INSTRUCTION MANUAL

HT10XC

HEAT TRANSFER SERVICE UNIT

HT10XC

ISSUE 5

OCTOBER 2007

NOTE: Compatibility of HT10XC with HT14, HT14C, HT16 & HT16C

In February 2006 a component becoming obsolete forced Armfield Ltd to change the mains outlet connector (OUTPUT 1) at the rear of the HT10XC console and the corresponding plug on the mains lead of the HT14, HT14C, HT16 and HT16C. No other accessories to the HT10XC are affected by this change.

An adaptor 'ADAPTOR1–HT10' is available from Armfield Ltd that allows a current HT10XC to be used with an original HT14, HT14C, HT16 or HT16C. If the mains plug on your HT14, HT14C, HT16 or HT16C has exposed pins that do not mate with OUTLET 1 on HT10XC then 'ADAPTOR1–HT10' is required.

Similarly 'ADAPTOR2-HT10' is available from Armfield Ltd that allows an original HT10XC to be used with a current HT14, HT14C, HT16 or HT16C. If the mains plug on your HT14, HT14C, HT16 or HT16C has pins protected by a shrouded cover that does not mate with OUTLET 1 on HT10XC then 'ADAPTOR2-HT10' is required.

If you need an adaptor please contact Armfield Ltd at the address below specifying if 'ADAPTOR1-HT10' or 'ADAPTOR2-HT10' is required for correct functioning of the equipment:

Armfield Ltd
Bridge House
West Street
Ringwood
Hampshire
England
BH24 1DY

Telephone number: +44 (0)142578781

Fax number: +44 (0)1425470916

Email address: support@armfield.co.uk

⚠ IMPORTANT SAFETY INFORMATION

All practical work areas and laboratories should be covered by local regulations which must be followed at all times. If required, Armfield can supply a typical set of laboratory safety rules.

Your HT10XC Heat Transfer Service Unit has been designed to be safe in use, when installed, operated and maintained in accordance with the instructions in this manual. As with any piece of sophisticated equipment, dangers may exist if the equipment is misused, mishandled or badly maintained.

⚠ ELECTRICAL SAFETY

The equipment described in this Instruction Manual operates from a mains voltage electrical supply. It must be connected to a supply of the same frequency and voltage as marked on the equipment or the mains lead. If in doubt, consult a qualified electrician or contact Armfield. The equipment must not be operated with any of the panels removed.

To give increased operator protection, the unit incorporates a Residual Current Device (RCD), alternatively called an Earth Leakage Circuit Breaker, as an integral part of this equipment. If through misuse or accident the equipment becomes electrically dangerous, the RCD will switch off the electrical supply and reduce the severity of any electric shock received by an operator to a level which, under normal circumstances, will not cause injury to that person.

At least once each month, check that the RCD is operating correctly by pressing the TEST button. The circuit breaker **MUST** trip when the button is pressed. Failure to trip means that the operator is not protected and the equipment must be checked and repaired by a competent electrician before it is used.

ARMFIELD LIMITED

HT10XC HEAT TRANSFER SERVICE UNIT

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1. INTRODUCTION

The Armfield HT10XC is a service unit, which can be used in conjunction with a range of small scale accessories to demonstrate the three basic modes of heat transfer (conduction, convection and radiation). The factors that affect the rate of heat transfer can be investigated and some of the practical problems associated with the transfer of heat can be clearly demonstrated.

The heat transfer accessories may be individually connected to the HT10XC service unit, which provides the necessary electrical supplies and measurement facilities for investigation and comparison of the different heat transfer characteristics.

The HT10XC incorporates the facilities and safety features to allow the accessories to be remotely controlled from an external computer (computer running Windows™ 98, 2000 or XP) connected via a USB cable. All the facilities can also be accessed locally using the front panel controls and displays.

The following heat transfer accessories are available for use under manual control using the control console:

HT11	Linear heat conduction
HT12	Radial heat conduction
HT13	Laws of radiant heat transfer and radiant heat exchange
HT14	Combined convection and radiation
HT15	Extended surface heat transfer
HT16	Radiation errors in temperature measurement
HT17	Unsteady state heat transfer

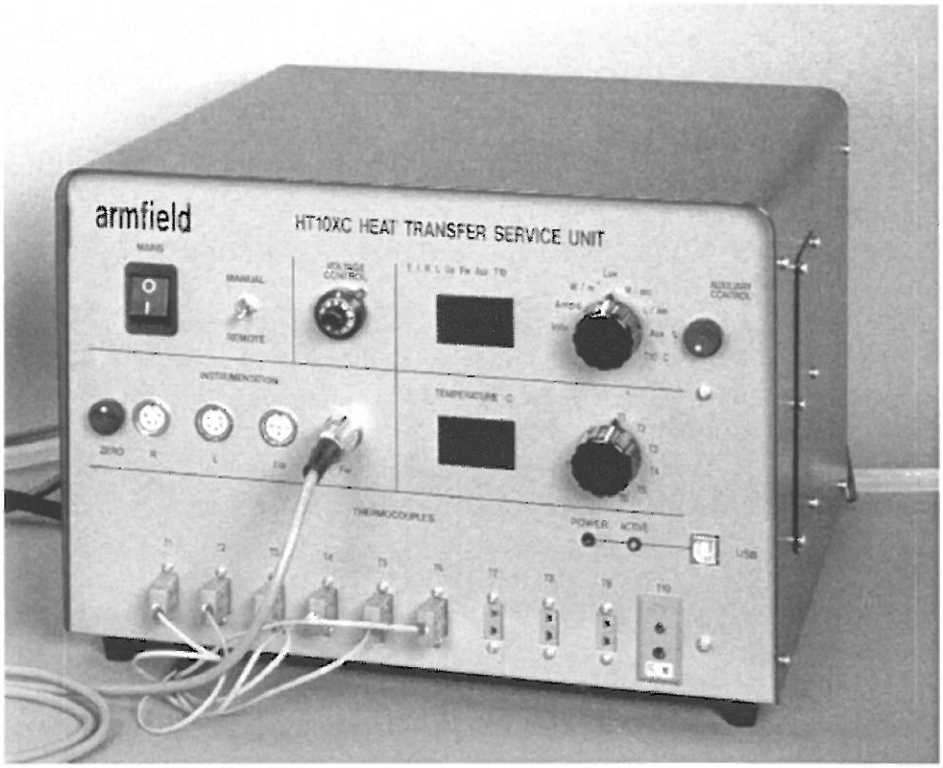
In addition the following accessories can be used in computer control applications with remote data acquisition:

HT11C	Linear heat conduction*
HT12C	Radial heat conduction
HT13	Laws of radiant heat transfer and radiant heat exchange*
HT14C	Combined convection and radiation (not yet available)
HT15	Extended surface heat transfer
HT16C	Radiation errors in temperature measurement (not yet available)
HT17	Unsteady state heat transfer*

* The HT11C, HT13 and HT17 all require manual intervention to alter the configuration of the apparatus, e.g. to change the material samples under test in the HT11C and to alter the radiometer distance in HT13. Once the equipment has been configured for the set of data required, data can then be logged remotely.

NOTE: The HT13, HT15 and HT17 are identical to the accessories available for the HT10X base unit, and may be used with both the HT10X and the HT10XC. Other accessories intended for use with the HT10X base unit may also be useable with the HT10XC, but will not have the full functionality of the C versions and may consequently require manual intervention.

This product manual describes the function of the HT10XC 'Heat Transfer Service Unit'.
Each of the individual heat transfer accessories (listed above) is supplied with its own instruction manual. The instruction manual describes the operation of the particular accessory when used in conjunction with the HT10XC service unit in relation to those functions normally associated with the laboratory technician. It also includes a set of Laboratory Teaching Exercises designed to cover the theory and experiments/demonstrations relevant to that accessory. Each exercise includes detailed instructions on how to record the appropriate readings and which calculations to perform to analyse the performance.



HT10XC Heat Transfer Service Unit

(Connected to thermocouples T1 – T6
and to flow rate sensor Fw)

2. EQUIPMENT DESCRIPTION

The service unit is housed in a robust steel enclosure and designed for use on a bench or table.

