

Motorola Enhanced SCADA Solutions

ACE3600 – Next Generation RTU for
Versatile Utility Applications and Industrial Solutions



Motorola SCADA Solutions Deliver Unparalleled Performance



- In today's highly competitive world it is the bottom line benefit that counts - and Motorola makes the difference. Over 120,000 Motorola SCADA (Supervisory Control and Data Acquisition) RTUs (Remote Terminal Units) installed worldwide and over three decades of accumulated experience are evidence of Motorola's ability to offer you top-class SCADA solutions.

- Both the Motorola ACE3600 and the former generation MOSCAD, MOSCAD-L, and MOSCAD-M RTUs utilize innovative design, control and data communication features. They facilitate integrated SCADA solutions tailored to applications in water and electric utilities, telecommunications, public safety, transportation, and other industries.

- Motorola RTUs' unique performance and uncompromising quality commitment translate into operating and cost benefits for our clients. Motorola SCADA solutions combined with reliable wired or wireless communications provide exceptional system architecture flexibility, reliable control, enhanced system performance, and data communications security.

- Motorola RTUs allow you to build new systems or expand existing ones, using a wide selection of Master Control Center (MCC) software, Human Machine Interface (HMI), data communication links and networks over wires, fiber optics as well as a variety of advanced wireless media. Thus, as your system needs grow, upgrades and expansions can be easily added.



Motorola SCADA Applications

Customers throughout the world have experience with SCADA solutions that boost operating reliability, help reduce operating costs, simplify operating procedures and help make maintenance crews more efficient.

Motorola designed the next generation ACE3600 RTU as upgradeable and expandable system to enhance the performance, data security and operating reliability of remote sites.

Thousands of Motorola SCADA systems with over 120,000 RTUs are operating worldwide, serving the oil and gas industry, electric and water utilities and public safety agencies.

Electricity Distribution

Distribution Automation (DA) and computerized remote control of Medium Voltage (MV) substations and power grids help electric utilities achieve higher reliability of supply and reduce operating and maintenance costs.

In the past, Sectionalizer Switchgears, Ring Main Units, Reclosers and Capacitor Banks, wind farm power generation connected to the MV power grid were designed for local operation with limited remote control. Today, using reliable wireless communication, Motorola RTUs provide powerful integrated solutions when upgrading remotely installed electric equipment. Motorola's upgrade solutions include integration of Capacitor Bank controllers, transducer-less AC Measurement units and Fault Passage Detection (FPD) units from 3rd party vendors. These operate as Intelligent Electronic Devices (IEDs) and can be connected to the RTU via Ethernet, RS-232 or RS-485 ports using MODBUS or DNP 3.0 protocols.

In a Distribution Management System (DMS), Motorola RTUs seamlessly interface with a wide range of high performance control centers supplied by leading vendors worldwide. Connection to these EMS, and DA/DMS control centers is typically provided via a high performance IP Gateway or OPC-type Interface.



Oil and Gas Industry

Oil and gas operations require remote control for production wellheads, along long pipelines and at valves located at difficult-to-access sites. This industry must maintain the strictest safety measures to prevent and detect leakages or fire at remote installations. Thus each site must be supervised via RTUs with communications to one or more control centers.

RTUs in gas installations calculate gas flow according to AGA-3 (American Gas Association), AGA-7, AGA-8 and other standard formulas, while RTUs along oil pipelines perform analog pressure control using PID (Proportional-Integral-Derivative) loops, monitor cathodic protection rectifiers, flow meters and more.

Intrinsically safe connection to RTUs from field sensors installed in restricted zones can be provided by adding barrier devices to the discrete Input/Output signals and RS-232 serial cables.





Water and Wastewater

Among the goals commonly cited by municipal and private water utilities worldwide are cost savings due to reduction of unaccounted-for-water, maintenance cost reduction, lift station early problem detection, energy and chemical material cost reduction, deferment of expansions due to more optimal operation, etc.

Motorola's wireless and wired data communication based RTUs provide solutions to these and other applications. They can be configured to monitor the flow in pipe lines improve regulation of pressure using Pressure Regulated Valves, cut down on unnecessary consumption and reduce water losses. RTUs collect real time information on reservoir levels and pump operation and communicate report-by-event based data that helps maintain a reliable supply and stable pressure.

