

# RT 453

## Pressure 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 pressure 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, configuration via PLC: change, save and transfer parameters during operation

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 453 trainer has all components required for an open and closed control loop. Two series-connected pressure vessels are available as the controlled system, which are connected to

each other via a motorised valve. The air pressure is controlled in a first order (1 vessel) or a second order (2 vessels in series) controlled system. A smart pressure sensor is installed in each of the two pressure vessels as measuring elements. The pressure sensor serves as the controlled variable. The actuator is an electropneumatic control valve with positioner, which is mounted in the supply line for the compressed air. Defined disturbance variables can be generated via valves.

The smart pressure sensors have an IO-Link interface for interference-free transfer of measured values and the exchange of configuration data.

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

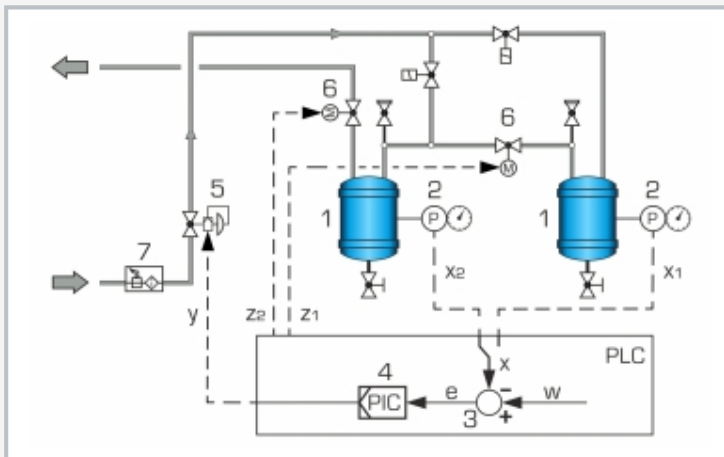
- design and function of a pressure control system
- investigate the properties of open and closed loops
- control response in
  - ▶ 1st order controlled system
  - ▶ 2nd order controlled system
- investigate disturbance and reference variable response
- manipulating variable limitation and effect on the control system
- fault finding (fault simulation via PLC)
- familiarisation with industrial control engineering components: Siemens PLC as digital controller, smart pressure sensors with IO-Link interface as measuring element, electropneumatic control valve with positioner as actuator
- familiarisation with IO-Link as communications interface for smart sensors
  - ▶ standardised, open technology
  - ▶ interference-free transfer of measured values
  - ▶ exchange of configuration data
  - ▶ system design (IO-Link device, IO-Link master, PLC)

# RT 453

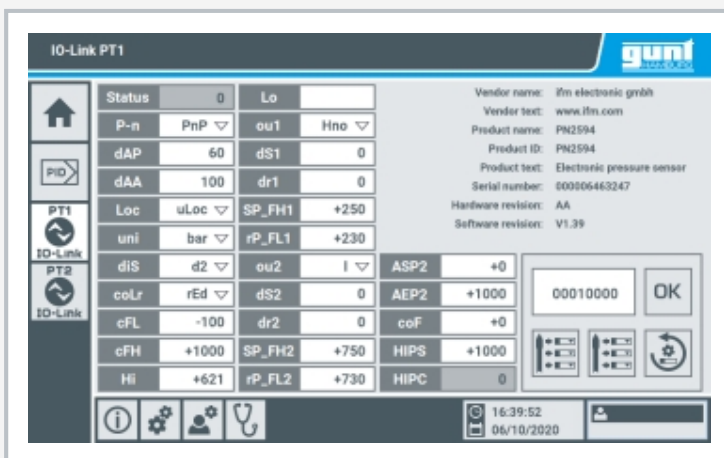
## Pressure control



1 various valves, 2 manometer, 3 pressure vessel, 4 smart pressure sensor, 5 control valve, 6 touch screen



1 controlled system: pressure vessel, 2 measuring element: smart pressure sensor, 3 comparator: part of the PLC, 4 digital controller integrated into PLC, 5 actuator: control valve, 6 generate disturbance variables via motorised valves, 7 maintenance unit  
 x controlled variable: pressure, y manipulated variable: degree of opening of control valve that directly affects the compressed air supply,  $z_1, z_2$  disturbance variables: opening degree of motorised valves, w reference variable: input values, e control deviation, P pressure



Screenshot from the PLC: configuration of smart pressure sensor via IO-Link

### Specification

- [1] pressure 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: 2 pressure vessels with safety valve and manometer for direct observation of the vessel pressures
- [4] investigation of a first order (1 vessel) or second order (2 vessels connected in series) controlled system
- [5] measuring element: smart pressure sensors with IO-Link interface for interference-free transfer of measured values and exchange of configuration data
- [6] smart pressure sensors configured via PLC
- [7] actuator: electropneumatic control valve with positioner
- [8] generate disturbance variables via motorised valves, operation via PLC
- [9] remote learning: follow and analyse experiments at any number of workstations with LAN/WLAN connection via network capable GUNT software
- [10] GUNT software for data acquisition via LAN under Windows 10
- [11] multimedia instructional materials online in GUNT Media Center

### Technical data

- 2 pressure vessels
  - volume: 10L each
  - max. pressure: 10bar
- PLC
  - type: Siemens SIMATIC S7-1200
  - modules: compact CPU (8 DI, 6 DO, 2 AI), signal board (1 AO), analogue I/O module (4 AI, 2 AO), IO-Link master
- 2 smart pressure sensors
  - measuring principle: ceramic-capacitive
  - communications interface: IO-Link

Pneumatically operated control valve DN 15

- $K_{vs}$  value: 0,25
- nominal stroke: 15mm

Measuring ranges

- pressure: 4x 0...10bar
- opening degree: 3x 0...100%

230V, 50Hz, 1 phase; 230V, 60Hz, 1 phase

120V, 60Hz, 1 phase; UL/CSA optional

LxWxH: 2030x790x1987mm

Weight: approx. 203kg

### Required for operation

compressed air connection: 7...10bar  
 PC with Windows recommended

### Scope of delivery

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

# RT 453

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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