



KE2 Controlled Environment

Temperature and Humidity Controller



Introduction

The KE2 Controlled Environment holds a constant room temperature and humidity level by maintaining a constant evaporator pressure with a high and low superheat limit control.

An electronically operated evaporator controller, the KE2 Controlled Environment is engineered to save energy in refrigeration systems through precise control of suction pressure, superheat, space temperature, humidity, fan cycling, reducing compressor runtime, and implementing demand defrosts.

KE2 Controlled Environment - Controls and Communicates

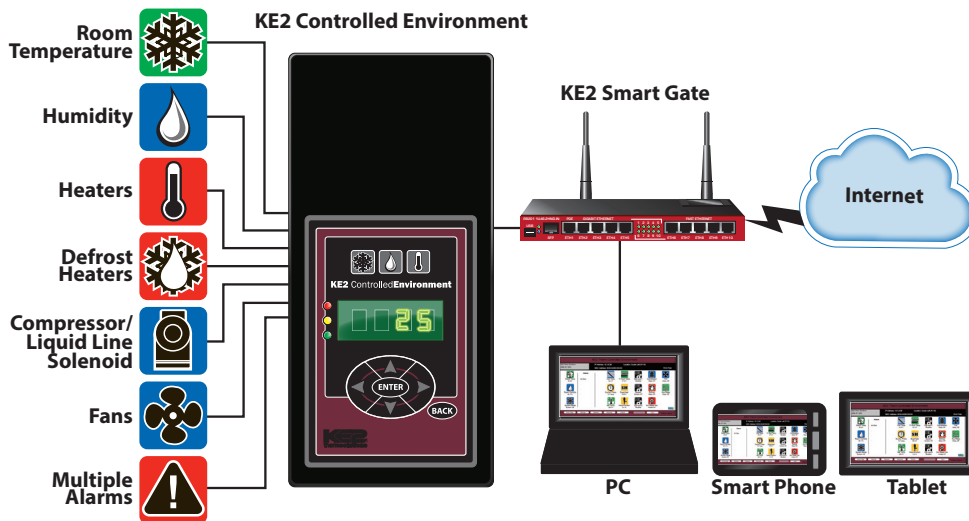


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Parts List

The following parts are included in the KE2 Controlled Environment controller kits:

- **Kit # 20650 with 120/208-240 VAC controller**
 - (3) **Temperature sensors**
part #20200
 - (1) **Pressure transducer**
part #20201
 - (1) **Humidity sensor**
part #20651
 - (1) **Air sensor mount**
 - (5) **Self-drilling screws**
 - (1) **Installation Instructions**
 - (4) **90 degree quick disconnect**



KE2 Controlled Environment
Temperature and Humidity Controller

Location

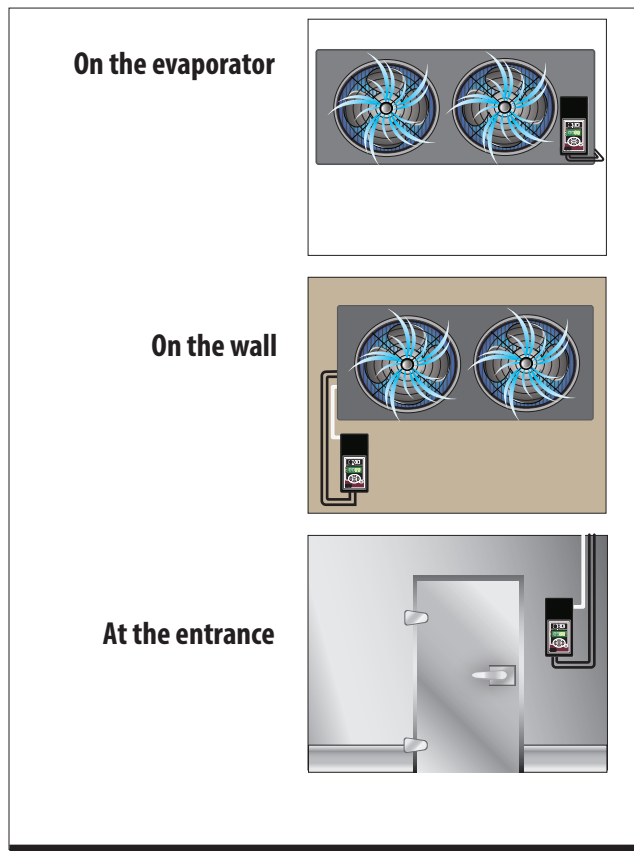
The KE2 Controlled Environment was developed with ease of installation in mind. The controller is supplied in an enclosure, and encapsulated to protect the circuitry from moisture damage. This extra level of protection allows the controller to be installed in the refrigerated space.

When installing the controller, it may either be mounted on an interior/exterior wall or on the evaporator. Many evaporators have sufficient space to install the controller on the face of the evaporator or on its housing. Locating the controller as close to the evaporator as possible reduces the amount of wiring when converting existing systems, as well as when it is applied on new applications.

Users may find it beneficial to install the controller in a location providing easy access -- on the wall or near the entrance. This enables easy viewing of the display, and eliminates the need to use a ladder or lift to modify the setpoints or check alarms.

If viewing the temperature from outside the walk-in or refrigerated room is desirable, the KE2 Controlled Environment may be used as a digital thermostat. The controller is then installed near the door of the space for easy viewing of the room temperature and/or system status. See **Figure 1** for locations.

Figure 1 - Installation Locations



If installing the controller on the face of the evaporator, preexisting knockouts on the evaporator should be used for installing the high voltage wiring. If knockouts do not preexist, hole(s) may be carefully cut into an unobstructed area of the evaporator case. If modifying the face of the evaporator is not feasible or desired, the controller's conduit knockouts may be used with 1/2 inch conduit.

The bottom side of the controller includes a cutout with cable tie slots providing a strain relief for the low voltage and sensor wires. Additional knockouts are available on either side if conduit is preferred.

Installation & Wiring

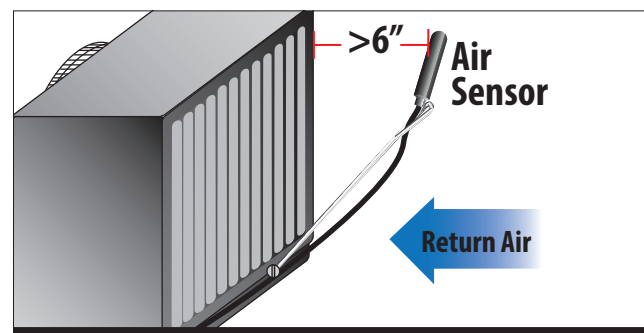
The KE2 Controlled Environment is supplied with pluggable connectors for all connections. Pluggable connectors permit the controller to be placed in a safe location while the wiring is installed. They also simplify the wiring, allowing the wires to be fastened to the screw terminals in the open air. Once all wiring is completed using accepted wiring practices, it is plugged into the controller prior to final mounting.

There are inputs for one pressure transducer, three temperature sensors, and a humidity sensor. The controller was designed to be used with electric expansion valves (EEVs), but can also be used on systems with mechanical expansion valves (TEVs). When installing the controller the humidity sensor is required. **NOTE! Sensor location is critical to the proper operation of the controller.**

Return Air Temperature Sensor - The air temperature sensor is installed in the return air of the evaporator using the included sensor mount. Most applications allow the sensor mount to be installed using an existing coil housing screw. On evaporators where using an existing screw is not possible, the included self-tapping screw may be used to secure the sensor mount to the evaporator. **Note: Be careful to avoid damage to an evaporator tube or causing a leak in the drip pan.** When installing, it is important to prevent the air sensor from coming into contact with the mounting bracket, cable ties, or any other solid material. **Figure 2** shows an example of how to mount the sensor. The sensor must be a minimum of 6 inches from the coil surface.

