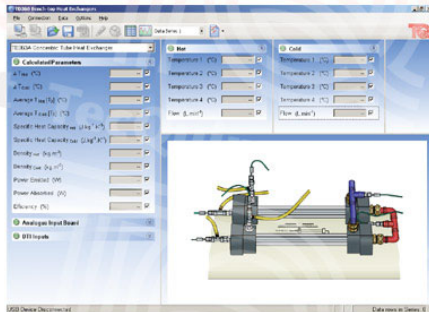


# TD360 Series

## Bench-top Heat Exchangers

**Examines and compares small-scale heat exchangers to help students understand how they work**

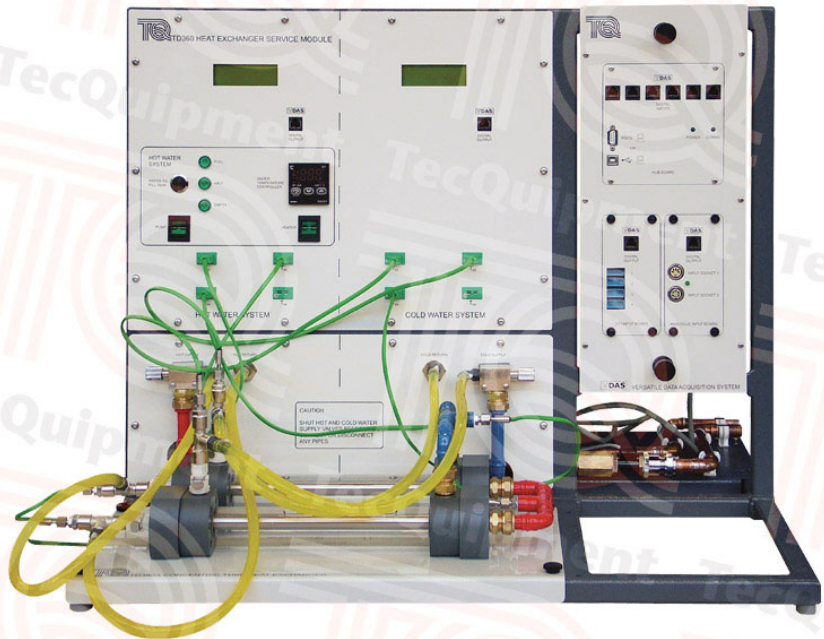
Works with  
**VDAS®**



Screenshot of the optional VDAS® software



Service Module (TD360)



Shown fitted with an optional heat exchanger and optional VDAS-F Interface

- A bench-top service module with optional small-scale demonstration heat exchangers – designed for teaching
- Optional heat exchangers include the most common types used in industry (tubular, plate, shell and tube, and a jacketed vessel with coil and stirrer)
- Simple and safe to use – foolproof fittings allow students to change and connect the optional heat exchangers quickly and easily - needs no tools
- The Service Module has clear digital displays of all readings – you do not need a computer to work it or take readings
- Optional heat exchangers have clear outside casings, so students can see their construction
- Heat-exchangers each have a bedplate with a clear schematic diagram to help students understand how to connect it
- Can connect to TecEquipment's Versatile Data Acquisition System (VDAS®)

- TecEquipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
- T +44 115 972 2611 • F +44 115 973 1520 • E info@tecquipment.com • W www.tecquipment.com
- An ISO 9001 certified company
- VDAS is a registered trademark of TecEquipment Ltd



## TD360 Series

## Bench-top Heat Exchangers

### Description - Service Module (TD360)

The Service Module (TD360) is the core of the TD360 range. It provides hot and cold water to the heat exchangers and all the instruments needed to measure their performance. All fluid connections to the optional heat exchangers are self-sealing quick connectors - for safety and simplicity. The hot and cold fluid streams have different connectors to reduce errors. Changing a heat exchanger takes less than one minute.

