Features and Benefits

- **Scalable, Cost-effective Design**: Scalability in functionality and performance optimizes each installation for the scope and task at hand.

- **Common Environment for Plant Automation and Safety**: The High Integrity controller provides the ability to combine safety loops with control applications within the same controller to facilitate maximum utilization of process equipment.

- **Fault Tolerance for Maximum Plant Availability**: Robust design, distributed functionality and highly flexible redundancy options secure productivity, yield, and return.

- **Open Architecture Reduces Lifecycle Costs**: Industry-standard fieldbus, network and data interchange protocols are supported, making it easy to integrate third-party plant systems.

- **Integrating, for Plug-and-produce Connectivity**: Industrial IT-enabled Control and I/O results in easy integration with similarly certified products such as drives, motors, valves, instrumentation, and higher-level applications.

- **Comprehensive Maintenance Features Reduce Downtime**: Comprehensive self-diagnostics and hot-swap capability reduce maintenance costs and increase uptime and plant productivity.

- **Flexible I/O for all Plant Environments**: A full line of industrial I/O types including intrinsically safe and SIL-rated. Packaging and mounting options are available for remote and local I/O installations.

- **Wide-ranging Control Functionality Meeting all Needs**: Controller software to fit all control and safety applications, from simple to complex, discrete to continuous, and basic regulatory to advanced expert applications.

Continuous productivity improvements and increased profitability are the driving forces behind the selection of today’s plant automation system. Traditionally, production facilities maintained many controller subsystems; each meeting specific plant needs. However, as business goals have changed, using a scalable controller platform possessing multi-functional capabilities, adaptability to changing requirements, openness, and maximum availability, is paramount to success.

The Industrial IT System 800xA family of controllers, communication interfaces and I/O modules match the most challenging requirements in all these areas. Combined with ABB’s rich experience in general and industry-specific process automation, AC 800M Control and I/O products deliver powerful and versatile solutions that are equally effective for small hybrid systems as for large, integrated, automation applications. Thereby, the products contribute to higher return on assets by improving overall production control, maximizing process availability, and minimizing maintenance.
Introduction

Industrial IT 800xA Control and I/O products extend continuous productivity improvement opportunities with options to meet all needs for control in manufacturing and processing. ABB controllers feature an extensive software library of pre-defined and user-defined control elements. These can be used to easily design simple to complex control strategies to fit any application, including continuous, sequential, batch, and advanced control. Designed from the ground up to leverage the power of industry-standard field buses and open communication protocols, ABB controllers provide a full range of controls, scalability, and fault-tolerant redundancy options. In addition, a full line of industrial I/O is offered that provides: remote and local installations, small footprints, rail mounting, and a broad range of I/O types, including intrinsically safe I/O.

The IEC 61508-certified high-integrity controller AC 800M HI can, to advantage, host safety and control applications and run them concurrently, within the same machine. Such an environment offers safe, instant, interaction between applications, and leads to a host of benefits, from easier handling, through better technical solutions, to lower costs.

Figure 1. AC 800M Control and I/O provide the functionality to support the entire production facility’s control requirements, from discrete and continuous to batch and advanced control and safety applications.
Scalable, Cost-effective Design

Through its modular design, AC 800M controllers and associated I/O options contribute to lower costs, higher engineering quality and higher operating efficiency. Equally effective for small hybrid systems as for large, integrated automation applications, the modularity of the subsystem results in higher return on assets by providing the flexibility to choose the specific functions required to meet actual requirements. Using the same base hardware, a wide variety of central processing units (CPUs), I/O, communication modules, and power-supply options is offered to provide flexibility in terms of functionality, performance, and size.

For example, a basic controller station may consist of a power supply module, a controller, and local I/O modules. A large system can consist of several AC 800M controller stations that communicate over an Ethernet-based control network. These stations may employ subclustered I/O assemblies connected to their host controllers via fiber-optic or industry-standard fieldbuses.

Redundancy at the I/O, controller and communication levels is available as options, affording maximum flexibility.

System 800xA Operations, Engineering, and other applications communicate with AC 800M Control and I/O subsystems over the same Ethernet control network. Additionally, localized communication is possible via dedicated serial links.

The AC 800M HI can host safety and control applications within the same controller. When safety and process applications are executed within the same controller or within the same system, they can freely exchange signals and data without the need for external, complex interface hardware, software, and mirroring of data. However, safety integrity is secured by certified embedded firewalls. The AC 800M HI’s extensive diagnostics and firewall mechanisms eliminate common-cause failures of control and safety circuits.

