



## COMPUTER CONTROLLED SOLAR THERMAL ENERGY TRAINER

### DL THERMO-A4



The Computer Controlled Solar Thermal Energy Trainer **DL THERMO-A4** is an educational and laboratory training system designed to demonstrate the principles of solar thermal energy conversion and automatic process control. It enables students and trainees to study how solar radiation is captured, converted into heat, stored, and managed through a computer-based monitoring and control interface.

This trainer provides a practical understanding of key topics such as heat transfer, solar collector performance, temperature regulation, energy efficiency, and system operation under different working conditions. By combining real components with computerized data acquisition and control, it offers a hands-on platform for learning the operation, analysis, and optimization of modern solar thermal systems.

From a technical standpoint, the trainer typically includes a solar collector circuit, storage tank, circulation pumps, heat exchanger, control valves, temperature probes, and a programmable electronic control unit with computerized monitoring and data acquisition. Through these



components, the system enables measurement and evaluation of key operating parameters such as collector inlet and outlet temperatures, storage temperature stratification, solar irradiance, fluid flow conditions, and thermal energy transfer efficiency. The computer-controlled interface supports real-time visualization and analysis of system variables, making it possible to investigate control strategies, energy balance, transient thermal response, and overall plant efficiency under different simulated or actual operating conditions.

## MAIN FEATURES

The element of the thermal flat-panel solar collector is a metal heat-absorbing plate. It is welded with the upper and lower collector tubes, where the metal frame and the back insulation material are made of high light transmittance glass. It is made of all-copper material, and the heat-absorbing coating adopts blue coating and black chrome technology. It also adopts double circulation, not easy to scale, and can discharge sewage to save pipes and avoid hail. The outer cover is made of tempered glass protective layer, which can bear pressure.

It has an adjustable collector inclination angle with selective absorption coating, and the absorbed thermal energy is given by the simulated solar radiation.



The solar collector is mounted on an aluminium frame and the fluid (water) flows through copper tubes. It is developed in such a way that the geometrical shape of the surface allows the most efficient absorption.

The trainer also includes a circulation station with pumps, **expansion tank**, safety valve measuring instrument, and a **solar simulator**.

- The expansion tank is protected with an anticorrosive material, and it has a computer-controlled heating element to perform a forced convection of the heat transfer fluid through it with a safety device to prevent over-temperatures.
- The solar simulator has lamps that emit radiations like those of the sun, which are measured by an irradiation sensor. The light is then converted into heat in the solar collector and transferred to the heat transfer fluid. The trainer is capable to simulate three different configurations with the intensity of the solar simulator.

The main structure of the trainer is made of aluminium profiles and plastic-sprayed steel plates, with high structural strength and strong corrosion resistance. The bottom is equipped with casters for easy movement.

It is also fitted with sensors and meters to record the relevant parameters (temperature, flow, and radiation) and safety valves are included for overpressure protection.



# RENEWABLE ENERGIES

The operator panel integrates the electrical power, control, monitoring, and data acquisition functions of the trainer in a single user interface. It typically includes the main power switch, protection devices, pump and simulator controls, and the computer interface required for real-time supervision of the process variables.

Through the panel, the user can start and stop the system, regulate the operating conditions of the circulation loop, and monitor the values measured by the installed sensors, such as temperature, flow rate, and solar irradiation.

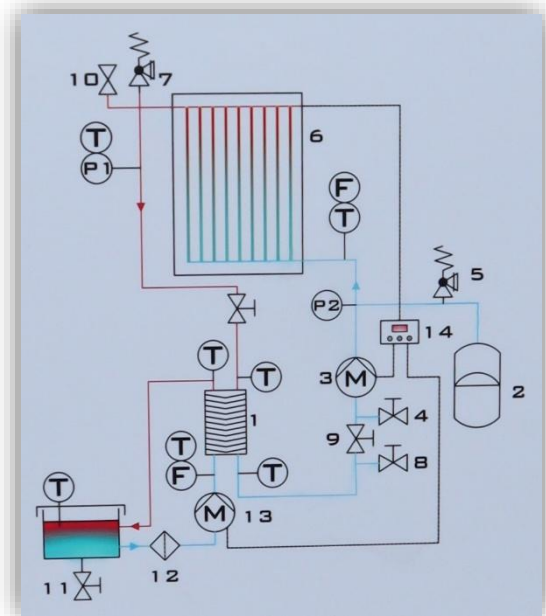
The panel is designed to provide safe, intuitive, and efficient operation of the trainer while supporting experimental analysis, parameter adjustment, and closed-loop control studies.



## TRAINER'S COMPONENTS

The main components in the trainer are the following, which are also identified in the diagram:

1. Heat exchanger
  2. Expansion tank
  3. Hot power pump
  4. Filling valve
  5. Pressure relief valve
  6. Flat collector
  7. Pressure relief valve
  8. Drain valve
  9. Filling valve regulating switch
  10. Bleed valve
  11. Drain valve
  12. Filter
  13. Cold water pump
  14. Solar heating controller
- F: Flow sensor  
T: Temperature sensor  
P1/P2: Pressure sensor





## TRAINING PROGRAM

With this trainer, the students can perform the following practices:

- Understanding the current utilization theory of solar thermal energy and its design.
- Understanding the installation and use requirements of computer-controlled solar thermal units and their components.
- Understanding the functions of solar collectors and heating circuits.
- Understanding the functions and uses of the solar simulator.
- Understanding the functions and uses of plate heat exchangers.
- Understanding the functions and uses of computer-controlled solar thermal units.
- Understanding the functions, control logic principles and data processing of the heat source circulation pump (Pump 1).
- Understanding the functions, control logic principles and data processing of the thermal energy water storage circulation pump (Pump 2).

## WORKING CONDITIONS & TECHNICAL FEATURES

- Ambient temperature: 5°C to +40°C.
- Relative humidity: < 85% (25°C).
- Power supply: single-phase from the mains, 50/60 Hz.
- Dimensions (approx.):
  - ◆ Solar simulator: 2500mm x 800mm x 870mm.
  - ◆ Main system: 2500mm x 930mm x 1770mm.
- Weights (approx.):
  - ◆ Solar simulator: 143 kg.
  - ◆ Main system: 330 kg.

Supplied with software and detailed user manual.