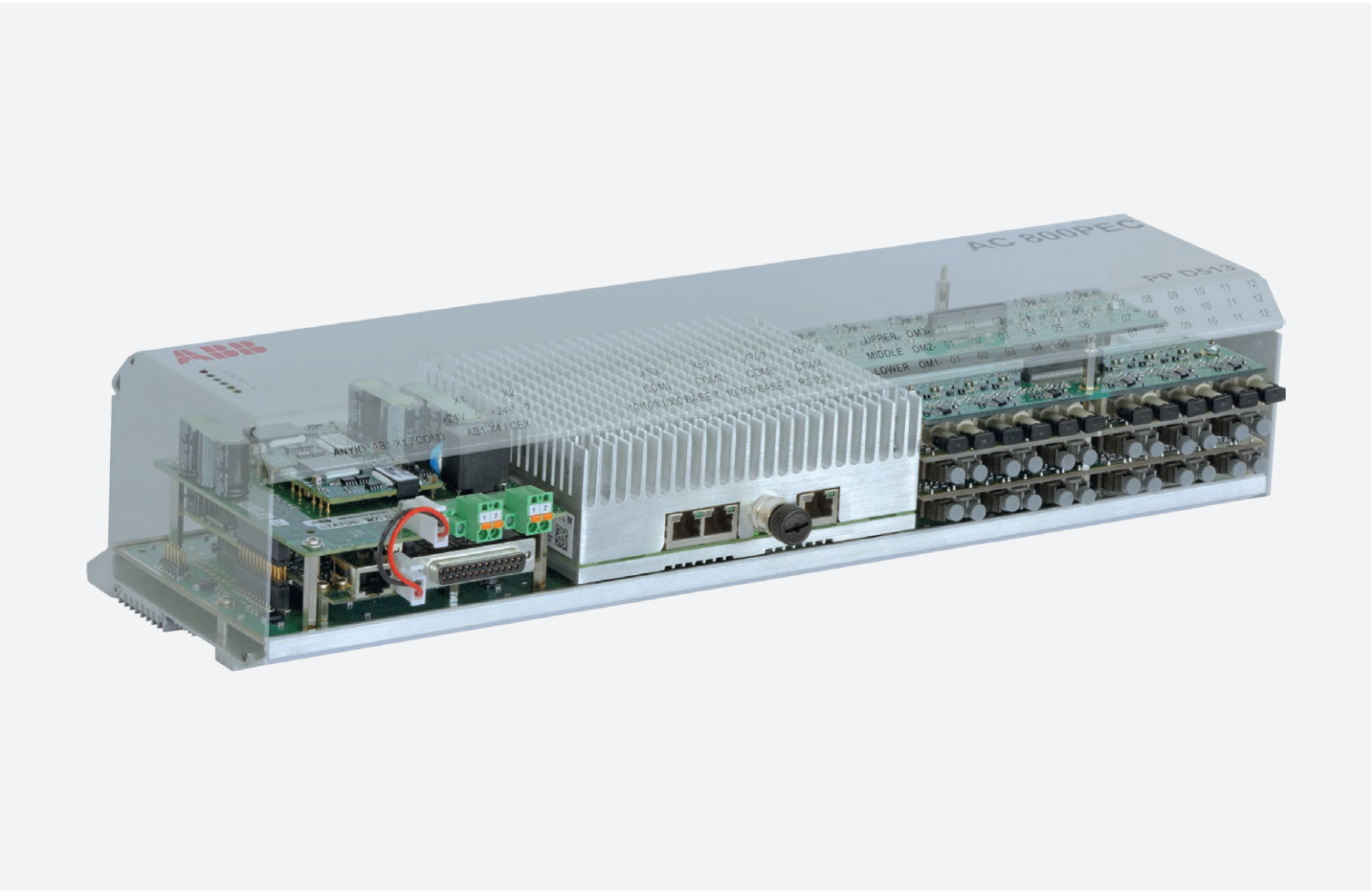
AC 800PEC

The high-performance control system for high power rectifier applications



High-performance applications with extremely fast control algorithms – cycle times that range from 100 µs (microseconds) for fast control loops to seconds for long-term operational transients – require specialized control devices.