With these scalability options, undue redundancies can be avoided, process control requirements can be met with less hardware, with similar software applications be applied to all system configurations, both large and small.
Fault Tolerance for Maximum Plant Availability

The fault tolerance of AC 800M Control and I/O results in maximum control system availability with no single point of failure, thereby securing production and profits.

At the core, the base controller’s inherent reliability features contribute to high availability. Industrial-grade, conservatively loaded, on-board electronics result in a controller designed for installation in harsh environments. Low power consumption allows for installation in sealed enclosures without requiring fans, louvers, air filters or other forced cooling techniques. This simplicity eliminates many potential trouble-factors and thus contributes to the controller’s high reliability.

Maximum availability is achieved when the redundancy options are implemented. Redundancy is available in all critical areas of the AC 800M Control and I/O subsystem. These include control networks, field buses, internal buses, power supplies, CPUs and I/O. If a fault occurs in a primary circuit, bumpless transfer to the backup ensures uninterrupted operation.

If one of the controller CPUs fails, fieldbus communication redundancy can be maintained unimpaired through the subsystem’s communication bus isolation and switchover scheme.

The AC 800M HI controller offers a SIL3, TÜV-certified, control environment for combining safety and business critical process control in one controller without sacrificing safety integrity. The AC 800M, in combination with the Supervisory Module, performs advanced diagnostics and monitoring of application execution and I/O scanning.

Control modules, applications and hardware settings, may be changed on line, in real time and under power, resulting in maximum control availability.

The “Load Evaluate Go” function takes this handling ease a step further by supporting actions such as Modify, Download and Evaluate, making it possible to download a new version of the running application to the controller without it interfering with the running version. The modified version is started in passive mode

in parallel with the running version and an Evaluation Report shows the differences in real time. For more details see 800xA Engineering Overview.

The application(s) and data can optionally be stored in Compact Flash memory to secure its contents e.g. after a power failure or during transport.

Finally, noise-immune fiber-optic communication is also available, safeguarding the operation of the AC 800M Control and I/O subsystem even under the most extreme electromagnetic conditions.

**Open Architecture Reduces Lifecycle Costs**

The open architecture of AC 800M Control and I/O reduces lifecycle costs by simplifying the task of integrating plant systems and devices. Additionally, the subsystem's useful life is extended since the open architecture allows for easy integration of new commercially-off-the-shelf (COTS) applications and products. In System 800xA, seemingly disparate plant systems and devices are accessed via OPC, Ethernet, TCP/IP, Modbus TCP, IEC 61850, PROFIBUS DP, and FOUNDATION Fieldbus (H1 and HSE) and their resident information used in control strategies and higher-level applications to produce tighter and more reliable process control solutions.

The open design of AC 800M Control and I/O ensures peer-to-peer communication with existing, distributed control systems by ABB. Communication and fieldbus options exist at both at the controller and I/O levels.

![Figure 4. AC 800M Control and I/O support industry-standard data interfaces, network protocols and field buses. Consequently the subsystem can interact with – and integrate – a wide range of devices and systems by both ABB and others.](image)
Integrating, for Plug-and-produce Connectivity

AC 800M Control and I/O seamlessly integrate traditionally isolated plant devices and systems into the 800xA system environment, thereby extending the reach of the automation system to all plant areas. The result is a simplified, software representation of the plant, from simple on/off-type switches and valves to smart field devices, dedicated control subsystems, variable-speed drives, intelligent INSUM switchgear and popular PC-based supervisory systems.

ABB’s Aspect Object technology makes all information in plant devices available and presented in a consistent, ready-to-use manner at the controller, engineering, and process visualization levels. Process objects include familiar items such as motor and valve controls. They can also include Operator interface objects, such as faceplates, trend displays, and other graphic elements, engineering objects and maintenance support objects. In this manner, AC 800M Control and I/O provide system applications with transparent, real-time access to all connected field devices, for everything from configuration and setup to production monitoring and maintenance.
Comprehensive Maintenance Features Reduce Downtime

AC 800M Control and I/O contribute to lower maintenance costs through a comprehensive set of self-diagnostics.

All modules are equipped with front-panel LED displays that show faults and degraded performance.

Modules can report these errors to operators and maintenance personnel as alarm and event messages - and the system forwards them to key plant personnel by e-mail and/or SMS. For information on reporting features, see the 800xA Operations Overview document.

AC 800M Control and I/O can be fully integrated with the 800xA's Asset Optimization features to electronically submit fault reports to a computerized maintenance management system as a basis for work orders, thereby streamlining maintenance processes. For more information on 800xA Computerized Maintenance Management System (CMMS) integration features, please refer to the 800xA Asset Optimization Overview document.

