ACE3600 Remote Terminal Unit

The Next Generation of High-Performance Control

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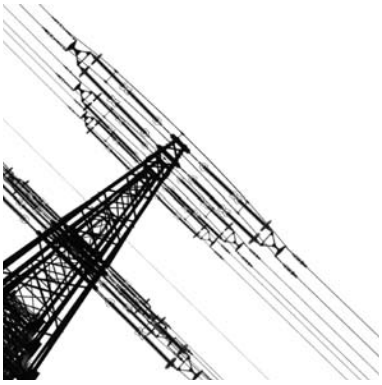

Empower Your SCADA Network

Utilities, now more than ever, are facing newer and greater hurdles. Multiple wired and wireless communication technologies are challenges to seamless networking. Heightened security concerns amplify the need for secure connections. Operating flaws, system breakdowns and security failures are unacceptable. Versatile network interoperability, powerful data management and an intuitive user interface are mandatory.

As the lead component in a SCADA system's remote monitoring and control capabilities, Remote Terminal Units (RTU) must face these challenges head on.

Operating within a wide variety of SCADA infrastructures and protocol requirements, RTU's must:

- Be versatile enough to support different communication media
- Adapt to existing and changing system requirements and platforms
- Encrypt information to protect against cyber-attacks and false signals
- Be cost-efficient to maintain and operate for future growth
- Possess the robust processing to manage large amounts of data accurately, quickly and reliably

A SCADA network equipped to meet these demands requires the next generation of RTU from a communications leader, Motorola.

The combination of ACE3600's unprecedented flexibility and straightforward operation makes it the perfect upgrade with minimal cost and effort.

Wireless Communication Versatility

ACE3600 is an all-in-one package that includes the RTU, radio and software for quick installation. The ACE3600 features a graphical user interface (GUI) that minimizes training time by allowing system configurations and network operations to be managed through simple, user-friendly applications. The GUI includes program and system self-maintenance software tools.

ACE3600 operates with multiple industry protocols and across a wide band of communication media, including:

- Fiber-optic links
- Telephone and leased lines
- VHF/UHF/800 conventional systems
- 800 MHz/UHF analog or digital trunked systems
- Multiple Address Systems (MAS)
- Broadband data over Internet Protocol (IP)
- Spread Spectrum communication
- Microwave
- Satellite
- Narrowband and broadband at speeds from 1200 bps to 100 MB

This flexible communications capability enables the ACE3600 to connect with several local devices, analyze the data and remit that information via different media to various other locations.

ACE3600 also accommodates a host of devices, sensors and display elements and has hot-swappable input/output (I/O) modules with Sequence of Event Recording (SER).

Available on-board ports can feature up to:

- Three 10/100Base-T ports
- Four serial ports
- Two radio modem ports

Robust Transmission Processing

The ACE3600's processing power provides accurate data analysis for the most critical, real-time monitoring and control applications.

- ACE3600's Optimized Wireless Protocol works in concert with its flexible communication capabilities to gather and analyze data from multiple sensors or other intelligent electronic devices (IED), at any number of remote sites.
- Transmissions from sensors and IED's are sent accurately and dependably to any number of locations or any computer that has access to an Internet/Intranet connection and a standard Web browser.
- The RTU acts as a communication node or Store-and-Forward repeater, allowing for coverage extension or data transfer between RTU's in the event of a disruption in service. This enables redundant data transfer for an even higher level of security, dead-spot elimination and additional reliability.
- The ACE3600 eliminates the need to make a choice between an RTU and PLC, by incorporating the best features of mid-sized PLC functions to provide local programming and communications capability.

The Latest in Security

Maintaining the integrity of SCADA systems requires an RTU network that sends and receives data securely. Providing security through reliable operation and automated disruption protection, the ACE3600 provides increased data security through multiple layers of encryption and time-based data authentication.

- ACE3600 can be used as a secure router with data sent to the RTU from various non-secure sources and held for secure forwarding.
- ACE3600's ability to diagnose, calibrate, program and update other RTU's alleviates technicians spending time canvassing remote sites, provides immediate assessment of a failure, and reduces service downtime.
- Over-the-air uploads and downloads are performed between RTU's or the control center for diagnostics in the event of an accidental or malicious disruption.
- Rigid password security protects the system from unauthorized access.
- Motorola's secure SCADA and Motorola Data Link Communication (MDLC) protocol is the trusted solution used by numerous Federal agencies and military bases across the globe.

