World leading supplier of engineering teaching equipment

Heat Transfer Ranges

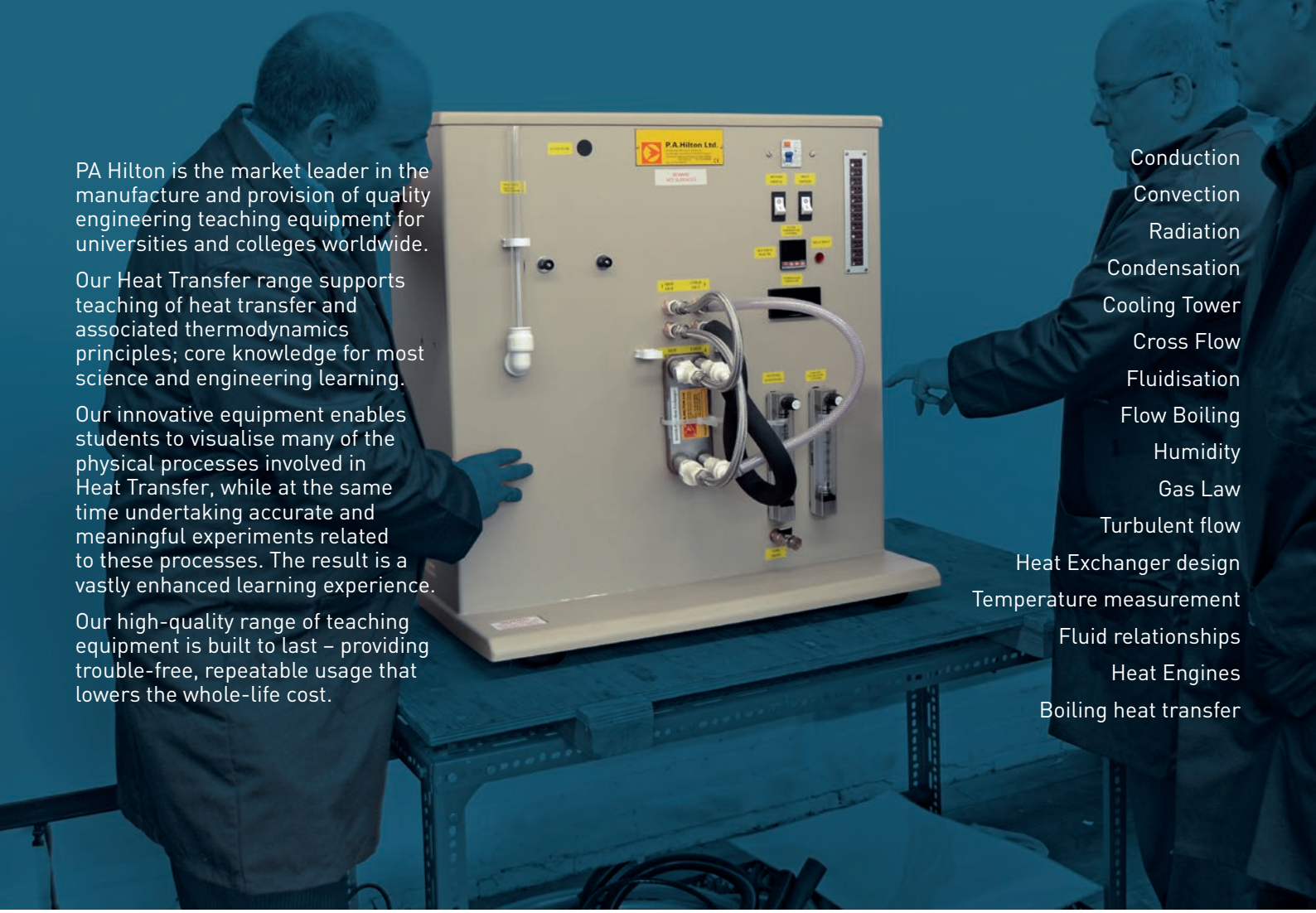
Heat Transfer

PA Hilton is the market leader in the manufacture and provision of quality engineering teaching equipment for universities and colleges worldwide.

