

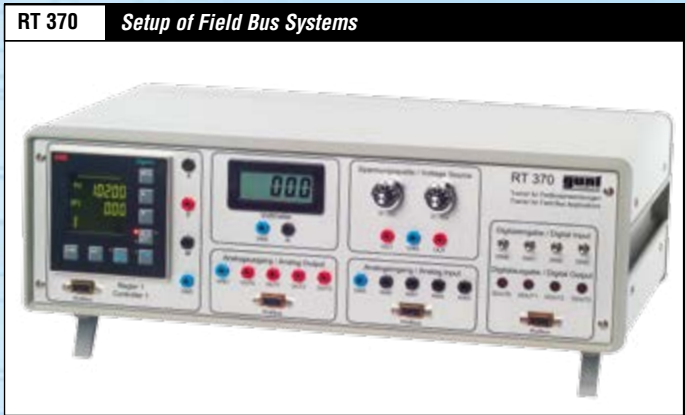
RT 350 – RT 380 TRAINERS FOR PROCESS AUTOMATION



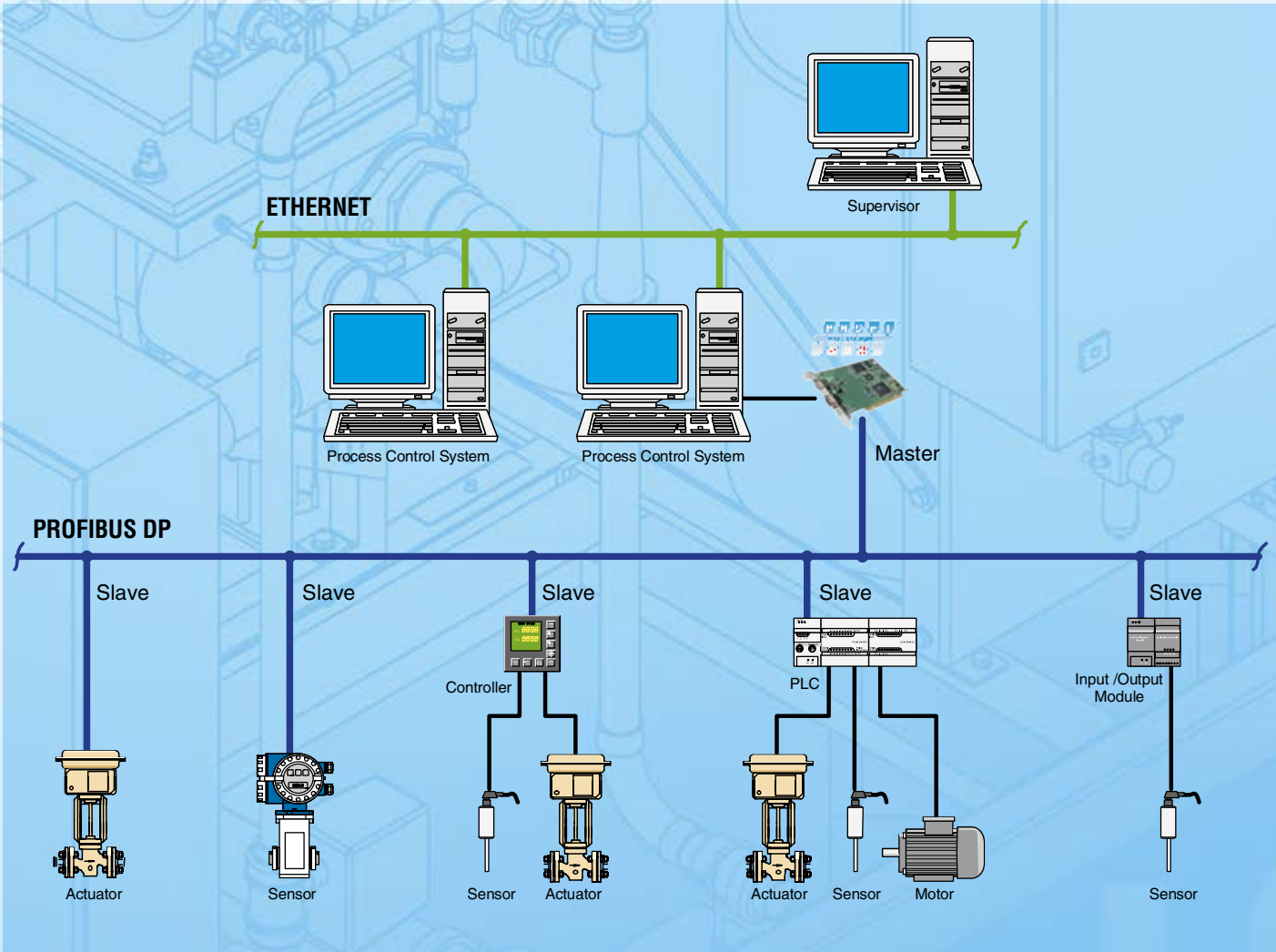
Nowadays most industrial processes are automated. Process controllers are at the heart of the automation of process applications. State-of-the-art digital process controllers offer a level of functionality which would have been inconceivable some years ago. Alongside extensive configuration and parameter setting functions to adapt to the control task, they also permit interconnected network-



