

PROCONTROL P

Control and Supervision
with Process Operator Station POS30



ABB

Innovative Human-System-Interface

The POS30 operator station available for PROCONTROL P has proven to be the ideal tool for controlling, supervising, monitoring, analyzing and optimizing the power plant process. It is a consistent and uniform user interface for the whole plant, even if the plant is subdivided into different locations.

Scalable system performance and flexible hardware and network expandability enables POS30 installations to grow up from the smallest single user configuration to the largest enterprise-wide full scope system to keep up with the user's growth requirements.

The functionality of POS30 is characterized by

- Unrestricted plant control and data access from any POS30 display station.
- Provision of a complete set of displays which are necessary for efficient control as e.g. mimics, trends, sequence of events and characteristics.
- Support of the operator in case of abnormal plant conditions by fast access to relevant displays and efficient navigation among displays.
- High resolution graphics and windowing; support of workplace concepts; multi-screening; mouse as preferred pointing device.
- Consistent and uniform color scheme, adaptable by authorized users.
- Basic process and plant management functions: data recording, calculations, counting of operating time, switch cycles, impulses and quantities and a broad range of reporting facilities.
- System security ensured by personal user accounts with password profiles.
- System diagnosis with summary status information.
- Client/server architecture based on industrial PCs, running Linux, a powerful and free portable operating system.



Staudinger power plant unit 4, Germany

The POS30 system consists of three main components:

1 OMS

The Operation & Monitoring Services. OMS is the basic component of POS30. It provides the functionality for all process control requirements.

2 RCR

The Recording, Calculation & Reporting Services. RCR is an option covering the process and plant management functionality.

3 XTC

The XTC Data Interface provides facilities to integrate 3rd party DCS and PLC systems (e.g. via OPC), to communicate with plant management & optimisation systems and to enable multifaceted remote access features.

Operation & Monitoring Services

By applying the latest knowledge in the fields of ergonomics and computer "intelligence", it is not only possible to easily view and control the plant, the system also guides the operator in critical situations. Since attention is also drawn to adverse trends at an early stage, the POS30 contributes significantly to the prevention of failures and thus to overall plant availability.

The process operator station makes use of information compression techniques and qualitative displays to exploit the intuitive abilities of the operator to recognize overall relationships. In spite of this, the hierarchical structure of PROCONTROL P enables the operator to intervene immediately at the lowest component level if necessary.

The following principles were considered when designing OMS:

- Supervision of the process using overview displays
- Control and supervision of the current status in mimic diagrams with on-line confirmation of any actions executed
- Fast homing-in on currently critical areas
- Context-related presentation of supplementary information
- Display of trends to give warning of potentially critical situations

All these features enable even complex power plants to be operated by a minimum of staff. Important in this respect are well designed operator stations which present the right information at the right time and provide the corresponding means of intervention.

Process control: The operator's toolbox

The primary instrument of process control is the POS30. Hardware and software of this system are so flexible that the homogeneous and consistent system platform can easily be scaled to adapt to large installations or small local control units.

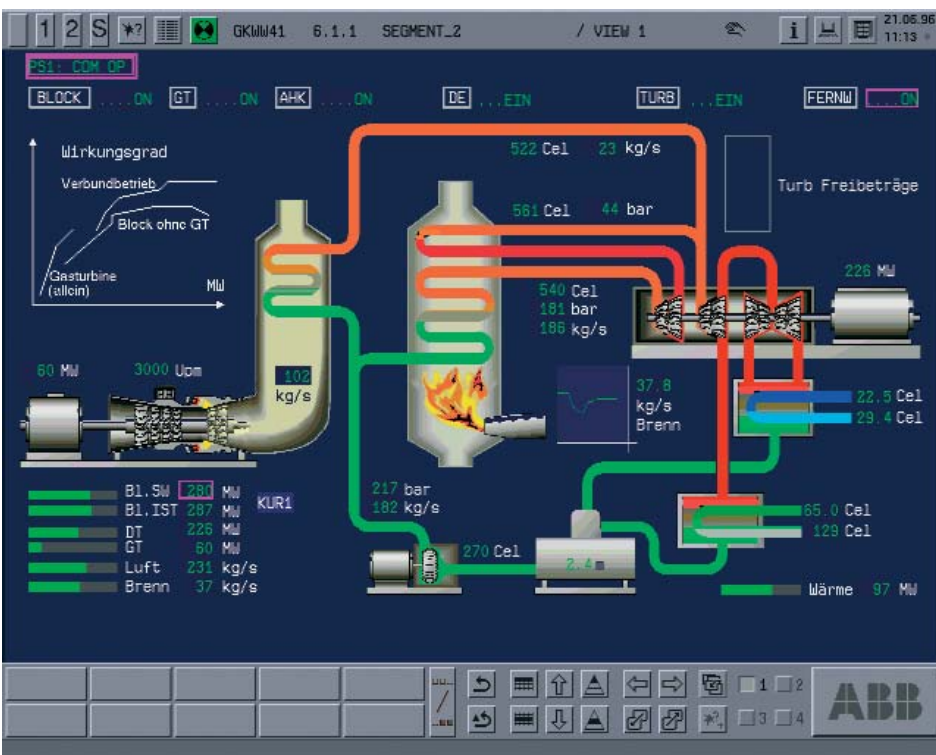
A typical configuration for a process operator station comprises one or several servers which receive the current process data via a coupling module from the PROCONTROL P bus. This process information can be accessed for display by the display stations connected to the communication network. Similarly, the commands from the process operator stations to the process return via the servers to the process bus. The display stations can be equipped with up to four TFT-displays. Process information is displayed either on office-size screens or on large-screen displays. The process is controlled by mouse operation.