Our Heat Transfer range supports teaching of heat transfer and associated thermodynamics principles; core knowledge for most science and engineering learning.

Our innovative equipment enables students to visualise many of the physical processes involved in Heat Transfer, while at the same time undertaking accurate and meaningful experiments related to these processes. The result is a vastly enhanced learning experience.

Our high-quality range of teaching equipment is built to last – providing trouble-free, repeatable usage that lowers the whole-life cost.



- Conduction
- Convection
- Radiation
- Condensation
- Cooling Tower
- Cross Flow
- Fluidisation
- Flow Boiling
- Humidity
- Gas Law
- Turbulent flow
- Heat Exchanger design
- Temperature measurement
- Fluid relationships
- Heat Engines
- Boiling heat transfer

PA Hilton

sales@pahilton.co.uk

PA Hilton

The range includes modular add-on units for more advanced studies and a common instrumentation and service unit with add-on modules for specific applications. Data Acquisition upgrades allow the capture of key experimental parameters using bespoke software.

This modular approach ensures maximum flexibility to align laboratory equipment investment to curriculum requirements and budgets.

> **To be successful in business, and in life, you need to connect and collaborate.**
>
> **Richard Branson**

H102 Series

Heat exchangers are a vital component in many industrial processes, enabling heat to be transferred from one fluid to another. There are many specialised forms of heat exchanger, but the four most common types found in industry are: Concentric Tube, Shell and Tube, Plate and Jacketed Vessel.

The H102 series includes all of these and a continually expanding range of variants.

Students will learn the characteristics of these and other heat exchangers, a vital knowledge tool in the design, operation or service of any heat transfer process.

H102 Heat Exchanger Service Unit

- Bench mounted panel with integral electric console
- 11 types of Heat Exchangers can be used on the Unit
- Safe and suitable for unsupervised student operation
- Responds rapidly to control changes
- Negligible operating and maintenance costs
- Re-circulating hot water circuit
- Optional computerised Data Acquisition Upgrade

H102A Concentric Tube Heat Exchanger

- Two separate concentric tubes arranged in series in a U format to reduce the overall length
- Provide a mid-position measuring point for both fluid streams
- Mounted on the H102 panel fascia and retained by locking pipe clips (can be fitted along with the H102B and C)
- Quick and easy to connect to H102 water hoses quick release connections

H102B Plate Heat Exchanger

- Multiple brazed stainless steel plates
- Four thermocouples measure hot and cold fluid entry and exit temperatures
- Self-sealing quick release connections
- Mounts onto the H102 fascia panel (can be fitted along with the H102A and C)

H102C Shell and Tube Heat Exchanger

- Thick walled glass shell with 2 baffles and 7 stainless steel tubes
- Four thermocouples measure hot and cold fluid entry and exit temperatures
- Mounted on the H102 panel fascia (can be fitted along with the H102A and B)

H102D Jacketed Vessel with Coil and Stirrer

- A vessel with a clear top and glass outer jacket
- Vessel contents of up to 2 litres
- Six thermocouples measure hot inlet and exit temperatures
- Glass coil can be used to emulate an immersion element
- Batch heating experimentation

H102E Extended Concentric Tube Heat Exchanger

- Extended version of the H102A Concentric Tube Heat Exchanger
- Three pairs of intermediate points giving 10 thermocouples in total

H102F Extended Plate Heat Exchanger

- Extended version of the H102B Plate Heat Exchanger
- Six thermocouples in total

H102G Water Water Turbulent Flow Heat Exchanger

- Determination of surface heat transfer coefficient inside and outside the tube
- Comparison of performance in concurrent and in counter-current flow

H102H Coiled Concentric Tube Heat Exchanger

- Demonstration of indirect heating or cooling by transfer of heat from one fluid stream to another when separated by a solid wall
- Conducting an energy balance across a shell and tube exchanger and calculate the overall efficiency at different fluid flow rates

