

In this equipment a group of thermocouples are used to measure the temperature of a stream of air at ambient temperature, passing through the centre of a duct while the wall of the duct is elevated in temperature to subject the thermocouples to a source of thermal radiation.



Heated Cylinder Guard

### Hardware Description

Radiative heat transfer between a thermometer and its surroundings may significantly affect temperature readings obtained from the thermometer, especially when the temperature of a gas is to be measured while the thermometer 'sees' surrounding surfaces at a higher or lower temperature than the gas.

The error in the reading from the thermometer is also affected by other factors such as the gas velocity over the thermometer, the physical size of the thermometer and the emissivity of the thermometer body. In this equipment a group of thermocouples are used to measure the temperature of a stream of air, at ambient temperature, passing through the centre of a duct while the wall of the duct is elevated in temperature to subject the thermocouples to a source of thermal radiation.

Each thermocouple gains heat by radiation from the heated wall and loses heat by convection to the air stream and conduction along the wire. The net result is an increase in the temperature of the thermocouple above the temperature of the air stream it is supposed to measure. The result is an error in the reading from the thermocouple. A radiation shield can be positioned in the duct to show the effect of screening the thermocouples from thermal radiation from the duct wall.

The effect of air velocity past the test thermocouples can be demonstrated by adjusting the air flow. On the HT16C this is achieved by a variable-speed fan with electronic control. On HT16 the fan is fixed-speed with a manually adjustable throttle plate.

A vane-type anemometer within the fan outlet duct enables the air velocity through the heated section to be measured.

A radiation shield, which remains close to the air temperature, can be raised or lowered over the thermocouples to demonstrate the change in readings when a radiation shield is used. On HT16C this radiation shield is controlled by an electro-mechanical servo actuator under software control. *On HT16 the radiation shield is positioned manually.*

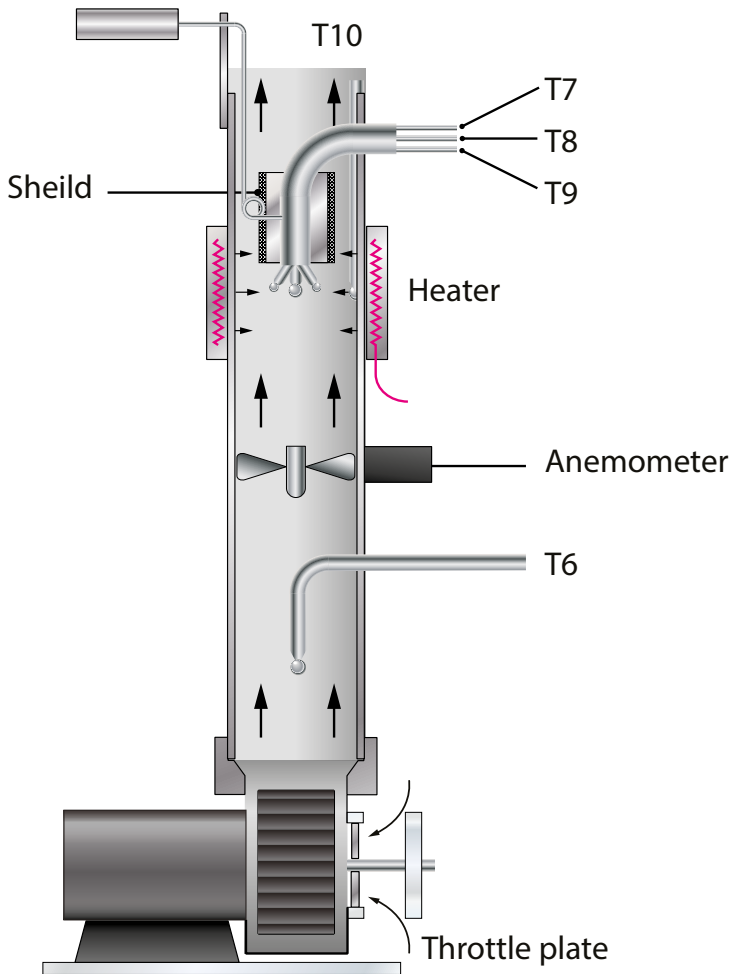
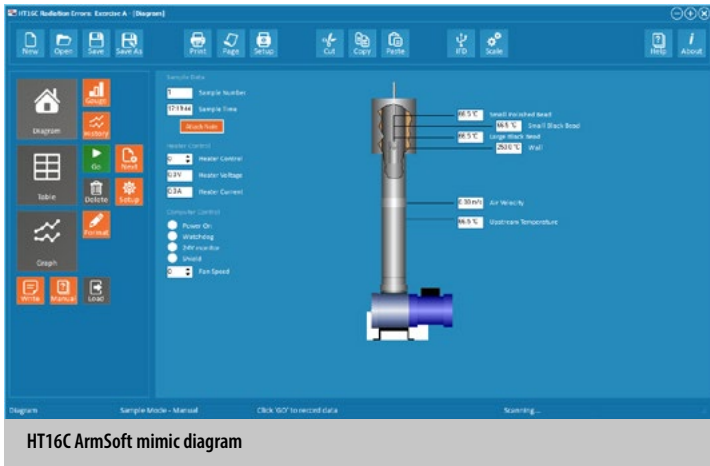
### Experimental Capabilities

