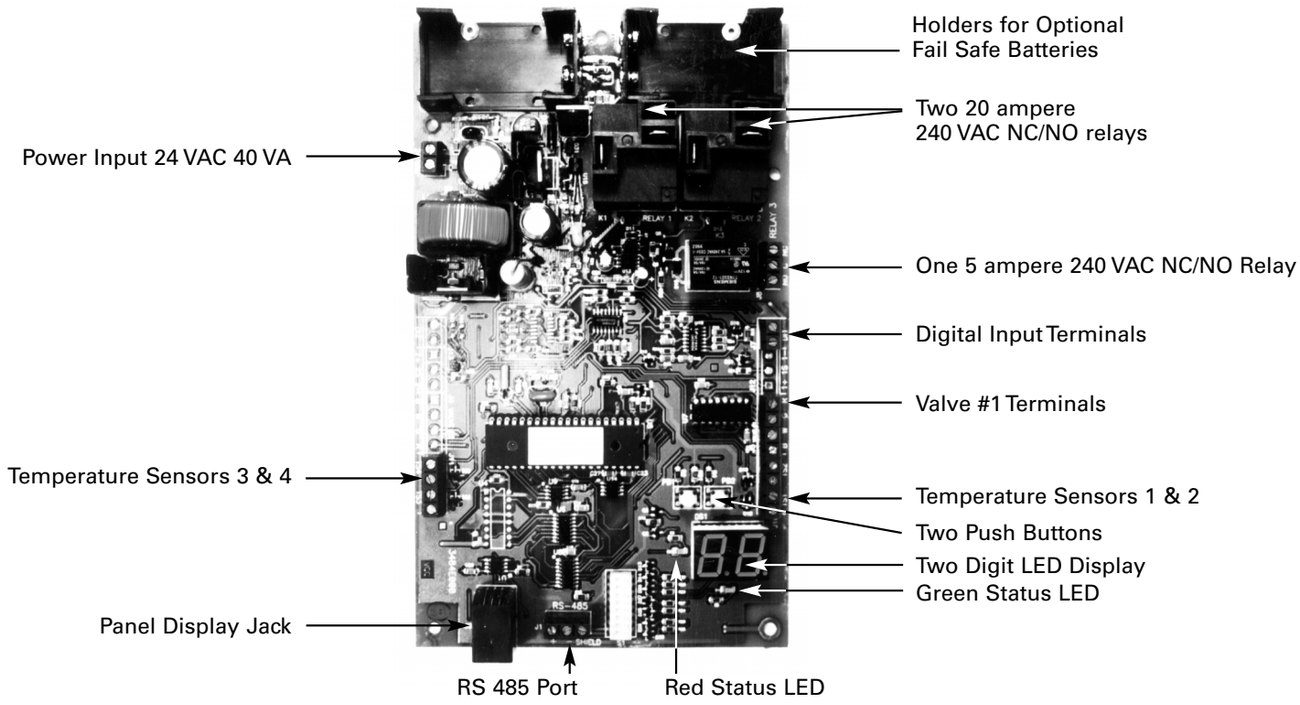
REFRIGERATION CONTROLLER - TWO TEMPERATURE SUPERHEAT CONTROL

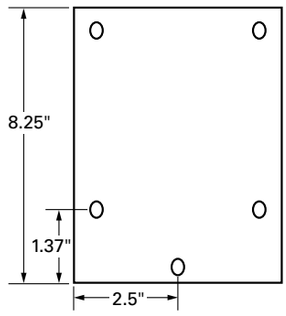


The Refrigeration Controller has been designed to control one Sporlan Electric Expansion Valves (EEV) in response to a two temperature superheat and room air temperature. The valve controlled may be SEI .5 through SEI 11, SEI-50, SEH-100 or SEH-175. Optional batteries provide for valve shutdown in the event of power failure.

The controller must be installed in a weather-proof enclosure. The controller should be mounted on standoffs, mounting holes are .250" from each edge and are .125" in diameter. The board must be supplied with 24 volts AC 50/60 Hz. at 40 VA. Unless otherwise requested, the boards are configured to operate with temperature sensors supplied by Sporlan.

