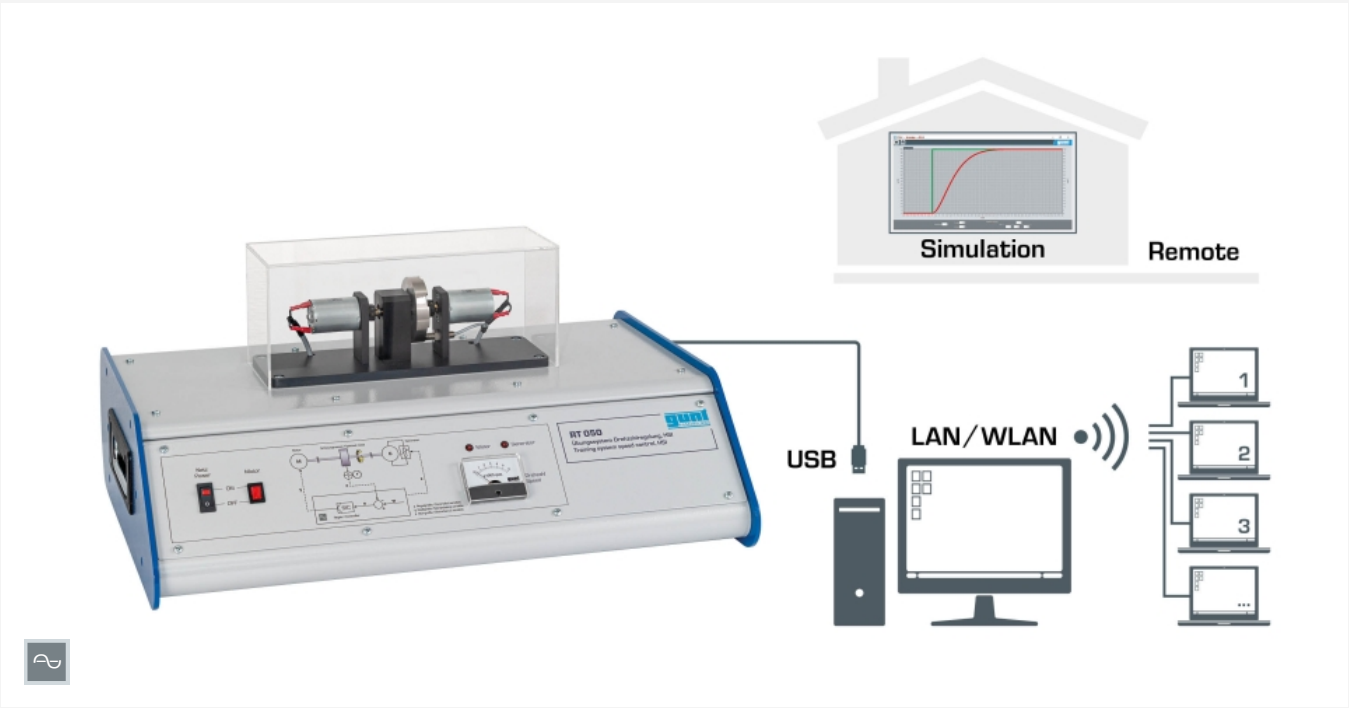
RT 050

Training system speed control, HSI



Description

- **basic control engineering relationships using the example of a speed controlled system**
- **configurable and parametrisable software controller with extensive functions**
- **experiment preparation and software simulation for remote learning**
- **experiments can be followed and analysed on the local network**

The RT 050 device offers basic experiments on a speed controlled system. A shaft with a flywheel is used as the controlled system. The speed represents the controlled variable, which is determined by a measuring element, in this case an inductive speed sensor. The output signal from the sensor is fed to the software controller. The output signal from the controller influences the actuator, in this case a motor, which causes the shaft to rotate. Switchable resistors are connected as a load to a generator, which is also located on the shaft. The software is used to generate different loads in order to study the effect of disturbance variables. In this way, the speed of the shaft can be influenced. The control response is displayed in the form of a time dependency. There is a speed indicator located on the flywheel, allowing the speed to be read directly at any time. A transparent protective cover allows the experiments to be observed safely.

The powerful GUNT software for the entire device series – in the form of Hardware/Software Integration (HSI) – is a major component for the entire series. The experimental unit and the PC are connected via a USB interface (external PC required).

The impact that modifications to the system behaviour have can be studied quickly and easily with the help of the software. An integrated programmer allows you to set reference values and time intervals to carry out reference value progressions. Further aspects of control engineering are studied using software simulations for controlled systems up to the 2nd order.

The combination of the clear, real-world controlled system and simulations of other controlled systems in the RT 010 – RT 060 device series aids understanding. Preparations for the experiments, as well as software simulations can be carried out in Remote Learning environments. The experiments can be observed at any number of workstations on the local network.