After the sensor is installed, route the wire back to the controller

Figure 2 - Return Air Sensor Placement



location. When routing sensor wire, it is important to avoid interference from high voltage lines. If sensor wire is run parallel to the high voltage, there is a potential for inductance to affect the sensor reading. This is of particular concern with long wire runs. When extending sensors, use the 18 gage, shielded twisted pair. Sensor wires can be run beyond 100 feet when using special considerations. Contact KE2 Therm. After the wire has been successfully routed, it may be connected to the pluggable terminal on the controller.

Coil Temperature Sensor - As a critical input to the controller, it is essential the sensor is located at the **coldest point on the evaporator coil at defrost termination** for optimal operation. The coil sensor is an integral part of the control algorithm used to determine coil efficiency, to initialize defrosts, and to terminate defrosts.

Determine the coil sensor location

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

Steps to Ensure Proper Coil Sensor Location

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. See **Figure 3**.

Locating the sensor too close to the elements will cause false defrost termination temperatures. It is important to note, the most active portion of the sensor is the first 1/2" of the 1-1/2" long stainless steel probe. As a result, it is important to touch two circuit tubes. When inserting the sensor into the coil, the tip should touch one of the circuit tubes. This location is appropriate for the sensor. **Figure 4** shows the proper sensor position.

When choosing the location, the sensor should not be located adjacent to the electric heating elements. The sensor should be approximately half the distance between the heaters if possible. Insert the probe into the fins approximately 1/16" deeper than the stainless shielding of the probe. Pinch the two fins gently together to secure the sensor in place. This provides the thermal ballast to ensure a complete defrost every time. See **Figure 5**.

It is important to verify heating elements are working properly.

Due to the many factors influencing the evaporator performance, it is impossible for KE2 Therm to provide the proper location of every installation. However, the coil sensor is an integral part of the control algorithm used to determine coil efficiency to initiate, as well as, terminate defrosts. The coldest point in

Figure 3 - Proper Sensor Location

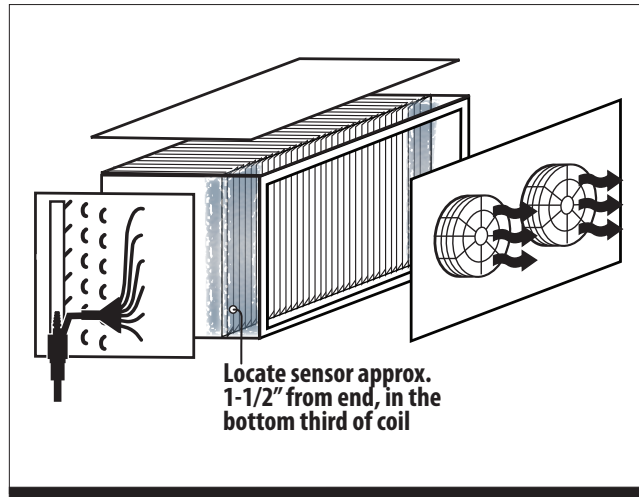


Figure 4 - Sensor Positioned to Touch Two Circuit Tubes

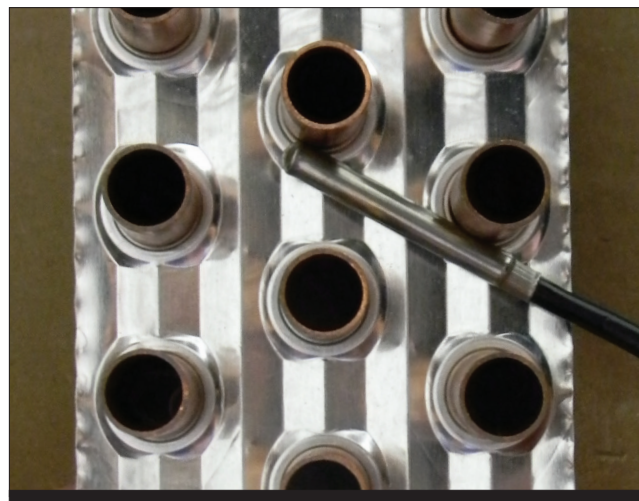
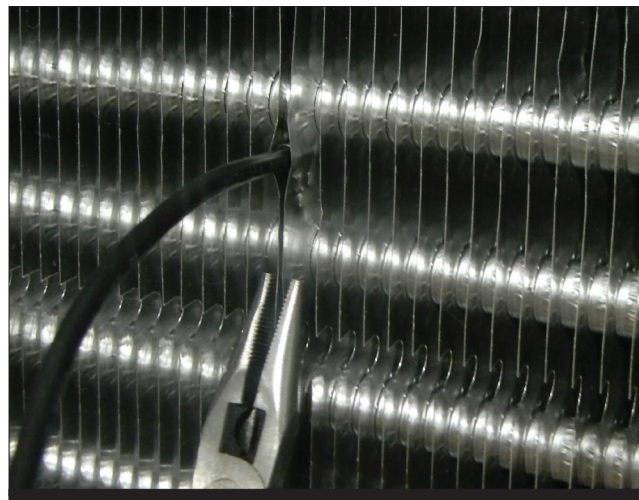


Figure 5 - Proper Sensor Positioning





the coil can be identified from existing system knowledge or by monitoring the normal operation.

Suction Temperature Sensor - Required when applying the controller with an electronic expansion valve. The sensor's proximity to the evaporator outlet differs slightly for electronically controlled valves from the placement of a TEV bulb. Due to the more refined control from an electronically controlled valve, the sensor must be placed as close to the outlet of the coil as feasible. Although the distance from the outlet is different, the nature of the refrigerant's flow through the tube remains unchanged, thus the orientation of the sensor remains at the 4 or 8 o'clock position. Secure the sensor to the suction line using the included wire ties designed for low ambient operation.

Pressure Transducer - In addition to the suction temperature sensor, a pressure transducer is also required for superheat measurement when applying an electronic expansion valve. The pressure tap should be mounted on the top of a horizontal section of tube. It should be located near the suction sensor, approximately 3 inches downstream from the position of the temperature sensor.

Humidity Sensor - The humidity sensor is included in the kit and is required for dehumidification and/or humidification. It should be located in the space, in an area representative of the desired control point.

Controller Power - The high voltage wiring is protected by a metal shield screwed to the back side of the controller. The shield should be removed to gain access to the wiring connections, making note of the location of the screws. The screws in the upper corners are coarse thread screws, while the screw in the middle is a 4-40 machine screw.

The controller accepts either 120V or 208/240V incoming power. The controller includes metal oxide varistors (MOVs), providing protection from voltage spikes. MOVs use the same technology commonly applied to protect consumer electronics in surge protectors. They function by filtering out voltages high enough to damage the board. When the voltage exceeds the allowed amount, the MOVs short to ground, protecting the circuitry. For additional protection, the board has a replaceable 1/2 or 500mA fuse in line. The grey plug is accessible without removing the metal shield in the fuse holder. Depress slightly and turn 1/4 turn counterclockwise to remove. Replace by depressing slightly and turning 1/4 turn clockwise. Do not overtighten. The board uses a pluggable screw terminal connector to connect incoming power. The terminal is located in the top right corner of the controller when the terminals are facing the user. See **Figure 6**.

Fan and Defrost Relays - There are 2 larger relays on the controller with spade connectors. These are used for the evaporator fans and defrost heaters. Due to the spacing of the enclosure the spades require a 90 degree terminal. KE2 Therm has included (4) spade connectors to assist in wiring the relays.

Evaporator Fan Relay - The fan relay is rated 10A inductive at

240V. One leg of the incoming power (L1) should be connected to the COM terminal of the fan relay, the upper of the two larger relays. The remaining leg, (L2) should be connected to one lead of the fan. The remaining fan lead should be connected to the NO (Normally Open) terminal on the fan relay. See **Figure 8**.