Without a SCADA solution, this type of operation would require additional pumps, storage tanks and pressure regulating equipment.

Siren Warning Systems

Electronic sirens warn the general public in cases of severe weather conditions, civil defense air raid alerts, pollution and radiation alerts around nuclear power plants. Toxic gas clouds might emanate from chemical plants or hazardous waste dumps. In order to minimize those risks, operators require a reliable method for immediately alerting the public – wireless triggering of multiple sirens is the preferred method. Such solutions often require redundant data communications.

ACE3600 RTUs installed at remote sites provide communication between the sirens and the control center and expand the usage options of the system. They are capable of selecting combinations of tones or pre-recorded voice messages. The use of multiple control centers, which communicate with all sirens offer advanced and flexible functions such as activation of sirens in selected groups, backup control, silent test, download of pre-recorded public warning messages as well as redundancy.

Public Safety and Fire Station Alerting

Accurate dispatch capability of fire equipment and ambulances in a community is an important requirement of Emergency Services departments. This action must be done quickly and effectively to maximize the responsiveness to the community.

A wrongly communicated address due to incorrect voice comprehension can lead to loss of life. RTUs can be programmed so that upon receipt of an alert at the fire station, they turn on lights, connect the voice dispatch message to the building public address system, open the fire station doors, identify the vehicles assigned to the task, and then send a message to dispatch when all vehicles have left the station.

These solutions also support a Computer Aided Dispatch (CAD) interface at the Dispatch Control Center, which permits easy and optimal selection of the regional fire station(s) and activation of vehicles in each station. The Dispatch Control Center can also provide voice dispatch capability and redundant two-way communications.

Natural Disaster Warning Systems

Governments today are acutely aware of the risk to the general public resulting from pollution, floods, storms, mud slides, earthquakes, Tsunami events and other environmental dangers. This creates a need for innovative solutions, which help report the status of electronic sensors located across a wide area.

Applicable SCADA software is used to collect and communicate critical information from RTUs to the control center. This data is processed and made available to the public via radio, TV, the Internet, etc.

Thanks to its low power consumption, solar panel operation and versatile communications, the MOSCAD-M, is particularly suited for this application.

Each RTU can report directly to the control center or can communicate in a hierarchical fashion via ACE3600 based data concentrators located at selected sites. Having such solutions in place, improves public awareness and upon a disaster provides quick public notification.



ACE3600 RTUs for Advanced SCADA Solutions

The wide range of SCADA RTUs and communication solutions offered by Motorola, including the ACE3600, allow Motorola or its partners to integrate turnkey solutions with versatile control centers and interface to 3rd party sensors, IEDs and PLC units.

The ACE3600 RTU is designed to allow both horizontal and vertical system expansion, which enhances the performance and operating reliability of remote installations.

At the heart of the Motorola ACE3600 technology is its powerful processing and communications capability that allows powerful local processing along with polling communications combined with peer-to-peer and RTU-to-host event based reporting.

On-site control conducted by the ACE3600 RTU can be based on local conditions, downloaded parameters as well as system-wide conditions using data imported via RTUs from other sites. The protocol conversion capability of ACE3600 allows integration of intelligent sensors through Ethernet, RS-232 or RS-485 ports.

The ACE3600 RTU may simultaneously communicate with other RTUs, PLCs, SCADA control center and IEDs via up to five communication ports.

The processing capability of ACE3600 provides powerful calculation and data analysis for the most critical, real-time monitoring and control applications. ACE3600 may emulate a number of widely used communication protocols. This facilitates gathering and analyzing data from multiple sensors and IEDs at remote sites.

The ACE3600 RTU provides on time data transmission to numerous locations with access to the SCADA system via a wireless network or an Internet/Intranet connection.

Each RTU in the network can also act as a communication node or Store & Forward (S&F) data repeater to cover a wider geographical area. This function also supports redundant data transfer links to achieve an even higher level of data reliability and dead spot elimination.



