

WARMFLO® II

Dual Heat System

Controller Portion of Electro-Mate

WarmFlo Electro-Mate EM-WU*****/EM-WD**** mechanical information – companion manual EI703/EI707.

Special applications and conditions, see page 23.

When used as a dual heat (backup gas or oil furnace) application, the system must also include Electro Industries' furnace interface module (sometimes called fossil fuel kit).

Use the appropriate colored section for the appropriate furnace interface.

WF-EM3 – non-heat pump, standard A/C	Yellow
WF-EZ3 – single speed HP, 4-wire, standard roomstat	Green
WF-LGR3 – heat pump manufacturer's multi-wire stat (product discontinued)	Blue

Note: For 2-speed heat pump, use WF-HP2 (information not contained in this manual)

Note: The WF-LGR3 is no longer in production, use WF-LGR4 which has its own installation manual. In other words, this manual is now only used for conventional, 4-wire, room thermostat application.

Also accompanying each system is a specific control program "chip". This is typically part of ordering information and should be listed on packing slip. A listing of these "chip codes" is in the controller setup or programming sections of this document.



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INTRODUCTION

Prior to installation we recommend that the installer verify the product intended application is applicable to your current installation needs. The system application for this model combination is dual heat, gas or oil furnace as standby, and may include heat pump. If your application does not include dual heat with standby furnace, but electric heat with an air handler, do not use this WarmFlo II series or this installation manual. Contact factory for other models (EM-WE series, WF-DH*** kits, etc.).

EM-WU***** – WarmFlo Electro-Mate ranging from 10 kW to 25 kW. Can be installed in upflow applications only.

EM-WD***** – WarmFlo Electro-Mate ranging from 10 kW to 25 kW. Can be installed in downflow and horizontal applications.

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.

First-time or non-routine user – before attempting installation or setup, suggest studying the last section of this manual, operational information and terminology definitions. Also if you have not attended a WarmFlo training session, the document HC321, Application Flowchart, may be of assistance.

In order to verify you have all the components necessary to complete your installation we recommend you verify that you have both the EM-WU*****/EM-WD***** Electro-Mate heater and the correct WarmFlo Furnace Interface (I/F) for your application. Heat pump manufacturer's fossil fuel kit is not used with WF II.

WarmFlo Furnace Interface (I/F) – All dual fuel installations require a furnace interface (I/F) module, which is typically a second line item on the order sheet. Depending upon overall system configuration one of the following furnace interface modules is required and covered by this product manual.

- **WF-LGR3** – HP manufacturer's **multi-wire room thermostat** – heat pump, EM-WU, EM-WD, gas/oil combination.
- **WF-EZ3** – standard **4-wire thermostat** – heat pump, EM-WU, EM-WD, gas/oil system.
- **WF-EM3** – standard **4-wire non-heat pump**, with or without standard air conditioning.

****Installation Notice** - Upon installation it is necessary that all the components of the heating system are in place and functional. This controller is designed to operate the complete heating system - heat pump, backup furnace (gas or oil), Electro-Mate, room thermostat, WF outdoor sensor, etc. If one of these components is missing or not initially installed, improper performance of WarmFlo II and the system may be experienced. In other words, if the gas furnace doesn't exist, LP tank not yet installed or filled, and the WarmFlo II is operating on a cold day; do not be disappointed if there is no heat.

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

INSTALLATION REQUIREMENTS

1. All installation work must be performed by trained, qualified contractors or technicians. Electro Industries, Inc., sponsors installation and service schools to assist the installer. **Visit our web site at electromn.com for upcoming service schools.**
2. All electrical wiring must be in accordance with National Electric Code 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 installations, and conditions which may bypass or compromise the built-in safety features and controls.

5. The only approved installation for this Electro-Mate series is upflow and horizontal furnace and above or downstream from the air conditioning or heat pump A-coil. Any other configuration or furnace plenum/ducting installation voids warranty and manufacturers product liability.

MECHANICAL INSTALLATION

WF Furnace Interface I/F (WF-EZ3, WF-LGR3, WF-EM3)

The mounting location of this enclosure is flexible to any convenient location where the thermostat connection is easily accessible. The distance between the I/F and WF II is limited only by the 4' cable provided with the I/F.

The housing has also been arranged for easy attachment directly to the right side of the Electro-Mate cabinet. Depending upon furnace surroundings, you can explore mounting this interface enclosure directly to the Electro-Mate, right cabinet end.

EM-WU*** Electro-Mate Upflow Application**

Electro-Mate nameplate or companion installation manual EI703 is required for correct mechanical installation. If you do not have manual #EI703 do not attempt to do the mechanical installation, contact the factory for a replacement manual. The primary installation concerns focusing on the existing furnace and ducting system's airflow capacity and necessary plenum baffling required by the specific Electro-Mate for correct installation. It is true that the WarmFlo II modulating control and the supply sensor adjust the electric heat or element capacity based upon temperature. But if you do not have the required CFM airflow (example 20 kW, 1400 CFM), you could have a situation where you cannot heat the house. Another even more serious situation (because of improper airflow) is when all stages are on at colder temperatures and the unit is cycling on mechanical safety hi-limit. When cycling on the hi-limit probe, the WarmFlo II supply sensor basically gets confused because at one point it is way up in temperature and then the elements simply disappear and it dips down, the net result probably is switching over to standby at premature intervals. There is no substitute for adequate airflow capacity and plenum baffling.

EM-WD*** Electro-Mate Horizontal Application**

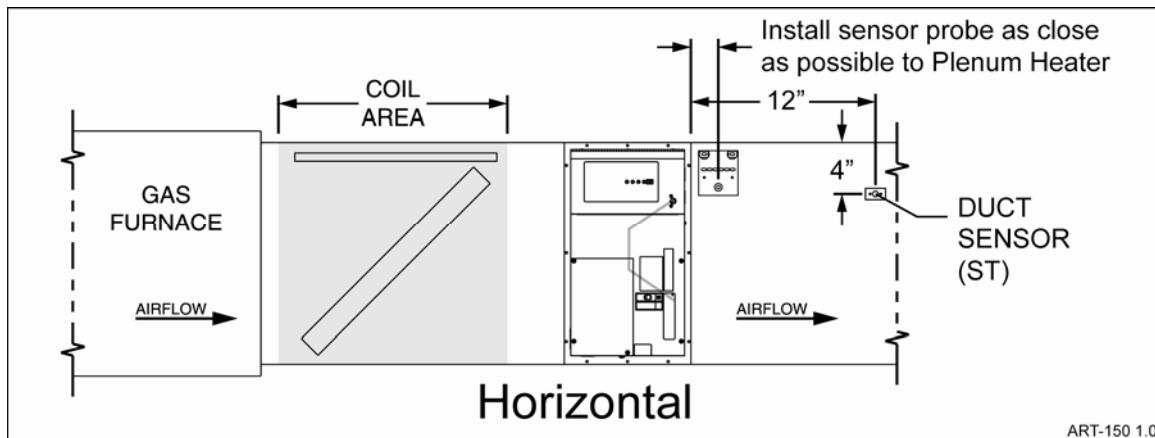
NOTE: It is **not** permissible to rotate the WarmFlo Electro-Mate 180°. These instructions apply to only rotating the Electro-Mate unit 90°.

With WarmFlo, IT IS permissible (and authorized by the manufacturer) to turn the Electro-Mate unit 90° for horizontal application. However, you must follow the instructions below relating to temperature sensor positioning, etc.

The reason this practice is acceptable is because the element power and temperature is controllable by the WarmFlo sensor. When placing the sensor at the top of the duct as stated below, heat rise will keep the elements off even without the blower.

Installation steps

- Ideally, the WF II Electro-Mate should be inserted on an appropriate duct side so that the circuit breakers are at the bottom.
- Locate the WF II Electro-Mate as high as possible in the horizontal duct. At the top, the elements should almost touch the top of the duct.
- If the vertical dimension of the horizontal duct is greater than the WF II Electro-Mate element area, baffle at the bottom.
- If the horizontal duct is deeper than the electric elements, baffling at the back is required.
- Locate and install the WarmFlo duct sensor approximately 4" down from the duct top and 12" away from the Electro-Mate elements.
- Checkout and operation should be identical to standard WarmFlo system.



EM-WD***** Electro-Mate Downflow Application

Electro-Mate nameplate or companion installation manual EI707 is required for correct mechanical installation. If you do not have manual #EI707 do not attempt to do the mechanical installation, contact the factory for a replacement manual. The primary installation concerns focusing on the existing furnace and ducting system's airflow capacity and necessary plenum baffling required by the specific Electro-Mate for correct installation. It is true that the WarmFlo II modulating control and the supply sensor adjust the electric heat or element capacity based upon temperature. But if you do not have the required CFM airflow (example 20 kW, 1400 CFM), you could have a situation where you cannot heat the house. Another even more serious situation (because of improper airflow) is when all stages are on at colder temperatures and the unit is cycling on mechanical safety hi-limit. When cycling on the hi-limit probe, the WarmFlo II supply sensor basically gets confused because at one point it is way up in temperature and then the elements simply disappear and it dips down, the net result probably is switching over to standby at premature intervals. There is no substitute for adequate airflow capacity and plenum baffling.

Generally, a base adapter or raised plenum is required for installation of this DOWNFLOW Electro-Mate. The instructions in manual EI707 for the field design and fabrication of this base adapter must be followed in detail.

WIRING INSTALLATION

High Voltage

Please reference manual EI707 pages 2 and 3.

Low Voltage

WarmFlo II Sensors

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

Note : With WF-EMA chip the outdoor sensor(OT) is not required. Installation is optional. If at some later date this system is converted to heat pump or another chip code, the sensor would be available for use at that time.

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

1. Determine best location for the OT sensor using the following ground rules.
 - a. Locate on the outside of the house to sample outside temperature least affected by sun.
 - b. Locate sensor away from other objects that produce a heat or cool effect such as heat pump freon line sets, drier vents, direct sunlight, steel siding, or other miscellaneous objects that affect the air temperature.
 - c. Do not install sensor in an enclosure which may have a "heat build up" or insulation effect.
2. Disconnect OT and ST sensor cable from Warmflo Controller noting the screw locations for future re-hookup.
3. The factory supplied OT cable is approximately 25'. Determine necessary length of cable to route to the predetermined outside location. If the sensor wire cable is too short, you must use the following rules for extending the cable.
 - a. Use unshielded (low capacitance, prefer twisted) 3 or 4 wire low voltage cable, **35 foot maximum**.
 - b. Do not under any circumstances use leftover wires within the thermostat cable going to the outdoor unit.
4. Mount OT sensor with sensor tip up (cable downward)
5. Drill $\frac{1}{4}$ " hole near the outside sensor location. Routing the cable along the freon tubing often makes the easiest installation.
6. Route wire from outside making sure not to crimp, cut, staple, or damage cable in any way.
7. Keep the sensor cables at least 12" away from any line voltage wiring, Romex, etc. Do not, under any circumstances, use part of existing thermostat cable, leftover wires, for the sensor cable.
8. Do not reconnect sensor wires to the 4-screw terminal block until both sensors are properly installed.

Warm Air Supply Sensor (ST)

1. Determine best location for ST sensor using the sketches below (horizontal is on previous page).
2. Locate directly above Electro-Mate element, preferably left side for upflow models. Locate directly below Electro-Mate element, preferably left side for downflow models. If you do not have the 12" height, locate in the major distribution duct, but as close as possible to the plenum and so there is a direct airflow path from the electric element to the sensor.
3. Drill $\frac{1}{2}$ " hole in the hot air distribution duct about 14 to 18 airflow inches away from the Electro-Mate element.
4. Prior to inserting ST white tube verify tip position
Note: The black tip inside of the white tube is the temperature 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 $\frac{1}{2}$ " to make it more sensitive and faster responding.
5. Mount ST white tube using two mounting holes.

