Hoffman Controls
Installation & Operating Instructions

880-60 Low Ambient Head Pressure Control for ECM Motors

General

CAUTION

Failure to read and understand the accompanying instructions and diagrams or failure to complete the "Checkout Procedure" prior to energizing the Control may result in permanent damage to the Control.

The 880-60 Low Ambient Head Pressure Control is designed to modulate energy efficient Electrically Commutated condenser fan Motors (ECM) in air conditioning and refrigration systems. The control monitors the head pressure by sensing the sub-cooled liquid line temperature, system pressure or via a 0-10Vdc control signal and varys the air volume through the condenser consequently regulating head pressure for proper heat rejection in low ambient conditions.

Pre-Installation

1. For use with ECM condenser fan motors capable of accepting a 0-10Vdc, 10-0Vdc (fail safe signal) or 13-17Vdc amplitude, 80Hz Pulse Width Modulated (PWM) variable speed control signal.
2. The control provides 60mA (typically six ECM motors) of motor drive capability and works with all motor line voltages.
3. The 880-60 Control can monitor one to two refrigerant circuits with Hoffman Controls 10K liquid line temperature sensors or PENN P499 type 0.5-4.5Vdc, 750psi ratiometric pressure transducers. When using more than one temperature sensor or pressure transducer, the hottest temperature sensor or the highest pressure transducer is in control. The 880-60 is not supplied with temperature sensors or pressure transducers. Temperature sensor p/n 100-0016-001 may be purchased from Hoffman Controls. P499 0.5-4.5Vdc, 750psi ratiometric pressure transducers are market available. Additionally, the 880-60 will accept any type of 0-10Vdc control signal. Other types and ranges of pressure transducer can be used. However, the "psi" scales on the Low & High Set point potentiometers are calibrated for the P499 0.5-4.5Vdc, 750psi transducer. The 0-10Vdc control signal input can also be used for any type of 0-10Vdc pressure transducer.
4. The control requires an external 24Vac, 4VA power source.
5. Wiring must comply with Local and National Electrical Codes.

WARNING

Disconnect power from the unit and electrically disable the compressor prior to installation.

Installation

- Install the 880-60 Control in a weatherproof control panel or use a NEMA Series type 2, 3, or 3R enclosure. The control is conformally coated but must be protected from direct moisture and condensation.
- Determine an appropriate mounting location and attach the control using four sheet metal screws through the circuit board four corner standoffs.
- Dimensions and mounting hole patterns for the control are included in Figure 2, 880-60 Wiring Diagram.
- Make the wiring connections as shown in Figure 2, 880-60 Wiring Diagram.
- Note: Attach the variable speed ECM motor control signal to the PWM(+) & GND(-) terminals for PWM type motors or attach the 0-10Vdc and 10-0Vdc type motors to the VDC(+) & GND(-) terminals. It is acceptable to use both PWM and 0-10Vdc type motors at the same time. 10-0Vdc type motors can not be used in combination with other type motors.
- The 24Vac "COM" terminal allows for grounded 24Vac supply if required.
- The 880-60 Control provides a +5Vdc 30mA power supply output to power up to two pressure transducers. However, the installer must review the pressure transducer literature to ensure the total current draw does not exceed 30mA. The P499 0.5-4.5Vdc, 750psi ratiometric pressure transducer draws a maximum of 7mA and up to two P499 transducers can be used without issue. Make the transducer connections as shown in Figure 2, 880-60 Wiring Diagram.
- If using the Hoffman Controls 10K temperature sensor(s), follow the Liquid Line Sensor Installation guide on page 2.

Liquid Line Sensor

- Install the purchased 10K Sensor to the top of liquid line where the line exits the condenser coil as shown in Figure 1, Sensor Installation.