ACE3600 RTU



ACE3600 CPU Module

- Secure RTU Operation can be ensured by utilizing encrypted data communication.

- Power Supply operation can be monitored and controlled via the application and RTU firmware.

- The Digital Output relays are supplied with manually switched control lines, which permit disabling relay operation. This function can be activated during field maintenance.

- The RTU can be used with a Motorola-supplied high quality rechargeable back-up battery pack or with a range of 3rd party rechargeable batteries.

- Reduced power consumption operation can be chosen to extend RTU backup operating time. A battery diagnostics feature is available to monitor the battery health and remaining operating time.

- All RTU modules are designed for "Hot Swap". If permitted by the application, I/O modules can be replaced without stopping RTU operation.

- The RTU architecture is " dual-radio ready", which makes it suitable for operating as a wireless-to-wireless or wireless-to-other data communication medium node.

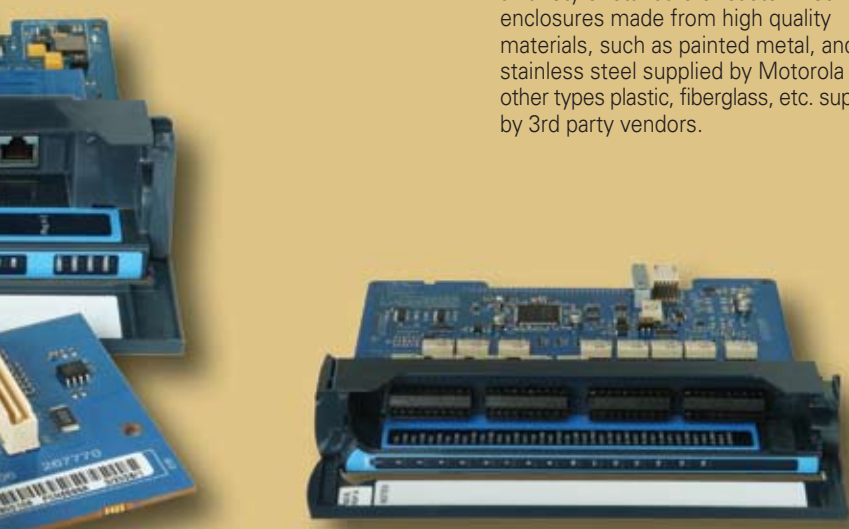
- The RTU utilizes VX-Works™ a real-time based multitasking operating system that maximizes operating performance.

- The RTU has up to 20 fast counters on the 32 DI module and 16 bit analog resolution on the AI module. The AI refresh rate is 10 ms, which allows multiple calculations to be performed quickly.

- The RTU operating temperature range is - 40 to +70°C, which ensures reliable operation under the most challenging environments (refer separately to radio and battery temperature restrictions).

- Cost effective RTU configuration is possible by utilizing a configurable mix of DI and DO, or AI and AO connections on unique mixed I/O modules.

To withstand harsh outdoor environments, the ACE3600 RTU can be integrated into a variety of standard or customized enclosures made from high quality materials, such as painted metal, and stainless steel supplied by Motorola and other types plastic, fiberglass, etc. supplied by 3rd party vendors.



ACE3600 I/O Module

Note: Motorola continuously adds enhanced features to the ACE3600.



The System Tool Suite - A Modern Tool for Programming



The System Tool Suite (STS) program is a framework for designing, configuring, programming and maintaining ACE3600 based SCADA systems. The STS provides the system engineer with a centralized project oriented intuitive tool that enables quick implementation of advanced SCADA projects.

The combination of ACE3600's configuration flexibility and straightforward operation makes it a perfect tool for implementing and upgrading new and existing SCADA systems at minimum cost and with minimum effort.

The main benefits of the STS are:

- Project oriented tool - handles multiple sites from a system design approach.
- Integrates all SCADA related functions in a single tool – Configuration, Setup, Programming, Debugging and Maintenance.
- Provides a graphical view of system sites and the entire network.
- Automatically manages all project related files.
- An inventory library of RTUs, ports and I/O modules allows creation of new sites simply by drag & drop operations
- Setup of RTUs, ports, I/O modules can be saved in the user library for later reuse in other projects
- RTU Network files are created automatically per project
- Provides batch download of files to all sites in a single command (broadcast)
- Implements Graphical User Interface (GUI) based on .NET technology

Setup: System building and setup is performed easily by dragging RTUs, ports and I/O modules from the Inventory library to the system view.

