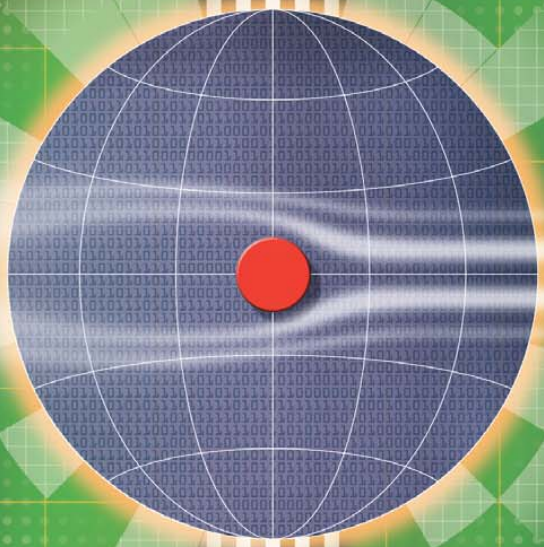
7 Renewable Energy



“ The TecQuipment teaching solutions and scalable teaching equipment has allowed the Thermal Engineering and Energy Department to provide training up to Masters degree level with continuous and undeniable quality. ”

Prof Jean-Noël Blanchard, IUT Orleans, France

Renewable Energy

Products for the future

TecQuipment recognises the importance of products that demonstrate future technologies. The Renewable Energy range covers three key methods used to harness and convert solar energy. These include:

- Photovoltaic (conversion to electricity)
- Focusing (to a collector)
- Flat plate collection (direct water heating)

Automatic data acquisition

VDAS®

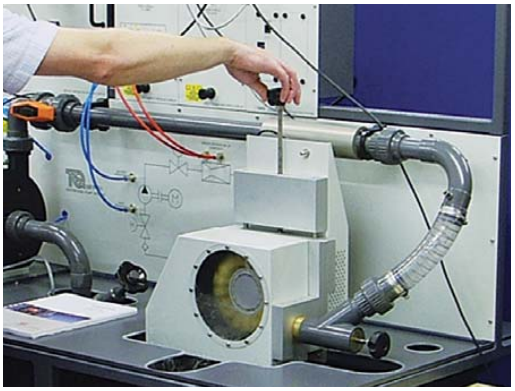
All the Renewable Energy products work with TecQuipment's unique Versatile Data Acquisition System (VDAS®). See **Section 2** for more details.

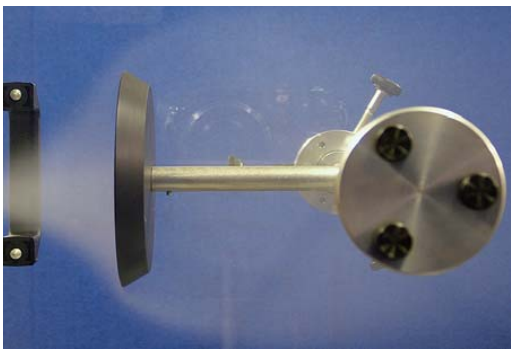
KEY FEATURES AND BENEFITS:

- **Photovoltaic, focusing and flat plate energy collection: demonstrate three key methods used in harnessing solar energy.**
- **Automatic data acquisition: monitoring solar energy collection can lead to long-term experiments, making automatic data acquisition a valuable tool.**
- **Safe and easy set up: low temperatures, safe connections and simple hand-operated controls allow you to set up an experiment safely and quickly.**

Check out our other ranges:

Other TecQuipment products link directly to renewable energy. For example, our **Modular Fluid Power** products (pages 137–152) includes turbines to harness the energy in water. The **Aerodynamics** (Section 3) and **Fluid Mechanics** (Section 5) ranges include experiments to show how shapes affect air and water flow. These are essential tools for engineers when designing wind or water energy systems.

