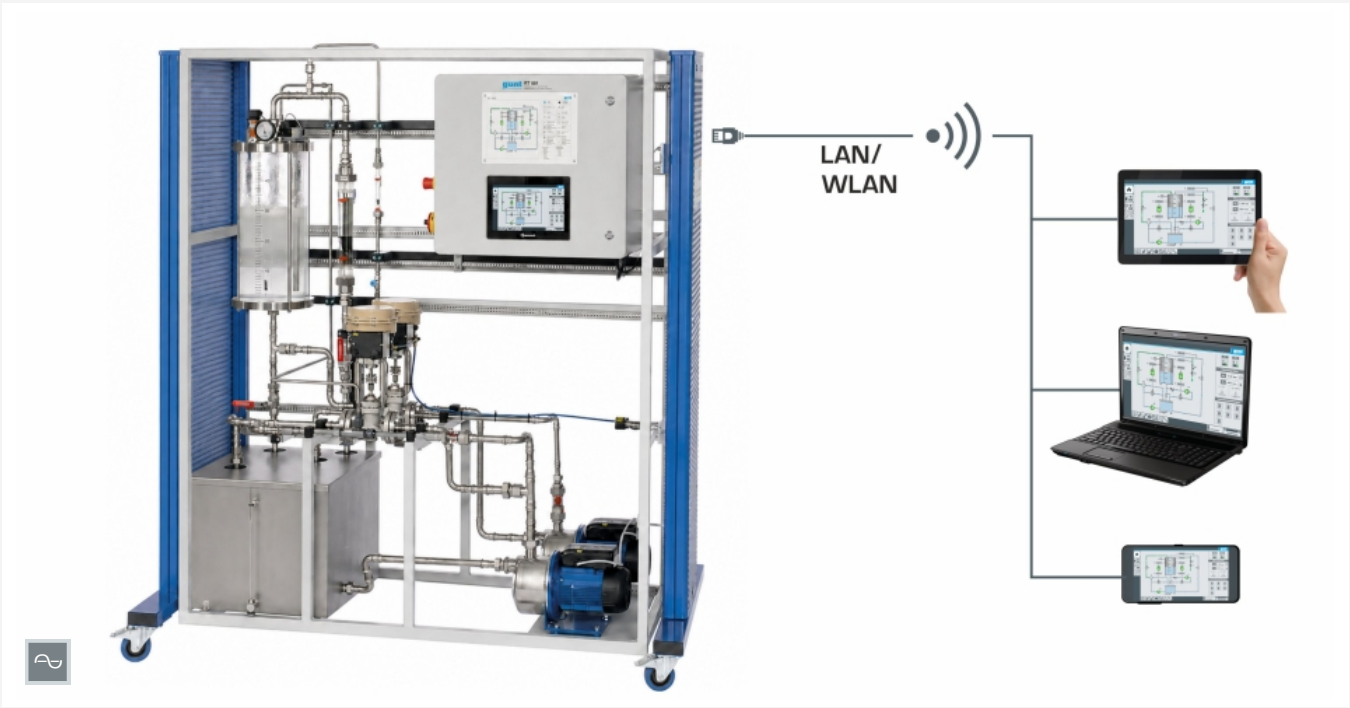
RT 681

Multivariable control: vacuum degassing



screen mirroring is possible on up to 10 end devices

Description

- **practical multivariable control of level and pressure in a vacuum tank**
- **model of “degassing of fluids” application from process engineering**
- **configurable controllers**
- **system controlled via integrated PLC with data acquisition**

With RT 681 the complexities of a multivariable control system can be learned in a practical manner. The model for the controlled process is a typical application from process engineering: separation of gas dissolved in liquid. The pressure falls below the vapour pressure of the dissolved gas in a vacuum tank, so that it passes into the gas phase and can be removed (desorption).

The liquid used in RT 681 is water, and the gas is ambient air. A water jet pump generates the negative pressure in the vacuum tank. The negative pressure firstly draws water from a collecting tank into the vacuum tank. Secondly, ambient air is drawn in and mixed with the water before entering the vacuum tank. The water/air mixing ratio can be adjusted by way of rotameters and valves. The negative pressure in the vacuum tank degasses the water again.