H102J Recycle Loops

- Coiled tube section that connects directly to the HOT OUT and HOT RETURN couplings on the H102
- Demonstrates efficiency and process control advantages of recycling

H102K Film and Dropwise Condensation

- Supplies both electrical power and instrumentation for the module via a control console
- Connects to the left side of the fascia panel
- Demonstrates two different types of condensing heat transfer through two separate heat exchanger coatings

H102M Water to Air Heat Transfer Module

- Small water to air heat exchanger, illustrating the use of extended surfaces (fins) as a means of improving the heat transfer to gases from tubes.
- Multi-speed blower fan

H112 Series

Our range includes a control, instrumentation and power supply console which can be connected to a wide variety of optional experimental and demonstrational modules. The equipment covers the three fundamental modes of heat transfer and a variety of additional experiments in thermodynamics and thermodynamic properties of materials.

H112 Heat Transfer Service Unit

- Fully instrumented bench top unit
- Provides 15 Fundamental Heat Transfer experiments
- Investigation of Convection, Conduction, Radiation, Steady State and Transient Heat Transfer
- Investigation of Gas Laws and Pressure-Temperature Relationship for Water
- Safe and suitable for unsupervised student operation
- Optional 'Computerised Data Acquisition Upgrade'

H112A Linear Heat Conduction

- Allows experimental investigation of linear heat conduction
- Measurement of the thermal conductivity of various solid conductors and insulators

H112B Radial Heat Conduction

- Investigates the basic principles of radial heat conduction
- Allows the thermal conductivity of the solid metal disc to be determined

H112C Laws of Radiant Heat Transfer and Radiant Heat Exchange

- Allows the basic laws of heat transfer by radiation (both heat and light) to be investigated
- 10 experiments with numerous attachments to explore such concepts as absorption, reflection and channelling of radiation

H112D Combined Convection and Radiation

- Allows investigation of both natural and forced convection from a heated cylinder in a cross-flow configuration
- Surface temperature of a duct mounted, matt black cylinder can be varied over a wide range
- Investigation of convection and radiation heat transfer and how they interact with each other

H112E Extended Surface Heat Transfer

- Measures the temperature profile and heat transfer along a horizontal extended surface (cylindrical pin)

H112F Radiation Errors in Temperature Measurement

- Investigates how measured temperatures can be influenced by the effects of radiation, temperature sensor design and surface finish

H112G Unsteady State Heat Transfer

- Allow experimental investigation of unsteady state heat transfer by conduction, thermal conductivity of samples
- Investigation of shape, size and material
- Investigation of Lumped Thermal Capacitance

H112H Thermal Conductivity of Liquids and Gases

- Investigates the thermal conductivity of liquids and gases and designed specifically for teaching purposes

H112J Perfect Gas Law Demonstration

- Investigates the first law of thermodynamics using the perfect gas law and the expansion of air

H112M Marcet Boiler (Saturation Pressure-Temperature)

- Self-contained unit allowing students to investigate the pressure-temperature relationship for water and steam

H112N Thermal Conductivity of Building Materials

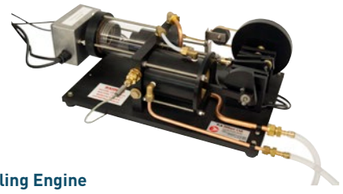
- Investigates the relative thermal conductivities of typical building materials
- Uses a relative method of thermal conductivity measurement based upon an international standard ISO 8301

H112P Free and Forced Convection from Flat, Pinned and Finned Plates

- Investigates both free (natural) convection and forced convection of varying heat exchanger designs

H112Q Thermoelectric Heat Pump

- Investigates the performance of a thermoelectric module as a generator and a refrigerator
- Uses a direct electrical current to transfer heat from one face of the device to the other



H112R Stirling Engine

- Investigates one of the methods available to convert heat energy directly into work

