Moxa Solutions Make Grids Smarter and More Efficient

- Expertise in computing, communication, and control
- IEEE 1613 and IEC 61850-3 certified for intelligent substations
- 1U, 2U, and 4U rackmount installation for easy implementation
- Well-suited for harsh environments
- Easy-to-use platform for software programming
A “smart grid” is an electric power delivery system that stretches from point of generation to point of consumption. Integrated with advanced communications and information technology, all equipment and devices in a smart grid are connected by sensory elements to form a complete power network. The information is integrated and analyzed to optimize power resources, reduce costs, increase reliability, and enhance electric power efficiency.

A smart grid is an intelligent automated system for monitoring the flow of electricity and making the distribution of electricity more efficient. In a world where protecting the environment is a major concern, it is important to find cost-effective ways of reducing power usage and increasing energy independence.

Existing power supply systems implement a “centralized power supply” that often involves high voltages and large-scale electric power networks. With this type of power supply, failures in the electricity network can have a huge impact on the entire power supply system, and often cause widespread system shutdowns.

Because of the potential benefits, many governments are developing smart grid solutions and implementing a distributed power network instead of a centralized one. Distributed power networks are highly integrated and include power generation, power transmission, and power distribution, with power meters and home appliances, such as refrigerators, TV sets, washing machines, and personal computers also considered part of the network. Engineers who design and manage distributed power networks must handle a number of tasks, including energy management, data communication, and information analysis.

Why Get Smart?

Using a smart grid solution provides the following benefits:

1. Enhances energy usage efficiency
2. Increases the proportion of distributed power generation systems and renewable energy solutions
3. Enhances the reliability of the power supply
4. Reduces the overall costs of delivering power to end users
5. Improves the stability and quality of the power supply
6. Makes all facets of energy distribution safer

Smart Grid Architecture

By optimizing the electric power grid we can get more out of the existing infrastructure without needing to invest a lot of capital in new technology for generation, transmission, and distribution facilities. In fact, by making the grid smart, we can create a completely integrated system, from power generation to power distribution to power use in the household, and to a certain degree, the smart grid concept can get the most out of renewable energy operations by integrating the local micro-electricity grid to replace more traditional power supply sources such as carbon-fueled and nuclear power plants.
Moxa’s Complete Solution for Creating a Smarter Grid

1 Renewable Energy
2 Intelligent Substation
3 Automatic Meter Reading

Finding the Right Products for your Applications

Industrial Computers
- IEC 61850-3 certified for e-substations
- 100-240 VDC input power source for easy field site installation
- 1U, 2U, and 4U rackmount installation for easy implementation
- RISC and x86-based computers for different field sites
- Easy-to-use platform for software programming
- Web server for easy monitoring and data analysis
- Modbus API for easy Modbus device reading

Industrial Ethernet Switches
- Turbo Chain self-healing technology (recovery time < 20 ms) enables flexible and reliable networks for widespread power distribution and wind farm networks
- Complete substation-specific functionality includes zero packet loss, and IEC 61850-3 compliance for demanding environments
- IEEE 1588 v2 PTP ensures precise time synchronization
- Layer 3 routing improves large-scale network performance
- Rugged industrial design: -40 to 75°C operating temperature, high MTBF, fanless, redundant power inputs
- Managed/unmanaged Ethernet switches with 3 fiber ports; ideal for long distance wind farm networks
- MXview industrial NMS provides rapid network troubleshooting

Industrial Cellular Solutions
- Five-band GSM/GPRS/EDGE/UMTS/HSDPA IP gateway
- Built-in memory and a ready-to-use TCP/IP operation mode
- Private IP management with OnCell Central Manager
- Choice of operation modes, including TCP Server/Client, UDP, Raw COM, Reverse Raw COM, and SMS Tunnel modes
- Desktop or DIN-Rail installation

Industrial Device Servers
- World’s lowest power consumption—only 1 W
- 3-step web-based configuration for easy deployment
- Small size for easy installation
- Surge protection for serial, Ethernet, and power lines
- Drivers available for most operating systems
- SNMP MIB-II for easy monitoring and network management
Introduction
Renewable energy is energy that comes from natural sources that are almost always available, such as sunlight, wind, rain, tides, and even heat. Since creating environmentally-friendly energy solutions is crucial, the renewable energy industry has become a key business that will only increase in importance in future years and decades.