Modules can be replaced under power and are keyed to ensure replacement with the proper module types.

The application and data can also be stored in Compact Flash memory to secure its contents e.g. after a power failure or during replacement or transportation.

AC 800M Control and I/O also support on-line upgrading of embedded firmware in CPUs and communication modules to avoid downtime.

Figure 6. Modules are equipped with diagnostic LED's and can be replaced live for ease of maintenance.
800xA Control and I/O Products - Description

AC 800M Controller

The AC 800M controller is a family of rail-mounted modules, consisting of CPUs, communication modules, power supply modules and various accessories. Several CPU modules are available that vary in terms of processing power, memory size, SIL-rating, and redundancy support.

Each CPU module is equipped with two Ethernet ports for communication with other controllers and for interaction with operators, engineers, managers, and higher level applications. These ports can be configured for redundancy for those cases where availability is of paramount importance. It is also equipped with two RS-232C ports that can be used for point-to-point communication with programming/debugging tools and with third-party systems and devices. A Compact Flash memory card can be inserted into a slot in the CPU module to store the application and data.

To this module, a number of communication and I/O modules can be added, for example:

- **Additional RS-232C ports**, making it possible to connect third-party systems and devices,
- **PROFIBUS DP, DP-V1 interfaces**, providing integration of S200, S800 and S900 I/O systems and access to the wide range of field devices, supporting these protocols,
- **FOUNDATION Fieldbus HSE interface**, provides a backbone for access to FOUNDATION Fieldbus system solutions,
- **IEC 61850 interfaces**, providing integration of IEDs (Intelligent Electrical Devices) in power control and management systems,
- **ABB INSUM interface**, facilitating efficient supervision and control of electric switchgear over multidrop bus connections,
- **MasterBus 300 interface**, providing backward compatibility with Advant OCS and ABB Master systems,
- **S100 I/O interface**, making it possible to upgrade from existing Advant Controller 410 or 450 - or even MasterPiece 200 - systems to AC 800M and retain existing I/O sections,
- **TRIO I/O interface**, making it possible to upgrade from existing MOD300 Controllers to AC 800M and retain existing TRIO I/O sections,
- **Satt I/O interface**, making it possible to upgrade from existing Satt Controllers to AC 800M and retain existing Satt I/O sections,
- **Modbus TCP interface**, combining the MODBUS RTU with the Ethernet and TCP standards, thus providing communication with 3rd-party equipment,
- **I/O modules** from the S800 I/O family as direct I/O.
Figure 8. The AC 800M Control and I/O subsystem is exceptionally comprehensive, open, scalable, reliable and maintenance-friendly.
These connectivity and expansion options make the AC 800M exceptionally open and scalable, that is, easy to connect to the surrounding world of supervisory systems and intelligent devices of all kinds - and adaptable to changing requirements as the process it controls changes, expands or contracts.

The AC 800M HI offers a certified TÜV control environment for combining safety and business critical process control in one controller without sacrificing safety integrity. The AC 800M, assisted by a supervisory co-processor, performs diagnostics and monitoring of application execution and I/O scanning.

To enable use of the same controller for both SIL and non-SIL applications, all functions/types in standard AC 800M HI Controller libraries are marked non-SIL or SIL to show their usability in the two application types. Embedded safety measures prevent inadvertent degradation of safety applications.

For more details, please refer to the 800xA Safety Overview.

The S800 I/O system is closely related to AC 800M, not only in appearance but also in features.

- **Comprehensive:**
  The S800 family of I/O covers virtually all conceivable signal types and ranges. From basic analog and digital inputs and outputs to pulse counters and intrinsic-safety I/O.

- **Flexible configuration:** S800 I/O may be set up in a variety of ways, from directly connected to the host controller, to subclustered (using fiber-optic cables), to PROFIBUS-connected. Redundancy solutions are available at all levels including; power supply, communication interfaces and I/O circuits.

- **Flexible installation:** Three mechanical designs are available:
  - *Compact* (plug-in modules with a basic I/O signal termination area),
  - *Extended* (plug in modules with ample space for I/O cable termination, fuses, jumpering and field power distribution), and
  - *S800L* (all-in-one modules and bases with detachable screw terminal blocks for I/O signals) for installations not requiring hot-swap capability.
**Easy to set up:** Once station numbers have been allocated and set, all other settings can be made from a network-connected engineering tool. A pass-through feature makes it possible to configure and examine all HART®-compliant field devices in a similar way.

**Reliable:** S800 I/O offer availability-improving features such as:

- *Input/Output Set as Predefined (ISP/OSP).* Each input/output can be set individually to default to a predefined value or freeze in case of communication loss.