As illustrated, the controller is provided with hardware and input/output connections for a number of user specified purposes. See below:

Figure 1



- One valve control
- One digital input (from external switches or relays)
- Four temperature inputs (Sporlan supplied surface or air sensors)
- Optional battery backup for onboard time clock and fail-safe valve closure
- Two digit LED readout
- One green LED indicator
- One red LED indicator
- Two push buttons for setting superheat, alarm cancellation, etc.
- One 8-position dip switch for addressing, mode selection, etc.
- Two 20 Amp, 240 VAC NC/NO relays
- One 5 Amp 240 VAC NC/NO relay
- RS 485 port
- Diagnostic port

Wiring of the board is shown in the table below.

TERMINALS	FUNCTION ON CONTROL BOARD
RELAY 1	240 Volt 20 AMP Inductive Load
RELAY 2	240 Volt 20 AMP Inductive Load
RELAY 3	Not Used
DI-1	Defrost - Valve Closed When Shorted
TS-1	Inlet Sensor
TS-2	Outlet Sensor
TS-3	Room Air Temperature
TS-4	Not Used
RS 485 PORT	Not Used
DIAGRAM JACK	Panel Display Output
24 VAC	24 Volt AC At 40 VA Input

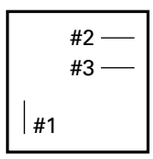
For two-temperature superheat control the location of the sensors is critical, and generally requires a considerable amount of testing to determine the correct location. The inlet sensor requires a saturated vapor condition. When starting, the sensors are the same temperature, therefore the controller will not "see" a superheat condition through the sensors. It doesn't know if the evaporator is flooded or lacking refrigerant. The controller is programmed to open the valve partially for a specified length of time to allow refrigerant flow to the evaporator. The percentage of opening and the time period are very system dependent.

CONNECTIONS FOR SPORLAN TWO TEMPERATURE REFRIGERATION CONTROLLER

- Connect the Inlet sensor so the tip of the sensor is at a 4 or 8 o'clock position on the tube. Mount the sensor downstream of the valve and distributor on a circuit that is physically lowest with respect to the ground. Wrap the sensor with insulation foam so that air streams cannot affect it.
- Connect the Inlet sensor to the controller at the terminals labeled 'TS1'.
- Connect the Suction sensor so the tip of the sensor is at a 4 or 8 o'clock position on the tube. Mount the sensor on the common suction line of the evaporator. Wrap the sensor with insulation foam so that air streams cannot affect it.
- Connect the Suction sensor to the controller at the terminals labeled 'TS2'.
- Connect the Room Temperature sensor in the discharge air or return air stream of the evaporator.
- Connect the Room Temperature sensor to the controller at the 2 terminals labeled 'TS3'.
- Connect Electric Expansion valve to 'Valve #1' terminals as follows:

  Connect black wire to terminal labeled 'B'.
  Connect white wire to terminal labeled 'W'.
  Connect green wire to terminal labeled 'G'.
  Connect red wire to terminal labeled 'R'.

- 'DI1' is defrost signal.
  - Open between 2 terminals puts controller in normal operation.
  - Short between 2 terminals puts controller in defrost, closes the valve, switches relays 'K1' and 'K2', and leaves it there until short is removed.



K1 or K2

#1 is the common terminal of the relay.
#2 is the normally closed terminal of the relay.
#3 is the normally open terminal of the relay.

- Relay 'K1' can be used for defrost heaters. Connect one leg of power in to pin #1 of relay 'K1' and the leg of the heater to pin #3 of relay 'K1'.
- Relay 'K2' can be used for evaporator fans. Connect one leg of power in to pin #1 of relay 'K1' and the leg of the fan to pin #2 of relay 'K2'.

ONBOARD 2 DIGIT DISPLAY AND BUTTONS

When power is applied, the green LED will be on constantly and the 2 digit display will show the room temperature as read by the controller. The red LED is the negative sign. If the red LED is off, the 2 digit display reading is between 0 to 99 deg F. If the red LED is on, the 2 digit display reading is between -50 and -1 deg F. Pressing button 'PB1' at any time will cause the 2 digit display to show the room temperature as read by the controller.

Pressing button 'PB2' at any time will cause the 2 digit display to show the superheat as read by the controller. The 2 digit display reading is between 0 to 99 deg F. Pressing button 'PB2' at any time will cause the 2 digit display to show the superheat as read by the controller.

Pressing buttons 'PB1' and 'PB2' simultaneously at any time will cause the 2 digit display to show the suction temperature as read by the controller. The red LED is the negative sign. If the red LED is off, the 2 digit display reading is between 0 to 99 deg F. If the red LED is on, the 2 digit display reading is between -50 and 0 deg F.

