



THERMO-ELECTRIC HEAT PUMP UNIT

R534



Year 1
study

Features

- Investigation of the performance of a semi-conductor module
- Safe and Suitable For Unsupervised Student Operation
- Does not involve any chemical refrigerants
- Responds Rapidly to Control Changes
- Negligible Operating and Maintenance Costs

Description

The Hilton Thermo-Electric Heat Pump has been designed to enable students to investigate the performance of a semi-conductor module which, on the application of an electrical power supply, will produce a refrigerating effect. Though the power required to produce this cooling effect is high, modules of this type find applications in a variety of high technology fields. Conversely, by producing a temperature difference across the module a direct conversion of heat to electrical energy results. Again, due to inefficiency the power produced per module is small but applications do exist where alternatives are either not available or impractical. The semi-conductor assembly is mounted on a heat sink protecting through the front face of the glass reinforced plastic instrument panel. The assembly consists of a module sandwiched between aluminium blocks giving both mechanical strength and thermometer wells for temperature measurement. A nickel chrome alloy

element heats the outer face of the cold side aluminium block and this thermally insulated within a stainless steel casing. Each of the experimental configurations described may be established simply by sequenced switching of four control switches. Variation of the power supplied to both the heater and semi-conductor module is achieved by separate long life heavy duty rheostats. Measurement of the power supplied to the heater and module is achieved by the use of separate ammeters and voltmeters. A small lamp provides a 'load' which may be switched across the module in order to investigate the generating effect and a milli-ammeter and voltmeter allow measurement of the power generated.

Related Laws/Applications

- Peltier Effect
- Thomson Effect
- Lenz Effect
- Seebeck Effect
- Power Generation
- Instrumentation
- Refrigeration
- Medicine
- Aeronautics
- Heat Transfer
- Electronics
- Thermodynamics
- Astronautics

Learning capabilities

- Investigation of the effects upon the surface temperature of either face of the module with increasing power supply (Peltier Effect).
- Investigation of the effect upon heat transfer of reversing the polarity of the power supply (Thomson or Lenz Effect).
- Investigation of the variation in open circuit voltage across the module due to the variation in surface temperature difference (Seebeck Effect).
- Investigation of the power generating performance of the module with a steady load and increasing temperature difference.
- Estimation of the coefficient of performance of the module when acting as a refrigerator.

Technical Specification

- Panel: Powder coated Aluminium.
- Module Assembly: Semi-conductor, thermo-electric device with hot and cold side thermometer pockets and insulated heater.
- Voltmeters x 3: Moving coil instruments; 2 x range 0 to 5 Volts; 1 x range 0 to 1.5 Volts.
- Ammeters x 3: Moving coil instruments; 2 x range 0 to 15 Amps; 1 x range 0 to 250 Milli Amps.
- Thermometers x 3: 300 mm liquid filled glass; 1 x range – 100 to +110°C; 1 x range 0 to 150°C; 1 x range - 50 to 30°C.
- Rheostats x 2: Rotary triple graded with silver graphite brush.
- Switches x 4: Multi-pole change over switches.
- Power Supply: Internally mounted. Single transformer, full wave rectifier and capacitor smoothing. Provides a DC supply of approximately 5 volts.
- Safety Features: All electrical components earthed and mains supply fused. Both module and heater operate on a safe low voltage DC supply.

What's in the Box?

- 1 x R534
- 4 x 300mm long Glass Thermometer (2 x spare)
- 1 x Power lead
- 1 x Spare bulb
- Instruction manual
- Packing list
- Test sheet

Weights & Dimensions

- Weight: 29 kg
- Length: 710mm
- Width: 240mm
- Height: 710mm

Essential Services

- 300W - 220-240 Volts, Single Phase, 50Hz (With earth/ground).
- 300W - 110-120 Volts, Single Phase, 50Hz (With earth/ground).

Ordering information

To order this product, please call PA Hilton quoting the following codes:
R534/230
R534/115

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COUNTRY OF ORIGIN - UK WARRANTY PERIOD - 5 YEARS