Since all the servers operate with the same data, one additional server is sufficient to provide full redundancy. For the same reason, the process operator stations can easily be extended, simply by adding a new server.

All the computer and communication hardware is commercially available and suitable for a multitude of applications. The user thus has a solid hardware basis which is open for all future developments. System openness is further enhanced by the implementation of international standards.

The screen: The window on the process

The process control user interface enables the operator to efficiently supervise and control every detail of the process. A convenient window and menu technique is easy to learn and supports intuitive operation. In the case of the power plant application, intuitive control is further supported by other features.



Mimic display

For example, every screen is divided into three areas:

- The header is reserved for functions related to disturbances, plant status information and for accessing system functions. Thus, regardless of the display currently on the screen, the operator never loses sight of what is happening in the process at large or in the control system itself.
- The footer is used for control tasks such as display hierarchy functions like recalling the last display or mimic, selecting displays from menus or the direct selection of certain displays via softkeys. Thus the operator can reach every item of plant with just a few "mouse clicks" in the display hierarchy and can even create his own access paths.
- The screen area between the header and bottom lines is used for the different kinds of displays. The most frequently used displays are mimics of the power plant where the operator performs his control actions.

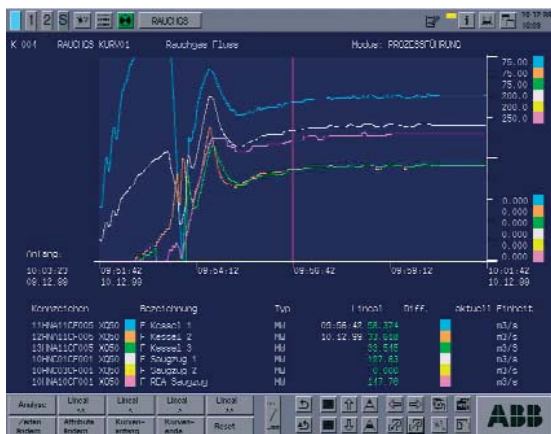
The hierarchy of the displays reflects the structure of the power plant. It is generated automatically for the standard displays from the engineering data for the PROCONTROL P programming. As a result, the hierarchy and displays are 100 % consistent with the current state of the power plant. The hierarchy includes the plant overview, area overviews, function group displays and detail displays. All these displays develop the operator's ability to recognize patterns so that the causes of sudden events are quickly identified.

The mimics are the main instrument of control. They present up-to-the-minute process information and the process itself in a form familiar to the operator. The mimics are fully configurable and include many graphics elements and symbols which give a precise and easily assimilated picture of the plant. To illustrate the current status of the process, the displays make use of dynamic color-coded symbols, trends, bar charts and numeric values.

A new integration quality becomes apparent when users call up function charts. Just using the mouse button they can activate the on-line function chart assigned to a specific plant component.

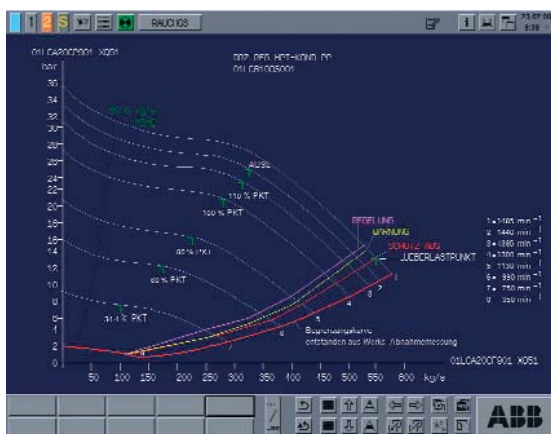
Various views of a sub-process are supported by supplementary displays which are available by pressing a key.

