

WL 920

Temperature measurement



Learning objectives/experiments

- familiarisation with different temperature measurement methods:
 - ▶ non-electrical methods: liquid thermometers, bimetal thermometers
 - ▶ electronic methods: thermocouple, 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

- comparison of 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 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.

The trainer includes liquid thermometers, bimetal thermometers, as well as a thermocouple, a Pt100 resistance thermometer and an NTC thermistor, each with different protective sleeves, for electronic temperature measurement. A psychrometer with two liquid thermometers is used to measure the relative air humidity.

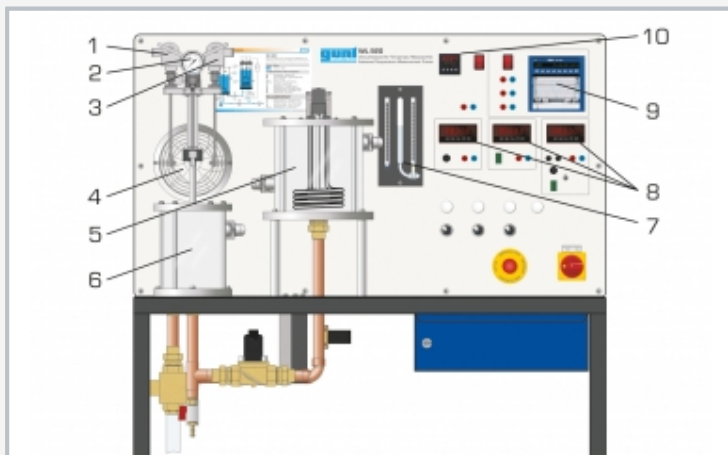
To compare the different measuring methods, the temperature sensors being studied are attached to a height-adjustable device above the experimental tank. A fan ensures almost constant ambient conditions. A second tank with electronically controlled heater supplies water temperatures up to approx. 80°C.

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 and the temperature measurement begins.

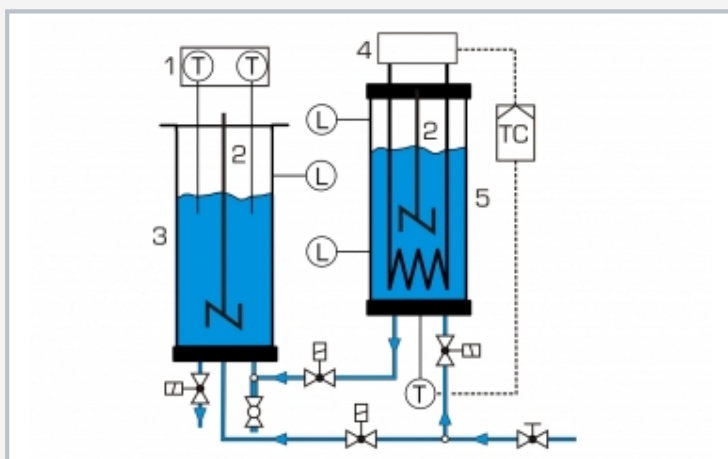
The measured values can be read as analogue or digital values. A 3-channel line recorder can record the measured values of the electronic temperature sensors continuously over time and thus also document the different time response. Defined temperature jumps and steady and transient temperature behaviour can be studied.

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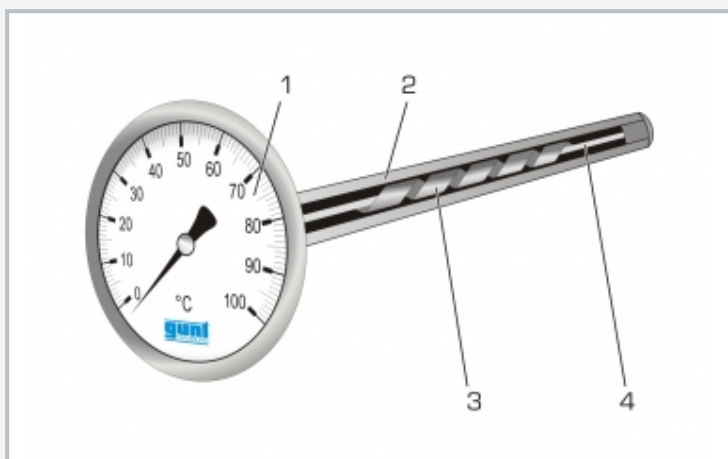
Temperature measurement



1 Pt100 resistance thermometer, 2 bimetal thermometers, 3 thermocouple, 4 fan, 5 heating tank, 6 experimental tank, 7 psychrometer, 8 digital displays, 9 3-channel line recorder



1 temperature sensor being studied, 2 stirring machine, 3 experimental tank, 4 heater, 5 heating tank; T temperature, L level, TC temperature controller, blue: water



Design of the bimetal thermometer

1 scale housing, 2 protective tube, 3 bimetallic strips, 4 fixed bearing

Specification

- [1] steady and transient temperature measurement with typical measurement instruments
- [2] temperature sensors: liquid thermometer, bimetal thermometer, Pt100, thermistor (NTC), type K thermocouple
- [3] psychrometer for determining the relative air humidity
- [4] defined temperature jumps up to 80°C
- [5] experimental tank and heating tank with temperature control, water-filled
- [6] both tanks equipped with stirring machine
- [7] fan generates constant air temperature above the experimental tank
- [8] 3-channel line recorder for recording the measured values

Technical data

Heater

- output: 2kW at 230V, 1,5kW at 120V
- tank capacity: 4L

Temperature controller

- PID

Line recorder

- 3 channels
- serial interface

Temperature sensors

- liquid thermometer with organic liquid
- bimetal thermometer
- psychrometer
- thermocouple type K
- thermistor (NTC)
- Pt100

Measuring ranges

- temperature: 0...100°C
- rel. humidity: 3...96%

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

LxWxH: 1200x700x1550mm

Weight: approx. 185kg

Required for operation

water connection, drain

Scope of delivery

- 1 trainer
- 1 set of accessories
- 1 set of instructional material