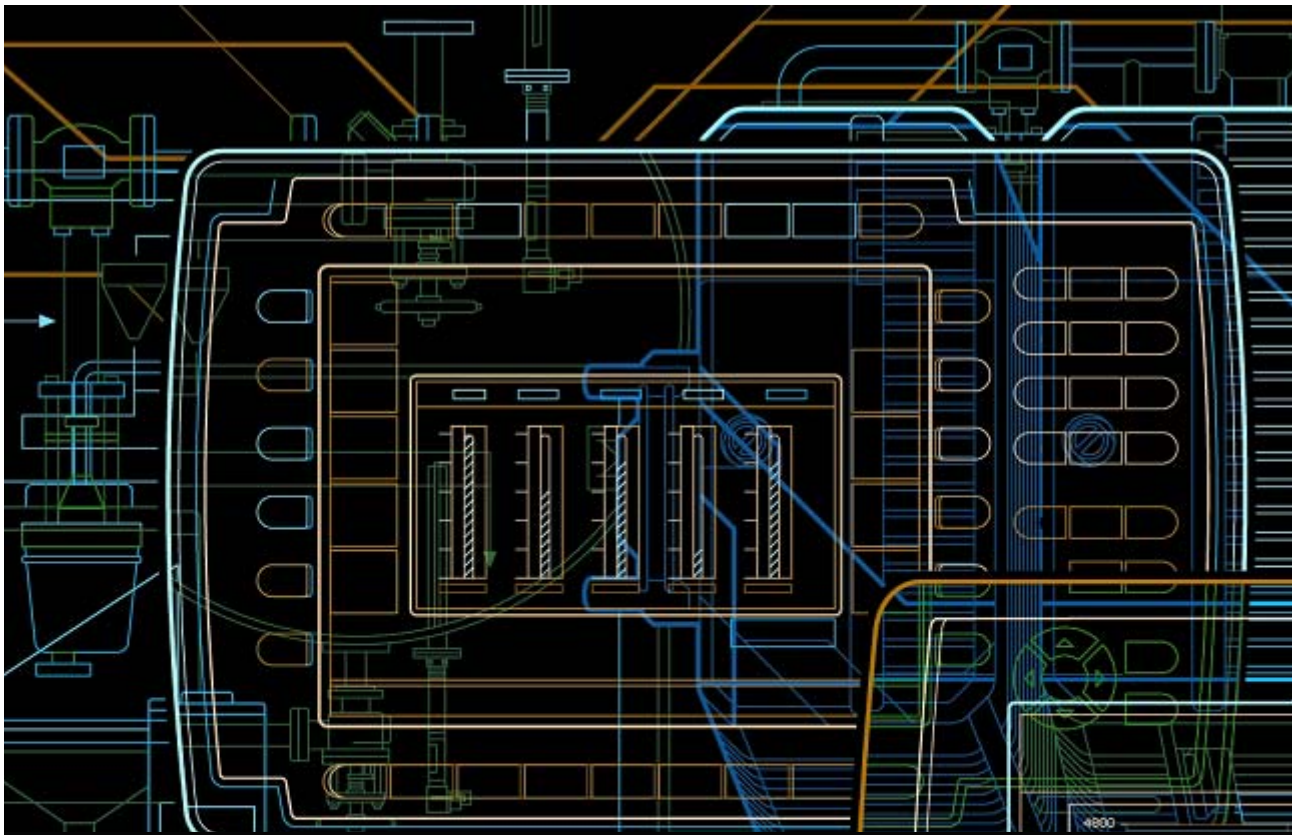

Compact HMI 800

Product Guide

System Version 5.1 Feature Pack 4 Revision D

Power and productivity
for a better world™

Compact HMI 800

Product Guide

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Section 1 Introduction

This Product Guide describes the Compact HMI 800 product.

Intended Use of This Book

Target Group

This Product Guide is primarily intended to provide sales representatives with an overview of the product and its capabilities.

Compact HMI 800

The Compact HMI 800 is a comprehensive HMI for process control and supervision for the PLC market. It covers operation and configuration of almost all types of HMI applications.

The Compact HMI 800 is a comprehensive HMI that is delivered ready to be used after installation, the software is installed in one or more PCs.

A Compact HMI 800 system consists of the following main parts:

- One Server Workplace with Operation and Engineering functionality.
- Up to nine Additional Clients with Operation functionality.

The smallest system configuration is one node, the Server Workplace. It can be expanded with up to nine client workplaces. The system is also scalable in size. The size scaling is defined by the number of communication signals that are allowed in the system.

Signals are purchased in packages. Packages are available for 50, 500, and 2500 signals.

The Compact HMI 800 products have been developed incorporating Information Technology with the experience and know-how collected over decades of successful deliveries and customer installations.

The foundation of the Compact HMI 800 products and system solutions is the concept of Aspect Objects™, which enables enterprise wide information availability, browsing, and navigation in a unified way.

The Compact HMI 800 is installed on standard PC hardware. The Compact HMI 800 can be used as a single PC workplace or as a server workplace combined with nine additional client workplaces.

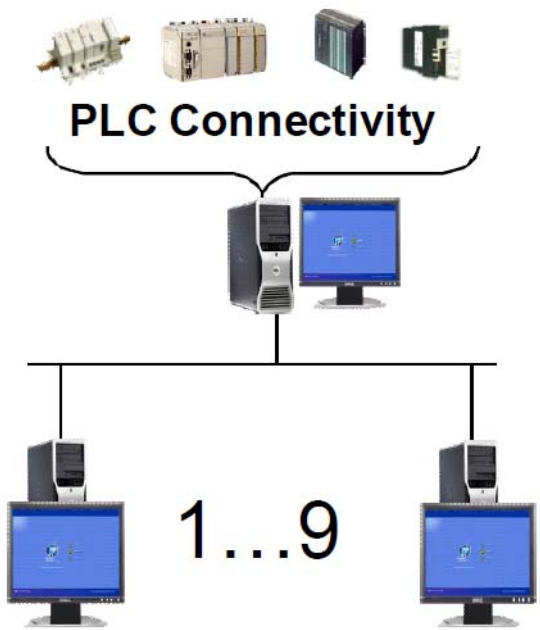


Figure 1. Compact HMI 800 System

The information resides in an integrated environment configurable for various user needs. The user interface can be used with default settings or be customized providing user categories, such as operators, engineers, and maintenance personnel, all with an environment focused on their main tasks.

As a result, the user can concentrate on the right actions, with a minimum of effort, resulting in increased productivity.

Within the Compact HMI 800 there are a number of Core Functional Areas. These are:

- Base System
- Operations
- Engineering

These Core Functional Areas are described in section 3.

Compact HMI 800 can be used together with AC 800M or with any other PLC. The controllers are accessed using the OPC standard interface.

Purpose, Scope and Intended Use

The scope of the Compact HMI 800 described in this document is:

- Traditional process automation, as well as hybrid automation. The control level ranges from simple binary control to closed loop control.

Aspect Objects Architecture

The Aspect Objects architecture is a cornerstone of the Compact HMI 800 concept. It provides:

- A consistent, scalable concept that integrates Process Control & Automation products.
- Information-centric navigation – a consistent way to instantly access all information without having to know how and by which application the information is handled.
- Integration of autonomous applications. Very little awareness is required between applications.
- Easy integration of new aspect systems (new applications). A homogeneous base for all applications. Open standards make it possible for users to integrate new aspect systems.

- High level of engineering efficiency through data integration between aspect systems.
- Extensive re-use during the life cycle. For example copy/paste, definition of object types and solutions, etc.

A central problem in plant operations, as well as asset life cycle management, is the need to organize, manage, and have access to information for all different aspects of a great number of plant and process entities. These entities, or real world objects, are of many different kinds. They can be physical process objects, like a valve, or more complex, like a reactor. Other examples are: products, material, batch procedures, manufacturing orders, and customer accounts.

Aspect

Each of these real world objects can be described from several different perspectives. Each perspective defines a piece of information and a set of functions to create, access, and manipulate this information. We call this an *aspect* of the object.

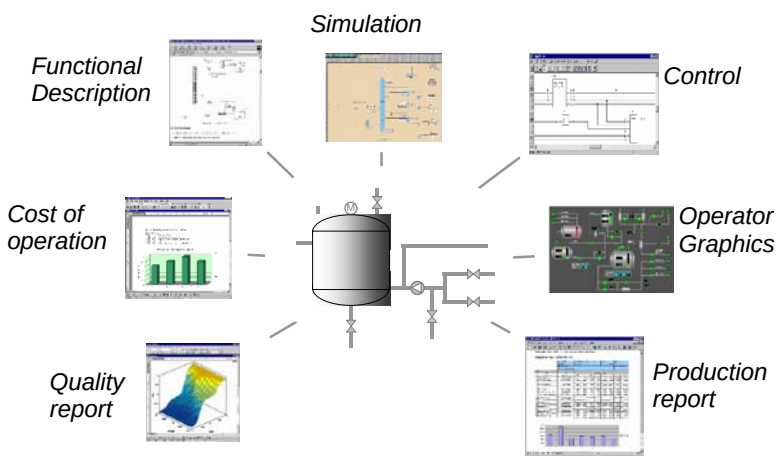


Figure 2. Examples of different Aspects of an Object

Aspect System

A software system that implements one or several aspect types by providing one or several aspect system objects.

It is necessary to be able to implement these aspects using many different applications, both existing and new, from ABB, third parties and customers, both now and in the future. It is desirable to be able to do this without changes to the applications. It is not reasonable to require that all these different applications be aware of each other. Still, the applications must cooperate to provide an integrated view and functionality of the object.

Aspect Objects

Aspect Objects provide a solution to this problem. In this concept, rather than creating one single object or data model in the system to represent the real world object, each aspect is modeled separately. An *Aspect Object* is thus not an object in a strict sense, e.g. like a COM object, but rather a container of references to implementations of the different aspects.

Terminology

This list contains descriptions for terms and abbreviations that are used in this document.

Table 1. Terms and Definitions

Term	Description
ActiveX	Microsoft standard for user interface components, based on definition of software interfaces.
AS	Aspect Server. The “central” intelligence in the system, including the aspect directory and other services related to object management, names, security, etc.
Aspect	See Aspect on page 12.
Aspect Objects	See Aspect Objects on page 13.
Aspect System	See Aspect System on page 13.

Table 1. Terms and Definitions (Continued)

Term	Description
CEXbus	Communication module expansion bus used in the AC 800M Controller.
CNCP	Control Network Clock Synchronization Protocol.
COM	(Microsoft) Common Object Model.
CS	Connectivity Servers provide access to controllers and other data sources.
CTK	Configuration Tool Kit.
DCS	Distributed Control System. A generic term for control systems for Process Automation, normally with a distributed database and real time data access.
DCU	Distributed Control Unit.
DMZ	Demilitarized Zone.
DTM	The Device Type Manager - DTM - is a software module delivered by the manufacturer together with a device. As an “FDT device driver” the DTM contains all device-specific data, functions, and graphical user interfaces and provides uniform access to these device-specific internals via the standardized FDT interfaces.
ECCP	Ethernet Communications Controller for the PCI bus.
EPA	Environmental Protection Agency.
ERP	Enterprise Resource Planning.
ES	Engineering System, which is used for engineering and potential test of applications intended for Production System.
FDA	Food and Drug Administration.
FDT	Field Device Tool. It is an open standardized communication interface for integrating field devices and their application into control systems or device management tools, e.g. Engineering Tools and Asset Management Tools.

Table 1. Terms and Definitions (Continued)

Term	Description
FF	FOUNDATION Fieldbus.
GSM	Global System for Mobile communication.
HSE	High Speed Ethernet (FOUNDATION Fieldbus).
HSI	Human System Interface.
HMI	Human Machine Interface.
Industrial^{IT}	Industrial^{IT} is ABB's solution that creates a business enterprise where your plant automation, Asset Optimization, and collaborative business systems are seamlessly linked in real time.
MES	Manufacturing Execution System.
NIC	Network Interface Card.
NLS	National Language Support.
Node	A computer communicating on a network, e.g. the Internet, Plant, Control or I/O network. Each node typically has a unique node address with a format depending on the network to which it is connected.
ODBC	Open Data Base Connectivity.
OCS	Open Control System. Similar meaning as DCS.
OLE	Object Linking and Embedding.
OPC	OLE for Process Control, a standard interface for data, event and history access based on COM.
PA	Process Automation.
Plant Explorer	An application that is used to create, delete and organize Aspect Objects and Aspects in the Compact HMI 800. The plant explorer organizes the Aspect Objects in structures according to functionality, location, etc.You can also use it to browse and search the structures of the plant.

