

**SECTION 269999 – SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS
VERSION 1.2**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. MOSCAD Remote Terminal Unit (RTU) equipment.
- B. DEMARC equipment.
- C. Input/Output Sensors.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. This Section includes equipment for monitoring and controlling remote systems and components, including generators, lift stations and pumping stations.

1.4 RELATED SECTIONS

- A. Section 263600-Transfer Switches
- B. Section 263213-Engine Generators

1.5 SYSTEM DESCRIPTION

- A. Supervisory Control and Data Acquisition (SCADA) Contractor shall provide:
 - 1. A fully assembled and operational MOSCAD RTU and Demarc control Panel.
 - 2. All wiring, conduit, panels, for all SCADA controls and data acquisition.
 - 3. All final electrical connections.
 - 4. Contractor shall be responsible for all electrical work associated with the SCADA system and as called for on the Drawings.
 - a. Perform all wiring in accordance with all local and national codes.
 - b. Install all line voltage wiring, concealed or exposed, in accordance with Division 16.
 - c. Contractor shall provide 120 volt, 20 amp circuits and circuit breakers from normal and/or emergency power panel for SCADA systems.
 - d. All low voltage electrical control wiring throughout the building shall be installed in accordance with Division 16.
- B. General Product Description:
 - 1. The supervisory control and data acquisition system (SCADA) shall provide control and data acquisition to remote equipment sites. The functions including equipment supervision and control, alarm management, energy management, and data collection. The Supervisory Control and Data Acquisition system shall be fully compatible and shall

- be fully integrated with the existing Wake County owned 800 MHz system presently owned and operated by Wake County. MOSCAD-L or MOSCAD-M are not acceptable.
2. The supervisory control and data acquisition system shall consist of the following: Motorola MOSCAD RTU, DEMARC Panel and all required accessories.

1.6 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections. A minimum of 7 complete sets of documents are required. Submit 3 copies of all submittals to owner at time of submittal to architect.
- B. Manufacturer's Product Data for each and all types of products specified. Include manufacturer's technical Product Data for each device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, installation instructions, and startup instructions.
- C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection
- D. Certificate for Motorola Certified MOSCAD Solution Provider and certificate for Wonderware Certified System Integrator from preferred vendor (prime or subcontractor).

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provision of Division 1.
- B. Accurately record actual location of components, including but not limited to, panels and sensors.
- C. Revise shop drawings to reflect actual installation.
- D. Provide hard copy and electronic files

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance instructions and spare parts list for each type of device.
- C. Interconnection wiring diagrams with identified and numbered system components and devices.
- D. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- E. Calibration records and list of set points.

1.9 QUALIFICATIONS & QUALITY ASSURANCE

- A. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of SCADA systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. Install system using competent workmen who are fully trained in the installation of SCADA equipment.

- C. Motorola MOSCAD equipment and related programming will be executed by a firm which is both a Motorola Certified MOSCAD Solution Provider and Wonderware Certified System Integrator.
 - D. Contractor **MUST** obtain a translation file from Wireless Communications that will allow the new SCADA system to communicate with the County's existing head-in equipment.
- 1.10 INPUT/OUTPUT SUMMARY
- A. Refer to Sheet E603 for list of points.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motorola.
- B. No others will be accepted. In addition, in order to provide a complete and working system the component manufacturers listed in this specification **MUST** be provided with no substitutions.

2.2 MOSCAD RTU

A. General:

- 1. The remote terminal unit (RTU) shall be an intelligent, modular unit capable of both data acquisition and local data processing. It shall monitor and control local equipment in a stand alone mode as well as being an intelligent node in a distributed processing system. It shall be microprocessor based and allow reconfiguration and optimization to occur via software only. To facilitate installation, maintenance and future expansion, all Input/Output (I/O) modules shall connect to the basic processor module via a passive motherboard on the RTU rack. A PC-compatible computer running a single, comprehensive standard application development and diagnostic software package shall be used for program development and downloading (directly to the RTU).

