HT-SUI-0313A

Surveillant

Demand Defrost

Evaporator Control

Installation and Operations Manual

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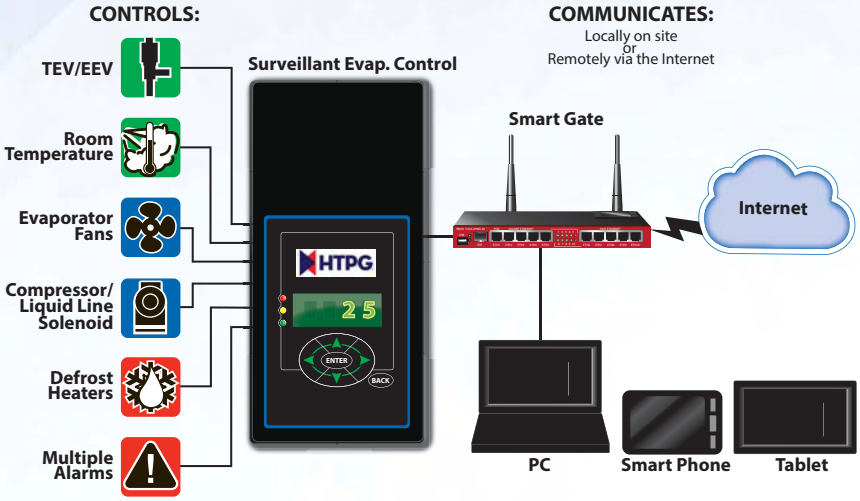
EvaporatorControl
Installation Instructions

Introduction

The Surveillant Evaporator Control is an electronically operated evaporator controller engineered to save energy in refrigeration systems through precise control of superheat, space temperature, fan cycling, reducing compressor runtime, and implementing demand defrosts. Surveillant was designed to be used in single and multiple evaporator installations, with a payback period of two years*, and a life expectancy that matches that of the system. Once the controller pays for itself, it continues to pay dividends for the life of the system.

*based on utility rate of $.09/kWh

Surveillant - Controls and Communicates



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Location

Surveillant Evaporator Control was developed with ease of installation in mind. The controller is supplied in an enclosure, with encapsulated electronics 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 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.

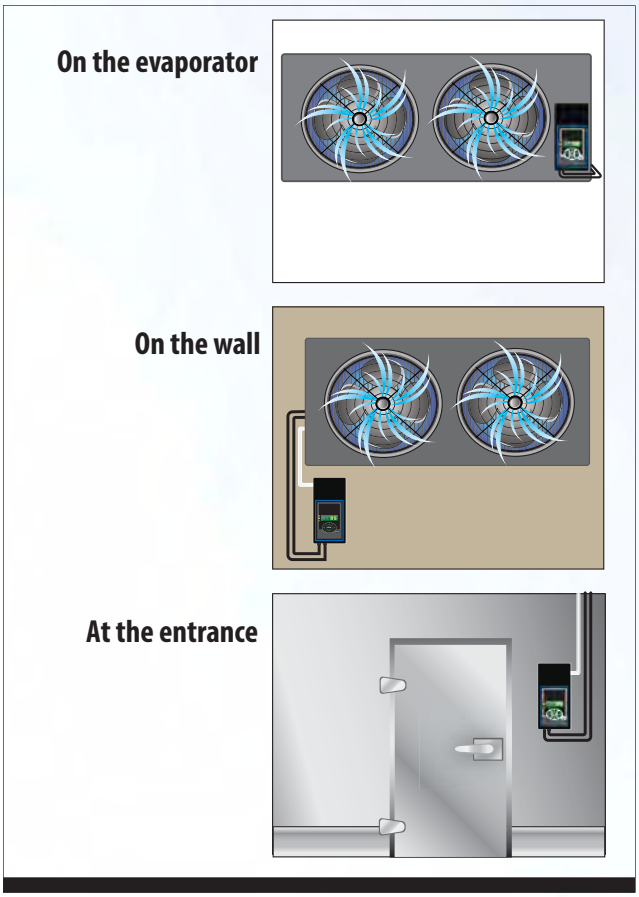
Alternatively, users may find it beneficial to install the controller in a location providing easy access -- on the wall or near the entrance. This enables the user to easily view the display, and eliminates the need to use a ladder or lift to modify the setpoints or check alarms.

If viewing the temperature outside the walk-in or refrigerated room is desirable, Surveillant 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.

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 ½ 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.

Figure 1. Installation Locations



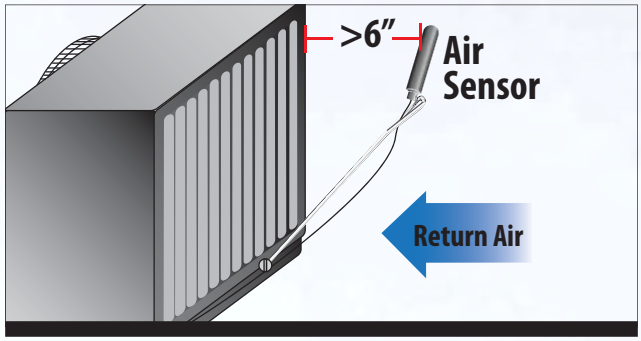
Installation & Wiring

The Surveillant Evaporator Control 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.

