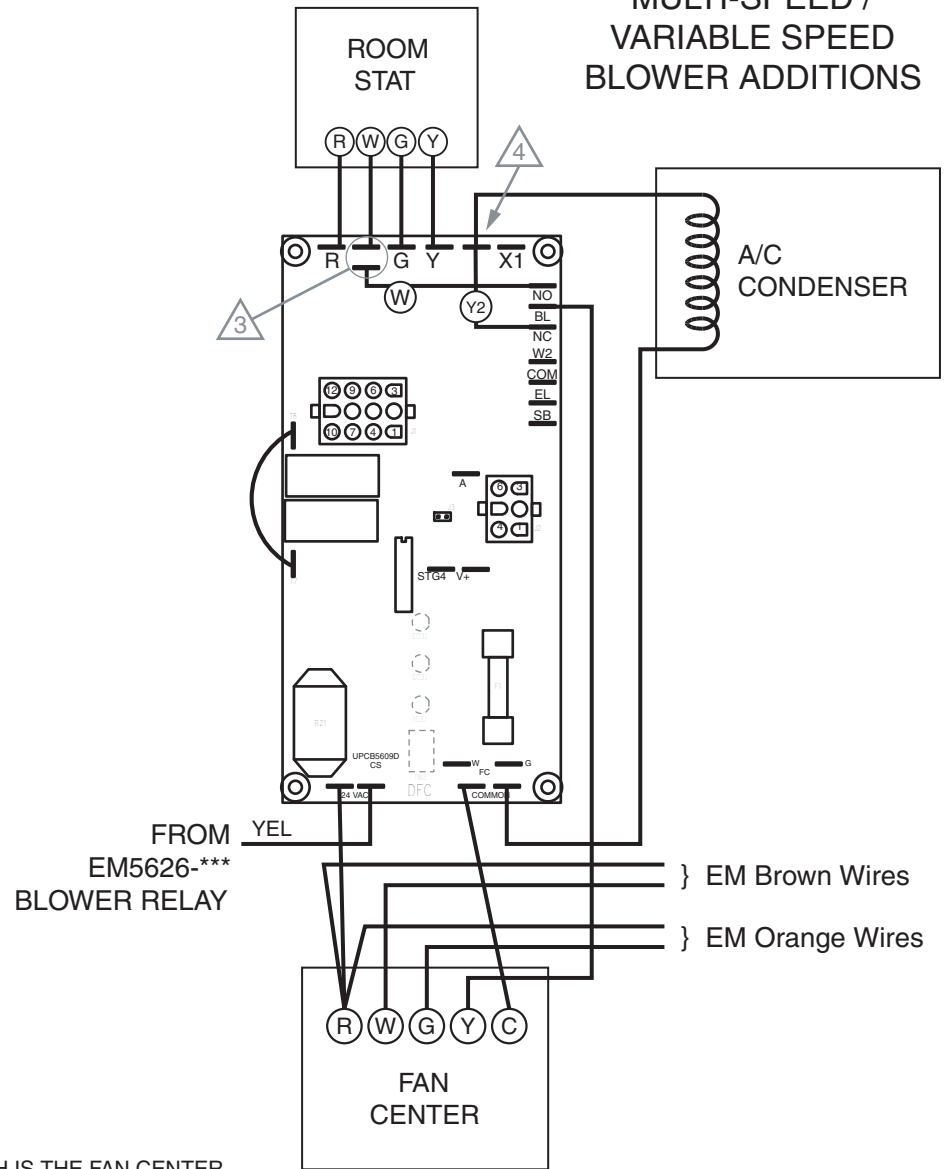
## STANDARD HOOKUP



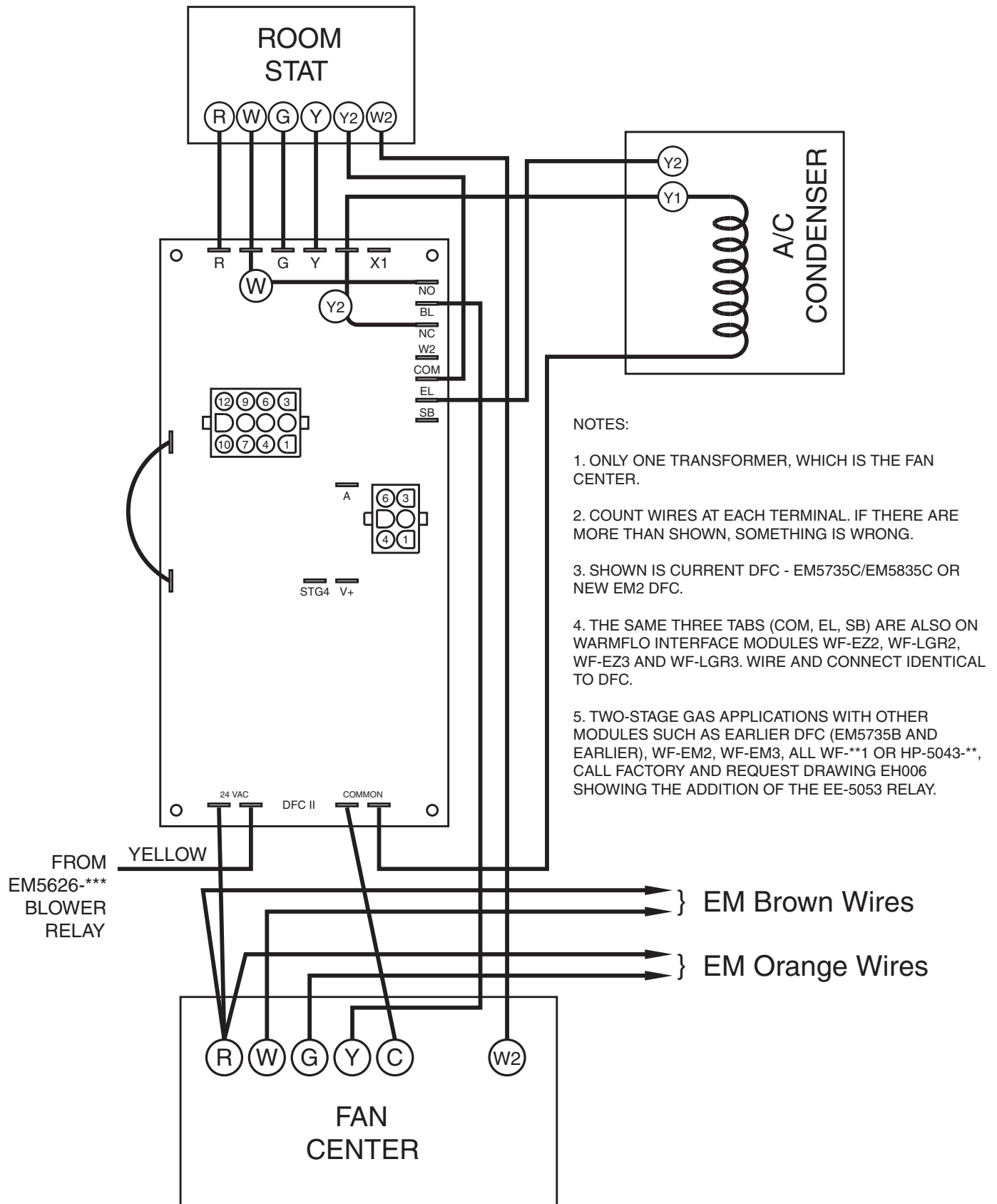
**NOTES:**

1. ONLY ONE TRANSFORMER. WHICH IS THE FAN CENTER.
2. LEFT DIA., COUNT WIRES AT EACH TERMINAL, IF THERE ARE MORE THAN SHOWN, SOMETHING IS WRONG.
3. OLD DFCs DO NOT HAVE 2ND W. ADD TO STAT W.
4. TWO WIRES ON Y2 TAB.