That is why we have designed the AC 800PEC, extending the capabilities of ABB's well-known automation technology to handle the high-speed algorithms of processes such as power electronic applications.

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Can you imagine a process cycle time of under 100 µs? We can – and we've built a new-generation AC 800PEC controller to achieve it.

Taking the technology a step further it is a dual-core processor unit that combines these high-speed controls with the low-speed process control tasks usually carried out by separate PLC (programmable logic controller) units. Embedded into a robust and flexible system structure with integrated standard communication, the AC 800PEC is unique in the field of industrial process controllers. The AC 800PEC is the ultimate approach for high demands.

The AC 800PEC has a unique combination of features for demanding applications:

- Short cycle times, down to 100 µs
- High processing power
- Fast communication and I/O via optical links
- Programming tools:
  - System engineering with IEC61131-3 languages using ABB's Control Builder, both Compact and Professional versions available
  - Product and control development using MATLAB®/Simulink® for model-based design, easily bridging the gap from simulation to implementation
- Full integration into ABB Ability™ System 800xA
- Innovative and flexible use of FPGAs to include protocols and application functionality in the devices without creating additional processor load
- Optical communication
- Industrial grade hardware with no moving parts
- Long life cycle, easy upgrading
- Robust reliance file system, insusceptible post power loss












Built to control power in Process Industries
ABB has global expertise and technical know-how in processes for industrial, marine and other applications. As a result, the AC 800PEC is a key controller for ABB's industrial applications, and also for third-party products and systems.
The AC 800PEC is an efficient and flexible controller family. The benefits of short cycle times, fast (input/output) I/O, high-processing power and advanced control using MATLAB®/Simulink®:

- Increases process quality and output
- Saves development and engineering costs
- Reduces the energy consumption of your products
- Shortens time-to-market for your development project
- Saves headcount and resources in engineering and software development
- Enhances Return on Assets (ROA)
- Hardware backup trip integrated with fast COMBI I/O

The modular structure of the AC 800PEC control system means it can adapt to any application size, from the largest industrial plants and propulsion systems down to very compact products, where space and cost are critical. All over the world, thousands of processors are now proving their worth in a wide variety of extremely demanding applications.

Tuned for performance and efficiency

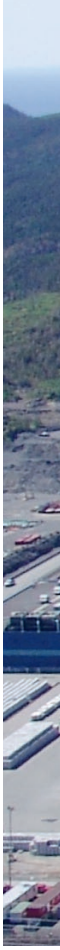
Powerful hardware for efficient, high-speed processing
The AC 800PEC combines the floating-point computing performance of the CPU with the flexibility and high-speed capability of a FPGA.

The system is separated into three performance levels covering different cycle times. Control tasks are allocated depending on their speed requirements:

- Very fast tasks down to 25 ns (nanoseconds for FPGA tasks)
- Fast tasks down to 100 µs (microseconds for Matlab/Simulink tasks)
- Slow tasks down to 1 ms (miliseconds for control tasks)

The hardware architecture of the AC 800PEC is an ideal match to the three-level software structure.

To support the short processing cycle times, the AC 800PEC provides a fast I/O system. Depending on the speed of the I/O connection, it is possible to achieve data throughput times below 100 µs, including the time required to read, process, write and transmit the signal.



