A Primer on Obtaining IEC 61850-3 Certification for Embedded Computers

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Introduction

IEC 61850 is an Ethernet-based protocol standard used mainly in substations for data communication. Substations use a number of controllers for a variety of purposes, including protection, measurement, detection, alarms, and monitoring. Problems arise when substation designers integrate controllers from different manufacturers. Since the different controllers often use different communication protocols, the cost of protocol integration and system maintenance can be high. The IEC 61850 standard is now counted on to ensure that all equipment and devices in a substation can communicate using the same protocol. In fact, many well-known manufactures, such as ABB and Siemens, are dedicated to using IEC 61850-based devices to build open, interoperable systems for constructing flexible substation automation architectures. Particularly in Europe and North America, some new substations are required to use control devices that are certified for IEC 61850-based communication. In this paper we introduce the requirements for obtaining IEC 61850 certification, focus on the IEC 61850-3 standard, and then explain how Moxa became the first IPC manufacturer to pass IEC 61850-3 certification.

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The Benefits of Using IEC 61850 in Substations

When used as a unified communication protocol in substations, the IEC 61850 standard provides benefits that help substation designers construct a complete, Ethernet-based communication system.

Integrated Protocol: The costs associated with setting up a monitoring system in a substation that uses different communication protocols (e.g., DNP3.0, UCA, and IEC 870-5) can be prohibitive. The IEC 61850 protocol is preferred since programmers only need to use one protocol to develop the required monitoring applications.

Maintenance and Implementation: System designers find it easier to select components and controllers that have been designed specifically to meet the standard requirements of the IEC 61850 protocol, saving on both implementation and system maintenance.

Time-to-Market: The fact that leading manufacturers such as ABB, Siemens, and Areva are producing integrated ICE 61850-based products saves time, since system integrators can design systems with products right off the shelf.

IEC 61850-3 Requirements

The IEC 61850-3 standard specifies general requirements for the hardware design of IEC 61850 devices used in substations. IEC 61850-3 devices must meet the following requirements:

Strong EMC design to protect against EMI: EMC (electromagnetic compatibility) is important since unprotected devices are easily damaged or destroyed when exposed to high levels of EMI (electromagnetic interference). Providing the necessary protection presents hardware engineers with a serious challenge, since it often requires using expensive components designed to handle electromagnetic interference. In addition to choosing the right components, engineers must also spend a good deal of time testing their design.

-40 to 75°C operating temperature range: The wide temperature requirement is important since substation environments can experience temperatures as high as 75°C and as low as -40°C. The wide temperature requirement can be satisfied with an efficient heat dissipation design for extremely hot surroundings, and an intelligent self-warming system that kicks in when the temperature drops to extremely cold temperatures.

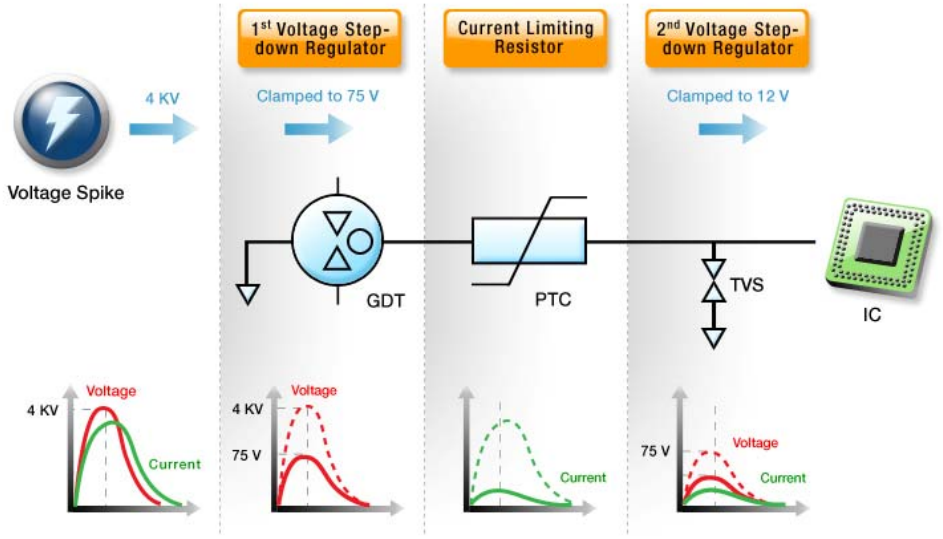
Anti-vibration and anti-shock: IEC 61850 devices must meet a 50G anti-shock and 5-500 Mhz anti-vibration requirement to ensure continued operation after being dropped from a rackmount in a device cabinet. The key to satisfying this requirement is to use protective components that work like a cushion to protect the device when it falls.