Solar energy is often regarded as the most efficient renewable energy source for generating electricity. However, constructing a solar energy system requires the sophisticated integration of a variety of systems. Currently, the Renewable and Distributed Systems Integration Program (RDSI) is helping alleviate congestion, reduce greenhouse gas emissions, and improve reliability in specific areas, such as microgrid technologies, distributed generation systems, bi-directional communications, and demand response programs. It is estimated that by 2015 the RDSI program can help reduce peak load on distribution feeders by 20%.

Solution Requirements
• A front-end embedded computer to control the electronic compass and monitoring solar panel effectiveness
• Ultra-low power consumption designed to maximize the electrical output of a solar power plant
• DI/DO interface for connecting to the electronic compass

Benefits
• Solar applications require low-power solutions, and Moxa’s Atom embedded computers have an ultra-low power consumption design, are energy efficient, and the compact form factor makes them cost-effective and easy to install.
• Multiple communication interfaces available to support each level of field site device
• RISC-based embedded computer with VGA to simplify local debugging and setup
• Both Linux and Windows platforms available for flexible programming

Recommended Products
Solar Tracking System
- EDS-608 Series 8-port compact modular managed Ethernet switches
- V2401 Series x86-based Atom N270 embedded computer

Solar Community
- IA341 Series RISC-based embedded computer with 2 serial ports, 4 DIOs, 2 AIs, and 2 thermocouples
- W406 Series RISC-based GSM/GPRS/EDGE wireless embedded computer

Solar Transportation Grid
- IA260 Series RISC-based embedded computer with 4 serial ports, 8 DIOs, and DIN-Rail mounting
- CB-108 Series 8-port RS-232 PC/104-Plus modules

Moxa provides an integrated platform that supports all of the communication needs of a solar energy monitoring application.
Introduction
The move from using traditional coal-fired power plants to renewable energy sources is well underway and is expected to accelerate considerably over the next decade. Wind power is a great renewable resource. The fuel is free, never runs out, and maintenance costs are relatively low compared to other energy sources. In addition, the environmental impact is low. Projects can be completed quickly, and wind farms do not interfere with agricultural land-use. From an economics viewpoint, a wind farm should have at least 33 wind generators that generate 100,000 MW of power. However, wind farms often include up to 66 wind generators that generate 100,000 MW of power. In addition to generating electric power, wind energy also generates local jobs and tax revenue. In fact, the Feed-in Tariff program, or FIT for short, allows wind farms to sell their power to power utilities through the grid.

One of the drawbacks of wind power is that the wind generally does not blow continuously, making it more difficult for utilities to maintain a reliable power source. This is where the “smart grid” comes in, since a “smart grid” allows for more efficient use of wind power.

One-stop Shopping for Wind Power Applications
Moxa supports a wide array of industrial networking solutions that can be used as part of wind power applications, including industrial Ethernet switches, industrial network management software (iNMS), serial-to-Ethernet solutions, IP video surveillance solutions, and front-end embedded computers to build a reliable wind power system that optimizes the performance of wind turbines.

Smart Grid ▶ Complete Solution

Wind Power Renewable Energy

Why Moxa?
• High MTBF with high reliability and effective system maintenance
• Space-efficient products for easy installation
• High-performance serial-to-Ethernet solution with advanced network management features (such as SNMP) and easy-to-use Windows utility for quick configuration.

Why Moxa?
• Wind power generation systems are located in harsh environments subject to both dust and wind. Under these circumstances, the rigorous quality control and fanless design of Moxa’s embedded computers helps prevent system crashes, and the innovative thermal design reduces fan problems.
• Palm size design suitable for field site cabinets with limited space
• Preinstalled operating system for simple migration of existing monitoring software

Moxa Solutions

Remote Monitoring of Wind Turbines

1 Remote Monitoring of Wind Turbines

System Requirements
• Must be able to connect to many serial devices, and completely integrate the devices with an Ethernet network
• The system must exhibit high reliability and performance, and be easy to maintain
• Rugged IP surveillance solutions for unmanned windmill monitoring

Why Moxa?
• The VPort 461 high-performance IP video encoder supports full D1 video monitoring for wind turbine operation.
• The EDS-408A supports a fiber uplink service and Turbo Chain redundant technology (recovery time < 20 ms) for building a non-stop, cost-effective wind farm system.
• The VPort 461 high-performance IP video encoder supports full D1 video monitoring for wind turbine operation.

