

HALLIKAINEN

Instruments

INDUSTRIAL and SCIENTIFIC

750 NATIONAL COURT, RICHMOND, CALIFORNIA, 94804

THERMOTROL TEMPERATURE CONTROLLER



PRINCIPAL OF OPERATION

The THERMOTROL is a general purpose laboratory temperature controller. It is designed to operate on any one of three control modes; on-off, proportional or proportional with reset.

When using the THERMOTROL, a resistance thermometer sensing element is usually employed as the variable arm in an A. C. Wheatstone bridge circuit. The bridge is operated at balance by means of an adjustable ratio arm which selects the temperature setting. A change in thermometer resistance produces an AC voltage that is amplified by a resistance coupled amplifier. This amplified AC voltage is then applied as a bias voltage to a thyratron tube energizing an enclosed mercury plunger relay which turns a heater on and off.

During proportional operation a negative feedback signal is applied to produce an "on" period that is directly proportional to the bridge unbalance voltage. Proportional control is secured through time cycle modulation. The

proportional band (gain) is adjustable from 0.023°C to 5.89°C (based on a nickel resistance thermometer), through means of a ten position gain switch.

Adding reset, produces a positive feedback signal of an appropriate time constant, which is superimposed on the negative feedback signal, restoring the bridge balance. Standard reset rates are adjustable from 6 to 90 seconds in 8 steps. With reset, the proportional band is reduced by a factor of 100.

A load of up to 25 amps (115 VAC non-inductive) may be connected directly to the terminal board mounted on the back of the instrument. On the standard unit a mercury plunger relay is utilized for load. A modification is available using SCR units in place of the relay. The maximum load for SCR units is presently 12 amps at 115 volts or at 220 volts. Special kits No. ZZ-508 for 115 V and No. ZZ-515 for 220 volt are available for installation in THERMOTROLS previously purchased. If the THERMOTROL is to be supplied with the SCR in place of the mercury relay, add suffix /S19 to Model Number. SCR units will be at additional cost.

SET POINT CONTROLS

Setting of the control point temperature on the standard THERMOTROL is accomplished through the use of two ten-turn potentiometers, one for coarse adjustment and one for fine setting.

RANGE

The range of the standard THERMOTROL is that of the resistance thermometer used as the primary element. The standard THERMOTROL therefore does not have a calibrated range and is not a direct set instrument.

DECADE MODEL

A special decade model is available which incorporates two ten-position switches in place of the coarse ten-turn potentiometer. Fixed precision resistors are selected to cover a specified range and by use of these decade switches, it permits the resetting of the instrument to a previous temperature setting. The standard decade THERMOTROL ranges are -100 to +170°F and 50 to 500°F using nickel resistance elements and 400 to 1000°F, 800 to 1300°F and 1000 to 1500°F for platinum resistance elements. Other ranges are also available, contact factory for availability and pricing.



DECADE MODEL

SPECIFICATIONS

Case — The case is constructed of 18 gauge steel, with mist blue enameled finish. The front panel is of $\frac{1}{8}$ inch duraluminum. Overall dimensions are: 10 inches wide by $7\frac{1}{4}$ inches high and 8 inches deep. A pilot light on the panel indicates the action of the control relay.

Power — 25 watts at 115 volts, 60 cycles, no load.

Contact Rating — 25 amps, 115 volts, AC non-inductive.
20 amps, 220 volts, AC non-inductive.

Connections to Case — Terminal board on back of sub-base, with removable cover on case.

Weight — 15 pounds.

Model Numbers:	Standard	Decade
115 volts	1053	1109
220 volts	1253	1140

SENSITIVITY

The control accuracy of any temperature controller depends on many factors other than the controller itself; such factors as time constants, mass and configuration of the thermometer sensing element, heaters, both tank and components, as well as stirring efficiency, insulation, etc. For this reason, the sensitivity characteristics of the controller are listed rather than how accurately it will control a bath temperature.

As an On-Off Controller — The temperature difference between "on and off" operation (or dead zone) is 0.001°C .

As a Proportional Controller — The proportional band temperature differential or 0 to 100% proportional range is adjustable from 0.02° to 5.89°C in nine finite steps.

As a Proportional with Reset Controller — Adding the reset function reduces the proportional band temperature differential by a factor of 100 providing a 0 to 100% proportional range from 0.002°C to 0.0589°C .

Reset rates are adjustable in eight steps from 6 to 90 seconds. A slight modification will permit reset times of 12 to 180 sec. (at additional cost - add suffix /S7 to model number for this feature).

Sensitivities mentioned are based on the use of thermometers with nickel wound elements.

RESET

With any proportional controller, the maximum gain that can be used depends solely upon the system being controlled. In some systems, in order to avoid "hunting" it is necessary to use a relatively low gain, which may produce an unacceptable proportional offset, or droop, as a result of load changes. Because of the reset function incorporated in the THERMOTROL, "droop" is reduced to about 1% of the value present in the absence of reset. While reset is well known in plant control systems, the THERMOTROL is the first laboratory controller to incorporate this feature.

FEATURES

When using the THERMOTROL as a proportional with reset controller, only one heater is required, thus eliminating multiple heaters usually employed with limited on-off controllers. Optimum control is readily achieved by appropriate adjustment of the gain and reset time setting knobs located at the top of the chassis.