Operator system

Safe and convenient process control with the SIMATIC PCS 7 operator system

The operator system of the SIMATIC PCS 7 process control system permits user-friendly and secure execution of the process by the operating personnel. The operator can observe the process sequence by means of various views and intervene to control the system when necessary. The operator system architecture is extremely variable and can be flexibly adapted to different plant architectures and customer requirements.

The basis is formed by perfectly coordinated operator stations for single-user systems (OS single stations) and for multi-user systems with client/server architecture.

Operator stations

All operator stations are based on modern SIMATIC PCS 7 industrial workstations that are optimized for use as an OS single station, OS client or OS server.

Die SIMATIC PCS 7 Industrial Workstations are attractive thanks to high-performance PC technology, combined with the operating system Microsoft XP Professional or Server 2003. They can be operated in rough industrial environments as well as in the office.

Standard components and interfaces from the PC world offer generous scope for system-, customer- or sector-specific options and expansions.

The connection of as many as 4 process monitors via an optional multi-VGA graphics card in the OS single station or in the OS client permits the user-friendly control of several plant areas from one operator station.

The system software of the operator stations is scalable, based on the number of process objects (PO):

- 250, 1,000, 2,000, 3,000 or 5,000 POs per OS single station
- 250, 1,000, 2,000, 3,000, 5,000 or 8,500 POs per OS server of a client/server system

The number of POs can be increased at any time by means of PowerPacks to allow for higher requirements or system expansions.

Single-user system (OS single station)

In a single-user system architecture, all operation and monitoring functions for a complete project (plant/unit) are concentrated in one station. A 10/100/1000 Mbit/s Ethernet RJ45 port is already onboard and can be used to connect to an OS LAN (local area network; terminal bus). The OS single station can be connected to the Industrial Ethernet plant bus in two ways:

- CP 1613 A2 communications processor for communication with a maximum of 64 automation systems of any type
- Simple 10/100/1000 Mbit/s Ethernet network cards and Basic Communication Ethernet for communication with up to 8 standard automation systems

The OS single station can be operated on the plant bus in parallel with other single-user systems or with a multi-user system architecture. Two OS single stations can, however, also be operated redundantly (SIMATIC PCS 7 single station redundancy).

Multi-user system with client/server architecture

A multi-user system consists of operator terminals (OS clients) which receive data (project data, process values, archives, alarms and messages) from one or more OS servers through an OS LAN. The OS LAN can share the transmission medium with the plant bus or it can be designed as a separate bus (Ethernet with TCP/IP).

In this architecture, redundant OS servers may be set up to meet higher availability requirements. Critical applications are monitored by health check for software faults. If a fault is detected, switchover to the redundant system is triggered. Synchronization of the redundant OS servers takes place automatically and at high speed.
OS clients can access the data of not only one OS server/server pair, but of several at the same time (multi-client mode). This makes it possible to divide a plant into technological units and to distribute the data to several OS servers/pairs of servers.

In addition to scalability, the advantage of distributed systems is the ability to decouple plant areas from each other, which results in higher availability.

SIMATIC PCS 7 supports multi-user systems with up to 12 servers or 12 redundant pairs of servers. In multi-client mode, OS clients can access data from one or more of the 12 servers/pairs of servers in parallel (up to 32 OS clients simultaneously on all).

The OS servers are designed in addition with client functions which permit them to access the data (archives, messages, tags, variables) from the other OS servers of the multi-user system. This means that process graphics on one OS server can also be linked with variables on other OS servers (area-independent displays).

Like the OS single stations, the OS servers can be connected to the plant bus using a CP 1613 communications processor or a simple Ethernet network card. An Ethernet RJ45 port is already onboard and can be used for connecting to an OS LAN.

**Performance and technical specifications**

The SIMATIC PCS 7 operator system is optimized for processing large quantities of data. It has an impressively high performance – even with large quantity frameworks – and can be operated simply and intuitively at the same time.