Although there is one pressure transducer and four temperature sensor inputs, when used with mechanical valves (TEVs), Surveillant only requires the **(3) sensors supplied with the kit.** One sensor reads the return air temperature and the other two measure the coil temperature. **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 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.

Figure 2 - Return Air Sensor Placement



After the sensor is installed, route the wire back to the controller 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 18 gage twisted shielded pair. 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** 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

For more robust installations, it is recommended that two coil sensors are used, located 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. 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.**

Figure 3 - Proper Sensor Location

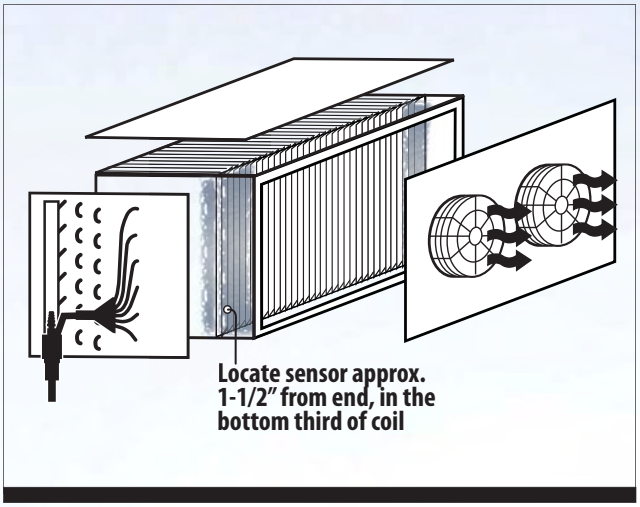


Figure 4 - Sensor Positioned to Touch Two Circuit Tubes

Figure 5 - Proper Sensor Positioning

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

Due to the many factors influencing the evaporator performance, it is impossible 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 the coil can be identified from existing system knowledge or by monitoring the normal operation.

Controller Power - The high voltage wiring is protected by a metal shield fastened 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 fasteners. 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. 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 BK/MDL-1/4 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. Spade connectors (4) are included 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) for the fans 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 Relay - The heater relay is rated 20A resistive at 240V. One leg of the incoming power (L1) for the heaters should be connected to the COM terminal of the heater relay, the lower of the two larger relays. The remaining leg, (L2) should be connected to one lead of the heater. The remaining heater lead should be connected to the NO (Normally Open) terminal on the heater relay.

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.

Auxiliary Relay - The auxiliary 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 may be connected to a variety of devices. 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 attached to one lead on the connected device. The remaining alarm lead, should be connected to the normally open (NO) position on the terminal.

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

Additional Inputs

Suction Temperature Sensor (T1 Auxiliary) - The suction temperature sensor is 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. The sensor should be secured to the suction line using the included wire ties designed for low ambient operation. In addition to being configured as a suction sensor, the T1 input may also be configured like the auxiliary sensor.

Pressure Transducer - In addition to the suction temperature sensor, a pressure transducer is also required for superheat measurement when applying a Hybrid Stepper Valve (HSV). 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.

Auxiliary Temperature Sensor -The auxiliary temperature sensor provides flexibility and may be used for any purpose desired by the user. The placement of the sensor is dependent on the requirements of the user's intended application. The Auxiliary Temperature sensor must be supplied by HTPG.

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

Figure 6 - Surveillant Evaporator Control - Diagram (back view)

