RT 200

Room temperature control

Learning objectives/experiments

- components of a control loop
- operation and parameterisation of an industrial controller
- comparison of various controller types
  - P, PD, PI and PID controllers
  - two-point controller
- layout of control loops
  - open control loop
  - closed control loop
- disturbance feedforward control

Description

- **introduction to industrial control engineering**
- **simple temperature control loop with parameterisable industrial controller**
- **control loop components laid out separately on panels**
- **layout of control loops**

This experimental unit aids introduction to industrial control engineering. The objective is to control the temperature in a virtual room. The individual components of this temperature control loop are laid out separately on panels. They are inserted in the frame and interconnected by cables.

The controlled system is a soldering iron. The soldering iron represents the heater in the virtual room. The room, with a temperature sensor, is mapped out on the panel as an aid to understanding.

The real temperature sensor is a thermocouple on the tip of the soldering iron. The transducer converts the temperature signal from the thermocouple into a standard voltage signal. This signal is sent to the input of an industrial controller. There the signal is compared against the reference variable. The controller sends a signal corresponding to the variation (manipulating variable) to the actuator. The actuator is a power controller which influences the electrical power to the soldering iron.

To generate disturbance variables, metal plates with differing thermal conductivities can be attached to the soldering iron. The industrial controller is parameterisable as a P, PD, PI or PID controller.

It can also function as a two-point controller. The controlled variable (virtual room temperature) and the manipulating variable are displayed digitally.

A line recorder (RT 200.01) is available as an accessory to record the control processes.

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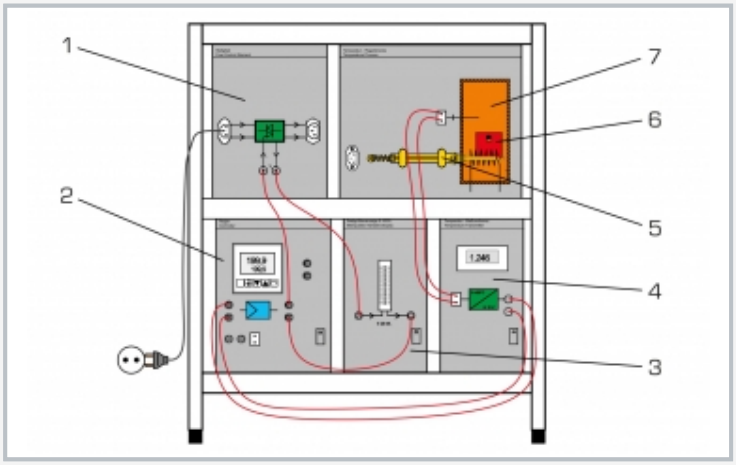
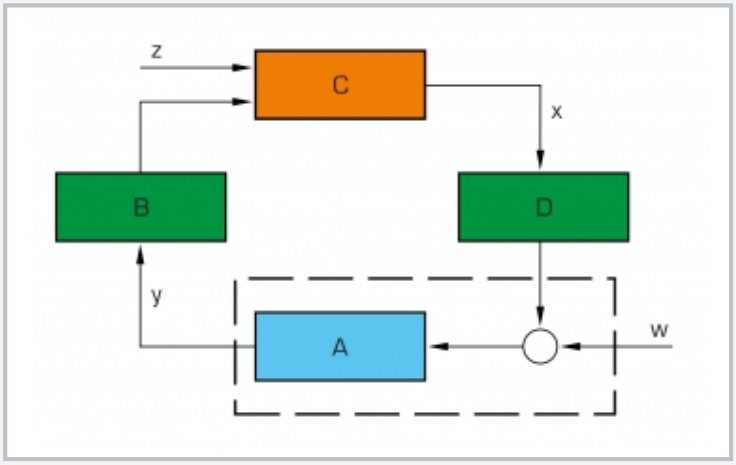
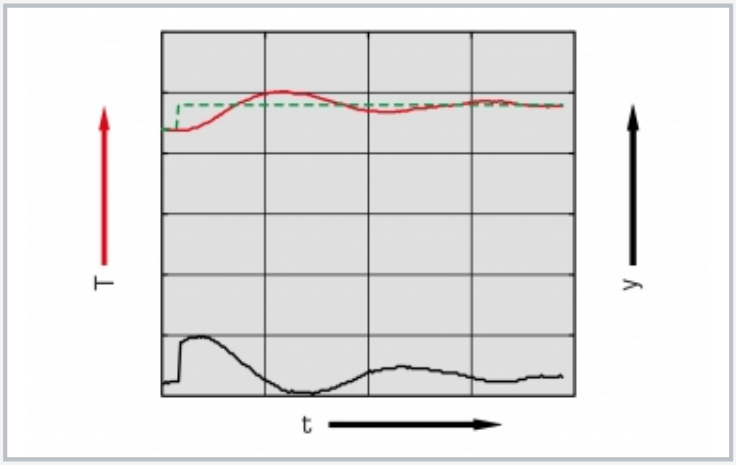


1 power controller, 2 controller, 3 manipulating variable bar display, 4 transducer, 5 soldering iron, 6 metal plate, 7 implied heating room



A controller, B actuator (power controller), C controlled system (soldering iron), D thermocouple and transducer;
y manipulating variable, w reference variable, x controlled variable, z disturbance variable



Control response with a PI controller: Characteristic curves of the controlled variable (red), reference variable (green) and manipulating variable y (black); T temperature, t time

Specification

[1] investigation of a temperature control loop
[2] control loop components on panels allowing for variation in installation in frame
[3] soldering iron as controlled system
[4] power controller as actuator
[5] parameterisable digital industrial controller
[6] thermocouple type K as temperature sensor
[7] transducer for thermocouple with digital temperature display
[8] bar display for manipulating variable
[9] 2 metal plates with differing thermal conductivities for disturbance generation
[10] line recorder (RT 200.01) available as accessory

Technical data

Soldering iron power output: 16W
Controller
- input signals: 0/4...20mA and 0...10V
- output signals: 0...20mA
- parameterisable as

P, PI or PID controller
2-point controller
Power controller
- output power: 0...16W
- input signal: 0...20mA

Thermocouple and transducer
- measuring range: 0...400°C
- output signal: 0...10VDC

2 metal plates for disturbance generation
- stainless steel
- copper

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 800x500x840mm
Weight: approx. 38kg

Scope of delivery

1 frame
1 panel, controlled system
1 panel, actuator
1 panel, controller
1 panel, transducer
1 panel, bar display
2 metal plates
1 set of cables
1 set of instructional material

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Optional accessories

080.20001	RT 200.01	3-channel line recorder
020.30009	WP 300.09	Laboratory trolley