

BROCHURE

# ABB Ability™ Symphony® Plus

## HR Series Control and I/O



# HR Series Control and I/O

## Achieving total plant automation with a single control and I/O platform

ABB Ability™ 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 7,000 Symphony DCS installations in operation all over the world, more than 5,000 of which are in power and water applications.

01 HR Series control and I/O

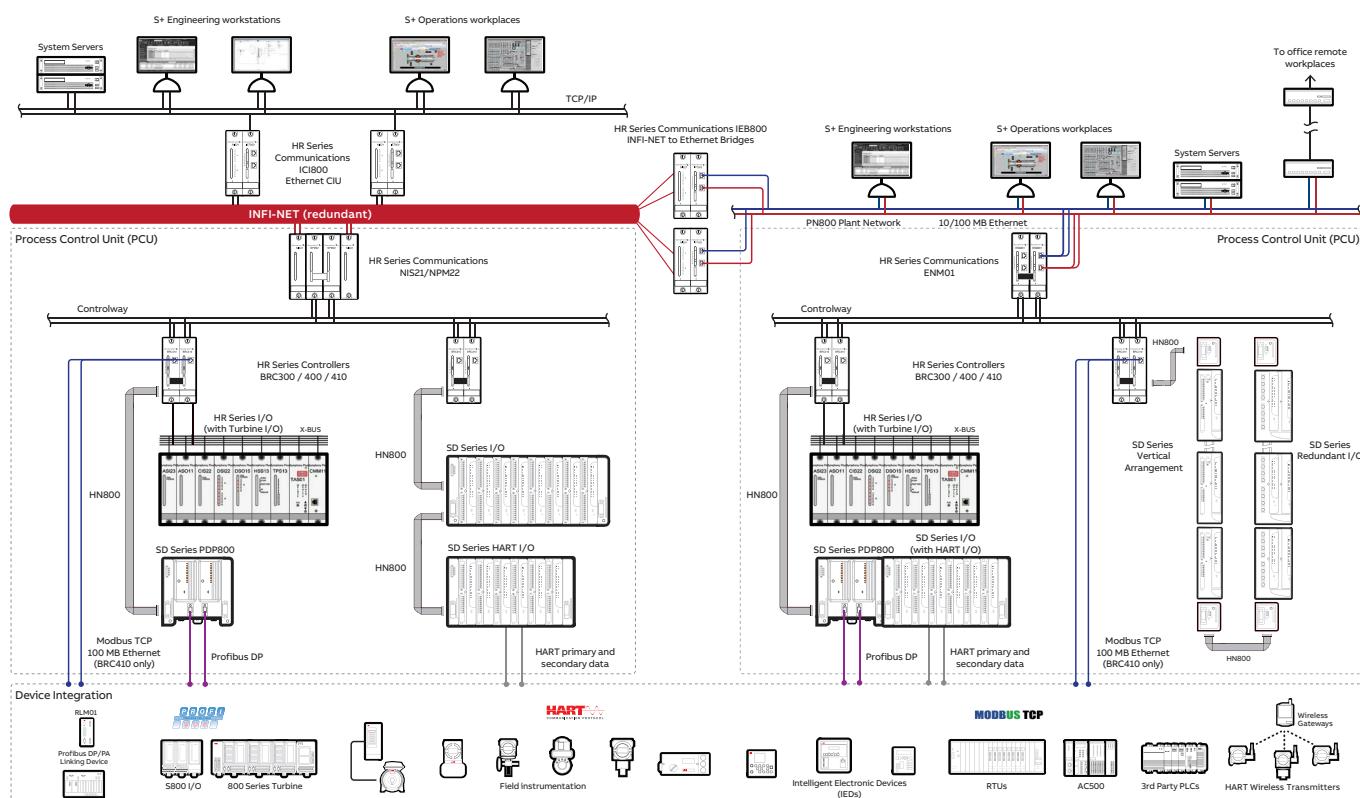


No other automation platform has such a long field record and large global installed base as ABB's Symphony Plus family. For more than 35 years, the system has progressed through several evolutionary steps. From Network 90 in 1980, through INFI 90™, INFI 90™ Open, and Symphony, to Symphony Plus, the 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.

Symphony Plus includes a comprehensive suite of standards-based control and I/O hardware and software that meets your requirements for total plant control. The suite's 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. 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 (1) environmentally hardened DIN-rail mounted native remote I/O option, (2) the integration of intelligent electrical and field devices via HART, PROFIBUS DP and Modbus TCP communication protocols, (3) upgrade of INFI-Net communications to redundant Fast Ethernet plant network and (4) compact DIN-rail mounted modular power system.