Recommended Products

1-ch H.264/MJPEG industrial video encoder
NPort 5800
Remote Ethernet I/O
MXview industrial network management software

Data Acquisition and Computing for Wind Towers

2 Data Acquisition and Computing for Wind Towers

System Requirements
• Each wind tower requires one embedded computer for collecting and computing a wind turbine’s rotation rate data and sending it back to the field site station.
• Wide operating temperature range and small form factor ideal for field site cabinet installation in outdoor harsh environments
• Reliable video surveillance system for delivering real-time video monitoring for safe operation

Why Moxa?
• Wind power generation systems are located in harsh environments subject to both dust and wind. Under these circumstances, the rigorous quality control and fanless design of Moxa’s embedded computers helps prevent system crashes, and the innovative thermal design reduces fan problems.

Recommended Products

Industrial Ethernet Switches

EDS-408A
8-port managed switch with 3 Combo switch / serial device server
NPort S800C
Serial-to-Ethernet video encoder
VPort 461
8-ch H.264/MPEG-4 industrial video encoder

Network Management

DA-681
x86-based rackmount embedded computer
MXview industrial network management software

The Most Reliable Wind Farm Infrastructure

3 The Most Reliable Wind Farm Infrastructure

System Requirements
• A communication gateway installed at a field site station for data acquisition
• Non-stop and reliable Ethernet infrastructure with secure data communication and fast fault recovery
• Network devices supporting fiber connections for long-haul and noise-immune transmission across large wind farms
• A highly scalable network that supports easy and hassle-free network expansions so that future turbines can be conveniently added

Why Moxa?
• The DS-811 can be used as both a communication processor and telecontrol communication processor that helps engineers and operators from a remote dispatch center retrieve data and monitor their systems.
• Moxa Turbo Chain redundant technology features a link-failure recovery time that is under 20 ms for building reliable Ethernet infrastructures for wind power systems.
• Moxa managed Ethernet switches support fiber optic connections (multi-mode/single-mode) for long-distance and noiseless transmission.
• Turbine Chain outperforms traditional ring topologies by being able to provide the best reliability, unrestricted expansion, and cost-effective configurations.
• Moxa’s x86-based rackmount embedded computer helps prevent system crashes, and the innovative thermal design reduces fan problems.

Recommended Products

8-port managed switch with 3 Combo switch / serial device server
VPort 461
1-ch H.264/MPEG-4 industrial video encoder

Intelligent Substation

Introduction
Adding locally intelligent nodes can create networks that are more efficient and reliable. The smart grid makes use of communications, computing, and power electronics to create a system that is self-healing and adaptive. The smart grid is also able to "interact" with end-users at the consumer, business, and industry level, and can be used to predict and prevent emergencies instead of just waiting around for something bad to happen.

How Do Intelligent Substations Fit into a Smart Grid?
The electric power dispatching control center supervises the grid while the automated management system for transmission and distribution is operating. Decision making and information is handled by the intelligent substation, which reports electric power consumption, operates the switchboard, and gathers information, with decision making sent back to the electric power dispatching control center.

IEC 61850 and IEEE 1613 Certified
Substation LANs and serial port requirements place heavy demands on the physical and functional reliability of all of the hardware used in the system. The IEC 61850-3 and IEEE 1613 standards define the highest standards of EMI immunity and error free communication requirements for network equipment used in substations. Moxa’s substation Ethernet switches and embedded computers are IEC 61850-3 and IEEE 1613 certified, guaranteeing that our products are protected against a variety of environmental factors.

The Important Role of Industrial Embedded Computers and Ethernet Switches
To achieve these missions, intelligent substations need powerful embedded computers with multiple serial ports for legacy device connectivity and to perform a multitude of front-end tasks, such as protocol conversion, data acquisition, numerical computing, data distribution, and remote device monitoring and management.

Industrial Ethernet switches are a fundamental building block of IEC 61850 based substation automation systems and must perform extremely reliably and continue to operate under challenging conditions, such as EMI threats.