ing. Thus, process automation by way of centralised process control systems or distributed control systems (DCS) is possible. This range of equipment provides a step-by-step introduction to process automation and process control engineering based on process controllers and field bus systems.



NETWORKING IN PROCESS AUTOMATION



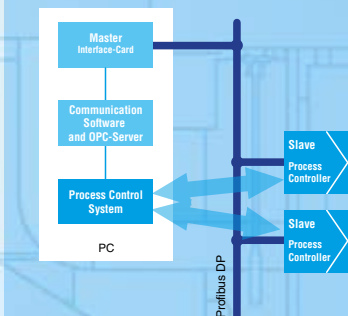
RT 350 OPERATION OF INDUSTRIAL CONTROLLERS

The RT350 is used to practice parameter setting and configuration of a state-of-the-art process controller. This can be carried out either manually by way of the front panel buttons or from a PC by means of a special software programme via an interface. In this case the controller is linked to the PC by a serial port.



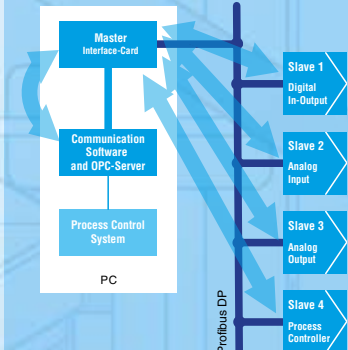
RT 360 NETWORKING OF INDUSTRIAL CONTROLLERS

The RT 360 allows the function of a simple process control system to be demonstrated. The network interconnection is over a field bus (Profibus DP). The PC with its interface card is the master, and the two process controllers are the slaves. The trainer can be used to demonstrate how the controller parameters can be configured from the process control system (adaptive control), and how the process data can be uploaded from the controllers to the process control system and visualised.



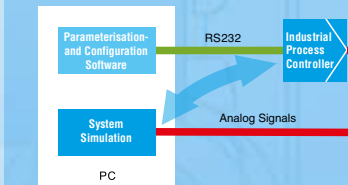
RT 370 SETUP OF FIELD BUS SYSTEMS

The RT 370 enables a field bus (Profibus DP) to be set up with various slaves (digital input and output modules, analogue input and output module, process controllers) and a master (PC with interface card). The definitions of the topology, the variables and the protocols are shown. Subjects such as the GSD file, system configurator, OPC server and tags are dealt with in detail. The objective is to interchange data between various field bus-compatible terminal devices and the PC.



RT 380 OPTIMIZATION OF CONTROL LOOPS

Tuning of a controller for optimal control system performance can be practised with the RT 380. The controller works together with a simulated system model. The simulation is created on a PC using a special software programme. A wide variety of system models are available. A configuration programme enables user-friendly, intuitive parameter setting of the controller from the PC.



RT 350 Operation of Industrial Controllers



- * Familiarisation with an industrial controller
- * Digital controller with freely selectable parameters
- * Simulation of controlled systems
- * Configuration software

Technical Description

This experimental unit familiarises students with the operation and function of a state-of-the-art industrial controller.

