# SIEMENS

## SIMATIC HMI

## WinCC V7.2
## SIMATIC HMI WinCC V7.2 System description

System Manual

Printout of the Online Help

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|---|---|
| SIMATIC WinCC System Overview | **1** |
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# Legal information

## Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

| ⚠ DANGER |
| --- |
| indicates that death or severe personal injury **will** result if proper precautions are not taken. |

| ⚠ WARNING |
| --- |
| indicates that death or severe personal injury **may** result if proper precautions are not taken. |

| ⚠ CAUTION |
| --- |
| indicates that minor personal injury can result if proper precautions are not taken. |

| NOTICE |
| --- |
| indicates that property damage can result if proper precautions are not taken. |

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

## Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

## Proper use of Siemens products

Note the following:

| ⚠ WARNING |
| --- |
| Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed. |

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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# SIMATIC WinCC System Overview 1

## 1.1 Your guide to WinCC

### What is a system description?

This system description is an **extremely compact** version of the **technical documentation** for WinCC.

### Who should read this publication?

The system description is intended for decision-makers and configuring engineers who want an **overview of all functions**, the look and feel, and the compatibility of WinCC.

### How is this system description structured?

This document speaks your language. Your requirements for an automation system are defined in the "Introduction" chapter and condensed into **customer-oriented** keywords in the "Highlights" chapter. The rest of the document is then **structured** according to these keywords.

Each **chapter**, for example, "Investment protection", documents a specific **range of solutions** offered by Siemens AG and the superior **functionality of WinCC**, which is based on Microsoft SQL Server technology and Microsoft Windows standards. Customer benefits and functions are highlighted in **bold**. The chapters have a **uniform structure**: Each presents a **definition** followed by the **application** demonstrating the advantages of WinCC for the customer. A list of **special features** follows a section detailing the **structure** of the defined concept.

**Cross-references** introduced by "See..." provide contextual links between the various sections. The chapters entitled "Highlights", "Scalable product range", Plant Intelligence", and "Efficiency/overview" provide an **overview** of WinCC.

**Specific steps** 1, 2, etc. under **Procedure** show you how easy it is to configure with SIMATIC WinCC, whether you want to interface third-party components in the **OPC browsers**; create an integrated configuration in **SIMATIC Manager**; set up an integrated communication network in the **plant-wide Tag Selection dialog**; publish your configuration on an intranet or the Internet using **WebPublisher**; select tags, WinCC servers, or Web servers in the **directory tree**; perform central **linking** of tags, functions, process pictures, or ActiveX controls at their **places of use**; or when using the many **WinCC wizards**, which take care of much of the configuration work for you.

By customizing the **WinCC wizards** to suit your individual needs, you can **automate your configuration**. This is particularly useful for wiring the interfaces of any **faceplates** you have developed yourself. You can **expand the functionality** of faceplates in an object-oriented manner at a later time. This will **automatically** update thousands of places where objects are used.

Linking function, faceplates, libraries, picture levels, dynamic display, mass configuration, online configuration, tag simulator, global script: This is **state-of-the-art** configuration in Tag Management, in the message system, in the archive system, etc.

Discover the possibilities of your new process visualization software – you will be convinced by the sophisticated **functionality**, **ease-of-use**, and **high performance** of WinCC.

Your SIMATIC product marketing and technical documentation team hopes you will enjoy learning more about WinCC. If you have any questions, please contact:

Siemens Technical Support:

Phone: +49 (911) 895-72 22

URL: http://support.automation.siemens.com/WW/view/en/16605032

# 1.2 Introduction

## 1.2.1 Requirements

### Machines

Machine manufacturers supply machines to global markets with the utmost precision and flexibility. To maintain global competitiveness, **time-to-market** and **machine cost** are critical. Manufacturers score points with end customers with their **productivity** and **manufacturing quality**. Automobile manufacturers rely on **customized** manufacturing **solutions** that are based on established **standards**. Such standards are contrasted by **manufacturer-specific expansions** infused with **industry- and application-specific know-how**.

A wide range of **consumer requirements** that are **changing with increased frequency** presents new challenges for the machine-manufacturing industry. Customers want **compact**, **low-maintenance**, **flexible** machines for cost-effective manufacturing even on a small scale, combined with the ability to **network** individual machines to create entire plants that can be **easily commissioned**.

### Plants

The advantage of automated plants for plant operators is that they ensure consistent **quality** and **productivity**; however, this requires **operational safety** and **availability** of the plant and its components, especially in critical production and process situations.

Today, saving **time** is a primary objective: less **downtime**, shorter **setup times**, faster **production cycles**, and better **material and information flows** are the keys to **increased productivity**, especially in highly automated industries:

- In the engineering phase
- During installation
- During production
- During maintenance
- Whenever servicing is required

When highly automated processes are implemented in all industries, this results in more efficient production, thus saving **resources** and minimizing the **environmental impact**. Optimized automation with Plant Intelligence and an intelligent, predictive maintenance concept reduces dangerous $CO_2$**emissions** and makes it possible for products to earn a **climate certificate**.
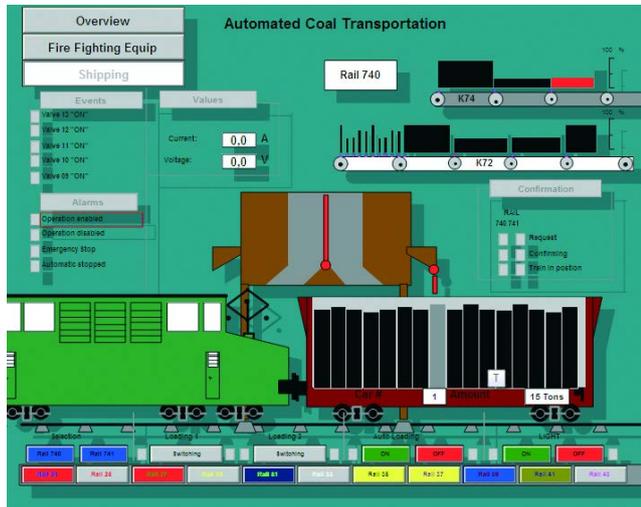


Figure 1-1    SIMATIC automates rail transportation

**Individual customer requirements**, **multifaceted** products with short life spans, and stringent **quality requirements** including complete **traceability** of each batch are factors that affect plants as well as machines. This requires a customized, **flexible** approach to automation that takes into account the need to maintain favorable cost parameters and remains **open** toward existing solutions and customer preferences, while at the same time achieving the objective of enabling the automation solution to be **expanded** as required.

Regulations, legal requirements, and more stringent quality and hygiene standards all have an impact on plants in the pharmaceutical industry, as well as the food, beverage, and tobacco industries, due to the high costs involved in **validating** such plants according to EU guidelines or the regulations of the Food and Drug Administration (**FDA**), for example.

The **demands** on industry are many and varied:

- Reduce downtime

- Optimize production cycles

- Acquire quality and process data

- Analyze and evaluate process data for optimal results

- Support "Good Manufacturing Practice"

- Optimize the production processes

- Synchronize the flow of materials, goods, and information across sectors

The production process is generating more and more **data**, which must be **integrated** into the IT infrastructure and the production level and corporate management level (Manufacturing Execution System MES and Enterprise Resource Planning ERP).

In most industries, all these demands necessarily call for a **holistic system perspective**, an **integrated view** of machines and plants in the following dimensions:

- Scalability and expandability

- Efficiency and productivity

- Security and availability

- Quality and traceability

- Openness and integration

## 1.2.2  The integrated solution: SIMATIC WinCC

### Integrated, scalable operator control and monitoring

SIMATIC WinCC is an HMI software program for the **operator control and monitoring** of automated processes in the machine-manufacturing and plant-engineering industries. This **scalable** engineering and runtime software enables **integrated** configuration, from the powerful single-user-system industrial PC to the open client-server multi-user system, including use of an intranet or the Internet.

Programmable controllers are continuously exposed to external influences such as vibration, cold, dust, heat, moisture, and even operation faults. SIMATIC industrial PCs have proven themselves time and again in the manufacturing industry. The fast-developing PC-based operator control stations, for example, SIMATIC IPC, also provide a high degree of **robustness** and **availability** due to their resistance to adverse influences such as shock and vibration.

Modern automation systems require **engineering software** that can handle the tough requirements they present. SIMATIC WinCC is a **visualization system** that can be customized according to price and performance. It has a proven track record on the market and comes with powerful features, an intuitive user interface, and easy-to-use configuration functions. SIMATIC WinCC is also the visualization component of the SIMATIC PCS 7 process control system.

## Trendsetter with innovative concepts

WinCC stands for Windows Control Center, meaning that it provides you with all the features and options of a standard Windows environment. Thus, WinCC systematically builds on standards and consistently uses **Microsoft SQL Server** technology, making it easily expandable at any time and open from the get-go. Siemens AG is a development partner of Microsoft and a **trendsetter** in automation. A whole host of reference projects provide evidence for the flexible and efficient engineering made possible with WinCC and its **innovative concepts**:

| | |
|---|---|
| Plant Intelligence | Totally Integrated Automation TIA (controller, I/O, HMI, management level) |
| Complete client/server functionality | Plant-wide access to tags and pictures |
| Object-oriented engineering with a modular approach | Block technology, re-use of blocks |
| Transparent configuration | Automated configuration |
| Configuration of mass data | Online configuration |
| Multilingual capability | Text management |
| Screen navigation | Long-term archiving and integrated analysis functionality |
| Web capability | Runtime simulation |

A **well-developed innovative capacity** that enables you to embrace and implement trends more quickly than with other systems and a **long-term product strategy** that will continue to **protect your investment** well into the future have made SIMATIC WinCC the **industry standard** and **market leader** in Europe and number 2 worldwide.

## 1.2.3        Highlights

| Keyword | Your requirements | Our solutions for your objectives |
|---|---|---|
| Investment protection<br><br>Market leader<br><br>Global markets<br><br><br>Quality, Tracking and tracing, Traceability<br>Expandability<br><br><br><br>Migration<br>Integration<br>Secure future<br><br>Openness | A visualization software program must be mature and well established on the market, must serve all industry sectors, and must open up international target markets. It must be safe, reliable, and expandable at any time without having any technology gaps or requiring reconfiguration from scratch; and must possess a well-developed innovative capacity enabling it to continue to set trends in the future. | The basic system makes consistent use of the **latest server technology** and **SQL databases**, is **technology- and industry-neutral**, and is equipped with proven **operator control and monitoring functions** that are especially developed for industrial settings. **References** from across a wide range of applications and sectors in the plant-engineering and machine-manufacturing industries provide evidence of this.<br><br>**Gestures and multi-touch operation** can be used in industrial environments.<br><br>You **configure** a **multilingual Runtime** environment (five European and four Asian languages are available) for just about any target language, such as Russian, which you can then change during normal operation by simply pressing a button.<br><br>**Quality-related** processes and events are continuously recorded and thoroughly verified, with optional **FDA compliance**.<br><br>WinCC is **universally scalable** even over the **Web**, **modular**, and has **flexible** expansion capability, from the small single-user solution to the redundant client/server solution with a central archive server and several **hundred Web-based operating stations**.<br><br>WinCC features a **migration function** for older projects and is fully integrated in the SIMATIC landscape, with a **long-term product strategy** ensured by **Totally Integrated Automation TIA**. What's more, WinCC can be expanded with **multi-vendor** third-party components for **specific technologies** and **industries**, features open **standard interfaces** for unlimited access by **user programs** to all data, for example, .NET, OPC (A&E, DA, HDA), OPC UA (UA Server DA, HDA and UA Client DA) or C-API and has the VBScript and ANSI C script languages required for this on board. |
| Efficiency and productivity<br>Time-to-market<br>Cost reduction<br><br><br>Integration | To configure increasingly complex plants, you need powerful engineering tools that will reduce engineering and life-cycle costs and spare you the time-consuming task of having to enter data multiple times, thus eliminating potential sources of error. | Highly sophisticated **configuration functions** drastically reduce your engineering effort and training requirements in capital-intensive production plants while increasing staffing flexibility and operational safety. These include an **object-oriented graphic editor**, extensive **libraries**, **online configuration**, and tools for engineering extremely large projects.<br><br>WinCC directly accesses the tags and messages of your SIMATIC controller via **TIA** and uses shared data and communication parameters. |

| Keyword | Your requirements | Our solutions for your objectives |
|---|---|---|
| Redundancy Availability<br><br>Flexibility<br><br><br><br>Security | You want to minimize downtimes and maintenance costs and ensure that only authorized personnel can operate a plant in which all operator input is thoroughly documented. | WinCC supports **redundant** WinCC stations, **Web clients**, **online engineering**, and **centralized maintenance** of a client project.<br>As part of its **TIA interaction** with other SIMATIC components, WinCC supports integrated **system** and **process diagnostics** during operation, **hardware diagnostics**, troubleshooting, and **predictive maintenance**.<br><br>WinCC also supports entry and access controls throughout the plant, **fail-safe** plant concepts, and **increased security** during communication. |
| Continuous vertical integration<br><br>Quality assurance<br>Plant intelligence<br>IT platform<br><br><br>IT & business integration | You make intelligent use of all production information to optimize quality, cost, utilization rates, or any other key performance indicators (KPIs) and achieve greater operating efficiency. | The **Microsoft SQL Server** is already fully integrated into the WinCC basic system as the **database server** and acts as the **information hub** for the entire company, along with **open interfaces**, an easy database interface, a **high-performance (long-term) archiving system**, backup functions, and a variety of corresponding **options**. Thus, you have a **platform** at your disposal with powerful tools for displaying, analyzing, distributing, and archiving all data **any time and anywhere** and for interfacing with **MES/ERP**, the production level and corporate management level. |

# 1.3 Investment protection

## 1.3.1 WinCC, the universal industry standard

### Solutions for all industries and technologies

With its modular structure, the WinCC base system is **technology- and industry-neutral** and combines production and process automation in a single HMI software package. The **client/server technology** enables simple single-user applications for machines as well as complex multi-user solutions and distributed redundant systems for plants. A whole host of WinCC options and add-ons is available for **industry-specific** solutions, including solutions for the water supply and distribution industry, for example. High-performance **databases** based on the **Microsoft SQL Server** form the central information hub for IT integration. **Open interfaces** and **flexible expansion capability** make it possible to integrate WinCC into every automation solution and every company.

Thus, after years of use in industry, it's not just by chance that WinCC has won over users with its wide array of applications and established itself as the industry standard. Countless references covering all applications and industries prove this:

- Automobile production and suppliers
- Chemical and pharmaceutical industries
- Food, beverages and tobacco industries
- Machine manufacturing and plant engineering
- Power supply and distribution
- Trade and services sector
- Plastics and rubber industry
- Metal processing and steel industry
- Paper manufacturing and processing, printing industry
- Transportation, traffic, and logistics
- Water and wastewater treatment
- Building control technology and property management

To see a large range of current reference projects, go to "http://www.siemens.de/hmi-referenzen" and "http://www.siemens.com/hmi-success-stories".
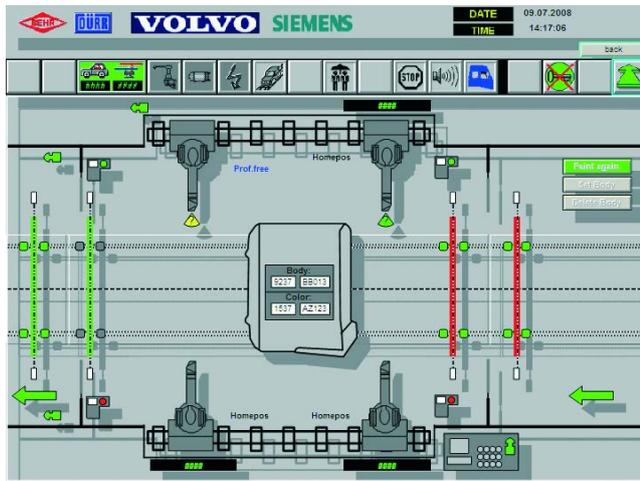
Figure 1-2    Industry standard in the automotive industry



Figure 1-3    Industry standard in the packaging industry



Figure 1-4    Industry standard for wastewater management
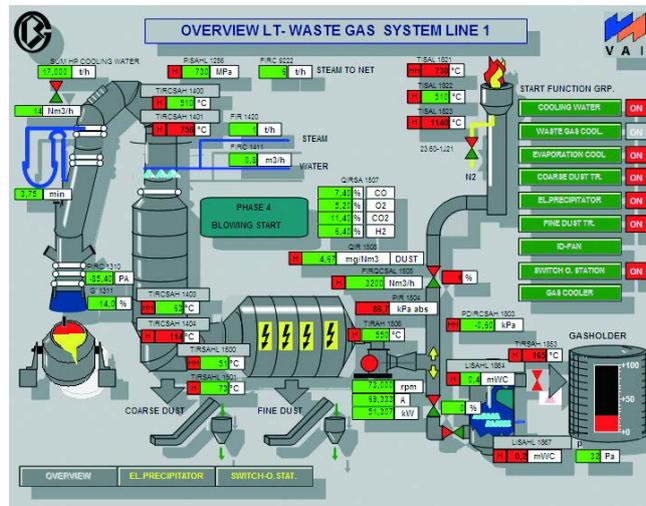
Figure 1-5     Industry standard in the chemical and petrochemical industries

## 1.3.2      Ready for worldwide use with UNICODE multilingual capability

You can switch the WinCC configuration interface language, choosing from 5 European and 4 Asian languages, **at any time with the push of a button**.

To implement the same automation solution in international target markets, you configure multilingual pictures, messages, and logs for all target languages supported by the operating system; WinCC supports multilingual configuration of almost all objects containing text that is visible in runtime. This means that multiple languages – for example, Chinese and English – can be displayed simultaneously in Runtime, for example, in message windows, regardless of the operating system settings.

The WinCC system dialogs allow you to switch rapidly between all configured languages in Runtime without ending Runtime and, thanks to UNICODE, regardless of the operating system settings. Picture text is entered directly when the pictures are created; all additional text is created centrally in the **Text Library**. Translation management is handled by the powerful **Text Distributor**, which also displays unused and untranslated text.

Examples: You are a French-speaking project engineer and are configuring a project for a system run by operators who speak Russian and English.

A French-speaking repair technician needs to optimize a Chinese plant based on the messages that have been issued by the system. With the 'switch language' during runtime feature, all messages are displayed immediately in both French and Chinese regardless of the settings in the operating system.
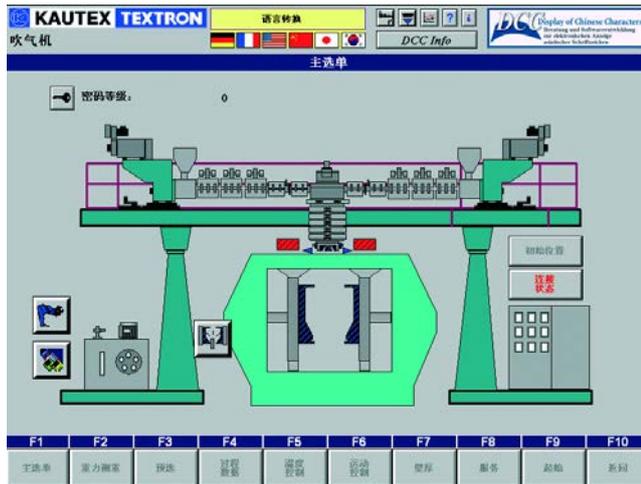


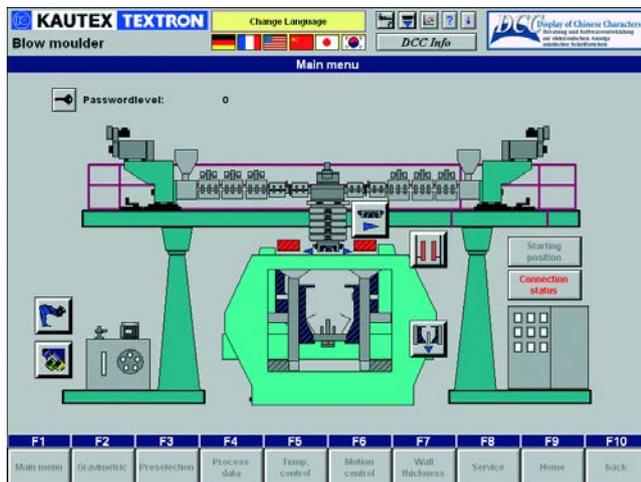Figure 1-6    Process picture from a plastics processing plant with language switch to Chinese



Figure 1-7    Process picture from a plastics processing plant with language switch to English

## 1.3.3 Always ready for validation

Today, the pharmaceutical and fine chemicals industries as well as the food, beverages, and tobacco industries all apply Good (Automation) Manufacturing Practice **G(A)MP** rules throughout the entire manufacturing sequence:

- Water quality
- Fertilizers and pesticides
- Humane animal husbandry methods
- Animal feed and pet food
- Phamaceuticals
- Primary products and food processing

These rules are specified in the Code of Federal Regulations (CFR) of the United States Food and Drug Administration (FDA) and in EU Regulation (EC) No 178/2002:

- http://www.fda.gov
- http://eur-lex.europa.eu/

They apply to all components of manufacturing:

- Plant with containers and reactors
- Tablet presses and packaging machines
- Process steps
- Manufacturing areas and access to these areas
- Messages and message behavior

Plant engineers and machine manufacturers are interested in producing and implementing components that support validation requirements.
For example, FDA 21 CFR Part 11 governs:

- Access management
- Electronic documentation of changes
- Change control
- Requirements pertaining to electronic signatures
- Archiving and retrieval of data records

Thus, for example, it must be ensured that only authorized persons can make changes to the manufacturing process, and that each change is logged and cannot be subsequently revised.

SIMATIC WinCC provides a comprehensive response to all these requirements, making your project "ready for validation":

- Logging function for configuration and runtime with the WinCC/Audit option
- Version management with the WinCC/ChangeControl option
- Central, plant-wide user and rights administration, integrated into Windows user management via SIMATIC Logon, a standard feature included in WinCC
- High level of security for users and administrators provided by a plant-wide access protection mechanism, including access over an intranet/the Internet
- All necessary engineering measures summarized in a declaration of conformity (SIMATIC WinCC White Paper)

## 1.3.4　　All functions on board (overview)

WinCC offers complete **basic functionality** for process visualization and operation. It provides a number of **editors** and **interfaces** that you can use to customize this functionality to suit your specific application.

| Basic functionality | Properties |
|---|---|
| **Central project management** in a **hierarchical structure** | • Fast access to all project data and central settings<br>• **Migration of older projects**<br>• "Language change" feature<br>• Complete **client/server functionality**<br>• **Microsoft SQL Server** integrated as the **database server** |
| **Graphics system** for visualization of process runs and process data | • **Scalable process pictures** adjusted to the screen resolution<br>• Freely definable graphical **vector objects**, predefined by means of **configuration dialogs**<br>• All properties are **programmable** and can be made **dynamic** using a **drag-and-drop** operation<br>• **Picture objects** that can be modified centrally and comprehensive **libraries** |
| **Menus and toolbars** | An editor for creating customized menus and toolbars that are integrated into the Runtime user interface. |
| **Tag Management** **WinCC Configuration Studio** | • Efficient configuration of the Tag Management<br>• Connect PowerTags, **internal tags**, or **persistent tags** using a **drag-and-drop** operation<br>• Search and filter functions for tags<br>• Universal support of **variable arrays**<br>• Plant-wide **Tag Selection dialog box**<br>• **Linking dialog** and **cross-reference list**<br>• **Tag simulator**<br>• Import of configuration data from SIMATIC STEP 7 300/400 and S7-1200/1500 |
| **Message system** for reporting, acknowledging, and archiving events | • User-configurable alarm/message view with **frames**<br>• User-definable **message classes** and **message groups**<br>• Initiate 32 messages using the **bit message procedure** with a **double word tag**<br>• Time stamps that are **accurate to the millisecond** guarantee an **exact message sequence** when using chronological reporting<br>• Monitor up to **256 limit values** for analog alarms with only two tags for all controller messages<br>• **Comprehensive message view** with **Alarm Hiding**<br>• Statistical **evaluation** of all message data in the **message hit list**<br>• **Predefined** message filters that can be **created in runtime**, with user selection of all parameters contained in the messages |

| Basic functionality | Properties |
|---|---|
| **Archive system**<br>for archiving process data | • Seamless acquisition, compression, and storage of measured values for **displaying tables and trends**<br>• Integrated **statistical evaluation**<br>• **FDA** verification<br>• Swapping of **individual archives** to **long-term archive servers** |
| **Reporting and logging system**<br>for messages, operator input, and process data | Time-driven or event-driven **tracking** in the form of a user report or project documentation in a **user-defined layout**. |
| **User archives** | User archives for user-defined configuration of database tables for storing process data |
| **User administration**<br>for administering users and access rights | • Optionally integrated into Windows user administration<br>• Integrated with SIMATIC Logon for local stations or Web stations |
| **Programming**<br>to expand functionality | Powerful script editors for Visual Basic Script and ANSI-C |
| **Text Library**<br>**Text Distributor** | Powerful tools for creating and managing multilingual projects |
| **Other tools** | • Dynamic Wizards<br>• ProjectDuplicator<br>• Basic Process Control<br>• Smart tools<br>• "WinCC Configuration Studio" bulk data editor<br>• Project migration tool for migrating earlier WinCC project versions (from V6.x) |
| **Communications links**<br>for communicating with controllers and other data sources | • Structured configuration of links<br>• SIMATIC protocols<br>• Direct access to control tags and all parameters of SIMATIC controllers<br>• AllenBradley, Ethernet IP, Modbus TCP/IP, Mitsubishi FX3U and Q-series included in scope of delivery<br>• Manufacturer-neutral solutions such as PROFIBUS/PROFINET and OPC included in scope of delivery<br>• Variety of interfaces |
| **Standard interfaces**<br>for open integration of Window applications | • OPC<br>• WinCC OLE DB<br>• ActiveX<br>• .NET/WPF controls |
| **Programming interfaces**<br>for accessing database and functions of WinCC and integration into user programs | • VBA<br>• VBScript<br>• C script (ANSI-C)<br>• C-API<br>• C#<br>• VB.NET |

## 1.3.5 Totally Integrated Automation

**Sharpen you competitive edge with Totally Integrated Automation**

In response to increasing competitive pressure for innovation, it is more important today than ever before to bring cost-effective, high-quality solutions to market as quickly as possible. Moreover, the only way to guarantee success is to achieve an innovative edge over the competition.

Totally Integrated Automation (TIA) provides just the architecture you need to achieve this in all industries and at all corporate levels:

- Management level
- Operations management level
- Control level
- Field level

Thanks to the unique integration of TIA, you can take advantage of the unrivalled interaction of all Siemens products and systems – even across different versions.
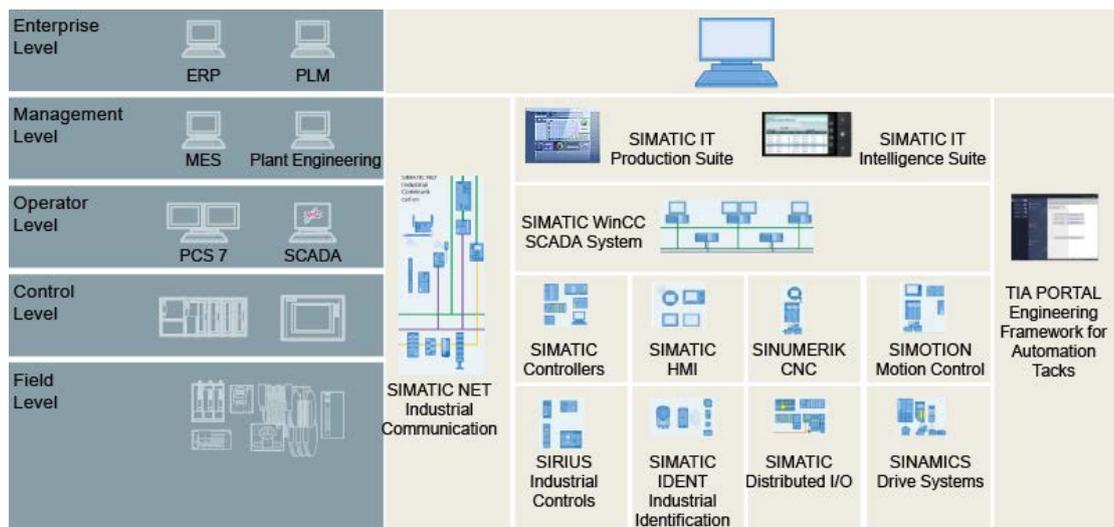


Figure 1-8    Totally Integrated Automation (TIA)

The hardware and software components from the TIA modular system reduce engineering costs, lifecycle costs, and total cost through **integration**:

- Integrated engineering Configure and manage all components of WinCC and STEP 7 on one **shared platform**, SIMATIC Manager (see "Project management with WinCC Explorer").

- Integrated communication: **Plant-wide tag selection dialog** for WinCC tags and STEP 7 symbols, **shared message configuration**, use of previously defined **communication parameters** (see "Unrestricted process communication"). In addition, TIA helps you avoid duplicated effort and sources of error.

## Integrated diagnostics



Figure 1-9    Diagnostics with WinCC/ProAgent and the STEP 7 engineering tools

In concert with other TIA components, integrated engineering and communication make it possible to perform system and process diagnostics of errors during operation.
For more information, please refer to the chapter "Diagnostics system".

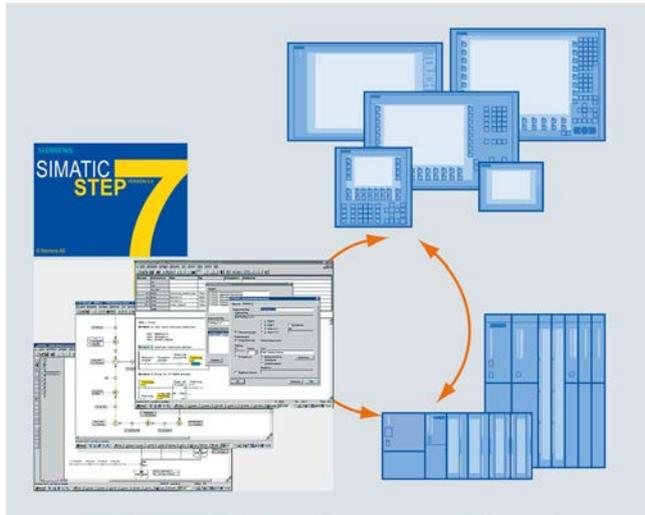## Integrated in the SIMATIC PCS 7 Process Control System

Integrated data management and communication enables the seamless integration of WinCC into SIMATIC PCS 7. In the company-wide TIA network, PCS 7 automates process control technology in all industries:

- Process industry

- Manufacturing industry

- Hybrid industry: a combination of continuous processes/batch processes and discrete manufacturing, for example, in the glass industry and pharmaceutical industry

What's more, PCS 7 also automates the secondary processes of a production site:

- Filling

- Packing

- Inbound logistics, e.g., material supply

- Outbound logistics, e.g., warehousing

The central components of PCS 7 are the engineering stations (**ES** ) for configuration and the operator stations (**OS** ) for operator control and monitoring of processes during runtime. An important component of PCS 7, WinCC is used in the engineering stations and operator stations.

High performance and outstanding system features guarantee that PCS 7 together with WinCC fulfills all the typical requirements of a process control system:

● Simple and reliable process control

● Convenient operator control and visualization

● Integrated high-performance engineering

● Redundancy at all levels

● Fail-safe automation

● Comprehensive fieldbus integration

● Flexible solutions for batch processes

● Direct interface with the IT world

## 1.3.6 A whole world of operator control and monitoring
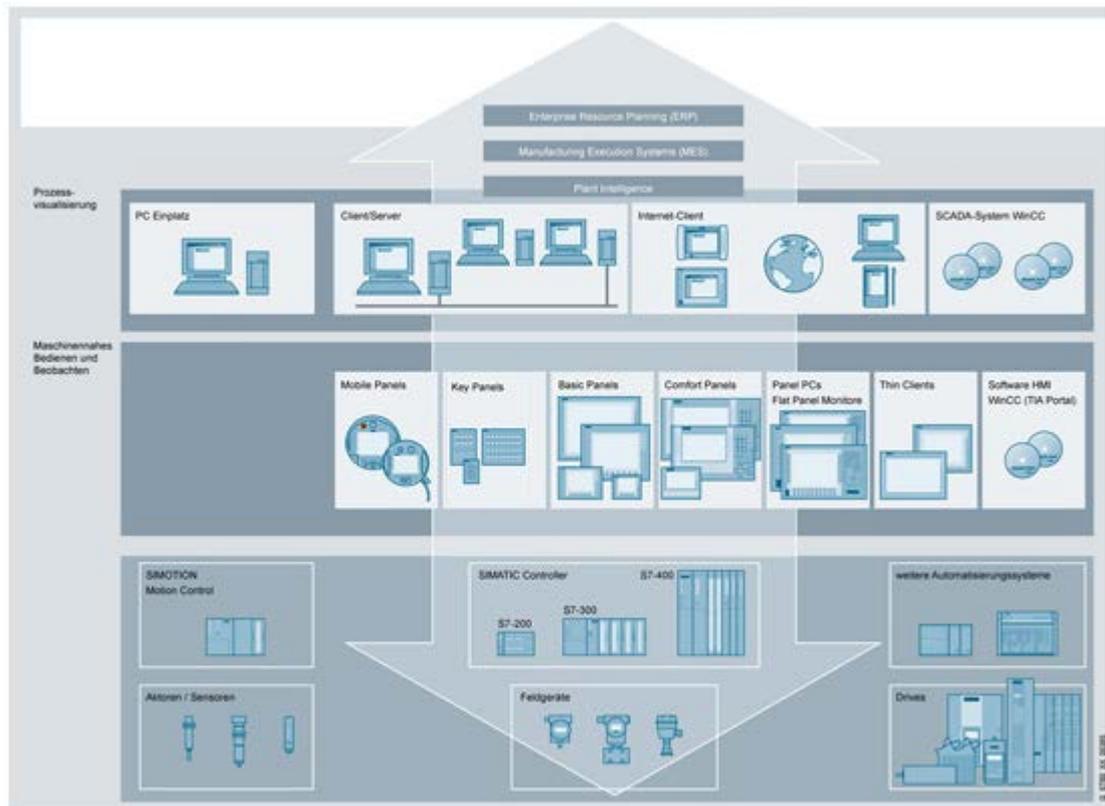


Figure 1-10    Operator control and monitoring

With SIMATIC HMI, Siemens AG offers a complete, scalable, proven range of products and systems from a single source to accomplish the multifaceted tasks performed by operator control and monitoring systems. Of course, we also implement customer-specific requirements. And we top off our offer with comprehensive services ranging from on-site training at customers' facilities and worldwide service to online ordering.

The process quality can be significantly improved with visualization even in the case of compact machines or smaller applications.

### SIMATIC HMI Panels

- SIMATIC HMI Key Panels
  Input fields connected to the bus for easy, direct machine operation

- SIMATIC HMI Basic Panels
  HMI devices with basic functions as a cost-effective solution for simple HMI applications

- SIMATIC HMI Comfort Panels
  HMI devices with high-end functionality for demanding applications

- SIMATIC HMI Mobile Panels
  Mobile HMI devices with or without cables for direct operation of the plant and machine from any location

- Fully enclosed SIMATIC HMI devices
  Fully enclosed IP65 built-in devices available as SIMATIC HMI IPC or Flat Panel Monitor for installation on a support arm or pedestal

### SIMATIC WinCC in the TIA Portal

The engineering software allows integrated configuration of all SIMATIC HMI Panels including PC-based visualization workstations. With WinCC in the TIA Portal, you can use non-device-specific configuration data on different target systems without conversion. The interface adapts to the functional possibilities of the target device. Common project data is managed centrally in the TIA Portal and can be used on all relevant devices.

### SCADA System SIMATIC WinCC

PC-based process visualization, from single-user systems right across the spectrum to distributed client-server solutions with clients on the Web and a platform for the integration of IT and business. SIMATIC WinCC is available for highly complex applications with Plant Intelligence solutions, integrated archive servers and redundant architectures.

## 1.3.7 Gestures and multi-touch operation in industrial environments

### Overview

Operation with gestures and/or more than one finger at once is also possible in an automation environment.

Advantages of multi-touch technology:

- The operator remains primarily concentrated on what is happening on the screen, instead of being distracted by having to select menus, toolbars, or additional navigation buttons.

- Multi-touch technology reduces the number of operating steps. The display is less cluttered and the content easier to follow.

- Multi-stage operating tasks are handled more smoothly.

With the SIMATIC IFP1900 MT, SIMATIC HMI offers an industrial monitor in widescreen format with gesture and multi-touch operation. The device can be used together with WinCC for gesture and multi-touch operation.

## Gestures for the HMI environment

Swipe and flick with one finger, for example, to browse process pictures or the bookmarks display in the system menu

Vertical and horizontal swipes and flicks to scroll down the display section in enlarged process/machine pictures

Zooming with two fingers to enlarge or reduce pictures

Two-handed operation for combined actions, such as the simultaneous operation of two elements for setup mode

Additional information is available at www.siemens.de/hmi-multitouch (http://www.automation.siemens.com/mcms/topics/en/simatic/display-technology/Pages/default.aspx)

# Process visualization with SIMATIC WinCC

# 2

## 2.1 Expandability

### 2.1.1 Scalable product range

**Introduction**

SIMATIC WinCC provides a complete **basic system** for operator control and monitoring. It provides a number of **editors** and **interfaces** that allow you to create highly efficient configurations for your specific application. All relevant configuration data is stored in a **WinCC project**. The WinCC basic system already contains all the editors and **SmartTools** you will need to perform the different configuration tasks.

**Licensing**

WinCC is available in two basic versions:

* WinCC complete package RC: license for runtime and configuring (engineering)

* WinCC runtime package RT: license for runtime

Both packages are available with 128, 512, 2k, 8k, 64k, 100k, 150k or 256k PowerTags.

**PowerTags** only license **process tags** that have a **communication link** via a WinCC communication channel to the controller or to other data sources (see "Unrestricted process communication"). Up to **32 messages** and up to **256 user-definable analog alarms** for limit value monitoring can be derived from one process tag. Moreover, **internal tags** without a process connection are available **free of charge** for additional system performance. Example: With a license of 2k = 2048 PowerTags, you can execute a WinCC project during runtime with up to 2048 configured process tags. The number of licensed and configured process tags will be seen in the status bar of WinCC Explorer.

**PowerPacks** increase the number of usable PowerTags. When your application grows, WinCC grows with it. You can start with the smallest variant and then upgrade as needed with convenient and economical PowerPacks. PowerPacks also increase the number of available **archive tags**: From 512 in the basic system by 1,500, 5,000, 10,000 or 30,000 to up to 80,000 per server.

## Options and add-ons

Individual functional or industry-specific **software expansions** are available as WinCC options and WinCC add-ons.

**WinCC options** are products from SIMATIC development that enhance the WinCC basic system by adding a range of useful functions. You can combine WinCC options to suit your individual requirements. You can obtain support from our regional specialist support and via the central hotline. Refer to Chapter 3 "Options" for a description of available options for SIMATIC WinCC.

**WinCC Add-ons** are developed and sold by other Siemens departments and external suppliers. Support for WinCC add-ons is provided by the respective product supplier, who is also the contact for integrating the product into the automation solution.
You can find more information on the Web at:
"http://www.siemens.de/simatic-wincc-addons"

## 2.1.2 Integrated configuration in SIMATIC Manager

## Definition

WinCC projects can be created and managed in STEP 7 within the framework of Totally Integrated Automation. This results in efficient links between the AS configuration and WinCC configuration. Together with SIMATIC Manager, STEP 7 provides you with a **common platform** for the central configuration and management of all components of your automation solution.

## Requirement

- Installation of SIMATIC STEP 7
- Installation with "AS-OS Engineering" and STEP 7 Symbol Server
- If necessary, with Basic Process Control (see "Control system configuration")

## Application

The **integrated configuration** of WinCC in SIMATIC Manager provides the following advantages:

- All control data relevant for operator control and monitoring processes are **available in WinCC**.
- **Direct access** to STEP 7 symbols during process connection
  (see "Unrestricted process communication")
- Configuration data is downloaded to Runtime
- Integrated communications configuration
- Integrated message configuration
- Extended diagnostics support
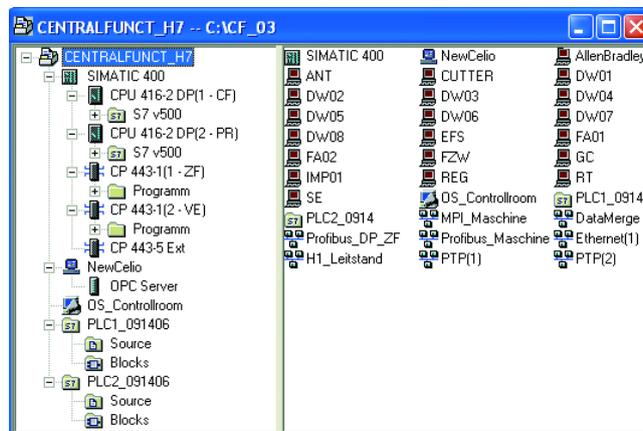- Integration of redundant systems

**Structure**



Figure 2-1      SIMATIC Manager

A WinCC project is created directly as a **PC station** or **operator station OS** in SIMATIC Manager:

**PC station**: In addition to software and hardware components for automation (communications processors, slot PLCs, or soft PLCs), the computer also contains the SIMATIC HMI components. Because the PC station is integrated into the network configuration, the HMI interfaces and access points are defined automatically. A WinCC project runs on this computer as a **WinCC application**:

- WinCC server in a multi-user system (see "Unlimited plant configuration")

- WinCC client in a multi-user system

- **Application reference** to a WinCC project, which can then be downloaded to several target computers

**Operator station OS**: The OS represents a WinCC project in SIMATIC Manager. Unlike the WinCC application, the OS is not integrated into the network configuration. However, the advantage of the OS is in its ability to reference to a WinCC project:

- WinCC server in a multi-user or distributed system (see "Unlimited plant configuration")

- WinCC client in a single-user or distributed system

- **OS reference** to a WinCC project as a basic OS, which can then be downloaded to several target computers

## 2.1.3 Unrestricted process communication

### Definition



Figure 2-2    Paint shop

WinCC is an open SCADA visualization system that allows you to connect different control systems. Industrial communication with WinCC means that within a **communication link**, process values from the controller are exchanged with the operator control station via **PowerTags**.

### Requirement

- The computer contains the appropriate communication hardware: communications processor, standard I/O port COMx, etc.

- The supplied hardware driver has been installed.

- Either an appropriate WinCC communication channel exists or an appropriate OPC server has been installed (see OPC).

- SIMATIC NET software. A range of different versions are used depending on the operating system. The DVDs are included in the scope of delivery for WinCC.

- .Net 4.0 is only installed with SQL Standard in the latest operating system.
  .Net 4.0 must be activated for WinCC Client installation in the operating system.

## Application

WinCC communication peers can be any component of a network that is in a position to communicate with others and to exchange data. In the SIMATIC environment, these can be the central modules and **communication modules** in the automation system (**AS**) and the **communications processors** in the computer. WinCC comes with a number of different **communication channels** for connection:

- **SIMATIC S5/S7/505** e.g. with **S7 Protocol Suite**

- **SIMATIC S7-1200** (max. 32TLN) / **1500** (max. 16 TLN)

- **SIMOTION**

- **Mitsubishi** FX3U and Q series

- **AllenBradley** Ethernet IP and Modbus TCP/IP

- Smart card reader

- With the WinCC ConnectivityPack via **WinCC OPC UA server** for OPC UA data access and OPC UA historical access

- **WinCC OPC UA DA client** for data access over a WinCC channel

WinCC also comes supplied with **open communication channels** such as PROFIBUS DP/FMS and OPC (Openness, Productivity and Collaboration, previously called OLE for Process Control). Because all controller manufacturers also provide **OPC servers** for their specific hardware, the options for interfacing with WinCC are virtually unlimited.

## Structure

With most communication channels, the required bit or byte in the controller can be read or written to directly by means of **bit/byte access**. Certain communication channels do not support bit/byte access and instead use the **BinWrite mechanism**:

- SIMATIC S5: Ethernet layer, programmers port, serial

- SIMATIC IT: Ethernet layer, serial

With the BinWrite mechanism, first the entire **data word** is read out from the controller, the bits/bytes to be addressed are then changed, and finally, the entire data word is written back.

To enable connection of a variety of controllers, the communication has a **modular** structure made up of **hierarchical layers**, thus providing maximum flexibility:

| Layer | Task | Connection of |
|---|---|---|
| Communication channel | Supplies the PowerTags with process values from an AS. | Automation system |
| Channel unit | Prepares data for communication over a specific communication network and transmission medium. | Communication network |
| Hardware driver | Controls the communications processor in the PC. | Communications processor |
| Connection | Creates a logical connection to a communication module in an AS by means of the **IP/station address** and **slot number**. | Communication module |

| Layer | Task | Connection of |
|---|---|---|
| Tag group | Classifies tags, for example, according to topic. | Configuration area |
| External tag, process tag, raw data tag | Accesses a process value in the AS via **data type**, **length**, and **address** consisting of data area (data block no., bit memory, input, and output) and start address. | Memory area in the controller, process connection |
| Internal tag, system tag | Stores an interim value. | Memory in the operator control station, no process connection |
| Structure tag | Combines any internal tags and PowerTags to form a self-defined data structure with a fixed **structure type**, from which any number of **structure instances** can be created. | Memory in the operator control station - entirely with, partially with, or without a process connection |

WinCC manages all tags centrally in the **WinCC Configuration Studio**, which is accessed by both the engineering and the Runtime system:

- PowerTags as a reference/link to a process value in the controller

- Raw data tag stores any measurement series of process values as a data block (see "Archive system")

- Internal tag with no process connection

- System tag stores a system value, such as **@**CurrentUser

- Structure tag: Model or template for all structure instances of this structure type. Example:
  Motor = FLOAT_**speed** & LONG_**serial number** & DOUBLE_**power**

- Structure instance: Tag composed of different data types according to structure type template. Example:
  Motor1 = Motor1.**speed** & Motor1.**serial number** & Motor1.**power**
  Motor2 = Motor2.**speed** & Motor2.**serial number** & Motor2.**power**
  Another example: Closed-loop controller with consistent control-parameter structure.

- Import of tags from third-party applications, e.g., WinCC V12 tags.

After transfer to the Tag Management, the current value of process tags is made available for further processing and evaluation in WinCC. You can also **configure the following values**:

- **Start value**: The start value is returned the first time the process tags are read, even if a process value already exists. As a result, a picture opens more quickly when runtime is started and when the picture is changed.

- **High/low limit**: If, for example, a process value exceeds the high limit, WinCC displayed this **value in gray** and stops processing it.

- **Substitute value**: WinCC sets the substitute value when the high limit/low limit is violated, or when a connection error occurs, depending on your selection.

- **Linear scaling**: Process tag values are mapped to another value range. Example:
  A **temperature sensor** measures resistance and gives the values in ohms.
  An ohm value corresponds to a specific temperature. With linear scaling, you convert ohm values directly to temperature values, which are then used in WinCC.