Table 1. Terms and Definitions (Continued)

Term	Description
PLC	Programmable Logic Controller. Controller for primarily discrete logic control.
PNSM	PC, Network and Software Monitoring
PS	Production System which is used for controlling a real process.
RNRP	Redundant Network Routing Protocol.
SIL	Safety Integrity Level.
SIS	Safety Instrumented System.
SMS	Short Messaging Service.
SNMP	Simple Network Management Protocol.
SNTP	Simple Network Time Protocol.
SOE	Sequence of Events.
SQL	Standard Query Language.
UTC	Coordinated Universal Time.
VPN	Virtual Private Network.
WMI	Windows Management Instrumentation.

Applicable Standards and Specifications

Openness provides solutions that enable and protect the future growth of the system. To utilize this openness, Compact HMI 800 conforms to standard technologies like OPC, Microsoft COM, ActiveX, IEC 61131-3.

The following table list the major standards incorporated into or supported by Compact HMI 800.

Table 2. Standards

Standard	Description
ActiveX	Microsoft standard User Interface.
COM	Microsoft standard.
DIN EN 500 22	Standard for DIN rail used by Module Termination Unit.
EMC Directive 89/339/EEC	CE Compliance Directives (standards; EN 61131-2, EN 50081-2, and EN 50082-2).
FDT/DTM	Concept for fieldbuses.
IEC 61131-3	IEC Standard for programmable controllers.
IEC 61508	IEC Standard for SIL1-2.
IEC 61512 (ISA S88)	IEC Standard for Batch Management.
IEEE 802.3	Ethernet
ISO-9506	Standard for sending information between industrial applications.
Low Voltage Directive 73/23/EEC	CE Compliance Directive (standards; EN 50178, EN 60950, EN 61010, EN 50178, EN 60439, or IEC 60255, depending on product).
OLE DB	COM based application programming interface (API) for data access.
OPC	OLE for Process Control. Standard for standard data, event, and history access based on COM.
S95	The ISA S95 Standard for Enterprise-Control System Integration defines interfaces between applications at the Industrial Control Level and applications at the MES (Manufacturing Execution Systems) Level.
TCP/IP	Defacto standard for computer networking.

Section 2 Key Benefits

Compact HMI 800 extends the reach of the traditional automation systems beyond control of the process to achieve the productivity gains necessary to succeed in today's business markets. For the first time, this scope is accessible from a single user interface that is configured to present information and provide interaction in a context appropriate to all user disciplines.

Compact HMI 800's unique operating environment allows the incorporation of “best in class” products, applications and services from the world's largest automation supplier. Built on the Industrial IT Aspect Object™ technology platform and industry specific expertise, ABB's automation portfolio provides the seamless link between process and business management to deliver knowledge-based solutions.

Features and Benefits

- **Full functionality**: Including dynamic graphics, event and alarm handling, graphic trending, historical data storage, reporting and faceplates.
- **Open to any controllers**: Supports the OPC standard, meaning that it is directly interfaced to the large and growing number of OPC-compliant controllers. Drivers are also available for the most popular, non-OPC-compliant PLCs.
- **Easy to Engineer**: Delivered preconfigured and ready for plant- and process specific adaptation.
- **Easy to Operate**: Intuitive point-and-click-style operation, to the Windows standard, from overview to detail and back.
- **Easy to Maintain**: Comes with built-in, automatic, back-up functionality.

Enhancing Reliability. Embracing the principles of open, real-time networking, Compact HMI 800 provides a scalable solution that spans and integrates loop, unit,

area, plant, and interplant controls. From providing a secure foundation with robust, but flexible, base level regulatory and sequence control to higher level management and advanced control functions, Compact HMI 800 meets the application needs of a wide variety of industries.

Compact HMI 800 provides a secure, reliable, control environment through built in security features such as access control, user authentication, and audit trail capability. ABB enhances secure system operations by incorporating “safe design” practices into product development, and by providing Compact HMI 800 hardening settings.

Based upon the Aspect Object technology and a common set of hardware, Compact HMI 800 seamlessly integrates traditionally isolated control systems.

Compact HMI 800 delivers its extended productivity gains by:

- Reducing Time to Decision and Action
- Engineering for Maximum Performance

These key value propositions are described in the paragraphs below.

Reducing Time to Decision and Action

Compact HMI 800 delivers the exact information - filtering out the noise - to facilitate consistent, sound business decisions and provides the environment to optimize the associated response.

Compact HMI 800 Operator Workplace, each user's login defines the type and class of information required for timely and informed decision-making. Thus, Compact HMI 800 delivers much more than a comprehensive operator console; Compact HMI 800's personalized workplaces provide an intelligent and focused presentation, enabling rapid response.
Optimal reaction requires real-time knowledge that an upset has occurred, or will occur. Compact HMI 800 provides notification through its audible and visual alarm and event presentation. Remote personnel are notified of critical events via mobile telephones, e-mail accounts, and pagers by Compact HMI 800's SMS and e-mail messaging service. Using GSM mobile phone technology, Compact HMI 800 allows remote acknowledgement of notification and confirmation of receipt.

Compact HMI 800 features include:

- **Personalized workplaces for focused information access:** Workplace layouts are adjusted and optimized to user preferences and needs with individualized menus, toolbar contents, and display locations. At delivery a layout adapted for Compact HMI 800 is configured.
- **Intuitive and flexible navigation for fast information access:** Quick access with familiar web browser tools to displays and information is provided. Favorites, tabbed navigation, history lists, shortcuts, and hot buttons provide navigation through a process production facility quickly and accurately.
- **Comprehensive operator functionality for reliable control:** Compact HMI 800 Operator Workplace provides a complete set of operator functions that include realistic process graphics with standard faceplates, superior trending capabilities, intelligent alarm and event handling, production reporting, and remote messaging.

Engineering for Maximum Performance

Providing a single, accurate, source of system information helps ensure data consistency and improves engineering performance throughout the lifetime of the automation system.

Compact HMI 800 Engineering provides real-time information integration for better and faster access. Working within a common engineering environment, Compact HMI 800 Engineering supports a consistent information flow from design, through installation and commissioning, to operation and maintenance.

Compact HMI 800 helps users engineer for maximum performance with:

- A fully integrated engineering environment for development and reuse of system standards, such as incorporating control logic, operator displays, maintenance support, and documentation.
- A single source for all data within the system.
- A comprehensive set of libraries to streamline the engineering workflow.

Compact HMI 800 Engineering features include:

- **Reusable Solutions**. The common framework allows logically defined solutions to be quickly reproduced and adapted to meet specific needs with minimum engineering and re-validation. When modifications are made to existing standards, instances are automatically updated. This is only valid for aspects inherited from object types, and for added new aspects.
- **Operator Graphics.** Interactive operator graphics can easily be customized through the use of predefined elements, symbols and high performance graphics elements.
- **Change Management.** System configuration changes can be recorded and tracked to help meet regulatory requirements.
- **Integrated Documentation.** Documentation of all integrated components and devices are easily accessible.

Integration of Installed Systems

The Compact HMI 800 can also be used to enhance existing installations. Enhancement is based on a number of assumptions, which determine the connectivity and evolution capabilities.

Different levels of an automation system may have different lifetime cycles. The workplace and server level typically has the fastest development. The customer's readiness to upgrade is also higher on workplace and server level than on controller and I/O levels. From this the following conclusions are made:

- New workplace and server products connect to existing PLC's.
- New PLC's connect to existing process I/O.
- A user´s investment in their application often has a larger value than the hardware and software investment. Hence, application conversion tools are provided to bring applications over from the existing to the new product.

Section 3 Compact HMI 800 Base System

The Compact HMI 800 functionality is divided in three main areas:

- Base System.
- Operations.
- Engineering.

A summary of the different functional areas is described in the following chapters.

Base System

The Compact HMI 800 base functionality is comprised of the Base System consisting of:

- Operator Workplace gives the operator an efficient environment used to operate the plant. (The functionality is described in Section 4, Operations.)
- Plant Explorer for creating and maintaining Aspect Objects and object structures.
- Alarm and Event handling for detection, generation, and logging of alarms and events.
- Security for handling of user permissions and authority in the control system.
- System Time Synchronization to synchronize the system time in the different nodes (PCs and controllers).
- Backup and Restore, handling back up and restore configuration data in Compact HMI 800.
- Export and Import of application data.

- Basic Computer Monitoring automatically monitors the resources of the Compact HMI workstation node.
- Localization: Compact HMI 800 is available in US-English. The Base System has support for making the localization to other languages.

Plant Explorer

The Plant Explorer is used to create, delete, and organize Aspect Objects and Aspects within the Compact HMI 800. It organizes the Aspect Objects in structures according to functionality, location, etc. It is also possible to use it to browse and search the structures of the plant.

Plant Explorer is the main tool used by engineers for exploring and building hierarchically structured models of a plant or system. It is based on a structural hierarchy, similar to Windows Explorer. The structures represent different views of the plant. Structures can be built and improved at any time. Examples of different types of structures are:

- Functional Structure
  Shows the plant from the process point of view. It is an overview of the functionality of items in the plant. It is used for operation of the plant.
- Object Type Structure
  Shows the object types that is the templates for the real objects. It is used mainly for engineering tasks.
- Control Structure
  Shows the control network in terms of networks, nodes, fieldbuses, and stations.

All the entities included in a plant are represented as objects; for example, valves, motors, controllers, and tanks. These objects have relevant information stored in aspects, as shown in Figure 3. For example process graphics, control dialogs, and alarm pages. In the figure the Aspect Object is in the left column and a list of the aspects connected to it is in the right column.

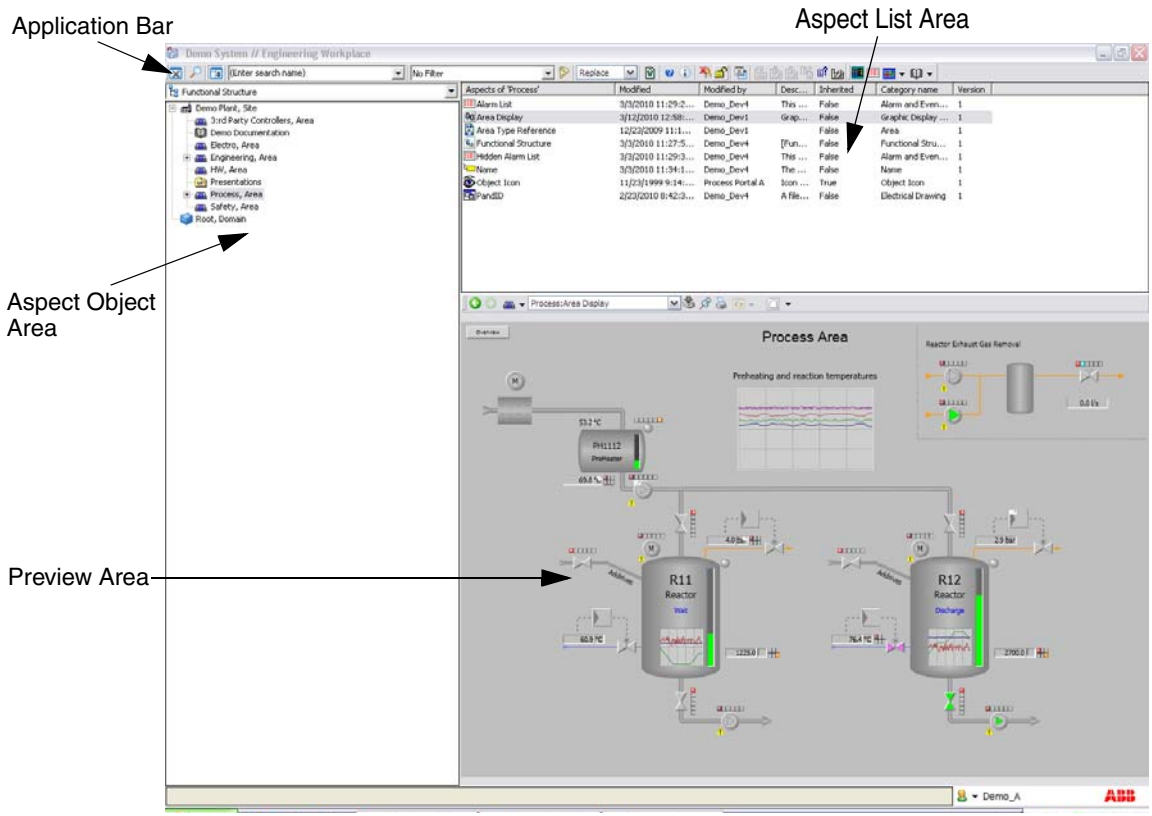


Figure 3. Example of the Plant Explorer window

Aspects have the following features:

- The aspect can be viewed in a pop-up window, in the preview area or in full screen window.
- Aspect filters can be used to decrease the amount of information to be displayed.
- Search function for finding a particular Aspect Object in any structure.
- The Aspect Object can also be directly accessed from the Compact HMI 800 Operator Workplace.