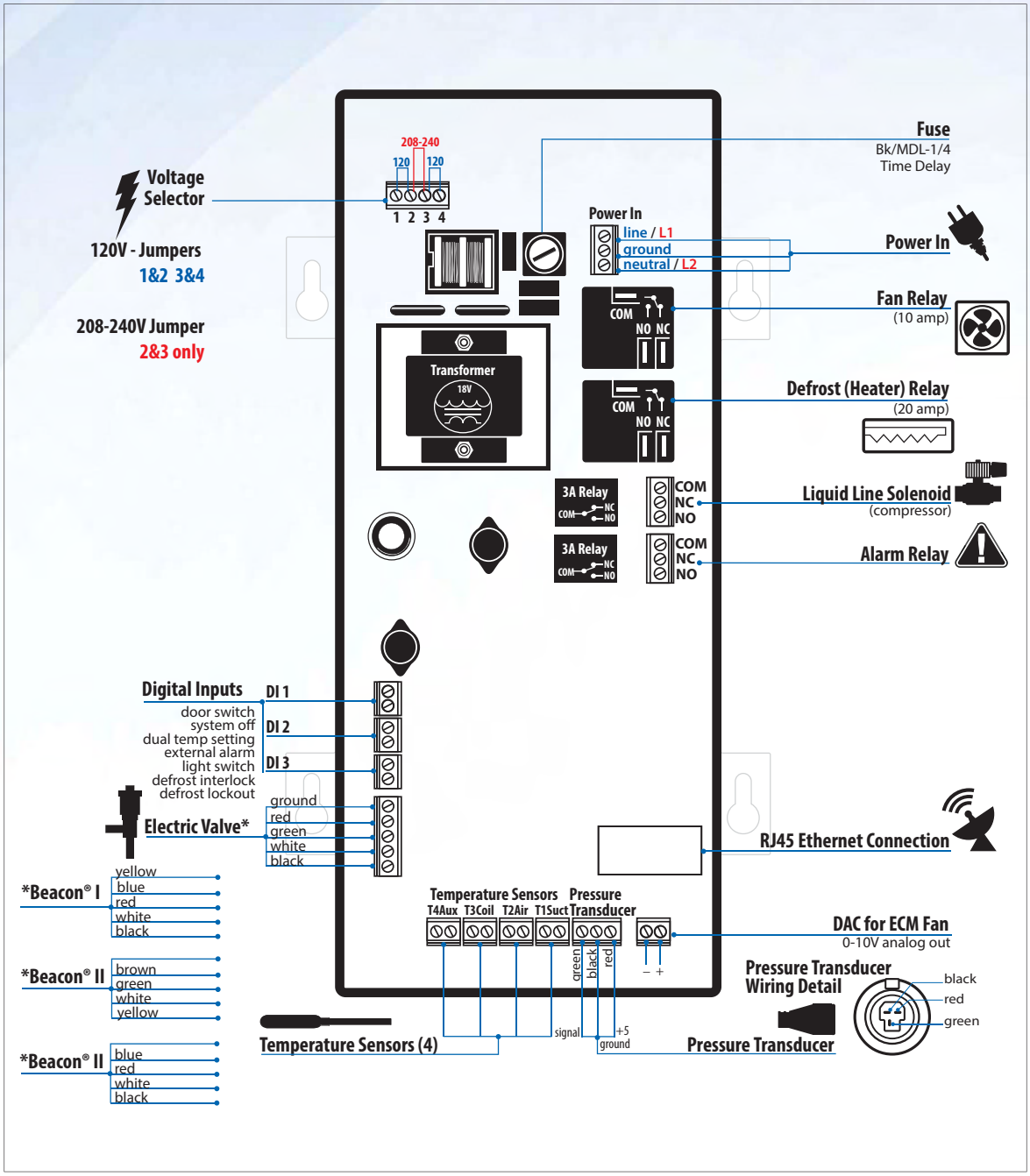
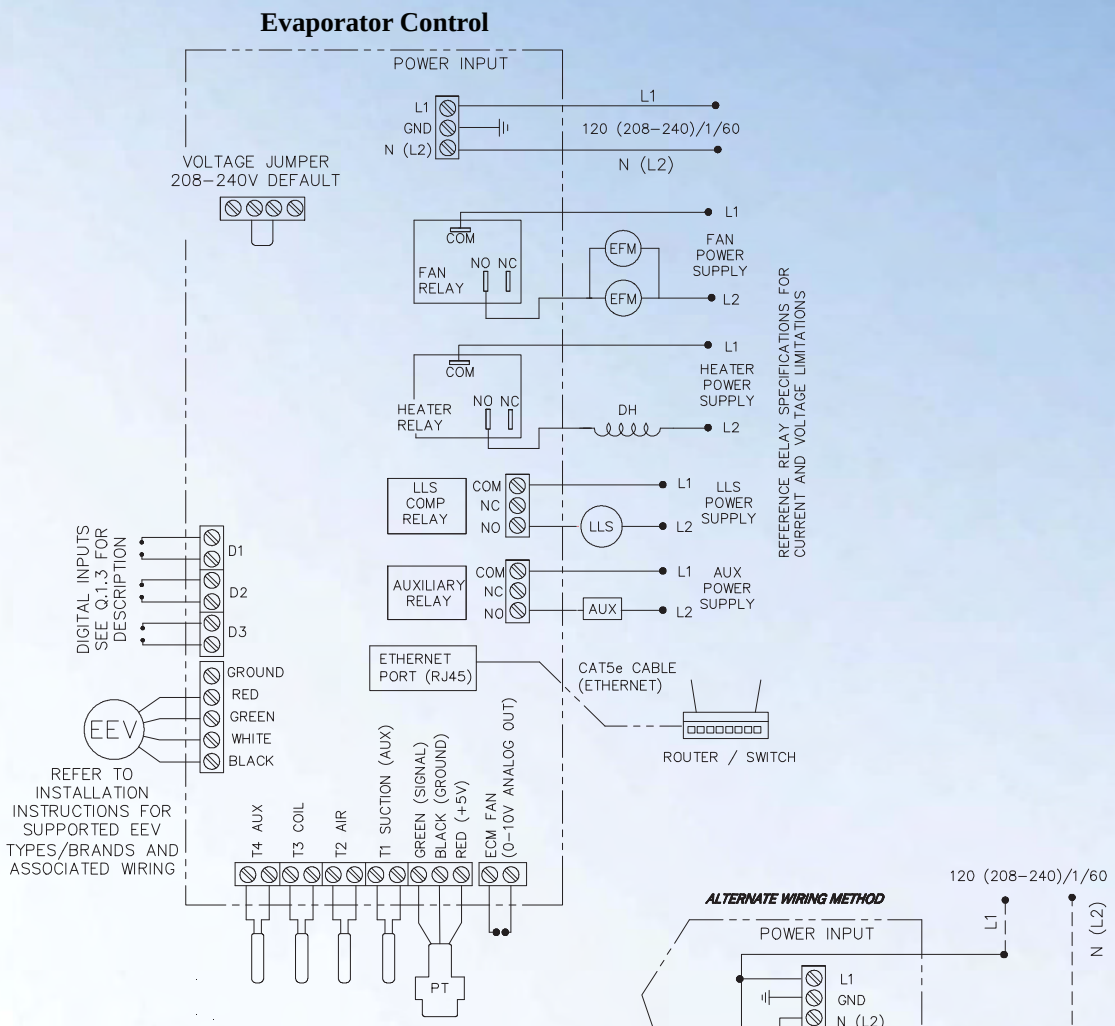


