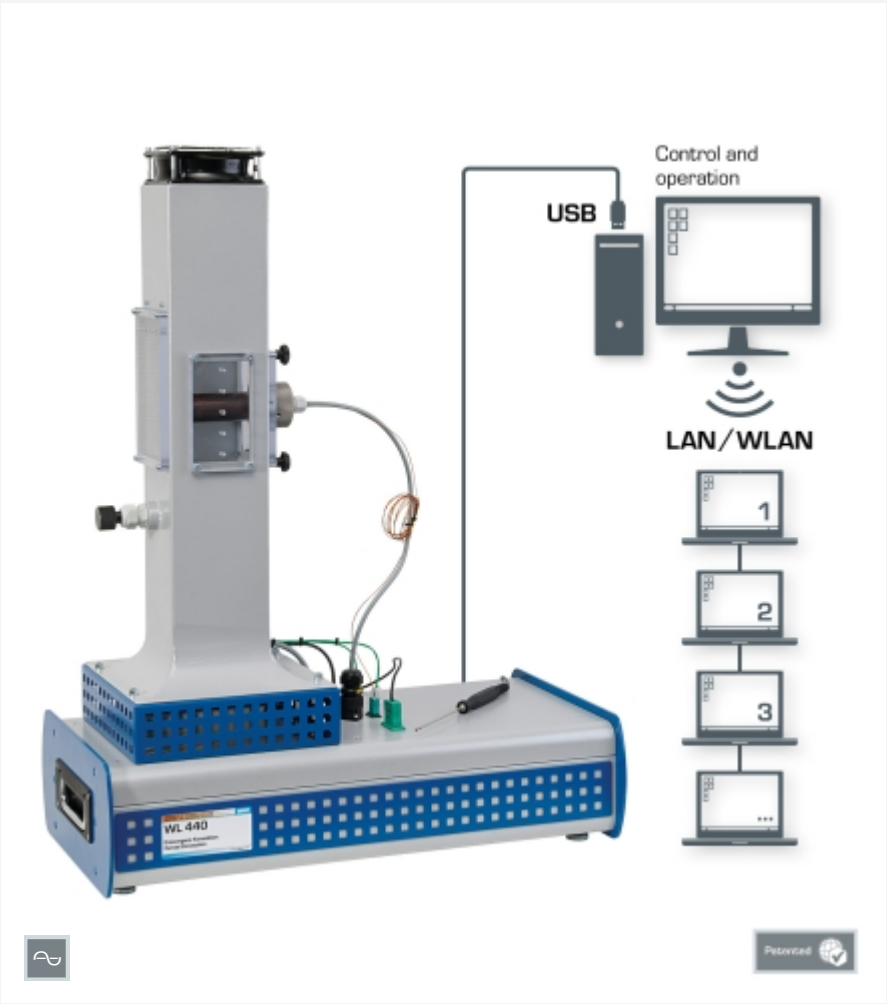
WL 440
Free and forced convection



Complete experimental setup with one PC for control and operation and any number of workstations with GUNT software for observation and evaluation of the experiments.

Learning objectives/experiments

- free and forced convection
- calculation of convective heat transfer at different geometries
  - flat plate
  - cylinder
  - tube bundle
- experimental determination of the Nusselt number
- calculation of typical characteristic variables of heat transfer
  - Nusselt number
  - Reynolds number
- investigation of the relationship between flow formation and heat transfer during experiments
- description of transient heating process

- GUNT E-Learning
  - multi-media online course, which enables learning independent of time and place
  - access via Internet browser
  - educational software including different learning modules
  - course in the fundamentals
  - detailed thematic courses
  - check through targeted review of the learning objectives
  - authoring system with editor that enables you to integrate your own, local content into the educational software

Description

- **free and forced convection using the example of various heating elements**
- **network capability: network access to ongoing experiments by any number of external workstations**
- **GUNT software: operation and control of the experimental unit, data acquisition and educational software**
- **E-Learning: multi-media didactic materials accessible online**

Convection is one of the three basic forms of heat transfer. Material-bound heat transport takes place. During convection the fluid is in motion.

The WL 440 offers basic experiments for targeted teaching on the topic of free and forced convection on various heating elements. At the heart of the experimental unit is a vertical air duct into which various heating elements are inserted.

An axial fan is located on top of the air duct. The fan draws in ambient air and guides it through the air duct. The air flows past a heating element and absorbs heat. Four heating elements with different geometries are available to be selected. In order to investigate free convection, two of the four heating elements can be operated outside of the air duct. The heating elements are designed in such a way to release heat only at their surface. The compact design ensures rapid heating and a short time for experiments.

The experimental unit is equipped with temperature sensors at the inlet and outlet of the air duct. The air velocity is measured to determine the air flow rate. Heating power and flow rate are adjusted and displayed via the software.

The microprocessor-based instrumentation is well protected in the housing. The GUNT software consists of a software for system operation and for data acquisition and an educational software. With explanatory texts and illustrations the educational software significantly aids the understanding of the theoretical principles. The operation and control of the experimental unit is carried out via a PC (not included in the scope of delivery) connected via a USB interface. Any number of workstations with the GUNT software can be used for observation and evaluation of the experiments via LAN/WLAN connection using only one licence.

