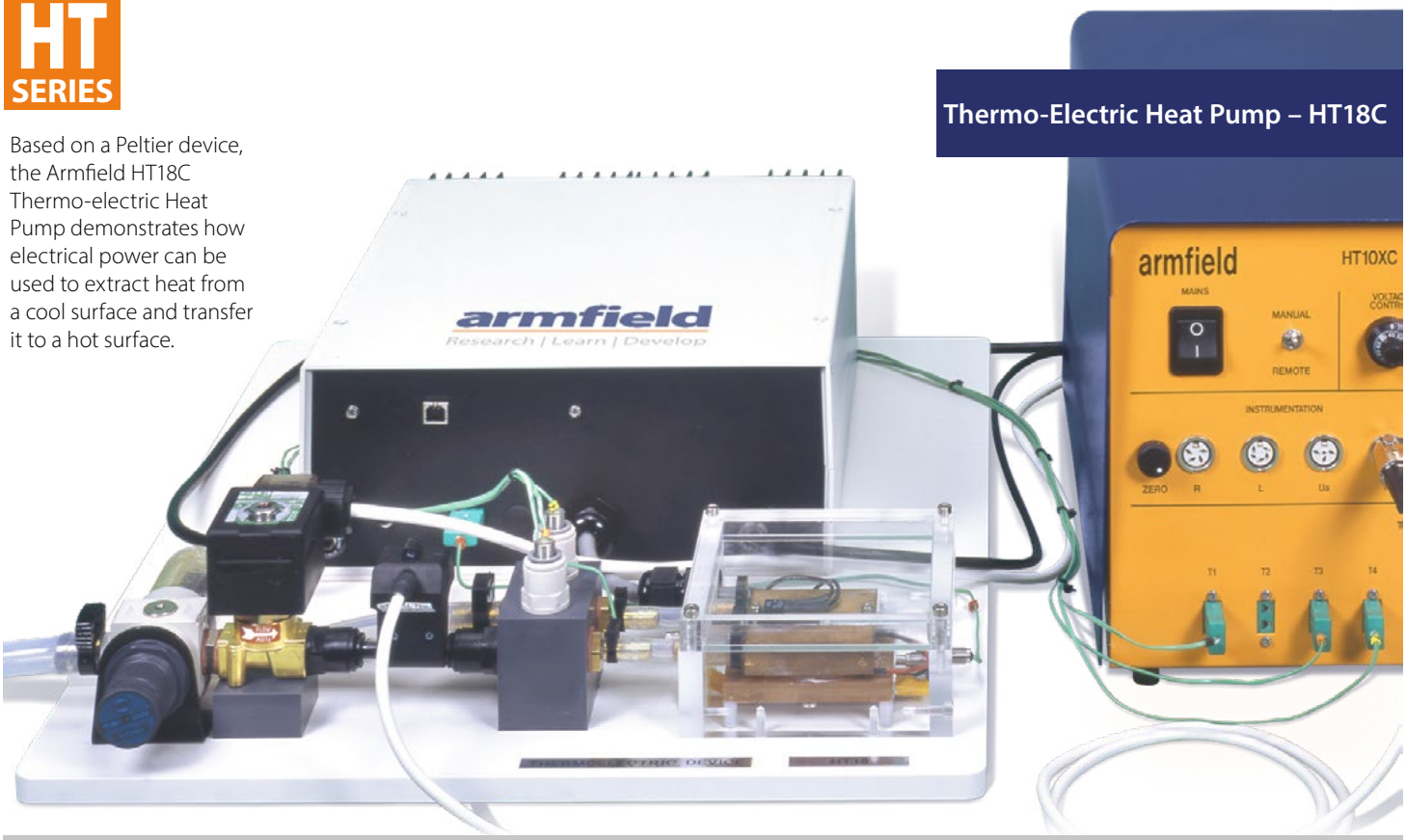
HT SERIES

Thermo-Electric Heat Pump – HT18C

Based on a Peltier device, the Armfield HT18C Thermo-electric Heat Pump demonstrates how electrical power can be used to extract heat from a cool surface and transfer it to a hot surface.



