

SECTION 13xxx

TELEMETRY CONTROL AND MONITORING SYSTEM

(IntraLink LC2000, OI3000, WS2000 Suggested Bid Specification)

PART 1 - GENERAL

1.01 INTENT OF SPECIFICATION

- A. The contractor shall furnish; install and place into operation a comprehensive and fully integrated Telemetry System for the control and monitoring of the Owners facilities as described herein. All equipment is to be completely factory assembled, wired and tested prior to shipment.
- B. The facilities control and monitoring system is described hereafter as the “Telemetry System” - as manufactured by Siemens Water Technologies, Control Systems. The naming of a manufacturer in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired. The Contractors bid shall be based on the use of Control Systems equipment.
- C. The local Control Systems authorized representative is *insert Rep. Name* located in *insert Rep. location*, Telephone: *insert number*.
- D. It is important for all bidding contractors to note that if alternate proposals based on substituted, microprocessor based control and telemetry systems are to bid, they must be pre-qualified. The Consulting Engineer must receive pre-qualification statement submittals seven- (7) days in advance of the bid date in accordance with the hereinafter-specified “Pre-submittal Approval Information Required” section.
- E. In the event a pre-qualified Telemetry System is installed by the Contractor and does not meet the specified intent of this specification with regard to reliability, efficiency, functional capability, or other system parameters; the Consultant may reject the alternate system. The system then must be replaced with the Control System equipment originally specified at no cost to the Owner or Consultant Engineer. The Owner or the Consultant Engineer may exercise this option at any time during the project tenure. Project tenure is defined, as beginning the date the project bids and ending on the date the system has operated satisfactorily for one year after final acceptance.

1.02 RESPONSIBILITY FOR COMPLETE SYSTEM

- A. The Contractor shall be responsible for and shall provide for the design, supply, delivery, installation, calibration and adjustment, software configuration, testing and startup, owner training, warranty and routine future field services support, of a complete coordinated Telemetry System, which shall perform the specified functions.

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- B. The Owner and the Engineer will review Telemetry System technical information as submitted by the Contractor for software; operating system, database, control strategies and the graphical user interface(s), i.e. report and log formats, graphics, trends, alarming, etc. for complete compliance with these specifications.
- C. The Contractor shall provide the Owner with all services and hardware to ensure that proper communications are established with off-site remote locations, which are to be monitored and controlled.
- D. All Telemetry System control, monitoring, data transmission equipment hardware and software furnished shall be standard catalogued products of the System Manufacturing Supplier to assure one source responsibility, proper system interconnections and reliable, long term operation.
- E. Non-manufacturers or companies who only integrate components manufactured by others are not acceptable Telemetry System suppliers. The supplier shall provide all control and telemetry equipment and employ full-time manufacturing, engineering personnel as well as service and support personnel necessary to provide and support the complete system.

1.03 OPEN COMMUNICATIONS PROTOCOL REQUIREMENT

- A. The Telemetry System manufacturer shall include, with the completed system, the required drawings and documentation relating to the communication, signaling (hardware and software) and protocols used within the Telemetry System. This relates in particular to the communication employed between the Master Telemetry Unit (MTU) and as required current and future Slave Remote Telemetry Unit (RTU) locations.
- B. The intention of this requirement is to allow the Owner, if he desires to purchase additional RTUs in the future from other suppliers with communication signaling and protocol to match the characteristics of this system. The described documentation is to be provided together with any necessary licensing, with any and all costs of it included in the bid amount for this contract. The Telemetry System protocol(s) shall support the Control Systems “Open” native protocol and the standard Modbus RTU, Modbus ASCII or Modbus TCP and TCP/IP protocols.
- C. The Telemetry System software provided under this contract shall be furnished with user-activate-able expansion for adding a quantity of not less than 100% additional RTUs with functions similar to those included in the contract/project at this time. The licensing referenced is limited to use with RTUs to be added to this system and extends to manufacturers or other vendors furnishing RTUs and related equipment only for this system. Such licensing shall be in effect for not less than 10 years.

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- D. In furnishing a bid/proposal in response to this specification the bidder acknowledges and accepts the described communication protocol documentation and licensing requirements as a condition of the award of this contract. Any bid taking exception to this requirement will be considered non-responsive to the specifications, job requirements and the invitation to bid.

1.04 DRAWINGS

- A. **SHOP DRAWING SUBMITTAL:** Shop Drawings shall be submitted for approval for all equipment herein specified. All project drawings shall be generated using AutoCAD, latest revision. The Shop Drawing Submittal shall include a Document List (index). An Order Specification shall be included which shall describe in detail all equipment provided. Each RTU panel shall be provided with a job-specific wiring diagram, parts list (with all parts keyed to the wiring diagrams), enclosure door layout and enclosure dimension drawing. Manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. Standard sales brochures shall only be provided to supplement technical data. Interconnection details shall be shown on the wiring diagrams for all field-mounted instrumentation. A Description of Operation shall be provided detailing the operation of the complete system, including the various control loops, systems power equipment and alarm handling.
- B. **AS BUILT DRAWINGS AND INSTRUCTION MANUALS:** As-built Drawings and Instruction Manuals must be provided in a timely manner. These manuals shall include corrected Shop Drawings. In addition, a detailed Programming and Operations Manual for the Microprocessor-based Controller/Transceiver and Control and Operator Interface monitoring software package shall be included. The manual shall include all "as programmed" setpoints for level alarms, pump control and other parameters.
- C. **OPERATION AND MAINTENANCE (O&M) MANUALS** shall be provided in accordance with "Final Documentation" requirements outlined in Part 3 of these contract documents.
- D. O&M manuals in final form shall be available within five- (5) working days following the completion of Field (Final) Witness Test and prior to Owner Final Acceptance.

1.05 PRESUBMITTAL APPROVAL INFORMATION REQUIRED

- A. Full description and performance data on all substitute items proposed with references for verification of performance for such equipment already in service. A minimum of ten (10) references of similar size and type telemetry control and monitoring specified here in shall be furnished. Each reference will include a contact name and telephone number and a statement of size and type of referenced telemetry system installed.