The Services Module's hot water system includes a tank with a PID controlled electric heater, a pump and tank level indicators. An electrically operated valve opens to let water in to fill the tank. The tank has protection in case of over temperature, low water level and overfilling. The hot water system gives stable flow rates and temperatures.

The Services Module's cold water circuit has a flow regulator and connection for an external mains water supply.

Both the cold and hot water system have precision needle valves and turbine flow meters to control and measure the flow rates.

Thermocouples at the connectors measure hot and cold inlet and outlet fluid stream temperatures. Some heat-exchangers also have built-in thermocouples for extra temperature measurements. Clear, multiline digital displays show the temperatures and flow rates of the fluid streams.

All optional heat exchangers have the same nominal heat transfer area and wall thickness, so students can compare them directly. Each heat exchanger is on a bedplate that has a clear schematic diagram showing the connections. The bedplate fixes to the Service Module with thumbscrews (students need no tools).

**Note:** You need at least one of the optional heat exchangers to do experiments. TecQuipment recommends that you buy the Concentric Tube Heat Exchanger (TD360a) first, because it has extra temperature measuring points.

You can do tests with or without a computer connected. However, for quicker tests with easier recording of results, TecQuipment can supply the optional Versatile Data Acquisition System (VDAS). This gives accurate real-time data capture, monitoring and display, calculation and charting of all the important readings on a computer (computer not included).

### Standard Features

- Supplied with comprehensive user guide
- Two-year warranty
- Made in accordance with the latest European Union directives

### Experiments (with optional heat exchangers)

- Demonstration of heat transfer from one fluid to another through a solid wall.
- Energy balance and efficiency calculations.
- Comparison of different types of heat exchanger in terms of performance, size and relative cost.
- Demonstration of Parallel-flow and Counter-flow operation of the heat exchangers.
- Measurement of the heat transfer coefficient, and the effect of fluid flow rates and the driving force (temperature differential) upon it.
- Introduction to the logarithmic mean temperature difference in heat exchangers.
- Flow-through and batch heating, with or without stirring, using a heating jacket or a coil (TD360d only).

### Essential Ancillaries

- Concentric Tube Heat Exchanger (TD360a)
- Plate Heat Exchanger (TD360b)
- Shell and Tube Heat Exchanger (TD360c)
- Jacketed Vessel with Coil and Stirrer (TD360d)

### Recommended Ancillaries

- VDAS-F (frame-mounted version of the Versatile Data Acquisition System)

### Operating Conditions

*Operating environment:*  
Laboratory environment

*Storage temperature range:*  
-25°C to +55°C (when packed for transport)

*Operating temperature range:*  
+5°C to +40°C

*Operating relative humidity range:*  
80% at temperatures < 31°C decreasing linearly to 50% at 40°C

### Sound Levels

Less than 70 dB(A)

### Essential Services

Bench Space Needed - 800 mm x 700 mm

Electrical Supply - Single-phase 220 VAC 50 Hz or Two-phase 220 VAC 60 Hz at 14 A (3 kW)

Clean Water Supply and Waste - 5 L.min<sup>-1</sup> at a minimum 1 bar and maximum 3 bar.

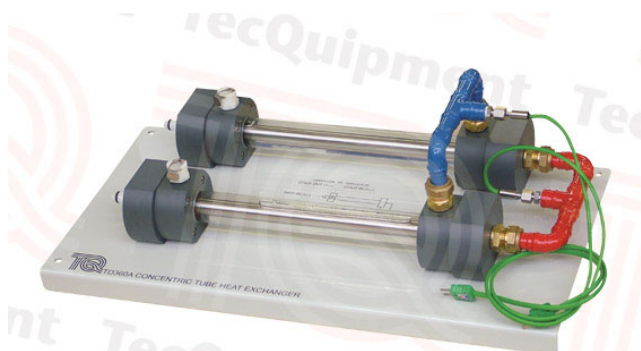
- TecQuipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
- **T** +44 115 972 2611 • **F** +44 115 973 1520 • **E** info@tecquipment.com • **W** www.tecquipment.com
- An ISO 9001 certified company
- VDAS is a registered trademark of TecQuipment Ltd



