

# HL 314

## Domestic water heating with tube collector



Display of the solar controller's user interface on any number of end devices

### Description

- **tube collector converts solar energy into heat**
- **system with heat exchanger and two separate circuits**
- **solar controller with data logger and integrated router for operation via web browser using an end device and for tracking experiments on numerous end devices: PC, tablet, smartphone**

Tube collectors have an empty glass tube as absorber and are therefore also called vacuum tube collectors. The vacuum reduces the heat losses, so that this type of collector achieves a higher degree of efficiency.

HL 314 can be used to demonstrate the principal aspects of solar thermal domestic water heating in a system with components used in real world applications. Radiant energy is absorbed and converted into heat in a commercially available evacuated tube collector. Heat-pipes located inside the absorbers enable heat transfer to a heat transfer fluid in the solar circuit. Subsequently another heat exchanger feeds the heat into the hot water circuit and into the storage tank. A solar controller controls the pumps for the hot water and solar circuits. The solar circuit is protected by

an expansion tank and a safety valve. The trainer has been designed so that it is possible to carry out a complete pre-heating as part of a practical experiment.

The temperatures in the storage tank, at the outlet from and the inlet to the collector are measured, as is the flow in the solar circuit. The measured values are recorded via the integrated data logger. Additionally, as in practice, the temperatures of the inlet and return are displayed on the solar circulation station.

The solar controller is operated via an integrated router. The user interface can be displayed on any number of end devices via a web browser. Different user levels with different functions can be selected. Access to recorded measured values is possible on Windows-based end devices via WLAN with integrated router or LAN connection to the customer's own network. An additional producer software of the solar controller is supplied for this purpose.

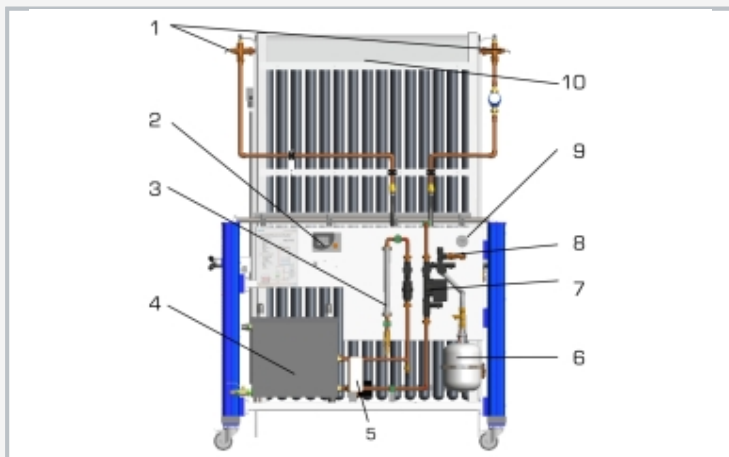
In order to ensure there is sufficient illuminance, the system should be operated with solar radiation or the optionally available HL 313.01 Artificial light source.

### Learning objectives/experiments

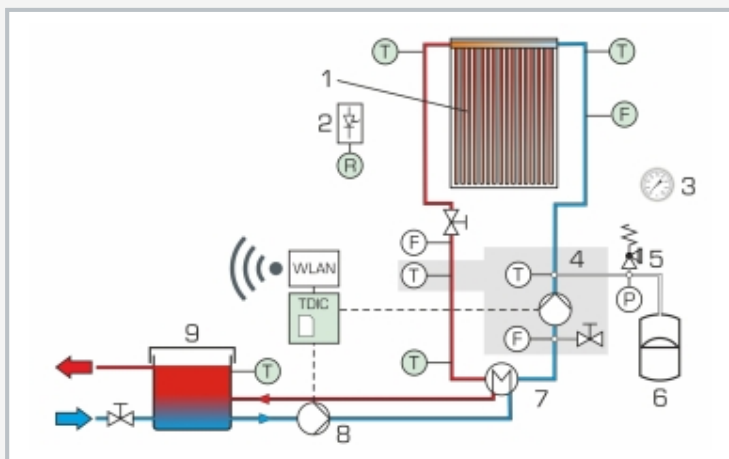
- **familiarisation with the functions of the evacuated tube collector and the solar circuit**
- **determining the net power**
- **relationship between flow and net power**
- **determining the collector efficiency**
- **relationship between temperature difference [collector/environment] and collector efficiency**

