Symphony Plus
HR Series control and I/O

Power and productivity
for a better world™

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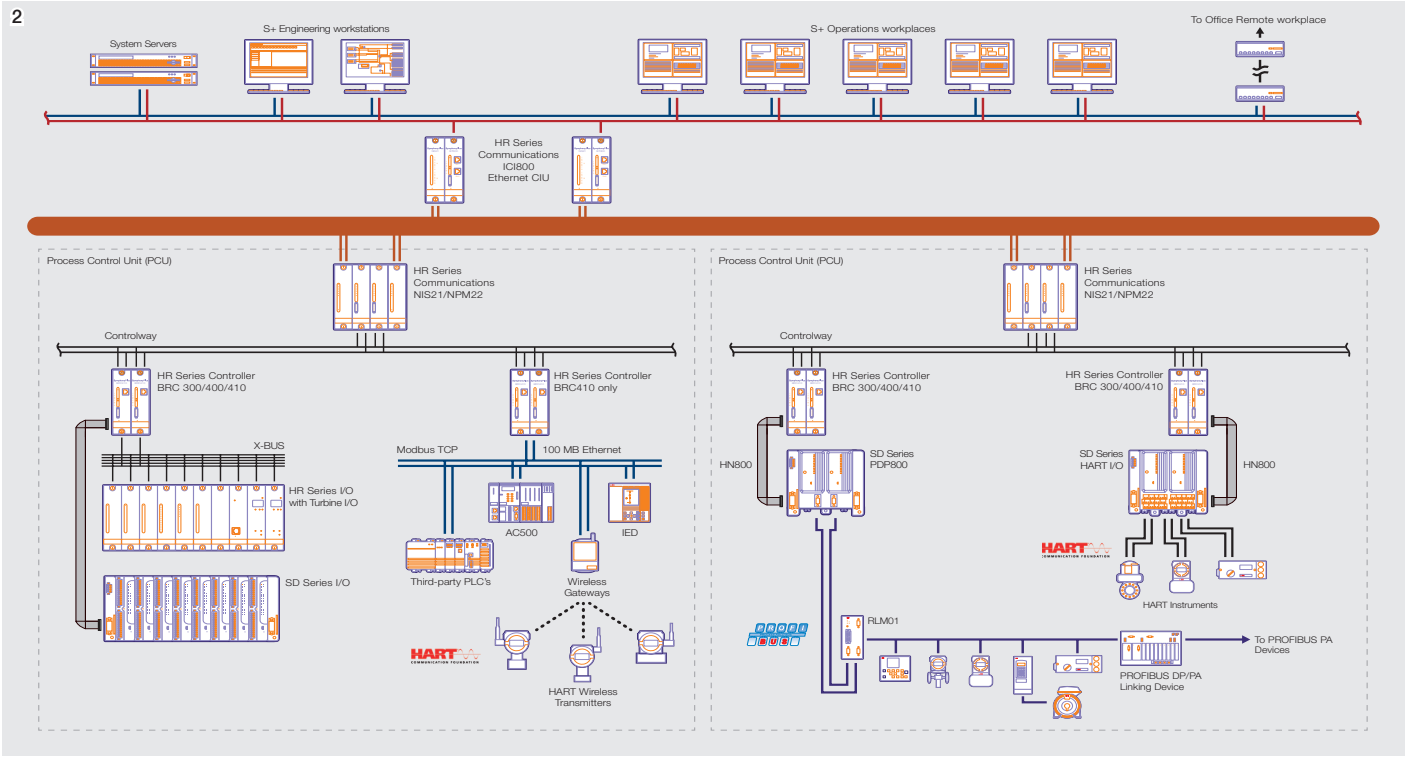
Achieving total plant automation with a single control and I/O platform. Symphony® Plus is the new generation of ABB's highly acclaimed Symphony family of distributed control systems – the world's most widely used DCS in power generation and water management applications. In all, there are more than 6,500 Symphony DCS installations in operation all over the world, more than 4,500 of which are in power and water applications.