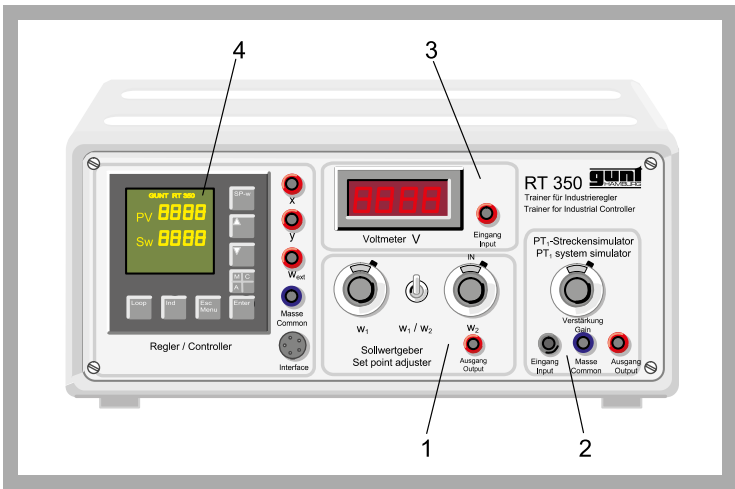
The controller has freely accessible inputs and outputs. Defined input levels and step signals can be produced with a signal generator. A digital voltmeter is used to measure the input and output signals. A simple first order lag is simulated to allow the response and stability of a closed control loop to be investigated. All signals are accessible via lab jacks so a standard x/y plotter or line recorder can be used. It is also possible to control external controlled system models with this controller. As well as manual configuration and parameter setting with keys, the controller can be configured (configuration software supplied) from a PC via USB.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

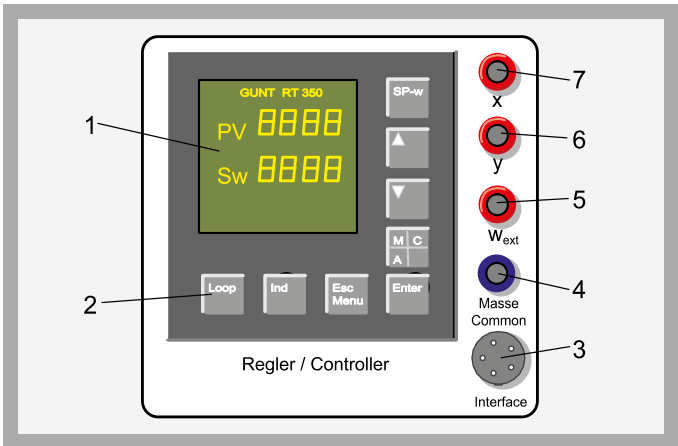
Learning Objectives / Experiments

- basic concept of a industrial controller
 - * operator control levels
 - * parameter level
 - * configuration level
- learning about basic terminology and methods of process control
 - * static and dynamic transfer function
 - * step response
 - * reference variable step
 - * closed control loop
- setting controller parameters
 - * setting input and output channels
 - * scaling displays
 - * using PC-based configuration tools

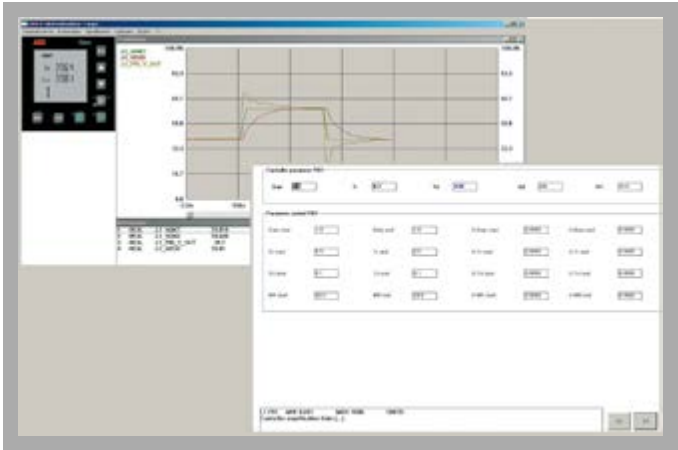
RT 350 Operation of Industrial Controllers



1 signal generator with switch between two pre-defined levels, 2 first order lag controlled system simulator with adjustable gain, 3 digital voltmeter, 4 controller