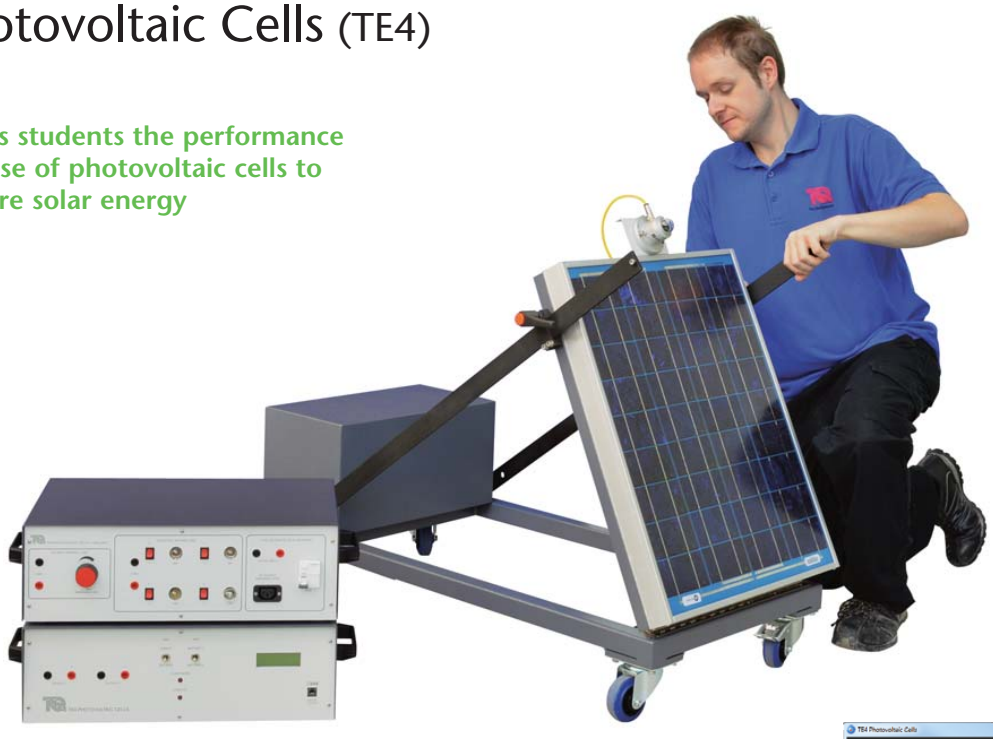




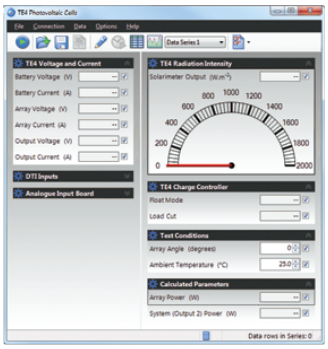
Photovoltaic Cells (TE4)

Works with VDAS®

Shows students the performance and use of photovoltaic cells to capture solar energy



- Demonstrates the performance of high-efficiency photovoltaic cell array and battery storage system
- Includes solarimeter, charge controller and control module with digital displays and d.c. outputs
- Supplied with both high and low-rated batteries to allow students to investigate charge and discharge cycle of the system in a typical laboratory session as well as longer cycles
- Includes three different types of electrical load



Screenshot of the optional VDAS® software

EXPERIMENTS:

- **Performance of the solar panel**
- **Demonstration of float mode**
- **Demonstration of load cut**

Shows students how well a photovoltaic cell array and battery storage system works. It uses a commercially available solar panel made from high-efficiency cells.

The solar panel is on a wheeled, lightweight frame that allows adjustment of the panel angle relative to the sun. A solarimeter on the frame measures incident radiation. The panel recharges a choice of two batteries through a charge controller. The charge controller recharges the battery at the correct rate of charge without damage to the battery. The frame holds a high-performance, deep-cycling battery in a storage box. The equipment also includes a second lower-rated battery. This allows students to examine the charge and discharge cycle of the system in a typical laboratory session.

A control module contains the charge controller. The control module has digital displays and shows the panel and battery storage performance. It has indicators to show when the charge controller is in float mode and load cut mode. It also has two power outputs.

Output 1 allows direct connection of external loads to the solar array, for direct load experiments. Output 2 allows connection through the charge controller to show how it works with a load and a battery.

A separate loading unit includes:

- a variable resistive load to show battery performance;
- an inverter to show practical conversion to a.c. voltages;
- four switchable lamps to show a practical application.

The equipment works with TecQuipment's Versatile Data Acquisition System (VDAS®). This allows accurate, real-time data capture, monitoring, display, calculation and charting of all the important readings on a suitable computer (computer not included).

Recommended Ancillary:	Page
• Versatile Data Acquisition System – Bench-mounted version (VDAS-B)	32

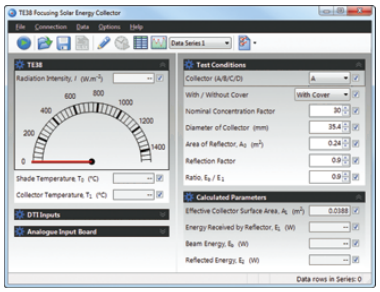
Alternative Products:	Page
• Focusing Solar Energy Collector (TE38)	186
• Flat-Plate Solar Energy Collector (TE39)	187

Focusing Solar Energy Collector (TE38)