Whenever the controller is in defrost, the 2 digit will display 'dF'.

Pressing and holding buttons 'PB1' and 'PB2' simultaneously until the green LED starts blinking will cause the 2 digit display to show the room temperature setpoint. While the green LED is blinking, pressing 'PB1' will increment the setpoint by 1 deg F. While the green LED is blinking, pressing 'PB2' will decrement the setpoint by 1 deg F. Do not press any pushbutton for 5 to 10 seconds or until the green LED stops blinking. The controller will use the last display for the room temperature set point and will go back to normal operation.

OPTIONAL PANEL DISPLAY

OPTIONAL PANEL DISPLAY - Plug the remote display into the telephone jack (J9) on the controller. The following is a list of readings available:

POSN	Number of steps the electric expansion valve is open
SUPH	Superheat read by controller
RMTP	Temperature read by the room temperature sensor (-50 to 102 degrees F.)
TOUT	Temperature read by the suction temperatures sensor (-50 to 102 degrees F.)
TSAT	Saturated temperature as calculated by the controller (-50 to 102 degrees F.)
COOL, DEFR	COOL when in normal operation, DEFR when in defrost
1596, 6386	1596 if the valve being used is an SEI-.5, SEI-1, SEI-2, SEI-3.5, SEI-6, SEI-8, or SEI-11. 6386 is used for all other expansion valves.
SHSP	Superheat set point
DASP	Room temperature set point

Pressing 'ENTER' will toggle display between one of the displays described above and the numeric value read for that particular display. Pressing 'UP' will scroll through the menu from 'POSN' to 'SUPH', etc. Pressing 'DOWN' will scroll through the menu the opposite way.

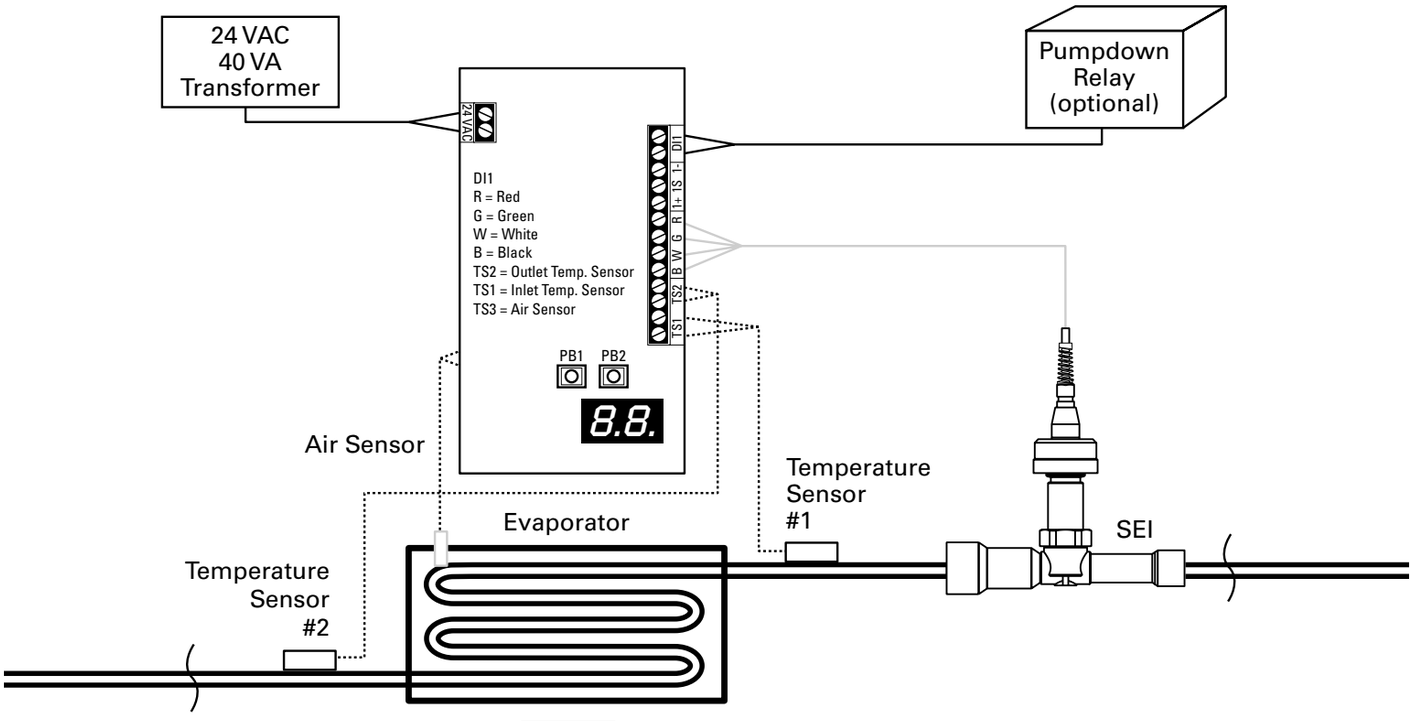
When in 'POSN', pressing and holding the 'UP' button and 'ENTER' button simultaneously for 5 seconds will put the valve in manual valve position. The number of steps open will be displayed and the 1000's digit will blink. Pressing the 'UP' button will open the valve 1000 steps. Pressing the 'DOWN' button will close the valve 1000 steps. Pressing the 'ENTER' button will change the flashing digit from 1000's digit to the 100's digit. Pressing the 'UP' button will open the valve 100 steps. Pressing the 'DOWN' button will close the valve 100 steps. Pressing the 'ENTER' button will change the flashing digit from 100's digit to the 10's digit. Pressing the 'UP' button will open the valve 10 steps. Pressing the 'DOWN' button will close the valve 10 steps. Pressing the 'ENTER' button will change the flashing digit from 10's digit to the 1's digit. Pressing the 'UP' button will open the valve 1 step. Pressing the 'DOWN' button will close the valve 1 step. Pressing the 'ENTER' button will change the flashing digit from 1's digit to the 1000's digit Press and hold 'UP' button and 'ENTER' button for 5 seconds will put the controller in normal control. The digits will stop blinking.