In summary, 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 control and I/O investments, and adding new products and features with ease.



02 HR Series  
functional overview

## 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 high-security 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. The recently available ENM01 module combines the PCU communication functions performed by NIS and NPM modules into a single module and utilizes redundant Fast Ethernet based PN800 (INFI-Net over Ethernet) Plant Network as the control network. Existing INFI 90, Symphony Harmony, Symphony Plus HR Series systems can be incrementally upgraded from INFI-Net control network to PN800 using the ENM01 and the INFI-Net to PN800 Bridge (IEB800).

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.



# HR Series

## Achieving greater levels of performance

03 HR Series scalable controllers BRC300, BRC400, and BRC410

04 Modular Power System IV



### Powerful, scalable control platform

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. HR Series controllers feature an extensive library of more than 150 predefined control algorithms or function codes. These functions provide the power to easily design 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
  - Modbus TCP device integration via 100 MB Ethernet port (BRC410 only)



### High reliability and availability

With redundant controller, communication, I/O and power options such as the recently released MPS IV (Modular Power System), 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 HTS-based 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.

05 HR Series Turbine control systems

06 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.

# HR Series

## Integrating field devices seamlessly

07 Proactive maintenance through system visibility of device performance

08 SD Series HART Analog I/O



### 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.

The HR Series seamlessly integrates intelligent field devices and protocols using PROFIBUS DP, HART, and Modbus TCP and RTU. This provides access to a wide range of intelligent field devices from both ABB and other third-party vendors including transmitters, actuators, motor control centers (MCC) and flame scanners. Each device's resident information can then be used in control strategies and higher level applications. In addition to producing tighter and more reliable process control solutions, these solutions lower installation costs by reducing wiring and system footprint.



### Intelligent HART I/O

HR Series controllers seamlessly integrate HART field devices through a variety of SD Series HART analog input and output 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. Data can be calculated, used as part of a control strategy, or for display and alarm purposes at the system's HMI console.

SD Series HART I/O features include:

- 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 (AI05 and AO05)

# HR Series

## Securing your control investments

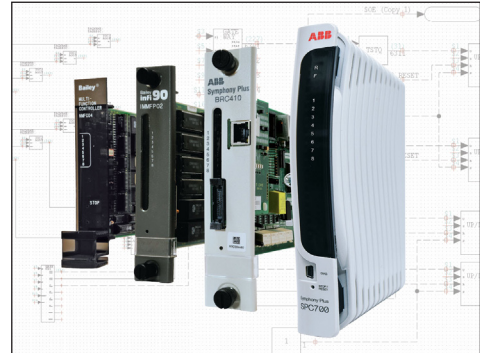
09 Cyber security

10 Evolution without obsolescence



### 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, ENM01 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.



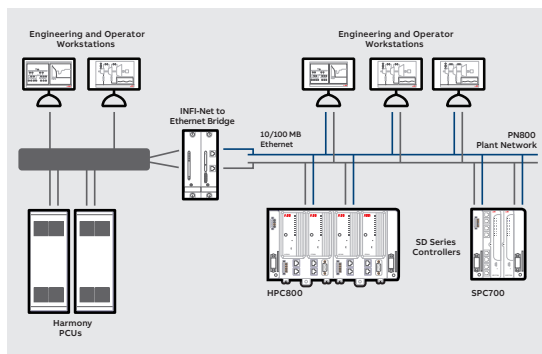
### Seamless upgrade path protects investments

True to ABB's 'Evolution without obsolescence' commitment, HR Series products provide backward compatibility to previous generation Network 90, INFI 90, INFI 90 Open and Harmony hardware and software, including support for existing function code executions, custom user programs, and all foreign device interfaces. ABB's 'Evolution without obsolescence' 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 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

11 INFI-Net to Ethernet bridge (IEB800)



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.

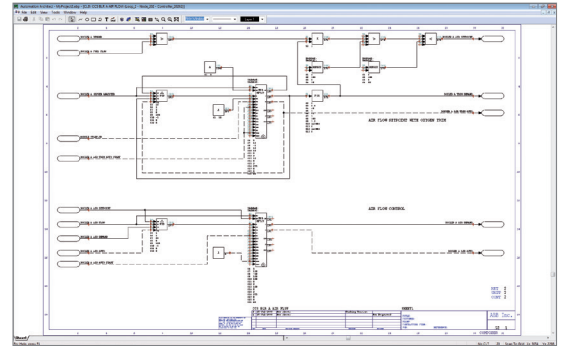
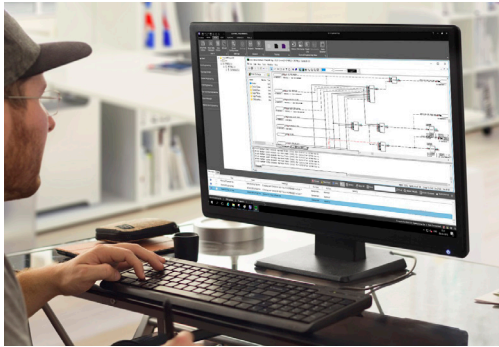


