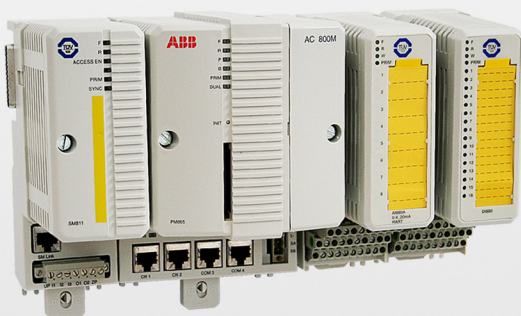
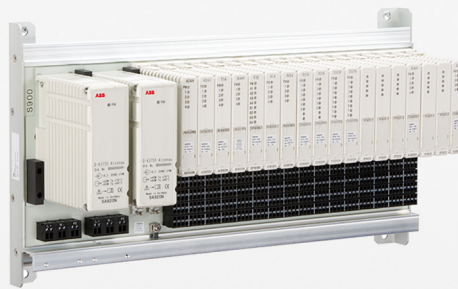
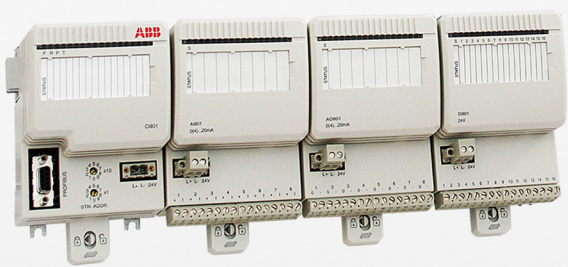

ABB Ability™ System 800xA

AC 800M, Control and I/O Overview





Extended Automation System 800xA

AC 800M Control and I/O seamlessly integrate traditionally isolated Process, Power and Safety 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 switchgear, protection relays (IED) 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 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.

More information - where to find

For updated information regarding System 800xA hardware, please visit our 800xA Hardware Selector. In the selector you can compare different communication modules, S800 IO modules, module termination units, AC 800M controllers, Panel 800, 800xA Networks and also print your own pdf files. www.800xahardwareselector.com

For more information about Ability™ System 800xA, please also visit our web: www.abb.com/800xA

ABB CONTROL SYSTEMS

System 800xA hardware selector

Select product

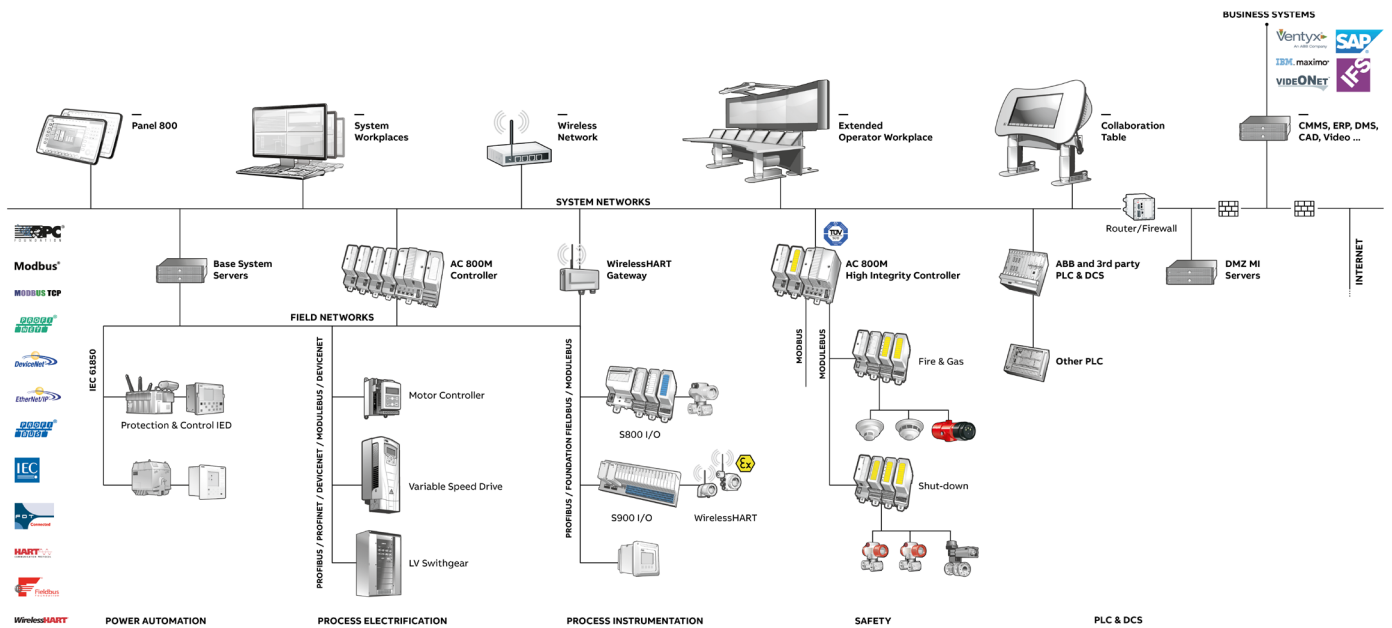
Communications SHOW PRODUCTS	Controllers SHOW PRODUCTS	I/O Modules SHOW PRODUCTS
Networks SHOW PRODUCTS	Panels SHOW PRODUCTS	Power supplies & Voters SHOW PRODUCTS