- **Persistence with internal tags:** After the runtime system is restarted, the last tag value is retained as the new start value.
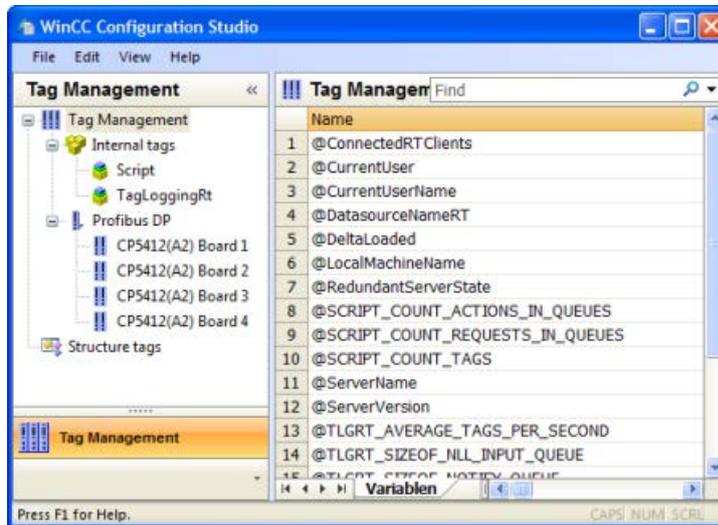


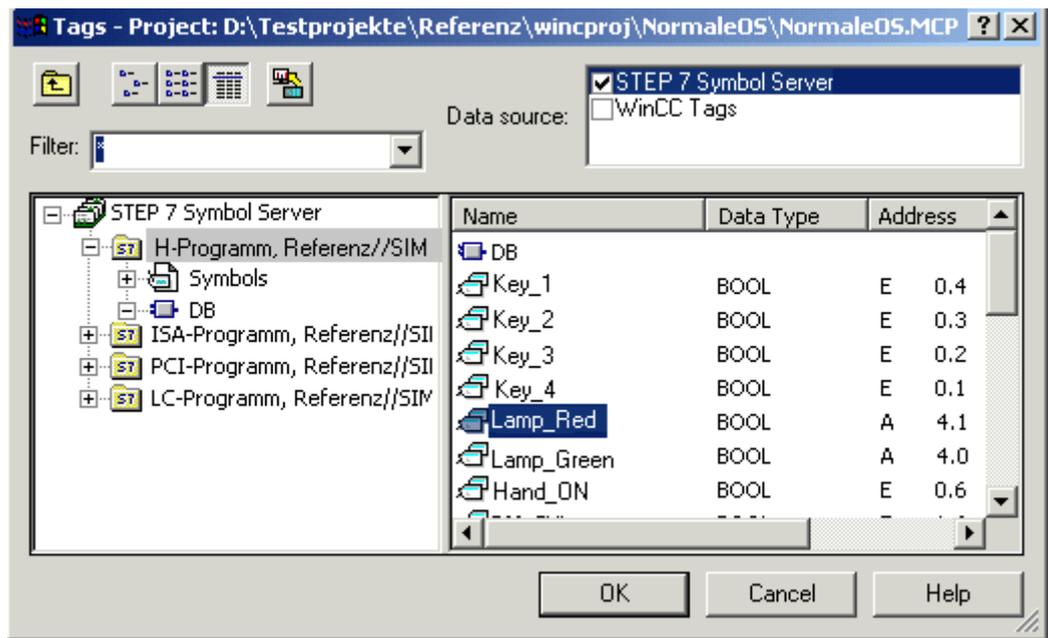Figure 2-3      WinCC Configuration Studio



Figure 2-4      Accessing STEP 7 symbol table

The **Plant-wide Tag Selection dialog** for integrated communication opens anywhere you need a tag:

- WinCC tags

- Inputs, outputs, and bit memory from the **STEP 7 symbol table** with predefined **communication parameters** and all global data block parameters for **integrated configuration** (see "Integrated configuration in SIMATIC Manager").

You **filter** and **find** tags, which you then insert using a **drag-and-drop** operation.

## OPC

**OPC DA server and OPC UA DA server** provide process data in many areas of SIMATIC automation systems and on a manufacturer-neutral basis. A number of other OPC interfaces are available in WinCC (for details, see "Openness and integration > OPC - Open Connectivity").

### Application examples

The WinCC basic system with OPC offers the following functions:

- Connect SIMATIC S5/S7 to WinCC via the SIMATIC NET OPC server.

- Exchange data anywhere with the SIMATIC NET OPC client.

- Connect WinAC controllers to WinCC via the WinAC OPC server.

- Connect an existing WinCC or TIA project to a higher-level operator station.

- Access to PROFINET (PN) tags via the PN OPC server within the framework of component-based automation.

With the OPC Item Manager from the basic system, you access a tag of an OPC DA server or OPC UA DA server, on the same computer or on a computer in the connected network environment. This is done in a directory tree structure during process execution.
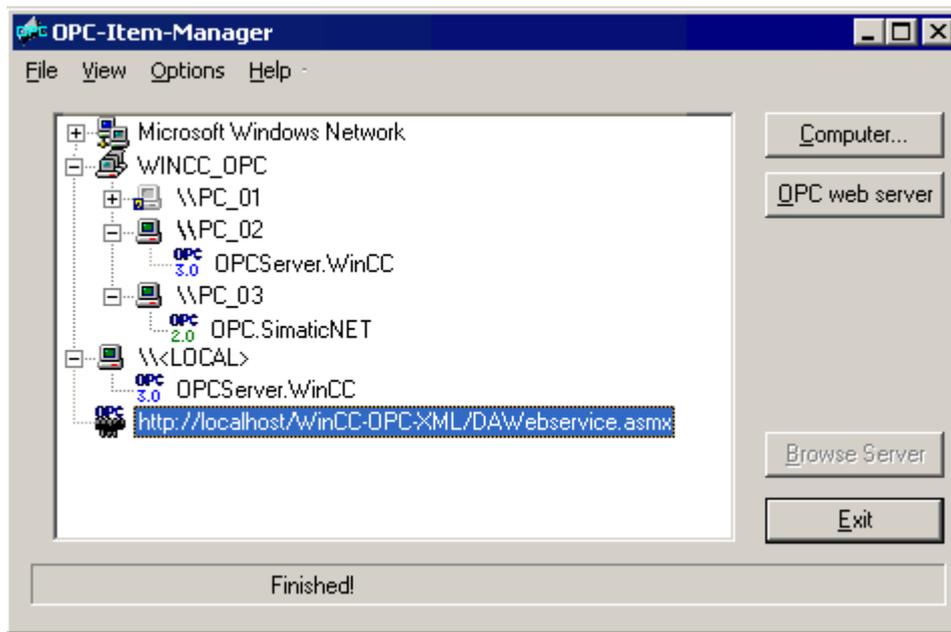


Figure 2-5    OPC Item Manager

## The WinCC System Info communication channel

This communication channel provides **system information** such as date, time, and drive capacity. The communication channel requires no hardware, since it directly accesses the system information of the computer on which it has been installed. The process tags required for the System Info channel **need no licenses**.

Possible applications:

- Represent the WinCC server **system time** in process pictures

- Display **CPU load** in a trend

- Monitor **swap file** size with limit values and issue corresponding messages

- Display bar graphs of available **main memory** and available **storage** on local hard disks/drives or different WinCC servers

- Monitor **drive capacity** and issue corresponding messages

- Monitor **print status, job status**, spooler size, etc.

- Evaluate system information in **scripts** and **events**.

- **Counter** function for special test purposes in scripts

In multi-user and distributed systems, you can monitor system information from **multiple WinCC servers** on one WinCC client.

## Special features

- Complex automation systems require comprehensive **diagnostics** (see "Diagnostics system").

- The **WinCC Configuration Studio** makes it easy to create connections and tags. The complete configuration and display of data is combined with the functions of a bulk data editor (see "Configuring complex projects").

- The **cross-reference list** provides a quick overview of the configured process tags (even for existing projects) and lets you know when process tags have been created but are not in use in the configuration (see "Configuring complex projects").

- When you point with the mouse to a link or tag in Tag Management, WinCC displays the **status information** as a **ToolTip**: status of a link, current process value with quality code, time of last tag change.

- The **quality code** provides coded information about the **tag status** and the quality of a tag.

# 2.1.4 Unlimited plant configuration

## 2.1.4.1 Single-user system

### Definition

An operator control station (which can also be redundant) has a view of **its own** project.

### Application

Single-user systems are usually used **at the production level**.
They are used for operator control and monitoring of relatively small applications, but also for **independent** subprocesses or plant units within larger plants. A single-user system operates **autonomously** with its own pictures and archives; all data is **local** on one PC.

### Structure
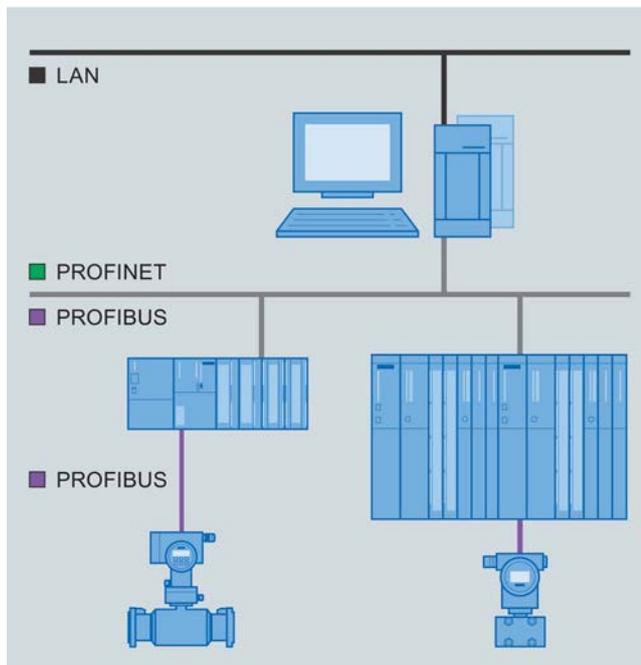


Figure 2-6      Single-user system

All WinCC data is stored in the integrated Microsoft SQL Server database on the PC. The PC/operator control station is also the configuring PC.

The modular WinCC server technology already supports expansions for a single-user system:

- To expand into a redundant system with a second, redundant single-user system (see WinCC/Redundancy option)

- To expand with a separate long-term archive server for efficient archiving

## 2.1.4.2 Multi-user system

### Definition

Up to 32 **coordinated** operator control stations (WinCC clients) have a view of **the same** (optionally redundant) server project.

All WinCC data is stored in the integrated Microsoft SQL Server database on the WinCC server. The WinCC clients do not have their own WinCC project, but rather they access the WinCC project on the WinCC server ("client without a project").

### Requirements on the WinCC server

- WinCC/Server option
- Microsoft operating system
    - Windows 2003 Server SP2
    - Windows 2003 Server R2 SP2
    - Windows 7 SP1 32-bit and 64-bit (Business / Enterprise / Ultimate), max. 3 clients
    - Windows Server 2008 32-bit
    - Windows Server 2008 R2 SP1 64-bit

### Application

Several operators monitor a single process, and each operator can see the manipulations performed by the other operators. A multi-user system is typically configured for small and mid-sized plants in which distribution of data to several servers is not required.

**Distribution of clients**

- You monitor **different views** of the same process, for example, process pictures on one operator control station and messages on another operator control station.
- You monitor and control the **same view** of the process from different locations, for example, along the production line.
- You configure and activate the server project locally or **remotely** with full access from a WinCC client, which is also used as a **maintenance PC**.
  Alternatively, you can use a separate configuring PC.

You use access rights to specify exactly which functions or plant sections are available to a given user on which operator control stations.
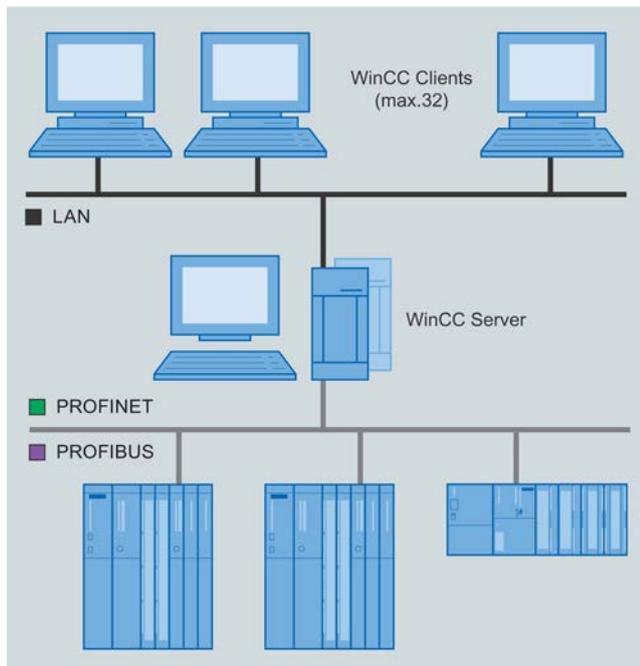
**Structure**



Figure 2-7     Multi-user system

The client-server technology makes it possible to easily separate WinCC clients from the WinCC server: You configure your project **centrally** on the WinCC server and manage a **list of WinCC clients** with their properties, such as the start screen and Runtime language. The WinCC server **automatically** takes over the task of supplying the WinCC clients:

- Runtime environment

- Pictures, process values, messages, archive data, and logs

- Interface with the automation system

- Communication and coordination of clients

- Archiving

## Special features

- Process specifications or message acknowledgments on one operator station are **consistently** available to the other operator stations.

- Because the WinCC clients access data from the WinCC server, you can also **connect WinCC clients to the system after the initial configuration**.

- You can also install a WinCC client **without the Microsoft SQL Server database** to comply with IT specifications.

- In a multi-user system, a WinCC client always accesses one single WinCC server and WinCC project only, in contrast to a distributed system.

- To increase plant availability, you must duplicate the multi-user project on a second, **redundant WinCC server** and use the WinCC/Redundancy option, which provides automatic database synchronization including client switchover.

The modular WinCC server technology also enables the following on the multi-user system:

- A second redundant WinCC server

- A separate long-term archive server

- Access to WinCC via the integrated OPC server

### 2.1.4.3 Distributed system

## Definition

Up to 32 operator stations (WinCC clients) each with views of up to **18 different**, optionally redundant server projects. You can use a maximum of 36 servers as 18 redundant server pairs.

Each WinCC client has its own WinCC project, in which its individual view of the WinCC server is configured ("client with own project"). You can also implement "clients without own project" within a distributed system. These clients only access one WinCC server (see "Multi-user system").

## Requirements on each WinCC server

- WinCC/Server option

- Microsoft Windows Server 2008, 2008 R2, 2003, 2003 R2 operating system

## Application

Distributed systems are used in large plants: Data traffic is distributed to several WinCC servers to reduce the load on each individual server. This results in:

- Better performance

- Larger data volumes

- Appropriate provision for plant topology

- More complex plants

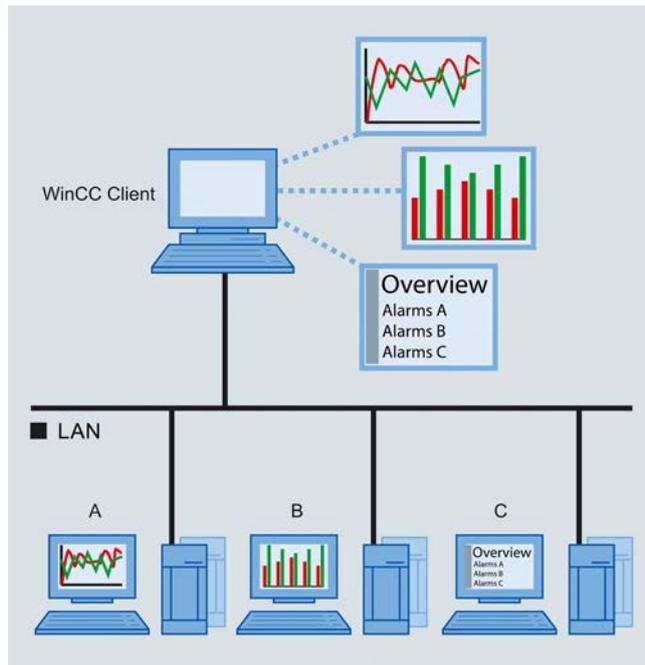- Overview of the entire project from one operator station



Figure 2-8    Distribution of servers A, B, and C

### Distribution of servers

- In a **technology-based** distribution according to process areas, each server manages a plant section that is dedicated to a specific technology, such as body-in-white construction, painting, or final assembly.

- In a **functional** distribution, each server performs a certain task, such as visualization, archiving, or reporting messages.

### Distribution of clients

- You configure views, for example, a **shared trend and message view** of one, several, or all WinCC servers.

- You configure **different views** of plant sections or selected data.
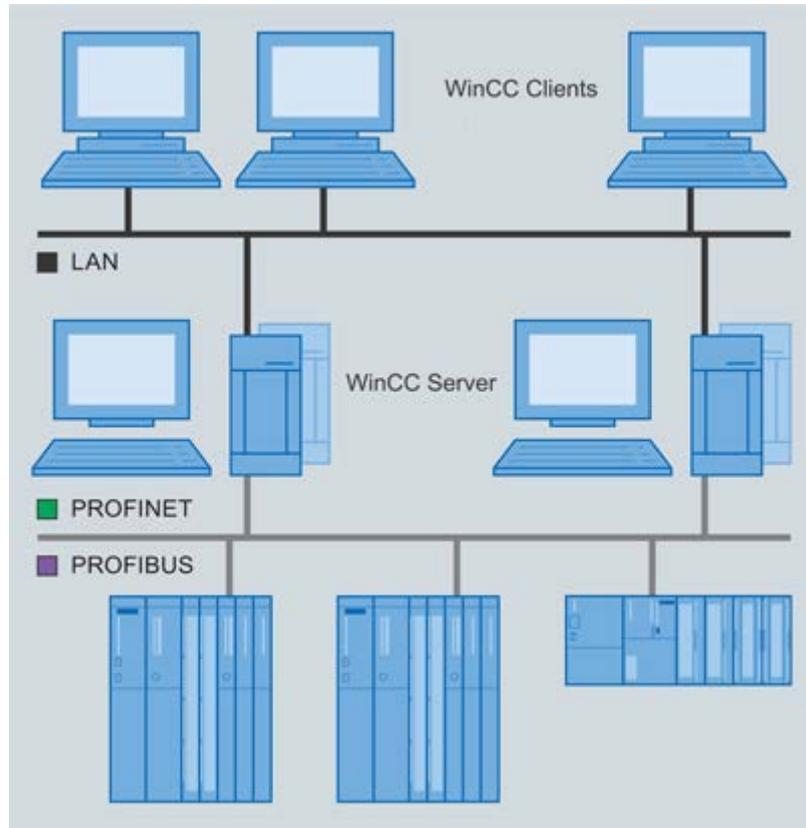
## Structure



Figure 2-9      Distributed system

The client-server technology makes distributed WinCC servers possible:
On each WinCC server, you configure a server project, which in turn provides
a **server package** with configuration data. You then use this server package to access
all information (pictures, tags, messages, archive data) of the server projects
in the respective **selection dialogs** in each client project. Examples:

● In a process picture, one output field for the process value from Server_1 and
  one output field for the process value from Server_2.

● Picture windows and change of process pictures from different WinCC servers

● Trend views that represent a combination of data from different WinCC servers

● Message windows and message sequence reports that display messages
  from multiple WinCC servers with a **loop-in alarm** to the server picture

● Display and evaluation of data from process value and message archives
  on WinCC clients, including data combined from multiple WinCC servers

WinCC **automatically** takes care of the rest:

- Importing of updated server packages on the WinCC clients

- Communication and coordination of WinCC servers and WinCC clients

- Interfacing with the automation systems

The modular WinCC server technology also enables the following on the distributed system:

- A second, redundant WinCC server (see WinCC/Redundancy option)

- A separate long-term archive server

- Access to WinCC via the integrated OPC server

## Special features

- You configure a **standard server** in each client project so that data for which no separate WinCC server is specified can be read by this standard server.

- Archive data, messages, and log data always come from the **WinCC server**, which has sole access to the process and the **runtime databases** used in the process.
  An operator input (such as acknowledgment) is sent to the WinCC server;
  the WinCC server then executes the input and distributes the information
  to all participating WinCC clients.

- You can increase the **availability** with a **redundant** WinCC server configuration.

- In a distributed system, a WinCC client accesses up to 18 WinCC servers simultaneously.
  In addition, each WinCC server can access data from other WinCC servers.
  This is useful, for example, when a separate WinCC server is used for each production area, and certain information, such as quality data, is also required in a downstream production area.

- WinCC requires the 32-bit version of Microsoft SQL Server 2008 R2 Service Pack 1.
  WinCC only supports the 32-bit version of Microsoft Office.

## 2.1.4.4 Other server systems

### SIMATIC Process Historian

**SIMATIC Process Historian** is a scalable, secure and high-performance long-term archive system. On the central, optional, redundant archive server, you save the process values and messages from WinCC OS (from one or more systems) and from PCS 7 OS in real time. Process Historian has integrated backup and recovery mechanisms.

Process Historian replaces WinCC/ CAS (Central Archive Server).
The data can be migrated.

A Windows Server 2008 R2 SP1 64-bit operating system and Microsoft SQL Server 2008 R2 SP1 (64-bit) archive system are required.
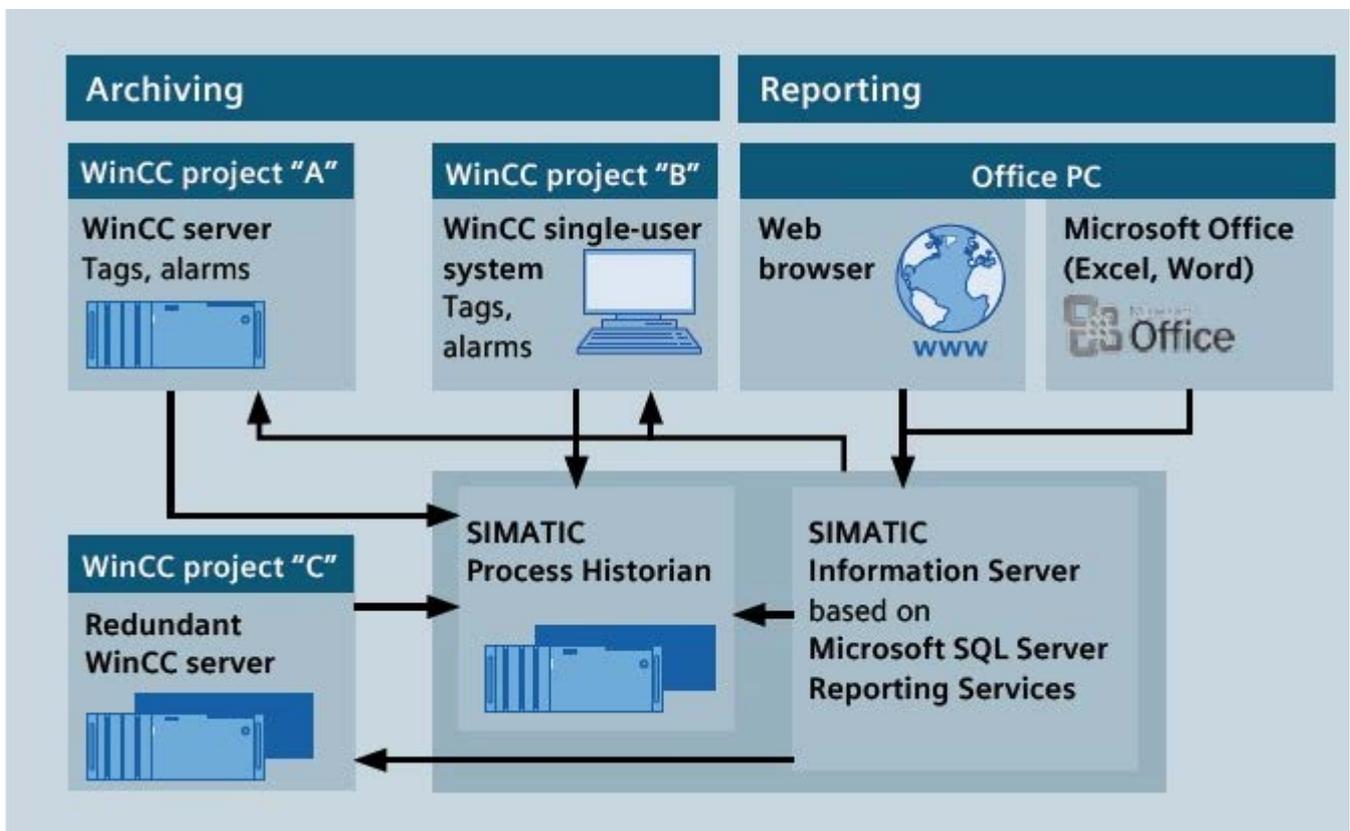


You can display the data saved on each WinCC client:

- Trend window

- Message window

- Web-based protocols with the SIMATIC Information Server

For more information, see the SIMATIC Process Historian option

## SIMATIC Information Server

The **SIMATIC Information Server** is a reporting system that uses the Microsoft Reporting Services and accesses the historical data of a process control system. The historical data consists of process values and messages.

The Process Historian with WinCC OS and PCS 7 OS can be used as data sources. The collected data is evaluated and visualized by means of reports.

The **highlights**:

- User-specific, web-based reporting and analysis functions
- Simple creation and management of user-specific report templates
- Logical links for archived data to calculate individual KPIs
- Individual reports can be created online
- Automatic transmission of reports by e-mail
- Access to archive data using add-ins in Microsoft Word and Excel
- Data security thanks to access protection and user management

Supported operating systems:

- Windows Server 2003 SP2 (32-bit), Windows Server 2008 SP2 (32-bit)
- Windows 7 SP1 (32-bit/ 64-bit), Windows Server 2008 R2 SP1 (64-bit)
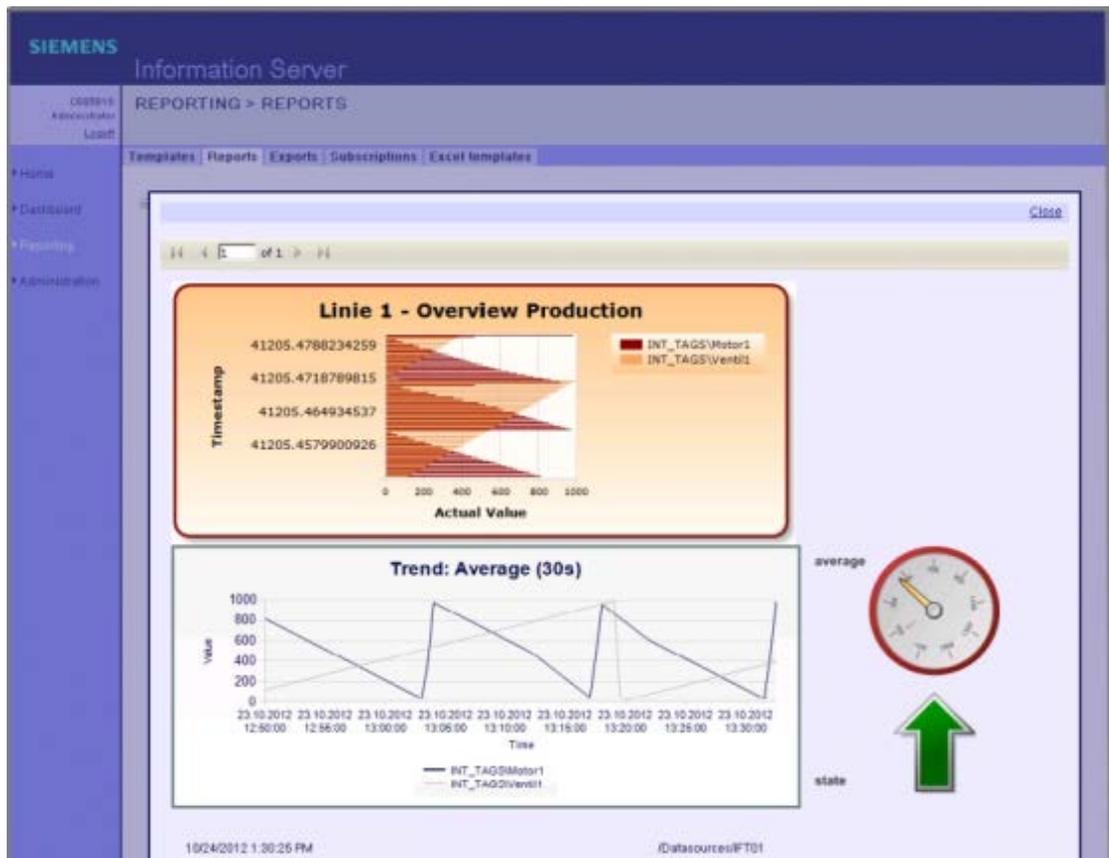


For more information, see the SIMATIC Information Server option

## Long-term archive server

You can swap process values and messages out of the WinCC archive database as a **backup archive** (see "Archive system"). These swap files are stored as compressed binary data files:

● On the hard disk

● On the network drive

● On a long-term archive server

● On a Process Historian

A long-term archive server is used to back up backup archives. It acts as a **file server** without a process connection, and its swap files can be accessed via OLE DB.
Web access is also possible with the WinCC/DataMonitor option.

## WinCC ServiceMode

In order to run WinCC Runtime, a user must be logged on to the computer. By contrast, in WinCC ServiceMode, WinCC Runtime runs as a service on the WinCC server even if a user is not logged on. This is useful, for example, for WinCC servers that are located in a separate computer room and are not used as the operator station.
For service purposes, however, a user can log on to the WinCC server at any time and activate interactive operator control.

● WinCC ServiceMode is only available on the WinCC server.

● WinCC Runtime is automatically started when the WinCC server is powered on.

● The server project cannot be controlled. For this reason, input dialogs and informational dialogs that require interaction with the user are not permitted for picture-independent ANSI-C and VB scripts.

● Users can log on to the WinCC server and log off again at any time.

## File server

Use "WinCC Fileserver Setup" during installation to designate a computer as the exclusive file server. WinCC projects are **stored centrally** on the file server, and backup copies are created regularly. WinCC servers only access the file server during configuration.
To increase system stability, you can equip the file server with additional hardware components such as a RAID system or dual hard disks, as necessary.

## 2.1.4.5    Web systems

### Definition

The Web systems enable you to distribute operator control and monitoring functions via an intranet or the Internet with virtually no configuration changes, even without an additional installation download.

- The WinCC/WebNavigator option allows you to control and monitor the process from anywhere.

- The WinCC/DataMonitor option makes WinCC process pictures, current and archived process data, and analysis functions, as well as reports and logs for the different corporate levels available anywhere. Remote access to a PCS 7 / WinCC station is possible.

- The SIMATIC Information Server option allows you to compile, evaluate and graphically visualize the process values, messages and recipe data of a process control system (see "Options > Plant Intelligence > SIMATIC Information Server).

Up to 150 web-based operator stations per server have **simultaneous** views of up to **18 different**, optionally redundant WinCC server projects and data from different WinCC databases.

### Requirements on the Web server

- WinCC/WebNavigator option and/or

- WinCC/DataMonitor option

- SIMATIC Information Server option

- Microsoft Internet Information Service IIS for displaying process pictures

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#### Note

#### One computer can only have either DataMonitor or the Information Server

You cannot run DataMonitor and Information Server simultaneously on the same computer.

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### New in WinCC V7.2

- Unicode support

- PDL password protection with WebNavigator PDLPad

- User login/logout at WebNavigator client

- Manual logout in Internet Explorer with ODK C-Script (PWRTLogout function())

## Application

Use of an intranet and the Internet provides new types of access and **specific views** of the process provided on-the-fly with **point-and-click functionality**:

- Views over large distances, for example, widely distributed systems in wastewater treatment plants

- Views over narrow-band connections

- Mobile views for remote diagnostics and remote maintenance

- Views of plants with a highly decentralized structure

- Periodic views for process analysis, for example, to supply key operating figures required by management

Web systems provide you with:

- A large number of WinCC clients, limited only by the maximum number of **simultaneous** access attempts.

- Minimum expense: **central licensing** on the Web server for simultaneous access, for example, of 30 Web clients that are not licensed themselves.

- **Sequential remote service** and maintenance of any number of WinCC plants with the WinCC **diagnostics license** for diagnostics clients.

- A high number of Web operator stations and **increased availability** through the use of **Web server farms** with the WinCC/WebNavigator Load Balancing license.

- Minimal installation effort on the Web clients. No WinCC basic system required.

- Low processor- or memory-related hardware requirements for the Web clients (see "Thin clients").

- Use of Web clients on devices with different operating systems and even older operating systems.

- Minimal maintenance costs through **central software administration** on the Web server.

**Structure**
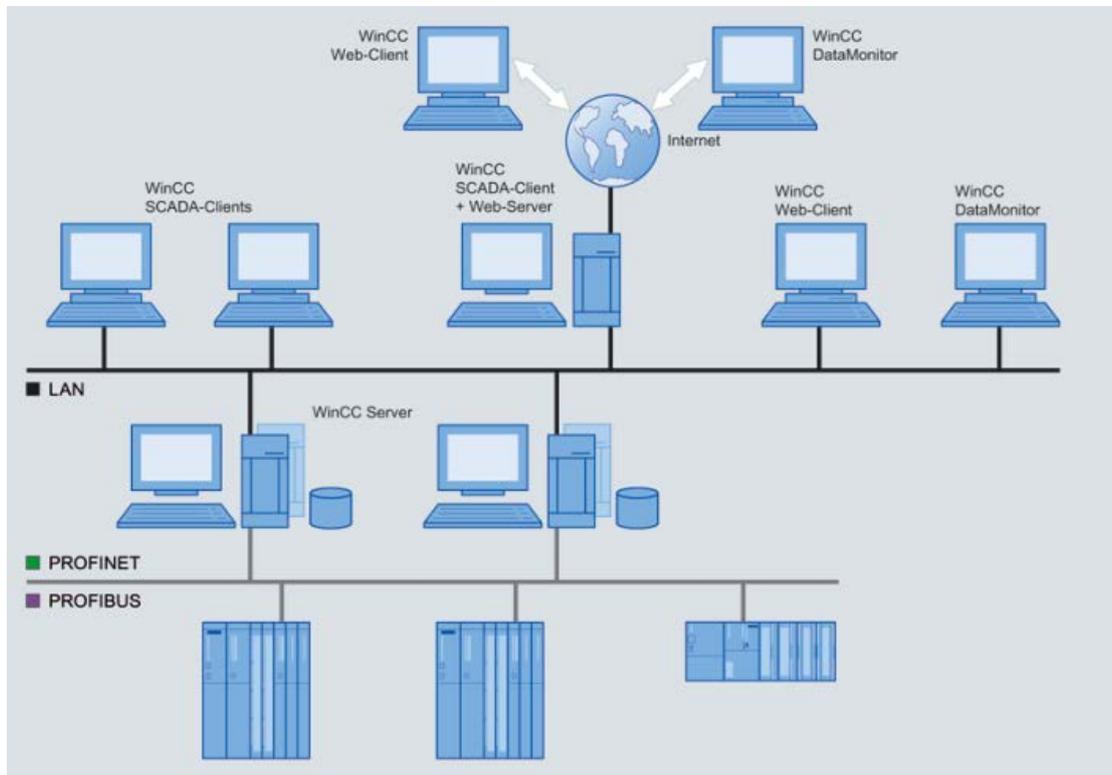


**WinCC/WebNavigator**

To build a WinCC/WebNavigator system, proceed as follows:

1. Place a WinCC project **online** on a computer with an intranet/Internet connection:
   By installing a WinCC/WebNavigator **server** and IIS on a single-user system,
   a WinCC client with a project, or a WinCC server, you create a **Web server**
   for this specific WinCC project.

2. Use the **WinCC Web Configurator** Wizard to set up Internet access in just a few steps
   without prior knowledge of Web servers: IIS, ports, and firewall.

3. In the **WinCC user administration** on the Web server, set up access rights for access via
   an intranet or the Internet, along with a user-specific **start screen** and **automatic logout**.

4. Use the **WinCC Web Publisher** Wizard to provide pictures, graphics, and scripts
   for intranet/Internet access without prior knowledge of HTML.

5. If necessary, use the **WinCC Plug-InBuilder** to provide plant-specific ActiveX controls or
   additional documents for download to the Web clients to increase their functional scope;
   this requires no prior knowledge of the setup technology.

6. Provide **Web-capability** to any Windows-device with intranet/Internet access:
   You create a **Web-Client** by installing the WinCC/WebNavigator **client**, either using the
   product DVD or online in Microsoft Internet Explorer via an intranet or the Internet.

Once an operator has entered the **Internet address** of a WinCC Web server in the Web client and has identified himself with his login/password, he can **control** and **monitor** his WinCC project in MS Internet Explorer. Internet Explorer Version 7.0 and higher supports **tabbed browsing** and can therefore display different views of WinCC projects in one window.

As an alternative to MS Internet Explorer, you can also use the **WinCCViewerRT** Web viewer which is installed with the WebNavigator client: a pure display program with its own Web communication that works **without Internet Explorer**. With it, the display corresponds to the WinCC client. It also satisfies the stringent requirements of customer IT, which has not approved Internet Explorer for security reasons (e.g., to prevent viruses and Trojan horses).

For more information, see WinCC/WebNavigator option.

## WinCC/DataMonitor

To display and analyze current process pictures as well as current and archived process values, messages, and reports on an intranet or the Internet, proceed as follows:

1. Just as with WinCC/WebNavigator, **place** a WinCC project **online** on a computer with an intranet/Internet connection: By installing the WinCC/DataMonitor **server** and IIS on a single-user system, WinCC client with a project, or WinCC server, you create a **Web server** for this WinCC project and **all connected databases**, including swapped-out archives on a long-term archive server.
   Alternatively, you can also put a **file server** with DataMonitor online: However, because the file server does not have its own project, only the Web center is available in this case, to analyze archived data, for example.

2. Use the **WinCC Web Configurator** Wizard to set up Internet access in just a few steps without prior knowledge of Web servers: IIS, ports, and firewall.

3. In the **WinCC user administration** on the Web server, set up access rights for process pictures, along with a user-specific **start screen** and **automatic logout**.
   For more information, see WinCC/DataMonitor option.

4. Now, from the directory tree-like structure, select "Network environment > Computer > **Connected WinCC Database**", for example, **Runtime Database**. You can **search** for available WinCC servers and active databases without prior knowledge of the plant structure.

5. You now have **online access** to all current and archived process values and messages of the connected WinCC servers, swapped-out archives and the long-term archive server.

   The WinCC/DataMonitor offers a number of Internet-capable tools for visualization and evaluation. For example, set up a **central information portal** for WinCC data in the intranet/Internet with the **Web center**.

6. In the **Web center**, assign process values and messages to the available **Web objects**, such as trend windows or message windows. Define your **own Web page layout** and assign to it any Web objects, for example, time frame and value axis, which you can configure individually.
   In **individual Web center views**, you group different types of information from the plant for different user groups according to corporate levels:

   – Fur **Quality Assurance/Management**, tables and trend charts with key figures

   – For the **plant operator/shift supervisor**, a view of process pictures and evaluations in the form of bar charts or pie charts

   – For **service engineers**, trends with temperature changes

   With these views, WinCC data can be compared, analyzed, evaluated and, if necessary, even exported over absolute or relative periods of time.

7. With the **Excel Workbook Wizard**, import current and archived process values from a local WinCC project or any WinCC server projects into an Excel worksheet.
   You do this in a **tag selection dialog** using a **drag-and-drop** operation. You configure the tag properties for the view in the Excel worksheet, which will later be linked to WinCC Runtime and **updated online**.

8. Then **publish** the Excel worksheet over an intranet or the Internet on the DataMonitor server and **activate** the connection to the WinCC server. The DataMonitor clients with Excel Workbooks download the Excel worksheet and display it in Internet Explorer.

9. Alternatively, you can make the Excel worksheet available as a **report template** for the **Published Reports** function.

10. In **Published Report**, select an Excel worksheet created with the Excel Workbook Wizard, assign a user, or specify an e-mail address as the target. The reports are either initiated **manually** through operator input or they are **event-driven**, for example, when a WinCC tag is changed, or **time-driven**, for example, automatically at the end of a shift.
    Thus, for example, it is possible to provide **automated reports** for management with statistics and analyses of current and archived data.

For more information, see WinCC/DataMonitor option.

## SIMATIC Information Server

Proceed as follows to use the **SIMATIC Information Server** as a **reporting system**:

1. Log on to the Information System as administrator.

2. Connect a data source on **Administration > Projects**, for example, the address of a PC with **Process Historian**, to the Information Server. Select a project and click "Connect". You have now connected the Information Server with the Process Historian on a separate PC. You can now compile, evaluate and graphically format the data from the Process Historian.

3. To **evaluate** the data loaded to the SIMATIC Information Server, you create a **report**. The Information Server has a number of templates for the graphical display of tag data and process values and creating message tables.
   Select a template under **Reporting > Templates**, for example, "Table" and enter the start and end date. Select the tags / message classes for messages. Click "Create report".

4. You can **Export reports** and create **subscriptions** to send reports by e-mail automatically.

5. The Information Server provides **add-ins** for Microsoft Excel and Word applications. These add-ins can be used to create and insert reports in Excel and Word.

For more information, see the SIMATIC Information Server option

## 2.1.4.6    Thin clients

### Definition

Up to 25 devices with low hardware requirements (thin clients) have **simultaneous** views of up to **18 different** WinCC server projects.

### Requirements on the terminal server

- WinCC/WebNavigator client option
- Microsoft Internet Information Service IIS
- Microsoft Terminal Services

### Introduction

WinCC uses Windows Server technology exclusively: Terminal Services of the Windows Server operating system enable multiple terminal clients to remotely access the desktop of a computer that supports terminal services, on which an application such as Microsoft Word is running.

With Terminal Services, only the user interface of an application (such as Microsoft Word) is presented at the terminal clients. This saves computer resources. The application itself runs only on the terminal server, not on the terminal clients. The terminal client keyboard inputs and mouse operations are returned back to the server for processing.

The WinCCViewerRT Web viewer is an optimized terminal client. The WinCC/WebNavigator client has already been created with "Thin" architecture and has minimal hardware requirements. Thus, many terminal clients are possible on different machines on which the WinCC/WebNavigator client itself is not or cannot be installed, such as Windows CE machines.

## Application

In contrast to typical WebNavigator installations, thin clients are located on the same network as the terminal server. However, the following can also be accessed:

- Wide Area Network WAN, for example, on provider networks
- Remote Access Service RAS for homeworking and telecommuting
- An intranet and the Internet

Terminal Servers have the following advantages:

- Rugged hardware with minimal memory requirements can be used as thin clients, including machines with no fan or hard disk operating in a dusty environment (SIMATIC ThinClients, for example).
- Mobile clients with limited power consumption can be used as thin clients; these include SIMATIC Mobile Panels Wireless as well as handhelds, palmtops, PDAs, Pocket PCs, and Smartphones.
- Different operating systems are supported: Windows CE (in SIMATIC ThinClients, for example), Windows Mobile, Windows XP, Windows 7, etc.
- All applications are located on the terminal server in a self-contained environment.
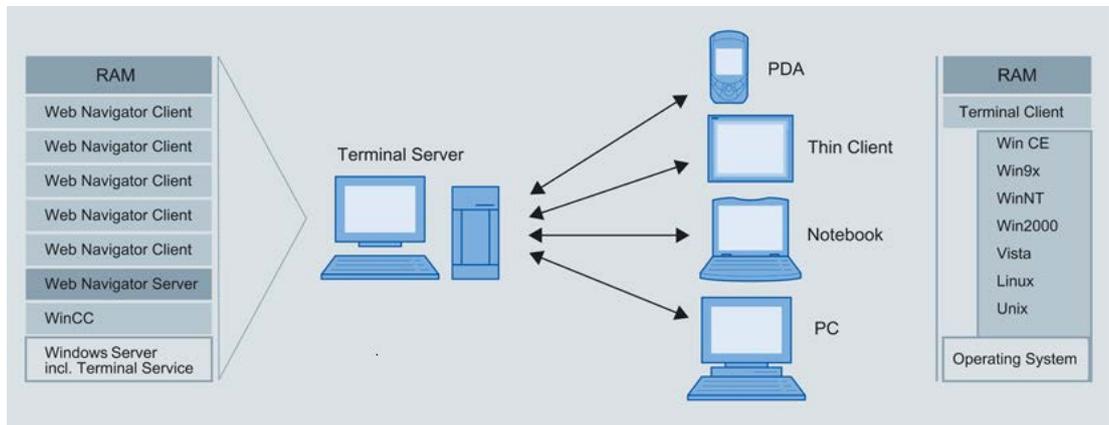- Easy central administration on the terminal server.

## Structure



Figure 2-10    Thin clients on different operating systems on the terminal server with WinCC/WebNavigator

To build a terminal system, proceed as follows:

1. Install WinCC/WebNavigator server and IIS on a WinCC client with its own project on a WinCC server or single-user system.
2. Activate Terminal Services with the wizard for Windows components (no knowledge of Web servers required).

3. Now, when you install the WinCC/WebNavigator client, you create a terminal server for WinCC projects in MS Internet Explorer. Alternatively, you can also use the WinCCViewerRT Web viewer that is installed with the WebNavigator client:
This is a display program only for Web projects with their own Web communication that works without Microsoft Internet technology and is therefore an extremely lean "THIN" terminal services application. It also satisfies the stringent requirements of customer IT, which has not approved Internet Explorer for security reasons (e.g., to prevent viruses and Trojan horses).

4. In Control Panel, open "Computer Management" and create Windows users and user groups for access via terminal services.

5. On any Windows machine with intranet/Internet access, establish a remote desktop connection to the terminal server. This creates a terminal client with no additional installation required.

After successfully logging on, the operator then launches Internet Explorer or the WinCC WebViewer (WebViewerRT) on the terminal server on the terminal client and can then perform operator control and monitoring functions with the WinCC project.

## 2.1.4.7 Plant Intelligence

### Definition

WinCC Plant Intelligence links the **SCADA level** with the **Manufacturing Execution Systems (MES)**. As the central integrators, the Manufacturing Execution Systems supply real-time data from production to the Enterprise Resource Planning (ERP) system.
MES is as essential for industrial manufacturing as ERP for the commercial and operational planning and logistics processes. The greatest benefit can be derived from these two system landscapes only when they are **integrated**.

Process visualization systems, enhanced with Plant Intelligence, create more **transparency** in production. More transparency means intelligent and efficient acquisition, archiving, compression, evaluation, and distribution of production data.

### Application

Increasing the degree of automation no longer results in appreciable **increases in efficiency**. Rather, increased efficiency results from the ability to utilize and correlate all the different types of data that are produced within a company with the objective of **optimal use of all resources**.

The resulting continuous flow of data between production, planning, and the control system provides key competitive advantages:

● Real-time, targeted process optimization

● Time-saving, targeted synchronization

● Simplification of production sequences

● Flexible production

● Efficient resource planning and use of production capacity

● Traceability, quality assurance, and sustainability

## Structure

With the integrative "Plant Intelligence" expansion, Siemens provides a **complete**, **scalable solution** from a single source - from the machine to the corporate level. **SIMATIC IT** makes it possible to upgrade seamlessly from a cost-effective, powerful, WinCC-based entry-level version to a comprehensive optimization solution on the MES level.

SIMATIC IT is able, for example, to correlate and analyze parameters such as key performance indicators (**KPI**) across multiple plants and can then also use these parameters to evaluate production data such as orders, genealogy, and batch data.

Plant Intelligence comprises the following WinCC options:

- **WinCC/DataMonitor**: display, analysis, evaluation and distribution of current process states and historical data on any office PC with Internet-capable tools

- The **SIMATIC Information Server** can be used to compile, evaluate and graphically visualize the process values and messages of a process control system.

- **WinCC/IndustrialDataBridge**: linking of external databases, office applications, and IT systems

- **WinCC/ConnectivityPack** and **WinCC/ConnectivityStation**: access for other applications to the WinCC archives or to current process values and messages via OPC or OLE-DB

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#### Note

#### One computer can only have either DataMonitor or the Information Server

You cannot run DataMonitor and Information Server simultaneously on the same computer.

# 2.2 Efficiency

## 2.2.1 Overview

### Requirements

Higher **production speed**, better **plant integration**, and the greatest **reliability** around the clock are key challenges for a company's management. At the same time, due to ever higher costs, **productivity** must be increased and **lifecycle costs** reduced. This makes it necessary to continually **optimize processes** in order to improve **competitiveness** in the long run.

**Increased efficiency** has been achieved through an increase in the degree of automation. Today, however, it is essential to be able to utilize and correlate all the different types of data that are produced within a company with the objective of optimal use of all resources (**Plant Intelligence**). A critical role in this strategy is played by **process visualization systems**, which must meet the following requirements:

- Easy **operation**
- **Clear** and **efficient** application in the engineering phase
- High **availability** and **safety** during plant operations

### Solutions

- **WinCC Configuration Studio** for configuring process communication
- **WinCC Explorer** as the main operational center of the project
- **Graphics Designer** for creating process pictures
- **Text Library** and **Text Distributor** for configuring multilingual projects
- **User Administration** for assigning access rights, locally or via an intranet or the Internet
- The **message system** for configuring the alarm and message system
- The **archive system** for configuring process-value and message archives
- **Reporting and logging system** for configuring line-oriented and page-oriented logs
- **User archives** for archiving user-defined data records (see WinCC/User Archives option)

## 2.2.2 Project management with WinCC Explorer

### Introduction

WinCC Explorer is the **main operational center of the project** that provides a **integrative engineering environment** for accessing all WinCC components. It is used to define central project settings and displays all **editors in the basic system** with their **objects** (such as the configured process pictures) **hierarchically** in the directory tree, along with the installed **options**. Thus, WinCC Explorer provides the **central project overview** and ensures **efficient project creation**. With the push of a button, you can switch the display language of the entire configuration interface, including the online help, from one of the installed languages to another (for example, from English to Spanish).