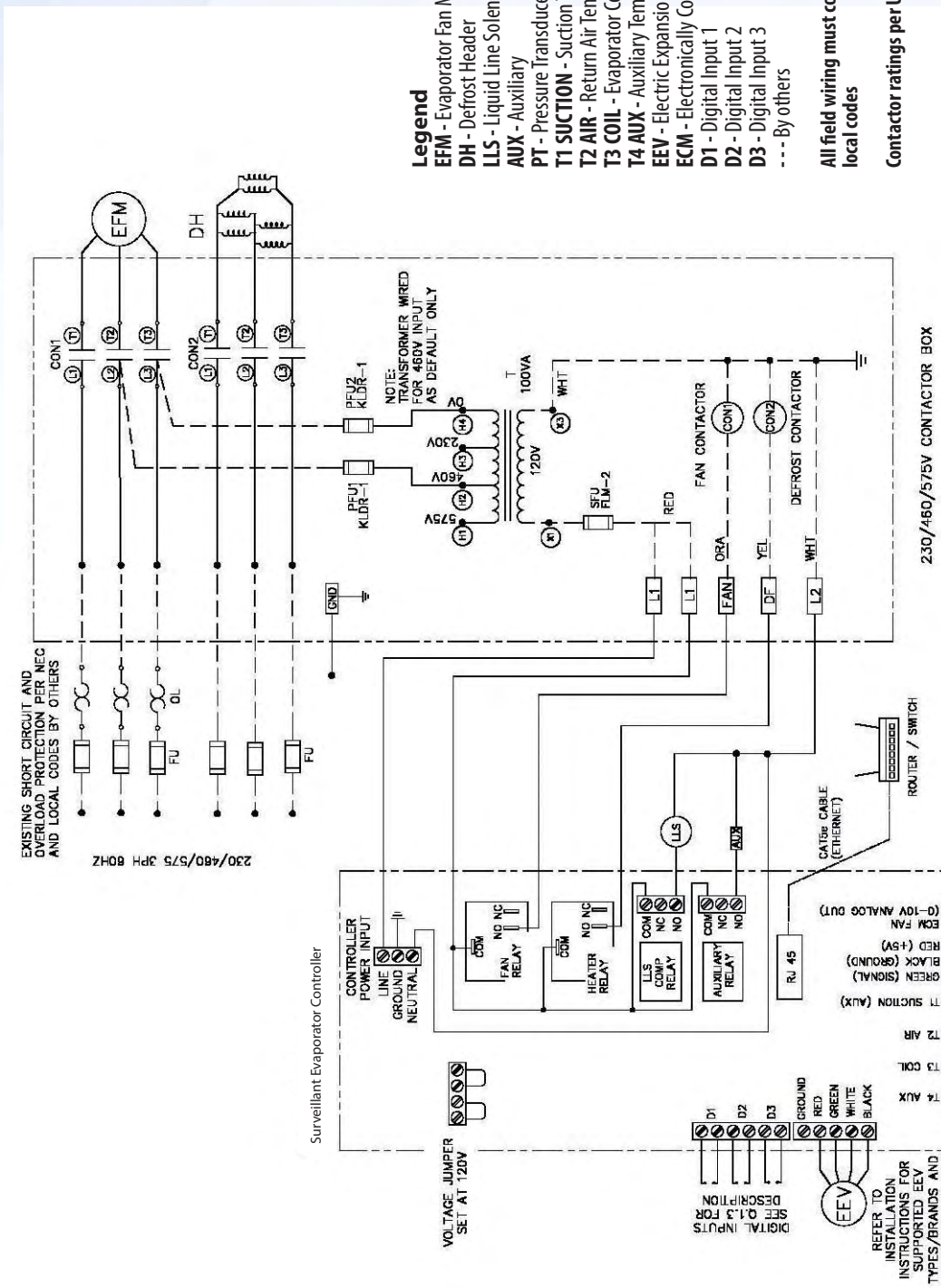
Figure 8 - Wiring Schematic - Controller New Install



