

Standard Control Options

Internal Wiring

Copper wire with a minimum of 105°C insulation is used throughout. Connections are made with either box lugs or connectors crimped on with calibrated tooling. Terminal blocks are provided for all field control and power wiring.

The Control Option concept to maintains compliance with changing UL and NEC requirements and to stay current with new duct heater temperature control systems. The concept has also been broadened to include numerous “Special Features” to meet a wide variety of special requirements.

Control Option G – Basic

Control Option G is a basic package designed for normal comfort heating applications – i.e., those that do not require pneumatic control or the unique features of SCR control. With Option G, the temperature is controlled by a pilot duty thermostat or a step controller.

Control Option G includes the following:

- **Automatic and manual reset thermal cutouts** to protect against overheating. The automatic reset cutout is wired into the control circuit; the manual reset de-energizes the heater load.
- A differential pressure **airflow switch** to de-energize the heater control circuit upon loss of airflow.
- **Magnetic contactors** for each heater stage.
- **Fuses** to protect each circuit in any heater drawing more than 48 amps.
- A control circuit **transformer**, with 24 or 120 volt secondary as specified, including any overcurrent protection required by UL or the NEC.
- A built-in, snap-acting **disconnect switch** with door interlock to protect service personnel.

Control Option J – Pneumatic

Control Option J is designed for pneumatic temperature control.† The contractor need only connect one air line and the main power lines to the heater.

Option J includes the following:

- **Automatic and manual reset thermal cutouts** and a differential pressure **airflow switch**. The manual reset thermal cutouts always de-energize the heater load. The automatic reset cutout and airflow switch are normally wired in the control circuit. However, when single-phase KW ratings do not exceed the values in **Table II**, both of these devices also carry the heater load directly, eliminating the need for magnetic contactors.
- **PE switches** to control heater staging. To minimize field labor, multiple PE switches are factory-piped to a single port projecting through the terminal box. All PE switches close on pressure rise and open upon loss of pressure to de-energize the heater.
- **Magnetic contactors** on all three-phase Option J heaters and on single-phase heaters whose KW ratings exceed those shown in **Table II**.

Table II

Open Coil Heaters				
Single-Phase Voltage	120	208	240	277
Maximum KW	1.8	—	—	4.1
Finned Tubular Heaters				
Maximum KW	1.8	3.1	3.6	4.1

- **Fuses** to protect each circuit in any heater drawing more than 48 amps.
- A **transformer**, with any overcurrent protection required by UL or the NEC, to supply the internal control circuit of heaters rated above 277 volts. All other heaters have line voltage control circuits.
- A built-in, snap-acting **disconnect switch** with door interlock to protect service personnel.

† Where more than six stages of pneumatic control are required, specify Option G with a step controller and pneumatic transducer as Special Features. Such a heater will function in the same manner as Option J with a maximum of 20 stages.



Control Option K – Proportional

Control Option K is designed for the most precise temperature control, using SCR proportional power controllers and a matching electronic thermostat. For heaters above the KW ratings in **Table III**, an electronic step controller is also provided. It works with the SCR to provide vernier proportional control. For more details on this system, see page 21.

Table III

Voltage		120	208	240	277	480	600
Maximum KW	1 Phase	23.0	39.9	46.0	53.1	91.1	115.2
	3 Phase	—	34.5	39.9	—	79.8	99.7

In addition to these electronic components, Control Option K includes the following:

- **Automatic and manual reset thermal cutouts** and a differential **pressure airflow** switch. The manual reset thermal cutouts always de-energize the heater load. The automatic cutout and airflow switch are normally wired in the control circuit. However, when single-phase KW ratings do not exceed the values in **Table IV**, the automatic reset cutout carries the heater load directly and the airflow switch either carries the load directly or is wired into the control circuit of the SCR, eliminating the need for magnetic contactors.
- **Safety magnetic contactors** controlled by the automatic reset cutout, for each heater circuit, when the KW exceeds the ratings in **Table IV**.

Table IV

Open Coil Heaters				
Single-Phase Voltage	120	208	240	277
Maximum KW	3.0	—	—	6.0
Finned Tubular Heaters				
Maximum KW	3.0	5.2	6.0	6.0

- **Magnetic contactors** for each heater circuit.
- **Fuses** to protect each circuit in any heater drawing more than 48 amps.
- A **transformer**, with any overcurrent protection required by UL or the NEC, to supply the internal control circuit of 24 or 120 volts per heater with a step controller for vernier control and 24 volts for all other heaters with SCR control. Wiring to remotely mounted thermostats can be Class II since thermostat circuits are low voltage limited power circuits.
- A built-in, snap-acting **disconnect switch** with door interlock to protect service personnel.
- A choice of room thermostat, page 12, Figure 15 or 16; duct thermostat, page 13, Figure 20 or 21; built-in PE transducer, page 13, Figure 17; or field inputs of 135 ohms, 2200 ohms, 0-10 VDC and 4-20mA are available.