The Segments of an Intelligent Substation
Intelligent substations can be classified into three categories: utility substations, industry substations, and commercial substations, which are differentiated by voltage level and overall size.

• Utility Substations consume a high amount of voltage and require a large scale operation. The high voltage is often required for large factories or mass public transit systems and is the top phase of the power distribution process. The voltage could be as high as 500 KV. There are fewer substations of this type but they must satisfy a high demand.

• Industry Substations are the most common. The voltage required is around 220 KV, and is used for medium-sized factories or commercial buildings.

• Commercial Substations require a voltage level around 100 to 110 KV, and are used for small-scale operations, such as store buildings or residential areas.
Intelligent Substation

IEC 61850-based Substation Automation System

Complete Substation-specific Functionalities of IEC 61850-3 Ethernet Switches

Due to the long life span of substation systems, substation engineers are always on the lookout for the most reliable components. Moxa has made substation EMI conditions and high network availability two of the main requirements for the design of its line of substation Ethernet switches.

Recommended Products

<table>
<thead>
<tr>
<th>Model</th>
<th>Total No. of Ports</th>
<th>Gigabit Ethernet</th>
<th>Fast Ethernet</th>
<th>Layer 3 Switching</th>
<th>Turbo Ring/STP</th>
<th>SNMP Snooping</th>
<th>Multi-port Mirroring</th>
<th>IEEE 802.1Q VLANs</th>
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<td>-40 to +85°C</td>
</tr>
</tbody>
</table>

Recommended Products

- Protocol Converter: Suitable for basic data processing
- Connects to multiple serial devices
- Converts protocols from different sources

Why Moxa?
- Zero packet loss under harsh EMI stress
- IEEE 1588 v2 based technology to synchronize sampled values on the process bus
- Fast ring recovery time (20 ms with 250 switchings)

Achievements
- Isolated redundant power inputs at 24/48 VDC or 110/220 VDC/VAC
- -40 to +85°C operating temperatures (no fans)
- IEC 61850-3 and IEEE 1613 Class 2 compliant (KEMA tested)

Embedded Computers are Available for each Substation Type

The three types of substation require different types of embedded computers, depending mainly on the voltage level used at the substation and the scale of the operation. Generally speaking, embedded computers can be divided into five types, depending on the function of the computer.

Why Moxa?
- Protocol Converter
- Suitable for basic data processing
- Connects to multiple serial devices
- Converts protocols from different sources

1. Protocol Converter
- Converts protocols from different IEDs
- Management function
- Monitor function (depending on the application)
- IEC 61850-3 certified
- Can connect IEDs using different protocols
- Can respond to emergencies in an instant

2. Front-end Communication Computer
- Collects information from other protocol converter computers for delivery to the control center
- More powerful processing than normal protocol converters
- HMI support (depending on the application)

3. Remote IED
- HMI interface display function
- Control function
- SCADA software support
- Powerful processing capability

4. Telecontrol Communication Computer
- Supports 4 to 6 LANs
- High-performance processor
- Fanless design helps ensure system reliability
- IEC 61850-3 certified

5. Backend Host
- HMI interface display function
- Control function
- SCADA software support
- Powerful processing capability

Smart Grid ▶ Complete Solution

Moxa Solutions

- Protocol Converter: Converts protocols from different IEDs
- Management function
- Monitor function (depending on the application)
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- Fanless design helps ensure system reliability
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- Backend Host: HMI interface display function
- Control function
- SCADA software support
- Powerful processing capability

Recommended Products

- Protocol Converter
- Protection Mgt. Computer
- Front-end Communication Computer
- Telecontrol Communication Computer
- Backend Host

- Protocol Converter
- Supports 4 to 6 LANs
- High-performance processor
- Fanless design helps ensure system reliability
- IEC 61850-3 certified

- Protection Mgt. Computer
- HMI interface display function
- Control function
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- Supports 4 to 6 LANs
- High-performance processor
- Fanless design helps ensure system reliability
- IEC 61850-3 certified

- Telecontrol Communication Computer
- Supports 4 to 6 LANs
- High-performance processor
- Fanless design helps ensure system reliability
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- Backend Host
- HMI interface display function
- Control function
- SCADA software support
- Powerful processing capability
Micro Grid and Feeder Automation

Introduction

A micro grid refers to a system with one or many distribution substations and energy storage systems that can cooperate with external systems or operate independently. A micro grid can vary in scope, size, and ownership; it is smaller for household applications and larger for some industrial districts or business centers. Micro grids can be constructed in a short time without long distance electric circuit deployment to quickly resolve electric capacity shortage problems.

