

RT 681

Multivariable control: vacuum degassing



Description

- practical multivariable control of level and pressure in a vacuum tank
- model of “degassing of fluids” application from process engineering
- 2 configurable industrial controllers
- optional process control software RT 650.60 available

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.

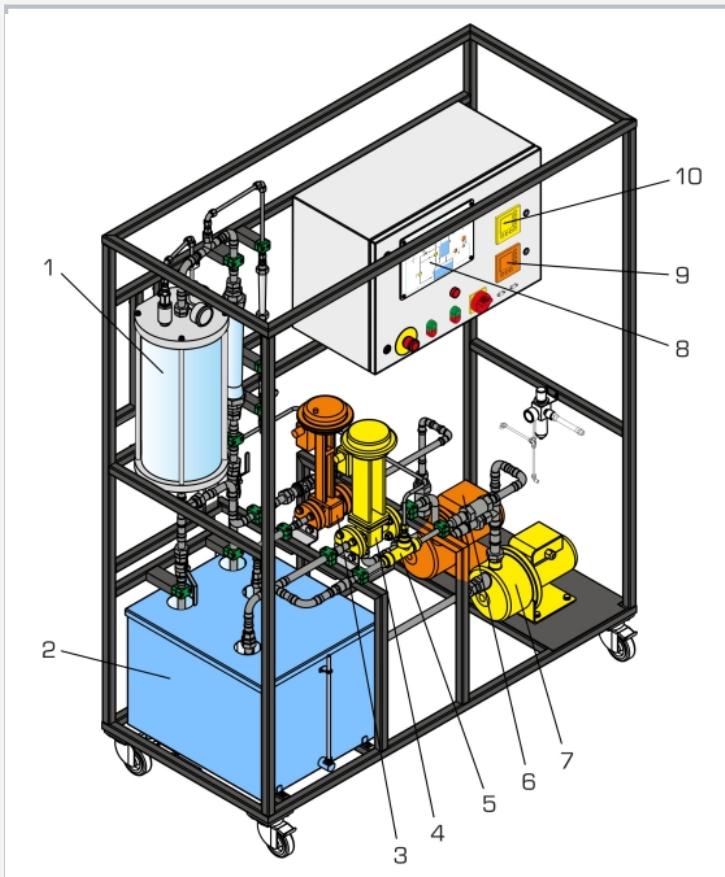
Two industrial controllers are provided as level and pressure controllers. They can be configured and parameterised using a supplied software. The controllers have a PROFIBUS DP interface. The interface permits monitoring of the trainer via an optionally available software RT 650.60. The RT 650.60 software also permits recording of the process variables and parameterisation of the controllers using the PC. It is also possible to interconnect multiple trainers from this series through the PROFIBUS DP interface.

Learning objectives/experiments

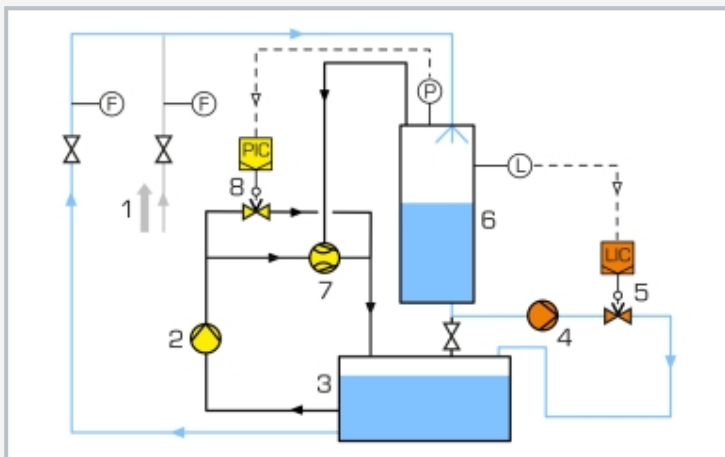
- coupled level and pressure control
- level control with various controller types
- pressure control with various controller types
- plotting step responses

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1 vacuum tank, 2 collecting tank, 3 level control valve, 4 pressure control valve, 5 water jet pump, 6 pump (vacuum tank), 7 pump for operation of water jet pump, 8 process schematic, 9 level controller, 10 pressure controller



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 (pressure), LIC controller (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 with software
- [8] optional process control software RT 650.60 via PROFIBUS DP interface

Technical data

Tanks

- 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
PC with Windows recommended

Scope of delivery

- 1 trainer
- 1 cable
- 1 hose
- 1 CD with software for parameterisation and configuration of the controllers
- 1 set of instructional material

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Optional accessories

080.65060

RT 650.60

Process control software for RT 681 and RT 682