## TD360 Series

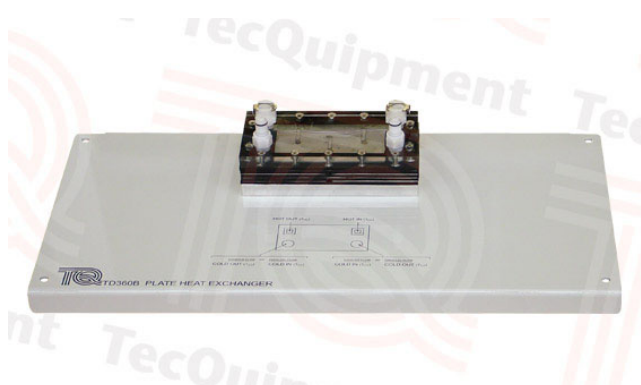
## Bench-top Heat Exchangers

### Description – Concentric Tube Heat Exchanger (TD360a)



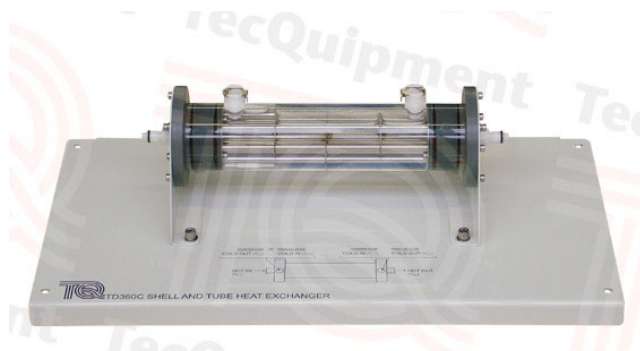
This is the simplest heat exchanger. It has two tubes, one inside the other. One tube carries hot fluid, the other carries cold fluid. Heat transfers between them. TecEquipment's heat exchanger is in two equal parts joined by intermediate pipes. This allows two extra measurement points at the midpoint (plus the standard four points at the connectors). This gives more useful experiment results, to show more clearly how the fluid temperatures change during heat transfer.

### Description – Plate Heat Exchanger (TD360b)



This heat exchanger is a set of metal plates separated by spacers (gaskets). The plates and gaskets have holes that make the hot and cold flow run on alternate sides of the plates, therefore transferring heat. The metal plates have flow disturbers on their sides to help improve the heat transfer. Plate heat exchangers are compact and therefore good for applications with limited space. It is also easy to alter their design to change their capacity - you simply add or remove plates and spacers.

### Description – Shell and Tube Heat Exchanger (TD360c)



This heat exchanger is one of the most common type used in industry. This is because it is compact, but can work at higher pressures than other designs. It is a large tube (shell) which surrounds several smaller tubes (a bundle). One fluid passes through the shell, and the other fluid passes through the tube bundle, therefore transferring heat. Baffles around the bundle help to create a turbulent mixed flow.

### Description – Jacketed Vessel with Coil and Stirrer (TD360d)



This heat exchanger mimics those used in the process industry. It can show heat transfer by using the outer skin (or 'jacket') of the vessel, or by a coil inside the vessel. You can set a continuous feed to the vessel for heating or you set a fixed batch for heating. The unit has an extra thermocouple to measure the batch temperature. It also has a motorised stirrer to show how stirring affects heat transfer.

- TecEquipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
- T +44 115 972 2611 • F +44 115 973 1520 • E info@tecquipment.com • W www.tecquipment.com
- An ISO 9001 certified company
- VDAS is a registered trademark of TecEquipment Ltd

## TD360 Series

## Bench-top Heat Exchangers

### Specifications – Heat Exchanger Service Module (TD360)

#### Dimensions and weight:

760 mm wide x 610 mm front to back x 600 mm high and 40 kg

#### Hot water system:

- 7.5 Litre (approx) Hot Water Tank
- 2.75 kW heater
- Tank full, half, and empty indicators
- Pump flow rate  $3.5 \text{ L}\cdot\text{min}^{-1}$  at 1 bar
- Water refill by electrically operated valve
- Temperature set by a PID (proportional, integral, derivative) controller
- Protection against low tank level, and over temperature

#### Cold water system

- Inlet pressure 1 bar minimum to 3 bar maximum, at  $5 \text{ L}\cdot\text{min}^{-1}$
- $5 \text{ L}\cdot\text{min}^{-1}$  flow regulator

#### Measurement and controls (duplicated for hot and cold streams)

- Flow control by precision needle valve
- Flow measurement by turbine flow meter, displayed digitally
- Four K type thermocouple inputs, displayed digitally
- Thermocouples in the outlet and return of each stream at the quick connectors
- Mounting point for VDAS, with power outlet at rear of unit, low voltage d.c outlet for stirrer motor on optional jacketed vessel with coil (TD360D)

### Specifications – Concentric Tube Heat Exchanger (TD360a)

#### Nett dimensions and weight:

500 mm x 260 mm x 160 mm and 3.5 kg

#### Other details:

- Outer tube - transparent, 30 mm outside diameter and 20 mm inside diameter
- Inner tube - stainless steel, 12 mm outside diameter and 10 mm inside diameter (1 mm wall)
- Mean heat transfer area  $0.02 \text{ m}^2$
- Additional thermocouple in midpoint of hot and cold streams
- Connection to Service Module with quick connectors

### Specifications – Plate Heat Exchanger (TD360b)

#### Nett dimensions and weight:

500 mm x 260 mm x 100 mm and 2.4 kg

#### Other details:

- Transparent top cover
- 4 stainless steel plates each  $0.005 \text{ m}^2$  and 1 mm thick with flow disturbers on surface
- EPDM rubber plate spacers
- Heat transfer area  $0.02 \text{ m}^2$
- Connection to Service Module with quick connectors

### Specifications – Shell and Tube Heat Exchanger (TD360c)

#### Nett dimensions and weight:

500 mm x 260 mm x 150 mm and 2.7 kg

#### Other details:

- Outer tube - transparent, 60 mm outside diameter and 50 mm inside diameter
- Tube bundle - 6 Stainless steel tubes, each 6 mm outside diameter and 4 mm inside diameter (1 mm wall), three baffles
- Mean heat transfer area  $0.02 \text{ m}^2$
- Connection to Service Module with quick connectors

### Specifications – Jacketed Vessel With Coil and Stirrer (TD360d)

#### Nett dimensions and weight:

500 mm x 260 mm x 310 mm and 5.2 kg

#### Other details:

- Transparent Lid
- Outer tube - UPVC, 125 mm outside diameter and 113 mm inside diameter
- Inner tube - stainless steel, 101 mm outside diameter and 99 mm inside diameter (1 mm wall)
- Coil - stainless steel, 6 mm outside diameter and 4 mm inside diameter (1 mm wall)
- Batch volume of approximately 0.5 L (set by overflow)
- Mean heat transfer area approximately  $0.02 \text{ m}^2$  for both the jacket and the coil
- Stirrer - low voltage motor-powered with speed controller
- Additional thermocouple measures the batch temperature
- Connection to Service Module with quick connectors.

**Note:** you need an additional drain connection for the overflow (for flow-through experiments)

- TecEquipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
- **T** +44 115 972 2611 • **F** +44 115 973 1520 • **E** info@tecequipment.com • **W** www.tecequipment.com
- An ISO 9001 certified company
- VDAS is a registered trademark of TecEquipment Ltd