

Control^{IT}

Features and Benefits

- **Flexible, cost effective assembly:** Decentralized, rail mounted controller assembly can be combined with local or remote I/O.
- **Comprehensive I/O system:** A wide range of local and remote I/O is available with optionally integrated intrinsic safety design and transmitter power supply options. Features, such as SOE time stamping (1 ms resolution), monitoring, filtering and HART communication is supported with selectable I/Os, such as AC 870P local I/O, S800, S900 and other remote PROFIBUS I/Os.
- **Distributed capability:** S800, S900, and AC 870P local I/O are connected via high speed serial communication busses (PROFIBUS and Fnet). Designed for long distances, remote I/O reduces cable and installation cost.
- **Efficient field device integration:** Standardized FDT/DTM interfaces enable plug-and-play integration of field devices.
- **Easy to configure:** Module configuration and service is executed using the AC 870P Engineering Tool and its extensive library of fully tested and field proven powerful software function blocks.
- **Inherent redundancy design:** System integrated redundancy options for power supply, communication and I/O provide the highest level of availability.
- **High performance modular network:** Uses a redundant, high speed serial communication network with inherent capability for remote communication, easy to expand without requiring routing configuration.



Continuous productivity improvements and increased profitability are the driving forces behind the selection of today's 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 multifunctional capabilities, adaptability to changing requirements, openness, and maximum availability, is paramount to success.

System 800xA's AC 870P family of controllers, communication interfaces, and I/O modules meet the most challenging requirements in each of these areas. Through its modular design and backed by ABB industry-specific expertise, AC 870P can be adapted to a wide variety of plant types and sizes, especially in the power generation industry. Further supported with an efficient engineering environment, the AC 870P contributes to higher return on assets by improving overall production control, maximizing process availability, and minimizing maintenance.

Overview

The AC 870P control sub-system includes a compact DIN rail mounted device, a wide range of I/O modules, and modern, standardized fieldbus interfaces. These modules offer all functions required for data acquisition and signal conditioning as well as powerful open-loop and closed-loop control, sequence control and monitoring. All process management tasks are executed on the basis of integrated complex control strategies. Without additional configuration, the AC 870P's inherent redundancy design, including integrated redundancy concepts for power supply, communication, and I/O, provides the highest level of availability.

Key features include:

- The AC 870P Controller uses a 32 bit processor for maximum computing power and modular scalability.
- A wide range of I/O Interfaces is available, with optionally integrated intrinsic safety (Ex-i) design and sensor supply. Features such as time stamping with a 1 ms resolution, monitoring, filtering and HART communication are implemented as an option directly in the I/O modules.
- PROFIBUS Interfaces provide connections of System 800xA's S800 and S900 remote I/O stations in Ex and non-Ex versions, as well as other PROFIBUS devices.
- AC 870P Network uses a redundant, high speed serial communication network with inherent capability for remote communication. The network is easy to handle, without requiring routing configuration.
- The Flexible Assembly enables decentralized rail mounting universal 19" Rack and upgrade of Melody cabinets. This allows optimal adaptation to all plant structures.
- The Assembly System permits efficient connection of process signals to the front panel of the I/O modules and a high packing density.

All AC 870P controllers are synchronized system-wide with a precision of 0.5 ms. Sequence of Events (SOE) time stamping with a resolution of 1 ms is implemented directly at the controllers and local I/O module level.

The control subsystem (as described in Figure 1) includes flexible communication options to I/O and intelligent field devices via system busses. HART information, including configuration and diagnostic information, is communicated via the control network. This information is available to system controllers and system level applications such as asset optimization and device management. In addition, multiple digital fieldbus protocols are supported.

