Flat Plate Solar Energy Collector

RE550

- ***Allows Thermal Evaluation of a Flat Plate Solar Collector.***
- ***Optional Focussing Solar Collector Allows Direct Comparison of Performance.***
- ***Optional Solar Array Allows Operation Inside Laboratory***
- ***Negligible Operating and Maintenance Costs.***
- ***Two year Warranty.***

Introduction

The rapidly increasing cost of fossil fuels and the visible signs of global warming are concentrating interest in renewable energy. The Hilton RE550 allows students to investigate the thermodynamic performance of solar water heating methods and will be of specific interest to students in the following disciplines.

- Renewable Energy
- Energy Conservation
- Mechanical Engineering
- Physics
- Environmental Engineering
- Plant and Process Engineering
- Building Services
- Engineering Physics
- Marine Engineering

Experimental Capabilities

- Measuring the efficiency of a flat plate solar collector
- With the optional focussing collector, RE550A comparison of the efficiency with a flat plate collector.
- Analysis of the efficiency and heat losses of the collector in use.
- Study of the variation of incident energy on the collector and collector inclination.
- With the addition of optional computerised data acquisition the daily variation of incident energy and system performance.
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Description

A flat plate solar collector similar to those used for heating swimming pools or domestic hot water is mounted on an adjustable frame. The unit is designed for internal or external operation.
For internal operation an artificial solar source is available on application as an optional extra.

An instrumentation and water circulating console is attached to the panel under test via flexible hoses and this displays all of the relevant measured parameters.

The operating temperature of the system is adjusted by adjustment of a flow of cooling water and this allows investigation of performance over a range of operating conditions.

The instrumentation records the circulating water flow, flow and return temperatures, ambient temperature and incident solar radiation.

The incident solar energy is measured using a solarimeter and this together with the other measured parameters allows the performance and efficiency of the system to be measured under all operating conditions

A compass and adjustable level indicator are supplied to allow adjustment of the panel on site.

In order to increase the potential outlet water temperature from solar collectors focussing of the solar radiation is often used.
An optional flat focussing type solar collector RE550A is available that can be supplied to allow a comparison of performance of the two types of collector.

Due to environmental concerns and increasing fuel costs, solar collection is of increasing interest in global areas that do not have abundant sunshine year round.
However it is important that students are able to investigate solar collection in a laboratory environment without having to wait for suitable weather conditions.

For environments where abundant solar radiation cannot be relied upon an optional solar simulator RE550B, is available that requires connection to a local electrical power supply.

In order to evaluate daily variations in performance an optional computerised data acquisition system REC551A is available that allows all of the relevant parameters to be recorded over extended periods. Data can then be evaluated in most spreadsheet programs.

The data logger is supplied with easily configured software that can be removed from the unit and used for other applications.

The RE550 unit is complimentary to the Hilton RE540 Photovoltaic Trainer which allows students to examine electrical power generation directly from solar energy.

Specification

An adjustable frame mounted flat plate solar collector with remote instrumentation and water circulation console. Instrumentation must include water flow rate, flow and return temperatures and incident solar radiation. An optional flat focussing type solar collector must also be available together with an optional computerised data acquisition system.

Dimensions

(Nominal, Depending on Panel Adjustment Angle)

Height: 1600mm Depth: 1600mm
Width: 1000mm Weight: 120 kg.

Services Required

RE540 (and RE550A)

Electrical:

A: 220-240 Volts, Single Phase, 50Hz
(With earth/ground)
Line current up to 6A at 230v

Or

B: 110-120 Volts, Single Phase, 60Hz
(With earth/ground)
Line current up to 10A at 110v

Cooling water:
Up to 3 litres/minute at up to 5m head

Drain:
For up to 3 litres/minute

RE550B

Electrical:

A: 2 x 220-240 Volts, Single Phase, 50Hz
(With earth/ground)
Line current up to 13A at 230v

Or

B: 210-220 Volts, Three Phase, 60Hz
(With earth/ground)
Line current up to 13A at 220v

Ordering Information

Order as:

Flat Plate Solar Energy Collector	**RE550**

Optional Items

Flat Focussing Solar Collector	**RE550A**
Solar Simulator	**RE550B**
Computerised Data Acquisition System	**REC551A**

Electrical Specification

Either: **A**: 220-240 Volts, Single Phase, 50Hz
(With earth/ground)
B: 210-220 Volts, Three Phase, 60Hz
(With earth/ground)

Language

Either: English, Spanish, French.

