Symphony Plus / Melody
Total plant automation for the power and water industries
Introducing Symphony Plus – Total plant automation for the power and water industries

Symphony™ Melody is a powerful combination of ABB’s unrivaled expertise and world-class products in power and automation. This well-proven automation system is widely used for demanding applications in many industries including power generation, chemical, petrochemical, food and beverage, and water and wastewater.

Over the past 30 years, ABB has continuously developed Symphony Melody in line with its policy of ‘Evolution without obsolescence,’ equipping it with new products and technologies specific to the needs of the power generation and water industries.

The evolution continues
Symphony Melody includes state-of-the-art HMI offerings that meet the many diverse requirements and preferences of customers and their applications. Recent system functions and technology updates for the Melody platform include rack and DIN rail-mounted control and I/O, fieldbus integration, and device and system management tools. Now, Symphony Melody is taking the next step forward in its evolutionary development.

Introducing Symphony Plus – Total plant automation for the power and water industries

Symphony Plus represents the new generation of ABB’s widely acclaimed Symphony family of distributed control systems – the world’s most widely used DCS in the power and water industries.

Like its predecessors, Symphony Plus is designed to meet the present and future needs of the power generation and water industries in all geographic regions. It meets the performance objectives of its various users – in maintenance and operations, engineering, IT and management. And it addresses all the key focus areas of the power and water industries – plant productivity, energy efficiency, operation security, plant safety and cost of ownership. All achieved by Symphony Plus - simple, scalable, seamless, and secure.
Secure and scalable system architecture

Symphony Plus is designed for plug-and-play operation. Its unique network-oriented architecture offers seamless communication throughout all automation levels - from process assets to plant-wide and multi-plant/multi-site information systems. This control network strategy offers a high degree of freedom for communication in the entire operation without neglecting the fundamental aspects of security and availability at the process level.

The system architecture is based on a high speed, high throughput, and high security redundant control network. The scalable system network supports any combination and quantity of process, engineering or operation stations. The use of open, standardized interfaces provides connectivity to third-party systems such as SAP R/3, CAE, or plant optimization tools. High system reliability and availability are key characteristics of this mission-critical control network, with reliability bolstered by redundant hardware and communication paths.

The communications technology is rugged, scalable and meets all the requirements for company-wide process management. With one millisecond time stamping within the entire system, complete system-wide sequence-of-events (SOE) reporting is provided.

At the control level, S+ Control AC 870P process stations include a set of modular high-performance controllers, an entire range of I/O modules, and state-of-the-art fieldbus interfaces. Now, the AC 870P family of controllers has expanded to include PM876. It extends the scope of the controller family by providing an Ethernet interface for the integration of electrical subsystems in accordance with IEC 61850. To meet the requirements of different markets and customer needs, AC 870P is available in rack or DIN rail-mounted versions.

Protecting the integrity and confidentiality of system data

Stricter national regulations, global economics and geopolitical issues are driving power generation companies toward enhancing the security of critical assets. Symphony Plus provides users with a secure, reliable and minimal-effort control environment through built-in security features such as access control, user authentication, and activity logging capability. ABB enhances secure system operations by actively participating in and monitoring security standards published by bodies such as FERC, NERC, ISA, IEC and ISO, as well as conducting threat-modeling studies and incorporating ‘secure design’ practices into product development.
When selecting an automation system, plant owners focus primarily on high availability, low life cycle costs, and the need to steadily increase plant productivity and profitability. To achieve these objectives, a scalable, multifunctional controller platform with high adaptability to new requirements, and maximum openness and availability is required. The S+ Control AC 870P family of controllers, communication interfaces and I/O modules fulfill these requirements in all areas.

Symphony Plus controller subsystems deliver powerful, versatile and scalable solutions. Redundant controllers, communications, I/O and power options provide the highest level of availability. Backward compatibility through ABB’s ‘Evolution without obsolescence’ life cycle program protects installed investments while providing the most cost-effective and seamless way of introducing new functions and technologies into a running plant.

**Powerful process controllers**
The system’s flagship controller, AC 870P, is the latest in a long line of proven process controllers. Designed for maximum computing power, the AC 870P controller can be adapted to a broad spectrum of applications and process requirements. Along with S+ Engineering Composer tools, the AC 870P makes a substantial contribution to improving asset profitability.