Legend
EFM - Evaporator Fan Motor
DH - Defrost Header
LLS - Liquid Line Solenoid
AUX - Auxiliary
PT - Pressure Transducer
T1 SUCTION - Suction Temperature
T2 AIR - Return Air Temperature
T3 COIL - Evaporator Coil Temperature
T4 AUX - Auxiliary Temperature
EEV - Electric Expansion Valve
ECM - Electronically Commutated Motor
D1 - Digital Input 1
D2 - Digital Input 2
D3 - Digital Input 3
- - - By others

All field wiring must conform to local codes

Figure 9 - Wiring Schematic - Controller with Contactor Box



Evaporator Fan Motors Con1 Max HP & Amp Ratings (Total All Fans)

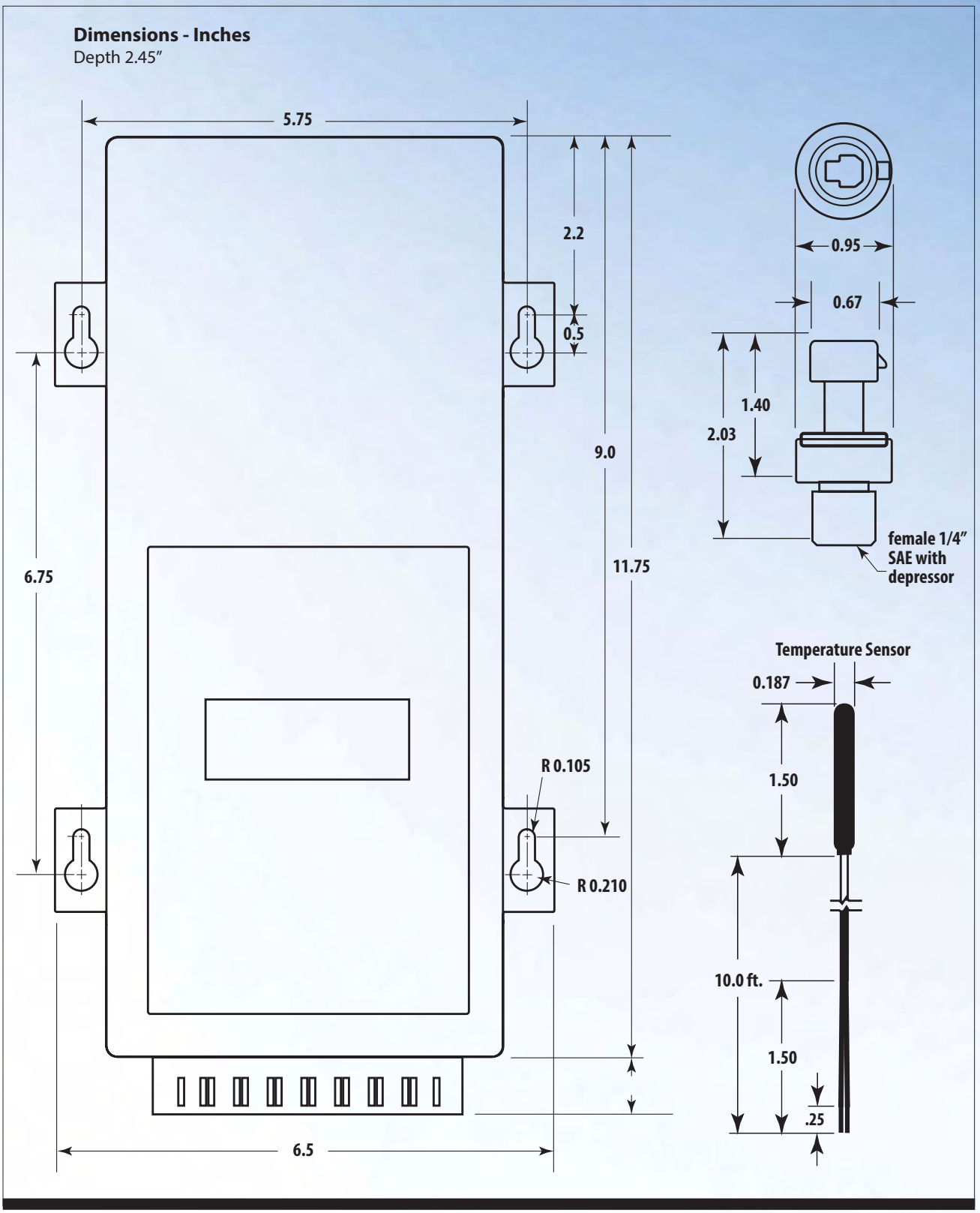
Voltage	Max HP	Max AMPS
230 3Ø	15	42
460 3Ø	30	40
575 3Ø	30	32