A pump transports the water out of the vacuum tank back into the collecting tank. A control valve is used to influence the flow rate and thus the level in the vacuum tank. Another pump circulates water from the collecting tank to operate the water jet pump. A control valve adjusts the flow rate in this circuit. In this way the negative pressure in the vacuum tank is adjusted. The negative pressure and level are mutually dependent variables. It is this dependence that makes this multivariable control system so complex.

Two controllers are provided as level and pressure controllers. They can be configured and parameterised via an integrated PLC. Process variables can also be recorded using the PLC. Via the PLC, the measured values can be stored internally.

By means of an integrated router, the trainer can alternatively be operated and controlled via an end device. The user interface can also be displayed on additional end devices (screen mirroring). Access to stored measured values is possible from end devices via WLAN with integrated router/LAN connection to the customer’s own network.

Learning objectives/experiments

- coupled level and pressure control
- level control with various controller types
- pressure control with various controller types
- plotting step responses

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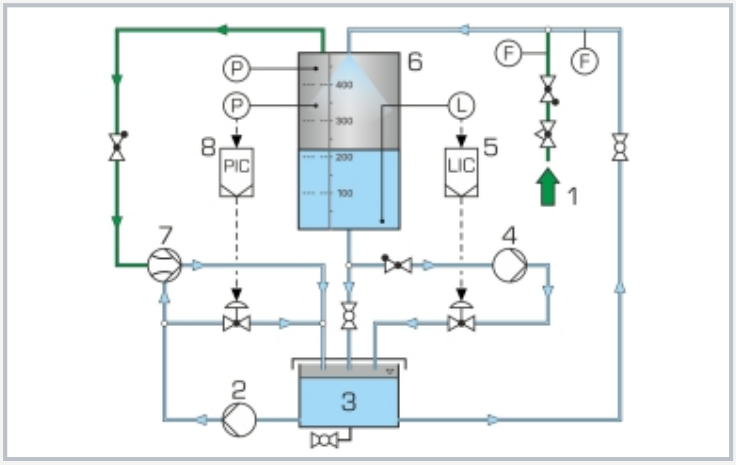
Multivariable control: vacuum degassing

1 vacuum tank, 2 collecting tank, 3 level control valve, 4 water jet pump, 5 pressure control valve, 6 pump (vacuum tank), 7 pump for operation of water jet pump, 8 PLC with touch screen



1 ambient air, 2 pump for operation of water jet pump, 3 collecting tank, 4 pump (vacuum tank), 5 level control valve, 6 vacuum tank, 7 water jet pump, 8 pressure control valve; F flow rate, P pressure, L level, PIC controller for pressure, LIC controller for level

Specification

[1] coupled level and pressure control in one vacuum tank
[2] water circuit with vacuum tank, collecting tank, pump and ambient air input device
[3] water jet pump to generate a negative pressure in the vacuum tank
[4] circuit with pump for operation of the water jet pump
[5] level control with pneumatic control valve as actuator
[6] pressure control with pneumatic control valve in the circuit for operation of the water jet pump
[7] level controller and pressure controller configurable and parameterisable
[8] data acquisition via PLC on internal USB memory, access to stored measured values via WLAN/LAN with integrated router/LAN connection to customer's own network or direct LAN connection without customer network
[9] screen mirroring: possible to mirror the user interface on up to 10 end devices

Technical data

PLC: Weintek cMT3108XP

Vacuum tank: 19L, collecting tank: 100L

2 centrifugal pumps
- max. flow rate: approx. 50L/min
- max. head: approx. 30m

Water jet pump: final vacuum: approx. 0,3bar

Pressure and level controller parameterisable as
- P, PI or PID controller
- switching controller

Measuring ranges
- pressure: -1...0,6bar
- level: 30...480mm
- flow rate: 1x 200...2500L/h, 1x 0...360L/h

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
LxWxH: 1150x700x2000mm
Weight: approx. 200kg

Required for operation

Compressed air connection for control valve: 3...10bar

Scope of delivery

trainer, 1 set of cables, 1 set of hoses, set of instructional material