Powerful Solutions for Essential Applications

Wastewater Control

- Monitors well parameters for sophisticated pump sequencing and alerts
- Monitors water levels at the reservoir/water tower, and flow and pressure in the distribution grid
- Controls regulating valves and monitors the water quality based on analytical parameters
- Protects and ensures water quality and conservation by the monitoring of wells so that excessive pumping is mitigated
- Provides critical response system fault detection for leaks or unauthorized water use

Public Warning Systems

- Provides secure communication between the sirens and the control center
- Provides back-up communications, silent test and download of recorded public warning messages, and siren activation
- Expands communication capabilities through a select combination of tones and pre-recorded voice messages

Oil and Gas Safety

- Continuously monitors, measures and controls different aspects of the production, refining, transportation, storage and distribution of oil and gas
- Measures oil and gas flow rates per American Gas Association (AGA) standards, accumulated flows, line and wellhead pressures
- Analyzes, coordinates and controls with enhanced system monitoring to manage oil spills, leakage and fire detection and emergency shut down procedures

Fire Station Alerting Solution

- Alerts specific bunkroom(s), waking only the appropriate response team(s) reducing work, stress and fatigue
- Protects the fire station from theft by closing the doors after the engines have left
- Guards against a fire in the fire station by shutting down designated high-risk areas within the station, such as the kitchen, which are quickly left unattended during an emergency

Electrical Distribution

- Monitors and controls transformers, substation protection relays and circuit-breaker reclosers utilizing detection technology to register which feeder sections experience a fault current
- Uses advanced communication capabilities for fault isolation and system restoration to remotely isolate a damaged MV power grid section and restore power to customers
- Regulates voltage and the power factor through remote control of capacitor banks along the grid providing more accurate billing and a reduction in energy losses along the network
- Helps power generation stations to effectively meet the growing demand for electricity through power quality monitoring

Why Motorola?

Only Motorola combines the best of technology and Six Sigma customer service processes to design the industry-leading ACE3600 Remote Terminal Unit, as well as a full-line of SCADA components for efficient and protected operations.

Only Motorola's 75 years of experience designing and manufacturing secure, mission critical communications systems can provide the most versatile, secure, and accurate SCADA operating system for your business. For the last 30 years, Motorola's reliable, compatible, wireless SCADA devices have been implemented all over the world.

Only Motorola has the global wireless technology infrastructure and engineering muscle with 21,000 patents and over $3.7 billion spent in research and development. Motorola's standards-based technology benefits customers with increased versatility, compatibility and seamless interoperability.

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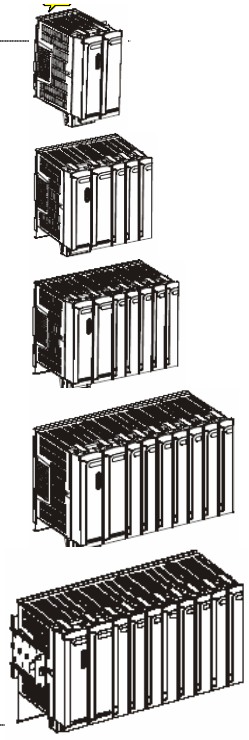
ACE3600 GENERAL SPECIFICATIONS



