RT 452
Flow control

Control and operation via touch screen or a PC with GUNT software. Observation and analysis of the experiments at any number of workstations via LAN/WLAN.

Description

- **digital control of the flow rate via PLC**
- **integrated touch screen or PC with GUNT software as HMI**
- **network capable GUNT software with data acquisition for remote learning**
- **use of smart sensors: additional transfer of the system status, e.g. error codes**

The RT 451 – 455 series is constructed entirely from industrial components in order to teach control engineering in a practical manner. The use of smart sensors lays the foundations for Industry 4.0 applications. Smart sensors provide signal processing in addition to the capture of measured values thanks to integrated evaluation electronics. Besides process data, it is also possible to exchange configuration, diagnostic or statistical data. In practice this makes it faster to change over production lines, for example, or enables predictive maintenance.

The RT 452 trainer has all components required for an open and closed control loop. The controlled system is a pipe section through which water is pumped.

The pipe section contains a smart flow rate sensor as a measuring element, which records the flow rate as the controlled variable. The actuator is an electropneumatic control valve with positioner. Defined disturbance variables can be generated via a proportional valve with motor drive. A separate flow rate indicator visualises the flow through the pipe section.

The flow rate is measured by a smart electromagnetic flow rate sensor. The sensor is connected via Profinet and also makes it possible to transmit the system status.

For further experiments, a cascade control system can be set up together with RT 451.

The trainer is controlled and operated via the integrated PLC and the touch screen or via GUNT software (external PC required). The control response is displayed in the form of a time function. The network capable software makes it possible to follow and analyse the experiments at any number of workstations via a LAN/WLAN connection to the local network.

Learning objectives/experiments

- design and function of a level control system
- investigate the properties of open and closed loops
- investigate disturbance and reference variable response
- manipulating variable limitation and effect on the control system
- fault finding (fault simulation via PLC)
- familiarisation with industrial control engineering components:

Siemens PLC as digital controller,
smart flow rate sensor as measuring element,
electropneumatic control valve with positioner as actuator

- together with RT 451: investigate cascade control of level and flow rate
- familiarisation with Profinet for connecting smart sensors
  - ▸ standardised, open technology
  - ▸ quick data exchange
  - ▸ additional transfer of system status
  - ▸ flexible network topologies

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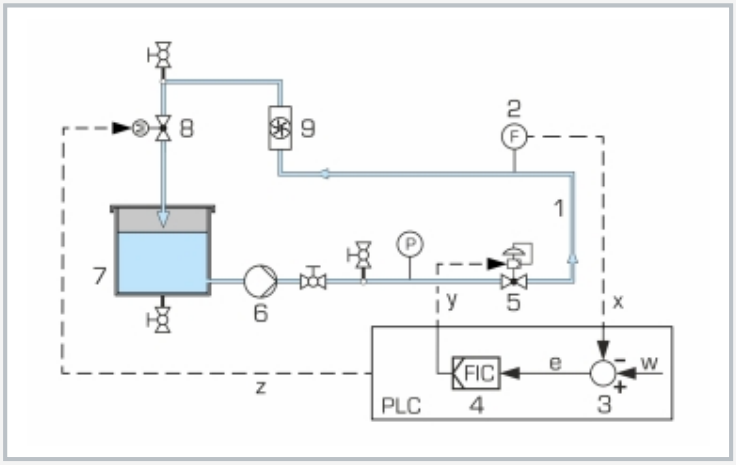
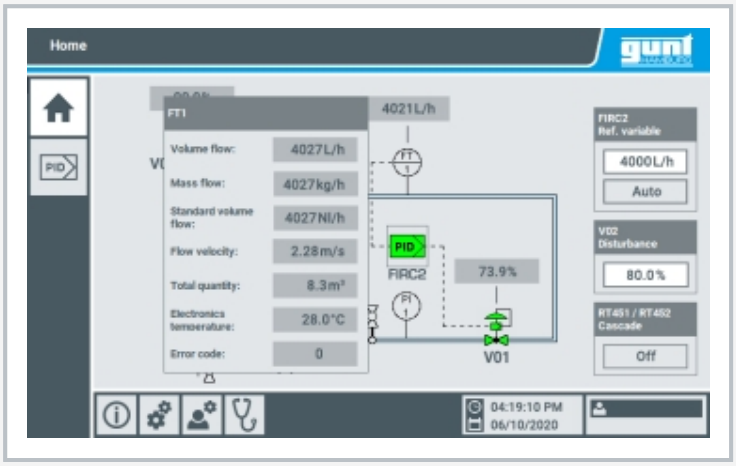
1 smart flow rate sensor, 2 flow rate indicator, 3 proportional valve with motor drive, 4 storage tank, 5 pump, 6 manometer, 7 control valve, 8 touch screen



1 controlled system: pipe section, 2 measuring element: smart flow rate sensor, 3 comparator: part of the PLC, 4 digital controller integrated into PLC, 5 actuator: control valve, 6 pump, 7 storage tank, 8 generate disturbance variables via proportional valve with motor drive, 9 flow rate indicator
x controlled variable: flow rate, y manipulated variable: degree of opening of control valve that directly affects the water flow rate, z disturbance variable: degree of opening of proportional valve, w reference variable: input values, e control deviation, F flow rate, P pressure



Screenshot from the PLC: start page with process schematic and separate window to display additional values from the smart flow rate sensor

Specification

[1] flow rate control process with standard industrial components and smart sensors
[2] digital control via PLC, controller can be parametrised as P, PI, or PID controller
[3] controlled system: pipe section with water flow
[4] measuring element: smart flow rate sensor with Profinet connection for transfer of additional values, electromagnetic measurement
[5] actuator: electropneumatic control valve with positioner
[6] generate disturbance variables via proportional valve with motor drive, operation via PLC
[7] closed water circuit
[8] remote learning: follow and analyse experiments at any number of workstations with LAN/WLAN connection via network capable GUNT software
[9] GUNT software for data acquisition via LAN under Windows 10
[10] multimedia instructional materials online in GUNT Media Center

Technical data

PLC
- type: Siemens SIMATIC S7-1200
- modules: compact CPU (8 DI, 6 DO, 2 AI), analogue output module (2 AO)

Smart flow rate sensor
- manufacturer: Endress+Hauser
- type: Promag P 300
- measuring principle: electromagnetic
- integrated display
- DN 25
- interface: Profinet

Pneumatically operated control valve DN 25
- K_{VS} value: 10,0
- nominal stroke: 15mm

Pump
- max. flow rate: 4,5m^3/h
- max. head: 21m

Storage tank: 50L

Measuring ranges
- pressure: 0...2,5bar
- flow rate: 0...100L/min
- opening degree: 2x 0...100%

230V, 50Hz, 1 phase; 230V, 60Hz, 1 phase
120V, 60Hz, 1 phase; UL/CSA optional
LxWxH: 2030x790x1987mm
Weight: approx. 208kg

Required for operation

compressed air connection: 4...10bar
PC with Windows recommended

Scope of delivery

trainer, 1 GUNT software, 1 set of accessories, 1 set of instructional material

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Optional accessories

as a supplement to expand the learning objectives

MT 101	Assembly exercise: pneumatically driven control valve
or	
MT 102	Assembly exercise: electrically driven control valve