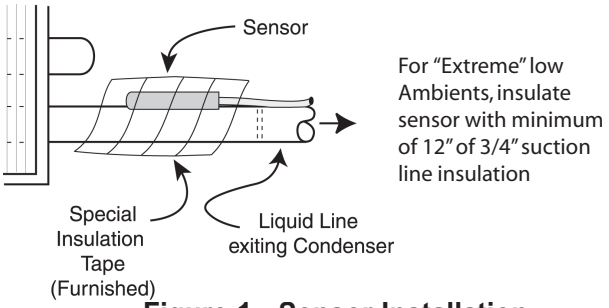


Figure 1 - Sensor Installation

- Use the special tape provided to secure the Sensor to the liquid line. Stretch the tape slightly, as you wrap Sensor around the liquid line. Use all the tape, lapping the Sensor. Firm contact is required between the metal tab of the Sensor and the liquid line.
- Connect the 1st sensor to the control's input terminals S1 & GND (minimum of 1 sensor required). Note that it doesn't matter which of the two sensor wires is attached to GND.
- If monitoring two refrigerant circuits, install the 2nd sensor to the 2nd condensor coil as shown above and connect it to the controls' input terminals S2 & GND.
- Additional insulation of the taped sensor and adjacent refrigerant line back to condenser header may be required in extremely cold ambients (+20°F).
- Refrigeration applications or extremely low ambient environments may require additional consideration. See Engineering Bulletin (HCC #81XEB02REVA) for "Low Ambient Considerations".

PWM ADJ Potentiometer

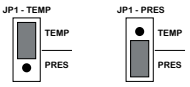
It may be necessary to adjust the PWM ADJ poteniometer when using an ECM condensor fan motor(s) that use a PWM type motor speed control signal. It will be necessary for the installer to have the motor manufacturers' specifications for the amplitude of the PWM signal.

Example: If the manufacturers' PWM amplitude specification is 9-15Vdc, set the PWM ADJ poteniometer below 15Vdc. If the manufacturers' PWM amplitude specification is 15-30Vdc, set the PWM ADJ poteniometer above 15Vdc. The PWM ADJ potentiometer is set at 15Vdc from the factory and this setting will work with most PWM type ECM condenser fan motors.

LOW & HIGH SET Potentiometers

The LOW SET point and HIGH SET point adjustments are critical settings for proper heat rejection in low ambient conditions. The 880-60 control maintains the pressure differential at the expansion valve for proper superheat. The LOW SET and HIGH SET point potentiometers have three scales that provide settings for temperature, pressure and Vdc. Use the scale that is appropriate for the input control signal application.

The set point scales are as follows:



When temperature (TEMP) is selected using the JP1 jumper tab, the LOW SET point range is 40°F to 80°F in 1°F increments. The HIGH SET point range is 60°F to 140°F in 1°F increments.

When pressure (PRES) is selected using the JP1 jumper tab, the LOW SET point range is 80psi to 400psi in 5psi increments. The HIGH SET point range is 180psi to 660psi in 5psi increments.

When there is a signal on the 0-10Vdc input and no signal present on the other inputs, the LOW SET point range is 0.5Vdc to 8.0Vdc in 0.1Vdc increments. The HIGH SET point range is 2.0Vdc to 10.0Vdc in 0.1Vdc increments.

This wide range of adjustment provides head pressure contol for a wide range of typical and unique applications.

The factory setting for the 880-60 Model is for the typical 410A family of refrigerants, pressure sensed application, with the JP1 jumper in the PRES position and a LOW SET point of 280psi and a HIGH SET point of 360psi providing an 80psi range (span) of ECM condenser fan motor modulation for the typical Thermal Expansion Valve (TXV) type systems. In this example, the condenser fan motor(s) modulate from full motor speed which occurs at 360psi and modulates the motor(s) down to minimum speed at 280psi. The motor(s) will cycle "OFF" at liquid line pressures below 280psi and cycles back "ON" first with a 2.5 second full speed hard start then to minimum speed at 290psi liquid line pressure providing 10psi of hysteresis between motor "OFF" and "ON".

Operation with Hysteresis

When the sensed input drops below the LOW SET point, the motor will turn off. When the input rises above the set point by the hysteresis value, the motor will turn back on. The hysteresis value for temperature is 3°F, pressure is 10psi and voltage is 0.8Vdc.