OT & ST Sensor Reconnection

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

WARNING - If the black and red sensor wires are crossed or incorrectly installed at the terminal block and power is turned on, burnout damage can result within the sensor probe

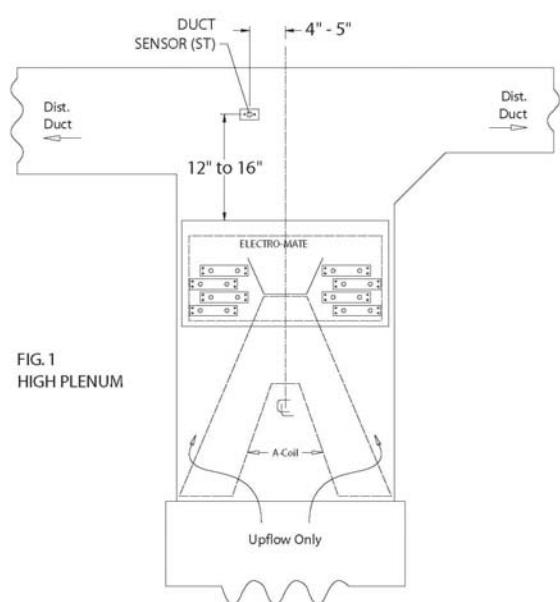
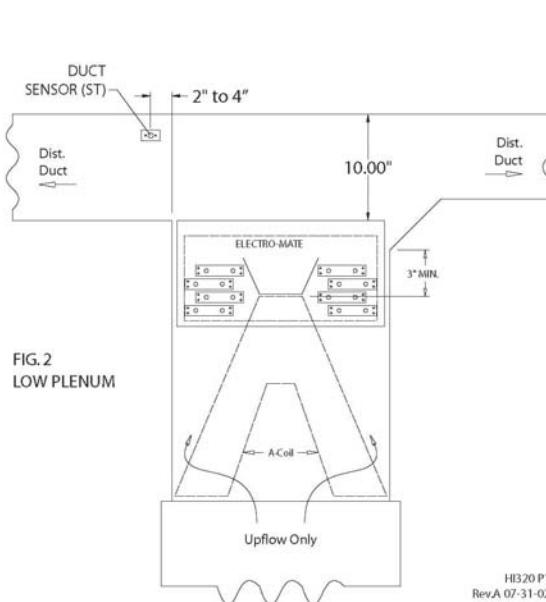
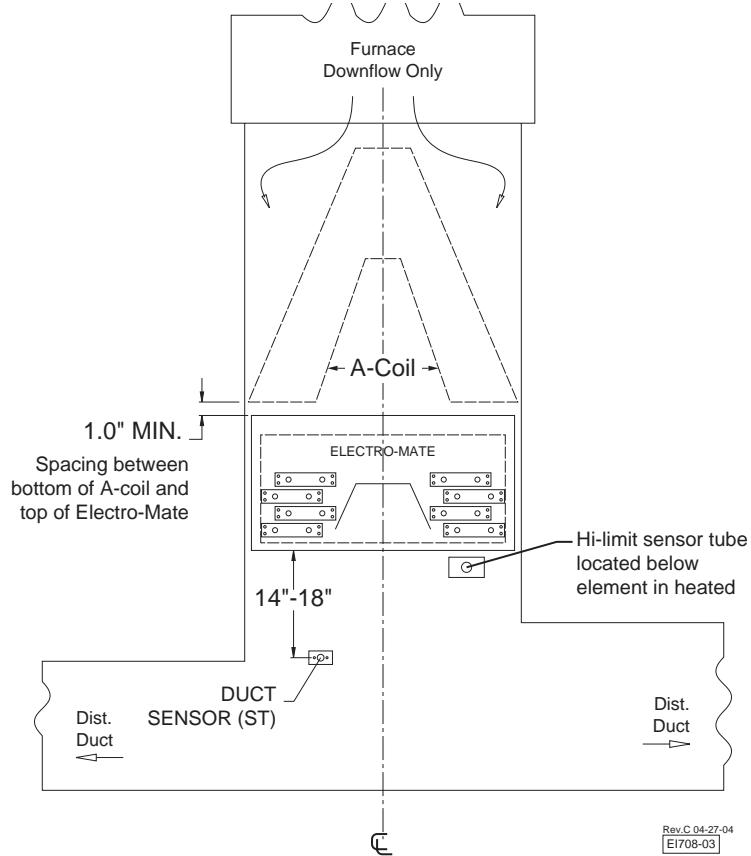


FIG. 1
HIGH PLENUM



HI320 P1
Rev.A 07-31-02



Rev.C 04-27-04
[E1708-03]

WF-EM3 & WF II WIRING & SETUP

WF-EM3

Application – non-heat pump, standard Electro-Mate/fossil fuel furnace/with or without air conditioning.

Reference Drawing HH318

- Attached to the WF-EM3 is a 4' cable harness that interfaces between the WF II and the WF-EM3.

Note: Units produced after 08-04-04 (ARL #3074 and up) have an updated control board. This update increases the size of the interface header from a four place to a ten place. See photo below for proper cable installation.



- Requirements:

- Thermostat connection One 4-wire cable
- Fan Center/Gas furnace connection One 4-wire cable
40VA or larger transformer
Blower connection "G" relay
- Outdoor Heat Pump One 2-wire cable

- Room Thermostat Connections** – Install room thermostat at the desired room location and route the typical four wires (red, white, green, and yellow) to the WF-EM3 upper left "stat" terminal block.

Note: If this is a mechanical stat, adjustment of the heat anticipator is required, set the heat anticipator to 0.2.

- Fan Center Connections** – Route a 4-wire cable from the I/F module, bottom center terminal block "fan center", to furnace fan center, same letter designated connections (R,W,G,C).
- If air conditioning is part of your installation simply route one 2-wire cable from the upper right terminal block Y and C to the compressor relay Y and C.
- Within the WF-EM3 is a wire harness that goes from WF-EM3 to the WF II controller. Within this WF-EM3 wire harness are two blue wires. Undo these, extend and connect to the utility load control receiver. For electric energy operation (off-peak) the two blue wires represent contact closure as shipped. **Do not apply external voltage or external power to the blue wires**, they are simply looking for a closed contact during off-peak.
 - Optional – where load management interrupt does not apply, simply leave the blue wires tied together and wire nut.
 - If load control reverse logic is required, keep the two blue wires shorted and connect load control switch between X1 and R.

WarmFlo II Controller Connection

- Sensor connection – see page 4 "WarmFlo II Sensors".
- WF II controller is located on the cabinet right side door.
- Plug the 4-wire pigtail from WF-EM3 into the left center connector. Do not force on the connector, the connector only plugs in one way and should slide on easily.
- Plug the yellow wire and connect to the WarmFlo II "Y" tab located on the top left portion of WF controller.

- Information** - The WarmFlo II controller receives its operating power through the plug-in wire harness. The yellow wire is simply the thermostat “call for heat” signal being forwarded to the WarmFlo II controller.
5. The harness also comes with a violet wire, do not use, tie off and do not plug into WF II board.
 6. The cable has a 7th wire (brn/yel) which is simply an extra wire for special stat field hookups, simply tie off.
 7. **Caution – 24 volts common grounding** – the installer must determine whether the furnace fan center COM screw terminal has a good ground bond (not simply furnace skin). If the fan center COM is not adequately grounded, use the pigtail green wire (WarmFlo board, upper, C tab) for a ground bond to the Electro-Mate cabinet power source ground lug. The upper right circuit board mounting screw is a static ground protection point.

If your installation has special application and hookup conditions please see section located in this manual called “Special Application/Installation Instructions”.

WARMFLO II CONTROLLER SETUP OR PROGRAMMING

Important - Located on the WF II board is a firmware chip that determines a specific set of defaults (see table below). However, this can be programmed (altered) with optional PC software (ET-SOFT-WF) or a plug-in WarmFlo analyzer (WF-ANZ*). As part of the WF II system this chip represents critical defaults and settings that can make your system operate correctly. It is a critical portion of the installation to verify that the chip code sent with your WF II is correct for your intended application. The chip code is located on a white label in the center of the WF II controller.

The table below represents the typical WF II chip codes and defaults for use with a WF-EM3. Please use this table as a reference as you setup your WF II. See Operational Information and last section of this manual for further information on these defaults.

Chip Code Reference Table

Code	Stg. Enable	MU Time	ODT Mode	OT Function
EMW	90°, 50°, 36°, 34°	90	EL to SB	DT cal.
EMR	90°, 50°, 30°, 20°	00	EL to SB	DT flat
EMA	-	00	-	Disable

MU Time - Standby or Gas Furnace Operation - Whenever all four stages are full on (if it is not a 4-stage Electro-Mate, this simply means full Electro-Mate output), and operating at a continuous 100% for a fixed delay (see Chip Code Reference Table, MU Time); the WarmFlo II controller automatically terminates all electric and starts the gas furnace. The gas furnace will be used to complete the heating cycle until room thermostat heat call ends. During the next heat call, the Electro-Mate stages again attempt to produce the WarmFlo II desired temperature. Again, if everything is at 100% plus the MU time, the gas furnace takes over.

EMW Chip Code

Electro-Mate, Non-Heat Pump, using EMW type program chip code – The outdoor sensor is used as a staging disable function. With a call for heat, the desired temperature (DT) attempts to rise to “cal DT” (WarmFlo calculated desired temperature). With this chip code the stages operating are limited by the enable temperature reflected below.

Stage 1 = 90°F Stage 2 = 50°F Stage 3 = 36°F Stage 4 = 34°F

MU – Set at 90 minutes

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – The lower inside yellow screwdriver adjustment dial sets a “floor” or level minimum operating temperature. The supply temperature will never go below this point independent of outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve referenced in this manual “Heat Loss Curve” graph.

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

Upper right dial switch – built-in ODT or Low Temperature Switch-Over – The “ODT” yellow screwdriver adjustment dial can be set to terminate the Electro-Mate for low outdoor temp. gas/oil operation. For outside temperatures below this set value, the gas furnace is used for **all** heat call cycles and requirements. **Comment:** Typically this is used for undersized Electro-Mate.

The temperature settings related to the “ODT dial” are:

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

Front control red dial - Temperature (Efficiency Dial) – Located on the front door of the main WF II cabinet. The small red adjustment screw is active and needs to be set. Verify the outdoor sensor (OT) is installed. 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 and the lesser the operating electric. The closer a selected setting is to G, the steeper the heat loss curve and more operating electric. Reference WarmFlo Operation Information section on heat loss curve for further information. Setting the dial to full electric will bring on all stages of electric at full capacity.

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

EMR Chip Code

Electro-Mate, Non-Heat Pump, using EMR type program chip code – The outdoor sensor is used as a staging disable function. With a call for heat the desire temperature attempts to rise to “flat DT” (desired temperature). With this chip code the number of stages is limited by the enable temperature reflected below.

Stage 1 = 90°F Stage 2 = 50°F Stage 3 = 30°F Stage 4 = 20°F

MU Time – 00 (disabled)

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – this inside screwdriver adjustment dial is not used with this chip code. Leave dial at factory setting.