#### ► Errors associated with radiative heat transfer:

- Effect of wall temperature on measurement error
- Effect of air velocity on measurement error
- Effect of thermocouple style on measurement error

#### ► Methods for reducing errors due to radiation:

- Design of a radiation-resistant thermometer
- Use of a radiation shield to surround the thermometer



Schematic diagram showing construction of HT16

### Overall dimensions

Model	HT16	HT16C
Length	0.35 m	0.49 m
Width	0.30 m	0.44 m
Height	1.22m	1.19m

### Packed and created shipping specifications

Volume	0.1m <sup>3</sup>	0.2m <sup>3</sup>
Gross weight	9kg	13kg

### Requirements

### Scale

HT10XC



All electrical requirements are obtained from the service unit.

**NOTE: The supply rating of the HT16/HT16C must be the same as that of the HT10XC it is used with:**

See ordering codes for specific requirements

### Essential accessories

HT10XC Computer-Controlled Heat Transfer Service Unit

### Ordering specification

- ▶ A small-scale accessory to demonstrate how temperature measurements can be influenced by sources of thermal radiation
- ▶ Comprises three K-type thermocouples with different styles of bead mounted in a vertical air duct. A fan at the base of the duct provides a variable air flow over the cylinder. A band heater heats the duct wall adjacent to the thermocouple beads
- ▶ Heater rating 216W at 24V DC
- ▶ K-type thermocouples measure the air temperature upstream and the surface temperature of the heated duct section
- ▶ On the computer-controlled unit the air flow is electronically adjustable over the range of 0-9 m/s by a variable-speed fan, otherwise it is manually adjustable
- ▶ The air flow rate is measured by a vane-type anemometer in the outlet duct
- ▶ A radiation shield can be lowered over the thermocouples to demonstrate the improvement in reading accuracy when the thermocouples are shielded from the source of radiation
- ▶ The accessory is mounted on a PVC baseplate, which is designed to stand on the benchtop and connect to the Heat Transfer Service Unit without the need for tools
- ▶ A comprehensive instruction manual is included



### Ordering codes

HT16-A	230V / 1ph / 50Hz
HT16C-A	230V / 1ph / 50Hz
HT16-B	115V / 1ph / 60Hz
HT16C-B	115V / 1ph / 60Hz
HT16-G	230V / 1ph / 60Hz
HT16C-G	230V / 1ph / 60Hz

Issue: 4

Applications

URL: <http://www.armfield.co.uk/ht10xc>

Me ChE CE IP

We reserve the right to amend these specifications without prior notice. E&OE © 2020 Armfield Ltd. All Rights Reserved

**armfield.co.uk**