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- B. Detailed description of how the proposed substitute Telemetry System differs from that specified, including but not limited to materials of construction, fabrication, operation, warranty, service, corrosion protection, power consumption and maintenance requirements.
- C. Detailed discussion of why the proposed substitute Telemetry System is equal or superior to that specified herein.
- D. Three- (3) copies of revised prints reflecting in detail any and all Contract Document changes in arrangements for materials, equipment, piping, fabrication, erection, maintenance, power supply, etc.
- E. The intent of the specification is that a standard Telemetry System be provided, with standard documentation. A custom or customized written system description of operation is not acceptable.
- F. Furnish the name and telephone number(s) of the substitute suppliers' individual to contact to answer questions or supply additional information. No alternate or substitute Telemetry System suppliers are exempt from pre-submittal approval requirements.
- G. Failure to name approved manufacturers of equipment in the pre-submittal proposal will constitute grounds for declaring the bid irregular, or if the Owner chooses, give the prerogative of equipment selection solely to the Owner. If more than one manufacturer is named for any given piece of equipment will declare that the Bidder has no preference and will give the prerogative of equipment selection solely to the Owner.
- H. Provide a Configuration and Operations Manual for the proposed microprocessor-based controller telemetry unit. The manual shall include the following information as a minimum:
 - 1. How to view and change between the various displays
 - 2. Alarm displays and a list of alarms handled
 - 3. Alarm handling (ISA sequence used, etc.)
 - 4. Status OIT displays and a list of statuses handled
 - 5. Status OIT Alarm handling
 - 6. OIT Analog control setpoint adjustment and displays
 - 7. OIT Analog alarm setpoint adjustment and displays
 - 8. Historical data handling
 - 9. An example of programming values
 - 10. Use of the real-time calendar/clock, including changing time and date

- I. The right is reserved to reject any and all pre-submittal proposals, to waive any informality, irregularity, mistake, error or omission in any pre-submittal proposals received and to accept the pre-submittal proposal, as determined by the Engineer or Owner, deemed most favorable to the Owner.

PART 2 – PRODUCTS

2.01 SCOPE OVERVIEW:

- A. The Telemetry System shall consist of the required telemetry components and equipment in accordance with the following specifications:
 - GENERAL TELEMETRY UNIT REQUIREMENTS - Article 2.02
 - LOGIC CONTROLLER TELEMETRY SYSTEM – Article 2.03
 - OPERATOR INTERFACE TERMINAL (OIT) UNIT – Article 2.04
 - TELEMETRY COMMUNICATION SYSTEM (OPTIONS) – Article 2.05
 - REMOTE ACCESS DIAL-IN ETHERNET MODEM – Article 2.06
 - LAPTOP COMPUTER HARDWARE (WEB ENABLED HMI) Article 2.07
 - WEB ENABLED HUMAN MACHINE INTERFACE (HMI) - Article 2.08
- B. The Telemetry System shall allow for the addition of future Repeater RTU’s and Slave RTU’s. Refer to the Contract Plan Drawings for the Telemetry System Block Diagram outlining the required telemetry units.

2.02 GENERAL TELEMETRY UNIT REQUIREMENTS

- A. WIRING: All wiring shall have not less than 600-volt insulation and all power wiring and bus shall be in complete conformity with the National Electric Code and state and local and NEMA Electrical Standards. Control wiring shall be color-coded. All job connections required to conveniently replacing control components shall be made at approved type terminal blocks with engraved Bakelite marker strips or similar approved means.
- B. NAMEPLATES - All major components and sub-assemblies shall be identified as to function with laminated, engraved Bakelite nameplates, or similar approved means.
- C. UL LABEL REQUIREMENT (OPTIONS)

OPTION A: SERIALIZED UL LABEL REQUIREMENT (508A) - telemetry unit panels provided under this section shall be constructed in compliance with Underwriter's Laboratories Inc. category 508A standards - Enclosed Industrial Control Panels listing and following-up. The control panel(s) shall bear the Underwriter's Laboratories serialized label for “Enclosed Industrial Control Panel”.

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1. While the use of U.L. listed components is encouraged, their use alone will not be considered an acceptable or satisfactory alternate to the “Enclosed Industrial Control Panel” serialized label specified above.
2. Upon request from the Engineer, the panel manufacturer shall supply documentation to the owner proving they are a U.L. recognized manufacturing facility for the type of equipment required.
3. Only the labeled products of U.L.508A/“Enclosed Industrial Control Panel” recognized panel manufacturer would be considered acceptable for use on this project.

NOTE: The following specification is to be used for applications requiring intrinsic safety barriers to render sensors located in hazardous sewage wet well environments (N.E.C. Class I, Groups C & D).

OPTION B: SERIALIZED UL LABEL REQUIREMENT (698A/913) - Panels provided under this section shall be constructed in compliance with Underwriter's Laboratories Categories 698A and 913 standards – “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” listing and following-up service. The control panel(s) shall bear the Underwriter's Laboratories serialized label for “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions”.

1. While the use of U.L. listed components is encouraged, their use alone and/or the alternate use of a U.L. 508A – “Enclosed Industrial Control Panel” serialized label will not be considered an acceptable or satisfactory alternate to the “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” serialized label specified above.
 2. Upon request from the Engineer, the panel manufacturer shall supply documentation to the owner proving they are a U.L. recognized manufacturing facility for the type of equipment required.
 3. Only the labeled products of U.L.698A and 913 “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” recognized panel manufacturer shall be considered acceptable for use on this project.
- D. **INCOMING SERVICE:** The incoming service for the telemetry unit panel shall be (480 volt, 3 phase, 3 wire) (240 volt, 3 phase, 3 wire) (120 volts, 1 phase, 2 wire) 60 Hertz. All metering shall be done ahead of the main disconnect and telemetry unit panel. The Owner in accordance with local power company requirements shall install the meter. A lightning arrestor shall be supplied in the panel and shall be connected to each line of the incoming side of the power input terminals. The arrestor shall protect the control against damage as the result of transient voltage surges caused by lightning interference, switching loads and power line interferences.

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- E. **CONDENSATION PROTECTIVE HEATER:** A 100-watt, 120 VAC condensation protective heater(s) and high temperature cutout thermostwitch shall be supplied in the telemetry unit panel. The heater's surface area for heat dissipation shall be large enough to prevent a skin burn (if an Operator's hand should inadvertently come in contact with the unit when energized).
- F. **CONVENIENCE RECEPTACLE:** A GFI convenience receptacle shall be furnished and mounted on the inner door of the telemetry unit panel. The control power transformer inside the telemetry unit panel shall provide at least 1500 watts of power for the receptacle in addition to the power required for the control logic and heater.
- G. **BATTERY BACKUP SYSTEM:** Included with each telemetry unit panel, and working in conjunction with the unit's DC power supply, shall be an intelligent battery back up system including voltage converter, battery health logic module, charger and sufficiently sized battery.
1. Battery system shall provide a seamless switchover to battery upon detection of main DC power supply failure. Once main DC power is restored, the unit shall provide seamless switchback to normal DC power source and recharge the battery.
 2. An on board LED, or local Operator Interface (OI) if provided shall locally indicate detection of an alarm condition.
 3. Battery system shall be of sufficient capacity to provide a minimum of seven (7) hours of backup in the event of a failure of the main power source. To avoid battery damage and erroneous data transmissions when operating on battery, should the battery voltage drop below 10.8 V, the Microprocessor Logic Controller shall be inhibited from operation. Recovery shall be automatic upon restoration of normal power.
 4. The intelligent battery back up system shall be able to source 5 Amps allowing operation of mission critical components including: sensors, local alarm and communication equipment during a power failure condition.
- H. **ENCLOSURES:** All enclosures shall be NEMA Type 12 or 4, stainless steel or painted steel enclosures (as required) complete with the required removable white enameled inner panel and drip edge.
1. Enclosures shall include a single, gasketed front door, full height hinges, locking hasp and 3-point door clamping hardware.
 2. All enclosures shall be wall mounted, properly sized for the application and UL listed. All enclosures shall include the correctly sized corrosion inhibitor device required to protect the interior panel components

