

Industry 4.0 Drives New Approaches in PLC Design

Build single-chip cloud-enabled PLCs ready for Industry 4.0 with integrated HMI, EtherCAT and secure Enterprise connectivity over OPC-UA with Altera Cyclone V SoC



Today's manufacturing automation environment of Industry 4.0 demands high-performance Programmable Logic Controllers (PLC) enabled with secure enterprise connectivity and Human Machine Interface (HMI).

Today, multiple international Industry 4.0 initiatives rely on cyber-physical systems to implement the promise of smart manufacturing, leveraging connected systems for Machine-to-Machine (M2M) and enterprise interaction.

New Challenges in PLC Design

Making PLCs ready for Industry 4.0 is fraught with new challenges, requiring grounds-up rethinking in PLC design.

Major challenges confronting PLC designers today include:

- **High Performance Control:** Smart-manufacturing environments require PLCs to process instructions, service interrupts and support integrated HMI at speeds faster than ever before. This has led to the use of more powerful processors with higher MIPS and multiple cores, resulting in high cost and power consumption penalties
- **Connectivity:** Deterministic M2M connectivity between disparate machines requires support of multiple Industrial Ethernet protocols within a single PLC system, while enterprise connectivity demands support of an applications-interopability framework such as OPC-UA
- **Secure communications:** PLCs connected outside the factory network and to the enterprise are vulnerable to cyber-attacks, making security a major concern
- **Cross-platform interoperability:** Choosing the wrong processor or ASSP can be an expensive error since functional interoperability between diverse systems requires the use of standardized operating systems running on non-proprietary processor cores
- **Future-proofing:** With an ever-evolving connectivity and interoperability environment, changes in market requirements are much more frequent, requiring changes to both software and hardware designs

Furthermore, pre-Industry 4.0 challenges remain, including scalability, functional safety, lower power consumption, smaller footprint and protection of investment in software-development.

A Smarter Approach to PLC Design

Altera System-on-Chip (SoC) Field Programmable Gate Array (FPGA) devices present a unique alternative to overcoming today's PLC design challenges:

- **High Performance Control:** Altera SoC FPGAs can off-load the PLC's processor by implementing high performance algorithms and HMI in the hardware fabric. Unlike sequential processors, FPGAs are massively parallel machines that can greatly accelerate algorithm execution. With embedded Digital Signal Processing (DSP) blocks and on-chip memory, FPGAs offer much faster hardware acceleration at lower cost and power consumption than conventional processors
- **Connectivity:** Altera FPGAs can implement a combination of Industrial Ethernet protocols simultaneously onto a single device simply by instantiating ready-made Intellectual Property (IP) cores. Protocols can be enabled by simply downloading the relevant protocol stacks which execute in the built-in Hard Processor System (HPS) of a SoC FPGA. The HPS can also run an OPC server, enabling enterprise communications over OPC-UA



- **Secure communications:** Open SSL encryption, implemented in FPGA fabric, provides up to 4x acceleration over processor-based implementations, enabling faster and more secure channels for enterprise communication
- **Cross-platform interoperability:** Altera SoC FPGAs with integrated ARM processor offer a scalable roadmap on an industry- standard processor
- **Future-proofing:** Hardware changes can be reprogrammed in FPGA fabric, which makes it immune to major redesign of entire systems. Altera's long FPGA product life - typically over 15 years - makes it perfectly suited to the long lifetimes of PLC and automation systems

Altera also offers devices, tools, methodology, boards and reference designs qualified for IEC61508 SIL3 Safety.

A SoC FPGA based PLC Platform Ready for Industry 4.0

Altera teamed with 3S Smart Software Solutions (developers of CODESYS), EXOR International, a leader in HMI development and Barco Silex, a security and encryption IP leader, to create a single-chip PLC design on its ARM-based Cyclone V SoC, implementing control, EtherCAT, HMI and secure enterprise communication over OPC-UA in a micro System-on-Module (microSOM) less than half the size of a credit card. With ready-made microSOM and evaluation design, Altera Cyclone V SoC is the ideal platform to develop PLCs ready for Industry 4.0, with faster time to production.

Want to Dig Deeper?

For more information about Altera FPGAs and PLC solution, contact your Altera representative, or visit the PLC solution page: www.altera.com/plc



Altera Corporation

101 Innovation Drive
San Jose, CA 95134
USA
www.altera.com

Altera European Headquarters

Holmers Farm Way
High Wycombe
Buckinghamshire
HP12 4XF
United Kingdom
Telephone: (44) 1494 602000

Altera Japan Ltd.

Shinjuku i-Land Tower 32F
6-5-1, Nishi-Shinjuku
Shinjuku-ku, Tokyo 163-1332
Japan
Telephone: (81) 3 3340 9480
www.altera.co.jp

Altera International Ltd.

Unit 11-18, 9/F
Millennium City 1, Tower 1
388 Kwun Tong Road
Kwun Tong
Kowloon, Hong Kong
Telephone: (852) 2945 7000