Controller: 1 LC display, 2 operating buttons, 3 configuration interface, 4 earth connection, 5 reference variable input, 6 manipulating variable output, 7 controlled variable input



Configuration software with time log window and parameter selection

Specification

- [1] experimental unit for industrial controllers
- [2] digital controller, configurable
- [3] signal generator with potentiometer
- [4] digital voltmeter
- [5] first order lag controlled system simulator
- [6] all variables accessible as analogue signals at lab jacks
- [7] configuration software via USB under Windows Vista or Windows 7

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
 - 2 inputs, 1 output
- Voltmeter
 - measuring range: 0...20V
 - resolution: 10mV
- Reference variables generator
 - 2 voltages selectable
 - output voltage: 0...10V
- Controlled system simulator
 - controlled system type: first order lag
 - time constant: 20s
 - controlled system gain: 1...10
 - process variables as analogue signals: 0...10V
- Connection of external instruments (e.g. oscilloscope, line recorder) via lab jacks

Dimensions and Weight

LxWxH: 370x330x150mm
Weight: approx. 5kg

Required for Operation

230V, 50/60Hz, 1 phase or 120V, 60Hz/CSA, 1 phase

Scope of Delivery

- 1 experimental unit
- 1 configuration software CD + USB cable
- 1 set of lab cables
- 1 set of instructional material

Order Details

080.35000 RT 350 Operation of Industrial Controllers

RT 360 **Networking of Industrial Controllers**



- * Process control system
- * Networking of industrial controllers
- * Controller parameter setting via field bus system
- * Profibus DP field bus system

Technical Description

One of the aims of process automation is to monitor and control plant or plant components centrally from a computer. This task performed by a process control system.

This experimental unit demonstrates the operation of a process control system based on a simple application. The experimental unit consists of two industrial controllers interconnected via a field bus interface (*Profibus DP*) and an interface card with a PC. On the PC, an OPC (*OLE for Process Control*) server makes the controller data available to other programs under *Windows* for further processing. The process control software developed by GUNT on the basis of LabVIEW accesses the process data on the controllers and enables it to be visualised. The software also allows the controllers' parameters to be set. Various functions such as recorders and alarm logs enable a simple control room function to be simulated.

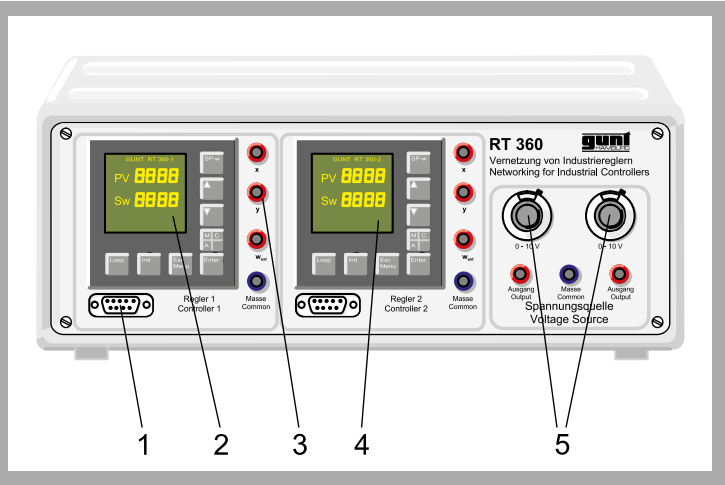
Two potentiometers permit the simulation of input signals for the controllers. The controlled variable, manipulating variable and reference variable data are delivered as standard signals at lab jacks, enabling the controllers to be integrated into real processes at any time.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

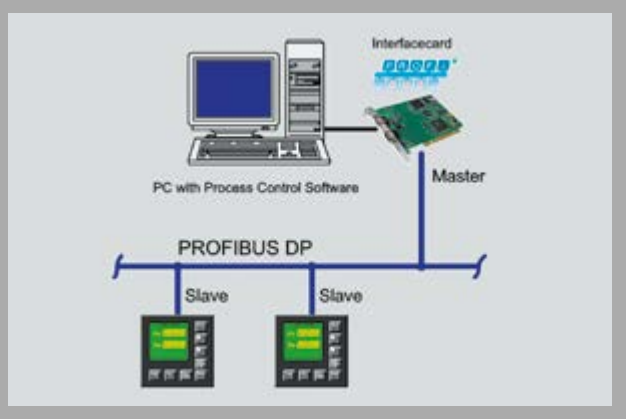
Learning Objectives / Experiments

- function and structure of a process control system under Profibus DP
- * Profibus DP field bus system
- * OPC server function
- * master / slave assignment
- * online controller parameter setting
- * reading control variables and displaying them online
- * configuring and displaying alarms