Existing Defrost Heaters Max Current Ratings (Amps are Total All Heaters)

Relay Box P/N	230V 3Ø	460V 3Ø	575V 3Ø
20217	54 Amps	52 Amps	52 Amps
20218	68 Amps	65 Amps	62 Amps
20219	80 Amps	77 Amps	62 Amps

Figure 9 - Wiring Schematic - Controller with Contactor Box

Figure 10 - Dimensions (front view)



Mounting the Controller

Once the wiring has been run to the controller location, the controller can be connected. When installing the Surveillant Evaporator Control, the (4) screws supplied in the kit may be preinstalled in the mounting surface. The controller has keyholes in each mounting tab to allow the controller to be installed over the screws.

User Interface

The Surveillant'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 though unrelated parameters 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.

The **ENTER** button is used to save an input option when it hasbeen changed. **The enter 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 hitting the **BACK** button.

The BACK button is used to return to the previous screen. Pressing the BACK button three times 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 **Introduction Mode** consists of as little as 3 setpoints that must be configured to begin controlling the system.

Table 1 shows the **Introduction Mode**. The first setpoint the user is asked to enter is the desired **ROOM TEMP**. This is followed by the **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 mechanical valve, but may be used with a variety of EEVs, including 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.**

Table 1 - Introduction Mode

Mechanical Valve TEV 3 steps	Standard EEV 4 steps	Custom EEV 6 steps
Room Temp	Room Temp	Room Temp
Defrost Type	Defrost Type	Defrost Type
Valve Type	Valve Type	Valve Type
	Refrigerant	Refrigerant
		Motor Step Rate
		Max Valve Steps

If using a standard/predefined EEV, the user will also be prompted to specify the **REFRIGERANT**. The Surveillant Evaporator Control may also be applied to user defined EEVs. When this option is selected, the user will be prompted to select **MOTOR STEP RATE**, and **MAX VALVE STEPS**. Once these have been set, Surveillant will begin controlling EEV and the system.

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 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 2 - Navigation Through the Controller Menu and Menu Paramenters

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 and Right Arrows** 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 toggle beween description and value : ENTER Press ENTER to go from parameter to value.

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

Menus:

Menu Parameters:

Non-adjustable
Variables (view only)
- ROOM TEMP
- COIL TEMP
- SYSTEM MODE
- SUPERHEAT
- SUCTION PRESSURE
- T1 SUCTION** TEMP
- SATURATION TEMP
- VALVE % OPEN
- T4 AUX** TEMP
- COMPRESSOR RELAY
- DEFROST RELAY
- FAN RELAY
- AUX RELAY
- DIG 1 STATUS
- DIG 2 STATUS
- DIG 3 STATUS
- IP OCTET 1
- IP OCTET 2
- IP OCTET 3
- IP OCTET 4
- SUBNET MASK OCTET 1
- SUBNET MASK OCTET 2
- SUBNET MASK OCTET 3
- SUBNET MASK OCTET 4
- FIRMWARE VERSION

Variables for DIG IN Mode
- DIG IN MODE = DISABLED
- DIG IN MODE = 2ND (ROOM) TEMP
- DIG IN MODE = DOOR SWITCH
- DIG IN MODE = EXT ALARM
- DIG IN MODE = SYSTEM OFF
- DIG IN MODE = DEFROST LOCKOUT
- DIG IN MODE = DEFROST INTERLOCK

** T1 and T4 are parameters that can be set to various functions. The default for T1 is Suction Temp, the T4 is Coil Temp.

Alarms (view only)
- NO ALARM
- PRESSURE SENSOR
- SUCTION TEMP SENSOR
- AIR TEMP SENSOR
- COIL TEMP SENSOR
- AUX TEMP SENSOR
- HIGH SUPERHEAT
- LOW SUPERHEAT
- HIGH AIR TEMP
- LOW AIR TEMP
- EXCESS DEFROST
- DEFR TERM ON TIME
- DOOR SWITCH
- COMMUNICATION ERROR
- EXT ALARM