### Object-oriented and modular

All relevant configuration data is stored in a **WinCC project**. WinCC has a continuously **object-oriented**, **modular** structure. **Objects,** such as picture objects and tags, are nested during configuration, e.g., Process Picture > Picture Object > Tag > Event.
This object-oriented, modular approach makes the following possible:

- Linking of objects (e.g., tag to picture object) via drag-and-drop

- Finding and replacing of objects

- Diagnostics on objects via tooltips, for example, with online information about tags and communication links (see "Unrestricted process communication")

- Object editing with the most important commands in a context menu

- Clear representation of objects with object properties

Table 2- 1    WinCC Explorer and its editors in the basic system

| Editor | Use | Import/export interfaces | Foreign language configuration with language switching function |
|---|---|---|---|
| PC | Specifies the **PC** (e.g., WinCC client or WinCC server) and central project properties | --- | Yes |
| Tag Management | Creates and edits **communication connections, tags and structure types** with **WinCC Configuration Studio** | WinCC Configuration Studio | --- |
| Graphics Designer | Creates and edits **process pictures** and dialogs | Export function of the editor | Yes |
| Menus and toolbars | Configures **menus and toolbars** | --- | Yes |
| Alarm Logging | Configures **alarms** and **messages** and archives events | WinCC Excel ConfigurationTool, Text Library | Yes |
| Tag Logging | Sets up the **archive system** and archives **process data** | WinCC Excel ConfigurationTool | --- |
| Report Designer | Configures **reports** with line-oriented and page-oriented log layout | --- | Yes |

| Editor | Use | Import/export interfaces | Foreign language configuration with language switching function |
|---|---|---|---|
| Global Script | **Programs** picture-independent actions as VBScript/C script and creates C functions | Export function of the editor | Yes |
| Text Library | Creates and edits multilingual **user text** | Export function of the editor | Yes |
| Text Distributor | **Exports** and **imports languages** and text of individual objects | Export function of the editor | --- |
| User Administrator | Manages **users**, **user groups**, and their access rights | Text Library | Yes |
| Cross Reference | Localizes and links the **places** where objects are used | --- | --- |
| Load Online Changes | **Transfers** edited data to the operator station | --- | --- |

In all editors, you can **configure online** during active runtime.

WinCC Explorer offers the following functions:

- Creation and modification of WinCC projects

- **Project configuration**: single-user systems, multi-user systems, distributed systems

- Central properties of **participating PCs**: WinCC client or WinCC server, name of PC, time basis, language settings, **design**, **color palette**

- Runtime settings: **startup list** for Runtime components, debugger, and other programs such as Microsoft Excel

- GraphicsRuntime settings: runtime language, start screen project- or sector-specific **menus and toolbars** with **picture navigation**, windows, hotkeys

- Management of project data and archives

- Project copying or duplication with **Project Duplicator**

- Project **activation** and **deactivation**

- Project documentation printout

- Switching of entire WinCC interface including online help to another language with the touch of a button (see "Ready for worldwide use with multilingual capability")

The **status bar** shows the following information:

- Number of configured external tags compared to the number of tags covered by the license

- Number of objects of the selected editor, for example, the number of pictures in Graphics Designer

## Activating and deactivating a WinCC project

When you **activate** a WinCC project, all objects are compiled and transferred to the target machine, where the relevant runtime is then started. To optimize memory requirements, you can activate only the specific runtimes that are needed. Example:

- GraphicsRuntime for process pictures

- AlarmLoggingRuntime for the message system

- TagLoggingRuntime for the archive system

**Communication** with the automation system begins. All process data is stored in the integrated Microsoft SQL Server databases, for example, "Alarms" and "Trends" (**Runtime databases**), which you can access directly in many ways (see "Unlimited plant configuration").

In a **distributed** or **multi-user system**, first activate runtime on all WinCC servers; if necessary, do this **remotely** from a remote PC. Then start runtime on the WinCC clients, which will then **connect automatically** with the WinCC servers.

To exit the WinCC system, follow the reverse order. When you first **deactivate** Runtime on a WinCC server, the missing connection is then displayed in the active client projects, for example, in the message window or trend window. Following this, all fields with missing process values in the process picture appear **shaded**.

## Central design



Figure 2-11    Central WinCC designs

The overall appearance of your projects in runtime is determined by predefined designs and customer-specific designs that you create yourself:

● Central color palette

● Colors, patterns, and other optical effects

● 2-D, glass-like shimmer effects. or 3-D

● Different style and color scheme for groups of object types

● On Windows 7: shadows, transparency, lights, and hover effect

With the hover effect, a picture object that can be activated changes color when the operator briefly rests the mouse pointer over it. Any changes to the design settings are made locally for each object.
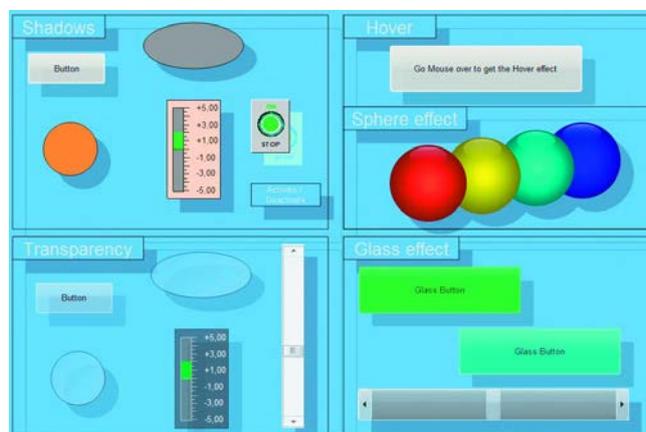


Figure 2-12    Graphical effects with Windows 7

The **WinCC Information System** is the **central information hub** of the online help with full-text search and a comprehensive index with the following chapters:

● "Installation Notes" contains important information on the scope of delivery, installation. and operation of WinCC.

● "Release Notes" gives you important, up-to-date information about WinCC.

● "First Information" contains "What's new", "Project migration", and WinCC System Overview, as well as "Getting Started" divided into sections for beginners and advanced users.

● "Working with WinCC" shows you how to make optimal use of WinCC functionality.

● "Communication" shows you how to exchange data between WinCC and a controller and perform diagnostics.

● "Configuration" provides an in-depth presentation of possible plant configurations.

● "Options" accesses the documentation of the installed options.

● "Interfaces" provides a detailed description of the different access options on WinCC.

## 2.2.3 Creating process pictures

### Introduction

The **graphics system** of WinCC processes all inputs and outputs on the screen during runtime. The **process pictures** that you use for the visualization and operation of your plant are created with **WinCC Graphics Designer**. Whether you are dealing with simple operator control and monitoring applications or complex control tasks, with WinCC standards, you can create **individually configured user interfaces** for each application – for increased security during process control and optimization of the entire production sequence.
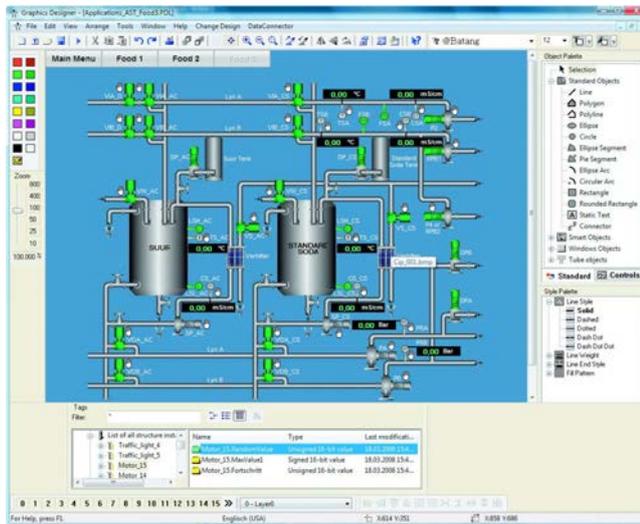


Figure 2-13    WinCC Graphics Designer

Process pictures are composed of individual **picture objects** ranging from simple, **standard** graphical objects such as the circle, square, and polygon to self-contained, preconfigured **smart** objects and **controls** with a **process connection**, i.e., an interface for the input and output of process values.
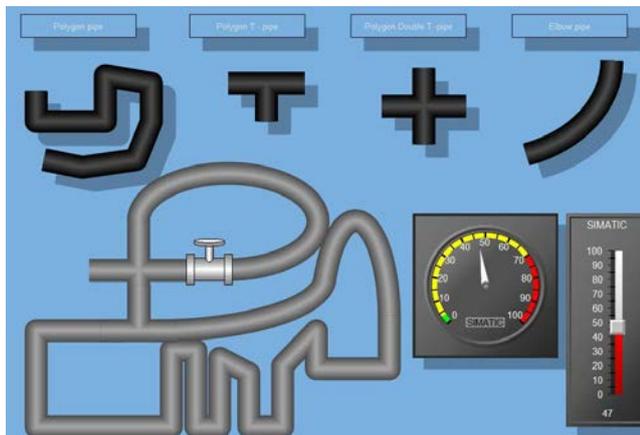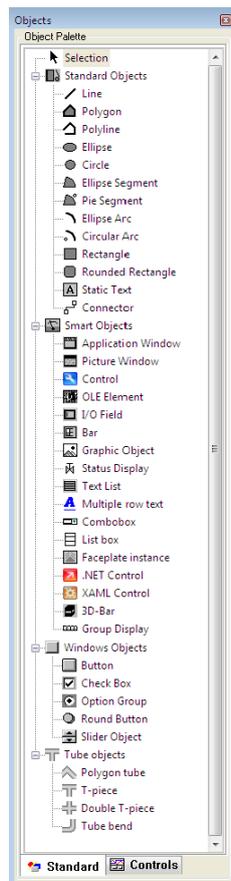


Figure 2-14    Picture objects in Graphics Designer

Figure 2-15    Object palette with standard objects and smart objects

## Properties

From the object palette, you **drag** a picture object to the process picture. The different picture object types have **default** properties. These properties are clearly arranged in **property groups**. You use the **dropper** to transfer the properties of one picture object to other picture objects.

**Almost all properties** of a picture object can be made **dynamic**, which means that they can be changed by a tag, a script, or a direct connection (see "Intelligent configuration"). To do this, **drag-and-drop** a tag from the tag palette, for example, to any picture object property such as process connection, background color, or flashing.

With **WinCC Graphics Designer**, you have a **complete graphics editor** at your disposal, making it easy and convenient to create process pictures:

- Vector-oriented, object-oriented

- Dialogs and windows can be moved by dragging, docked at random and arranged as tiles in tabs.

- Automated configuration with VBA (see "Openness and integration")

- Palettes for font, style, and color selection

- Object palette and tag palette

- Default objects, Smart objects, Windows objects, and controls

- Alignment, centering, distribution

- Positioning, grouping, nesting

- Scaling, rotating, mirroring

- Zooming, panning, decluttering

- Shape, appearance, visibility of picture objects

- Coordinate systems, grids, connectors

- 32 picture levels can be shown or hidden

- Block library, project library, function library

- Password protection of process pictures

- Faceplates (picture objects that can be modified centrally)
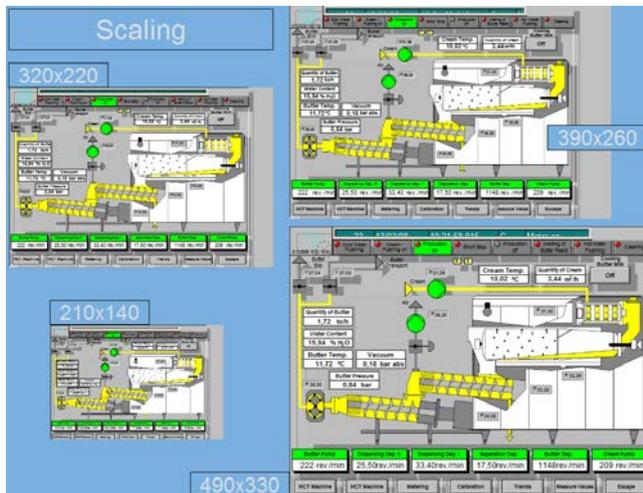
The following are some of the techniques that support **visualization of a process picture** in Runtime:

- **Decluttering**: showing/hiding of layers and the picture objects they contain based on the zoom factor. Example: show level 8 "Basic view" with a zoom factor between 2% and 800%; show level 9 "Detailed view" with a zoom factor between 150% and 800%.

- **Extended zooming**: zooming in and out of process picture with the mouse wheel. Prerequisite: mouse driver by Logitech or Microsoft IntelliMouse. Picture objects are shown or hidden based on the zoom factor. You specify how big picture objects must be in order to be shown, for example, minimum 10 pixels, maximum 1000 pixels.

- **Panning**: using the mouse to move and scroll a section of a large process picture in the window.

- **Multi-touch**: You can configure two-finger operation. You require a screen that supports multi-touch if you want to use the touch function.

Graphics Designer enables **picture-in-picture display**: pictures that show other process pictures in the current process picture. Moreover, externally edited text and graphics can be embedded in various formats: BMP, animated GIF, JPG, JPEG, PNG, EMF, or via OLE. In addition, the **WinCC Media control** also plays the **streaming formats** ASF, WMV, AVI, MPG, MPEG, MP4, QT, and MOV. The required codec must be available in the Windows operating system.



Figure 2-16    WinCC Media control

## 2.2.4        Object-oriented configuration

### Grouped picture objects

Whenever you combine several picture objects into one **group**, Graphics Designer treats the group as a single picture object with common properties that can be moved, rotated, and positioned as an entity. If you change a shared **group property**, this central change will apply to all grouped picture objects that have this property. However, it is still possible to make individual changes to grouped picture objects. To **reuse** the group several times, place it in the **project library**.

### User objects

A **user object** is a **group** of picture objects with self-defined interfaces that is stored in the **project library** for reuse. When you use a user object in a process picture, a copy of the original is created.

In the **Configuration dialog**, you define the configurable properties and events of the user object with no programming involved. Example: myBackgroundcolor = Circle1.Backgroundcolor + Square2.Linecolor. Just as with any other picture object, these self-defined interfaces of the user object can be made dynamic in Graphics Designer using a drag-and-drop operation.

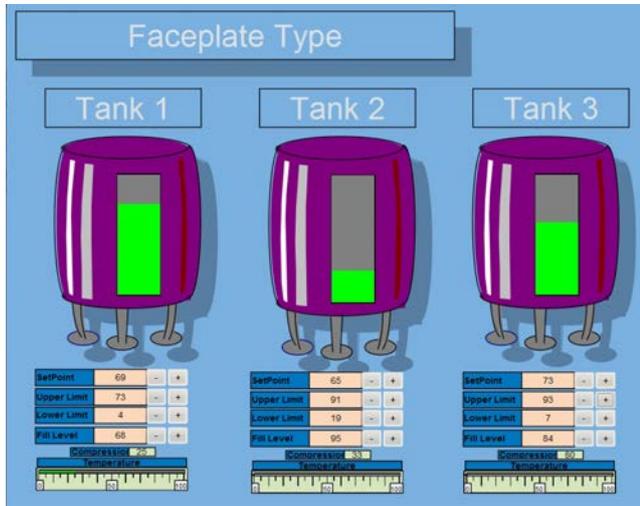### Faceplates (picture objects that can be modified centrally)



Figure 2-17    Faceplates in WinCC

WinCC supports **building-block** configuration. With this technique, any picture objects can be grouped into a specific new user object, in which only the interfaces that are relevant for the process link can be seen from outside. These **faceplates** are centrally generated, managed, and stored in the project library. **Central changes** to the faceplate are automatically applied to all places of use (**faceplate instances**).

This allows you to add **additional functionality** to an existing faceplate, for example, and as a result, thousands of faceplate instances used in the project would then be modified automatically the next time the process pictures are opened.

In addition to the centrally modifiable properties of a faceplate, the **instance-specific** properties, which cannot be modified centrally, are also defined in the **configuration dialog**: The instance-specific properties are **preconfigured**, but they can still be modified individually in the faceplate instance. Changes do not affect the central faceplate in the project library, and vice versa.

Within a faceplate, you can only access tags specifically associated with the faceplate; you cannot directly access WinCC tags. WinCC tags are connected to the faceplate instance by means of **dynamization**. In this way, the faceplates can also be used in other projects. Just as with any other picture object, these self-defined interfaces of the faceplate can be made dynamic in Graphics Designer using a drag-and-drop operation.

## 2.2.5 Intelligent configuration

### Introduction

In addition to the block technique and faceplates (see "Creating process pictures"), a number of other advanced configuration tools are available in WinCC.

### Libraries

With the aid of the library, previously created objects can be used again and again via drag-and-drop. This allows you to establish your own company-specific, technology-specific, or industry-specific standards for efficient configuration.
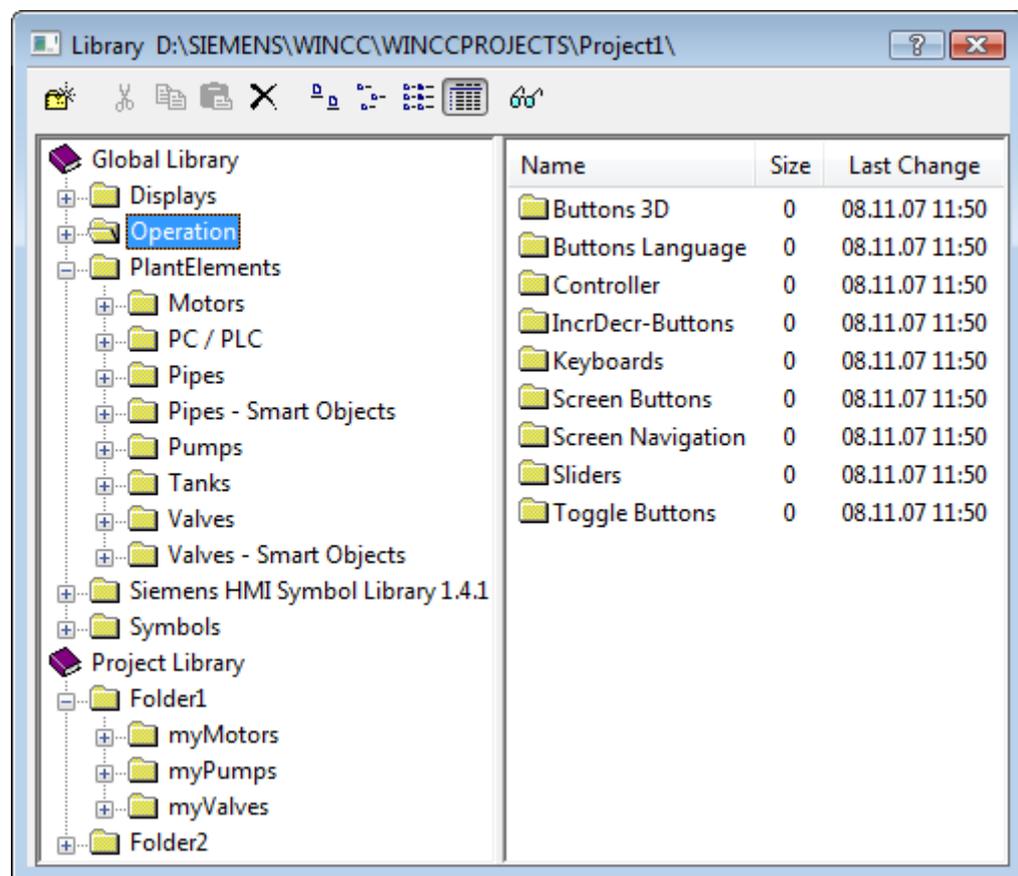


Figure 2-18    Libraries in WinCC

The **global library** contains a number of ready-made, standardized **picture objects** from various industrial sectors. The **project library**, which is broken down into directories and subdirectories, contains **project-specific and industry-specific** user objects or complete process pictures. You can **reuse** the user objects you have **tested** however you wish with all their configured properties and dynamic elements. You can convert libraries that were created in an older WinCC version to the current format and continue to use them.

The **HMI Symbol Library** contains a comprehensive collection of ready-made picture objects for the display of plants and plant components.
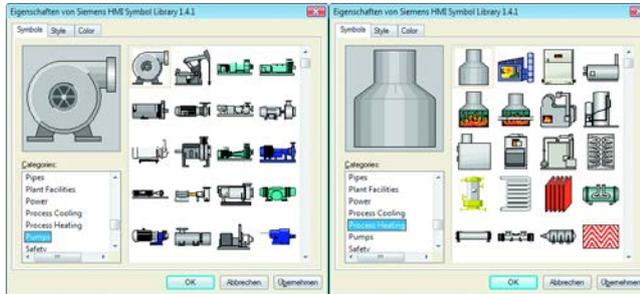


Figure 2-19    HMI Symbol Library

## WinCC as an integration platform

WinCC Graphics Designer allows you to incorporate a number of **controls**. Controls integrate elements for control and monitoring into a process picture, e.g., a message window. They often have comprehensive interfaces to Graphics Designer, for example, to change sizes and properties:

- .NET controls: control elements from any providers based on Microsoft .NET Framework 2.0

- WPF controls: control elements from any providers based on the WPF interface of Microsoft .NET Framework 3.0

- ActiveX controls: Control elements from any provider with an OLE-based interface. This also includes all elements of WinCC controls, such as message output in the **message window** and trend chart displays in the **trend window** (see "Message system" and "Archive system").

- .Net 4.0 is only installed with SQL Standard in the latest operating system. .Net 4.0 must be activated for WinCC Client installation in the operating system.

You can create your own additional ActiveX controls with the WinCC/IndustrialX option. You can configure the selection of controls available in the project yourself. **OLE objects**, by contrast, are used to integrate files that were created with other Windows programs, such as Microsoft Excel.

## Predefined properties

Whenever many picture objects in a complex process have the **same picture properties**, you define the picture properties once and use them as **customized default settings** for your project. You can export and import default settings in projects.

Instead of assigning actual colors, such as "yellow", you work with **color indices** ("1=yellow"), which you save in a **color palette**. If you then change the color palette for a customer-specific design (for example with "1=green"), this changes all graphical elements from yellow to green.
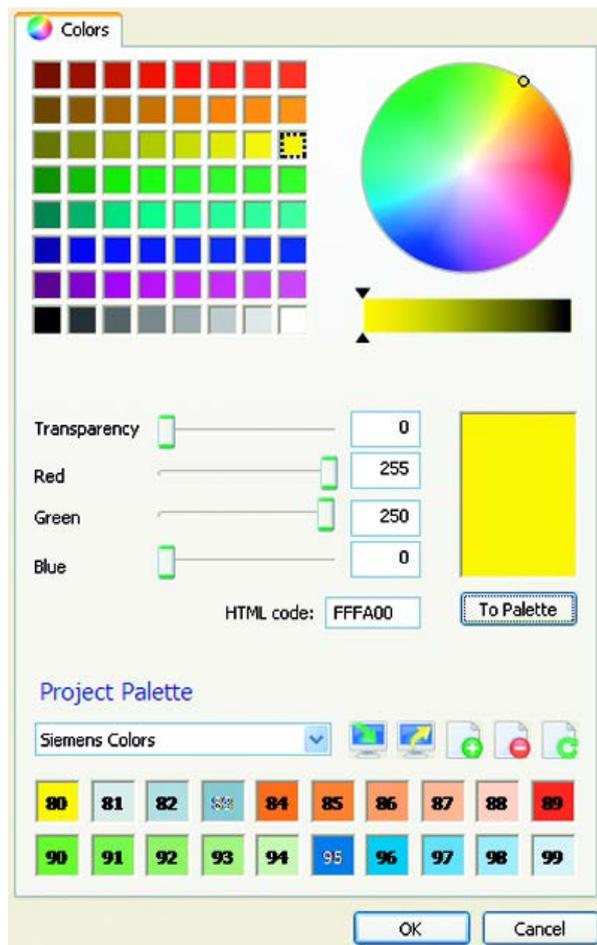


Figure 2-20     Color palette

## Picture levels

WinCC supports the configuration of 32 picture levels. In complex process pictures, you can combine picture objects on different logical **levels** and show and hide them level-by-level as needed, even in runtime via VBScript. This gives you a better overview: for example, all pumps on Level 1 and all valves on Level 2. Alternatively, you can combine various details (outline view to detailed view) on different levels, which are then displayed as a function of the zoom factor (**decluttering**). You can also place operating windows on a separate level; you can then hide these during configuration with the push of a button.

## 2.2.6        Dynamic configuration

**Dynamization**

When a property of a picture object (for example, background color) is made **dynamic**, it changes in Runtime based on the process state:

- Static: BackgroundColor = Red
- D with a tag: BackgroundColor = _FillHeight
- D with an action: BackgroundColor = Function(_FillHeight)

You have several options for creating dynamic elements, which you can then modify centrally in the **Linking dialog** (see "Configuring complex projects").
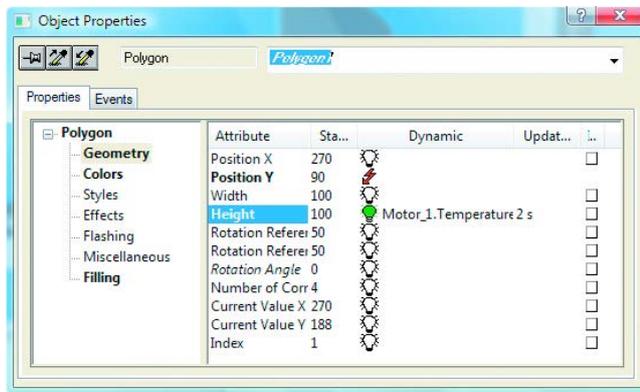


Figure 2-21    Dynamized picture object properties

| Symbol | Dynamization |
|---|---|
| White light bulb | Not dynamized |
| Green light bulb | Dynamized with a tag |
| Red thunderbolt | Dynamized with a Dynamic dialog |
| Blue thunderbolt | Dynamized with a direct connection |
| Green thunderbolt with "VB" attached | Dynamized with a VBScript action |
| Green thunderbolt with "C" attached | Dynamized with a C action |
| Yellow thunderbolt with "C" attached | Dynamized with a non-compiled C action |

1. In the simplest case, you dynamize a property directly with (the value of) a tag:
   Height = _Temperature. In this case, **indirect addressing** is also permitted:
   Height = _TagName; Value(_TagName) = _Temperature.
   The update cycle is preset, but can also be adjusted accordingly.

2. An extremely high-performance option is to enter a formula in runtime via the **Dynamic dialog**. This option allows you to map the value range of a tag in a non-linear manner to color values, for example. The formula calculation must be triggered by an event such as a tag change.

3. The **simplest action** is created by means of **direct connection** of properties with no programming involved. Example: When an event such as a mouse click occurs, a given property becomes equal to another given property or tag:
   Bar.BackgroundColor = Button.ForegroundColor.

4. **More complex dynaminzation** can be created by means of **VBScript/C actions** in scripts. In this case, the project engineer is responsible for the refresh rates and thus also for the Runtime performance (see "VBScript for openness without bounds" and "ANSI C for integration without bounds").

In addition to properties, picture objects also have **events** (for example, "Property X has changed" or "Picture object has been selected"). You can configure an **action** associated with these events. Then, whenever the event occurs, this would **call** a specific **function** , for example, Item.BackColor = RGB(255,0,0).

## Configuration dialogs

Graphics Designer provides optimized configuration dialogs for **quick configuration** of individual picture objects: Whenever you insert a SmartObject from the object palette into the process picture, a configuration dialog opens with the most important properties, some of which are preconfigured.

The **Plant-wide Tag Selection dialog**, available in a wide range of locations, is one example of these quick configuration dialogs; another is the **configuration dialog for user objects**.
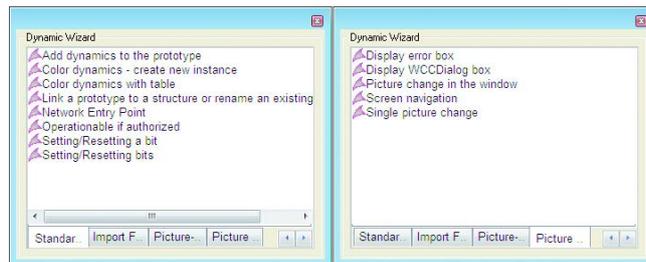
## Dynamic Wizards

Figure 2-22     Dynamic Wizards

WinCC provides project engineers with software-aided wizards that accomplish routine tasks for them. An example of this is the Dynamic Wizard in Graphics Designer, which **automates** frequently recurring configuration steps. Examples:

- Set/reset bit

- Configure language switching

- Configure complex color change

- Move picture object

 You can add these functions in the **Dynamic Wizard Editor** as needed according to a **predefined template**, with very little programming knowledge required. This template gives all functions of the Dynamic Wizard a similar work flow, similar dialog pages, a similar Help system, etc.

## Additional wizards (partial listing)

- "Export/Import Picture Objects" Dynamic Wizard
- DataConnector
- Graphic Object Update
- ConfigurationTool
- CrossReference Wizard
- Message System Wizard with Interconnection Wizard
- Archive Wizard
- Web Configurator and Web Publisher
- Excel Workbook Wizard
- User Archive Wizard
- SQL Server Import/Export

## 2.2.7 Multilingual configuration

### Overview

A WinCC project can contain all languages for which the PC has been set up.
The available locales and fonts can be configured at the same time and used in runtime.

When an operator **switches the Runtime language**, the corresponding **foreign-language text** appears in the process pictures. This includes **static texts**, labels, **tooltips** for buttons, etc. For this function, switch the **configuration language** during configuration and enter the corresponding static foreign-language text **at the picture object** directly in Graphics Designer, for example. By directly entering text on the picture object, you can adjust the size of the picture object if necessary to fit the foreign-language text.

Likewise, you can configure **foreign-language message text** directly in the message system via the configuration language. Because it does not matter how long the message text is, all configured message texts are stored centrally in the multilingual **WinCC Text Library**, as are the following language-dependent objects created in multiple languages:

- Message blocks, message classes, and message types in the **message system**
- Page layouts for project reports and runtime logs in the **reporting and logging system**
- Access rights in the **user administration** system
- Tag names in **user archives**
- Text such as container names from Picture Tree Manager

Certain objects must be unique and are therefore not language-dependent. These include archive names, tag names, and script functions.

Instead of displaying static text on a picture object, you can also reference the WinCC Text Library with an internal tag of data type "**text reference**". In this case, the text will always be displayed in the runtime language of the PC that was used to create the text reference.

If you have a large number of language-dependent objects and many target languages, configure the project in a **configuration language you know** and then export all text with **Text Distributor**. After completion of an **external translation** for each target language, reimport the text to your project.

## WinCC Text Library
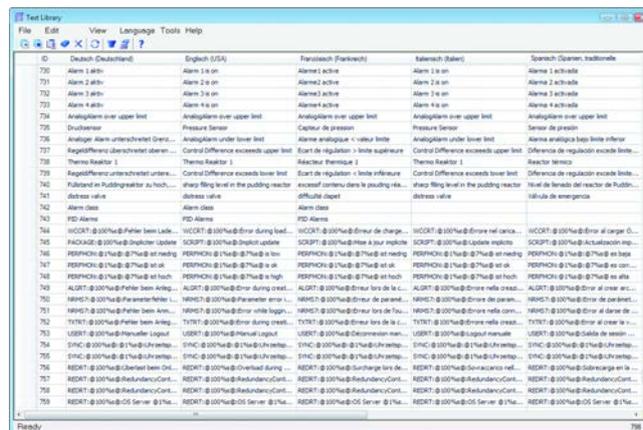


Figure 2-23    WinCC Text Library

The Text Library allows you to manage the language-dependent text of your project (for example, from the message system) **centrally** in a clear tabular format.
From Graphics Designer, however, the Text Library only stores text from the configured text lists. Each text contains a **unique ID**, which is used to reference it in WinCC. You enter translated text directly in the language columns. You can also access all text stored in the Text Library with **WinCC Excel ConfigurationTool** (see "Configuring complex projects"). When the operator **switches the runtime language**, the text switches in accordance with what is stored in the corresponding language column.

If there is **no translation** of the text in the current runtime language, the text is displayed in the configured **default runtime language**. If the configured default runtime language does not contain the corresponding text, either, the display shows "???".
The Text Library also shows:

- **Text filtered** according to editors

- Text in its **own letter type**, which is particularly important for languages that do not use the Latin alphabet (such as Russian, which uses the Cyrillic alphabet)

- **Missing text** with point of use, which does not exist in the Text Library, but was created during the configuration

- **Unused text**, which exists in the Text Library, but not in the configuration

- **Non-system text**, for example, text from VBScript/C script or text lists
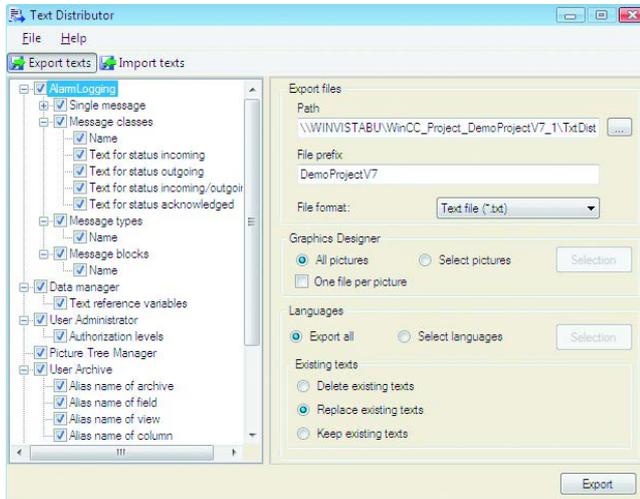
## WinCC Text Distributor



Figure 2-24     WinCC Text Distributor

If an **external translator** does not have access to WinCC, you can use the Text Distributor to **export** all language-dependent text.

To facilitate the translation process, you can also use the Text Distributor to perform a **targeted export** of **all language-dependent WinCC text**, including text from the Text Library and from process pictures in Graphics Designer. This includes:

● Specific languages

● Specific process pictures

● Specific editors and objects

The exported .csv files can be edited and translated in Excel or in a text editor, for example.

After the export or import, a dialog appears displaying a list of all export or import procedures. You can filter this list according to the following criteria:

● Export or import successful

● Warning

● Read error during export or import

● Information about objects that do not contain language-dependent text

## 2.2.8 Configuring complex projects

### Application

For a service engineer or plant supervisor, it is often difficult to come to grips with a project and analyze specific, complex project conditions.

- How do I effective manage 10,000 tags without losing track of anything?
- How do I edit 100 picture objects with 50 properties each?

Overlapping configuration functions in WinCC help you **engineer complex projects**.

### WinCC Configuration Studio

WinCC Configuration Studio provides a simple and efficient way to configure bulk data for WinCC projects. WinCC Configuration Studio is the editor for **tag management** in WinCC.

Its user interface consists of a navigation area and a data area with tables.
Select an element from the tree view in the navigation area to display the associated tags in the data area.
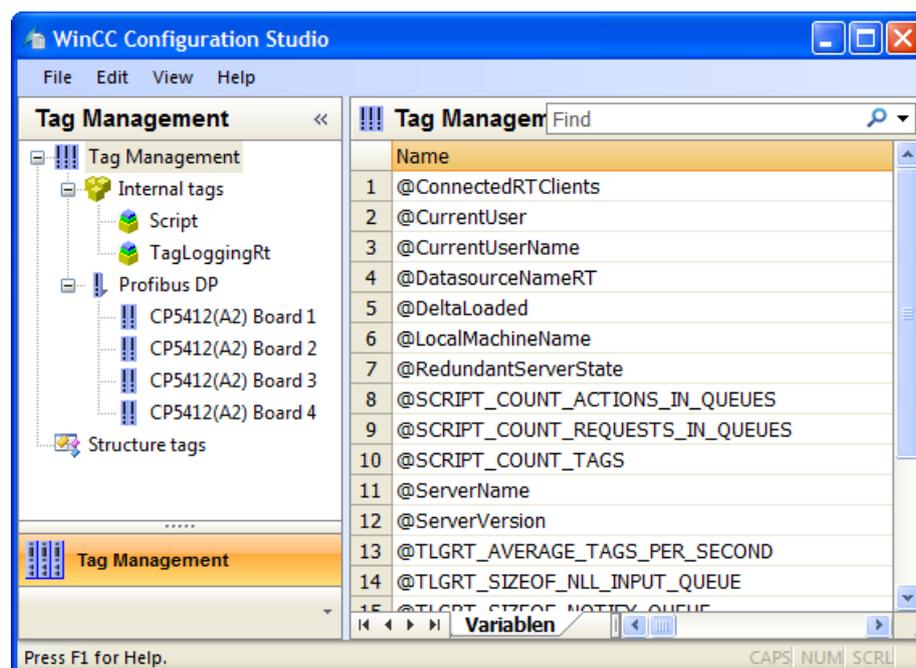


You can copy, paste, and delete elements in the tree view and the data area.
The data records you copy can be added to third-party applications.

You can insert data records from **third-party applications** in WinCC Configuration Studio by **importing data**. These data records must be available in "Office Open XML Workbook" format. Files of this format have the ".xlsx" extension and can be opened and edited in spreadsheet programs.

A **filter** can be set for each column of the data area. You can use text filters, number filters and date filters as filter criteria.

You can also search and replace text in the managed data records in Configuration Studio.

## WinCC Excel ConfigurationTool

Note that, as of WinCC V7.2, WinCC ConfigurationTool is gradually being replaced by the WinCC Configuration Studio mentioned above.

WinCC V7.2 already enables efficient bulk data configuration of tag management in WinCC Configuration Studio. For detailed information, refer to the online help of WinCC V7.2.
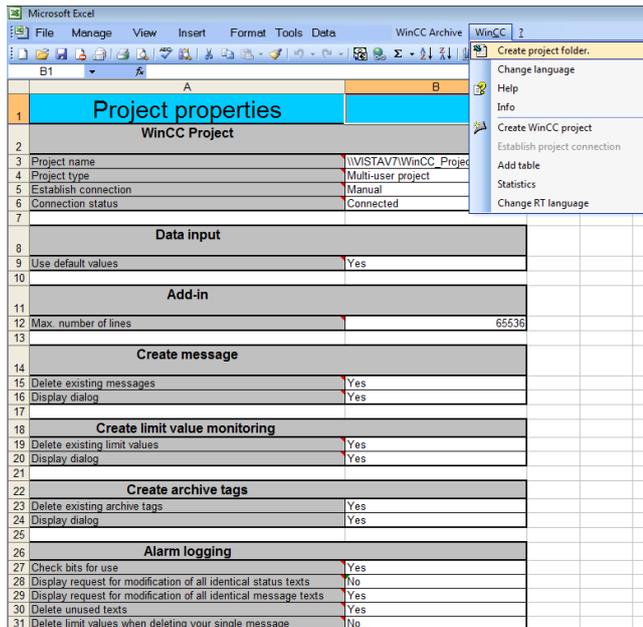
Figure 2-25    WinCC Excel ConfigurationTool

With the WinCC Excel ConfigurationTool, you can configure a new WinCC project in Microsoft Excel or make changes to an existing project quickly and efficiently. With the **versatile Excel functions** (AutoFill, filtering, sorting, combo boxes, Office wizard) or by creating additional **macros**, you can create objects such as the following easily and effectively:

- Communication links and parameters

- 20,000 internal tags, 40,000 process tags and structure tags

- Message archives with 10,000 individual messages

- Process value and compression archives with 40,000 archive tags

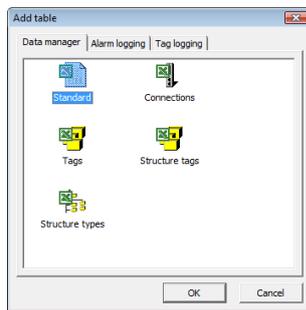- Text Library with 80,000 texts

Figure 2-26     WinCC Excel ConfigurationTool, tags, and communication links

With the WinCC Excel ConfigurationTool, you carry out your configuration on a PC with WinCC installed, but outside of WinCC. This means that the **Tag Selection** and **Archive Tag Selection dialogs** with multiple selection and **server packages** are also available in Microsoft Excel. You can **change all data** and then **apply** the changes globally or **selectively** in the WinCC project. **With the click of a mouse**, you can create process tags and associated archive tags, structure tags, messages, and analog alarms (see "Message system").

First, you specify central project settings, communication links, message blocks from the message system, and tag properties from the archive system are as **default settings** with the help of the "New Project Folder: and "New WinCC Project" **wizards**. Then you configure the internal tags and process tags (tag type, linear scaling, start value, substitute value, high limit, and low limit), individual messages, and archive tags.

The WinCC Excel ConfigurationTool **checks** all your input for **consistency**, and invalid data is **corrected automatically**. Each change is commented with an **input note**. Each time an Excel worksheet is written to or read from WinCC, an **error list** is created. When an Excel worksheet is written to WinCC, an **error column** is displayed on each sheet. Double-click the entry in the error list to **jump directly** to the faulty object.

In the WinCC Excel ConfigurationTool, you can also **switch the runtime language** and the language of the configuration interface, just as in WinCC.

## WinCC Archive ConfigurationTool

Note that WinCC Archive ConfigurationTool is gradually being replaced by the WinCC Configuration Studio listed above from WinCC V7.2.

With the WinCC Archive ConfigurationTool, you configure a new or existing WinCC process value archive in Microsoft Excel. With the **versatile features of Excel** (AutoFill, filtering, sorting, combination fields, Office Wizard) or by creating additional **macros**, you can create up to **65,634** archive tags:

● Analog archive tags

● Binary archive tags

● Process-controlled archive tags

With the WinCC Archive ConfigurationTool, you can carry out your configuration outside of WinCC, even when WinCC is not installed. However, if a WinCC project is open, the **Tag Selection dialog** with multiple selection is available in Microsoft Excel.

The process value archive created in the WinCC project can only be edited in Microsoft Excel. You can change all properties of the archive or of individual archive tags and **selectively apply** these changes in the WinCC project. Before they are applied, **checked for consistency** before it is applied to the WinCC project.

## 2.2.9 Configuring clearly laid out projects

### Picture properties in WinCC Explorer

You can display the picture properties in WinCC Explorer to find out which objects and functions are included in a given picture.
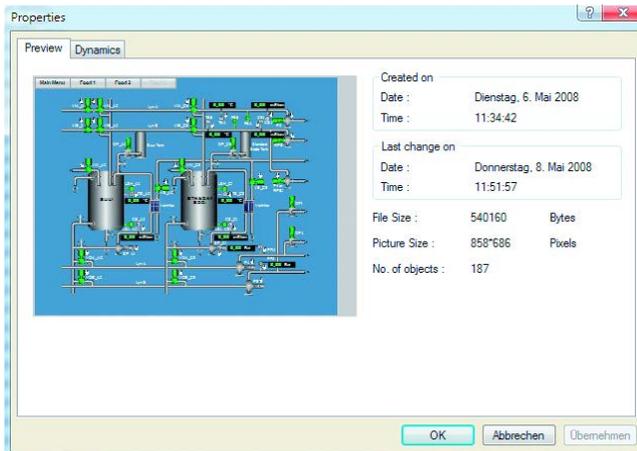


Figure 2-27    Picture properties in picture preview

For each configured process picture, the **picture preview** is displayed first:

- Miniature preview picture
- Picture and file size
- Number of picture objects

With the picture preview, you can see at a glance which tags are connected and how as well as which scripts are used:
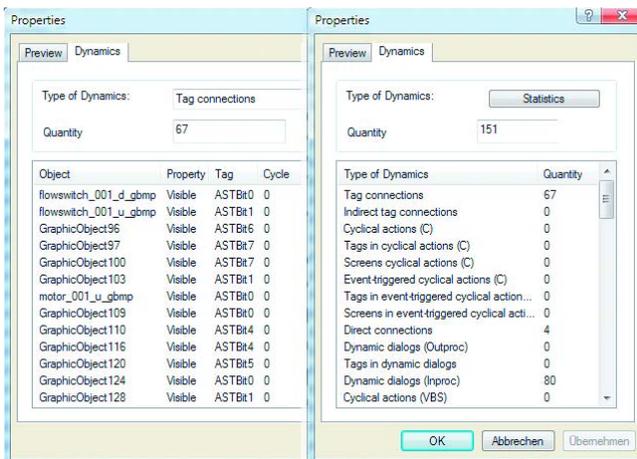


Figure 2-28    Picture properties with dynamization

All **dynamic instances** of the process picture are listed as statistics and possibly filtered (see "Intelligent configuration"):

- Dynamization statistics
- Connected tags
- Scripts and functions
- Direct connections
- Dynamization via a Dynamic dialog

In WinCC Explorer, you can **search** for the following elements with wildcards and according to change date:

- WinCC client PC
- WinCC server PC
- Communication links
- Communication channels
- Tag groups
- Tags

## CrossReference



The cross-reference list in the "Cross Reference" editor is a table indicating the **places of use** of all objects defined in the project, such as tags, functions, process pictures, etc. The cross-reference list provides transparency in the project and facilitates change configuration, even it this is done quite some time later.

Use the **filter settings** to create an individual **cross-reference list**, which can be saved, printed, or exported to .csv or Excel format for further processing/analysis.

The cross-reference list provides the following functions:

- **Linking**: This involves searching for a tag (in the archive, message system, or in VBScript/C scripts, for example) and replacing it **centrally** with another tag.
  Example: "Tank" is replaced with "Fill container":
  _TemperatureTank_1 -> _TemperatureFillContainer_1
  _MotorTank_1 -> _MotorFillContainer_1
  _Tank_2 -> _FillContainer_2
  Go directly to the **places of use** , (for example, the picture) to display and change them.

- Search for **places of use of deleted process tags** to change or delete the places of use. For example, non-existent tags that are used in output fields or trend displays indicate a possible configuration error.

- Delete **unused process tags** to conserve WinCC RT licenses.

To enable CrossReference to find the tags or pictures used in scripts, you must define these objects in the scripts. The **CrossReferenceAssistant** helps you structure the scripts so they can be used by the CrossReference Editor by converting the function calls accordingly.

## Linking

In the **Linking dialog**, you change all tag connections centrally, for example, directly in Graphics Designer. The "Link texts" command is used to change all the configured picture object texts.
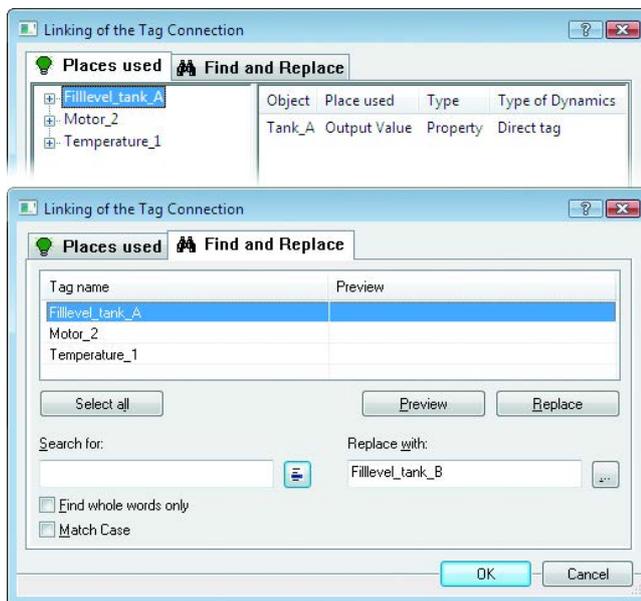


Figure 2-29    Linking

The "Placed used" tab shows an overview of the **tags used** in picture objects on the left and the specific properties dynamized with the tag on the right. On the "Find and Replace" tab, you can search for all the places where the selected tag is used, see a preview of the planned uses, and replace the tag with another at selected locations.

Thus, the cross-reference list and Linking dialog provide you with powerful tools for editing a large number of process connections.

## 2.2.10 Configuring control systems

### Definition



Figure 2-30    Chemical plant

Basic Process Control (BPC) is **included in the WinCC basic system** and provides additional configuration tools for implementing typical **control tasks**.

### Application

With BPC, you benefit from a whole range of **control functions** from power plant technology, process engineering, and process control for your configuration. The control system is **generated automatically** and helps you create an **efficient configuration**.

### Structure



Figure 2-31    Control system process picture in Microsoft Internet Explorer

A control system process picture comprises from top to bottom an overview area, a working area, and a key area with the following functions (partial listing):
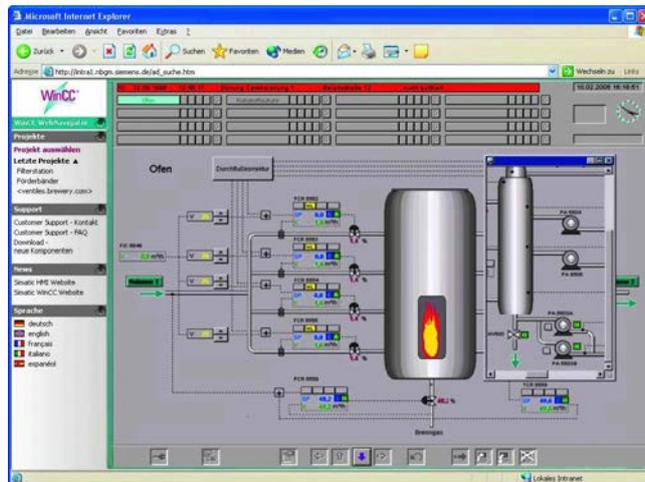
- Logon via **chip card** or password

- **Group displays** in the overview area

- Various **message lists**

- **Process control** in the working area

- Initiation of operator input and **navigation** in the key area

- **Customized arrangement** of process pictures

- **Online compilation** of trends

- Visualization, setup, and modification of **SFC charts**

- **Message sequence report** printout

The **group displays** present process displays and operational displays in **compressed format** and are integrated into the overview area. In the group display, you can see if a picture object has triggered a message or if a message is waiting for acknowledgment in a lower-level process picture. Group displays are **automatically** derived from the **picture hierarchy** thus enabling the operator to navigate to the picture object that triggered the message simply by **pointing and clicking**.