H112S Boiling Heat Transfer

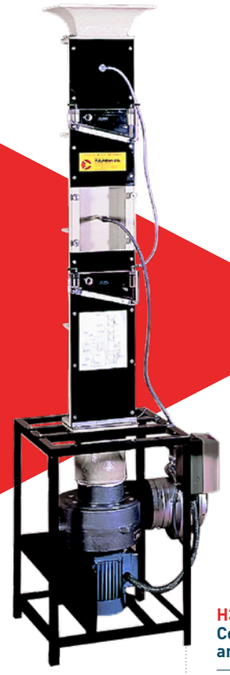
- Allows students to experimentally investigate convective, nucleate and film boiling

H352 Series

Cross Flow Heat Exchangers are used in countless engineering applications, including engine radiators, air heaters, refrigeration evaporators and condensers, super-heaters and economisers.

The normal configuration involves heat transfer between one fluid flowing through a bundle of tubes and another flowing transversely over the outside of the tubes.

The tubes can have extended surfaces internally and/or externally to enhance heat transfer between the two fluids.



H352 Cross Flow Heat Exchanger

- Allows investigation of Plain and Finned Cross Flow Heat Exchangers
- Expandable free and forced convection Heat Transfer study
- Investigates Local Heat Transfer Coefficient around a cylinder
- Safe and suitable for unsupervised student operation
- Responds rapidly to control changes
- Negligible operating and maintenance costs
- Optional 'Computerised Data Acquisition Upgrade'

H352D Free and Forced Convection from Flat, Pinned and Finned Plates

- Includes three plates with integral heaters and temperature sensors that are each designed to fit the aperture in the H352 duct
- Varying heat exchanger design to analyse effects on heat transfer ability

H352A Plain Tube and Tube Bundle in Cross Flow

- Investigates the variation in heat transfer, temperature difference and surface heat transfer variation with air stream velocity and varying heater position

H352E Heat Pipe Investigation

- Used in many applications to transfer heat rapidly from one location to another
- When compared with equivalent cross sections of high conductivity materials, such as copper and silver, heat pipes are many more times effective

H352B Local Heat Transfer Element

- By passing an electrical current through the conducting surface, heat is generated
- Allows calculation of the power, surface temperature and air stream temperature, and convective heat transfer coefficient local to the thermocouple

H352F Pitot Static Traverse Plate

- Includes a sliding plate, and pitot tube with multiple locations designed to be traversed across the duct of the H352 base unit to measure pressure distribution around tubes/heaters

H352C Finned Tube Bundle in Cross Flow

- Includes a clear plastic plate that is designed to fit the aperture in the H352 duct
- Examines addition of extended surface in improving heat transfer

H352G Water to Air Heat Exchanger

- Includes a series connected copper tube bundle with flexible flow and return hoses designed to fit the aperture in the H352 duct
- The flexible hoses connect to a small service console containing a water heater, reservoir, circulating pump and flowmeter

H050 Boyle's Law Demonstrator

- Investigates Boyle's Law
- Optional low cost version available as H050A
- Allows investigation above and below atmospheric pressure
- Allows investigation with other safe gases if available
- Optional Computerised Data Acquisition upgrade

H411 Flow Boiling Demonstration Unit

- Provides students with a clear visual demonstration of what is happening inside the vapour generating tubes of practical plants
- See all the processes and types of flow involved during an actual (NOT simulated) evaporation process, from sub-cooled liquid to superheated vapour
- Safe and suitable for unsupervised student operation
- Negligible operating and maintenance costs
- Low laboratory foot print

H656 Boiling Heat Transfer Unit

- Three modes of pool boiling observed easily
- Allows safe investigation into the normally dangerous condition of film boiling
- Ozone-friendly, low pressure, non-toxic working fluid
- Optional 'Computerised Data Acquisition Upgrade'

H694 Fluidisation and Fluid Bed Heat Transfer

- Provides visual and quantitative results related to the flow of air through both a packed and fluidised bed of granular material contained in a vertical glass cylinder
- Bed material is easily changed, allowing the unit to be in operation again in two or three minutes
- Experimentation with custom diffuser designs and working material possible for projects
- Optional 'Computerised Data Acquisition Upgrade'