## MULTI-SPEED / VARIABLE SPEED BLOWER ADDITIONS



# DFC / AIR CONDITIONING HOOKUP - TWO-STAGE A/C & TWO-STAGE GAS



CONTROL WIRING

1. 240VAC ELEMENT POWER CAN BE SINGLE OR DOUBLE FEED.

2. BLUE WIRES, LOAD MANAGEMENT CONTROL CONNECTIONS, LOW VOLTAGE - EXTEND TO UTILITY CONTROL DEVICE.

3. 24VAC, 40VA, TRANSFORMER MUST BE PART OF A TYPICAL FAN CENTER. EXTEND "R" AND "C" TO THE DFC BOTTOM TERMINALS

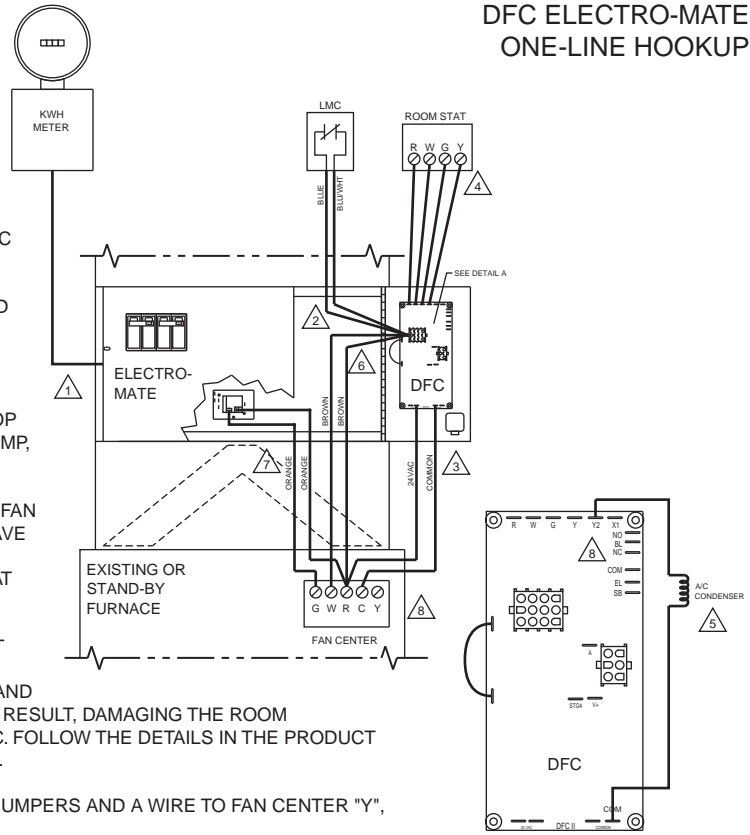
4. EXISTING ROOM THERMOSTAT WIRES ARE REMOVED FROM FURNACE FAN CENTER (CAN USE SAME ROOM STAT, CHANGE HEAT ANTICIPATOR TO 0.2) AND CONNECTED TO THE DFC TOP TERMINALS.

5. AC COMPRESSOR IS CONNECTED BETWEEN DFC TOP "Y2" AND FAN CENTER "COMMON". IF ADD-ON HEAT PUMP, ORDER HP-5739 CONTROL.

6. BROWN WIRES ARE TERMINATED ON THE FURNACE FAN CENTER "R" AND "W." NOTE: ALL ROOM STAT WIRES HAVE BEEN MOVED TO DFC, THE BROWN WIRES ARE NEVER TERMINATED ON THE SAME SCREW AS THE ROOM STAT CABLE ITSELF.

