Small Box energy

Q.1.35
October 2015

KE2 AdaptiveControl (pn 21177)

Quick Start Guide

This reference should remain on site with the installed KE2 Adaptive Control controller.

Parts List

The following parts are included in the KE2 Adaptive Control controller kits:

- **Kit # 21177 with 120/208-240 VAC controller**

A (1) KE2 Adaptive Control controller

B (1) high voltage safety shield

C (1) 3-pack of colored 15' temperature sensors

D (6) 90° spade connectors

E (2) straight spade connectors

F (5) self-tapping screws

G (2) 1/2" plastic knockout plug

H (1) air sensor mount

I (3) course thread screws

J (1) KE2 Terminal Board*

(1) Warranty card (not shown)

Supplies List

The KE2 Adaptive Control is supplied with all of the accessories required for the controller to work, however, standard truck stock items will also be required to install the controller. To simplify the installation, a list of items has been provided.

- **Conduit to go between the controller and the evaporator**
- **(2) Conduit connectors** (straight or elbow as required)
- **(8) High voltage wires matched to the load of the heaters, fans, liquid line solenoid, and the controller.**
- **(8) Spade Connectors matched to the gauge of high voltage wires**
- **Wire labeling** (numbers, colors, etc.)
- **Wire ties**
- **18 gauge twisted shielded pair** (if extending sensor wires)
- **Foam insulation if running wires outside the space.**
- **Silicone** (for sealing any box penetrations)

Accessories to Aid in Installation

The following parts are available separately:
10' Wire Harness pn 20736, **25' Wire Harness** pn 20670, or **40' Wire Harness** pn 20737
Further information on the Wire Harness can be found in literature Q.1.21.

** When used with the KE2 Adaptive Control controller, the fuses must be sized to match the application (i.e. Replace existing fuses with 30 Amp Time Delay fuses for fans and compressor)*

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Arriving at the Jobsite

When arriving at any jobsite, it is good practice to verify the correct operation of the system. Even systems running for a considerable amount of time without requiring a service call may not be running properly.

Inspect the coil to see the current frost pattern. If the unit has not recently performed a defrost, look for the heaviest area of frost. This will be used to locate the coil sensor.

Installers should account for a full system diagnostic in the installation estimate for the controller.

Although it may seem unnecessary, identifying system issues before the controller is installed will save time overall. It will also allow the controller to provide the highest energy savings.

Verify the system is running correctly. Taking several measurements will help determine the current health of the system. Using the diagram below, fill in the necessary information.

Two of the most critical indicators of system health are the superheat and subcooling.

Superheat - Superheat is the most overlooked inefficiency in existing systems. Typically the superheat on a TEV is set when there is not product in the controlled space, if it is set at all.

When applying the controller to an existing system with a mechanical expansion valve, the superheat should be between 6-8 degrees for low temperature applications, and 8-10 degrees for medium temperature.

Subcooling - There should be a solid column of liquid at the inlet of the valve. This can be verified by looking at the sight glass, however, the proper method requires measuring the subcooling of the liquid entering the valve.

Verify Temperature Difference

A typical Temperature Difference (TD) between the coil temperature and the air temperature is between 5 and 15°F. An insufficient TD, between the coil and air temperature, indicates a system issue that needs to be addressed before installing the KE2 Adaptive Control.

Understanding Frost

The air exiting side of the evaporator is often the coldest spot on the coil. As air travels through the fins of the evaporator, the Relative Humidity will reach 100%. Moisture will begin to drop out of the air and deposit on the coil surfaces to form frost. Although frost typically has a negative connotation when discussed in refrigeration, initial frost formation has a positive effect. Some may even say "frost is our friend." It is not uncommon to see a small amount of frost on the coils that have KE2 Adaptive Control controllers installed. The KE2 Adaptive Control is continually measuring, monitoring, and managing the frost to assist in maximum energy efficiency. When the efficiency of the coil is reduced due to excessive frost, the KE2 Adaptive Control will initiate a defrost.

Trouble Shooting Diagram

Refrigerant _____

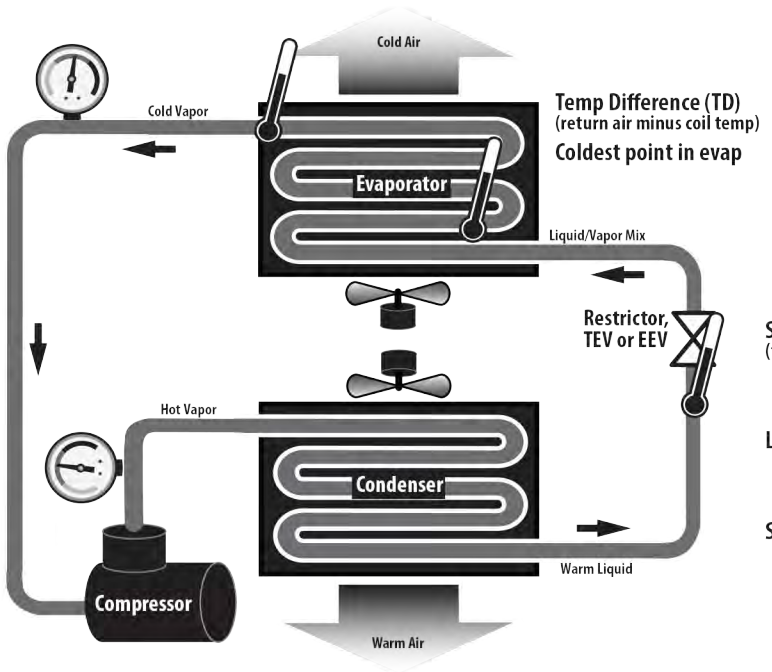
Suction Pressure _____ PSI

Suction Temp (evaporator outlet) _____ °F

Saturation Temp (calculated from Suct. Pressure) _____ °F

Superheat _____ °

Discharge Pressure _____ PSI



Temp Difference (TD) (return air minus coil temp) _____ °F

Coldest point in evap _____ °F

Saturation Temp (from receiver pressure) _____ °F

Liquid Temp at Valve _____ °F

Subcooling _____ °

AMPS _____

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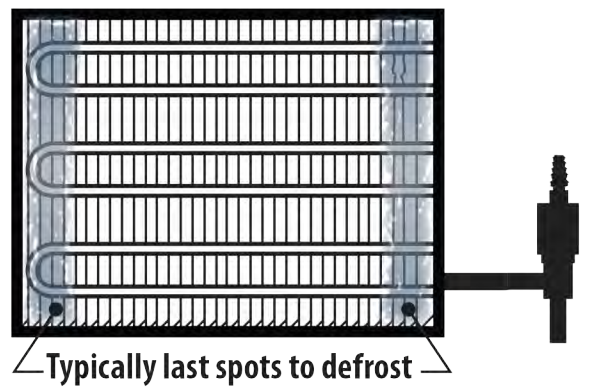
IMPORTANT Preliminary Steps
Determine the coil sensor location

A To determine the most appropriate sensor location, when arriving on site, put the system into defrost.

B The location where frost is last to disappear is where the coil sensor should be placed. Monitor both the air entering side, as well as the air exiting side, of the evaporator coil. Don't be surprised if the last place for frost to disappear is on the air exiting side. It is usually near the right or left end of the coil.

⚠ It is important to verify all heating elements are working properly.

B



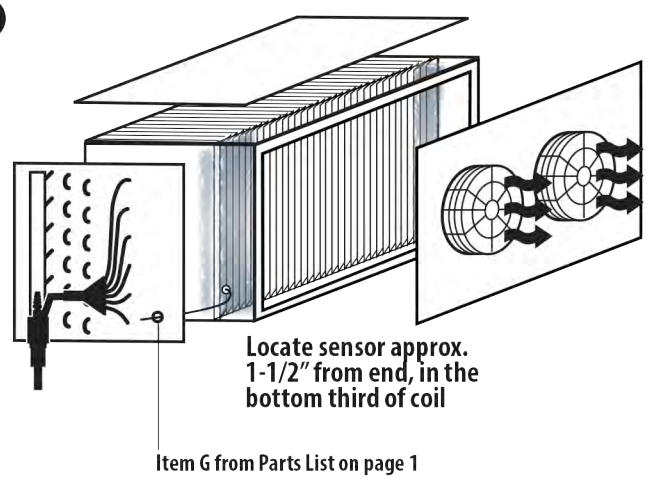
Steps to Ensure Proper Coil Sensor Location

C KE2 Therm recommends locating the coil sensor as described above. Typically the coldest spot is on the side of the suction header/expansion valve side of the evaporator. Select two places that are the last to defrost, preferably at each end of the evaporator.

More often than not on coils, the location of the sensor is a short distance from the end, approximately 1 to 1-1/2" away from the right and left edges of the active coil surface. The ice tends to grow from these edges towards the center. Therefore, the sensor location is best situated approximately 1 to 1-1/2" from the outer edges and typically near the bottom 1/3rd portion of the evaporator. The sensor needs to be as far away from the defrost heat sources as possible.

Note: Insert plug (Item G from parts list) into coil housing when mounting sensor wire to prevent damage to the sensor from sharp edges. The plug provided should be inserted into the inner housing to access the coil. Installer must puncture plug to insert sensor.