Accessories and Spares

Unit supplied with:

- One experimental operating and maintenance manual in English, Spanish, French.
- Accessories and spares for 2 years normal operation. List available on request

Also Available On Request

Further detailed specification
Additional copies of instruction manual.
Recommended list of spares for 5 years operation

Optional Extra RE550A
Focussing Flat Solar Collector

The Optional Focussing Flat Plate Solar Collector RE550A is designed to operate with the control and instrumentation console of the standard RE550 Flat Plate Solar Collector.

The solar panel incorporates evacuated clear tubes that thermally insulate the black heat collecting tubes that are located internally. Specially formed polished reflectors focus the solar radiation on the enclosed black tubes thereby increasing the potential water exit temperature for this type of collector.

The performance of the RE550A Optional Focussing Flat Plate Solar Collector may be compared directly with the standard RE540 using the standard instrumentation or alternatively using the optional REC551A Computerised Data Acquisition upgrade.

The latter option allows long term performance to be evaluated during daily solar cycles.

Optional Extra RE550B
Solar Simulator

In countries where solar radiation cannot be relied upon, the optional Solar Simulator RE550B allows the RE550 or optional RE550A to be investigated in detail, under controlled conditions.

The full equatorial solar heat flux can be simulated with the Optional RE550B.

Optional Extra REC551A
Data Acquisition Upgrade

Hardware details
The Optional Computerised Data Acquisition Upgrade REC551A consists of a 21 channel Hilton Data logger (D103), together with pre-configured, ready to use, Windows ™ compatible educational software.

Factory fitted coupling points on the RE550 allow installation of the upgrade to the unit at any time in the machine's extensive life.

The Hilton Data logger (D103) connects, using the cable supplied, to a standard USB port on the user-supplied PC. If more than one logger is required connection is via a second USB port or standard USB hub.

The combined educational software and hardware package allows immediate computer monitoring and display of all relevant parameters on the RE550.

Software Details
The pre-configured menu driven Software supplied with the Computer Upgrade REC551A allows all recommended experiments involving the electronic transducers and instruments on the RE550 to be carried out with the aid of computerised data acquisition, data storage and on-screen data presentation. This enhances student interest and speeds comprehension of the principles being demonstrated.

Students are presented with either raw data for later hand calculation or alternatively data may be transferred to most spreadsheets for computerised calculation and graphical presentation.

Data may be stored on disc and displayed at any time using the software supplied. Alternatively data may be transferred to any compatible spreadsheet together with individual time and date stamp on each reading for complex analysis.

Additional Data Logging Facility Supplied As Standard
The D103 is the third generation of Hilton Data Logger. It comprises an industrially proven 21 channel interface with 8 thermocouples (type T and K as standard) / differential voltage inputs (±100mv DC), 8 single ended DC voltage inputs (±8v), 4 logic or frequency inputs and one mains voltage input. In addition there are on board 12v DC, ±5V DC and ±15v DC power supplies for most commercially available transducers.

The Hilton Data Logging software supplied as standard with the REC551A package allows the D103 to be disconnected from the RE550 and used together with most standard transducers as a stand alone computer data logger for the instrumentation and monitoring of existing laboratory equipment using locally sourced industrial transducers. The software is also backwards compatible with our many second generation D102 data loggers that are already in use worldwide.

Full data logger command protocol and communications details are provided in an extensive user manual that allows other software applications to communicate with the logger via the USB interface. Users can write their own software, typically in LabView, Matlab, C, C++, Visual Basic etc. This further expands the student project capabilities of the REC551A package from teaching and demonstration into the field of research and postgraduate study.

Computer Hardware Requirements
The menu driven Software supplied with the Computer Upgrade REC551A will operate on a PC which has at least 0.5Gb Mb ram, VGA graphics, 1Gb hard drive, CD drive and an available USB port. The software is Windows 2000, XP and 7 compatible.

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