OmegaLand

Omega Simulation Co.,Ltd.

Innovations for Plant Operations

Omega Simulation offers a highly accurate Operator Training System with a realistic feel, an environment for examining and verifying control methods, functions for plant optimization, energy saving designs and, for online operation support through the use of modeling and simulation technologies.

OmegaLand ...
is an Integrated Environment for Dynamic Simulation that enables creating a virtual plant on a computer environment. OmegaLand consists of independent modules which each have specific functions and offers an environment for the achievement of all sorts of objectives.

Multi-Purpose Modular Structure

Different functionalities are divided and arranged in independent modules, so as to provide a variety of combinations to meet the diversified needs of end users. Users can easily add other modules afterwards as required.

Highly Accurate and Fast Simulation

The plant simulator Visual Modeler is the core technology of OmegaLand. It features rigorous models, can handle large processes on a plant level, and can perform high-speed simulations.

Open Interface

Data exchangeability between various programs allows both the effective use of data and the realization of multiple functions. An interface to connect modules is exported and a development kit is provided so as to enable users to create modules for OmegaLand.

Functional Modules of OmegaLand

OmegaLand, offers a varerity of functional modules, using the plant simulator Visual Modeler as its core module. Each module has a specific function, and VMspace is a software control bus configured to exchange data between these modules or to communicate information with a control system.

Visual Modeler – Plant Model Module

A plant simulator which is the core technology of OmegaLand.

PHY – Physical Property Calculation Module

Provides physical property data and physical property calculation functions for Visual Modeler.

EXEC – Execution Control Module

Controls the entire execution of OmegaLand, administers its modules and data used by them. In other words, EXEC plays the role of the central command module of OmegaLand.

DB – Database Module

Provides a tag database function usable in real-time. It can store recorded data of a process model, process data by calculating functions, and register and edit tags in a spread sheet format.

GRAPHIC – Graphic Module

Provides a GUI (Graphical User Interface) that an end user can operate directly. Faithful simulations of PCS operation monitoring windows and of field operation can be created to convey the impression that a real plant is being operated. GRAPHIC is based on the CENTUM VP Graphic Function, a product of Yokogawa Electric Corporation.

AUTO – Automatic Operation Module

Provides a function to automate the execution of the simulation. The execution of the same operations can be repeated accurately for the purpose of verifying operations. Including this module into the training system also allows automatically executing training scenarios in which malfunctions occur.

EVAL – Replay Evaluation Module

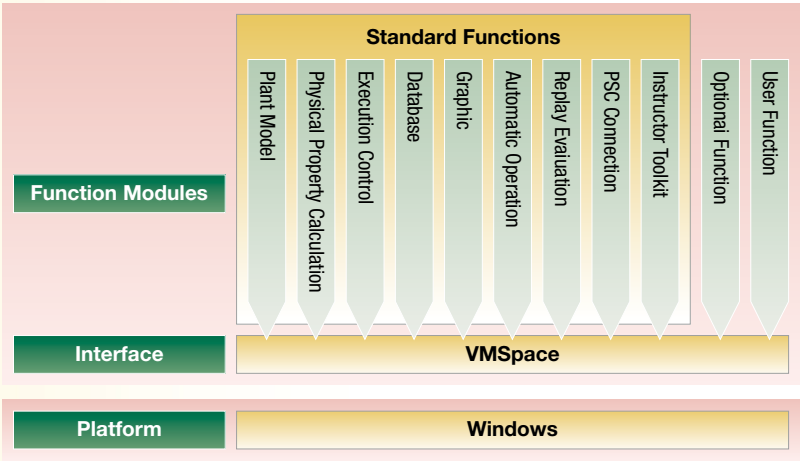
Logs operating information and events during the operator training and faithfully reproduces executed simulation. It also provides logged data that are useful for evaluating the training.

PCS - Process Control System Communication Module

Provides functions for connecting a PCS (including DCS), thus allowing to construct an operator training simulator that recreates the atmosphere of an actual plant. It is also usable for verification of PCS control logic for real operation.

ITK – Instructor Toolkit Module

Provides a graphical user interface for instructors to control the activation and monitoring of an operator training system.



Operator Training Simulator

The principal application of OmegaLand is building Operator Training Simulators (OTS).
By making use of a realistic plant-like operational environment, operators can be trained to perform a variety of plant operations. Training operators with an OTS is an effective means of helping them learn how to deal with unsteady state conditions and improve their operation skills.

Training Type

Operation training can be can be divided into two categories according to corresponding events: training for “planned events” which involve pre-planned operations, or for “unplanned events” which occur in abnormal circumstances. Furthermore training procedures can also be classified “normal operations” which are performed in normal operating conditions, and “exceptional operations” which are not performed under normal conditions.
It is possible to perform any of these types of training by combining the functional modules of OmegaLand.