1 HR Series control and I/O

No other automation platform has such a long field record and large global installed base as ABB's Symphony Plus family. For more than 30 years, the system has progressed through several evolutionary steps. From Network 90 in 1980, through INFI 90™, INFI 90™ Open, and Symphony, to Symphony Plus, the system progression has followed ABB's long-held policy of 'Evolution without obsolescence,' ensuring that each new generation enhances its predecessor all the while maintaining full compatibility with them.

Included in Symphony Plus is a comprehensive suite of standards-based control and I/O hardware and software that meet the requirements of total plant control. Within this suite, S+ Control and I/Os expanded HR Series (Harmony Rack) meets the past, present and future needs of its users by protecting their previous control investments while delivering higher performance, reliability, and capacity. Following ABB's industry leading 'Evolution without obsolescence' life cycle policy, the HR Series represents yet another step in this contiguous evolution by delivering products that are backward compatible with previous generation rack products. HR Series control-based systems feature scalable, high-performance controllers, a comprehensive set of I/O options, fast, secure and redundant communications, an efficient easy-to-use engineering tool, and a state-of-the-art HMI workplace. Newest additions to the HR Series portfolio include an environmentally hardened DIN-rail mounted native remote I/O option and integration of intelligent electrical and field devices via PROFIBUS, HART and Modbus TCP communication protocols.

Together, HR Series control-based solutions lower system life cycle costs and total cost of ownership by delivering the value needed to remain competitive in today's challenging business environments: increasing reliability, minimizing equipment downtime, improving production yields, reducing maintenance and support costs, reusing physical and intellectual asset investments, and adding new products and features with ease.



2 HR Series control communications functional architecture

Simple, scalable, seamless, and secure

Overview

Symphony Plus' HR Series provides a scalable solution that spans and integrates loop, unit, area, plant and interplant controls. Its system communication architecture is based on a high-speed, high-throughput and highsecurity redundant INFI-Net control network. The scalable network supports any combination and quantity of control, engineering, operation and application interface nodes. Each node on the control network operates independently of other nodes. Acting as its own communication manager, the system requires no traffic directors. INFI-Net to INFI-Net communication modules support multi-network system topologies that provide a system capacity of more than 62,000 nodes.

High system reliability and availability are key characteristics of this mission-critical control network. Reliability is bolstered by redundant hardware and communication paths. Extensive use of error checking and message acknowledgment assures accurate communication of critical process data. Patented exception reporting technology optimizes the use of control network bandwidth. The store and forward ring topology of INFI-Net, along with multi-master and multi-cast messaging features result in INFI-Net having an effective bandwidth that exceeds 300 Mbaud. INFI-Net communications are also highly deterministic.

HR Series process control unit (PCUs) communication products including the NIS21/NPM22 modules provide significant increases to performance and capacity compared to previous generations. Additionally, new HR Series INFI-Net to Computer Interface (ICI), INFINet to INFI-Net Local and Remote Bridge modules, and INFINet to PN800 (INFINet over Ethernet) Bridge modules are available.

The Harmony OPC server provides OPC connectivity between devices on the INFI-Net control network and OPC client applications. In non-redundant and redundant configurations, it can be used in conjunction with ABB products such as DataLink and popular non-ABB products such as OSIsoft PI System and Aspen InfoPlus.21.

HR Series ICI800 Ethernet CIU provides Ethernet-based communication between INFI-Net and the system's engineering tools, HMI and the Harmony OPC server for connection to third-party applications. As per NERC CIP-007-2 R5, SSL certifications authenticate its connections with interface applications, further safeguarding the integrity and privacy of the ICI800 communication path.

Protecting the integrity and confidentiality of system data

The process and power industries face intensifying cyber security risks. In order to increase stability, security and robustness in its solutions, ABB has established an independent Device Security Assurance Center (DSAC) where cyber security robustness is tested as part of the product development process. The DSAC test facility uses state-of-the-art open source, commercial and proprietary robustness and vulnerability analysis tools. All Symphony Plus Ethernet-based devices - including HR Series products such as the BRC410, ICI800, and IEB800 - are continually tested at the DSAC center in different configurations and with an explicit focus on operational performance. This ensures that all Symphony Plus products are robust, secure and of the highest quality.