Alarm and Event

There is support for alarm and event management on several levels throughout the system. Alarms and events are treated in a consistent way (an alarm is an event that alerts the user of an abnormal state and needs to be acknowledged). The Base System supports management and logging of events.

Supported levels of alarm and event management can be described as:

- Event detection provided on controller, field, and application level
- The Base System supports storing and state management of events and alarms.
- Following functionalities are supported for alarms and events:
  - Alarm logger for printer output.
  - Alarm bands to provide a number of active and unacknowledged alarms in a summary display for selected alarm lists.
  - The Sequence bar displays a defined number of alarms horizontally. The alarms shown are the newest alarms from the defined list.
  - SMS and e-mail Messaging provides a method for sending messages based on alarm and event information to user devices such as mobile telephones, e-mail accounts, and pagers.
  - All client applications are applying filters which are configured as part of the alarm or event list to determine which alarms or events from the system global alarm or event stream shall be included in the client functions.
  - Alarm list configurations can be shared between lists.

  The functionality provided by the Operator Workplace is described in the Operations Section.

Alarm List

The Alarm List (Figure 4) displays all events matching the configured alarm filter. Either all or a subset, of an event's attributes, along with the current value for those objects, can be displayed.

The Alarm List allows flexible views. The user can adjust the sort order by double-clicking on the headers. The user can also adjust the layout by dragging and dropping columns to suit their requirements. Clicking on the reset button displays the default layout.

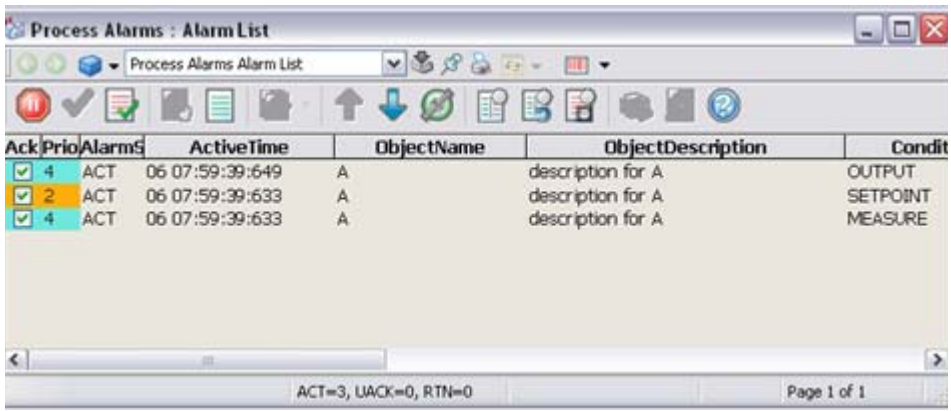


Figure 4. Alarm List Display

The user can acknowledge individual alarms, selected multiple alarms, or an entire page of alarms from the Alarm List. The run-time filter function enables the operator to filter the alarm list by any column using combined expressions.

In a graphic display, to acknowledge all the alarms for an aspect, users can click the **Acknowledge All Visible Alarms** icon on the display bar or right-click the graphic display and select **Acknowledge All Visible Alarms** from the context menu.

Alarm statuses for the alarm list such as number of active alarms, number of unacknowledged alarms etc. can be found at the bottom of the list.

The colors and blinking of alarms are configurable. It is also possible to define what columns to present, the time format, and the sorting order of the list.

The user can use the Hiding function to clear irrelevant alarms from the Alarm List. Irrelevant alarms are the ones which do not require an action from the operator. The user can thus choose to hide such alarms.

Alarm shelving allows the operators to temporarily remove standing or nuisance alarms from the main alarm list and places it on the shelve list.

Alarm Shelving is a license-protected function.

The users can use the Shelving function to shelve nuisance alarms for a specified time. A shelved alarm does not reappear on the main list until it is removed from the shelf. There are two modes available to shelve an alarm:

- Standard shelving (Manual).
- One-shot shelving.

Alarm Analysis

The Alarm Analysis function is an effective alarm management function that allows the operators to monitor the quality of the alarm system and help analyze problems in the alarm system.

The Alarm Analysis function is a license-protected function that is installed as part of Compact HMI 800.

The key feature of the Alarm Analysis function is the easy and precise configuration. By pointing to an Alarm & Event list, the Alarm Analysis function calculates the KPIs accurately for this list without the need to setup complex and error-prone filter configurations. The graphic elements display the values of the KPIs provided by the Alarm Analysis functions.

Key Performance Indicators

- Top 20 alarms
- Number of alarms over time
- Top 20 Longest in alarm
- Alarm Priority distribution
- Number of standing alarms over time
- Disabled / Inhibited / Shelved / Hidden alarms
- Alarm Performance Benchmark

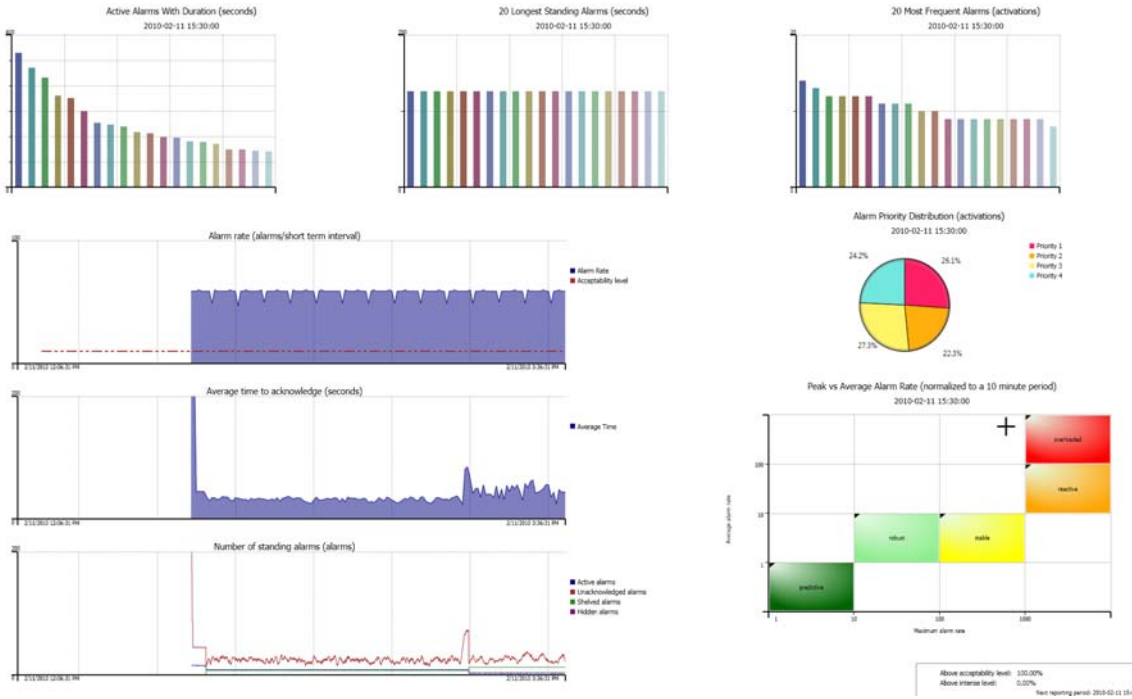


Figure 5. Key Performance Indicators

Trend Logs

The ability to store, view, and retrieve process data and historical information is an integral function of the system. To accomplish this, the system provides scalable options to satisfy the information needs of all levels of users, including process operators, engineers, maintenance personnel, and operations managers.

The data storage capabilities in the Base System are:

- Event storage (up to 50,000 events)
- Trend data storage (up to 2,000 logs)

Security

The foundation for Compact HMI 800 user administration is the Windows user administration. A user is registered in Windows, and can belong to one or more groups. The user group can be freely selected, but it may simplify user administration if the user groups correspond to the Industrial IT user groups.

Roles will control what is visible to a certain user group (here Industrial IT user groups apply). For example, Controller limits in the faceplate can be made invisible for an operator.

Operations or actions in the system can be assigned different required permissions. This assignment defines what permission a user needs to have in order to perform the operation or action. Examples of permissions are: Read, Configure and Operate. As an example; to configure the permission for a user to be allowed to execute a setpoint change, the user need to have Operate permission. The system supports that each attribute of a control object can have a different permission assigned, so that access rights can be differentiated down to a particular operation on an object.

In the finest granularity, the above-mentioned functionality gives the administrator the possibility to define exactly who can do what and from where. The functionality can be applied to each aspect in the system at the same time in order to provide basic security with minimum configuration.

The user groups are assigned different permissions relative to substructures down to an individual object. This supports the concept of users/ user groups having different authority for different areas of the system. Authority is set at an Aspect Object in an arbitrarily selected structure, such as the functional structure. All sub-ordinate objects inherit this authority. It is also possible to set authority explicitly for any single Aspect Object.

Default configurations of security are available to reduce the system configuration work.

User log-over

User log-over provides the ability to temporarily change users without a complete Windows logon/logoff sequence. This makes it much faster, for example, for another user to log in to perform tasks which require a higher authority level without logging off the current user.

Clock synchronization of Workplaces

The system supports a system-wide time synchronization of all nodes handling time related data. The AfwTime Service is used to synchronize the time on the server and client nodes defined in a system. This service is also used to change the current time in the system.

The Time Service has two components, a Time Server and a Time Client:

The Time Server component is the administrator of the clock synchronization. It receives and distributes the clock synchronization telegrams to/from other nodes.

A Time Client is responsible for keeping the date and time in its node updated and synchronized with the global time broadcast from the Time Server. It is also responsible for allowing or disallowing manual setting of date and time, according to how it is configured. A Time Client resides in all Compact HMI 800 nodes.

Daylight Savings Time is supported and handled as a presentation issue. The system time, the event detection, and the storage of events are done in universal time (UTC) in order to keep track of the correct sequences and across any time changes.

Windows Backup and Restore

Before backing up the system application data, the Windows system must be fully backed up. This can be performed with for example Symantec Ghost™ software or or Windows backup. The backup should include the system and all used system extensions.

In case of a hard drive failure you use the full Windows backup and the Windows Backup tool to restore the system to the same state as it was before the hard drive failure.

Compact HMI 800 Backup and Restore

The backup stores all system application and configuration data to a disk at a configurable location. It also stores service data that is not stored in the Aspect Directory.

Backups are either full or incremental. The server workplace includes a second Hard Disk and a DVD writer to support the handling of the back-up data.

The Backup Restore function makes it possible to make an on-line backup of a node and perform an off-line restore to any node. Backups are always made on a running system. They can be started manually or scheduled.

The Maintenance Structure contains the backup definitions as well as backups which have been executed.

The restore recreates a system equivalent to the original after a computer failure. It is also a recommended way to transfer data between one version of the system to another during an upgrade.

The Backup function is also used to create a complete System Configuration Version with an identity.

Export and Import of Application Data

The Import/Export tool is an instrument for storage and distribution of objects and aspects. An object and aspect structure can be saved and then imported into the same or another part of the structure. Data from the system, in the form of objects and aspects, can be imported and exported into archive files.

The system enforces that exported data contain all necessary data to fully restore the functionality of the exported objects. Data that the object function is dependent on will automatically be included, even if they belong to other objects or even other structures.

PLC Connect

PLC Connect provides an integration of PLC-controllers into the Compact HMI 800. This function makes it possible to access PLC based control functionality.