C



D **Make note of the location you have determined for placement of the coil sensors.**

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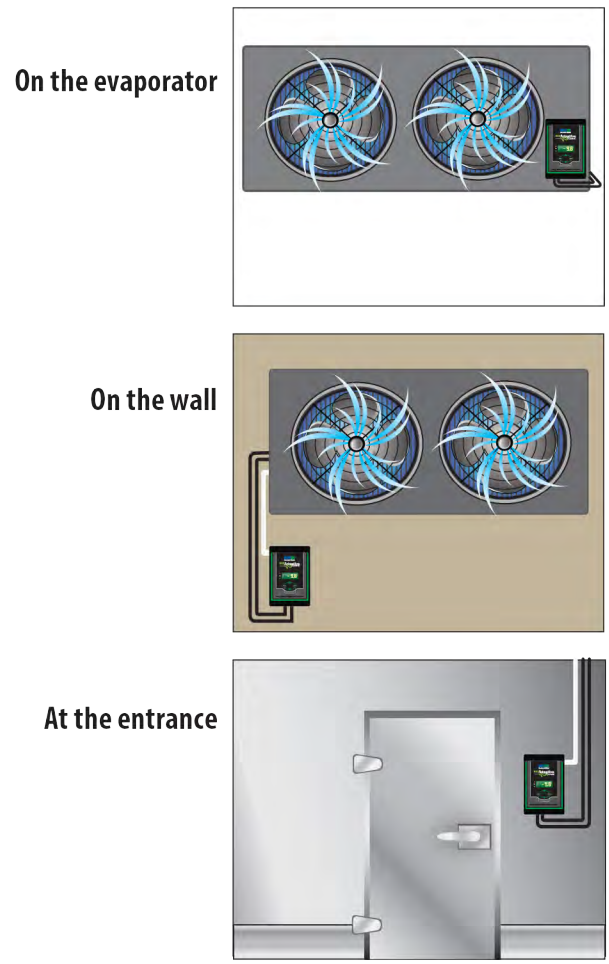
Determining Location

1

- The controller is designed to be as versatile as possible. The location should be discussed with the end users to determine if they have a preference. It is designed so it can be installed inside or outside the controlled space.
- The controller can also be located at the condenser, but should not be installed outdoors without an enclosure to protect it from sunlight and moisture (must be within operating range -40°F to 120°F)

1



2

Cut a length of conduit to go from the controller to the evaporator

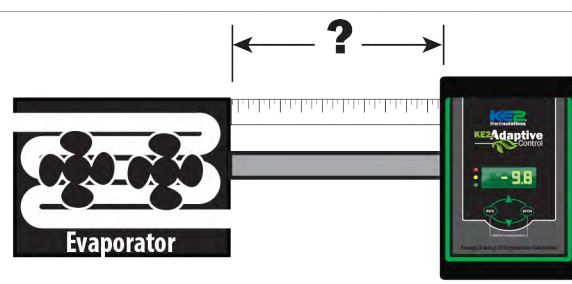
- Measure the distance between the controller and evaporator to account for the extra length necessary to properly route conduit.

Determine the number of wires to go to the controller.

- Controller power (2 wires)
- Fan control (2 wires)
- Defrost (heater) control (2 wires)
- Liquid line solenoid (2 wires)

Note: Install in accordance with local wiring codes. KE2 Therm does not accept responsibility for incorrect or unsafe wiring.

2

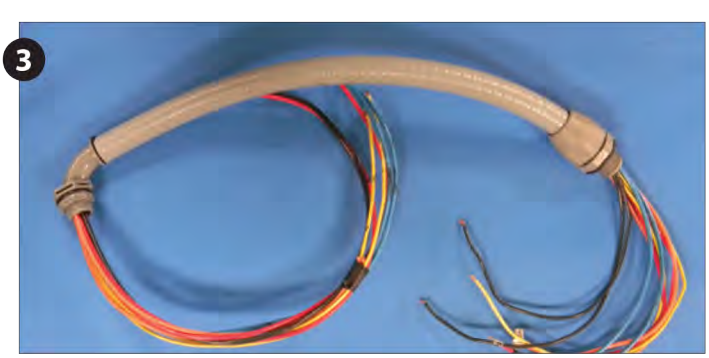


3

Cut wires to length

- Once the number of wire is determined, cut the wires to length.
- The wire should be long enough to account for the necessary connections in the controller and evaporator.
- Use the optional KE2 Wire Harness, or select different colored wires, (blue - fan, orange - heaters, yellow - solenoid, purple - alarm). This will simplify the installation and troubleshooting. If only a single color is available, both ends of the wires should be labeled with a matching number. This will save time when wiring the evaporator.

3



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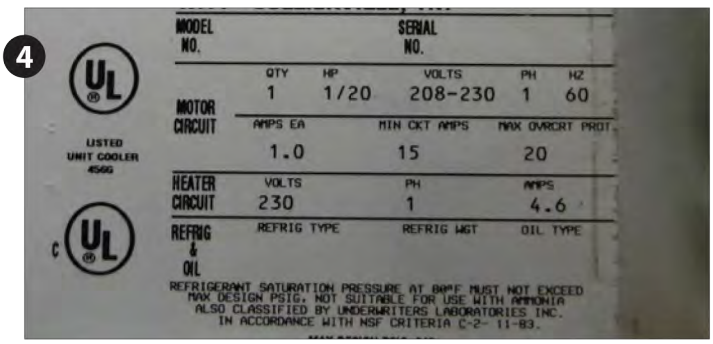
Determine the current draw of the unit.

4

- Use the nameplate to determine the Amp rating of the unit. This information should be used to select the proper sized wire. It should also be used to verify the unit does not exceed the relay rating on the KE2 Adaptive Control controller.

4

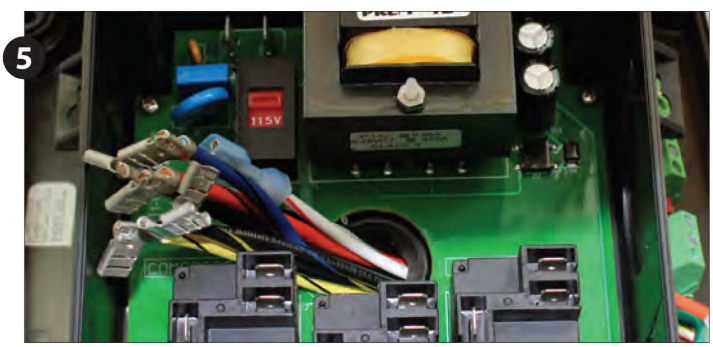


Preparing conduit

5

- Feed the wires through the conduit.
- The conduit connectors can be added at this time. Determine if a straight or 90 degree connector is most appropriate for the installation, and attach to the conduit.
- Securely connect one end of the conduit to the controller.

5



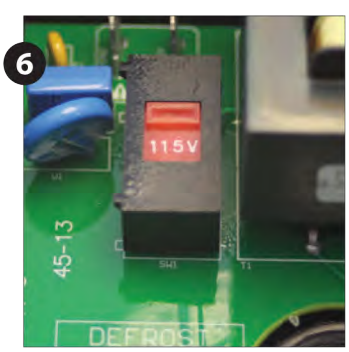
Wiring the controller

6

- Locate the Voltage Selector Switch.
- It is a 2 position switch with red indicator.
- The selected voltage will be displayed on the face of the switch.

The controller will still illuminate the display when 115V is applied with 208-240V selected, however the controller may not function properly. If 208-240V is applied with 115V selected the controller's display will cycle.

6



115V

208-240V

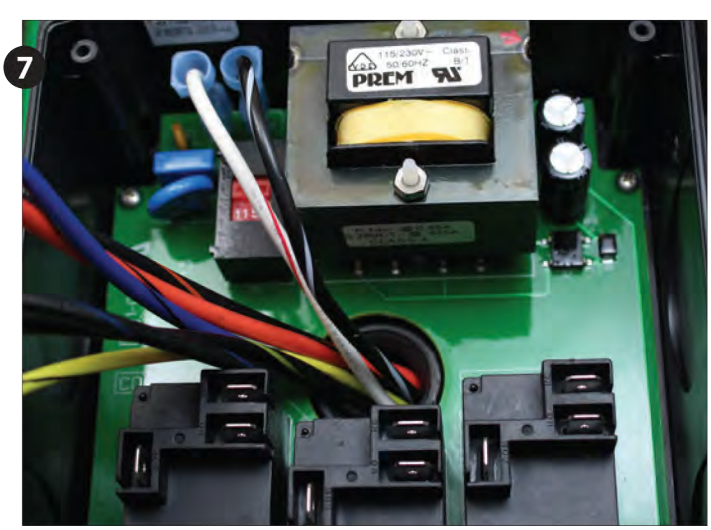
Controller Power

7

- Strip the end of the wires used to provide power to the controller (If using the KE2 Wire Harness the wires are pre-stripped)
- Crimp on female spade connectors (Item E from list on page 1)
- Plug into the board as indicated in Wiring Schematic.

Note: All terminals should be crimped to withstand 30 lb pull test.

7



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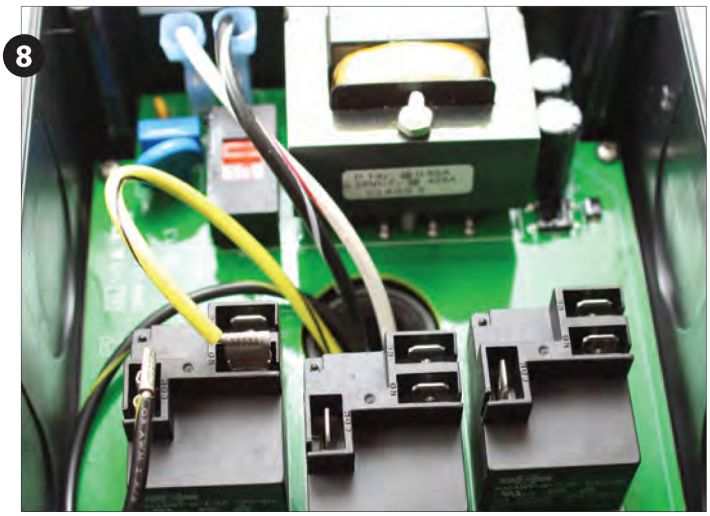
Liquid Line Solenoid /Compressor Relay

8
- Strip the end of the 2 wires used for the liquid line solenoid.
- Locate 2 90° female spade connectors in the accessories kit.
- Crimp on the female connectors.
- Plug the connectors to the COM and NO positions of the Liquid Line Solenoid /Compressor Relay

Liquid Line Solenoid (LLS)/Comp. Relay Using KE2 Wire Harness
- **The yellow wires are used for Liquid Line Solenoid control.**
- Locate a 3-position connector from the accessories kit.
- Fasten the black with yellow stripe to the fused lead.
- Fasten yellow w. black stripe from the LLS to NO terminal position.
- Plug into the location as indicated in Wiring Schematic.

⚠ Confirm compressor load is not over 30 FLA.