RT 360 **Networking of Industrial Controllers**



1 interface for Profibus DP, 2 controller, 3 lab jacks for analogue process variables, 4 controller, 5 signal generator



Topology of the process control system with networking over a field bus



GUNT process control software with recorder function and controller operation

Specification

- [1] experimental unit for networking of industrial controllers
- [2] 2 digital controllers, configurable as P, PI or PID controllers, with field bus interface
- [3] 2 signal generators
- [4] Profibus DP interface card for PC
- [5] OPC server and GUNT process control software under Windows Vista or Windows 7
- [6] all process variables accessible as analogue signals at lab jacks

Technical Data

Controller

- configurable as P, PI or PID controller
- proportional gain X_p : 0...999,9%
- integral action time T_n : 0...3.600s
- derivative time T_v : 0...1.200s

Process variables as analogue signals: 0...10V
Signal generator: 0...10V
Connection of external instruments (e.g. oscilloscope, line recorder) via lab jacks

Dimensions and Weight

LxWxH: 450x450x150mm
Weight: approx. 10kg

Required for Operation

230V, 50/60Hz, 1 phase or 120V, 60Hz/CSA, 1 phase

Scope of Delivery

- 1 experimental unit
- 1 interface card
- 1 set of cables
- 1 software CD with driver software, OPC server and GUNT process control software
- 1 set of instructional material

Order Details

080.36000 RT 360 Networking of Industrial Controllers

RT 370 Setup of Field Bus Systems



- * Profibus DP field bus system
- * Networking of field bus modules
- * Communication protocols
- * Recording digital and analogue signals

Technical Description

Field bus technology plays a key role in modern-day process automation. The field bus permits networking of terminal devices such as controllers, sensors or actuators in the plant system (field level) with the higher-level control room (control level). A network of this kind can be quite extensive; line lengths of as much as 1000 metres and more are possible.

This experimental unit is used to teach the initial basic steps in field bus technology based on the example of Profibus DP. Various terminal devices (slaves) are activated and read by a PC with a Profibus DP interface (master). The required hardware is largely pre-configured. Students are able to concentrate on the software programming of the field bus system. The following specific topics can be covered: System configurator with DMF (Device Master File), bus topology, communication protocols, tags, OPC (OLE for Process Control) server, input and output of process data, and much more.

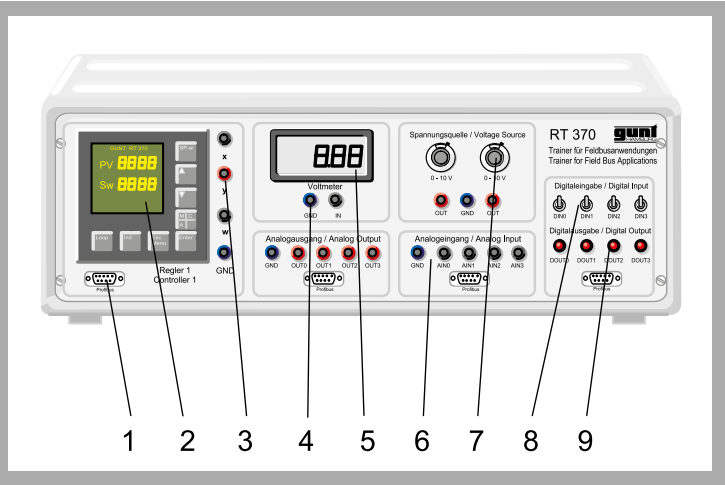
The experimental unit includes a digital controller as well as analogue and digital input and output modules with a Profibus DP interface. Two potentiometers permit the simulation of input signals for the controllers. A digital voltmeter displays the output signals. Digital signals are generated by switches and displayed by LEDs. The controlled variable, manipulating variable and reference variable data are delivered as standard signals at lab jacks, enabling the controllers to be incorporated into real processes at any time.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

