WL 920
Temperature measurement

Learning objectives/experiments

- familiarisation with different temperature measurement methods:
  - non-electrical methods: liquid thermometer, bimetal thermometer
  - electrical methods: thermocouple type K, Pt100 resistance thermometer, NTC thermistor
- determination of air humidity with a psychrometer
- familiarisation with the function of the individual temperature measuring instruments
- response behaviour of the sensors
- steady and transient behaviour

Description

- **different temperature measurement methods**
- **investigation of transient temperature behaviour and defined temperature jumps**

Different physical processes are used to measure temperatures. Temperatures can be read off directly on a scale, e.g. by the expansion of a measuring medium. In industry, temperatures are often measured electronically. The advantage of electronic measurement is that further processing or transmission of electrical signals to remote locations (controllers, external displays) is easier.

The WL 920 trainer can be used to carry out and compare different temperature measurement procedures. Non-electrical methods are investigated with a liquid thermometer and a bimetallic thermometer. For electrical temperature measurement, a thermocouple type K, a Pt100 resistance thermometer and a thermistor NTC are supplied. A psychrometer with two liquid thermometers is used to measure relative humidity.

The temperature sensors to be examined are attached to a height-adjustable device above the experimental tank. A fan ensures almost constant ambient conditions. A second tank with electronically controlled heater supplies water temperatures up to approx. 80°C. The heated water at a specified temperature is fed into the experimental tank. By lowering the height-adjustable device, the temperature sensors are immersed in the water for measurements.

In order to vary the response, the temperature sensors of the thermocouple and the resistance thermometer can be inserted into thermowells made of copper or stainless steel.

The measured values of the liquid thermometer, bimetallic thermometer and psychrometer are read in analogue form. The measured values of the of the electric temperature sensors are displayed digitally and additionally transferred directly to a PC via USB. With the help of the GUNT software supplied, the temperatures are logged in a measurement record over time, thus documenting the different time behaviour. Defined temperature jumps and steady and transient temperature behaviour can be studied.

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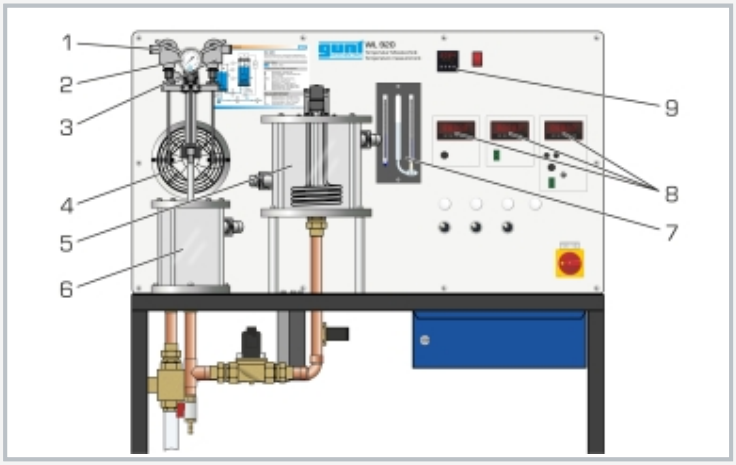
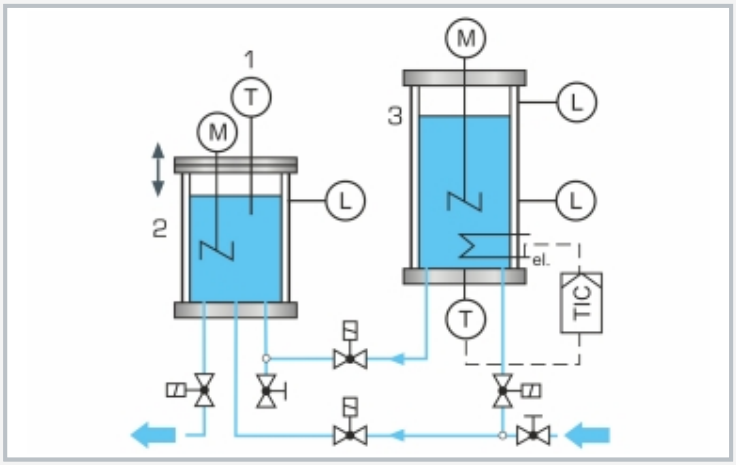
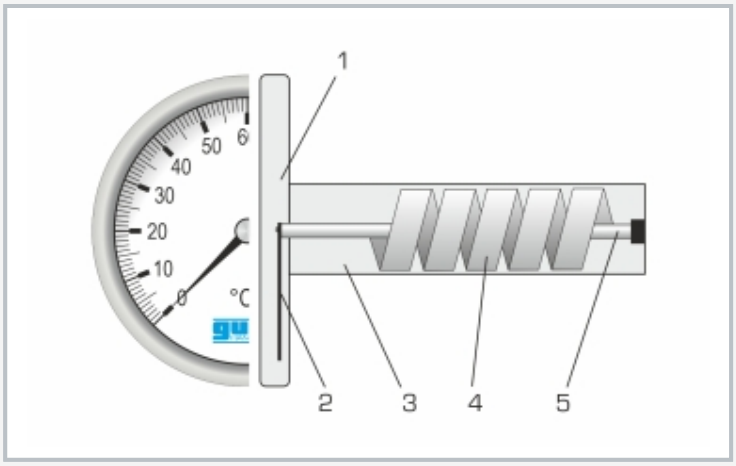