CAUTION: These various set point adjustments are provided only to ensure proper ambient control when the system is properly charged (no vapor in the sight glass), filters, condenser and evaporator coils are clean, and the system is properly charged.

LED Set Point Indicator

When either of the LOW or HIGH set point potentiometers is turned, the LED will flash the new reading. A sequence of flashes indicates a digit from 1-9. A "zero" is indicated by a low-brightness pulse. For example, if the set point is 105°F, the LED will flash once, then pause, then display a dim glow, then pause, then flash five times. If the input type is changed, the set point indication will display the new set point.The LED set point indicator provides the installer with the assurance that the set points have been entered exactly as desired.

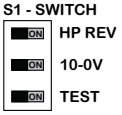
During normal operation the LED intensity will increase with the fan motor speed.

S1 Switch Selections

When the heat pump is operating, the fan motor(s) run at high speed. The heat pump is sensed as ON when the 24Vac signal is present on the heat pump (HP24V) input line and the heat pump (HP REV) switch is OFF. The heat pump is also sensed as ON when the 24Vac signal is not present on the heat pump (HP24V) line and the heat pump (HP REV) switch is in the ON position.

When using an ECM condenser fan motor(s) that accepts a 10-0Vdc (fail safe) speed control signal, the S1 10-0V switch should be in the ON position. For 0-10Vdc operation, the switch should be OFF.

When performing a self-test checkout procedure, put the TEST switch in the ON position. This will cause the ECM condenser fan motor(s) to ramp up and down with a period of 15 seconds. Once testing is completed, the switch should be in the OFF position.



880-60 Control Input Signals

The 880-60 control provides one to two temperature sensor or one to two pressure transducer inputs. Whichever line is giving a valid reading is used. If more than one line is valid, the maximum of the valid lines is used. If none of the lines are valid, the VDC IN input line is used. If this line has a signal less than 0.3Vdc, then the 880-60 control assumes that there are no valid inputs, the LED will flash continously and the motor(s) will run at full speed.

880-60 Control Output

The 880-60 control PWM and 0-10Vdc motor maximum speed output is 97% duty cycle PWM and 9.7Vdc. The minimum speed output is 20% duty cycle PWM and 2.0Vdc. Motor off is 0% duty cycle PWM and 0.0Vdc. If using 10-0Vdc (fail safe) mode, the motor maximum speed output is 0.0Vdc and the minimum speed output is 8.0Vdc. Motor off is 9.7Vdc.

Checkout Procedure

CAUTION

Verify all ECM motor connections & configurations before applying power.

1. Verify line voltage is correctly applied to the motor(s) terminals.
2. Verify motor(s) has been programmed for correct rotation (CW/CCW) and is selected for the reccommended propeller blade.

Prepare for Operation:

1. It is recommended that the compressor be disabled prior to control and condenser fan motor(s) operation checkout.
2. Motor speed control can be tested by putting the TEST S1 switch in the ON position. The motor(s) speed will ramp up and down over a period of 15 seconds. Put the switch in the OFF position for normal operation..
3. An alternate test method is to disconnect one lead off all temperature or pressure sensors and if used , disconnect the VDC IN lead from the control. The LED will flash continuously and the motor(s) will run at full speed if all wiring is correct.
4. Once the control and motor(s) wiring is verified, reconnect the sensors/VDC IN inputs and the compressor power may be restored.
5. Set thermostat for cooling demand and apply voltage to the unit. Condenser fan(s) will hard start if the liquid line is 3°F (if temperture sense is being used) above the LOW SET point value and modulate over the span of the range selected.
6. Verify that the motor is operating properly for temperature sensed. Depending on the LOW & HIGH set points, when the sensor temperature at “start up” is:
   a. Below Selected Range, the motor(s) will not start.
   b. Within Selected Range, the motor(s) will first hard start and then modulate to a reduced speed proportional to the temperature sensed.
   c. Above Selected Range, the motor(s) will start and remain at full speed.
7. Verify operation as described above by monitoring liquid line temperature and observing motor speed.
8. If using pressure or Vdc inputs, monitor the control signals for proper operation.