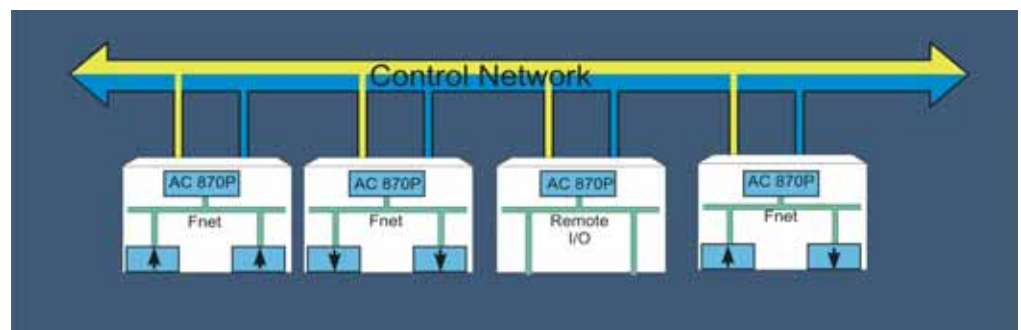


Figure 1: Network Architecture

Scalable Control Stations

The AC 870P control stations are composed of modular AC 870P controllers and I/O modules. Depending on the scope of the automation task, the control station is extended by different modules, such as I/O modules or communication interfaces (see Figure 2).

The control stations are interconnected via the control network (Cnet) where system-wide signal exchange with other control stations, operations, system level applications and the AC 870P engineering tool occurs in real-time.

Control stations operate autonomously. The controller's associated I/O modules are connected via the high speed redundant serial field network or via integrated PROFIBUS DP.

The controller's fieldbus connection also provides for communication with intelligent field devices.

An AC 870P Control Station includes all functions required for data acquisition, monitoring, closed-loop and open-loop control of plant processes including complex control strategies.