Defrost Heater / Dehumidification Relay - The heater/dehumidification relay is rated 20A resistive at 240V. One leg of the incoming power (L1) for the heater/dehumidification should be connected to the COM terminal of the heater/dehumidification relay, the lower of the two larger relays. The remaining leg, (L2) should be connected to one lead of the heater/dehumidification. The remaining heater/dehumidification lead should be connected to the NO (Normally Open) terminal on the heater/dehumidification relay. For air defrost systems this relay defaults to dehumidification relay. For electric or hot gas systems use External Digital Switch.

Compressor/Liquid Line Solenoid Relay - The compressor relay is rated at 3A inductive at 240V. This relay uses the 3-position pluggable screw terminal to make the connection to the board. The relay is not intended to control the compressor directly. It is designed to be used to control the liquid line solenoid or as a pilot to the compressor contactor. One leg of the incoming power supply (L1) should be connected to COM terminal of the compressor relay, the upper of the two smaller relays. The remaining leg, (L2), should be connected to one lead on the solenoid/compressor contactor. The remaining lead, should be connected to the normally open (NO) position on the terminal.

Humidification / Aux Relay - This relay is rated at 3A inductive at 240V. This relay uses the 3-position pluggable screw terminal to make the connection to the board. One leg of the incoming power supply (L1) should be connected to COM terminal of the auxiliary relay, the lower of the two smaller relays. The remaining leg, (L2), should be connected to one lead on the attached device. The remaining auxiliary lead, should be connected to the normally open (NO) position on the terminal.

External Digital Switch - This output is rated 12-14 VDC, minimum of 100 ohm, maximum of 0.12A DC. This output is intended to be connected to an external relay with the coil of the relay within the above ratings. This external relay will then switch an external heat source on and off. The output uses the 2-position pluggable screw terminal to make the connection to the board. One leg of the coil of the external relay is connected to the bottom terminal (same terminal that the red lead from the humidity sensor is connected.) The other leg of the coil of the external relay is connected to the other terminal.

After all high voltage wiring is completed the metal shield must be replaced and screws tightened.

Additional Inputs

Digital Inputs - The controller includes (3) digital inputs. See **Table 3** for configuration options.

Figure 6 - KE2 Controlled Environment - Diagram (back view)

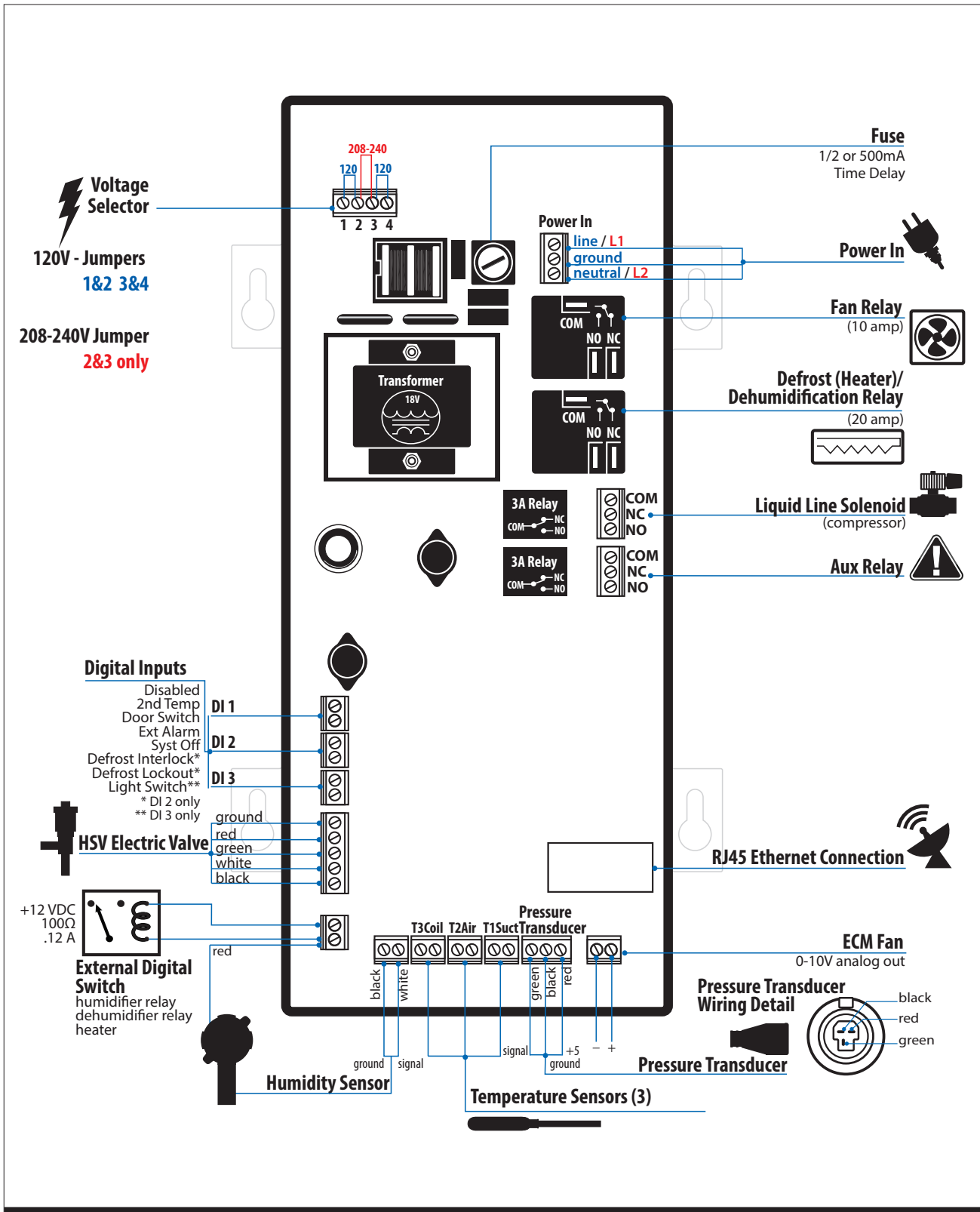
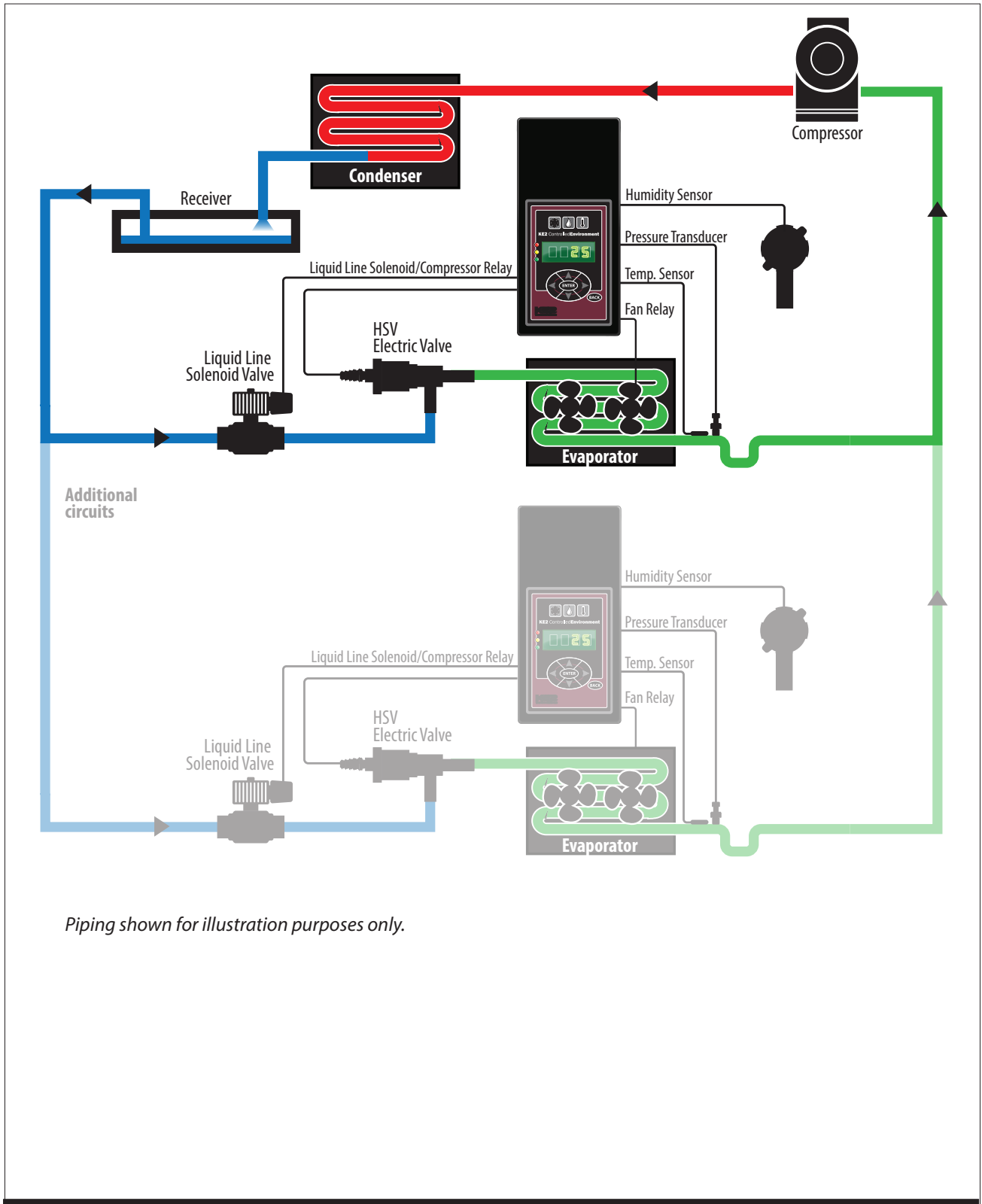


