RT 380
Optimization of control loops

The illustration shows a similar unit

Description

- **closed-loop control system response**
- **choice of optimum controller parameters**
- **tuning rules such as Ziegler-Nichols**
- **stability and transient response**
- **software simulation of controlled systems**

This experimental unit with the interaction between controller and controlled system, the objective being for the closed control loop, comprising the controller and the controlled system, to exhibit the desired optimum response. The setting of controller parameters – a key practical aspect – can be practised safely and intensively using simulation software. Concepts such as open and closed loop control, stability, step response, disturbance and control response are clearly demonstrated.

The particular feature of this experimental unit is that no real controlled systems are used; the controlled system is simulated on a PC by a simulation program developed by GUNT. This principle is in widespread application in product development in industry and is known as Hardware in Loop (HIL).

All major types of controlled systems can be selected in the program. The controlled system parameters can be set within broad limits so that – unlike actual controlled systems – extreme parameter situations can be investigated. The time response can be recorded and analysed using the software. The controller and the PC are connected via a USB interface.

The controller that is used can be easily configured from the PC across an interface using the software provided.

Learning objectives/experiments

- learning basic terminology and methods involved in process control
  - control loop comprising controller and controlled system
  - difference between open and closed loop control
- adapting the controller to different controlled systems
  - determining the controlled system parameters
  - choosing optimum controller parameters
  - using commonly applied tuning rules
  - investigating control and disturbance response
  - investigating the stability of the closed control loop

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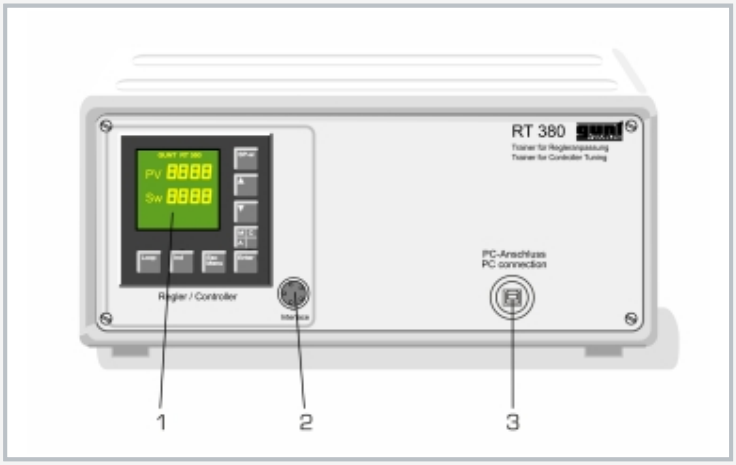
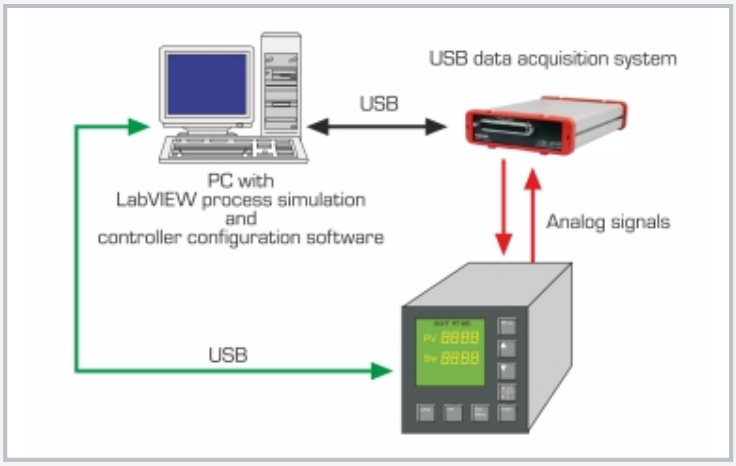
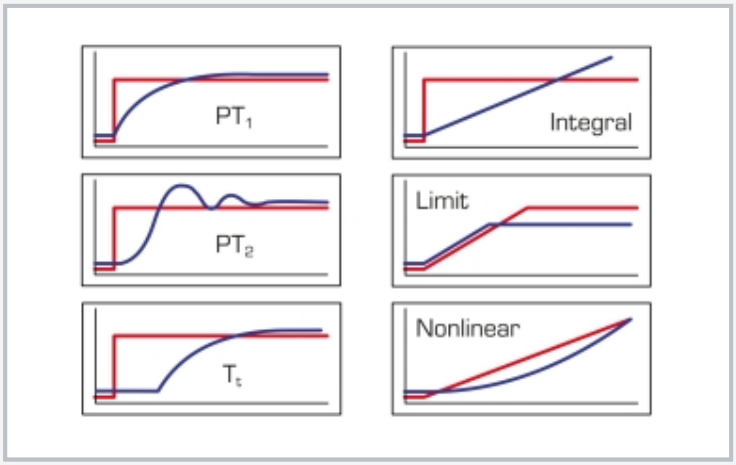


1 controller, 2 interface for controller parameter setting, 3 PC connection



The real controller works together with a simulated controlled system (HIL: Hardware in Loop)



A wide range of controlled system characteristics can be simulated: PT_1 first order lag; PT_2 second order lag; T_t time-delayed process

Specification

[1] experimental unit for controller tuning
[2] digital controller, configurable as a P, PI or PID controller with interface
[3] interface for PC
[4] GUNT simulation software for different controlled system types, such as first and second order lags, time-delayed systems etc.
[5] recording and evaluation of time response on PC
[6] configuration software for process controller
[7] software via USB under Windows 10

Technical data

Controller
- configurable as P, PI or PID controller
- proportional gain X_p: 0...999,9%
- integral action time T_n: 0...3600s
- derivative time T_v: 0...1200s

Process variables as analogue signals: 0...10V
Controlled system simulation models with proportional, integral, first-order lag, second-order lag
Time-delayed response, non-linearity and limitation possible

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 370x330x150mm
Weight: approx. 5kg

Required for operation

PC with Windows

Scope of delivery

1 experimental unit
1 GUNT simulation software for controlled systems
1 configuration software for the controller
1 set of cables
1 set of instructional material