



## AC 800PEC

The high-performance control system for model-based design

Power and productivity  
for a better world™



Can you imagine a process with a cycle time of less than 100  $\mu$ s?  
We can – and we've built the AC 800PEC to achieve it



High-performance applications with extremely fast control algorithms – cycle times that range from 100 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 ControlIT automation technology to handle the very high-speed algorithms of processes such as power electronics applications. We've even gone a step further: now, a single processor unit combines these high-speed controls with the low-speed process control tasks usually carried out by separate PLC units.

To facilitate the implementation of control algorithms, the AC 800PEC can be programmed using MATLAB® / Simulink® – the code is automatically generated from the model and can be downloaded without manual interaction.

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, the ultimate approach for high demands

The AC 800PEC provides the unique combination of features required in demanding applications:

- Short cycle times down to 100  $\mu$ s
- High processing power
- Fast communication and I/O
- Programming tools:
  - System engineering with IEC61131-3 languages using ABB's Control Builder, either as Compact or Professional version
  - Product & control development using MATLAB® / Simulink® for model-based design, easily bridging the gap from simulation to implementation
- Full integration into ABB's 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



### Built to control power – in industry, utilities and traction

ABB is a globally active company with full process know-how in a wide field of industrial, utility, traction, marine and other applications. As a result, the AC 800PEC is a key controller for ABB's own range of industrial applications, and also for third party products and systems.

The AC 800PEC is an efficient and flexible controller family. Thanks to its short cycle times, fast I/O, high processing power and advanced control using MATLAB® / Simulink®, the AC 800PEC:

- 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)

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, many 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

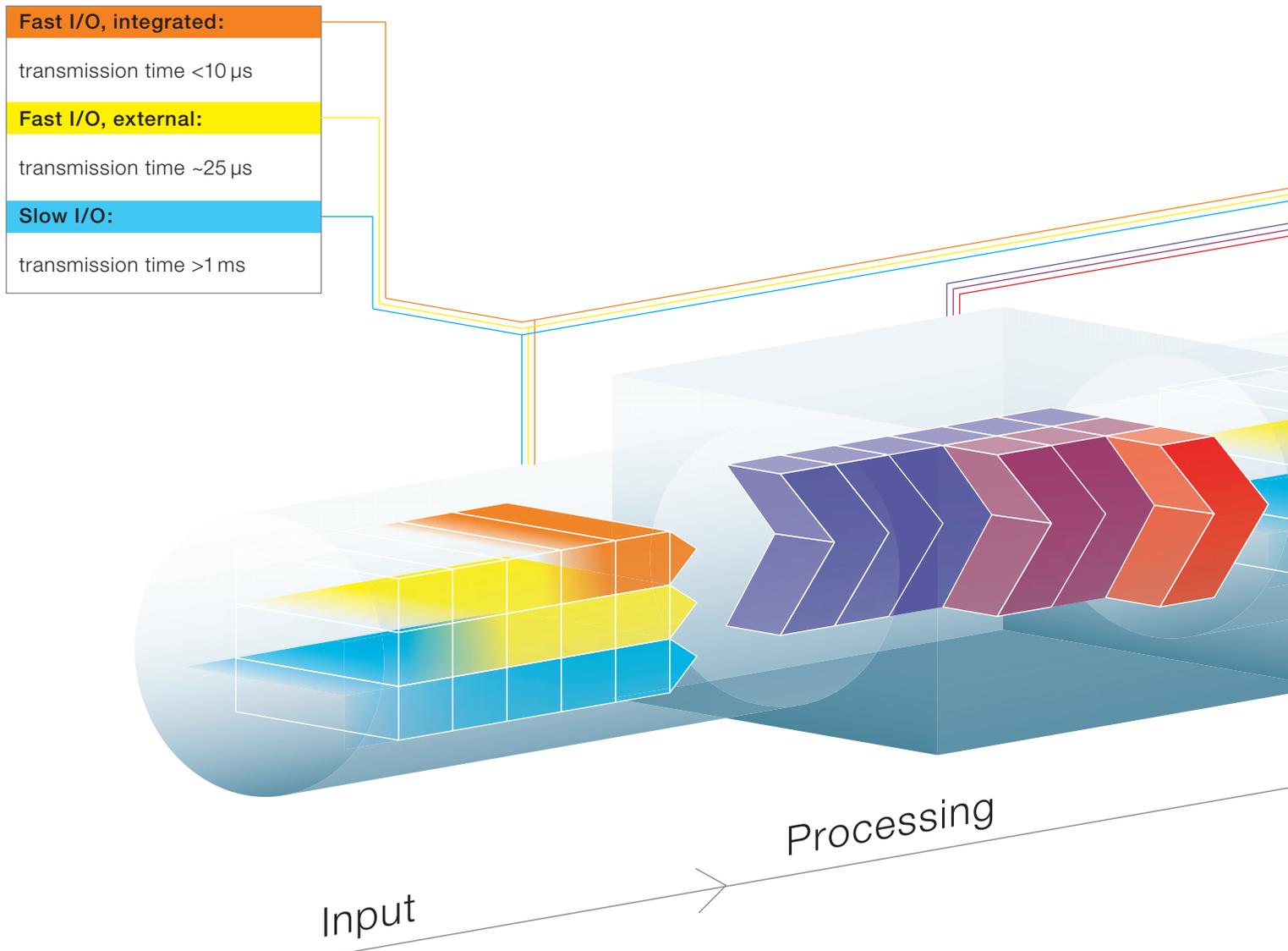
The AC 800PEC combines the floating-point computing performance of the CPU with the flexibility and high speed capability of an FPGA.