1 Pt100 resistance thermometer, 2 bimetal thermometers, 3 thermocouple type K, 4 fan, 5 heating tank, 6 experimental tank with height-adjustable device for the temperature measuring devices, 7 psychrometer, 8 displays, 9 temperature controller for heater



1 temperature sensor being studied, 2 experimental tank with stirring machine, 3 heating tank with heater and stirring machine; T temperature, L level, TC temperature controller, blue: water



Design of the bimetal thermometer
1 scale housing, 2 indicator, 3 protective tube, 4 bimetallic strips, 4 fixed clamped end

Specification

[1] steady and transient temperature measurement with typical measurement instruments
[2] non-electrical methods: liquid thermometer, bimetal thermometer
[3] electrical methods: thermocouple type K, Pt100 resistance thermometer, NTC thermistor
[4] with thermowells made of copper and stainless steel, the response of the thermocouple and the resistance thermometer can be varied
[5] psychrometer for determining the relative air humidity
[6] defined temperature jumps up to 80°C
[7] heating tank with temperature control
[8] both tanks equipped with stirring machine
[9] fan generates constant air temperature above the experimental tank
[10] GUNT software via USB under Windows 11

Technical data

Heating tank
- heater, output: 2kW at 230V, 1,5kW at 120V
- capacity: 4L
- temperature controller: PID

Temperature sensors
- liquid thermometer with organic liquid
- bimetal thermometer
- psychrometer
- thermocouple type K
- NTC thermistor
- Pt100 resistance thermometer

Thermowells
- 2x copper: inner-Ø 6,2mm, 7mm
- 2x stainless steel: inner-Ø 6,2mm, 7mm

Measuring ranges
- temperature: liquid thermometer: 0...100°C
- temperature: bimetal thermometer: 0...120°C
- temperature: resistance therm. Pt100: 0...100°C
- temperature: thermocouple type K: 0...100°C
- temperature: thermistor NTC: -20...70°C
- temperature: psychrometer: 2x -10...160°C
- rel. humidity: 3...96%

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
LxWxH: 1200x700x1500mm
Weight: approx. 185kg

Required for operation

water connection, drain
PC with Windows recommended

Scope of delivery

1 trainer
1 set of accessories, GUNT software + USB cable
1 set of instructional material