Each RTU must be supplied with the number and type of I/O points as indicated elsewhere in the plans and specifications. Future expansion shall be possible by simply plugging in additional I/O modules to the I/O bus. Each RTU shall be supplied with the following minimum configuration:

- a. Mother Board
- b. Power Supply
- c. I/O Bus
- d. Battery
- e. Enclosure
- f. I/O Modules as required
- g. CPU Processor Module
- h. Communications Interface

B. Communications:

- 1. General: The RTU shall support the establishment of a sophisticated data communication network for SCADA applications utilizing 800 MHz radio links, smart zone compatible and flash port upgradeable. Radio links shall include conventional trunked radio.

2. Data Protocol: Data communications shall utilize a secure, smart protocol designed in accordance with the Open System Interconnection (OSI) model as defined by the International Organization for Standardization (ISO). The protocol should allow flexible, efficient communications for transmission of data, complete programs, databases or other parameters. Complete configuration and diagnostic programs shall be transferable from/to the Central site (full data upload/download capability). Complete RTU/system debugging shall be allowed without visiting each remote site. The protocol shall support a complex hierarchical system structures of multiple host computers and sub-master stations. Its detail structure, however shall be transparent to the system user and allow him to concentrate upon the application.

C. Communications Methods:

1. In addition to the simplistic master/slave polling configuration, the RTU shall operate in a number of more efficient contention formats required by point to multipoint networks. The RTU must support quiescent operation and initiate data transmissions under the following conditions:
 - a. Report by Exception - Automatically transmit upon defined exception condition(s); analog, digital or any combination.
 - b. Timed Transmission -Automatically transmit data on programmed time interval.

D. Special Communication Requirements:

1. In addition to the communication methods above, the RTU must also support the following special modes:
 - a. Trunked Radio Interface: Each RTU shall be able to use a trunked radio communication system.

E. Radio Communication Channels:

1. The RTU shall operate on 800 MHz trunking. Each RTU shall monitor the communication channel(s) to prevent transmission during a busy period. Channel priority assignments shall be available (both network and individually) to handle avalanche conditions. The RTUs are fixed equipment that transmit digital information over radio frequencies.

F. Hardware Modules:

1. Basic Processor Module: The basic processor module (CPU) of the RTU shall be a real time process controller and support:
 - a. Bus communication with I/O modules
 - b. System memory allocation
 - c. System parameter/logic programming
 - d. Communication port control
2. The Central Processing Unit (CPU) shall be a high speed (16MHz clock rate), 32 bit CMOS microprocessor, Motorola 68302 or equivalent. This VLSI design must incorporate a separate co-processor (embedded RISC Chip) to handle all external communication tasks so as to not affect base CPU performance.

3. The CPU shall be equipped with a minimum of 704 kbyte on-board memory of different types.

EPROM -	for system programs
RAM -	for data and parameters
FLASH(EEPROM) -	for application programs

Total RTU memory must be expandable to a minimum of 2.5 Mbyte. Provision must be available to add anumerical co-processor (Motorola 68882 or equivalent) with true double precision floating point capabilities along with additional memory and support for trigonometric and transcendental functions.

4. The CPU module must incorporate a real-time clock (RTC) with lithium battery backup for both RTC and module RAM. Large scale CMOS gate array technology must be used for minimum component count and maximum performance and reliability. CPU features include:
 - a. Watch-dog timer (WDT)
 - b. Symbolic debugging support
 - c. Diagnostic LED indication
 - d. Power monitor for clean program start/stop
5. The CPU module must include at least the three built-in communication ports as listed below:
 - a. Port 1 :RS-232 or RS-485, software controlled, full DCE/DTE operation to 9600 bps.
 - b. Port 2 :RS-232, full DCE/DTE, 9600bps, transient protected.
 - c. Port 3 :Configurable (Plug-In) communication module for radio, wireline, trunked radio, and dial-up wire line, 600-9600 bps, dependent upon media.
6. Support shall be available for additional serial channels, second radio, wireline or other external communications.