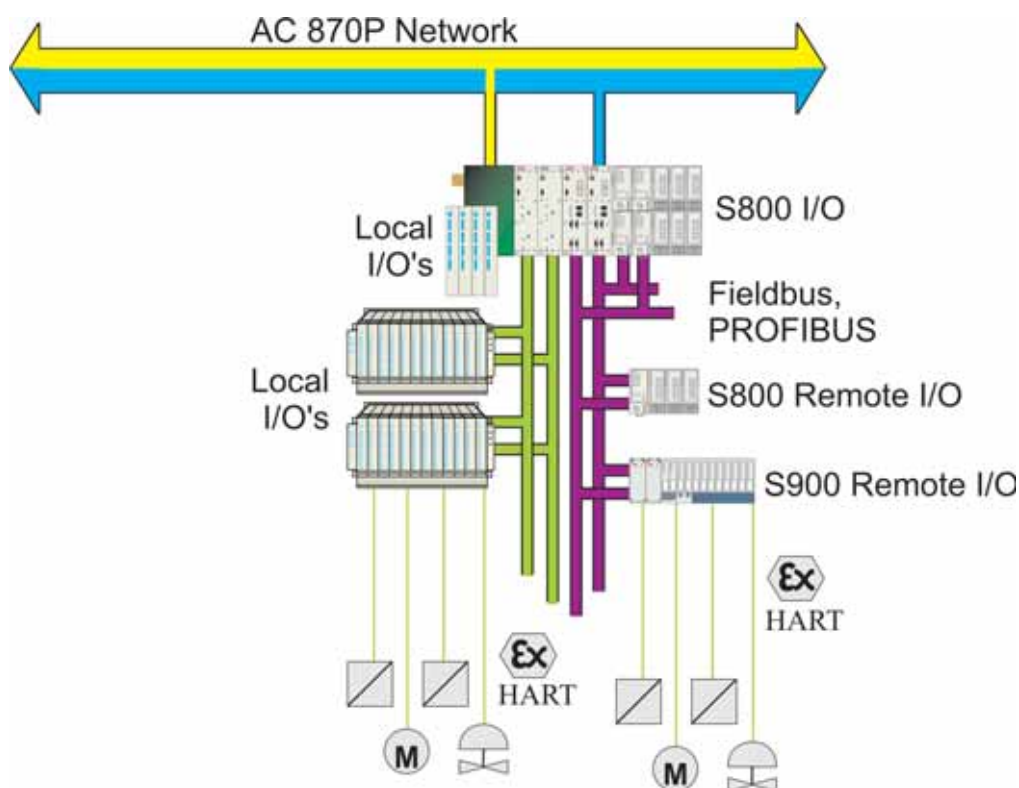


Figure 2: AC 870P Controller and I/O

The AC 870P Controller



Figure 3: AC 870P Controller

The AC 870P controller uses a 32 bit processor for maximum computing power and modular scalability.

Each controller can handle up to 2000 analog and/or digital I/O points via local I/O and additionally 6000 analog and/or digital I/O points via PROFIBUS DP. In addition to the traditional tasks such as signal processing, loop and logic control, the AC 870P Controller also performs complex computation such as sequential, batch and advanced controls.

Diagnostic routines periodically check the hardware and firmware integrity. In case a problem is recognized, the unit automatically sends a message to the 800xA Process Portal or other operator station alarm and events list.

The redundant design of AC 870P provides the means for automatic one-to-one backup, thus ensuring high system availability. If the primary controller is faulty, the hot-standby controller, executing the same control strategy and process data, immediately assumes control.

The AC 870P controller provides “open data connectivity” via a wide range of data interfaces.

To ensure maximum availability, the automation interfaces are designed with redundancy features including:

- **Cnet:** Peer-to-peer communication between various AC 870P control stations.
- **Onet:** Connection for communication with 800xA Process Portal or other operator station for operation and visualization and to AC 870P Engineering for configuration and service (see Figure 9).
- **Fnet:** Communication to process signal modules.
- **PROFIBUS-DP:** Communication to intelligent field devices and remote I/O.

AC 870P Controller Features

Key features of the AC 870P include:

- Large variety of powerful functions available in tested libraries
- Easy configuration, service and commissioning via AC 870P Engineering
- Inherent redundancy without configuration/wiring costs
- Real time multitasking operating system
- Up to 16 different cycle times available
- Monitoring and diagnostic functions
- Interface for radio clock connection
- Downloadable firmware and application programs (no EPROMs)
- Data Security:
 - Firmware stored in Flash Memory
 - Configuration data buffered in RAM with dual battery backup
 - Production and Operating data stored in NVRAM

The function blocks range from simple control and individual drive functions to complex recipes based on S88 and NAMUR using sequential function charts based on IEC 61131-3.

The function blocks may also be used to define customer specific libraries in the AC 870P Engineering System, see Figure 4.