Upper right dial switch – built-in ODT or Low Temperature Switch-Over – The “ODT” screwdriver adjustment dial can be set to terminate the Electro-Mate for low outdoor temp. gas/oil operation. For outside temperatures below this set value, the gas furnace is used for **all** heat call cycles and requirements. **Comment:** Typically this is used for undersized Electro-Mate.

The temperature settings related to the “ODT dial” are:

\emptyset = Disabled, no ODT switch-over	
1 = -15°F	5 = 10°F
2 = -10°F	6 = 20°F
3 = 0°F	7 = 30°F
4 = 5°F	

Factory set on #0 = disabled.

Front control red dial - Temperature (Efficiency Dial) – Located on the front door of the main WF II cabinet. The small red adjustment screw is **not active** and not part of this option. Install the white loose decal located in the manual envelope over the small red adjustment dial on the front of the WF II.

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

EMA Chip Code

Electro-Mate, Non-Heat Pump, using EMA type program chip code – Since this chip is a Electro-Mate concept with fixed output temperature there is no temperature enable/disable - follow special instructions accompanying this program chip for supply temperature.

MU Time – 00 (disabled)

WF II DIAL SETTINGS

Lower right dial switch – This yellow screwdriver dial is the adjustment for the operating supply temperature. The dial switch settings for fixed output temperature are:

0 = 100	4 = 116	Factory set on #5.
1 = 104	5 = 120	
2 = 108	6 = 124	
3 = 112	7 = 128	

Comments:

- When setting this dial remember this temperature must be capable of heating the whole house on the coldest days.
- There is no automatic override to gas based on thermostat call, etc.
- If there is not adequate air flow and system is cycling on hi-limit, system will not be able to function properly and maintain fixed outlet temperature.

Upper right dial switch – built-in ODT or Low Temperature Switch-Over – Located on the top right of inside WF II board the “ODT” screwdriver adjustment dial should be set at “0”. This is **not used** on an EMA chip.

Front control red dial - Temperature (Efficiency Dial) – Located on the front door of the main WF II cabinet. The small red adjustment screw is **not active** and not part of this option.

Install the black loose decal (UAI006) located in the manual envelope over the small red adjustment dial on the front of the WF II.

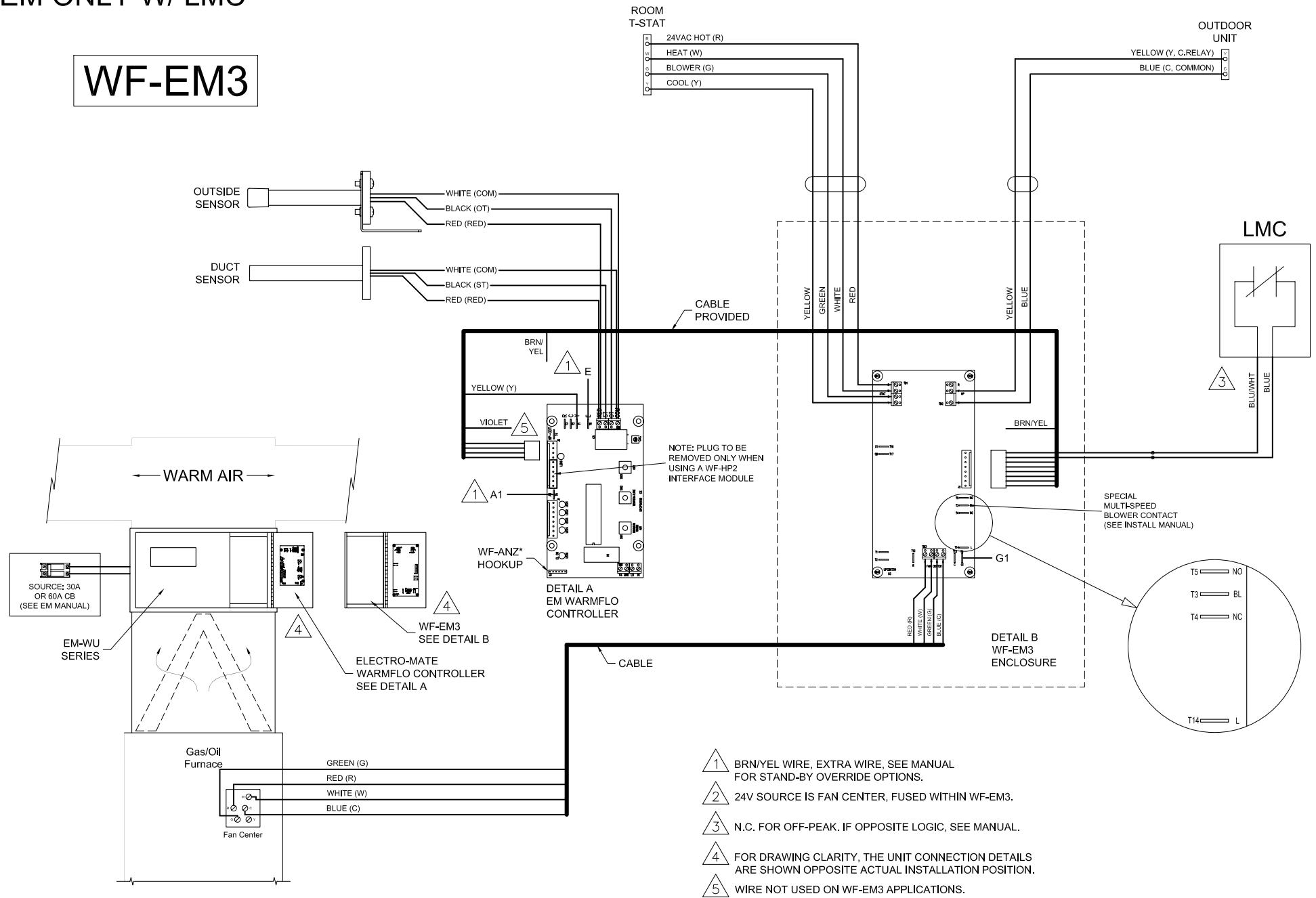
Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

Furnace Interface Necessary Adjustments

No adjustments are necessary. The normal/standby switch provides the standard user override function (some power companies request inactivation or deletion of this switch).

WF-DUAL HEAT EM ONLY W/ LMC

WF-EM3



ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

HH318

REV.C 07-25-07

WF-EZ3 & WF II WIRING & SETUP

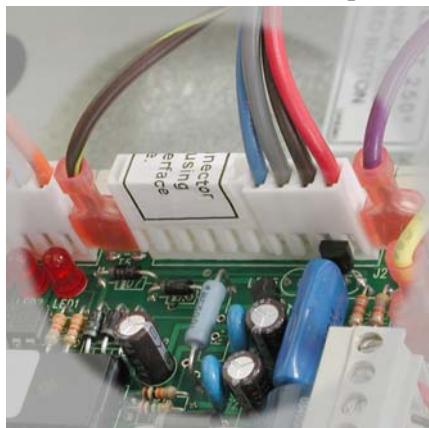
WF-EZ3

Application – 4-wire thermostat, heat pump, WF II Electro-Mate/fossil fuel furnace. HP manufacturer's fossil fuel kit not required.

Reference Drawing HH317

- Attached to the WF-EZ3 is a 4' cable harness that interfaces between the WF II and the WF-EZ3.

Note: Units produced after 08-04-04 (ARL #3074 and up) have an updated control board. This update increases the size of the interface header from a four place to a ten place. See photo below for proper cable installation.



- Requirements

- Thermostat connection One 4-wire cable
- Fan Center/Gas furnace connection One 5-wire cable
40VA or larger transformer
Blower connection "G" relay
- Outdoor Heat Pump One 4-wire cable

- Room Thermostat Connections** - Install room thermostat at the desired room location and route the typical four wires (red, white, green, and yellow) to the WF-EZ3 upper left "stat" terminal block.

Note: When using this WF-EZ3 module, use only a standard single stage heat/cool subbase room thermostat. The heat pump multi-wire stat will not work correctly with an WF-EZ3. If this is a mechanical stat, adjustment of the heat anticipator is required, set the heat anticipator to 0.2.

- Fan Center Connections** – Route a 5-wire cable from the WF-EZ3 module, bottom center terminal block "fan center", to furnace fan center, same letter designated connections (R,W,G,C). The 5th wire may be required for variable speed furnace "Y" terminal, see diagram in white section.

- Within the WF-EZ3 is a wire harness that goes from WF-EZ3 to the WF II controller. Within this wire harness are two blue wires. Undo these, extend and connect to the utility load control receiver. For electric energy operation (off-peak) the two blue wires represent contact closure as shipped. **Do not apply external voltage or external power to the blue wires**, they are simply looking for a closed contact during off-peak.

- Optional - Where load management interrupt does not apply, simply leave the blue wires tied together.
- If load control reverse logic is required, keep the two blue wires shorted and connect load control switch between X1 and R.

- HP Outdoor Unit Connections** – Since the WarmFlo controller inherently knows defrost and has its own methods for distinguishing heat or cooling mode, only four basic electrical connections are required to the outdoor unit. The upper right terminal block and reference drawing show basic heat pump terminology for these four wires. Depending upon heat pump manufacturer, the letters or wire colors shown may have slightly different terminology. If additional terminology interpretation is required, consider the following definition.

- R - 24 volt hot, same as furnace fan center "R" (except for fuse).

- Y - The HP compressor relay coil, when the Y terminal goes to 24-volt, the compressor and its internal functions should be on.
 - RV - Reversing valve, determines outdoor unit heat or cool mode. See below for logic selection. This may also be called “0”.
 - C – 24-volt system common, same as furnace fan center.
7. **Heat Pump Reversing Valve Logic** - Depending upon the heat pump manufacturer, the “RV” may be different logic for heating and cooling. This is selectable on the WF-EZ3 circuit board, top.
- Heating – RV = 24-volt, high – jumper header between center pin and H.
 - Cooling – RV = 24 volt, high – jumper header between center pin and C.
- Factory set at 24 volt = Cooling

WarmFlo II Controller Connection

1. Sensor connection – see page 4 “WarmFlo II Sensors”.
2. WF II Controller is located on the cabinet right side door.
3. Plug the 4-wire pigtail from WF-EZ3 into the left center connector. Do not force on the connector, the connector only plugs in one way and should slide on easily.
4. Plug the yellow wire and connect to the WarmFlo II “Y” tab located on the top left portion of WF controller.
 - **Information** - The WarmFlo II controller receives its operating power through the plug-in wire harness. The yellow wire is simply the thermostat “call for heat” signal being forwarded to the WarmFlo II controller.
5. The harness also comes with a violet wire, the violet wire is used as a “built-in” ODT for heat pump compressor shut-off function. Connect the violet wire to the WarmFlo II tab “HP ODT” or T4 (this wire must be connected).
6. The cable has a 7th wire (brn/yel) which is simply an extra wire for special stat field hookups and options. Reference “Special Applications/Installation Instructions” part of this manual.
7. **Caution – 24 volts common grounding** – the installer must determine whether the furnace fan center COM screw terminal has a good ground bond (not simply furnace skin). If the fan center COM is not adequately grounded, use the pigtail green wire (WarmFlo board, upper, C tab) for a ground bond to the Electro-Mate cabinet power source ground lug. The upper right circuit board mounting screw is a static ground protection point.

If your installation has special application and hookup conditions please see section located in this manual called “Special Application/Installation instructions”

CONTROLLER SETUP OR PROGRAMMING

Important - Located on the WF II board is a firmware chip that determines a specific set of defaults (see table below). However, this can be programmed (altered) with optional PC software (ET-SOFT-WF) or a plug-in WarmFlo analyzer (WF-ANZ*). As part of the WF II system this chip represents critical defaults and settings that make your system operate correctly. It is a critical portion of the installation to verify that the chip code sent with your WF II is correct for your intended application. The chip code is located on a white label in the center of the WF II controller.