AC 870P controllers enhance process control and process availability, and reduce maintenance work. With their extensive set of pre-defined function blocks and system libraries, AC 870P controllers make it easy to design complex control strategies to fit any application-specific requirements, including continuous, sequential, batch and advanced control.

For different markets and customer requirements, ABB offers rack or DIN rail-mounted versions of the AC 870P controller. While the rack-mounted AC 870P is optimized for ultimate I/O packing density in central cabinets, the rail-mounted AC 870P is for decentralized use within distributed system structures or fieldbus systems.

To ensure increased availability, both variants allow scalable system redundancy without the need for additional engineering work. The redundancy may vary from simple module redundancy to redundancy throughout the entire system. With ABB Hot Configuration in Run (HCIR) functionality, redundant AC 870P controllers provide bumpless switchover in case of failure or hardware exchange.

AC 870P controller features include:
- Large variety of powerful functions available in tested libraries
- Easy configuration, service and commissioning with S+ Engineering
- Inherent redundancy without configuration/wiring costs
- Real-time multitasking operating system
- Up to 16 different cycle times
- Comprehensive monitoring and diagnostic functions
- Interface for radio clock connection
- downloadable firmware and application programs (no EPROMs)
- Data security:
  - Firmware stored in flash memory
  - Configuration data buffered in RAM with dual battery backup
  - Production and operating data stored in NVRAM
**Comprehensive I/O system**

Melody I/O modules, available for local and remote mounting, provide a wide variety of input/output and signal conditioning capabilities. In combination, these Melody rack and DIN I/O modules can be combined to form the optimal automation solution. Each controller can handle up to 2,000 analog and/or digital I/O points from the local I/O, and additionally 6,000 analog and/or digital I/O points connected via PROFIBUS DP.

Melody I/O modules’ integrated intelligence provides extended functionality such as error detection, alarm signaling, one millisecond time stamping and extensive diagnostic functions. Analog I/O process interface components provide HART interfaces for each channel. Maximum availability design allows for the hot-swap exchange of modules while in operation.

Melody rack I/O types include:
- Analog input (CAI) Ex and non-Ex
- Temperature input (CTI)
- Analog output (CAO) Ex and non-Ex
- Digital input (CBI) Ex and non-Ex
- Digital output (CBO)
- Controller output/individual drive output (CAC/CBC)
- Frequency input (CFI)
- Serial communication interfaces (CCF)

Remote I/O is accomplished via ABB’s S800 I/O and S900 I/O connected via PROFIBUS DP. To facilitate local mounting to sensors in the plant, the S800 I/O and S900 I/O families are designed with small, modular DIN form factor footprints. They provide options for all signal types ranging from basic analog and digital inputs and outputs to pulse counters and intrinsically safe applications.

S900 I/O for hazardous areas further expands Melody’s I/O capabilities. Three versions of S900 I/O are available and include mounting in Zone 1 hazardous areas, Zone 2 hazardous areas, and in non-hazardous areas.

Additionally, DIN I/O options include S+ Turbine control-specific devices. These include:
- Turbine SIL 3 overspeed protection (TP800)
- Servo valve positioner (VP800)
- Turbine auto synchronizer (AS800)
- Condition monitoring (MCM800)

**Device integration**

The system’s secure and open architecture supports the complete and seamless integration of a wide variety of devices and systems, providing a single window into the entire plant. AC 870P’s comprehensive bus concept allows for the easy integration of HART and PROFIBUS field devices, as well as PROFIBUS and IEC 61850 electrical assets. With the complete integration of systems, intelligent devices and fieldbus technology, Symphony Plus reduces installation costs and enhances maintenance capabilities.

The AC 870P controller provides two redundant PROFIBUS DP lines that allow interfacing with redundant PROFIBUS field connections. Non-redundant sections of the PROFIBUS network can be seamlessly integrated using the RLM01 redundancy link module.

S+ Engineering’s field device tool, Composer Field, supports the configuration, commissioning and maintenance of PROFIBUS devices via device type manager (DTM) technology. Additionally, HART devices can be integrated, configured and parameterized via the standard HART protocol without the need for additional tools by using a standard HART DTM that comes with the system.