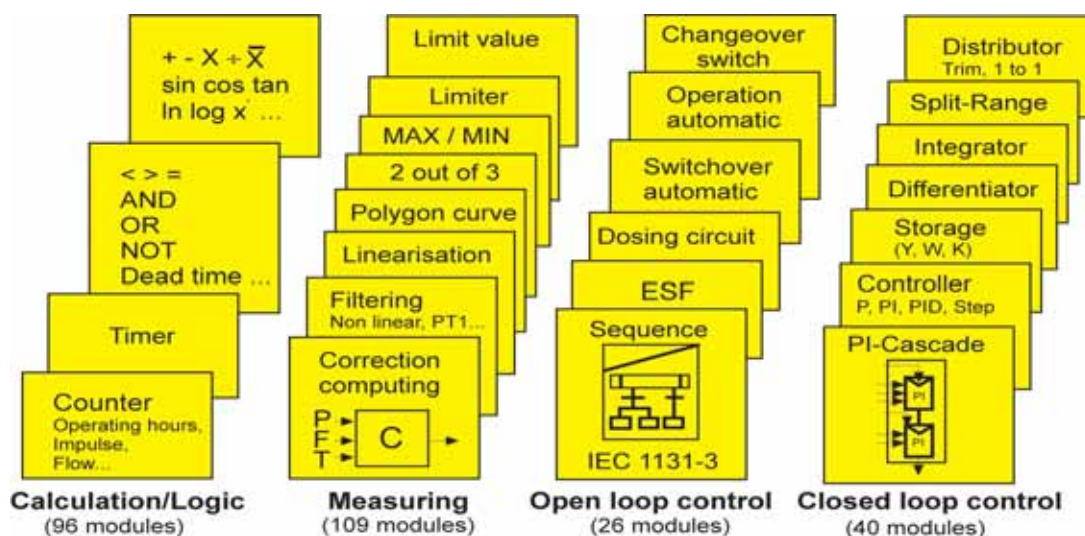


Figure 4: Library of Software Function Modules

Remote I/O

S800 I/O Family

AC 870P remote I/O is accomplished via S800 I/O connected via PROFIBUS. S800 I/O features include:

- **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 and jumpering), 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 the AC 870P 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 take on 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 physical 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 of importance: 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.



Figure 7: S800 I/O is available in three different designs: Compact, Extended, and S800L.

S900 I/O Family

The S900 remote I/O system communicates with 800xA or other controllers using PROFIBUS. Suitable for applications in the chemicals industry, the pharmaceuticals industry, the oil and gas industry, and the power generation industry, S900 I/O can be installed on site, thereby reducing marshalling and wiring costs. Further maintenance savings can be achieved through S900's extended diagnostic functions 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



Figure 8: 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.

Series	Installation site	Field devices/signals	Ex certificates
S-series	in Zone 1	in Zone 1 or 0	ATEX
B-series	in Zone 2	in Zone 1 or 0	ATEX Zone 2
N-series	non-hazardous area	non-hazardous area	none

Additional solutions for specific applications are available:

- **Field housing:** for wall mounting and field mounting in Zone1 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). For example, 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 DIN rail or directly to the sub-distribution board. The passive backplane includes internal bus communication, terminal units for field circuits, communication, and the 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 the communication interface, and 16 slots for the various function modules. The digital function modules have up to 8 channels, while the analog function modules are designed with up to four channels. 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:

- Flexibility for a large number of different applications: not only various hazardous-area applications but also standard non-hazardous-area applications, various options and solutions
- 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 auto-diagnostics
- Easy configuration either using FDT/DTM or by means of 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.

AC 870P Process Interface Modules

The AC 870P controller sets new standards for user convenience with industrial process interface modules. A large variety of I/O modules can be combined to form an optimal automation solution.

The main components of the AC 870P control station are the I/O modules and a high speed, redundant serial field network. Together they operate as a subsystem dedicated to the AC 870P controller. An I/O module processes inputs from and outputs to field devices and transfers these signals to the AC 870P controller module via Fnet.

Local I/O

The AC 870P controller has the following local I/O types available:

- Analog input (CAI)
- Temperature input (CTI)
- Analog output (CAO)
- Digital input (CBI)
- Digital output (CBO)
- Controller output/Individual drive output (CAC/CBC)
- Frequency input (CFI)
- Serial communication interfaces (CCF).

The cabinet resident I/O modules are powered by a modular power supply, which can also be provided redundantly.

All process signals are accessible at the front panel. The field cables are connected to cable termination units. For I/O redundancy, related termination units are used. With these termination units, replacement of defective modules is possible without disconnection of field cable and accordingly without field interruption; resulting in maximum availability.



Figure 5: AC 870P process signal connection to redundant and non-redundant I/O interfaces.