The Challenge of Obtaining IEC 61850-3 Certification

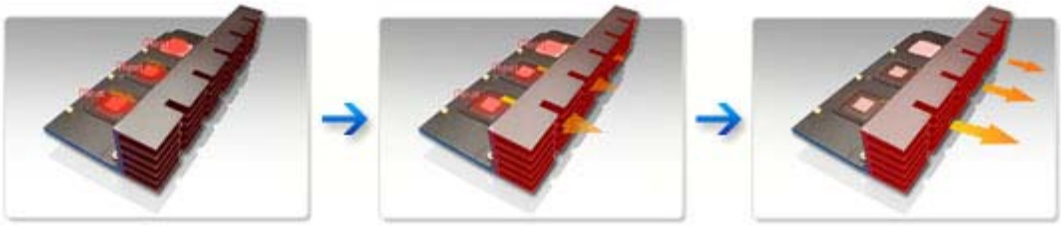
The engineers for Moxa's DA-681-IDPP-T embedded computer, which is the first computer in the world to receive IEC-61850-3 certification, faced a number of challenges in the design and development stage.

EMC: The biggest challenge when designing products with EMI immunity is determining the most optimal combination of voltage step-down regulators and current limiting resistors. After a good deal of trial and error, Moxa's engineers settled on a combination of two voltage step-down regulators and one current limiting resistor.

A voltage spike is met first by a voltage step-down regulator that clamps the voltage to75 V. Next, a current limiting resistor isolates both high voltage and current, followed by the second voltage step-down regulator that clamps the voltage to 12 V. This strong EMC design protects the computer and components from being damaged by voltage and current electromagnetic interference.



Wide temperature: Moxa's IEC 61850-3 embedded computers employ a heat sink plus intelligent heater combination to battle hot and cold temperatures. Moxa has introduced an "L-type" heat sink (Patent Pending) that is used to keep the computer's internal temperature cool enough to ensure reliable operation in temperatures as high as 75°C. The "L-type" heat sink includes a metal plate that resides inside the embedded computer's housing, and abuts the computer's main heat sources. The "L-type" heat sink is particularly efficient since the heat produced internally is absorbed by the plate before being dissipated from the sink. In addition, the embedded computer uses an intelligent heater mechanism that automatically raises the internal temperature when the computer is used in an extremely cold environment.



Anti-vibration and anti-shock: Moxa's IEC 61850 embedded computers have been certified to withstand 50 G's and vibrations of between 5 and 500 MHz. The computers have also been subjected to a 6-sided 25 cm drop test under normal working conditions, ensuring that the computer is well protected when used on moving objects or when an earthquake occurs.

Moxa's DA-681-IDPP-T embedded computer was developed to address these specific needs, and to provide system integrators with multiple Ethernet ports for substation automation. Embedded with various application programs, the DA-681-IDPP-T series can perform numerous industrial automation tasks, including data control, data acquisition, and numerical computing.

World's First IEC 61850-3 Certified Rackmount Computer


Interocean Technology Corp.

Verification of Conformity

Applicant: MOXA Inc.

Product: x86 Rackmount Computer

Model No.: DA-681-I-DPP-T, DA-681-I-DPP-T-CE, DA-681-I-DPP-T-XPE, DA-681-I-DPP-T-LX

On the basis of the tests undertaken, the sample(s) of the above product have been found to comply with the essential requirements of the referenced specifications at the time the tests were carried out.

Relevant Standard(s) / Specification(s):

IEC 61850-3: 2002 for EMC, climatic and mechanical conditions

IEEE 1613: 2003 for EMC and climatic conditions

IEC/TS 61000-6-5: 2001 for EMC immunity in substation environments

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JT Chen / General Manager

Both IEC 61850-3 and IEEE 1613 define the highest standard of EMI immunity and error free communication requirements for equipment used in substations. Substation LAN and serial port requirements place heavy demands on the physical and functional reliability of all of the hardware used in the system. This also applies to embedded computers, which must work reliably as front-end computing and backbone hosts. As a leading manufacturer of industrial-grade embedded computing, Moxa offers IEC 61850-3 products.

Conclusion

Since IEC 61850 is becoming one of the most commonly used communication protocols in substations, manufacturers and system integrators should provide more IEC 61850-based devices. In order to comply with the IEC 61850-3 standard, embedded computers need to meet the following requirements.

1. Strong EMC protection provided to protect devices from being harmed by sudden voltage spikes.
2. Incorporate wide temperature features to ensure that the computer can operate reliably in extremely hot and cold environments.
3. Anti-shock and anti-vibration requirements that ensure continuous operation when used near large equipment and in earthquake zones.