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3 HR Series scalable controllers BRC300, BRC400, and BRC410 | 4 S+ Engineering tool

Powerful process controllers

HR Series controllers are the latest in a long line of field-proven multi-function rack process controllers, and include the BRC300, BRC400, and the BRC410 bridge controllers (figure 3). This scalable family of controllers, based on a 160 MHz, 32-bit Freescale Coldfire processor, can be adapted to a broad spectrum of applications and process requirements. Configured by the S+ Engineering tool, the HR Series controllers feature an extensive library of more than 150 predefined control algorithms or function codes (figure 4). These functions enable easy building block design of complex control strategies to fit any control application, including continuous, sequential, batch and advanced control. In addition to standard function blocks, HR Series controllers support C programming and batch functions.

HR Series controller features include:

- Enhanced controller reliability
- More than 10x performance of previous generation controllers
- Simultaneous support for all HR Series I/O, SD Series I/O and S800 I/O subsystems
- Intelligent device integration via HART I/O and PROFIBUS DP V0, V1, V2
- Downloadable firmware
- BRC400 / BRC410 specific enhancements:
  - Extended user configuration memory (2 MB NVRAM)
  - Support for 30,000 function blocks
  - Flexible online configuration capability
  - 100 MB Ethernet port using the Modbus TCP protocol (BRC410 only)

High reliability and availability

With redundant controller, communication, I/O and power options, HR Series controller subsystems provide the highest level of availability. Compliance with international standards assures the highest level of reliability and quality needed to meet the most rigorous global specifications and requirements. Backward compatibility through ABB's 'Evolution without obsolescence' life cycle program ensures protection of installed investments while providing the most cost-effective and seamless way of introducing new functions and technology into a running plant. Together, the HR Series provides users with fast, accurate, uninterrupted control of their process, resulting in greater production efficiency, increased availability, and lower maintenance costs.

Soft controller reduces commissioning times

For new plant, upgrade, or expansion projects, HR Series soft controllers can dramatically reduce commissioning and start-up time and costs by permitting thorough testing and pre-tuning of control loops prior to its implementation in the field. The HR Series soft controller uses the same control logic (ie, function block configuration) as the physical HR Series controllers. Coupled with virtual communication devices, the entire HR Series control-based system can be implemented within one or more PCs which allow for testing results made in the virtual environment to be directly transferable to the operating system environment.

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5 HR Series Turbine control systems | 6 SD Series remote I/O

Comprehensive I/O product portfolio

S+ I/O, available for local and remote mounting, provides a wide variety of input/output and signal conditioning capabilities. In combination, these rack and DIN I/O modules can be combined to form the optimal automation solution.

HR Series controllers can communicate with up to 64 rack I/O modules locally with additional remote rack I/O modules connected via the RIO22 module. Use of rack sequence of events (SOE) I/O modules provides one millisecond timestamp resolution across the entire rack system.

HR Series I/O module types include:
- Analog input (ASI, FEC)
- Analog output (ASO)
- Control input/output (CIS, QRS)
- Digital input (DSI)
- Digital output (DSO)
- Pulse input (DSM)
- SOE digital input (SED)

Turbine control

In addition to traditional signal-type I/O, HR Series provides for integrated turbine control via a series of turbine control-specific modules, including:
- Hydraulic servo module (HSS)
- Turbine protection module (TPS)
- Turbine auto synchronization module (TAS)
- Condition monitoring module (CMM)

These unique modules make it possible to provide a fully integrated single-vendor solution for all aspects of turbine automation. HR Series turbine modules are based on proven technology that controls steam turbines, gas turbines and hydroelectric turbines in more than 15 different countries around the world, and have been tested, accepted, and used by several major global turbine manufacturers as part of their standard offering. The combination of HR Series controllers and turbine I/O results in a powerful governor control system solution.

