ACE3600

Motorola Solutions for Electricity DA/DMS Systems

Electric utilities world-wide strive to achieving higher power reliability, to lowering operating and maintenance costs and to defer unnecessary investments.

Use of Supervisory Control And Data Acquisition (SCADA) systems for computerized control of Medium Voltage (MV) substations and power grids helps meeting these objectives without allocating major budgets for refurbishing the electric network.

Upgrading of installations with automation is possible with the use of an ACE3600 Remote Terminal Unit (RTU), equipped with suitable communications means (wire lines, fiberoptics or wireless).

The communication links field installed RTUs to the Distribution Automation (DA) or Distribution Management System (DMS) Control Center.

DA/DMS Applications Overview

Motorola made RTUs and systems are widely used by many electric utilities worldwide. The following are the most common Medium Voltage (MV) electric power grid control applications:

Substation Monitoring

This solution primarily allows monitoring of load conditions of the input and output feeders via transducer-less Intelligent Electronic Devices (IED), which are connected to a wide range of Potential Transformers (PT) and Current Transformers (CT). In addition these RTUs perform monitoring and control of Substation Protection Relays (SPR) and Circuit Breaker Reclosers (CBR).

Fault Passage Detection (FPD)

This is a relatively new technology for upgrading the reliability of MV power feeders. It provides indication on which feeder sections "felt" the fault current passing through. These FPDs are usually installed at locations where RTUs control the position of Load Break Switchgears (LBS) and CBR and also perform load monitoring via IED.
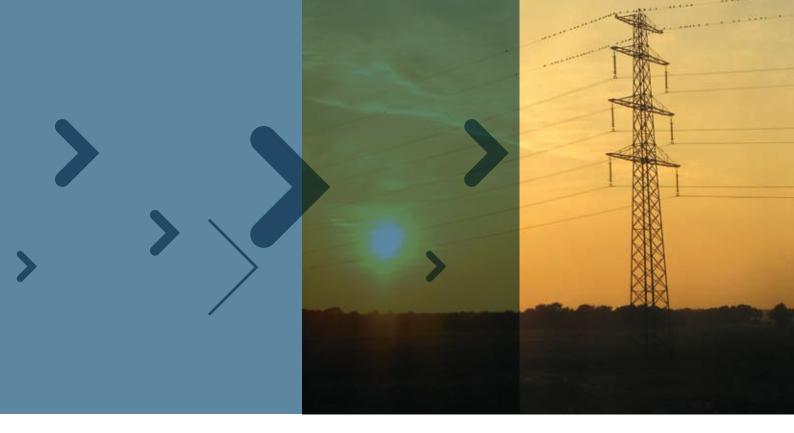
Fault Isolation and System Restoration (FISR)

By using RTUs and communications, this function allows isolation of the damaged MV power grid section and restoration of electricity supply to maximum number of customers and it can be performed remotely.

Remote Control of Capacitor Banks

Capacitor banks along the MV grid perform voltage regulation and power factor ($\cos\Phi$) correction. Use of RTUs and communications makes the optimization of the MV power grid characteristics more efficient, provides more accurate billing and leads to reduction in energy losses along the network.

Power Quality Monitoring (PQM)

Improving supplied power quality is important as customers today expect uninterrupted power supply. Motorola DA solutions include enhanced PQM along with load level measurements and calculations using standard IEDs. PQM is characterized by several parameters such as: duration and occurrence of short spikes and sags, voltage and current harmonic distortion, phase voltage variation, etc.

ACE3600 Advantages for Electricity DA/DMS

Wide Range of Communications Media

The ACE3600 system architecture is designed with wide area SCADA communications in mind. This is achieved using built-in data interfaces. RTUs can be configured to operate optimally over a wide range of wireless and physical communications media including: Digital and Analog conventional or trunking radio, cellular (GSM/GPRS, CDMA), microwave, satellite, dial-up, multidrop leased/private lines, fiber optics, or any combination of these links.

Data Reliability

DA/DMS operators need to be absolutely sure that SCADA commands received and executed at the remote site can be trusted as being genuine. The ACE3600 provides full message integrity confirmation and high reliability of the reported indications and parameters. This is easily achieved when using the highly reliable MDLC protocol, which is optimized for the characteristics of each selected communication media. The MDLC protocol utilizes efficient error handling mechanisms which minimize erroneous transmissions without overloading the data communication.

Time Synchronization

Time synchronization is a mandatory requirement for DA/DMS Systems, and is resolved in an optimal way in ACE3600 systems. It allows precise analysis of time-stamped messages. ACE3600 systems provide wide-area time synchronization across the network with the needed accuracy (ms range). This unique feature is possible even when using analog and digital conventional/trunking wireless communications networks and over combined networks utilizing multiple media types.

Note:
IP based communication cannot support precise time synchronization of the network sites, and therefore one may need to integrate a GPS receiver at each substation site linked to the RTU.