Learning objectives/experiments

- fundamentals of control engineering using the example of a speed controlled system
- open control loop response
- controlled system without feedback
- effects of different controller parameters and methods on the closed loop system response
- controller optimisation by changing the controller parameters: K_p, T_n, T_v
- recording of step responses: manipulating variable step, reference value step and disturbance variable step
- manipulating variable limitation and effect on the control system
- effect of disturbance variables
- software simulation of different controlled systems (P, I, PT_1, PT_2)
- comparison of different controlled system parameters

- specific GUNT software for the entire device series
- controller: manual, uncontrolled manual operation, continuous controller, two or three-point controller
- programmer for your own reference value progressions
- design of disturbance variable controllers
- recording of time dependencies
- remote learning: software simulation at any number of workstations

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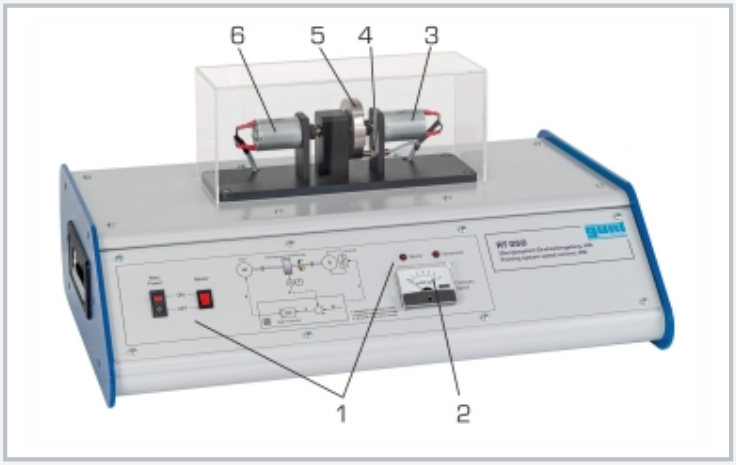
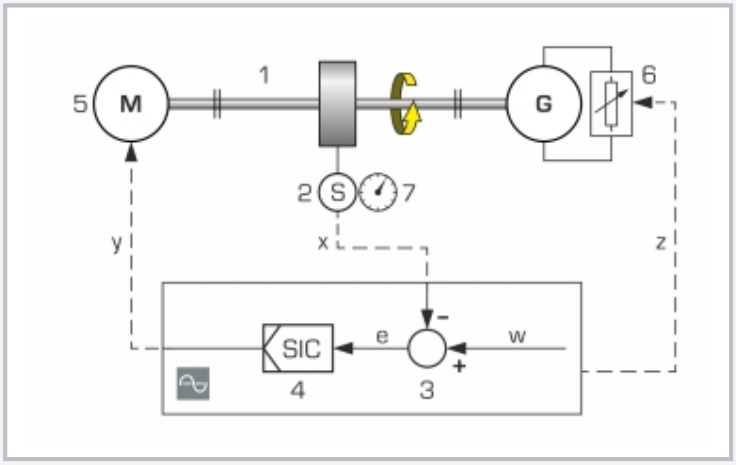
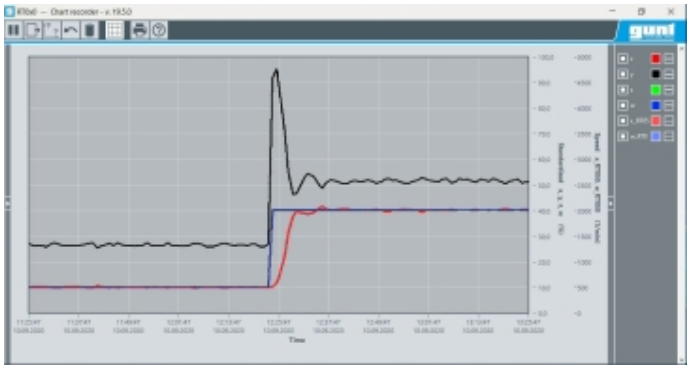


1 displays and controls, 2 speed indicator, 3 generator, 4 speed sensor, 5 shaft with flywheel, 6 motor



1 controlled system: shaft with flywheel, 2 measuring element: speed sensor, 3 comparator: part of the GUNT software, 4 software controller, 5 actuator: motor, 6 disturbance variable generated by a generator under load, 7 speed indicator
x controlled variable: speed, y manipulating variable: motor current, z disturbance variable: mechanical resistance to load the generator, w reference value: input values, e control deviation, S speed



Software screenshot: speed control with PID controller, reference value step, no disturbance variable

Specification

[1] speed control: typical controlled system
[2] controlled system: shaft with flywheel
[3] controlled variable: speed
[4] measuring element: inductive speed sensor
[5] software controller can be configured and parametrised as P, PI, PID and switching controller
[6] actuator: motor
[7] disturbance variable generated via adjustable load (resistors) on the generator
[8] transparent protective cover over motor, shaft and generator
[9] speed indicator for observing the speed
[10] software simulation: various controlled systems
[11] GUNT software: option to connect any number of external workstations on the local network to follow and analyse the experiment
[12] experiment preparation and software simulation at any number of workstations for remote learning
[13] GUNT software with control functions and data acquisition via USB under Windows 10
[14] multimedia instructional materials online in GUNT Media Center

Technical data

Motor
- operating voltage: 12VDC
- max. speed: 5000min^{-1}
- max. motor output: 12W
- max. torque: 25mNm

Generator
- operating voltage: 12VDC
- max. speed: 5000min^{-1}
- max. power: 12W
- max. torque: 25mNm

Software controller can be configured and parametrised as P, PI, PID and switching controller

Measuring ranges
- speed: 0...6000min^{-1}

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 600x450x310mm
Weight: approx. 18kg

Required for operation

PC with Windows

Scope of delivery

1 experimental unit
1 GUNT software + USB cable
1 set of accessories
1 set of instructional material

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Optional accessories

020.30009	WP 300.09	Laboratory trolley