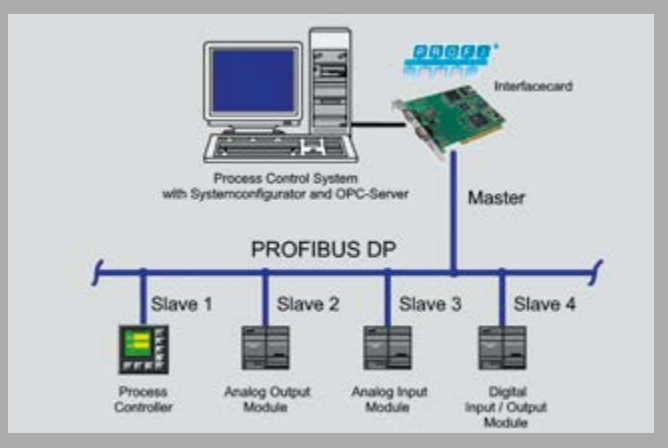
Learning Objectives / Experiments

- function and programming of a field bus system
 - * defining the bus topology with the stations
 - * writing the communication protocols
 - * familiarisation with the device master file
 - * familiarisation with the OPC server
 - * defining tags
 - * accessing the OPC database from a process control program
- familiarisation with the field bus stations
 - * function of a digital process controller
 - * function of an analogue input / output module
 - * function of a digital input / output module

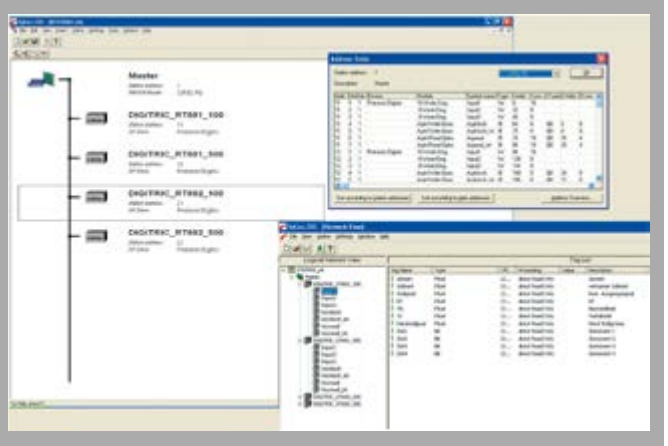
RT 370 Setup of Field Bus Systems



1 interface, 2 controller, 3 Lab jacks for process variables, 4 analogue output module, 5 voltmeter, 6 analogue input module, 7 signal generator, 8 digital input, 9 digital output



Topology of the field bus used, with master and slaves



Sycon system configuration program with topology manager, variables and tags list

Specification

- [1] experimental unit for field bus systems
- [2] digital controller, configurable as a P, PI or PID controller with Profibus DP interface
- [3] analogue Profibus DP I module
- [4] analogue Profibus DP O module
- [5] digital Profibus DP IO module
- [6] signal generator
- [7] digital voltmeter
- [8] Profibus DP interface card for PC
- [9] OPC server and GUNT process control software under Windows Vista or Windows 7
- [10] all process variables accessible as analogue signals at lab jacks 0...10V

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

Signal generator: 0...10V

Digital voltmeter: 0...20V

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

4 analogue inputs: 0...10V

2 analogue outputs: 0...10V

4 digital inputs, 4 digital outputs

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

Dimensions and Weight

LxWxH: 480x450x150mm

Weight: approx. 10kg

Required for Operation

230V, 50/60Hz, 1 phase or 120V, 60Hz/CSA, 1 phase

Scope of Delivery

- 1 experimental unit
- 1 interface card
- 1 software CD with driver software, system configuration program, OPC server and GUNT process control software
- 1 set of cables
- 1 set of instructional material

Order Details

080.37000 RT 370 Setup of Field Bus Systems

RT 380 Optimization of Control Loops



- * 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

Technical Description

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 by a data acquisition card with AD and DA converters.