Setpoints*
- **ROOM TEMP**
- **DEFROST TYPE**
- **VALVE TYPE**
- *MOTOR STEP RATE*
- *MAX VALVE STEPS*
- SUPERHEAT
- MAX OPERATING PRES
- REFRIGERANT
- AUX TEMP MODE
- AUX RELAY MODE
- DAC FAN
- MIN COMP RUN TIME
- MIN COMP OFF TIME
- REFRIG FAN MODE
- DEFROST MODE
- DEFROSTS / DAY
- 1ST DEFROST DELAY
- DEFROST FAN STATE
- DEFROST TERM TEMP
- DEFROST PARAMETER
- DRAIN TIME
- COMP RUN TIME
- ELEC DEFROST MODE
- FAN DELAY TEMP
- MAX FAN DELAY TIME
- PUMP DOWN TIME
- ***MULTI AIR TEMP CTRL***
- ***MULTI EVAP COOL***
- ***MULTI EVAP DEFROST***
- MULTI EVAP SENSOR
- HIGH TEMP ALARM OFFSET
- HIGH TEMP ALARM DELAY
- LOW TEMP ALARM OFFSET
- LOW TEMP ALARM DELAY
- DOOR ALARM DELAY
- DIG IN 1 MODE
- DIG IN 1 STATE
- DIG IN 2 MODE
- DIG IN 2 STATE
- DIG IN 3 MODE
- DIG IN 3 STATE
- 2ND ROOM TEMP
- SUCT PRES OFFSET
- SUCT TEMP OFFSET
- AIR TEMP OFFSET
- COIL TEMP OFFSET
- AUX TEMP OFFSET
- TEMP UNITS
- AIR TEMP DIFF
- EXTREME TEMP DIFF

Manual
- MANUAL CONTROL
- MANUAL VALVE
- CLEAR ALARMS
- MANUAL COMPRESSOR RELAY
- MANUAL DEFROST RELAY
- MANUAL FAN RELAY
- DHCP
- FACTORY RESET

* The Setpoint paramenters shown in **BOLD** (Valve Type, Room Temp Setpoint and Defrost Mode) need to be set by the user prior to start up. The other Setpoint Parameters can also be adjusted, however the factory setpoints are generally correct for most applications.

The Setpoint parameters shown in *ITALIC* are only displayed when an EEV is used.

The Setpoint parameters shown in ***BOLD ITALIC*** are displayed for bonded controllers only.

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
FACTORY RESET	Reset the controller to the factory default setpoints	RESET	

Variables Menu - Non Adjustable (view only)

Parameter Name	Description
ROOM TEMP	Walk-in freezer or cooler room temperature 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 SUCTION TEMP	Suction temperature as measured by the controller
SATURATION TEMP	Saturation temperature as calculated by the controller
VALVE % OPEN	Percentage the EEV is open
T4 AUX TEMP	Auxiliary Temperature (Taux) sensor reading as measured by the controller
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 state of the auxiliary relay
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 LOCKOUT	inactive = NORMAL CONTROLLER LOGIC; active = PREVENT INITIATING DEFROST
DIG IN MODE = DEFROST INTERLOCK	inactive = NORMAL CONTROLLER LOGIC; active = DEFROST HEATERS OFF

Alarms Status Menu Non Adjustable (view only)

Parameter Name	Description
NO ALARM	No alarms active, everthing is running correctly
PRESSURE SENSOR	Suction pressure sensor is shorted, open or pressure out of range
T1 SUCTION SENSOR	Suction temperature sensor is shorted or open
T2 AIR SENSOR	Return air temperature sensor is shorted or open
T3 COIL SENSOR	Coil temperature sensor is shorted or open
T4 AUX SENSOR	Auxiliary temperature sensor is shorted or open
HIGH SUPERHEAT	Superheat above upper limit
LOW SUPERHEAT	Superheat below lower limit
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**
EXCESS DEFROST	Three consecutive defrosts with less than a one hour interval between each defrost
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

Table 4 - Defrost Defaults

Setpoint	Electric	Air	Hot Gas
Defost Fan State:	Off	On	Off
Defrost Termination Temperature Setpoint:	50	40	50
Maximum Defrost Time	25	40	15
Electric Defrost Mode:	Pulse	Permanent	Permanent

Communication

The Surveillant Evaporator Control 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 Surveillant MasterView. The information is stored on the controller, so special software is not required.

A standard Ethernet cable should be used 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 router. 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. Surveillant Router is available in a 4-port and a Switch in an 8-port model. The Surveillant Router includes wireless access. The 8-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 Adminstrator should be contacted to facilitate the network installation.