Figure 7 - Typical Piping Diagram



Piping shown for illustration purposes only.

Figure 8 - Wiring Schematic - Controller New Install

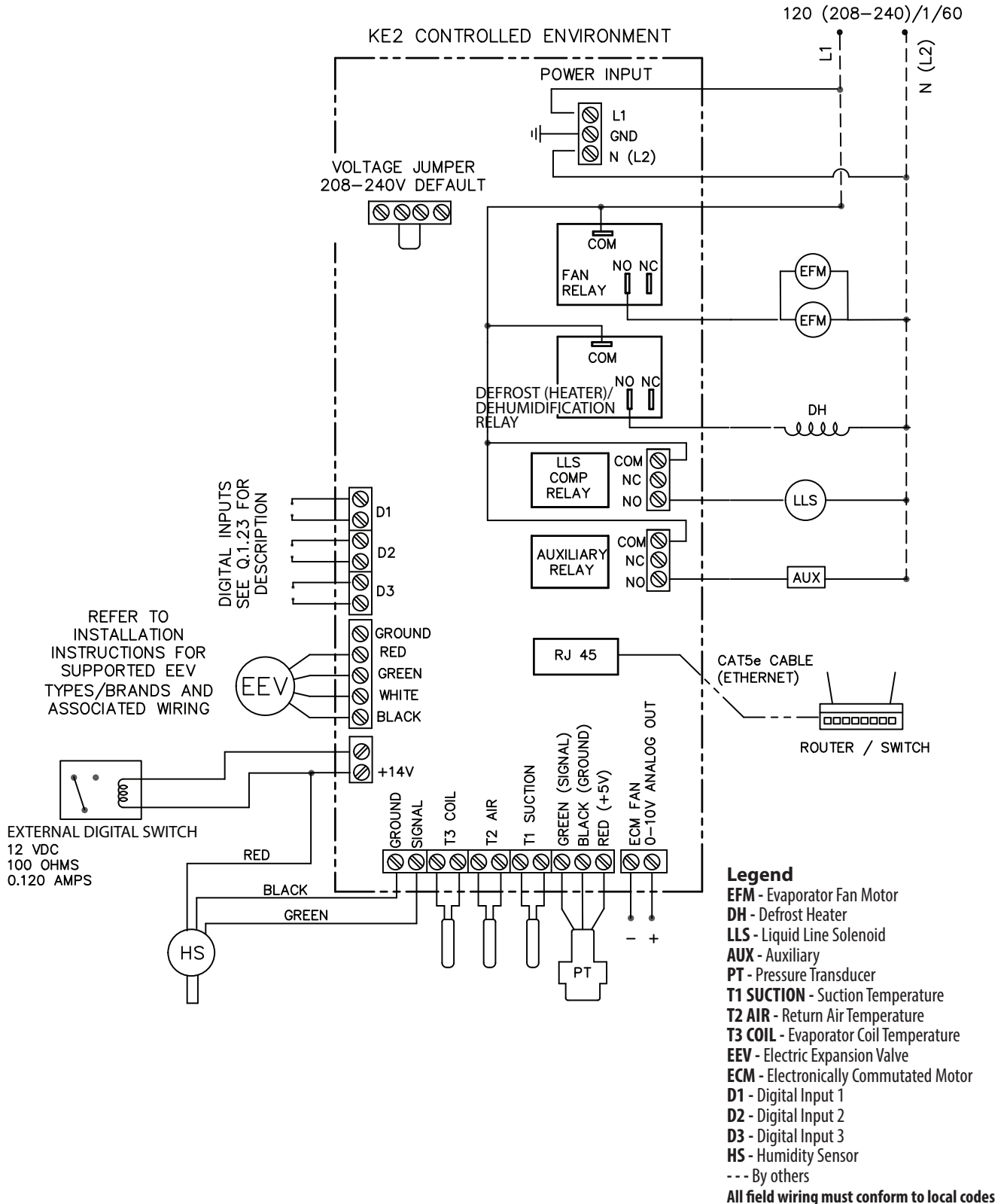
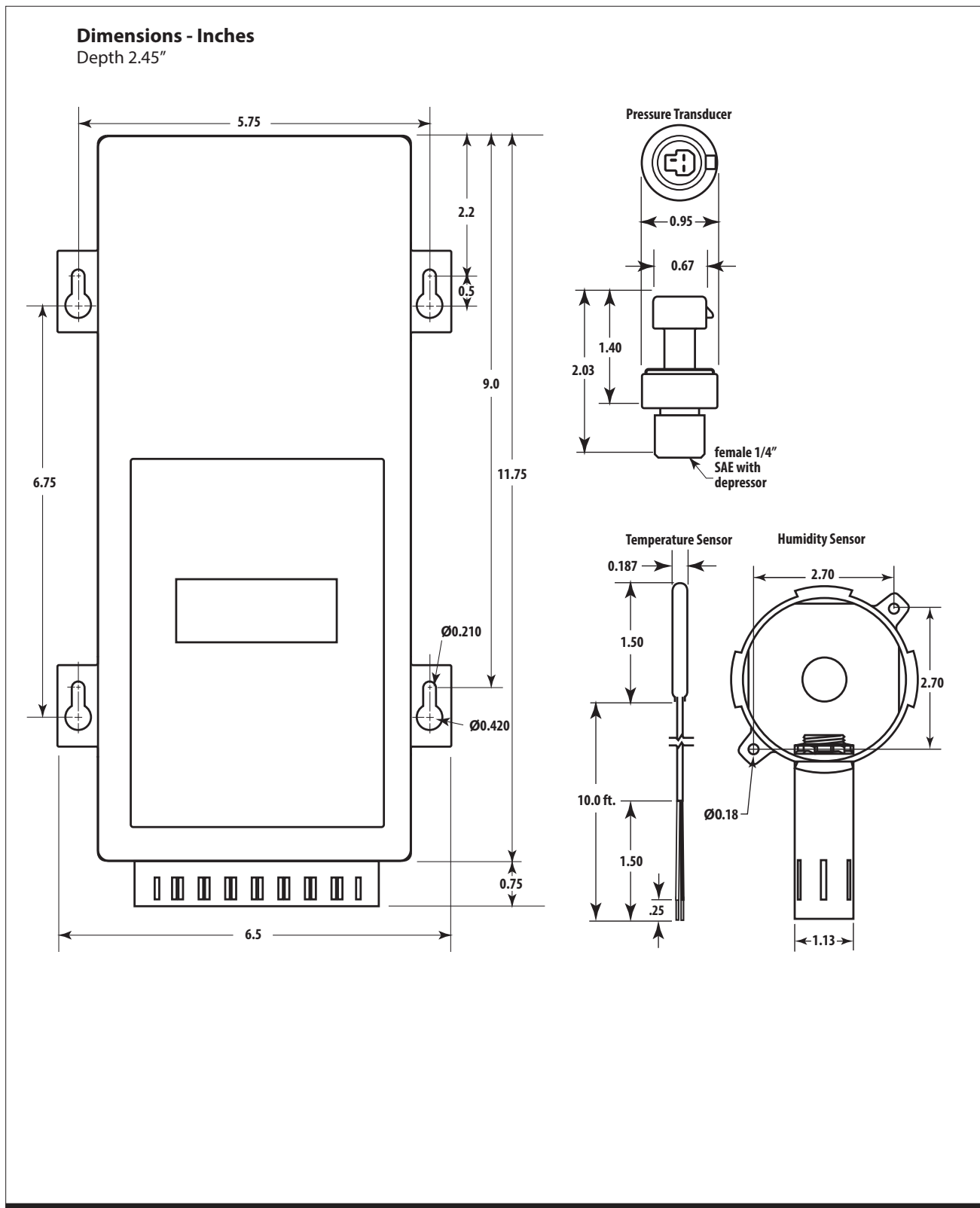