- Curve displays can show up to six trends at a high resolution in relation to time. Individual curves can be switched on and off. The time scale displayed is infinitely variable and permits uninterrupted surveillance of selected parameters. A ruler can be moved to any location to "measure" and translate any point of a curve into a numerical value.



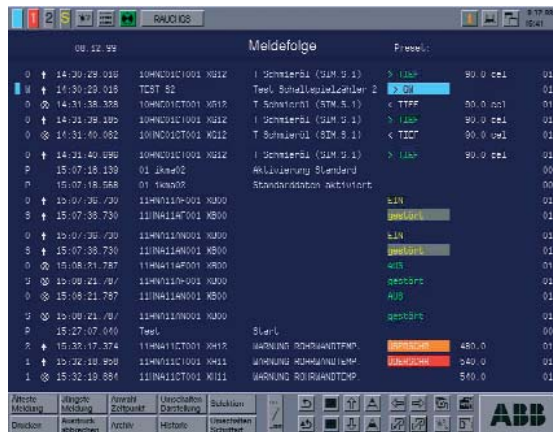
Curve display

- Characteristic displays show the current and historical operating points of important plant components together with their efficiency and operating limits. They are used for determining permissible or optimum operating modes.



Characteristic display with historical data

- Profile displays are groups of measurements of the same type of variable, e.g. boiler temperatures. They show the deviations of a given variable compared to the others and enable irregularities to be quickly detected.
- The sequence-of-events (SOE) display lists all recorded events in chronological order. This includes disturbance signals, changes of status and operator actions. The list supports straightforward analysis of the causes of particular incidences. The analysis procedure can be accelerated by a series of selection filters which can be activated to suppress irrelevant events.

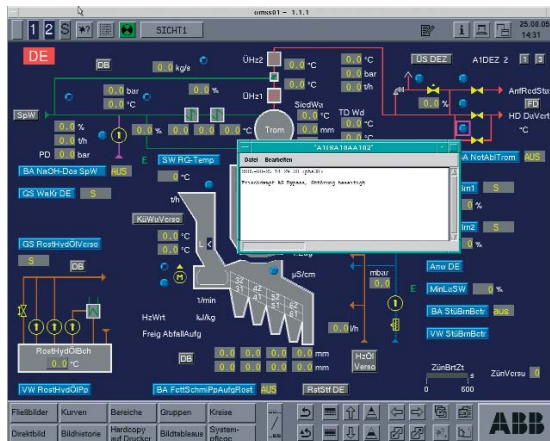


Sequence-of-events (SOE) display

Common to all the displays is a uniform color scheme. But authorized users can modify any color. This is done by simply clicking on any object with the desired color and changing it. Thus it is possible to select any background color and adjust the colors of the various objects.

Object related notes

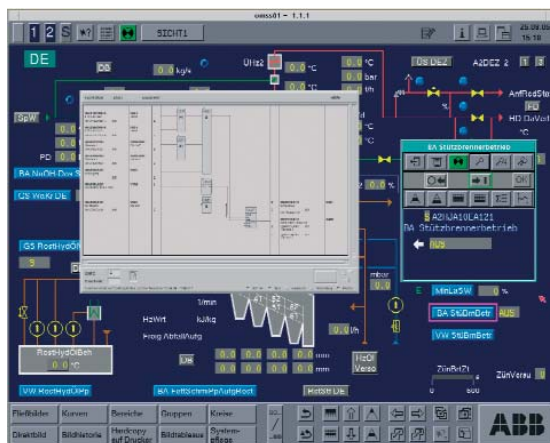
Another new feature is an option for creating object-related notes. For instance, a shift crew can leave some information about a drive or a valve for the next crew. These notes replace the many little yellow notes that used to stick on the monitors.



Object-related notes within a mimic display

Immediate access to on-line function charts

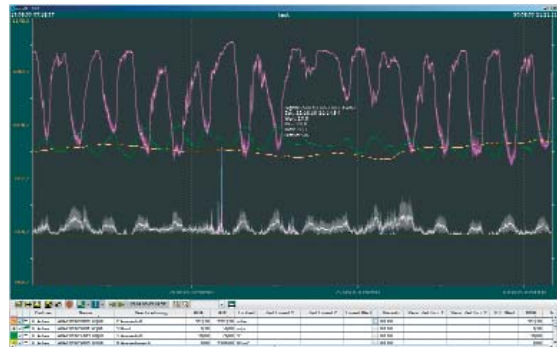
An integration quality becomes apparent, for instance, when users call up function charts. They can activate the on-line function chart assigned to a specific plant component. The chart will then be represented so that the respective functionality is visible immediately. This new quality of information access goes well beyond the traditional approach of importing windows from other documentation computers.