The table below represents the typical WF II chip codes and defaults for use with a WF-EZ3. Please use this table as a reference as you setup your WF II. See Operational Information and last section of this manual for further information on these defaults.

Chip Code Reference Table

Code	Stg. Enable	MU Time	ODT Mode	OT Function
HPDH	50°, 38°, 36°, 34°	90	HP W/STEP	DT cal.
HPDF	50°, 38°, 36°, 34°	30	EL to SB	DT cal.
HPEL	50°, 38°, 36°, 34°	00	HP	DT cal.

MU Time – Standby or Gas Furnace Operation - Whenever all four stages are full on, and operating at a continuous 100% for a fixed delay (see Chip Code Reference Table, MU Time); the WarmFlo II controller automatically terminates all electric and starts the gas furnace. The gas furnace will be used to complete the heating cycle until room thermostat heat call ends.

During the next heat call, the heat pump and Electro-Mate stages again attempt to produce the WarmFlo II desired temperature. Again, if everything is at 100% plus the MU time, the gas furnace takes over.

HPDH Chip Code – Electro-Mate Sized for Complete Heating Load

Application: 4-wire Thermostat, WF II Electro-Mate, Heat Pump, gas/oil furnace using ODT to control heat pump only – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

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

MU Time – Set at 90 minutes

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – The lower inside yellow screwdriver adjustment dial sets a “floor” or level minimum operating temperature. The supply temperature will never go below this point independent of outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve. Reference manual “heat loss curve graph”.

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 or Low Temperature Switch-Over – The top inside yellow screwdriver adjustment dial can be set to **terminate the heat pump**. Special programming can terminate heat pump and electric to allow total gas operation below ODT temp. (reference manual WF-ANZ*).

In addition this defaults as “HP W/STEP”. This means below the ODT selected temperature, the Electro-Mate output goes to “Flat DT” (see last page definition).

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”. At no time can the outdoor compressor built-in ODT and WF II ODT setting (other than 0 = disable) be used at the same time.

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 go to “DT flat”.

WF-EZ3 adjustments and settings – only one setting, selection of the reversing valve logic. See page 10, paragraph 7. The normal/standby switch provides the standard user override function (some power companies may request deactivation or deletion of this switch, call factory).

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

HPDF Chip Code – Electro-Mate Undersized

Application: 4-wire Thermostat, WF II Electro-Mate, Heat Pump, and gas/oil furnace using ODT setting as full electric control – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

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

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 a dial switch temperature selection at about the combination heat pump and Electro-Mate output energy (probably 0°) or position #3.

MU Time – Set at 30 minutes

WF II DIAL SETTINGS

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

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 or Low Temperature Switch-Over – The yellow screwdriver adjustment dial can be set to **terminate all electric** to allow total gas operation below ODT temp. (reference manual WF-ANZ* for special programming).

The temperature settings related to the “ODT dial” are:

Ø = Disabled, no ODT switch-over

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

This arrangement provides low temperature interrupt of **both** the heat pump and the Electro-Mate elements. If you desire to interrupt only the heat pump, this is the wrong chip code or can be altered with Handheld.

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 go to “DT flat”.

WF-EZ3 adjustments and settings – only one setting, selection of the reversing valve logic. See page 11, paragraph 7. The normal/standby switch provides the standard user override function (some power companies may request deactivation or deletion of this switch, call factory).

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

HPEL Chip Code – Maximum Electric Gas Only Operates with Utility Control

Application: 4-wire Thermostat, WF II Electro-Mate, Heat Pump, and gas/oil furnace. This code will only allow gas/oil on during utility control – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

Stage 1 = 5Ø°F

2 = 38°F

3 = 36°F

4 = 34°F

MU Time = 00 (disabled).

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – This is the screwdriver adjust which sets a “floor” or level minimum operating temperature. The supply temperature will never go below this point independent of outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve. Reference manual “heat loss curve graph”.

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 or Low Temperature Switch-Over – The yellow screwdriver adjustment dial can be set to **terminate heat pump** below ODT temp. Electric will stay on until thermostat is satisfied. Gas will operate only during utility control (reference manual WF-ANZ* for special programming).

The temperature settings related to the “ODT dial” are:

Ø = Disabled, no ODT switch-over

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

COMMENT: If you are using outdoor compressor built-in ODT, set the dial to “0”. At no time can the outdoor compressor built-in ODT and WF II ODT setting (other than 0 = disable) be used at the same time.

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 go to “DT flat”.

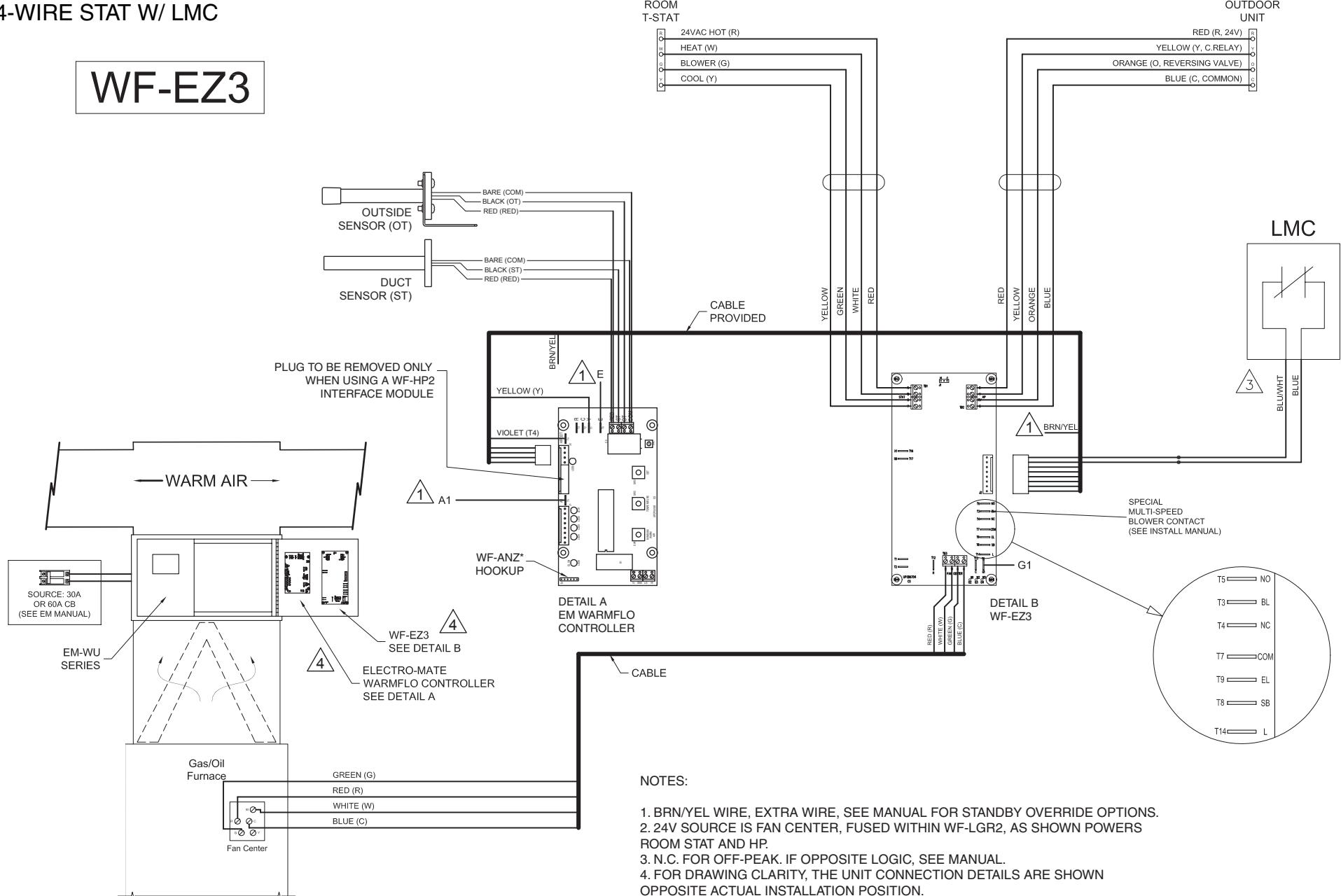
WF-EZ3 adjustments and settings – only one setting, selection of the reversing valve logic. See page 11, paragraph 7. The normal/standby switch provides the standard user override function (some power companies may request deactivation or deletion of this switch, call factory).

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

ELECTRO-MATE / WARMFLO SIMPLE PACKAGE

4-WIRE STAT W/ LMC

WF-EZ3



ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

HH329

Rev.B 07-25-07

WF-LGR3 & WF II WIRING & SETUP

WF-LGR3

Application – Standard heat pump room thermostat, heat pump, WF II Electro-Mate, gas/oil furnace. HP manufacturer's fossil fuel kit is **not** required.

Reference Drawing HH316

1. Attached to the WF-LGR3 is a cable harness that interfaces between the WF II and the WF-LGR3.

Note: Units produced after 08-04-04 (ARL #3074 and up) have an updated control board. This update increases the size of the interface header from a four place to a ten place. See photo below for proper cable installation.



2. Requirements:

- Thermostat connection One 8-wire cable
- Fan Center/Gas furnace connection One 5-wire cable
40VA or larger transformer
Blower connection "G" relay
- Outdoor Heat Pump One 4-wire cable

3. **Room Thermostat Connections** – Including emergency and stage 2 connections

- a. Install room thermostat at the desired room location with typical 8-wire thermostat cable to the WF-LGR3.

Note: If this is a mechanical stat, adjustment of the heat anticipator is required, set the heat anticipator to 0.2.

- b. **Thermostat Stage 2, Typically W or W1** - WarmFlo II does **not** incorporate Stage 2 function, there is no termination or connection for this wire. Nor is Stage 2 an optional pickup point for any other function related outside of the WarmFlo II control requirements. Simply leave unterminated or unused.
- c. **Thermostat Emergency, Typically E** – If emergency hookup is requested or required by the homeowner, see next page, paragraph 6, need to make the choice on emergency switch action and note the comments concerning blower.

4. **WF-LGR3 Connections**

- a. Install two wires (yellow "Y" and green "G") from the 8-wire thermostat cable to the WF-LGR3 upper left "stat" terminal block. If using emergency, wire according to above guidelines. Basically the HP manufacturer's thermostat is connected directly to the outdoor unit as specified by the HP manufacturer, except the below wiring exceptions:

- The "Y" (first stage) is routed through this module.
- The "G" (blower) always goes to this module or inside air handler.
- The "E" (emergency) if emergency hookup is required simply attach emergency "E" from thermostat connection to the BRN/YEL wire in the harness going to the WF II controller.
- The "W" (second stage) is not used with the WarmFlo II™ product (reference thermostat section).

