

RT 542

Temperature control trainer



Learning objectives/experiments

- fundamentals of control engineering
- real industrial control engineering components: controllers, transducers, actuators
- operation, configuration and parameterisation of the local industrial controller
 - ▶ manually (by keyboard / controller software RT 450.14)
 - ▶ using the RT 650.50 process control software
- control response to
 - ▶ switching control (2-point / 3-point controller)
 - ▶ continuous control
 - ▶ dead times
- investigation of disturbance and control response
- controller optimisation
- investigation of the properties of the open and closed control loops
- processing of process variables using external equipment, e.g. oscilloscope or plotter
- together with accessory RT 650.50 and other trainers (RT 512 – RT 532, RT 552): familiarisation with and use of process control software (SCADA)

Description

- experimental introduction to control engineering using an example of temperature control
- construction of the system with components commonly used in industry
- digital controller with freely selectable parameters: P, I, D and all combinations
- controllers configurable: Continuous controller, 2-point or 3-point controller
- integrated 2-channel line recorder
- optional process control software RT 650.50 available
- a complete networked system can be constructed with Profibus interface

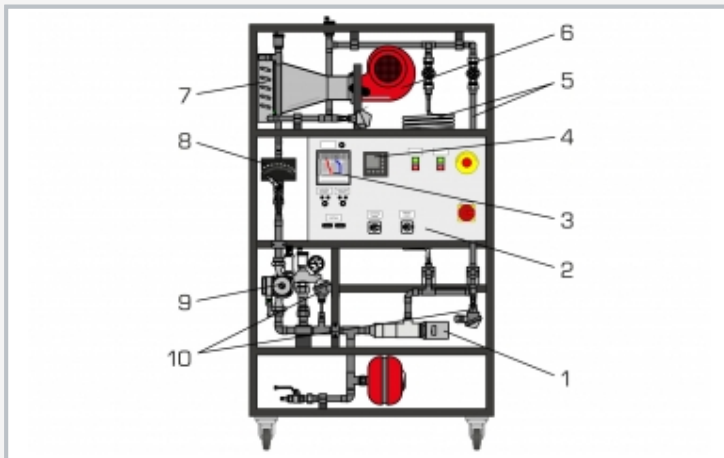
This trainer provides a comprehensive experimental introduction to the fundamentals of control engineering using an example of temperature control.

A circulating pump delivers water within a closed circuit. The flow rate of water can be adjusted by a hand-operated valve. The loop also contains a screw-in heater, a heat exchanger with fan, and three integrated thermocouples for temperature measurement. Dead times can be represented by the use of different lengths of process delay. A thyristor power controller is used as the actuator. The controller used is a state-of-the-art digital industrial controller. It can be configured as a continuous or a switching device, and can activate the heater via the actuator and / or the fan. The controlled variable X and the manipulating variable Y are plotted directly on an integrated 2-channel line recorder. Alternatively, the variables can be tapped as analogue signals at lab jacks on the switch cabinet. This enables external recording equipment, such as an oscilloscope or a flatbed plotter, to be connected.

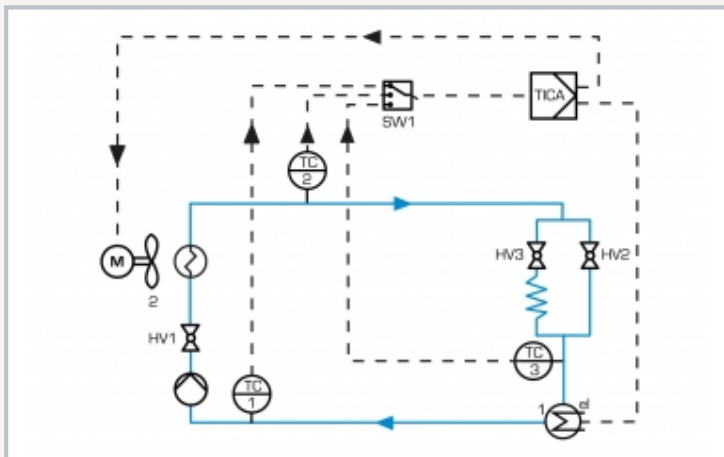
A process control software (RT 650.50) is optionally available. The software permits the construction of a complete networked system comprising multiple trainers from the RT 512 – RT 552 series. The key process variables can also be represented, and control functions executed.

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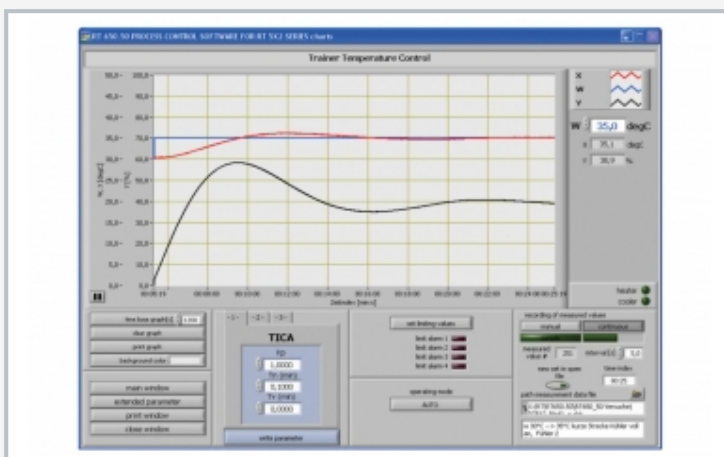
Temperature control trainer



1 screw-in heater, 2 switch cabinet, 3 line recorder, 4 controller, 5 process delays, 6 fan, 7 heat exchanger, 8 ball valve with scale, 9 pump, 10 thermocouples



Process schematic: controller can activate heater power controller (continuous or switching) and/or fan (switching) according to mode



Screenshot of optional process control software RT 650.50: step response to change in reference variable, PI controller

Specification

- [1] trainer for control engineering experiments
- [2] temperature control process, equipped with standard industrial components
- [3] water circuit with pump, heater and 2 different lengths of process delay
- [4] screw-in heater with dry-running protection and temperature limiter
- [5] air/water heat exchanger with fan
- [6] temperature measurement with thermocouples at multiple points
- [7] generation of disturbance variables by ball valve with scale in water circuit
- [8] thyristor power controller as actuator
- [9] digital controller, configurable as switching or continuous controller
- [10] 2-channel line recorder
- [11] process variables X and Y accessible as analogue signals via lab jacks

Technical data

Pump, 3-stage

- max. power consumption: 70W
- max. flow rate: 3,6m³/h
- max. head: 4m

Screw-in heater: 2kW

Heat exchanger: approx. surface area 2,8m²

Fan

- power output: 250W
- max. flow rate: 780m³/h
- max. differential pressure: 430Pa
- speed: 2880min⁻¹

Thermocouple: type J: 0...200°C

Thyristor power controller max. load current: 25A

Line recorder

- 1x 4...20mA, 1x 0...20mA
- feed rate 0...7200mm/h, stepped

Controller

- process variables X, Y as analogue signals: 4...20mA

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase

230V, 60Hz, 3 phases

UL/CSA optional

LxWxH: 1000x700x1750mm

Weight: approx. 120kg

Scope of delivery

- 1 trainer
- 1 set of cables
- 1 hose
- 1 set of instructional material

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Optional accessories

080.45014	RT 450.14	Software for Controller Configuration
080.65050	RT 650.50	Process Control Software for RT 512 - RT 552 Series