PLC Connect acts as an integrated controller integration towards Compact HMI 800. As a result, integration into the Industrial IT concept is achieved. PLC Connect thus makes it possible to configure the Compact HMI 800 as a hybrid PLC system.

PLC Connect adds traditional PLC type functionality as an integrated part of the Industrial IT concept. This means that traditional system capabilities, typically requiring a large number of process I/O:s to be connected through a range of controllers from different manufacturers, can be realized with a Compact HMI 800.

PLC Connect provides the following features:

- Basic object types for PLC type signals and softpoint signals.
- Configuration tools for creating and editing PLC type objects.
- A full set of faceplates for the PLC type objects.
- Integrated Real Time Database (RTDB) to keep an updated image of connected process points as well as calculated softpoints.
- Communication drivers.
- Dial Manager for remote communication.
- Alarms detection and OPC Alarms and Events generation for PLC binary signals.
- Alarm limit detection and OPC Alarms and Events generation for PLC integer and real signals.
- Open interface to PLC signals and softpoints from application programs in VB and C++.

PLC Connect is typically used in the following cases:

- For integration of AC800M/C Industrial IT Baseline 2 controllers when full DCS controller integration is not required.
- When remote connection of PLCs and RTUs are required.

Basic Computer Monitoring

Basic Computer Monitoring, after being installed and configured, automatically monitors all Base System workstation nodes and alerts the operator to potential workstation resource problems via alarm messages.

When a workstation goes into a low resource state an alarm appears on the Alarm and Event list. This list indicates which workstation has a problem of type Resource Alarm.

System Options

FDA 21 CFR Part 11 Support

The US Food and Drug Administration (FDA) issued 21 CFR Part 11 in response to the pharmaceutical industry's request to utilize paperless record systems under the current good manufacturing practice (cGMP) regulations in parts 210 and 211 (21 CFR parts 210 and 211). Part 11 went into effect on August 20, 1997. The regulation does not require a manufacturer to maintain records electronically. However it does provide the criteria under which the FDA will consider electronic records to be equivalent to paper records.

The support of compliance to 21 CFR Part 11 is an absolute, non-negotiable requirement for automation products sold into manufacturing environments subject to FDA regulation. This is primarily a concern for manufacturers in the life science industry, but can also include food, beverage, and cosmetics manufacturers as well. Also some chemical and other manufactures who supply materials to the life science industry are required to comply with the regulation.

The requirements for Compact HMI 800 to enable compliance have been categorized in the following table. Several requirements identified in 21 CFR Part 11 require the system owner to comply by having appropriate Standard Operating Procedures (SOPs) in place. Not all of the required SOPs are included with Compact HMI 800 product offering, however ABB engineering services for validation can provide assistance in creating the appropriate documentation on a project basis. The primary sections from Part 11 are listed below.

Subpart B – Electronic Records

Sec 11.10 – Controls for closed systems

Sec 11.30 – Controls for open systems

Sec 11.50 – Signature manifestations

Sec 11.70 – Signature/record linking

Subpart C – Electronic Signatures

Sec 11.100 – General requirements

Sec 11.200 – Electronic signature components and controls

Sec 11.300 – Controls for identification codes/passwords

Table 3. Feature Categories

Feature Category	Section references from 21 CFR Part 11 Regulation
Authorization	SubPart B, Sec 11.10: (g)
Access Control	SubPart B, Sec 11.10: (d)
Electronic Signature	SubPart B, Sec 11.50: (a) Subpart B, Sec 11.70 Subpart C, Sec 11.100: (a) Subpart C, Sec 11.200: (a),(1), (i), (ii), (3) Subpart C, Sec 11.300: (a), (b), (d)
Audit Trail	SubPart B, Sec 11.10: (a), (e) SubPart B, Sec 11.50: (a), (b)
System Checks	SubPart B, Sec 11.10: (f), (h)

Authorization - User Re-authentication and Double Authentication

Re-authentication can be optionally used for critical operations such as writes to the control system and configuration changes in order to ensure that only authorized persons can take actions in the Compact HMI 800. This option forces the user to re-supply his/her user credentials before the operation is executed. A double authentication may also be optionally used. In this case an additional person who has the respective secondary authentication authority has to give username and password in order to approve the operation.

Electronic Signature - Digital Signature

Electronic signatures are supported as a Digital signature for all aspects of objects. A digital signature is generated and linked to an aspect. User verification via electronic method is performed by using Windows user id and password in combination with a selected reason for signature and an optional comment.

Audit Trail

The security concepts in the system allows audit of operator actions and security. The system supports logging of security violations, configuration changes, and operator actions to the process.

The audit logs can be viewed in the alarm and event list, providing the possibility to see the effect of an operation. The audit log contains the following information:

- date and time for the operation.
- node from which the operation was performed.
- user name of the individual performing the operation.
- type of operation.
- object, property or aspect affected by the operation.
- additional information from the involved aspect system.

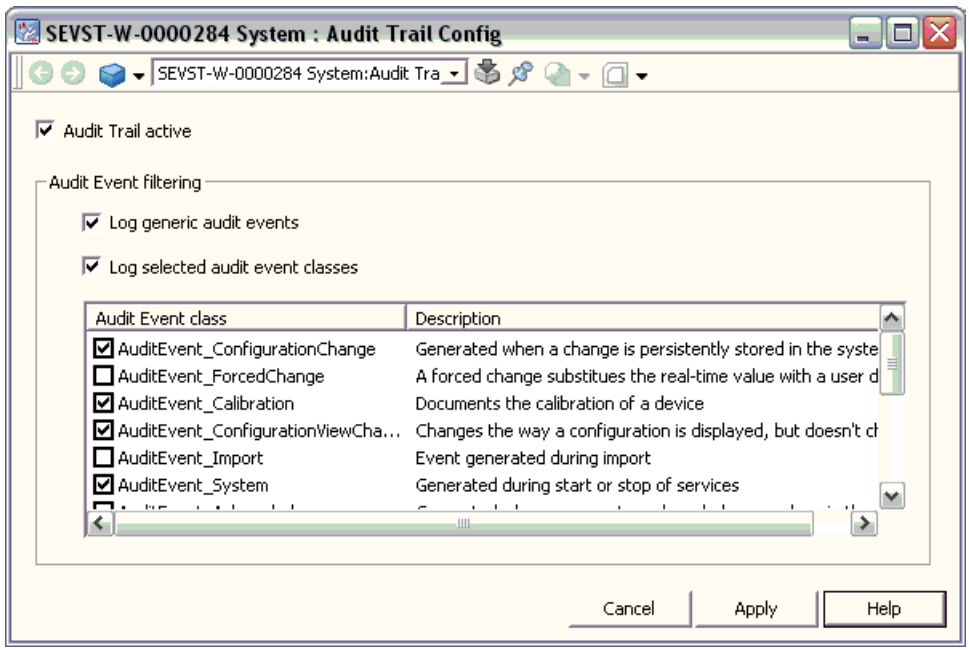
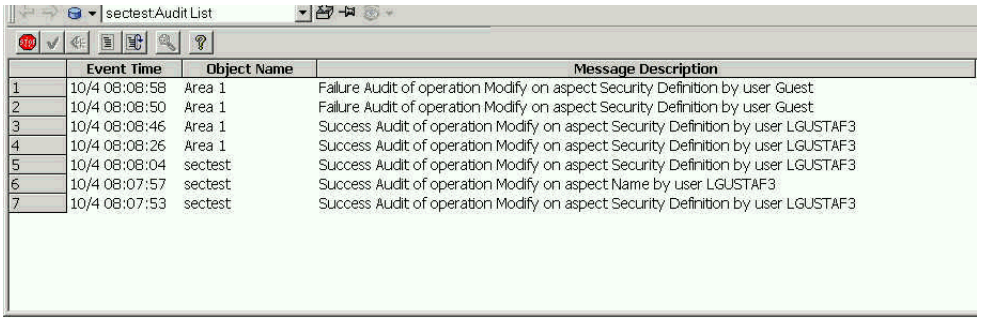


Figure 6. Audit Trail Configuration

The audit log is protected against modifications if the Aspect Servers via Windows login are configured with access restrictions.

As a complement to the audit logging available in the Windows system, the security and access control system in the Compact HMI 800 allows audit of more process control-specific activities.

The audit event list is user configurable to either show more information, or to filter out specific events from the complete event list.



	Event Time	Object Name	Message Description
1	10/4 08:08:58	Area 1	Failure Audit of operation Modify on aspect Security Definition by user Guest
2	10/4 08:08:50	Area 1	Failure Audit of operation Modify on aspect Security Definition by user Guest
3	10/4 08:08:46	Area 1	Success Audit of operation Modify on aspect Security Definition by user LGUSTAF3
4	10/4 08:08:26	Area 1	Success Audit of operation Modify on aspect Security Definition by user LGUSTAF3
5	10/4 08:08:04	sectest	Success Audit of operation Modify on aspect Security Definition by user LGUSTAF3
6	10/4 08:07:57	sectest	Success Audit of operation Modify on aspect Name by user LGUSTAF3
7	10/4 08:07:53	sectest	Success Audit of operation Modify on aspect Security Definition by user LGUSTAF3

Figure 7. An Example of an Audit List

The audit list is stored on disc. The size of the storage is configurable.

SMS and e-mail Messaging

SMS and e-mail Messaging provides a method for sending messages based on alarm and event information to user devices such as mobile telephones, e-mail accounts, and pagers. It is possible to control sending messages by configuring a message schedule for each user. The message schedule allows one active paging time interval for each day of the week.

Figure 8 shows and Table 4 lists the three methods SMS and e-mail Messaging employs to notify users of alarm and event information. The table also lists the devices that are compatible with each notification method, and which devices, using the SMS/GSM notification method, allow the user to confirm receipt of the message back to the Compact HMI 800.

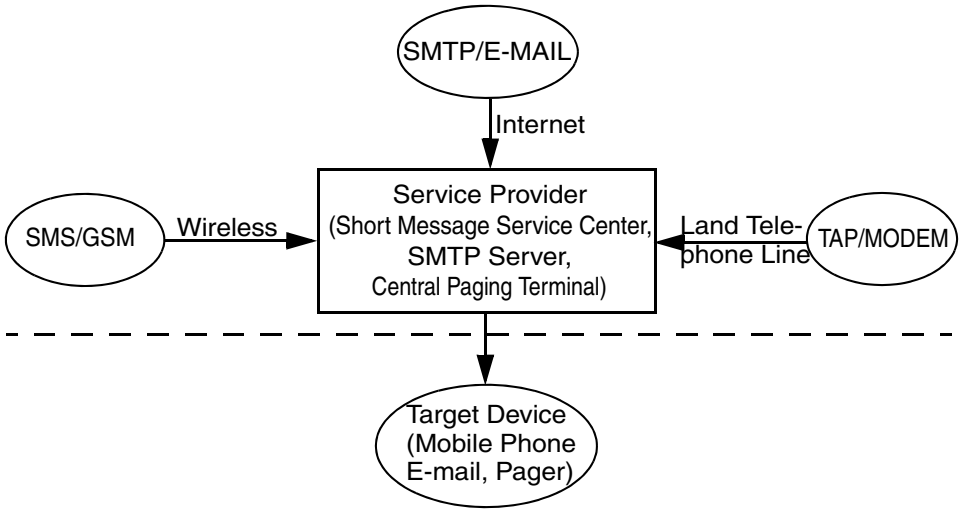


Figure 8. SMS and e-mail Messaging Notification Methods

Table 4. Notification Methods

Device(1)	Notification Method		
	SMTP/ E-mail	TAP/ Modem	SMS/GSM
Numeric Pager	—	—	—
Alphanumeric Pager	Notify	Notify	Notify
2-Way Pager - Fixed Reply	Notify	Notify	Notify
2-Way Pager - User Entered Reply	Notify	Notify	Notify/Confirm Receipt
2-Way GSM Pager	Notify	Notify	Notify/Confirm Receipt
Text Messaging Enabled Telephone	Notify	Notify	Notify/Confirm Receipt
Wireless Equipped PDA	Notify	Notify	Notify/Confirm Receipt
E-mail	Notify		Notify/Confirm Receipt

(1) This table lists the capabilities of SMS and e-mail Messaging. The selected hardware and/or service provider may impose other limiting factors.