Works with VDAS®

Shows how a focusing solar energy collector works and allows students to study its performance

- Mobile, self-contained focusing solar energy collector specially designed for educational use
- Shows principles, advantages and limitations of focusing solar energy collectors
- Includes four different sizes of collector for studies of different energy concentration ratios
- Removable transparent cover allows students to compare properties of shielded and unshielded collectors



Screenshot of the optional VDAS® software

EXPERIMENTS:

- **Demonstrations of the performance, advantages and limitations of a focusing solar energy collector**
- **Understanding the effective use of the direct component of solar radiation**
- **Measurement of the efficiency of the collector with and without a transparent cover**
- **Measurement of the maximum possible energy collector temperature**

A focusing solar energy collector on a mobile frame. Specially designed for educational use, the apparatus shows the principles, advantages and limits of this method of capturing solar energy.

It is a highly polished stainless-steel parabolic reflector, supported on trunnion bearings on a turntable. By adjusting the horizontal and vertical position of the reflector, students focus solar energy onto an energy collector. The energy collector is a copper cylinder with an embedded thermocouple which measures the cylinder temperature. To enable students to compare different concentration ratios, TecQuipment supplies four different sizes of energy collector. Also supplied is a removable transparent cover for the collector, so students can study the properties of shielded and unshielded collectors.

Attached to the reflector carrier is a solarimeter (pyranometer) which measures the incident solar radiation. An extra thermocouple measures ambient temperature for reference. The cylinder thermocouple, the solarimeter and the ambient temperature thermocouple connect to a display unit. The display unit shows ambient temperature, collector temperature and solar intensity from the solarimeter. It also has a socket for connection to TecQuipment's optional Versatile Data Acquisition System (VDAS®).

The equipment works with TecQuipment's bench-mounted version of the Versatile Data Acquisition System (VDAS-B, not included). This allows accurate, real-time data capture, monitoring, display, calculation and charting of all important readings on a suitable computer (computer not included).

Recommended Ancillaries:	Page
• Versatile Data Acquisition System – Bench-mounted version (VDAS-B)	32
• Stopwatch (SW1)	30

Alternative Products:	Page
• Photovoltaic Cells (TE4)	185
• Flat-Plate Solar Energy Collector (TE39)	187

Flat-Plate Solar Energy Collector (TE39)

Works with VDAS®

Shows how a flat plate solar energy collector works and allows students to study its performance

- Educational flat plate solar energy collector with full instrumentation
- Allows students to investigate the effective use of a renewable, environment friendly energy source
- Purpose designed and built solar panel for high quality
- Includes digital display of flow, radiation intensity and temperatures at different points throughout the apparatus

EXPERIMENTS:

- **Efficiency of the collector**
- **Efficiency and heat losses**

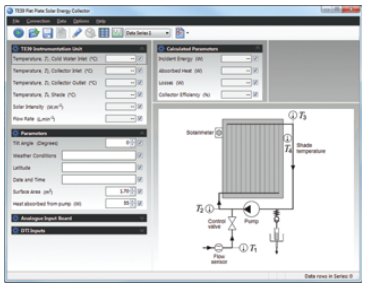
Also, students can do further experiments on the effect of collector angle.

This equipment shows how a flat plate solar energy collector works. It allows students to measure and find the efficiency and heat losses of a flat plate solar energy collector.

The collector has a purpose designed and built panel for quality and reliability. The panel has a thin sheet metal absorber backed by riser tubes and insulating material to reduce heat loss to the rear. A box with a clear cover encloses the panel, forming the collector. A sturdy mobile frame supports the collector. To allow users to adjust its angle, the frame has a hinge.

Cold mains water enters the collector. Sunlight energy heats the water in the collector. The heated water returns to a pump that mixes the heated water with the incoming cold water. A pressure sensitive valve allows the heated water to leave the equipment at the same rate as cold water enters it. A flow transducer measures the water flow rate and a solarimeter (or pyranometer) measures incident radiation. Thermocouples measure the water temperature at all the important points, and the shade temperature.

The separate Instrumentation Unit displays the temperatures from the thermocouples, the flow rate and the radiation intensity. It includes a switch to control the pump and a socket for connection to TecQuipment's optional VDAS®.



Screenshot of the optional VDAS® software

For quick and reliable tests, TecQuipment can supply the optional VDAS® (Versatile Data Acquisition System). VDAS® gives accurate real-time data capture, monitoring and display, calculation and charting of all the important readings on a computer. Computer not supplied.

To compare efficiencies, the Flat Plate Solar Energy Collector is an ideal companion to TecQuipment's Focusing Solar Energy Collector (TE38).