SD Series remote I/O option

HR Series remote I/O capabilities are further expanded with use of the SD Series DIN rail mounted I/O products. Compatible with all HR Series controllers, BRC300 / 400 / 410, SD Series I/O connects directly to the controller via the HN800 I/O network without the need for an intermediate interface or gateway. SD Series I/O is configured using standard function blocks and includes traditional analog and digital I/O as well as integration with intelligent field devices via PROFIBUS DP and HART. 24 VDC power requirements, low module power consumption, and a module temperature rating of 70 DEGC (ambient) makes SD Series I/O the optimal choice for remote I/O applications. G3 coating makes SD Series I/O suitable for use in corrosive environments without requiring costly sealed cabinets or purging systems.

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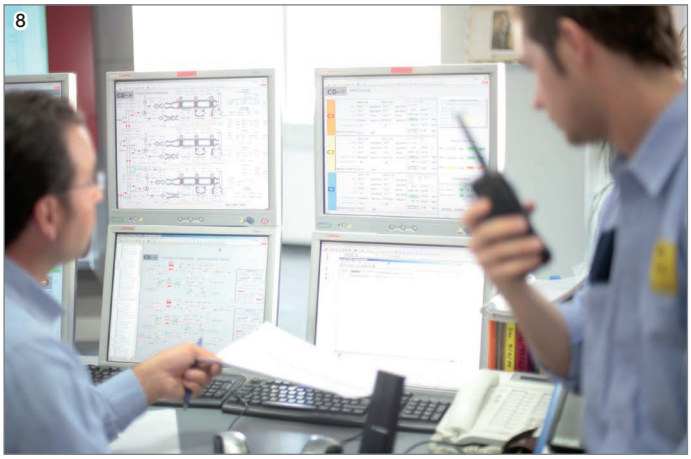


7 Remote field device management | 8 Proactive maintenance through system visibility of device performance

Device integration capability

In today's power generation and process industries, only about 10% of field instruments have a digital pathway back to the control system. This reduces smart devices to under-utilized assets where the existing diagnostic and connection information residing in the field instruments is not utilized in system operations. HR Series controllers seamlessly integrate electrical systems, intelligent devices and fieldbus technology using standard protocols such as HART, PROFIBUS and Modbus TCP and RTU. This provides access to a wide range of intelligent electronic devices from ABB and other vendors including transmitters, actuators, motor control centers (MCC) and flame scanners, where the resident information in each device can then be used in control strategies and higher level applications. This reduces installation costs, enhances maintenance capabilities and provides a single window into the entire plant.

Device integration details

HR Series controllers seamlessly integrate HART field devices through SD Series HAI805 and HAO805 HART modules. Besides the 4-20 mA primary variable, all secondary, tertiary and quaternary variables in a HART device can be accessed by Function Code control applications in the HR Series controller. Real-time use of this data is practical because of the modules' individual HART modem per channel design.

Data can be calculated, used as part of a control strategy, or for display and alarm purposes at the system's HMI console. HAI805 and HAO805 features include:

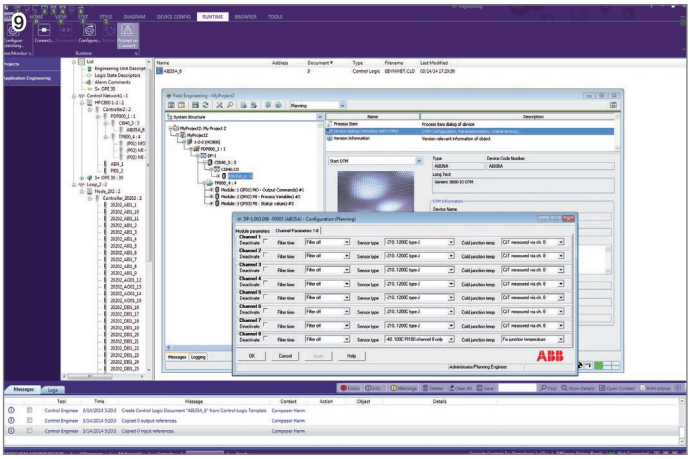
- HAI805 (8 analog input channels)
- HAO805 (8 analog output channels)
- Dedicated HART modem for each I/O channel
- Each channel's secondary/tertiary/quaternary variables are available for use in control applications
- Update rate of secondary/tertiary/quaternary variables is less than one second