A feeder automation system deals with the “last mile” of electric power transmission to end-users in either households or manufacturing sites. Building a feeder automation system often involves multiple IP-based networks that make use of both wired and wireless architectures to construct many distributed systems based on Feeder Terminal Units (FTUs). Unlike traditional systems that rely mainly on manual operations, a feeder automation system can enhance the reliability and quality for electric power feeder systems, reduce downtime when the system is out of order, and monitor the real-time operation status, reducing both risk and maintenance costs. A feeder system can be implemented using traditional above ground utility poles, or below ground, with the choice depending on the situation at the field site.

A Feeder Remote Terminal Unit (FRTU) is the main control center that monitors various FTUs. The FRTU is a self-healing and redundant system that uses fiber network communications with DNP over TCP/IP networks. Because of this, the FRTU requires a powerful computer and various switches and IP modems to ensure that the automation system is both efficient and reliable.

Moxa Feeder Automation Solution

Solution Requirements

• Wireless solutions (GSM/GPRS/EDGE/3G) for network redundancy
• Embedded computer to work as a powerful FRTU for system monitoring and data analysis
• Fiber communication with DNP 3.0 over a TCP/IP network
• Multiple communication interfaces available to support each level of field site devices
• Embedded computer with SCADA and FDIR (Fault Diagnosis, Isolation and Recovery Site) systems for data acquisition, monitoring, and control FTUs
• Redundant Ethernet network ensures maximum system uptime

Benefits

• Reliable wireless solutions with GSM/GPRS/3G media
• Powerful embedded computer to control all FTUs at various field sites
• Ready-to-run platform for easy protocol conversion and integration.
• The embedded computer with installed SCADA system and FDIR (Fault Diagnosis, Isolation and Recovery Site) function acts as an FRTU (Feeder Remote Terminal Unit) in the main control center that monitors and controls FTUs.
• Turbo Ring with fast recovery time under 20 ms for reliable non-stop operation

Moxa Solutions

Recommended Products

EDS-405A/408A

5-port and 8-port managed Ethernet switches

DA-661

x86-based rackmount embedded computer

OnCell G3150-HSDPA Series

Industrial 5-band GSM/GPRS/EDGE/UMTS/HSDPA IP gateways

W406

RISC-based wireless embedded computer with GSM/GPRS/EDGE

Benefits

• Promotes new renewable energy solutions
• Self-healing power supply for utility power outages
• Stable energy delivery and power quality
• Electric circuit deployment cost reduction
• Electricity recycling via Feed-in-Tariff system increases energy efficiency
**Automatic Meter Reading**

### Introduction

Automatic Meter Reading (AMR) is based on the Advanced Metering Infrastructure (AMI), which provides smart meter data collection and analysis. One of the keys to managing dwindling energy resources is accurately measuring energy usage. Measurement is one of the first steps toward effective management and refining consumer behavior. AMI includes three major parts: smart meters, a control center, and a communication center. Current practice requires using power embedded computers as data concentrators to collect meter data from households and then send the data back to the control center for further analysis. The analysis can be used for demand management, implementing differential electricity rates, and for determining of new power plants are needed. Currently, electricity loss is higher than 40% in some developing countries; AMR can be expected to reduce this loss to less than 10%.

An AMR system requires some meters that can handle meter reading from home appliances and some power computers that can handle more complicated tasks, such as data acquisition, data computing, and data analysis. By integrating these meters, computers, and software programs, a smart solution can be created to establish an intelligent and distributed architecture for efficient meter reading and management.

### Smart Meters

This type of advanced meter can be used to collect information from a local meter, and power consumption behavior can be recorded and analyzed for monitoring and billing purposes. By building a smart meter platform, meter communication, meter calibration, and outage detection can be easily achieved.

### Communication Center

The communication center includes a reliable network for establishing a communication link between smart meters and the control center. It often involves a powerful computing unit, referred to as a data concentrator, that works through either a wired or wireless unit to provide a reliable and stable network for data transmission.