7. THE ORANGE WIRES REPRESENT A RELAY CONTACT TELLING THE FURNACE BLOWER TO OPERATE WITH THERMOSTAT ACTION. CONNECT TO FAN CENTER "R" AND "G". NOTE: IF NOT WIRED CORRECTLY, FEEDBACK CAN RESULT, DAMAGING THE ROOM THERMOSTAT, BLOWER MOTOR SPEED WINDINGS, ETC. FOLLOW THE DETAILS IN THE PRODUCT INSTALLATION MANUAL OR REQUEST DRAWING EH001.

8. MULTI-SPEED BLOWER WILL REQUIRE ADDITIONAL JUMPERS AND A WIRE TO FAN CENTER "Y", SEE DRAWING EH001.



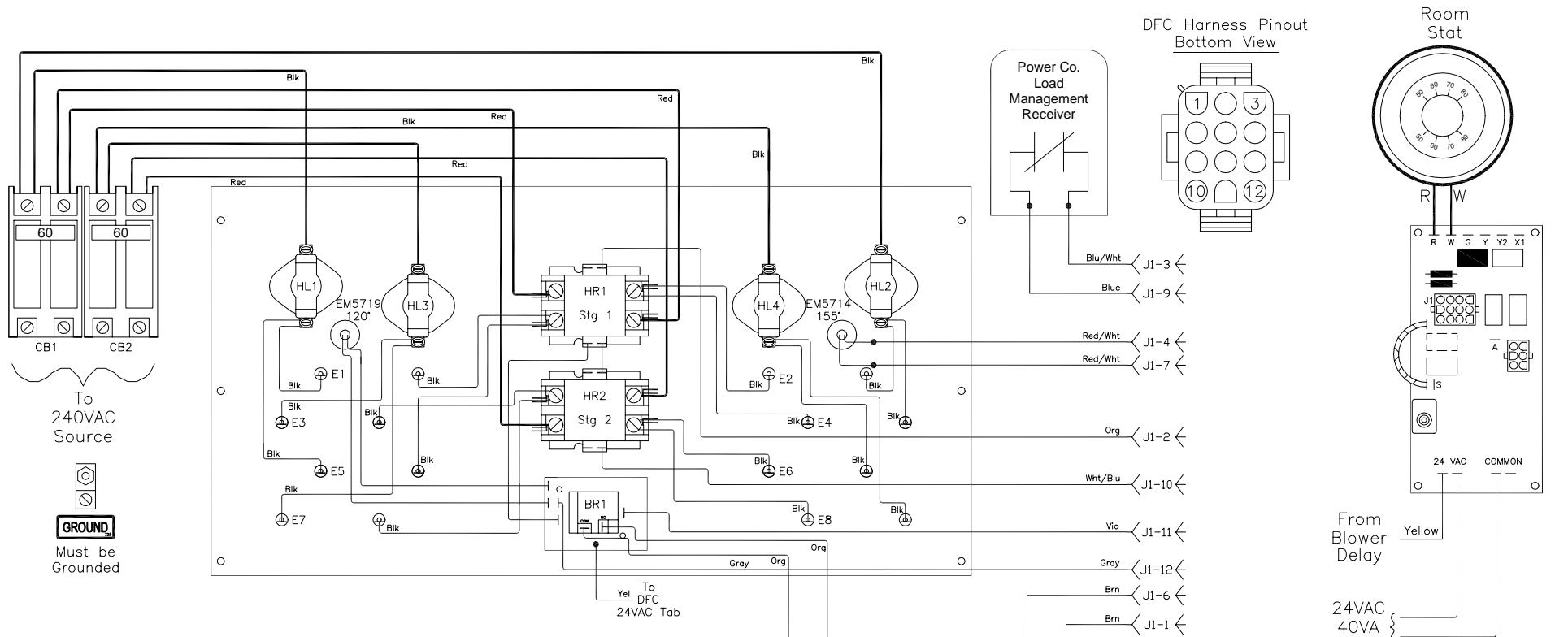
DFC ELECTRO-MATE  
ONE-LINE HOOKUP

DETAIL A  
SCALE 2:1

rev.D 09-05-02

ES006





To  
240VAC  
Source

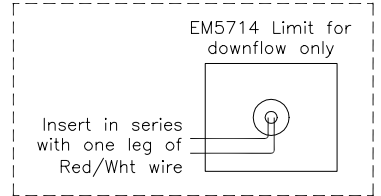
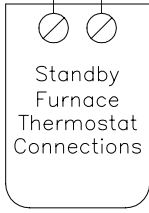
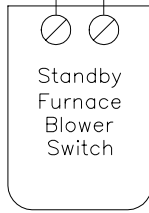
**GROUND**  
Must be  
Grounded

NOTES:

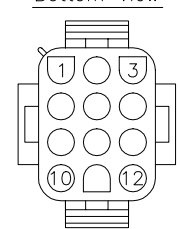
- EM-L#2021\*: AS SHOWN.
- EM-L#1527\*: DELETE E7 AND E8; CHANGE CB1 AND CB2 TO 40AMP (#05641)
- EM-L#1011\*: DELETE E5, E6, E7, E8, HL3, HL4, HR2 AND CB2; REWIRE: E3 TO HR1 AND HL1; CHANGE: CB1 TO CB2 POSITION.

# = V - UPFLOW  
D - DOWNFLOW.

\* = 5 - 15" FRAME  
8 - 18" FRAME

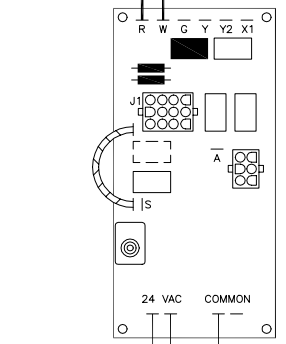
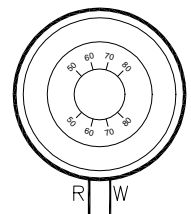


DFC Harness Pinout  
Bottom View



- Blu/Wht J1-3 ←
- Blue J1-9 ←
- Red/Wht J1-4 ←
- Red/Wht J1-7 ←
- Org J1-2 ←
- Wht/Blu J1-10 ←
- Vio J1-11 ←
- Gray J1-12 ←