Frames	No I/O slots - PS and CPU modules only, wall mount 117 W x 244 H x 198* D mm (4.61” x 8.23” x 7.80”*), 0.95 Kg (2.1 Lb) 3 I/O slots - PS, CPU and up to 3 I/O modules, wall mount 234 W x 244 H x 198* D mm (9.21”x 9.61” x 7.80” *), Approx. 1.9 Kg (4.19 Lb) 5 I/O slots - PS, CPU and up to 5 I/O modules, wall mount 314 W x 244 H x 198* D mm (12.36”x 9.61” x 7.80” *), Approx. 2.4 Kg (5.3 Lb) 7 I/O slots - PS, CPU and up to 7 I/O modules 391 W x 244 H x 198* D mm (15.39” x 9.61” x 7.80” *), 3. Kg (6.6 Lb) 8 I/O slots - PS, CPU and up to 8 I/O modules, wall mount or 19” rack 435 W x 244 H x 198* D mm (17” x 9.61” x 7.80” *), Approx. 3.3 Kg (7.3 Lb) * Depth including module panel
Metal Chassis	Large - for PS, CPU and up to 7 I/O slot frame, two radios and 6.5 or 10 Ah backup battery, wall mount, 448 x 468 mm x 200* D mm (17.64” x 18.43” x 7.88”*) Small - for PS, CPU and up to 3 I/O slot frame, one radio and 6.5 Ah backup battery, wall mount, 335 W x 355 H x 198* D mm (17.64” x 18.43” x 7.80”*) * Depth Including Frame and Module
Enclosure	Large NEMA 4X /IP65 painted metal - up to 7 I/O slot frame, two radios and 6.5 or 10 Ah, backup battery, 500 W x 500 H x 210 D mm (19.7” x19.7” x 8.26”) Small NEMA 4 /IP65 painted metal - up to 3 I/O slot frame one radio and 6.5 Ah backup battery, 380 W x 380 H x 210 D mm (15” x 15” x 8.26”)
Power Supply	10.8-15.5 V DC (default) 18-72 V DC 18-72 V DC with 12 V smart battery charger 85- 264 V AC, 50-60 Hz 85- 264 V AC, 50-60 Hz, with 12 V smart battery charger
Backup Battery	6.5 Ah - Sealed Lead-Acid 10 Ah - Sealed Lead-Acid
Operating Temperature	-40 ºC to +70 ºC (-40 ºF to 158 ºF) Note: In models with radio, the radio operating temp. range is: -30 ºC to +60 ºC (-22 ºF to 140 ºF)
Storage Temperature	-55 ºC to +85 ºC (-67 ºF to 185 ºF)
Operating Humidity	5% to 95% RH @ 50 ºC without condensation
Mechanical Vibrations	Per EIA/TIA 603 Base station, Sinusoidal 0.07mm @ 10 to 30 Hz, 0.035 mm @ 30-60 Hz
Operating Altitude	-400m to +4000 meter (-1312 ft to + 13120 ft) above sea level

REGULATORY STANDARDS

Safety	UL 60950-1:2001 CSA 22.2-60950-1 IEC 60950-1 AS/NZS 60950
Emission	Emission standards per: CFR 47 FCC part 15, subpart B (class A) EN55022:2003 Class A EN61000-3-2 EN61000-3-3
Immunity	Immunity standards for industrial environments per EN50082-2 /IEC 61000-6-2 IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-11

COMMUNICATIONS

Communication Ports:	Up to 5 ports per CPU Serial - up to 4 x RS-232 ports Multi-drop – up to 3 x RS485 ports Ethernet - up to 2 x 10/100 MB ports and 1 x 10 MB port Two-way radio/analog trunked radio - up 2 x modem ports
Motorola Radio Support	Mobile two-way radio - CM200, CM340, GM3188, EM200, CDM750 Portable two way radio – HT750, GP320, GP328, PRO5150 Astro – XTL5000 (digital and analog trunk), XTS2500 (digital trunk) Dimetra – MTM800 (PD)
Third Party Radio Support	Two way radios, data radios, TETRA radio (PD)
Modem Support	Dial-up modems, cellular modems (dial mode & PD)
Protocols	MDLC, TCP, UDP, IP, PPP, NTP, DHCP
Third Party Protocol	MODBUS RTU (master/slave, RS-232/RS-485), DF1 (Allen Bradley – Master on RS-232)
User Protocol (in user program)	Possible on RS-232, RS-485 and Ethernet ports