The notification methods work as follows:

- SMS (Short Message Service)/GSM (Global System for Mobile Communication) is used to send messages based on alarm and event information to the GSM service provider's SMS Center (SMSC) over a wireless network. The SMSC sends the message to compatible devices of users configured to receive them. This method allows users of the compatible devices to confirm receipt of the message.
- SMTP (Simple Mail Transfer Protocol)/E-mail is used to send messages based on alarm and event information to an SMTP server over the Internet. The SMTP server sends the message to e-mail accounts, or to compatible devices via e-mail accounts, of users configured to receive them.
- TAP (Telocator Alphanumeric Protocol)/Modem is used to send messages based on alarm and event information to the pager service provider's CPT (Central Paging Terminal) over a land telephone line. The CPT sends the message to compatible devices of users configured to receive them.

Calculation Engine

Calculations can be performed on any object or value in the system and are supported by Visual Basic scripting language. The Calculations Services provide the ability to run mathematical calculations on any available Compact HMI 800 aspect property or attribute. This includes a special set of aspect objects called Softpoints, see SoftPoint Server on page 41. Calculations may also be applied to system object types. This allows configuration re-use of calculations. Calculation operations can be triggered by changes to system point values, or can be scheduled to execute either cyclically or at a given date and time. A calculation aspect may be applied to any Aspect Object such as a unit, vessel, pump, or softpoint. Inputs can be any Aspect Object property, and outputs can be any changeable point in the system. Data quality and alarm generation are supported.

SoftPoint Server

SoftPoint services makes it possible to create and configure user defined object types, and deploy them like any other object in the base system. A softpoint is different from other system points because it is not directly connected to hardware system I/O. Softpoints execute on an application or Connectivity Server. Once configured, the softpoints is managed and accessed just as any other point in the system. Softpoint values may be stored in system history and displayed for operations. Reporting functions (such as Excel) may access softpoints for presentation in reports. In addition, softpoints can be displayed on Desktop Trends. Softpoint alarms can be configured and are directly integrated with minimum/maximum, limits and a unit descriptor. Data types supported are: Boolean, integer (32 bit), single precision floating point (32 bit) and string. Also, double precision floating point (64 bit) is supported as an extended data type.

Report Services

Reporting capabilities include the ability to schedule reports to execute cyclically, at specified times (e.g. the last Friday of the month), at a single time, and on event. Support for tools such as Excel is provided. In addition to reports, the integrated scheduler can be used to schedule other system operations.

Report scheduling capabilities include:

- Cyclic, event, and time based scheduling.
- Handling of finished reports, including e-mail, saving to file (and managing a number of instances of that report), saving to history, and printing.
- Display to view status of reports scheduled.

Multisystem Integration configuration

The Compact HMI 800 is based on the same technology as system 800xA which is a DCS system from ABB. This technology allows these systems to be combined in a seamless fashion where all information normally used for operation in the compact HMI system can be made available in an 800xA through the Multisystem Integration function.

Multisystem Integration (MI) allows the viewing and operating of objects configured in one system (provider Compact HMI 800) from another system (subscriber 800xA).

This makes it possible for geographically separated systems with local control rooms to be controlled from a common control room. MI enables sectioning of a multiline process to increase integrity and simplify maintenance.

Section 4 Operations

Overview

The Operator Workplace function is built on the 800xA technology and is the Compact HMI 800 operator interface.

The key functions provided are: presentation of process graphics, execution of process faceplates, presentation of trends, and alarms.

Operator Workplace Client

The Operator Workplace provides efficient control and supervision of different kinds of processes in integrated systems. The Operator Workplace can be used on both on the client and on the server.

Operator Workplace functional overview:

- Graphic displays
- Faceplates for process objects.
- Alarm and Event management and presentation.
- Trend data, including short trend presentation.
- Reports - Excel based reporting (scheduled and on demand).
- System Status Viewer.

The Operator Workplace provides a number of configurable options that allow a user to tailor the workplace to suit their needs, be they an operator, an engineer, a maintenance technician, a manager supervisor or a system administrator.

Layout options

The workplace is subdivided into 3 main areas (see Figure 9):

- An application bar area.
- A graphic display area.
- A status area. (Not configured as default).

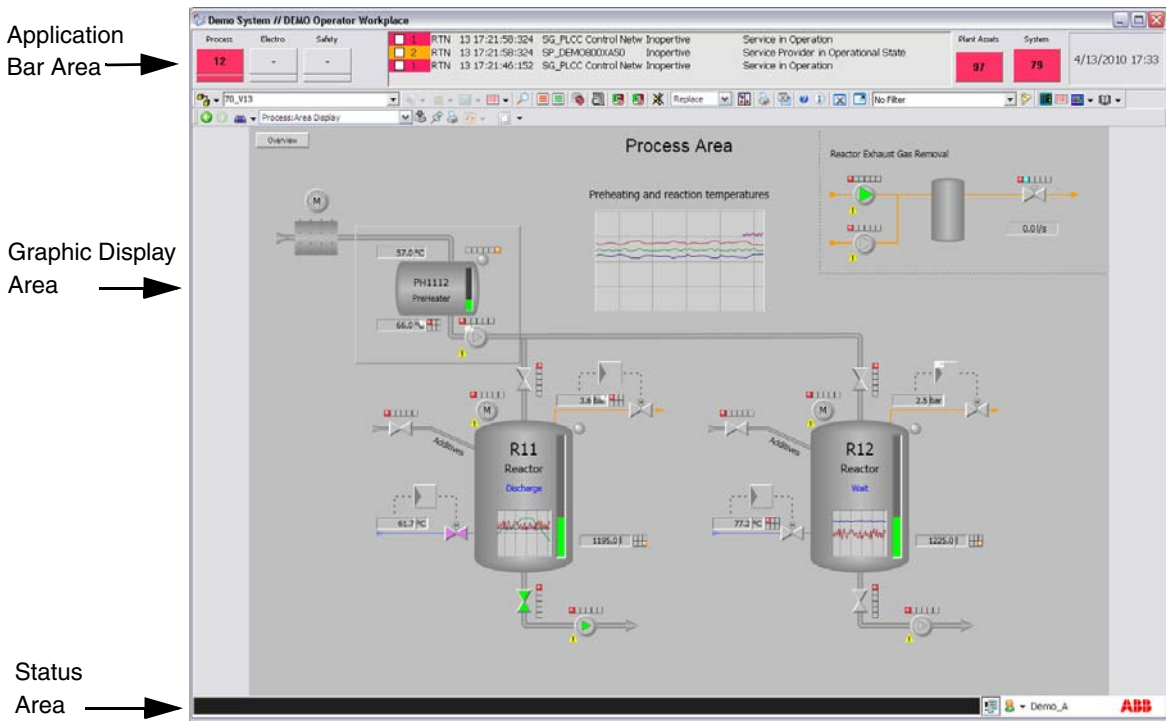


Figure 9. Operator Workplace layout

The application bar area, located at the top of the screen, is divided into two parts – a fixed display part and a tools collection part. Both parts are fully configurable.

Examples of information in the fixed display part are Alarm Group Bar, Alarm List, Clock, company logo (“any bitmap”), and User Login Name.

Examples of information in the tools collection part are short cuts to alarm and event lists, shortcuts to display graphics, Help, Silence external alarm, user favorites.

The graphic display area, located between the application bar and status areas, is available to display any aspect. The aspects available for selection are determined by the user role and user security defined for the user currently logged in to the PC. Depending on the aspect view class setting, the aspect can be displayed to fully consume the area or it can be displayed as an overlap in front of the graphic display area. User roles can be configured such that one class of user cannot move an overlap in front of the application bar or status area (e.g., an operator) while another user can (e.g., an engineer).

The status area, located at the bottom of the screen, is configurable and may include the following information, User Login Name, Operator Message Line, Operator Link Message Line, Alarm List, Event List, Clock.

Faceplates

Faceplates are designed mainly for operator use, to monitor and affect control of a process. Each object can have up to three different sized faceplates, depending on the needs of the object and the user (see Figure 10.)

The Operator Workplace provides a flexible faceplate framework, making the creation and the customization of the product-supplied faceplates straightforward and intuitive. The faceplate framework is composed of five main areas.

At the top of the faceplate is the header area. This includes the object name and description, as well as alarm state indication, acknowledgement button, and object in-use (or locked) indication.

Below the header area is the status area. This includes object state indication (e.g., manual mode) and link buttons to other aspects (e.g., operator note).

At the bottom of the faceplate are the faceplate size selection buttons (for reduced, normal, and expanded size faceplates). Above the faceplate size selection buttons is the control button area. The configuration of the status and button areas is done through simple fill-in-the blanks configuration and provides the ability to link in button and status indicators.

Between the status and button area is a faceplate element area. This is a free-form graphic that is configured in the same way as any process graphic.

By pressing F1 when a faceplate is selected, on-line help is invoked for that faceplate.

When there is a faceplate on the screen and another is selected, the normal behavior is to replace the first faceplate. There is however possible to configure the Operator Workplace to be able to show several faceplates at the same time. This may be done resulting in two different behaviors.

- All faceplates that are brought up are displayed separately. Each faceplate needs to be removed separately. The maximum number of simultaneous faceplates is configurable and the default number is five.
- Faceplates contains a pin-button in the lower right corner. If the button is pressed that faceplate is pinned and remains on the screen. If the faceplate is not pinned, it is replaced by the next faceplate that is brought up.

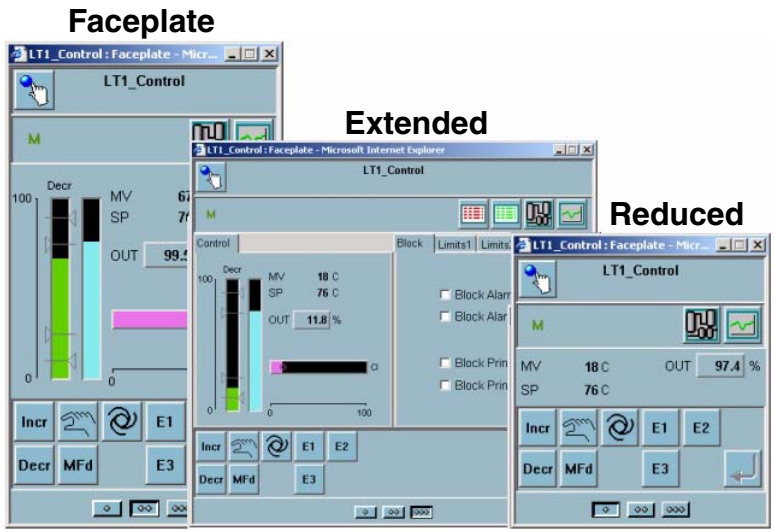


Figure 10. Faceplates

Display Call-up

The Operator Workplace supports the ability to provide different aspect view behaviors depending on the type of aspect view being displayed. The following aspect view behaviors are available:

- Initial call-up at cursor.
- Initial call-up at an offset relative the cursor.
- Initial call-up at a pre-defined X-Y coordinate.
- Stacking Order to determine which displays are in front of other displays.
- Height and Width of a Screen on initial call-up.
- Whether the screen is fixed in size or can be re-sized.
- Whether the screen can be pinned to prevent a user from closing it accidentally.
- Dedicated screen areas for alarm management functions, such as event/alarm bars.

- Dedicated screen areas for menus and tool bars.
- Pre-assigned direct access to user, object, and system related actions.
- Number of views/windows per workspace.

Users can also control the screen behavior to preserve a display, such that a new display call-up overlaps the existing one (thereby preserving the existing display), or to replace a display, such that a new display call-up replaces the existing one.

Navigation

The Operator Workplace supports the ability to right-click on any object to view and select available actions or display call-ups from a context menu. For a given user, the context menu is the same, no matter where the object is displayed.
The configuration of an object automatically defines the possible selections available in the context menu. The context menu is possible to filter based upon the user log-in, such that an engineer might have access to certain actions that are configuration-related, while an operator would not have access to them. The context menu also contains a reference list of other graphics or displays in which the same object is used, allowing the user to quickly navigate to them. This reference list is provided automatically without requiring the user to do any manual mapping.

Within the tool collection of the application bar, a number of navigational buttons and pull down menus are available to provide quick access to displays and information. Object and aspect history lists as well as back and forward buttons allow an operator to view and recall past selections quickly. Associated displays of a selected object or aspect can be quickly called up using short cut buttons that are automatically enabled when the object or aspect is selected.

