SIMATIC HMI operator control and monitoring systems

Introduction

Overview

SIMATIC HMI operator control and monitoring systems – efficient machine-level operator control and monitoring

Equipment for monitoring and operator control is needed wherever people have to work with or on machinery and plants performing diverse tasks from cylinder driers to waste compactors.

It is not difficult to find the right device for your specific task. The challenge is to find a solution that is future-proof and flexible, that can be integrated into higher-level networks, and that can also meet the ever-increasing demands for transparency and data provision.

SIMATIC HMI Panels have proven their value in a variety of different applications in all industrial sectors over many years. The range of the systems in use is just as wide as that of the applications and technologies in the respective plants.

SIMATIC HMI stands for highly efficient machine-level operator control and monitoring and has some unique advantages:

- Efficient engineering
  Visualization can be created more quickly and easily than ever before.
- Innovative design and operation
  Visualization becomes the outstanding feature of the machine.
- Brilliant HMI operator panels
  The right operator panel for every application.
- Backup – with security
  Protection for investments and know-how, secure operation.
- Commissioning in the fast lane
  Lose no time with testing and servicing.
- Openness with PC-based
  For flexible, independent applications

http://www.siemens.com/hmi

SIMATIC HMI software – a lot more than just visualization software

With the SIMATIC WinCC (TIA Portal), SIMATIC WinCC and SIMATIC WinCC Open Architecture product families, SIMATIC HMI covers the entire engineering and visualization software spectrum for the human machine interface.

- Almost the entire range of SIMATIC operator panels can be configured with SIMATIC WinCC (TIA Portal), the successor to SIMATIC WinCC flexible. The functionality covers both visualization tasks at machine level and SCADA applications on PC-based multi-user systems.
- The current version 7.4 of SIMATIC WinCC is available for extremely complex process visualization tasks and SCADA applications, e.g. taking account of redundant solutions and vertical integration all the way to plant intelligence solutions.
- Ultimately, SIMATIC WinCC Open Architecture addresses applications that require extensive customer-specific adaptations or manage large and/or complex applications, as well as projects that demand special system requirements and functions.

http://www.siemens.com/hmi-software

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Overview (continued)

SIMATIC HMI – brilliant and rugged operator panel

Basic HMI – for the entry level
- Key Panels
  Pre-assembled and ready for installation, for conventional operator panels. No configuration required with WinCC!
  http://www.siemens.com/key-panels
- Basic Panels
  The entry level series for simple HMI applications.
  http://www.siemens.com/basic-panels

Panel-based HMI Advanced - for more sophistication
- Comfort Panels
  High-end functionality for demanding indoor and outdoor HMI applications.
  http://www.siemens.com/comfort-panels
- Mobile Panels
  Portable HMI operator panels for mobile deployment on site.
  http://www.siemens.com/mobile-panels

Individual HMI devices in customized versions
http://www.siemens.com/customized-automation
SIMATIC HMI operator control and monitoring systems

Application examples

Overview
Control system optimizes the productivity of a hot dip galvanizing plant

Control room

As semi-finished products, galvanized steel sheets play a key role in industrial production, such as car manufacturing. One proven method of protecting steel sheets from rust is the application of a zinc coating in a hot dip galvanizing process, in which strips of sheet steel are drawn through a bath containing liquid zinc. Plants for this process are complex and in continuous operation, thus placing high demands on the process control system and the hardware used.

Advantages of the SIMATIC SCADA system and SIMATIC IPC solution:
- SIMATIC WinCC V7 SCADA control system whose scalability and openness also permits the implementation of future functional expansions.
- Redundant setup of the control system and operating stations with industry-compatible SIMATIC industrial PCs and Thin Clients.
- Optimum overview thanks to multi-monitor solution in the control room and more than 27 operating stations throughout the plant and production hall.
- Availability of the production data over a long period in SIMATIC Process Historian for reasons of traceability.
- Increased productivity using long-term analyses of plant availability, productivity, energy consumption and quality.
- More effective support and shorter downtimes thanks to fast, web-based access to plants with the SIMATIC WinCC WebNavigator.
Overview

Modernization of a plant in the food and beverage industry on the basis of an integrated automation and visualization solution

The modernization involved equipping 3 production lines with an expanded SCADA system, a new control architecture, converters and motor starters.

The project was implemented smoothly, and the integrated hardware and software solution with the TIA Portal enabled the simplification of the engineering process.