Articles



Features and benefits

- **Common Environment for Process and Power Automation and Safety:** The High Integrity controller provides the ability to combine safety loops with control applications even within the same controller to facilitate maximum utilization of process equipment. The support of the IEC 61850 standard for substation makes System 800xA an efficient platform for a combined Process and Power Automation solutions.
- **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, wireless and data interchange protocols are supported, making it easy to integrate third-party plant systems.
- **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 Process, Power and safety applications, from simple to complex, discrete to continuous, and basic regulatory to advanced expert applications.
- **HART pass-through**
- **Redundancy on all levels, also on I/O module level**
- **High Integrity I/O modules certified to SIL3**
- **I/O modules with Intrinsic Safety interfaces**



Collaboration between people, systems, and equipment

In order to be competitive, various plant entities, departments and personnel have to work as one flexible, integrated, collaborative environment. For this to be accomplished, an automation platform with incredible connectivity capabilities is needed.

Collaboration is a necessity to increase engineering efficiency, asset utilization, energy savings, and operator effectiveness.

System 800xA's 'xA' stands for Extended Automation and utilizes the Industrial IT architecture, which was built for collaboration in a fully redundant, reliable environment. It provides connectivity to all seven ABB DCS systems, as well as other ABB and 3rd party plant systems and applications.

In addition, System 800xA's integration capabilities extend from Process Automation to Power Automation and Safety for highest operator effectiveness and optimized control.

The controller is the heart of the control system and often taken for granted as a commodity. This is not the case with the ABB Ability™ System 800xA.

800xA's flagship controller, the AC 800M, has the ability to integrate various networks, fieldbusses, serial protocols, and I/O providing seamless execution of advanced and unhindered process control strategies as well as functional safety, electrical, quality control, and power management applications.

By permitting installation in the field, close to sensors and actuators, S800 I/O reduces the installation cost by reducing the cost of cabling. And thanks to features such as hot swap of modules, on-line reconfiguration and redundancy options, it contributes to keeping production -- and thereby profits up.

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.

— 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.

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 may consist of a power supply module, a controller, and local I/O modules. A large system can consist of several AC 800M controllers that communicate over an Ethernet-based control network.

These stations may employ subclustered I/O assemblies connected to their host controllers via cable, fiber-optic or wireless industry-standard fieldbuses.

Redundancy at the I/O, controller and communication levels is available as options, affording maximum flexibility and availability. 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 Control Builder software can be used to configure AC 800M control and safety applications. In addition to editors compliant with IEC 61131, the Control Module Diagram Editor is provided for object-oriented design and engineering of control applications.



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.