Figure 10 - KE2 Controlled Environment - Dimensions (front view)



Mounting the Controller

Once the wiring has been run to the controller location, the controller can be connected. When installing the KE2 Controlled Environment, the (4) screws supplied in the kit may be pre-installed in the mounting surface. The controller has keyholes in each mounting tab to allow the controller to be installed over the screws. The mounting pattern can be seen in Figure 10.

User Interface

The KE2 Controlled Environment's onboard user interface uses a familiar 6-button arrangement to simplify navigation through the controller's menus. The menu has been grouped by category to provide an easy to program structure. By grouping the menu by each functional area, the user is not required to scroll through unrelated setpoints to access the desired functionality.

The **left** and **right arrows** move between the categories. When pressed while in a menu, the left and right arrows will move to the main screen or the adjacent menu.

The **up** and **down arrows** move the user through the available options for each group. All users are allowed access to the variable alarms. All other information is password protected to prevent unauthorized access to the controller's functionality.

Use **ENTER** button to save an input option when it has been changed. **Button must be held for 3 seconds to prevent accidental changes.** Changes may be discarded by waiting, to allow the controller to timeout and return to default screen, or pressing **BACK** button.

The **BACK** button is used to return to the previous screen. Pressing the **BACK** button twice at any time will return the user to the default view. **See Table 2 (following page).**

Controller Setup

Upon initially applying power to the controller, the controller will initialize, then automatically enter the **Introduction Mode**. The Intro Mode has as little as 4 setpoints to configure for KE2 Controlled Environment to begin controlling the system.

Table 1 shows the Intro Mode. The first setpoint the user is asked to enter is the desired **ROOM TEMP**. This is followed by the **TARGET HUMIDITY**, then **DEFROST TYPE**. The controller is designed to work with electric, hot gas, and off time defrosts. The last setpoint is the **VALVE TYPE**. The controller is defaulted to be used with a KE2 EEV, but may be used with a mechanical valve or a customer defined valve. These are the only setpoints required to begin controlling the system, when applied on a single evaporator with a mechanical valve, **See Table 1.**

Adjusting Controller Parameters

The controller has the ability to access an abundance of information from the 4-digit alphanumeric display. However, the controller requires a password, adding a degree of protection from unwanted modifications. The controller will prompt the user for a password **PASSWORD** when the user attempts to access setpoints they do not have permission to change.

Table 2 shows the menu structure of the controller. The default display of the controller always displays the actual room temperature. Pressing the **up** and **down** arrows moves the display through the **VARIABLES** menu. See **Table 2** By default, the controller only allows access to the room temperature. The **VARIABLES** menu consists of the current sensor readings and the relays' state. The **User Password (1111)** only provides access to the ROOM TEMP setpoint.

For the protection of the system, access to the **SETPOINT** and **MANUAL** control requires an **Installer Password (2222)**. Pressing the right or left arrow will move from the Variables menu to the next menu, shown in **Table 2**, a complete list of parameters are shown in **Table 3.**

Pressing the **BACK** key at any time will return the user to next level up the menu. A second press will either return to the **Main Menu** or to the room temperature reading.

Table 1 - Introduction Menu

Mechanical Valve TEV 4 steps	KE2 HSV (default) 5 steps	Custom EEV 7 steps
Room Temp	Room Temp	Room Temp
Target Humidity	Target Humidity	Target Humidity
Defrost Type	Defrost Type	Defrost Type
Valve Type	Valve Type	Valve Type
	Refrigerant	Refrigerant
		Step Rate
		Max Steps

If using a standard/predefined EEV, the user will also be prompted to specify the **REFRIGERANT**. Once these have been set, the KE2 Controlled Environment will begin controlling EEV and the system. **Table 3**

Web Login

When accessing the controller using the webpage, the Username and Password are required. The defaults are set as: **User:** ke2admin **Password:** ke2admin

IMPORTANT: The Password should be changed from the default for security purposes.

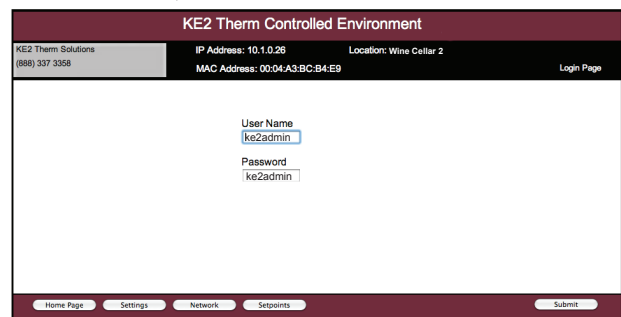


Table 2 - Navigation Through the Controller Menu and Menu Parameters



Indicator lights

- **Red light** - critical alarm (system off)
- **Yellow light** - non-critical alarm (system running)
- **Green light** - compressor on
- **Green flashing** - compressor waiting on timer to start/stop

To move through controller menus:

- Left Arrow and Right Arrow**
Use to move between **Menus**
- Up Arrow and Down Arrow**
Scroll through **Menu Parameters**

To return to Main Menu: **BACK** Press BACK to return to the previous view.