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- I. **SELECTOR SWITCHES, PUSH BUTTONS & LIGHTS (OPTIONAL)**: Furnished this functionality in accordance with the individual telemetry unit requirements.
1. An Operator's door mounted, 1-3/16" diameter, "hand-off-auto" 3-position, rotary, oil-tight, heavy-duty type selector switch shall be furnished for each required device. Each switch shall have an extra contact for input to the microprocessor logic controller.
 2. An Operator's door mounted, 1-3/16" diameter, oil-tight, push button shall be furnished for each of Control Panel component test functions.
 3. An Operator's door mounted, 1" diameter, oil tight pilot light with bulb shall be provided for each of the status and alarm condition requirements.
- J. **PUMP RUNNING TIME METERS (OPTIONAL)**: An Operator's door mounted, 120 VAC powered running time meter measuring hours and tenths of hours of operation up to 99999.9 hours shall be furnished for each pump motor indicated.
- K. **PUMP OVERTEMPERATURE PROTECTION (OPTIONAL)**: Over-temperature protection shall be provided in the telemetry unit panel to operate in conjunction with the over-temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a yellow failure indicating light and reset pushbutton on the inner panel for each pump for alarm indication and manual reset capability.
- L. **PUMP SEAL FAILURE ALARM (OPTIONAL)**: A seal leak relay shall be furnished for each pump to sense a seal leakage condition. The control manufacture shall coordinate the relay furnished with the pump manufacture to insure compatibility. A door mounted pilot light and seal leakage sensor shall be provided to indicate a pump seal failure alarm condition of each sewage pump.
- M. **INTRINSICALLY SAFE BARRIER (OPTIONAL)**: The pump level control/abnormal level alarm module shall connect to the float level sensors through a UL Listed intrinsic safety barrier.
1. The module shall provide an intrinsically safe interface for up to six sensors located in a hazardous area rated Class 1, Group A, B, C and D, and Class 2 Groups E, F, and G.
 2. The module shall contain an LED indicator for each of the six sensors providing visible indication of sensor actuation as well as an LED to indicate barrier "Power On" status.
- N. **LOCAL ALARM SYSTEM (OPTIONAL)**: An audible alarm horn weatherproof alarm silence pushbutton (mounted on the side of the enclosure) shall be provided. The alarm horn shall be weatherproof, operating on 12 VDC producing 87 dB (minimum) at 10 ft. The horn shall be surface mounted with weatherproof enclosure on the side of the telemetry unit control cabinet.

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1. The alarm light shall be a weatherproof strobe operating on 12 VDC, producing a 500,000 candlepower flash through a high-impact red lexan lens operating at 60 to 90 flashes per minute.
 2. The light shall be surface mounted on the top of the telemetry unit control cabinet, through a cut-out in the sun shield and be very noticeable both night and day.
 3. The horn and strobe light shall be energized on a high-level alarm condition.
- O. **GENERATOR RECEPTACLE (OPTIONAL):** A generator receptacle with angled backbox shall be provided and mounted on the side of the enclosure by the panel manufacture. The Generator receptacle shall be of the metallic NEC style configured to UL 1686 specifications.
1. Receptacle must be suitable for NEMA 4X environments. Caps shall be of “Breech-Lock” design capable of being used as a flip lid or screw cover. Cable clamps must be of contoured smooth 2-screw design.
 2. Wire terminals must be of the increased safety design. The receptacle shall be rated at 100 or 200 amperes, 600 VAC/250VDC, 50-400 Hertz.

2.03 LOGIC CONTROLLER TELEMETRY UNIT SYSTEM

- A. All Owner facilities Telemetry System control signals, status signals, alarm and process variable data shall be transmitted and received between the Master Telemetry Unit (MTU) and the Remote Telemetry Unit (RTU) locations via a standard communication sub-system specified elsewhere.
- B. The main MTU site and each remote RTU locations shown on the plan drawings and as described herein shall be of the microprocessor logic controller type with adequate memory and instruction sets required to make the telemetry unit perform all of the functions required by this specification.
1. Systems using a personal computer (PC) or Laptop computer for Telemetry System communications shall not be acceptable.
 2. The system shall convert commands, alarms and variable analog data to digital blocks and transmit this information between the MTU and the multiple RTU locations.
 3. The MTU and RTU microprocessor logic controllers shall be capable of stand-alone control and monitoring functionality when the communications sub-system is not operational for any reason.
- C. Logic controller telemetry units shall be furnished completely configured and tested providing the specified communication, monitoring, display, input/output, annunciation, computations and other requirements for operation of the Telemetry System.

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1. Each logic controller telemetry unit shall be a modular hardware form factor style consisting of a CPU with adequate memory and instructions, power supply, on-board and remote input/output signal conditioning, communications ports, and all other components required to make the telemetry unit perform all of the functions required in this specification.
- D. The logic controller telemetry system shall be modular and scalable to be efficiently applied at each of the specified sites within the system. The logic controller telemetry unit shall be based on a robust, field proven, current technology hardware platform allowing utilization of the latest advances in technology and permitting the most open programming and communication architectures.
- E. The logic controller telemetry unit shall support a true system open architecture allowing the use of specialized water and wastewater process hardware and software and also support full integration of other third party generic hardware/software devices. The architecture shall meet the requirements as herein defined and allow economical expansion of function and features based on new and evolving technologies. Systems using non-scalable and/or closed proprietary architectures shall not be acceptable.
- F. The logic controller telemetry unit shall include a real time of day time clock w/battery back up for time stamping of data log records and scheduling of periodic time of day based events. Clock shall not require reset after a site power failure has occurred.
- G. The logic controller telemetry unit shall store system parameters including, logic configuration, setpoints, time delays, alarm and event data, counters and totalizers, etc. in field programmable (FLASH) non-volatile memory.
1. Sufficient non-volatile memory must be provided to protect the required system wide variables. This data shall be unaffected by power interruptions through the use of the battery backup system previously specified.
 2. The logic controller telemetry unit shall have enough processing power and working Dynamic Random Access Memory (DRAM) to enable high level programs such as Internet Web servers to operate efficiently without affecting other simultaneous multitasking operations.
- H. The logic controller telemetry unit shall be furnished with a minimum of four- (4) communication ports with true multitasking and allow simultaneous support of all ports. Communication can be configured for RS485 Input/Output Ethernet module expansion, Operator Interface Terminal (OIT) display support, LAN/WAN, etc.