Note: You can use this WF-LGR3 enclosure as a "wiring center or cable termination" position for the room thermostat cable going to the outside unit. As shown on HH316, the large black dots represent three tie points for R, C, and O. Again, for

- convenience, you can make these three tie points within this enclosure. Over and above the three tie points mentioned above, simply terminate “Y” and “G” at the upper left terminal block.
- b. Within the WF-LGR3 is a wire harness that goes from WF-LGR3 to the WF II controller. Within this wire harness are two blue wires. Undo these, extend and connect to the utility load control receiver. For electric energy operation (off-peak) the two blue wires represent contact closure as shipped. **Do not apply external voltage or external power to the blue wires**, they are simply looking for a closed contact during off-peak.
 - 1. Where load management interrupt does not apply, simply leave the blue wires tied together.
 - 2. If load control reverse logic is required, keep the two blue wires shorted and connect load control switch between X1 and R.
 - c. **HP Outdoor Unit Connections** – Over and above the three tie points mentioned above, the only additional connection is the “Y” at the upper right terminal block. Since the WarmFlo II controller inherently knows defrost and has its own methods for distinguishing heat or cool mode, the switch over valve or reversing valve (RV) function only applies to the thermostat and the outdoor unit.
 - d. **Fan Center Connections** - route a 5-wire cable from the WF-LGR3 module, bottom center terminal block, to furnace fan center, same letter designated connections. The 5th wire may be required for variable speed furnace “Y” terminal, see diagram in white section.
 - e. **Multi-speed Blower operation** – reference manual “Special Application/Installation Instructions” section.

WarmFlo II Controller Connection

Assumption - The WarmFlo II is strictly an enhancement or “add to” product. This manual does not attempt to define the heat pump manufacturers installation, and assumes the heat pump is functional and has not been altered from the factory. Also, the installing technician must have basic knowledge and understanding of heat pump control logic and/or wire colors/functions. The basic heat pump installation, checkout, troubleshooting, repair of its factory standard components is not covered in this manual.

Wiring Connections

1. Sensor connection – see page 4 “WarmFlo II Sensors”.
2. WF II Controller is located on the cabinet right side door.
3. Plug the 4-wire pigtail from the WF-LGR3 into the left center connector. Do not force on the connector, the connector only plugs in one way and should slide on easily.
4. Plug the yellow wire and connect to the WarmFlo II “Y” tab located on the top left portion of WF controller.

Information - The WarmFlo II controller receives its operating power through the plug-in wire harness. The yellow wire is simply the thermostat “call for heat” signal being forwarded to the WarmFlo II controller.

5. The harness also comes with a violet wire, the violet wire is used as a “built-in” ODT for heat pump compressor low temperature shut-off function. This function can have different meanings depending upon setup. Reference “WarmFlo Handheld Analyzer/Laptop Software” section of manual on ODT settings. Connect the violet wire to the WarmFlo II tab “HP ODT” or T4 (this must be installed).
6. The cable has a 7th wire (brn/yel) is an extra wire for emergency connection. Depending upon your desire for the emergency hookup you can choose one of two options:
 - i. **Full electric as emergency** - Connect the thermostat “E” wire through the BRN/YEL in the WF-LGR3 to the main WarmFlo board “E” tab. In this case keeping the blower running must be very carefully evaluated. According to Electro’s experience, most older HP room thermostats drop the G function when you move the thermostat to “emergency”. If this is the case, add a piggyback or second wire from the main WarmFlo board “E” tab to the interface module “G1” tab. **However**, in the case of operating with special jumpers for multi-speed blower, simply activating “G1” does not give you the same multi-speed

- step up function. Reference manual “Special Installation/Application Instructions” for additional assistance.
- ii. **Gas/oil as emergency** – depending upon the action within the HP stat sub-base, the “A1” tab on the main WarmFlo board could be used as an input to cause standby **mode**. However, even though you apply 24 volts to “A1” the system still needs a call for heat (in this case probably W). In other sub-bases the “E” wire turns on and off as a temperature controlled function. Support drawing HH320 can provide additional hookup information. Assuming only two sub-base types exist, a hookup summary would be:
- Stat “E” direct function of lever, still need W – connect Stat E to A1 and route stat W through “COM” (T7) and adjacent “SB” (T8) tabs, see HH320 page 2.
 - Stat “E” function of temperature bulb – requires an additional 2-pole, 24-volt relay at WF-LGR enclosure. The relay coil goes to stat “E” (and “C”), one contact goes across “SB” tab (T17, left center) and COM on the LGR3 board. The second contact goes across furnace fan center TB “R” and “W”, see HH320 page 1.

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

CONTROLLER SETUP OR PROGRAMMING

Important - Located on the WF II board is a firmware chip that determines a specific set of defaults (see table below). However, this can be programmed (altered) with optional PC software (ET-SOFT-WF) or a plug-in WarmFlo analyzer (WF-ANZ*). As part of the WF II system this chip represents critical defaults and settings that make your system operate correctly. It is a critical portion of the installation to verify that the chip code sent with your WF II is correct for your intended application.

The table below represents the typical WF II chip codes and defaults for use with a WF-LGR3. Please use this table as a reference as you setup your WF II. See Operational Information and last section of this manual for further information on these defaults.

Chip Code Reference Table

Code	Stg. Enable	MU Time	ODT Mode	OT Function
HPDH	50°, 38°, 36°, 34°	90	HP	DT cal.
HPDF	50°, 38°, 36°, 34°	30	EL to SB	DT cal.
HPEL	50°, 38°, 36°, 34°	00	HP	DT cal.

MU Time - Standby or Gas Furnace Operation - Whenever all four stages are full on (if it is not a four-stage Electro-Mate, this simply means full Electro-Mate output), and operating at a continuous 100% for a fixed delay (see Chip Code Reference Table, MU Time); the WarmFlo II controller automatically terminates all electric and starts the gas furnace. The gas furnace will be used to complete the heating cycle until room thermostat heat call ends.

During the next heat call, the heat pump and Electro-Mate stages again attempt to produce the WarmFlo II desired temperature. Again, if everything is at 100% plus the MU time, the gas furnace takes over.

HPDH Chip Code – Electro-Mate Sized for Complete Heating Load

Application: 8-wire standard heat pump thermostat, WF II Electro-Mate, Heat Pump, gas/oil furnace using ODT to control heat pump only – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

Stage 1 = 50°F

2 = 38°F

3 = 36°F

4 = 34°F

MU Time – Set to 90 minutes

WF II DIAL SETTINGS

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

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 or Low Temperature Switch-Over – The yellow screwdriver adjustment dial can be set to **terminate the heat pump** or via special programming can terminate heat pump and electric to allow total gas operation below ODT temp. (reference manual WF-ANZ*).

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 go to “DT flat”.

WF-LGR3 adjustments and settings – The normal/standby switch provides the standard user override function (some power companies request inactivation or deletion of this switch). No other adjustments or settings are necessary.

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

HPDF Chip Code – Electro-Mate Undersized

Application: 8-wire standard heat pump thermostat, WF II Electro-Mate, Heat Pump, and gas/oil furnace using ODT setting as full electric control – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

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

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 a dial switch temperature selection at about the combination heat pump and Electro-Mate output energy (probably 0°) or position #3.

MU Time – Set to 30 minutes

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – The yellow screwdriver adjustment dial sets a “floor” or level minimum operating temperature. The supply temperature will never go below this point

independent of outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve. Reference manual “heat loss curve graph”.

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 or Low Temperature Switch-Over – The yellow screwdriver adjustment dial can be set to **terminate all electric** to allow total gas operation below ODT temp. Electric will stay on until thermostat is satisfied. The only time gas will be used is in utility control (reference manual WF-ANZ* for special programming).

The temperature settings related to the “ODT dial” are:

\emptyset = Disabled, no ODT switch-over

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

This arrangement provides low temperature interrupt of **both** the heat pump and the Electro-Mate elements. If you desire to interrupt only the heat pump, this is the wrong chip code or can be altered with Handheld.

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 go to “DT flat”.

WF-LGR3 adjustments and settings – The normal/standby switch provides the standard user override function (some power companies request inactivation or deletion of this switch). No other adjustments or settings are necessary.

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

HPEL Chip Code – Maximum Electric Gas Only Operates with Utility Control

The primary intent for this default arrangement is total electric heat pump without standby gas/oil furnace. However, there are some specific dual heat applications where HPEL could apply.

1. On a temporary basis gas furnace is not operative.
2. Gas/oil furnace is intended or used only during load control function.

Application: 8-wire standard heat pump thermostat, WF II Electro-Mate, Heat Pump, and gas/oil furnace. This code will only allow gas/oil on during utility control – The WarmFlo II controller with this chip has outside temperature reference for enabling the electric heat staging (except “E” tab). The outside temperature (actual sensor) must be below these values before the stage will come on, independent of supply sensor requirement.

Stage 1 = 5 \emptyset °F 2 = 38°F 3 = 36°F 4 = 34°F

MU Time – disabled or 00

WF II DIAL SETTINGS

Lower right dial switch – min. warm air – This is the screwdriver adjust which sets a “floor” or level minimum operating temperature. The supply temperature will never go below this point independent of

outdoor temperature. In other words, this is the flat horizontal line on the warm air versus outdoor temperature curve. Reference manual “heat loss curve graph”.

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 or Low Temperature Switch-Over – This is the screwdriver adjustment dial that can be set to **terminate heat pump** below ODT temp. The only time gas will be used is in utility control (reference manual WF-ANZ* for special programming).

The temperature settings related to the “ODT dial” are:

\emptyset = Disabled, no ODT switch-over

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

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

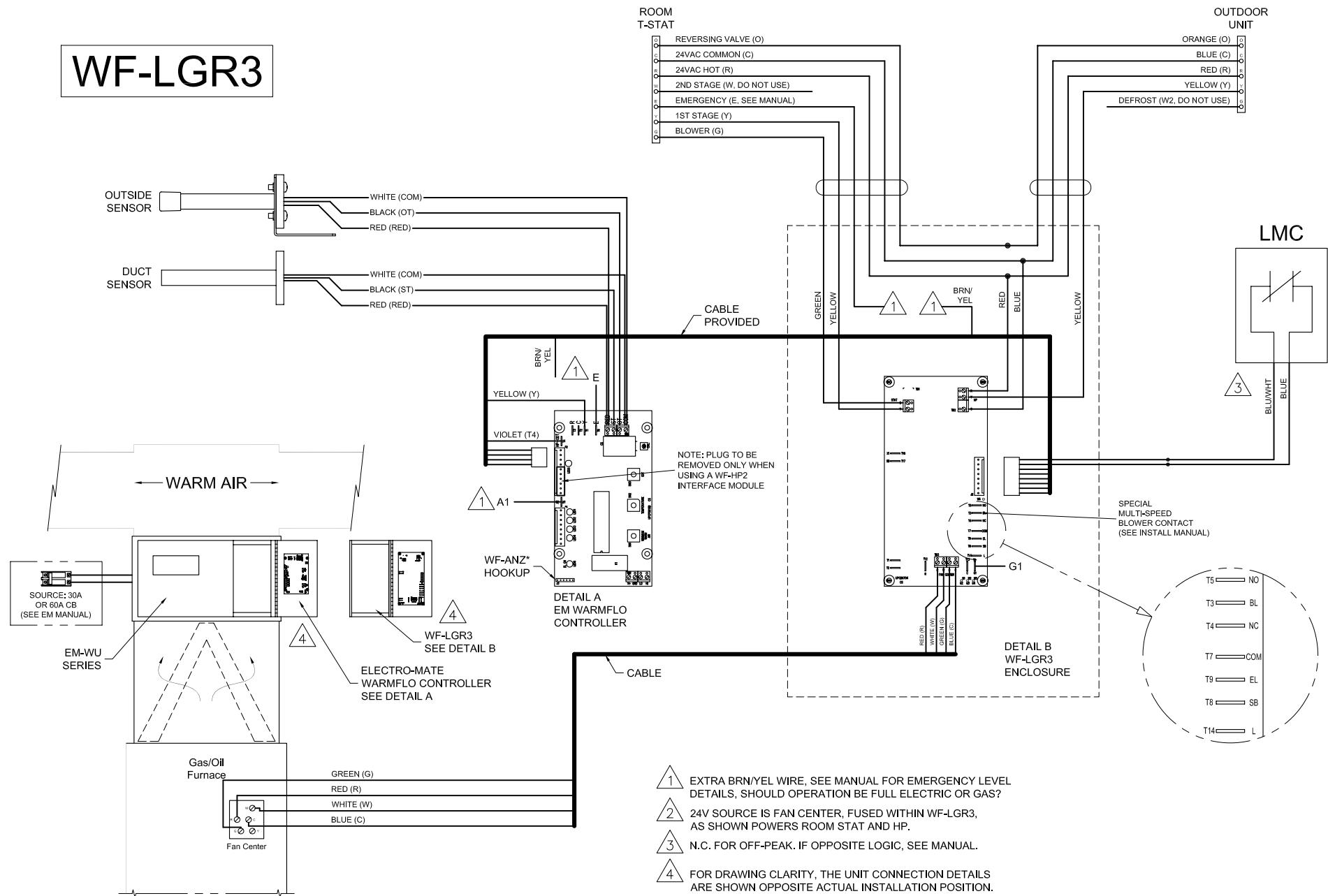
Temperature (Efficiency Dial) – Located on the front cover of the WF II Electro-Mate, the center red screwdriver adjustment dial has a selection of A through G. These A through G selections represent a supply temperature point at 0° outdoor. The closer the user or installer selection is to A, the flatter 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 go to “DT flat”.