**Integration of electrical devices using IEC 61850**

Symphony Plus supports the IEC 61850 standard for communications with medium and high voltage switchgear and protection equipment. Via the AC 870P’s PM 876 Ethernet interface, Symphony Plus delivers seamlessly integrated automation and electrical solutions providing interoperability between intelligent electronic devices (IEDs) using the IEC 61850 protocol.

Through this integration, the system controls and supervises the plant’s motor control centers, switchgear, transformers, excitation systems and protective relays. Managed by S+ Engineering Composer tools, it provides single window access to process and electrical overview displays, alarms and events, trend data, reports, etc, and improves operational reliability.

**S+ Turbine**
Efficient and easy-to-use engineering tools

S+ Engineering Composer comprehensively supports the complete automation project including planning and data acquisition, configuration management, commissioning, operation, maintenance and decommissioning. This single window approach to the system controllers and field devices minimizes system implementation costs.

Providing a single, accurate source of system information, Composer helps to ensure data consistency and improves engineering performance throughout the lifetime of the automation system. Composer’s efficient multiuser engineering environment simplifies configuration, documentation, commissioning and maintenance throughout the entire life cycle of the production facilities.

It supports the life of the system from the definition of process points and loops, the functional planning of process control functions, the creation of the system structure and cabinet configuration to the fully integrated field device configuration for HART and PROFIBUS devices.

Composer supports distributed and multiuser engineering workflows and provides extensive support for delivery in lots. Supporting sandbox engineering, Composer strictly separates the engineering environment from the runtime system and provides object and project versioning, documentation and backup functionality in accordance with local standards.

Composer also offers service and diagnostics functions for economical system configuration, documentation, commissioning and maintenance. During the operation, integration and commissioning phases of the process control system, it is important that the engineering system provides problem and error analysis features. With Composer the same applications that are used during the planning and design phase are used during the commissioning phase. Component status, such as ‘initialized’ and ‘loaded,’ is displayed in the engineering diagrams without the need for additional survey windows.
**Functional planning**

The Composer engineering workflow uses function block diagrams and sequential function charts (SFC) for the main representation of the automation solution. The function block diagram consists of a structured aggregation of base functionalities like a PID controller or an I/O block. The function block is itself a view on the automation functionality as well as its representation in operations and plant-wide information management systems. Thus, the function block diagram contains operating, monitoring, processing or input/output functions and, if required, field components. Function block diagrams as well as the hardware structure of the control system are structured in an underlying automation network.

The application is organized in pre-defined structures like functional structure, system structure or location structure. User-defined structures can easily be set up to reflect user requirements. The user can efficiently navigate through the application by using the system's cross reference functionality to navigate from one instance to the other by a single mouse-click.

General charts and area charts give a quick overview of all automation functions in a project. Switching back and forth between these and the corresponding detailed function charts is possible.

Besides function block diagrams, Composer allows for the configuration of sequences with its IEC 61131–3 SFC editor. The Composer SFC editor automatically generates the required function charts, thus ensuring that the functional forward documentation is consistent.

The user can directly navigate from a function chart in Composer to the related operations faceplate in S+ Operations HMI and vice versa. With this feature, the user can call up not only Composer-specific data, but also external documents or applications.

For the integration of DCS engineering into the plant engineering workflow, Composer provides extensive bulk data functionalities for Microsoft Office Excel and interfaces to computer-aided engineering (CAE) tools. Any exchanged data is subject to Composer versioning and quality assurance technologies.

**Re-usable standard solutions**

Engineering libraries are the basis for all Composer applications. All components, devices, P&I diagrams, symbols, operation and control processing function blocks, I/O configuration, coding and dimensions are included in these libraries. In the background, plausibility checking tools ensure correct use of library elements. Composer libraries can be supplemented and modified to meet project-specific needs. The macro editor, symbol editor and assignment editor features are used to define and/or extend the library's standard function blocks.