Wiring Diagrams

Typical wiring diagrams for many of the commonly used control options are located on pages 56 – 58. These diagrams of open coil and finned tubular heater constructions are intended to provide general component arrangements and wiring information. Specific wiring diagrams will be attached to the inside of the enclosure doors for each heater and remote panelboard and are available with certified prints.



Standard Control Options

Thermostats

Room Thermostats

Single Stage, Catalog No. 1006998

- Non-digital, non-programmable, snap-acting bimetal, mercury free, SPST, with positive off single stage
- Range: 50° to 90°F (7° to 32°C)
- Accuracy: $\pm 3^\circ\text{F}$ ($\pm 1.5^\circ\text{C}$)
- Color: White
- Inductive Rating: 1.2 amp at 30 volts max
- Offered with duct heater selection



Figure 11.

Single Stage, Catalog No. 1023721

- Digital, with programmable 5-1-1 day program or 5-2 day program, mercury free
- HEAT-OFF-COOL-AUTO and fan AUTO-ON selections
- Easy to read backlit display
- Range: 40° to 90°F (4.5° to 32°C)
- Accuracy: $\pm 1^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$)
- Color: White
- Inductive Rating: Hardwire, two wire heat only Class II circuit, 1.0 amp at 30 volts max
- Special Order



Figure 12.

Two Stage, Catalog No. 1007030

- Digital, non-programmable, mercury free
- COOL-HEAT-OFF EMERGENCY HEAT and fan AUTO-ON selections
- Easy to read backlit display
- Range: 40° to 90°F (4.5° to 32°C)
- Accuracy: $\pm 1^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$)
- Color: White
- Inductive Rating: Hardwire, three wire heat only Class II circuit, 1.0 amp at 30 volts max



Figure 13.

Two or Three Stage, Catalog No. 1023723

- Digital, with programmable 5-1-1 day program or 5-2 day program, mercury free
- HEAT-OFF-COOL-AUTO EMERGENCY HEAT and fan AUTO-ON selections
- Easy to read backlit display
- Range: 40° to 90°F (4.5° to 32°C)
- Accuracy: $\pm 1^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$)
- Color: White
- Inductive Rating: Hardwire, three or four wire heat only Class II circuit, 1.0 amp at 30 volts max



Figure 14.

Electronic Proportional, Catalog No. 1007101

- Tamperproof construction
- Range: 40° to 90°F
- Type: Ohmic – 2200 ohms
- For use with S95 step controllers

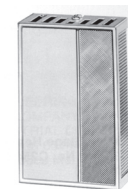


Figure 15.

Electronic Thermostat, Catalog No. 1016941

- C1025 Thermostat is microcomputer-based, PI Control
- Range: 50° to 90°F
- Type: Proportional 0-10 VDC
- For use with HEATREX SCR's and S208 step controllers



Figure 16.

Standard Control Options Thermostats

PE Transducer

Catalog No. 1020887

- Built into heater terminal box
- PSIG range: 0 to 15
- Throttling range: 1 – 12 psi
- Maximum pressure: 25 psi
- Type: Ohmic – 135 ohms
- For use with SCR's and step controllers



Figure 17.

Duct Thermostats

Single Stage Heavy Duty, Catalog No. 1023953

- Liquid filled sensing element with snap-acting contacts
- Range: -30° to 100°F
- Differential: 3 to 12°F between stages
- Bulb Dimensions: 3/8" x 4"
- Capillary Length: 8'
- Resistive Rating: 22 amps, 120 to 277 volts



Figure 18.

Two Stage Light Duty, Catalog No. 1007044

- Two single-pole, double throw switches
- Adjustable by screw on graduated cam dial
- Range: 55° to 85°F
- Differential: 2°F between stages
- Bulb Dimensions: 5/8" x 11 11/16"
- Capillary Length: 5'6"
- Resistive Rating per Heater Stage:
13.3 amps at 120 volts
6.6 amps at 277 volts



Figure 19.

Electronic Proportional

Catalog No.: Sensor, 1001083

Adjuster, 1001068

- Range: 60° to 120°F
- Type: Ohmic – 2200 ohms
- For use with S95 step controllers

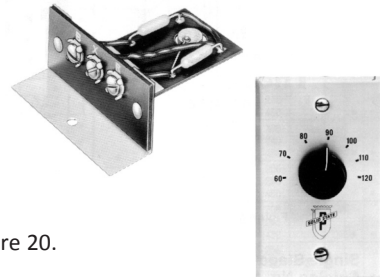


Figure 20.

Electronic Thermostat

Catalog No.: Sensor, 1016942

Adjuster, 1016941

- Range: 50° to 90°F
- Type: PI Proportional 0-10 VDC
- For use with SCR's and S208 step controller



Figure 21.



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