### Embedded Computers in AMR

Moxa’s embedded computers can be used as the data concentrator in AMR applications by offering a reliable platform for data acquisition from meters in both households and control centers for further analysis. The embedded computer can be used for electric power demand management and determining a proper differential electric power rate, which in turn can be used to determine when a new power plant is needed.

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**Recommended Products**

<table>
<thead>
<tr>
<th>Solution / Product Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meter</strong></td>
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<td>Wireless</td>
</tr>
<tr>
<td>WiFi</td>
</tr>
<tr>
<td>Ethernet</td>
</tr>
<tr>
<td>Modbus</td>
</tr>
</tbody>
</table>

**System Requirements**

- Industrial grade IP gateway with dual power inputs and built-in relay to ensure system reliability
- Secure TCP/IP connections to essentially all remote sites and devices
- IP modem to make use of high speed wireless GSM/GPRS/EDGE technologies

**Benefits**

- Cost reductions achieved by using less cabling
- Boundless monitoring with cellular solutions

**System Requirements**

- Front-end computer used for remote monitoring, data acquisition, data logging, reporting, and protocol conversion
- Real-time, web-based communication to compute and quickly report to the control center over the Internet
- Multiple devices using different protocols for data communication

**Benefits**

- Ensures data accuracy, and reduced lead time and costs
- Secure software platform that supports management and billing systems with easy programming and application deployment
- RISC-based platform offers a cost-effective solution
- W325 wireless embedded computer features GSM/GPRS module for mobile communication
## Renewable Energy

**x86-based 1.1 GHz Atom embedded computer**
- Dual independent displays (CRT + LVDS)
- -40 to 65°C wide operating temperature
- 2 Gigabit Ethernet ports, 3 DIs and 3 DOs

**x86-based 1.6 GHz Atom embedded computer**
- Dual independent displays (VGA, DVI, LVDS selectable)
- -40 to 85°C wide operating temperature
- 2 Gigabit Ethernet ports, 3 DIs and 3 DOs

## Intelligent Substation

**x86-based 1U rackmount embedded computer**
- 6 10/100 Mbps Ethernet ports
- Dual power inputs for redundancy (dual power and power protected modules only)
- Multiple serial ports and LAN ports for network redundancy

**x86-based 2U rackmount embedded computer**
- Built-in DDR2 SDRAM and industrial flash disk module, CompactFlash built in
- Quad 10/100/1000 Mbps Ethernet for network redundancy
- 2 PCI expansion slots for inserting expansion modules

**x86-based 4U rackmount embedded computer**
- 4 PCI slots for expansion modules
- Quad 10/100/1000 Mbps Ethernet for network redundancy
- Dual 100 to 240 VAC/VDC wide range power input provided

**IEC 61850-3 24+4G-port Gigabit modular Ethernet switches**
- Fully compliant with IEC 61850-3 and IEEE 1613
- Zero packet loss
- Isolated redundant power inputs with universal 24/48 VDC or 110/220 VAC/AC inputs

**IEC 61850-3 24+4G-port modular managed Ethernet switches up to 14-port IEEE 10M x2 support**
- Fully compliant with IEC 61850-3 and IEEE 1613
- Nanosecond-precise time synchronization with IEEE 1588 x2
- Turbo Ring and Turbo Chain (recovery time < 20 ms) for Ethernet redundancy

## Feeder Automation

**S-port and 8-port cost-effective managed Ethernet switch**
- Turbo Ring and Turbo Chain (recovery time < 20 ms), and RSTP/STP for Ethernet redundancy
- QoS, port-based VLAN, SSMIPv1/2c supported
- Slim, fanless design and -40 to 75°C operating temperature

**GSM/GPRS/EDGE IP Gateway**
- 2 digital inputs and 1 relay output for remote alarms
- Connect both Ethernet and serial devices to cellular networks
- Centralized private IP management software

**RISC-based Wireless Embedded Computer with GSM/GPRS/EDGE**
- Embedded computing platform for programming, with built-in HSDPA wireless module
- SMS supported for remote management
- -40 to 75°C wide operating temperature model available