Function chart within a mimic display

Process analysis via trend displays

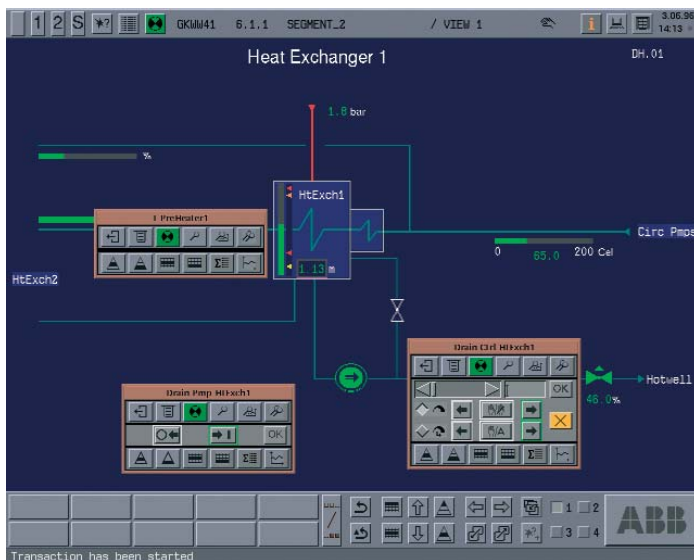
The system's trend representation features reliably support effective process analysis. POS30 includes comprehensive and, to some extent, innovative solutions for trend identification. Trend displays offer seamless overviews that include both real-time data and history data. The time span under review can be defined freely. The "time offset" function allows users to compare real-time trends with trend curves from yesterday, last week, or last month. A zoom function displays any data over a certain time span to the minute. The trend displays offer a number of new functions, e.g. the creating horizontal rulers or for defining horizontal or vertical areas.



Innovative process analysis via trend displays

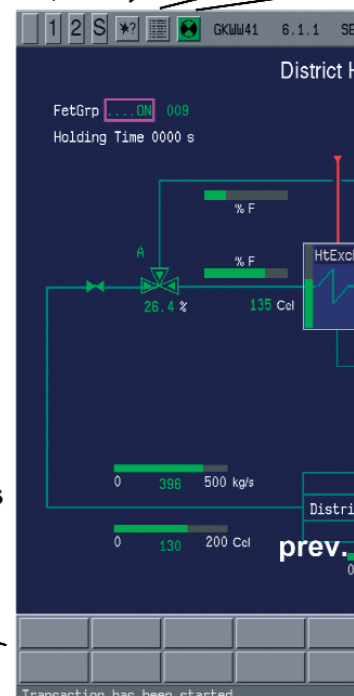
**Process operation:
Every megawatt at your fingertips**

Pointing and clicking on any dynamic process component in a display, from the drive level to the highest control level opens a control window. In the center of the window, the control elements for the components appear. Commands are given with the aid of buttons and slides on the screen. The OK button replaces the conventional release function. Top and bottom sections are common to all control windows and simplify acknowledgement, viewing loop details and cross-selecting related displays. Every control window can be moved to any location on the screen and opened from any kind of display. Up to four control windows can be open at the same time and operations in them performed in parallel.