	Planned Events	Unplanned Events
Normal Operations (Steady State Operations)	Training for normal conditions	Training for abnormal conditions (malfunctions)
Exceptional Operations (Transient Operations)	Training for transient conditions	Training for emergencies

● Training for Normal Conditions

Training for normal operating conditions consists in training for continuous operations, such as load changes, equipment changes, and grade switching (such as, for instance, in polymer plants).

● Training for Abnormal Conditions

Abnormal process conditions and instrument and equipment failures are called malfunctions. In the simulator, it is easy to deliberately cause malfunctions, so as to perform training for abnormal conditions. Troubles (abnormal conditions) that have occurred in the past at a plant can be reproduced on a simulator to transmit knowledge on safe operation practices.

● Training for Transient Conditions

This consist in training for starting a continuous process from the stopped state and bringing it to a steady state operating condition (start-up), or conversely bringing the process from a steady state operating condition to the stopped state (shutdown). Recently, as plant downtime for repairs and maintenance is seen to be decreasing, opportunities for actually performing these operations have declined. Therefore, they are increasingly rehearsed by using a simulator beforehand.

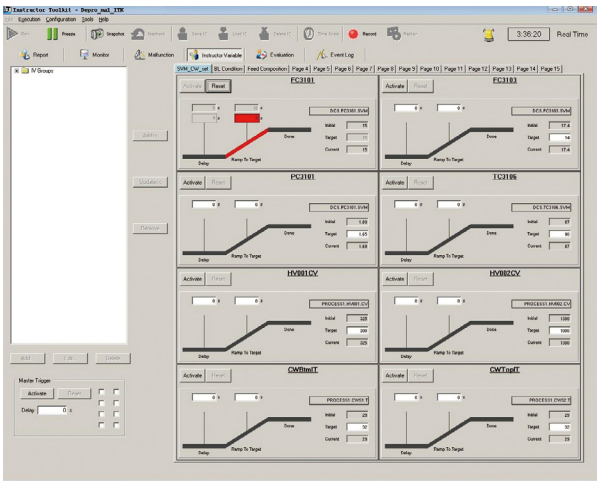
● Training for Emergencies

This consists in training for reacting to outages in utility supplies (such as steam, cooling water, or electricity) or to problems in another plant which is closely related to the plant being operated.

Functions for Instructors

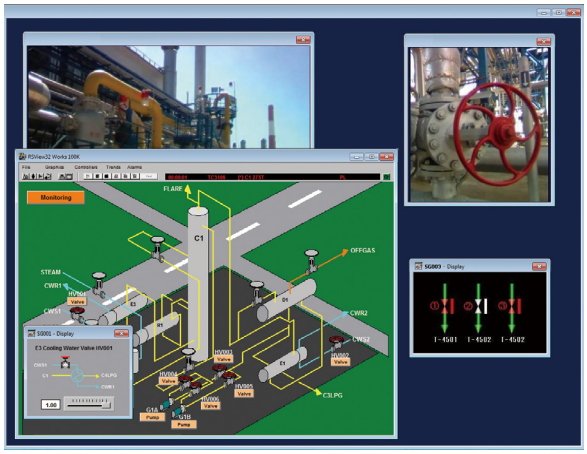
An Operator Training Simulator is also required to support various functions for instructors. These functions are included in the Instructor Tool Kit (ITK) module of OmegaLand.
ITK provides the following functions to help instructors have an overview of training status, customize training scenarios, monitor the trainees' progress, and evaluate and report the training results.

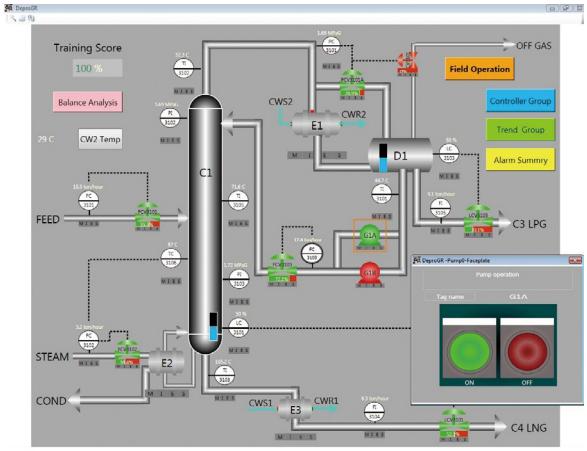
- Scenario Function
- Monitor Function
- Malfunction Function
- Instructor Variable Function
- Evaluation Function
- Record and Replay Function
- Report Function