Group displays can also be used in process pictures, **configured according to user requirements** via object properties, and **linked** irrespective of the picture hierarchy. The group display is controlled by a process tag that represents the **message status** with a total of **16 message types**.

The **message system** is conveniently displayed in a **message window** in which you can switch between the different message lists (for more information, see "Message system"):

- New messages that have not yet been acknowledged

- Acknowledged messages that have not yet gone out

- I&C system messages

- Operator messages and system messages

- List of hidden messages

The **Split Screen Manager** manages the **individual picture composition** and saves each change made to a basic picture in a dedicated picture history.

When selecting a picture, the operator has the following options:

- Group display

- Picture memory

- Navigation in the picture hierarchy

- Names with picture preview

- Measuring point

- Alarm source (Loop-in alarm)
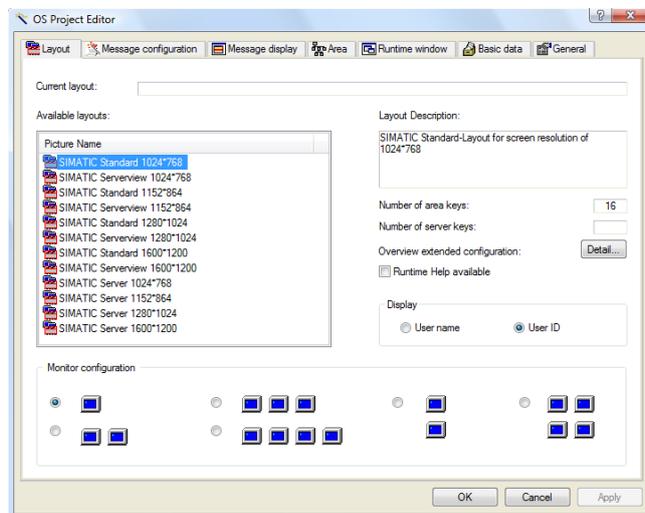
## OS Project Editor



Figure 2-32    OS Project Editor

The control system, the message system, and the picture hierarchy are **generated automatically** in the WinCC project by the OS Project Editor, thus **reducing the engineering requirements**. With integrated configuration, the OS Project Editor **runs automatically**, generating all required configuration data and an **image of the plant configuration** (see "Integrated configuration in SIMATIC Manager"). In a non-integrated configuration, the picture hierarchy is derived from the hierarchy tree in WinCC (see "Picture Tree Manager").

The OS Project Editor is only necessary if you want your configuration to differ from the default settings or if you are creating a new project in WinCC with Basic Process Control:

* On the "Layout" tab, you configure the appearance of the **runtime user interface**.

* On the "Message Configuration" tab, you configure settings for the **message system**. The basic settings correspond to the specifications for message configuration.

* On the "Message Display" tab, you configure the **message pages**, **group displays**, and **message filter**.

* On the "Areas" tab, you configure the **overview of plant sections**.

* On the "Runtime Window" tab, you configure the number and arrangement of the **pre-configured picture windows**. A customized screen arrangement can be saved and displayed **for each user**.

* The "Basic Data" tab specifies, among other things, whether basic data such as **individually modified process pictures** and actions should be retained during **automatic generation**. The **plant sections of all server projects** are displayed in the overview of the basic data picture. If a WinCC server fails, all associated plant sections are highlighted.

## Picture Tree Manager

In Picture Tree Manager, you arrange the process pictures in a **hierarchy tree** of plants and process units using a **drag-and-drop** operation. This **automatically** generates a **navigation with picture selection** function. In runtime, the operator scrolls through the picture hierarchy and selects process pictures and measuring point by name.

**Hierarchy information** is stored in the message system, in the user administration system, in block lists, and in server packages. In the message system, you assign specific messages to a plant section ("paint shop", for example). In user administration, you assign **access rights** for specific **plant sections**. A message is only displayed if the operator has access rights for that specific plant section.
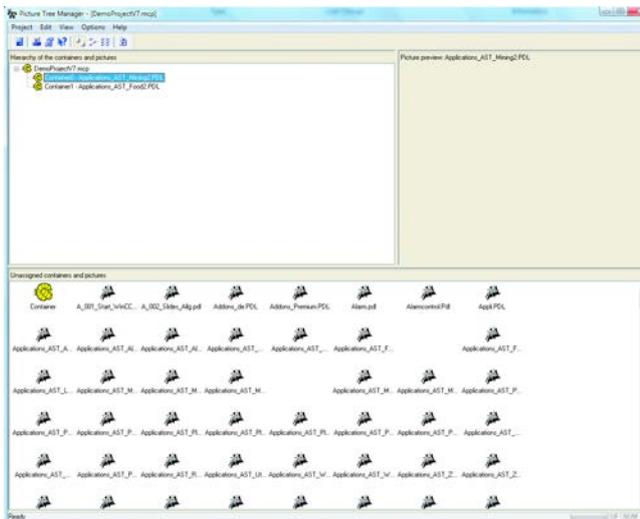


Figure 2-33    Picture Tree Manager

## Time Synchronization

**Time synchronization** is configured for automation systems (AS) and WinCC over the Industrial Ethernet bus/plant bus and for Operator Stations (OS) over the local area network/terminal bus. An OS is the active **time master** and receives the current time of day, for example, by means of the optional **time signal receiver** (Siemens DCF77, SICLOCK, or Siemens GPS receiver). A **time slave** receives the current time and synchronizes its internal clock. If a time master fails, a **standby time master** that supports both **master broadcast** (time master transmits time signals) and **time polling** (time slaves request time) takes over the task of time synchronization.

## Horn

The "Horn Editor" is used to control optical or acoustic **sensors** or output **sound files** to sound cards whenever a message from a specific message class, type, or priority comes in.

The WinCC option package includes a **signal module** with a watchdog to which you can connect up to three different signaling devices (horns, buzzers, and lamps) as well as a hardware acknowledgment.

## Lifebeat monitoring

**Lifebeat monitoring** monitors the WinCC clients as well as the **communication connections** between the OS and AS. During its **automatic execution**, the OS Project Editor generates a corresponding **plant configuration** of all communication connections to be monitored and creates the necessary **process control messages**. Manual configuration of lifebeat monitoring is not necessary on the WinCC client itself.

The **plant configuration** shows the configuration of the WinCC server whose WinCC packages are loaded. In a WinCC client project, the **status** of the lifebeat objects monitored by the WinCC servers is displayed as well as the communication connections to the WinCC servers. In the **event of a fault**, the faulty lifebeat objects are displayed.

## Component List Editor

When the OS Project Editor is executed, the component list is **created automatically**. The Component List Editor displays all information of the component list. With the Component List Editor, you configure for a measuring point the **entry point picture** for the **loop-in alarm** and the assignment to the plant sections. If necessary, you can also create **new measuring points**.

## Special features

Basic Process Control is also released for Web clients that are used as WinCC clients via WinCC/WebNavigator:

- **Simultaneous access** to several WinCC servers
- All **message views**, including **loop-in alarm**
- **Access rights** for specific plant sections
- User-specific **start screen** and **runtime language**
- Support of **operator messages**
- **Look&Feel** of the WinCC user interface with **group display** and **extended status display**

## 2.2.11 Commissioning and maintenance

**Testing in tag simulator**
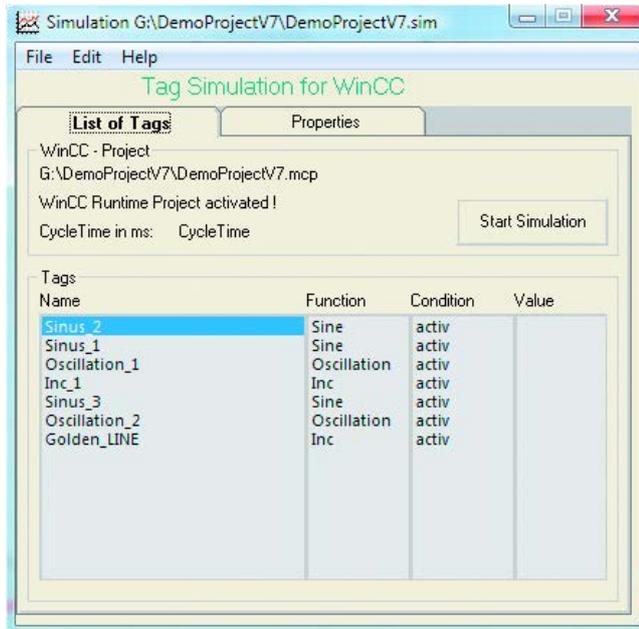


Figure 2-34    Tag simulator

Even before the connection to the controllers is established, a WinCC project can be tested. In the **tag simulator**, you assign a configurable value curve to each of the used tags. For example, a sinusoidal curve for tag 1, a random curve for tag 2, etc. The **tag simulator** calculates the corresponding process values and stores them in the tags. Then, **in Runtime**, you observe the changes that occur in the process picture and elsewhere. These include the configured color changes, for example, and they take place both in the simulation and on a connected operator station. In this way, you conduct a **function test** of the operator control and monitoring system using the original hardware:

* Verify limit value stages and message output.
* Test the integration of alarms, warnings, and error messages.
* Check status displays.
* Preset, read out, and change digital and analog inputs and outputs.
* Simulate alarms.

The tag simulator is also a simple way to **animate** your project for **demonstration purposes**. You can save and reload a simulation configuration.

## Displaying tag status information in runtime

In runtime, you can view information on connections and tags as a tooltip in WinCC Explorer. When you activate tag status display in WinCC Configuration Studio, the updated tag status for the tags connected in the project is displayed every 2 seconds, for example:

- Status of a connection
- Current process value of a tag
- Quality code of a tag
- The date on which a tag was last changed
- Time stamp

## Online configuration

WinCC supports necessary adjustments during **commissioning** along with active runtime in a **second editor window** (see table in "Project management with WinCC Explorer").
In the editor window, you modify a process picture, for example, and save it without ending runtime. The next time a picture is selected in runtime, the modified process picture is loaded **automatically**. You can also test the modified process picture immediately using the **Runtime button**.

## Load Online Changes

In most cases, you create, change, and test large, distributed projects with many operator stations on one configuring PC. The finished, tested project is then transferred to the respective operator station. Instead of transferring the entire project or changing it locally, the Load Online Changes function allows you to **apply subsequent central changes locally**, directly to runtime operation.
To do this, enable the "Load Online Changes" function in WinCC Explorer on the configuring PC. WinCC will now record all changes made to the project.

At any time, with just the click of a mouse, you can transfer only the modified or added Runtime objects (including tags, process pictures, alarms, and archives) to another WinCC computer online during its Runtime without having to close WinCC on this machine. With this function, however, it is not possible to delete objects such as tags online during runtime.

In a multi-user system, WinCC generates server packages for each server; these packages are then imported automatically by the operator stations. The projects on the configuring computer and the WinCC computer must be consistent.

Load Online Changes opens up the following possibilities:

- You can modify the current project and test it immediately during **commissioning**, **operation**. and **maintenance**.
- Your changes are made online from a **central configuring station**, thus saving the time and effort required for local changes.
-  You then test your intended changes on the configuring PC **offline in a secure environment**. Your changes are only applied to active operations after they have been successfully tested. This allows you to correct any potential configuration errors before they cause your plant to shut down.
- Changes can be **transferred consistently** and can **take effect simultaneously**:
  Configuration changes are often interrelated and **mutually contingent**: You recalculate a value, create a corresponding tag, and add it to an archive and a trend view.
  These changes are self-contained and are applied entirely during operation.
  This prevents **error conditions** and **instabilities** in runtime.

# 2.3 Security and availability

## 2.3.1 User administration

### Definition

With the WinCC User Administrator, you assign and control users' access rights for configuration and Runtime software. This protects your automation solution against unauthorized access.

All of the operator stations are included in the user administration system, thus including WinCC/WebNavigator and WinCC/DataMonitor clients. SIMATIC Logon, which is also included in WinCC, provides you with a central, plant-wide user administration system that is integrated into Windows (see "SIMATIC Logon").

### Application

In case of a project in manufacturing engineering, the environment at the equipment manufacturer has to be differentiated from the environment at the end customer as plant operator. The equipment manufacturer grants user "Foreman", for example, specific access to the project. However, user "Foreman" does not exist at the end customer.

Similar difficulties arise when, in process engineering, for example, different projects in a plant are to be integrated into one project, which requires unrestricted access during commissioning.

For this reason, access rights in the user administration system are not assigned directly to users, but rather to **user groups** (for example, "Commissioning engineers").
At the end customer, a new user (for example, "Meier") is simply assigned to the user group "Commissioning engineers" and is automatically granted the access rights for that group.
The configured user groups and access rights remain unchanged. User groups provide more **flexibility for access protection**.

## Structure
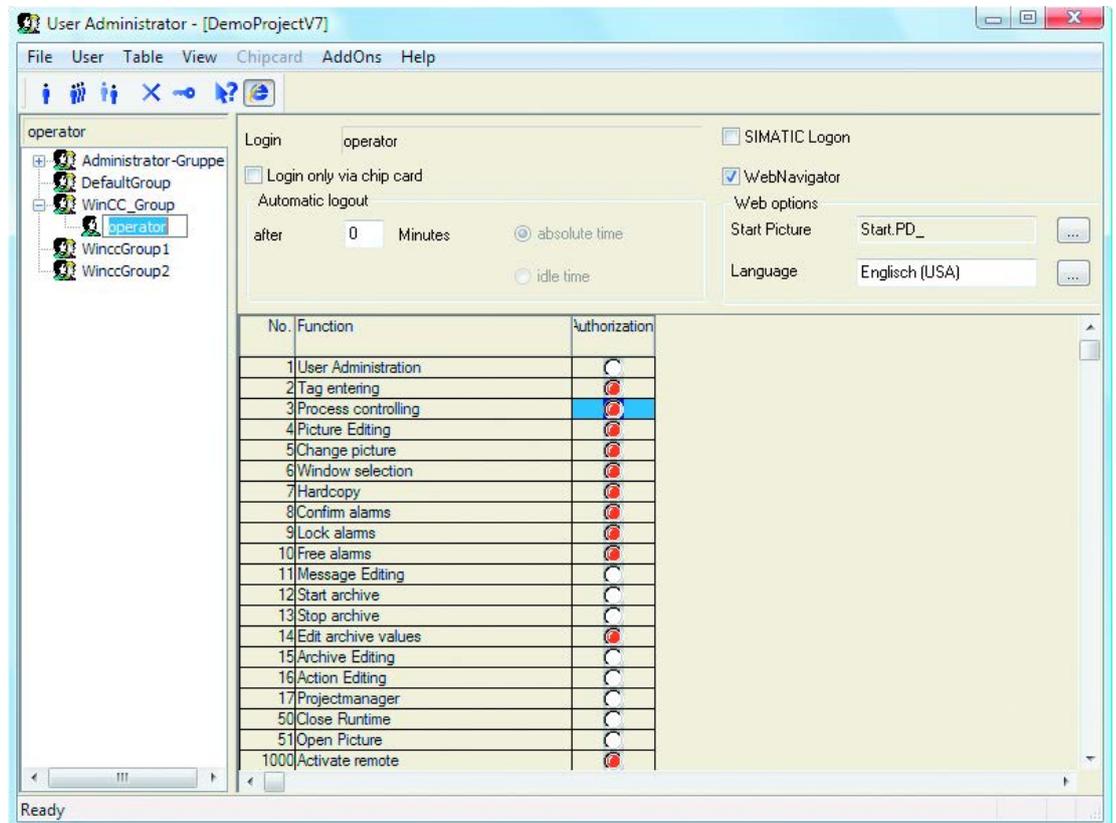


Figure 2-35    User administration

1. To extend the predefined access rights, you define your own **access rights** for example, "Change values".

2. You create **user groups** such as "Operator" and "Commissioning engineer" and **activate access rights**.

3. For a user group, you set up a **user**, for example, "Miller", who then **automatically** receives all enabled access rights for that specific user group.

The **logged-on user** "Miller" can perform control tasks with an **access-protected** object only if he belongs to the user group for which this access right is enabled. A system message is output each time the user logs on or off.

In WinCC, a number of access rights are predefined. Examples:

- User administration
- Value entry
- Process controlling
- Window selection
- Locking, unlocking, and acknowledgment of messages
- Starting, stopping, and editing of archives
- Remote activation and configuration

## Special features

- For operator control over an intranet or the Internet, a **Web user** requires "Web access" system permission. You can assign an **individual start screen** and a runtime language for each Web user (see WinCC/WebNavigator option).

- If necessary, you can define an **automatic logout** after a specific time or following a period of inactivity for each individual user.

- WinCC supports logon via **chip card**. You write and read the user name and password on the chip card. To log on in WinCC, the user inserts his chip card into the chip card reader. If the chip card is inserted, it is not possible to log on to the system manually.

- WinCC supports **logon by means of a tag** for each user station. This enables users to log on to the operator station in Runtime, for example, by means of a **key-operated switch**: 0 = Logout, 1 = Ruby, 2 = Miller, etc.

## 2.3.2 SIMATIC Logon

## Definition

With SIMATIC Logon included in WinCC, you can administer users and user groups **throughout the entire plant**, **across all applications**, and **online** on different systems such as single-user systems or distributed client-server systems. SIMATIC Logon uses the latest Microsoft Windows **security technologies**:
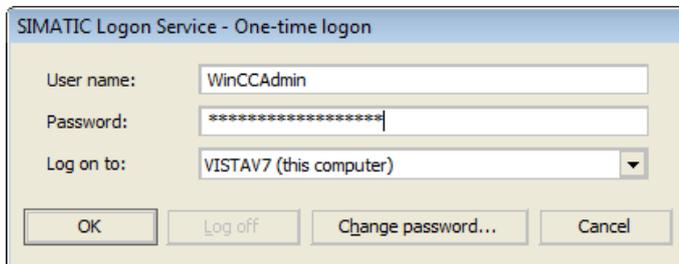


Figure 2-36    SIMATIC Logon

- Unique identification with user ID, user name, and password

- Automatic logout after a predefined time period

- Password aging

- Password settings policy, including maximum password age and minimum password length

- Account lockout after several incorrect password entries

- Account lockout policy

- Monitoring of logon events and logon attempts

- High availability provided by primary/secondary domain controller and local Windows user administration

## Application

A central, plant-wide user administration system that is integrated into the Windows user administration system provides considerable advantages in **large, distributed** plants. For example, operators can log on to the company network and WinCC using the same user ID and password. The central administration **saves costs** whenever you:

- Set up and delete users
- Disable users

In plants monitored and controlled with **process control systems**, there are often specific requirements for accessing functions and plant sections. Important requirements for plant **validation** include:

- Avoidance of **unwanted access** to a plant. This is achieved by assigning corresponding access rights through user administration.
- **Documentation** of operator access. This creates and archives an audit trail of important operator input. SIMATIC Logon facilitates the validation of plants in compliance with FDA 21 CFR Part 11.

## Structure

To implement SIMATIC Logon in WinCC, proceed as follows:

1. Install **SIMATIC Logon Service** on all participating PCs.

2. As soon as you enable the **SIMATIC Logon** option, the users created in the WinCC user administration system are ignored. The connection between Windows user administration and WinCC user administration is made based on identical user group names.

3. To record **logon operations**, specify the desired settings in "Audit Policy" under "Local Security Policy" in Microsoft Windows.

4. Specify settings for **user accounts** in "Account Policies" under "Local Security Policy" in Windows.

## 2.3.3          Message system

### Definition

SIMATIC WinCC records process messages and local events, saves them in message archives, and displays them filtered or sorted, as needed. The message structure can be defined as required and can therefore be customized for the special requirements of the plant.

Microsoft SQL Server, which guarantees seamless acquisition of all events, is used to archive messages. The archiving procedure is described in "Archive system".

Messages are triggered by **message events**:

- Predefined **system message** triggered by a system event
- **Single message** or **group message** on change of process status
- **Operator message**  on manual manipulation of control objects

### Message procedure

The WinCC message system supports the following message configuration mechanisms:

- With the **bit message procedure**, a configured individual message is triggered whenever a **message bit** in the assigned process tag (**message tag**) changes.

  Instead of configuring a specific message tag for each individual message, WinCC allows up to 32 individual messages to be triggered by means of a **single message tag**: Bit1 -> Message1, Bit 2 -> Message2, etc. You therefore require fewer PowerTags and save WinCC RT licenses.

  Time stamps indicating the date and time of the message are **automatically generated** by the message system.

- With **chronological reporting**, the controller sends a frame with a time stamp and message data from the message system each time an event occurs.

- With **limit value monitoring**, the pattern of an analog tag is monitored for violation of the high and low limit values and an **analog alarm** is issued.

When using the bit message procedure, you specify that the message will be generated, for example, on a falling signal edge starting from "1": "**Incoming message**". In all other message procedures, the message is always generated on a positive signal edge.

The message disappears when the message event no longer exists: "**Outgoing message**". However, you can also specify that the operator must acknowledge the message: "**Message acknowledged**".
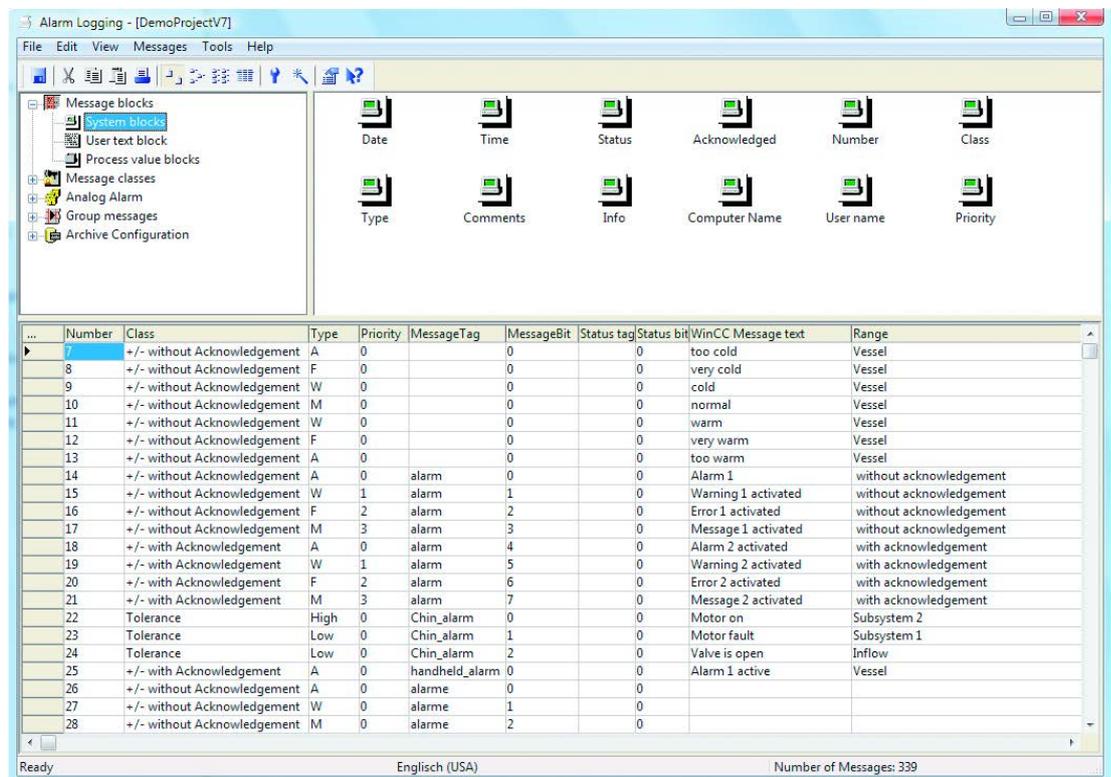
**Structure**



Figure 2-37    Message System Editor

To configure a message system that uses the **bit message procedure**, employ the '**Message System Wizard** or proceed as follows:

1. Freely define a message based on ready-made information blocks, or **message blocks**:

   – **System blocks** contain system data such as the **date** and **time**. Other options: Priority, triggering CPU/AS or PC, user name, loop-in alarm, **message status** ("came in/went out", **acknowledgment status** "acknowledged/not yet acknowledged", time between "Incoming" and "Outgoing" or "Acknowledged".

   – **Process value blocks** contain a **current process value** (such as fill level or temperature) at the time the message occurs: up to 10 process values can be configured.

   – Up to 10 customized **user text blocks** containing personalized text up to 255 characters in length. Examples: Message text with point of error and an info text that can be **displayed**, for example, the higher level designation or information about the cause of a fault. This clear overview also helps the operator during **runtime analysis** because it allows the operator to, for example, filter for all messages from a specific plant section (point of error).

     You can add **additional information** to the user text block: a current process value from a process value block, PC name, application name, user name, comments in the long-term archive list.

2. For similar messages, specify the properties in a freely definable **message class**, for example, "Fault requiring acknowledgment":

   – Message classes divided into **message types**, such as "Alarm" and "Warning". Each message type is assigned its own color scheme consisting of a font and background color for "Incoming", "Outgoing", and "Acknowledged". Each message type in turn can include up to 16 **message priorities**.

   – **Acknowledgment philosophy** specifying how messages are handled: Single message, initial value message (only the first message in the message class flashes), new-value message (operator message on change of value), with/without acknowledgment (initial acknowledgment) or "went out" acknowledgment (second acknowledgment), with/without "went out" status, with/without flashing.

   You can connect a **central signaling device**, such as an optical or acoustic sensor. An incoming message from a given message class triggers the signal device. The signal device is acknowledged with the single message or via a separate acknowledgment button.

   – **Status text** for message status and acknowledgment status in the message list, archive list, and lock list (for example, incoming = CFlt, acknowledged = ACK).

   – The message status (1 bit) and acknowledgment status (1 bit) of up to 16 individual messages can be recorded in one **status tag**. The acknowledgment status (1 bit) of up to 32 individual messages can be recorded in one **acknowledgment tag**.

   – The **standard** classes already included are the message class "Fault" and the two default system message classes "System requires acknowledgment" and "System without acknowledgment".

3. Configure individual messages, en masse in **table format** or individually in the **Configuration dialog**:

   – Assign message group, message class, message type, message priority.

   – Specify message text and infotext.

   – Connect message tags, as well as the optional status tags, acknowledgment tags, and process tags. The **Interconnection Wizard** connects WinCC tags as message and acknowledgment tags.

   – If necessary, define the status tag, acknowledgment tag, and lock tag for the entire group of messages in one message class (**message group**). In this case, the status tag will indicate whether at least one message in the message class has come in or gone out (**group message**).

   Group messages increase the **transparency** by signaling that there is a general problem, for example with a motor, because a "Motor" message is present. If necessary, you can use the acknowledgment tag to acknowledge all individual messages that belong to the group message.

   – If necessary, configure **loop-in alarm**: In the message, you place a **process picture**, which the user will select in the message window.

   – The "Message will be archived" **option** is selected by default (see "Archive system"). With this option, the messages appear in the long-term and short-term archive lists in the **message window**.

   – Configure **analog alarms for limit monitoring** in a **Configuration dialog**: For a tag, store up to 256 **limit values for monitoring**: If the tag exceeds one of these limit values (for example, 200), a message such as the following is displayed in Runtime: "The tank temperature has exceeded 200".

     Alternatively, you can specify that the message will only be issued if a limit value has been violated within a definable **delay time**. This will prevent a message overload from occurring when an extremely sensitive sensor constantly responds.

## 2.3.4     User-friendly message view

### Introduction

Messages in Runtime display the freely definable WinCC AlarmControl (**message window**), which you insert into a process picture and configure by means of a **Configuration dialog**:

- Window properties: Font, color, design

- Server selection

- System blocks and process value blocks

- Toolbar containing available buttons, for example

- Status bar showing current information

All WinCC controls supplied with WinCC V7.0 and later generally offer the following options:

- Operators can use the Configuration dialog to **customize WinCC controls  in runtime** according to their needs. This includes filtering, selecting, or sorting the display based on individual message blocks (for example, chronologically or according to message priority or point of error). Settings can be stored globally or specifically for each operator.

- **Export** displayed **data** as text files (as .csv files in runtime).

- **Print displayed data in report format** by means of a predefined **print job** (see "Reporting and logging system").

- Configure buttons with their own **project-specific functions** on the user-defined toolbar.

- Create symbolic representations of statuses and **infotext**.

- **Scroll up or down** in the displayed lists.

- **Connect and disconnect** swapped archive databases **online**.

- Protect operator input by means of **access rights**.

WinCC AlarmControl, which you are familiar with from previous versions, is still available.
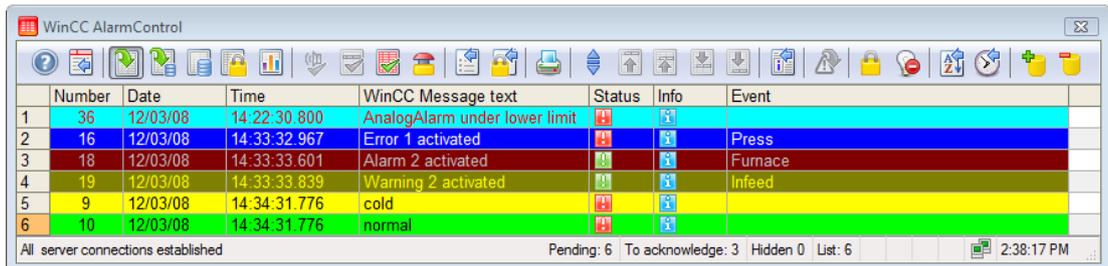
## WinCC AlarmControl



Figure 2-38    Message window for displaying current and archived messages

The message window shows the following basic elements:

- Each message in a separate **message line**
- Message status and color scheme according to the configured message class and message type
- Selected **message blocks**, each in a separate column
  The message blocks can be displayed with their corresponding message color

A message window contains six different lists, which are selected via the toolbar:

- The message list shows the currently pending messages.
- Long-term archive list shows the archived messages ("Message will be archived" option; see "Message system"). Operators can add comments to each archived message.
- Short-term archive list shows the archived and current messages.
- Hit list shows statistical information.
- Lock list shows locked messages (see Special features).
- List of messages to be hidden shows the hidden messages (see Special features).

The **hit list** contains the archived messages each with its own filter and sort order, a limited selected of message blocks for each message, and the following statistical calculations:

- Frequency of occurrence of a given message
- Cumulative and average time between "Incoming message" and "Outgoing message"
- Cumulative and average time between "Incoming message" and initial acknowledgment
- Cumulative and average time between "Incoming message" and second acknowledgment



Figure 2-39    Hit list of messages

## Additional functions:

- **Filtering** of messages using message blocks as the filter criterion and SQL instructions, **saving** of individual filters for each user, **linking** of filters, also in runtime
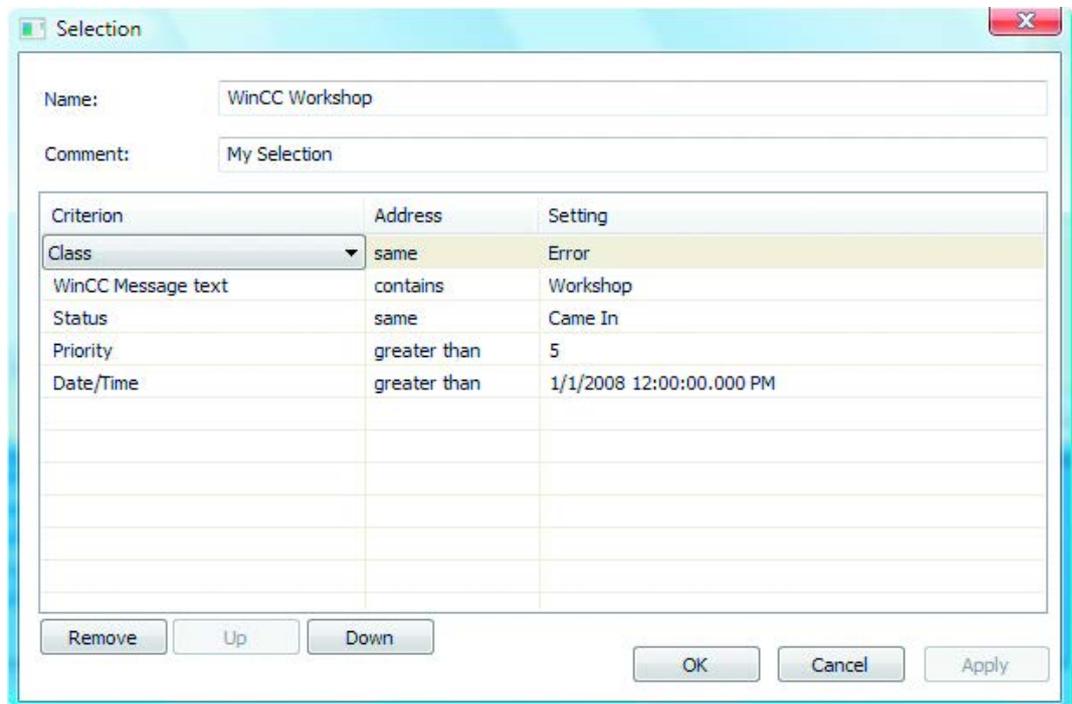


Figure 2-40    Filtering messages

- **Sorting** messages according to date, tag, device, and maintenance message, also in runtime.

- **Message colors**, e.g., configuring columns with different message colors.

- Message **flash function**, e.g., changing text and background color in each flash cycle or switching between message and table color in each flash cycle.

- Automatic generation of an **operator message** whenever the operator locks, unlocks, acknowledges, hides, or shows a message (see Special features).

- In the **message sequence report**, chronological documentation of selected messages and output of all status changes to a printer.

- **Printout** of selected messages by means of a predefined **print job** (see "Reporting and logging system").

## Special features

- A message group can be **expanded and customized for specific users** by adding any number of individual messages and additional message groups. This creates a **message hierarchy**, in which a **collective message** consists of group messages, which themselves are made up of group messages and individual messages.

- The **Message System Wizard** supports you in configuring the message system. The Message System Wizard generates a message system in all installed languages in the Text Library with frequently used message blocks and message classes, which you can then customize as needed.

- **AlarmHiding**: You can **hide** non-essential messages such as operational messages to prevent the operator from being subjected to an **information overflow** in the case of high message traffic. Hidden messages are still archived in the background, but are not displayed. Outgoing messages that require acknowledgment are acknowledged by the system.

  **Manually hidden** messages are shown again after a specified time; they can also be displayed by the operator at any time. **Automatically hidden** messages are hidden and shown according to the plant status by means of a "hide mask" on a tag.

- Messages can be **locked** and **unlocked**: When you lock individual messages, message types, message classes and group messages, you suppress the display and archiving of messages, for example, messages relating to a known but not yet eliminated fault or a sensor that responds continually. WinCC supports active locking (in an automation system, for example) and passive locking in the WinCC "Alarms" Runtime database.

- You can integrate **system messages** from various WinCC components into the message system for additional processing, for example.

- You can configure messages for **complex projects** quickly and easily in Microsoft Excel using the WinCC Excel ConfigurationTool.

- Configure the **loop-in alarm** feature any way you like: When configuring a message, add a function of your choice, for example, "OpenPicture" and pass a parameter of your choice, for example, the process picture to be selected. When an operator activates the loop-in alarm for a selected message in the message window, the stored function is executed; in this example, the process picture is selected.

- After a **power failure**, the last 60 messages, for example, can be reloaded from the message archive to the message window. Thus, when the system is restarted, the last message map prior to the power failure is reconstructed.

- With the WinCC/DataMonitor option, you can analyze current and archived messages via an intranet or the Internet.

- The SIMATIC Information Server option can be used to compile, evaluate and graphically visualize messages from a process control system and from SIMATIC Process Historian.

- With the WinCC/ConnectivityPack option, you can filter current or archived messages and pass them on to the higher-level production level and corporate management level (MES/ERP) via the **WinCC OPC A&E Server** (Alarms & Events). There, the messages can be analyzed and even acknowledged.

## 2.3.5 Diagnostics system

### Definition

In a complex automation system, diagnostics encompasses both system and process diagnostics. **System diagnostics** finds errors within the automation system:

- Programming errors
- Memory errors
- Communication errors
- Module failure

**Process diagnostics** finds errors within the plant process:

- Interlock not fulfilled
- Runtime errors on control valves
- Motor contactor triggered
- Limit switch error

### Application

Extremely high availability is only possible if errors and faults can be quickly and safely localized and eliminated. To avoid long downtimes, automation solutions must be transparent and manageable. The diagnostics options available in the event of errors determine the productivity and lifecycle costs of the plant.
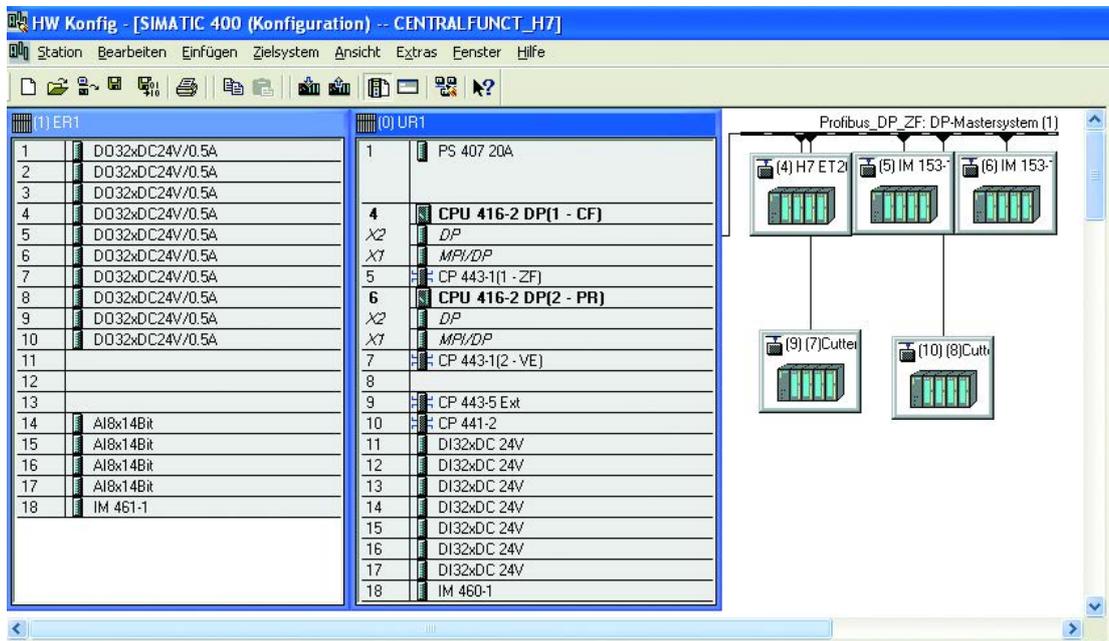
**Structure**



Figure 2-41    Call-up of STEP 7 hardware diagnostics from WinCC

Totally Integrated Automation provides integrated diagnostics as an essential system feature. In conjunction with other SIMATIC components, SIMATIC WinCC also supports system diagnostics and process error diagnostics during normal operation:

- **STEP 7 block call command** (integrated configuration with STEP 7): In runtime, you jump directly to a STEP 7 "LAD/FBD/STL" editor for the connected **program block** and then back to WinCC. The focus is placed automatically on the STEP 7 symbol associated with the process tag.

  Along with the integration of E-Plan data in a WinCC control, comprehensive error diagnostics can be performed on the **circuit diagrams** of the **PLC program** without lost time spent referencing charts.

- **STEP 7 diagnostics call command** (integrated configuration with STEP 7): From a WinCC process screen, you jump directly to STEP 7 hardware diagnostics for comprehensive error diagnostics from circuit diagrams right up to the start of the PLC program.

  To this end, the STEP 7 "Perform hardware diagnostics" function is called for the associated controller following a user-defined event.

- Automatically generated **S7 system diagnostics messages** from the automation system can be represented in WinCC as multiple-line message text in tooltips (even without installation of STEP 7).

- Diagnostics of the communications link via expanded WinCC Channel Diagnosis (see "User-friendly communications diagnostics").

- The **WinCC/ApDiag** application diagnostics program provides support for **runtime diagnostics** of script errors and performance problems (see "Openness and Integration").

**Related functions:**

- With the WinCC/ProAgent option, you can create high-performance process diagnostics for error localization and elimination in S7 automation systems with no additional configuration overhead required.

- The SIMATIC Maintenance Station options displays multiple-vendor servicing and maintenance data and automatically generates diagnostics screens, thereby reproducing the hierarchy of the WinCC process pictures. This allows for early detection and elimination of potential faults.

- Besides checking the access point, the **"Set PG/PC Interface"** application tests the communications processor, in SIMATIC NET as well.

## 2.3.6 User-friendly communications diagnostics

**Structure**

A fault or error in establishing a communication link is generally first detected in runtime:

1. Whenever current process values are missing, WinCC first shows the corresponding fields and dynamized picture objects, such as I/O fields, bar charts, etc., in **gray** (see "Configuration management with WinCC Explorer").

2. If just a few tag dynamizations in a link are faulty, the error is probably due to incorrectly written or addressed tags. Tag management in WinCC Explorer provides **status information** about this in a **ToolTip**.

3. If all tag dynamizations in a link are faulty, the error is probably due to the connection itself.

## Communication links in WinCC Explorer

WinCC Explorer first provides an overview of the **status** of all communication links in runtime:
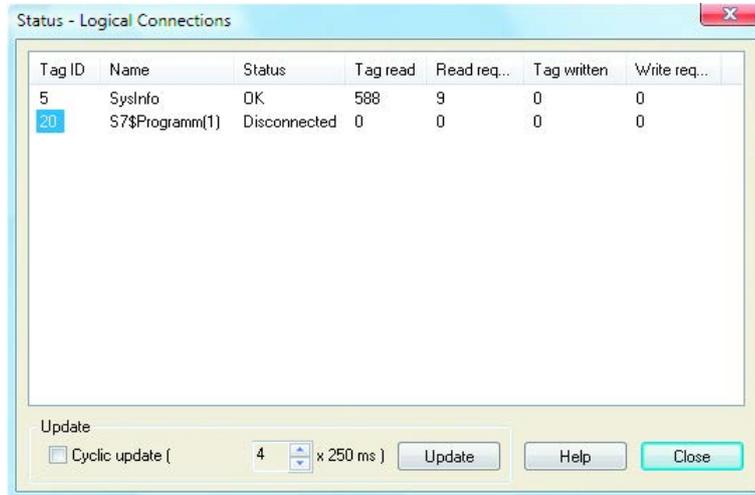


Figure 2-42    Connection status

- In addition to a simplified version of WinCC Channel Diagnosis, the **"Logical Connections" status** shows the current status of all configured communication links in runtime.

- The **"Server Connections" status** shows the server-to-server communication in a distributed system on the WinCC client and WinCC server.

- The **"Client Connections" status** shows the communication of all participating WinCC servers and WinCC clients on the WinCC server.

The "Disconnected" status can indicate a configuration error or hardward fault on a communication channel.

## WinCC Channel Diagnosis

WinCC Channel Diagnosis provides status information and diagnostics information pertaining to the communication channels that support diagnostics, for example, SIMATIC S7 and the "System Info" communication channel:

- Output of status/statistics information in **WinCC ChannelDiagnosisControl**. For example, you can compile diagnostics information in a separate diagnostics process picture.

- Output of status/statistics information as an **independent Windows application**. In this way, Channel Diagnosis is always available and is not contingent on the selection of a process picture, as is the case with WinCC ChannelDiagnosisControl.

- Text output of start/end messages and communication errors to a **log file** for fault analysis and error correction by **Service**. In runtime, the operator configures which fault displays are to be output.

- Text output of additional information and errors to a **trace file** to help the **hotline** localize communication problems. The operator activates the trace file in Runtime and configures which status and fault displays are to be output, as well as the number and size of the trace files.

# 2.4 Quality and traceability

## 2.4.1 Archive system

### Definition

Historical values and value patterns are stored in **process value archives** for documentation purposes. In addition to process values, WinCC also archives messages in the **message archive** and user data in the **user archive**.

This data (such as alarms and trends) is stored in the integrated Microsoft SQL Server **runtime databases** "Alarms" and "Trends", which you can access directly in many ways (see "Unlimited plant configuration").

The memory requirement is minimal due to powerful, lossless compression functions. Historical data is necessary to compile essential operational and technical information about the plant:

- What exactly happened in the process?
- When was the specified temperature reached?
- Why was the quality of batch A higher than that of batch B?

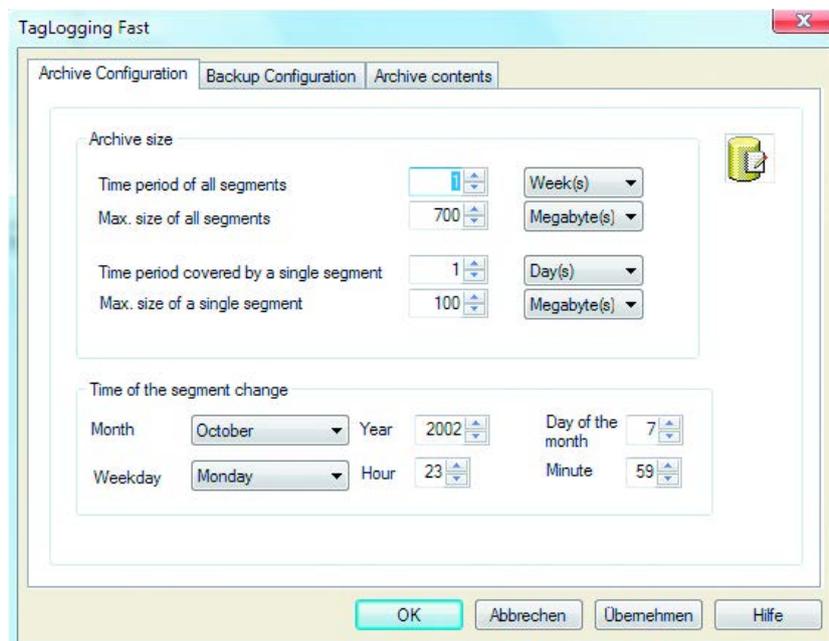### Archive size and segmentation made to order



Figure 2-43    Configuring the short-term archive

Process values or messages are stored in a **short-term archive** , the size of which can be configured by the user. The maximum archiving period can be specified as required by the application at hand, for example, one month, one year, or until a maximum volume of data is reached. Each individual archive can also be **segmented**.

The following **example** applies analogously to process value archives: You configure a 100-MB message archive for one week's messages. This message archive consists of 5 individual segments of 20 MB each for one work day's messages. When the end of the first work day or the individual segment has been reached, the system continues archiving in the second segment. When the end of the week or the message archive has been reached, the first segment is deleted, newly created and the system continues archiving in this segment.

In order to ensure **seamless**, **continuous documentation** of the process, messages are placed in a **backup archive**, either locally, on a network drive, or on a **long-term archive server**, each time the end of a message archive is reached. If necessary, the backup archive can be read out by WinCC and analyzed with on-board instruments at any time. The swap out ensures that no data is lost even during long-term archiving.

## Storing messages in the archive

All messages with the "Message will be archived" **option** are placed in the message archive, where additional comments can be added (see "Message system").

All values of a process tag that are **assigned to a process value archive** are stored internally in **archive tags** on a continuous basis:

- An **analog** archive tag stores numerical process values, such as Fill level.

- A **binary** archive tag stores binary process values, such as Motor On/Off.

- A **compression tag**, for example, stores the average value of the last 60 process values each minute.

- A **process-driven** tag stores **raw data**, such as a measurement series of process values.

In order to acquire a **measurement series** comprising many measurement points or quickly changing process values, a **frame** of **raw data** is transferred from the automation system to WinCC and archived in a process-driven tag. Example: Time stamp, data type, one or more process values of one or more process tags, high and low limits for acquisition and archiving. Because the frame can have varying structures (for example, it is also used by S5/S7 functions), a special standardization DLL breaks down the frame into individual process values.

In the WinCC basic system, up to **512 archive tags** can be configured. Powerpacks allow an expansion in the final structure to up to **80,000 archive tags** per server.

## Timing

Messages are archived on so-called message events (for example, "Incoming message" or "Message acknowledged"). Process values are archived cyclically or on an event-driven basis, depending on the archiving method:

| Archiving | Parameters | Meaning |
|---|---|---|
| **Continuous cyclic**: control of the process value | Archiving cycle = integer multiple of the acquisition cycle | Cycle in which the process value is stored in the process value archive. Cycle in which the process value is read from the AS. |
| **Continuous selective**: control of the process value within an event-driven period | Start event<br><br>Stop event<br><br>Archiving cycle | Starts the process value archiving cycle, for example, when the motor temperature is exceeded.<br>Ends the process value archiving cycle, for example, when the motor temperature has dropped to a normal level.<br>Cycle in which the process value is to be stored in the process value archive. |
| **Acyclic**: control of critical events | Event | The process value is archived when the event occurs, for example, when a given temperature is exceeded. |
| **Acyclic**: control of status changes | Value change | The process value is archived each time a change occurs. |

An **event** occurs whenever a connected tag or ANSI C script has a value of "1" or "TRUE". With binary archive tags, you can also indicate the **signal change** upon which the process value is archived, for example from 0 to 1. With **analog archive tags**, you can influence the archiving in the following additional ways:

- **Hysteresis** for cyclic archiving, absolute or as a percentage. A process value is archived whenever its value changes by at least a certain percentage (for example, 10%).