Faceplates offering a varying number of functions

alarm summary alarm search sequence event



Soft keys for -additional functions for displays

-direct selection of displays of display groups

Information line

shift key for direct display selection

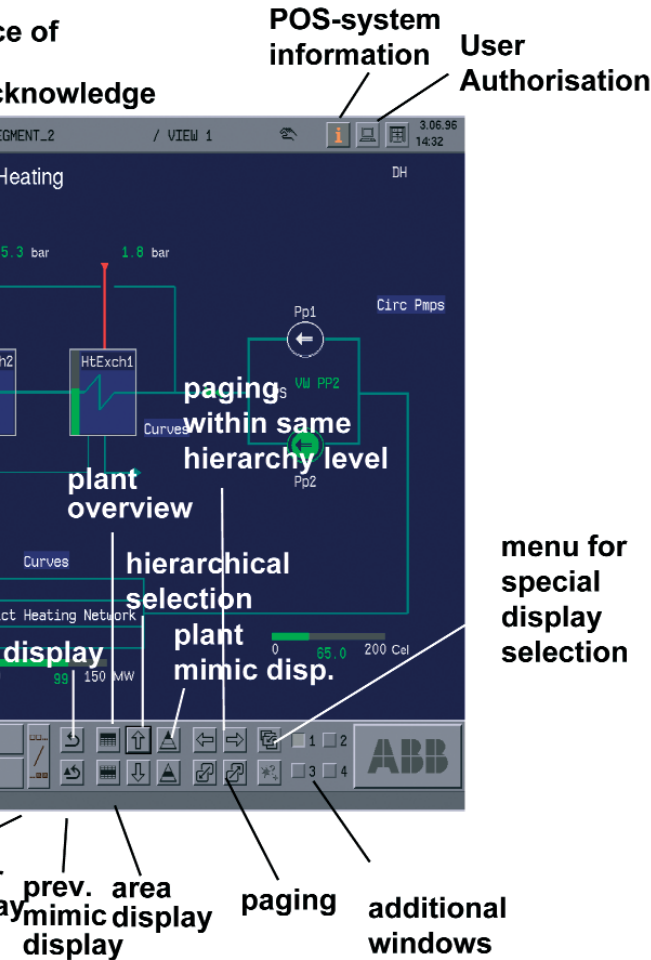
Simple navigation

**Navigation:
The compass in the power plant**

Fast navigation around the plant displays - especially in critical situations - can significantly affect power plant efficiency and availability. This applies to normal operation, but is especially true for disturbed operation.

The process operator station provides a number of standard and configurable options for fast navigation:

- Buttons for navigating around in the display hierarchy, separately for standard displays and mimics, enabling the operator to switch quickly from the higher-level plant overview to a mimic or detail display.
- Buttons for paging through the hierarchy which enable the operator to go on an "inspection tour" through the plant at any desired level



**The search key:
Every disturbance under control**

The most useful navigation aid, especially during abnormal conditions, is the search key which covers the entire plant or context-related special areas. Its function is based on the process operator station signaling concept. The latter activates a general alarm which is visible regardless of the display being shown at the time and signals failures according to their priority. New signals flash to make sure they are noticed.

Clicking on the search key next to the signal causes the display to switch directly to the respective mimic so that corrective action can be taken. The most recent alarm with the highest priority is signaled. Older signals or signals of lower priority are shown by clicking on the search key more often. The context-related search keys (e.g. in the footer line of the screen) enable the search to be limited to the area or function group selected at the time.

The display, control and navigation system provides the operator with a tool which enables him to deal with all the normal operation tasks as well as critical situations quickly and simply.

- "Last display" and "Last mimic" buttons enable the operator to back-track through the last 10 displays.
- Selection from display lists and selection from a field of user-configurable softkeys.
- The softkeys in the footer are configured by assigning current displays or by accepting pre-defined monitor and window combinations.
- Assignment of up to 8 displays is possible with one keystroke, providing just the right combination of displays for certain operations, e.g. start-ups.

As a further aid to navigation through the displays, it is possible to allocate certain displays (e.g. curves) either temporarily or permanently to a specific screen or window, i.e. a screen or window can be reserved for a particular mimic so that it is always instantly available.

Recording, Calculation & Reporting

Process supervision: The shift supervisor's tool box

Process data are saved, documented and evaluated for a number of purposes:

- Detection of deviations and initiation of corrective action early on
- Analysis of the causes of unexpected events
- Documentation of plant statuses for the authorities or plant management systems, etc.
- Provision of balance reports for selected process values, e.g. for verification or commercial purposes

These functions are based on cyclic or event-oriented history archives. The corresponding data are processed by arithmetic modules, or different kinds of reports are generated from them. A powerful ancillary system which is capable of managing all the information generated throughout the entire power plant is optionally available, where a need exists, for more comprehensive analysis, extensive documentation or adaptation to specific plant conditions.

RCR Recording Histories and archiving: Resources for the future

The POS30 OMS component of the process operator station has two buffers for short-term and for medium-term recording of analog variables and one buffer for process events.

The short-term buffer for analog variables has sufficient capacity for one day at a high resolution (1 second). The medium-term buffer can store analog variables for eight days at a condensed resolution. Both buffers record the mean, maximum and minimum values, are available on-line and can be analyzed using the curve display.

The optional long-term archive) only records changes of analog, counter and binary values. This enables an overall resolution of less than a second for analog values, combined with a relatively high data compression. At first this data is stored on internal hard disks or on the disks of a NAS server (NAS = network attached storage). In both cases RAID technology is supported.

For archiving purposes, data can be transferred to magneto-optical disk, CD-R(W) or DVD-R(W) so that they are available for analysis and viewing later on.