8



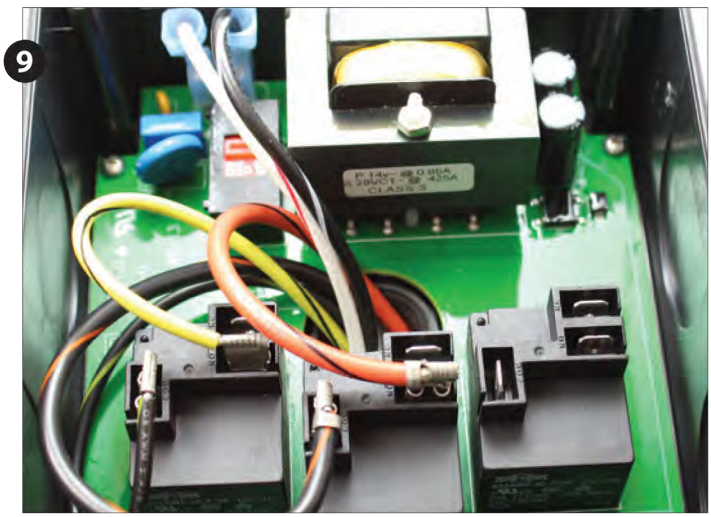
Defrost (Heater) Relay

9
- Strip the end of the 2 wires used for the defrost control.
- Locate (2) 90° female spade connectors in the accessories kit.
- Crimp on the female connectors.
- Plug the connectors to the COM and NO positions of the Defrost Relay.

Defrost (Heater) Relay Using the KE2 Wire Harness
- **The orange wires are used for the heater control.**
- Locate the orange with black stripe, and black with orange stripe.
- Plug the black with orange stripe to the COM terminal.
- Plug the orange w. black stripe to the NO position of Defrost Relay.

⚠ Confirm combined heater load is not over 30 amps.

9



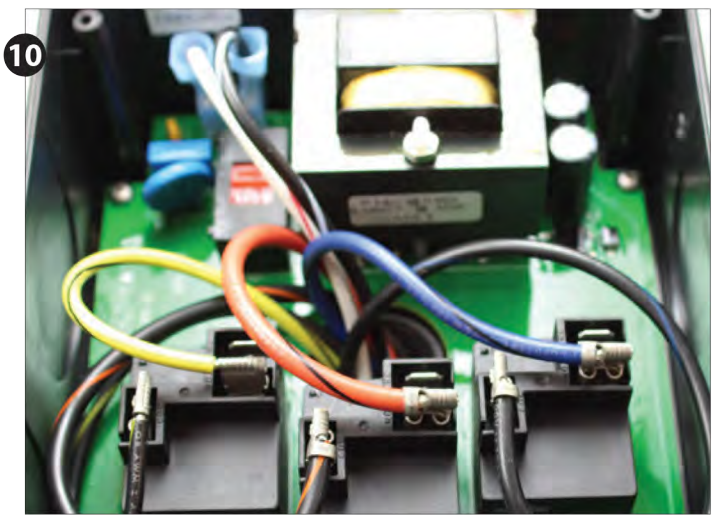
Fan Relay

10
- Strip the end of the 2 wires used for fan control.
- Locate 2 90° female spade connectors in the accessories kit.
- Crimp on the female spade connectors.
- Plug the connectors to the COM and NO positions of the Fan Relay.

Fan Relay Using the KE2 Wire Harness
- **The blue wires are used for fan control.**
- They are blue with a black stripe, and the black with a blue stripe.
- Plug the black with a blue stripe to the COM terminal.
- Plug the blue with a black stripe to the NO position of the Fan Relay

⚠ Confirm combined fan motor load is not over 30 FLA.

10



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Install Safety cover

11
- Once all of the high voltage wiring is complete, install the plastic cover on the controller.
- Locate the cover and 3 small screws from the accessories kit.
- Position the cover over the 3 mounting posts.
- Using the 3 small coursely threaded screws attach the controller to the plastic posts.

11

Connecting sensor wires to controller

- The temperature sensors are designed to be attached to the controller using 2 position screw terminals. The terminals are located on the controller's lid, on the bottom side of the display.
- Connect all sensors to the appropriate locations, which can be determined from the label on the circuit board or from the Wiring Schematic.
- The sensors are not polarized, so wire location does not effect sensor performance.

Set the controller in a safe place.

Preparing the Evaporator

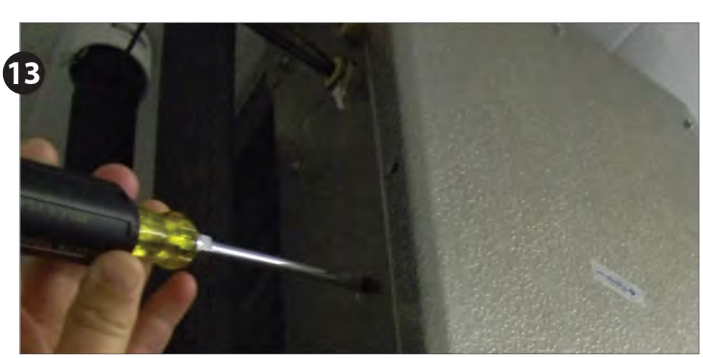
12
- The evaporator wiring will require access to the high voltage terminal block on the coil.
- Turn off power to the system.
- Verify power is no longer present using a multimeter.

12

Evaporator wiring

13
- Now that the conduit is prepared, it can be connected to the evaporator.
- Locate the proper sized knockout and carefully remove knockout.
- Connect conduit to the evaporator

13



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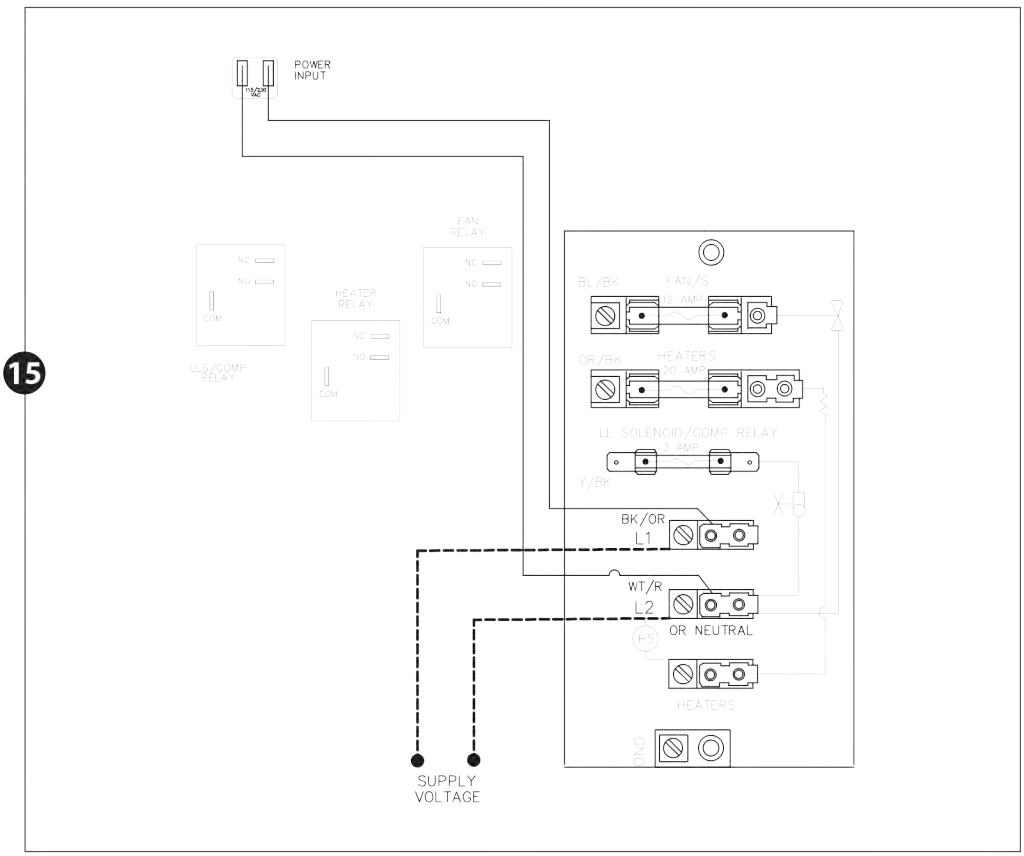
Existing wiring.

14
- Start by removing all of the existing wires from the terminal strip.
- Determine the location of the following: incoming power, fan leads, heater leads, defrost termination leads, and fan delay leads.

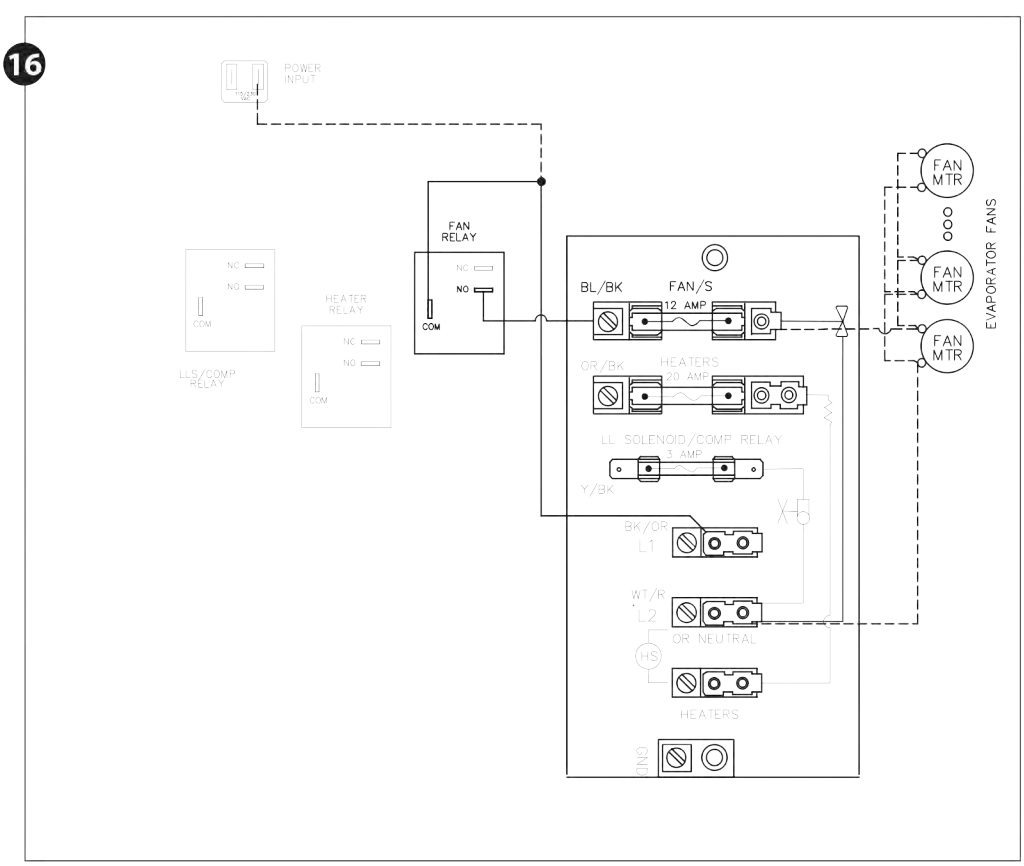
Evaporator wiring – Controller

15
- Strip the end of the wires used to power the controller.
- Attach to the line power to provide continuous power to the controller.