Many individual measures reduce the system load and improve the image selection and updating times, e.g.:  
- Combination of status and analog values with alarm information into expanded status displays  
- Suppression of nuisance alarms and triggering of renewed transmission via acknowledgment  

### Operator system

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. number of OS servers/pairs of servers</td>
<td>12</td>
</tr>
<tr>
<td>Max. number of automation systems per OS server/pair of servers</td>
<td>64</td>
</tr>
<tr>
<td>Max. number of OS clients in multi-client mode</td>
<td>32</td>
</tr>
<tr>
<td>Max. number of monitors per operator station with multi-channel operation</td>
<td>4</td>
</tr>
<tr>
<td>Max. number of OS areas</td>
<td>64</td>
</tr>
<tr>
<td>Max. number of OS clients in multi-client mode (per multi-user system)</td>
<td>32</td>
</tr>
<tr>
<td>Number of trends per trend window</td>
<td>10</td>
</tr>
<tr>
<td>Selection time for OS area display (100 process symbols)</td>
<td>&lt; 2 s</td>
</tr>
<tr>
<td>Max. number of process objects</td>
<td></td>
</tr>
<tr>
<td>- Per OS single station</td>
<td>5 000 POs</td>
</tr>
<tr>
<td>- Per OS server</td>
<td>8 500 POs</td>
</tr>
<tr>
<td>Max. number of configurable messages per server</td>
<td>150 000</td>
</tr>
<tr>
<td>Number of process tags</td>
<td></td>
</tr>
<tr>
<td>- Per OS single station</td>
<td>Approx. 3 000</td>
</tr>
<tr>
<td>- Per OS server</td>
<td>Approx. 5 000</td>
</tr>
<tr>
<td>- Per multi-user system</td>
<td>Approx. 60 000</td>
</tr>
<tr>
<td>Integral high-performance archive system (cyclic buffer), based on Microsoft SQL server, for:</td>
<td></td>
</tr>
<tr>
<td>- Process value archiving (per OS server/single station)</td>
<td>Approx. 1 000/s</td>
</tr>
</tbody>
</table>
| - Message archiving (per OS server/single station) | Steady-state load approx. 10/s  
Message burst approx. 3 000/4 s |
| Long-term archiving |  |
| - Process data archiving with StoragePlus |  |
| - Process data of one server | Process data from up to 4 single stations, servers or pairs of servers  
Approx. 1 000/s  
Approx. 1 600/s |
| - Process data of all servers |  |
| - Process data archiving with Central Archive Server CAS |  |
| - Process data of one server | Process data from up to 11 servers/pairs of servers  
Approx. 1 000/s  
Approx. 10 000/s |
| - Process data of all servers |  |

1) If every OS client has access to all OS servers/pairs of servers

- Data transmission from the automation system only following changes instead of with every cycle
- Blocking/enabling of messages for individual process tags or all tags of an area
- Hiding messages, depending on the operating state of the plant unit
Operator system

OS software

GUI

The predefined GUI of the operator system has all the features typical of a control system. It is multilingual, clearly structured, ergonomic and easy to understand. Operators can survey the process extremely easily, and rapidly navigate between different views of the plant. The system supports them in this process with hierarchical display structures that can be configured as required. These facilitate the direct selection of lower-level areas during process control.

Process displays and process tags can also be simply called up by name. An online language selector permits the user to change the display language during runtime.

A standard view and a server view are available for the technological representation of a plant, each with variously designed area overviews. Features provided in both views include:

- Message line for the last received message (display sequence configurable according to maximum message class or highest priority)
- Date, time and name of the operator
- Area overview with up to 36/49/64 areas
- Working area for plant displays and movable windows for faceplates, trends, messages etc.
- System function keys

In a special message view it is possible to switch between the control system message pages such as new list, old list, cleared alarm list, operator action list, control element list and message history list.

The display tools available permit the operator to assemble individual displays, to save them, and to recall them later.

Trends

Trends can be displayed as a full-size picture or as a window in the working area, and directly printed out. Some trends/trend groups are predefined during plant configuration. Particularly for comparisons, in addition to the absolute presentation standard curve displays with percentage scaling can also be created. The standard settings for units of measure and limit values (e.g. minimum/maximum) specified in the configuration can be transferred automatically for runtime mode. At runtime, operators can compose their own trends, select them by process tag name, and save them for reuse.