- Brn J1-6 ←
- Brn J1-1 ←

Room  
Stat



From  
Blower  
Delay  
Yellow

24VAC  
40VA  
Source

DFC Module:  
EM5735C (2 Stg)

BR1	EM5626-2060	2
CB1-2	#05640	2
E1-8	#05620	8
HL1-4	#05635	4
HR1-2	#05126	2

B = 04-15-97

Electro Industries, Inc. Monticello, MN 55362			
Date 10-16-97	Revision B	Drawn By MEF	Approved
Description: EM-L***** Wiring Diagram			EII Part # ---
			Drawing # EW101

## ELECTRO-MATE – DFC MODULE

Identifier – Green, amber, red front LED's

(Previous models had three red LED's or one green and two red LED's)

Standard Models – EM5845 – door bracket, applies to all basic EM plenum heaters

EM5735C – U-shaped bracket, applies to all basic EM plenum heaters

EM5835C – Flat plate bracket, applies to all Electro-Boilers, custom duct heaters, some air handlers, Electroil furnace update kits, etc.

### DFC Staging

This DCF outputs all three stages, but both 2 and 3 come on at the same time. If this is a concern during field replacement, order option relay EE5053DC to plug-in the “STG4” tabs shown on the back of the board. With this option relay, the normal staging delay between 2 and 3 is retained.

## INPUT/OUTPUT FUNCTIONS

### ROOM THERMOSTAT

Heating Only (typical P/N Ø5Ø1Ø) – “R” & “W”, set heat anticipator Ø.2

Heating and Cooling (add sub-base, typical P/N Ø5Ø13) – “R”, “W”, “G”, “Y”.