The Operator Workplace also supports the ability to access any display from any other display through one, or at most, two mouse clicks. To manage this, the user can define the displays to which quick access is needed in the same way that favorites are added when using Internet Explorer. The user can add displays to folders as user specific favorites. The user can also add folders to help classify the displays by function, by area, or by the plant structures.

Tabbed Workplace

Tabbed Workplace allows the user to navigate between graphic displays using buttons, tabs, and drop-down lists. Tabbed Workplace is used for easy navigation

and responsiveness to alarms and events. A Tabbed Workplace is created by copying predefined Tabbed Workplace, located in the Workplace Structure. This workplace includes a breadcrumb list and status indicators for each tab. The breadcrumb list shows the object path, starting from the currently displayed object back to the root object, see Figure 11. The breadcrumbs show where the operator has navigated and allows for quick navigation to the immediate parent or to the overview display.

The Status Indicators include an Alarm Indicator and a Status Indicator, see Figure 11. The Alarm Indicator shows the alarm severity. These indicators guide the user through the object hierarchy to locate the display that contains the alarm. This saves engineering time for navigation configuration.

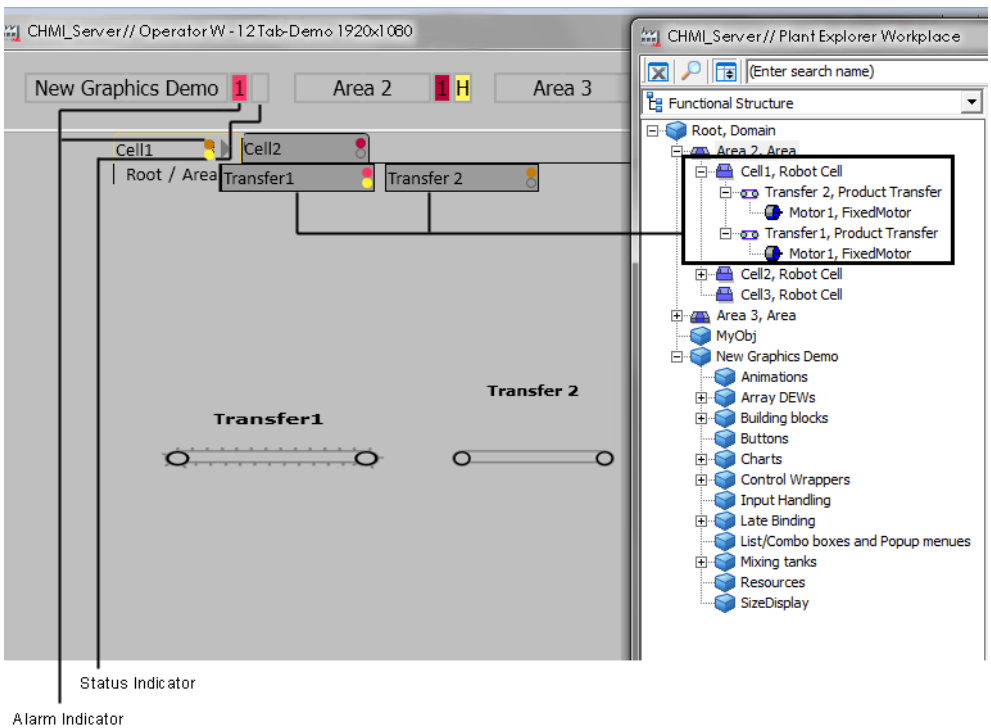


Figure 11. Tabbed Workplace (With the Drop-down and Status Indicators)

Hot Keys

The Operator Workplace provides the ability to map key strokes (e.g. F4 key) or key stroke combinations (e.g. Alt-F4) to perform an action available to a selected object such as Alarm Acknowledge or Call-up a Process Graphic. The mapping of the keystrokes is user-configurable. The Operator Workplace will include default mappings for key actions such as Alarm Acknowledgement.

Hot Key support makes it possible for customers to use prepared configuration menus and in an easy way set up global operations (independent of workplace, display, or selected object) and object sensitive operations.

Alarm List

The Alarm List displays all events matching the configured alarm filter. All, or a subset of an event's attributes, along with the current value for that objects can be displayed. Viewing the alarms is very flexible. Use the default sort order or adjust the sorting by double clicking on the headers. Adjust the layout by drag & drop columns to suit your needs. Return to the default layout by just clicking on the reset button.

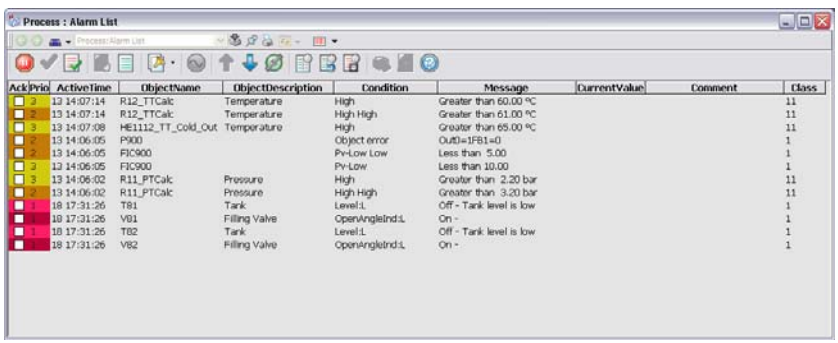


Figure 12. Alarm List

Acknowledge of individual alarms, selected multiple alarms, or an entire page of alarms can be performed from the Alarm List.

The colors and blinking of alarms are configurable. It is also possible to define what columns to present, the time format, and the sorting order of the list.

If an alarm is irrelevant it should not be shown in an alarm list. An alarm is irrelevant if it does not require an action from the operator. A function called hiding will help the operator to clear the alarm lists from irrelevant alarms.

Event List

The Event List displays all events matching the configured event filter. The event list functionality is the same as for the alarm list, except for the acknowledge feature.

Trend Display

Trend displays are some of the most important tools associated with operating and analyzing industrial processes. The Operator Workplace addresses this need by presenting the operator with an extensive set of trending features and functions.

The Trend display can present data seamlessly from both run-time and historical data. When a trend display for an object is selected all available data is shown. This also means that the user can move the time range back and forth without worrying about where data is coming from. The user can also use the time-offset function to trace a signal in real time and compare it with values from yesterday.

Figure 13. Trend Display

The Trend Display can hold a number of trend traces and the user can trend any attribute. Thus it is possible to trend both the value and the alarm limits for several objects in the same Trend Display. With one click the user can hide or show traces and browse for new objects.

It is also possible to present trend relationship between two values as X/Y plots. The plot may be presented on a background display for example a JPEG picture. Two such displays can be dynamically selected.

Functionality for rulers, time zooming, magnifying glass etc. are available.

Operator Workplace - Remote Client

The remote client concept enables remote access to Compact HMI 800 from a standard workstation, which does not have an ABB-specific software installed.

The remote client provides operation capabilities and access to historical information. Configuration capabilities are limited on the remote client. The same

security concept utilized for a rich client will be used for the remote client, making it possible to define those actions that are permitted from a remote client.

The remote clients adhere to the access control concept generally supported by Operator Workplace clients.

The following functions are remote client enabled:

- Plant Explorer navigation.
- Operation graphics, alarm and event, trend, history logging, system status, and faceplates.

The recommended solution to implement remote clients is Microsoft Terminal Server (available as option to Windows Server 2008).

To get the Remote Client Server functionality, the Windows Terminal Services must be enabled. For information about the related licenses, please refer to the Microsoft website (www.microsoft.com).

The Terminal Service concept also enables connections over, for example, a Virtual Private Network (VPN) spanning the internet. It is also possible for use with rather low bandwidth channels, like ISDN or dial-up lines.

Section 5 Engineering

Overview

The major goal for the Compact HMI 800 Engineering suite is to provide maximum engineering performance. To reach this goal, a suite of tools are offered. All tools are integrated and support the Aspect Objects architecture. The tools scale from simple standards-based control configuration tools to software development kits, which enable the use of custom tools to gain performance.

The tools can be applied throughout the plant lifecycle from the design phase into the operation phase maximizing the performance in design and maintenance.

Standard Engineering Tools are to be used by application engineers and maintenance engineers implementing and servicing the control configuration.

Engineering Workplace

The set of Standard Engineering Tool is called Engineering Workplace. It consists of the following features:

- Engineering Platform including Bulk Data Manager.
- Graphics Builder.

The Engineering Workplace functionality is available on the Server Workplace.

Engineering Platform including Bulk Data Manager

The Engineering Platform offers the following functionality.

- Use of a powerful designation handling with self adapting designations

- Create and maintain your documentation by the integrated *Document Manager*. The data reference function of Document Manager enables actual data from other applications or actual values of central parameters in all Word, Excel, and AutoCAD documents. Different versions of documents can be stored. Document packages can be created.
- Efficiently manage, view, report and store common plant parameters with the integrated *Parameter Manager*

Bulk Data Manager

The ability to efficiently manage large amounts of data is a crucial part of any automation system. The Compact HMI 800 meets these requirements through a tight integration with Microsoft® Excel. By using a series of Excel add-ins, the bulk data management features couple the full productivity benefits of Microsoft Excel with Compact HMI 800.

The basic bulk data management functionality allows users to configure a worksheet to read and write aspect and object properties, supporting an iterative analysis and design process. In addition, the bulk data management features allow the import and assignment of external data such as signal lists or documents. System data can be exported at any time to simplify data validation and modification. The track changes function provides the ability to compare two sets of data in order to identify changes. This function allows users to check for and introduce changes in a controlled manner.

Graphics Builder

Graphics Builder (Figure 14) is a tool that enables configuration of graphic aspects (graphic displays, graphic elements and faceplate elements for example). Graphics Builder provides several features for configuring graphic aspects, and writing expressions. The configuration of graphic displays of graphic elements does not require programmer skills since it is very intuitive and easy to learn. The following features are specific to the Graphics Builder.

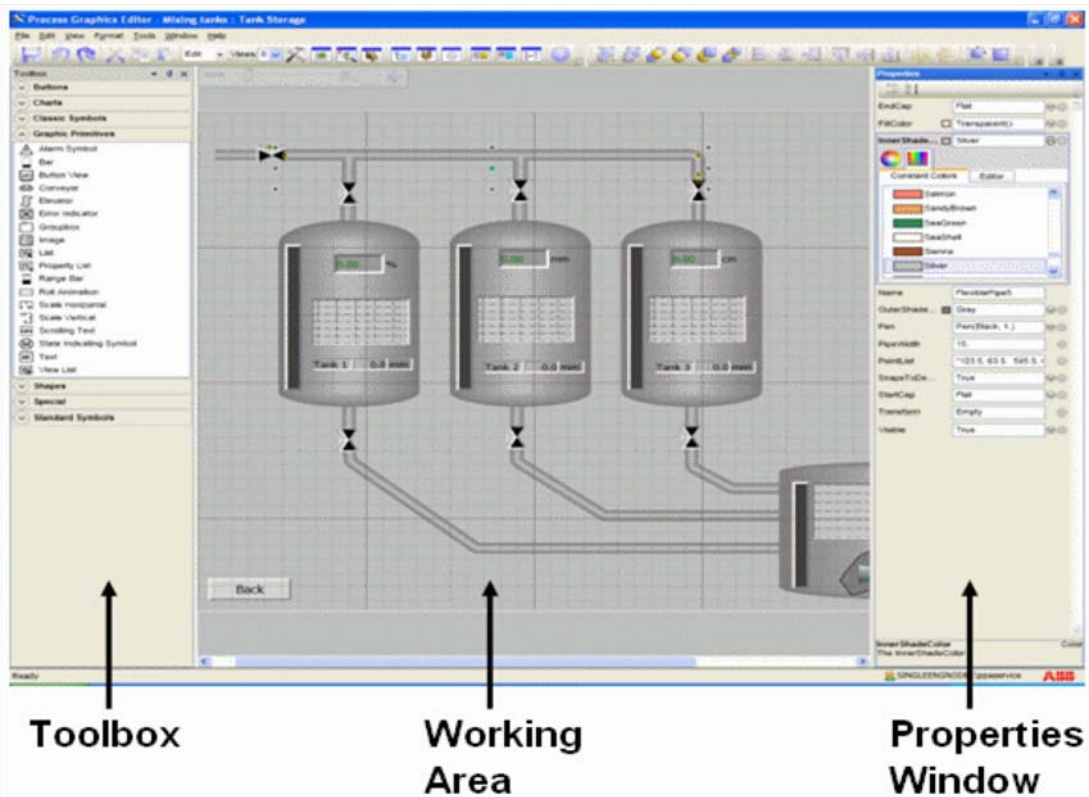


Figure 14. Graphics Builder

- Expression Builder that allows you to assign expressions (that is, to specify subscriptions and specify the relationship between the process data and the data that is to be displayed).
- Graphic Libraries dialog which allows you to add Primitives and Sub-elements to your toolbox.
- Element Browser in which you can select to include appropriate graphic elements.