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- I. The logic controller telemetry unit shall meet the following design capabilities as a minimum:
 1. CPU - True 32 Bit running at 50 MHz.
 2. 16 MB – 32 bit Dynamic RAM w/ 16 MB FLASH
 3. 512 K bytes Non-volatile RAM (battery backed)
 4. Real time clock accurate to ± 15 seconds per month
 5. One- (1) Ethernet 10/100 BaseT port (RJ45)
 6. One- (1) RS-232 Serial Communications (115 KB PS) (RJ45)
 7. One- (1) RS485 Serial Multi-Drop Communications
 8. One- (1) RS232 Operator Interface Terminal Display Communications Port
 9. On-Board Input/Output support of twelve- (12) discrete inputs (DI), eight- (8) discrete outputs (DO) and six- (6) analog inputs (AI)
- J. The logic controller telemetry unit shall not require any specialized tools for removal of the unit and must be capable of removal and replacement while still under system power. System components including RTU, power supplies, etc. shall be DIN rail mounted. Terminations shall be via plug in connectors facilitating quick field replacement.
- K. Logic controller telemetry units on-board I/O and associated local/remote I/O modules shall meet national and international safety standards including UL, CSA, CE, DNV and Zone 2 Rated. In addition to the safety standards RTU system components shall also meet IEEE-472 (ANSI C37.90) surge withstand and IEC68-2-6 Vibration standards.
- L. The logic controller telemetry unit shall operate from a 10-30 VDC power source. A battery and charger as specified elsewhere shall be supplied to power the master and remote telemetry units during 120-Volt service power outage conditions.
- M. The logic controller telemetry unit and associated components shall have an operational temperature range of -40C to 70C (-40F to 158F) under relative humidity conditions of 5 to 95% non-condensing. Storage temperature range up to 85C (185F)
- N. The logic controller telemetry unit shall have a high performance open source software architecture that utilizes a true multitasking operating system running a combination of standard and specially designed for Water and Wastewater application software configurable modules.
 1. The system provided shall utilize an integrated system approach providing a comprehensive common configuration tool for all components within the system including I/O, Processor, Communications, and Operator Interface (OIT) display.
 2. The architecture shall permit all system components to be configured, simulated, tested and downloaded from one terminal to all system components.
 3. The operating system shall be multitasking and allow a minimum of two separate programs to run simultaneously without affecting each other.

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- O. To provide for and insure multiple source support, the logic controller telemetry unit system shall utilize industry standard programming language certified by the PLC Open Committee for all five languages supported by the IEC 61131-3 standard including; Sequential Function Chart, Ladder Diagram, Structured Text, Instruction List and Function Block Diagram. All five languages must be included. Any one or a combination of the aforementioned programming languages can be used to implement the system strategy. The programming software must be Windows™ based and be able to operate on Microsoft operating systems.
- P. Logic controller telemetry units provided under this specification shall be capable of performing the necessary logic to control the Owners local and remote facilities as defined in the contract documents. These inherent capabilities shall include, but not be limited to the following:
- | | |
|---------------------------------|-----------------------------------|
| 1. Discrete input/output | 10. Latch/unlatch relays |
| 2. Analog input | 11. Counters |
| 3. Analog output | 12. Comparators |
| 4. Timers | 13. Ladder logic |
| 5. Pump Controller | 14. Flow Totalization/Integration |
| 6. Pump Alternation | 15. Intrusion Detection |
| 7. Mathematical Function Blocks | 16. Time of Day Control w/Lockout |
| 8. Stage Blocks | 17. Ramp Blocks |
| 9. Trending | 18. Data Logging |
- Q. Logic controller telemetry units shall be capable of performing diagnostic functions. The CPU shall continuously monitor the functionality of the system and record errors and specific system events. A diagnostic buffer shall retain fault and interrupt events.
- R. Each logic controller telemetry unit shall have memory protected built in historical archiving/data logging of system alarms & events and process variables.
1. Data logger shall be able to log data base point on time or an event. The logic controller telemetry unit shall have enough memory allocated to allow the time and date stamping of the required discrete and analog values to be archived. Process point time stamping frequency shall be selectable within the configuration software.
 2. The historical archive shall allow the oldest data to roll off the system as memory is used keeping the most current data points available.
 3. It shall be possible for the archived data to be exported in Comma Separated Variable (CSV) format allowing use with standard spreadsheet and data base software applications.

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- S. The logic controller telemetry unit system shall utilize Control Systems “open” and/or Modbus industry non-licensed standard communications protocol that will permit interface with other equipment that may not be supplied by the same manufacture. Protocols that are proprietary and closed ended will not be acceptable. Upon request by the end user, the System Manufacturing Supplier shall provide, to the owner, documentation describing the supplied communications protocol so that it may be used in future telemetry additions to insure interface-ability of other third party RTUs or PLCs.
- T. The logic controller telemetry unit system must be able to simultaneously support multiple communications protocols. The Telemetry System supplied, as a minimum shall be able to supply Control Systems “open” and Modbus RTU/ASCII (Remote/Slave) output data via RS-232, 485 & Ethernet format thus insuring a primary means of interfacing with non-related equipment.
- U. The logic controller telemetry unit system shall allow for operations over multiple (LAN/WAN) communication media affording the most efficient and reliable solution. Standard communication media include the following as a minimum:
 - 1. Metallic wire-pair, dedicated leased voice grade phone line, standard dial up phone line, wireless cellular dial up system, cable TV, Fiber optics, wire and wireless Ethernet 10/100 BaseT, VHF Radio, UHF Radio, and Microwave Radio.
 - 2. System communication architecture can be based on any one or a combination of these media. The communications speed shall be set to the highest speed allowed by the selected media.
- V. The system shall support multiple modes of telemetry operation allowing highest possible system reliability and real-time response including: standard polling cycles, peer-to-peer, quiescent (Report on exception), store and forward (Repeater). The system shall support the following:
 - 1. System communication architecture can be based on any one or a combination of these modes of operation.
 - 2. The logic controller telemetry unit system shall employ a high level, efficient and secure communications protocol for communications between Master MTU and Slave RTU.
 - 3. As a minimum the Telemetry System shall utilize Bose-Chaudhuri-Hochquenghem (BCH) code, Cyclic Redundancy Check (CRC16) or other high-level error detection/rejection protocol to ensure true transmission/reception of data.
 - 4. Systems utilizing communications protocols with less capable error detection/rejection capabilities shall not be suitable for this application and will be summarily rejected.

- W. The logic controller telemetry unit shall have I/O resources to support a wide variety of applications without needing to depend upon alternate, third party technologies to meet various system data requirements. The I/O sub-system shall maintain the following minimum design requirements:
1. Each individual RTU shall be supplied with the required inputs and outputs (I/O) to meet the specified requirements and allow for a minimum of 50% spare capacity for future expansion.
 2. Each logic controller telemetry unit shall be easily scalable from a stand alone unit capable of supporting a minimum of twenty-six (26) logic controller on-board I/O points to an maximum of two hundred and fifty six- (256) distributed local and/or remote I/O points.
 3. The logic controller telemetry system shall support a wide variety of modular I/O with various configurations to permit the most efficient use of I/O hardware and panel space.
 4. I/O modules shall be available for local and remote distributed I/O utilizing a standard Ethernet based I/O sub-system.
 5. Each I/O module shall be DIN rail mounted, have compression wire type terminals capable of accepting 14 AWG wire, have wire identification markers and I/O wiring diagram.
 6. Each I/O module shall include diagnostic LEDS indicating module operational and I/O status.
 7. Each I/O module shall be electrically isolated, meet IEEE-472 (ANSI C37.90) surge withstand certification, shall be removable under power and easily field replaced with a spare module requiring no software/hardware reconfiguration adjustments.
 8. Each I/O module shall be safety keyed to insure proper installation and shall allow for remove and replacement under power. I/O modules shall permit installation and operation in hazardous locations as classified under UL, CSA Class 1, Div. 2, Groups A, B, C & D.
- X. The microprocessor logic controller for all telemetry units shall be IntraLink LC2000 Logic Controller with the required standard system components as manufactured by Siemens Water Technologies or pre-approved equal.