Local I/O

AC 870P local I/O features include:

- A processor in each I/O module provides advanced functions such as event detection and alarm generation, time stamping with 1 ms resolution and system diagnostics.
- Downloadable firmware eliminates need for PROM changes.
- Local I/O modules provide integrated transmitter power supply, integrated intrinsic safety, and HART communication.
- Distribution of I/O modules reduces cable and installation costs. A high-speed serial communication bus (Fnet) that is designed for long distances combined with flexible cabinet mounting options enables both centralized and remote I/O locations.
- Simplified user configuration eliminates need for calibration and on-board jumpers settings.
- Maximum availability through inherent redundancy design including redundant communications via Fnet and optionally redundant I/O modules.
- All local I/O can be reconfigured and extended with new I/O modules online, while in full normal operation.
- Input/Output set as predefined: each input and output can be set individually to taken on a predefined value or freeze in case of disturbed values or communication loss

Control Modules

Especially for the power generation industry, the following control I/O modules are used for close loop and open loop control.

The individual drive control (CBC 11-P) modules are used for:

- On/off actuators,
- Motor drives,
- Solenoid valves, or
- Hardwired individual control stations

The closed loop output (CAC 10-P) is used for:

- Continuous controller,
- PI step controller,
- Current signal output to I/P converter for pneumatic actuators,
- Three-position step controller with PI behavior,
- Three-point switch as positioning circuit, or
- Hardwired individual control station.

Both modules operate independently from the AC 870P controller.

Profibus Interface

The AC 870P controller integrates PROFIBUS-DP communications, thus enabling system level engineering of devices and device communications. In addition to communication with the system engineering environment, fault and diagnostics messages are displayed at the 800xA Process Portal workplace or other ABB Operator Station.

Features include:

- PROFIBUS-DP
- Two PROFIBUS lines per AC 870P
- Redundancy
- Transfer rate adjustable in steps from 9,6 kbit/s to 12 Mbit/s
- PROFIBUS-DP/PA converter

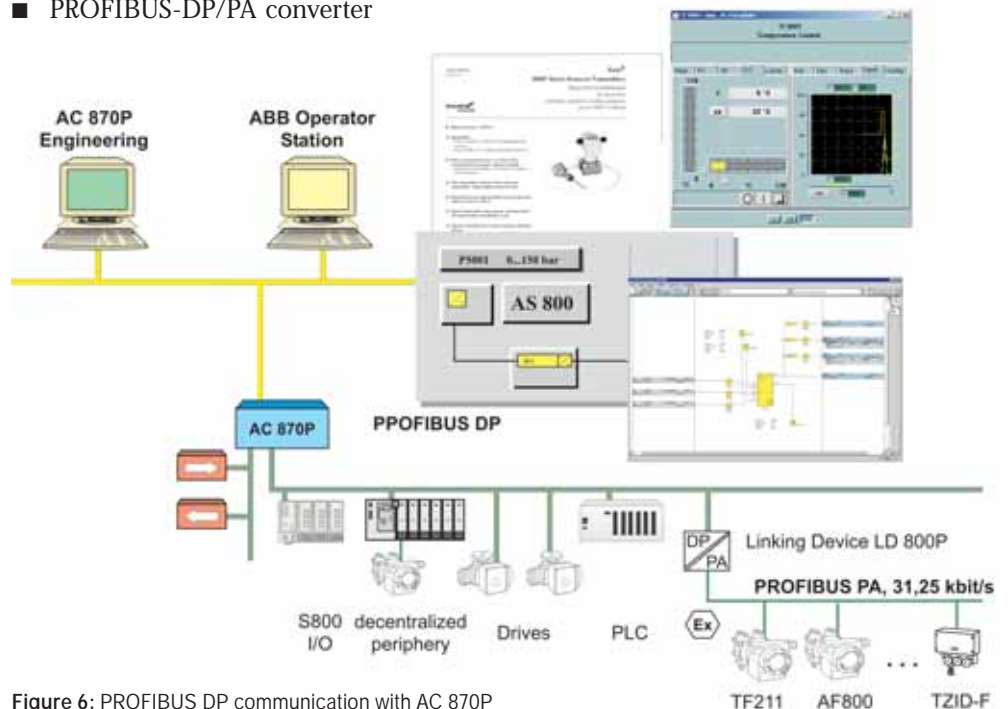


Figure 6: PROFIBUS DP communication with AC 870P

Network and Communication

Network

The AC 870P control network is subdivided with respect to hierarchy and functionality. The network is adapted to the respective plant size based on the hierarchical grouping into stations, plant areas and entire plant. The hierarchical grouping supports automatic data transfer between the AC 870P stations.