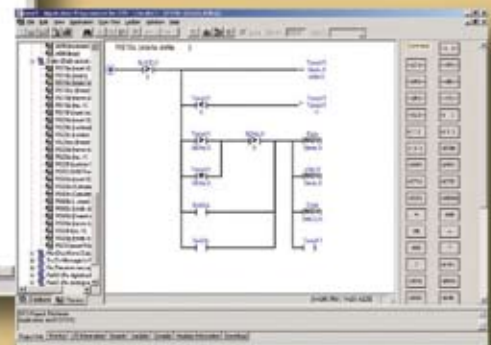
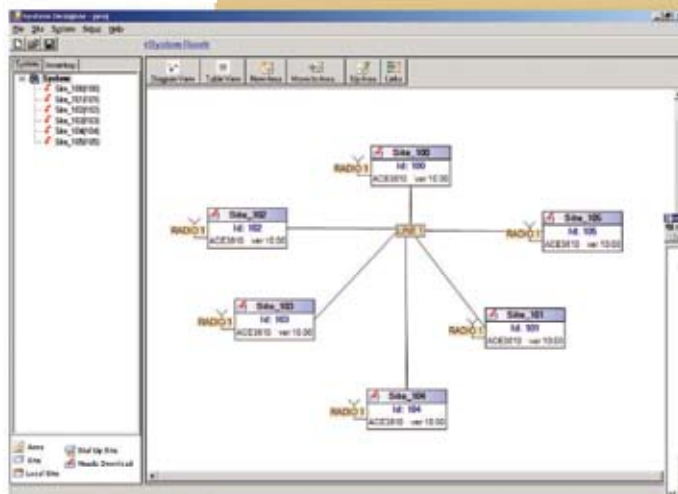
STS Programming Screen

The system can also be presented in table format. Clicking on a site icon enables the following operations:

- Edit site ID, site name, and site description.
- Configure Ports, I/Os and other advanced parameters.
- Associate files to a specific site.
- Save configured items (ports, I/Os or the entire RTU configuration) to User library.
- Download or Upload firmware, configuration, Date & Time, network and other associated files.
- Upload RTU configuration, Data Loggers, application program source files, etc.
- Perform complete hardware test.
- Edit Ladder programs associated with the site.

Several RTUs can be grouped under one geographical /logical area in the system view. This permits dividing the system view into several areas. The STS also enables batch file downloading to any group of RTUs in the system. The user may choose which files will be downloaded to the RTUs in the batch download. This feature saves considerable time and effort during new system setup or when numerous changes are made to existing configurations.

Programming: The ACE3600 application programs may be written in "Ladder Diagram or in "C" programming language. Motorola provides a 'C' ToolKit with comprehensive 'C' function library and 'C' compiler. The STS Application Ladder Programmer enables complete RTU application Ladder programming and debugging. The Application Manager tool enables quick association of a Ladder Diagram and/or a 'C' program to any RTU in the system for download.



Motorola SCADA Communication Solutions



The ACE3600 RTU is designed for reliable, secure, versatile and easy connectivity to a wide range of SCADA control centers offered by leading vendors worldwide.

Motorola offers multiple interface options to these control centers using a range of industry standard interfaces.

ACE3600 RTUs may simultaneously communicate via five ports including up to three Ethernet ports.

LAN Interface Processor (IP Gateway)

The IP Gateway plugs into the standard LAN (Local Area Network) of your Ethernet-based SCADA system and allows wide area connectivity. Via the IP Gateway, the control center has instant access to a large number of RTUs in the network and collects up-to-date field information. A Client/Server architecture allows the IP Gateway to distribute data to multiple clients – both to one or more SCADA control centers and to all RTUs in the field.