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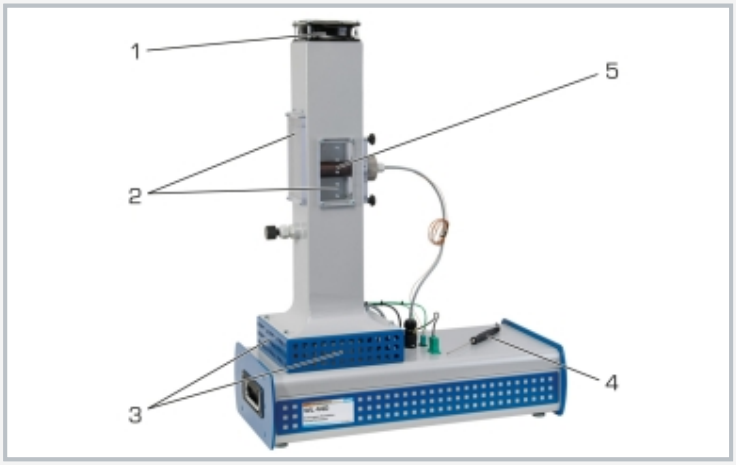
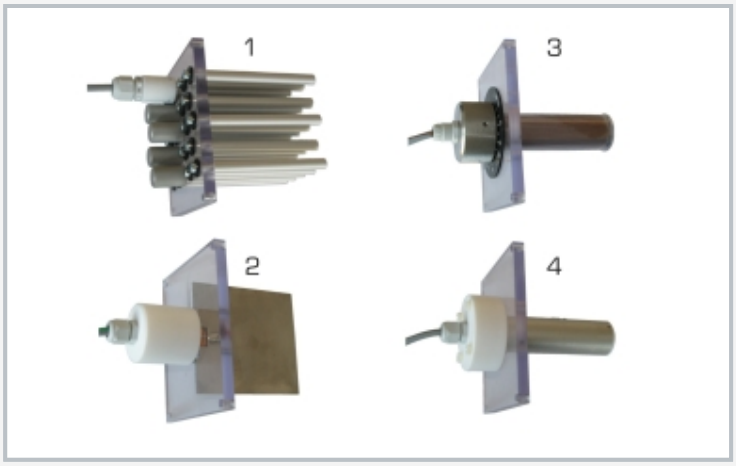
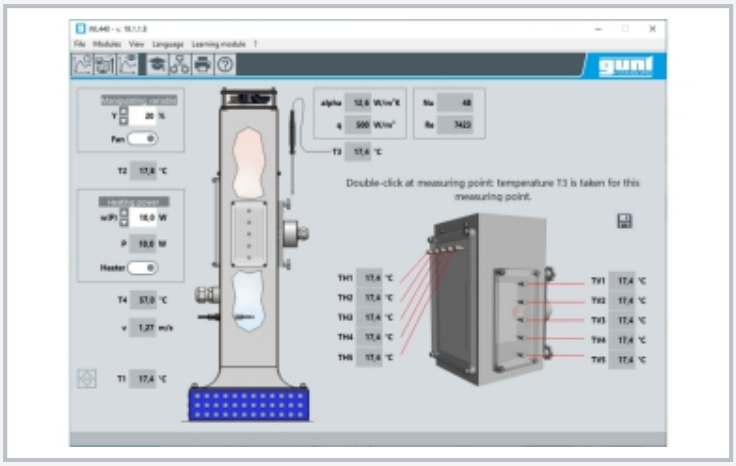


1 fan, 2 sight window, 3 air inlet, 4 hand-held meter for temperature, 5 heating element



Various interchangeable heating elements: 1 tube bundle, 2 plane plate, 3 cylinder with heating foil to examine the local heat transfer, 4 cylinder with an even temperature at the surface



User interface of the powerful GUNT software, experiment with a plane plate

Specification

[1] part of the GUNT-Thermoline: Fundamentals of heat transfer
[2] investigate heat transfer in the air duct by forced convection
[3] study of free convection
[4] air duct with axial fan
[5] 4 heating elements with different geometries
[6] continuously adjustable heating and fan power
[7] display of temperatures, heating power and air velocity in the software
[8] due to integrated microprocessor-based instrumentation no additional devices with error-prone wiring are required
[9] functions of the GUNT software: system operation, data acquisition, educational software
[10] network capability: LAN/WLAN connection of any number of external workstations with GUNT software for observation and evaluation of the experiments
[11] E-Learning: online multi-media didactic materials
[12] GUNT software for data acquisition via USB under Windows 10

Technical data

Air duct
- flow cross-section: 120x120mm
- height: approx. 0,6m

Heating elements, temperature limitation: 90°C
- tube bundle
  - number of tubes: 23
  - one tube in variable position is heated
  - heating power: 20W
  - heat transfer area: 31,41cm^2
- cylinder with an even temperature at the surface
  - heating power: 20W
  - heat transfer area: 111cm^2
- plate
  - heating power: 40W
  - heat transfer area: 2x 100cm^2
- cylinder with heating foil to investigate the local heat transfer
  - heating power: 40W
  - heat transfer area: 111cm^2

Axial fan
- max. flow rate: 500m^3/h
- max. pressure difference: approx. 950Pa
- power consumption: 90W

Measuring ranges
- air velocity: 0...10m/s
- temperature: 4x 0...325°C
- heating power: 0...50W

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 670x350x880mm; Weight: approx. 25kg

Required for operation

PC with Windows

Scope of delivery

experimental unit; 1 GUNT software + USB cable; 1 set of instructional material