It provides two outputs to the accessories:
A stabilised, variable low voltage DC supply to the heater of the heat transfer accessory under evaluation.

- A variable output (Auxiliary Output) to drive other functions (accessory dependant). This auxiliary output takes two forms, a 0-5V signal and a 24V pulse width modulated signal. Either of these signals can be used as appropriate by the Heat Transfer Accessory.

The Service Unit also incorporates the necessary instrumentation to measure the variables associated with heat transfer, namely:

- Temperatures
- Heater voltage
- Heater current
- Heat radiated
- Light radiated
- Air velocity
- Cooling water flowrate

2.1 Modes of Operation

Manual Mode

In manual mode, the outputs listed above are under control of potentiometers on the front panel of the unit. A ten turn potentiometer (3) controls the heater voltage, and a one turn potentiometer (15) controls the auxiliary output.

Manual mode is entered whenever the standby switch (1) is ON, and the Manual/Remote switch (2) is in Manual

The outputs from the accessory being used are shown on the front panel displays. One display is used for the ten temperature inputs, and a selector switch is used to choose the appropriate input. Similarly, all the other inputs are displayed on the other display, and a selector switch used to choose the input being displayed.

Remote Mode

In remote mode the two outputs to the accessories are controlled by the computer, or other external device. As the heater output is capable of providing high currents, and producing high temperatures in the accessories, a number of safeguards have been incorporated to ensure operator and equipment safety in event of a computer failure.

To enter remote mode, the following conditions need to be met.

Off/Standby switch in Standby and Manual/Remote switch in remote

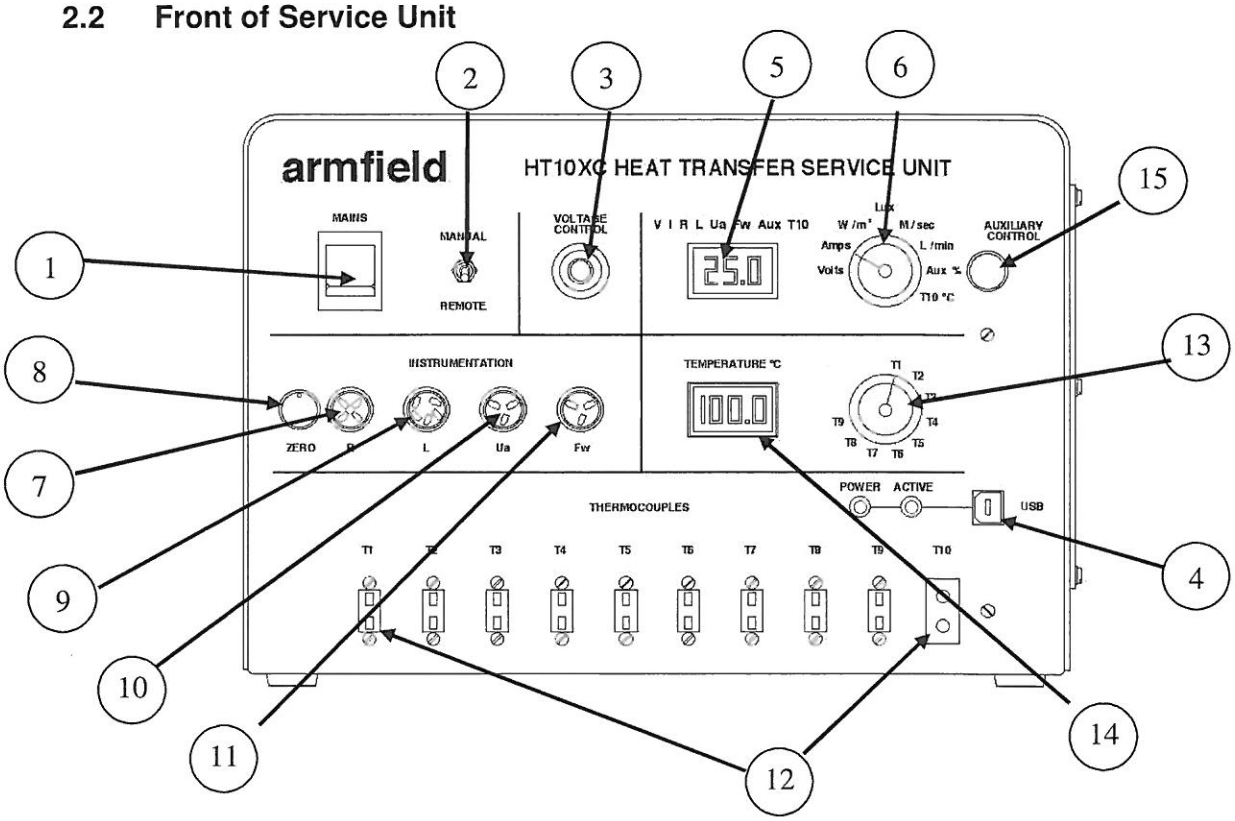
A series of regular 'Watchdog' pulses on the watchdog input

The unit can be then powered up fully by setting the 'Power On' bit on the interface.

Note: in the event of a failure of the controlling device, e.g. a software 'crash', the watchdog pulses will stop and after a few seconds the HT10XC will switch itself back into the Standby condition.

In remote mode the sensor readings are usually displayed on the controlling or remote computers according to the software being used. However, the front panel displays described in Manual mode are still active in Remote mode.

2.2 Front of Service Unit



The following facilities are provided on the front panel of the service unit:-

A mains standby switch (1), located on the front of the service unit allows the service unit to be turned off totally, or enabled into Standby Mode. All of the individual electrical circuits inside the enclosure are disabled when switched off.

The Manual/Remote switch (2) defines whether the unit is to be operated under Front Panel Control, or under Computer Control, as described above. Note: the front panel displays and selector switches are functional under both modes of operation.

The variable DC voltage supplied to the heat transfer accessory, via socket OUTPUT 2 at the rear of the service unit, is adjusted using the multi-turn potentiometer (3) marked VOLTAGE CONTROL. The range of the output voltage is continuously adjustable from 0 Volts to 24 Volts DC using the multi-turn potentiometer. The selector switch (2), adjacent to the potentiometer, should be set to the MANUAL position to allow adjustment using the potentiometer. The selector switch is only set to the REMOTE position if the voltage is to be controlled from an external signal via the USB Port connector (4).

The actual voltage supplied can be monitored using the top panel meter (5) when the measurement selector switch (6) is set to position V. The readout is calibrated directly in Volts with a range of 0 to 24 VDC and a resolution of 0.1 Volts.

Similarly the current can be monitored when the selector switch (6) is set to position I. The readout is calibrated directly in Amps with a range of 0 - 9 A and a resolution of 0.01 A.

Other relevant parameters on the heat transfer accessories can be measured as follows:

Thermal radiation R

A radiometer is incorporated on the HT13 to measure the thermal radiation. This instrument is connected to the socket marked R (7) on the front of the service unit. The thermal radiation is read on the top panel meter (5) when the measurement selector switch (6) is set to position R.

The thermal radiation is indicated directly in units of Watts/metre^2 over the range 0 - 333 W/m^2 with a resolution of 1 W/m^2.

A zero potentiometer (8) to the left of the radiometer socket allows any offset in the reading from the radiometer to be corrected.

Light illumination L

A light sensor is incorporated on the HT13 to measure the light illumination. This instrument is connected to the socket marked L (9) on the front of the service unit. The light illumination is read on the top panel meter (5) when the measurement selector switch (6) is set to position L.

The light illumination is indicated directly in units of Lux over the range 0 - 234 Lux with a resolution of 1 Lux.

Air Velocity Ua

A vane type anemometer is incorporated on the HT14, HT14C, HT16 and HT16C to measure the velocity of the air passing through the duct. This instrument is connected to the socket marked Ua (10) on the front of the service unit. The air velocity is read on the top panel meter (5) when the measurement selector switch (6) is set to position Ua. The air velocity is indicated directly in units of metres/second over the range 0 - 10 m/s with a resolution of 0.1 m/s.