CPU 3610/CPU 3640 MODULES SPECIFICATIONS

Microprocessor	Freescale – Power PC II, MPC8720, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
User Memory	Flash: 3 MB DRAM: 10MB
Real-Time Clock Milliseconds).	Full calendar with leap year support (Year, Month, Day, Hours, Minutes, Seconds, Time drift: max. 2.5 seconds per day (when power is on)
SRAM and RTC Retention	Rechargeable lithium backup battery
Serial Port 1	Configurable RS-232C or RS-485 port: - RS-232C: Async, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-Wire up to 460.8 kb/s
Serial Port 2	RS-232C, Async, Full Flow Control, up to 230.4 kb/s, GPS receiver interface
Plug-In Port 1	Supports the following Plug-In ports: - Radio Modem, DPSK 1.2 kb/s, FSK 2.4 kb/s, DFM 4.8 kb/s and Duo-binary 9.6 kb/s - RS-232, Sync/Async, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-wire, up to 460.8 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2 kb/s and	Supports the following Plug-In ports: - Radio Modem (General Radio Interface) DPSK 1.2 kb/s, FSK 2.4 kb/s, DFM 4.8 Duo-binary 9.6 kb/s - RS-232, Sync/Async, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-Wire up to 460.8 kb/s - Ethernet 10 Mb/s
Ethernet Port 1	10/100 Mb/s, (on CPU 3640 only)
LEDs Display	4 CPU diagnostics LEDS, port status LEDs and user application LEDs
Operating Voltage	10.5 – 15.5 V DC
Power Consumption	Max. 4.2 W (300 mA @ 14 V DC)
Operating voltage	10.5-15.5 V DC (from the motherboard connector)
Power Consumption	Max. 4.2 Watt
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2“W x 8.7“H x 7.1“D)
Weight	Approx. 0.38 Kg (0.84 Lb)

POWER SUPPLY MODULE SPECIFICATIONS

Input Voltage	DC 10.8-15.5 V DC18-72 V DC 18-72 V DC with 12 V smart battery charger 85-264 V AC, 50/60 Hz 85-264 V AC, 50/60 Hz with 12 V smart battery charger
Total Power	Max. 60 Watt continuous, Max. 105 Watt peak @ 25% duty cycle
Outputs	To motherboard (for CPU and I/O modules): 13.2 V DC ±20%, max. 8 A AUX1a/AUX1b user connectors: 13.2V D ±20% C, max. 8 A AUX2a/AUX2b: 13.2 V DC ±20%, max. 8A or 3.3/5/7.5/9 V DC ±10%, max. 2.5A
Battery Charger	12 V Lead Acid battery charger (in PS with charger) Automatic charging of 6.5 or 10 Ah backup battery, battery temperature sensing, overcharging protection, battery capacity test and diagnostics, automatic battery switch-over
Diagnostics LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs voltages and battery
Efficiency	DC: 80% typical, 76% typical (full load) AC: 80% typical @230 V AC, 76% typical @115 V AC (full load)
Inrush Current	DC: 10 A maximum, for 2 mSec. Max, cold start at 25°C AC: 25 A maximum, for 2 mSec. Max, cold start at 25°C
Power Factor	AC: 0.98 typical at 230 V AC, 0.99 typical at 115 V AC
Input Protection	Internal Line Fuse, replaceable
Protection	Overload and Short Circuit, automatic recovery
Over-Voltage Protection	Automatic output shut down
Insulation	DC: Input to case: 500 V DC, input to output: 500 V DC AC: Input to case: 1500 V AC, input to output: 3000 V AC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2“ W x 8.7“ H x 7.1“ D)
Weight	DC 10.8-15.5 V: Approx. 0.43Kg (0.95 Lb), all others approx. 1Kg (2.2 Lb)

8/16 ANALOG INPUT MODULE SPECIFICATIONS

Total Number of Inputs	8 AI, ±20 mA 16 AI, ±20 mA 8 AI, ±5 V 16 AI, ±5 V
Input Configuration	Isolated (floating) analog inputs
A to D Resolution	16 Bit (including sign)
Input Accuracy	±0.1% of full scale
Input Sampling Time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
Smoothing	Selectable input averaging: 2, 4, 8, 16, 320, 64 or 128 samples
Permitted Potential Between Inputs	75 V DC, 60 V AC (RMS)
Input Impedance	±20 mA input: Rin < 250 Ω ±5 V input: Rin > 1 MΩ
Crosstalk Rejection	Better than 80 dB between any pair of inputs
Temperature Stability	25 PPM/ºC
Interference Suppression	Selectable 50 or 60 Hz filtering, Common mode rejection > 80 dB, Differential mode rejection > 50 dB
24 V DC Output	Supports optional isolated 24V /0.35 A plug-in Power Supply (one in 16 DI, two in 32 DI)
Diagnostics LEDs	Overflow and Underflow LED per each input, module error LED The module Overflow and Underflow levels can be configured to: Current inputs: ±20mA/4-20 mA Voltage inputs: ±5 V/0-5 V/1-5 V
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Input Isolation	1.5 kV between input and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC, per IEC255-5
Power Consumption	8 AI: 0.1 W Typical, 0.5 W Max. (all LEDs on) 16 AI: 0.1 W Typical, 0.3 W Max. (all LEDs on) (Not including Plug-in 24 V Power Supply)
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5“ W x 8.7“ H x 7.1“ D)
Weight	8 AI: approx. 0.32 Kg (0.71 Lb), 16 AI: approx. 0.34 Kg (0.75 Lb)