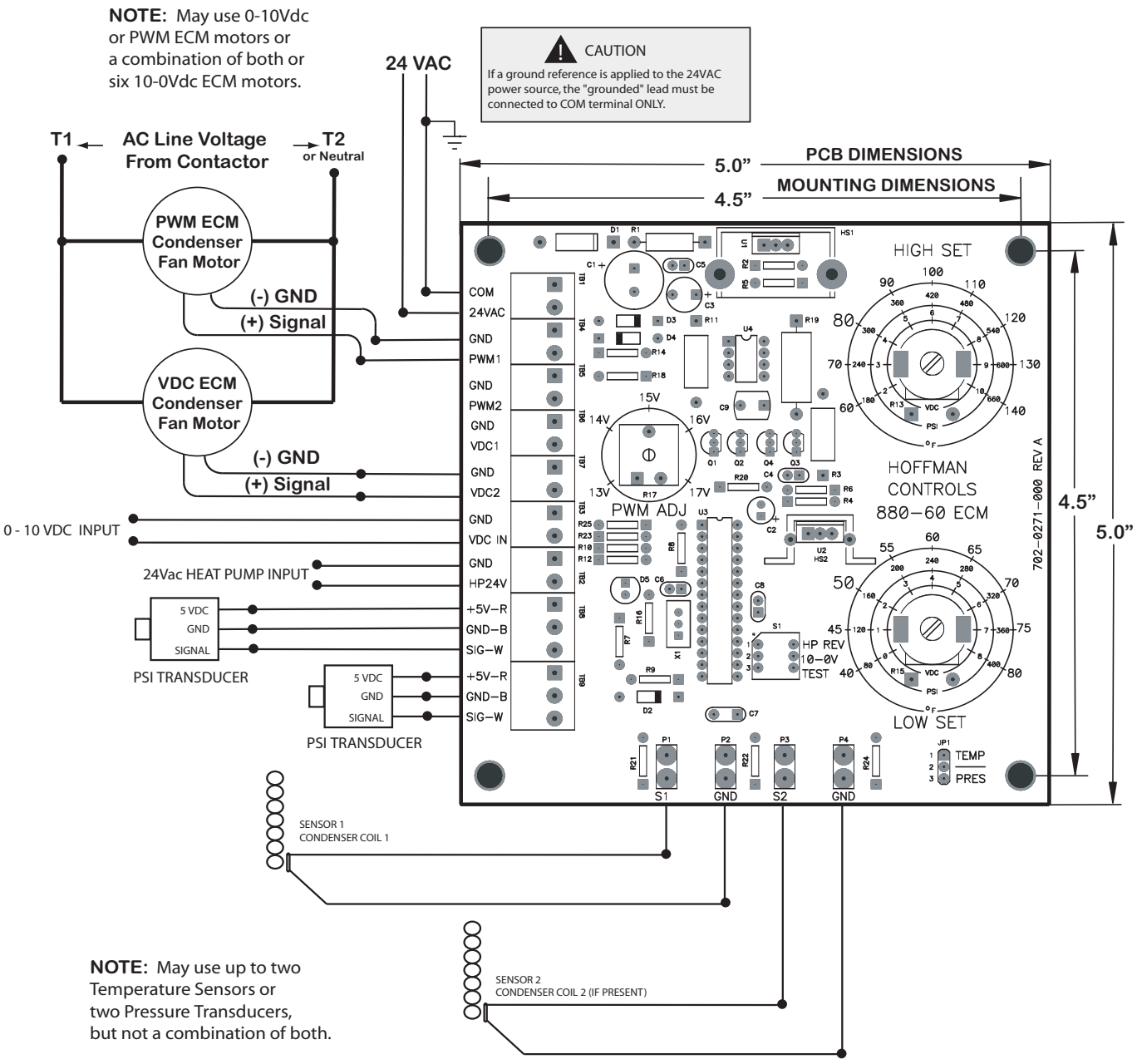


Figure 2 - Wiring Diagram for the 880-60 Control