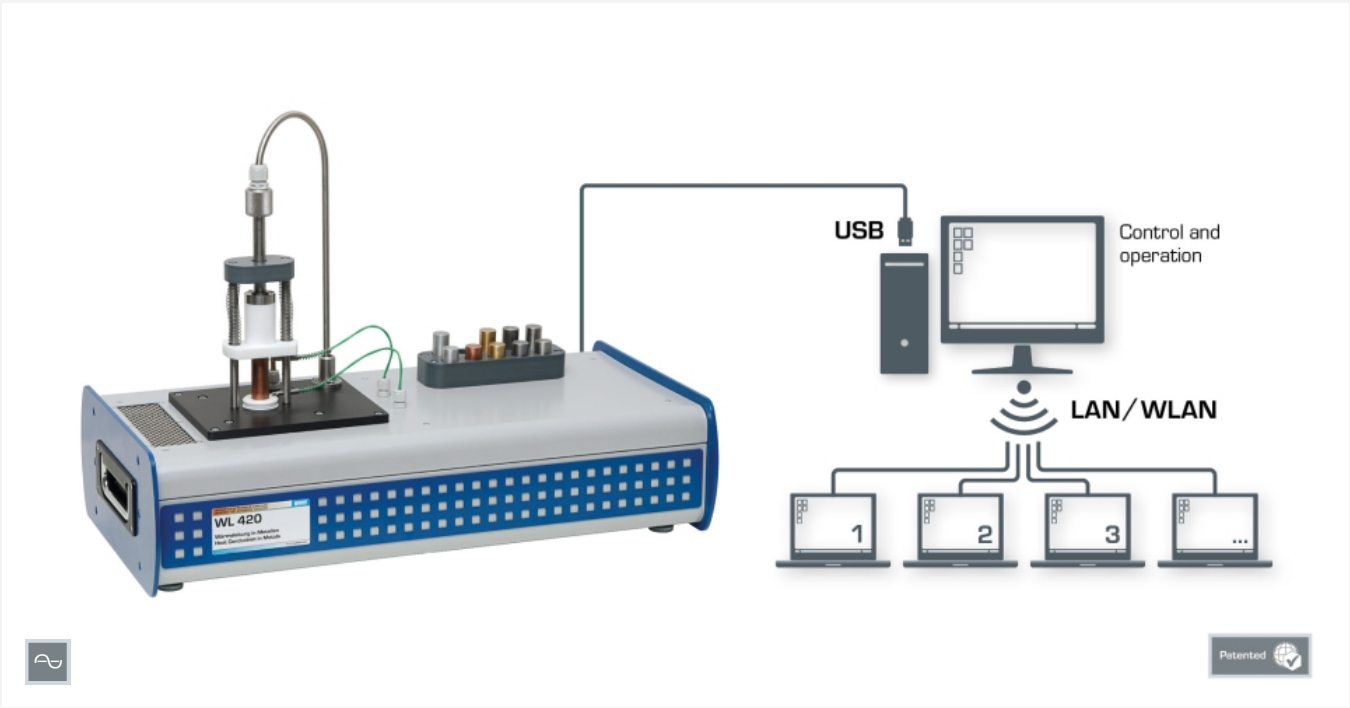
WL 420

Heat conduction in metals



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.

Description

- **effect of different metals on heat conduction**
- **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**

Heat conduction is one of the three basic forms of heat transfer. According to the second law of thermodynamics, heat is always transferred from the higher energy level to the low energy level. If the temperature of a body does not change despite continuous addition or removal of heat, this is known as steady-state heat conduction.

WL 420 offers basic experiments for targeted teaching on the topic of heat conduction through various metals. To this end, one of eleven specimens is used. The upper region of the specimen is heated by an electrical heater and the lower section cooled by a Peltier element. Heat conduction occurs through the respective specimen from top to bottom. Two specimens can be inserted into the experimental unit at the same time, in order to investigate thermal conductivity through multi-layered metals. Perfectly matched components ensure rapid heating and trouble-free measurements.

The temperature of the metal specimens is taken on the top and bottom by means of thermocouples. 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.