Evaporator wiring – Fans

16
- Strip the ends of the wires (connected to the KE2 Adaptive Control) used to control the evaporator fans.
- The fan wires from the controller can be attached to the terminal block using either screw down terminals or spade connectors.
- Attach the **black wire with blue stripes to the L1/Line.** This wire will be connected to COM of fan relay on the controller.
- Attach **blue wire with black stripes to the NO terminal** on the Fan Relay to one set of the fan leads. This wire will be connected to the NO of the fan relay on the controller.
- Connect L2/Neutral to remaining fan leads.



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Evaporator wiring – Heater

17

- Strip the ends of the wires being used for heater control.
- The heater wires can be attached to the terminal block using either screw down terminals or spade connectors.

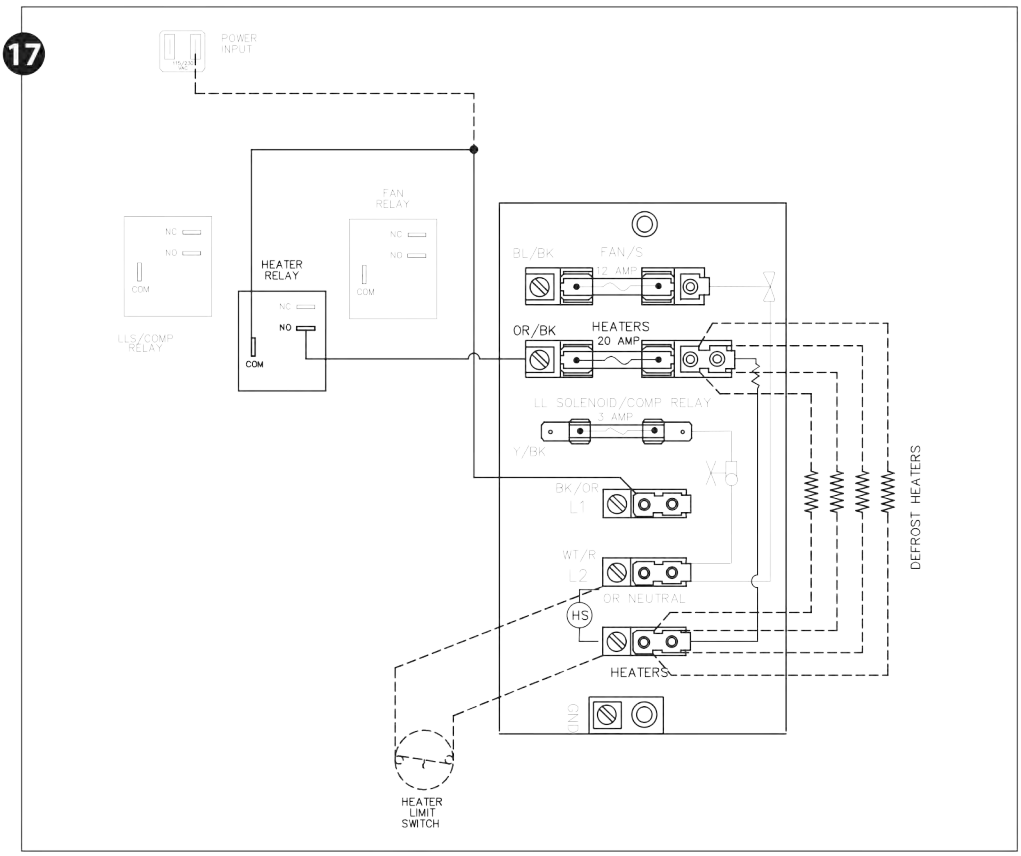
Remove defrost termination (Klixon®) from circuitry

18

- Attach the **black wire with orange stripe to the L1/Line.** This wire will be connected to COM of defrost relay on the controller.
- Attach the **orange wire with the black stripe to the NO terminal** on the Defrost Relay to one of each of the defrost leads.
- Connect L2/Neutral to the remaining defrost leads.

⚠ The defrost safety should not be removed from the circuit. Its purpose is to prevent the heaters from over heating and causing damage.

17



Evaporator wiring – Liquid Line Solenoid /Compressor

19

- Strip the ends selected to control the liquid line solenoid.
- Attach the **black wire with the yellow stripe to the L1.** This wire will be connected to the COM of the L.L. Solenoid/Compressor.
- Attach the **yellow wire with black stripe connects to the NO terminal** on the L.L. Solenoid/Compressor relay to a solenoid lead
- Connect L2/Neutral to the remaining L.L. Solenoid/Compressor lead.

19

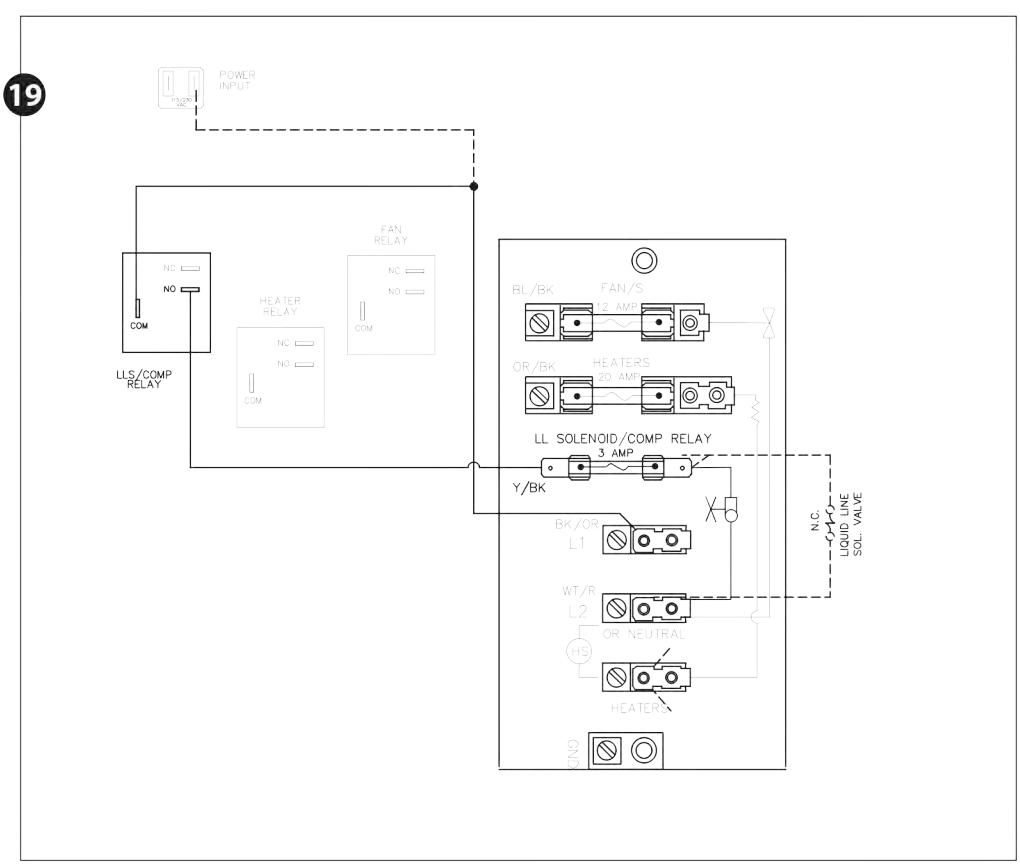


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Figure 8 - Wiring Schematic - Ladder Diagram