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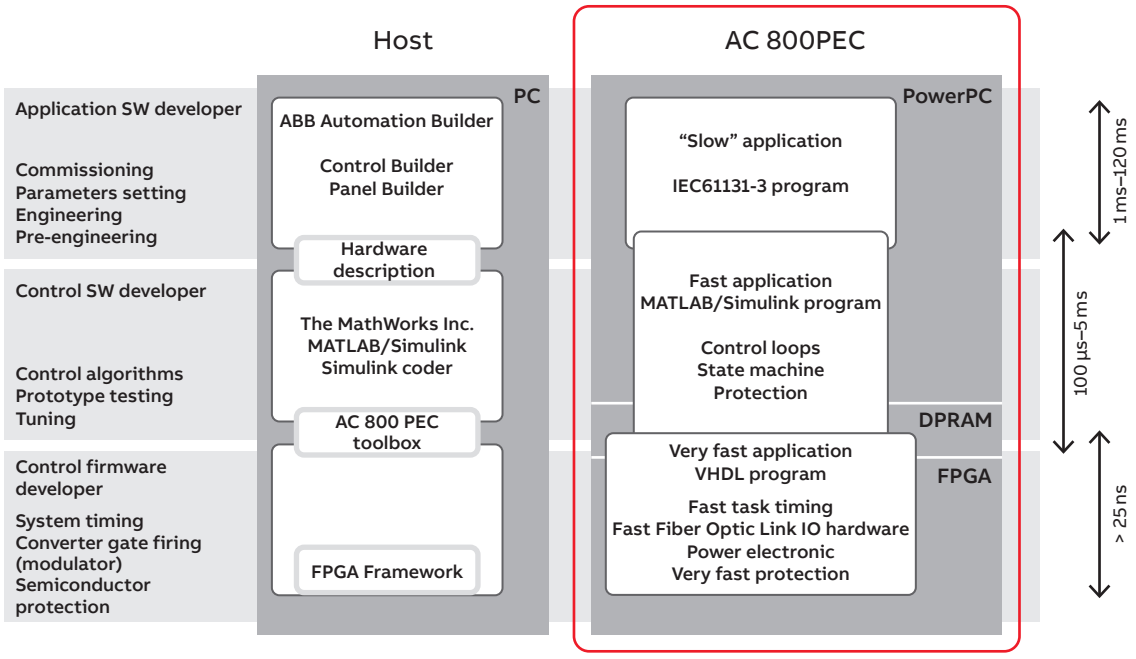
AC 800PEC:
3 level software topology



Implementation of the AC 800PEC software on the three performance levels provides an exceptional range of control and communication functionality. The following software packages have been developed to support each of our specific high power rectifier applications.

Aluminium applications

- AC 800PEC Unit controller ↔ AC 800PEC Master controller communication via PEC - PEC fiber optical link (100 µs)
- Units can be controlled independent from master
- Allows emergency operation (full smooth current control, in emergency mode, without AC 800PEC, available only in combination with DCS800 pre-magnetization)
- Predictive maintenance features can be included
- Open circuit-, over current-, under voltage-, over voltage protection packages included in software
  - A newly developed OPC (open circuit protection) stand-alone PLC (programmable logic controller), working in combination with the AC 800PEC Master controller functions or as standalone protection, in case of the master panel maintenance
- Controlled shutdown in an event, not needing an immediate trip → less disturbance for your processes
- Potline load swing detection and load shedding function integrated in application software
- On Load Tap Changer fast tapping function in order to prevent DC current overload during disturbances
- A special potline-to-earth resistance measurement system based on an AC 800PEC family available (PERMS)
- Maximum power regulation
  - To prevent over-shooting of power consumption and to support your power generators
- Maximum DC voltage regulation for stabilizing your process

Electrical arc furnace applications
- Stable arc detection
- Different control modes (constant current, constant power or constant resistance)
- Fast link to power quality system (PQS)

ELREG (electrode regulation; anode hydraulic system control) features included:
- Electrode manual control (analog or digital)
- Electrode fast lift function (with or without separate fast up valve)
- Automatic arc strike function
- Automatic arc restrike function
- Adaptive electrode control according to furnace behavior or heat stage
- Superimposed integral control circuit
- Voltage fluctuation measurement (stability index calculation)
- Arc-to-roof detection/protection
- Arc-to-roof protection during arc strike sequence
- Hydraulic oil pressure supervision and electrode protection
- Cave-in detection
- High-voltage detection
- Counter pressure valve control logic
- Voltage-to-ground supervision
- Roof voltage monitoring
- Electrode auto raise function after furnace off command (distance or position selectable)
- Blocking valve control
- Electrode speed limitation for electrode and arm protection
- Future features
  - Automatic proportional valve linearization check
  - Automatic proportional valve linearization
  - Dynamic voltage setpoint control for a stable melting process

Chemical applications:

- OLTC step compensation for smooth process control
  - IDC current step compensation for smooth current change when stepping up
- Power factor compensation by OLTC
- Predictive maintenance features can be included
- Software protection packages including:
  - DC over current protection
  - AC over- and undervoltage protection
  - AC phase unbalance protection
  - System unbalance protection for 12 pulse systems
- DC earth fault detection available by 3 voltmeter method
- Process pulse block loop with SIL 3 level
- Voltage ride-through in case of incoming voltage dips

Electrowinning industries (copper & zinc):

- IDC current step compensation for smooth current change when stepping up
- Power factor compensation by OLTC
- Predictive maintenance features can be included
- DC overcurrent protection
- AC over- and undervoltage protection
- AC phase unbalance protection
- System unbalance protection for 12 pulse systems
- Master DC current control for parallel rectifier units
- DC open loop detection during start-up
- DC open loop protection during operation

DC power supplies for graphite electrode plants

The graphitisation process demands a large variation of voltage and current from the DC power supply.

- Constant DC power suppy for the process irrespective of changing process resistance
  - Possible due to the very fast cycle times of AC 800PEC controller.
- Customer tailed process recipes can be added and modified from the operator panel in order to meet the specific customer requirements.
- After adding the corresponding recipes, the rectifier follows the predefined DC current, DC voltage and maximum allowed power set points, including all necessary graphitisation specific protection functions.

Scalability in performance

You and your process define what you need

Your process defines the required performance level. Several preconfigured software packages are available for easy and straightforward engineering.

DCS (Distributed Control System)
- Processing cycle times down to 1 ms
- Use of slow I/O
- Programming in Control Builder

HMI (Human Machine Interface)
- Processing cycle times down to 1 ms
- Use of slow and fast I/O
- Programming of interface in Control Builder
- Nearly all common field busses supported
- Hardware time stamping available upon request

PLC (Programmable Logic Controller)
- Processing cycle times down to 1 ms
- Use of fast and slow I/O
- Programming in Control Builder

PAC (Programmable Automation Controller)
- Cycle times down to 100 µs
- Use of fast and slow I/O
- Programming in MATLAB®/Simulink® and Control Builder

Process interfaces for any speed
The AC 800PEC provides two kinds of I/O – fast and slow. The fast I/O system covers read and write operations requiring less than 1 ms, and the slow I/O system covers speeds above 1 ms.

The fast I/O system is AC 800PEC specific, using devices connected exclusively via fiber optic links, and brings substantial advantages compared to electric concepts:
- Fast communication between controller and I/O devices
- High immunity to electromagnetic interference
- Potential-free connections, making isolating transmitters obsolete

The slow I/O modules from ABB's S800 system can be added to any configuration, depending on project needs.

Versatile and reliable
The AC 800PEC adapts to any application

Seamless integration into plant control
In today's demanding market, a controller must not only deliver maximum performance but also provide transparency. In this respect, the AC 800PEC provides a large range of possibilities. Integrated communication ensures transparent, plant-wide data exchange and control – from overall plant control to separate processes. Use of ABB's System 800xA with the powerful AC 800PEC controller permits uniform automation throughout the plant, seamlessly integrating advanced solutions into the process control system. The AC 800PEC provides connectivity, using either native (built-in) or add-on functionality.

Native (depending on the configuration):
- MMS
- Modbus TCP Slave
- IEC61850
- ABB Fast Fiber Optic Link
- ABB Drivebus (DDCS)
- IbaPDA
- Optical Modulebus (S800)
- CANopen

Add-on
Using ABB CEX Modules:
- ABB Drivebus (DDCS)
- Profibus Master DPV1
- Modbus RTU
- S100 I/O
- Masterbus 300

Using Anybus modules
- CANopen
- ControlNet
- DeviceNet
- Profibus Slave
- Profibus Slave DPV1
- Profibus Master DPV1
- Profinet I/O
- EtherCAT Slave
- Ethernet/IP