Key Composer features include:
- Efficient engineering for instrumentation and control systems
- Function-oriented configuration, commissioning and maintenance
- Functional CAE tool integration
- Delivery in lots
- Support for distributed concurrent engineering
- Multiuser engineering
- Integrated FDT/DTM field device configuration
- Integration of IEC 61850 electrical subsystems
- Integration of external documents and applications
- Consistent functional forward documentation
- Online and offline processing
- Project-specific libraries and macro technology
- Straightforward navigation and intuitive user guidance
Melody offers a complementary series of HMI platforms that supplement the inherent functionality of the control system. Its console portfolio includes Symphony Plus S+ Operations and 800xA Process Portal (PPA). Designed to improve operator effectiveness, these operator consoles provide intuitive, easy-to-use operation environments that facilitate process monitoring, control, fault mitigation and optimization. Third-party equipment and applications, such as steam or gas turbine control or balance of plant control, are integrated with system operations via OPC, allowing the operator workstation to be the ‘window’ for the entire plant operation.

Essential to effective operation, all HMI options include the following integrated functions:

- Intuitive contextual display navigation
- Faceplate control of any device in the plant
- Integrated alarm and event management with sequence of events
- Trend curves displaying current as well as historic values
- Comprehensive system status displays

To avoid production downtime and minimize operation risk, console upgrades can be performed online and in parallel operation with the existing HMI.
**S+ Operations**

S+ Operations is a Windows-based, Web-enabled human machine interface that provides outstanding information integration and user navigation within a standard Windows environment. Based on industry standards, S+ Operations provides users with detailed, well-arranged process overview displays that present better situation awareness and recognition of abnormal conditions.

S+ Operations’ unique system architecture provides flexible and scalable configurations for small, medium and large power or water applications. S+ Operations provides server-less as well as server-based solutions. Switching between these configurations is swift and simple. This flexibility makes adapting to evolving needs an easy step. For server-based applications, the architecture can expand over multiple levels in a hierarchical structure. Multi-level redundancy and store-and-forward functions prevent data loss, while preserving full functionality and performance.

Direct access navigation produces information-rich control faceplates, superior trending capabilities according to VDI/VDE 3699 Part 4, EEMUA 191-based alarm and events, and a comprehensive range of reports.

In addition to the inherited system alarms, diagnostic and management features can be visualized on S+ Operations, including:

- Controller load
- Network status overview
- Redundancy status

Favorite places, history lists, short cuts and hot buttons facilitate quick and easy navigation through the power or water facility. Workplace layouts are adjusted and optimized according to user requirements, individual preferences and access rights. Windows management functions such as safe areas, pinning and stacking prioritize the presentation of important material.

Single point of entry for configuration information is enabled by the direct import of configuration files from the Composer Melody workstation. Direct and seamless cross-navigation between operation displays and Composer engineering documentation provides users with the ability to easily troubleshoot any control loop or process area.

S+ Operations is enhanced by additional connectivity packages for:

- General Electric SPEEDTRONIC Mark V/VI via GSM protocol (GE standard messages) over Ethernet TCP/IP
- Siemens Teleperm, via the XU interface and Siemens proprietary protocol over Ethernet TCP/IP
- ABB TURBOREG (Ansaldo turbines) via the PGP interserver protocol

In addition to the single window concept, S+ Operations can easily be deployed in SCADA systems for the management of power, gas and water networks, as well as those applications requiring the integration and control of geographically distributed systems and remote data acquisition. Various communication protocols, like IEC 60870-5-104 and DNP3.0, are available and can be used to easily integrate remote systems.

Additionally, S+ Operations’ flexible architecture includes a thin Web client option:

- S+ Operations Office thin Web client is a pure thin client solution based on a Web server embedded in S+ Operations. With this solution, plant information is presented to users within Internet Explorer by dynamically creating Web pages equivalent to the original S+ Operations pages, including navigation tree.
Extended operations environment

800xA Process Portal (PPA)
800xA Process Portal offers an extended operations environment with comprehensive process information for the power or water plant operator. It does this while preserving Melody system data, standard Melody displays and operator functions.

Unique to Process Portal is the ability to gather information from multiple plant sources and transform it into relevant information for a diverse set of users, such as maintenance technicians, process engineers, production managers and plant operators.

The enabling technology for this data access, storage and management is ABB’s patented Aspect Object™ framework. Aspect objects relate all plant data (the aspects) to specific plant assets (the objects). For example, aspects are informational items associated with objects, such as I/O definitions, engineering drawings, process graphics, reports and trends that are assigned to each object in the system.