SUMMARY OF BENEFITS

The unique capabilities of ACE3600 based SCADA systems allow implementation of advanced DA/DMS solutions in which each and every RTU can fulfill four important tasks:

1. Local Processing
ACE3600 RTUs perform local monitoring and control functions via their Input/Output ports. The I/Os can be serial ports, dry and wet contact inputs, FET and relay outputs, analog inputs and analog outputs. Combined I/O modules offer mixed I/O connections integrated into a single module.

2. Store & Forward Repeater
ACE3600 RTUs allow seamless wireless networking between RTUs, either directly or via multiple RTUs, which act as S&F repeater, over a single radio frequency. This capability allows significant cost saving, eliminating the need for additional radio channels and use of costly master repeater stations.

3. Network Routing
ACE3600 RTUs provide reliable data networking function, allowing an RTU to communicate with other RTUs over a variety of communications media. Each RTU may also serve as a communication node linking two or more communication media into the network.

4. Protocol Convertion
ACE3600 RTUs may act as protocol converters for disparate SCADA protocols. This can be achieved using either protocol encapsulation or protocol emulation methods.

ACE3600 RTU has the Most Advanced Architecture

Application Programming

Development of the application program for ACE3600 RTUs is simplified using the ACE3600 programming software, running on standard Windows® based program. This is the only tool required for programming, configuration and maintenance including testing and commissioning of ACE3600 RTUs.

The ACE3600 STS programming tool connects to the network of ACE3600 RTUs via any available RS-232 serial port or LAN port. From that node, the PC with the STS software can connect to any RTU, linked to the network.

Versatile Data Transaction methods

RTUs can be polled by the DA/DMS control center, but can also initiate unsolicited calls to the host computer. The link establishment process is very fast since radio is an inherently multi-drop medium and the only delay is the channel access time (typically 10-200 ms, depending on radio type). This action is commonly referred to as "Event Driven Reporting" and takes place when unusual conditions are detected by an RTU.

Power Supply Solutions

ACE3600 RTUs operate with "true" power supplies, in which the electrical equipment (motor drive of pole mount or vault installed switch-gear, etc.) may be activated either from the AC power supply (110V provided from a PT) or from the local backup battery. This is a highly important feature for DA/DMS systems.

Since low voltage AC power (110V/220V) might not be available in some installations, high quality RTUs feature low power consumption electronics with built-in power management capabilities. The unique advantage of the power management function is, that it allows the user of smaller size solar panels (less attractive to theft), lower capacity battery and provide extended RTU operation during a power outage.

Maximum Flexibility with Operating Redundancy

ACE3600 RTUs support redundant communication links to the control center(s). It also allows for integration of a redundant/secondary CPU within the RTU enclosure. This configuration is needed in critical applications to guarantee fail-safe transfer of the control function from one CPU to a backup CPU.

HIGH OPERATING RELIABILITY ENSURES LONG LIFE CYCLE

Experience has shown that typical life-cycle cost of SCADA hardware (RTUs, radio modems, etc.) is more than double the initial purchase cost. One must also take into consideration that a significant share of the system cost lays in its implementation, programming, commissioning, post-installation modifications, expansions and occasional repairs.

Use of ACE3600 RTUs and associated communication solutions helps to coping with these challenges and reduces the acquisition and operating bottom line figures.
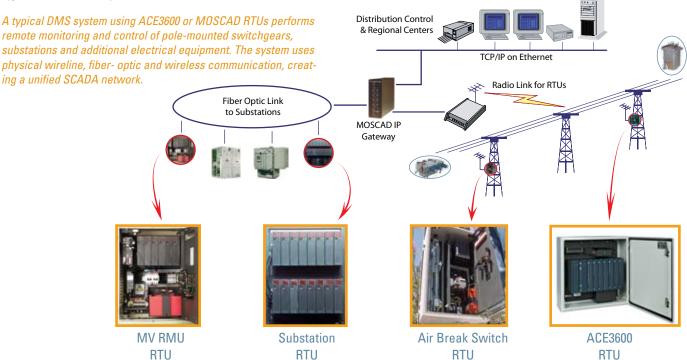
Reduced RTU Maintenance

Efficient, convenient and remotely performed maintenance is highly important in DA/DMS systems. This function includes remote-upload or download of parameters and application programs. It is possible to execute programs in any RTU connected to the network, even "over-the-air" from a distant location or via a phone line modem connection to one of the RTUs, linked to the network.

Advanced Remote Diagnostics

ACE3600 RTUs can supply hardware and software diagnostics, both locally and remotely, without interrupting the application. Upon detection of a problem a technical support person can upload the log file from all ACE3600 RTUs for post-event analysis. This helps detect rare events, such as interrupted communications, power failures, etc.

Typical DMS Block Diagram

A typical DMS system using ACE3600 or MOSCAD RTUs performs remote monitoring and control of pole-mounted switchgears, substations and additional electrical equipment. The system uses physical wireline, fiber- optic and wireless communication, creating a unified SCADA network.

Distribution Control & Regional Centers

TCP/IP on Ethernet

Radio Link for RTUs

MOSCAD IP Gateway

Fiber Optic Link to Substations

MV RMU RTU

Substation RTU

Air Break Switch RTU

ACE3600 RTU

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