Messages and alarms

Up to 150 000 messages/alarms can be configured per OS single station/OS server. Message priorities are issued as an additional attribute to the known signal classes in order to make it easier to assess large quantities of signals and to be better able to distinguish important messages from less important ones.
By means of intelligent alarm management, alarms that are of lower importance for safe and fault-free operation of the plant in certain plant states can be hidden and silenced. These alarms are still logged and archived as before. This saves a noticeable amount of work for the operators.

Insignificant alarms can be hidden in two ways:

- Dynamically, i.e. depending on preconfigured definition for up to 32 operating states (Smart Alarm Hiding)
- Manually, with time limit

Operators can specifically disable messages (alarms) from individual process tags or from all process tags of a display/area in the event of faults in a sensor/actuator or during startup. Disabling and enabling are recorded in an input report.

Active messages are signaled visually by group displays representing preconfigured views of message/alarm lists based on signal groups. The group displays also show whether messages are blocked or not.

The last message to have arrived — or the message with the highest priority when alarm priorities are utilized — is displayed at the top edge of the standard view. A predefined window with further messages can be called up with the “Extended message line” button.

The "Loop-in-alarm" and "Select display using process tag" functions support the quick evaluation and elimination of faults. Via "Loop-in-Alarm", the operator gets directly into the process image with the object that caused the fault. Here the operator can also call the associated block icon (loop display) via the tag for which the block icon is color highlighted. The window of the faceplate (loop display) can be anchored so that it remains visible even when the display is changed.

Flexible options for adjusting audible output and priorities that can be defined using signal variables support the signaling of messages/alarms through a sound card or by controlling external horns via a signal module.

SFC visualization

The SFC visualization function of the operator system enables display and operation of the sequential controls configured with the SFC editor in the same way as on the engineering system. No additional configuration work is necessary.

In an overview display it is possible, for example, to open step and transition displays and to present step comments or dynamically supplied step enabling conditions.
Central user management, access control and electronic signature

With the integrated SIMATIC Logon, the operator system has central user administration with access control that complies with the validation requirements of 21 CFR Part 11. The administrator can divide the users into groups and assign differently defined access rights (roles) to these groups. The operator obtains the specific rights when logging on within the scope of the access control.

Apart from the keyboard, an optional chipcard reader, for example, can be used as the logon device. In addition, SIMATIC Logon offers the "electronic signature" function.

Sign-of-life monitoring

With the "Sign-of-life monitoring function", the operator system is able to monitor the correct operation of all subordinate systems connected to the plant bus. A graphical plant configuration display shows the status of each monitored component. Additional functionality in this respect is offered by the SIMATIC PCS 7 asset management.

Clock synchronization

Together with a SICLOCK time generator, the operator system of the SIMATIC PCS 7 process control system can implement system-wide synchronization on the basis of UTC (Universal Time Coordinated). This feature is especially beneficial for widely distributed plants present in different time zones, e.g. pipelines.

Script languages

Users can also program their own OS applications on the basis of the Visual Basic and C script languages.

Operator system highlights

■ Flexible, modular architecture with scalable hardware and software components for single-user and multi-user systems
■ Powerful operator stations based on standard PC technology, can be used in office and industrial environments
■ Client/server multi-user systems with up to 12 OS servers/pairs of servers, each for 8 500 POs and up to 32 OS clients per server/pair of servers
■ High-performance archiving system with short-term archives and integral archive backup, optionally with long-term archiving via StoragePlus/CAS
■ Health check for important server applications
■ Modification and copying of modifications without interrupting runtime operations, and online testing with selective loading of redundant servers
■ Optimized AS/OS communication: Data transmission only following change in data, independent of AS reply cycle
■ Convenient process control and high operational safety
■ Alarm suppression during startup or on malfunction of a sensor/actuator
■ Dynamic or manual hiding of visual and acoustic alarms that are unimportant, depending on plant status
■ Alarm priorities as additional attribute for filtering important messages
■ Central user management, access control, electronic signature
■ Sign-of-life monitoring for subordinate systems connected to the plant bus
OS archiving

An integral component of the OS software of OS single stations and OS servers is a high-performance archiving system that is configurable at runtime for the short-term archiving based on the Microsoft SQL server technology. It is used for recording process data (typical period of between 1 and 4 weeks) and alarms/events (typical period 2 months) in short-term archives.