The Motorola IP Gateway's API (Application Programming Interface) provides easy implementation of a driver for the SCADA application software. Via the API, the IP Gateway may seamlessly integrate with virtually any Master Control Center (MCC) utilizing industry standard operating systems. Several major SCADA software vendors have already developed drivers for MOSCAD IP Gateway connectivity.

The IP Gateway provides interface for communications with field-installed ACE3600 and MOSCAD RTUs.

OPC Interface Server (M-OPC)

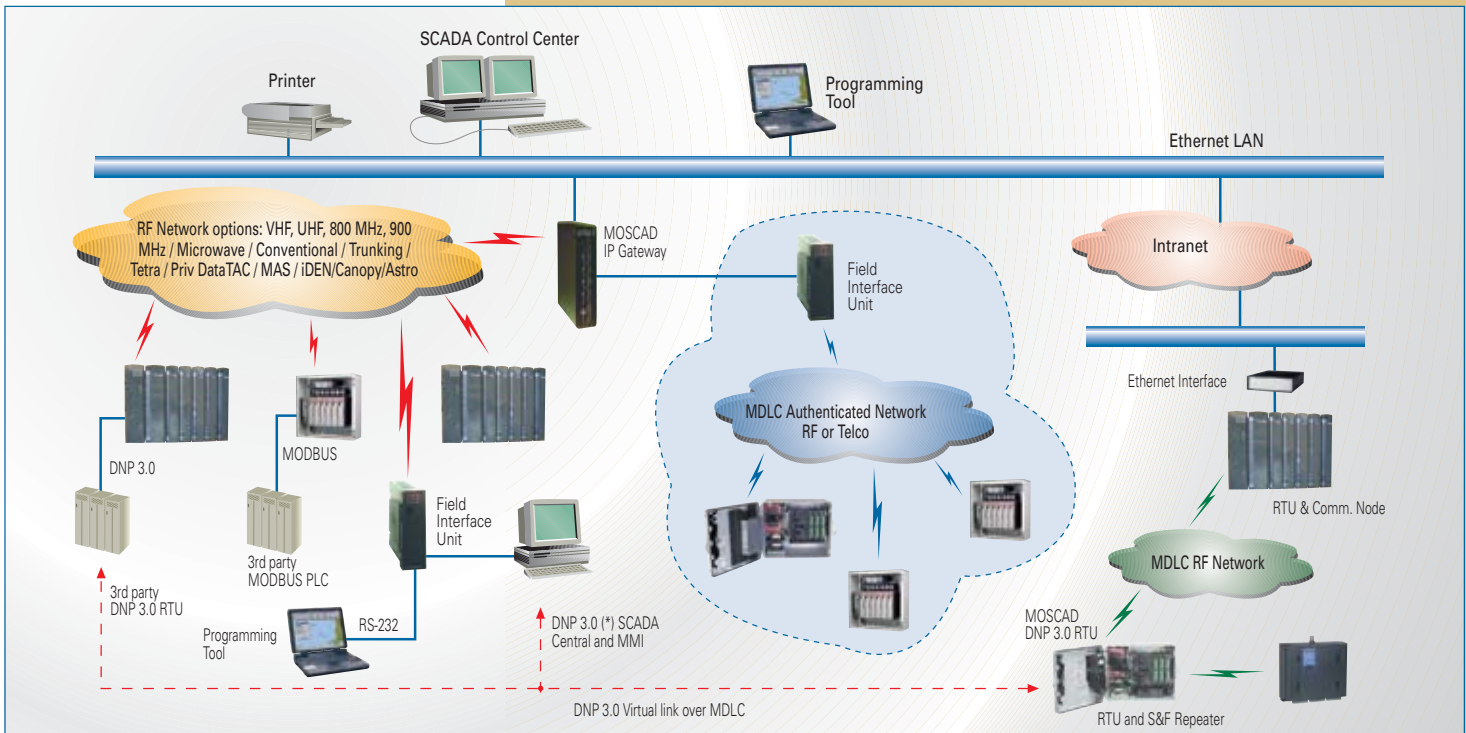
The M-OPC uses the OPC (OLE for Process Control) and is based on standard MS Windows connectivity to a wide range of modern control centers. M-OPC runs on a Windows standard PC OS and makes the field data instantly accessible to the SCADA computer.