— Optional redundancy in all areas of importance: power supply, CPUs, communication links and I/O circuits, is only one of many features of AC 800M Control and I/O that contributes to the highest possible plant availability.

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 back-up ensures uninterrupted operation.

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

The AC 800M HI controller offers a 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 Safety Module, performs advanced diagnostics and monitoring of application execution and I/O scanning.

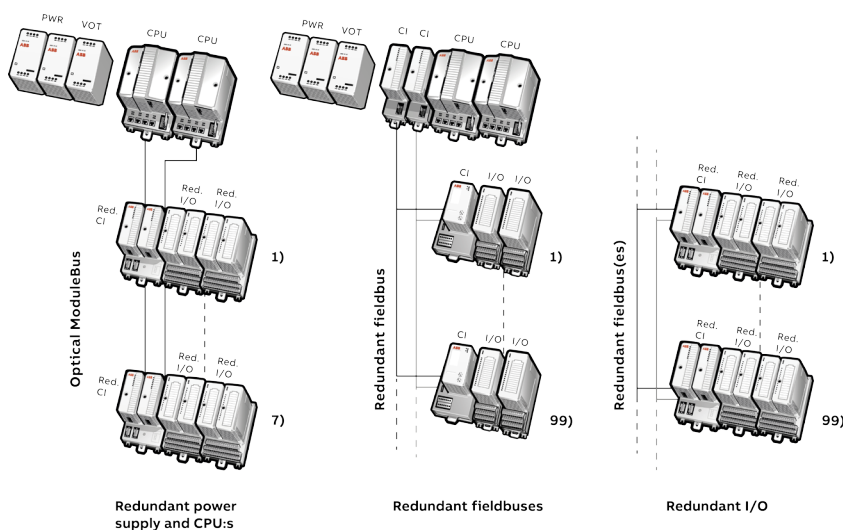
Control modules, applications and hardware settings, may be changed on line, in real time and under power, resulting in maximum control availability.

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 and a Task Analysis tool shows the differences in real time.

The application(s) and data can optionally be stored in 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.



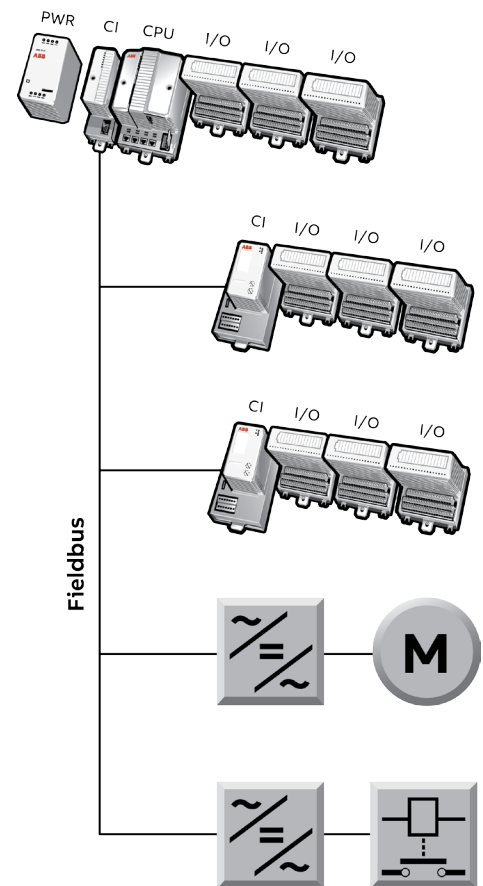
Open architecture reduces lifecycle costs

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, Ethernet IP, DeviceNet, Modbus TCP, PROFIBUS DP, PROFINET I/O 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. Wireless communication options exist at both the controller and I/O levels.

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.



Expansion by fieldbus

AC 800M control and I/O products

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.

System 800xA's combination of EtherNet/IP and DeviceNet connectivity provides a native interface to simple I/O and electrical equipment like that often used in the Americas. Cyclic data from DeviceNet devices can easily be integrated via the LD 800DN Linking Device. As more and more devices in this application domain start to support EtherNet/IP, this equipment can also be connected on the same network through the same communication interface.