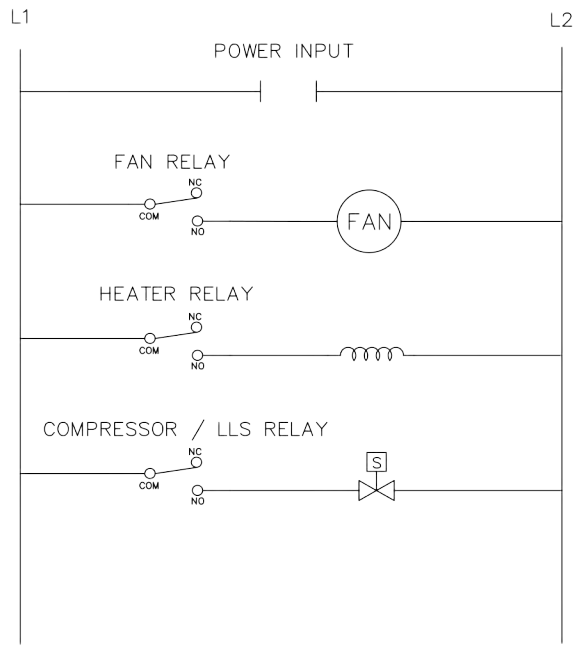
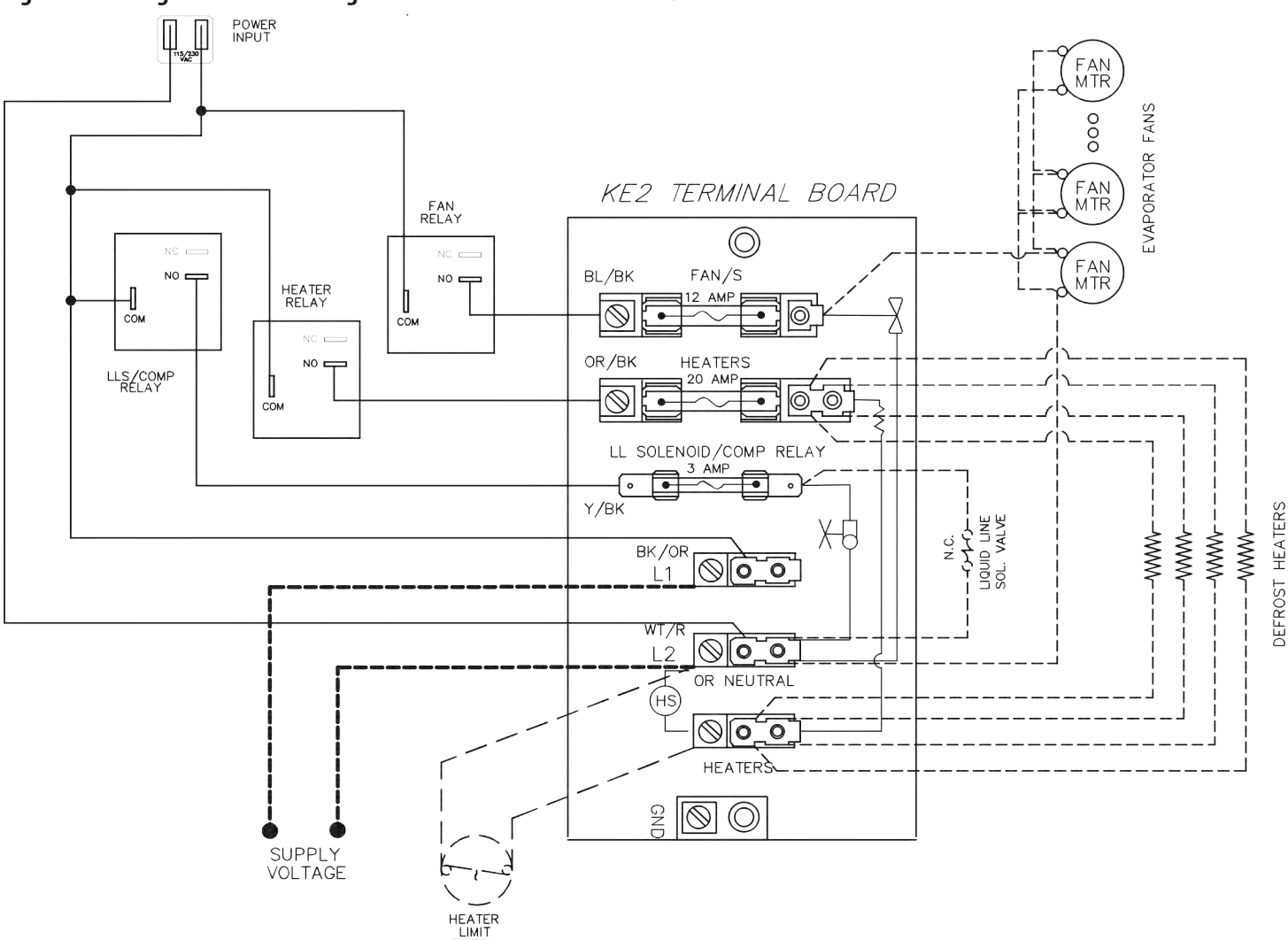


Figure 8 - Wiring Schematic - Using KE2 Terminal Board



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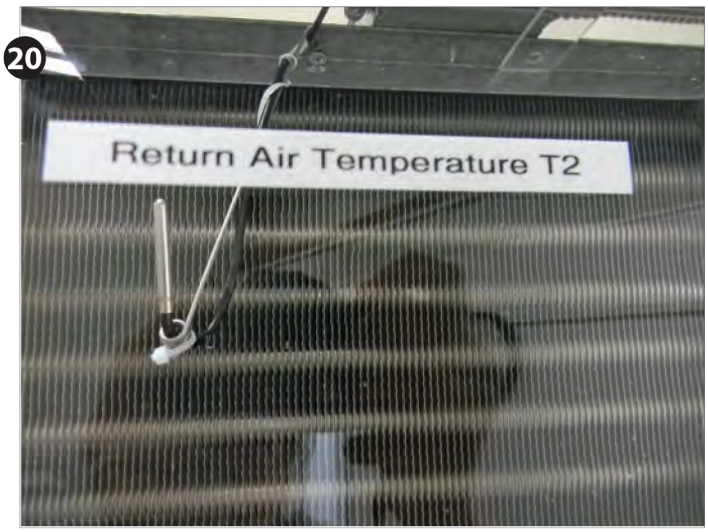
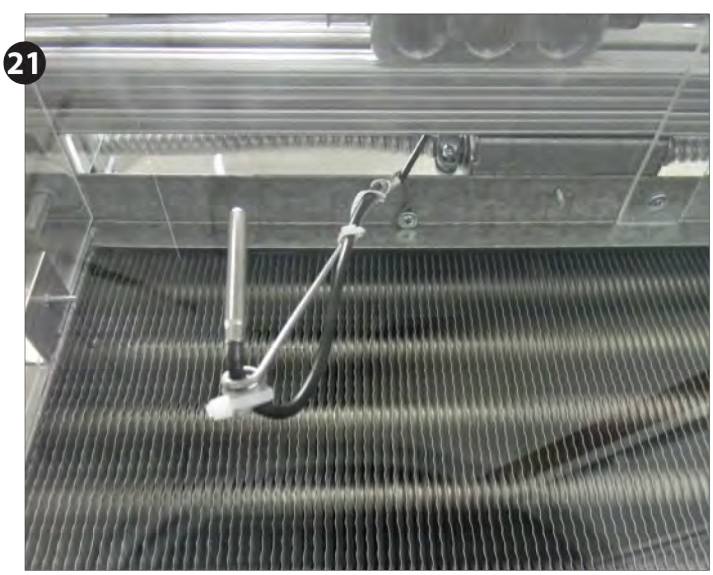
Installing the sensors

20 ■ Although not required, sensors should be labeled with their function. This will eliminate confusion when connecting the sensors to the controller.



Air Sensor Bracket

21 ■ Install the Air Temperature Sensor using the Stainless Steel self-piercing screw and bracket from the accessory kit.
■ The end with the single loop is designed to be mounted with the screw included.
■ The end with multiple loops is designed to hold the sensor.
■ Locate the best place to install the sensor.
■ The sensor should be located between 6 and 12 inches away from the face of the evaporator. This distance prevents the sensor from sensing heat from the heating elements during the defrost cycle, but close enough to accurately sense the return air temperature.
■ The sensor bracket may be bent as necessary to locate the sensor in the proper position.



WARNING!
Do not allow the metal portion of the air sensor to touch anything other than air. It should not touch the bracket, nylon cable tie, or any other solid surface.

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Coil Sensor

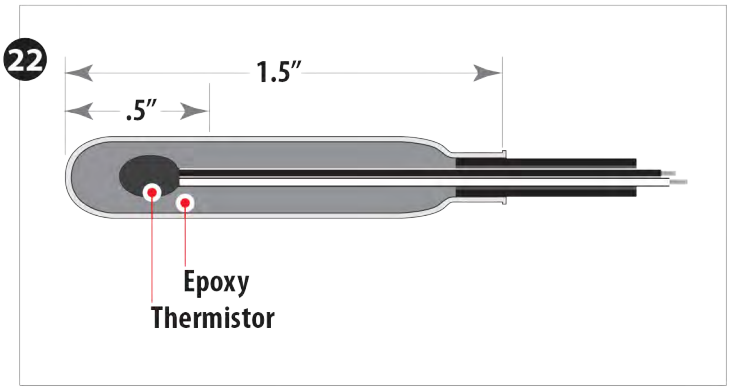
- **The coil sensor location is of the utmost importance for the proper operation of the controller. It is essential that the sensor is in the coldest location on the coil at the end of the defrost cycle, to ensure a complete defrost. See preliminary steps A-D on page 3 to determine the coldest location on the coil.**

Once you have determined the proper sensor location as described in preliminary steps A-D on page 3, the sensor can be installed.

Installing the Sensor Properly

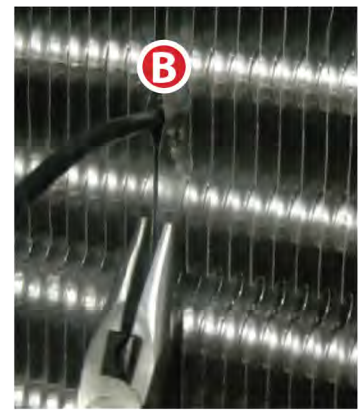
22 Note, the most active portion of the sensor is the first 1/2″ of the 1-1/2″ long stainless steel probe. Figures 23 and 24 show two methods for installing the sensor in the coil. The method shown in 23 will work in most applications, however in some cases inserting the sensor into the coil may position it too close to the defrost heat source. In these instances, the method shown in Figure 24 can be used.

22



23 **Figure 23A** shows the sensor touching two circuit tubes. When inserting the sensor into the coil, the tip should touch one of the circuit tubes. It should not be located adjacent to the electric heating elements. It should be about half the distance between the heaters if possible. In **Figure 23B** the probe is inserted into the fins approximately 1/16″ deeper than the stainless shielding. Pinch the fins gently together, securing the sensor in place. This provides thermal ballast to ensure a complete defrost.

23



24 **Alternate method -** As the defrost termination sensor, it is important to ensure the sensor does not terminate defrost before all frost has been removed from the coil. In some installations, inserting the sensor into the coil may position it too close to the defrost heat source. An alternate method of positioning places the sensor vertically between the coil fins. This shows the coil sensor properly secured.

24

Extending sensor wires

- After the sensors are mounted, they are routed back to the controller. If the wires must be extended, use 18 gauge twisted shielded pair. Maximum length for 18 gauge: 100ft.
- When running the wires back to the controller care must be taken to avoid interference being introduced into the sensor wires. Interference can be introduced when sensor wires are located near high voltage lines. High voltage is defined by Underwriter's Laboratories as above 30V. The higher voltage the more likely it is to introduce interference, and the more important to avoid.
- If crossing a high voltage line is necessary, the sensor wiring should be run at right angles to prevent noise.

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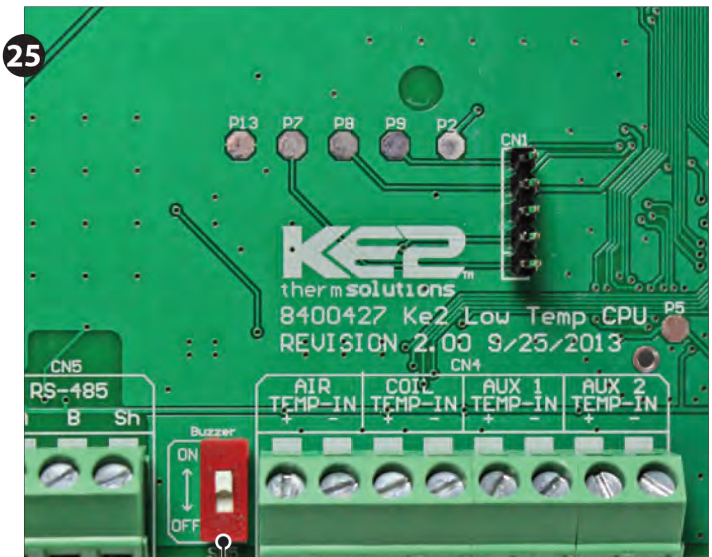
Setting the dip switch to activate on board buzzer

25
- To disable the audible alarm buzzer feature of the KE2 Adaptive Control the dip switch must be switched to OFF (default from the factory is ON)
- The red dip switch is located at the bottom of the controller, and is equipped with a switch that indicates ON or OFF.
- By selecting OFF, the buzzer will be in an inactive state, and will not sound when any type of alarm occurs.