To change settings: **ENTER** Press and hold ENTER for 3 seconds, when display begins blinking changes can be made

To save setting changes: **ENTER** Press and hold ENTER for 3 seconds to save change

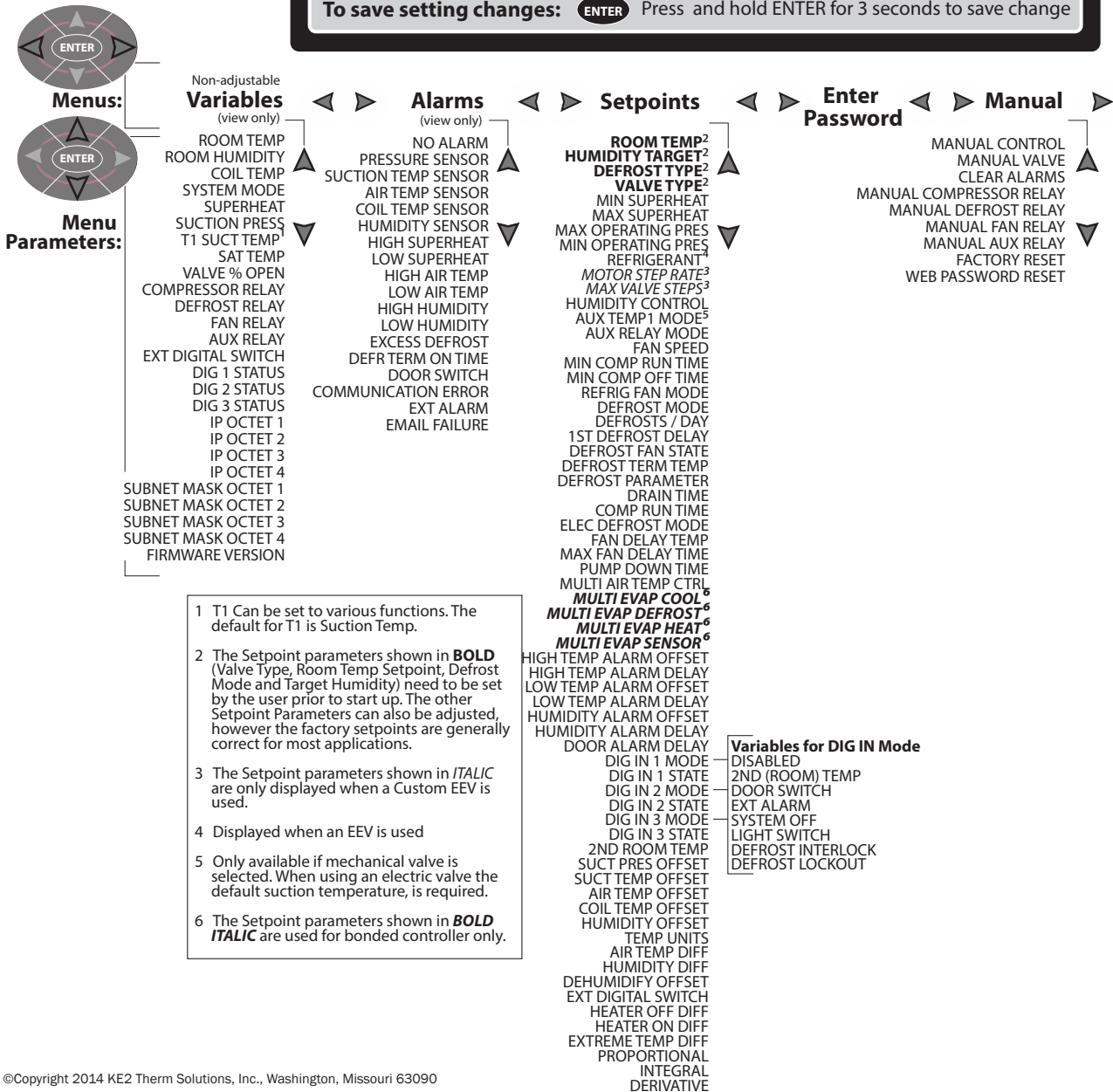



Table 3 - Controller Menus and Menu Parameters
Manual Menu

Parameter Name	Description	Range	Default
MANUAL CONTROL	Force the controller into the next operating mode	REFRIGERATE, OFF, DEFROST, DRIP TIME, FAN DELAY	
MANUAL VALVE	Manually open or close the EEV in percentage increments	1% increment	
CLEAR ALARMS	Clear all active alarms		
MANUAL COMPRESSOR RELAY	Manually energize or de-energize liquid line solenoid /compressor relay	AUTO (ON/OFF), MANUAL OFF, MANUAL ON	AUTO
MANUAL DEFROST RELAY	Manually energize or de-energize defrost relay	AUTO (ON/OFF), MANUAL OFF, MANUAL ON	AUTO
MANUAL FAN RELAY	Manually energize or de-energize evaporator fan relay	AUTO (ON/OFF), MANUAL OFF, MANUAL ON	AUTO
MANUAL AUX RELAY	Manually energize or de-energize auxiliary relay	AUTO (ON/OFF), MANUAL OFF, MANUAL ON	AUTO
FACTORY RESET	Reset the controller to the factory default setpoints	RESET	
WEB PASSWORD RESET	Reset the web password to the factory default setpoints	RESET	

Variables Menu - Non Adjustable (view only)

Parameter Name	Description
ROOM TEMP	Room temperature as measured by the controller
ROOM HUMIDITY	Humidity as measured by the controller
COIL TEMP	Coil temperature as measured by the controller
SYSTEM MODE	Current operating status
SUPERHEAT	Superheat as calculated by the controller (requires suction pressure transducer and suction temperature sensor)
SUCTION PRESSURE	Suction pressure as measured by the controller
T1 SUCT TEMP	Suction temperature as measured by the controller
SAT TEMP	Saturation temperature as calculated by the controller
VALVE % OPEN	Percentage the EEV is open
COMPRESSOR RELAY	Current state of liquid line solenoid/compressor relay
DEFROST RELAY	Current state of the defrost relay
FAN RELAY	Current state of the evaporator fan relay
AUX RELAY	Current status of the Aux Relay
EXT DIGITAL SWITCH	Current status of the Ext Digital Switch
DIG 1 STATUS	Current status of the Digital Input #1
DIG 2 STATUS	Current status of the Digital Input #2
DIG 3 STATUS	Current status of the Digital Input #3
IP OCTET 1	The first three digits of the IP address
IP OCTET 2	The second three digits of the IP address
IP OCTET 3	The third three digits of the IP address
IP OCTET 4	The fourth three digits of the IP address
SUBNET MASK OCTET 1	The first three digits of the subnet mask
SUBNET MASK OCTET 2	The second three digits of the subnet mask
SUBNET MASK OCTET 3	The third three digits of the subnet mask
SUBNET MASK OCTET 4	The fourth three digits of the subnet mask
FIRMWARE VERSION	Current version of the firmware on the controller

Variables Menu Options for DIG IN MODE

DIG IN Setting	Status Displayed on Controller
DIG IN MODE = DISABLED	DISABLED
DIG IN MODE = 2ND (ROOM) TEMP	inactive = 2ND ROOM TEMP OFF; active = 2ND ROOM TEMP ON
DIG IN MODE = DOOR SWITCH	inactive = DOOR CLOSED; active = DOOR OPEN
DIG IN MODE = EXT ALARM	inactive = NO ALARM; active = EXT ALARM (x)
DIG IN MODE = SYSTEM OFF	inactive = SYSTEM ON; active = SYSTEM OFF
DIG IN MODE = LIGHT SWITCH	inactive = LIGHTS OFF; active = LIGHTS ON
DIG IN MODE = DEFROST INTERLOCK	inactive = DEFR AUTO; active = DEFR OFF
DIG IN MODE = DEFROST LOCKOUT	inactive = DEFR AUTO; active = DEFR LOCKED OUT

Alarms Status Menu - Non Adjustable (view only)