Recommended Ancillary:	Page
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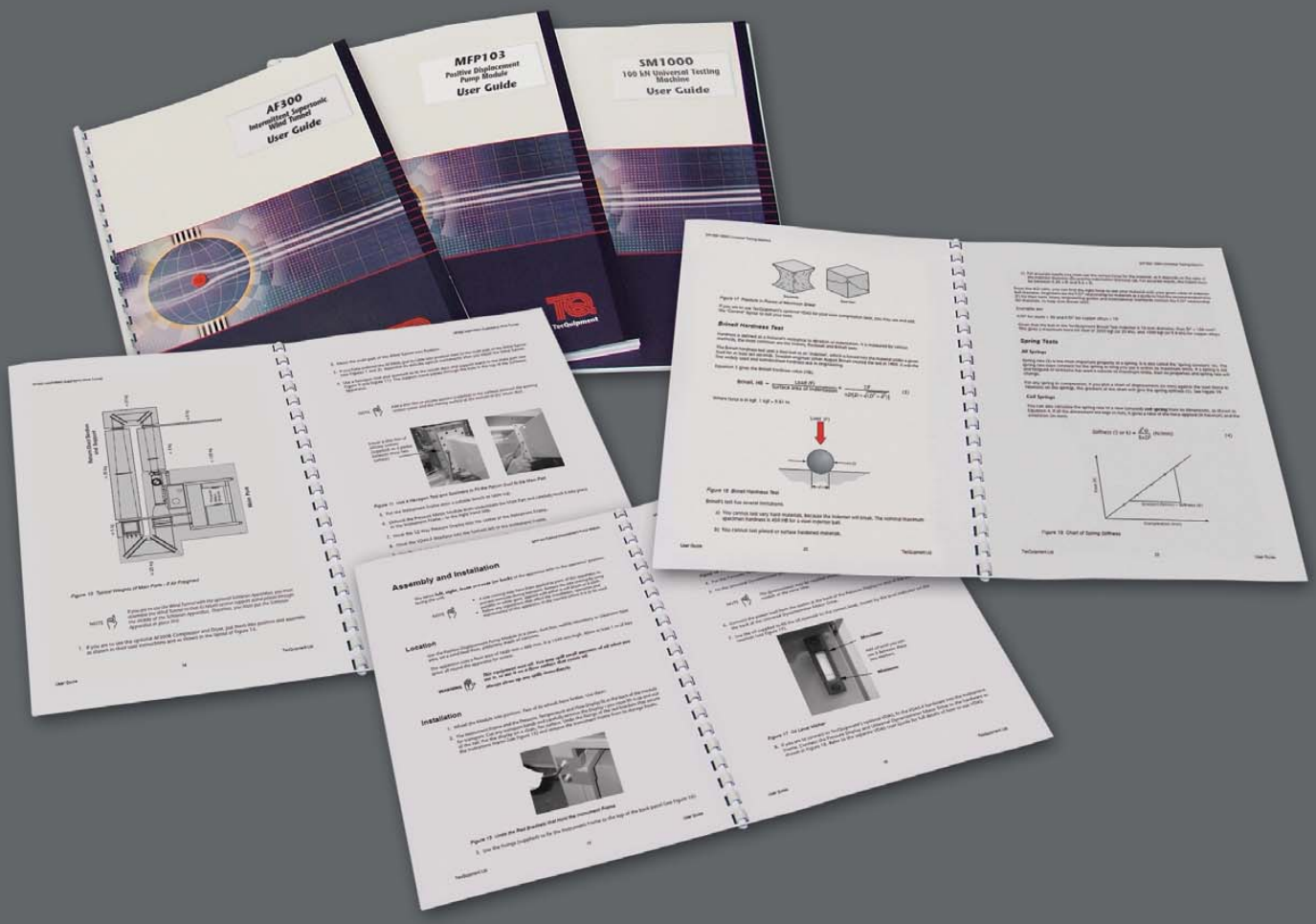

TecQuipment Document Packs

Making it clear for the customer

We send document packs with all TecQuipment products* which contain:

- **Packing contents list** (PCL) – shows you what parts we pack with the product.
- **Test certificate** – shows you that we've thoroughly tested the product before we send it to you.
- **User guides*** and **safety information** – show you how to use the product safely and learn how it works.

Some packs also include **compact discs** (CD-ROMs) with TecQuipment software (e.g. VDAS®).

At TecQuipment we continually improve our user guides so they include pictures of the products, clear diagrams and plain English text. This helps you to understand the product more clearly. Where necessary, the guides include theory, suggested experiments and typical results to help students understand what the product teaches.

*Some products may not need user guides, as their details are already shown in their parent product, for example the optional pumps on the MFP103.