Cooling Water Flowrate Fw:

A cooling water flow sensor is incorporated into the HT11C and the HT12C. It is also available as an optional accessory with the HT11 and HT12. The sensor is connected to the socket marked Fw (11) on the front of the service unit. The flow of cooling water is read on the top panel meter (5) when the selector switch (6) is set to position Fw.

The flowrate is indicated directly in units of litres/min over the range 0 - 1.50 l/min with a resolution of 0.01 l/min.

Temperatures T1 - T10:

Temperatures on the various heat transfer accessories are measured using up to 10 type K thermocouples installed in appropriate tappings on the accessory (thermocouples are supplied with the accessory). Each thermocouple lead is numbered to allow connection to the appropriate thermocouple socket (12) at the bottom of the front panel on the service unit.

The required temperature reading is selected via a switch (13) and displayed on the adjacent panel meter (14). Temperature readings are displayed directly on the meter in units of °C.

Thermocouples T1 - T9 are connected using miniature plugs/sockets. Readings are in the range 0 to 133°C with a resolution of 0.1°C.

Thermocouple T10 is connected using standard plugs/sockets. Readings are in the range 0 to 600°C with a resolution of 1°C. (The sockets are polarised by size to prevent high temperature thermocouples from being connected to low temperature channels.)

Auxiliary Drive

The Auxiliary drive potentiometer (15) controls the output to the cooling water flow control valve (HT11C and HT12C) or the air flow control (HT14C and HT16C). The output percentage is read on the top panel meter (5) when the selector switch (6) is set to position Aux. The relevant cable (to the flow control valve or fan) should be connected to the socket marked AUXILARY OUTPUT on the back of the HT10XC console. On the HT16C this cable connection also allows computer control of the radiation shield.

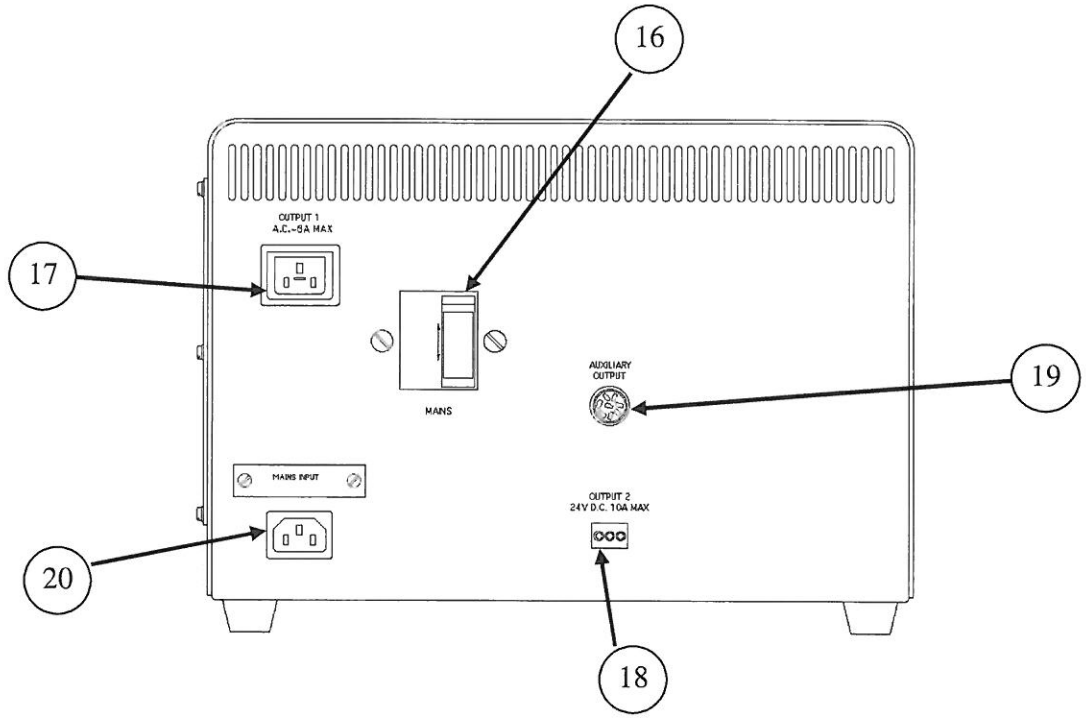
USB Port

This is a USB socket (4) on the right hand side of the front panel. It allows all of the temperatures and other measurements to be connected simultaneously to a PC. It also allows the PC software to control the Heater voltage directly, together with another input (use may vary on different accessories).

Educational and Data Logging Software is available for all of the HT10XC range of Heat Transfer equipment.

Other interfaces could also be used with this I/O Port. Full details of the signals and scaling are given in Section 4.3

2.3 Rear of Service Unit



The following facilities are provided on the rear panel of the service unit:-

The Residual Current Circuit Breaker (16) is a device for the protection of personnel in the event of an electrical fault or short to earth. All electrical circuits inside the service unit and all accessories connected to it are protected by this device. Normal operation of the equipment is achieved with the switch in the UP position.

The mains power output socket OUTPUT 1 (17) is a mains power source used for driving external ancillary equipment up to 4 Amps maximum but specifically the accessories HT14, HT14C, HT16 and HT16C which incorporate a mains powered centrifugal fan. The mains supply from OUTPUT 1 is at the same voltage and frequency as the electrical supply to the service unit.

The low voltage DC export socket OUTPUT 2 (18) is used to provide variable DC voltage from 0 to 24 V to the heater on the appropriate heat transfer accessory and provides immunity from fluctuations in the mains electrical supply.

This supply is also used to operate the circulating pump when using the HT17 accessory. The electrical lead and matching plug are integral with the appropriate accessory.

3. OPERATION

The apparatus must be set up in accordance with the installation sheet supplied (see Appendix A for details). Additionally, ensure that you have read the safety information at the beginning of this manual.

3.1 Switching on the unit

The unit is switched on using the switch on the front of the unit. The circuit breakers and RCD device located at the rear of the unit should be turned on beforehand. Both the temperature controller and conductivity display should illuminate.

3.2 Manual Operation

Setting the Heater Voltage (All accessories except HT17)

When operating the equipment manually using the front panel controls ensure that the selector switch (2) is set to the MANUAL position. This allows the voltage supplied to the heater to be adjusted using the multi-turn potentiometer (3) marked VOLTAGE CONTROL.

The selector switch is only set to the REMOTE position if the voltage is to be controlled from an external signal via the USB Port connector (4).

The range of the output voltage is continuously adjustable from 0 Volts to 24 Volts DC using the multi-turn potentiometer. (Ensure that the clamp on the side of the knob is released before turning the knob.)

Note: The 24 volt DC supply is used to operate the circulating pump on the accessory HT17. The pump is connected to the DC outlet socket (OUTPUT 2) on the rear panel of the service unit. The speed of the pump can be adjusted by varying the setting of the multi-turn potentiometer in the same way as changing the voltage to a heater.

Measuring the Power to the Heater (All accessories except HT17)

While adjusting the heater voltage the actual voltage supplied to the heater can be monitored by setting the selector switch (6) to position V. The reading is displayed directly in Volts on the top panel meter (5).

The current drawn by the heater in the accessory can be monitored by setting the top measurement selector switch (6) to position I. The reading is displayed directly in Amps on the top panel meter (5).

As the electrical supply to the heater is Direct Current the power supplied to the heater is simply obtained from the product of the Voltage and Current, i.e.

Heater Power Q = Voltage V x Current I

eg. If V = 15.0 Volts and I = 2.00 Amps then Q = 2 x 15 = 30.0 Watts

Note: Some of the accessories incorporate a thermostat to limit the maximum operating temperature. If the heater voltage is set too high, resulting in excessive temperature, the current to the heater will be disconnected until the thermostat resets when the temperature falls. If the display shows no current when voltage is applied to the heating element check that the relevant temperature on the accessory is not excessive. If the temperature is excessive set the Voltage Control to zero and allow the thermostat to reset (Refer to the Operational Procedures in the teaching manual supplied with the accessory for further information).

Measuring Temperatures (T1 - T10 as appropriate on all accessories)

To monitor any of the thermocouples installed on one of the heat transfer accessories simply set the temperature selector switch (13) to the required position and read the corresponding value on the lower panel meter (14).