Aspect Object navigation presents the entire production facility in a consistent, easy-to-view fashion. This allows a single window environment to include control functions, smart field devices, asset optimization functions, information management, safety systems, and manufacturing execution system (MES) applications.

Familiar Web browser tools provide quick access to displays and information. Favorites, history lists, shortcuts and hot buttons provide navigation through a power plant or water facility quickly and accurately. Use of the right mouse button provides access to additional details.

Workplace layouts are adjusted and optimized to user preferences and needs with individualized menus, toolbar contents and display locations. Operator, maintenance, engineering and management personnel are at ease and perform their responsibilities efficiently using Windows management functions, such as safe areas and pinning and stacking priorities, thus minimizing operation errors.

S+ Engineering Composer tools provide the basis for the 800xA Process Portal configuration. A simple importing process from Composer sets up the tag configuration data and standard Melody information views within 800xA Process Portal.
**Information management**

Information functions specific to power generation and water applications are inherent in Symphony Plus and are integrated within the S+ Operations environment. When using 800xA Process Portal, these features are provided via Power Generation Information Manager (PGiM).

Historical, process and business data is collected from disparate sources and stored securely. The data is transformed into meaningful information, which is presented in a manner that is easy to understand and that follows EEMUA 191 alarm management guidelines. This provides important support at every level to improve efficiency and profitability.

The reporting functions draw on all current and historical process information that is retrievable from the Melody system and other information systems. Reports can be easily adapted to the specific requirements of a plant, including a report generator where users can freely create customized reports.

The following reports normally cover all requirements of efficient plant monitoring and can be delivered by Symphony Plus systems:

- Instantaneous value reports
- Sequence-of-events (SOE) reports
- Alarm messages, status messages, operator interventions
- Filtering by priority, plant area, etc
- Operation reports (shift, daily, monthly and yearly)
- Status reports (plant snapshots)
- Maintenance reports

Desktop displays give managers concise, enterprise-wide information in familiar Microsoft Office formats without them having to leave their desks. A discrete tag ticker, continuously showing key performance indicators (KPI), can be supplemented with a trend display when more information is required. While operator displays provide information in the control system environment, these displays are able to seamlessly present both real-time and historical trend data as well as alarms and events.

Versatile scheduling options, which provide automatic triggers for key actions, support all plant personnel with both standard procedures and exception handling. Examples include support for root cause analysis with event triggered pre- and post-event logging. This improves quality and asset availability by using calculations and event triggering to provide predictive alarms and scheduled reports.

User-defined data structures and calculations provide powerful, re-usable algorithms and applications. These can be used to transform raw data into information and other sophisticated control support. The data structures can also be used to integrate external application data into the system.

Fault-tolerant and distributed data configurations provide dependable data availability. The information is also protected by user access restrictions and offline storage. Users can be confident that electronic record keeping requirements are being met and that their decisions are based on reliable information.
Productivity-enhancing plant optimization

The key to energy efficiency is to reduce the cost of fuel and consumables. Industrial plants are huge energy consumers - a small percentage in savings can have a significant impact on their bottom line. ABB provides a suite of plant optimization solutions for the power and water industries that enable plants to run at maximum efficiency while balancing the tradeoff between revenues, asset life cycle costs and emissions.

Maximum performance and efficiency
ABB’s OPTIMAX® monitoring and diagnostic tools issue early warnings for equipment diagnosis, sensor validation and preventive maintenance, thus providing plant owners with the capability to predict plant performance. OPTIMAX optimization tools enable utilities with complex generation portfolios to minimize energy generation costs. Questions such as whether or not to buy or sell power or fuel, start or stop a unit, extend the plant’s operating life, or postpone a preventive maintenance outage can be easily answered.

Minimum maintenance costs
Maintenance expenses are second only to fuel as variable costs. The key to asset optimization is having information that is accurate, timely and actionable. Work preparation and condition-based maintenance are increasingly important for the reduction of downtime. OPTIMAX maintenance management solutions achieve and maintain a high level of availability, quality and safety at the plant. This applies to current plant operations as well as to inspection, overhaul and service activities.

Reduced emissions and improved control
Reducing greenhouse gas emissions has measurable economic value, and plant owners have a real incentive to lower emissions. OPTIMAX environmental solutions reduce emissions by providing advanced process control, which optimizes combustion, shortens boiler startup times and improves coordinated boiler-turbine control and unit frequency response.