Hardware Description

Based on a Peltier device, the Armfield HT18C Thermo-electric Heat Pump demonstrates how electrical power can be used to extract heat from a cool surface and transfer it to a hot surface. This effect is becoming widely used for point cooling (eg of semiconductor devices) and small-scale volumetric cooling.

The HT18C is designed for use with the Armfield HT10XC Heat Transfer Teaching Equipment.

The thermoelectric Peltier device is positioned in a heat transfer path, between two copper blocks. It extracts heat from one block (cold reservoir) and transfers it to the other block (hot reservoir). In order to measure the heat transfer rate, the cold reservoir is fitted with an electric heater, powered by the HT10XC. By varying the electric power into the system, the behaviour of the system at different operating points and temperatures can be established.

The heat extracted is transferred to the hot reservoir, together with heat generated by the electrical supply to the Peltier device. This heat is removed by a water-cooled heat exchanger. The flow rates can be adjusted to provide a range of operating temperatures.

The Peltier device can also be used to generate a small quantity of electric power when a temperature difference is applied. This effect can also be demonstrated with the HT18C.

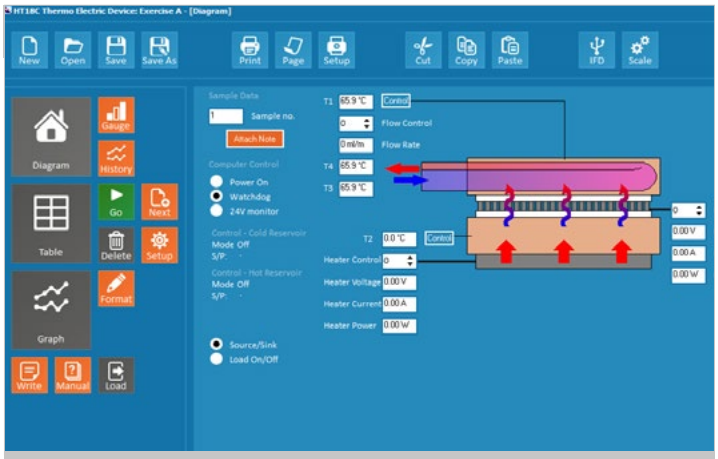
Instrumentation is provided to measure the temperatures of the blocks, the electric power supplied to the Peltier device, the cooling water flow rate and the cooling water temperature rise. The heater power is measured by the HT10XC, and so it is possible to establish a complete energy balance for the system.

All facilities are controlled directly from the computer, including heater power, Peltier power and water flow rate. All measured information is available on the computer. HT18C includes its own integral USB interface, connecting to the same computer as the HT10XC. The software supplied integrates the data to and from both these interfaces into a simple, user-friendly software control environment.

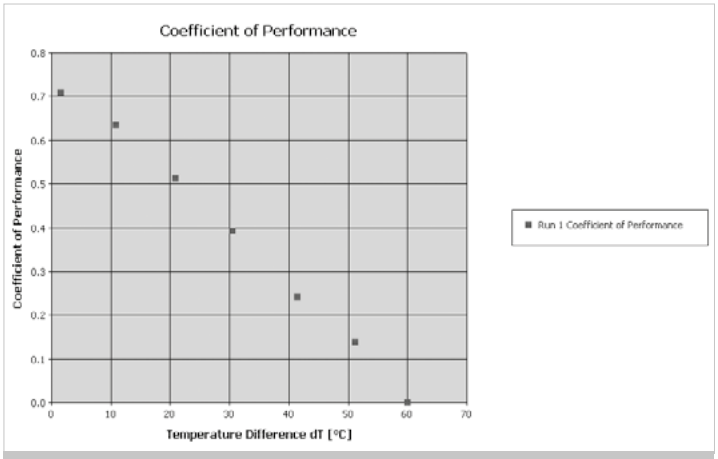
The HT18C derives its power from the HT10XC, and so is protected by the same safety features when used in remote configuration.