2.04 LOCAL OPERATOR INTERFACE TERMINAL (OIT) UNIT

- A. An Operator Interface/Keyboard Display (OIT) shall be supplied for the all microprocessor based logic telemetry control unit panels including all Master MTU and Slave RTUs. These OIT units shall be mounted on the front door of each enclosure for easy Operator access. The OIT shall perform the following functions:

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1. Keypad/Display shall allow the Operator to view and modify system variables within the logic controller telemetry unit.
 2. Keypad/Display shall be NEMA 4 rated, have 20 system/function keys with tactile feedback, and have a minimum of 64 x 128 pixels capable of displaying graphics and a minimum of 8 lines with 20 characters per line.
 3. The display shall be a high contrast backlit LCD display so that it is unaffected by a wide-range of ambient light conditions.
- B. Operator interface shall have sufficient performance to permit real time updates of system data and shall be capable of display update at least 3 times per second. Operator initiated screen change shall occur within 50 msec.
- C. The display shall incorporate a power save feature that shuts down the display after 5 minutes of keyboard inactivity.
- D. The system display shall be pre-configured to reflect system parameters. The display shall support a minimum of 100 customizable main level process system displays. These displays shall be configured with graphical and text based data for the specific application to meet system monitoring and process control needs. The display shall be easily navigated by using a simple menu type format branching down to sub menus/levels.
- E. The display shall allow an Operator to return to the main level with a one step push button entry. All system data and parameters shall be security protected. The system shall employ a hierarchical security password system affording a minimum of three (3) levels of password-protected access to the system.
- F. The display system shall incorporate a basic trending package that shall allow sixty samples of time-based single discrete or analog data on a signal screen display. The Operator shall have the ability to scroll through time, forward and backwards, utilizing right and left function keys. The system shall allow trend display of any data point in the system.
- G. The display system shall be able to display current and historical alarms and events. Upon the occurrence of a new unacknowledged alarm, the display shall show the date and time and sound an audible tone indicating the presence of an unacknowledged alarm. Acknowledging the alarm via the display keyboard shall silence the audible tone. Subsequent alarms shall reactivate the alarm audible tone. Historical alarm and event information shall be viewable from the display with the last 1,000 alarms or events including date and time of alarm being available.
- H. The Operator Interface Terminal for all telemetry units (Master and Slaves) shall be IntraLink OI3000 OIT as manufactured by Siemens Water Technologies or pre-approved equal.

2.05 TELEMETRY COMMUNICATION SYSTEM (OPTIONS A, B and/or C)

OPTION A: LEASE LINE TELEPHONE COMMUNICATION SYSTEM

- A. A lease line telephone modems shall be provided, as required with the previously specified logic controller telemetry unit for system wide telemetry communication.
- B. The telephone modem shall be a least 1200-baud or greater speed device, as required by the Owner supplied telephone system.
- C. All data and control signals between the telephone modem and logic controller telemetry unit shall be pinned compatible at RS-232 levels.
- D. The telephone modem shall have on-board LED's for indication of transmit data, receive data, etc. and shall be compatible with leased voice grade transmission lines.
- E. The Contractor shall make arrangements with the local telephone facility for the installation of a type 3002 voice grade telephone line between remotely located Slave RTU sites and the central Master MTU location as shown on the plan drawings. A 3002 line is as defined by FCC Interstate Tariff No. 260 for point to point or multiple point communications.
- F. Contractor shall bear all costs associated with the installation of this line. The Owner shall be responsible for all leasing costs charged by the telephone facility for the use of this line once installed.

OPTION B: UHF/VHF LICENSED RADIO SYSTEM

- A. Integrated wireless modem telemetry communication hardware that complies with applicable FCC or NTIA requirements for Refarming shall be supplied.
 - 1. The radio and the modem must be packaged together and internally interfaced with each other.
 - 2. On-line, non-intrusive RF network diagnostic monitoring shall be provided as a standard feature in the system architecture.
 - 3. Wireless modem hardware of a 'packetized' design may not be used.
 - 4. Units shall be data transparent to allow for a minimum amount of data transmission latency and to limit data transmission overhead, thus allowing the wireless modem to obtain the data rates specified.
 - 5. Keying of wireless modem hardware may be accomplished by either RTS signaling or data activated transmit.
 - 6. Data can be presented to wireless modem hardware for transmission when the Data Activated Transmit or DOX mode is selected.
 - 7. The wireless modem hardware must be protocol transparent and independent. It must support 7 or 8 data bits, 1 or 2 stop bits, even, odd, or no parity.

SUGGESTED SPECIFICATION

- B. The master or base wireless modem unit shall operate within the 380-512 MHz or 132-174 MHz frequency band as locally required and available. The master or base unit must be extended duty cycle capable with a cooling fan option. Front panel mounted status indicators shall be available for status monitoring. Separate data ports must be provided for both application data and for on-line, non-intrusive diagnostic monitoring. The unit shall have type acceptance for operation at 9600 bps within a 12.5 kHz bandwidth. To comply with this requirement, unit must carry a 9K30F1D FCC emission designator or better. The radio RF output power shall be at least 5 watts and must be adjustable down to 1 watt and any level in between.
- C. The remote station wireless modem shall also operate within the 380-512 MHz or 132-174 MHz frequency band matching the master or base band requirements. The remote station wireless modem shall have authorization of notification or type-acceptance for legal operation in a 12.5 kHz bandwidth channel, including 9600 bps operations at 12.5 kHz. The unit shall be operated at either 4800 bps or 9600 bps in a 12.5 kHz channel, but must be capable of operation at a speed of at least 9600 bps. The unit shall operate in the half-duplex mode with the base wireless modem transmitter. In the RTS Mode, assertion of RTS by the remote terminal unit shall initiate the data transmitting sequence. The remote wireless modem unit will provide a CTS signal to the remote terminal unit, indicating readiness to begin sending data over the air. In the DOX Mode, the presence of data will activate the transmitter and begin sending data over the air without the need of RTS handshaking from the remote terminal unit. The radio RF output power shall be at least 5 watts and must be adjustable down to 1 watt and any level in between.
- D. A remote on-line diagnostic feature shall provide information required to monitor and maintain all wireless communication links. It shall be capable of monitoring unit power, temperature, voltage, signal strength, antenna/feed line condition, and data decode performance. It shall transmit this available data online without application interruption and the diagnostic output shall support OPC Enabled Diagnostics feature.
- E. Furnish and install an antenna for each transceiver. Mount antennas on wood poles, self-supporting steel towers or masts as shown on the plan drawings or as required for reliable signal transmission. All antennas and supporting structures shall be designed to withstand a 100-Mph wind with a 1/4" coating of ice.
1. Remote telemetry unit panel antennas shall be a 3-element Yagi array with a gain of at least 7 dB or reuse the existing.
 2. The master or base monitoring telemetry unit panel antenna shall be omni directional type with a minimum gain of 3 dB or reuse the existing antenna system.
 3. Each telemetry location shall be provided with a bulkhead-type antenna/cable lightning arrestor, one hundred feet of Helix low loss coaxial cable and all required connectors.