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

AC 800M controller ensures availability to meet all production requirements, with redundancy options practical at all levels.



PM891



PM851 to PM867

with third-party systems and devices. A 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.
- PROFINET IO, PROFIBUS and DeviceNet interface providing integration of a wide range of process equipments and I/O-systems.
- IEC 61850 interface, making it possible to protect and control substation equipments by IEDs (Intelligent Electronic Devices) or protection relays.
- ABB INSUM interface, facilitating efficient supervision and control of electric switchgear over multidrop bus connections.
- MasterBus 300 and AF100 interface, providing 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.

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.

AC 800M control and I/O products

S800 I/O family

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).
- **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

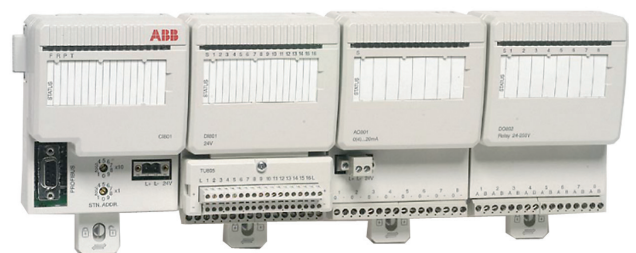
S800 I/O modules can time-stamp events, i.e. input signal transitions, at the source with millisecond accuracy. Thereby providing the basis for meaningful sequence-of-events recording by the host system. In tightly interlocked processes this is essential to finding the root causes of production disturbances.

For harsh environments, all control and I/O modules are compliant to G3 severity level of ISA-S71.04, Environmental Conditions for Process Measurement and Control Systems.

S800 I/O is available in three different designs: Compact, Extended, and S800L.



S800 I/O



S800L I/O

AC 800M High Integrity controller

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 HI, in combination with a diverse 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.

The SIL 3-rated, IEC 61508-certified AC 800M HI Controller is ideally suited to running both process control and safety application concurrently, in the same machine.



AC 800M High Integrity Controller

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.



S800 High Integrity I/O

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.

The entire S800 I/O family 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.

S900 I/O family

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

- 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

Series	Assembly	Field devices / signals	Hazardous area approval
S series	In Zone 1	In Zones 2, 1 and 0 (intrinsically safe signals)	ATEX Zone 1 (Blue TU921S)
B series	In Zone 2	In Zones 2, 1 and 0 (intrinsically safe signals)	ATEX Zone 2 (Blue TU921B)
N series	In safe areas	In safe areas	No (Black TU921N)

Additional solutions for specific applications

- 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.

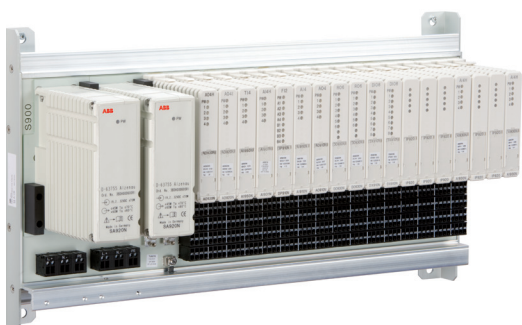
The S900 components are based on a passive backplane suitable for mounting on a DIN rail or directly in a sub-distribution board. The passive backplane includes internal bus communication, terminals for field circuits, communication, and power supply. The function modules are plugged into the backplane 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

- 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.

The intrinsically safe S900 I/O system can be installed in Zone 1 and Zone 2 areas and offers features such as hot swap and optional redundancy.



Engineering software

System 800xA Engineering provides real-time information integration for better and faster access.

800xA Engineering, is designed to facilitate one-time data entry for all areas within the automation system, from field devices to asset optimization, while ensuring built-in data consistency.

Providing a single source of accurate and real-time plant information results in maximum engineering performance, quality, and reliability.

This integrated environment results in fewer startup delays, reduced maintenance costs, and more effective engineering practices.