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:	(4) temperature sensors (KE2 SKU 20200)
	(1) pressure transducer (KE2 SKU 20204)
Valve Types:	bipolar stepper motors (12V)
Relays:	20A resistive (defrost)
	10A inductive (evaporator fan)
	(2) 3A inductive rated cycles
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 lockout, defrost interlock
Digital Input 3:	door contact, use 2nd air temp setpoint, disabled, system off, external alarm notification, lights
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

Replacement Parts

8219537 - Surveillant Controller
8219516 - EEV Power Cable for AA/AE evaporators
8219517 - EEV Power Cable for CTA/CTE evaporators
8219520 - Suction Temperature sensor for AA/AE
8219521 - Suction Temperature sensor for CTA/CTE
8219522 - Return Air Temperature Sensor for AA/AE
8219523 - Return Air Temperature Sensor for CTA/CTE
8219978 - Air sensor mounting wire
8219524 - Coil Temperature sensor for AA/AE
8219525 - Coil Temperature sensor for CTA/CTE
8219526 - Coil Temperature sensor for CTA/CTE (AUX)
8219539 - Electronic Expansion Valve - less cable
8219981 - Transducer only - No cable
8219518 - Transducer Cable for AA/AE evaporators
8219519 - Transducer Cable for CTA/CTE evaporators
8219528 - Strain relief wire

Setpoints Menu

	Parameter Name	Description
	ROOM TEMP	Room temperature 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, pre-configured electric, custom EEV configuration
Custom EEV only	**MOTOR STEP RATE**	If **VALVE TYPE** = CUSTOM: The motor speed setting in number of steps per second
Custom EEV only	**MAX VALVE STEPS**	If **VALVE TYPE** = CUSTOM: The total number of steps required to move the valve from closed to fully open
	SUPERHEAT	The superheat value that the controller will maintain, (not applicable if **VALVE TYPE** = MECHANICAL)
	MAX OPERATING PRES	The maximum allowable suction pressure, (not applicable if **VALVE TYPE** = MECHANICAL)
	REFRIGERANT	The type of refrigerant used in the refrigeration system
	AUX TEMP MODE	Configuration mode of the auxiliary temperature sensor
	AUX RELAY MODE	Configuration mode of the auxiliary relay.
	DAC FAN	Provides 0-10V DC signal to control variable speed
	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 MOD**E = 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.
	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	Select control method to use with multiple room temperature sensors
Bonded Controllers Only	**MULTI EVAP COOL**	Select type of multi evaporator control - options are synchronous or independent
Bonded Controllers Only	**MULTI EVAP DEFROST**	Select whether to have all bonded controllers initiate defrost mode at the same time or independently.
Bonded Controllers Only	**MULTI EVAP SENSOR**	Select whether or not to share room temperature, coil temperature and suction pressure sensor data with 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**
	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, if needed
	SUCT TEMP OFFSET	An offset added or subtracted from the suction temperature sensor reading, if needed
	AIR TEMP OFFSET	An offset added or subtracted from the room temperature sensor reading, if needed
	COIL TEMP OFFSET	An offset added or subtracted from the coil temperature sensor reading, if needed
	AUX TEMP OFFSET	An offset added or subtracted from the auxiliary temperature sensor reading, if needed
	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
	EXTREME TEMP DIFF	ADVANCED TOPIC: Call Applications Engineering for assistance

	Range	Default	Current
	-50°F to 90°F	-10°F	
	ELEC, AIR, HOT GAS COMP ON, HOT GAS COMP OFF	ELEC	
	MECHANICAL, SER/SEI 1 TO 20, SER B TO L, SEI 30, SEI 50, SEH, ETS12 TO 50, ETS100, ETS250/400, KV, CAREL, CUSTOM;	MECHANICAL	
	30 to 400 steps/second	200 steps	
	200 to 6400 steps	1600 steps	
	5°F to 30°F	8°F	
	10 to 150 psig	150 psig	
	404A, R507, 407A, 407C, 422A, 422D, 134A, R22, R717, 438A, 408A, 409A, 410A, R744	404A	
	DISABLED, MONITOR, 2ND AIR TEMP, 2ND COIL TEMP	DISABLED	
	ALARM RELAY, 2 SPEED FAN CTL, 2ND COMP RELAY, 2ND FAN RELAY, 2ND DEFR RELAY, LIGHT RELAY	ALARM RELAY	
	-100% to 100%	0.000 (Off)	
	0 to 15 minutes	2 minutes	
	0 to 15 minutes	5 minutes	
	ON WITH COMPRESSOR, PERMANENT, CYCLE	ON WITH COMPRESSOR	
	DEMAND, SCHEDULED, RUN TIME	DEMAND	
	0 to 8	5	
	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	PULSE	
	-40°F to 35°F	20°F	
	0 to 20 minutes	2 minutes	
	0 to 10 minutes	0 minutes	
	AVERAGE, WARMEST	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 180 minutes	30 minutes	
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF	DOOR	
	OPEN, CLOSED	CLOSED	
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF, DEFR INTER-LOCK	DISABLED	
	OPEN, CLOSED	CLOSED	
	DISABLED, 2ND ROOM TEMP, DOOR SWITCH, EXT ALARM, SYSTEM OFF, LIGHT SWITCH, CAMERA SWITCH	DISABLED	
	OPEN, CLOSED	CLOSED	
	-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	
	-5.0°F to 5.0°F	0.0°F	
	FAHRENHEIT/CELSIUS	FAHRENHEIT	
	0°F to 5°F	1°F	

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