WF-LGR3 adjustments and settings – The normal/standby switch provides the standard user override function (some power companies request inactivation or deletion of this switch). No other adjustments or settings are necessary.

Reference “WarmFlo Handheld Analyzer/Laptop Software” section in this manual for changes to your chip functions.

WF-DUAL HEAT STD. HP STAT W/ LMC

WF-LGR3



ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

HH316
REV.C 07-25-07

OPERATION INDICATORS

Furnace Interface Module – WF-EZ3, WF-LGR3, WF-EM3

WF-EZ3, WF-LGR3, and WF-EM3 Front Monitor LED's

- **Utility, off-peak** – utility load management receiver is not interrupting.
- **HP or A/C call** – the output “Y” screw terminal is active at 24 volts high. The outdoor unit should be on and running.
- **T-stat call** – the room thermostat W and/or Y is active or 24 volts high.
- **Gas call** – the fan center “W” or terminal block feeding fan center W is 24 volts high.
- **Standby mode** – either override switch, load control receiver (blue wires), or program logic MU timeout have setup an internal relay function for standby operation. The fossil fuel furnace (Gas on LED) is now a function of the T-stat call.
- **Monitor LED Comments** – the “utility, off-peak” LED is a true representation of the load control blue wires. It will not react to the override switch, A1 tab, program MU timeout, etc. The “standby mode” LED represents the internal logic condition directed by the various items requiring fossil fuel furnace or standby action. The actual “gas call” LED is further tied in with the room thermostat function represented by “t-stat call” LED.

Override Switch – the front panel slide switch (very similar to standard Electro-Mate DFC) is a direct hardware disabling of any WarmFlo and electric elements functions. The room thermostat heat call wire or function is directly controlling the fossil fuel or gas furnace. This totally resides within the furnace interface module, the WarmFlo II controller could be completely disconnected or completely non-functional but the override switch will still allow fossil fuel furnace operation. This function can also be on a remote switch, see page 25 “SB” tab.

Blower Operation – the blower function, via furnace fan center “G”, is totally within the furnace interface module (EZ3, LGR3, or EM3) and has nothing to do with the main WarmFlo controller. When activated by a thermostat function, there will always be an approximate 10-second turn-on delay and a 1-minute turn-off delay.

- Stat terminal block “G” directly activates this blower on/off delay and relay function to the fan center “G”.
- Tab “G1” can bypass this delay function.
- Stat “W” or HP stat “Y” also activates this blower function when in off-peak or non-standby mode. Whenever the system is forced to standby, this blower function will timeout and the blower is controlled by the furnace itself. This puts the gas furnace speed back in the “hands” of the gas furnace and also keeps the blower from falsely operating during load control (for some heat pump stats this may not be the case and may be a load control discomfort situation). This is another reason why WF-EZ3 and basic 4-wire stat are a better choice (also see page 24).

WarmFlo II Controller

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

Depending upon program code chip and information in the colored sections, the strip heat may not activate or operate unless the WF outdoor sensor is below the ODT dial setting. Typically for a heat pump, factory settings are:

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

Monitor LED's on WF II Controller

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

- As a secondary function this green LED provides status of the two remote sensors. If a sensor is inoperative, incorrectly wired, or malfunctioning; this monitor light is in a blinking or pulsing mode. By checking the pulsing pattern, the appropriate sensor can be identified.
- OT sensor - 100 ms blink every second.
- ST sensor - two, 100 ms blinks every second.
- Both bad - ½ second on, ½ second off, alternating.

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

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).

EM-WU***/EM-WD**** Inside Relay Board Monitor Light**

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

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

Triac Relay Module (under inside relay board)

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

STAT OVERRIDE TIMER (SOT)

This is a field option internal timer which can be field programmed with WF analyzer to select a roomstat cycle run time. If this downloaded run time (typically 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 unmonitored.
- SOT E – this must be shorter time than above, is typically used to overcome morning setback pickup issues. In other words, if you would field download 30 minutes and you program the **setback stat** to begin bringing up the temperature 30 minutes prior to the wakeup time; and the system is not at the new higher temperature at the 30-minute point it will automatically jump to all stages full on (DT flat) in order to more rapidly raise the building temperature. **However**, this also means you will be “short cycling” the HP compressor during **other** heat calls. The maximum run time for the compressor is then about 30 minutes at any time of the day or at any particular heat call.

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

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For Various Heat Pump, Multi-Speed, Multi-Stage Furnaces, Blower Options, Oil Furnace, etc.

Furnace Interface Module Interchangeability

The WarmFlo II controller can operate with any furnace interface module series (1, 2, 3). The updated I/F module series have additional features and are more convenient for installation, but all I/F module models will work (without new features) with this controller. **This manual includes the installation and operation for the I/F modules listed on cover.**

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If during the initial building construction there is a need for Electro-Mate **only** operation for an extended period of time, move the yellow (or heat call wire) from Y to E tab. This conditions the WarmFlo II to all stages on and essentially bypassed all temperature functions.

Fossil Fuel Furnace Comment

Furnace interface modules (WF-EZ3, LGR3, EM3, etc.) are designed to interface directly with a furnace fan center containing 24-volt transformer (40VA or larger), blower relay, and a "W" function to operate the fossil fuel furnace. If this installation is for an **oil furnace** with only oil control "T and T" terminals, a fan center will need to be added plus an isolation relay at the "W" terminal so only isolated contacts are connected to the oil burner master control "T and T". Another choice is to use a standard fan center and order EE-5053 relay with accompanying HD001 instruction sheet.

Wood Furnace Or Other Non-Automatic Standby Furnace

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

Load Control Interrupt, Blower Function

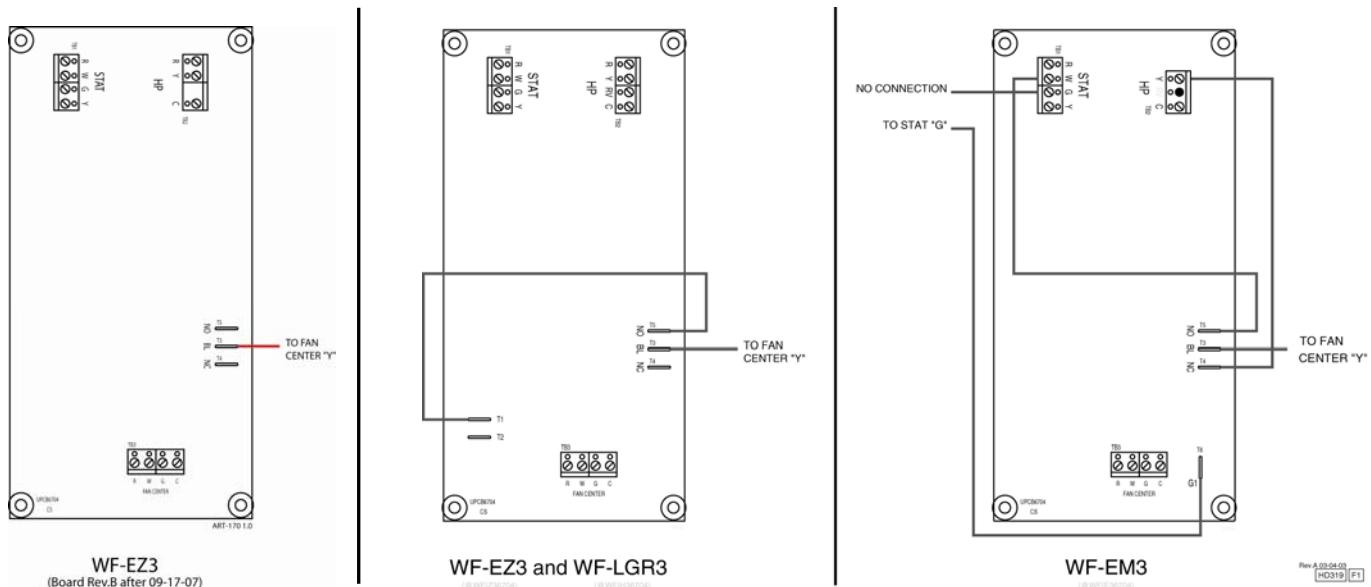
Internal to the furnace interface module the control logic applies a "G" function to the furnace fan center whenever there is a call for heat (electric mode only). In the heating mode this is independent of the thermostat "G". In the cooling mode only the thermostat "G" gets to the fan center "G". Some thermostats (especially multi-stage HP manufacturer's stat) provide the "G" function for both heat and cool. In this case the green wire coming from the thermostat will take precedence and be in direct control of the furnace blower.

If there is a desire to interrupt the roomstat "G" during load control (gas furnace operates its own blower), route the roomstat green wire through the interface module left tabs (EZ3 and LGR3 only) COM and EL.

Optional, gas furnace outlet temperature HP safety – the interface module 100° gas furnace temperature sensor probe, protects HP compressor, can still be added. Order part EM5713 and follow its instructions (R37 on PC board must be cut).

Optional - Multi-speed/variable-speed blower connection - Newer "high tech" gas furnaces, special blower speeds, may require energizing fan center "G" and "Y" during WarmFlo II heating cycle. Provisions are included for an extra blower relay contact for appropriate multi-speed wiring.

- Added jumper wires



Variable speed blower, operate a low speed during low heat requirements – fall 2002 new feature allows selecting an outdoor temperature to change furnace blower speed. Ideal for newer and 2-stage heat pumps, but requires special connection and special programming. Request description document HD319 with its appropriate hookup and support drawings.

OPTIONAL ACCESSORIES

Standby Override – The front switch provides a very effective override switch to fossil fuel furnace capability. This is a hardware override switch and does not depend upon the WarmFlo board, microprocessor, electronics, etc. Typically this takes the place of dual fuel heat pump thermostat "emergency lever" function. Although when using WF-LGR3 there is another optional hookup for roomstat emergency switch, see previous page 16 or special drawing HH320.

