

Process-Automation: Training Simulators with WinMOD

WinMOD shows the efficient way to Training Simulators

- Highly realistic by usage of the real control software.
- Economic engineering by efficient re-use.
- Good support by standard WinMOD functionality.

The increasing complexity of process control systems in plant engineering and plant construction requires qualified personnel. But possibilities for training of personnel at installations in operation are strongly limited. This results in a need for training systems that are independent from the real installation.

The WinMOD Real-Time Simulation Center is an ideal basis for the required training simulators. It enables solutions that combine both,

- *simulating the relevant behavior of the real system with*
- *efficient engineering of the simulator for reasonable costs.*

Needs for Simulator Training

Well trained, reactive personnel for the operation and maintenance of installations is a prerequisite for optimal and stable operation, for minimal risks and the safe handling of critical situations.

But how can the required high level of qualification be achieved? Which qualifications are the result of everyday's work, which have to be obtained in special training?

Some examples may illustrate this:

(1) A power plant is to be modernized within four months. Then it is to be started up again.

How can the personnel, at this point in time, be set into an optimal state of training?

(2) In a sewage plant an emergency stop is released. It has to be ensured that the operating personnel react correctly and fast.

How can it be continuously trained for emergency situations that occur rarely?

(3) A process installation is refurbished with a new control system. How can the personnel be qualified for trouble-free start up?

Solutions to these questions require training systems that are usable independently from the real installation, but at the same time, reflect the real installation to a high degree.

The Concept of Training Simulators

For a user interface and control procedures that correspond to the real installation, the original control software is required. This is achieved relatively easily: The control software runs on the original hardware or on a cost-efficient PC.

Critical are the missing peripheral devices and the missing real installation. There, the reactions to control activities take place, device failures emerge, environmental conditions take effect, humans interact with the process and material is transformed.

Hence, a system is required that simulates the devices and relevant processes of the real installation. The simulated installation has to enable the control system to interact under realistic conditions.

Then operating and inspection activities take place under conditions very close to the situation at the real installations.

The following has to be ensured:

- The signal exchange of the simulated installation with the control system has to exactly correspond to that of the real installation.
- The fieldbus configuration in simulation has to be the same as in reality or it has to be replaced by an equivalent communication.
- The simulated installation has to react to control output in real-time.
- The behavior of the simulated installation corresponds to the behavior of the real installation.
- Operation scenarios and training procedures have to be easy to create and to activate.
- Disturbances, events of fault, as well as nominal operating conditions, have to be easy to provoke.

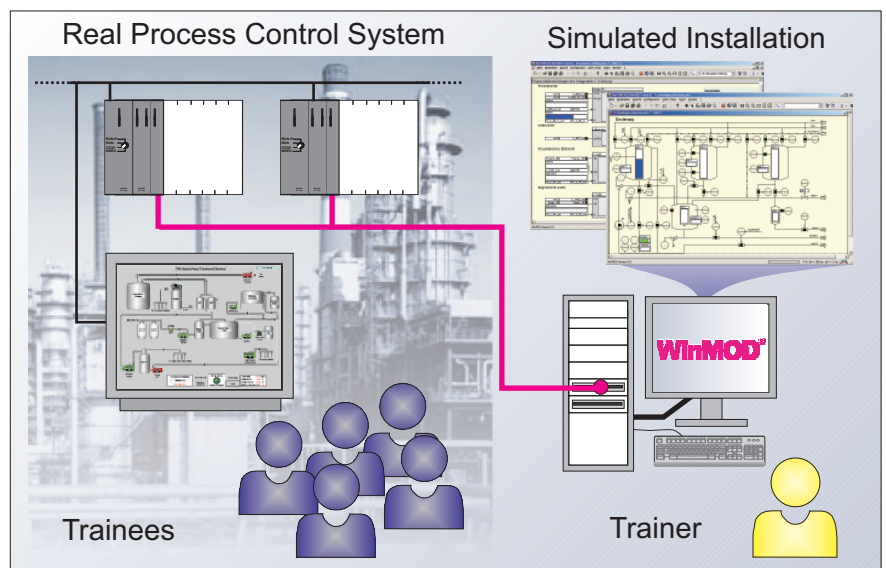


Fig. 1: The trainees at the control system are trained in scenarios that the trainer at WinMOD plays into the simulation of the installation.