Temperatures T1 to T9 are indicated in the range 0.0 - 133.0°C with a resolution of one decimal place.

Temperature T10 is indicated in the range 0 - 600°C with a resolution of no decimal places.

Measuring Thermal Radiation (Radiometer on HT13)

When the radiometer is connected to the socket (7) marked R then the thermal radiation can be read on the top panel meter (5) with the selector switch (6) set to position R.

The thermal radiation is indicated directly in units of Watts/metre^2 (maximum 333 W/m^2).

A zero potentiometer (8) to the left of the radiometer socket allows any offset in the reading from the radiometer to be corrected.

Measuring Light Illumination (Lightmeter on HT13)

When the lightmeter is connected to the socket (9) marked L then the illumination can be read on the top panel meter (5) with the selector switch (6) set to position L.

The light illumination is indicated directly in units of Lux (maximum 234 Lux).

Measuring Air Velocity (Anemometer on HT14, HT14C, HT16 and HT16C)

When the anemometer is connected to the socket (10) marked Ua then the air velocity can be read on the top panel meter (5) with the selector switch (6) set to position Ua.

The air velocity is indicated directly in units of metres/second (maximum 10.0 m/s).

Measuring Cooling Water Flow Rate (Flow sensor on HT11C and HT12C, optional on HT11 and HT12)

When the flow sensor on HT11C or HT12C (optional flow sensor SFT2 on HT11 or HT12) is connected to the socket (11) marked Fw then the flowrate can be read on the top panel meter (5) with the selector switch (6) set to position Fw. The cooling water flowrate is indicated directly in units of Litres/min (Maximum 1.50 l/min).

3.3 Using the Educational Software/Data Logging Accessory

The Software includes presentation screens to give an overview on its use, and also includes full help text. To switch on the HT10XC in remote mode, using the Armfield software, the Power On switch must be selected from the Diagram screen. Where appropriate, the heater output and the auxiliary output can be controlled using slider bars from this screen.

4. SPECIFICATIONS

4.1 Overall dimensions:

Height: - 240mm
Width: - 320mm
Depth: - 370mm

4.2 Electrical supply:

	HT10XC-A	HT10XC-B	HT10XC-G
Green/yellow lead	Earth (Ground)	Earth (Ground)	Earth (Ground)
Brown lead	Live (Hot)	Live (Hot)	Live (Hot)
Blue lead	Neutral	Neutral	Neutral
Fuse rating	5A	10A	5A
Voltage	220-240V	110-120V	220V
Frequency	50Hz	60Hz	60Hz

4.3 USB Port Channels

Channel	Function/ Description	Scaling
Analog Inputs		
0	Temperature T1	
1	Temperature T2	0 - 5V, 0 - 133°C
2	Temperature T3	0 - 5V, 0 - 133°C
3	Temperature T4	0 - 5V, 0 - 133°C
4	Temperature T5	0 - 5V, 0 - 133°C
5	Temperature T6	0 - 5V, 0 - 133°C
6	Temperature T7	0 - 5V, 0 - 133°C
7	Temperature T8	0 - 5V, 0 - 133°C
8	Temperature T9	0 - 5V, 0 - 133°C
9	Temperature T10	0 - 5 V, 0 - **500** °C
10	Air Flow F1	0 - 5 V, 0 - 10 m/s
11	Water Flow F2	0 - 5 V, 0 - 1.5 l/min
12	Voltage V	0 - 5V, 0 - 25V
13	Current C	0 - 5V, 0 - 10 Amp
14	Radiometer R	0 - 5V, 0 - 333W/m^{-2}
15	Light Meter L	0 - 5V, 0 - 234 Lux
Digital Inputs		
0	24 V monitor	
1	Bottom Limit HT16C	
4	Top Limit HT16C	

Analog Outputs

0	Voltage Control (PSU)	0 – 24 Vdc
1	Fan inverter speed control (HT14C or HT16C) Cold water valve control (HT11C or HT12C)	0 – 5 Vdc

Digital Outputs

0	Power On required	1 = on
1	Watchdog pulse	1 pulse every 5 secs
4	Shield up/down (HT16C)	1 = up

5. OPERATING HT10XC USING CUSTOMER GENERATED SOFTWARE

5.1 Channel Allocations

General Information

The interface between the Armfield heat transfer service unit and the computer is a Universal Serial Bus (USB) interface, meeting the standard Microsoft protocols. Armfield are registered with Microsoft as an authorised supplier of USB interfacing equipment.

The interface is capable of passing data on 26 channels, as described below:

- Analogue Inputs – 8 differential channels or 16 single ended channels, each with –5V to 5V signals digitised into a 12-bit number. The interface will pass a value between –2047 and 2047 to the computer.
- Analogue Outputs – 2 channels, each with –5V to 5V signals, taken from a 12-bit number. Computer must pass a value between –2047 and 2047 to the unit.
- Digital Inputs – 8 channels each receiving a 0 or 1.
- Digital Outputs – 8 channels each passing a 0 or 1.

The channel allocations for the HT10XC are shown in section 4.3

6. MAINTENANCE AND FAULT FINDING

6.1 Routine Maintenance

Regular servicing/maintenance of the equipment is the responsibility of the end user and must be performed by qualified personnel who understand the operation of the equipment. However, the HT10XC requires a minimum of routine maintenance, most of which is standard good practice.

1. The 'Heat Transfer Service Unit' should be disconnected from the electrical supply when not in use.

2. The heat transfer accessory under evaluation should be disconnected from the service unit and drained of water (if appropriate) after use.

3. Test the RCD by pressing the TEST button at least once a month. If the RCD does not trip when the TEST button in pressed then the equipment must not be used and should be checked by a competent electrician.

6.2 Fault Finding

Maintenance of the HT10XC 'Heat Transfer Service Unit' does not require access to the electrical circuits or components located inside the metal enclosure. However, in the event of an electrical problem it may be necessary for a competent electrician to gain access to the inside of the enclosure as follows:

- Ensure that the service unit is disconnected from the electrical supply (not just switched off).
- Disconnect any accessory connected to the service unit.
- Unscrew the four socket headed screws on the sides of the enclosure, and the screws holding on the thermocouple calibration inspection hatch.
- Carefully lift the top metal panel from the enclosure taking care to disconnect the earth connection between the top and bottom sections of the enclosure.

The electrical circuits inside the enclosure are now accessible for working on.

Reassembly of the service unit is the inverse of the above instructions. Ensure that the earth connection between the top and bottom panels is remade before replacing the top metal panel.

Details of the connections between the service unit and any of the accessories is given in the appropriate product manual supplied with each accessory.

Fuses: The 0-24 Volt DC variable power supply inside the enclosure (mounted on the base) incorporates a 10 Amp slow blow fuse for internal protection. If no output is available from the socket OUTPUT 2 (18) then this fuse should be checked for

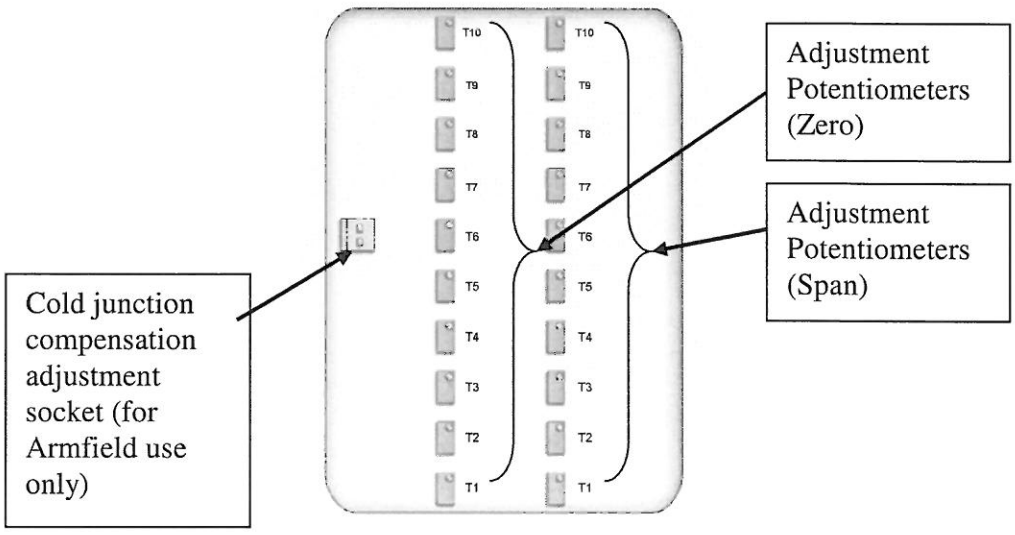
continuity. The fuse is located in an in-line holder adjacent to the smoothing capacitors on the power supply.