25



Buzzer dip switch

Controller Mounting

26
- Locate the 4 stainless steel screws in the accessories kit
- Install the 4 screws
- Place the controller on the mounting screws and tighten down the screws.

26

Final Step

27
- Leave these installation instructions onsite in a convenient location, where it can be easily located, for future service.

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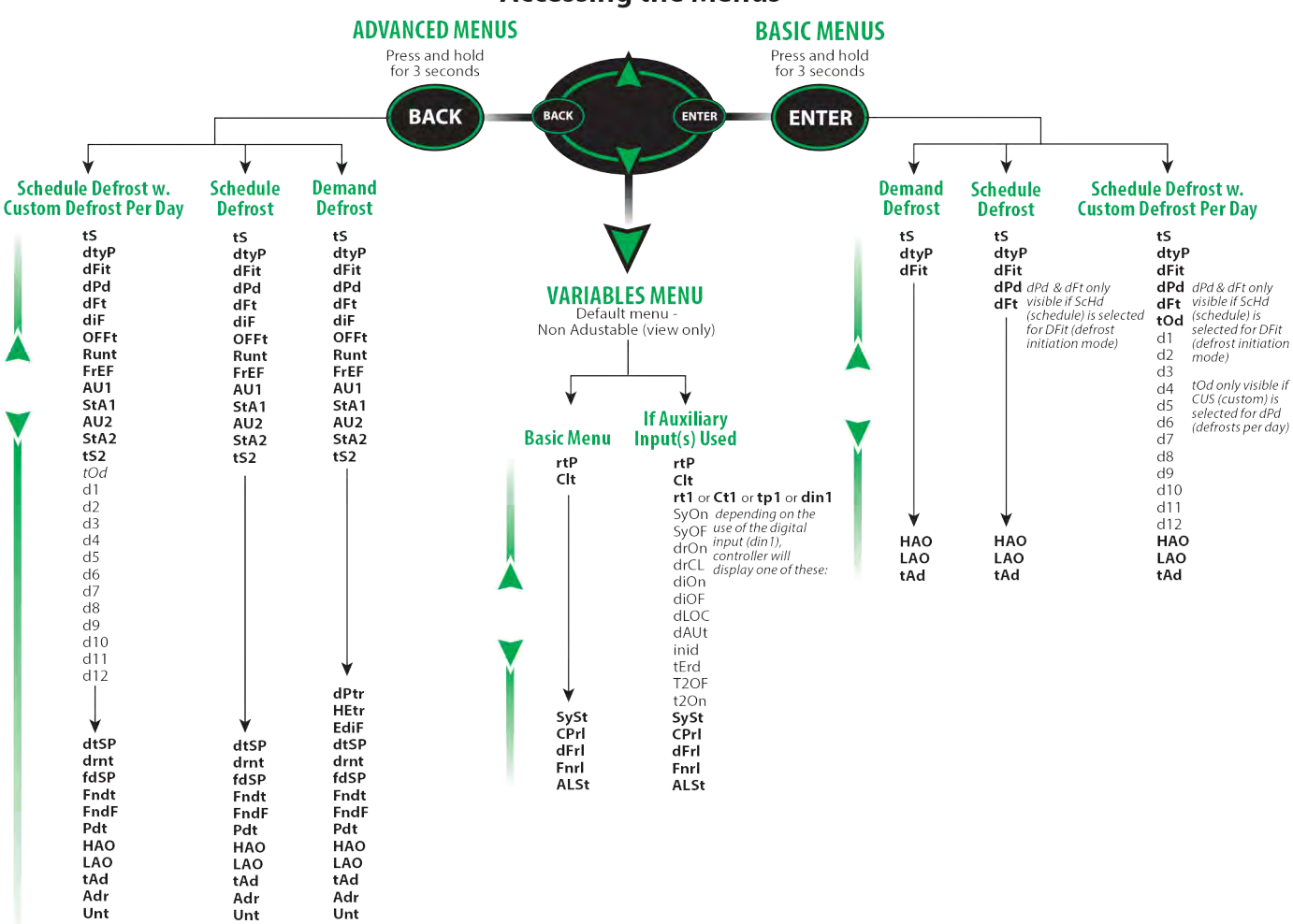
Controller Navigation - Menu Structure

Indicator lights

- **Red light** - Basic Menu - not used
- **Yellow light** - non-critical alarm (system running)
- **Green light** - compressor on
- **Green flashing** - compressor waiting on timer to start/stop

- **Access Setpoint mode by pressing and holding the ENTER button until tS (temperature setpoint) displays on the screen**
- **Use the ▲ up and ▼ down arrows to scroll through the available setpoints.**
- **Press ENTER to view the current setting.**
- **Use the ▲ up and ▼ to change the setpoint**
  Press ENTER to move between the digits to accelerate the changes.
- **Press ENTER and hold to confirm each setpoint change**
- **Press BACK to escape.**

Accessing the Menus



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Specifications

Controller					
Input Voltage:		120V / 208-240V			
Storage Temp:		-40° to 120°F (-40° to 49°C)			
Operating Temp:		-40° to 120°F (-40° to 49°C)			
Display:		4 digit 7-segment LED			
IP Rating:		IP65			
Inputs (4):		3 colored 15' temp sensors (KE2 SKU 21151)			
		2 dual purpose temperature or digital inputs			
Outputs: (3) Relays Single Pole Double Throw		**Normally Open**		**Normally Closed**	
		120V	**240V**	**120V**	**240V**
	FLA	30A	30A	N/A	12A
	LRA	98A	80A	N/A	24A
	Resistive	N/A	30A	N/A	30A
	Horsepower	1 hp	2 hp	1/4 hp	1/2 hp
	Pilot Duty	800VA	720VA	290VA	360VA
Communication:		RS-485 (Modbus)			
Temperature Sensor					
Sensor Specs:		-60° to 150°F (-51°C to 66°C) moisture resistant package			

User Interface
The KE2 Adaptive Control's onboard user interface uses the familiar 4- button arrangement to simplify navigation through the controller's menus.
To provide the most pleasant user experience, the menu structure has been split into 2 groups: Basic and Advanced.

Basic Menu
For the majority of users, the Basic menu will provide the necessary parameters to setup the controller.

The Table – Basic Menu provides a listing of the abbreviations for the controller.

Advanced Menu
Some users will require more complex configurations to achieve the desired product performance. These more in depth applications require additional parameters found under the Advanced Menu.

Due to the vast number of potential configurations, users must investigate the proper setup independently of these instructions.

The Table – Advanced Menu provides a listing of the abbreviations and descriptions of available options. For a more in depth description of each parameter contact your KE2 Therm Sales Engineer.

Navigating Setpoints
To move between the setpoint displayed and its associated value, requires a momentary press of the Enter button. To return to the value press the BACK button.

Manual Defrost
To enter Manual Defrost mode, press and hold the BACK and the ENTER buttons simultaneously for three seconds. dEFr will appear on the display.

Changing Setpoints
When the parameter value is displayed it may be changed by using the Up, Down, and ENTER buttons.

The Up and down buttons will increase or decrease numerical values and scroll through the available options on the non-numerical options.

Pressing and holding the ENTER button for 3 seconds will save the displayed value.

To abort changes pressing the BACK button will return the parameter abbreviation.

Advanced Defrost Heater Management:
The KE2 Adaptive Control incorporates heater management to reduce fogging associated with excessive defrost heat when applied in demand defrost mode.

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Table 3 - Controller Menus and Menu Parameters

Alarms Non Adjustable (view only)

When the KE2 Adaptive Control is in alarm, it notifies the user by illuminating the amber LED, and displaying the appropriate Alarm Code:

Alarm Code	Alarm Name	Description
nOAL	No Alarm	
AtSA	Air Sensor	Return air temperature sensor is shorted or open
CLSA	Coil Sensor	Coil temperature sensor is shorted or open
AU1A	Auxiliary Input 1 Alarm	Auxiliary temperature sensor is shorted or open
AU2A	Auxiliary Input 2 Alarm	Auxiliary temperature sensor is shorted or open
HtA	High Temperature Alarm	Temperature is above temperature setpoint (tS) + temperature differential (diF) + high temp alarm offset (HAO) for longer than temperature alarm delay (tAd)
LtA	Low Temperature Alarm	Temperature is below temperature setpoint (tS) - low temp alarm offset (LAO) for longer than temperature alarm delay (tAd)
dOOr	Door Open	If door is open and room temperature is 5 degrees above temperature setpoint (tS) + temperature differential (diF) and input stays active for 90 minutes, ignores temperature alarm delay (tAd)
dttA	Defrost Term on Time	Defrost terminated on time instead of temperature for two consecutive cycles
ECdF	Excessive Defrost	Controller has performed 11 consecutive defrost cycles without terminating on temperature
PF	Power Failure	Indicates power has been off and just turned on (only when dPd = CUS)