Disturbance analysis makes full use of all this data storages. This arrangement provides for flexible evaluation of faults, because the range of signals is extensive and there is basically no limit on the period of time.

RCR Calculation: Abacus for process control

The POS30 component "RCR Calculation" includes a module called "software analog and binary values" for specifying e.g. calculation of efficiency figures and executing them immediately on-line. This module is based on the programming language TCL, which is most commonly used in internet applications. It's a scripting language, well documented, easy to learn and to manage.

The system treats all calculated values similar as process variables and therefore all the process operator station functions can be applied to them, in particular, their use in other calculations.

Further arithmetic modules are available as options for more complex calculations such as water/steam tables or for the integration of user programs e.g. created with tools like MATLAB.

RCR Calculation also provides a facility to send calculation results via POS30 coupling module to the PROCONTROL system.



Report

RCR Reporting: The process curriculum vitae

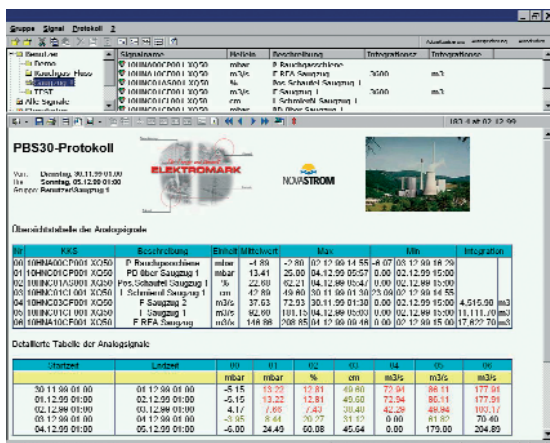
Standard reports are available for listing such process data as:

- Operating balance reports
- Instantaneous values
- Operating hours
- Switching cycles

Operating balance sheets can be generated for fixed time scales like shift, day, week, month and year or for any custom time scales from some minutes up to many years. They record the accumulated values over a desired period and show mean, minimum and maximum values for the period.

The instantaneous-value report is used to record either all the analog, binary, computed and metered values or selected single values at a given instant of time, in order to document a particular operating mode and/or operating status. This information is useful for defining optimum operating conditions and for generating operational documentation, e.g. for change-of-shift reports.

The operating-hours and switching-cycles reports replace conventional meters for the main plant components. The data can be used to change from costly cyclic or event-oriented maintenance to a wear-oriented maintenance scheme based on the actual use of the components.



Spread sheet type report

All reports can be conveniently configured on-line and interactively with drag & drop support. Report generation and printing can be triggered either manually on request or cyclically. Once a report has been generated, it remains on the hard disk from which it can be transferred for archiving. Reports are generated in HTML language. Hence all reports can be viewed on the screen and printed with standard web browsers (e.g. MS Internet Explorer). As each report is based on a user-definable template layout, custom fonts, colors, arrangement of tables, integration of graphics may be applied easily with any HTML layout editor like MS Frontpage.

RCR Reporting includes an integrated automatic data export of generated reports to other applications, e.g. Microsoft Excel.

To complement the above mentioned tabular report style, any report can be displayed additionally as a graph with user adjustable scaling of y-axis and time resolution (from minutes to years), detailed signal legend and up to four rulers. The standard graph type has time on x-axis and values on y-axis but graphs with on signal on x-axis and another on y-axis is feasible.

The following reports are also available as options for special demands:

Measured-value-sequence report

The measured-value-sequence report lists a predefined number of analog variables over a given period. This is especially useful for examining transitory operating procedures, e.g. the turbine start-up procedure.

Plant status report

The plant status report can be prepared for all the variables or for disturbed variables only. Since it reflects the current status of the plant, it is frequently used when handing the plant over to the next shift.

XTC Data Interface

The POS30 is equipped with an XTC communication interface and supports the following system features:

- Open system architecture, suitable for all types of data communication and third-party system interfacing: plant management systems, process information systems, maintenance systems, SAP, any type of user-defined or purchased application, interactive input/output features
- Homogeneous and consistent hardware and operating system platform for operator station and XTC communication interface
- Homogeneous and consistent engineering of operator station and communication interface
- Access to all the process data and historical data of the plant, high level of performance, no restrictions with regard to bill of quantities or dynamics
- Operating modes: intermittent/event-oriented, cyclic, continuous
- Access even to preprocessed and archived data (integration data, averages, counter values, computed values)
- Delivery of data in conditioned form (physical values, status information), independent of control system specifications
- Options for direct interfacing of third-party systems (including process operation)
- Network interfacing, via TCP/IP, with LAN and/or WAN (modem, ISDN)
- Optimized features for remote and advanced services by means of consistent application of Internet technology, such as browsers, HTML, HTTP
- Providing for security of investments through application of industrial standards, such as OPC, OLE/Active X/DCOM, TCP/IP