Parameter Name	Description
NO ALARM	No alarms active, everything is running correctly
PRESSURE SENSOR	Suction pressure sensor is shorted, open or pressure out of range
SUCTION TEMP SENSOR	Suction temperature sensor is shorted or open
AIR TEMP SENSOR	Return air temperature sensor is shorted or open
COIL TEMP SENSOR	Coil temperature sensor is shorted or open
HUMIDITY SENSOR	Humidity sensor is shorted or open
HIGH SUPERHEAT	Superheat above upper limit (Only with HSV)
LOW SUPERHEAT	Superheat below lower limit (Only with HSV)
HIGH AIR TEMP	Room temperature is above ROOM TEMP + AIR TEMP DIFF + HIGH TEMP ALARM OFFSET for longer than HIGH TEMP ALARM DELAY
LOW AIR TEMP	Room temperature is below ROOM TEMP - LOW TEMP ALARM OFFSET for longer than LOW TEMP ALARM DELAY
HIGH HUMIDITY	Room humidity is above ROOM HUMIDITY + HUMIDITY DIFF + HIGH HUMIDITY ALARM OFFSET for longer than HIGH HUMIDITY ALARM DELAY
LOW HUMIDITY	Room humidity is below ROOM HUMIDITY - LOW HUMIDITY ALARM OFFSET for longer than LOW HUMIDITY ALARM DELAY
EXCESS DEFROST	32 or more defrosts in 48 hours
DEFR TERM ON TIME	Defrost terminated on time instead of temperature for two consecutive cycles
DOOR SWITCH	If door is open and room temperature is 5 degrees above ROOM TEMP + AIR TEMP DIFF for DOOR ALARM DELAY time
COMMUNICATION ERROR	ONLY FOR BONDED CONTROLLERS: No communication between controllers for one minute or more
EXT ALARM	If DIG IN (1, 2 and/or 3) MODE = EXT ALARM : The digital input is in an active state
EMAIL FAILURE	Email alert was not confirmed by email server provided after seven consecutive attempts

Setpoints Menu

Parameter Name	Description
ROOM TEMP	Room temperature to be maintained
HUMIDITY TARGET	Room humidity to be maintained
DEFROST TYPE	Method of defrost used on the evaporator coil: Electric, Air, Hot Gas with Liquid Line Solenoid/Compressor relay off, Hot Gas with Liquid Line Solenoid/compressor relay on
VALVE TYPE	Type of valve used on the system: mechanical, KE2 HSV (electric)
MIN SUPERHEAT	The low superheat value that the controller will override pressure control
MAX SUPERHEAT	The high superheat value that the controller will override pressure control
MAX OPERATING PRES	The maximum allowable suction pressure, (not applicable if VALVE TYPE = MECHANICAL)
MIN OPERATING SETPOINT	The minimum allowable suction pressure
REFRIGERANT	The type of refrigerant used in the refrigeration system
MOTOR STEP RATE	Step rate for the EEV in steps per second
MAX VALVE STEPS	Number of steps for full stroke of EEV
HUMIDITY CONTROL	Humidity sensor
AUX TEMP1 MODE	Configuration mode of the auxiliary temperature sensor if VALVE TYPE = MECHANICAL
AUX RELAY MODE	Configuration mode of the auxiliary relay.
FAN SPEED	Control variable fan speed by using setpoint as % off and on
MIN COMP RUN TIME	Minimum amount of time the liquid line solenoid/compressor relay must remain on after it is energized
MIN COMP OFF TIME	Minimum amount of time the liquid line solenoid/compressor relay must remain off before it can be energized again.
REFRIG FAN MODE	Fan operation while in refrigeration mode
DEFROST MODE	The method the controller uses to determine when to initiate a defrost.
DEFROSTS / DAY	If DEFROST MODE = SCHEDULED: The number of evenly spaced defrosts per day the controller will initiate.
1ST DEFROST DELAY	If DEFROST MODE = SCHEDULED: The amount of time from controller power up until the first defrost is initiated.
DEFROST FAN STATE	Whether or not to run the evaporator fans during defrost
DEFROST TERM TEMP	The temperature the coil sensor(s) must exceed in order to terminate defrost. The defrost relay is de-energized at this point.
DEFROST PARAMETER	The maximum amount of time the defrost relay will be energized for schedule defrosts.
DRAIN TIME	Time to be in drain mode (drip time)
COMP RUN TIME	If DEFROST MODE = RUN TIME: The amount of time liquid line solenoid/compressor relay is energized before the next defrost is initiated.
ELEC DEFROST MODE	If DEFROST TYPE = ELEC: Whether to leave the defrost relay energized during the defrost cycle or to utilize advanced defrost algorithm.
FAN DELAY TEMP	After defrost, the coil sensor reading must fall below this temperature set point in order for the controller to resume normal fan operation.
MAX FAN DELAY TIME	Maximum amount of time after defrost to resume normal fan operation.
PUMP DOWN TIME	Minimum amount of time between de-energizing the liquid line solenoid/compressor relay and energizing the defrost relay.
MULTI AIR TEMP CTRL	Set to use average or warmest air temp when multiple air temps are available
MULTI EVAP COOL	Select whether to sync bonded controllers or let run independently in COOL or OFF modes
MULTI EVAP DEFROST	Select whether to sync bonded controllers or let run independently in DEFROST or DRAIN modes
MULTI EVAP SENSOR	Select whether to SHARE or NOT SHARE sensor readings for bonded controllers
HIGH TEMP ALARM OFFSET	The number of degrees above ROOM TEMP for a HIGH TEMP ALARM condition.
HIGH TEMP ALARM DELAY	Minutes the room temperature must remain above ROOM TEMP + HIGH TEMP ALARM OFFSET before issuing a HIGH TEMP ALARM
LOW TEMP ALARM OFFSET	The number of degrees below ROOM TEMP for a LOW TEMP ALARM condition.
LOW TEMP ALARM DELAY	Minutes the room temperature must remain below ROOM TEMP - LOW TEMP ALARM OFFSET before issuing a LOW TEMP ALARM
HUMIDITY ALARM OFFSET	The %RH above or below ROOM HUMIDITY for HIGH HUMIDITY ALARM condition or LOW HUMIDITY ALARM condition
HUMIDITY ALARM DELAY	Time the %RH must remain above or below ROOM HUMIDITY, HUMIDITY DIFF, HUMIDITY ALARM OFFSET before issuing a HIGH HUMIDITY ALARM OR LOW HUMIDITY ALARM
DOOR ALARM DELAY	If DIG IN (1, 2 and/or 3) MODE = DOOR SWITCH: The amount of time, in minutes, before an alarm condition is initiated if door is open and room temperature is 5 degrees above ROOM TEMP + AIR TEMP DIFF
DIG IN 1 MODE	Sets the function of the digital input
DIG IN 1 STATE	Sets whether the switch activates when opened or closed
DIG IN 2 MODE	Sets the function of the digital input
DIG IN 2 STATE	Sets whether the switch activates when opened or closed
DIG IN 3 MODE	Sets the function of the digital input
DIG IN 3 STATE	Sets whether the switch activates when opened or closed
2ND ROOM TEMP	If DIG IN (1, 2 and/or 3) MODE = 2ND ROOM TEMP: This value becomes the ROOM TEMP setpoint when the digital input is active
SUCT PRES OFFSET	An offset added or subtracted from the suction line pressure transducer reading
SUCT TEMP OFFSET	An offset added or subtracted from the suction temperature sensor reading
AIR TEMP OFFSET	An offset added or subtracted from the room temperature sensor reading
COIL TEMP OFFSET	An offset added or subtracted from the coil temperature sensor reading
HUMIDITY OFFSET	An offset added or subtracted from the humidity sensor reading
TEMP UNITS	Units for temperature's display in °F or °C
AIR TEMP DIFF	The number of degrees above ROOM TEMP before the controller will go into REFRIGERATION mode
HUMIDITY DIFF	The number of %RH above or below before the controller will go into DEHUMIDIFICATION or HUMIDIFICATION mode
DEHUMIDIFY OFFSET	An offset from ROOM TEMP to keep cooling if humidity is above setpoint
EXT DIGITAL SWITCH	Provides external output to control: HEATER, HUMIDIFIER, or DEHUMIDIFIER RELAY
HEATER OFF DIFF	ROOM TEMP minus HEATER OFF DIFF setpoint turns heaters off
HEATER ON DIFF	ROOM TEMP minus HEATER ON DIFF setpoint turns heaters on
EXTREME TEMP DIFF	ADVANCED TOPIC: Call KE2 Therm for assistance
PROPORTIONAL	A coefficient to the valve control algorithm that increases valve responsiveness
INTEGRAL	A coefficient to the valve control algorithm that increases valve responsiveness
DERIVATIVE	Should not be adjusted unless instructed by KE2 Therm technical support