Experimental Capabilities

- Performance of a Peltier device as a cooler
- Heat transfer characteristics as a function of temperature and drive current
- Measurement of the coefficient of performance
- Energy balance
- Demonstration of a Peltier device as an electrical generator

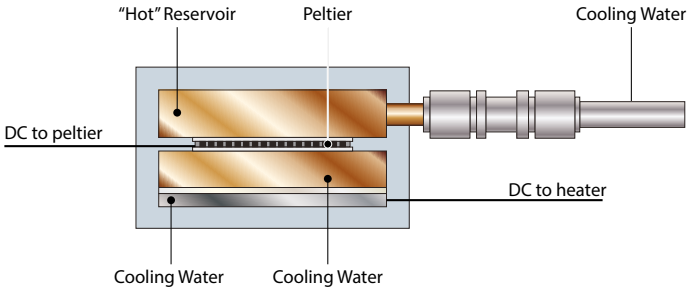


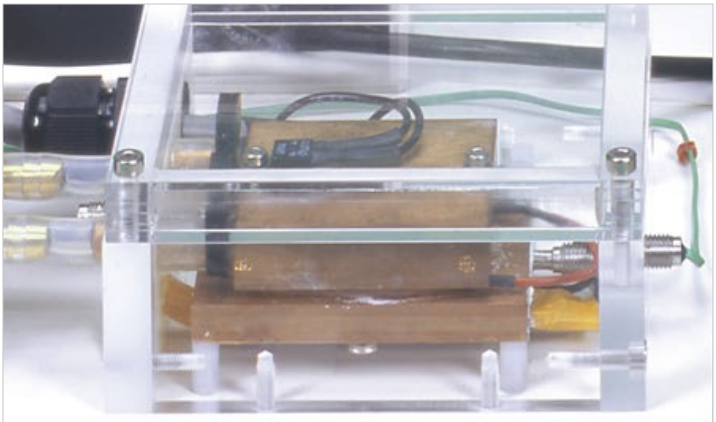
Mimic Diagram



HT18C graph

Thermoelectric device with thermal reservoir – HT18C





Detail showing the thermoelectric Peltier device of the HT18C

Requirements

Scale

COLD HT 10XC

Cold water supply: 1.5 l/min @ 1 bar

Electrical supply:

All electrical requirements are obtained from the HT10XC service unit.

NOTE: the supply rating of the HT18C must be the same as the HT10XC that it is used with, ie:

HT18-A:	230V / 1ph / 50Hz
HT18-B:	115V / 1ph / 60Hz
HT18-G:	230V / 1ph / 60Hz

Essential accessories

HT10XC Computer-Controlled Heat Transfer Service Unit with associated PC for data logging

Ordering specification

- Small-scale accessory designed to demonstrate the use of a Peltier device to transfer heat across surfaces
- Comprises a Peltier device, a heater, and a water-cooled heat exchanger
- Heat transfer rates up to 68W
- Heater power, Peltier drive and cooling flow rate all fully electronically adjustable under computer control
- Measurement of cooling water temperatures and flow to allow an overall energy balance
- The accessory is mounted on a PVC baseplate, which is designed to stand on a benchtop and connect to the heat transfer service unit without the need for tools
- A comprehensive instruction manual is provided
- Software is provided

Overall dimensions

Length	053 m
Width	0.43 m
Height	0.13m
Packed and crated shipping specifications	
Volume	0.07m^3
Gross weight	15kg

Ordering codes

HT18C-A:	230V / 1ph / 50Hz
HT18C-B:	115V / 1ph / 60Hz
HT18C-G:	230V / 1ph / 60Hz