Setpoints - Basic Menu

Setpoints - Basic Menu DEMAND DEFROST	Setpoints - Basic Menu SCHEDULE DEFROST	Setpoints - Basic Menu SCHEDULE DEFROST w. CUSTOM DEFROST PER DAY	Description	Minimum	Default	Maximum
tS	**tS**	**tS**	Temperature Setpoint	-50°F	0°F	100°F
dtyP	**dtyP**	**dtyP**	Type of Defrost, Air or Electric	Air	ELEc	ELEc
dFit	**dFit**	**dFit**	Defrost Initiation Mode	dEnd	dEnd	ScHd, FSCH
↓	**dPd**	**dPd**	Number of Defrost Per Day	0	4	12, CUS
↓	**dFt**	**dFt**	Defrost Time	0	45 min	720 min
↓	↓	**tOd**	Time of day	0:00	12:00	23:59
↓	↓	**d1**	Start time of Defrost #1	0:00, diS	diS	23:59
↓	↓	**d2**	Start time of Defrost #2	0:00, diS	diS	23:59
↓	↓	**d3**	Start time of Defrost #3	0:00, diS	diS	23:59
↓	↓	**d4**	Start time of Defrost #4	0:00, diS	diS	23:59
↓	↓	**d5**	Start time of Defrost #5	0:00, diS	diS	23:59
↓	↓	**d6**	Start time of Defrost #6	0:00, diS	diS	23:59
↓	↓	**d7**	Start time of Defrost #7	0:00, diS	diS	23:59
↓	↓	**d8**	Start time of Defrost #8	0:00, diS	diS	23:59
↓	↓	**d9**	Start time of Defrost #9	0:00, diS	diS	23:59
↓	↓	**d10**	Start time of Defrost #10	0:00, diS	diS	23:59
↓	↓	**d11**	Start time of Defrost #11	0:00, diS	diS	23:59
↓	↓	**d12**	Start time of Defrost #12	0:00, diS	diS	23:59
HAO	**HAO**	**HAO**	High Alarm Offset	0°	10°if tS < 32°; 3 if ts > 32°	50°
LAO	**LAO**	**LAO**	Low Alarm Offset	0°	4°	10°
tAd	**tAd**	**tAd**	High and Low Temp Alarm Delay	1 min	60 min	180 min

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Setpoints - Advanced Menu

Setpoints - Advanced Menu DEMAND DEFROST	Setpoints - Advanced Menu SCHEDULE DEFROST	Setpoints - Advanced Menu SCHEDULE DEFROST w. CUSTOM DEFROST PER DAY	Description	Minimum	Default	Maximum
tS	tS	tS	Temperature Setpoint	-50°F	0°F	100°F
dtyP	dtyP	dtyP	Type of Defrost, Air or Electric	Air	ELEc	ELEc
dFit	dFit	dFit	Defrost Initiation Mode	dEnd	dEnd	ScHd
↓	dPd	dPd	Defrost Per Day	0	4	12, CUS
	dFt	dFt	Defrost Time	0 min	45 min	720 min
diF	diF	diF	Temperature Differential	1°	1°	30°
OFFt	OFFt	OFFt	Minimum Compressor Offtime	0 min	5 min	10 min
rUnt	rUnt	rUnt	Minimum Compressor Runtime	0 min	2 min	10 min
FrEF	FrEF	FrEF	Fan mode during refrigeration mode - ti24, OnCP, PErn	PErn	OnCP	ti24
AU1	AU1	AU1	Type of 1st Auxiliary input -diS, COiL, rtP,SyOf, dOOr, t2nd, trdF, indF, dFin, dFLO		COiL	
StA1	StA1	StA1	Digital input active state for 1st Aux input	OPEn	SHrt	SHrt
AU2	AU2	AU2	Type of 2nd Auxiliary input -diS, COiL, rtP,SyOf, dOOr, t2nd, trdF, indF, dFin, dFLO		diS	
StA2	StA2	StA2	Digital input active state for 2nd Aux input	OPEn	SHrt	SHrt
tS2	tS2	tS2	2nd room temp setpoint	-50	-50	100
↓	↓	tOd	Time of day	0:00	12:00	23:59, diS
		d1	Start time of Defrost #1	0:00	diS	23:59, diS
		d2	Start time of Defrost #2	0:00	diS	23:59, diS
		d3	Start time of Defrost #3	0:00	diS	23:59, diS
		d4	Start time of Defrost #4	0:00	diS	23:59, diS
		d5	Start time of Defrost #5	0:00	diS	23:59, diS
		d6	Start time of Defrost #6	0:00	diS	23:59, diS
		d7	Start time of Defrost #7	0:00	diS	23:59, diS
		d8	Start time of Defrost #8	0:00	diS	23:59, diS
		d9	Start time of Defrost #9	0:00	diS	23:59, diS
		d10	Start time of Defrost #10	0:00	diS	23:59, diS
		d11	Start time of Defrost #11	0:00	diS	23:59, diS
		d12	Start time of Defrost #12	0:00	diS	23:59, diS
dPtr		↓	Defrost Parameter	0	30 if ELEc 40 if Air	90
HEtr			Heater Mode - Permanent or Pulse	Pern	PuLS if ELEc Pern if Air	PuLS
EdiF			Extreme Differential	0	20	200
dtSP	dtSP	dtSP	Defrost Term Temperature Setpoint	35°F	50°F if ELEc 40°F if Air	90°F if ELEc 89.9°F if Air
drnt	drnt	drnt	Drain Time	0 min	2 min	15 min
FdSP	FdSP	FdSP	Fan delay temp	-40°F	20°F if Elec 35°F if Air	35°F
Fndt	Fndt	Fndt	Max fan delay time	0 min	2 min	20 min
FndF	FndF	FndF	Fan State During Defrost	OFF	OFF if Elec; On if Air	On
Pdt	Pdt	Pdt	Defrost pump down time	0 min	0 min	10 min
HAO	HAO	HAO	High Alarm Offset	0°	10° if tS <32 3° if tS >32	50°
LAO	LAO	LAO	Low Alarm Offset	1°	4°	10°
tAd	tAd	tAd	Temp Alarm Delay	1 min	60 min	180 min
Adr	Adr	Adr	Modbus address	1	1	247
Unt	Unt	Unt	Temp units FAH or CEL	FAH	FAH	CEL
CLAL	CLAL	CLAL	Not a setpoint, press "Enter" and hold until display changes. All Alarms Cleared			

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Variables Menu Non Adjustable (view only)

	Parameter Name	Status Displayed on Controller
	rtP	Room temperature
	Clt	Coil temperature
Only visible if **AU1** is used	**rt1** or **Ct1** or **tp1** or **din1**	**rt1** = room temperature is displayed ; **Ct1** = coil temperature is displayed; **tp1** = monitor temperature only; **din1** = digital input 1(depending on the use of the digital input will display: **SyOn** (system on), **SyOF** (system off), **drOn** (door open), **drCL** (door closed), **diOn** (defrost interlock on), **diOF** (defrost interlock off), **dLOC** (defrost lockout), **dAUt** (defrost auto), **inid** (initiate defrost), **tErd** (terminate defrost), **t2OF** (use main air setpoint), **t2On** (use second air setpoint)
Only visible if **AU2** is used	**rt2** or **Ct2** or **tp2** or **din2**	**rt2** = room temperature is displayed ; **Ct2** = coil temperature is displayed; **tp2** = monitor temperature only; **din2** = digital input 2(depending on the use of the digital input will display: **SyOn** (system on), **SyOF** (system off), **drOn** (door open), **drCL** (door closed), **diOn** (defrost interlock on), **diOF** (defrost interlock off), **dLOC** (defrost lockout), **dAUt** (defrost auto), **inid** (initiate defrost), **tErd** (terminate defrost), **t2OF** (use main air setpoint), **t2On** (use second air setpoint)
	SySt	System state - **dEFr** (defrost), **drAn** (drain), **FndL** (fan delay), **rEFr** (refrigerate), **OFF** (system off)
	CPrl	Compressor relay
	dFrl	Defrost relay
	Fnrl	Fan relay
	ALSt	Alarm state: **noAL** (no alarm), **AtSA** (air sensor), **CLSA** (coil sensor), **AU1A** (aux input 1 alarm), **AU2A** (aux input 2 alarm), **HtA** (high temp alarm), **LtA** (low temp alarm), **dOOr** (door open), **dtta** (defrost term on time), **ECdF** (excessive defrost), **PF** (power failure)

Abbreviations - Alphabetical Listing

Abbreviation	Name	Type	Description
Adr	Modbus Address	Setpoint	Controller's address for communications
Air	Air Defrost	Setpoint	Air Defrost option
ALSt	Alarm State	Variable	Pressing ENTER from ALSt will show alarm menu
AtSA	Air Sensor Alarm	Alarm	Displays when air sensor is shorted or open
AU1	Type of 1st Auxiliary input	Setpoint	diS, SYOF, dOOr, t2nd, dFin, dFLo, indF, trdF, COiL, rtP
AU1A	Auxiliary Input 1 Alarm	Alarm	Displays if type of 1st Auxiliary input (AU1) is set to coil (COiL) or room temp (t2nd) and sensor is shorted or open
AU2	Type of 2nd Auxiliary input	Setpoint	diS, SYOF, dOOr, t2nd, dFin, dFLo, indF, trdF, COiL, rtP
AU2A	Auxiliary Input 2 Alarm	Alarm	Displays if type of 2nd Auxiliary input (AU2) is set to coil (COiL) or room temp (t2nd) and sensor is shorted or open
CEL	Celsius	Setpoint	Option for temperature units
CLAL	Clear Alarms	Setpoint	Clears all alarms
CLSA	Coil Sensor Alarm	Alarm	Displays when coil sensor is shorted or open
CLt	Coil Temp	Variable	Temperature of the coil
COiL	Coil	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2)t - input is to be used as an additional Coil Temperature for defrost termination and fan delay termination
CPrL	Compressor Relay	Variable	Status of whether compressor relay is energized or de-energized
CSH	Compressor Starts/Hour	Setpoint	Maximum number of compressor starts per hour
Ct1	Coil Temperature 1	Variable	Coil temperature if AU1 (1st Auxiliary input) is set to Ct1
Ct2	Coil Temperature 2	Variable	Coil temperature if AU2 (2nd Auxiliary input) is set to Ct2
CUSt	Custom	Setpoint	Option under defrosts per day (dPd)
d1	Defrost #1	Setpoint	Start time of Defrost #1 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d2	Defrost #2	Setpoint	Start time of Defrost #2 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d3	Defrost #3	Setpoint	Start time of Defrost #3 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d4	Defrost #4	Setpoint	Start time of Defrost #4 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d5	Defrost #5	Setpoint	Start time of Defrost #5 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d6	Defrost #6	Setpoint	Start time of Defrost #6 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d7	Defrost #7	Setpoint	Start time of Defrost #7 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d8	Defrost #8	Setpoint	Start time of Defrost #8 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d9	Defrost #9	Setpoint	Start time of Defrost #9 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d10	Defrost #10	Setpoint	Start time of Defrost #10 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d11	Defrost #11	Setpoint	Start time of Defrost #11 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
d12	Defrost #12	Setpoint	Start time of Defrost #12 when in defrosts per day (dPd) is custom (CUSt); based on 24-hour clock
dAUt	Defrost Auto	Variable	Defrost is in Automatic mode, i.e. normal operation
dEFr	Defrost	System State	Displays when system is in defrost mode
dEnd	Demand Defrost	Setpoint	Choice for Defrost Initiation Mode (dFit)
dFin	Defrost Interlock	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - digital input that immediately turns off defrost heaters
dFit	Defrost Inititation Mode	Setpoint	Selects defrost mode - Demand Defrost (DEnd) or Schedule (ScHd)
dFLo	Defrost Lockout	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - digital input that prevents controller from going into defrost mode
dFt	Defrost Time	Setpoint	Maximum time system is allowed in defrost
dFrL	Defrost Relay	Variable	Status of whether defrost relay is energized or de-energized
diF	Differential	Setpoint	Number of degrees air temp must be above room temp setpoint (tS) to return system to refrigeration mode
din1	Digital Input 1	Variable	1st Auxiliary input (AU1) is configured as one of the digital input options
din2	Digital Input 2	Variable	2nd Auxiliary input (AU2) is configured as one of the digital input options
diOn	Defrost Inertock On	Variable	In variables menu, display when 1st or 2nd Auxiliary input (AU1 or AU2) set to dFin (Defrost Interlock) and is active
diOF	Defrost Interlock Off	Variable	In variables menu, display when 1st or 2nd Auxiliary input (AU1 or AU2) set to dFin (Defrost Interlock) and is inactive
diS	Disabled	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2)- input is not in use