The instrumentation switch mode DC power supply inside the enclosure (mounted on the rear panel) incorporates a 2 Amp fuse to protect the mains input to the power supply. If the panel meters on the front of the console do not illuminate when the RCD, the Standby switch and the Manual switch are all enabled then this fuse should be checked for continuity. The fuse is located in a holder at the bottom of the PCB.

6.3 Thermocouple Calibration

The thermocouple conditioning circuits (which provide readings from the thermocouples fitted to each of the heat transfer accessories) are located on a PCB inside the electrical console. These circuits are calibrated before despatch and should not require recalibration. Should calibration become necessary, the USB output channels can be calibrated within the HT10 range software. The calibration process is fully described in the software Help Text.

Manual recalibration of the HT10XC console is achieved using the manual adjustment potentiometers. These can be accessed by removing the Thermocouple Calibration Hatch on the side of the HT10XC.



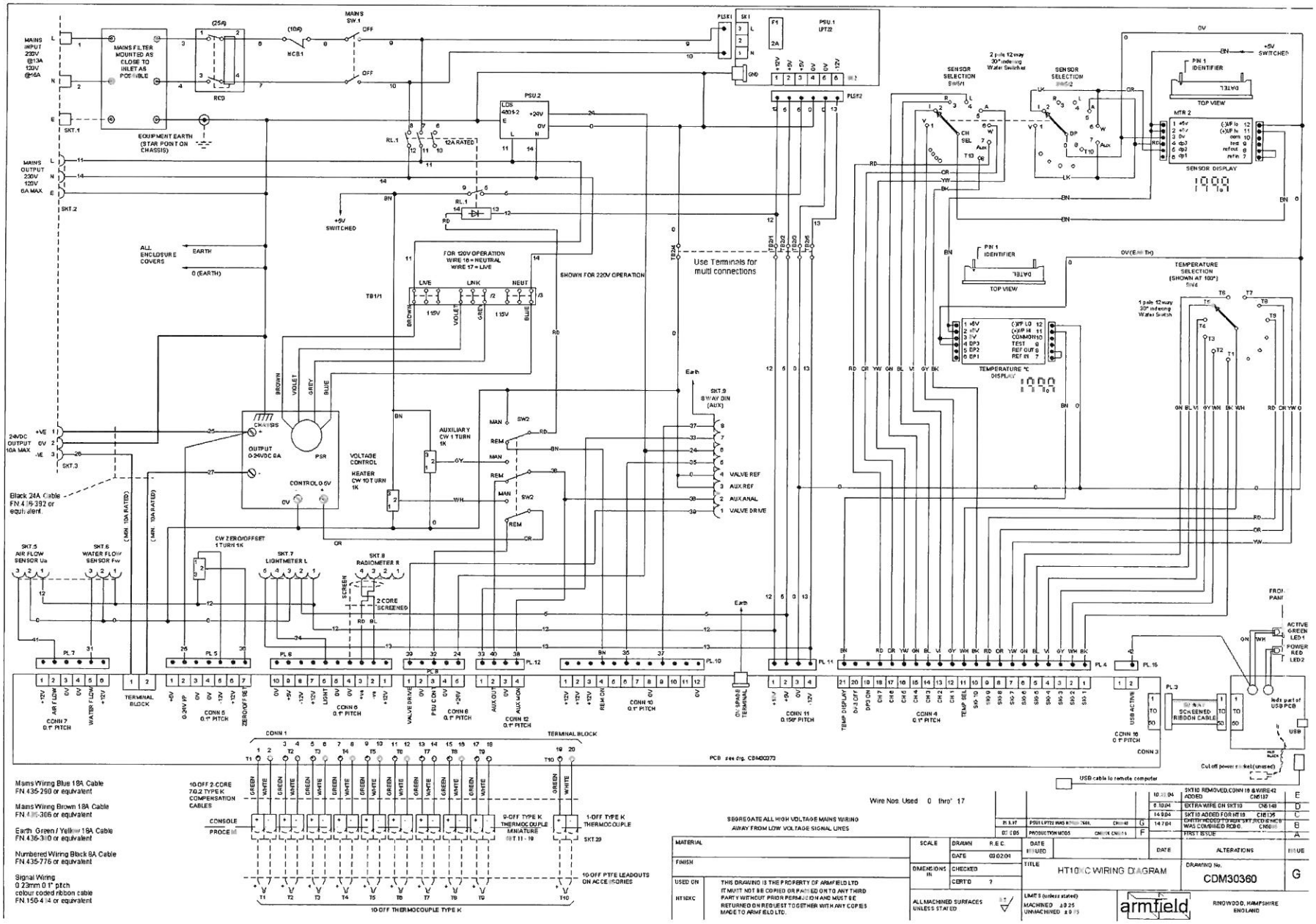
Each Thermocouple Channel has an offset adjustment (zero) and range adjustment (span) potentiometer. There is also a cold junction compensation adjustment which affects all channels.

Minor adjustments can be made to each channel independently, but to do a full calibration follow the following procedure:

- Remove the access panel, switched on the unit and allow the unit to reach a stable temperature.
-
- Accurately measure the temperature of the printed circuit board using a reference thermometer, and subtract 0.3 °C from this reading.
-
- Calculate the equivalent cold junction compensation voltage for this temperature. (E.g. 20 °C would be 20*5 /200, = 0.5 Volts) and adjust the cold junction offset potentiometer to achieve this voltage on pin 12 of the measurement socket.
-
- Connect a thermocouple simulator to each channel in turn. This can be set to any temperature within the range, but for most accurate setting up, choose the cold junction compensation temperature. Adjust the relevant offset potentiometer until the correct value is achieved.
-

  The front panel displays, the measurement connector or the computer software can all be used to read the temperature values. If possible then use whichever method is usually used to collect experimental results during the normal operation of the equipment.

  Note: the Armfield computer software also has an inbuilt calibration facility for each channel. Multiple point calibrations can be generated to match the sensor performance exactly. However, once calibrated in this way the values obtained from the sensors using the software may not exactly match the values displayed on the HT10XC front panels.


MAINS INPUT 230V @13A 120V @16A
MAINS FILTER MOUNTED AS CLOSE TO INLET AS POSSIBLE
EQUIPMENT EARTH (STAR POINT ON CHASSIS)
MAINS OUTPUT 230V 120V 6A MAX
ALL ENCLOSURE COVERS
0 (EARTH)
+5V SWITCHED
FOR 120V OPERATION WIRE 16 = NEUTRAL WIRE 17 = LIVE
SHOWN FOR 220V OPERATION
Use Terminals for multi connections
24VDC OUTPUT 10A MAX
OUTPUT 0-24VDC 6A
PSR
VOLTAGE CONTROL
HEATER CW 10 TURN 1K
AUXILIARY CW 1 TURN 1K
CONTROL 0-5V
Black 24A Cable FN 4.436-392 or equivalent
CW ZERO/OFFSET 1 TURN 1K
2 CORE SCREENED
SENSOR SELECTION Switch
TEMPERATURE SELECTION (SHOWN AT 180°)
TEMPERATURE °C DISPLAY
SENSOR DISPLAY
TOP VIEW
PIN 1 IDENTIFIER
VALVE REF
AUX REF
AUX ANAL
VALVE DRIVE
Mains Wiring Blue 18A Cable FN 435-290 or equivalent
Mains Wiring Brown 18A Cable FN 435-306 or equivalent
Earth Green / Yellow 18A Cable FN 436-310 or equivalent
Numbered Wiring Black 8A Cable FN 435-776 or equivalent
Signal Wiring 0.23mm 0.1" pitch colour coded ribbon cable FN 150-414 or equivalent
10 OFF 2 CORE 7/0.2 TYPE K COMPENSATION CABLES
9 OFF TYPE K THERMOCOUPLE MINIATURE
1 OFF TYPE K THERMOCOUPLE
10 OFF PTFE LEADOUTS ON ACCESSORIES
10 OFF THERMOCOUPLE TYPE K
TERMINAL BLOCK
Wire Nos Used 0 thro' 17
SEGREGATE ALL HIGH VOLTAGE MAINS WIRING AWAY FROM LOW VOLTAGE SIGNAL LINES
USB cable to remote computer
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MATERIAL
FINISH
USED ON HT10XC
SCALE
DRAWN R.E.C.
DATE 03.02.01
DIMENSIONS IN
CHECKED
CERT'D ?
ALL MACHINED SURFACES UNLESS STATED
LIMITS (unless stated) MACHINED ±0.25 UNMACHINED ±0.75
DATE ISSUED
TITLE HT10XC WIRING DIAGRAM
DRAWING No. CDM30360
ISSUE G
ALTERATIONS
SKT10 REMOVED,CONN 18 & WIRE 42 ADDED CN0137 E
EXTRA WIRE ON SKT10 CN0148 D
SKT10 ADDED FOR HT10 CN0136 C
WAS COMBINED ROBE CN0085 B
FIRST ISSUE A
armfield
RINGWOOD, HAMPSHIRE ENGLAND