POS30 OPC Client

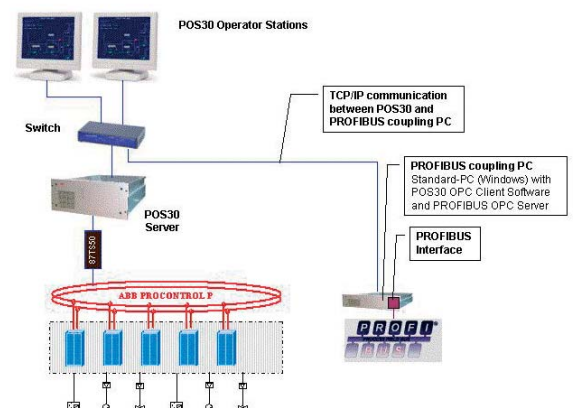
OPC means OLE for Process Control and is an open standard for the communication between PLC and DCS systems on the one hand side and software applications (mainly process operator stations) on the other - even if the control system and the operator station are products from different vendors.

Within the following examples, the POS30 OPC client software provides the acquisition of data from PROFIBUS, connected via a PROFIBUS OPC server. Even process operation from POS30 into e.g. PLC systems connected to the PROFIBUS is possible.

Process data derived from OPC signal tags may be used within the POS30 system for all POS30 functions like standard displays, mimics, trend curves or reports. From the operators point of view, the source of information (OPC or PROCONTROL) is transparent, i.e. operators have a homogeneous user interface to all process information independent from data origins and interface types.

System Configuration

A normal PC with a build-in PROFIBUS interface card serves as coupling device between the PROFIBUS and the POS30 servers by using PROFIBUS OPC server software and POS30 OPC client software (details see next chapter). This "PROFIBUS coupling PC" is integrated into the POS30 LAN (twisted pair connection to a POS30 LAN switch) and communicates with the POS30 servers via TCP/IP protocol.



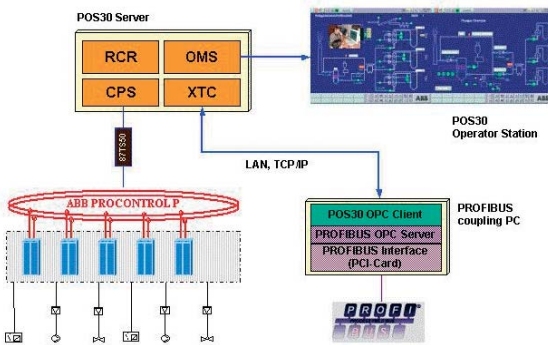
Report

The following configuration shows the system architecture of interfacing PROFIBUS to a POS30 system with OPC:

If necessary, this configuration can be provided with redundant coupling PCs.

Software Architecture

As described in the previous chapter, the PROCONTROL system is connected to the POS30 server via coupling module 87TS50. Within the POS30, the software component CPS manages the communication between PROCONTROL/87TS50 and the other POS30 software components like OMS (Operation & Monitoring Services) and RCR (Recording, Calculation & Reporting Services).



Software architecture

XTC implements all POS30 data interfacing and transferring requirements. In this case it manages the communication between the POS30 OPC client software and the other POS30 system software components.

The POS30 OPC client software is installed on the PROFIBUS coupling PC and communicates here directly with the PROFIBUS OPC server software which utilizes appropriate driver software for the acquisition of data from the PROFIBUS interface card installed in this PC.



Remote access

POS30 supports many "Remote Access Functions" using internet technology.

The main features are:

- Remote monitoring of live and historical process data
- Remote report generation, displaying and printing
- Remote analysis and diagnosis of POS30 (hardware, operating system and application software)
- Remote analysis and diagnosis of the PROCONTROL system.
- Message forwarding in case of disturbances (E-mail and SMS)

Technical Data

POS30 server	
Model	Any Linux compatible industrial or standard PC
Memory	Main 1024 MB Disc 80 GB Optical Disc 4 GB
Network interface	Fast Ethernet twisted-pair
Number of POS30 servers per plant segment	Max. 16
POS30 operator station	
Model	Any Linux compatible industrial or standard PC, standard PC with WindowsXP or special operator station PCs based on Embedded Linux (without moving parts like fans and hard disks)
Display resolution	1280 x 1024 pixels
Main Memory	256 MB
Interfaces	
- Monitor	DVI or analog
- Network	Fast Ethernet twisted-pair
- Keyboard/mouse	Standard (PS/2, USB)
Number of monitors per POS30 system	Max. 64
Number of monitors per workplace	Max. 8
Number of workplaces	Max. 32
Peripherals	
Monitor (Example)	
- Model	TFT flat screen
- Size / diagonal	19" or more
Operating devices	
- Mouse	or trackball
- ASCII Keyboard	standard
Printer (Reports and Hardcopy)	
- Type	Laser (Postscript, with network interface)
- Number of printers per system	Max. 32
Network	
Transmission medium principle	Fast Ethernet twisted -pair
Topology	Standard Twisted-pair LAN configuration