SUGGESTED SPECIFICATION

- F. Provide cable connecting the radio antenna port to the antenna, which is low-loss foam-dielectric type, 0.5 inch in diameter. A six-foot section of "super-flex" transmission cable at the radio antenna port shall be provided. Make this section pass through the enclosing panel and the control building exterior wall. Provide standard Type N connectors for connection to a continuous piece of cable extending to the antenna. Provide weatherproof transmission cable, suitable for direct environmental exposure. Use "O" ring seals on connections. Coaxial lines to antennas shall be enclosed in conduit to protect against vandalism.
- G. System Manufacturing Supplier shall include performing a UHF/VHF path study based on data provided to the System Manufacturing Supplier by the Owner/Engineer. The System Manufacturing Supplier shall be responsible for obtaining the FCC station and operating licenses for the owner. This shall include performing a path study based on data provided to the System Manufacturing Supplier by the Owner/Engineer. This information shall include:
1. Area topographic maps with Latitude and Longitude for each site
 2. Site names/locations and addresses
 3. Site ground and building/pole elevations
 4. Approximate path length

The System Manufacturing Supplier shall be responsible for the following:

1. Obtain FCC approval for system operation
 2. Prepare all materials required by the FCC
 3. Obtain all license application forms, write in all required information and forward to the owner for signature(s)
 4. Provide all information required by the area frequency coordinator
- H. The UHF/VHF licensed radio system shall be a synthesized Integra-TR integrated wireless modem system as manufactured by Dataradio COR Ltd.

OPTION C: 900 MHz LICENSE-FREE RADIO COMMUNICATION SYSTEM

- A. Integrated radio modem hardware shall be supplied which complies with applicable FCC or NTIA requirements for Refarming. The radio and the modem must be packaged together and internally interfaced with each other. Radio transceivers shall be 100% solid-state units operating in the FM Spread Spectrum 902-928 MHz range.
- B. All radio connections shall be via plug-in connectors. This requirement applies to the Heliac/coaxial cable feed line, radio power and data connections.

SUGGESTED SPECIFICATION

- C. Master, Repeater and Remote radio units shall operate in the 902-928 MHz frequency band. Each master radio and its assigned remote units shall operate on a unique transmit/receive frequency pair and on a non-interfering basis with the other master/remote systems. This will be accomplished through the use of six independent channels consisting of 64 separate master transmit frequencies.
- D. The radio units shall have FCC and Industry Canada authorization of notification or type-acceptance under FCC rules Part 15.247 and IC TRC-76. **No license will be required to operate radios.**
- E. The radio unit shall use the spread spectrum Frequency Hopping modulation technique for data communications. Frequency hopping has the advantage of spreading its channels across the spectrum; utilizing advanced process gain techniques to maximize transmit signal power while also using traditional narrow band filtering techniques to reject noise and interference.
- F. The radio units shall use a minimum of six separate channels and four hopping patterns. This will allow multiple systems to operate in the same area with minimal interference from other spread spectrum radio users.
- G. The radio units shall have the ability to delete up to 14 of the usable 64 frequencies in any channel. This minimizes the effects of interference and provides the highest possible communications availability.
- H. The radio units shall meet the following data characteristics:
 - 1. Signaling Standard: RS-232C Interface
 - 2. Connector: DB-25
 - 3. Data Rate: 1200, 2400, or 4800 BPS Asynchronous
 - 4. Data Turnaround Time: Seamless Data Mode: 90-180 msec
Quick Response Mode: 20-90 msec
 - 5. Byte Length: 10 or 11 Bits
 - 6. Maximum Data Transmit: Continuous at 1200 and 2400 BPS,
14 seconds at 4800 BPS, 120 Bytes
Maximum at 9600 BPS
- I. The radio units shall utilize a Link Check mode normally enabled at the master to allow the user to check the radio link to all of the associated Remotes' 64 usable frequencies. This test may be initiated from any radio in the system. The Poll mode checks the radio link between the master and a single remote by sending a command to make the remote return an average of how many channels are being received out of the available 64. This test may be initiated from any radio in the network.

SUGGESTED SPECIFICATION

- J. The radio units shall meet the following diagnostic interface environmental characteristics.
 - 1. Signaling Standard: RS-232C Interface
 - 2. Connector: DB-25
 - 3. I/O Devices: Hand-Held Programmer/Terminal/PC

- I. Furnish and install an antenna for each transceiver. Mount antennas on wood poles, self-supporting steel towers or masts as shown on the plan drawings or as required for reliable signal transmission. All antennas and supporting structures shall be designed to withstand a 100-Mph wind with a 1/4" coating of ice.
 - 1. Remote telemetry unit panel antennas shall be a 3-element Yagi array with a gain of at least 7 dB or reuse the existing.
 - 2. The master or base monitoring telemetry unit panel antenna shall be omni directional type with a minimum gain of 3 dB or reuse the existing antenna system.
 - 3. Each telemetry location shall be provided with a bulkhead-type antenna/cable lightning arrestor, one hundred feet of Helix low loss coaxial cable and all required connectors.
 - 4. The antenna radio system requires line-of-sight installation and must be installed within the recommended distance limits for a license free Spread Spectrum Radio system.

- J. Provide cable connecting the radio antenna port to the antenna, which is low-loss foam-dielectric type, 0.5 inch in diameter. A six-foot section of "super-flex" transmission cable at the radio antenna port shall be provided. Make this section pass through the enclosing panel and the control building exterior wall. Provide standard Type N connectors for connection to a continuous piece of cable extending to the antenna. Provide weatherproof transmission cable, suitable for direct environmental exposure. Use "O" ring seals on connections. Coaxial lines to antennas shall be enclosed in conduit to protect against vandalism.

- K. System Manufacturing Supplier shall include performing a path study based on data provided to the System Manufacturing Supplier by the Owner/Engineer. This information shall include:
 - 1. Area topographic maps
 - 2. Site names/locations and addresses
 - 3. Site ground and building/pole elevations
 - 4. Latitude and Longitude for each site
 - 5. Approximate path length

- L. The radio must be an Integra-H 900 MHz License Free Wireless Radio system as manufactured by Dataradio COR Ltd or pre-approved equal.