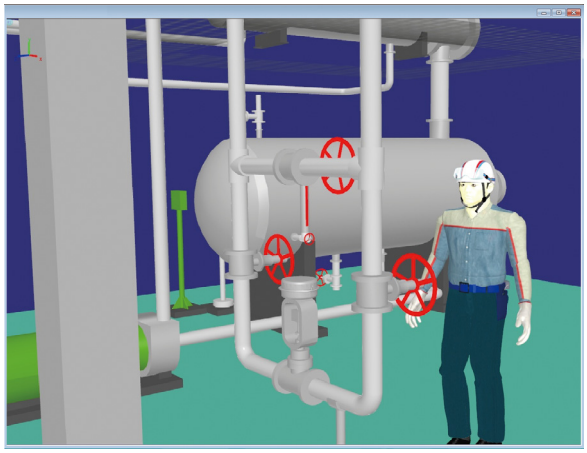


Operation Display

In order to make the training experience more realistic, graphic capabilities can be enhanced by use of screens for emulating field operations, and DCS screen emulations.





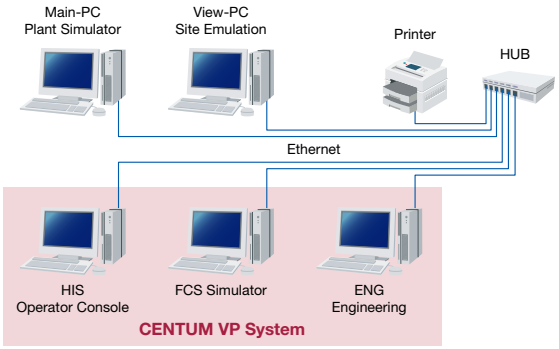


System Configuration

There are two types of configurations that that OmegaLand can support for the realization of an OTS: a type that uses a connection with an actual DCS, or a type that emulates DCS screens and DCS control logic.

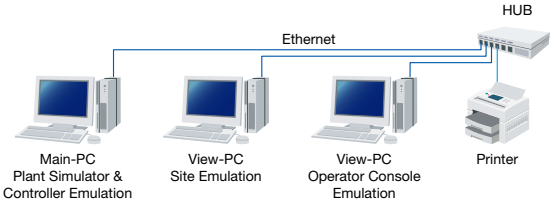
● DCS Connection Type

By using the same control logic and control parameter values, and by having the operator use the same DCS operator consoles as on the plant site, this type of configuration allows realizing a operational environment which is as close as possible to an actual plant.
On the right, is an example of a connection configuration using the CENTUM VP DCS product manufactured by Yokogawa Electric Corp.



● DCS Emulation Type

The DCS operator console can also be emulated by using the graphical functions of OmegaLand, and by modeling the control logic in the plant simulator model. This type of configuration has the merit of being more compact.

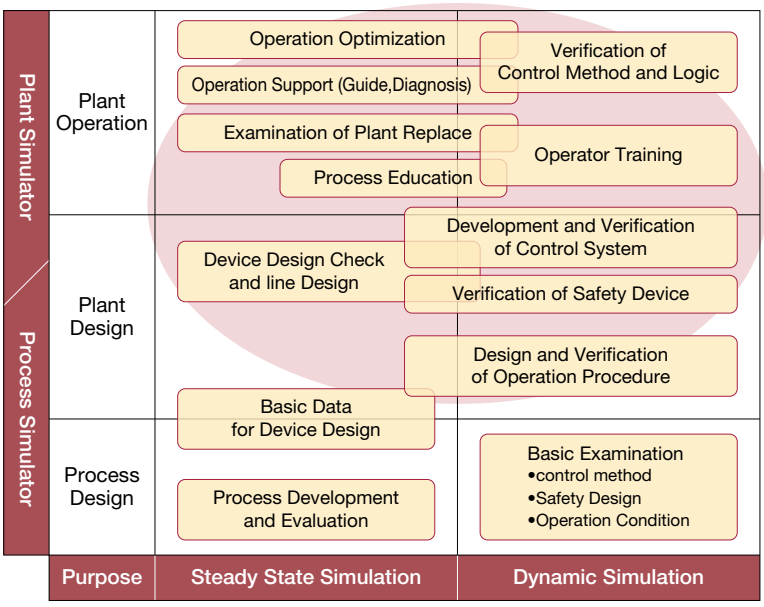


Applications of OmegaLand

A virtual plant constructed by the plant simulator presents an environment that is similar to real plant operation. The virtual plant can be applied to a number of different situations other than OTS.

