RT 580

Fault finding in control systems

Description

- **practical control of level, flow rate and temperature**
- **simulation of typical faults**
- **PLC to monitor safety devices**
- **refrigeration system for independent cold supply**

The RT 580 facilitates practical learning in the control of three controlled variables which are commonplace in process engineering.

A circuit with a collecting tank, pump and graduated tank is provided for control of level and flow rate. A pneumatic control valve is used as the actuator. There is a valve in the tank outlet to generate a disturbance variable in level control. Cascade control is possible whereby the level in the tank is controlled by way of the flow rate.

Two circuits are used in the control of the temperature. A refrigeration system cools the water in the collecting tank. A pump circulates the water via a heat exchanger (cooling circuit). A heater heats the water in the graduated tank. Another pump also circulates the warm water via the heat exchanger. In the heat exchanger the water in the cooling circuit is heated.

The controlled variable is the temperature of the water in the cooling circuit after heating in the heat exchanger. The actuator is the pneumatic control valve which adjusts the flow rate of the warm water. Cascade control is also possible to control the temperature.

Two industrial controllers are supplied which can be employed as the master and slave in the implementation of cascade control. They have a Profibus DP interface. This enables the trainer to be controlled by way of a software. The software also permits recording of the process variables and parameterisation of the controllers on the PC.

The trainer is equipped with a PLC for monitoring of safety devices, such as a low water cut-off which protects the heater. On the switch cabinet there are also pushbuttons for the simulation of typical faults such as failure of sensors or cable breaks.

Learning objectives/experiments

- familiarisation with industrial control loop components
- setup, parameterisation and configuration on the controller
- optimisation of controller settings
- level control
- flow rate control
- temperature control
- cascade control, level – flow rate
- cascade control, temperature – flow rate
- plotting step responses
- fault finding

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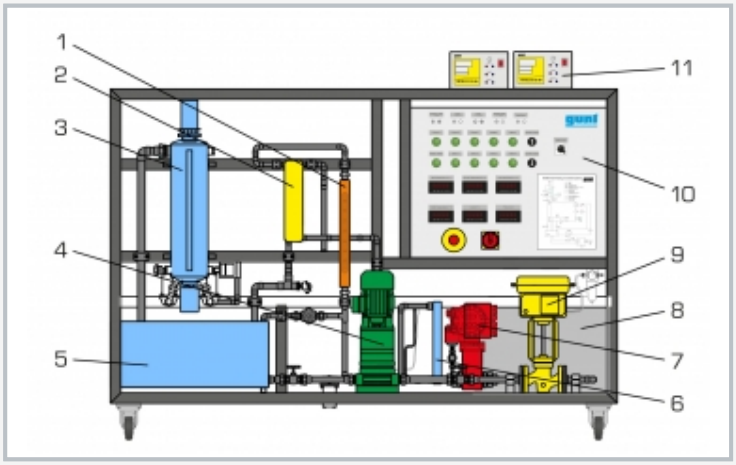
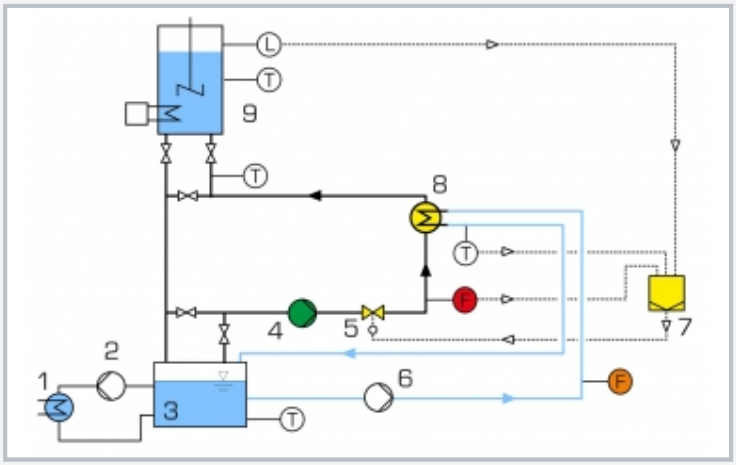
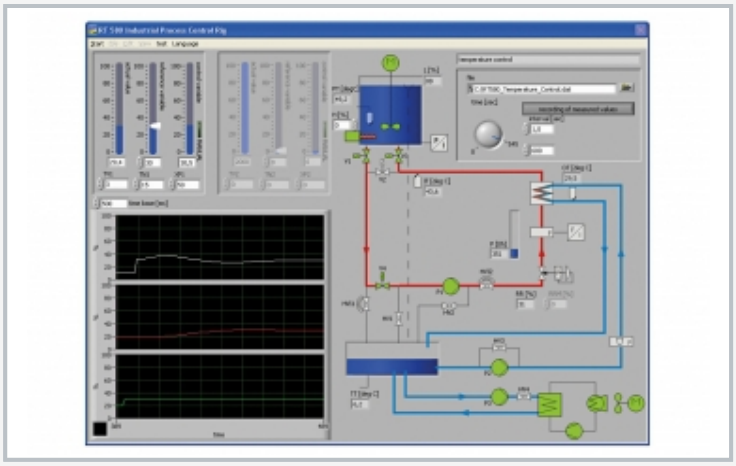


1 flow meter, 2 heat exchanger, 3 stirred tank with heater, 4 main circuit pump, 5 collecting tank, 6 refrigeration system evaporator, 7 flow rate sensor, 8 refrigeration system, 9 control valve, 10 switch cabinet, 11 controller



1 refrigeration system evaporator, 2 refrigeration system pump, 3 collecting tank, 4 main circuit pump, 5 control valve, 6 cooling circuit pump, 7 controller, 8 heat exchanger, 9 stirred tank with heater; F flow rate, L level, T temperature



Process control software screenshot

Specification

[1] control of level, flow rate, temperature and cascade control
[2] main circuit with collecting tank, graduated stirred tank with heater, pneumatic control valve and centrifugal pump
[3] cooling circuit with pump, heat exchanger and rotameter
[4] refrigeration system and pump to cool the water in the collecting tank
[5] pneumatic control valve in main circuit as actuator for all controls
[6] sensors for the measurement of the controlled variables; level, flow rate and temperature
[7] 2 parameterisable industrial controllers
[8] 6 pushbuttons for fault simulation
[9] PLC to monitor safety devices
[10] GUNT process control software via PCIe under Windows 7, 8.1, 10

Technical data

Tanks
- stirred tank with scale: approx. 7L
- collecting tank: approx. 90L

Main circuit centrifugal pump
- max. flow rate: approx. 75L/min
- max. head: approx. 20m

2 pumps, cooling circuit and refrigeration system
- max. flow rate: approx. 60L/min
- max. head: approx. 4m

Heater power output: approx. 2kW
Controller parameterisable as
- P, PI or PID controller

Measuring ranges
- level: 0...350mm
- flow rate: 0...1999L/h
- temperature: 0...100°C

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 230V, 60Hz, 3 phases
UL/CSA optional
LxWxH: 1920x800x1530mm
Weight: approx. 245kg

Required for operation

compressed air: 3...8bar; 25...50L/min
PC with Windows recommended

Scope of delivery

1 trainer
2 controllers
1 set of cables
1 Profibus card
1 CD with PLC programming software
1 GUNT process control software CD
1 set of instructional material