Subject to time or event control, data – as well as OS reports and batch data from SIMATIC BATCH – can be swapped out of the short-term archive to a long-term archive.

Two alternatives with different features are available for the OS long-term archiving:

- **StoragePlus**
  - More economical version for the lower performance range; for the archiving of about 1 600 values/s from as many as four single stations, servers or pairs of servers
- **Central Archive Server (CAS)**
  - High-performance version for archiving about 10 000 values/s from as many as 11 servers or pairs of servers

During long-term archiving with StoragePlus, the archived data can be visualized by means of the StoragePlus viewer.

The operator can display the data swapped out to the central archive server directly on the OS clients or with the StoragePlus viewer of the CAS.

For both long-term archiving systems, data selection is supported by integral filter functions. Alarms and process data can be shown in table form, and process data also in graphic form. Tables of process data can be exported in CSV format for processing in other Windows applications, e.g. Microsoft Excel.

The archive tags defined as a general billing unit for short-term and CAS long-term archiving are offered in the form of SIMATIC PCS 7 archive licenses and SIMATIC PCS 7 archive PowerPacks. If no CAS is used, the archive licenses and PowerPacks are installed on the OS single stations and OS servers of the plant. Otherwise they are only installed on the CAS, from whose tag inventory the OS single stations and OS server “debit” their archive tags. The short-term archive is limited to 10 000 archive tags, while the CAS long-term archive is limited to 120 000 archive tags.

OS archiving

The hardware platforms for the StoragePlus computer and the central archive server are the SIMATIC PCS 7 Workstations. Both are nodes on the terminal bus and have no connection to the plant bus.

The central archive server can also have a redundant design. This increases the availability of the long-term data that are accessible from the OS clients or the OpenPCS 7 station. SIMATIC BATCH currently does not yet archive the batch data on both CAS systems. Through automatic archive synchronization, however, the batch data is available after archiving to both CAS systems.

With the aid of additional hardware and software for the corresponding operating system, e.g. with a DVD writer and appropriate software, the data managed in StoragePlus and in the central archive server can be backed up on commercially available storage media (e.g. DVDs).
Operation and monitoring via World Wide Web

The PCS 7 Web server based on the Microsoft Windows Server 2003 operating system permits operation and monitoring of a plant via intranet/Internet. The PCS 7 Web server uses the mechanisms of a multi-client for accessing the subordinate OS servers, and makes the project data globally available via intranet/Internet. For this purpose it uses the Web View Publisher to convert process displays and scripts into a form suitable for display with the Internet Explorer.

When carrying out operation and monitoring via the World Wide Web, the operator can access project data made available by the SIMATIC PCS 7 Web server via the Web client. The Web client requires Internet Explorer and plug-ins which can be installed via the World Wide Web.

Using a Web client, the plant can be operated in the same manner as with an OS client. The user must log on to the Web client in the same way as an OS client and the rules for assigning rights are also identical. The input operations made on the Web client are recorded in the OS operating log.

With regard to licensing, a distinction is made between the following constellations:

- **Standard**
  Up to 50 web clients access the data of a SIMATIC PCS 7 web server over the intranet/Internet. The server license required for this is scalable for 3, 10, 25 or 50 web clients.

- **Diagnostics**
  One or only a few web clients have access to several SIMATIC PCS 7 web servers/single-user systems for remote operation, diagnostics or monitoring. Each system involved requires a PCS 7 Web diagnostics license (server/client).

The integrated OS user management guarantees a high level of security when the PCS 7 Web server accesses the OS servers. Corresponding to the safety requirements of the plant, further extensive protective measures can be implemented according to the SIMATIC PCS 7 safety concept.