Communication protocols	TCP/IP, X protocol
Configuration variants	Single or redundant
Transmission medium	
- Cable type	Twisted-pair Cat. 5e or Cat6
- Length	Max. 100 m
Alternative communication medium	
- Cable type	Fibre optical cable
- Length	x km Max. length dependent on: - fibre type (singlemode or multimode) - transmission equipment (switches, hubs etc.)
Redundancies	
POS30 server	n+1 redundancy: Number of required servers according to - number of monitors - number of signals - applied functionality plus one extra server for redundancy In most cases two POS30 servers are sufficient
Large-screen projection	Suitable rear projection screens or large LCD screens
Network	LAN redundant (optional)
Process data history	RAID1 or RAID5 (optional)
Display structure	
Color scheme	
- Display mode	Light or dark background (configurable)
- Key designations	Symbols
Standard displays	
Plant segment display	Max. 32 plant views
Plant overview	Max. 28 areas/page (several pages)
Area display	Max. 28 function groups/page (several pages)
Function group display	Max. 16 I&C loops/page (several pages)
- Total	Max. 2000 function groups
Loop object window	
- I&C loop	1 page
- Binary or analog control loop (several pages)	1 page plus max. 30 control conditions
- Total	Max. 30000 loops/segment
- Signals	Max. 50000 signals/segment

Sequences of events (SOE)	
Size of History	Max. 50.000 events per Buffer, (number of available buffers depends only on size of harddisk, standard disk: ~10.000 buffers)
Types of signals	
- Process disturbances	Priorities 1 ... 3 (colors)
- Maintenance signals	Discrepancy/forced manual/time/run-time monitor
- Control conditions	
- State Signals	
- Control system disturbances	Priority S
- POS30 system disturbances	
- Control operations	
Acoustic signal for alarms	buzzer or horn (via PROCONTROL P)
Acknowledgement	Common per display, per page of sequence of events or single
SOE display	
- Number of freely assignable SOEs	30 presets (= selection criteria)
- Number of SOEs directly selecting a display	1
- Control	Paging / go to / acknowledge
- Selection	Direct via display button
- Signal suppression/filtering	Configurable presets
SOE reports	
- Number	10 presets (= selection criteria)
- Report layout	similar to SOE display
Process displays	
Number	Max. 450
Dynamic display elements (process variables)	Max. 200 / process display
Process display hierarchy	- Plant overview display - Plant segment display - Area display - Detail display
Available dynamic elements	- Symbols - Bar charts - Curves - Digital displays - Interconnecting lines - Texts
Characteristic displays	
Number	Max. 100
Number of operating points/field	4 per characteristic field

Curve displays/history

Number of standard curve displays	Max. 3.000
Number of operator configurable curve displays	Max. 200
Curves/display (suppression and zooming of individual curves)	Max. 6 (12 in analysis trends)
Recording period	
- Upon selection	15 min
- Continuously adjustable between	5 min and 24 h
- Short-time trend	8 min
Memory	
- Number of analog variables	Max. 5000

Profile displays

Number	Max. 100
Number of bars per display	Max. 30
Limits per display (common for all bars)	Max. 4

Access rights

User identification	- Max. 40 names - Password
Access profiles	- Configuration (system manager) - Process operation - Acknowledgement - View only

Performance data

Control command to return confirmation	1 s typical
Display build-up time	
- Standard display	< 1 s
- Process display	< 1 s
- Curves (6 curves, 15 min)	< 1 s
- Variable refresh rate	on event
Time resolution of signals	< 10 ms (dependent on resolution of control system bus)
Timestamp resolution	1 ms



ABB AG
Power Technology Systems
P.O. Box 10 03 51
68128 Mannheim
GERMANY
Phone: +49 (0) 6 21 381-30 00
Fax: +49 (0) 6 21 381-26 45
E-Mail: powertech@de.abb.com
Internet: www.abb.com

Note:

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction - in whole or in parts - is forbidden without ABB's prior written consent.

Copyright© 2006 ABB
All rights reserved