Extending the asset life cycle
OPTIMAX solutions for asset life cycle monitoring provide continuous evaluation of critical plant components. Additional optimization tools schedule the most economical operation of different generating units and balance income from sales with life cycle costs. The tools also take emission costs into account; for instance, the introduction of more stringent emission requirements may make some plants uneconomical to run. The advantage of these decision-support tools is that they include plant aging models as a means to determining the optimal operating strategy under various environmental constraints.
Optimax applications enable power and water plants to run at maximum efficiency while balancing the trade-off between revenues, life cycle costs and emissions.
ABB offers a complete portfolio of life cycle management services, from repairs and spare parts to Full Service® contracts and complete plant upgrades and equipment retrofits. ABB services are available for each phase of the plant life cycle, from first concept to decommissioning:

- Concept
- Front-end engineering
- Detail engineering
- Equipment selection and procurement
- Construction
- Commissioning
- Startup
- Operation
- Decommissioning

**Project management**
ABB’s certified project managers take care of all relevant issues during an automation project – a competent partner for the entire ABB contribution.

**Asset management**
ABB provides life cycle assessments of critical plant equipment, including component reliability calculation analysis. Our assessments equip power generators with the information required to make cost-effective, long-term decisions on overall system operation and maintenance. ABB service contracts guarantee that our experts are only a phone call away.

**Environmental services**
ABB provides benchmark recycling solutions for defective parts and systems. In accordance with all applicable regulations and requirements, ABB takes care of the proper disposal or recycling of installed or returned parts.

A complete portfolio of services

*Figure: Diagram showing the complete portfolio of services offered by ABB.*
Training
A skilled and efficient workforce is a plant’s most valuable asset. We can increase workforce skill levels and knowledge so that a more productive response to system and process challenges is achieved. Our training programs for engineers, programmers, maintenance and operations personnel provide comprehensive and up-to-date technical expertise in products, processes and technology advances. Training is available on-site at ABB training facilities or locally at your plant.

Upgrades and retrofits
Our upgrade and retrofit programs focus on integrating all system and control components to provide operational improvements. ABB has the expertise to develop and deliver measurable results to your ABB products and systems.

Evolution
The ABB life cycle management model provides the framework for evolutionary services that maximize availability and performance throughout the life cycle of ABB equipment. The model enables ABB to provide optimal support to end users and a smooth transition to new software and equipment when a product reaches the end of its operating life. Throughout the product life cycle, ABB continues to provide solutions that expand the functionality and extend the life cycle of the equipment, while maintaining the customer’s core investment.

Diagnosis and consulting
ABB experts have a profound knowledge of global best practices in a wide range of business and engineering operations. We develop and implement service solutions based on industry-specific technologies and competencies to help customers improve overall equipment effectiveness and return on investment.

Support and remote services
Advanced remote technology delivers higher service value and performance. ABB’s portfolio of remote services provides assistance for a wide range of support needs, from telephone and Web support to direct and secure system interaction. ABB remote services offer real-time access to technical specialists globally, service experts 24 hours a day, and direct connections to plants from ABB facilities for system and process diagnostics and checks.

Spare parts and repair services
ABB’s global logistics network provides fast delivery of parts and repair services throughout the world, 24 hours a day, to ensure components are delivered efficiently and promptly to your site.

Troubleshooting
ABB engineers are trained and certified to provide expert knowledge for root cause analysis and troubleshooting to bring the plant quickly back to normal operation again.

Maintenance
Our local service teams are backed by global resources, with more than 10,000 professionals ready to provide a fast and efficient response to service needs. Our service professionals are trained and certified to help avoid downtime and get the plant online and in production as quickly as possible. We know that the key to providing world-class service is not only to respond quickly, but provide the best solutions.

Commissioning
We take care of all phases of commissioning, from I/O-check and plant startup to systems tuning and acceptance testing.

Installation
We prepare the schedule for delivery and installation in close cooperation with our project partners, and we plan and procure site facilities and provide complete installation.

Engineering
ABB engineers are skilled in control and process technologies and use well-proven tools for consistent and project-wide data storage that can be accessed on site or by remote.
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