G. Input/Output Modules:

1. Support shall be available for additional serial channels, second radio, wireline or other
2. The RTU shall address variable I/O requirements by the addition of appropriate expansion modules. Each module shall communicate with the CPU module via a high speed (> 1 Mbps) data bus. Up to 44 modules shall be supported by a single CPU module; dual CPU configurations shall optionally be available. Each expansion module may be plugged into an empty slot on the I/O bus.
3. All modules, regardless of type (unless specifically noted), must share the following features:
 - a. Input Protection:dc/dc converter with 2.5kv optical isolation per IEEE SWC 472/587.
 - b. Output Protection: 1 kv between contacts, 1.5kv between contact and coil per IEEE SWC 472 CMOS Gate Array: all logic, bus and LED interface contained in one gate array on each module to minimize components and increase reliability
 - c. Diagnostics: Loopback test, system clock, WDT, 20 diagnostic LED indicators of status and module failure modes.

- d. Terminal Boards: Removable, Phoenix type up to 14 AWG (2.5 sq. mm) or DIN connector.
- 4. Module Identification: Check hardware I/O versus application specification.
- 5. Digital Input Module - Type 1.
 - a. Capacity: 16 dry contacts, all isolated inputs; 2 high speed counters (up to 10 KHz).
 - b. Counters: All base inputs may be defined as low speed counters, 50-500Hz.
 - c. Interrupt-Handling: Change of State (COS) reporting to 1 ms in interrupt mode.
 - d. Input filtering 1-32 ms, software controlled.
- 6. Digital Output Module
 - a. Capacity: 16 electrically-energized relay contacts
- 7. Analog Input Module
 - a. Capacity: 8 floating, isolated inputs.
 - b. Type: 4-20Ma.
 - c. Resolution: 13 bits including sign
 - d. Accuracy/Linearity: $\pm 0.05\%$ full scale/ ± 1 LSB.
 - e. Calibration: Automatic, software controlled (no potentiometer).
- 8. Analog Output Module
 - a. Capacity: 4 optically isolated outputs.
 - b. Type: 0-5 V or 4-20Ma performance dependent upon power supply.
 - c. Resolution: 12 bits including sign.
 - d. Accuracy: $\pm 0.1\%$ full scale.
- 9. Mixed Input/output Module
 - a. Capacity: 8 isolated dry contracts digital inputs, 4 electrically-energized relay contacts, 2 analog inputs
 - b. Type: 4-20Ma.
 - c. Resolution: 12 bits including sign
 - d. Accuracy/Linearity: $\pm 0.05\%$ full scale/ ± 1 LSB.
 - e. Calibration: Automatic, software controlled (no potentiometer).
- H. Construction:
 - 1. The RTU shall be totally modular in design and construction, allowing specific configuration merely by plugging in the appropriate CPU and I/O modules. All modules and their assembly shall be accomplished without screws or fasteners of any type. All connections shall utilize a "snap-in" action and a tool shall be supplied to aid easy connector removal. The RTU shall be available in several sizes to fit different application requirements including 3, 6, 8 and 16 module assemblies. Basic RTU models shall consist of a mounting plate and motherboard, a CPU module (occupies 1 slot) and a power supply/charger.
 - 2. All elements must use CMOS components and LSI circuitry. No jumpers, DIP switches, or adjustable potentiometers shall be allowed. Extensive use of SMD (surface mount device) is required.

3. Front access to all controls, indicators, lithium battery and external cables shall be provided. Motherboard connection to I/O modules shall be direct; no daisy chain or multiple ribbon cable connections allowed.
4. All I/O modules shall be equipped with a front cover door to serve as: module latch release, wiring identification label and terminal board protection. Space shall be available to direct and route external wires from outside the RTU that are connected to the I/O modules.

I. Enclosures:

1. The RTU shall be wall mounted NEMA 4X , stainless steel.

J. Environmental:

1. The RTU must operate over an ambient temperature range of -30 to+60 degrees C with relative humidity < 95% @ 50 degrees C. It must meet or exceed EIA standards RS-204B and RS-152B.
2. The RTU shall meet or exceed the SWC standards as defined in IEEE C37.90A for all inputs and outputs. In the appropriate enclosure, the RTU shall meet all qualifications for UL 611, paragraph 26.
3. The RTU shall operate from 115/230 VAC, \pm 15%, 50/60 Hz primary power. A battery and charging circuit shall be included to provide 4 hour standby operation (for defined RTU capacity and use). Larger capacity batteries shall be available to extend operating time.