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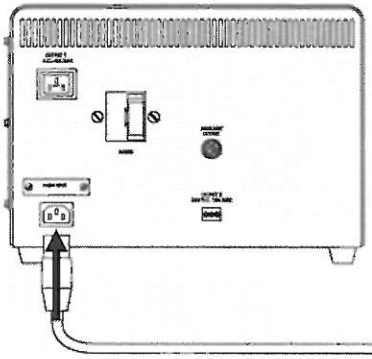
7. APPENDIX 1: INSTALLATION GUIDE

1

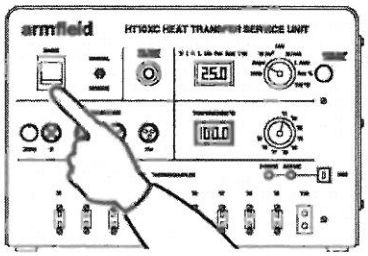
Connect the HT10XC to a suitable mains supply, using the mains lead supplied.

The voltage and frequency requirements are noted on a plate by the mains connector.

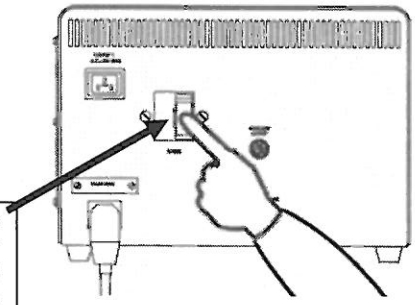


	Volts	Freq (Hz)	Current
HT10XC-A HT10XC-G	220-240	50/60	6 A
HT10XC-B	110-120	50/60	10 A

Connect to suitable supply



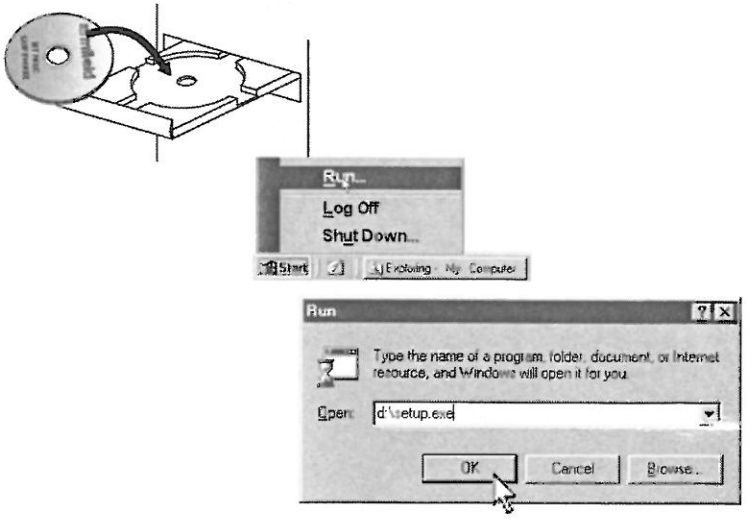
Switch on the console.



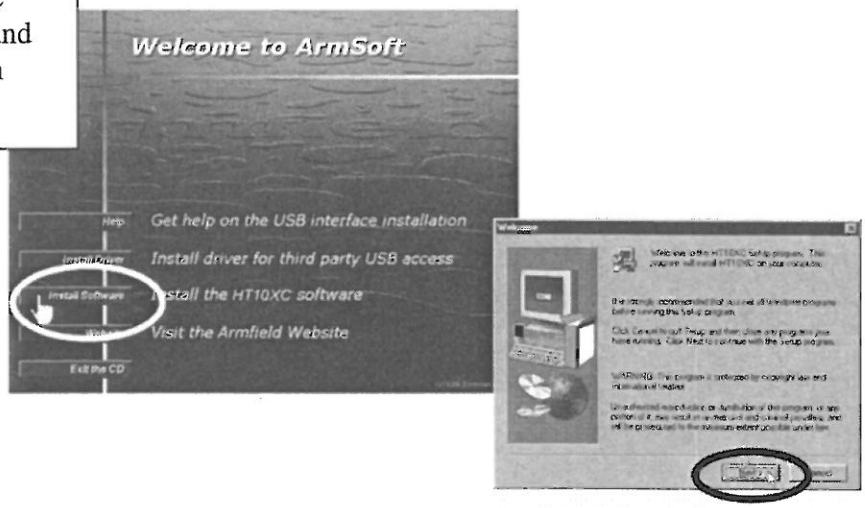
Test the operation of the Residual Current Device (RCD) by pressing the 'TEST' button:

2

Install the software supplied with the equipment onto a suitable PC: insert the CD in the CD drive. If autorun is disabled, select 'Run…' from the Start menu, and type 'd:\setup.exe' where 'd' is the letter of the CD-ROM drive.

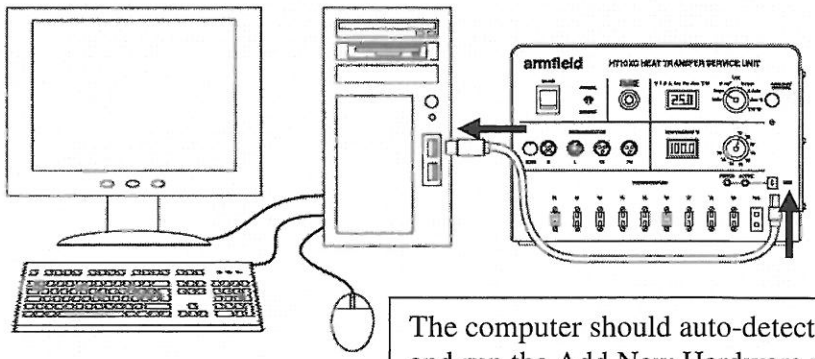


Select the Install Software option from the start menu of the HT10XC-304 CD, and follow the on-screen instructions.