2.06 REMOTE ACCESS DIAL-IN ETHERNET MODEM

- A. The remote access dial-in Ethernet modem shall create a Local Area Network (LAN) and share telephone and Internet access over a 56K analog line, which shall unify all data communications in the system. It shall also provide simultaneous dial-out and dial-in access, talk on the phone or fax while on the Web, and share a printer and files locally over a minimum 10 Mbps Ethernet (100 Mbps preferred). A built-in management interface shall provide a user-friendly utility for setup and operation.
- B. This remote access Ethernet device shall combine a four- (4) port manager switch with a 56K modem, allowing a remote connection to the system wide Ethernet network. It shall support up to ten- (10) configurable dial-in accounts providing the required system security such as ID Detection, Call Back and encrypted message authorization.
- C. This remote access Ethernet device shall operate from on an 8 to 48 VDC power source. A battery and charger as specified elsewhere shall be supplied to power the master and remote telemetry units during 120-Volt service power outage conditions.
- D. The remote access dial-in Ethernet modem must conform to the following specifications, as a minimum. If any specification is not met in its entirety, the System Manufacturing Supplier must clearly identify the specific area of non-conformance as an exception to the specification.
 - 1. Network Ports: four- (4) RJ-45 10/100 full/half duplex jacks
 - 2. Phone Interface Connection: RJ11C
 - 3. Phone Line Requirements: unconditioned PSTN dial-up
 - 4. Line Rates (V.90): 56K through 28K bps
 - 5. Line Rates (V.34): 28.8 through 2400 bps
 - 6. Protocols: TSP/IP, PPP, RIP, NAT, Telnet, FTP, DHCP, BOOTP.
 - 7. Mounting: standard DIN rail mounting and latching.
- E. Standards Compliance of the dual 56K LAN Ethernet modem shall include the following:

CE	FCC part 15-class b
UL/CUL Certified	FCC part 68
CTR 21	UL Class 1 Div 2 Hazardous
- F. The remote access dial-in Ethernet modem shall be a standard, off-the-shelf, readily available networking device.

2.07 LAPTOP COMPUTER HARDWARE (WEB ENABLED HMI)

- A. A One- (1) standard, Laptop computer shall be provided for local and remote access of the complete telemetry control and monitoring system. The Laptop computer shall be supplied with Microsoft Windows compatible Web-Enabled graphical user interface software.
- B. The Laptop computer shall meet the following suggested specifications as a minimum and shall be the latest and most current Laptop available:
 - 1. Pentium 4 microprocessor operating at 2.80 Ghz (provide the latest chip set)
 - 2. User Memory (RAM) 512 MB
 - 3. Integrated VGA adapter with 1-MB video memory. Active matrix TFT LCD color display not less than 15" diagonal.
 - 4. Integrated hard disk/diskette drive controller
 - 5. 3.5 inch/1.44 MB diskette drive
 - 6. 60 GB hard disk drive
 - 7. Modular 24x CD Burner/DVD Combo drive
 - 8. 77 - key enhanced keyboard
 - 9. One parallel, one serial and one PS/2-compatible mouse port
 - 10. Integral pointing device (trackball, touchpad or "joystick (eraser head)" type)
 - 11. PCMCIA 56 K baud fax/data modem
 - 12. PCMCIA Ethernet port
 - 13. Battery and AC Adapter/Charger
 - 14. Leather Carrying Case

2.08 WEB ENABLED HUMAN MACHINE INTERFACE (HMI)

- A. The Telemetry System Master MTU panel shall include Web Enabled HMI local and remote capability allowing automatic notification of alarms and reports, and provide for a remotely accessible graphical interface via direct dial in, local area network or via standard Internet access. System data and control parameters as herein defined shall be directly monitored and made available via local or remote access.
- B. The Telemetry System shall be supplied with a built in (56Kbd) dial up modem for connection to standard dial up phone lines as supplied by the Owner. The dial up modem shall allow for direct connect to the local Master MTU. A 10/100 Base-T Ethernet port shall be available for local connection of the furnished Web Enabled Laptop computer.

SUGGESTED SPECIFICATION

- C. System data shall be presented in an easy to view graphical and tubular formats that can be displayed on any Microsoft based local or remote access Laptop computer using Microsoft's standard browser, Internet Explorer™ 5.0 or newer. Displays shall be in the form of pre-configured high-resolution three-dimensional (3D) graphic; multiple pen trends, current and historical alarm and standard process report screens. No specialized or PC workstation licensing software shall be required to access the system. The system shall employ high, resolution HTML based displays to insure Internet/intranet web browsing compatibility.
- D. System shall employ a high level hierarchical based security system that shall limit local and remote system access to only authorized users. There shall be a minimum of six levels of user security providing system access associated with each of the defined access levels.
- E. The hierarchical levels of security shall be defined as Operator 1, Operator 2, Supervisor, Maintenance, Engineering, and Administrator. Each security level shall be assigned a specific level of system access. Each security level shall allow up to 15 authorized users with a total system support of not less than 90 authorized users.
- F. The system shall be configured with a main display graphic with site-specific access icons placed on a system overview screen. Each site-specific icon shall graphically represent one site as monitored by the system. Accessing an icon brings up a site-specific display. Each site display shall be based on pre-configured 3D graphical display that best represents the process being monitored. A display library shall be available for quick and easy implementation.
- G. Each site specific display shall include a graphical representation template of local and remote site specific equipment and shall have a system status box including for presentation of analog signals (levels, pressures, flows, and totals) and discrete status and alarm points. Graphical screens with pump or valve control shall be interactive using graphic based operators for Pump/Motor H-O-A and Manual Speed Control or Valve O-C-A and Manual Position, allowing remote operation.
- H. The system shall allow remote access and adjustment of up to 30 process setpoints including on/off points, alarm level and cutoff/restore points. Setpoint parameters shall be displayed on one common display. Each setpoint shall be identified with a specific identification tag allowing a user to easily identify the setpoint parameter. Systems that use cryptic and or abbreviated descriptors shall not be acceptable.
- I. System alarm summary displays for current/active alarms and historical non-active alarms shall be built in. Each alarm screen shall display date and time of alarm and definition of alarm parameter. Each alarm screen shall allow alarms to be segregated into 3 separate groups for specific group display or all groups can be displayed. System memory shall allow the storage of not less than 30 days with up to 30,000 time and date stamped alarm points.