- *Hot swap of modules.* A faulty I/O module can be replaced live, i.e. without powering the station down and without the rest of the station being affected. A hardware key ensures that only modules of the right type can be inserted.

- *Hot configuration in run (HCIR).* An S800 I/O station can be reconfigured while in full normal operation, i.e. without having to switch it over to configuration mode.

- *Redundancy options* in all areas: power supply, fieldbus media, fieldbus interfaces and I/O modules.

**Accurate:** S800 I/O modules can time-stamp events, i.e. input signal transitions, at the source with millisecond accuracy. Thereby providing the basis for meaningful sequence-of-events recording by the host system. In tightly interlocked processes this is essential to finding the root causes of production disturbances.

For harsh environments, S800 modules are also available in variants satisfying the G3 severity level of ISA-S71.04, *Environmental Conditions for Process Measurement and Control Systems.*

**High Integrity I/O**

Within the S800 family, there are SIL3 certified modules that can be used for safety critical applications. These I/O modules include those for 4 - 20 mA analog inputs, 24 Vdc normally closed digital inputs, and 24 Vdc digital outputs. The digital output module provides both Normally Energized (ESD) and Normally De-energized (F&G) outputs. Analog inputs support HART routing for easy calibration checking and diagnosis with configurable access, while the digital inputs support local time-tagging of signal changes for high-accuracy sequence-of-events logging.

*Figure 11.* A comprehensive assortment of I/O modules are available for safety-critical use. These include a range of SIL-3-rated S800 I/O modules for analog inputs, digital inputs, and digital outputs.
The S900 remote I/O system communicates with 800xA or other controllers over PROFIBUS. Suitable for applications in the chemical, pharmaceutical, oil and gas industries, S900 I/O can be installed in hazardous areas, thereby reducing marshalling and wiring costs. Further maintenance savings can be achieved through S900’s extended diagnostics and the use of HART®-compliant field devices.

Three versions of S900 I/O are available:

- **S-series** for applications in Zone 1 hazardous areas
- **B-series** for applications in Zone 2 hazardous areas
- **N-series** for applications in non hazardous areas

<table>
<thead>
<tr>
<th>Series</th>
<th>Installation Site</th>
<th>Field Devices/Signals</th>
<th>Ex Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-series</td>
<td>Zone 1</td>
<td>Zone 1 or Zone 0</td>
<td>ATEX</td>
</tr>
<tr>
<td>B-series</td>
<td>Zone 2</td>
<td>in Zone 0 or Zone 0</td>
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</tr>
</tbody>
</table>

Table 1.

Additional solutions for specific applications are available:

- **Field housing** - for wall mounting and field mounting in Zone 1 installations with system approval fully certified in accordance with ATEX. The high-grade steel housing is prepared for wall-mounting with facility for insulated screen rails or terminals.

- **CB220 compact box** - S900 in compact form (with up to 4 I/O modules). This variant is suitable for use in applications such as temperature multiplexers and solenoid valve circuits.

The S900 components are based on a passive backplane suitable for mounting on a DIN rail or directly in a sub-distribution board. The passive backplane includes internal bus communication, terminals for field circuits, communication, and power supply. The function modules are plugged into the backplane in their appropriate slots. The redundant backplane has two slots for power supply units, two slots for communication interfaces, and 16 slots for function modules. Digital function modules have up to 8 channels, analog modules up to four. Therefore, when using a redundant backplane, 128 digital or 64 analog channels can be connected per station. In the case of the S and B series, up to ten S900 stations can be connected on a single fieldbus line.
Key S900 benefits include:

- **Intrinsically safe** - can be installed in Zone 1 and Zone 2 areas,

- **Good price/performance ratio** because external barriers have been removed and costs are reduced in terms of cabling, installation, hardware, and maintenance,

- **High reliability** thanks to smooth automatic transfer of data and to auto-diagnostics,

- **Easy configuration** using either FDT/DTM or GSD files, allowing easy integration with 800xA process control systems,

- **High availability** of the plant thanks to redundancy and hot-swap capability of all components during operation.

**Control Software**

Control Software includes an extensive library of control elements, ranging from simple AND gates to powerful adaptive PID controllers, predefined and ready-to-use process objects and control functions e.g. for motors, valves and INSUM switchgear. It also supports the development of user-defined control elements.
Control Software and its engineering tools support all five of the IEC 61131-3 programming languages (function block diagram, structured text, ladder diagram, sequential function chart and instruction list) plus ABB’s own high-powered Control Module language.

For details on controller configuration features, see the 800xA Engineering Overview document.