- **Low** and **high limit**: A process value is only archived if it lies between a given low and high limit.

- In the case of cyclic archiving from all process values that were read out from the process tag during the period between acquisition and archiving, an **processing function** calculates a specified value. This can be the mean value, the cumulative value, the minimum or maximum value, the most recent value, the difference, or a value calculated using a function. This **processed value** is then archived instead of the acquired process values.

**Reducing data volume by compression**: Example: Every minute, a processing function calculates the average value, for example, of the process values that were processed at a rate of one per 60 seconds. These calculated values are archived continuously in a separate **compression archive**, internally in a **compression tag**.
You choose whether the archived process values should be deleted, copied to the compression archive, or moved following compression. You can include the status of the process values in archiving using the **quality code**.

## Data output

Archived data can be output in runtime:

- Process values in WinCC OnlineTrendControl and WinCC OnlineTableControl (see "User-friendly display of tables and trends")

- Statistical evaluation of process values in WinCC RulerControl

- Process values in F(x) representation in WinCC FunctionTrendControl

- As hard-copy archive log (see "Reporting and logging system")

- Messages in the message window (see "User-friendly message view")

You can also process the data further with SIMATIC Information Server, and display data simply and easily with the dashboard.

## Special features of the process value archive

- The "**Tag Logging Fast**" short-term archive stores process values whose archiving cycle is less than or equal to a definable threshold (for example, <= 1 minute). You can also archive **process-driven** tags (raw data) and **acyclically** acquired process values here. The process values are first compressed and stored in a binary file. When a specific file size is reached, they are then transferred to the short-term archive.

- The "**Tag Logging Slow**" short-term archive stores process values whose acquisition cycle exceeds a threshold of 1 minute, for example. The process values are written directly to the short-term archive without first being compressed.

- You can also store process value archives in the **main memory**. The advantage of this is that process values can be written to and read very quickly.
  Disadvantage: Process value archive in the main memory are deleted as soon as runtime is over and are not saved to a backup archive.

- The **Archive Wizard** creates preconfigured process value archives and compression archives.

- All settings and parameters can be specified not only for one archive tag, but also as **default settings** for the type as a whole, for example, **binary** archive tags.
  Each newly added binary archive tag will then be configured with the default parameters.

- To avoid **archive spikes** and distribute the archiving load evenly, archiving timing within the archiving cycle can be adjusted on a case-by-case basis.

- In addition to cyclic times, you can also use calendar periods, such as monthly, for the **acquisition and archiving cycles**.

- The **Swinging Door algorithm** compresses measured process values for archiving.
  Only tag values that come in last within a calculated compression distribution are saved in this process.

- **Archive values** can be **added manually** in runtime. The values can be written to the archive using external interfaces, such as ODK or OPC, or via WinCC OnlineTableControl. The added or edited values are identified as manual values in the database and in the (table) display. An operator message can be generated by specifying the old/new value, user and time. Compressed archives can be recalculated following manual changes to the archive values.

## Special features of the message archive

Configuration data and runtime data are stored for each message:

- Message status

- Time stamp, time difference with respect to "Incoming" status

- Name of PC, application, and user

- Message class, message type, message priority

- Configured message text and colors

- Loop-in alarm

Therefore, provided you do not **subsequently modify the configuration data**, the archived **message data remains unchanged**. Because the entire message context was archived along with the message itself, archived messages are always displayed **in their original format**, for example, with the archived message type and color.

## Special features of the archive system

- You activate the **file signature** to prevent subsequent changes from being made in a swapped backup archive.

- A configured **alternative path** for the backup archive is used if a backup medium is occupied or unavailable (for example, due to a power failure).
  In this case, system messages are issued accordingly, if configured.

- To access the data of an already **swapped backup archive** in Runtime, **connect** the backup archive to the project, for example, in the Archive System **Editor**, online in the WinCC controls, or automatically in Runtime **via VBScript**, or by placing the backup archive **in the directory** "<Project>\CommonArchiving". The archived values are inserted in configured tables and trends in Runtime according to their time stamp.

- The **SIMATIC Process Historian** option is a central long-term archiving system for storing process data such as process values and messages.

- The **SIMATIC Information Server** option enables the simple evaluation of WinCC archives. The data is evaluated and visualized using reports. Reports can have tabular or graphical contents for the evaluation.

- All swapped WinCC archives can be accessed via the WinCC/DataMonitor and WinCC/ConnectivityPack options.

- The WinCC/ConnectivityPack option gives you direct access to archived process values and messages through interfaces such as WinCC OLE-DB Provider.

- The WinCC/ODK (Open Development Kit) option provides additional access options.

## 2.4.2 User-friendly display of tables and trends

### Introduction

Process values in Runtime show the WinCC controls OnlineTrendControl, OnlineTableControl, RulerControl, and FunctionTrendControl, which you insert into a process picture and customize via **Configuration dialogs**:

- Window properties: Font, color, design

- Server selection

- Representation of process values: tables, trends, axes, etc.

- Toolbar containing available buttons, for example

- Information on the status bar

### WinCC controls

All WinCC table controls and trend controls supplied with WinCC V7.0 and later generally offer the following options:

- Operators can use the Configuration dialog to **customize WinCC controls  in runtime** according to their needs. Settings can be stored globally or specifically for each operator.

- **Export** displayed **data** as text files (as .csv files in runtime).

- **Print displayed data in report format** by means of a predefined **print job** (see "Reporting and logging system").

- Configure buttons with their own **project-specific functions** on the user-defined toolbar.

- **Modify the data interface in runtime** and represent other tags, archives, and backup archives.

- **Connect and disconnect** swapped archive databases **online**.

- In a process value archive, **scroll forward or backward** or skip to the start or end of the archive.

- Display **statistical functions** such as integrals.

- Protect operator input by means of **access rights**.

WinCC online controls and trend controls that you are familiar with from previous versions are still available.

## WinCC OnlineTableControl



Figure 2-44    Table window

The **table window** features the following basic elements:

- A **time column** with specified times (either **static** or **dynamic**) at which one or more process values are displayed.

- An assigned **value column** that displays a process value for each time: archived values of an **archive tag** from the process value archive or online values of a **process tag** from tag management.

You assign several value columns to a time column. You configure several time columns each with different value columns.

There are three ways of specifying the times:

- Start time and finish time (for example, 14:59:01 to 14:59:30).

- Start time and time period (for example, 14:59:01, 6 x 5 seconds)

- Start time and number of measuring points (for example, 14:59:01, 30 measuring points)

**Static** means that times cannot be changed after configuration (for example, starting at 14:59:01). **Dynamic** means that the times are calculated back from the current system time: In this example, it is always the last 30 seconds.

When runtime is started, the values to be displayed are either read from the process value archive and tag management or are set to zero.

### Special features

- **Manually modifying and inserting values**: You can manually modify the values displayed in runtime or add new values. The modified or newly generated values are archived and are identified as manual values in the database and in the display.
  The values in compression archives can be recalculated for the time range affected.
  You can configure **operator messages** to be triggered when an archive value is modified or created.

- In runtime, you can move, show, and hide **columns**; change the displayed **time interval**; and switch between **static** and **dynamic** times.
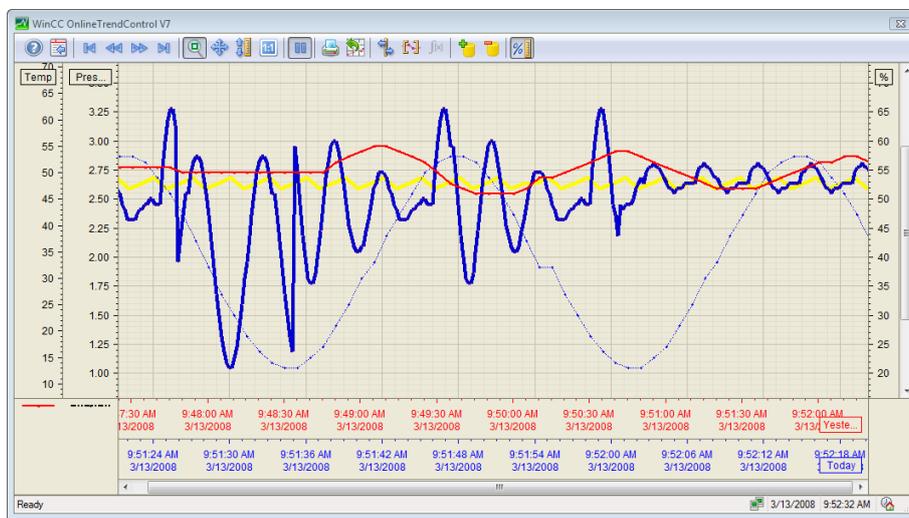
## WinCC OnlineTrendControl



Figure 2-45    Trend window

The **trend window** features the following basic elements:

- One or more **time axes**, each having specified times (either **static** or **dynamic**) at which the process values are displayed (see WinCC OnlineTableControl).

- One or more **value axes** with a fixed or automatically adjusted **value range** and linear, logarithmic, percentage, or user-defined **scaling** in which a value range such as "0 - 50000" is displayed in Runtime as "100 - 500".

- Any number of **trends** that display a process value for each point in time: archived values of an **archive tag** from the process value archive, online values of a **process tag** from tag management, or Runtime data from a **linked script**.

- Display of **multiple** trend windows

You can link multiple trend windows in order to **compare process values**, for example. Trend windows linked in this way will then share the same zoom function, scroll bar, time axis, and ruler.

Each trend window is made out of individual objects that you combine:

1. You assign multiple **time** and **value axes** to one or more **trend windows** and configure **rulers** and **grid lines**.

2. You can configure as many **trends** as you wish for each **trend window**.

3. When doing so, you can select specific **time** and **value axes** for each trend or apply the same ones to multiple trends.

4. You also select **individual** trend, line, and point types, as well as a color. The **color of a trend value** can also change as a function of an high and low **limit value**.

**Special features**

● You define the **writer orientation** for the trend values: from the right, left, top, or bottom.

● Instead of a fixed **value range**, you can also dynamize the high and low limit of the value range with tags.

● You can **zoom in** on any section of the trend window in runtime. You can **move** the displayed section along the time and value axes in any way you like.

● In runtime, you can move and hide **time and value axes** of each trend and change the displayed **time interval online** by moving the mouse. This can be used to compare several batches, for example. You can show and hide individual **trends** or bring them to the foreground.

● A **ruler** displays the trend values on its scale markings (see WinCC RulerControl). For specific value ranges, the ruler also displays a configured **trend name**, for example, 0 - 50000 = "Body-in-white", 50000 - 100000 = "Painting".
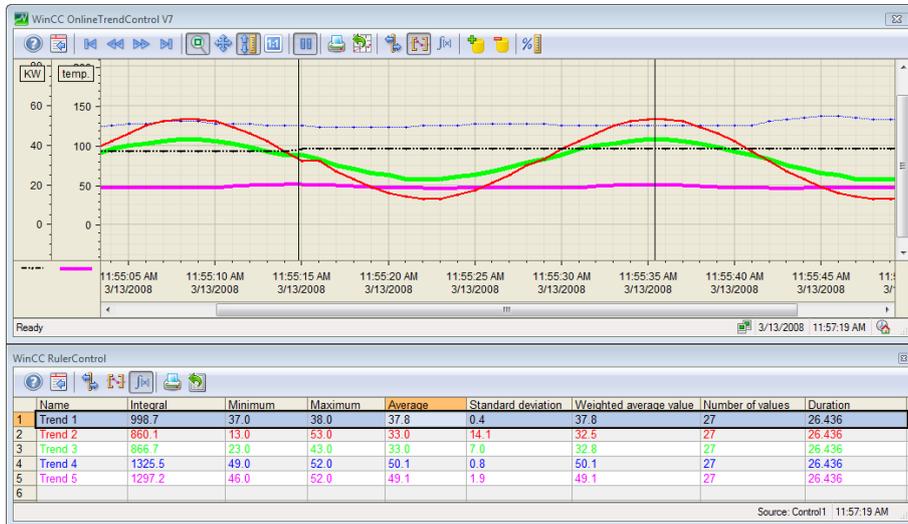
## WinCC RulerControl



Figure 2-46    Trend window with ruler window

In Graphics Designer, you **link** an already configured WinCC OnlineTrendControl or OnlineTableControl to the ruler window. You position the ruler window in the process picture independently of the linked WinCC controls. Whenever an operator uses the **ruler** in runtime to select a point in time or a time range **in the WinCC control**, the **ruler window** displays additional information and statistics.

In runtime, operators can choose from three different available views:

● The **coordinate window** shows the x and y coordinates of the trends at the point selected with the ruler.

● The **statistics range window** shows the values within the limits of the range selected in the trend or table window.

● The **statistics window** shows the statistical evaluation of the time range selected in the trend or table window: minimum, maximum, average, standard deviation, integral.

In the ruler window, you configure all information that is then displayed in the individual table columns.

## WinCC FunctionTrendControl

The **function window** resembles the trend window, but the time axis is replaced by a second value axis. Thus, a process value is not represented in relation to time, but rather in relation to an additional process value, for example. Example: Pressure in relation to temperature or voltage in relation to current. In contrast to the trend window, the **function window** features the following basic elements:

* An **x axis** with a fixed or automatically adjusted **value range** and linear or logarithmic **scaling**.

* A **y axis** with a fixed or automatically adjusted **value range** and linear or logarithmic **scaling**.

* A **trend** that shows two process values, for example, the temperature curve on the x axis and the associated pressure at a given temperature on the y axis.
  Thus, pressure is shown as a function of the temperature. Linked process values can include archived values of an **archive tag** from the process value archive, online values of a **process tag** from tag management, or columns, for example, a **setpoint trend** from **user archives** (see WinCC/User Archives option). However, both tags must have the same update cycle.
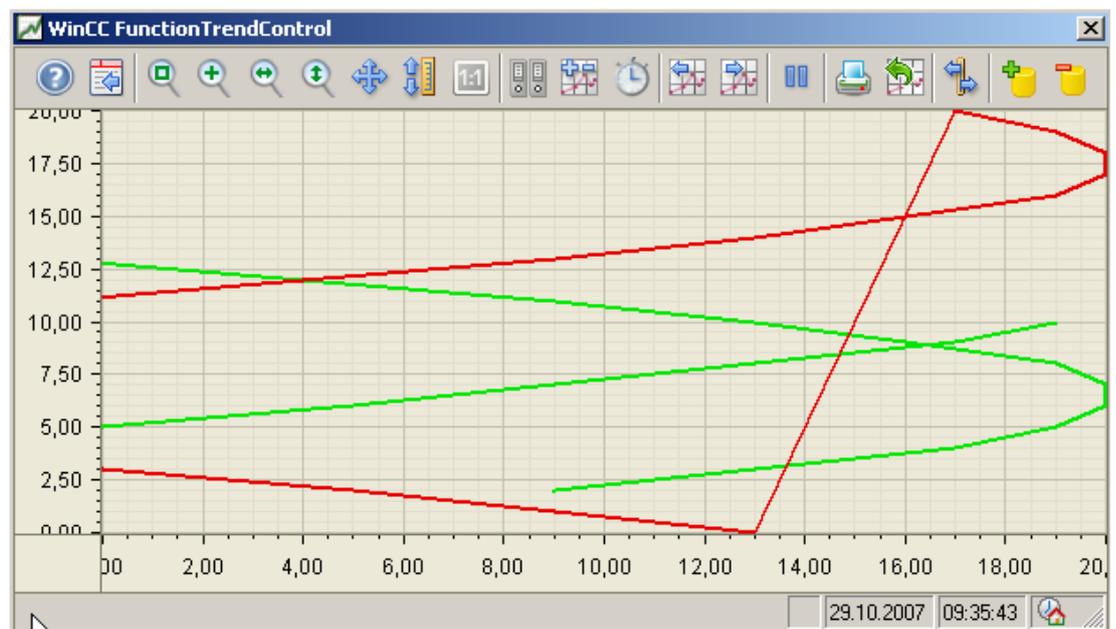


Figure 2-47    Function window

For each trend, you define a specific **time interval**, either **static** or **dynamic**, during which the process values are displayed in relation to each other (see WinCC OnlineTableControl). If a user archive is connected, you specify the number of measuring points.

All other properties and functions are the same as for WinCC OnlineTrendControl.

## 2.4.3        Reporting and logging system

### Definition

The **reporting system** is used during configuration for **project documentation** of the engineering measures (see Project documentation). By contrast, the **logging system** comprises various **runtime logs** that are used to print data acquired from WinCC or other applications during runtime:

- Message sequence report

- Message and archive log

- Measured value log

- Operator activity log

- System message log

- User log

Before sending a log to the printer, you can also save it as an **.emf file** and display it on screen using the preview function.
Operator commands are used to query the **status of print jobs** online.

The **SIMATIC Information Server** option is a reporting system that accesses the historical data of a process control system. A number of report templates are available for generating web-based reports.

## Runtime logs

The content of a log is defined by means of page layouts. A page layout contains the cover sheet, table of contents, and final page, as well as headers/footers and a page body. WinCC has a number of predefined page layouts. With the **WinCC Page Layout Editor**, you have a **complete graphics editor** at your disposal, making it easy and convenient to modify or create new page layouts using much the same technique as with Graphics Designer: From the **object palette**, you **drag** a **log object** to be printed to the page layout. Most WinCC editors provide **configurable** log objects for this purpose.
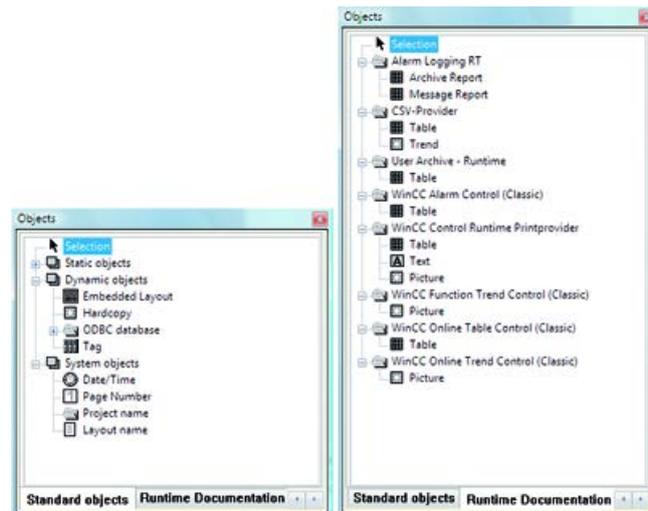


Figure 2-48    Log objects

## Message sequence report

For all issued messages, message sequence reports are output in chronological order to a line printer. The logs are printed in **line layouts**, which you configure in the **Line Layout Editor**. The message sequence report is activated by means of a predefined print job.

## Higher-level log objects

- Static log objects: circle, square, polygon
- Dynamic log objects that are assigned their current value during output
- System objects: Date/time, project name, page number
- Log objects for the project report
- Log objects for the runtime log
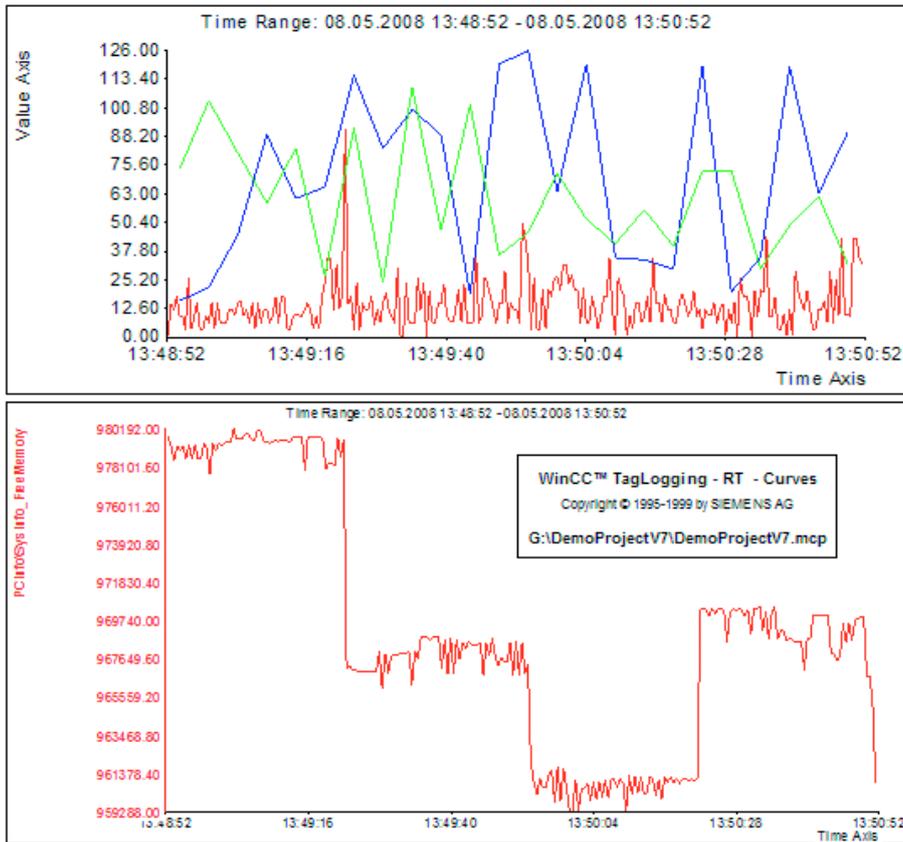
## WinCC-specific log objects



Figure 2-49    Runtime log

- Display of **WinCC controls**: windows for messages, tables, trends, functions, and user data. The log objects assume the configured properties of the associated WinCC controls, for example, time interval, time axis, value axis; however, these properties can be modified.

- Current value of a **process tag**

- **User archive** contents, WinCC/User Archives option

- **Layout inserted** into another page layout

- **Hard copy** displays the current contents of the screen or picture window.

## Log objects for the integration of third-party data

- CSV provider outputs a **.csv file** as a table or characteristic curve.

- ODBC database field outputs a field of an **ODBC data source** as text.

- ODBC database table outputs a table of an **ODBC data source** as a table.

- **COM provider** (see Special features)

## Print job

The current contents of the log objects of a page layout are output via a predefined print job or one you created yourself. If necessary, this process can be **time-controlled**.
To do this, specify in **WinCC Report Designer** both the **page range** to be printed and the **time range** of the data, the latter of which can also change dynamically.

In runtime, print jobs are called via the following objects:

● Operator input via the toolbar in WinCC controls

● Configured button in the process picture

● "Print job list" application window in the process picture

● Time-controlled print job

● Script functions, for example, based on process values

● Automatically or via operator input with the WinCC/DataMonitor option

## Project documentation

Engineering measures are documented in a project **report** in the WinCC engineering system:

● Configured process pictures and picture objects with properties, events, actions, and direct links

● Configured tags, properties, and communication links

● Configured message classes, message blocks, and messages

● Configured archive tags, and configuration data for archives

● Configured user groups and users

● Programmed source text of actions/functions

● Text from the Text Library

● Basic Process Control BPC (see "Control system configuration")

## Special features

● **Multilingual configuration** of predefined page layouts is possible for all **runtime languages**. WinCC has a number of predefined multilingual layouts. If a layout file does not exist for a runtime language, a warning symbol is displayed, and the English layout file is used.

● **COM provider**: In order to output random **user-specific data** that does not come from WinCC in the report or log, you must integrate a **COM server** into the log system. The COM server makes a user-specific, specially programmed COM object available over the **COM interface** of WinCC; you then insert this COM object into the page layout using the Page Layout Editor. The COM object can be of the type text, table, or picture.

# 2.5 Openness and integration

## 2.5.1 VBScript for openness without limits

### Definition

WinCC offers Visual Basic Script (VBScript), enabling you to **dynamize** the **graphical runtime environment** by means of actions. You do this just as you **automate** your **Office environment** using your own **VBScripts**, for example, to start programs, create directories, and control applications such as Microsoft Excel, over an intranet or the Internet if you wish.

Code examples:

- objWshShell.Run "**Notepad** Example.txt", 1

- HMIRuntime.BaseScreenName = "Serverprefix::**New screen**"

- HMIRuntime.Tags( **"Tag1"** ).Write 6

An **action** is a list of instructions and functions that are called by one or more **triggering events**, such as a value change. Different actions can use the same functions. Functions can be called more than once, can be triggered by a mouse click on a picture object, and can call other functions.

### Application

VBScript is a **programming interface** provided by WinCC. With the hierarchical Windows object model, you have access to picture objects and applications from **other vendors**, such Microsoft Excel and SQL databases.

- **Read** and **write tags** directly. Example:
  Clicking on the operating element with the mouse sets the setpoint or background color.

- **Dynamize** properties and events with **actions, independently of pictures**.
  Examples: Switching the runtime language, configuring color changes,
  showing picture levels, and displaying higher level designations of items (HID).

- Trigger **picture-independent** actions **cyclically**, for example, every day, or **acyclically**,
  for example, on a specific date.
  Example: Daily transfer of values to a Microsoft Excel worksheet.

- Trigger **actions upon change** of one or more **tags**.
  Example: Calculation of a formula as soon as a value changes.

- Call actions in runtime via **user-defined menus and toolbars**.

- Control the **Windows environment**.
  Examples: Starting external applications from WinCC, creating files and folders;
  the multiple start of an external application is to be monitored by a program.
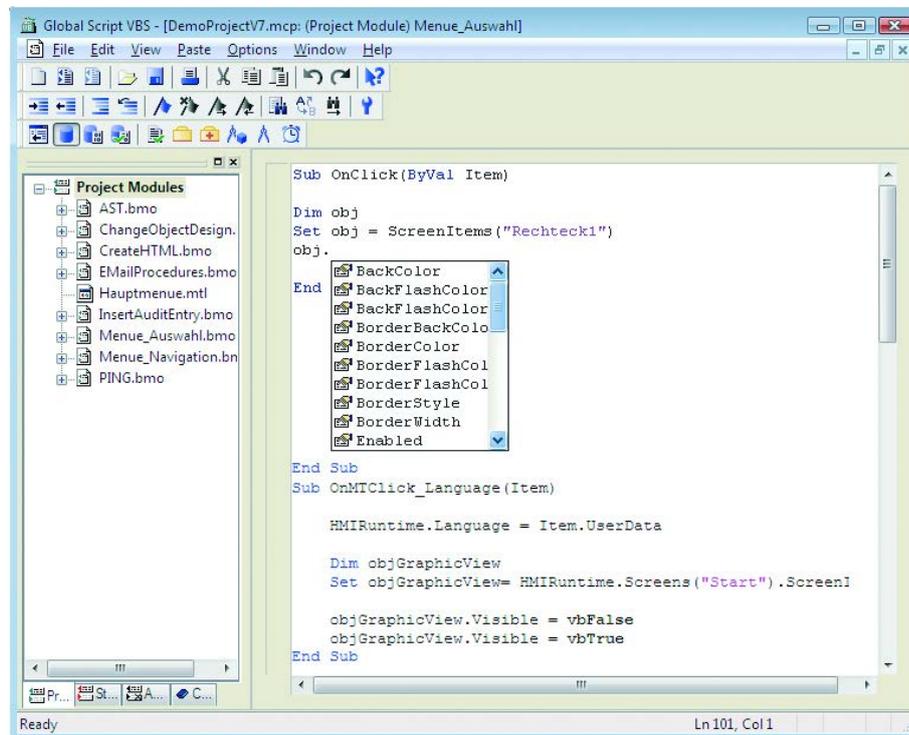
## Structure



Figure 2-50    VBScript in the Global Script Editor with Intellisense

You have access to the hierarchical WinCC object model "Project > HMIRuntime > Picture Window > Picture Level > Picture Object > Property and Method".
Thus, the following picture objects with their properties are available:

● Default objects, Smart objects, and Windows objects

● WinCC controls

● Groups and user objects

You create functions, events, and tags for the entire project independently of pictures in the **Global Script** integrated programming environment.
In **Graphics Designer**, you dynamize **process pictures** and **picture objects** with actions, configure an action on an **event** (see "Intelligent configuration"), or create a picture-dependent action for the current process picture **directly** in the **Action Editor**.

## Global Script

- The Global Script Editor helps you create code by providing bookmarks, **color coding**, **syntax highlighting**, **syntax verification** and **Intellisense**, which lists the possible objects, properties, and methods at a given point in the code.

- Global Script provides **constructs** such as IF-THEN-ELSE and all **standard VBScript functions** such as Abs, Array, and Year, which you **drag** from the navigation window to your code.

- **Selection dialogs** provide quick, secure access to WinCC tags, process pictures, and picture objects.

- Actions can be **exported** to another project and **imported**.

- Whenever you create or modify a file with functions, the **date of creation** or **date of change** is **automatically** and permanently entered into the **accompanying information** along with your comments.

- **Programming errors** such as missing references are displayed during generation. You can detect and correct the errors using the integrated **Microsoft Script Debugger**, which is supplied with WinCC. Files with **incorrect** or **unfinished functions** are **identified** in the Global Script navigation window. Processes are monitored in the **Global Script Debugger**.

- **Additional debuggers** for debugging your scripts in runtime: "InterDev" debugger is included in the installation scope of Developer Studio and Microsoft Script Editor MSE in the Microsoft Office scope of supply.

- If you use the **standard formulations** HMIRuntime.BaseScreenName = "Process picture" and HMIRuntime.Tags("Tag") in the code, you can **identify** and link the places of use of process pictures and tags in the **CrossReference Editor** (see "Configuring complex projects").
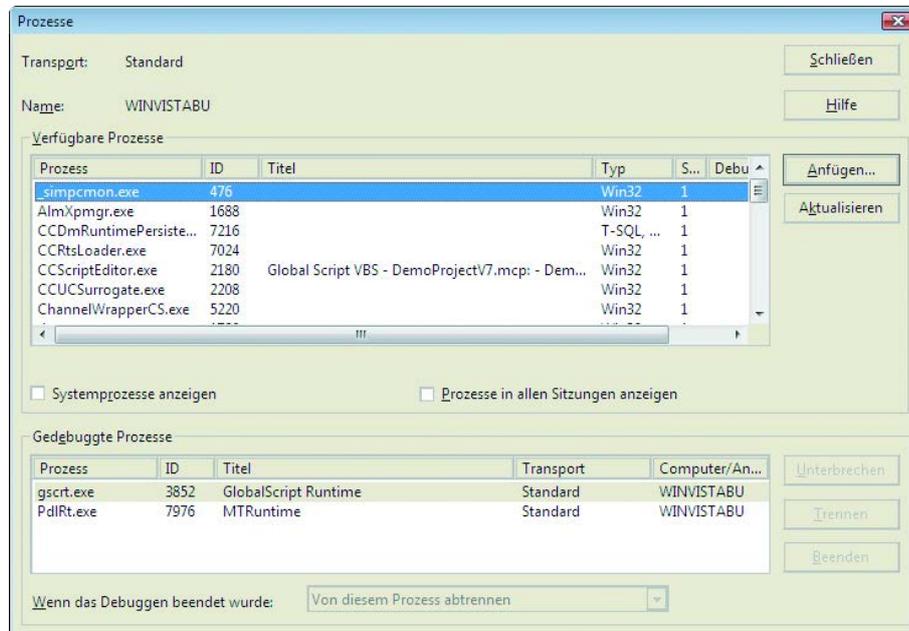


Figure 2-51    Global Script Debugger

## Runtime behavior of actions

To prevent a cyclic actions from being **impeded** by an acyclic action, cyclic and acyclic actions are performed **independently** in runtime.
These types of actions have separate data areas and can be **synchronized**.

Picture-dependent actions of the same type and picture-independent actions are **executed sequentially**; if necessary, they are placed in a **queue**.

If the execution of cyclic actions in process pictures is impaired, for example, due to a **heavy system load** or other actions, the action is executed **one time** at the next available opportunity. One minute after the picture changes and five seconds after runtime is ended, all actions still being executed are **automatically ended in order**.

## Diagnostics

WinCC provides the following tools for analyzing the **runtime behavior of actions**:

- **Global Script Runtime diagnostics window** in the process picture:
  Provides information on the dynamic behavior of all Global Script actions, enables the individual startup of each action, and offers an access point to the Global Script Editor during active runtime.

- **Global Script Diagnostics diagnostics window** in the process picture:
  Outputs trace instructions "HMIRuntime.Trace(<Output>)" inserted into actions in the chronological order in which they are called. By using trace instructions for a specific purpose, for example, to output tag values, you can trace the course of actions and the functions called from within these actions.

- Runtime diagnostics with **WinCC/ApDiag**

## Other access options

- OPC (see WinCC/ConnectivityStation option)

- OLE DB (see WinCC/ConnectivityPack option)

- WinCC/ODK (Open Development Kit) option

- WinCC/IndustrialX option

## 2.5.2 ANSI C for integration without bounds

### Definition

WinCC offers the ANSI C programming language. In contrast to VBScript, ANSI C enables you to access the entire **Runtime environment** (for example, the message system, the reporting and logging system, etc.) via functions. ANSI C is used to create **platform-independent** applications and expansions, for example, for WinCC.

Code examples:

- ProgramExecute( "C:\\Winnt\\system32\\**notepad.exe**" );

- void OpenPicture( **new screen** );

- SetTagDouble( **Tag1**, 6 );

- **rt_language** = GetLanguage ();

- **AcknowledgeMessage**( GetTagWord("U08i_MsgNr") );

Functions are also used in an **action**, which is called by one or more **triggering events** such as a value change. Functions can be called more than once, can be triggered by a mouse click on a picture object, and can call other functions.

### Application

ANSI C is a **programming interface** provided by WinCC. **Other vendors** can access WinCC objects in their own software programs over the C API application programming interface (see WinCC/ODK option). ANSI C functions enable you to perform **complex calculations** and **monitor tags**, among other things. (Other applications are similar to those described in "VBScript for openness without bounds".)
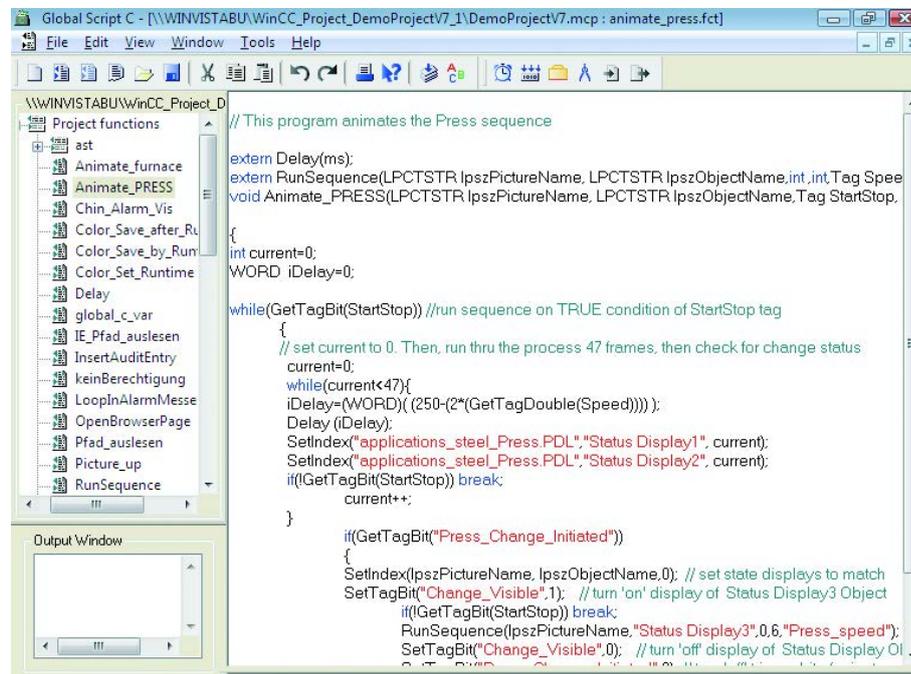
**Structure**



Figure 2-52    C script in the Global Script Editor

WinCC provides ready-made ANSI C logic blocks in C functions:

- User-created, user-defined **project functions**, for example, for the event "mouse click" or for dynamization in the **Dynamic dialog**, or functions created with the **Dynamic Wizard**. Functions that are called for **loop-in alarm** in the message system or **start of archiving** and **backup** in the archive system.

- A whole host of cross-project WinCC **standard functions** for Graphics Designer, for the message systems and archive system, for the reporting and logging system, etc. You can add to these WinCC standard functions.

- **Internal** WinCC functions for memory allocation and tag access, which can be used but not modified.

- **DLL functions** in their own Dynamic Link Libraries (DLLs). By contrast, the functional scope of existing DLLs can be used and added to.

You use these ready-made C functions in **project functions created and defined by you**, for example, for the event "mouse click" or for dynamization in the **Dynamic dialog**, or functions created with the **Dynamic Wizard**. You also use them in project functions that are called for **loop-in alarm** in the message system or for **start of archiving** and **backup** in the archive system.

For information on additional structuring with the **Global Script Editor**, on actions and their runtime behavior, on diagnostics, and on other access options and special features, refer to "VBScript for openness without bounds".

## 2.5.3 WinCC/ApDiag for comprehensive diagnostics

### Definition

ApDiag, the application diagnostics tool integrated into WinCC, helps you analyze errors and performance problems in the process visualization system.

### Application

VBScript and ANSI C make WinCC an open system with many options for calling Windows APIs and your own DLL functions.
However, incorrect programming can also disrupt the automation system.
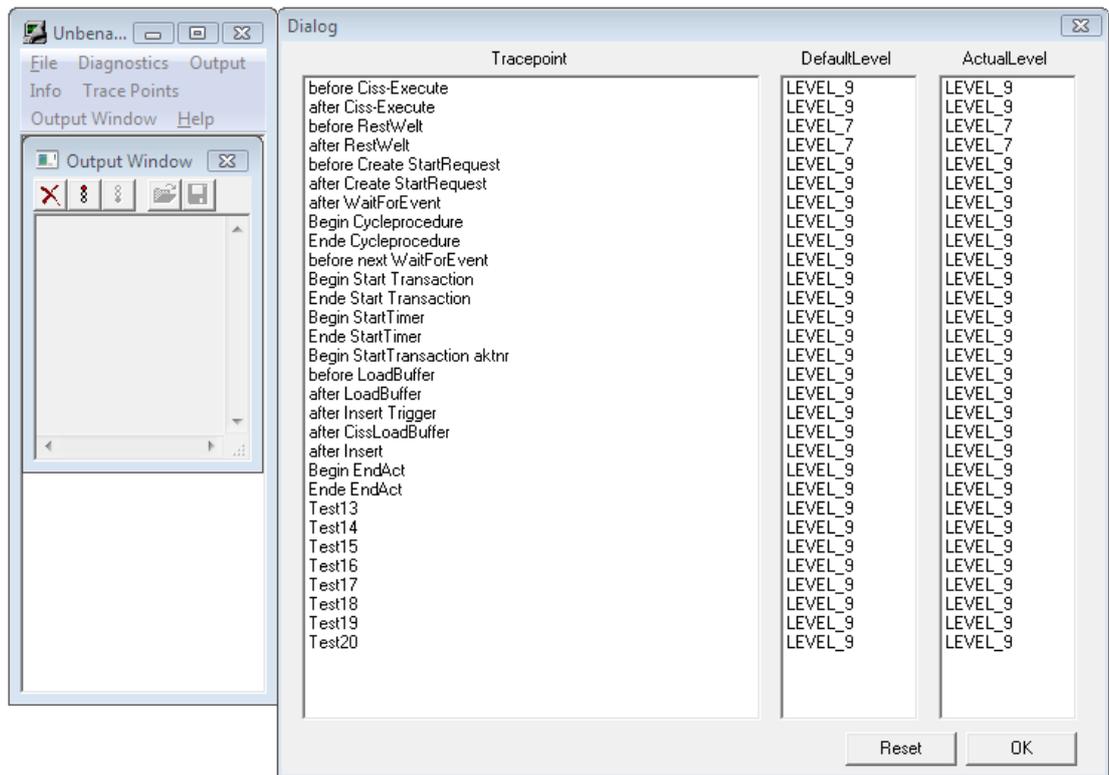
### Structure



Figure 2-53    Tracepoints in WinCC/ApDiag

WinCC/ApDiag provides a number of predefined diagnostics points (**tracepoints**) for which WinCC/ApDiag provides a definable **level** of information:

- Number and runtime of **actions**
- Monitoring of the **action queue**
- Early detection of a growing action queue
- List of **applications** associated with action control

- Number of **transactions** and requested **tags** A transaction is established, for example, for every action configured on an event, for every picture window containing at least one cyclic action, and for picture-independent actions.

- List of **standard functions** and **project functions**
  (see "ANSI C for integration without bounds")

- **Printf()** outputs

Diagnostics information is collected in a **circular buffer** and can be output on **screen**, to a **file**, or to an **internal tag**. With the **internal functions** TraceTime() and TraceText(), you can create your **own diagnostics information** in the code.

### Queue overflow

A queue can overflow whenever too many actions are executed in a too small cycle or an action becomes stuck, for example, in a loop, a dialog, or because it is waiting for another application. Newly triggered actions are added to the queue and cannot be processed.

WinCC/ApDiag is able to detect a **gradual increase in size** of the queue, which undetected would give rise to the error message "More than 10,000 actions to work" after several hours or days. Individual process pictures can also be checked for **correct action programming**.

## 2.5.4 VBA for automated configuration

### Definition

With Visual Basic for Applications (VBA), you **automate** your **office applications** such as Microsoft Excel or Microsoft Word in application-specific **VBA macros**.
VBA is available in WinCC so you can **automate work steps** that recur frequently in the **configuration** in the following editors:

- Tag Management

- Graphics Designer

- Message System

- Archive System

- Text Library

In this way, you can, for example, created several tags and change their values, edit text entries in the Text Library, or customize messages directly from the program code.

Code examples:

- Shell( "C:\WINDOWS\NOTEPAD.EXE", 1 )

- Application.Documents.Add hmiOpenDocument

- objHMIGO.CreateTag( "Tag1", TAG_SIGNED_32BIT_VALUE )

- With objHMIGO
  .TagStart = 6
  End With

## Application

With Visual Basic for Applications (VBA), you to **add** functions to WinCC to automate the configuration. This makes it easier for you to **create industry-specific solutions**, for example, by customizing Graphics Designer according to your requirements. The hierarchical WinCC object model provides you with access to tags, picture objects, messages, archives, and text. You use the **Windows object model** to access applications of **third-party vendors**, for example, the Microsoft Office family.

- Generate, modify, and delete **tags** and read out and change their properties, types, and values

- Create specific **Quick Configuration dialogs** for user objects

- **Dynamize** properties of pictures and objects

- Generate, modify, and delete **messages**

- Generate, modify, and delete **process value archives** and archive tags

- Generate, modify, and delete text from the **Text Library** and read out text IDs and text

- **Automatically check plausibility** when closing a process picture

- **Import external data** for automatic picture generation
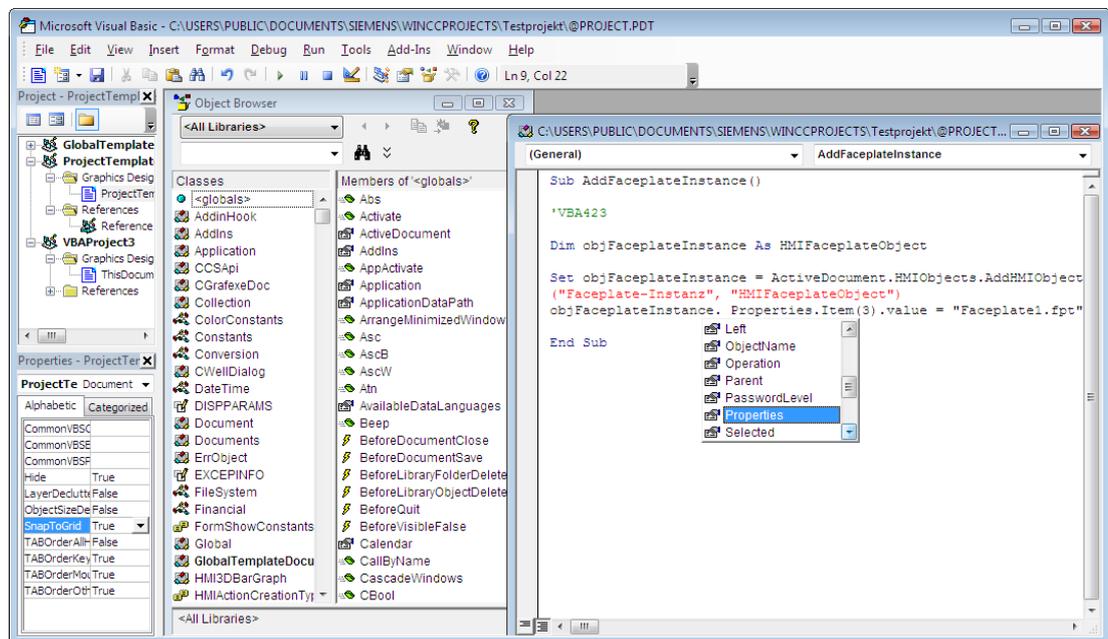
## Structure



Figure 2-54    VBA script for a project template

In contrast to the WinCC/ODK option, you have **object-oriented access** to the hierarchical WinCC object model "Application > Process Picture > Picture Level > Picture Object> Property and Method, Dynamization and Event-driven Actions" and to events during configuration.

In principle, you can use VBA macros to automate all configuration steps that you would normally perform manually.
All picture objects of a process picture with their properties are available for this process:

- Default objects, Smart objects, and Windows objects

- Groups and user objects

- Libraries

- Dynamic dialog

- Direct connection

- Toolbars and menus for configuration

You organize the VBA code in the **VBA Editor**.
In this editor, you specify where the VBA code is available:

- Global VBA code in all projects

- Project-specific VBA code

- Picture-specific VBA code

VBA changes in the WinCC user interface can be application-specific or picture-specific.
Application-specific user interfaces are developed for specific industries, for example.
Picture-specific user interface elements such as a menu or a toolbar only appear
when you are editing a specific process picture.

## Additional access options

- WinCC/ODK (Open Development Kit) option

- OLE DB (see WinCC/ConnectivityPack option)

- WinCC/IndustrialX option

## Special features

- **Dynamic Wizards** are also expanded with VBA.

- You can debug your VBA scripts with the VBA Editor **debugger**.

- You can **export** VBA code and **import** it into the VBA Editor.

- You use **Object Linking and Embedding OLE** to exchange data between WinCC
  and Microsoft objects, for example, to integrate a Microsoft Excel worksheet
  into a process picture.

- An **add-in** is code that is stored in **DLL** format and provides specific functions
  for specific cases, for example, **expansions** for Graphics Designer.
  You can combine VBA macros to form an add-in.
  Then, when changing the configuring PC, all you need to do is copy the add-in.
  In Graphics Designer, you use the **Add-In Manager** to specify the loading behavior
  of add-ins, for example, load add-in automatically upon opening.

## 2.5.5     OPC - Open Connectivity

### Definition

The OPC standardized software interface allows you to combine devices and applications from various manufacturers in a uniform manner.
WinCC can be used as both an OPC server and an OPC client.

The figure below shows the WinCC OPC communication concept:
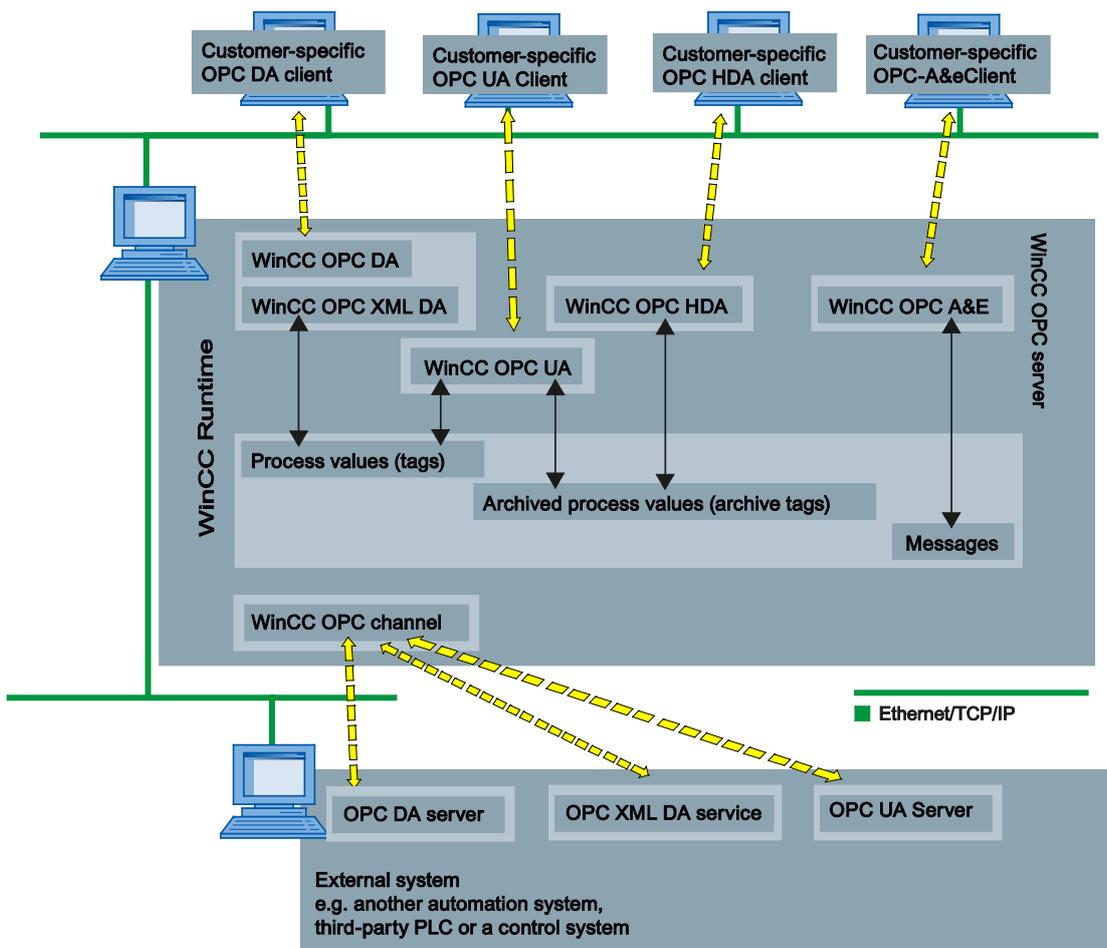
## Application

In WinCC, servers are available for the following OPC interfaces:

● OPC Data Access, OPC XML Data Access: Access to the WinCC body of data

● OPC Historical Data Access: Access to the WinCC archive system

● OPC Alarms&Events: Access to the WinCC message system

● OPC Unified Architecture: Access to the WinCC body of data and archive system

The default WinCC version also contains an OPC channel. The OPC channel can access the relevant OPC servers as client via OPC DA, OPC XML DA or OPC UA DA.