H813 Dew Point Hygrometer

- Directly measures Ambient Dew Point
- Allows sampling of air from remote locations such as air ducts
- Rapid operation and reversibility

H814 Humidity Measurement Bench

- Investigates different methods of humidity measurement
- Fundamental for the study of Air Conditioning and Plant Engineering (Cooling Towers)
- May be used In Conjunction with Hilton H813 Dew Point Hygrometer

H893 Bench Top Cooling Tower

- Demonstrates all processes found in a full scale forced draught cooling tower
- Rapid stabilisation allows experimental work to commence immediately upon switching on
- Columns with varying packing densities available as optional extras including blank column for custom design
- Optional 'Computerised Data Acquisition Upgrade'

H911 Film and Dropwide Condensation Unit

- 2 Specially developed water cooled condensers present an almost isothermal surface to the steam
- Bench top, compact and portable unit requiring only a 3 kW electrical supply, cooling water and a drain
- Stabilises very quickly – many different conditions may be investigated in a normal laboratory period
- Heat fluxes approaching 106w M-2 are possible
- Thermocouple attachment technique allows measurement of mean surface temperature without interfering with the surface properties
- Allows investigation to the benefits and difficulties of each design
- Optional 'Computerised Data Acquisition Upgrade'

H981 Temperature Measurement Methods and Calibration Unit

- Allows students to thoroughly examine a large variety of temperature measurement devices, how errors can be introduced and avoided, methods of calibration and the structure of the International Temperature Scale (ITS-90)
- Optional UKAS/NAMAS Calibration Certificate

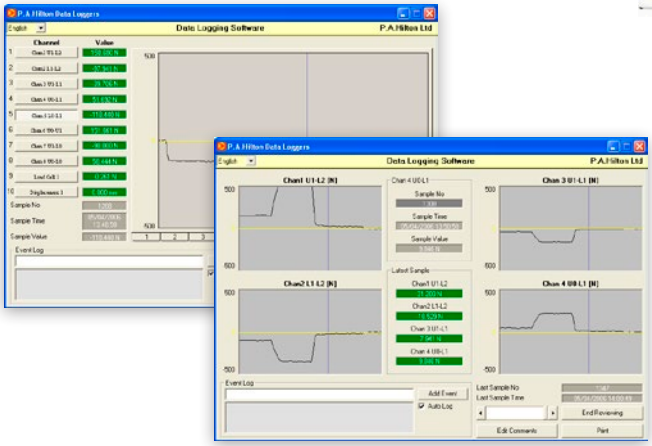
H931 Steam of Water Heat Exchanger

- Provides visual and quantitative results related to heat transfer in shell and tube type water cooled condensers
- Safe and suitable for unsupervised student operation
- Quickly changeable heat exchanger sizing for comparison of results.
- Optional 'Computerised Data Acquisition Upgrade'

Maximise students per session, so **more efficient use of lab** and **student time.**

Hilton Data Acquisition Upgrade

- Available for most of the Hilton Heat Transfer units
- Allows key experimental parameters of temperature, pressure and flow to be measured, displayed, recorded, printed and graphically/numerically displayed on a host computer or laptop
- Data files can be exported to Excel or another spreadsheet programme
- Allows for rapid data acquisition where equipment maybe being used for research



Other Experiments Available (refer to PA Hilton website for details)

H953 – Water/Water Turbulent Flow Heat Transfer Unit
H971 – Laminar/Viscous Flow Heat Transfer Unit

The rig itself is compact, highly visual and very suitable for our undergraduate teaching purposes. The visual demonstration of various boiling modes is very engaging for students.

The computer interface allows a recording of all the quantities required to get an in-depth understanding of the physical processes in play within the experiments.

Dr. Francois Nadal
Wolfson School of Mechanical Electrical and Manufacturing Engineering
Loughborough University

+44 (0) 1794 388 382

www.pahilton.co.uk