Advantages of the solution with the SIMATIC SCADA system WinCC Professional in the TIA Portal, S7-1500 and SIMATIC IPC:
- Simplified application engineering
- Efficient monitoring of the production lines enables the optimal path through the production to be defined for each batch.
- Increased productivity
- Simple and intuitive operation implemented thanks to good visual support
- Better control of the motors involved with the process
- Integration of the production data into the existing ERP system
- Faults in the current process can be easily localized

Tunnel control system for the longest railway tunnel in the world

The SIMATIC WinCC Open Architecture tunnel control system is at the heart of the monitoring systems for the entire tunnel infrastructure. Continuous availability of the entire system is essential to ensure the trouble-free operation of the Gotthard Base Tunnel.

The Gotthard Base Tunnel has a tunnel control center at the south and north portals. The two tunnel control systems installed there monitor and control all of the installed systems and plants. All the required data are acquired, collated and visualized on the tunnel control system. A fully integrated maintenance management tool and an operations control system are also part of the tunnel control system with a large screen display.

The advantages of the solution:
- Highest failure safety thanks to the presence of doubly redundant tunnel control equipment – Disaster Recovery System (2x2 redundancy)
- Central monitoring of the infrastructure simplifies fault management
- More efficient operation through central control of the entire infrastructure
- Integration of many (sub-)systems thanks to OPC UA as a standardized interface throughout the entire project
- Optimal user friendliness through uniform user interface across all plants, overview of all systems at one workstation as well as large screen display (multi-monitor management)
PC-based Automation

Introduction

Overview

SIMATIC PC-based Automation
http://www.siemens.com/pc-based

Industrial IoT Gateway - SIMATIC IOT2000
An intelligent gateway which harmonizes communication between the various sources of data before analyzing it and forwarding it to the corresponding recipients. An easy-to-implement solution.
http://siemens.com/iot2000

Industrial PCs
Our reliable and innovative industrial PCs are the optimal PC hardware platform for PC-based Automation from Siemens.
- Rack PC
- Box PC
- Panel PC
- Tablet PC
- Industrial monitors and thin clients
- Devices for special requirements
  - Fully-enclosed IP65 devices
  - Devices with stainless steel fronts
  - Devices for hazardous areas
- IPC software
- Embedded bundles/software packages
http://www.siemens.com/simatic-ipc

Software controller
The SIMATIC S7-1500 Software Controller implements a SIMATIC S7-1500 controller on SIMATIC IPC. It is particularly suitable for control solutions in special-purpose machine manufacturing which involve a high-performance implementation of complex control tasks, the integration of PC applications, or the realization of multiple tasks on a single device.

PC-based controllers
PC-based controllers combine the functions of a PC-based software controller with visualization, PC applications and central I/Os (inputs/outputs) in a single, compact device.

The SIMATIC ET 200SP Open Controller is an industrial PC with the design of the ET 200SP I/O system and a pre-installed S7-1500 Software Controller.
http://www.siemens.com/open-controller
Overview (continued)

Innovative PC-based solution with safety for solar panel production

For a new plant for the production of solar panels, the existing highly heterogeneous concept is to be replaced by a new, state-of-the-art automation solution which can cover the comprehensive demands in a compact and integrated way.

There are increased performance and memory requirements due to the increased complexity of the system.

The PLC should also be able to provide the specified safety functions (emergency stop, access protection to hazardous areas).

Various bus systems must be linked in plant 3. Also a customer-specific Windows application is to be used on the selected systems and therefore the connection to a higher-level MES system has to be implemented. The system should be designed for high throughput and three-shift operation.

The advantages of the solution with SIMATIC PC-based Automation:

- Thanks to its openness (Open Development Kit), S7-1500 Software Controller / WinAC RTX on the host SCADA industrial PC offers the possibility for integrating a Windows customer application with very little effort, and is thus used as a data concentrator (process quality/diagnostic data), and communication with the host MES system is also implemented in combination with WinCC (SCADA).
- Industry-standard products from the SIMATIC range offer maximum quality for 24/7 round the clock operation.

Safe transfer at sea

For transferring persons at sea to wind energy plants or oil platforms, a Dutch company has developed a six-legged platform on hydraulic cylinders.

This platform is basically an upside-down flight simulator, and allows safe transfer from a ship even in bad weather.