# HR Series

## Efficient engineering tools for design and maintenance

12 Unified workbench for collaborative engineering

13 Automation Architect



### Robust – efficient – comprehensive

S+ Engineering is the comprehensive engineering tool set for HR Series based systems. The unified workbench offers all the necessary functionality needed to engineer, configure, administrate, secure, commission and maintain every component in your Symphony Plus Control System - from control and I/O, field instrumentation and electrical devices to network architecture, and operations, engineering, and advanced system applications.

S+ Engineering's seamless tool integration, powerful workflow automation, multi-user and remote access capabilities and comprehensive bulk import/export functions improve overall engineering efficiency. Integrated version control, version comparison and rollback framework offer progress tracking and significantly reduce commissioning time. Using intelligent bulk interfaces, S+ Engineering allows for full control of engineering data consistency in each phase of the project life cycle.

### Secure user management

The simple and intuitive workbench interface allows engineers to configure user information for the Windows and Engineering databases. It allows and secures the creation of user profiles along with their roles and project access permissions through Role Based Access Control (RBAC). Audit trail functionality tracks and archives user actions including system changes made at any engineering workstation onto a central database. These events can then be archived in the system's historian for long term security audit purposes.

### Integrated control engineering

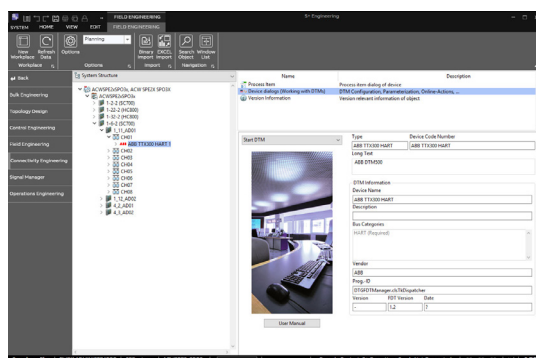
S+ Engineering allows for easy reuse and upgrade of previous generation Symphony, INFI 90 OPEN, INFI 90, and Network 90 control applications. In addition, the extensive reuse concept of S+ Engineering allows users to optimize plant design with field-proven solutions based on ABB's in-depth experience in the power and water industries.

S+ Engineering's Automation Architect provides for visual creation, editing, monitoring and tuning of control logic. Rather than textually programming strategies, the Automation Architect represents pre-defined control strategies as function blocks. By connecting function blocks, users are able to easily specify the signal flow of a control strategy and visually define the control strategy. Monitoring and tuning capabilities provide the ability to troubleshoot and maintain an operational system using the same information used to create the system.

In addition to function blocks, S+ Engineering supports batch or sequential programming via the Batch Data Manager (BDM). BDM is a family of engineering tools used for creating, editing, managing, downloading, and debugging Batch 90, sequential, and user-defined function code configurations.



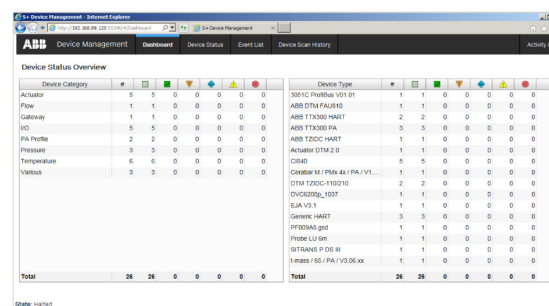
### 15 Drill-down web-view for device alerts and conditions



S+ Engineering improves the quality of control strategy software by minimizing the risk of errors of starting from scratch. S+ Engineering allows users to define and maintain their field proven control logic through the use of its Control Logic Templates (CLT) and Configurable Function Codes (CFC).

CLTs are thought of as control strategy blueprints. Its linking functionality allows users to define logic that is controlled by the template or can be modified on each configured instance. Any subsequent changes made to a template can be propagated to all linked instances.

