# RT 624

## Flow control demonstration unit

### Learning objectives/experiments

- fundamentals of control engineering
- latest industrial control engineering components: controllers, transducers, actuators
- operation and parameter setting of a multifunctional state-of-the-art digital controller: e.g. parameter setting as P, PI and PID controller
- investigation of disturbance and control response
- influence of different controller parameters on stability and control quality
- investigation of the properties of the open and closed control loops
- processing of process variables using external equipment, e.g. plotter or oscilloscope
- together with accessory RT 650.40: familiarisation with and use of I&C software

### Description

- **experimental introduction to control engineering using an example of flow control**
- **construction of the system with components commonly used in industry**
- **digital controller with freely selectable parameters: P, I, D and all combinations**
- **optional I&C software RT 650.40 via USB**

This experimental unit provides a comprehensive experimental introduction to the fundamentals of control engineering using an example of flow control.

All components are clearly laid out on a vertical front panel. The large-format process schematic provides an aid to understanding.

The controlled system is a pipe section through which water is pumped. The pipe section contains a paddle-wheel sensor as a measuring element, which records the flow rate as the controlled variable. The transparent rotameter enables the control process to be observed very clearly. The controller used is a state-of-the-art digital industrial controller. The actuator in the control loop is an electric control valve. A ball valve in the pipe section enables defined disturbance variables to be generated. The controlled variable X and the manipulating variable Y can be tapped as analogue signals at lab jacks. This enables external recording equipment, such as a plotter or an oscilloscope, to be connected.

An instrumentation and control software (RT 650.40) with interface module (USB) is available as an accessory. This enables the key process variables to be represented, and control functions executed.

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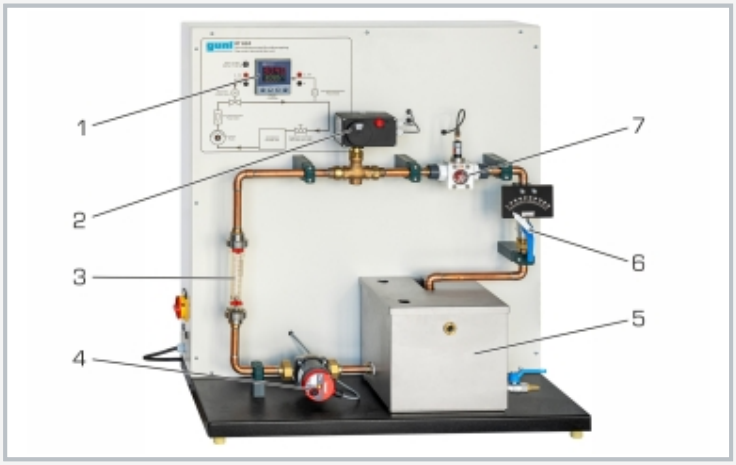
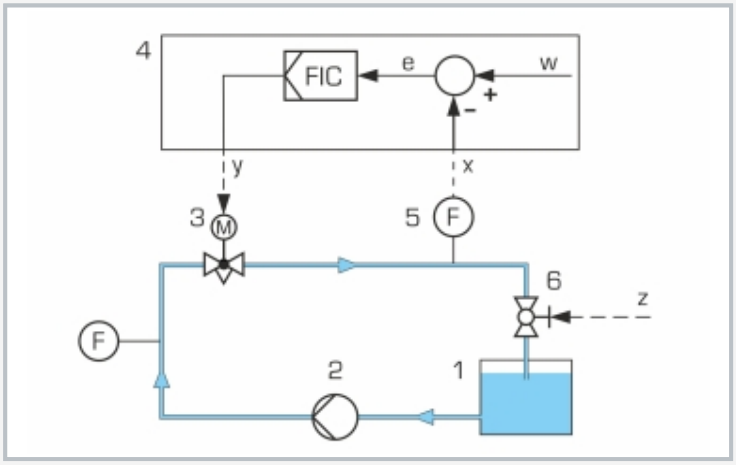
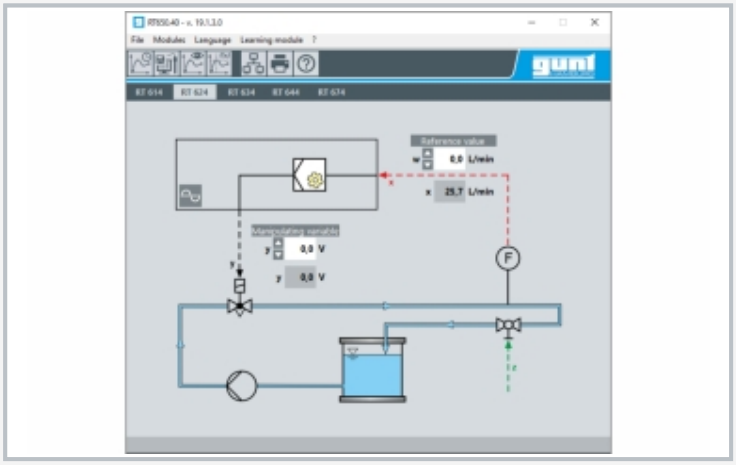
## Flow control demonstration unit




1 controller, 2 control valve, 3 rotameter, 4 pump, 5 storage tank, 6 ball valve with scale, 7 paddle-wheel sensor




1 storage tank, 2 pump, 3 actuator: control valve, 4 digital industrial controller, 5 measuring element: flow rate sensor, 6 generate disturbance variables via ball valve;
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




Screenshot of optional I&C software RT 650.40

## Specification

[1] flow control with components commonly used in industry
[2] controlled system: pipe section with water flow
[3] measuring element: paddle-wheel sensor
[4] rotameter to visualise the flow rate
[5] digital industrial controller, parameterisable as a P, PI or PID controller
[6] generation of disturbance variables by ball valve with scale in pipe section outlet
[7] actuator: electric control valve
[8] closed water circuit
[9] process variables X and Y accessible as analogue signals via lab jacks
[10] large process schematic on front panel

## Technical data

Storage tank
- stainless steel
- capacity: 15L

Pump, 3-stage
- power consumption: 90W
- max. flow rate: 83L/min
- max. head: 6m

Paddle-wheel sensor: 3...50L/min
Rotameter: 160...1600L/h

Electric control valve: Kvs: 5,7$m^3$/h

Controller parameterisable as P, PI or PID controller

Process variables as analogue signals: 0...10V

Connection of external recording devices (e.g. oscilloscope, line recorder) via lab jacks

230V, 50Hz, 1 phase; 230V, 60Hz, 1 phase
120V, 60Hz, 1 phase; UL/CSA optional
LxWxH: 1000x500x1070mm
Weight: approx. 72kg

## Scope of delivery

1 experimental unit
1 set of laboratory cables
1 set of instructional material

# RT 624

## Flow control demonstration unit

Optional accessories

| | |
|---|---|
| RT 650.40 | I&C software for RT 614 - RT 674 series |
| WP 300.09 | Laboratory trolley |