The advantages of the solution with SIMATIC PC-based Automation:

- Fault-tolerant SIMATIC S7-400H in redundant design for general control tasks
- Two lower-level SIMATIC S7 Modular Embedded Controllers which meet the requirements for high speeds, integration of fast I/O cards, and a flexible, modular and rugged design.
- An integrated programming environment with SIMATIC STEP 7
- Automation products from Siemens comply with the stringent requirements of the offshore sector
**Unit-type cogeneration unit**

When redesigning unit-type cogeneration units, the automation approach should also be restructured.

The objective was to execute all control, visualization and archiving tasks which were previously handled by a PLC and a PC on a compact unit. Space was to be saved in the control cabinet, and the administration and training requirements reduced.

At the same time a rugged, maintenance-free device was required which can also be easily connected over the Internet.

The advantages of the solution with SIMATIC PC-based Automation:
- **Microbox PC as a rugged, compact embedded system**
- Control, visualization and archiving of the process parameters in one device
- Space and cost savings thanks to integration of several tasks on a single embedded industrial PC
  Previously: one PLC and one visualization PC
- Easy and quick access to the embedded IPC over the Internet

**Measurement of foil thickness**

During the manufacture of plastic foils, a highly accurate and uniform foil thickness over the entire width is a decisive quality criterion. For this purpose, a measuring head with radioactive source moves back and forth above the foil and perpendicular to the continuously transported reel, and a sensor moves underneath the foil.

From the attenuation of the radiation, the foil thickness can be determined exactly at each position by extensive mathematical calculations, and deviations from the reference thickness can be compensated.

The advantages of the solution with SIMATIC PC-based Automation:
- Visualization is performed using WinCC, and control using WinAC RTX on a PC.
- Complex mathematical algorithms are required for evaluation of the extensive measured data.
- These are meaningfully implemented in the high-level language C++. Seamless and high-performance integration of these algorithms into the STEP 7 program is via the ODK (Open Development Kit).
- Data exchange between WinAC RTX and WinCC, for visualization of the extensive measured curves, takes place very quickly via the hard drive cache. This functionality was also implemented via the ODK.
- Interconnection of the standardized technology function is via CFC (Continuous Function Chart).
Overview (continued)

PC-based machine data acquisition optimizes the production of farming machinery

To introduce more efficient, resource-saving and therefore cost-effective production processes in the factory, a leading farming machinery manufacturer has integrated a central, plant-wide machine data acquisition system using Panel PCs.

Due to the need for retrofitting in the existing environment, flexible and space-saving installation of the Panel PCs was paramount.

More than 200 fully enclosed SIMATIC IPC477 PRO Panel PCs for central machine data acquisition, with communications interfacing to the production machinery and the production planning computer. Mounting of the Panel PCs directly at the machine without additional control boxes on stand-alone columns.

The advantages of the solution with SIMATIC PC-based Automation:
- Enhanced efficiency by optimizing the complete production organization through a high degree of uniformity.
- Minimized use of resources (less paper is required in production).
- Simple, low-cost retrofitting of the Panel PC directly in production on a stand, without the installation of an additional operator console.

PC-based control in automotive test rigs

Test rigs in the automotive industry require trouble-free operation and high quality.

A high-performance system is required in the control, processing, archiving and visualization of measured data which can also provide openness and flexibility for connection to different bus systems and for the use of software.

The advantages of the solution with SIMATIC PC-based Automation:
- Flexible, easy-to-service and maintenance-friendly system with Windows in conjunction with CPU 1500S Software Controllers.
- Reduction in integration overhead thanks to integral interfaces such as PROFINET, PROFIBUS, Ethernet, CAN, and the flexibility provided when using modules for different bus systems, e.g. PCIe/104.
- System availability concept ensures round-the-clock operation and reduced downtime costs.
- Fan-free, temperature-resistant operation up to 60 °C saves additional cooling measures.
- High investment security through long-term availability of the components.

The plant concept
PC-based Automation

Introduction

Overview (continued)

PC-based control in the semiconductor industry

In the semiconductor industry, high quality and fault-free operation round-the-clock are decisive criteria. A high-performance system that guarantees fast and precise production of the semiconductors is required for controlling the machines, monitoring the production system, and processing the production data.

High flexibility and openness are also required for connecting to the production control system and machine engineering system.

The advantages of the solution with SIMATIC PC-based Automation:

- Compact, rugged industrial PCs with powerful processors and the latest technology enable high processing performance.
- Pre-installed systems save time and costs when integrated into the overall system.
- WinCC ToolLink-EDA (Equipment Data Acquisition) enables diagnostics of process and machine data in real time.
- System availability concept with integral RAID1 functionality and remote monitoring with SIMATIC IPC DiagMonitor ensures fault-free 24-hour operation.
- High investment security through long-term availability of the components.
- International certification and worldwide support makes global use possible.