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
- Fast tasks down to 100  $\mu$ s
- Slow tasks down to 1 ms

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  $\mu$ s – including the time required to read, transmit, process, transmit and write the signal.



# Transparent software structure and easy programming

The AC 800PEC is the perfect way to unite the system design capabilities of ABB's ControlIT with the control and simulation capabilities of MATLAB® / Simulink®. Quick implementation of complex control algorithms (e.g. model predictive control) reduces development cycles and costs. Furthermore, the system is open to future technologies.

Implementation of the AC 800PEC software on the three performance levels provides an exceptional range of control and communication functionality:

## Level 1: System engineering (ControlIT)

ABB's ControlIT supports all 5 IEC61131-3 programming languages and uses ABB's Control Builder as the programming tool. This is the level on which system engineers implement functions that do not require high-speed performance but demand quick and easy adaptation to a specific project.

AC 800PEC controllers can also be fully integrated into ABB's 800xA automation systems.

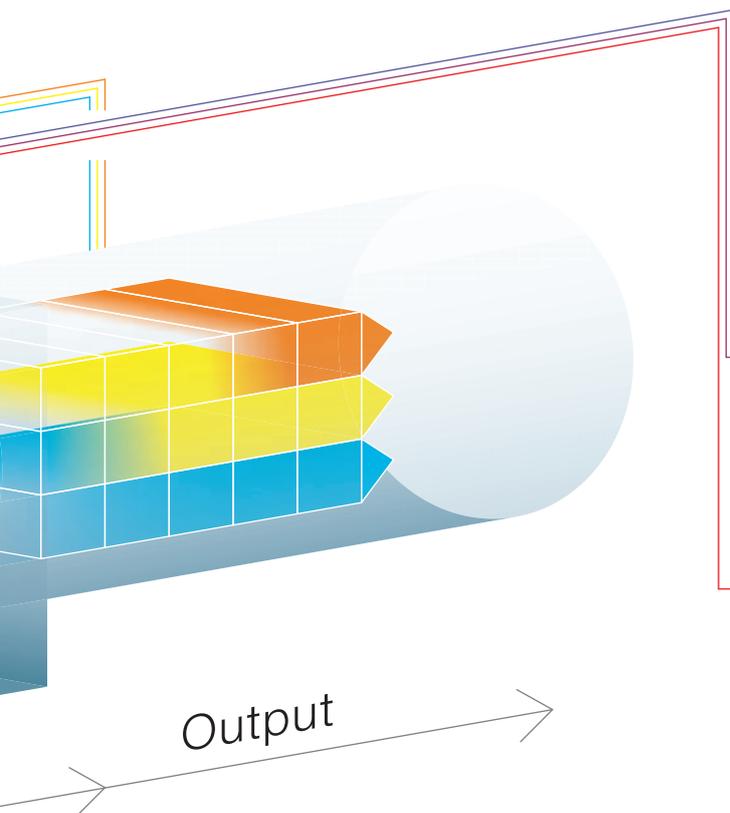
## Level 2: Product & control development (MATLAB/Simulink™)

Fast closed-loop control applications are designed using MATLAB® / Simulink®. C-code is automatically generated and downloaded to the embedded device using Real-Time Workshop® from MathWorks®.