M-OPC manages communications with field installed Motorola RTUs and provides opportunity for SCADA system owners to migrate to OPC.

Interface Using CPU as FIU

The ACE3600 may interface to a wide range of Master Control centers (MCC) utilizing MODBUS or DNP 3.0 over RS-232 or Ethernet protocols. Such MCC connectivity is established via the ACE3600 CPU, acting as a Field Interface Unit (FIU).

Integrated Motorola SCADA Architecture



(*) Similar solutions apply for IEC 60870-5-101 protocol based systems

SCADA Communications Network



Motorola's experience in SCADA systems and data communications provides support for a large selection of communication media and data protocols.

Your SCADA system, no matter how widely scattered or complex, can operate through radio, cellular, microwave, fiber optic, dedicated or switched wire-lines, RS-232/RS-485 serial links, Local Area Networks (LAN) or a versatile data network combining these media.

Motorola Data Link Communication (MDLC) Protocol

The ACE3600 and MOSCAD-M RTUs support the MDLC data communications protocol that delivers major benefits especially for wireless-based SCADA systems. Its seven-layer, OSI/ISO compatible structure delivers powerful network communication functions.

RTUs can connect directly to VHF, UHF, 800/900 MHz, trunked and conventional radios, Private DataTAC modems, Motorola ASTRO analog and digital networks, iDEN, TETRA, GSM/GPRS, dial-up AT modems, MAS (Multiple Address System) data radios using dual or single frequency, or 900 MHz and 2400 MHz Spread Spectrum radios, Wi-Fi media, 5.3 GHz, 900 MHz and 2.4 GHz Motorola Canopy, Motorola MESH products, broadband, etc.

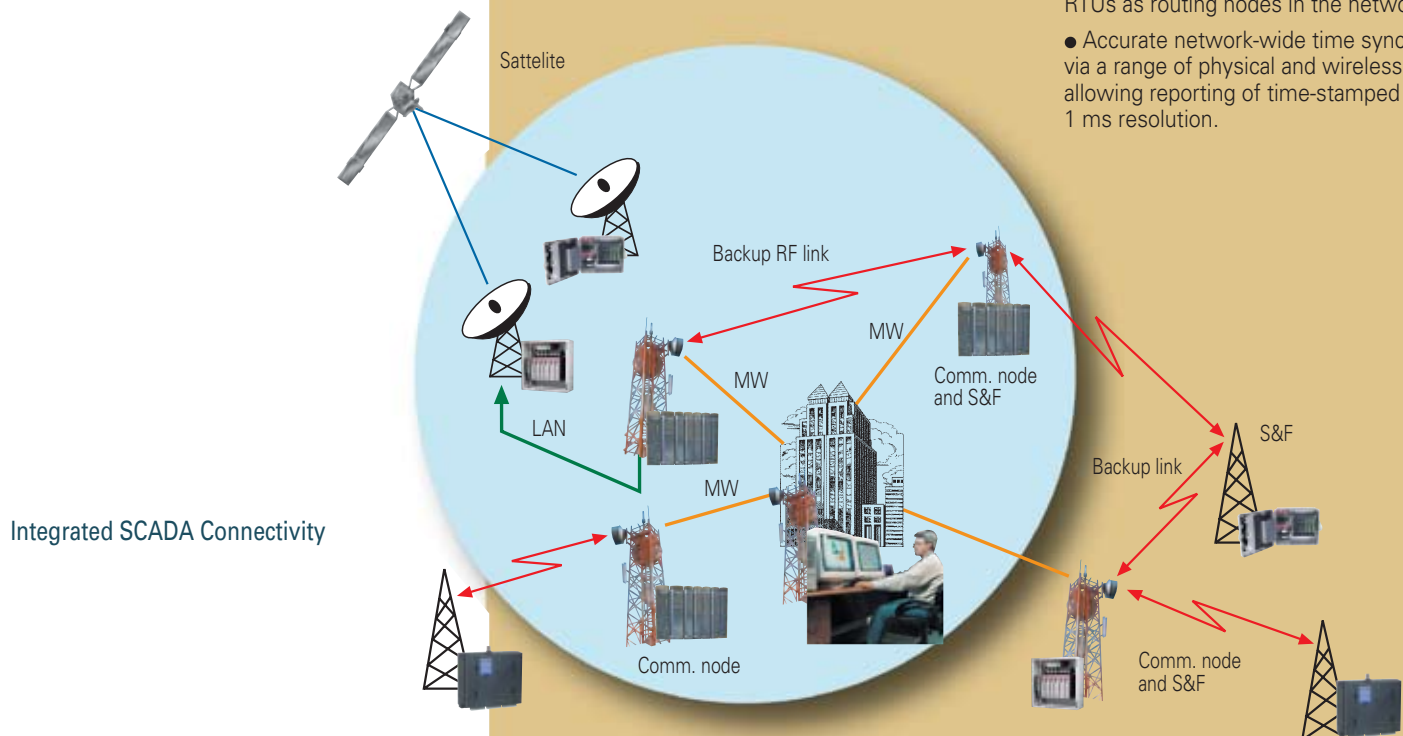
These communication devices interface to the RTU via serial link or direct Ethernet connection. The ACE3600 RTU may communicate with other vendors' PLCs (Programmable Logic Controllers), IEDs and RTUs, using DNP 3.0, MODBUS, Allen Bradley DF/1 and other industry accepted protocols.

