



## Free and Forced Convection Apparatus (SMT-HT-18)

This ESOLS Apparatus consists of a vertical duct that holds the chosen heat transfer surface and all instruments needed, which includes three different common heat transfer surfaces with the equipment: A flat plate, A pinned surface – similar to a tubular heat exchanger and A finned surface – similar to the fins on air-cooled engines or electrical heat sinks

Each surface has its own built-in variable-power electric heater. Students choose which surface they need to test and fit it to the duct using simple fixings. For free convection tests, the heated air rises from the surface and up the duct. For forced convection tests, a variable-speed fan draws air up through the duct and across the surface. Thermocouples measure the air temperature upstream and downstream of the surface and the temperature at the heat transfer surface. The downstream probe moves in a traverse mechanism to measure the temperature distribution across the duct, allowing calculation of the bulk outlet temperature.

The unit has Touch LCD display for visualization of process and the measurements. The Unit is also connected to Software for computer connectivity and data analysis. The Touch screen and computer software is included in the package.



## TECHNICAL SPECIFICATIONS

### Specifications:

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- Touch LCD with GUI Interface for better monitoring and accurate measurement of Plant variables.
- Includes three of the most common heat transfer surfaces: flat plate, pinned and finned
- Continuously adjustable heating power and fan power.
- Thermocouples and a sensitive anemometer measure temperatures and air velocity – shown on a LCD display
- Table Top stand-alone Unit.
- ESOLS DAQ Software for monitoring and control.

### Technical Data:

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- Air duct:
  - Flow cross-section: 120x120mm.
  - Height: approx. 1000mm.
- Heating elements, temperature limitation: 90°C.
- Pinned Heat Exchanger:
  - Number of tubes: 20.
  - Heating power: 40W.
- Finned Heat Exchanger:
  - Heating power: 40W.
  - Fins: 8
- Flat Surface Heat Exchanger:
  - Heating power: 40W.
  - Size: 100\*100mm Approx.
- Measuring ranges:
  - Air velocity: 0 to 10m/s.
  - Temperature: 4x 0 to 325°C.
  - Heating power: 0 to 50W.
- 230V, 50Hz, 1 phase  
230V, 60Hz, 1 phase; 230V, 60Hz, 3 phases
- Touch LCD with GUI Interface for better monitoring and accurate measurement of Plant variables.
- ESOLS DAQ Software for monitoring and control.
  - Graphical visualization.
  - Security mechanism for login.
  - USB Connected
  - Compatible with Windows 7,8.1,10.
- Digital Instrumentation
- Capability to modify according to end user.
- Can be used in Research Purposes.

## Experiments:

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- Comparing free and forced convection for Pinned Surface.
- Comparing free and forced convection for Finned Surface.
- Comparing free and forced convection for Flat Surface.
- Comparison of free convection from vertical and horizontal (finned) surfaces
- Comparison of heat transfer surface efficiency
- Comparing the coefficient of heat transfer and Nusselt Number for forced and free convection
- Temperature distribution along finned and pinned surfaces