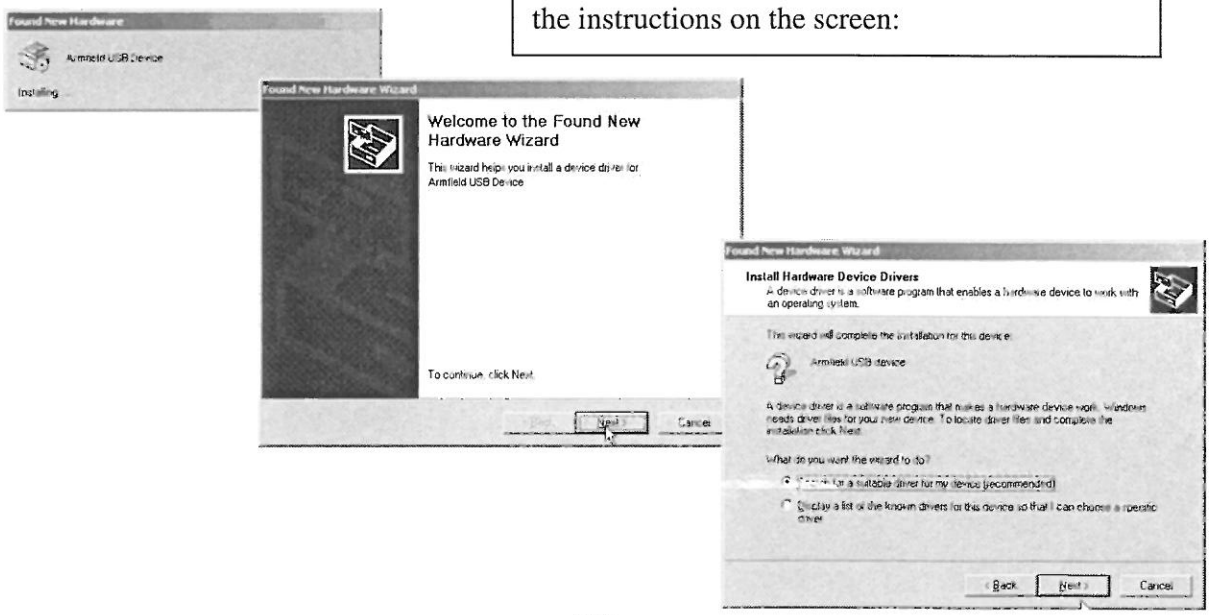


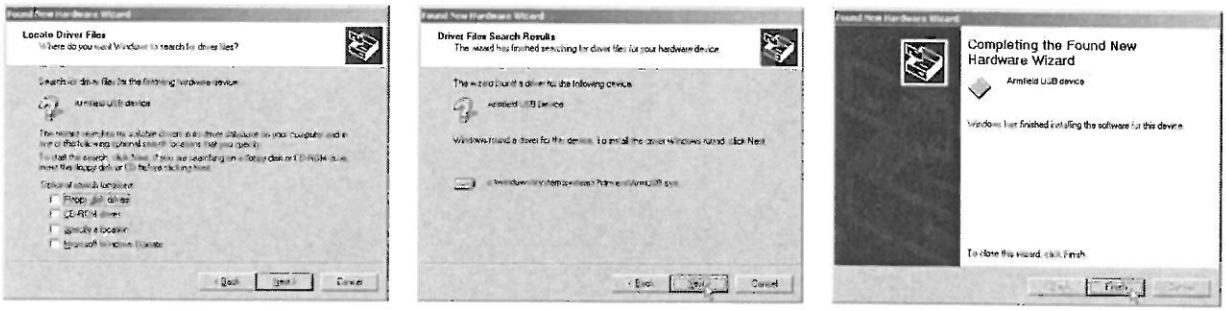
3

Connect the computer to the HT10XC USB port using the USB connection lead provided. The red and green LED's on the HT10XC front panel will be illuminated whenever the computer is powered up connected to the service unit via the USB.



The computer should auto-detect the interface and run the Add New Hardware wizard. Follow the instructions on the screen:

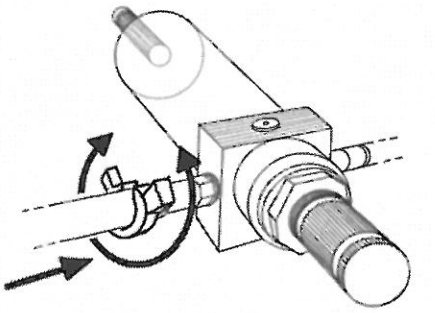




The software and USB connection are now set up for use with the HT10XC and accessories.

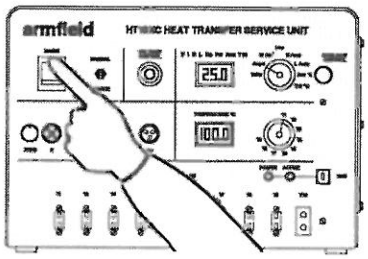
4 CONNECTING TO A WATER SUPPLY (HT11/HT11C and HT12/HT12C)

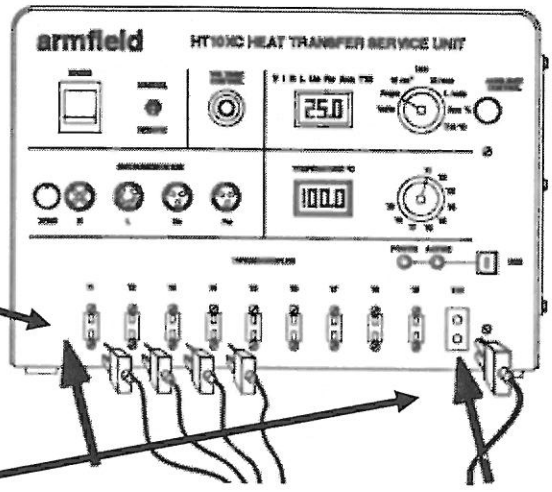
Use a 12mm (half inch) hose to connect the cooling water supply to the pressure regulator (water inlet), and secure the tube with a suitable clip.



5 CONNECTING THE POWER AND SENSOR LEADS (ALL ACCESSORIES)

Switch off the HT10XC console.

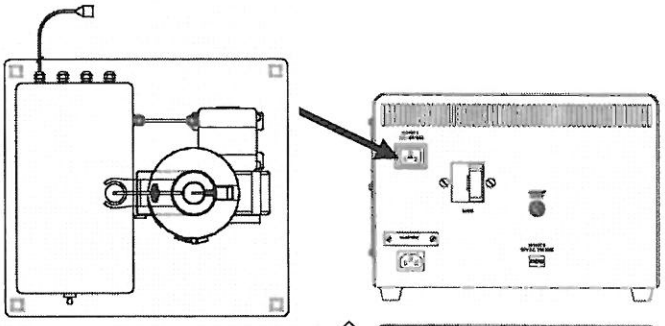




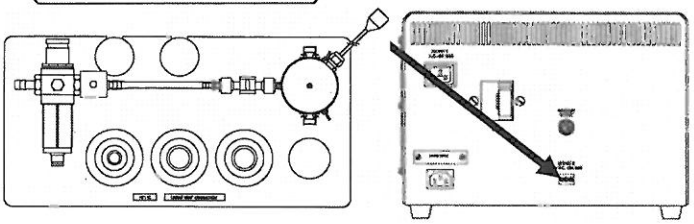
The green miniature thermocouple plugs numbered 1 upwards (maximum 9) should be connected to the corresponding thermocouple sockets numbered T1 to T9.

The larger green thermocouple plug (if present for the accessory) should be connected to the thermocouple socket numbered T10.

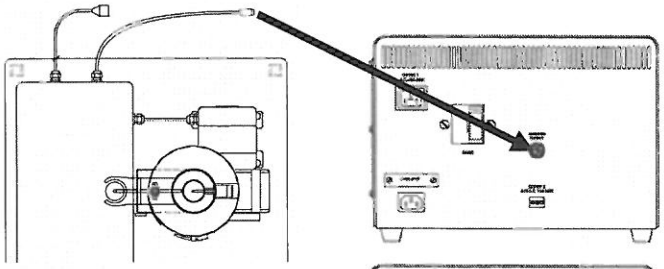
The power supply cable for the centrifugal fan (HT14, HT14C, HT16 or HT16C) should be connected to the socket marked OUTPUT 1 at the rear of the service unit.



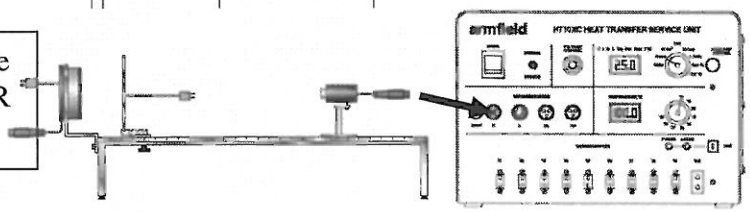
The appropriate heat source, light source or circulating pump (HT17) should be connected to the socket marked OUTPUT 2 at the rear of the service unit.