Typically, it is on this level that control developers will implement the control, the protection, the state machine and other functions.

## Level 3: Communication & very fast logic (VHDL)

Extremely fast processes are programmed in VHDL. Protocols and some control logic requiring extremely short cycle times are implemented on this level. The standardized tasks are available as firmware modules and are not accessible to the application developers.



Level 1: Slow processes	
Cycle time: 1 ms	Engineering & application development: – System-level control – System engineering – Parameter setting
Programming tool: Control Builder (IEC 61131-3)	
Level 2: Fast processes	
Cycle time: 100 µs	Application development: – Product-level control – Protection – State machine
Programming tool: MATLAB® / Simulink® & Real-Time Workshop	
Level 3: Very fast processes	
Cycle time: 25 ns	Controller firmware development: – Communication protocols – Modulation & pulse generation – Very fast protection – Very fast control processes
Programming tool: FPGA Framework & VHDL development tools	

# Modularity and connectivity for any size and performance

## Scalability in size – from small and compact to large and modular

For any application size, the optimum hardware configuration is easily achieved: the processing power can either be centralized at one location with distributed logical I/O devices, or intelligent I/O devices can carry out specific tasks in the field to enhance performance and relieve the central processor.

Three system architectures provide scalability from small and compact to large and modular systems:

### Compact

One processor module with integrated, fast I/O devices. This configuration is ideally suited for:

- Smaller applications
- Limited-space applications
- Intelligent field devices, e.g. subsystems in distributed applications

### Standard

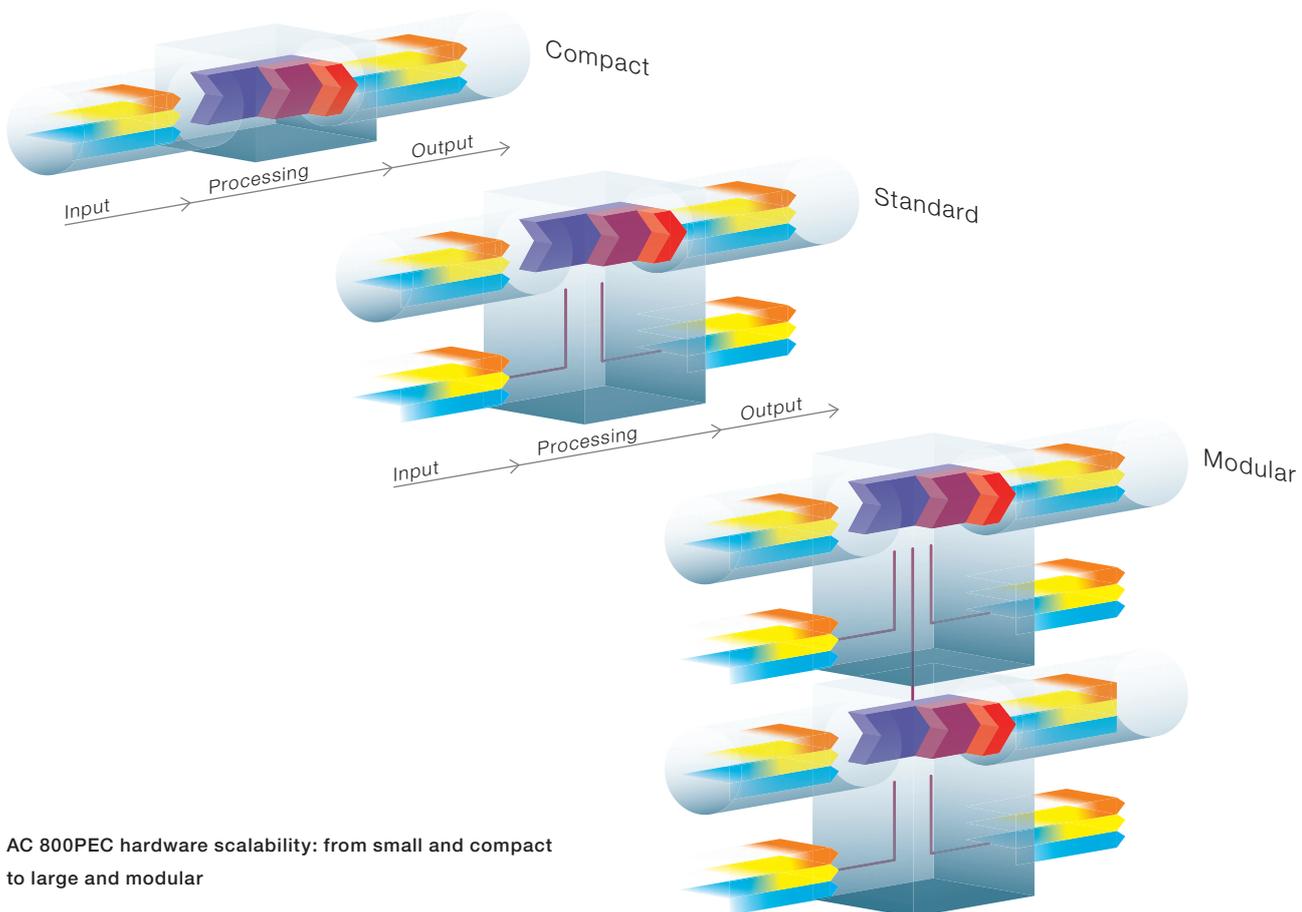
One processor module with separate, fast logical I/O devices. This configuration is ideally suited for:

- Standard industrial applications with central processing
- Small applications with detached, fast I/O

### Modular

One or several central processor modules with separate, fast, intelligent I/O and fast logical I/O devices.

Full and trouble-free integration into higher-level plant control systems as well as future expansions and reconfigurations are easy thanks to the fully modular architecture.



AC 800PEC hardware scalability: from small and compact to large and modular

### Scalability in performance – you and your process define what you need

Your process defines the required performance level. Several pre-configured 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
- 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  $\mu$ s
  - Use of fast and slow I/O
  - Programming in MATLAB/Simulink and Control Builder

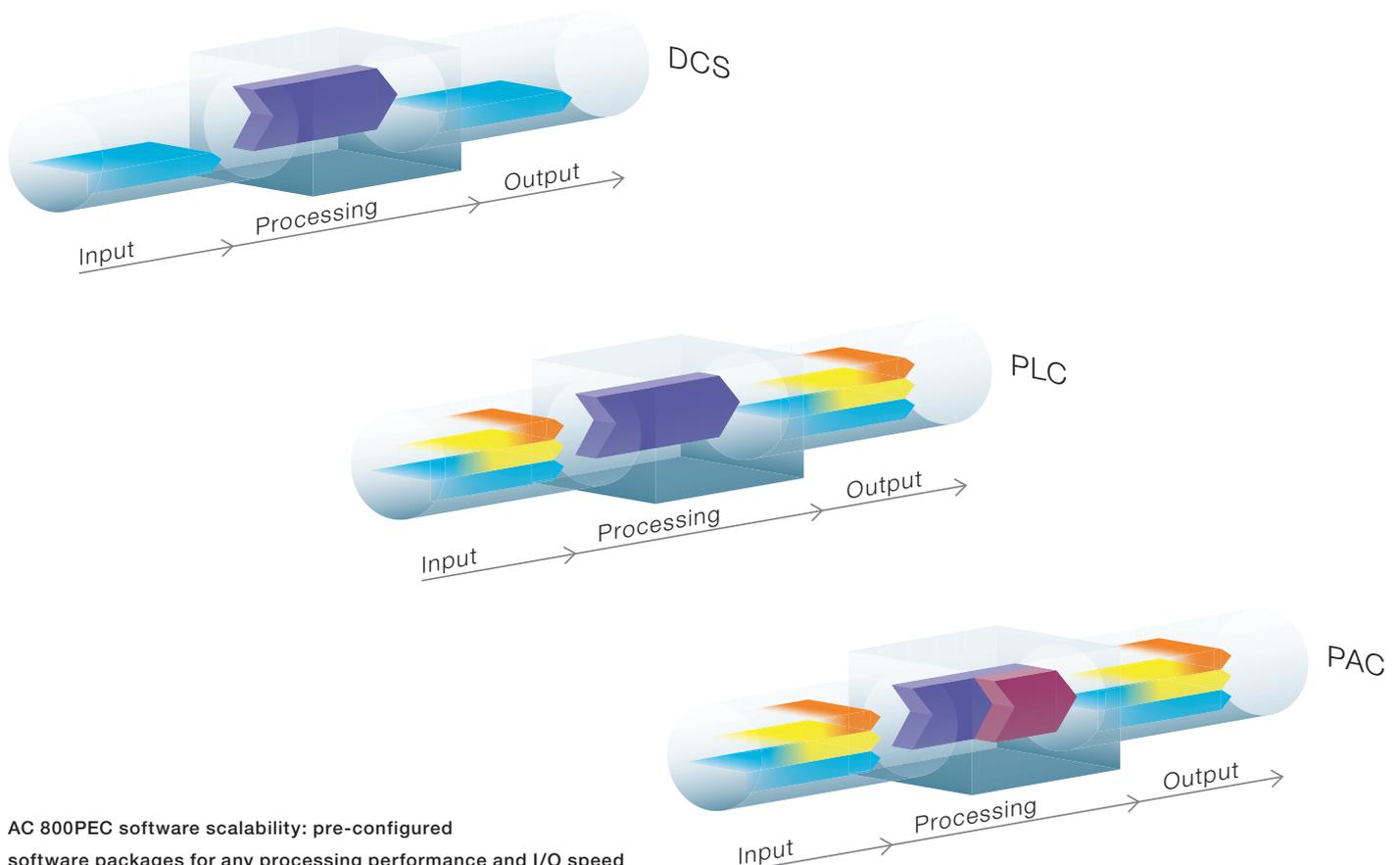
### Process interfaces for any speed

The AC 800PEC provides two kinds of I/O – fast and slow. Whereas the fast I/O system covers read and write operations requiring less than 1 ms, 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 down 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. Strict security procedures and effective firewalls prohibit unauthorized intrusions and ensure permanent system safety.

The AC 800PEC provides connectivity, using either native (built-in) or add-on functionality.

Native (depending on the configuration):

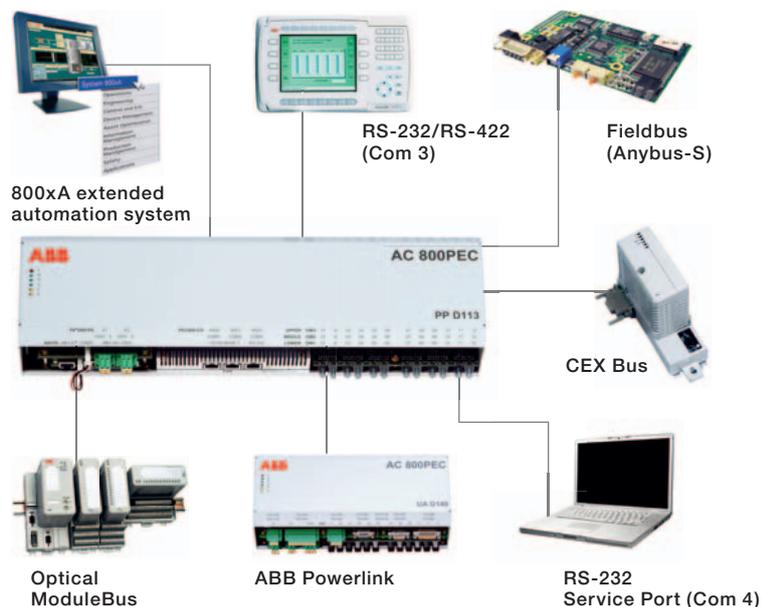
- MMS
- Modbus TCP Slave
- IEC61850
- ABB Powerlink
- ABB Drivebus (DDCS)
- Iba-PDA
- Optical Modulebus (S800)
- CANopen