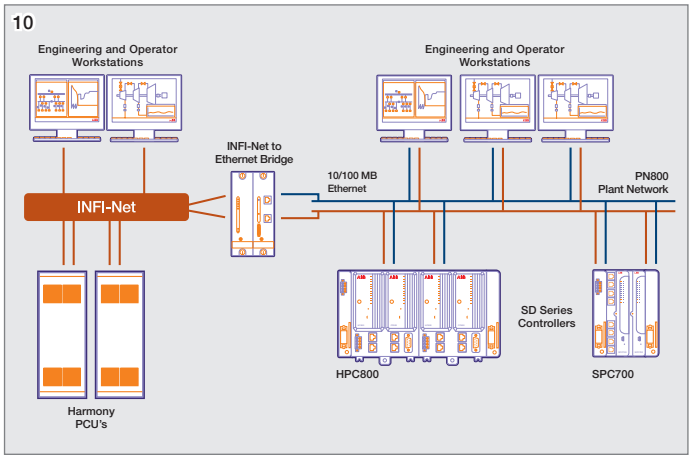
PROFIBUS DP V0, V1, V2 can be seamlessly integrated using the SD Series PDP800 module. This PROFIBUS interface supports redundant and non-redundant connections:

- PROFIBUS DP V0, V1
- V2PROFIBUS PA devices through DP/PA linking device
- 1ms time stamping of devices by PROFIBUS DP V2
- Electric and fiber optic media for PROFIBUS DP link

All HR Series controllers support Modbus RTU with the BRC410 supporting Modbus TCP via its 100 MB Ethernet port. Modbus TCP interface features include:

- Bi-directional communication of up to 4,000 Modbus points
- Availability of Modbus data as system points to be integrated within the control application.
- High availability and fault tolerance in a redundant pair configuration
- Ability to operate as client, server or server/client (concurrently) on the Modbus TCP network
- Expanded number of concurrent connections





9 S+ Engineering Field Device Management Tools | 10 INFI-Net to Ethernet bridge (IEB800)

Field device management

HART and PROFIBUS devices are fully integrated with Symphony Plus, yielding benefits far beyond reduced footprint and cable costs. The S+ Engineering tool suite supports configuration, commissioning and maintenance of HART and PROFIBUS devices using device type manager (DTM) technology. For field devices that have conventional device description files (GSD), a basic PROFIBUS DTM is available to allow standardized configuration. HART devices are integrated, configured and parameterized via standard HART protocol without the need for additional tools by using a standard HART DTM. Individual DTMs can be accessed from the engineering tool's multiple data views, such as the system or location overview and others. S+ Engineering includes automatic net calculation and loading of process items by using the device specific channel configuration generated from the DTM.

Seamless upgrade path protects installed investments

True to ABB's 'Evolution without obsolescence' policy, HR Series products provide backward compatibility to previous generation Network 90, INFI 90, INFI 90 Open, and Harmony hardware and software, including support for all existing function code executions, custom user programs, and all foreign device interfaces. Staying true to this policy ensures the protection of installed investments while providing the most predictable, cost-effective, risk-averse, and seamless way of introducing new functions and technology into a running plant.

Specifically, HR Series communication, control, and I/O products:

- Replace previous generation rack products on a form / fit / function basis
- Preserve installed I/O through simultaneous connection to HR Series I/O, previous generation rack and block I/O, SD Series I/O and S800 I/O
- Use the same field-proven INFI 90 function code algorithms as previous generation controllers (ie, MFCxx and MFPxx, controllers)
- Enhance existing Composer engineering tools with device management capabilities

Further, HR Series and SD Series control networks, INFI-Net and PN800 (INFI-Net over Ethernet) respectively can be connected via a self-configuring INFI-Net to Ethernet bridge (IEB800 module). This allows for the easy expansion of existing INFI-Net communication networks with INFI-Net on Ethernet technology and SD Series DIN rail mounted products. Additionally, resident data from either network is available for use in control applications or for display in applications connected to the other.

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