- Design and Test function that enables you to build graphic aspects in design mode and then check their behavior in test mode. Included is also a test data provider.
- Solution library where user-defined graphic solutions can be stored (using drag and drop) for reuse.
- Help function that offers you access to Online Help.
- Functions that allows you to add properties, methods, and events to a graphic element.
- The finding and replacement of references enables the efficient copying and modification of graphics.

Section 6 Communication Network

This section describes the Compact HMI 800 network architecture. Different network security measures that should be considered when an Compact HMI 800 is connected to external networks of different kinds are also presented.

The Industrial IT Network Architecture

Overview

The Compact HMI 800 network architecture is illustrated conceptually in Figure 15:

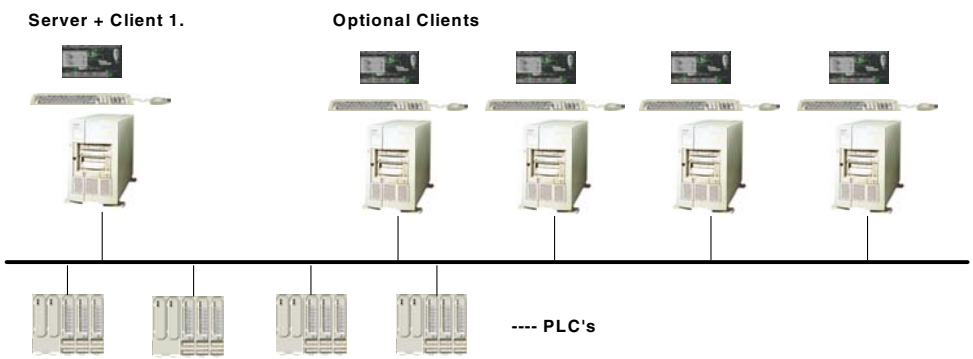


Figure 15. Conceptual communication network configuration

The *Compact HMI 800 network* is used for communication between *workplaces, servers* and *PLCs*. It is a local area network (LAN) that is optimized for high performance and reliable real-time communication with predictable response. Servers run software that provides system functions.

Workplaces run software that provides various forms of user interaction. Controllers are nodes that run control software.

The automation system network can be connected to a *plant network*, such as an office or a corporate network, via some form of network isolation device. The nature of this device depends on the nature of the plant network and the level of security that is required for the automation system – it may actually be a set of interconnected computers and devices that cooperate to provide the level of security required in a particular installation. Compact HMI 800 is pre-loaded using a workgroup configuration. Connection to a plant network requires a reconfiguration.

A redundant network is continuously being monitored by the RNRP protocol. All network events, including configuration errors, are reported to the user.

Further connection of the plant network to the Internet or any other type of external network should be performed in accordance with adequate network security practices.

Third party PLCs using other communication standards and protocols may also be connected. The Compact HMI 800 has been tested with a number of different protocols.

Note that for performance and integrity reasons, direct connection to an automation system network or systems not based on Industrial IT should be avoided.

The automation system network is based on TCP/IP over Ethernet. The routing protocol that is used is RNRP (Redundant Network Routing Protocol). This protocol supports redundant network configurations based on standard network components.

Detection of a network failure and switch over to the redundant network takes less than one second, with no loss or duplication of data. A redundant network consists of two fully separate Ethernets. It works as a standard TCP/IP network, with the addition of RNRP, which works as described in the section below.

Redundant Network Routing Protocol (RNRP)

RNRP is an IPv4 routing protocol developed by ABB. It is specially designed for use in automation networks with limited topology but with high demands on network availability. The protocol has alternative paths between nodes to enable quick reaction on network failures. In Compact HMI 800 only one network is used.

RNRP handles the node and network supervision. RNRP quickly detects if a node or remote network is down. This information is used to detect if a redundant server is down and whether a new server can be connected.

Each node cyclically sends a routing vector as a multicast message. The routing vector indicates which other nodes this node can see on the network. Each node uses received routing vectors to build a table listing which nodes can be reached on which of the two networks. Routing vectors are distributed with a cycle of 1 second.

The automation system network is a private IP network. IP addresses are static, and must be selected according to a scheme defined by RNRP. Each node has two IP addresses, one on the primary network, and one on the backup network, see IP Address Use on page 66.

Advantages with the RNRP redundancy concept are that it works with standard network devices (hubs, switches or bridges), and that no special Network Interface Cards (NICs) are required.

Industrial IT Network Security Considerations

For more information see the document 3BSE032547, Industrial IT Integrated Automation System - Network Security Consideration in ABB Library.

Security

The security information in this document are provided to you for background information only. Consult your IT Network professional in order to determine your specific implementation. It is the responsibility of the end-customer to have an updated and implemented IT security policy in his process automation.

Firewall

There should always be a correctly configured dedicated firewall as the only interconnection-mechanism between the Internet and the ABB process control installation.

A firewall is a system which main purpose is to control the access to or from a protected network (for example a control network). A correctly configured and maintained firewall ensures that all communications attempting to cross from one network to the other meet an organization's security policy.

Firewalls track and control communications, deciding whether to allow, reject or encrypt communications. In addition to protecting trusted networks from the Internet, firewalls are increasingly being deployed to protect sensitive portions of local area networks and individual PCs.
The design of a firewall system should be based on the user's corporate security policy, therefore it is very important to discuss and investigate this carefully.
It should be revised on a regular basis because of the increasing number of resources and applications which are available on the Internet and local networks.
A firewall system can be a router, PC, dedicated hardware solution, workstation, one or more servers, or a mix of these, configured to protect a site or subnet from protocols and services that can be abused by hosts outside the subnet. A firewall system is usually located at a higher-level gateway, such as a site's connection to the Internet. However, firewall systems can be located at lower-level gateways to provide protection for smaller collections of servers or subnets.

As of the writing of this document the following types of firewalls exist:

- packet-filtering firewall.
- a circuit level gateway.
- an application level gateway.
- a stateful inspection firewall.

ABB suggests consulting the user's corporate IT department or consultant to determine which firewall is most appropriate for the user's installation.

Some popular firewall systems available today include:

- Checkpoint Firewall-1 (http://www.checkpoint.com/).
- Cisco PIX (http://www.cisco.com/).
- Netscreen (http://www.netscreen.com/).
- Nokia Firewall (http://www.nokia.com/securitysolutions/).

When accessing the process control system from the internet, a VPN (Virtual Private Network) must be set up through the firewall. The internet-based computer must be clean, under strict user access control, not used for other purposes and have no other connections to the Internet other than the one used for the VPN connection. The VPN should end in a VPN concentrator placed in the DMZ (Demilitarized Zone) of the firewall.

Virus Risks

It is very important that the systems are protected from viruses, trojans and other malicious software.

Do not allow running of non-authorized software on the clients or servers used for process control, or on other PCs connected to any part of the network without a firewall between the network and these other elements.

Use an updated virus scanner to regularly scan the systems for viruses. McAfee VirusScan and NetShield are possible examples. (http://www.mcafee.com/, http://www.nai.com/).

Run all external traffic through the firewall. Set up a virus-scanner for all traffic through the firewall.

Allow only authorized users to log on to the systems. Do not allow guests.

Do not allow users to run the system with an authority level that is different from that for which they have been approved.

Domains

Windows Workgroup

A Windows Workgroup is not managed on a dedicated PC. The workgroup configuration needs to be done on all PCs that belong to the workgroup. This includes handling the names and addresses of the PCs and definition of users and groups. The users and groups need to be created exactly the same way on all PCs in the workgroup and the host names are handled with a host-file that must be the same in all PCs.

There is no fixed limit for the number of nodes or number of users that can be handled within a workgroup, but systems with more than 10 PCs or 5 users are normally easier to manage in a domain.

System Servers

Any service (piece of software) can, from an architectural perspective, run on almost any server (logical piece of software) in any server node (physical PC server) in the system. To create simple configuration rules, avoid unsuitable configuration combinations, and to describe, test and verify various supported configurations, definitions for three classes of servers follow. Even though it is in some cases possible to optimize an installation by using other configurations, it is recommended the guidelines given in this section be followed.

- ***The Aspect server*** runs the "central" intelligence in the system, including the aspect directory and other services related to object management, names, security, etc. Examples of services that run on Aspect Servers are the Aspect Directory, Structure and Name Server (SNS), Cross Referencing (XRef), and File Set Distribution (FSD).
- ***The PLC Connect server*** provides access to controllers and other data sources. Several groups of connectivity servers may exist in a system, each serving one set of data sources. Examples of services that run on a connectivity server are OPC related services (DA, AE, and HDA).

Compact HMI 800 runs using Workgroups.

Server classes are deployed on *nodes*. A node is a network addressable machine (a PC). For very small installations, one single node (PC) can carry all these server categories as well as the client part(s) of the product(s).

Communication Hardware

Switches and Routers

A **Hub** is a connection device within a network segment. It is an Ethernet multiport repeater. A hub only allows one message to be transferred at a time between all of its ports. This means that there will be message collisions when more than one node transmits at the same time, just as it used to be with the old coax cables. Collisions are handled by the media access mechanisms of Ethernet, but in a network with heavy traffic the collisions decrease the data throughput and give non-deterministic response times in the network.

A **Switch** is a more sophisticated type of hub.

It filters and forwards frames based on the destination address of each frame.

A switch eliminates most of the message collisions caused by several nodes transmitting at the same time. This is basically accomplished by queueing messages per port and by allowing several point-to-point messages to be transferred simultaneously, if they go between different pairs of ports. This means that a network using switches will allow a much higher throughput than a network using hubs and it does not have the same problem with non-deterministic response times.

Switches that only store and forward ethernet packets without being accessible as nodes on the network are called **un-managed switches**.

Switches that act as a node with an IP address on the network giving access to network management information are called **managed switches**. The network management information is for example configuration data for the different ports regarding port speed and status information about number of bytes transferred, check sum errors etc. The amount of management information may differ very much between different switch types.

The actual ethernet packet switching function is often the same for managed and un-managed switches. These are some pros and cons for managed and un-managed switches:

- Un-managed switches are typically cheaper.
- Managed switches give the possibility to supervise the network better.
- Managed switches may give possibilities to control the traffic better by e.g. address based traffic filtering.
- In a small network the additional features of a managed switch may be unnecessary.
- In a large network the additional features of a managed switch may be very useful.

Network Cables

In industrial environments optical Ethernet cables are preferred.

Switches having both optical and electrical interfaces can be used between the two media types.

Within a cabinet, or within a control room where there are no unsuppressed loads or other disturbances, shielded, twisted pair cables (cat5 or cat6) can also be used.

Network Performance

The number of nodes in one control network is limited to five, due to limited routing resources in the controllers, and to the load generated from RNRP in the controllers. RNRP provides a redundancy changeover time of ca 1 s.

For larger installations, the controllers should be placed on separate Control Network areas with the connectivity servers as routers.

It is recommended to use 100 Mbit/s switched fast Ethernet communication between clients and servers. Controllers use 10Mbit/s, and should be connected via switches to 100 Mbit/s backbones.

IP Address Use

The nodes (clients, servers and controllers) in the control network should use the IP v4 private address range 172.16.x.x, or 172.20.x.x, or 172.24.x.x, or 172.28.x.x, as RNRP requires dual sequential address ranges. The sub-net mask should be 255.255.252.0.

If connection and routing to a plant network is required using an other IP address range, a router should be used in between.

Section 7 System Management

Product Installation

The Compact HMI 800 software is delivered as a DVD to be installed on a standard PC with Windows 7 or Windows Server 2008. A demo license file is included on the installation DVD.
The project specific license file needs to be downloaded and installed separately.