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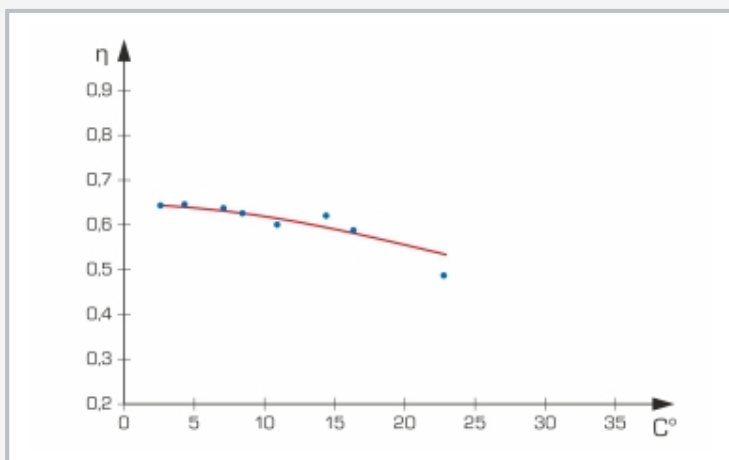
## Domestic water heating with tube collector



1 inlet and return thermometer, 2 solar controller, 3 flow meter, 4 buffer tank, 5 heat exchanger, 6 expansion vessel, 7 solar circuit pump, 8 pressure relief valve, 9 ambient air thermometer, 10 collector



TDIC solar controller with data logger and SD memory card  
 1 collector, 2 illuminance sensor, 3 ambient air thermometer, 4 solar circulation station with solar circuit pump, 5 safety valve, 6 expansion tank, 7 heat exchanger, 8 hot water circuit pump, 9 buffer tank  
 F flow rate, T temperature, P pressure, R illuminance



Efficiency as a function of the temperature difference

### Specification

- [1] investigating the function and operating behaviour of a tube collector
- [2] solar thermal evacuated tube collector with selectively absorbing coating
- [3] connection of absorbers by heatpipes
- [4] adjustable collector inclination angle
- [5] solar circuit with collector, pump, expansion vessel and safety valve
- [6] hot water circuit with buffer tank, pump and plate heat exchanger
- [7] 4 bimetallic thermometers
- [8] solar controller with temperature, flow rate and illuminance sensors
- [9] data logger with SD memory card
- [10] integrated router for operation and control via web browser using an end device and for tracking experiments on any number of end devices
- [11] experiment evaluation on Windows-based end devices possible, with additional producer software of the solar controller
- [12] operation with solar radiation or HL 313.01 Artificial light source

### Technical data

#### Solar circuit

- collector
  - ▶ total surface: 2,5m<sup>2</sup>
  - ▶ absorbing surface: 1,4m<sup>2</sup>
  - ▶ number of tubes: 15
  - ▶ rated throughput: 58L/h
- solar station
  - ▶ solar pump: adjustable
  - ▶ safety valve: 6bar

#### Hot water circuit

- plate heat exchanger: 3kW, 10 plates
- buffer tank 70L

#### Measuring ranges

- flow rate: 20...320L/h
- temperature: 4x 0...160°C
- pressure: 0...6bar

230V, 50Hz, 1 phase  
 230V, 60Hz, 1 phase  
 120V, 60Hz, 1 phase  
 UL/CSA optional  
 LxWxH: 1660x800x2300mm  
 Weight: approx. 240kg

### Required for operation

PC with Windows recommended

### Scope of delivery

- 1 trainer
- 1 producer software for solar controller
- 1 set of instructional material

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Optional accessories

HL 313.01      Artificial light source