

# WL 102

## Change of state of gases



### Description

- isothermal and isochoric change of state of air
- GUNT software for acquisition, processing and display of measured data

Gas laws belong to the fundamentals of thermodynamics and are dealt with in every training course on thermodynamics.

The WL 102 experimental unit enables two changes of state to be studied experimentally: isothermal change of state, also known as the Boyle-Mariotte law, and isochoric change of state, which occurs at constant volume. Transparent tanks enable the change of state to be observed. Air is used as the test gas.

In the first tank, positioned on the left, the hermetically enclosed air volume is reduced or increased using a compressor and hydraulic oil. This results in an isothermal change of state. The compressor can also operate as a vacuum pump. If the changes occur slowly, the change of state takes place at an almost constant temperature.

In the second tank, positioned on the right, the temperature of the test gas is increased by a controlled electric heater and the resulting pressure rise is measured. The volume of the enclosed gas remains constant.

Temperatures, pressures and volume are measured electronically, digitally displayed and transferred to a PC for processing.

### Learning objectives/experiments

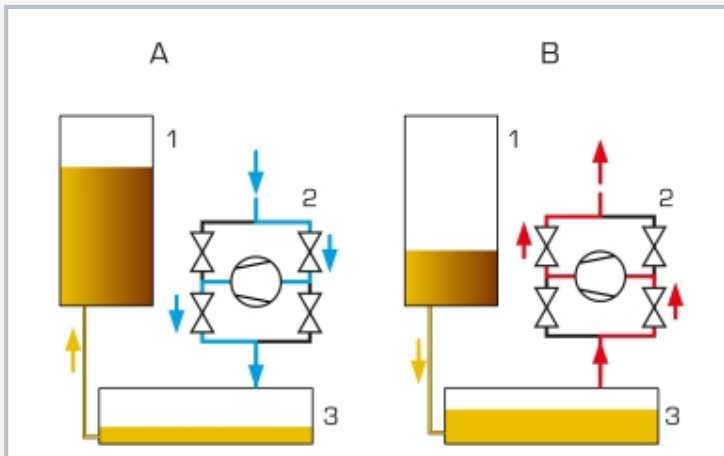
- demonstrating the laws of state changes in gases experimentally
- isothermal change of state, Boyle-Mariotte law
- isochoric change of state, Gay-Lussac's 2<sup>nd</sup> law

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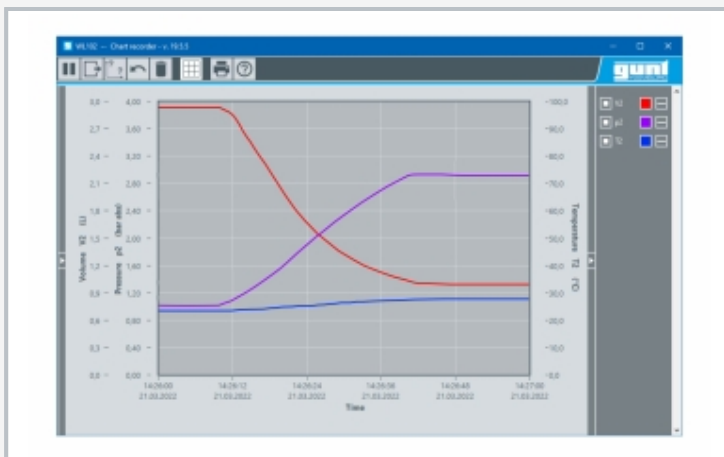
## Change of state of gases



1 tank 1 for isothermic change of state, 2 digital displays, 3 switching between compression and expansion with 5/2-way valve, 4 heating controller, 5 tank 2 for isochoric change of state



Representation of the change of volume  
1 oil-filled tank for isothermic change of state, 2 valve arrangement with compressor, 3 storage tank; A compression (blue), B expansion (red)



Software screenshot: charts for isothermic compression

### Specification

- [1] experimental investigation of gas laws
- [2] transparent measuring tank 1 for investigation of isothermic change of state
- [3] hydraulic oil filling for changing volume of test gas
- [4] test gas volume determined by level measurement in the tank with differential pressure sensor
- [5] built-in compressor generates necessary pressure differences to move the oil volume
- [6] compressor can also be used as vacuum pump
- [7] 5/2-way valve for switching between compression and expansion
- [8] transparent measuring tank 2 for investigation of isochoric change of state
- [9] electrical heater with temperature control in tank 2
- [10] sensors for temperatures, pressures in both tank
- [11] digital displays for temperatures, pressures and volume
- [12] GUNT software for data acquisition via USB under Windows 10

### Technical data

Compressor / vacuum pump

- power output: 60W
- pressure at inlet: 213mbar
- pressure at outlet: 2bar

Temperature controller: PID, 300W, limited to 70°C

Measuring ranges

- temperature:
  - ▶ tank 1: 0...70°C
  - ▶ tank 2: 0...70°C
- pressure:
  - ▶ tank 1: 0...4bar abs.
  - ▶ tank 2: 0...2bar abs.
- volume:
  - ▶ tank 1: 0...3L

230V, 50Hz, 1 phase

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

UL/CSA optional

LxWxH: 900x550x900mm

Weight: approx. 50kg

### Required for operation

PC with Windows recommended

### Scope of delivery

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

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Optional accessories

for Remote Learning

010.10000      GU 100              Web Access Box

with

060.10200W      WL 102W              Web Access Software

Other experiments

020.30009      WP 300.09              Laboratory trolley