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dLOc	Defrost Lockout	Variable	In variables menu, display when1st or 2nd Auxiliary input (AU1 or AU2)set to Defrost Lockout (dFLO) and is active
dOOr	Door Open Alarm	Alarm	If door is open and room temperature is 5 degrees above temperature setpoint (tS) + temperature differential (diF) and input stays active for 90 minutes, ignores temperature alarm delay (tAd)
	Door Input	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - is used to determine if the door is open or closed
dPd	Defrost Per Day	Setpoint	Number of defrosts per day 0-12, Custom (CUS)
dPTR	Defrost parameter	Setpoint	If Defrost Initiation mode (dFit) = Demand Defrost (dEnd); Coefficient to KE2 Defrost algorithm
drAn	Drain	System State	Displays when system is in drain mode
drCL	Door Closed	Variable	In Variables menu, display when AU1 and AU2 set to dOOr and is inactive
drOn	Door Open	Variable	In Variables menu, display when AU1 and AU2 set to dOOr and is active
drnt	Drain Time	Setpoint	Amount of time in drain mode
dtSP	Defrost Term Temperature Setpoint	Setpoint	Coil temperature reaches defrost term temperature setpoint to terminate defrost
dttA	Defrost Termination on Time	Alarm	Defrost terminated on time instead of temperature for two consecutive cycles
dtyP	Type of Defrost	Setpoint	Air or Electric
ECdF	Excessive Defrost	Alarm	Controller has performed 11 consecutive defrost cycles without terminating on temperature
EdiF	Extreme Differential	Setpoint	ADVANCED TOPIC: Contact KE2 Therm for assistance
ELEC	Electric	Setpoint	Defrost option
FAH	Fahrenheit	Setpoint	Default for all temperatures displayed
FdSP	Fan delay temp Setpoint	Setpoint	Coil temp must reach this setpoint to turn fans back on after defrost
FndF	Fan State During Defrost	Setpoint	Fans on or off during defrost
FndL	Fan Delay	System State	Displays when system is in fan delay mode
Fndt	Max fan delay time	Setpoint	Maximum time system can stay in fan delay (FndL) mode
FnrL	Fan Relay	Variable	Status of whether fan relay is energized or de-energized
FrEF	Fan mode during refrigeration	Setpoint	Determines how fan operates during refrigeration mode -- permanent (PErn), On with compressor (OnCp) Title 24 (ti24)
FSCH	Forced schedule	Setpoint	Controller automatically changed from demand defrost to schedule defrost due to excessive defrost alarm
HEtr	Heater mode	Setpoint	If defrost mode = ELEC: whether to leave the defrost relay energzied during defrost cycle or to utilze advanced heater mgmnt.
HtA	High Temperature Alarm	Alarm	Average temperature is above the Temperature Setpoint (tS) + Temperature Differential Setpoint diF + High Alarm Offset (HAO) for the amount of time in the Temperature Alarm Delay (tAd)
HAO	High Alarm Offset	Setpoint	Number of degrees above the Temperature Setpoint (tS) for a High Temp Alarm (HtA) condition.
inid	Inititate Defrost	Variable	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - digital input that will initiate defrost
LAO	Low Alarm Offset	Setpoint	Number of degrees below the Temperature Setpoint (tS) for a Adaptive Control Alarm (LtA) condition.
LtA	Low Temperature Alarm	Alarm	Average temperature is below the Temperature Setpoint (tS) - Low Alarm Offset (LAO) for the amount of time in the Temperature Alarm Delay (tAd)
NOAL	No Alarm	Alarm	System is clear of alarms
OFF	System Off	System State	The system is currently not running
OFFt	Minimum Compressor Off Time	Setpoint	Minimum time the liquid line solenoid/compressor relay must remain off before it can be energized again
OnCP	On with compressor	Setpoint	Fans are on when compressor is running
OPEn	Open	Setpoint	Digital input is active/inactive when open
Pdt	Defrost pump down time	Setpoint	Amount of time to pump down the system before defrost
PErn	Permanent	Setpoint	Fans on permanently
PF	Power Failure alarm	Alarm	Alarm indicates that there was an interruption in the power supply to the controller
rEFr	Refrigerate Mode	System State	System mode displayed when controller is in cooling mode
rt1	Room Temperature 1	Variable	Room temperature displayed if AU1 (1st Auxiliary input) is set to rtP (Room Temp)
rt2	Room Temperature 2	Variable	Room temperature displayed if AU2 (2nd Auxiliary input) is set to rtP (Room Temp)
rtP	Room Temp	Variable	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - input is used as an additional room temperature averaged in with the other room temperature inputs
rUnt	Minimum Compressor Run Time	Setpoint	Minimum amount of time the liquid line solenoid/compressor relay must remain on after it is energized
ScHd	Schedule Defrost	Setpoint	Choice for Defrost Initiation Mode (dFit)
SHrt	Short	Setpoint	Digital input is active/inactive when short
StA1	State of 1st Auxiliary Input	Setpoint	Digital input active state for 1st Auxiliary input (AU1) - set whether it is open or short
StA2	State of 2nd Auxiliary Input	Setpoint	Digital input active state for 2nd Auxiliary input (AU2) - set whether it is open or short
SYOF	System Off	Variable	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2)- digital input that puts the controller into System Off Mode
SYOn	System On	Variable	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2)- digital input that puts the controller into System On Mode
SYSt	System State	Variable	Displays mode of system operation
t2nd	2nd Room Temp Setpoint	Setpoint	Choice for input type for 1st or 2nd Auxiliary input (AU1 or AU2) - input is used to switch between the main Room Temp Setpoint and the 2nd Room Temp Setpoint
t2Of	2nd Air Off	Variable	Use main air temperature setpoint
t2On	2nd Air On	Variable	Use second air temperature
tAd	Temp Alarm Delay	Setpoint	Amount of time to delay a high temp or low temp alarm
tErd	Terminate Defrost	Variable	In Variables menu, display when 1st or 2nd Auxiliary input (AU1 or AU2) set to trdF (terminate defrost) and is active
ti24	Title 24	Setpoint	Configure the controller to be Title 24 for runtime compliant during refrigeration system's off cycle
tOd	Time of day	Setpoint	Time is displayed based on 24 hour clock
tP1	Monitor Temperature 1	Variable	When AU1 is set to tP1 controller is monitoring temperature only
tP2	Monitor Temperature 2	Variable	When AU2 is set to tP1 controller is monitoring temperature only
trdF	Terminate Defrost	Setpoint	Choice for input type for1st or 2nd Auxiliary input (AU1 or AU2) - digital input that will terminate defrost
tS	Temperature Setpoint	Setpoint	Room temperature to be maintained
tS2	Temperature Setpoint 2	Setpoint	Alternate room temperature setpoint
Unt	Temp units	Setpoint	Fahrenheit (FAH) or Celsius (CEL)

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Small Box energy

KE2 AdaptiveControl
Quick Start Guide

Custom Defrost Setup

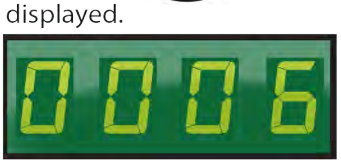
The following steps will guide you through the setup of the custom defrost feature.

Abbreviations: CUS = custom
d1 = custom defrost 1
diS = disabled
dPd = defrosts per day
ts = temperature setpoint
tod = time of day

STEP 1 - Press and hold the ENTER button, **tS** is displayed on the LEDs

STEP 2 - Press the ▲ up arrow until **dPd** is displayed,

then press ENTER, 6 (default) will be displayed.



STEP 3 - Press the ▲ up arrow until **CUS** is displayed.

Press and hold the ENTER button for 3 seconds until the **dPd** is displayed.

STEP 4 - Press the ▲ up arrow until **tod** (time of day) is displayed,

then press ENTER

Use the ▲ up arrow and ▼ down arrow to set the time.

Note: The time is displayed in military time (24-hr clock) The 1st 2 digits are the hour. The minutes are after the decimal. Since there are only 3 digits, the time will be set to the nearest 10 minutes. See examples below.

Examples:

8:10 am would be 8.1 on the controller's display

4:32 pm would be 16.3 on the controller's display.

After the time is set, press and hold the ENTER button for 3 seconds, until **tod** is displayed

STEP 5 - Press the ▲ up arrow to display Defrost 1 **(d1)**.

To set the first defrost, press ENTER button.

diS (disabled) will be displayed.

Use the ▼ down arrow to set the defrost time.

Note: Defrost times may only be set on the hour.

Example:

2:00 am would be 2

Once the correct time is displayed, press and hold the ENTER button until **d1** is displayed.

STEP 6 - Repeat steps as necessary for **d2** to **d12.**

STEP 7 - Press the BACK button to save settings, and return to the main screen (room temp will be displayed).

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Q.1.35 October 2015 supersedes Q.1.35 August 2015 and all prior publications.

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