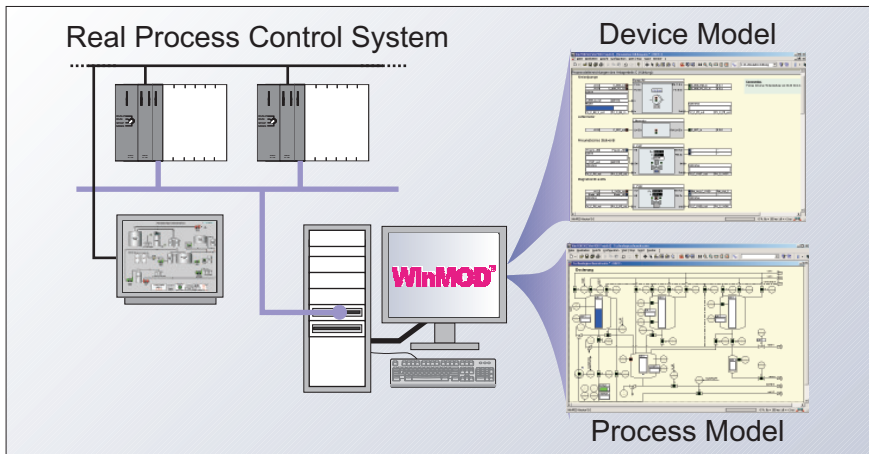


Fig. 2: The training system consists of the original control software that is connected by the original controller I/Os to the WinMOD-Simulation of the installation.

The Architecture of the Training System

Consequently, the training system has to consist of the control system for the installation and the simulation of the installation (Fig. 1). At the control system, the operating personnel is trained, while the trainer controls training scenarios at the simulated installation.

The WinMOD Simulation of the Installation

The system platform WinMOD exactly meets these requirements. A WinMOD system consists of a PC, the WinMOD Real-Time Simulation System and the coupling with the control system (Fig. 2).

From the perspective of the operating personnel, the behavior of the installation consists in reactions to operating activities and reactions to incidents in the installation. The behavior of the real installation originates from electronic and mechanic components and from the technological process. The simulation of the installation closes the control loop from the control outputs to the control inputs, and enables to provoke respective incidents in the simulated components.

Coupling the Control System with WinMOD

The signal list of the control system and the bus configuration are available in the engineering tool of the controller. These data are imported into

WinMOD where they are used to comfortably configure the connection to the control system.

After creation of the connection, online data exchange is established. Signal values can be observed and manipulated in WinMOD.

Device Models of the Installation

For each type of real bus module and device, a WinMOD component is configured. The inputs and outputs of the WinMOD components correspond exactly to the real components. Then, similarly to the construction of the real installation, the WinMOD Simulation is composed from WinMOD components and connected to the control system.

Further component inputs and control panels enable setting parameters. In this way the behavior of the components is manipulated during simulation and special operating conditions, fault situations, and so forth are induced.

This stage of simulation already enables, testing the control system.

The Process Model

Process behavior is modeled by process components that simulate physical effects like transmission, flow-rates, pressure, and so forth. Their signals are connected to the device components and to the control system. In this way control loops through the process are completed.

The level of detail and the simulation depth are optimized for the needs of

training. Similar to device models, process model are manipulated during simulation, in order to create operating conditions and scenarios.

WinMOD Training Scenarios

WinMOD provides a variety of visualization elements for clear and significant presentation. They enable to easily trace signals and to observe technological relations.

The WinMOD Recorder records signal progressions, that are plotted as charts and exported for documentation and further evaluation. This supports analyzing training sessions and operation procedures.

The WinMOD Force Machine playback training situations and scenarios that were previously recorded or edited. It enables to reproduce training scenarios systematically. The combination of WinMOD Recorder and Force Machine forms a powerful instrument to create and evaluate simulator training.

The Decisive Advantages

The realization of training simulators with original control software and WinMOD Simulation shows significant advantages:

- Training does not interfere with operation of the installation.
- Provoking critical situations harms neither personnel nor installation.
- Training is performed repetitively and is systematically evaluated.
- Using the real control software reduces efforts and costs.
- Real controller software ensures realistic behavior.

WinMOD provides strong support:

- WinMOD provides couplings to various control systems.
- WinMOD provides efficient modeling of devices and processes.
- WinMOD enables direct manipulation of the behavior of the simulated installation.
- WinMOD provides recording and evaluation of trainings.
- WinMOD allows easy creation and play-back of training situations.

This functionality of WinMOD already proved valuable in a variety of WinMOD applications.

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