

RT 644

Temperature control demonstration unit



Learning objectives/experiments

- fundamentals of control engineering
- latest industrial control engineering components: controllers, transducers, actuators
- operation and parameter setting of a multifunctional state-of-the-art digital controller: e.g. parameter setting as P, PI and PID controller
- investigation of disturbance and control response
- influence of different controller parameters on stability and control quality
- investigation of the properties of the open and closed control loops
- processing of process variables using external equipment, e.g. plotter or oscilloscope
- together with accessory RT 650.40: familiarisation with and use of I&C software

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
- optional I&C software RT 650.40 via USB

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

All components are clearly laid out on a vertical front panel. The large-format process schematic provides an aid to understanding.

The system comprises two water circuits. In the secondary circuit fresh water is heated up by a heat exchanger. The temperature at the fresh water outlet is recorded as the controlled variable by a temperature sensor. The outlet temperature of the fresh water is controlled by the flow rate of warm water in the primary circuit. The primary circuit comprises an electrically heated tank, a pump and an electromagnetic proportional valve as the actuator.

Both circuits include rotameters. The controller used is a state-of-the-art digital industrial controller. A ball valve in the secondary circuit enables defined disturbance variables to be generated. The controlled variable X and the manipulating variable Y can be tapped as analogue signals at lab jacks. This enables external recording equipment, such as a plotter or an oscilloscope, to be connected.

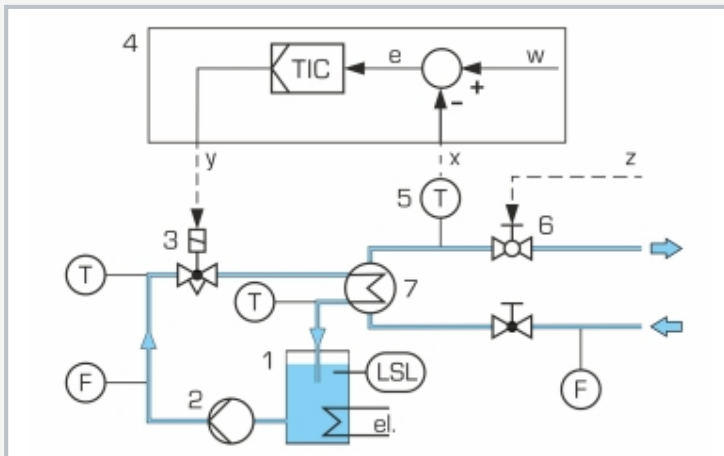
An instrumentation and control software (RT 650.40) with interface module (USB) is available as an accessory. This enables the key process variables to be represented, and control functions executed.

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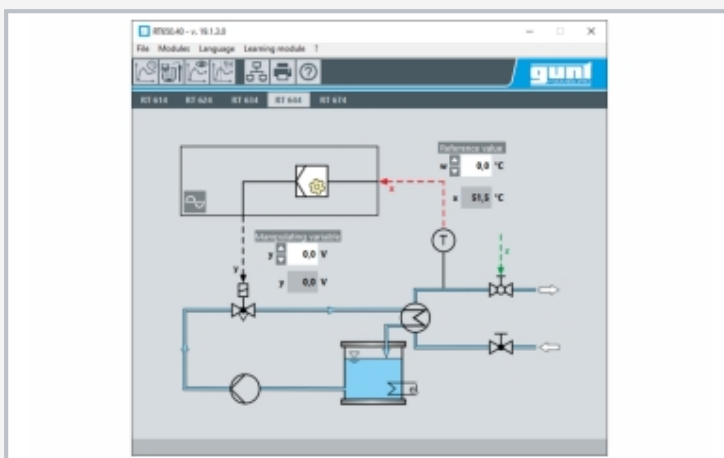
Temperature control demonstration unit



1 controller, 2 control valve, 3 thermometer, 4 rotameter, 5 pump, 6 heater with thermostat, 7 tank, 8 plate heat exchanger, 9 ball valve with scale, 10 temperature sensor at fresh water outlet



1 heated tank, 2 pump, 3 actuator: control valve, 4 digital industrial controller, 5 measuring element: temperature sensor, 6 generate disturbance variables via ball valve, 7 plate heat exchanger;
 x controlled variable: temperature, y manipulated variable: degree of opening of control valve, z disturbance variable: degree of opening of ball valve, w reference variable: input values, e control deviation, F flow, T temperature, LSL level switch



Screenshot of optional I&C software RT 650.40

Specification

- [1] temperature control with components commonly used in industry
- [2] 2 water circuits thermally coupled via a heat exchanger
- [3] primary circuit with electrically heated tank, pump, control valve, rotameter and protection against lack of water
- [4] secondary circuit with fresh water connection, temperature sensor, rotameter
- [5] digital industrial controller, freely parameterisable
- [6] ball valve to generate disturbance variables in fresh water circuit
- [7] actuator: electromagnetic proportional valve
- [8] process variables X and Y accessible as analogue signals via lab jacks
- [9] large process schematic on front panel

Technical data

Tank: 15L, stainless steel

Heater

- power output: 2kW
- thermostat: 20...85°C

Plate heat exchanger: 30 plates

Pump, 3-stage

- max. flow rate: 70L/min
- max. head: 5,5m

Temperature sensor: Pt100: -50...200°C

2x dial-gauge thermometers (bimetal type): 0...120°C
 2x rotameters: 30...320L/h

Electromagnetic proportional valve: Kvs: 0,8m³/h

Digital controller, can be parameterised as P, PI or PID controller

Process variables as analogue signals: 0...10V

Connection of external recording devices (e.g. oscilloscope, line recorder) via lab jacks

230V, 50Hz, 1 phase; 230V, 60Hz, 1 phase
 120V, 60Hz, 1 phase; UL/CSA optional
 LxWxH: 1000x500x1070mm
 Weight: approx. 75kg

Required for operation

Fresh water connection approx. 350L/h

Scope of delivery

- 1 experimental unit
- 1 set of laboratory cables
- 1 set of instructional material

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Optional accessories

RT 650.40	I&C software for RT 614 - RT 674 series
WP 300.09	Laboratory trolley