Updates and security related software from non-ABB companies must be downloaded and installed separately, as guided from the Automated Installation program.

Section 8 Technical Data and Performance

Compact HMI 800 Capabilities

The Compact HMI 800 is scalable both in functionality and size. This chapter defines these combinations and rules for Compact HMI 800.

Servers and Clients

Different system functions are provided by different types of nodes in a Compact HMI 800 installation. A node in this context is a computer (PC) that has a network address on the Compact HMI 800 network, used as a server, or as a client.

Basic Node Types

The basic node types are:

- **Compact HMI Server** - runs the ‘central’ intelligence in the system, including the aspect directory and other services related to object management, object names and structures, security etc. It can is in addition used as Operator- and Engineering-Workplace The Compact HMI Server is installed in one node.
- **Compact HMI Client** - runs Operator Workplace functionality, such as Graphics viewing, Alarm and event interaction, faceplates, reports, etc, up to 9 clients can be part of a compact HMI system

Compact HMI 800 Dimensioning

Signal Calculation

The server and clients are scaled based on signals.

- A **Signal** is any aspect object of the type PLC xx Signal Type, where xx defines the type of signal. Each signal represents a value that is read or written from or to a controller, PLC or other external device connected to Compact HMI 800.

Configuration Rules

Network Configuration

The maximum number of nodes (PC nodes and controllers) in one control network area is given in Table 5. The limitation is primarily due to the load generated from RNRP in the controllers in the control network. This will give a redundancy changeover time of ca 1 s.

For larger systems a split into separate Client/Server and Control networks is recommended, if needed with several control network areas (see The Industrial IT Network Architecture on page 59). The maximum number of (PC) nodes on a client/server network is stated in Table 5.

It is recommended to use 100 Mbit/s switched, fast Ethernet communication between clients and servers. Controllers use 10 Mbit/s, and should be connected via switches to 100 Mbit/s backbones.

History Logs

The history function in Compact HMI 800 is storing the data on the C-disk in the server workplace. The disc space and the number of logged items per second is limited based on server computer capacity. The following basic rules applies:

Max number of logged, time stamped values, stored per second are 500 in the server.

The amount of historical data that can be stored in the server is only limited by the disc space. The space required is calculated as shown below:

DS: discs pace required

TSV: number of Time stamped values

DS = TSV*20 Byte/value

e.g if 600.000.000 values are stored are in a server, this consumes 12 GB Disk space.

Max number of logs continuously running (primary and secondary) in a server is 2000.

The following sample calculation shows how to calculate the maximum period for which the server can store historical data:

- LS (Logged Signals): Number of signals retrieved from the controllers and stored cyclically in the server.

- CT (Cycle Time): Time between each sample in seconds.

- LT (Logged Time): The length of the history log.

LT = 600.000.000 * CT / (LS*3600*24*365) Years

Example:

LS = 500

CT = 10 min

=> LT = 600.000.000*10 / (500*60*24*365) = 22.8 Years

If 500 signals are logged every 10 minutes values can be stored for 22 Years.

Configuration Rules Summary

The following table details the limits in system and application size.

Table 5. System Configuration limits

Parameter (max numbers)	Compact HMI 800 with server based client
Signal	10000
Client nodes	9 (including server based clients)
Engineering Clients	1 (server based)
PLC Connect connectivity server	One included in the Operator Workplace Server
History logs	2000

Available Functions

The Compact HMI 800 offering is extensive and flexible. In the “System Capacity and Performance Data” section guidelines are given, such as PC requirements, capacity, limits, and technical configuration rules.

In addition to this information, some system guidelines have been stated, during verification and validation, to make the ordering easier, to avoid unsuitable combinations of options, etc.

Table 6: Available Functions

Licensed Functions	Comments
Operator Workplace Server	Must always be selected
Operator Workplace (Client)	1 license required for each running client
Engineering Workplace - Rich Client	
50, 500, 2500 signals	Some must always be selected
PLC Connect Dial-Up	Can only be combined with AC 800M
Audit Trail	
Advanced Access Control	
SMS and e-mail Messaging	
Calculation Engine	
Excel Based Reporting	Requires Operator Workplace.
Snapshot reports	
Alarm Analysis and Alarm Shelving	Requires Alarm Management additional license

System Capacity and Performance Data

PC Requirements for the Compact HMI 800

Recommended PC Performance and Capacity

Recommended performance and capacity of the PCs for different node types can be found in the Third Party HW Products Verified for Industrial IT System 800xA (3BSE046579) instruction via ABB SolutionsBank (http://solutionsbank.abb.com).

Screen Resolution

For best readability, the recommended screen resolution is 1920x1080.

Supported Operating Systems

Compact HMI 800 supports the following operating systems:

- Windows 7 for clients (Service Pack 1)
- Windows 7 and Windows Server 2008 for servers

The US English version is required for Windows 7 even if a translated version of Compact HMI 800 is used.

Supported Applications

Compact HMI 800 supports Microsoft Office 2013.

Base System

Scheduling Service

The maximum scheduling capacity is 200 simultaneous jobs per scheduling server.

Softpoint Service

The Softpoint Server can have up to 2500 softpoint objects. Each softpoint object can have up to 100 signals; however, the total number of signals cannot exceed 25,000.

CPU time for each read or write transaction is one millisecond. The Softpoint server can write 10 events per second to platform-based Aspect Objects.

Events

The disk space requirements for event storage is:

- Storage per numeric history value stored: 21 bytes
- Storage per message: 260 bytes

The Event burst capacity is shown in Table 7.

Table 7. Event Burst Capacity

Parameter	AS+CS+(AO) with server based client
Continuos alarm throughput/second	20
Event burst (events per 100ms) applied to one Controller	200
Event burst (events evenly distributed over controllers)	600 total over 3 sec.
Event burst recovery time, 1000 events evenly distributed	60 sec.

Display Call-up

Display Call-up time is the time from when the user requests a display and the display is completely updated with all values.

Table 8 shows the typical display call-up time when connected to AC 800M controller.

Table 8. Display update rate

Graphic Displays	Display Call-up Time
Graphic Display with maximum 800 OPC items (100 objects)	≤ 1 secs. [1]
Group Display with 10 faceplates	≤ 5 secs.
Faceplate	≤ 1 secs.
Extended Faceplate	≤ 2 secs.
Trend Display, at first call-up of trend with 10 variables	≤ 2 secs. typical [2]

NOTE:
1. Graphic display references are cached after the first call up which makes subsequent display call ups faster. Each display in a system is cached after the first call up which means there is no limitation in the number of cached displays. The performance figure reflects a cached display.
2. When a trend display contains OPC string values (engineering units), the call-up time will depend on the OPC server string handling configuration. With the default configuration the call-up time will typically be higher.

Calculations

Table 9. Calculations Parameters

Parameter	Description
OPC Base Rate	Rate at which input variables are updated by their respective OPC data sources. Range: 100 milliseconds to 1 hour Default: 1000 milliseconds (1 second)
Cycle Base Rate	Rate at which the Calculations Scheduler scans the list of cyclically scheduled calculations. Range: 100 milliseconds to 1 hour Default: 500 ms (1/2 second)

Table 9. Calculations Parameters (Continued)

Parameter	Description
Number of calculations that may be queued waiting to be executed	10,000 Maximum
Execution Rate	100 calculations/second, see write transaction rates specified below to determine capabilities
Number of Calculation Services	10
Write transactions/second	The Calculation server can write up to 10 values/second to process (AC 800M) objects.
Write transaction/second to softpoints	The Calculation server can write up to 100 values/second to process softpoint objects

OPC Performance

The capacity for number of OPC-items/second to an OPC Client (Compact HMI 800 OPC Client Connection) is shown in Table 10.

Table 10. Number of OPC-items/second to an OPC Client

OPC Clients (800xA OPC Client Connection)[3]	
OPC items from external subscription	1000
Externally subscribed OPC items throughput (items per sec.)	500
Maximum OPC items subject to a new or changed external subscription (one request in one group)	200

Control Network Clock Synchronization

Table 11. Control Network Clock Synchronization

Type of Clock Synchronization	Accuracy per node
High Precision SNTP	1 ms
SNTP	200 ms
CNCP (between AC 800M)	1 ms
CNCP (AC 800M to AC 800C/Advant Controller 250)	200 ms
CNCP (AC 800M to PPA)	200 ms

Section 9 Ordering and Licensing

General

One of the goals of this product guide is to help sales representatives when ordering the Compact HMI 800 and its licenses.

This section describes the price lists needed when ordering and provides ordering examples.

However, it is outside the scope of this product guide to give a complete description of all ordering procedures and tools, as well as licensing conditions for other Industrial IT products. Each sales representative is assumed to know how to use price lists, pricing and ordering tools to order.

In order to offer market-appropriate functions & features, structure and pricing, the product is divided in server and client functions. In addition the system is scaled on signals.

In addition to scaling of signals, the system is scaled based on the number of Workplace clients, to further optimize the product for a specific application. Information about signals and how to calculate them are described in Signal Calculation on page 69.

Use of the Compact HMI 800 software presupposes that a corresponding licensing is purchased. Any use of the Compact HMI 800 software requires at least one Operator Workplace Server license.

Price List Structure

The Compact HMI 800 offering is described in the Compact HMI 5.1 Price Book, 3BSE045561. It consists of a number of price lists.
See Table 12.

The price lists and the selling tools have information about purchasable items. Please refer to them for more information.

Note that multiple items in the price lists are required if you need more signals than what is given in one item.

The complete Compact HMI 800 is comprised of the following price lists:

Table 12. Compact HMI 800 Version 5.1 Price Lists

Price List Identity	Price List Name
3BSE045561	Compact HMI 800 5.1
3BSE045561	Compact HMI 800 5.1 Expansion

Information about export control conditions are given in the document 3BSE035412-510, Export Control Conditions for the System 800xA 5.1. It is available in the System 800xA Price Book.

User Documentation

The Compact HMI 800 Getting started manual is delivered together with the product other user documentation is available on the Compact HMI 800 delivery media only. After installation the documentation is available in the start menu.

Licensing

A license is required to use licensed ABB software. The SW included in Compact HMI 800 is delivered together with a license that gives the user that right to use the SW.

Software Updates

To get access to software updates the license owner needs to register as an owner of the license. Information about how to register is delivered together with the software. After registration software updates and product information is accessible on the internet.

End User Runtime Licenses

Ordering is made from the price lists and performed as described in Ordering on page 81.

Licenses, licence extension and license keys are downloaded from ABB Software Factory, using the Software Factory Web site http://softwarefactory.abb.com, by local ABB personnel, who provides the customer with the license information, or in special cases directly by the customer. An optional way to retrieve the license information is to send a license application form to the supplying delivery center.

The SoftCare support is described in Software Maintenance on page 81.

Ordering

When ordering a Compact HMI 800, use the price list and available ordering tools.

Sales Configurator Wizard for Compact HMI 800

A sales wizard for Compact HMI 800, “Wizard Compact Products 800" is available for download. The 800xA Sales configurator Wizard does not support Compact HMI 800.

Software Maintenance

Software Upgrade

Upgrade of the Compact HMI 800 5.0 SP2 or later software is performed by creating a backup of the system, saving it to a secured location and then importing the backup to the new installed version. Contact your ABB sales contact to order the Compact HMI 800 5.1 DVD.

Note: Upgrade of Compact HMI 4.1 is only available as a purchasable service.

Roll-ups and service packs

Roll-ups and service packs are installed on top of the software delivered according to the instructions included with the packages. Normally this requires a shutdown and restart of each computer.

New Software releases

New major releases of the software is delivered in new media boxes. This has to be ordered together with a license update for the new release.

Life Cycle Policy

Product versions are tied to separate price lists. This means the version delivered is controlled by which price list it was ordered from.

The software for a product version is actively maintained as long as the product version is actively sold - the version is in an active phase. When a new major version is released, the previous major version is still supported for a number of years. This means critical errors will be corrected, service packs may be planned, and Microsoft security updates will be verified. There will be no updates as to what operating system the version is running on.

After the supported period the version becomes retired. It may still be possible to do corrections to a retired product version. Such maintenance is normally charged for.

Eventually, when a product version is no longer possible to maintain, for technical and/or economical reasons, it will become obsolete.

At revisions (service packs) the replaced revision will normally go immediately into retired phase. However, this policy will not be put in place until it is possible to upgrade to the next revision without shutting down the system.

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