1. Under no circumstances, use a two stage roomstat and connect the second stage to the standby gas furnace.
2. When using a heat pump multi-wire room thermostat, must add option module HP5738B, or new DFC-HP (order model #HP5739).

### 24VAC INPUT

External 24 volt, 40VA minimum, input connect at bottom tabs – “24VAC” and “COMMON”. When using the 4 wire thermostat and A/C, terminal “COMMON” must be common to all other 24 volt components.

### DIRECT BLOWER CONTROL

The roomstat “G” terminal can directly control a furnace blower relay via the violet wire (pin 11) independent of any DFC operational mode. The roomstat “G” wire terminates at the top of the DFC only, do not run directly to furnace fan center.

**Note:** Assumes the EM is equipped with standard EM5626-\*\*\* blower relay and orange wires are connected to the furnace center “R” and “G”. Also 15 second delay for blower on and 60 second delay for blower off.

### STANDBY (FOSSIL FUEL) FURNACE CONNECTION

Pins 1 and 6 (brown wires) form a simulated thermostat for the secondary furnace. This is an isolated switch loop only, normally connected directly to the furnace oil burner T T or fan center “R” and “W”. Do not worry about the heat anticipator requirements of the standby furnace.

### LOAD MANAGEMENT AIR CONDITIONING INTERRUPT

With the room stat connected to “Y” and the compressor relay connect to “Y2”, the compressor will interrupt with the standard load control function. **Note:** Override switch must be in normal status.

### LOAD MANAGEMENT CONTROL (LMC)

As shipped from factory most Electro-Mates are equipped as N. C. = Off-Peak.

NC = Electric Heat

- pin 9 (BLU) & pin 3 (BLU/WHT)

NO = Electric Heat

- wire nut (short) pin 9 to pin 3

- use “R” tab and pin 8 (BLK.YEL)

### ANTI-FREEZE UP OPTION – SWITCH TO STANDBY (GAS)

Using a separate and external room thermostat (close on decrease or heating) connect between “R” and “X1” (upper right). This performs the identical function as manually pushing the front switch to standby.

## MONITOR LIGHTS

GREEN – 24V Power on  
 AMBER – Electric heat mode  
 RED – Roomstat closed

Note: The red LED also responds to the three-minute lockout. After power up or after the gas furnace runs, there is a three-minute lockout for electric elements. The red LED is off even though the thermostat may be closed.

## CONTROL FUSE

- Standard AGC-2 (2A)
- Optional MDL-2 (2A)

## WIRE HARNESS CONNECTOR

In order to help understand the DFC and field troubleshooting, the following is the definition of each pin with appropriate wire colors.

- 1 - Brown, standby furnace, connect to fan center either "R" or "W".
- 2 - Orange, Stage 1 output.
- 3 - Blue/white, load management receiver.
- 4 - Red/white, internal hi-limit loop
- 5 - Orange/black, Stage 3 output
- 6 - Brown, the other furnace lead
- 7 - Red/white, other internal hi-limit loop
- 8 - Normally vacant, used when changing LMC logic (black/yellow)
- 9 - Blue, other load management wire
- 10 - White/blue, Stage 2 output
- 11 - Violet, internal blower control
- 12 - Gray, common (same as lower tabs marked "common")

## STAGE 2 INTERLOCK JUMPER (WHT/BLUE)

Various optional staging devices, such as EB-5415, require cutting of this jumper and extending the two leads to the appropriate terminals on the zone staging device.