When in 'SHSP', pressing and holding 'UP' button and 'ENTER' button simultaneously for 5 seconds will enable the superheat set point to be changed. The set point is displayed and the 100's digit will blink. Pressing the 'UP' button will increase the setpoint to 30 degrees. Pressing the 'DOWN' button will decrease the set point to 0 degrees. Pressing the 'ENTER' button will change the flashing digit from 100's digit to the 10's digit. Pressing the 'UP' button will increase the setpoint by 10 degrees. Pressing the 'DOWN' button will decrease the set point by 10 degrees. Pressing the 'ENTER' button will change the flashing digit from 10's digit to the 1's digit. Pressing the 'UP' button will increase the setpoint by 1 degree. Pressing the 'DOWN' button will decrease the set point by 1 degree. Pressing the 'ENTER' button will change the flashing digit from 1's digit to the 100's digit. Press and hold 'UP' button and 'ENTER' button for 5 seconds will save the set point. The digits will stop blinking.

When in 'DASP', pressing and holding 'UP' button and 'ENTER' button simultaneously for 5 seconds will enable the room temperature set point to be changed. The set point is displayed and the 100's digit will blink. Pressing the 'UP' button will increase the setpoint by 100 degrees. Pressing the 'DOWN' button will decrease the set point by 10 0 degrees. Pressing the 'ENTER' button will change the flashing digit from 100's digit to the 10's digit. Pressing the 'UP' button will increase the setpoint by 10 degrees. Pressing the 'DOWN' button will decrease the set point by 10 degrees. Pressing the 'ENTER' button will change the flashing digit from 10's digit to the 1's digit. Pressing the 'UP' button will increase the setpoint by 1 degree. Pressing the 'DOWN' button will decrease the set point by 1 degree. Pressing the 'ENTER' button will change the flashing digit from 1's digit to the 100's digit. Press and hold 'UP' button and 'ENTER' button for 5 seconds will save the set point. The digits will stop blinking.

If display reads '1596' or '6386', pressing and holding 'UP' button and 'ENTER' button simultaneously for 5 seconds will enable the controller to change to the other type of valve. All 4 digits will start to blink. Pressing either the 'UP' button or the 'DOWN' button will toggle the display between '1596' and '6386'. Press and hold 'UP' button and 'ENTER' button together for 5 seconds to save the selection. The digits will stop blinking.

REFRIGERATION PRESSURE / TEMPERATURE SUPERHEAT CONTROLLER WIRING SCHEMATIC



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