MIXED I/O 16DI + 4 DO + 4AI MODULE SPECIFICATIONS

Total Number of Inputs/Outputs	16 Digital Inputs + 4 EE Relay Outputs + 4 Analog Inputs, ±20 mA 16 Digital Inputs + 4 ML Relay Outputs + 4 Analog Inputs, ±20 mA
I/O Arrangement	1 group of 16 DIs- shared common, 4 relay outputs-Form C, 4 isolated analog inputs
DI Counter Inputs	All inputs can be configured as fast counters
DI Frequency	0 - 1 KHz
DI Fast Counter Frequency	0 - 5 KHz
DI Max. DC Voltage	Max. 40 V DC
DI “ON” DC Voltage Range	+11 to +30 V DC
DI “OFF” DC Voltage Range	-5 to +5 V DC
DI Current	6-10 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
DI Filtering	0 to 255 mSec (DC, programmable in 1 mSec steps)
DI Counter Filtering	0 to 6.375 msec (programmable in 0.025 mSec steps for high speed counter inputs)
DO Contact Voltage Ratings	Max. 60 V DC or 30 V AC RMS (42.4 V peak).
DO Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
DO Relay Back Indication	Contact position - hardware back indication
DO Fail State	Configurable relay state on CPU fail: On, Off or ‘last value’
AI Resolution	16 Bit (including sign)
AI Accuracy	±0.1% @ -40ºC to +70ºC
AI Sampling time	10 mSec @ 50 Hz filtering, 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 2,0,8, 16, 30, 60 or 128 samples
AI max. potential between AIs	75 V DC, 60 V AC (RMS)
AI Impedance	Rin < 250 Ω
AI Crosstalk Rejection	Better than 80 dB between any pair of inputs
AI Temperature Stability	25 PPM/ºC
AI Interference Suppression	Selectable 50 or 60 Hz filtering, common mode rejection > 80 dB, differential mode rejection > 50 dB
Diagnostics LEDs	LED per each input/output status, module error LED
24 V DC Output	Supports one isolated 24V/0.35 A plug-in ”Wetting” Power Supply
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Input / Output Isolation	DI: 2.5 kV DC/AC between input and module logic per IEC255-5
	DO: Between open contacts: 1kV, between contact and coil: 1.5 kV, between contact sets: 1.5 kV
	AI: 1.5 kV between input and module logic
Input Insulation	Insulation resistance 100 MΩ @ 500 V DC per IEC255-5
Operating Voltage	10.5-15.5 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	0.1 W Typical, EE: 1.3 W max. (all relays & LEDs on), ML: 0.8 W max. (all LEDs on)
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5“ W x 8.7“ H x 7.1“ D)

4 ANALOG OUTPUT MODULE

Total Number of Outputs	4
Output Configuration	Isolated floating channels: each channel can be connected as 0 -20 mA or 0-10 V DC voltage
D to A Resolution	14 Bit
Output Accuracy	±0.1% of full scale @25°C
Temperature Stability	30 PPM/°C
Internal Settling Time	Max. 1 ms
Output Load	> 1.0 kΩ, < 1.0 µf, Current: < 750 Ω (with internal power source)
Crosstalk Rejection	Better than 50 dB between any pair of inputs
Interference Suppression	Common Mode Rejection: > 60 dB
Voltage output protection	Short-circuits protection, max. 30 mA (all other operating channels remain fully functional)
Current output no-load voltage	Max. 22 V DC
Isolation	1.5 kV between output and module logic
Insulation	Insulation resistance 100 M Ω @ 500 VDC, per IEC255-5
Diagnostics LEDs	Module Error LED. Voltage mode LED, Current mode LED, Calibration LED per channel
User Connection	2 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Operating voltage	10.8 -16 V DC and 3.3 V DC (from the motherboard connector)
Dimensions	7 mm W x 225 mm H x 180 mm D (1.5“ W x 8.7“ H x 7.1“ D)
Weight	8 AI: 0.29 Kg (0.64 Lb)

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