800xA Engineering features

- Graphic display configuration
- Control application design
- Safety application design
- Control system configuration
- Field device and instrumentation configuration
- Control System and field device maintenance
- Trend and history configuration
- Integration with CAE tools as Intergraph SmartPlant® Instrumentation



The screenshot displays the ABB Ability System 800XA AC 800M control interface. The main window shows a 'Process Area' diagram for 'Reactor 11'. The diagram includes a 'Refiner Process' with a 'PH1112 PreHeater' and 'Reactor 11' with a 'Discharge' section. Key parameters shown include '54.5 °C' for the Refiner Process, '68.5 °C' for the PreHeater, and '19.6m3/h' production for Reactor 11. A 'Set Point' of '19.0m3/h' is also indicated. A 'Preheating and reaction temperatures' graph shows three temperature lines: 68.5 °C, 61.2 °C, and 54.5 °C. A 'Process Area: Display Alarm Indication' window shows three active alarms: 'HE1112_TT_Cold_Out' (High High), 'HE1112_TT_Cold_Out' (High High), and 'R11_PTCalc' (High High). On the right, an 'R11: ReactorSeq SFC Viewer' shows a sequence of steps including 'Tr_ChargeProd1', 'Wait1', 'Tr_Wait1', 'ChargeProd2', 'Wait2', 'Tr_Wait2', 'ChargeProd3', 'Tr_ChargeProd3', 'Reaction1', and 'Tr_Reaction1'. A 'Transfer1' step is highlighted in green.

The screenshot shows the 'PID Diagram Editor' interface. At the top, a table lists variables with their data types, attributes, initial values, I/O addresses, access variables, and descriptions.

Name	Data Type	Attributes	Initial Value	I/O Address	Access Variables	Description
1 Comission_310	bool	retain	false			Condition for comissioning and tuning.
2 Error_310	bool	retain	false			Error present in the loop, force to nominal loop value.
3 Temp_PID_310	string	retain				Name of the PID
4 Track_Value_310	real	retain	46			Nominal temperature value
5 TT_310_ReallIO	ReallIO	retain				Temperature from the field
6 VP_310_ReallIO	ReallIO	retain				Analog output from the PID control
7 Comission_310	bool	retain	false			Condition for comissioning and tuning.

Below the table, the 'PID Diagram Editor' shows a control loop diagram. The diagram includes the following components and connections:

- Temp_PID_310** (string) is connected to the **Name** input of the **PidCC 1:4** block.
- TT_310_ReallIO** (ReallIO) is connected to the **AnalogInput** of the **AnalogInCC 1:1** block.
- VP_310_ReallIO** (ReallIO) is connected to the **AnalogOutput** of the **AnalogOutCC 1:5** block.
- Comission_310** (bool) and **Error_310** (bool) are connected to the **IN1** and **IN2** inputs of the **or-2** block.
- The output of the **or-2** block is connected to the **In** input of the **TOn 1:3** block.
- The **TOn 1:3** block has a **PT** of 3s and its **Q** output is connected to the **TrackValue** input of the **PidCC 1:4** block.
- The **PidCC 1:4** block has **Out**, **ERF**, and **Track** outputs.
- The **AnalogOutCC 1:5** block has an **In** input connected to the **Out** output of the **PidCC 1:4** block.

The interface also shows a status bar at the bottom with 'Row 1, Col 1' and 'DemoA'.

Control Builder software includes an extensive library of pre-defined and support of user-defined control elements, ranging from simple AND gates to powerful adaptive PID controllers and ready-to-use process objects and control functions e.g. for motors, valves and switchgear. These can be used to easily design simple to complex control strategies to fit any application, including continuous, sequential, batch and advanced control.

Control Builder software and its engineering tools support all five of the IEC61131-3 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 scenarios where the plant design is driven by highly repetitive units, the Control Modules are available. With Control Modules, user defined types covering a unit like a reactor can be designed and efficiently parameterized and instantiated multiple times.

For most efficient engineering the Control Diagram Editor can be used. This Graphical Engineering tool is in addition to the 61131 languages and brings it all together allowing for function blocks, structured text and sequences etc to all be in one engineering environment making it easier to create and maintain application software.

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