Remotely located standby override switch – on the left side of the I/F board is a "SB" tab. Using an external switch between this "SB" tab and a common tab provides the same function as the front override switch. Whichever switch is in the up or override position takes priority. In other words, they **both** need to be in the down position during **cooling**.

Note: All override switches must be in normal or electric position during cooling.

Manual switch or forced gas furnace (stand-by) function - On the main WarmFlo II board, top center, is tab marked "A1". A switch or jumper from "A1" to "R" will cause a direct gas furnace operation and interrupt or terminate the heat pump. This can be used for a test switch.

Load Shedding, Electrical Service Entrance Not Adequate - When using the 10 kW Electro-Mate on a 100-amp service with other major appliances, there are very simple techniques to make sure the 100-amp service is not overloaded. These are based upon inserting one 240 wire from either or both the electric dryer/electric range through a small donut CT. This detection of appliance turn-on immediately drops out a secondary 5 kW load. Both techniques have the necessary input detection delay window to compensate for pulse modulation stove top burners.

- EM-LV104L* – Order EZ-Mate plenum heater with load shed capability – 5 kW firm, 5 kW shed.
- PI-ØA1DYMO – Sensor CT (1 or 2, ½” donut), 4 wire low voltage connection to standard Electro-Mate or WarmFlo II/ Electro-Mate – drops 1 stage or typical 5 kW (reference drawing PH510).
- PI-Ø31DYHO – Sensor CT (1 or 2, ½” donut), service panel wiring, drops electric water heater or any 25-amp circuit appliance/electric heater.

TROUBLESHOOTING

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

Sensor Temperature Calibration - Both remote sensors are digital electronic and factory calibrated. Normally these do not require field calibration or verification. However, if sensor temperature error is determined, there are two field calibration techniques. Proceed with extreme caution.

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.

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 air handler circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.
2. The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.
3. Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.
4. The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor “hang in conditioned space” and attempt to run this system.
5. Acquiring the WarmFlo 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 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

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

WarmFlo Furnace Interface Internal Fuse – the internal fuse is between the fan center “R” and all other WarmFlo II functions, including the “R” going to the outdoor unit. Use only two amp, fast blow.

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

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 is only used when needed by the WarmFlo II supply air temperature calculations. When the warm air sensor is calling for more than the heat pump and Stage 1 100% output, Stage 2 turns on. Stage 1 may not necessarily remain at 100%, but is modulated downward to meet the requirements of the warm air sensor.

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

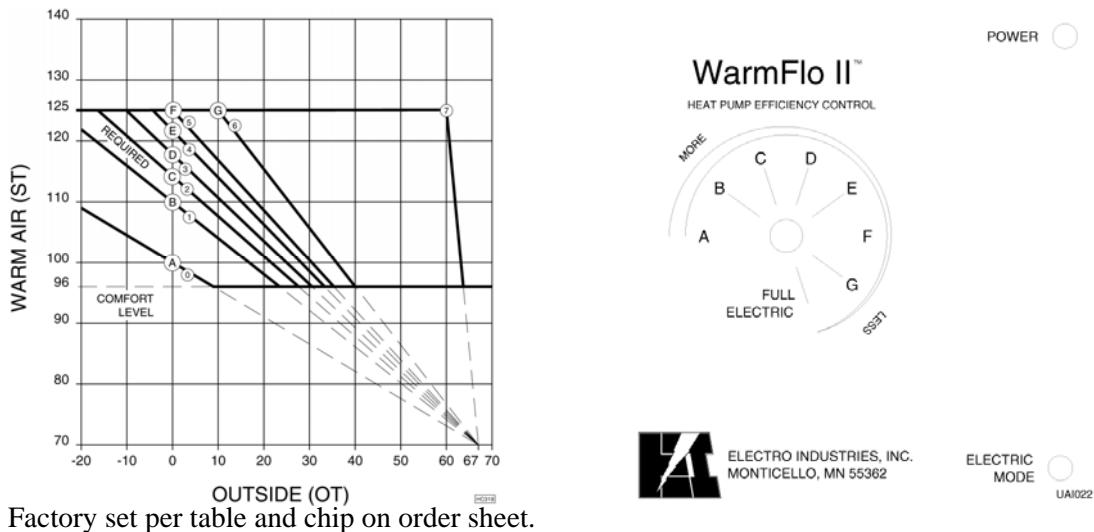
Efficiency* – the characteristic of a heat pump dual heat system is the heat pump’s ability to deliver warm air at efficiencies greater than 100%. Gas and oil systems are always less than 100% (60% through 90%), resistance electric (Electro-Mate) is always exactly 100%, but the heat pump is always at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

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, above) allows the compressor to operate with a minimal amount of electric resistance supplement or temperature boost.

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.

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



Factory set per table and chip on order sheet.

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 go to “DT flat”.

***Does not apply to chip codes such as EMA, and “flat DT” such as EMR.**

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.

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.

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 4-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 4 minutes in order for the blower to cool down the furnace heat exchanger.

SB (Gas) 5-Minute Safety – when in the standby mode (see previous section) there is now a 5-minute timer which begins at each heat call. If after the 5 minutes the ST sensor is less than 85°, 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 you have a Load Control on-peak or A1 tab high. **Note:** Handheld can disable (must have latest firmware chips).

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, LGR3, 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 – see page 24 and associated hookup instructions.
- Using E tab with HP stat emergency output – see previous “E-tab” section for blower operation caution.

OPERATION INDICATORS

Furnace Interface Module – WF-EZ3, WF-LGR3, WF-EM3

WF-EZ3, WF-LGR3, and WF-EM3 Front Monitor LED's

- **Utility, off-peak** – utility load management receiver is not interrupting.
- **HP or A/C call** – the output “Y” screw terminal is active at 24 volts high. The outdoor unit should be on and running.
- **T-stat call** – the room thermostat W and/or Y is active or 24 volts high.
- **Gas call** – the fan center “W” or terminal block feeding fan center W is 24 volts high.
- **Standby mode** – either override switch, load control receiver (blue wires), or program logic MU timeout have setup an internal relay function for standby operation. The fossil fuel furnace (Gas on LED) is now a function of the T-stat call.
- **Monitor LED Comments** – the “utility, off-peak” LED is a true representation of the load control blue wires. It will not react to the override switch, A1 tab, program MU timeout, etc. The “standby mode” LED represents the internal logic condition directed by the various items requiring fossil fuel furnace or standby action. The actual “gas call” LED is further tied in with the room thermostat function represented by “t-stat call” LED.

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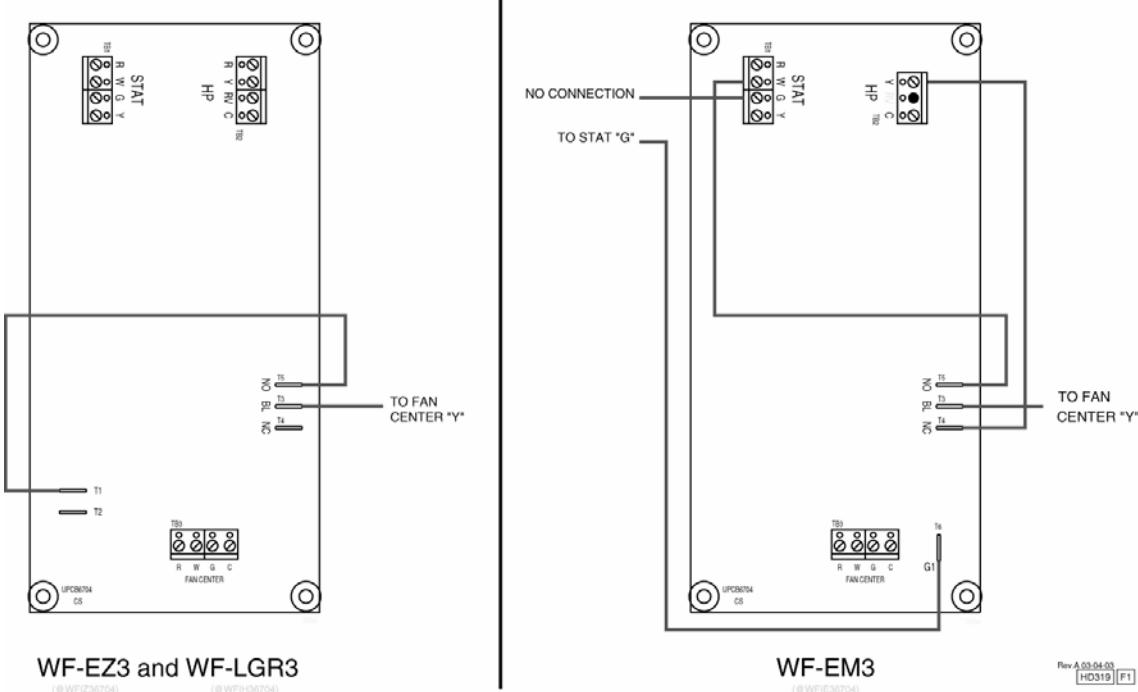
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If there is a desire to interrupt the roomstat "G" during load control (gas furnace operates its own blower), route the roomstat green wire through the interface module left tabs (EZ3 and LGR3 only) COM and EL.

Optional, gas furnace outlet temperature HP safety – the interface module 100° gas furnace temperature sensor probe, protects HP compressor, can still be added. Order part EM5713 and follow its instructions (R37 on PC board must be cut).

Optional - Multi-speed/variable-speed blower connection - Newer "high tech" gas furnaces, special blower speeds, may require energizing fan center "G" and "Y" during WarmFlo II heating cycle. Provisions are included for an extra blower relay contact for appropriate multi-speed wiring.

- Added jumper wires



Variable speed blower, operate a low speed during low heat requirements – fall 2002 new feature allows selecting an outdoor temperature to change furnace blower speed. Ideal for newer and 2-stage heat pumps, but requires special connection and special programming. Request description document HD319 with its appropriate hookup and support drawings.

OPTIONAL ACCESSORIES

Standby Override – The front switch provides a very effective override switch to fossil fuel furnace capability. This is a hardware override switch and does not depend upon the WarmFlo board, microprocessor, electronics, etc. Typically this takes the place of dual fuel heat pump thermostat "emergency lever" function. Although when using WF-LGR3 there is another optional hookup for roomstat emergency switch, see previous page 16 or special drawing HH320.

Remotely located standby override switch – on the left side of the I/F board is a "SB" tab. Using an external switch between this "SB" tab and a common tab provides the same function as the front override switch. Whichever switch is in the up or override position takes priority. In other words, they **both** need to be in the down position during **cooling**.

Note: All override switches must be in normal or electric position during cooling.

Manual switch or forced gas furnace (stand-by) function - On the main WarmFlo II board, top center, is tab marked "A1". A switch or jumper from "A1" to "R" will cause a direct gas furnace operation and interrupt or terminate the heat pump. This can be used for a test switch.

Load Shedding, Electrical Service Entrance Not Adequate - When using the 10 kW Electro-Mate on a 100-amp service with other major appliances, there are very simple techniques to make sure the 100-amp service is not overloaded. These are based upon inserting one 240 wire from either or both the electric dryer/electric range through a small donut CT. This detection of appliance turn-on immediately drops out a secondary 5 kW load. Both techniques have the necessary input detection delay window to compensate for pulse modulation stove top burners.

- EM-LV104L* – Order EZ-Mate plenum heater with load shed capability – 5 kW firm, 5 kW shed.
- PI-ØA1DYMO – Sensor CT (1 or 2, ½” donut), 4 wire low voltage connection to standard Electro-Mate or WarmFlo II/ Electro-Mate – drops 1 stage or typical 5 kW (reference drawing PH510).
- PI-Ø31DYHO – Sensor CT (1 or 2, ½” donut), service panel wiring, drops electric water heater or any 25-amp circuit appliance/electric heater.