Track & trace line controller for tobacco industry

In order to comply with new legal regulations, a track & trace system in an existing plant has been extended.

The requirement is to test 100 cartons per minute in three-shift operation and to save the data in an SQL database for traceability reasons.

The automation system should be characterized by high ruggedness, but also offer the openness required to connect additional components such as printers and the Machine Vision system.

The advantages of the solution with SIMATIC PC-based Automation:

- Compact automation solution consisting of Microbox PC embedded industrial PC, PLC with preinstalled and ready-to-use PLC software and visualization with WinCC
- Control of the entire track & trace system and interfacing to the control system.
- Open solution with the help of the WinAC ODK (Open Development Kit) thanks to a link to an SQL database for managing the serial numbers and other data.
- Additional openness and flexibility by connecting printers and vision system.

The plant concept
Overview (continued)

Retrofit of a woodworking machine – safe!

In the past, machines and plants for wood-working were equipped with specially developed, proprietary controllers. Today, future-oriented standard components are used for retrofit projects.

The customer decided in favor of integrating standard automation and safety technology in a single unit with the SIMATIC WinAC RTX F software controller in a fan-free and maintenance-free IPC, the Microbox PC.

PROFNET as an innovative fieldbus connects distributed I/O, safety and operator panels quickly and easily.

The advantages of the solution with SIMATIC PC-based Automation:

- The compact PC-based automation solution multiplies the performance and precision of the plant.
- Implementation of PROFINET resulted in a series of additional advantages such as the diagnostics capability.
- Integration of standard and fail-safe automation in a single unit achieved component savings. The size of the cabinet was reduced by 20 percent and the wiring by 50 percent. The customer benefited from a high level of operating convenience and minimized machine downtimes.

Image processing with data backup

In image processing applications, high performance computers are required due to the large volume of data to be processed. The image data must be recorded, processed and saved quickly.

Frame grabber cards with a high data throughput, for example, are used for recording image data. The interfaces for the expansion cards must not become bottle-necks in this case. To ensure continued problem-free processing of the acquired data, you need a state-of-the-art system with up-to-date processor and memory technology.

Lots of data is produced again during the subsequent data backup. Thus the available storage medium must be fast and fail-safe at the same time. An open system is required for connecting to existing plants.

The advantages of the solution with SIMATIC PC-based Automation:

- Rugged SIMATIC PC with state-of-the-art processor performance and the latest technology.
- Current interfaces such as PCI Express for applications with a high data throughput rate, e.g. frame grabber cards for recording image data.
- Visualization on up to two monitors with an optional, high-performance graphics card.
- Onboard communication interfaces such as Ethernet and PROFINET, e.g. for connecting to EPS systems or integration in existing systems.
- International certifications and global support facilitate the worldwide use of the image processing solution.
PC-based Automation

Introduction

Overview (continued)

High-performance industrial PC for reliable control and monitoring of wind power plants

All Siemens turbines for offshore wind power plants feature special technical characteristics that ensure long-term, low-maintenance operation.

In contrast to sites on land, offshore wind farms are not always accessible to service teams. The basic quality requirements and standards for all components used in terms of absolute fail-safety and reliability, are therefore extremely high.

The SIMATIC Box PC of the 627 series that has been implemented matches the requirements of the solution provider all the way down the line. The rugged industrial PC is designed for 24-hour continuous duty at ambient temperatures up to 55 °C.

For reliable operation, the Box PC is installed in a solid metal enclosure that is resistant to shock and vibration and that demonstrates a high degree of electromagnetic compatibility (EMC). For a high level of data security, the option of a mirror disk system with two hard disks (RAID1) was selected. The RAID1 controller is already onboard, and does not occupy a PCI slot.

The rugged, reliable hardware with extremely compact dimensions in durable industrial design also stands up to the demands of continuous operation in a harsh environment.

The advantages of the solution with SIMATIC PC-based Automation:

- The mounting dimensions of Box PCs remain identical over several device generations and mounting solutions can be simply reused for the next generation.
- Furthermore, when a new device generation is used, any front-accessible interfaces and function elements can be retained. For example, the Siemens Wind division already utilized a complete lifecycle of a Box PC generation and no adjustments to a new hardware platform were required when the successor product was introduced.
- Through compliance with international standards, such as CE and UL, and worldwide service, the Box PC can be implemented round the globe.