Motorola RTUs can be equipped for direct connection to your Corporate Intranet LAN, if available at the remote sites. This allows direct high-speed messaging by reusing an existing communication infrastructure investment.

Using the advanced features embedded within the ACE3600 RTU such as remote diagnostics, application program and parameter uploading/downloading, and transmission of time-tagged messages result in significant enhancement of the monitoring and control capabilities of your SCADA system.

The MDLC protocol supports:

- Integrated networks with a mixture of wire-line, LAN and a wide range of wireless synchronous and asynchronous communication links.
- Remote control of customer sites utilizing polling communications, Report-by-Exception and Report-by-Event messages.
- RTU-to-RTU (peer-to-peer) communications, as well as RTU communications to multiple hierarchically structured control centers.
- Multi-session communications, allowing execution of simultaneous operations such as Store & Forward (S&F) and routing of data using RTUs as routing nodes in the network.
- Accurate network-wide time synchronization via a range of physical and wireless networks, allowing reporting of time-stamped events with 1 ms resolution.



Migrating from MOSCAD to ACE3600



Motorola and its VARs/partners have supplied thousands of turnkey solutions with ACE3600 RTUs and MOSCAD family of RTUs, connected with versatile control centers, 3rd party smart sensors and IEDs.

Using the MDLC protocol, newly installed ACE3600 RTUs can be integrated side by side with existing MOSCAD family RTUs into a single system.

The powerful communication capabilities of ACE3600 RTUs enhance the networking capability, performance and operating reliability and security of remote installations. Application programming for these RTUs can be implemented using Ladder Diagram or C language.

Using the STS tool, application programs developed for the MOSCAD family of RTUs can be ported to the ACE3600 RTU.



Integrated System with ACE3600 and MOSCAD family of RTUs

The modular design of ACE3600 provides built-in intelligence and powerful communications that allows making on-site decisions based on local conditions, downloaded parameters as well as system-wide conditions using data imported from ACE3600 or MOSCAD RTUs at other sites.

The modularity of ACE3600 with a large selection of Input/Output modules allows you to configure each remote site cost effectively. Protocol conversion code loaded into the ACE3600 CPU allows integration of new and existing intelligent sensors through Ethernet, RS-232 or RS-485 serial ports.

A range of standard backplanes and enclosures is available for three, five and seven module sizes, and for a 19" rack-mount basic frame that accepts 8 ACE3600 modules.