Learning objectives/experiments

- time dependency until the steady state is reached
- calculate the thermal conductivity λ of different metals
- calculate the thermal resistance of the specimen
- heat transfer with different specimens connected in series
- effect of specimen length on heat transfer
- 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

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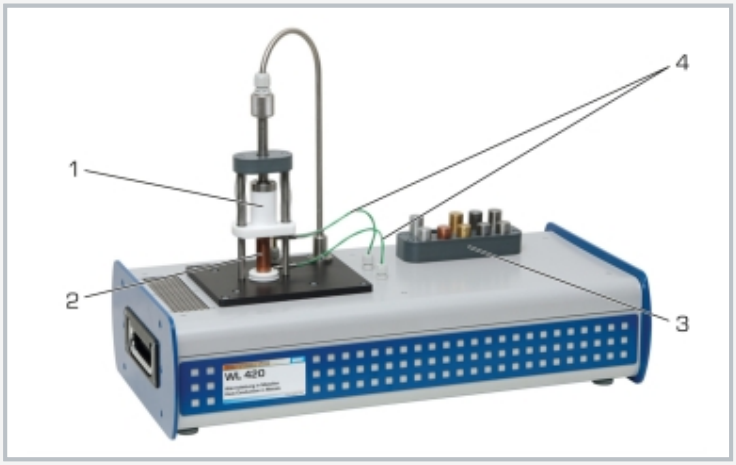
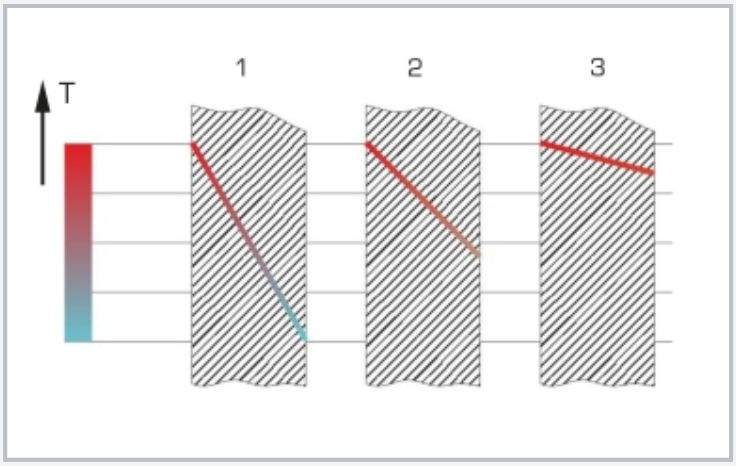
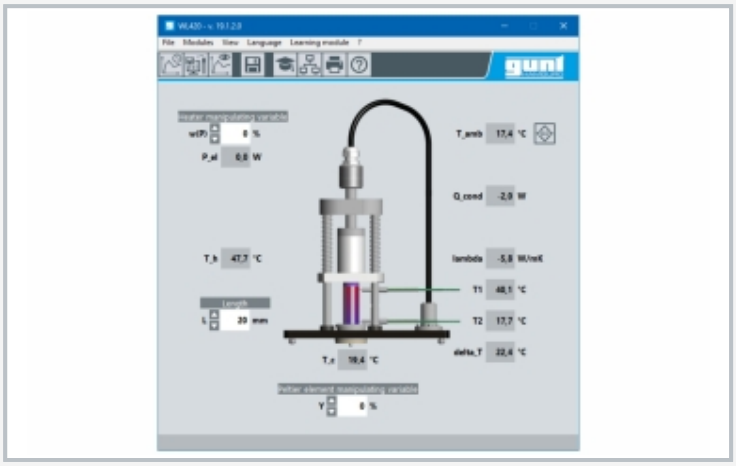


1 heater, 2 specimen, 3 storage for specimens, 4 thermocouple; Peltier element concealed



Heat conduction through different metals: 1 temperature profile in metal with low thermal conductivity, 2 temperature profile in metal with medium thermal conductivity, 3 temperature profile in metal with high thermal conductivity; T temperature; red: hot, blue: cold



User interface of the powerful GUNT software

Specification

[1] part of the GUNT-Thermoline: Fundamentals of heat transfer
[2] investigation of the thermal conductivity of different metals
[3] continuously adjustable heater
[4] Peltier element as cooler
[5] 11 specimens made of 5 metals, different lengths
[6] display of temperatures and power consumption in the software
[7] due to integrated microprocessor-based instrumentation no additional devices with error-prone wiring are required
[8] functions of the GUNT software: system operation, data acquisition, educational software
[9] network capability: LAN/WLAN connection of any number of external workstations with GUNT software for observation and evaluation of the experiments
[10] E-Learning: multi-media didactic materials accessible online
[11] GUNT software for data acquisition via USB under Windows 11

Technical data

Peltier element
- cooling capacity 56,6W

Heater
- heating power 30W
- temperature limitation: 150°C

Specimens: Ø 20mm
Length between measuring points
- 5x 20mm (copper, steel, stainless steel, brass, aluminium)
- 5x 40mm (copper, steel, stainless steel, brass, aluminium)
- 1x 40mm with turned groove (aluminium)

Measuring ranges
- temperature: 5x -25...325°C
- heating power: 0...50W

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 670x350x480mm
Weight: approx. 18kg

Required for operation

PC with Windows

Scope of delivery

1 experimental unit
1 set of specimens
1 authoring system for GUNT educational software
1 GUNT software + USB cable
1 set of instructional material