Fields of Application of Plant Simulators

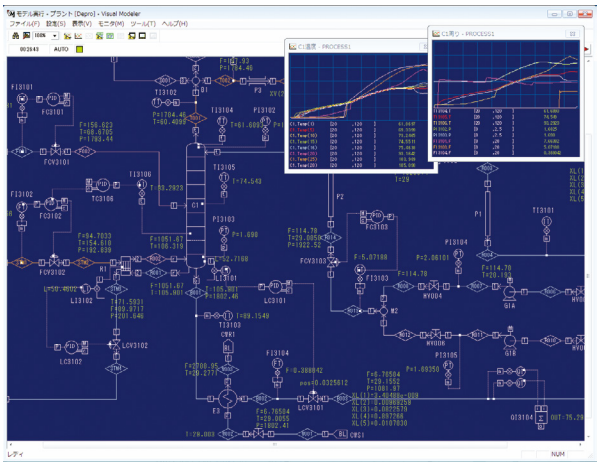
Plant simulators designed for operator training cover the area included in the oval in the figure below. Possible applications include "Process Analysis and Examination", "Chemical Process Education", and "Control Assistant".



Process Analysis and Examination

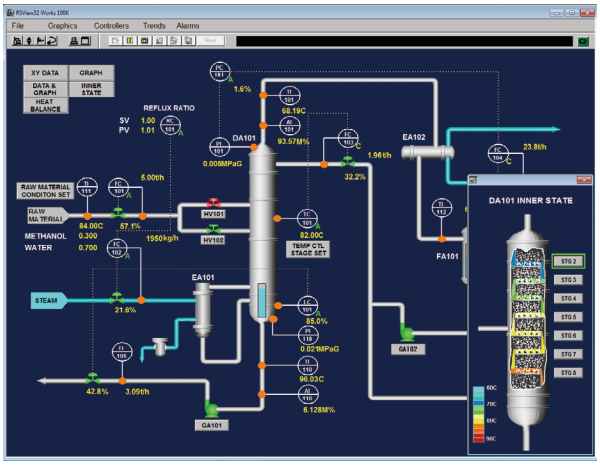
It is possible to carry out dynamic analyses and examinations of processes and control systems that take plant operations into account.
The followings items can be examined by a virtual plant prior to actual operation.

- **Operating procedures for startup and shutdown of a new plant can be verified prior to the actual plant operation.**
- **Prior to remodeling lines and equipment, limitations and capacity can be evaluated.**
- **Advance feasibility studies can be performed when operating conditions including feed composition, operation load, and equipment are to be changed.**
- **Changes in control systems can be examined, and control systems can be tuned.**



Chemical Process Education

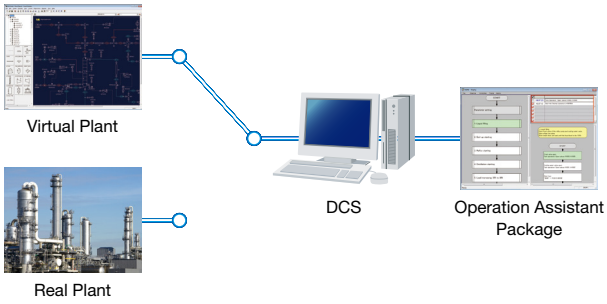
A virtual plant can enable engineers or operator-trainees to acquire analytical abilities and capabilities to complement their education on chemical processes which is otherwise only typically acquired through classroom lectures and exercises.
Operating a realistic control system and graphically monitoring the behavior of a virtual plant will help trainees not only to master the basic knowledge of chemical engineering and grasp the principles of process engineering, but also to deepen their understanding of processes, control systems, and operating variables.
In addition, knowledge acquisition can be improved by taking advantage of the features unique to a plant simulator, such as being able to verify the inner conditions of equipment.



Control Assistant

If a control assistant software package is connected to a virtual plant, a control model of the software can be developed and the controllability of the plant can be verified in advance. Tuning can be done sufficiently from the virtual plant without causing disturbances on the real plant, and the reliability of the control system can be considerably increased.

With an operation improvement package that automates transient operations such as grade or line changing, operation procedures can be developed and verified for various situations.
Moreover, for advanced control packages using features such as multivariable model prediction control or neural networks, it is possible carry out the evaluation of introduction effects, the selection of appropriate introduction points, and the creation of control models.



Operating Environment

Hardware

- **Windows compatible PC**
  RAM 2GB or higher
- **Monitor**
  1280 x 1024 resolution recommended
- **Hard disk**
  Greater than 1GB usable space
- **CD-ROM drive, Keyboad, and Mouse**
- **Sound board and speaker**
  (Required to use sound functions of GRAPHIC)
- **LAN board**
  (Required to run on multiple personal computers)

Software

- **Windows OS**
  Microsoft Windows 7 Professional (32bit/64bit)
  Microsoft Windows 8.1 Pro (64bit)
  Microsoft Windows Server 2008 R2
  Microsoft Windows Server 2012 R2
- **Visual C++**
  Microsoft Visual C++ 2005/2008/2010/2012/2013
  (Required for Visual Modeler)
- **Excel**
  Microsoft Office Excel 2007/2010/2013
  (Required for GRAPHIC/EVAL/ITK)

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