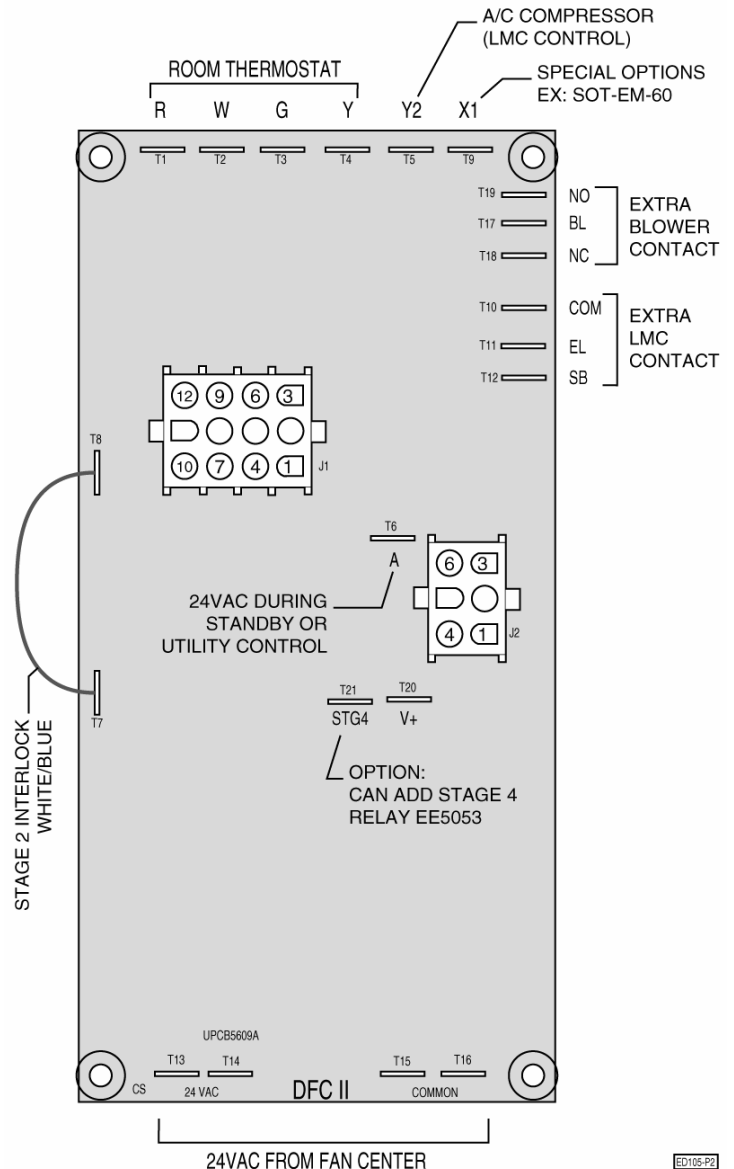
## 6-PIN AUXILIARY FUNCTIONS CONNECTOR

An auxiliary connector harness (EM-5711) is available to address a number of options. The connector comes with a 12" wire harness.

- 1 - Gray – common
- 3 - Brown – 24VAC during standby or utility control
- 4 - Orange – 20VDC constant
- 6 - Yellow – 24VAC constant

## OTHER OPTION MODULES

Stat Override Timer (SOT) – SOT-EM-60  
 5 kW Insert Adder – EM-LV25-KIT



ED105-22



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 sales@electromn.com • www.electromn.com

# Electro Industries, Inc. Residential Limited Product Warranty

Effective November 1, 2009

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

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

## **TWENTY YEAR (20) LIMITED WARRANTY ON BOILER ELEMENTS AND VESSELS**

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

## **TWENTY YEAR (20) LIMITED WARRANTY ON SPIN FIN ELEMENTS**

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

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

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



## 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.

ALL IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED WITH RESPECT TO ALL PURCHASERS OR OWNERS. ELECTRO INDUSTRIES, INC. IS NOT BOUND BY PROMISES MADE BY OTHERS BEYOND THE TERMS OF THESE WARRANTIES. FAILURE TO RETURN THE WARRANTY CARD SHALL HAVE NO EFFECT ON THE DISCLAIMER OF THESE IMPLIED WARRANTIES.

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.