Add-on:

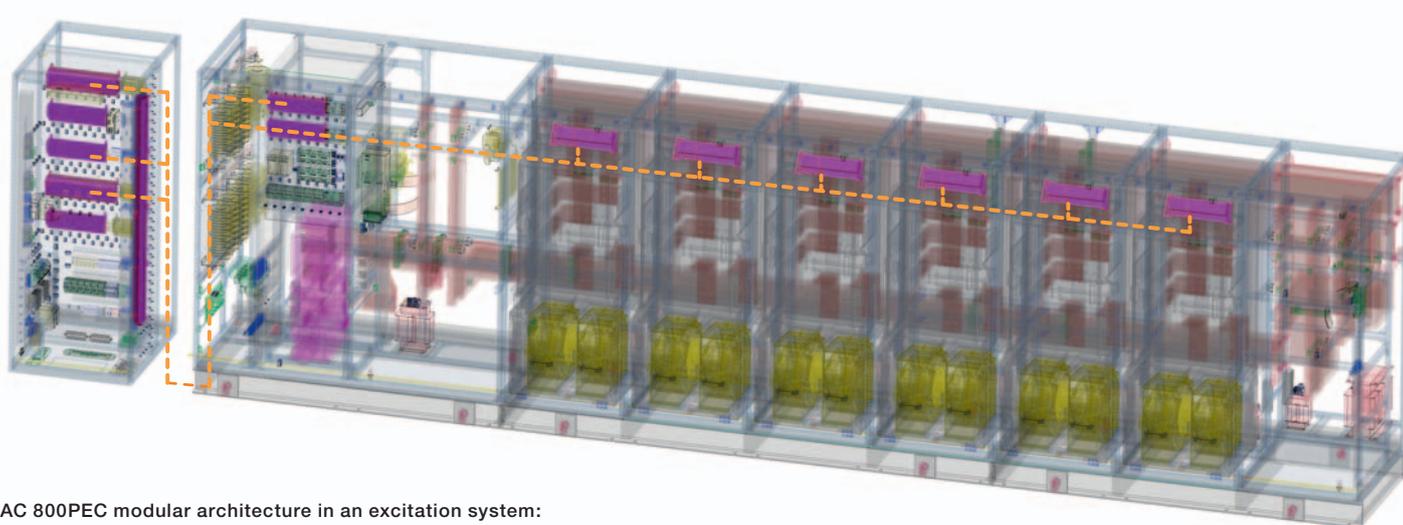
- Using ABB CEX Modules:
  - ABB Drivebus (DDCS)
  - Profibus Master DPV1
  - Modbus RTU
  - S100 I/O
  - Masterbus 300

Using Anybus modules:

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



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



**AC 800PEC modular architecture in an excitation system:**  
top reliability through redundant subsystems and distributed control logic

#### Well suited to a harsh environment – the AC 800PEC for traction

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/Os in the same compact hardware device.

#### Top 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 thanks to redundant subsystems also provides increased reliability. In the case of a problem 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 and its ability to implement C-Code beside the standard IEC 61131-3 program level, a new thickness control solution for cold rolling mills has been developed based on an MIMO (Multi-Input Multi-Output) control concept. The benefit to the customer is an improvement in thickness deviation by up to 50 percent.