SUGGESTED SPECIFICATION

- J. Historical records are to be available for viewing by local or remote Laptop computers for print out.
- K. System events shall be monitored and viewable through an event history display. The display shall be configured similar to the alarm screen and allow events to be segregated into 3 separate group displays or all groups. System memory shall allow not less than 30 days with up to 30,000 time and date stamped event points. Historical files are to be available for downloading to local or remote Laptop computer for print out and long term storage.
- L. The system shall provide trending of system data (analog and discrete) for up to 32 parameters. These parameters shall be viewable in-groups of 1 to 4 points that can be assigned on line via Operator selection. The system shall support a minimum of 8 trend screens allowing display of all available trend points. Each data trend point shall be assignable to one of two Operator configurable data sampling rate groups. Each group shall be configurable with a minimum of 6 Operator selectable data sampling rates for optimal resolution including: 30 Seconds, 1 Minute, 2 Minute, 3 Minute, 5 Minute, 10 Minutes, and 15 Minutes. Each trend display shall allow up to 4 points of trend data at 30-second resolution for up to 24 hours.
- M. Trend displays shall allow user adjustments to include start date, start time, and duration with backward and forward time scrolling. Trend point parameters shall be displayed on each associated trend display including minimum and maximum limits, current value in engineering units. Specific time point data shall be available via a sliding cursor that can be moved to a desired time point in the trend graph for a reading of the sampled data. A minimum of 60 days of trend data shall be available for each trended data point.
- N. A Flow report shall be automatically generated for on-demand display. The system shall allow configuration for a minimum of two reports with 10 points each for a total of 20 flows. Each report shall display the Current Rate, Daily Minimum and Maximum with time of occurrence, and Daily Total Flow.
- O. A Level report shall be automatically generated for on-demand display. The system shall allow configuration of a minimum of two reports with 10 points each for a total of 20 levels. Each report shall display the Current Level, Daily Minimum and Maximum with time of occurrence.
- P. A Run Time report shall be automatically generated for on-demand display. The system shall allow configuration of a minimum of three reports with 10 points each for a total of 30 run times. Each report shall display the Daily Total, Monthly Total and Cumulative Total for piece of equipment monitored.

SUGGESTED SPECIFICATION

- Q. A system diagnostic and set up screen shall be built in allowing trend data rate interval selection, e-mail trend file report enable/disable, system configuration status, data link connection health and trend, alarm and event data storage days. The system shall have dedicated connection ports that support local connection of VGA monitor, Keyboard and Mouse to facilitate local access to system for viewing of all system data and set up parameters.
- R. The system shall support as an option a minimum of ten- (10) e-mail delivery accounts that are user configurable on line. The system will allow each account to be configured to automatically receive alarm or report text messages.
- S. The Web Enabled HMI system software shall be Siemens Water Technologies, Control Systems IntraLink WS2000 or pre-approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Coordinate all work with the Owner/Engineer to avoid conflicts, errors, delays and unnecessary interference with operation of the existing system during installation, testing, cutover and startup.

3.02 EXAMINATION

- A. Prior to installation of the work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that work may be completed in strict accordance with the original design and with the manufacturer's recommendations as approved by the Owner/Engineer.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.03 FACTORY STAGING AND TEST

- A. The System Manufacturing Supplier shall stage the Telemetry System and conduct a test at the manufacturing factory following system integration and shall be done prior to delivery of the system to the customer's site.
- B. All elements of the Telemetry System shall be tested to demonstrate that the total system satisfies all of the requirements of this specification. As a minimum the Factory Testing requirements are as follows:
 - 1. The System Manufacturing Supplier shall provide all special testing materials and equipment.

2. The Contractor shall coordinate and schedule all of his testing and start up work with the Owner/Engineer.
 3. The Laptop computer with peripherals, all logic controller telemetry units and all other associated hardware shall be tested at the factory, prior to shipment, so as to demonstrate that each component is operational and meets the requirements of these specifications.
 4. The complete Telemetry System shall be Factory Tested at one time to assure communications and control, which demonstrates step-by-step conformance with this specification and the functional description outline in the contract documents.
 5. The Factory Test shall demonstrate system functions under nominal operating conditions and under simulated failure or malfunction conditions. The System Manufacturing Supplier shall completely integrate all equipment necessary to demonstrate the functionality of the system, including simulated inputs and outputs.
- G. Upon request, the owner will be notified of the factory test to allow the owner or his representative to witness the factory test. The owner will be responsible for all costs of travel and lodging.

3.04 FIELD SERVICE, WARRANTIES AND GUARANTEE SUPPORT

- A. **ON-SITE SUPERVISION:** The System Manufacturing Supplier shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the complete telemetry control and monitoring system. The personnel shall be present on-site as required to effect a complete and operating system.
- B. **START-UP SERVICES:** The System Manufacturing Supplier shall provide the services of factory trained qualified representative, for one- (1) trip with a minimum of four- (4) working days, including travel and living expenses, for the purpose of inspecting the installation and providing telemetry control and monitoring system start up and commissioning services.
- C. **FIELD TEST:** All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly.
1. Witnessed field tests shall be performed on the complete system during start-up.
 2. The Contractor shall notify the Owner at least one (1) week prior to the commencement date of the field tests.
 3. **Field Test Acceptance:** The field test described above shall be witnessed and signed off by the Owner upon satisfactory completion.

SUGGESTED SPECIFICATION

- D. **WARRANTIES AND GUARANTEE:** The System Manufacturing Supplier of the equipment shall guarantee for 12 months from the date of final acceptance, not to exceed eighteen- (18) months from date of shipment, that all equipment will be free from defects in design and workmanship.
1. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the System Manufacturing Supplier will not be accepted. The System Manufacturing Supplier shall be solely responsible for the guarantee of the complete Telemetry System and all its components.
 2. In the event components fail to perform as specified or is proved defective in service during the guarantee period, the System Manufacturing Supplier shall provide a replacement without cost or obligation to the owner

3.05 INSTALLATION

- A. The Contractor shall install the work of this section in strict accordance with the System Manufacturing Suppliers recommendations as approved by the Owner/Engineer.
- B. Contractor shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the Telemetry System. The personnel shall be present on-site as required to effect a complete and operating system.

3.06 TRAINING

- A. The System Manufacturing Supplier shall be capable of providing standard on-site training on all aspects of the Telemetry System.
- B. The System Manufacturing Supplier representative shall instruct the *OWNER'S* operating personnel, at a time designated by the *OWNER*, as to the proper method of operation and recommended maintenance procedures.
- C. The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied.
- D. The on-site training program shall consist of one and half days, which shall include a minimum of twelve- (12) hours. Both on-site classroom-type and field site sessions shall be provided.
- E. At least two weeks prior to the requested start of the program, the proposed dates of training shall be submitted to the Owner and the Engineer for approval.

SUGGESTED SPECIFICATION

- F. The System Manufacturing Supplier shall provide all instructional course material, equipment and manuals to conduct the training program. Owner shall provide facilities for the training.
- G. The scheduling of the instruction shall be at the convenience of the *OWNER* and may not coincide with the start-up inspection.

3.07 FINAL DOCUMENTATION

- A. OPERATION AND MAINTENANCE MANUALS (O&M): The System Manufacturing Supplier shall provide (3) complete sets of hard-covered ring bound loose-leaf O&M manuals. In addition to “as-built” system drawings as described in Part 1 of this specification, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided under this section.
- B. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.

3.08 DEFINITION OF ACCEPTANCE

- A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:
 - 1. All O&M documentation has been submitted, reviewed and approved.
 - 2. The complete Telemetry System and instrumentation have successfully completed all testing requirements specified herein and have successfully been started up.
 - 3. All Owners staff personnel training programs have been completed.
 - 4. Owner/Engineer sign a document indicating the completed Telemetry System has formally been accepted.

--- END OF SPECIFICATION ---