TROUBLESHOOTING

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

Sensor Temperature Calibration - Both remote sensors are digital electronic and factory calibrated. Normally these do not require field calibration or verification. However, if sensor temperature error is determined, there are two field calibration techniques. Proceed with extreme caution.

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.

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 air handler circuit breaker), when the green LED goes out, count to 10, and re-energize power supply.
2. The terminal blocks for control wire hook-up are designed for a wire insertion and screw clamp down. If there is no wire connected and the screw is loose, the screw may not necessarily make a good electrical contact to the inside components. Example – if you are jumpering the thermostat terminals without thermostat wire connection or if you are attempting to measure voltage on the screw head, you may get erroneous or unpredictable results if the screw is not tightened down.
3. Use general heating system logic information and basic understanding of the terminal block wiring functions when measuring voltage to determine proper operation of this module.
4. The outdoor sensor must be located outdoors for this controller to correctly operate. Do not leave the outdoor sensor “hang in conditioned space” and attempt to run this system.
5. Acquiring the WarmFlo 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 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

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

WarmFlo Furnace Interface Internal Fuse – the internal fuse is between the fan center “R” and all other WarmFlo II functions, including the “R” going to the outdoor unit. Use only two amp, fast blow.

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

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 is only used when needed by the WarmFlo II supply air temperature calculations. When the warm air sensor is calling for more than the heat pump and Stage 1 100% output, Stage 2 turns on. Stage 1 may not necessarily remain at 100%, but is modulated downward to meet the requirements of the warm air sensor.

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

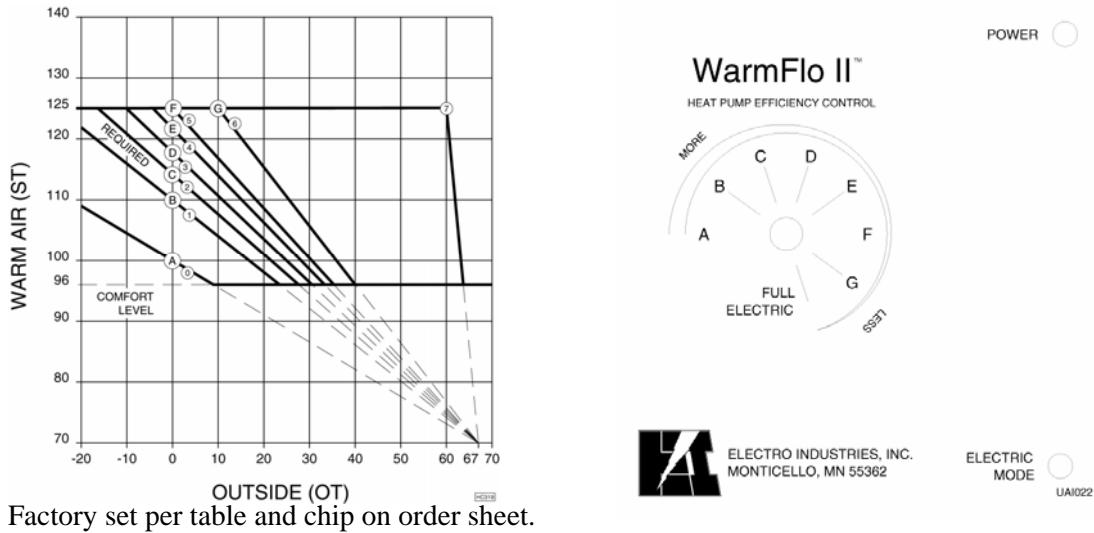
Efficiency* – the characteristic of a heat pump dual heat system is the heat pump’s ability to deliver warm air at efficiencies greater than 100%. Gas and oil systems are always less than 100% (60% through 90%), resistance electric (Electro-Mate) is always exactly 100%, but the heat pump is always at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

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, above) allows the compressor to operate with a minimal amount of electric resistance supplement or temperature boost.

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.

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



Factory set per table and chip on order sheet.

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 go to “DT flat”.

***Does not apply to chip codes such as EMA, and “flat DT” such as EMR.**

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.

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.

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 4-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 4 minutes in order for the blower to cool down the furnace heat exchanger.

SB (Gas) 5-Minute Safety – when in the standby mode (see previous section) there is now a 5-minute timer which begins at each heat call. If after the 5 minutes the ST sensor is less than 85°, 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 you have a Load Control on-peak or A1 tab high. **Note:** Handheld can disable (must have latest firmware chips).

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, LGR3, 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 – see page 24 and associated hookup instructions.
- Using E tab with HP stat emergency output – see previous “E-tab” section for blower operation caution.

Electro-*HELPS IV*

WarmFlo Terminology, Key Terms

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

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

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

DT Flat – this is an internal reference point, as WarmFlo establishes this mode it in essence sets the operating point at 125° F. (Analyzer or software may have any value from 123 to 125).

Electric element modulation and staging are still in effect. The staging will be based upon the ST sensor detecting and operating around the 125° point.

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

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

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

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

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

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

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

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

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

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

- New 2008 – version 2.38, 10.03, 12.04, 15.03, etc. – once activated, it remains for the completion of the heat call. Thus it only needs to be a temporary jumper (5 seconds or more) to step on all stages. User needs to remember to cycle the roomstat to cancel this E tab function.
 - A potential convenience or secondary usage for this upgraded E tab function is to provide an easy manual means for rapidly bringing up the building or room temperature if the system has been set for non-occupancy. By installing a pushbutton between W and E tab, the homeowner can easily activate all stages on to the end of the thermostat cycle.
- Warning:** This is all stages on, no temperature monitor. This should only be used in this manner when it is a very cold building from non-occupancy, the outdoor temperature is quite low with low temperature rise coming from the heat pump.

Stat override timer (SOT) – this is an option WarmFlo internal timer which can be programmed with WF analyzer to select a roomstat run time. If this downloaded run time (typically 90 minutes) is exceeded before the thermostat is satisfied, the system automatically switches to either full electric elements or standby.

- SOT S – this is the longer set timer which allows **transfer to standby** if something might have happened to the electric system.
- SOT E – this must be shorter time, is typically used to overcome morning setback pickup issues. In other words, if you would field download 30 minutes and you program the **setback stat** to begin bringing up the temperature 30 minutes prior to the wakeup time; and the system is not at the new higher temperature at the 30-minute point it will automatically jump to DT Flat in order to more rapidly raise the building temperature. **However**, this also means you will be “short cycling” the HP compressor during **other** heat calls. The maximum run time for the compressor is then about 30 minutes at any time of the day or at any particular heat call.

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

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

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

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

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

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

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

- EL to SB – interrupts all electric elements **and** the heat pump
- HP – interrupts only the outdoor compressor unit, electric energy continues without an OT temperature shut down reference

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

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

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

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

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

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

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

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

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

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

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

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

Bad sensor, safety – if the internal logic detects open sensor wire, incorrectly wired sensor, or some bad sensor transmitted value conditions; the green LED reverts to a pulsing mode.

Basically the appropriate sensor is set internally to a default value and there will be an attempt to cause the electric heat output to go “DT Flat”.

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

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

WarmFlo Analyzer or Software Bad Sensor Indicators

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

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

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

HANDHELD ANALYZER/LAPTOP SOFTWARE

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

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

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

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

OPERATIONAL INFORMATION

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

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

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

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

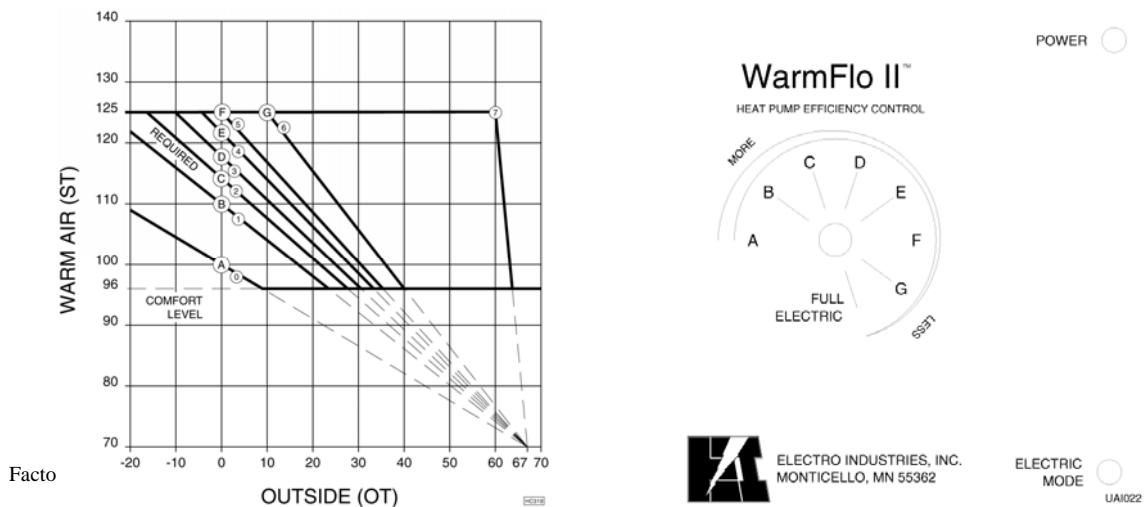
Also on the next call for heat, the WarmFlo II controller remembers what stages were on and starts at that point. A clamp-on amp meter at the service input can be used to “visualize” the Stage 1 modulation and/or Stages 2, 3, and 4 functions.

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

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

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

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



Temperature (Efficiency Dial)* – the red center screwdriver adjustment dial has a selection of A through G. These A through G selections represent a supply temperature point at 0° outdoor. The closer the user or installer selection is to A, the flatter the heat loss curve or the higher the operating efficiency. The closer a selected setting is to G, the steeper the heat loss curve or the lower overall heat pump system efficiency. If dial is turned to “full electric” the WF II will automatically put all stages of electric to full capacity.

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

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

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

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

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

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

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

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

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

²EZ-Mate – dual is HPDF, not HPDH.

Other defaults, all Forced Air models.

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

ST SPD A – N/A
ST SPD B – 105°
CT STG DISABLE – all 0, except EZ-Mate = 3
CT STG DISABLE – all 0, except EZ-Mate = 4



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Electro Industries, Inc.

Limited Product Warranty

Effective February 5, 2009

Electro Industries, Inc. warrants to the original owner, at the original installation site, for a period of two (2) years from date of installation, that the product and product parts manufactured by Electro Industries are free from manufacturing defects in materials and workmanship, when used under normal conditions and when such product has not been modified or changed in any manner after leaving the plant of Electro Industries. If any product or product parts manufactured by Electro Industries are found to have manufacturing defects in materials or workmanship, such will be repaired or replaced by Electro Industries. Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Electro Industries may request that the materials be returned to Electro Industries at the owner's expense for factory inspection. The determination as to whether product or product parts shall be repaired, or in the alternative replaced, shall be made by Electro Industries or its authorized representative. Electro Industries will cover reasonable labor costs to repair defective product or product parts for ninety (90) days after installation.

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

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

TWENTY YEAR (20) LIMITED WARRANTY ON SPIN FIN ELEMENTS

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

FIVE YEAR (5) LIMITED WARRANTY ON OPEN WIRE ELEMENTS

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



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THESE WARRANTIES DO NOT COVER:

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

CONDITIONS AND LIMITATIONS:

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

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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