### OPC Data Access

The WinCC OPC DA server makes the process data from the WinCC project available to other applications. The WinCC OPC DA client can also access the process values of programmable controllers from any manufacturer provided they have an OPC server. These applications can exist either locally on the same computer or in the connected network environment on computers that can be accessed via their IP address.

### OPC XML Data Access

The WinCC OPC XML server provides the OPC XML client with the OPC process values as Web page via HTTP. OPC XML clients are no longer limited to a Windows environment; they can now access WinCC Runtime data over an intranet or the Internet via any operating system.

### OPC Historical Data Access

The WinCC OPC HDA server makes archived data from the process value archive available to other applications. An OPC HDA client, for example, requests archive data from a specific time interval and the requested data is read from the saved archive. Archive data can be read, edited, inserted, replaced, and deleted.

### OPC Alarms&Events

The WinCC OPC A&E server makes messages from the WinCC message system available to the OPC clients. The alarm and its accompanying process values can be forwarded to any subscribers at the production or corporate management level and filtered.

### OPC Unified Architecture

OPC UA (Unified Architecture) is the successor technology to OPC. OPC UA is platform-independent and supports different protocols as the communication medium. The WinCC OPC UA DA server is installed as Windows service and started automatically. The server provides process values and values from tag archives. For authorization between WinCC OPC UA DA server and OPC DA UA client, certificates are exchanged.

# Options

# 3

## 3.1 Scalable plant configurations

### 3.1.1 WinCC/Server

**Definition**

All process data of a WinCC project is stored in the Microsoft SQL Servers "Process Image", "Alarms", "Trends", "User Archive", and "Reports" (**runtime databases**).
These Runtime databases can be located on a central PC, the **WinCC server**,
which is then accessed by the operator stations, the **WinCC clients**.
A WinCC client itself can have a WinCC project with its own Runtime databases or
it can be used without its own project data (see "Unlimited plant configuration").
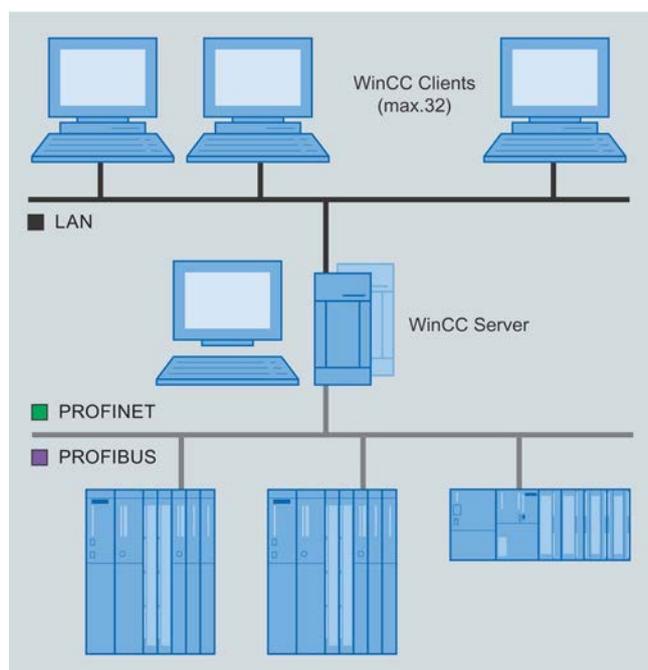
Each WinCC server requires a server license.



Figure 3-1    Multi-user system with up to 32 clients on one WinCC server

## Multi-user system

You can user the server option to expand a WinCC single-user system to a **high-performance multi-user system** with up to 18 WinCC servers.
If the quantity structure of the plant is very large, you can run several **coordinated operator control and monitoring stations** in a common association with networked automation systems.

One or more WinCC servers can supply up to 32 connected WinCC clients with process and archive data, messages, pictures, and logs.

## Distributed system

In a complex plant, you can also run WinCC with the server option as a distributed system. The distribution of the overall application on up to 18 servers allows considerably **higher configuration limits**, lessens the load on individual servers, and ensures **good performance**. You can mirror the topology of the plant (for example, body-in-white construction, paint shop, final assembly) or you can distribute the WinCC servers according to functionality (for example, visualization, archiving, message system).

## WinCC clients

Operator control of the plant takes place via WinCC clients:

- WinCC clients without their own project that access exactly one WinCC server in a multi-user system configuration.

- WinCC clients with a project that provide a central view of several WinCC servers in a distributed system configuration.

For the WinCC clients, only the **smallest runtime license** is required; for configuration on the client, only the **smallest complete license** is required.

## 3.1.2    SIMATIC Process Historian

### Definition

**SIMATIC Process Historian** is a central **long-term archiving system** for storing process data such as process values and messages. You need to install SIMATIC Process Historian on a separate computer with a Windows Server 2008 R2 SP1 64-bit operating system.

The Process Historian uses Microsoft SQL Server 2008 R2 SP1 64 Bit.
It archives historical data originating from a WinCC Operator Station (OS) or PCS 7 OS. The data can belong to different WinCC or PCS 7 projects. Access to the historical data is transparent for the OS clients.

Process Historian replaces WinCC/CAS (Central Archive Server).

Process Historian employs four services for processing, storing and backing up data:

- SIMATIC Process Historian server

  This service implements all functions the server needs to process and store data.

- Process Historian Maintenance Service

  This service implements all functions that are necessary to maintain the Process Historian database.
  The Maintenance Service handles tasks such as starting mirroring, mirror monitoring, restore functions, maintenance of the transaction log and suchlike.

- Process Historian Redundancy Service

  This service implements functions that are necessary for data exchange between two redundant server systems.

- Process Historian Discovery Service

  This service supports the search for connected Process Historian systems.
  The Discovery Service is essential for the functionality of the Process Historian.

### Licensing

The archive tags are licensed locally on the WinCC servers. WinCC permits a maximum of 80,000 archive tags per WinCC server.
There is no limit on the number of archive tags per Process Historian server.

Process Historian has a different license concept to its predecessor, WinCC/CAS.
There is automatic data migration. Please note, however, that the migration may incur additional license costs:

- Non-redundant WinCC/CAS and one redundant WinCC server:
  One additional "Archivetags 5k" license is required for the redundant WinCC server.

- Redundant WinCC/CAS and one redundant WinCC server:
  Two "CAS-> PH upgrades" plus one additional "PH redundancy" are required.

- Non-redundant WinCC/CAS and multiple WinCC servers:
  Additional archive licenses may be required for additional WinCC servers depending on the server archive tags.

## Application

The schematic diagram below shows the use of Process Historian together with SIMATIC Information Server:
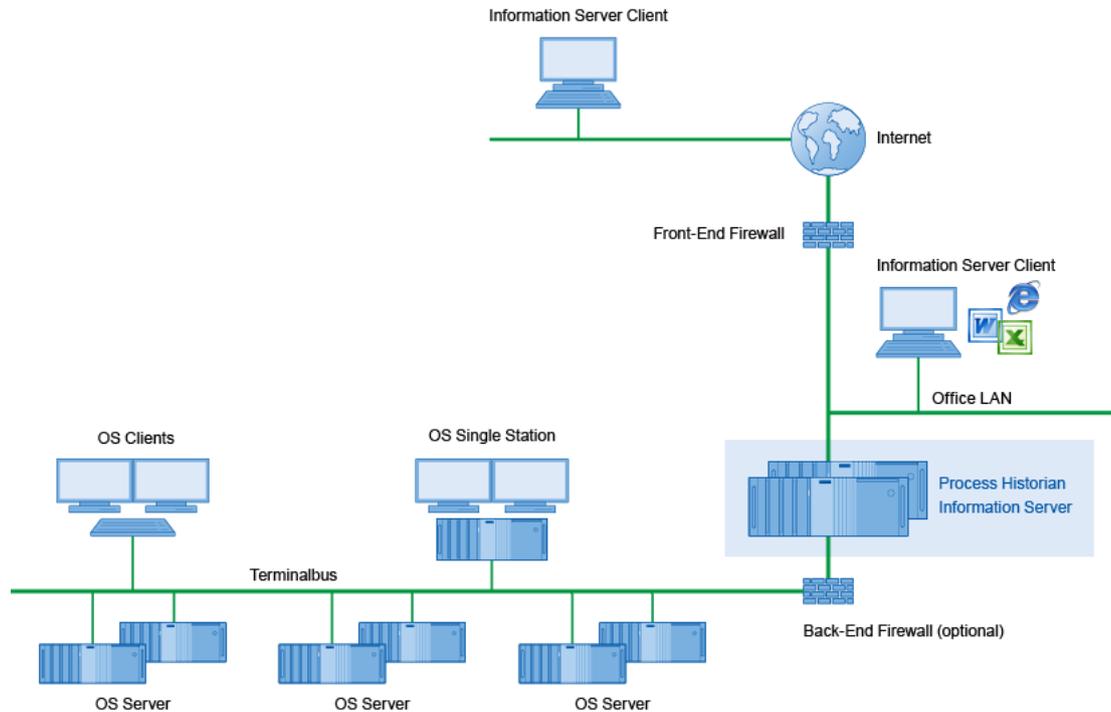


Historical and current process values and messages can be centrally archived, connected and compressed in real-time without additional engineering work.
Archiving and company-wide access allow quick decisions on the basis of saved data.

Process Historian is fully scalable. There is no restriction on the number of single stations, servers or server pairs that can be archived.

Thanks to its seamless integration in WinCC, including redundant configurations, SIMATIC Process Historian meets strict security requirements.

SIMATIC Information Server is used for process data evaluation and reporting.
The server provides the archived data on a Web interface in the form of shift, daily, weekly or monthly logs.

## Segmentation

Process Historian can process and manage extremely large amounts of data.
To maintain performance capability, the data saved is divided into two types of **segments**, runtime and archive segments.

Runtime segments are always online and cannot be deleted.
As soon as a runtime segment becomes an archive segment, it can be backed up.
A segment contains the amount of data that was recorded during a predefined time period.
Process Historian continuously creates segments within defined time periods.

## Configuration and diagnostics with the Management console

For **configuration** and **diagnostics** of the Process Historian system, you use the **dashboards** in the Management console.
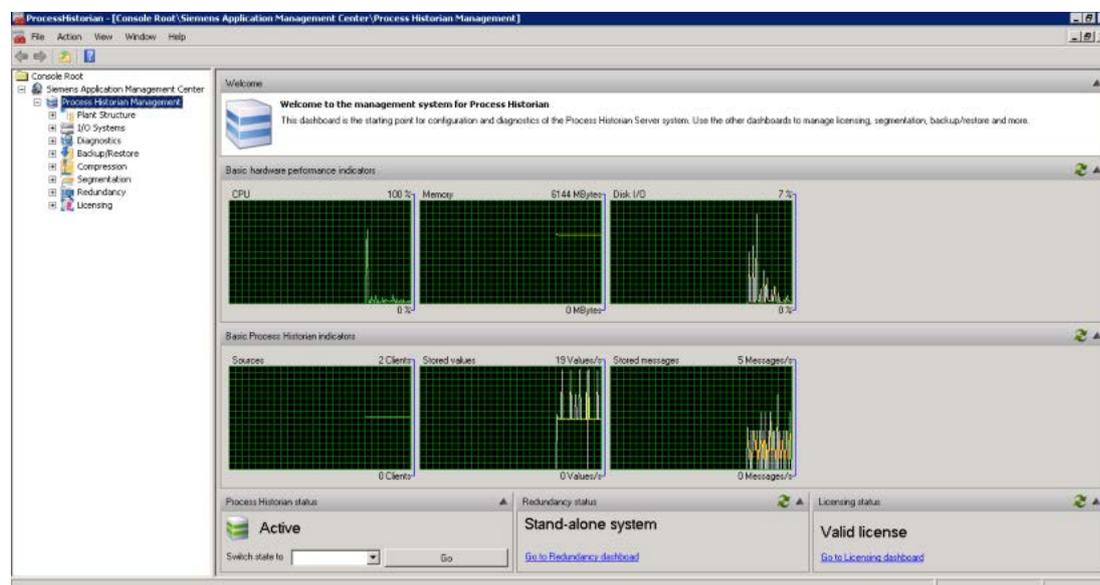


The following dashboards help with configuration and diagnostics:

- Process Historian Management: Provides information on the basic indicators and the operating state of Process Historian.

- Diagnostics: Displays the event logs (diagnostics messages) of Process Historian.

- Backup/restore: When an archive segment is backed up, the runtime data is stored in a backup file. If you want to access data that is stored in an archived segment, you must restore the respective segments.

- Segmentation: Configures archive segmentation and provides an overview of the current segmentation configuration.

## Redundant system

For increased availability, Process Historian can also be operated as a **redundant** server pair.

Process Historian has its own redundancy concept.
The redundant systems are based on Microsoft SQL Server mirroring.

A redundant Process Historian system consists of symmetrically configured servers for master (principal) and standby (mirror) operation.

Process Historian requires a third system to monitor the availability of redundancy.
The **WinCC Server/** Information Server can usually be assigned the role of "Witness".
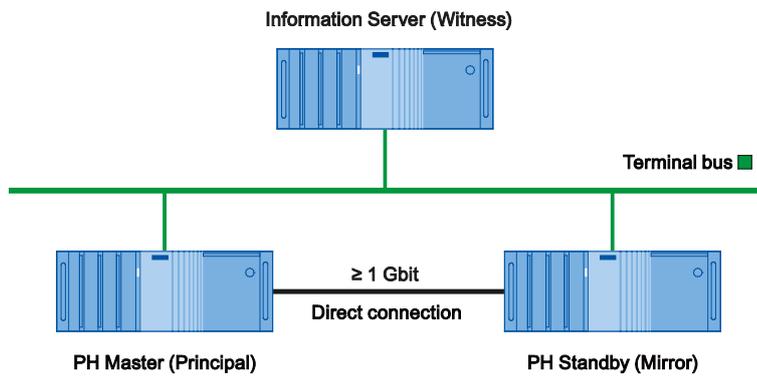


## See also

SIMATIC Information Server (Page 149)

## 3.1.3 WinCC/WebNavigator

### Definition

Up to 150 Web operator stations provide simultaneous views of up to **18 different**, optionally redundant server projects.

### Licensing

A central license is required on the WinCC/WebNavigator server in accordance with the maximum number of machines with simultaneous access, for example, 1, 3, 5, 10, 25, 50, 100 or 150 Web clients. No license is necessary on the WinCC/WebNavigator clients.

Alternatively, a WinCC **diagnostics license** can be used with WinCC/WebNavigator. This gives you the capacity to provide remote maintenance sequentially to many WinCC plants via a WinCC Web server from just a few central maintenance computers. This requires a license on each **diagnostics client** rather than on the WinCC/WebNavigator server.
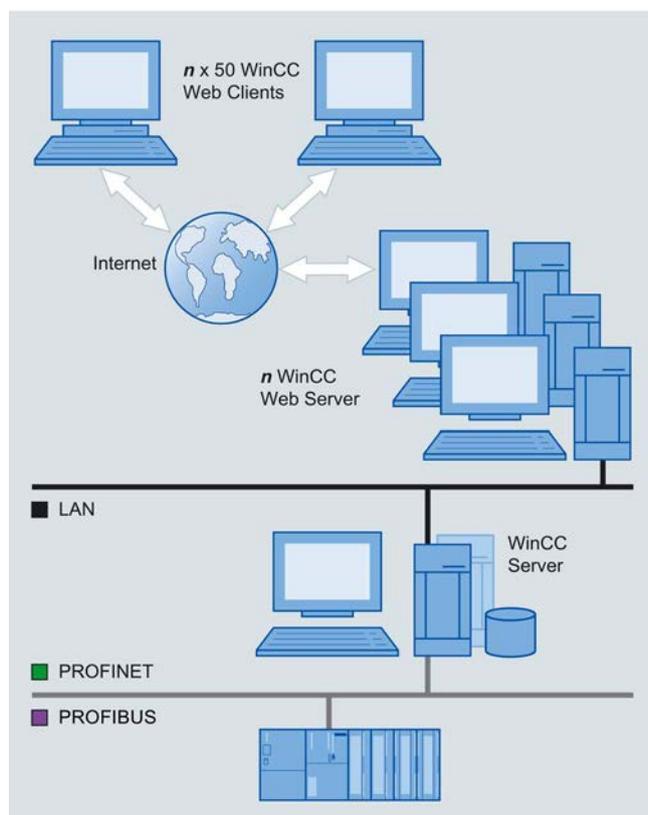
### Application



Figure 3-2    Web server farms (load balancing) with many Web clients

With WinCC/WebNavigator, you can perform operator control and monitoring functions on your automation system via an intranet or the Internet **with almost no configuration changes required**. When connected over a high-speed communication line, you can achieve the same update times as on-site. This enables you to perform operator control and monitoring functions on process pictures **from anywhere in the world**.

You can provide solutions for specific applications that must be implemented at **minimal cost**. In particular, this includes applications with a highly distributed structure, such as water/wastewater treatment, or in which process information is only accessed periodically, such as building management. In addition to this, Web clients can be easily used as cost-effective operator stations on the LAN.
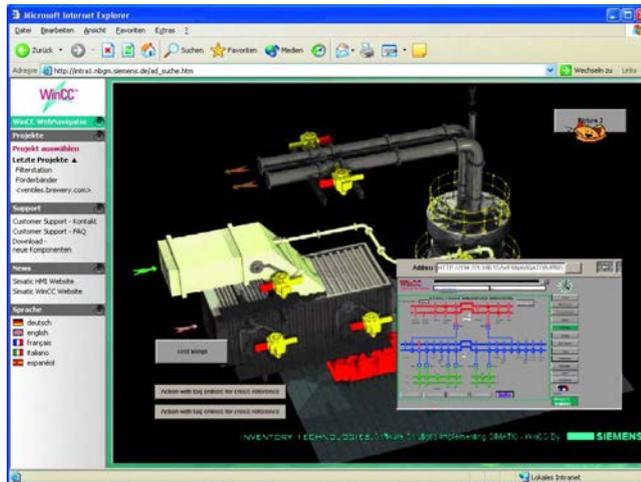


Figure 3-3      Operator control and monitoring of the plant via an intranet or the Internet

## Operator control and monitoring in Microsoft Internet Explorer

- Just as in WinCC, operator input on the WebNavigator client requires the appropriate **access rights**, which are specified in the WinCC user administration.
  You can also choose to specify a "ViewOnly" operator authorization.

- For the WebNavigato client, each operator receives an **individual start screen**, **runtime language**, and and optional **automatic logout** after a set time or a period of inactivity.

- WinCC/WebNavigator is based on the standard HTTP protocol with ActiveX and supports the latest security mechanisms.

- Logon and logoff procedures on the WebNavigator client and operator control actions are recorded on the WebNavigator server as WinCC operator messages (**validation request**).

- The WebNavigator client is started with via Microsoft Internet Explorer with activated ActiveX controls or, if there are special IT requirements, via the **WinCCViewerRT** supplied. With the WebViewerRT, use as a **terminal service** for a thin client such as wireless data terminal equipment is also possible (see "Thin clients").

- A WebNavigator client can establish contact to different Web servers and switch between views. This is facilitated in Internet Explorer with **tabbed browsing**, which allows multiple tabs to be opened in the browser, each displaying a different window.

● In Kiosk mode, you use the **full screen** and **concealed** controls for the operator.
  You can **disable keys**, thus preventing operator input errors.

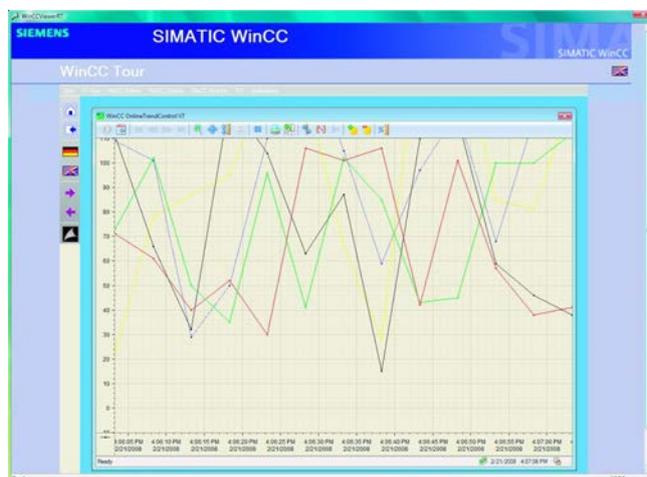● Users can log in to runtime with **different user names**.



Figure 3-4      WinCCViewerRT



Figure 3-5      Tabbed browsing in Microsoft Internet Explorer

## Special features

● **MS Sidebar Gadgets** are mini pictures providing useful information for the sidebar.
  The WebNavigator client provides a ready-made gadget that displays cyclic snashots
  of WinCC process pictures in varying display detail.
  The WinCC process picture is displayed by double-clicking.



Figure 3-6      Windows 7 Gadget

- With Internet Information Services (IIS), only one Web page with one WinCC project can be active on a WebNavigator server at a given time. However, WebNavigator-Server 1 can distribute its load to **lower-level WebNavigator servers** 2 and 3. A WebNavigator client only needs to log on to Web server 1 to access the project of Web server 2 and 3. The physical separation of WebNavigator servers 1, 2, and 3 also allows you to separate the WebNavigator servers from a security standpoint or a functional standpoint. Example: Server 1 in the IT department and servers 2 and 3 in plant management.

- Higher availability and greater quantities structures can be achieved with Web server farms with **load balancing**. To use this feature, enter multiple WebNavigator servers in the load balancing list. When a WebNavigator client logs on to one of these WebNavigator servers, the Web client is rerouted to another participating WebNavigator server if the load is too heavy. If an actively participating WebNavigator server drops out, all of the Web clients connected to it are automatically distributed to the remaining WebNavigator servers.

- **Remote Publishing**: You can distribute projects among the Web servers without being present on-location. Example:
  On Web server 1, you publish a project, for example, from Web server 2 to Web server 3.

- With **Download On Demand**, additional client expansions such as WinCC UserArchiveControl, language add-ons, or IndustrialX controls are available to users for download.

- The WebNavigator server is installed on a WinCC server or on a WinCC client with its own project. By separating the WinCC server and Web server, you increase security and availability. Of course, availability can also be increased by using multiple independent WebNavigator servers. In this case, however, automatic synchronization is not possible, in contrast to load balancing.

  WebNavigator also supports **redundancy switchover** of multiple lower-level WinCC servers when installed on a WinCC client with its own project (see WinCC/Redundancy option).

- A WebNavigator client can be linked to the **Siemens Mobile Wireless** Panel via **WLAN**.

- With **thin client solutions**, any computer running a Windows operating system such as Windows 7, rugged local devices such as SIMATIC Thin Client, and mobile clients such as PDAs running Windows Mobile can all be connected.

  Such solutions have only minimal hardware requirements because the thin clients are connected to a terminal server with WebNavigator via terminal services. Up to 25 thin clients can be connected to this terminal server (see "Thin clients").

- You can protect published, password-protected process pictures in WinCC Explorer with an additional password for access via WebNavigator.

- Unicode support

- User login/logout at the WebNavigator client and manual logout in Internet Explorer with ODK C-Script (PWRTLogout() function).

- Freely configurable background image when logged off

# 3.2 Increased availability

## 3.2.1 WinCC/Redundancy

### Definition

A redundant system consists of two WinCC servers configured to perform the same functions and operating in parallel: one master server and one standby server.

### Requirement and licensing

- WinCC/Redundancy option on every WinCC server
- An additional network connection via LAN for server coupling.
- A license on the redundant single-user system or on the redundant WinCC server

### Application

With WinCC/Redundancy, you increase the availability of the plant through parallel operation of two server PCs that are coupled to each other:

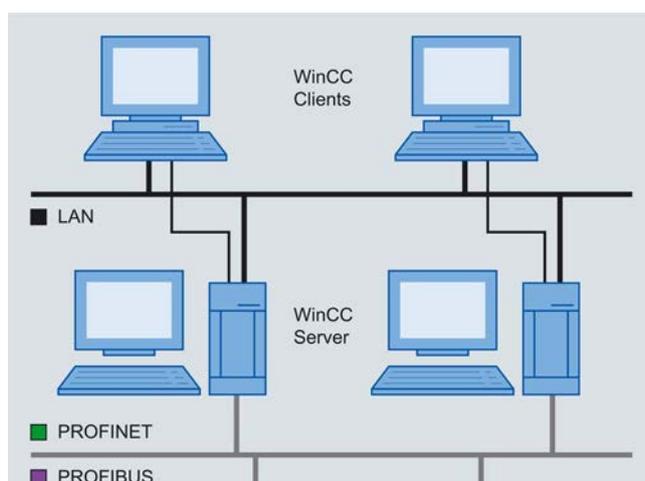- Single-user system
- WinCC server

### Structure



Figure 3-7    Redundant operation of a second WinCC server

With the **Project Duplicator**, you can easily create a functionally identical project (with the same data archives, for example) on the redundant WinCC server:

- Two WinCC servers are completely parallel: Each WinCC server has its own process connection and its own archives.

- The connected WinCC clients can be distributed to either of two WinCC servers, which results in a load reduction. A **preferred server** can be configured for each WinCC client.

- **Online synchronization** of all archives, message information, and internal tags.
  To carry out this synchronization, the WinCC servers communication via the LAN network connection.

- The two WinCC servers **monitor each other** in runtime. An **additional connection** via a network adapter or a serial connection between the servers is used to **monitor status**.

- In addition, **Application Health Check** provides sign-of-life monitoring of WinCC applications beyond the WinCC servers.
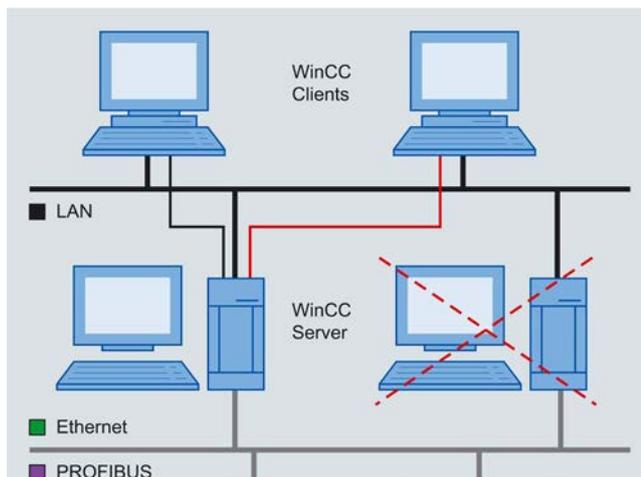
## Server failure



Figure 3-8    Failure of a WinCC server

- When one of the two WinCC servers fails, the other takes over the archiving of messages, process data and user data. This guarantees **data integrity with no gaps**.

- In client/server mode, the WinCC-Clients are **automatically switched over** to the redundant peer, and a **system message** is issued.
  This ensures **continuous visualization** and control of the plant at every operator station.

- This automatic switchover does not take place only when a WinCC server fails; it also takes place in the event of a **faulty application** or **interrupted process communication**.
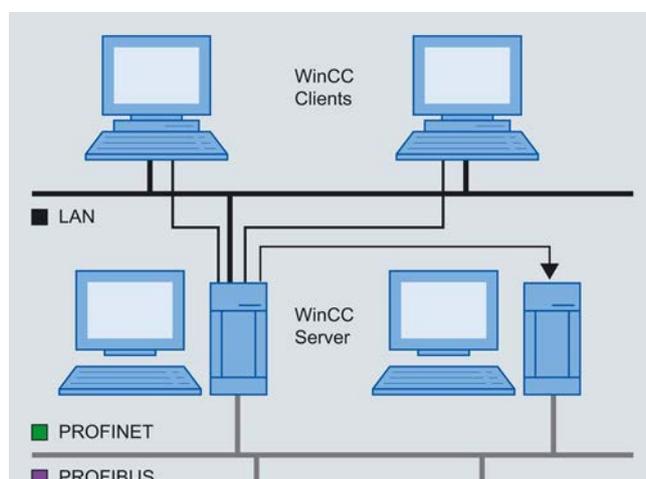
## Sever recovery



Figure 3-9      Recovery of the failed WinCC server

- When a failed WinCC server is recovered, all of the archived process values, messages (including message status, acknowledgments, message lists and comments), data from the user archive of the failure period, and internal tags are automatically synchronized with the peer – without affecting the system that is operating.

- As a result, two fully operational WinCC servers are available again.

- The connected WinCC clients redistribute themselves to their preferred WinCC server.

## Special features

- In addition to WinCC/Redundancy with parallel operation of two WinCC servers, you can also create a **redundant configuration** of the **communication channels** for controlling SIMATIC S7 in a WinCC application. To do so, you insert two communication modules and configure duplicate communication pathways using the **S7 REDCONNECT** communication software.

- By using the failsafe H series SIMATIC S7 controllers, you considerably increase **availability at the control level**.

## 3.2.2          WinCC/ProAgent

### Definition

The S7-PDIAG and S7-GRAPH options integrate diagnostics blocks into the controller. These diagnostics blocks monitor process states in much the same way as a software debugger. With the WinCC/ProAgent option, you integrate these diagnostics blocks and their messages into WinCC for display on the operator station (OS).

### Requirement

- STEP 7 is installed.

- AS-OS engineering

- WinCC/ProAgent option

- The controller is already configured (in multiple languages, if necessary) with STEP 7 LAD/FBD/STL and the S7-PDIAG or S7-GRAPH option.

- If the controller is configured in LAD/FBD/STL, additional diagnostics blocks for troubleshooting are created with S7-PDIAG, and troubleshooting is activated.

- All diagnostics blocks are compiled.

### Application

This **powerful process diagnostics** functionality help you quickly identify and eliminate potential faults. You benefit in terms of increased system availability, shorter downtimes, and reduction of costs.

The flexibility of process diagnostics allows you to detect errors **at an early stage** in the process sequence. For example, wear on a tool is indicated by an increase in forces. Process diagnostics can be used to monitor these forces and initiate acquisition and replacement of the tool in due time.

You can **initiate directed movements** on the OS in order to eliminate the fault. The OS indicates whether any plant components are damaged so that you can initiate corresponding repairs at the same time.
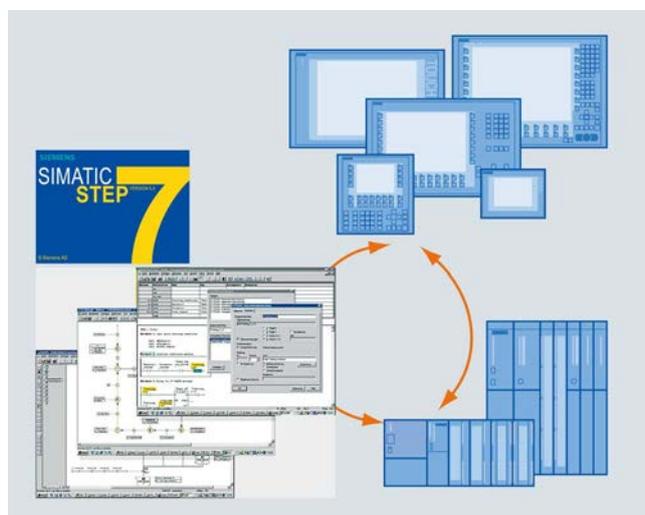
## Integrated interaction



Figure 3-10    Diagnostics with WinCC/ProAgent and the STEP 7 engineering tools

ProAgent is a universal system concept designed for optimum interaction between STEP 7, STEP 7 options, and WinCC.

When compiling the PLC program, the STEP 7 options store all the data required for process diagnostics in a shared database. WinCC/ProAgent then accesses this database when the OS is configured. Diagnostics data is provided in different views; the operator selects a view by pressing a button.

- The **user view** is an example of a view configuration that contains the global key set for calling ProAgent screens.

- In the **message screen**, all messages with diagnostics capability are identified. Based on this identification, the operator sees how to retrace the cause of the fault in the process control sequence. Moreover, a number of additional functions are available for **selection** and editing, including **acknowledgment** of individual fault messages.

- In the **unit overview**, **units** and their subunits are displayed. Here, the operator can identify at a glance the current **operating mode** and status of each unit.

- The **motion view** provides quick assistance with rectifying faults. This view shows you at a glance which movements are blocked and which can still be executed. Keys are provided to **initiate specific movements** of individual units.

- In the **sequencer view**, you can see the steps in a step sequence. You can search for and initiate specific steps.

- The **detailed view** shows the result of the **automatic error analysis** of the OS. A simple signal list, a more detailed statement list (STL) or a ladder diagram (LAD) is shown in the display with the corresponding section of the STEP 7 program code. At the same time, the status bits of the operands and all the logic operation results can be displayed. Signals that have caused a fault are highlighted.
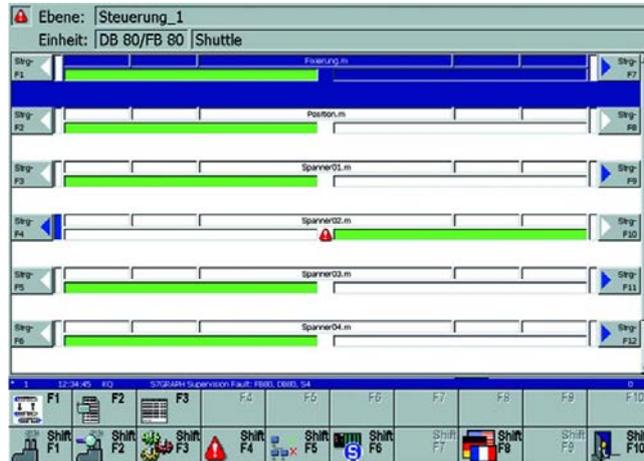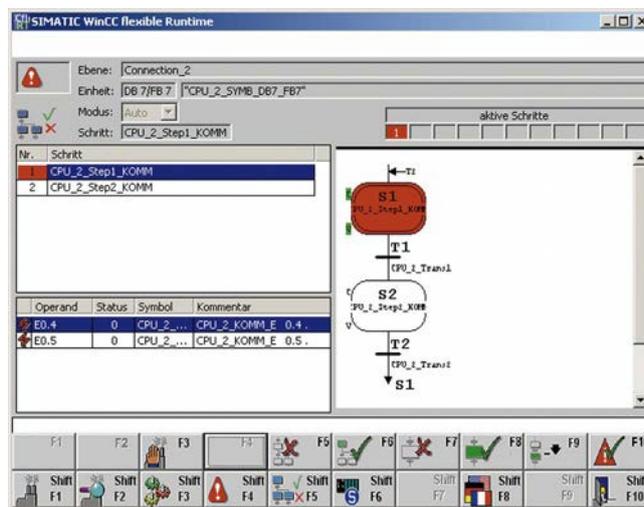


Figure 3-11    Motion view



Figure 3-12    Sequencer view

## Structure

To perform diagnostics, proceed as follows:

1. In the **ProAgent Configurator**, click with the mouse to select the target hardware and the controllers, units, and network connections on which you want to perform diagnostics with this OS.

2. Specify the **start screen** and **diagnostics screen** for an ALARM_S error message: Unit overview, detailed view, or motion view.

3. Select the display classes, and **scope of logs and messages** (for example, process control messages) to be displayed on the configured OS. Specify the **access rights** that an operator needs to open the LAD/FBD/STL Editor of the selected unit directly in edit mode.

4. Finally, generate **completely ready-to-use diagnostics screens** with all message texts and transfer them to the target device, even **online to the current runtime**.

With the **ProAgent Configurator**, all required data from the shared database is added to WinCC:

- In **tag management**, the communication links, channels, and tags of units with diagnostics capability.

- In **Graphics Designer**, completely ready-to-use diagnostics screens for the different operator stations with the "@Diag" suffix.

- In **Alarm Logging**, all ALARM_S messages relevant for process diagnostics with "*" in the "Diag" message block and message text for criteria analysis, system error messages, and any process control messages. In addition, new message classes are created, enabling precise selection of messages for process diagnostics in the message view.

- In **Global Script**, necessary functions for diagnostics under "Standard Functions > ProAgent".

## ALARM_S

The STEP 7 option packages S7-PDIAG and S7-GRAPH issue ALARM_S messages as a prerequisite for process diagnostics with ProAgent.

In addition to the status of the message ("Incoming", "Outgoing", "Acknowledged"), ALARM_S messages contain message text in accordance with the **message number procedure**, as well as the **time of day** for precise, causal diagnostics of the cause of the fault.

You configure the messages in STEP 7. The message numbers for unique assignment of message text are assigned automatically by STEP 7.

If you insert **format strings** into the message text when configuring messages, these faulty operands are displayed in each message line of a WinCC message window.
In this way, you isolate the source of error immediately, enabling you in many cases to make corrections right away.
For more complex sources of error, open the ProAgent-detailed view for criteria analysis.

## Criteria analysis

Criteria analysis entails retracing a process error to the corresponding locations in the program code.

S7-PDIAG monitors a single operand in the S7 controller and issues a message when it detects a change in status. Example: The desired status of operand Q1.3 is 0. If the status of this operand changes during the process to Q1.3 = 1, the message "Level of operand Q1.3 is 1" is issued.

ProAgent receives the message and examines the network configured in STEP 7. ProAgent creates a **list of all faulty operands**, for example, inputs or bit memory that have contributed to the occurrence of the process error.

## Special features

- During commissioning, if **minor changes** are made in S7-PDIAG you can apply the network data relevant to diagnostics **directly to the CPU**. For the time being, you then do not have to recompile your ProAgent project and can save time.

  You can also see directly how small changes to your S7–PDIAG project affect the WinCC/ProAgent project.

- If you are using S7-PDIAG, you can combine individual **units into groups**. When you select units in ProAgent, these groups are displayed, and you can select all units for diagnostics in one go.

- If you combine multiple STEP 7 projects into a **STEP 7 multiproject**, the diagnostics-capable units of all projects included in the multiproject are displayed in the "ProAgent Unit Selection" dialog.

- For **complex projects**, this generation process can take a while. However, it is not necessary to generate for all involved CPUs/programs in every generation run. In the ProAgent configuration, you can select the CPUs/programs to be included in the generation.

- All diagnostics screens in ProAgent are **multilingual** with text stored in English, German, and French. During runtime, the operator can switch the interface language at any time. In addition to the three ProAgent default languages, you can also add text in **other languages** to your projects.

- You can also customize the **design of the diagnostics screens** using a variety of options available in Graphics Designer.

## 3.2.3    SIMATIC Maintenance Station

### Definition

SIMATIC Maintenance Station provides diagnostics functions for maintenance that enable precise analysis of the plant components, namely the assets; and as such it is an **asset management** system at the plant level. The diagnostics screens, which are generated automatically from the hardware configuration, show maintenance-related information from the entire automation system, for example, from SIMATIC PCs, networks, programmable controllers, HMI devices, etc.:

- ALARM_S messages
- Maintenance requests
- Uniform, integrated status displays

All data, visualization, and operator control from the SCADA system and Maintenance Station are consistent and uniform.

### Application

Maintenance technicians not only prevent production loss, but also **optimize** the plant over the long term. **Preventive maintenance** has the following effects:

- Prevention of expensive production downtimes and rejects
- Creation of planning security in terms of resource expenditure:
  Imminent orders are signaled in due time
- Increased system availability
- More cost-effective than corrective intervention
- Reduced stockkeeping costs

From a machine manufacturer's perspective, maintenance applies to packaging or filling machines, for example. For a plant engineer, maintenance is limited to the servicing of the process plant. However, the plant operator sees maintenance from an **integral** perspective and would like to keep track of the entire process sequence at a glance.

## Totally Integrated Maintenance

Completely in keeping with the concept of Totally Integrated Automation, SIMATIC Maintenance Station is **automatically generated** from the hardware configuration of the automation systems displayed in STEP 7. Based on this configuration, the Maintenance Station detects which devices belong to the plant and generates an image with universal symbols for maintenance in an existing or separate WinCC station.
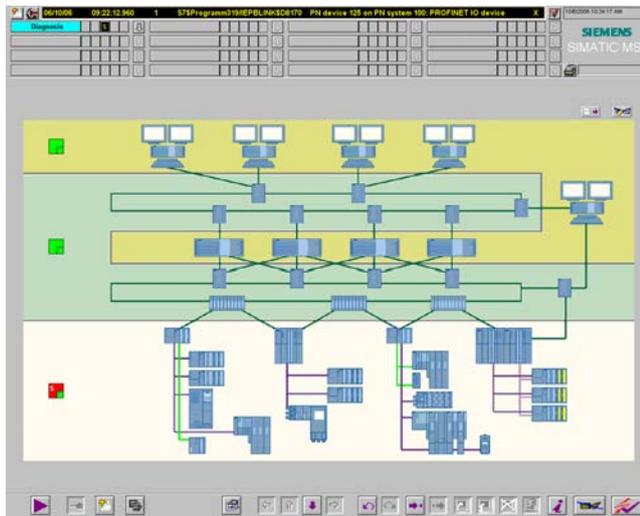


Figure 3-13    SIMATIC Maintenance Station

Operators continue to monitor the production process, while maintenance technicians acquire specific information about the status of the production equipment.
The Maintenance Station is available for the PCS 7 process control system as well as for the WinCC SCADA system with STEP 7.

With SIMATIC Maintenance Station, you can perform **intelligent**, **preventive** maintenance with **minimal resource utilization**, for example, less staff, material, energy, and cost with the following options:

● Overview of information for assessment of plant and component status and comprehensive analysis of weaknesses

● Electronic identification of components, for example, firmware version, manufacturer, and article number.

● Reporting of system errors, overview of long-term archives

● Assistance with decisions concerning maintenance measures such as plant service, inspection, repairs, and elimination of weak points.

● Maintenance request and status management If the premium add-ons **Alarm Control Center** (ACC) or **PM-MAINT** are installed on the WinCC system, maintenance requests from the operator can also be directly forwarded to these systems.
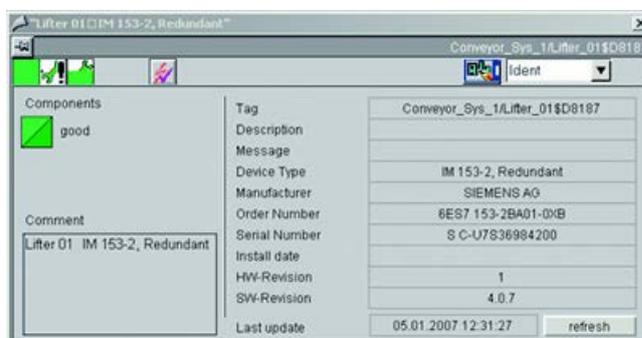


Figure 3-14    Electronic identification of components

## Structure

To set up a diagnostics system, proceed as follows:

1. In **SIMATIC Manager** in the STEP 7 project, set up a "Maintenance Station" PC station with a communication module such as PROFINET.

2. In the **"HW Config" Editor**, add the network components.

3. Using the **Compilation Wizard** in SIMATIC Manager, assign the STEP 7 programs to the Maintenance Station and network connections; a diagnostics screen will then be derived automatically from this.

4. For each automation system, initiate the **automatic generation** of the associated **diagnostics screen** including the picture hierarchy and diagnostics faceplates.
   You can modify the generated diagnostics screens with WinCC at a later point.

5. In SIMATIC Manager, transfer the generated **diagnostics faceplates** to the associated automation system and **click** with the mouse to compile.

## Tools

When SIMATIC Maintenance Station is started up, the following elements are displayed in the diagnostics area:

● An **overview** of the entire automation system of a plant: PC stations, network and automation components, distributed field buses, and external I/O.

● A **message table**, including, for example, a **message list** and a **long-term archive list**

● Faceplates, operating windows, message lists, and diagnostics windows called during operator control

● **Group displays** of queued diagnostics messages with **loop-in alarm**:
   This takes you directly to the diagnostics screen of the component that caused the message to be issued in the respective plant section.
   If more than one diagnostics message is in the queue, the system displays the diagnostics screen that is the highest in the hierarchy and that shows the status of all queued diagnostics messages.

- A **section selection button**: This takes you directly to the top diagnostics screen in the picture hierarchy of the associated plant section.

- **Diagnostics screens** of individual components:
  From the overview of an **AS component** or **PC station** with diagnostics status, for example, "Maintenance alarm", you jump to the **diagnostics faceplate**.
  This faceplate shows the component data, status displays, and queued messages, as well as the requested and initiated maintenance measures.
  The same applies to **lower-level components** such as field bus systems, drives, sensors, and switchgear. Messages in this view can be **acknowledged** and managed.

- In the **Picture Tree Navigator**, you navigate to PC stations, network components, and AS components in a hierarchical tree structure - otherwise, you have the same functional scope as with diagnostics screens.

- If SIMATIC STEP 7 is installed with an associated STEP 7 project:
  You jump from a network component to the **HW Config Editor**, where you check the hardware data.
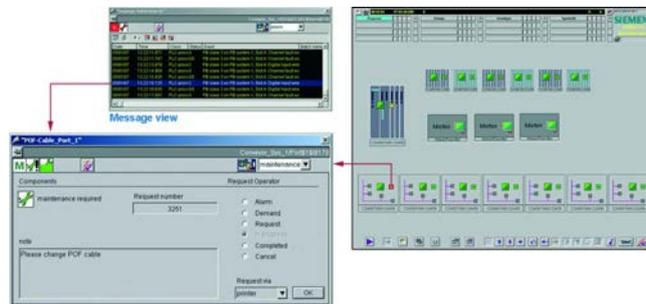


Figure 3-15    SIMATIC Maintenance Station: diagnostics screens of individual components

## Special features

- Maintenance measures are **documented via WinCC operator messages**.
  This supports the work flow and creates a **comprehensive database** for subsequent plant optimization. This database is evaluated with WinCC as a **Maintenance** history.

- Just as in WinCC, the appropriate access rights are required to perform diagnostics with SIMATIC Maintenance Station.

- New hardware components from the latest STEP 7 version are automatically available for SIMATIC Maintenance Station and therefore do not have to be added manually.

# 3.3 Plant Intelligence

## 3.3.1 SIMATIC Information Server

### Definition

The **SIMATIC Information Server** is a **reporting system** that uses Microsoft Reporting Services and accesses the historical data of WinCC, Process Historian and PCS 7.

The historical data consists of process values and messages.
The Process Historian, WinCC OS and PCS 7 OS can be used as data sources.
The collected data is evaluated and visualized by means of reports.

---

**Note**

**One computer can only have either DataMonitor or the Information Server**

You cannot run DataMonitor and Information Server simultaneously on the same computer.

---

### Licensing

- You require a **server license** to operate the Information Server.

- You require a **data source license** to access a data source, such as a WinCC archive, from a WinCC station. You require two licenses for access to redundant WinCC servers.

- You require one **client access** license for each active client PC connection on the Information Server, regardless of the number of applications.
  Applications include the Office add-ins and Microsoft Internet Explorer as soon as the connection to the Information Server has been established.

The Information Server basic package includes the server license,
three client access licenses, and a data source license.
Client access licenses and data source licenses can be expanded.
No data source license is required for access to SIMATIC Process Historian.

### Application

SIMATIC Information Server ensures that you always have comprehensive data tailored to suit your requirements. The transparent access to all archived production values provides you with all necessary task-related system performance indicators (management, quality assurance, maintenance). Weak points become clear and necessary optimization measures can be developed quickly and efficiently to increase system productivity and availability.