CFCs allow engineers to create specific control logic using standard Harmony function codes and then save it as a package which can then be used as a standard Harmony function code in control logic design. This simplifies the control logic design and documentation by eliminating the need to re-write the entire CFC logic contents in every instance it is used in the control scheme. The CFC can be represented by a custom shape, control logic, defined inputs, defined outputs, defined specifications and tag mapping. Black box options secure user intellectual investments in their control solutions.

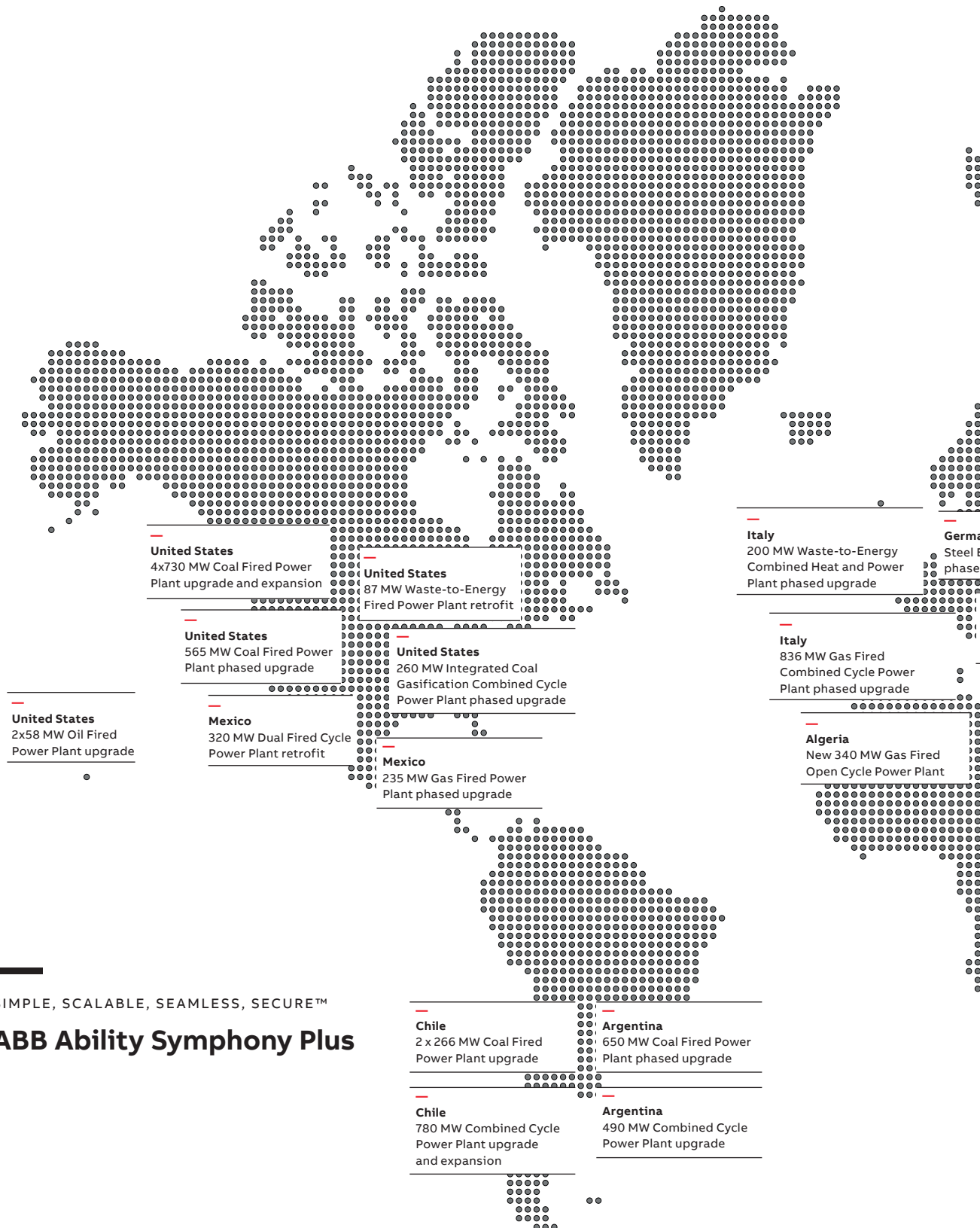


HART and PROFIBUS devices are fully integrated with Symphony Plus, yielding benefits far beyond reduced footprint and cable costs. The engineering suite supports configuration, commissioning and maintenance of HART and PROFIBUS devices using device type manager (DTM) technology. For field devices that 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.

On-line features allow for proactive device monitoring and notification of problems with quick access to device alerts and high priority conditions. A built-in web view provides a Device Status Dashboard, as well as an Event Viewer and Device Details pages, allow for quick drill-down to identify device root problems and corresponding resolution. This enables to users to take decisive action to increase plant reliability while lowering maintenance costs.