# What you simulate is what you implement

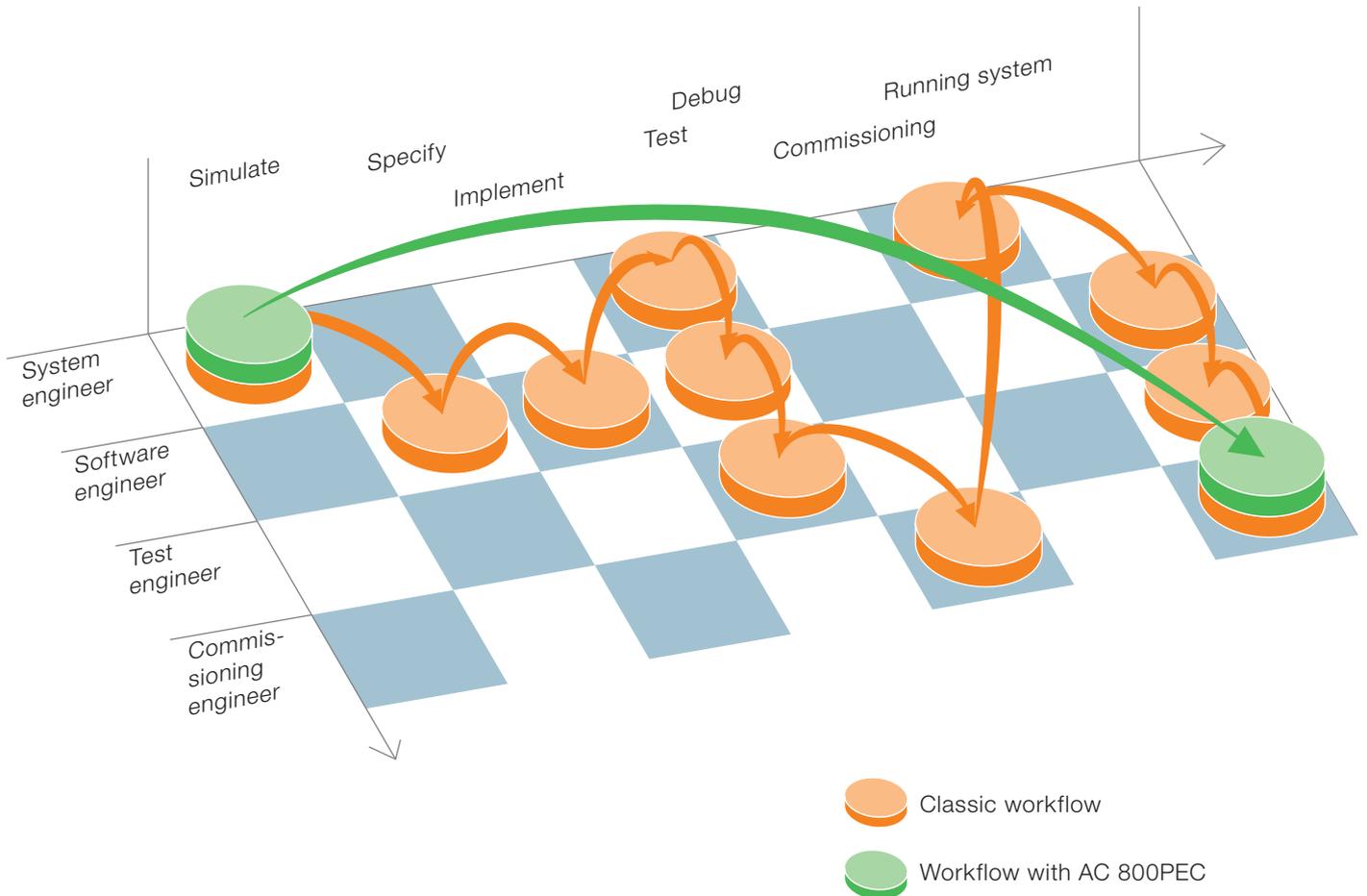
## Straightforward engineering workflow

In the traditional development process, system engineers would define the specifications, which software engineers would then interpret – a time-consuming and error-prone process that also reduced the likelihood that the resultant software would correspond to the original specifications and concept.

The AC 800PEC development workflow uses MathWorks® tools for model-based design as a single development platform for the entire development process.

Simulink® is used to run system simulations. Real-Time Workshop® then automatically generates and downloads controller code from the Simulink® models to the AC 800PEC controller, eliminating the need to translate the models manually into C-code.

The use of Real-Time Workshop® allows interactive debugging of the software on the controller. Specification and code are synchronized throughout the development process by using Simulink® models as executable specifications. Parameters can be changed and optimized on the PC, and code can be generated automatically from the models and then transferred to the controller directly via an Ethernet connection.



# 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 some 100 countries, ABB is well placed to offer the best technical advice and local support around the clock. ABB's worldwide 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 can gain the full benefit of our products. For further details about all our services, please contact your nearest ABB office or visit us on [www.abb.com/powerelectronics](http://www.abb.com/powerelectronics).



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