RT 040
Training system: temperature control, HSI

Description

- **experimental unit with temperature control system**
- **extensive range of experiments on fundamentals of control engineering**
- **heating and cooling with Peltier element**
- **state-of-the-art software for all experimental units of the RT 010 – RT 060 series, with extensive controller and recorder functions**
- **software-based simulation of the controlled system**

This compact experimental unit offers every opportunity to learn the fundamentals of control engineering through experimentation on a temperature control system.

The experimental setup is mounted on a housing which accommodates all the electronics. A metal bar, which is thermally insulated with cladding, is heated or cooled at one end by a Peltier element. Three temperature transducers along the axis of the bar allow the variation in temperature along the

length of the bar, and hence the associated thermal lags, to be obtained for differing operating conditions. A dial-gauge thermometer offers the advantage that the temperature can be read off directly at any time. The temperature is measured using a thermal resistor (PTC). The sensor output signal is sent to the software controller. The output signal from the controller influences the operating voltage of the Peltier element and hence the heating capacity. A fan that dissipates part of the heating power can be activated by the software to investigate the influence of disturbance variables.

The powerful state-of-the-art software is an integral part of the training system, embodying the principle of hardware/software integration (HSI). It enables the experiments to be conducted and evaluated in a user-friendly manner. The software has network capability. The link between the experimental unit and the PC is made via a USB port.

Learning objectives/experiments

- open loop control response
- effects of different controller parameters and methods on the response of the closed loop system
- recording of step responses
  - ▶ reference variable
  - ▶ disturbance variable
- controller optimisation
- software-based controlled system simulation
  - ▶ comparison of different controlled system parameters
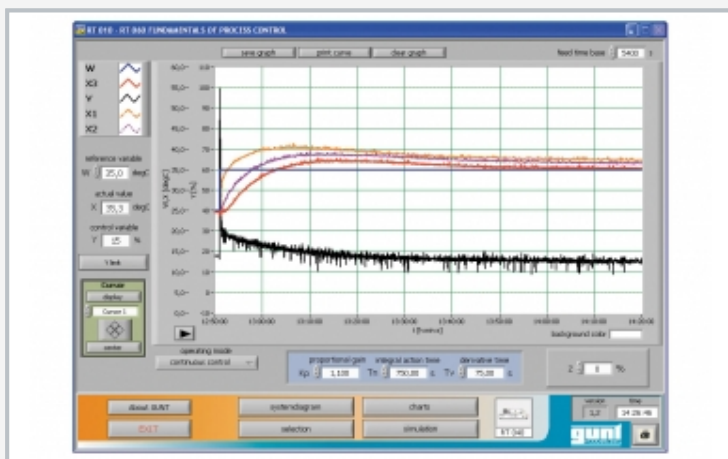
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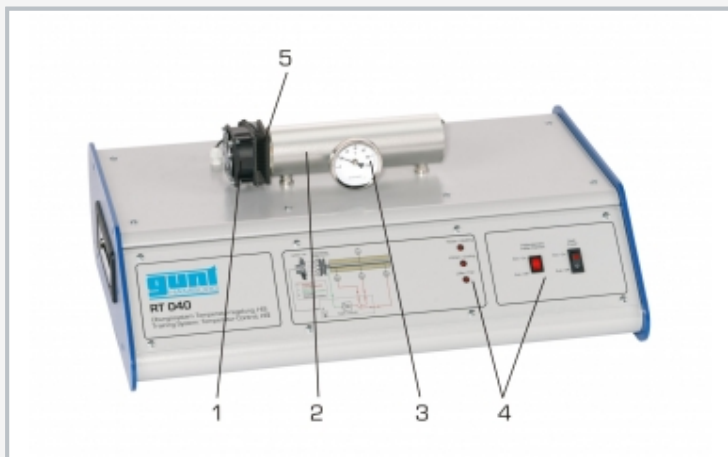
1 fan, 2 bar in cladding tube, 3 thermometer, 4 displays and controls, 5 heater/cooler
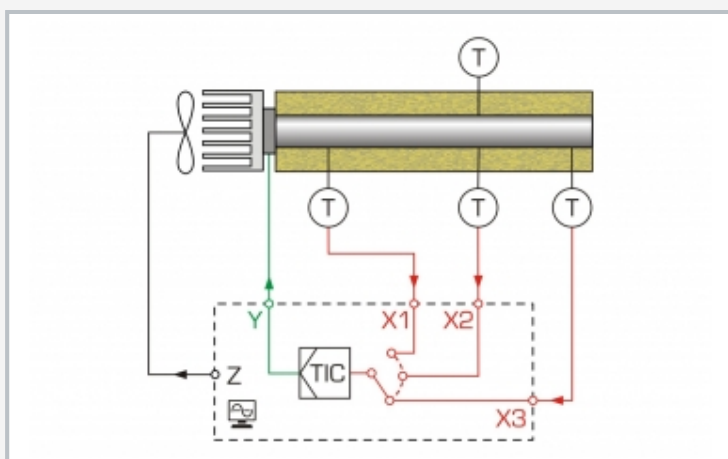
Process schematic

Software screenshot: step response to reference variable with PID controller with non-optimised values for K_p, T_n and T_v

Specification

[1] experimental unit for control engineering experiments
[2] temperature control of a heated metal bar
[3] heating and cooling by Peltier element
[4] temperature sensors at 3 different points along axis of bar to establish thermal lags
[5] software activated fan to generate disturbance variables
[6] software-based controlled system simulation
[7] process schematic on front panel
[8] networkable GUNT software
[9] GUNT software with control functions and data acquisition via USB under Windows 7, 8.1, 10

Technical data

Heated bar: DxL: 20x200mm, aluminium
Peltier element
■ power consumption depending on temperature
  ▶ power at 300K: 38,2W
  ▶ power at 50°C: 44,3W
■ operated by DC voltage
Fan
■ power consumption: 2W
■ max. flow rate: 40m³/h
Temperature sensor: 0...100°C
Thermometer: 0...100°C
Temperature control range: 0...100°C
Software controller configurable as P, PI, PID and switching controller
Software
■ process schematic with controller type selection (manual, continuous controller, two- or three-point controller, programmer)
■ time functions
■ simulation function
■ disturbance variable input

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 600x450x260mm
Weight: approx. 16kg

Scope of delivery

1 experimental unit
1 GUNT software CD + USB cable
1 handbook: Fundamentals of control engineering (RT 010 – RT 060)
1 manual for RT 040

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Optional accessories

020.30009   WP 300.09   Laboratory trolley

We reserve the right to modify our products without any notifications.