# HR Series

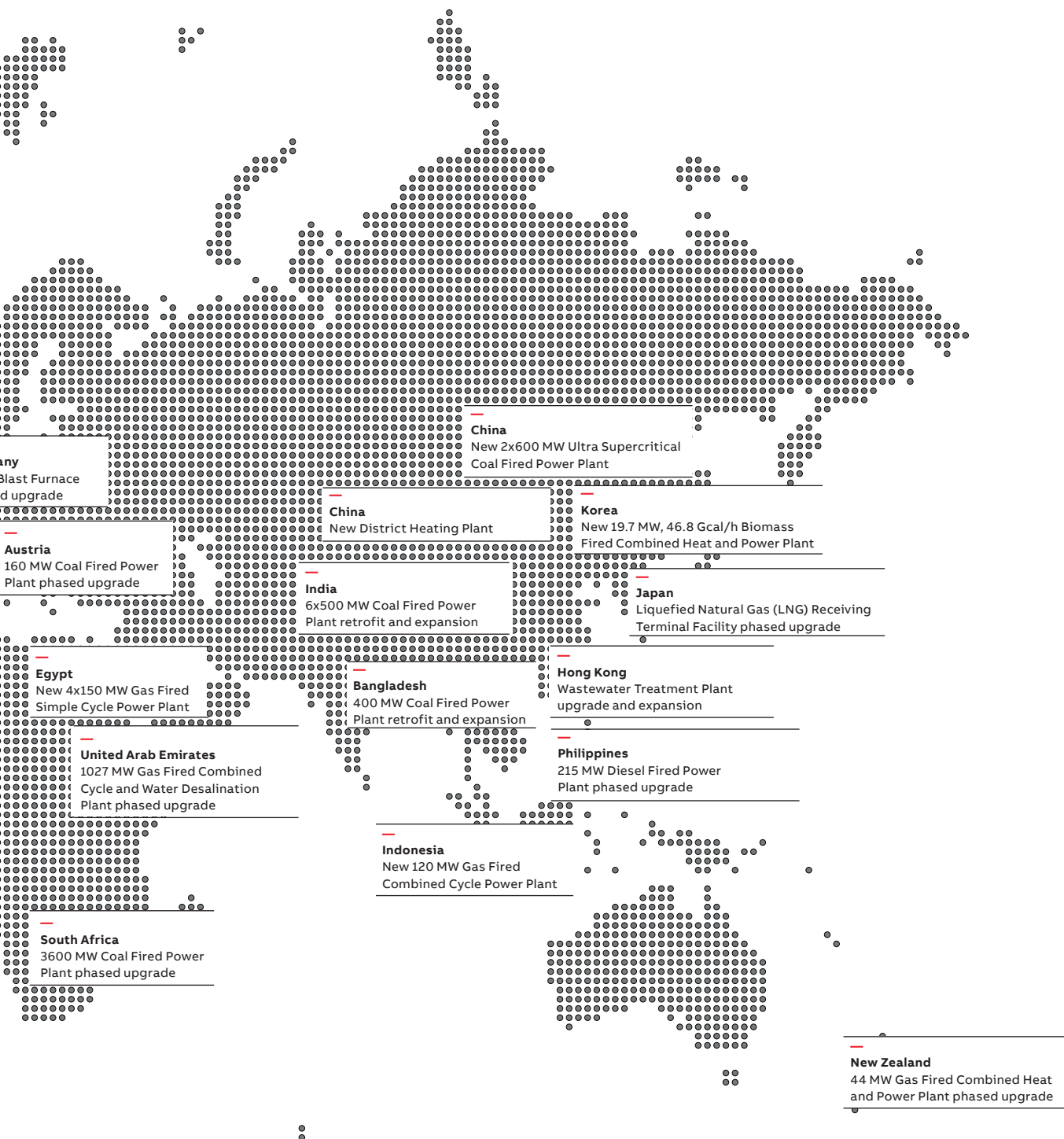
Field tested, field proven



SIMPLE, SCALABLE, SEAMLESS, SECURE™

**ABB Ability Symphony Plus**

Since its introduction in 2011, ABB has delivered or is delivering Symphony Plus solutions that control more than 70,000 MW of additional power generation. These solutions range in complexity from the simplest to the most challenging of automation requirements, and for power and water facilities of all sizes. Below is a sample of the breadth of Symphony Plus HR Series based solutions selected for power generation and water from installations around the world.



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