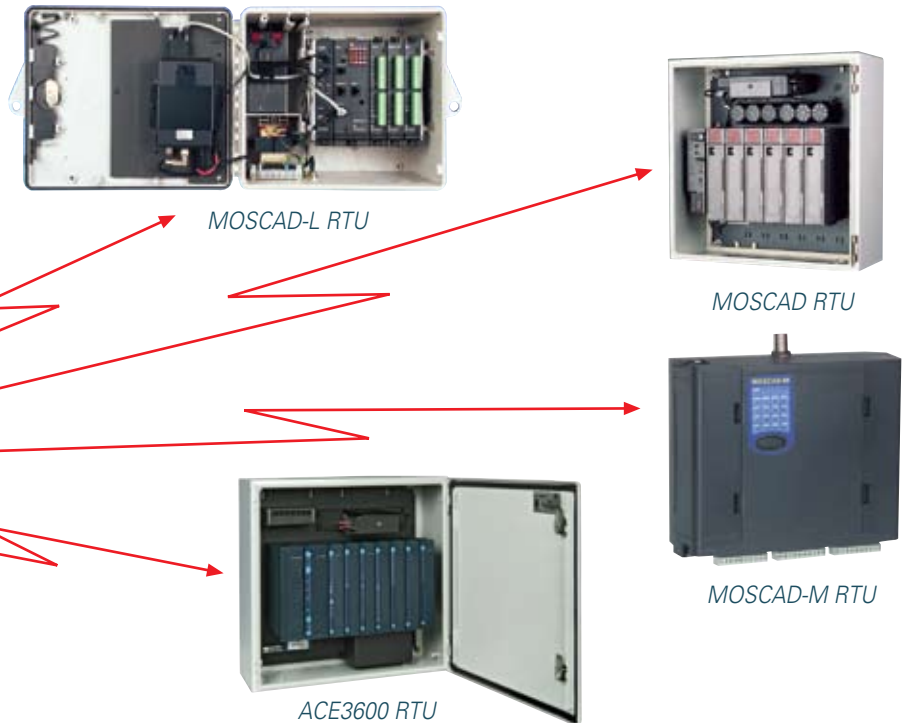
The capability of ACE3600 systems can be significantly improved by direct LAN connection, if available at the remote site. This option allows seamless interface over IP to the SCADA control center as well as other networks using the built-in Ethernet connection.

MOSCAD-M is the smallest member of the Motorola RTU family and also uses the MDLC protocol. The small size enables MOSCAD-M to be placed in space-restricted locations and inside equipment provided by others.

MOSCAD-M RTUs feature Application Oriented Power Management capability that allows integrating optimal solution for battery operated sites.

MOSCAD-M's I/O capability is sufficient for small size SCADA installations and its low power consumption makes it ideal for solar-powered sites. Communications by internal or external radio or wire-line modem is available. SCADA systems may comprise only MOSCAD-M RTUs or may be combined in a system with ACE3600 RTUs.

Note: The MOSCAD and MOSCAD-L family of RTUs will not be available for new systems after January, 2008. Current users may obtain replacement MOSCAD and MOSCAD-L modules through 2012 only for field replacement.



Selecting Motorola

Motorola has been one of the world's leading providers of computers, components, communication, and control systems for over 75 years. To ensure reliable system operation after integrating a new system or upgrading an existing one, Motorola provides field training via local service teams, or by local system integration firms, who speak your language and understand your operating needs.

Motorola has been providing reliable wireless SCADA RTUs and systems solutions for three decades with over 120,000 installations worldwide in a wide range of applications. Motorola is committed to uncompromising quality of products, services and system solutions and delivers Six Sigma quality on all its products. Motorola has received the prestigious Malcolm Baldrige National Quality award.

- **Enhanced performance.** The Motorola ACE3600 RTUs allow you to get the most from your installations and provide you with the best-in-class solution to match your growing requirements.
- **Advanced Communications.** ACE3600 RTUs can work seamlessly with most standard SCADA systems and interface with other devices and protocols to create cost-effective turnkey solutions over multiple communications media.
- **Built-in Protocol Transcoder.** ACE3600 RTUs support transcoding between several common SCADA industry protocols, such as Motorola Data Link Communications (MDLC), Modbus RTU/Binary, DF/1, DNP3.0, IEC 60870-5 and more.

Reliably Operating and Cost Effective SCADA Solutions are vital to your organization.

Motorola has the solutions for all your needs: The New Generation ACE3600.



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