Functional subdivision of the network is effected in control buses and operation buses. Differing demands, data exchange with the automation facilities and communication with the operator, are both accounted for with this architecture. Several control stations are functionally connected for automation of a related process plant or process area. For communication with control stations, signals are transferred via the control bus Cnet. Via Cnet, several control stations, for related process plant or process area automation, are functionally connected.

With respect to process visualization, configuration and maintenance of the system, all information is routed via the operation bus, Onet.

This division of tasks permits control loops to be closed via control buses and protective signals to be transmitted. No influx of messages, irrespective of their size, impedes the automation of the process.

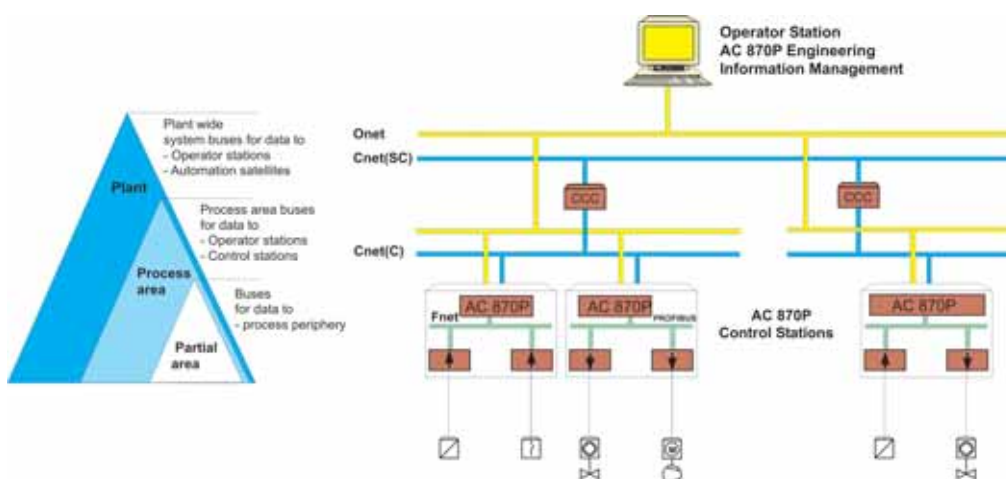


Figure 9: Network Architecture

Communication

Without additional configuration, a signal marshalling function automatically establishes the bus interconnection of the conditioned measured value (signal source) with all subsequent processing functions (signal sinks) throughout the system.

For each established interconnection, the active signal is cyclically and spontaneously transmitted individually from a signal source to a signal sink.

Decentralized Assembly System

Common features include:

- Modules with 7 height units
- Front panel width 8 or 16 graduations
- Light emitting diodes for fault signalling
- Selective module protection

The assembly system of AC 870P is designed for decentralized applications. Following variants are available:

- **CPU Housing:** The housings are mounted on standard rails. The controllers are easily connected via redundant interfaces. Each controller provides two redundant PROFIBUS DP interfaces, which may be used independently (see Figure 10).
- **Extension Housing:** In addition to the redundant controller, up to eight local I/O interfaces may be added to the extension housings. Furthermore, the redundant Fnet may be attached to the field via repeaters (Coax, fiber optic cable), in order to connect additional AC 870P controllers. Thus, the housings may be used with the proven local I/O as cost-efficient, remote I/O, without additional CPU.

Maximum two extension per station are possible (see Figure 11).



Figure 10: The AC 870P CPU Housing



Figure 11: The AC 870P Extension Housing

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