CUSTOM
EEV
ONLY

BONDED
CTRLRS
ONLY



KE2 ControlledEnvironment
Temperature and Humidity Controller

	Range	Default
	-50°F to 90°F	55°F
	0% to 100%	65%
	ELEC, AIR, HOT GAS COMP ON, HOT GAS COMP OFF	AIR
	MECHANICAL, KE2, CUSTOM	KE2
	4 TO 20	5°F
	20 to 60	25°F
	10 to 150	150 PSIG
	0 to 150 PSIG	0 PSIG
	404A, R507, 407A, 407C, 422A, 422D, 134A, R22, R717, 438A, 408A, 409A, 407F, 410A, R744	404A
	30 to 400 steps per second	200 steps per second
	200 to 6400 steps	1300 steps
	ON, OFF	ON
	T1 SUCTION TEMP, MONITOR, TI ROOM TEMP, TI COIL TEMP	T1 SUCTION TEMP
	ALARM RELAY, 2ND COMP RELAY, 2ND FAN RELAY, 2ND DEF RELAY 2 SPEED FAN CTL, LIGHTS RELAY, PERM DEF, HUMIDIFIER RELAY	ALARM RELAY
	-100% to 100%	0%
	0 to 15 minutes	2 minutes
	0 to 15 minutes	5 minutes
	ON WITH COMPRESSOR, PERMANENT, MANAGED DEMAND, SCHEDULED, RUN TIME	ON WITH COMPRESSOR DEMAND
	0 to 8	4
	0 to 240 minutes	120 minutes
	ON/OFF	OFF if DEFROST TYPE = ELEC, HOT GAS COMP ON, HOT GAS COMP OFF ON if DEFROST TYPE = AIR
	35°F to 90°F	50°F if DEFROST TYPE = ELEC, HOT GAS COMP ON, HOT GAS COMP OFF 40°F if DEFROST TYPE = AIR
	0 to 90 minutes	25 minutes if DEFROST TYPE = ELEC 10 minutes if DEFROST TYPE = HOT GAS COMP ON, HOT GAS COMP OFF 40 minutes if DEFROST TYPE = AIR
	0 to 15 minutes	2 minutes
	0 to 24 hours	6 hours
	PULSE, PERMANENT	PERMANENT
	-40°F to 35°F	20°F
	0 to 20 minutes	2 minutes; 0 if Room Temp Setpoint is > 35°F
	0 to 10 minutes	0 minutes
	WARMEST, AVERAGE	WARMEST
	SYNC, INDEPENDENT	SYNC
	SYNC, INDEPENDENT	SYNC
	SHARED, NOT SHARED	SHARED
	0°F to 99.9°F	10°F
	0 to 120 minutes	60 minutes
	0°F to 20°F	4°F
	0 to 30 minutes	10 minutes
	0% to 25%	5%
HUMIDITY ALARM	0 TO 360 minutes	120 minutes
	0 to 180 minutes	30 minutes
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF	DISABLED
	OPEN, CLOSED	OPEN
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF, DFR INTERLOCK, DFR LOCKOUT	DISABLED
	OPEN, CLOSED	OPEN
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF, LIGHTS SWITCH, OPEN, CLOSED	DISABLED
	OPEN, CLOSED	OPEN
	-50°F to 90°F	-50°F
	-5.0 to 5.0 psig	0.0 psig
	-5.0°F to 5.0°F	0.0°F
	-5.0°F to 5.0°F	0.0°F
	-5.0°F to 5.0°F	0.0°F
	-5% to 5% RH	0%
	FAHRENHEIT/CELSIUS	FAHRENHEIT
	0.1°F to 5°F	1°F
	0% to 25%	5%
	-20°F to 0°F	0°F
	HEATER SWITCH, DEHUMIDIFY RELAY, HUMIDIFIER RELAY	HEATER
	-99.9°F to 0°F	-99.9°F
	-100°F to -0.1°F	-100°F
	3	0 to 255
	5	0 to 255
	3	0 to 255

Table 4 - Defrost Defaults

Setpoint	Electric	Air	Hot Gas
Defrost Fan State:	Off	On	Off
Defrost Termination Temperature Setpoint:	50	40	50
Maximum Defrost Time	25	40	10
Electric Defrost Mode:	Pulse	Permanent	Permanent

Communication

The KE2 Controlled Environment uses standard TCP/IP communication. The controller is equipped with an RJ-45 female connector to connect to Ethernet cable.

To communicate with the controller, the user will use a web browser to see the KE2 MasterView. The information is stored on the controller, so special software is not required.

Use a standard Ethernet cable between the peripheral device and the controller. One end is connected to the controller, and the other to the Ethernet port on the PC or KE2 Smart Gate. The Ethernet port will look similar to a telephone jack. The difference is the Ethernet port is larger with 8 wires instead of 6.

In installations where multiple evaporators are piped to a single condenser, networking the controllers is required. This prevents damage to the system by synchronizing the defrost cycles. Networked controllers have an additional safety layer to protect the system. When networked, the controllers share information, such as air temperature, to allow a controller in alarm mode to continue to provide refrigeration until the system is serviced.

When networking multiple controllers an ethernet switch or router is required. KE2 Smart Gate is available in a 9-port and KE2 Switch in an 8-port or 16-port models. The KE2 Smart Gate includes wireless access. The 8 or 16-port switch should be used for larger networks. Multiple switches can be ganged together to create additional ports for the network. When necessary, the local Network Administrator should be contacted to facilitate the network installation.

Literature on our website to help when setting up network communications with the controller include:

- Q.5.2** KE2 Switch - Part of the Refrigeration Network
- Q.5.3** KE2 Establishing Gmail
- Q.5.5** Making Ethernet Cable
- Q.5.10** KE2 Evap Advanced Configuration
- Q.5.11** How to: Change to Static IP Address
- Q.5.14** How to: Change the Network Setup of the KE2 Evap (or KE2 Controlled Environment)
- Q.5.24** KE2 Smart Gate Installation and Setup
- Q.5.25** KE2 Smart Gate VPN Configuration
- Q.5.26** KE2 WiFi Service Tool
- Q.5.31** How to: Setup Email/Text Alerts

Table 5 - Ethernet Specifications Summary

Specifications	Ethernet - Unshielded Twisted Pair (UTP)
Topology	star
Network Friendly	YES
Maximum Cable Length	330 feet (copper)
Maximum Data Rate	1,000 mbs
Native Internet	YES
Supported Devices	thousands
Response Time	milliseconds

For additional information on Ethernet Cable, consult IEEE 802.

Table 6 - Specifications

Controller	
Input Voltage:	120V or 208 - 240V
Ambient Temp:	-40° to 140°F
Operating Temp:	-40° to 140°F
Display:	4-digit alphanumeric LED
IP Rating:	IP65
Inputs:	(3) temperature sensors (KE2 SKU 20200) (1) pressure transducer (KE2 SKU 20204) (1) humidity sensor (KE2 SKU 20651)
Valve Type:	bipolar stepper motors (12V)
Relays:	20A resistive (defrost) 10A inductive (evaporator fan) (2) 3A inductive rated
Digital Input 1:	door contact, use 2nd air temp setpoint, disabled, system off, external alarm notification
Digital Input 2:	door contact, use 2nd air temp setpoint, disabled, system off, external alarm notification, defrost interlock, defrost lockout
Digital Input 3:	door contact, use 2nd air temp setpoint, disabled, system off, external alarm notification, light switch
Communication:	Standard TCP/IP
Pressure Transducer	
Pressure Range:	0 to 150 psia
Proof Pressure:	450 psi
Burst Pressure:	1500 psi
Operating Temp:	-40° to 275°F
Temperature Sensor	
Sensor Specs:	-60° to 150°F moisture resistant package
Humidity Sensor	
Sensor Specs:	0% to 100% Relative Humidity