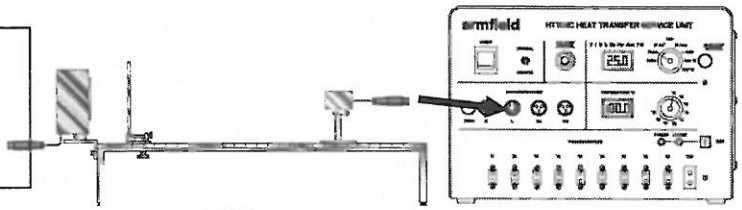
The flow control valve (HT11C or HT12C) or fan control cable (HT14C or HT16C) should be connected to the socket marked AUXILIARY OUTPUT at the rear of the service unit.



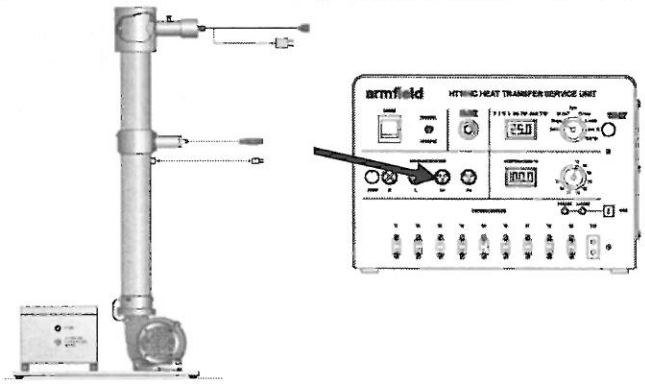
The radiometer (HT13) should be connected to the socket marked R at the front of the service unit.



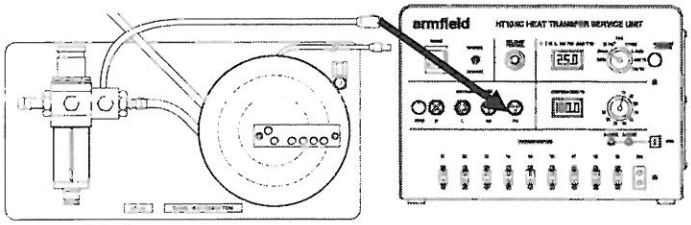
The light sensor (HT13) should be connected to the socket marked L at the front of the service unit.



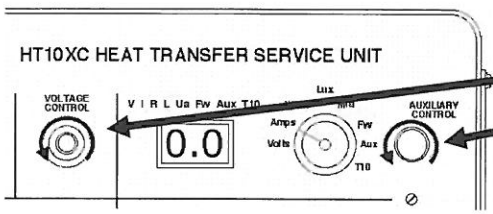
The anemometer measuring air flow velocity (HT14, HT14C, HT16 or HT16C) should be connected to the socket marked L at the front of the service unit.



The flow meter measuring cooling water flow rate (HT11C or HT12C, HT11 or HT12 if optional sensor fitted) should be connected to the socket marked Fw at the front of the service unit.

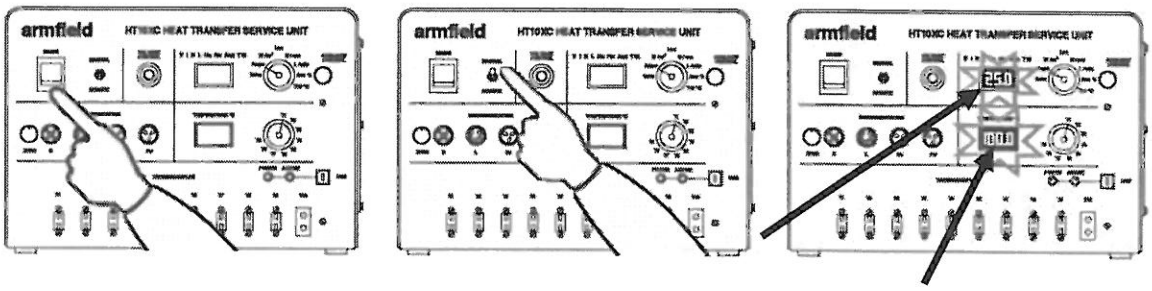


6 CHECKING THE CONFIGURATION

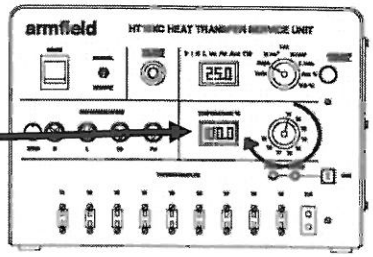


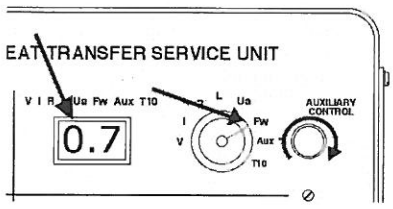
Set the Heater Control and the Auxiliary Control on the HT10XC front panel to minimum (fully counter-clockwise)

Switch on the HT10XC and set to 'Manual' mode. The displays should illuminate.



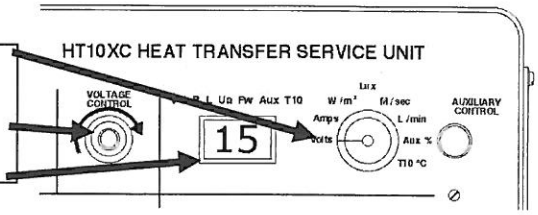
Use the Temperature selector switch to check all thermocouples in use read sensible values (room temperature, usually between 15 and 30 °C) on the display. (An over-scale reading usually means the thermocouple is disconnected.)

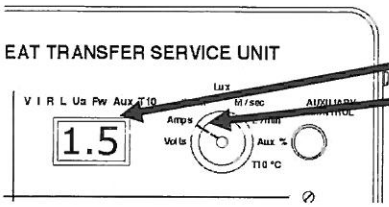




Set the 'Auxiliary' control to 50%.
On HT11C/12C water should flow (see note 7 to set the pressure regulator). Set selector switch to 'Fw' and check the flowmeter is reading.
On HT14C/16C the fan should start. Set selector switch to 'Ua' and check the air velocity is reading.

Set the Function selector switch to 'V' for the heater voltage and adjust the voltage to approximately 15V.



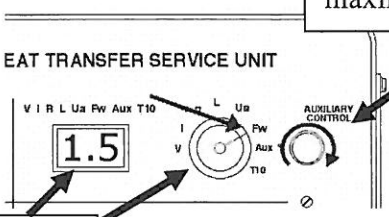


Set the function selector switch to 'I' to measure the heater current. This should be approx 1.5 Amp. If the reading is 0 check that the heater lead is connected properly to OUTLET 2.

7 SETTING THE WATER PRESSURE REGULATOR

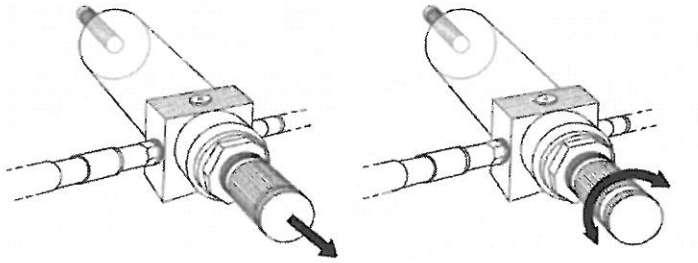
(HT11C and HT12C)

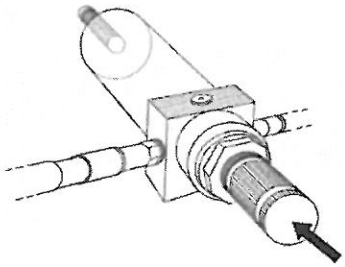
With the cooling water supply connected and switched on to its normal setting (usually full on), set the Auxiliary Control to maximum (100%).



Set the selector switch to 'Fw' and measure the flow rate. This should be between 1.4 and 1.5 litres/minute.

If the flow is not around 1.4 – 1.5 l/min, adjust the pressure regulator: pull out the grey knob, and turn the knob until the correct flow rate is reached.





When the flow is correct, lock the valve by pushing back in the handle.

Set the Aux control to zero and check that the flow stops.