You can create report templates based on global system data for specific target groups and without specific programming knowledge.
The reports you create are available on web-based user interfaces and can be sent directly by e-mail. The reports you can generate include:

- Efficiency reports for various production lines

- Standstill reports and summaries of alarms that have been triggered

- Usage data and energy balances

- Material consumption reports

## Create report

The Information Server can visualize the data accessed in tables or graphs.
Various report templates are available for creating reports.
The selected **report templates** are displayed in user-defined page layouts.

The reports and report templates are created using the Web application or Office add-ins. Use the same report templates in both applications.

A configured connection has to exist between the Information Server and the Process Historian in order to create a report. The connection requires authentication for access to the selected Process Historian server, WinCC OS or PCS 7 OS.

The Information Server offers various options for creating, editing and viewing a report:

- **Dashboard**

   You can define the layout of Web parts when creating pages.
   The Web parts can themselves be reports.

- **Preconfigured report templates**

   You can assign parameters to frequently used report templates to suit your requirements and store these along with these settings on the Report Server.

- Microsoft Reporting Services allow you to create **individual report templates**.

- **Export**

   You can output and/or export reports in Word, Excel and/or PDF file format.

- **Preview**

   You can configure a report template and use it to generate a report.
   This report is displayed in a preview window and is not saved.

You can upload individual report templates created in Excel to the Web application as ERT files (Excel Report Templates). Excel templates include custom layouts, texts and contents.

## Access rights and role administration

If you are connected to a Process Historian server or a PCS 7 OS/ WinCC OS, you can access the archived data of projects for which you are authorized.
These access rights are linked to the corresponding projects.

The access rights for data used in the Information Server are linked to the folders in which the data is stored. All users can access the "Public" folder.
Data stored in the "Private" folder is only available to the user logged on at the given time.

Access rights depend on the roles as follows:

- Administrator: Unlimited access to all administrative tasks.

- Published by: Uploading report templates, creating subscriptions and creating reports.

- User: Configuring and editing pages, creating reports and exporting reports.

## Web applications

The homepage of the Web application provides access to the various work and task areas of Information Server.

You create new pages in the **"Dashboard >** Configuration" area.
This working area offers a selection of preconfigured layout files for the Information Server.
These layout files define the number and position of the Web parts.
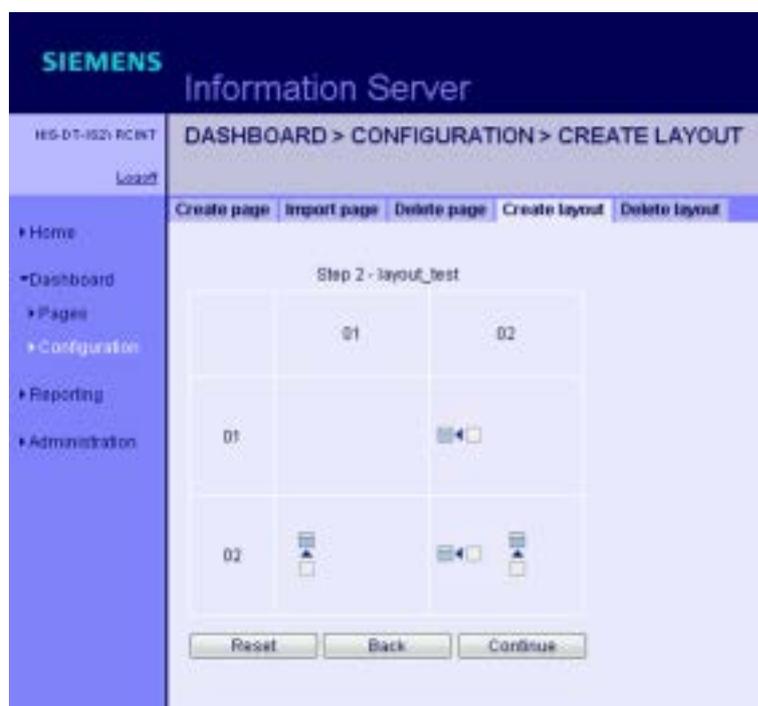
A page consists of **Web parts** containing various different items of information from projects and reports. Web parts can be used to simultaneously view the process values and data from message archives of any time period.
You can export the configuration of Web parts as an XML file.

Web parts are used to combine multiple report templates to form a page.
You determine whether all users or only yourself may access the dashboard you have created by saving it either to the "Public" or to the "Private" folder.

## Office add-ins

The Information Server has add-ins for Excel and Word Microsoft applications.
These add-ins can be used to create and insert reports in Excel and Word.

The Office applications distinguish between two types of reports:

- Report templates

  You can create a report on the Information Server and integrate it as a graphic in an Excel or Word file. Report creation corresponds to the procedure in the Information Server Web application.

- Excel report templates

  You can create report templates for Excel.
  Process values or messages are inserted into the cells of an Excel worksheet.
  You can update the cell contents when you use relative time information.

  You can continue processing the data with the Excel functions.
  You can visualize process value progress with the Excel graphic function, for example.

The following add-ins are available in Excel and Word (2003, 2007 and 2010):
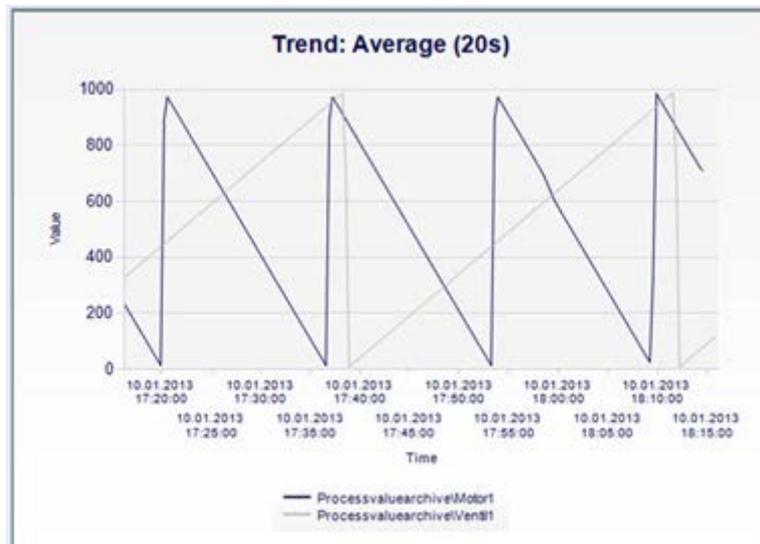
- Creating a new report based on a report template

- Creating and inserting a report based on a configured report template

- Inserting and editing tags

- Inserting and editing messages

- Reading out data for configured tags or messages from the Process Historian database or PCS 7 or WinCC OS

- Opening an Excel report template from a file or from the Information Server

- Storing an Excel report template in a file or on the Information Server

- Connecting Information Server

## Report templates

The Information Server has the following report templates for process values:

| Template | Description |
|---|---|
| Aggregation trend | Diagram: Aggregated tags within a defined time interval |
| Trend | Diagram: Tags within a defined time interval |
| Aggregation matrix | Table: Compiled tags within a defined time interval in columns |
| Matrix | Table: Tags within a defined time interval in columns |
| Aggregation table | Table: Compiled tags within a defined time interval in sequential order |
| Table | Table: Tags within a defined time interval in sequential order |
| Archive configuration | Table: Archive configuration of selected tags |
| Archive configuration chain | Table: Archive configuration of selected tag including all derived archive tags |

Examples:

The Information Server has the following report templates for messages:

| Template | Description |
|---|---|
| Acknowledgment delay | Frequency distribution diagram: Number of messages within a defined time interval requiring acknowledgment, sorted by acknowledgment duration (duration from occurrence of message until acknowledgment) |
| Messages per day | Bar graph: Number of messages requiring acknowledgment per day, classified by message class |
| Messages by origin | Bar graph: Number of messages by origin, sorted in descending order. Only messages requiring acknowledgment are considered |
| Messages by priority | Bar graph: All messages by priority (messages requiring acknowledgment) |
| Messages per 10-minute period | Histogram: Number of messages per 10-minute period as time-related measure. According to EEMUA, more than 10 messages within a 10 minute period indicate the start of a message surge during which messages are displayed faster than they can be processed by the operator |
| Messages by priority | Circle diagram: Number of messages requiring acknowledgment by priority |
| Average acknowledgment delay | Bar graph: Number of messages by average acknowledgment delay of messages within a time window |
| Messages filtered by message class | Table: All messages of a selected message class |
| Messages sorted by priority | Table: All messages sorted by priority |
| Messages sorted by timestamp | Table: All messages sorted by timestamp |
| Commented messages | Table: All commented messages |
| Quantity by message class | Bar graph: Number of messages for all message classes |
| Total acknowledgment delay | Bar graph: Hit list of messages requiring acknowledgment sorted by total acknowledgment delay. All acknowledgment delays are totaled individual acknowledgment delays: Time period from "incoming" to "acknowledged" |
| Total outgoing delay | Bar graph: Hit list of messages requiring acknowledgment sorted by total acknowledgment delay. All acknowledgment delays are totaled individual acknowledgment delays: Time period from "incoming" to "outgoing" |
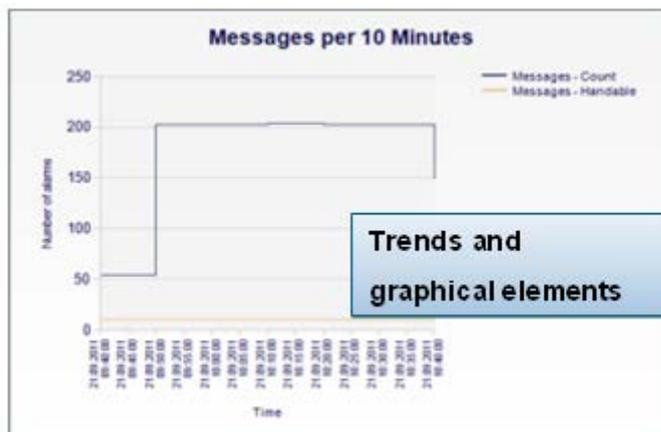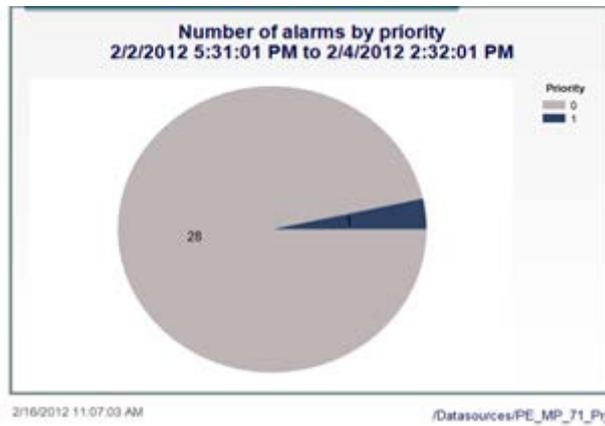
Examples:





## See also

SIMATIC Process Historian (Page 129)

## 3.3.2 WinCC/DataMonitor

### Definition

With the WinCC/DataMonitor option, you can monitor, analyze, and distribute current process states and historical data **via an intranet or the Internet**. WinCC/DataMonitor provides several tools for displaying and analyzing data.

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**Note**

**One computer can only have either DataMonitor or the Information Server**

You cannot run DataMonitor and Information Server simultaneously on the same computer.

---

### Licensing

A central license is required on the WinCC/DataMonitor server according to the maximum number of machines with simultaneous access, for example, 1, 3, 10, 25, or 50 Web clients. No license is necessary on the WinCC/DataMonitor clients.

### Application

The display and evaluation of current process states and archived data allows you to **efficiently monitor** and **analyze** the production line as well as to create reports and send them to the relevant individuals. WinCC/DataMonitor provides **easy access** to production data via an intranet or the Internet, thus enabling you to **quickly ascertain** the production situation.

The DataMonitor client, a **normal office PC** with Internet access, uses **standard tools** such as MS Internet Explorer Version 7, 8 or 9 and MS Excel Version 2003 / 2007 / 2010 to display data.

The data provider, a WinCC/WebNavigator server or a WinCC/DataMonitor server, can be installed on any WinCC single-user system, WinCC server, or WinCC client with its own project. This makes it possible to access process states, diagnostics information, and analyses for different corporate levels from anywhere on earth.

The WinCC/DataMonitor server can also be installed on a file server. This makes it possible to access an existing plant (Web center and Trends & Alarms only).

WinCC/DataMonitor offers the following advantages:

- View production status and process/plant operation anywhere and anytime
- Make production situations transparent in individual views
- Corroborate decisions with reports
- Automated report creation
- No training required for standard products
- Easy exchange of configuration data

## Tools

The Trend & Alarms, Published Reports, and Webcenter tools access WinCC data via a WinCC database:

- WinCC runtime database

- Database of a swapped archive such as the long-term archive server
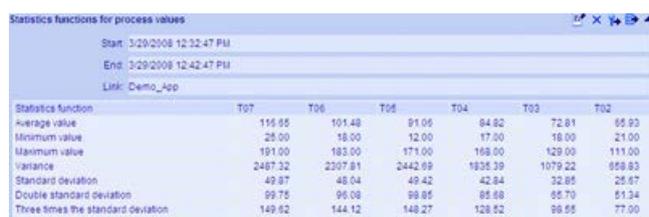
You can **connect** and **disconnect** swapped archive databases **online**.

Excel Workbooks and the Excel Workbook Wizard use the WebNavigator internally to access WinCC data.

For visualization and evaluation, WinCC/DataMonitor provides a range of **Internet-capable tools**, which support all common security mechanisms such as login/password and firewalls:

1. The Web viewer "**WinCCViewerRT**" and MS Internet Explorer are used purely for monitoring and navigating in WinCC process pictures as "View Only Clients". WinCC/DataMonitor uses the same mechanisms as WinCC/WebNavigator, for example, for communication, user administration, and process picture display.
"View Only" is indicated to the operator by a special configurable cursor symbol.

2. **Trend & Alarms** are used to display and analyze archived process values and messages in trends and tables and for evaluation with statistics functions.



Figure 3-16    WinCC/DataMonitor statistics

In the tables, the operator can group the required archive data (process values and messages) **individually online** during runtime. **Multiple configuration** of x and y axes is possible, as well as configuration of **relative** or **absolute time ranges**.
Data selected online can be **exported to a file in .csv format**.

3. **Excel Workbooks** are used to present current and archived process values and messages in an Excel worksheet for evaluation purposes, for display **over an intranet or the Internet**, or as a **print template** for reports. The data can then be prepared graphically in Excel, for example, in a **pie chart**, and evaluated with **complex statistical functions**.

With the **Excel Workbook Wizard**, you transfer process data to an Excel worksheet (requires **no knowledge of WinCC**), for example, "<Speed_Motor1> + 10", from the WinCC project of the DataMonitor server, one of its lower-level WinCC servers, or from an XML file previously generated with the "Export Configuration Data" function. In this way, (print templates for) reports can also be created **offline**, loaded to the DataMonitor server at a later point, and then distributed for **user-specific evaluation**. **Offline editing** offers the following options:

- An external engineering office compiles the reports.
- Management, which has no direct access to the plant, compiles the reports.
- Reports are evaluated by skilled personnel, thus increasing plant efficiency.
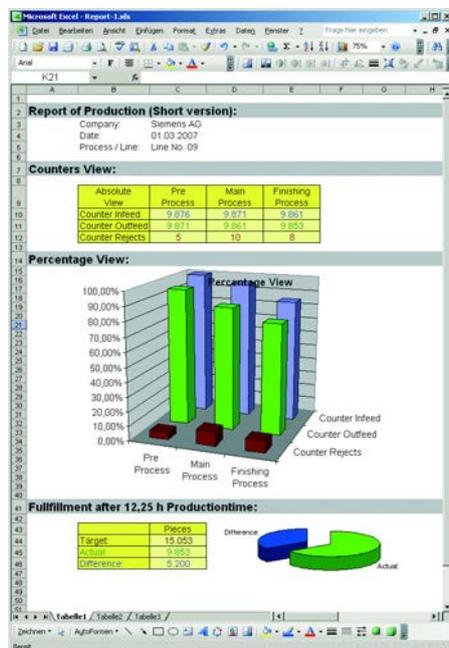


Figure 3-17    WinCC/DataMonitor Excel Workbooks

4. **Published Reports** are used to create **reports** in .pdf or .xls format from WinCC print jobs or published Excel worksheets; this is only possible in DataMonitor.
These reports are initiated by the DataMonitor server **manually** (for example, by a plant operator), **event-driven** (process tag), or **time-driven** (for example, at the end of a shift) and stored in **directories** or distributed via e-mail if a mail server is available (problem analysis, improvement measures). Each of these directories can only be accessed with the appropriate authorization; this includes access over an intranet or the Internet.



Figure 3-18    WinCC/DataMonitor Published Reports

5. The **WebCenter** is the central information portal for access to WinCC data via an intranet or the Internet. Here, users with corresponding access rights can compile **Web objects** with WinCC process data or messages for any number of screen views for various groups of persons.



Figure 3-19    WinCC/DataMonitor WebCenter



Figure 3-20    WinCC/DataMonitor Web objects

Up to 15 of the following **Web objects** can be combined into one screen view:

- WinCC process picture view: WinCC pictures are integrated into the WebCenter with no installation download. A JPG screenshot of the process picture is created on the WinCC/DataMonitor server at regular intervals.

- Process values in a trend or table (timestep): Several process values are displayed over a given period of time (compressed using specified functions) graphically or in table format.

- Process values in a bar chart or pie chart

- Statistics view

- Trend (timestep) provides a clear representation of precompressed values with the aggregate functions: initial value, minimum/maximum over time, sum/average/number over time, variance, and one/two/three standard deviation(s)

- Message view

- Alarm hit list

- Links (Favorites) to internal WebCenter pages and external Internet pages, such as stock market news

- Graphics in JPG format: This can be any type of information, such as a product logo, trade name, etc.

- Messages that are displayed at specific times.

- History of the most recently compiled reports with direct selection.

**Special features**



Figure 3-21    WinCC/DataMonitor user administration

- For Process Screens and Excel Workbooks, a **user** is required in the WinCC project with the system authorization **"Web access - view only"**. For Trends & Alarms, Published Reports, and the WebCenter, a user is required in the Microsoft Windows operating system with access rights to directories.

- A logged on **user** must be a member of a **user group** (assigned to the directory), for example, "Operations manager" or "Shift supervisor", in order to have read or write access to the Web pages and reports stored in the directory. Exception: All users have read- and write-access to their own **"Private"** directories at all times. In addition, all employees have access to the **"Public"** directory. In this directory, users can place information that is of interest to everyone.

- In the **user administration for the WebCenter**, you assign read and write permissions to the user groups in the Windows user administration system.

- The WinCC/DataMonitor clients connect to **different Web servers** and switch from view to view. This is facilitated in Internet Explorer with **tabbed browsing**, which allows multiple tabs to be opened in the browser, each displaying a different window.

- Web pages and reports are stored in **directories** that are arranged clearly on **different tabs**. There are also "Public" and "Private" directories.

- On the **Web client**, you only need to install WinCC/DataMonitor for the Excel Workbook Wizard on the client side and for the ActiveX controls of Process Screens. All other functions of WinCC/DataMonitor are used in Internet Explorer **with no additional installation required**.

## 3.3.3 WinCC/PerformanceMonitor

### Definition

The WinCC/PerformanceMonitor provides support for plant controlling and helps you to substantiate decisions with KPIs.
These KPI calculations for management are based on the current process data.

This means that the PerformanceMonitor offers data analysis for specific target groups and optimal transparency of production. You can use the PerformanceMonitor to identify deviations and optimization potential earlier. You lower costs and reduce downtime.

The analysis of the archived data helps you to identify weak points and understand the correlations.

### Integration into the WinCC architecture

The PerformanceMonitor processes the automation data directly from the WinCC Data Manager and uses it to calculate the operands.

For calculation, you use the WinCC tags and limits which you can link by means of freely definable formulas. The calculated operands are archived and serve as the basis for historical analyses.

You can store details about the respective batches and plant components by means of context information, for example, box size or supplier of the used materials.
You can then group and filter the key performance indicators based on this information.

Three controls with integrated print templates are available for the output in WinCC Runtime:

- WinCC PerformanceViewControl: Graphical analysis of KPIs in a performance chart and extended cause analysis by drill down to the triggering operands

- WinCC PerformanceGanttControl: Trend chart for time-based operands, such as machine states (operation, fault, maintenance, etc.)

- WinCC PerformanceTableControl: Output of operand raw data in table form

You use the controls either integrated in WinCC visualization or on the WinCC Web clients if you are using the WinCC/WebNavigator option.

The PerformanceMonitor controls as well as report templates are available for detailed reporting, for example, cyclic creation of reports, in SIMATIC Information Server.

If necessary, you can make these evaluations available to the persons in charge of the process worldwide via the Internet/intranet.
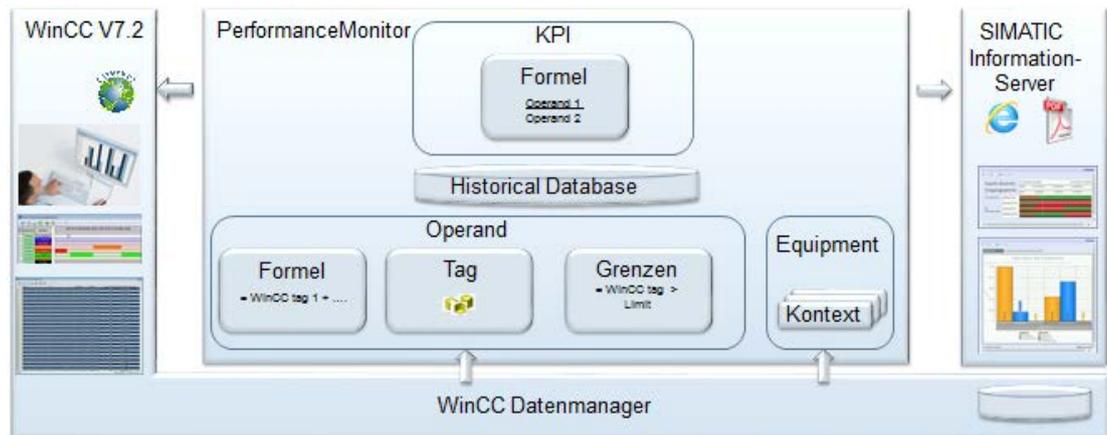


## Requirement

### Operating system - PerformanceMonitor server

- Minimum: Windows Server 2008 Standard SP2 32-bit

- Recommended: Windows Server 2008 Standard SP2 32-bit;
  Windows Server 2008 R2 Standard SP1 64-bit

### Operating system - PerformanceMonitor client

- Minimum: Windows XP Professional SP3 32-bit

- Recommended: Windows 7 Professional SP1 32-bit / 64-bit;
  Windows 7 Enterprise SP1 32-bit / 64-bit; Windows 7 Ultimate SP1 32-bit / 64-bit

### SIMATIC HMI WinCC

- Minimum: WinCC V7.2 Update 4

- Recommended: WinCC V7.2 Update 5 or higher

### SIMATIC Information Server (for reporting)

- Minimum: Information Server 2013 Update 3

- Recommended: Information Server 2013 Update 3 or later

## Licensing

The number of used archive tags is licensed.

A archive tag corresponds to an operand or context information whose values are saved in the Process Historian component of WinCC.

### PerformanceMonitor Basic Package and Archive Packages

A basic package includes 30 PerformanceMonitor archive tags and can be expanded by an additional 30, 100, 300 or 1000 archive tags.

### WinCC Analyze and Reporting Starter Package

The starter package consists of the WinCC/PerformanceMonitor Basic Package and the SIMATIC Information Server Basic Package.

## Application

The PerformanceMonitor offers integrated functionality for all user groups:

- Management and quality assurance
    - Creating correlations (context)
    - Plant-specific individual key performance indicators
    - Web-based reporting (with the SIMATIC Information Server)
    - Grouping by "Shop Floor" context
- Line management and plant operator
    - Calculation of key performance indicators cyclically and triggered by process events
    - Overview and integration in WinCC process pictures
    - Alarming through integration into Alarm Management
    - KPI recording by integration into Tag Logging
    - Manual correction of input values
- Servicing and maintenance
    - Benefiting from WinCC infrastructure
    - Standardization through machine status model
    - Cause analysis with "drill down"
    - Chronological display of the machine status
- WinCC Engineer
    - Fast configuration with WinCC Configuration Studio
    - Efficient configuration through type-instance concept
    - Integration in WinCC (text library, project handling)
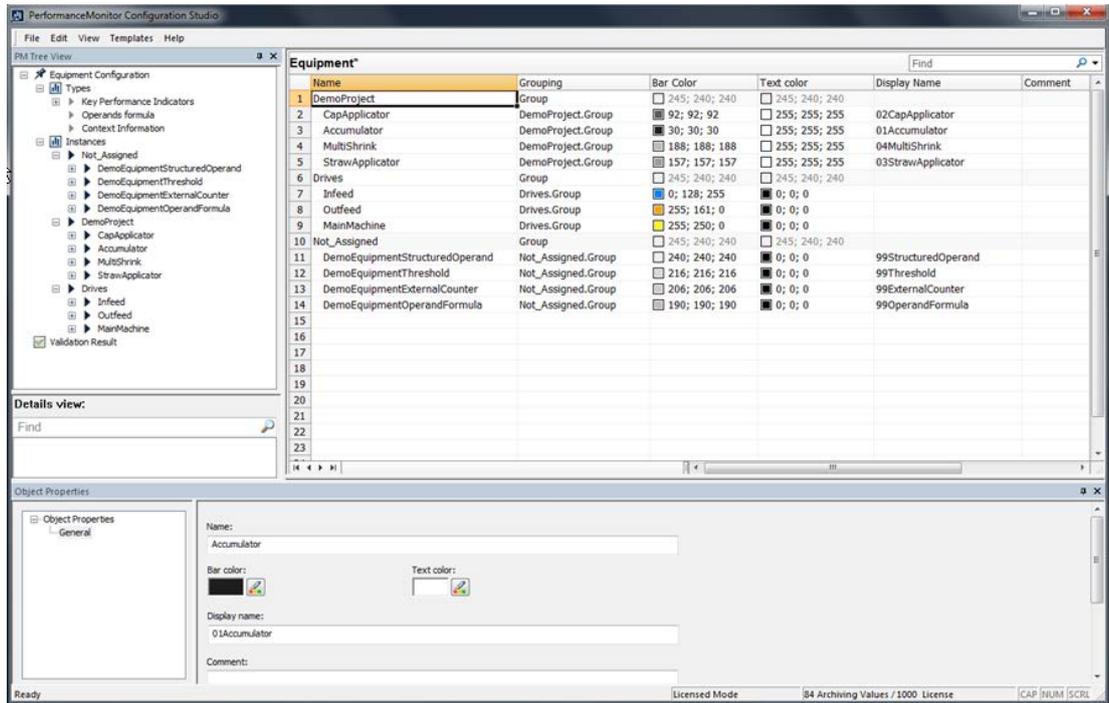
### Structure

To calculate and display KPIs and the associated information, the PerformanceMonitor uses the following objects:

- Equipment:

  Represents a freely-definable plant or unit. You assign to each piece of equipment the desired KPIs that are calculated for the equipment.

- KPI (Key Performance Indicator):

  A key performance indicator is calculated on request for a defined period.

- Operand:

  Saves a value with a time stamp in the Process Historian component.
  The value is obtained from a WinCC tag or a formula.

- Structured operand (for standardization):

  Contains a list of states that are assigned values or value ranges.
  The states are evaluated in calculations and saved in the Process Historian component including time stamp.

- Operand formula:

  Calculates a value from process values. The result is returned to an operand.

- Context information:

  Defines criteria that describe a piece of equipment in more detail, for example, manufacturer, product, batch, operator. Required for detailed evaluation in a report or plant picture.

**Creating KPI and displaying evaluation in Runtime**

To configure and evaluate a Key Performance Indicator, proceed as follows:

1. Start WinCC and open the "PerformanceMonitor" editor in WinCC Explorer.

2. Define the equipment.

3. Define operands, for example, reject parts or total parts.

4. Use the operands to define a KPI in the formula editor, for example,
   reject rate = reject parts / total parts.

5. Assign the KPI to the equipment in an instance with drag-and-drop.

6. Interconnect the operands and assign them to the corresponding WinCC tags.

7. Configure the WinCC PerformanceViewControl in the WinCC Graphics Designer.

The latest value is always displayed in the WinCC PerformanceViewControl in Runtime as a table or chart, depending on the configuration.

**Evaluating context and grouping**

To compare different batches with each other, for example, assign a defining context to each item of equipment:

1. Create context information, for example, different recipes.

2. Assign a context to the equipment.

3. Connect the context with the WinCC tag.

4. Configure the WinCC PerformanceViewControl in the WinCC Graphics Designer.

The KPIs are displayed with the respective context information as a comparison in Runtime.
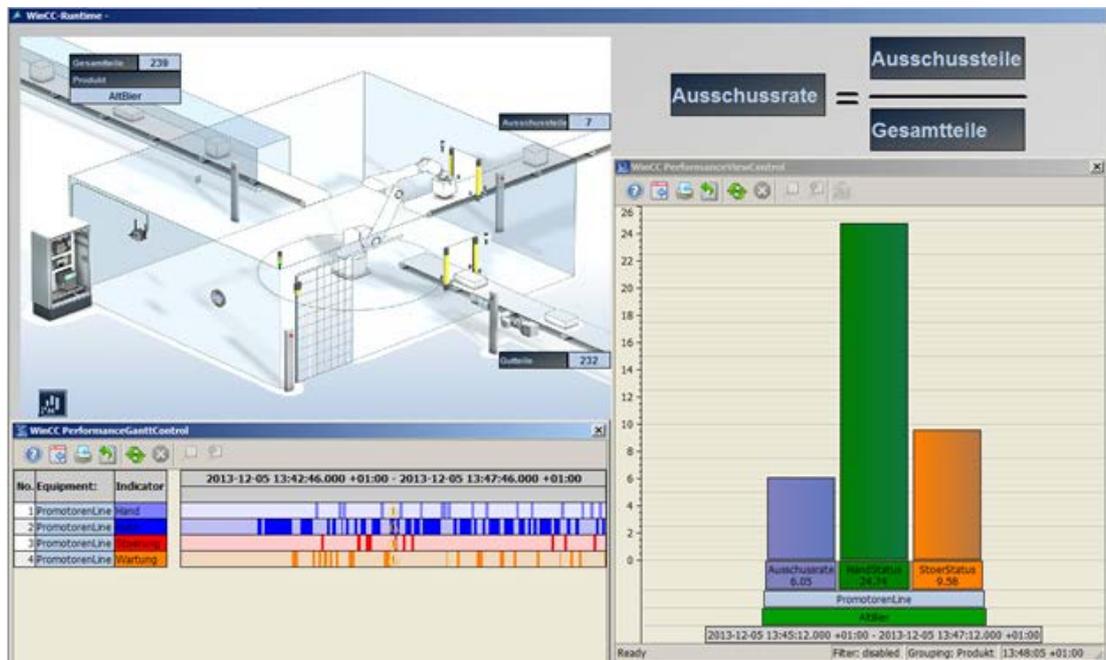


**Displaying machine status by means of structured operand**

To analyze the status of the plant, configure structured operands:

1. Create structured operand, for example, "Status production line".

2. Assign two matching KPIs to the equipment to be evaluated, for example, "Status Manual" and "Status Fault".

3. Connect the operand with the WinCC tag.

4. Configure the PerformanceMonitor controls in the WinCC Graphics Designer.

The WinCC PerformanceViewControl visualizes the selected KPIs in Runtime and the WinCC PerformanceGanttControl visualizes the machine status by means of the structured operand.

With a double-click on the respective KPI or operand, PerformanceViewControl shows the status details as "drill down" representation.

## 3.3.4        WinCC/IndustrialDataBridge

### Definition

WinCC/IndustrialDataBridge connects data that is provided at different standard interfaces. Example: The WinCC tag "OPC_Server_Motor1" from the **WinCC OPC DA server** (**data source**) is **linked** to the "Motors" column of a Microsoft Office **Access database** (**data destination**). OPC XML DA Provider and Consumer enable data exchange over the Internet using HTTP and SOAP.

### Licensing

Licenses with 128, 512, 2000 and 10,000 tags are available for data exchange with databases and OPC servers in line with the data volume.

### Application

WinCC/IndustrialDataBridge exchanges data between automation systems from different vendors, for example, via OPC.
A typical application is the connection of WinCC with SQL databases of **IT systems** to exchange data in both directions. WinCC data are, for example, to be entered automatically into a database table at batch end.

Another application is the storage of process data in **MS Office formats** such as Excel 2007, 2010 and Access 2007, 2010.

For the acquisition of operating data and archiving of large quantities of data, you can also integrate the **Oracle 11g, MySQL 5.5** and **ODBC** databases as well as the **Microsoft SQL servers** 2008 and 2008 R2. The BLOB data type for databases enables easy archiving. When a database is the data source, recipes and default values can be transferred directly to WinCC or to a controller. Text files, .csv files, Microsoft Excel, and IndustrialDataBridge OPC server can only be used as the data destination.

## Structure
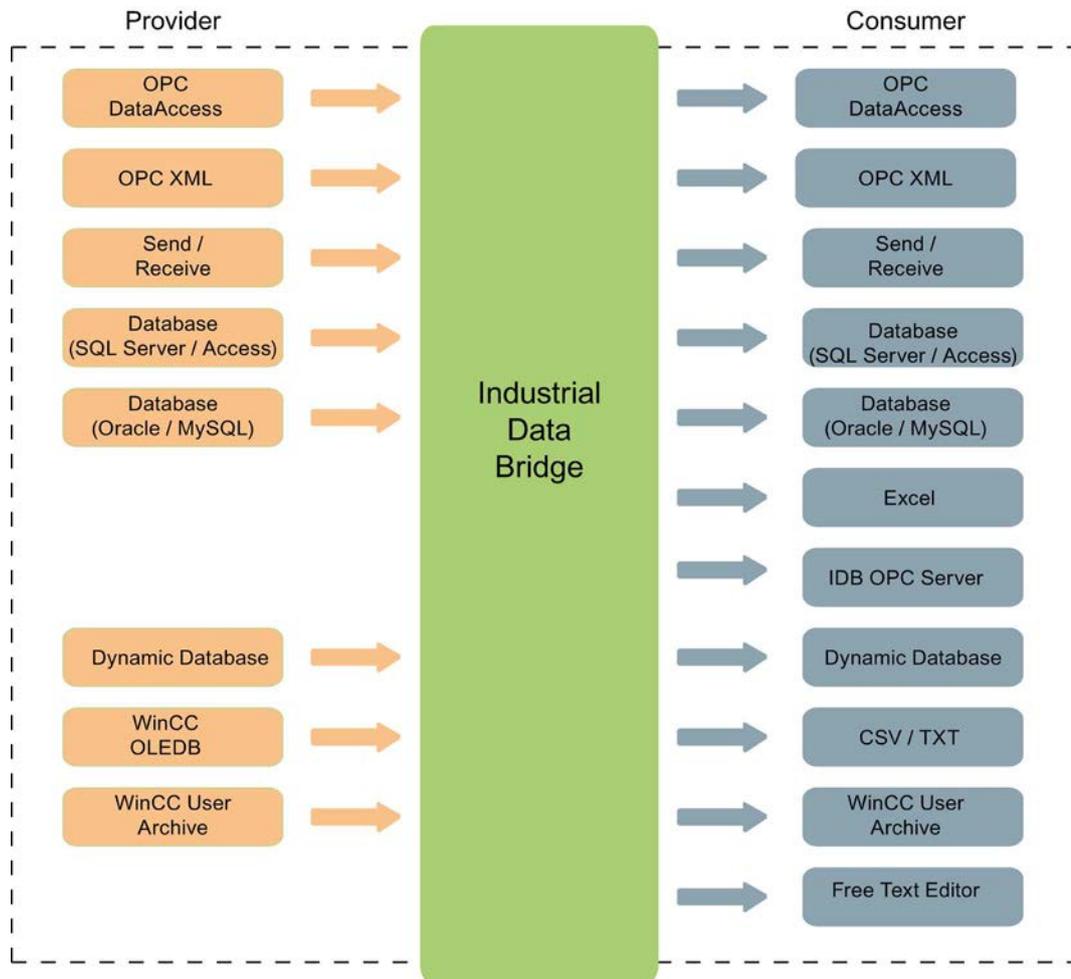


WinCC/IndustrialDataBridge has a uniform, higher-level **modular connection design**:
In addition to data, the data source makes available the "Provider" software module,
and the data destination makes available the "Consumer" software module.
You can select the provider and consumer using standard names and standard paths.
As part of a **data connection**, Provider and Consumer are **linked** and communication
with each other in runtime using different protocols.
Data is transferred cyclically, on an event-driven basis, or when a value changes.

WinCC/IndustrialDataBridge is **fully integrated into WinCC**, but can also run as an
**independent software** application without WinCC. Due to its modular design,
WinCC/IndustrialDataBridge can be **expanded** at any time to include additional interfaces,
for example, with the addition of plug-ins.

You create and edit data connections in the **Configuration Wizard**:

1. **Link** data source and data destination and configure connection parameters.

2. Define the transfer behavior of the **connection group**.

3. **Connect** source data to destination data.

If the source data and destination data are not of the same data type or if they cannot be converted, a warning is displayed on the status bar.

In the **runtime environment:**

1. **Load** the configuration you created.

2. **Establish a connection** between the linked Consumer and Provider runtime components.

3. **Start** the data transmission.

Once the data source and destination have been successfully connected, the runtime environment **monitors** their lifetime and **automatically reestablishes** the connection, if necessary. The runtime environment offers the following tools for commissioning, error analysis, and monitoring:

- The **trace view** shows status messages, error messages, and output parameters for each connection.

- The **trace recording** provides a comprehensive logging function with error messages and function calls of Provider and Consumer.

- In the **status view**, the connections are shown, and their respective connection status is shown in green, yellow, or red.

## Special features

- Access to runtime with WinCC control elements. The WinCC ActiveX control element **"IDB Runtime Control"** is added as OCX in Graphics Designer.
  This makes it easier for WinCC users to start IDB runtime in their environment.

- **IDB Runtime Control** in WinCC pictures in the **WebNavigator** allows a user to browse for configuration files on a server, load configuration data and start or stop data transmission from a client computer. Multiple clients can be connected to the same server.

- Unicode support for multilingual configuration of all elements containing text that is visible in the configuration and Runtime interface. Asian languages are supported.

- Just as WinCC in ServiceMode, the runtime environment can be started as a **Windows utility**. In this case, the configuration is **automatically loaded**.

- The separation into configuration and runtime makes it possible to create a configuration on a development computer and transfer it to a production computer in runtime.
  You can load one configuration on different computers at different production sites or you can create a separate configuration file for **each product**.

- **At a later point**, you can switch the data source and destination and add a connection group or connection. Hence, your basic configuration contains connections that are **flexible and can be changed**.

- Comprehensive documentation:

  – Description of special features required

  – FAQ section

  – Getting Started for data exchange between WinCC User Archive and Microsoft Access

- The functions "Start", "Connect", and "Disconnect" can be password-protected.



Figure 3-22    WinCC/IndustrialDataBridge: configuration interface and runtime

## 3.3.5    WinCC/ConnectivityPack

### Definition

With WinCC/ConnectivityPack, you have **direct access** to archive data of WinCC systems via **OLE DB**. In addition, the "ConnectivityPack" license activates the **WinCC OPC Server**, which is available in every WinCC Runtime. The OPC server enables **external OPC clients** to access WinCC online data and archive data (see OPC server). The **WinCC OPC DA server** is already included in the basic system.

The open **OLE DB** standard is the interface for accessing different databases.
The data in each specific database is accessed via the respective database provider.

In addition to the standardized OLE DB interface, WinCC offers a special **WinCC OLE DB Provider**, which gives local or remote **clients** direct, transparent access to the following WinCC archive databases:

- Message archives, process value archives, and user archives

- Archive databases of the long-term archive server (WinCC file server)

Access to databases in the following programming languages can be integrated via the **WinCC OLE DB interface**:

- C#

- VB.NET

C# and VB.NET access the databases via the ADO.NET programming interface (.NET Framework). This requires the Visual Studio 2005 or .NET Framework 2.0 programming environment. Examples of database access via C# and VB.NET are included in the scope of delivery of WinCC/ConnectivityPack.

**OPC** (Openness, Productivity and Collaboration, previously OLE for Process Control) provides **standardized**, **vendor-independent interfaces** for data access:

- OPC is based on Windows COM (Component Object Model) technology, among other things. COM objects are distributed transparently in the local network. Clients access them via DCOM (Distributed Component Object Model).

- OPC XML is based on data exchange via XML with the platform-independent, XML-based SOAP (Simple Object Access Protocol). SOAP enables applications to communicate with each other via the Internet or in heterogeneous computer networks by means of HTTP (HyperText Transfer Protocol).

- OPC UA (Unified Architecture) is the successor technology to OPC. OPC UA is platform-independent and supports different protocols as the communication medium.

### Requirement and licensing

- "ConnectivityPack" license for access with a WinCC installation at the location of the online and archive data

- "ConnectivityStation" license for access without a WinCC installation

- Client Access License for every client without a WinCC license

- Internet Information Service IIS for the WinCC OPC XML server

**Application**

With WinCC OLE DB Provider, you can access the **WinCC-specific archive structure** in the Microsoft SQL Server database from outside. This enables you to connect WinCC to any number of applications from third-party providers.

With WinCC OLE DB, you can display, browse, or evaluate archive data:

● Calculate statistical values using archive data

● Find process errors

● Optimize processes

OPC defines a standardized procedure used by Windows-based applications to exchange data, for example, data exchange between WinCC and the production level or corporate management level. An OPC HDA client is used for the following purposes, for example:

● Analysis and evaluation of archived data

● Statistical process control of archives from different OPC HDA servers

An OPC A&E client, for example, can be used for analysis and joint evaluation of messages from different WinCC OPC A&E servers.
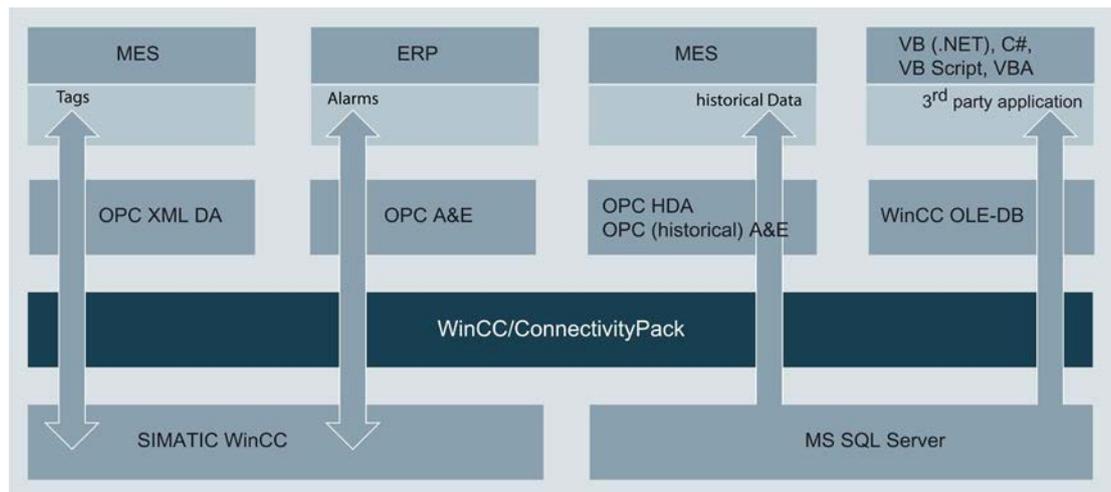


Figure 3-23    Access to WinCC via OPC and WinCC OLE DB

## OPC servers

WinCC includes the **WinCC OPC servers** described below.
Any software that is based on the relevant OPC specification can be used as an **OPC client**.
WinCC can also access itself as an OPC client (see OPC Special features).
Access to redundant WinCC systems is also possible.

- As part of the WinCC basic system, the **WinCC OPC DA server** makes process data from the WinCC project, such as tags, available to other applications (**OPC clients**), for example, WinCC/IndustrialDataBridge. Conversely, the WinCC OPC DA client can access process values of programmable controllers from any other vendor, as long as they have an OPC server. These applications can exist either locally on the same computer or in the connected network environment on computers that can be accessed via their IP address.

- The **WinCC OPC XML server** (XML: eXtensible Markup Language) makes the OPC process values available to an OPC XML client in the form of a Web page via HTTP. OPC XML clients are no longer limited to a Windows environment (DCOM); they can now access WinCC Runtime data through an intranet or the Internet via any operating system (such as LINUX), regardless of the platform.

- The **WinCC OPC HDA (Historical Data Access) server** makes archived data from the process value archive available to other applications. An OPC HDA client, such as a reporting tool, requests specific archive data with a start time, end time, and time interval; as a result, the requested data is read from the stored archive. If necessary, the data can first be compressed before it is transferred to higher-level systems for information processing.
  Archive data can be read, edited, inserted, replaced, and deleted.

- The **WinCC OPC A&E server** (Alarms & Events) makes messages from the WinCC message system available to the OPC A&E clients.
  A WinCC message (conditional event) is displayed as an alarm with a message class, message type, message status, priority, and many other attributes. The alarm can be filtered and forwarded with its accompanying process values to any subscribers in the production level or corporate management level where it is also acknowledged. In addition, the WinCC OPC A&E server signals events such as a program start (simple event), as well as operator messages that have been issued in the plant, for example, "Controller adjusted" (tracking event). With the WinCC OPC A&E server, you can also access **archived messages** (historical alarms & events).

- The **WinCC OPC UA DA server** (Unified Architecture) is installed as Windows service and started automatically. The server provides process values and values from tag archives. For authorization between WinCC OPC UA DA server and OPC UA DA client certificates are exchanged.

To access tags on the OPC client during a running process, select the following path in the **OPC Item Manager** tree structure: "Network Environment > Computer > (OPC DA Server or OPC XML Server) > Tag", for example, "OPC_Server_Motor1". When establishing a connection, OPC Item Manager makes all necessary connection settings and automatically configures the data type, name, and address parameters of the selected tags. Follow the same procedures to select the archive tag in the **HDA Server Browser** and a message in the **A&E Server Browser**.

## Structure

Turn any PC into a **ConnectivityPack client** by installing the ConnectivityStation software with the Client Access License (CAL) or with the following WinCC software:

- WinCC/ConnectivityPack client

- WinCC Basic System

- WebNavigator Server

- DataMonitor Server

- ConnectivityPack Server

To access databases with **WinCC OLE DB**, you can write your own applications. With WinCC OLE DB, you can only access process value archives **transparently**. The **Export-Import Wizard** of the SQL Servers can be used to decompress WinCC process data for access with standard SQL queries via the MS OLE DB Provider.

## Archive Connector

The Archive Connector reconnects already swapped WinCC archives to the SQL Server. This enables any client computers to directly access archives on the long-term archive server via WinCC OLE DB, in addition to accessing current and archived data on the WinCC server. The Archive Connector monitors directories and connects archives copied to these directories automatically to the SQL Server.

## Analysis functions for archived messages and process values

The analysis query for message archives returns a specific data record, which contains configuration and runtime data for each message as well as the result of the following aggregate functions:

- Sum of message frequency

- Cumulative and average time between "Incoming message" and "Outgoing message"

- Cumulative and average time between "Incoming message" and initial acknowledgment

- Cumulative and average time between "Incoming message" and second acknowledgment

The analysis query for process value archives returns the result of the following aggregate functions:

- Minimum and maximum

- Average

- Sum

- Number of process values

- Standard deviation and variance

You can program any type of further analysis in VBScript.

## WinCC DataConnector for access in process pictures

The **DataConnector Wizard** in the Graphics Designer Editor is used to configure the following elements in a process picture:

- Display of archived messages

- Table view of archived process values
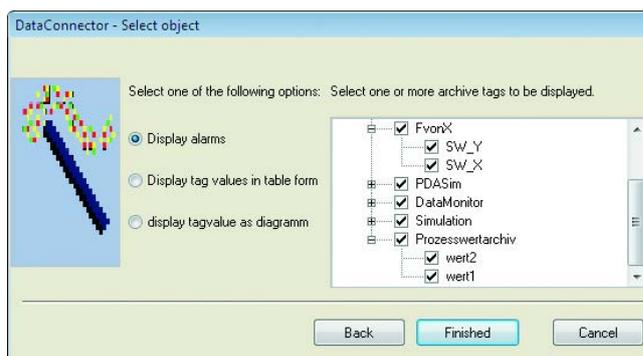
- Graphical view of archived process values



Figure 3-24    DataConnector browser

In the **DataConnector browser**, select "Server > Connected Database > Archive Tag or Message". Once the process picture is open, the **DataConnector control** will execute the archive query and display the data found.

## Special features of OPC

- You can also turn **any WinCC project** into an **OPC client** by accessing data from any OPC server, for example, another WinCC project or application, via the "OPC" channel (see "Unrestricted process communication").

- If you use the OPC server and OPC clients within a WinCC system, DCOM, the user accounts, and the firewall are **configured automatically**.

- If you use an OPC server and OPC client from different computers or applications, you must configure DCOM, the user settings, and the firewall manually.

