

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 ball 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

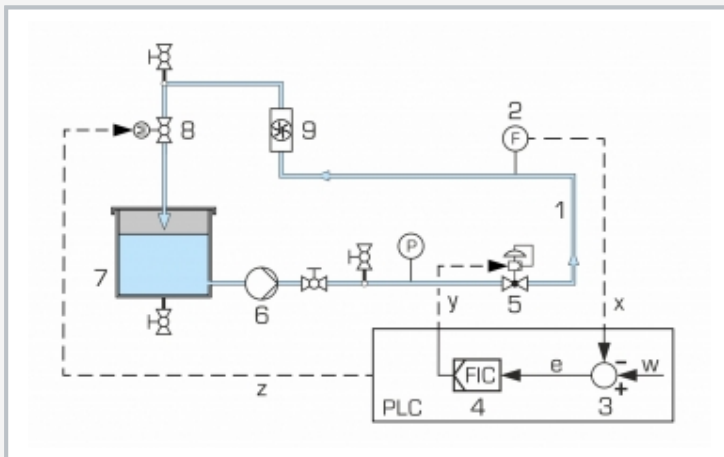
- design and function of a level control system
- investigate the properties of open and closed loops
- investigate disturbance and reference variable response
- familiarisation with industrial control engineering components: Siemens PLC as digital controller, smart flow rate sensor as measuring element, 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

RT 452

Flow control

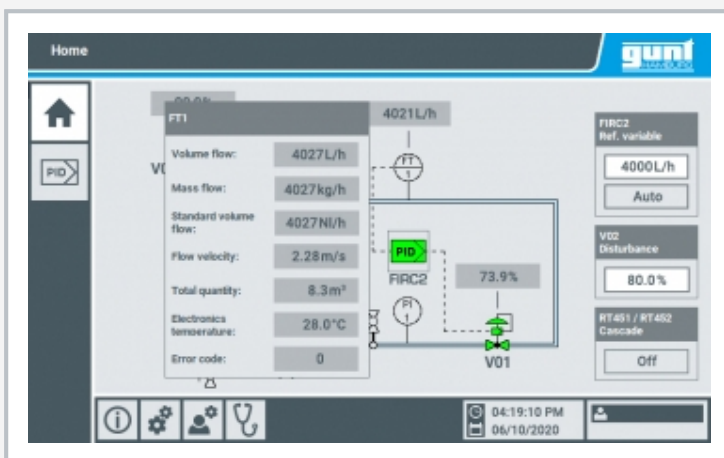


1 smart flow rate sensor, 2 flow rate indicator, 3 ball valve with motor drive, 4 storage tank, 5 pump, 6 manometer, 7 control valve, 8 touch screen



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 ball 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 ball 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 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 ball 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 8.1, 10

Technical data

PLC

- type: Siemens SIMATIC S7-1200
- modules: compact CPU (8 DI, 6 DO, 2 AI), analogue I/O module (4 AI, 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: 4,5m³/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

RT 452

Flow control

Optional accessories

as a supplement to expand the learning objectives

051.10100 MT 101 Assembly exercise: pneumatically driven control valve

or

051.10200 MT 102 Assembly exercise: electrically driven control valve