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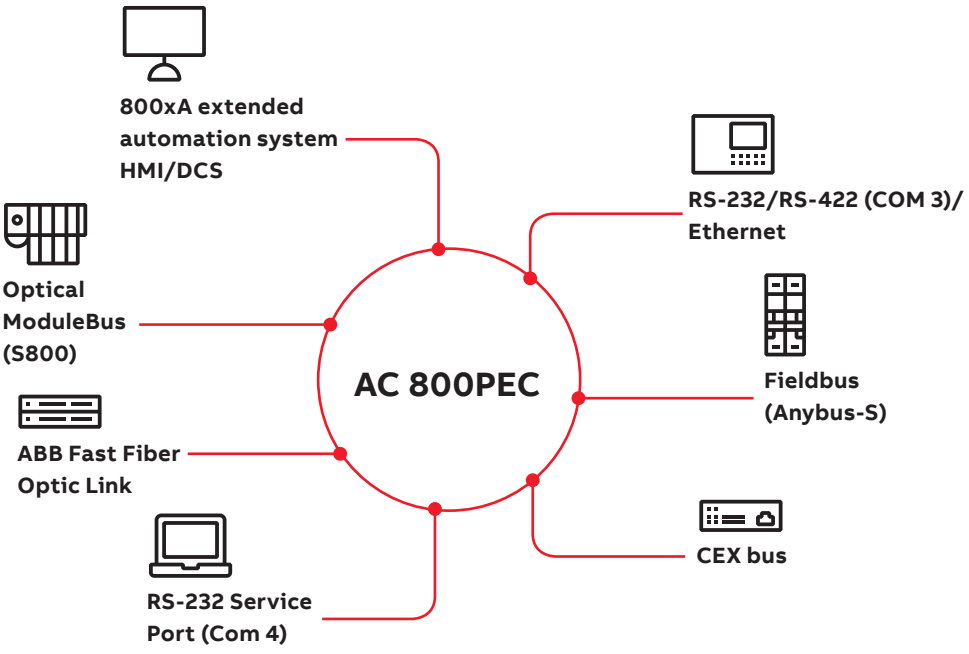
AC 800PEC connectivity from overall plant control down to the process



Well-suited to a harsh environment – the AC 800PEC
Since the AC 800PEC controller is used in different ABB solutions, there is a huge installed base, which enables the extraction of long-term lifecycle experiences.

Traction, with its particularly harsh environmental conditions, is one of the most important applications of the AC 800PEC.

The controller operates through a wide temperature range (-40 to +70 °C), with vibrations according to traction standards. The compact solution is the ideal response to the demands of restricted spaces and allows integration of the processing unit together with all the I/O's in the same compact hardware device.

Reliability is a must – the AC 800PEC in power generation
Typically, excitation systems are used for generator control in power plants where high reliability is the no. 1 requirement. Due to the very short process cycles, traditional redundancy concepts are no longer applicable.

The modular architecture of the AC 800PEC not only greatly reduces the complexity of the overall system, but redundant subsystems also provide increased reliability. Should a problem occur in one subsystem, the main controller switches over to the remaining subsystems, which are scaled in such a way that the overall task can still be fulfilled. Should the main controller fail, a second controller is available in hot-standby.

Precision for optimum quality – the AC 800PEC for industrial processes
The most demanding function in a rolling mill is thickness control. By using the powerful AC 800PEC controller, a new thickness control solution for cold rolling mills has been developed based on a MIMO (Multi-Input Multi-Output) control concept. The benefit to the customer is an improvement in thickness deviation by up to 50 percent.

Whenever you need us, we’re there

Powerful tools and effective training
The AC 800PEC tool is used for all AC 800PEC controller handling operations. It supports you in all project phases, from engineering, installation and commissioning to operation and maintenance. Training courses help you increase your return on investment, reduce down time and improve the skills and motivation of your personnel. Throughout a product’s lifetime, ABB provides training and technical support, and arranges service contracts – all backed by a world-class global sales and service network.

Local presence – worldwide
With offices in over 100 countries, ABB is well-placed to offer the best technical advice and local support around the clock. ABB’s global presence is built on strong local companies. We offer local sourcing while drawing on our worldwide experience. By combining the experience and know-how gained in local and global markets, we ensure that our customers gain the full benefit of our products. For further details about all our services, please contact your nearest ABB office or visit us at www.abb.com/power-electronics.

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