- With OPC server and OPC clients, you can also easily create **cascaded WinCC operator stations**. In a cascaded configuration, the higher-level station accesses tags of the lower-level stations.

- Either cyclic **connection monitoring** or keep-alive is integrated into the WinCC OPC DA client.

- The **trace tool** logs tag values and function calls for testing and troubleshooting. A trace file shows each step involved in the connection setup procedure, thus making it easier to identify the source of a connection problem.

- The **OPC UA** security concept is structured as follows:

  – By default, the WinCC OPC UA DA server creates a self signed instance certificate during installation.

  – The instance certificate is stored in the certificate memory.

  – For the WinCC OPC UA DA server and an OPC UA DA client to communicate with each other, the certificates must be known to each other. Either the common certificate memory of the operating system is used, or you copy the certificates to the certificate memory of the relevant communication partners.

## 3.3.6 WinCC/ConnectivityStation

### Definition

WinCC/ConnectivityStation enables **remote access** to WinCC system data from any computer via **OPC**, even without a WinCC installation.

WinCC/ConnectivityStation also includes the **WinCC OLE DB Provider** for **direct access** to Runtime data and archive data of WinCC systems (described in "WinCC/ConnectivityPack"). WinCC/ConnectivityStation is configured in the same STEP 7 projects in which the WinCC stations are managed.

**OPC** (Openness, Productivity and Collaboration) enables devices and applications from different vendors to be interconnected uniformly and consistently, thus realizing **open, multivendor communication** in automation (for more information, see Option WinCC/ConnectivityPack).

### Requirement and licensing

- Installation of WinCC/ConnectivityPack client and WinCC/ConnectivityStation

- "ConnectivityStation" license for access without a WinCC installation

- "ConnectivityPack" license for access with a WinCC installation
  No license is required for access via OPC DA.

- The OPC client requires DCOM access rights to the ConnectivityStation.

## Application

Automation solutions combine a range of components, usually from different vendors, from sensors and drives to control and operator input to management of process data. With OPC, you connect devices and applications, for example, from different vendors over a **standardized interface**. Example: You write an HMI client that accesses WinCC process data via OPC and visualizes this data.

The OPC Foundation, which is supported by Siemens AG and other well-known companies from the automation industry. Microsoft guarantees conformity with Windows. For more information, go to http://www.opcfoundation.org.

## Structure

The WinCC OPC servers integrated into the ConnectivityStation **automatically establish** a connection to WinCC and implement **remote access**. The OPC client is implemented on a separate PC or locally on the ConnectivityStation. With OPC, you have **transparent** access to all archive databases on the WinCC stations.

You configure the Connectivity Station in the STEP 7 project using a separate NCM PC or SIMATIC Manager:

1. In SIMATIC Manager, add a SIMATIC PC station.
   It will be assigned the properties of the ConnectivityStation via the configuration.

2. Configure the SIMATIC PC station in the HW Config Editor.

3. Assign the WinCC stations.

4. Transfer the ConnectivityStation to the target system.
   The configuration file is copied to the target system.

# 3.4 SCADA expansions

## 3.4.1 WinCC/User Archives

### Definition

With the WinCC/User Archives option, you can store any type of **associated data** as data records in a **separate user archive**. WinCC and its automation systems (for example, a SIMATIC S7 controller) can write to these data records and exchange them with each other, if required.

### Application

An operator enters **parameter sets in WinCC** (such as the operating parameters of a machine), which are stored in the user archive and can be forwarded to the automation system if necessary, for example, by means of an operator command. Conversely, an automation system can **continually acquire production parameters** during a shift and send these to WinCC at the end of the shift.
Other application examples:

- Acquisition of batch data

- Specification of production parameters

- Management of warehousing data

User archives can accommodate batch data, shift production data, or even product quality data and can satisfy legal verification requirements by means of seamless recording of data.

**Structure**
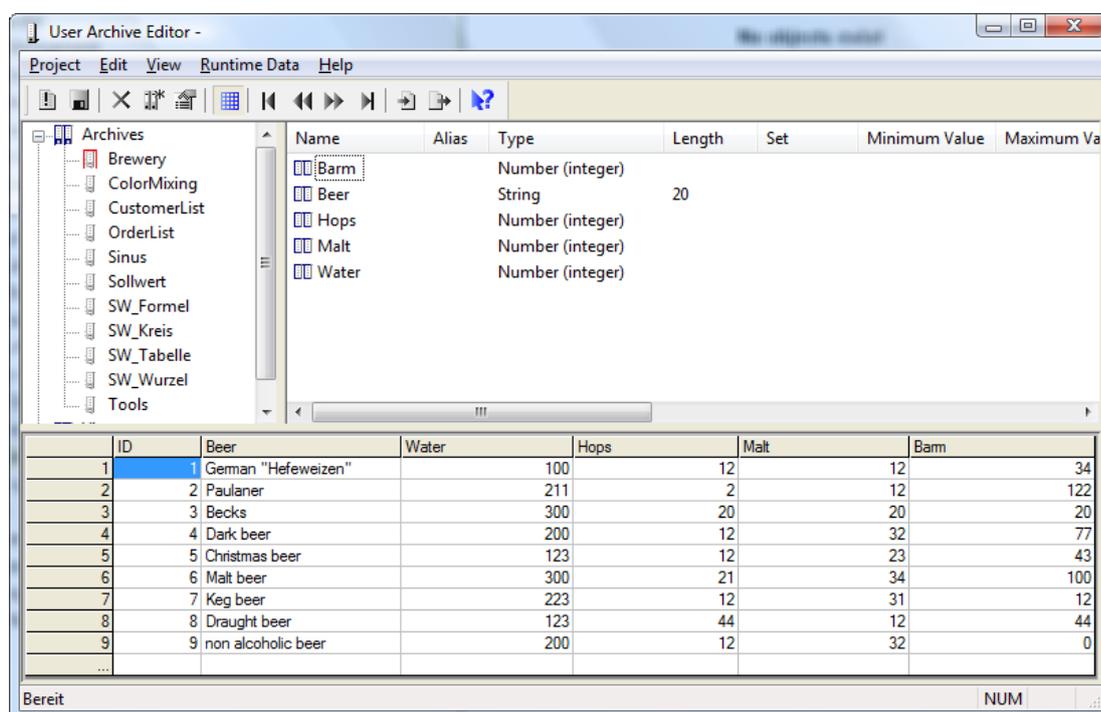


Figure 3-25    User Archive Editor

Using **associated parameters** (quantity, temperature, time, etc.) for "water, hops, malt, yeast", for example, you build a "beer recipe" data record in the user archive.
**Recipes** are examples of user archives that are filled in advance and adjusted in Runtime if necessary, for example, in the special WinCC **UserArchiveControl** (see WinCC UserArchiveControl); their values are then written to the controller **directly online**.
Thus, **at the touch of a button**, you can change the recipe or **modify the adjustable parameters** or **setpoints**, etc.

1. To fill the user archive, connect WinCC UserArchiveControl to the "beer recipe" user archive.

2. Enable the access types "Change", "Insert" and "Delete".

3. To communicate with the controller, connect each archive tag individually to a **process tag** or connect the entire data record to a **raw data tag** (see "Archive system").

In the opposite direction, process tags can be **continually stored** in the user archive as DataRecord1, DataRecord2, etc; this can be event-driven or can occur as a result of operator input.

You can create **new data records** from any archive tags in different user archives and store these in an individual **user view**. Example: The **user view tags** "BeerRecipe.Water" and "DoughRecipe.Water" each make up a data record in the user view "Water consumption". User views can also be displayed and edited in WinCC UserArchiveControl. The modified data is applied to the original archive.

You can **define a relation** between user view tags, for example, BeerRecipe.Water > DoughRecipe.Water. You can do this either **interactively** with the predefined relation operators or directly in **SQL language**. This will filter the user view in Runtime, and only data records that satisfy this relation will be displayed.

With the **User Archive Wizard**, you set up four **control tags**, which you will use to access a user archive. The **control job** enables you to perform such actions as outputting and editing archive tag values in I/O fields.

## Special features

- For user archives, archive tags, user views, or user view tags, you can **switch the language** via the Text Library.

- In the User Archive Editor, you can already create new data records **during configuration** of the user archive.
  You can **modify data records later**, for example, by adding archive tags.

- The User Archive Editor also **checks** whether the process tags linked to the archive tags exist in WinCC.

- **Data** can be **exported** and **imported** as a text file (.csv file) or printed out as a **report**.

- The **WinCC script language** provides **quick access** to user archives and comprises VBScript/C elements and database functions based on the SQL standard.
  Configuration functions configure and assign parameters to user archives.
  Runtime functions open, control, analyze, and close user archives and user views in Runtime and read, write, or overwrite archive tags.

## WinCC UserArchiveControl

WinCC UserArchiveControl, which you insert into a process picture and configure freely via **Configuration dialogs**, shows data from the user archive in runtime.
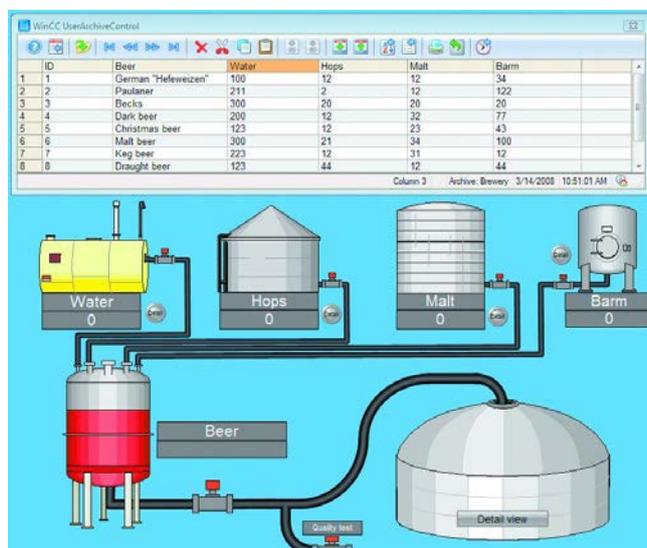


Figure 3-26    "Beer recipe" user data window in the process

The **user data window** features the following basic elements:

- One or more **columns** with values pertaining to the user data record.
  You configure the values to be displayed in the columns.

- A number of **rows**, each of which represents an entire data record.

You assign a user archive or user view to the **user data window**.

## Special features

- **Modifying values**: In Runtime, you can manually modify the displayed values and cut, copy, paste, and delete rows. Whenever you modify values in the user data window, these modified values will be written back to the user archive.

- Data is transferred online via a direct connection to the automation system.
  Data transfer is triggered by a process tag or by operator input.

## 3.4.2 WinCC/Calendar options

### Definition

The WinCC/Calendar options contain the WinCC/Calendar Scheduler and the WinCC/Event Notifier. You can use these options independent of one another.

The **Calendar Scheduler** enables the simple **management of time-controlled activities** which are used to control automated processes monitored by WinCC. **Action schedules** can be configured quickly and easily. They modify the values of WinCC tags to control real I/O components and switch devices on and off.

The **Event Notifier** enables simple **schedule management** for employees who are to receive notifications from automated processes monitored by WinCC. The Event Notifier gives users a simple scheduling tool for notifying the correct person about an alarm according to the time and day of the week.

### Application of the Calendar Scheduler

The WinCC/Calendar Scheduler provides the following options:

- Setting WinCC tag values or starting global scripts at set times to control real input/output components and switch devices on and off.

- Reliable scheduling for operators with the allocation of access authorization.

- Creation of series schedules with defined exceptions for vacations and maintenance.

- Choice of system configuration for the installation of this option: WinCC client/server system, multi-user system, redundant system or WebNavigator.

## Components of the Calendar Scheduler

The Calendar Scheduler consists of server and client components that can be installed together on the same computer.

### Calendar Options Editor

The Calendar Options Editor is accessed in WinCC Explorer.
The Calendar Options Editor is used to set up or edit the configuration of the Calendar Scheduler or Event Notifier for a WinCC project.
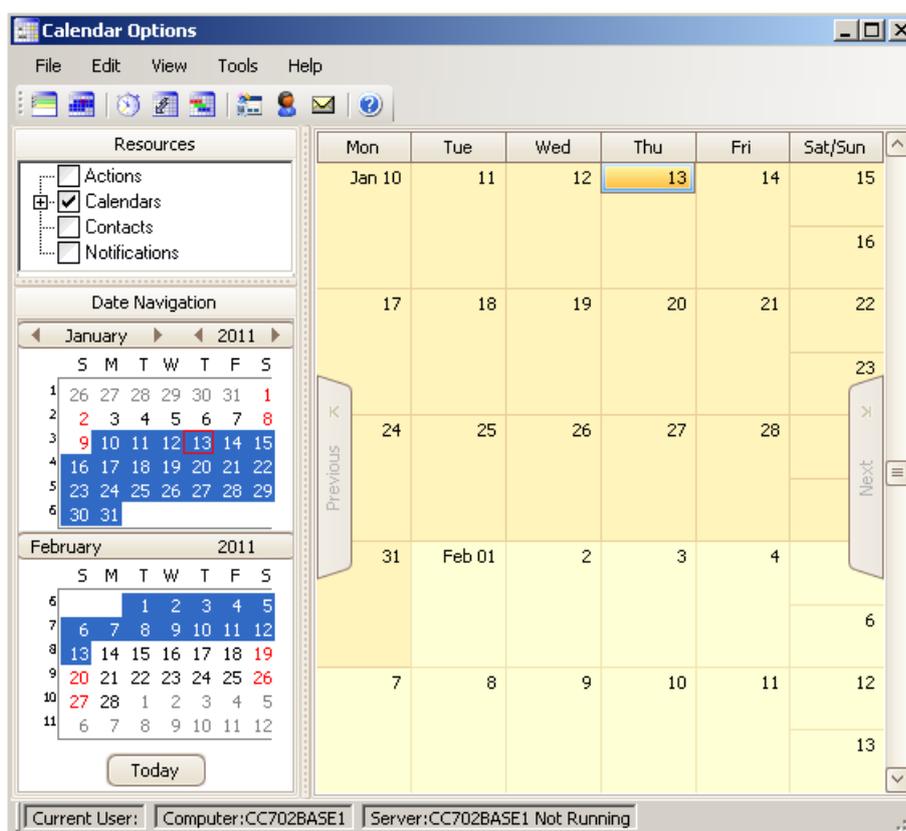


The following editors are opened from the toolbar:

- The Action Schedule Editor is used to create and edit action schedules.
  You can specify the start and end time for the execution of selected actions.

- The Action Editor is used to create and edit tag and script actions that are executed in an action schedule.

- The Calendar List Editor is used to create and edit calendars.

- The Notification Schedule Editor is used to create and edit notification schedules.

- The Contact Editor is used to create and edit contacts and groups of contacts.

- The Notification Editor is used to create and edit notifications.

### Calendar Scheduler server

The Calendar Scheduler server runs on each WinCC server as a background service
in the project in which the configured activities are being executed.
The Calendar Scheduler server is started when the WinCC project is activated in runtime
and is stopped when runtime is deactivated.

### Calendar Control

The .Net control "Calendar Control" can be added to one or more WinCC pictures with the
WinCC Graphics Designer. You configure this control to display and manage that part of the
schedules that relates to the part of the application process displayed on the screen.

## Application and components of the Event Notifier

The WinCC WinCC/Event Notifier provides the following options:

● Easy function for e-mailing messages to the relevant person's cell phone in line
  with his/her working hours.

● Creation of series of working hours with defined exceptions for vacations
  and maintenance.

● Display of scheduling for one person by filtering the views by personnel.

● Filtering views by alarm category to ensure that sufficient personnel is available
  for notifications.

● Reliable scheduling for operators with the allocation of access authorization.

● Choice of system configuration for the installation of this option:
  WinCC client/server system, multi-user system, redundant system or WebNavigator.

### Event Notifier server

The Event Notifier server runs as a background service on each WinCC server in the project
and sends the configured notifications to the specified contacts.
The Event Notifier server is started when the WinCC project is activated in runtime and is
stopped when runtime is deactivated.
The Event Notifier server loads the configuration data upon startup.
This ensures that any changes made by the operator are immediately loaded.

## 3.5 Energy management

### 3.5.1 SIMATIC B.Data

**Definition**

**Simatic B.Data** is an **energy management software** that clearly displays energy levels and costs in tables and graphs.
This indicates **potential for savings** to help you optimize energy management.
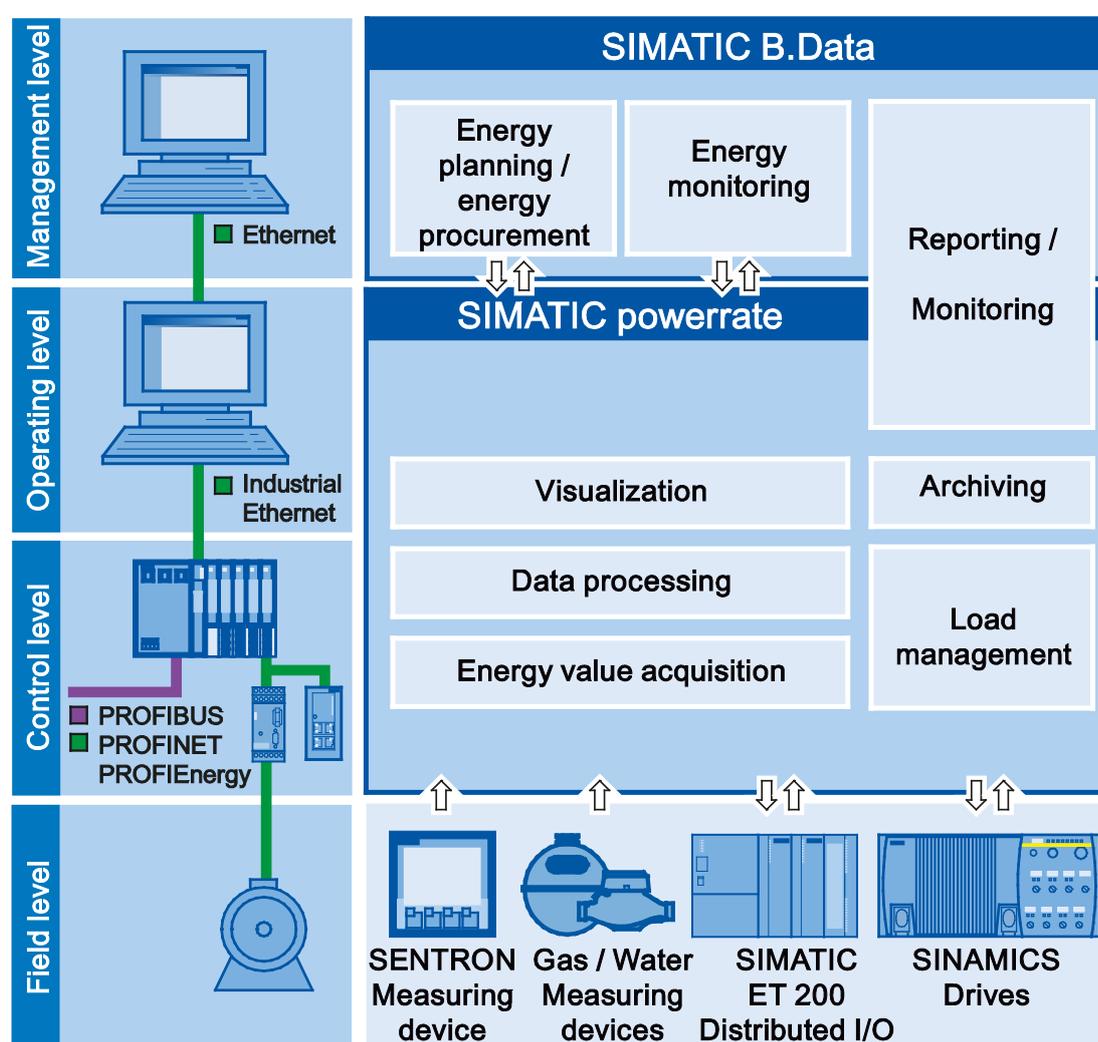
## Application of SIMATIC B.Data

SIMATIC B.Data offers an integrated system solution for the process and manufacturing industry, power plant operators and municipal service suppliers.

- Monitoring: Monitoring of the current energy situation
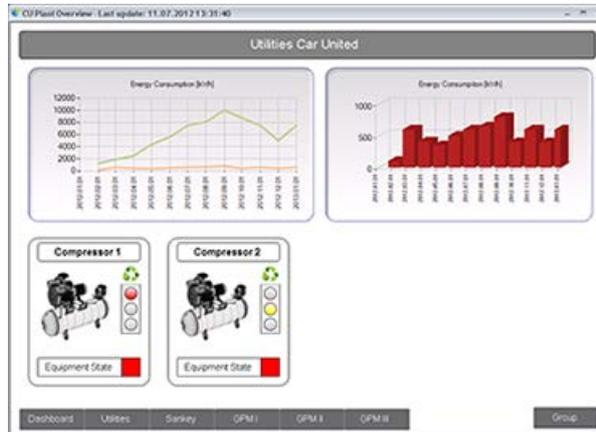


- Accounting: Source-based accounting of energy and material flows and allocation to cost centers

- Management accounting: High flexibility in determining performance indicators through the inclusion of consumption and production data
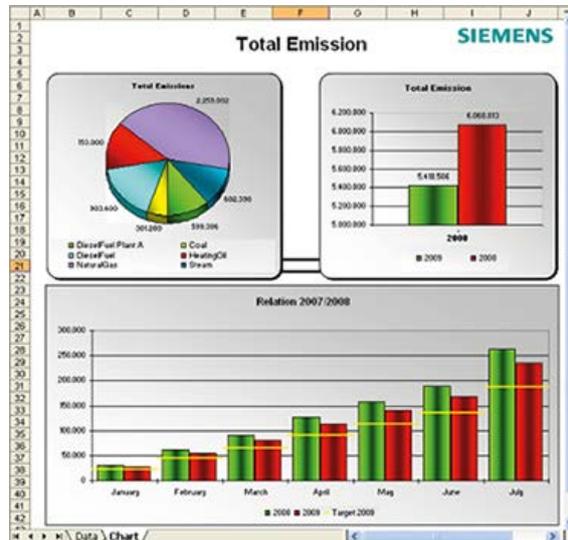


- Projection and planning: Optimum budget planning and procurement optimization through accurate prediction of energy requirements.
  Figures calculated can be used as a management accounting mechanism
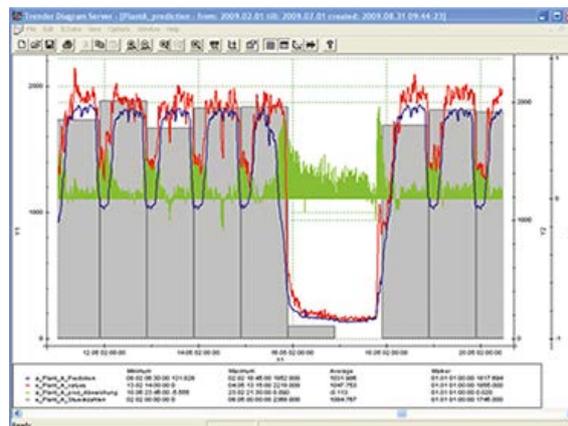


- Automatic reporting: Preparation of reports including automatic e-mail delivery
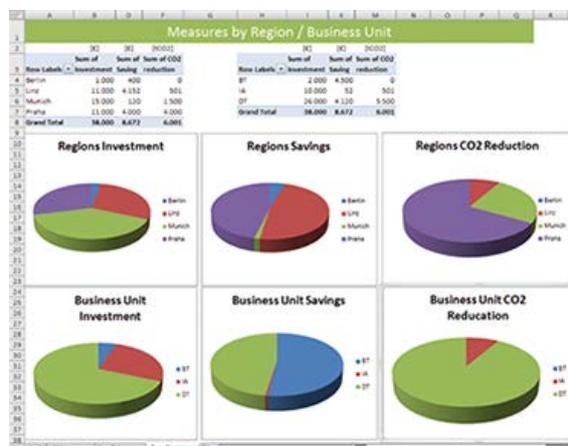
## 3.5.2 SIMATIC powerrate

**Definition**

**SIMATIC powerrate** is used to visualize and manage **energy measurement** and **energy distribution**. Energy data is continuously collected, archived and processed. Knowing the precise consumption profile enables efficiency in energy acquisition.
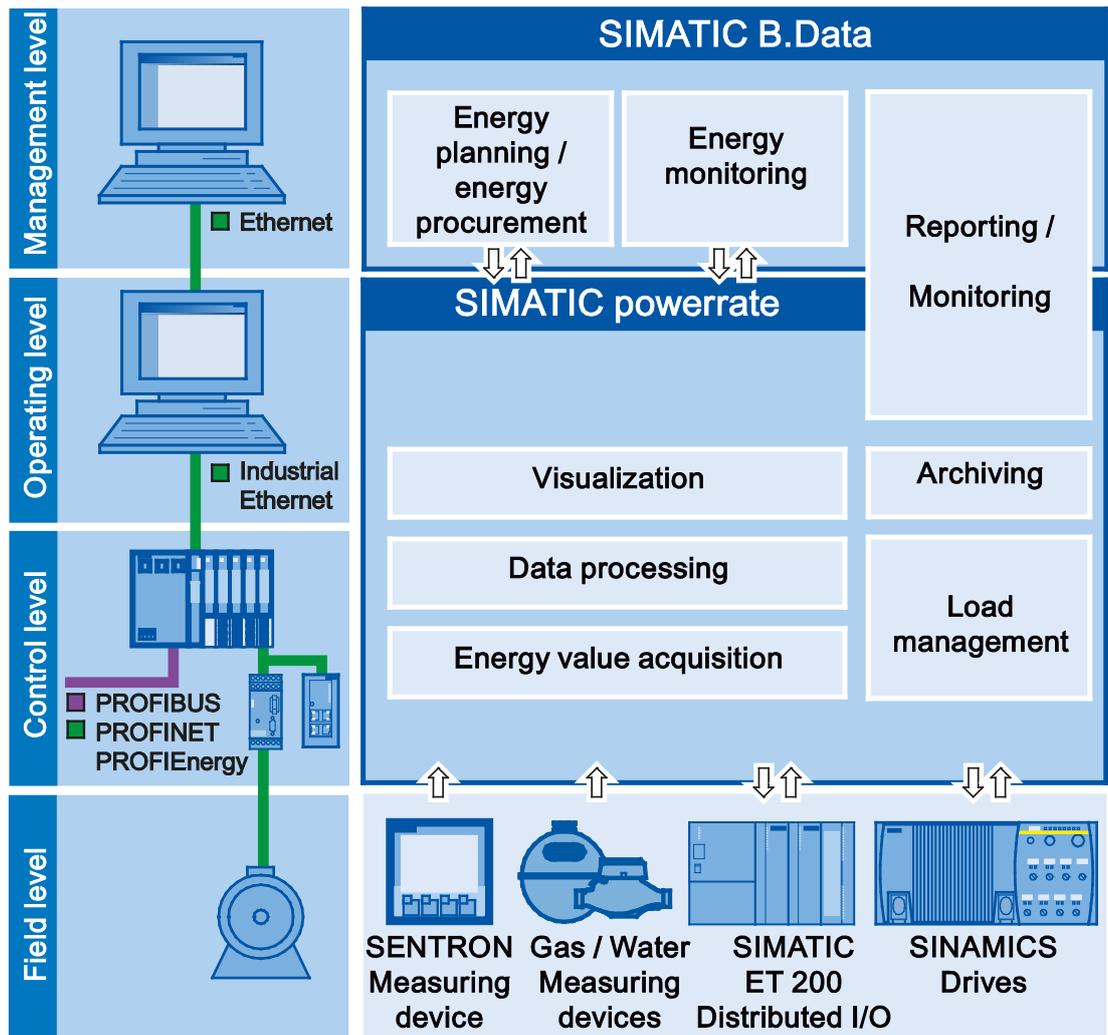
## Application of SIMATIC powerrate

### Energy measurement

- Energy measurement regardless of the hardware used

- Faceplate for displaying energy values

- Assignment of energy values to batches

- Use of standard mechanisms for archiving measured values

- Export of the acquired energy and batch data to MS Excel

### Power distribution

- Basic functions for operating and monitoring switches

### Load management

- Load management for up to 100 consumers

- Faceplate for configuring and operating & monitoring load management

- Communication blocks for data exchange between several PLCs

### Reporting

- Writing archive data from WinCC process value and user archives to MS Excel logs

- Further processing of archive data

- Analysis of costs and consumption for different cost centers

# 3.6 Traceability and validation

## 3.6.1 WinCC/Audit

### Definition

WinCC/Audit is used to **track runtime** and **engineering changes** in an audit database. You log **operator control actions**, such as recipe specifications or setpoint changes, in Runtime and **configuration changes**, including **project versioning**, in the engineering phase. Together with SIMATIC Logon, this satisfies all requirements according to FDA 21 CFR Part 11, particularly in the pharmaceutical industry and the food, beverages, and tobacco industries (see "Always ready for validation"). All **validation** measures included in a WinCC project are documented in a **white paper**.

The project versioning in WinCC/Audit corresponds to the WinCC/ChangeControl option, which is fully included in WinCC/Audit.

### Requirements and licensing

- Microsoft Windows Server operating system at the location of the audit database

- Audit complete package RC: license for runtime and configuration (engineering) on each operator station on which WinCC/Audit is configured.

- Audit runtime package RT: license for runtime on each operator station on which operator control actions are logged.

### Application

WinCC/Audit enables seamless **traceability** of **operator control actions** as well as **configuration changes** and their **version management** in a protected database. Plant operators are able to see which configuration changes were made by the **plant constructor**. You are able to maintain a clear **overview** of your automation project while reducing the engineering overhead.

### Structure

Proceed as follows to set up WinCC/Audit:

1. Install WinCC/Audit.

2. In the **Audit Editor**, select "Network Environment > Computer > **WinCC Database**", just as you would in a tree structure, or select the local WinCC database of the current WinCC project.

3. Decide whether you want to display changes from the current WinCC project or changes from several WinCC projects.

4. Select the **audit functions** you wish to use (audit functions are described below).

The **Audit DB Setup Wizard** sets up the Microsoft SQL Server **audit database**, in which **changes** are recorded centrally.

The following three functions are now available with WinCC/Audit:

## Configuration auditing and document control

See WinCC/ChangeControl option.
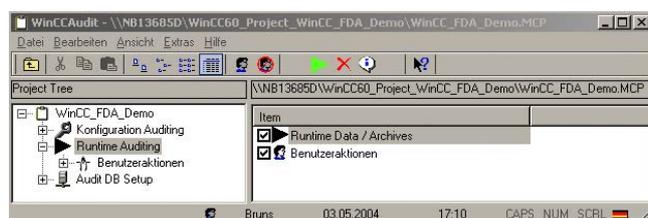
## Runtime Auditing



Figure 3-27    Monitoring runtime mode with Runtime Auditing

During runtime, operators make changes to setpoints and user data in recipes (see WinCC/User Archives option). These changes are logged by Runtime Auditing.

Every change generates an **audit trail** entry, which is stored in the audit database. This audit trail contains the following information:

- Time stamp, time range

- Modified object: number, old value, new value

- User logged on to the WinCC server

## Operator Actions Monitoring

To log changes in **default objects, smart objects, and Windows objects**, you must enable the logging function for the corresponding object type in the **Audit Editor**, separately for each process picture:

- I/O field

- Slider

- Text list

- Check box

- Option button

Each **property change** made to one of the selected picture objects generates an **audit trail** entry that is stored in the audit database and contains the following important information:

- Time stamp

- Modified property: old value, new value

- User logged on to the WinCC server

- Change comments

- Computer name of the WinCC server

**Direct connections** that set properties of the picture objects are logged as soon as the triggering event takes place (see "Intelligent configuration").

You can configure the VBScript/C function "**InsertAuditEntry**" for every event or in every script, thus enabling you to **generate your own audit entries** however you wish. These audit entries are then stored in the audit database when the function is called. In addition, **external programs** that can run in Windows can also generate audit entries via the API interface (see "ANSI C for communication without bounds").

If necessary, you can **display a Change dialog** for I/O fields, sliders, text lists, and InsertAuditEntry, in which operators in runtime are prompted to enter **change comments** and other data that will be logged along with the value change.



Figure 3-28    Accessing the audit trail database with the Audit Viewer

## Comments

- In the **Audit Viewer**, audit trails can be displayed, searched, filtered, printed, and exported as .xls files. **Query Builder** is used to create, save, and edit **user-specific queries** for audit databases.

- You can connect **any audit database** of a deactivated WinCC project to the local Microsoft SQL Server to **display its audit trails** and perform corresponding functions.

- For access to WinCC/Audit, audit administrators set up audit users (who must also be WinCC primary users) in the **audit user administration**. **SIMATIC Logon**, which is valid for the entire plant, replaces the WinCC user administration (see "SIMATIC Logon").

## 3.6.2 WinCC/ChangeControl

### Definition

WinCC/ChangeControl is used to **track engineering changes** in a database. During the engineering phase, WinCC/ChangeControl **automatically** records all **configuration changes** from a specific project version onward. However, to begin tracking changes starting from the **defined project versions**, all files in a WinCC project version can be **versioned**, and any desired version can then be **reactivated**.

The WinCC/Audit option logs all changes, including both **engineering** and **Runtime changes**. Therefore, the WinCC/ChangeControl option is fully included in WinCC/Audit. WinCC/ChangeControl by itself is intended for users who are only interested in **configuration changes**, including **project versioning**, in the engineering phase.

This enables users to keep track of each and every change that has been made.

### Requirements and licensing

- Microsoft Windows Server operating system at the location of the audit database
- Audit complete package RC: license for runtime and configuration (engineering) on each operator station on which WinCC/ChangeControl is configured.
- Audit runtime package RT: license for runtime on each operator station on which configuration changes are logged.

### Application

Once a plant has been commissioning and **validated**, if necessary, the project version is archived via project versioning. Each time the configuration changes as the result of small **adjustments**, large **expansions**, or anything in between, all changes made in the plant are **recorded seamlessly** with WinCC/ChangeControl (in a change log), thus providing **specific, documented evidence**.of changes made, for example, when the plant is expanded. The change log covers the entire plant, from machine-level configurations all the way to higher-level WinCC projects.

The **reproducible versions** of the WinCC project created with project versioning make it possible to **go back** to the last executable version or any other version in the event of **problems with the plant** or expansions.

In the event of **plant shutdowns**, for example, plant constructors (such as **OEMs**) or plant operators can **quickly** and **efficiently** verify the changes that have been made in the plant and can infer the cause of the problem. This facilitates error analysis, saves services costs, and reduces downtime. You can also perform a **risk analysis of the change** based on the change log in the event of plant expansion and subsequent **revalidation**. WinCC/ChangeControl also helps you fulfill **traceability** requirements in compliance with FDA 21 CFR Part 11 and EU 178/2002.

## Configuration auditing

In the course of a configuration, changes are made in various **WinCC editors**.
These changes are logged with configuration auditing. Examples:

- WinCC Explorer with central properties, such as client-server

- Tag management with communication links

- Message system

- Archive system

- Text Library

- User administration with access rights

- Reporting and logging system

- WinCC/User Archives

Every change generates an **audit trail** entry, which is stored in the audit database.
This audit trail contains the following information:

- Time stamp

- Modified object: old value, new value

- User logged on to the WinCC server

- Computer name of the WinCC server

- WinCC project

Some objects are not stored in the WinCC database and therefore cannot be logged
in audit trails. These include process pictures or scripts that you created yourself.
Changes made to these objects are recorded by **document control**.
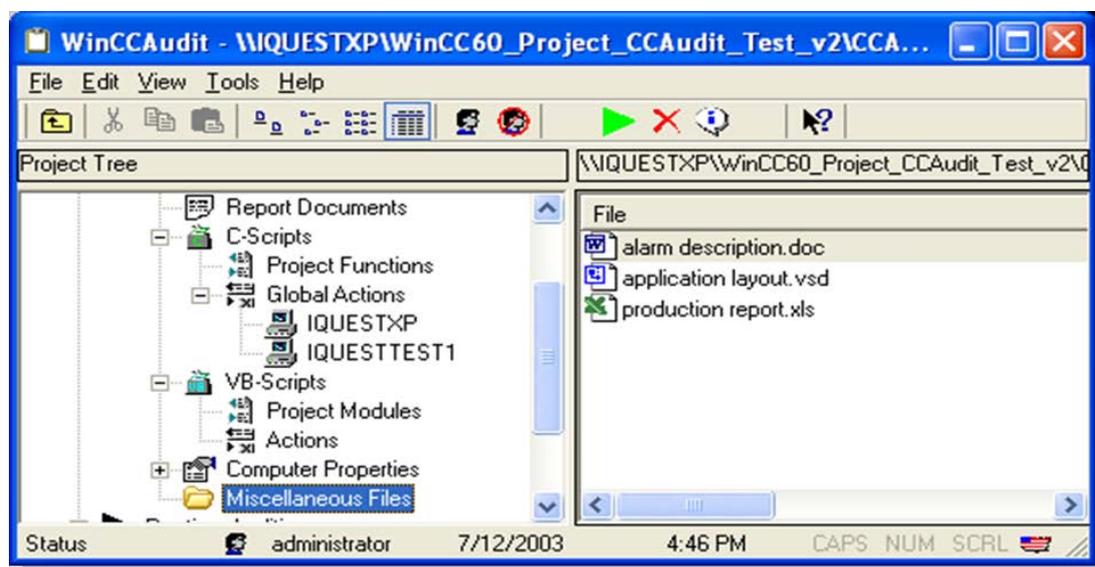
## Document control



Figure 3-29    Archiving and restoring projects or project data

In order to **version** individual local **files** in the WinCC project during configuration, place them in the **document control database**:

● Process pictures

● C functions and C actions

● VBScript functions and VBScript actions

● Line layouts and page layouts

● Any documents in the project folder

When a file is changed, a **local copy** of the file from the document control database is created. Other users are not able to edit the file during this time. After the change is made, the file is returned to the document control database as a **new version**, along with **change information** added by the user: This allows you to track individual changes from version to version, in the **change history**, for example, in which each change is clearly documented. If necessary, previous versions and deleted files can also be restored in WinCC.

## Special features

● In the **Audit Viewer**, audit trails (configuration auditing) can be displayed, searched, filtered, printed, and exported as .xls files. **Query Builder** is used to create, save, and edit **user-specific queries** for audit databases.

● All **documents** are also added in the project folder under "Misc. Documents" **automatically** to the document control.

● You can **compare** the current version of a file with its previous version.

● The document control database can be **archived**.

# 3.7 Openness

## 3.7.1 WinCC/ODK (Open Development Kit)

### Definition

The WinCC/ODK (Open Development Kit) option describes the open programming interfaces of WinCC, which are designed as C Application Programming Interfaces (**C APIs**). Via C API functions, you use the internal functions of WinCC in your own software programs and access tag management data or data in the archives.

As of WinCC Version 7.2, the Open Development Kit includes the previous **WinCC IndustrialX** option. You use IndustrialX to create and standardize picture objects you need repeatedly in **ActiveX technology**. These **IndustrialX controls** access **WinCC data** via internal WinCC functions. These **user-specific** IndustrialX controls are used and **configured** in process pictures in the same way as WinCC controls, such as the table window.

### Requirement and licensing

- The programming environment is installed, for example, Microsoft Visual Studio.
- WinCC is installed.
- Each configuring PC has a license for WinCC/IndustrialX.

### Application and structure of the ODK functions

With API functions, you can expand the functionality of WinCC for **industry-specific** applications or **integrate your own data** into WinCC tools, such as the reporting and logging system. You develop **customized software programs** that access WinCC directly, for example, to **generate** and **configure** WinCC objects (tags, process pictures, messages, archives, text, users, reports, and logs).

- Access tag management and archives.
- Export database tables.
- Control the recording of measured values.
- Use WinCC configuration screen forms for software options developed by you.

**Examples**:

- MSRTCreateMsg(): creates a message
- DMGetValue(): determines a tag value
- PDLRTSetProp(): sets a picture object property

API functions are also used by the **WinCC Competence Centers** and partner companies to develop technology-specific and industry-specific **WinCC Add-ons**.

API functions are used in the following places:

- **Inside** WinCC, for example, in C scripts (see "Openness and integration")

- In C actions in **Graphics Designer**

- **Outside** WinCC in Windows applications created in C/C++ programming language.

To use WinCC/ODK in the **C#** or **VB.Net** programming language, you must program a corresponding **wrapper**. A brief example for each language shows you how to build a wrapper, which you can then use, for example, as a TypeLibrary in C#.

## Application of IndustrialX controls

IndustrialX controls can be **customized** for different applications in specific industries, for example, in the chemical, glass, or paper manufacturing industries.

You use an IndustrialX control to **standardize** complex, frequently used picture objects. For example, you are using 47 servomotors **of a similar type** in a plant. In this case, create an IndustrialX control "Servomotor", for example, with the **data structure** "Setpoint, actual value, temperature, and operating mode" and various pointer instruments. You can **use** the IndustrialX control "Motor" **multiple times** in process pictures. To do so, just specify the name of a **structure tag** or **raw data tag** in WinCC. This will then be **linked automatically** to the data structure in the IndustrialX control during runtime. This way, you can link many **1,000 tags** with the push of a button.

If, in addition, the representations of **motors**, **pumps**, and **valves** in a plant are similar, use a **unified** IndustrialX control instead of different picture objects.

Because IndustrialX controls are based on ActiveX technology, they can also be displayed in Internet Explorer via an **intranet or the Internet**. IndustrialX controls are made up of fast, **compiled VBA code**.
This means you do not need to supply the VBA code itself with the project. This allows you to protect your intellectual property from unauthorized use and manipulation.

**Central changes** to the IndustrialX control are automatically applied to all places of use. Thanks to this feature, you can add **additional functionality** to an IndustrialX control at a later time, for example. This means 1,000 IndustrialX controls used in the project, for example, **change automatically** the next time you open the process pictures.

## IndustrialX server components

Various **COM servers** provide WinCC data to the IndustrialX controls via the **COM interfaces** of WinCC:

- Data Server: Read/write access to all **process values** of WinCC

- User Administration Server: Access to users and their **access rights**

- Operation Message Server: Access to the **message system**

- Text Server: Access to the **Text Library**

- Message Tracer: Issues **messages upon operation** of the IndustrialX control

By default, the connection between IndustrialX controls and WinCC is established and tag values are read at the start of Runtime. Alternatively, to avoid a high **data load**, the activation of data exchange can be delayed until the first picture is opened.

## IndustrialX standard controls

Standard controls are included in the Microsoft Visual Basic scope of delivery:

- Collection Signals: A simple **group display** for messages

- Simple Bar: A graphical representation of a process value as colored **bar**

- Extended Bar: **PID controller** (proportional-integral-derivative) with three bars: Setpoint, current process value, high and low warning and alarm limit

- Extended Slider: **Slider** for setting a process value

- Input Double: **Input** of a process value in "Double" format, with optional high and low limit

- Disk Space: Bar chart showing **drive capacity** with change of color and high and low warning and alarm limit

- Performance: Display of the physical and virtual **memory**; provides an indication of **system utilization**

- Shortcut menu, list option, and sidebar: provide a **range of navigation options**

- Color Picker: Microsoft **Windows color selection dialog**, which specifies the foreground and background colors for forms and controls.

- Tag Simulation: Provides up to 300 structure tags with **simulated values** for a function test of your IndustrialX control

**Example**: In an IndustrialX control you created, you are using the Visual Basic controls "Disk Space" and "Color Picker". When the memory usage reaches the alarm limit of **"Disk Space"**, it triggers the **event** "InAlarm", which you process further in the VBA code. With the **"Color Picker"**, the user changes the alarm color.

Individually created IndustrialX controls affect the runtime behavior of WinCC.
The person who created these IndustrialX controls is responsible for testing them and ensuring that they function correctly.

## How to create an IndustrialX control in VB.NET

1. Create a new **IndustrialX project**. Select a ready-made **IndustrialX control template**:
   - Single View: Single window with frame
   - Multi View: Window with multiple tabs
   - Web View: Single View with additional user verification

   A **VBA project group** is created and includes the following:
   - File with the IndustrialX control **form** and settings
   - File with the **code template**: Contains such functions as "Switch tab" in the Multi View template and "Check access rights of logged on users" in the Web View template.
   - Test project with the **test form** to test your control.

   The **Master Add-In** control helps you create code.
   The **code template** contains more **ready-to-use code**:
   - Predefined properties of the IndustrialX control
   - Auxiliary functions for connecting to the WinCC data sources
   - Auxiliary functions for updating the views and tags
   - Auxiliary functions that store tag structure information
   - Event procedures

2. With the **IndustrialX Control Designer**, create the **user interface** by dragging VBA objects from the tool window and inserting them into a form.
   You can build your own IndustrialX controls from the following **ready-made components**:
   - WinCC controls (for example, trend window)
   - IndustrialX server components
   - IndustrialX standard controls

3. Link WinCC **structure tags** to the properties of the IndustrialX control.

4. If necessary, insert additional **program lines** and **troubleshooting**.

5. Use the **Publish Wizard** to distribute, install, and register the IndustrialX controls.
   This requires very little programming knowledge.

6. Use the **Project Designer** to create setup files.
   This requires no knowledge of setup technology.

7. With the **Package and Deployment Wizard**, create an executable program
   and use it to distribute and install the IndustrialX controls.
   This requires no knowledge of setup technology.

8. Alternatively, use the **WinCC Plug-In Builder** to provide a .cab file for download
   on the **Web clients** (see the WinCC/WebNavigator option); this does not require
   prior knowledge of the setup technology.

## Special features

In addition to a CD-ROM with many examples, the WinCC/ODK scope of supply
also includes a coupon for a one-day intensive seminar.

## 3.8 More information about WinCC

| Information source | Contents |
|---|---|
| SIMATIC WinCC **homepage** http://www.siemens.de/wincc http://www.siemens.de/wincc-options | **News**, new versions, features, system requirements **ordering system**, **add-ons**, technical info, **support**, **training** **Software Update Service**, **WinCC/Comprehensive Support** **WinCC Competence Center**, **qualified partners**, **specialists**, **contacts** product briefs, manuals and technical articles, Plant Intelligence, FDA |
| **Newsletter** http://www.siemens.de/automation/newsletter | Latest developments in SIMATIC products |
| **Ordering system** http://www.siemens.com/automation/mall | Catalog and online ordering system for Siemens Industry Automation |
| **Add-ons** http://www.siemens.de/addons or via the homepage | WinCC add-ons: Add-ons for specific applications and industries are developed and sold by internal and external Siemens suppliers. |
| **Support** http://support.automation.siemens.com | Whether you are looking for product information and support documents or participating in discussions in the Technical Form, you will always receive extensive support. |
| **Training** http://www.sitrain.com | SITRAIN, the training program of Siemens Industry Automation, provides training to technical experts in 130 on-site locations or worldwide via the Internet. Training sessions are tailored to the regional needs of users and configuring engineers, as well as management. |
| **Software Update Service (SUS)** http://www.automation.siemens.com/hmi/html_00/products/software/sus/index.htm or via the homepage | With the SUS, all released editions of your SIMATIC Industrial Software are automatically delivered directly to you; this includes all upgrades and service packs. In addition, when you order SUS, you receive the Customer Support CD-ROM several times a year. This CD-ROM provides a comprehensive knowledge base with tips, tricks, and FAQs that help you use your SIMATIC Industrial Software even more efficiently. <br>• Efficient support reduces configuration times. <br>• Knowledge base answers questions that arise quickly and cost-effectively. <br>• SUS ensures that your software always includes the latest developments. |
| **WinCC Competence Centers** http://www.siemens.de/competencecenter | These authorized, Siemens-internal WinCC Competence Centers provide services for consulting, engineering, system integration, and configuration, as well as customer-specific/project-specific training, all pertaining to SIMATIC WinCC. Our automation and industry competence and WinCC system expertise ensure efficient solutions. Different WinCC Competence Centers focus on different areas of expertise. |
| **Qualified partners** http://www.automation.siemens.com/solutionpartner | The Solution Partner program is a standard-setter in terms of the specific competencies of participating companies and the global network of partners. Siemens Industry Automation Solution Providers are carefully selected and receive training on an ongoing basis, thus ensuring that you always have access to competent contact partners who are versed in the latest technology. |

| Information source | Contents |
|---|---|
| **Specialists** <br> http://www.automation.siemens.com/ providerv2/guiFindSolProvs.aspx | WinCC specialists are external system integrators who have made a name for themselves in SIMATIC WinCC and who, as a result of numerous projects realized with WinCC, have developed specific expertise, which they frequently offer for sale as WinCC add-ons. |
| **SIMATIC Portal** <br> http://www.siemens.com/simatic | SIMATIC is Siemens' future-proof answer to the ever-increasing demands placed on modern machines and plants in the production and process-control industry: <br> an integrated system for solving a diverse range of automation tasks with utmost efficiency, flexibility, and cost-effectiveness. |
| **Contacts** <br> http://www.automation.siemens.com/partner | In many countries and regions, a Siemens contact is available for all questions concerning SIMATIC HMI and WinCC. |

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