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

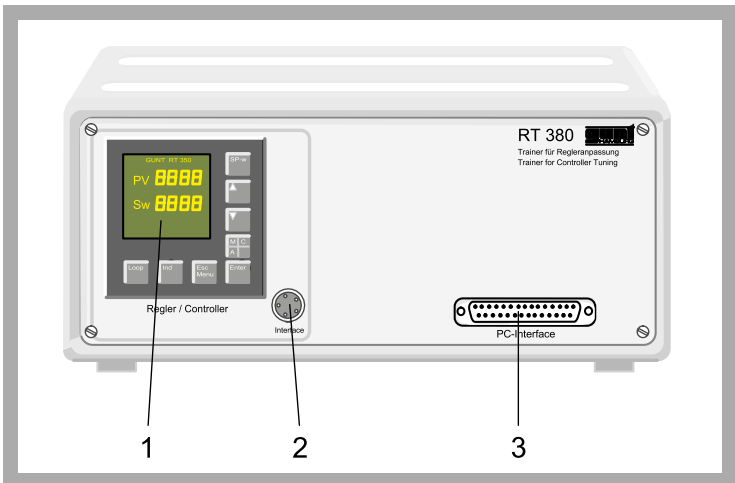
The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

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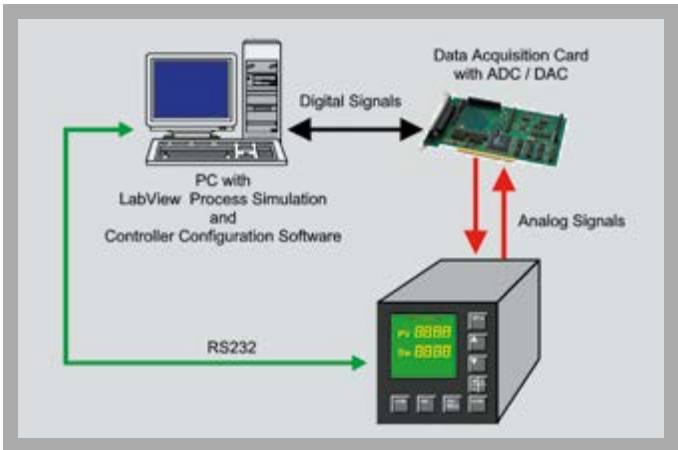
Learning Objectives / Experiments

- 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

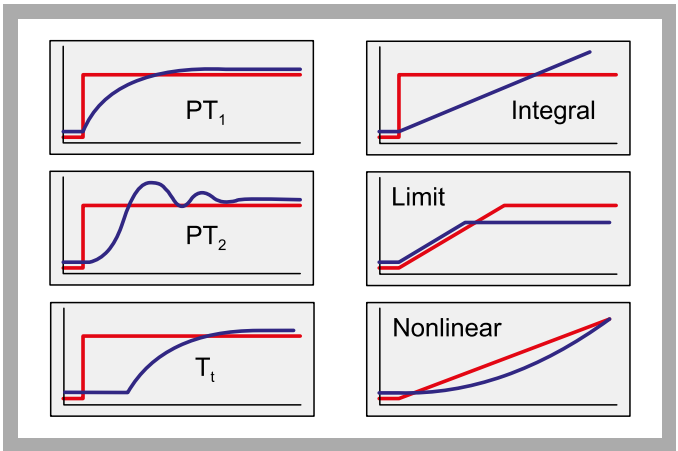
RT 380 Optimization of Control Loops



1 controller, 2 interface for controller parameter setting, 3 interface with analogue signals for data acquisition card



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



A wide range of controlled system characteristics can be simulated: PT₁ first order lag; PT₂ 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] data acquisition card for PC
- [5] GUNT simulation software for different controlled system types, such as first and second order lags, time-delayed systems etc.
- [6] recording and evaluation of time response on PC
- [7] configuration software for process controller under Windows Vista or Windows 7

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

Dimensions and Weight

LxWxH: 370x330x150mm
Weight: approx. 5kg

Required for Operation

230V, 50/60Hz, 1 phase or 120V, 60Hz/CSA, 1 phase

Scope of Delivery

- 1 experimental unit
- 1 data acquisition card
- 1 software CD with GUNT simulation software for controlled system models and configuration software for the controller
- 1 set of cables to connect the practice unit to the PC
- 1 set of instructional material

Order Details

080.38000 RT 380 Optimization of Control Loops

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