K. Application Software & Related Programming:

1. Operating System: The software shall be based upon a multi-tasking executive system optimized for real-time environments, Motorola's Object Oriented MTE or equivalent.
2. Application Software: The RTU shall be programmed with a high level, multiple process ladder diagram language which includes Boolean and arithmetic functions as well as specialized function blocks such as proportional, integral, derivative (PID) control and American Gas Association (AGA) flow calculations. The ladder diagrams shall be used for process definitions as well as symbolic monitoring and debugging.
3. Motorola MOSCAD hardware must be programmed and configured with the appropriate RTU software application program by Motorola 'Certified MOSCAD Solution Provider' / Wonderware Certified System Integrator firm.
4. The MOSCAD engineer will program/download the application program to be executed in the RTU utilizing the Programming ToolBox. This includes but is not limited to downloading the site configuration, application program and network configuration

2.3 DEMARC PANEL

- A. Enclosure shall be AM Products, series JIC size junction box, Stainless steel.
- B. DIN Rail shall be Automation Direct, Rail # DN-R3551.
- C. Terminal blocks shall be Automation Direct # DN-T10, gray, DN-T10-BLK, black, DN-T10-GRN, green.
- D. Loop power supply shall be Automation Direct # PS24075D.

2.4 INPUT/OUTPUT SENSORS

- A. AC current transducer shall be an American Aerospace Controls, Inc., series 100 SX, 4 to 20 mA, 2 wire operation.
- B. Room temperature transmitter shall be Kele Model ST-T91E, 1000 OHM platinum room temperature transmitter.
- C. AC voltage transducer shall be an American Aerospace Controls, Inc., series VX, 4 to 20 mA loop powered.
- D. Monitoring system battery voltage system shall be Engineering Concepts Unlimited, Inc., Model ECU-VLD2-12 for 12 volt system or Model ECU-VLD2-24 for 24 volt system.
- E. Electronic engine speed sensor shall be Thomson Technology Model FSR 230.
- F. Single station level switch shall be Gems sensor.
- G. Relay shall be cube electro-mechanical type with LED. The relay shall be rated for ampere and voltage as required for the application.
- H. Relay sockets shall be compatible with cube relay.

2.5 ANTENNA

- A. Antenna shall be Celwave Model PD10108-1, frequency 806-896 Mgz.
- B. The coax between the antenna and the RTU shall be in accordance with manufacturer's recommendations.

2.6 RACEWAY

- A. EMT: Electrical metallic tubing; ANSI C80.3, zinc-coated steel, with compression fittings.
- B. FMC: Flexible metal conduit; zinc-coated steel.
- C. LTMC: Liquid-tight flexible metal conduit; zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket

2.7 WIRES, CABLES, AND CONNECTIONS

- A. Conductor, minimum No. 14, Solid or stranded copper.
- B. Insulation: Thermoplastic, rated 600 V, 75 deg C minimum, Type THHN.
- C. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field end devices and wiring are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install equipment as indicated to comply with manufacturer's written instructions.
- B. Verify location of sensor and panels with plans before installation.
- C. Install labels and nameplates to identify components.
- D. Install electrical work in accordance with Division 16. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.
- E. Coordinate the direction of the antenna with Wake County General Services Administration's Representative.
- F. Coax must be supported in accordance with the manufacturer's recommendations.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 1.
- B. Start-up systems. Allow sufficient time for start-up prior to placing systems in permanent operation.

3.4 COMMISSIONING

- A. Test and adjust safeties and communications.
- B. Replace damaged or malfunctioning components and equipment.
- C. Start, test, and adjust systems.
- D. Demonstrate compliance with requirements.

3.5 DEMONSTRATION

- A. Demonstrate a complete and fully operational system to Owner.

END OF SECTION 269999