## Automatic Meter Reading

**Mini RISC-based Wireless Embedded Computer with GSM/GPRS/EDGE**
- GPRS Class 10, coding scheme from CS1 to CS4 supported
- 2 software-selectable RS-232/422/485 serial ports
- 10/100 Mbps Ethernet for network redundancy

**RISC-based communication embedded computer**
- Customized flexible expansion for greater versatility
- 8 RS-232/422/485 serial ports, 4+4 DIO/channels
- 16 MB NOR Flash onboard to store OS, 32 MB NAND Flash onboard for data storage

**RISC-based DIN-Rail embedded computer**
- Rich I/O combinations of integrated serial ports, DIOs, AIs, thermocouples, and LAN ports for various connectivity options
- Web server and Modbus API for easy monitoring and programming

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**Web Interface**
- 1-channel H.264/MJPEG industrial video encoder
- Three simultaneous video streams for H.264 and MJPEG
- Video latency under 200 ms
- Industrial design includes -40 to 75°C operating temperature and industrial certification approval

**Electric Power/Device Server**
- 2 software-selectable RS-232/422/485 serial ports
- 10/100 Mbps Ethernet for network redundancy
- Rugged and compact form factor
- Daisy-chain remote Ethernet I/O with 4 AIs, 4 DIs, and 4 DOs
- 5-port and 8-port cost-effective managed Ethernet switch
- Turbo Ring and Turbo Chain (recovery time < 20 ms), and RSTP/STP for Ethernet redundancy
- QoS, port-based VLAN, SSMIPv1/2c supported
- Slim, fanless design and -40 to 75°C operating temperature

**IEC 61850-3 24+4-port Gigabit modular Ethernet switches**
- Fully compliant with IEC 61850-3 and IEEE 1613
- Zero packet loss
- Isolated redundant power inputs with universal 24/48 VDC or 110/220 VAC/AC inputs

**IEC 61850-3 24+4-port modular managed Ethernet switches up to 14-port IEEE 10M x2 support**
- Fully compliant with IEC 61850-3 and IEEE 1613
- Nanosecond-precise time synchronization with IEEE 1588 x2
- Turbo Ring and Turbo Chain (recovery time < 20 ms) for Ethernet redundancy
Moxa’s Core Competence

1. **23 Years of Experience Providing Industrial Communication Solutions**
   Moxa has 23 years of experience and know-how in providing world-class industrial communication products and networking infrastructure solutions for harsh, industrial applications, including power automation, traffic control, process automation, factory automation, building automation, and more.

2. **IEC 61850-3 and IEEE 1613**
   The IEC 61850-3 and IEEE 1613 standards define the highest standard of EMI immunity and error free communication requirements for network equipment used in substations. Moxa’s substation Ethernet switches and embedded computers comply with the IEC 61850-3 and IEEE 1613 standards, guaranteeing that the computers are protected against various environmental factors.

3. **Rcore**
   With Moxa’s products, programmers find it easy to develop their embedded software on the ready-to-run platform called Rcore, which offers easy-to-use application libraries, proven and bug-free sample code, and fast concept validation and development cycle, enabling a faster time-to-market that satisfies customers’ demands. The Rcore Community is also available to provide our partners with free and easy access to software and technical knowledge about embedded systems, and an interactive forum to discuss the latest embedded technologies. Visit [http://rcorecommunity.moxa.com/](http://rcorecommunity.moxa.com/) for details.

4. **Turbo Chain New Self-healing Technology**
   Turbo Chain is a highly flexible self-healing Ethernet technology (recovery time < 20 ms) designed for distributed and complex industrial networks. This innovative breakthrough provides the ability to create multiple redundant networks. Compared to traditional ring coupling topology, it is a flexible and cost-effective solution and can provide enormous savings on cabling costs, and its highly scalable and expandable nature make it ideal for future network extension.

5. **Available Globally, Serviced Locally**
   To let our customers enjoy zero lag time for service, Moxa formed a network of professional distributors in more than 56 countries around the world. Moxa believes the best service is to provide customers with an immediate response and timely problem solving, so we can stay “plugged-in” to all your application needs, whenever and wherever you need them.

6. **3 or 5-year warranty**
   As an ISO 9001:2000 and ISO 14001 certified company, Moxa adheres to strict quality control standards applied to design, production, and shipment processes, and prides itself on providing a solid 3 or 5-year warranty on most products.