

## IntraLink™ LC3000 PLC

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. The functions and features specified herewith are the minimum acceptable requirements for the SCADA system. The provided system shall equal or exceed each requirement.
- B. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/firmware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described.
- C. Major equipment, component and software items are specified; however the Contractor shall, provide all appurtenant items necessary to achieve the required operation as hereinafter specified.

#### 2.2 FUNCTIONAL REQUIREMENTS

**INSERT OPERATIONAL DESCRIPTION HERE. DESCRIPTION SHOULD INCLUDE THE FOLLOWING AS A MINIMUM:**

- **Basic system overview description**
- **Descriptive control strategies required**
- **Input/Output listings for all locations**
- **Mandatory system functions to be performed**
- **Mandatory software functions to be performed.**

#### 2.3 COMPONENT SPECIFICATIONS

##### A. General

1. Remote and Master PLC enclosures shall be corrosion resistant welded NEMA Type 4 for outdoor locations, NEMA Type 12 for indoor locations. Enclosures shall be fabricated from a minimum of 14 gauge cold rolled steel with a baked enamel finish in the manufacturer's standard color. Units shall include a single gasketed front door. Full height hinges, locking hasp and door clamping hardware shall be included. All enclosures shall be UL listed.
2. Controls shall operate from a source of 120 volts, 1 phase, 60 Hz. All controls shall be protected from lightning or other transient voltages by a power arrestor.
3. Condensation protection shall be provided. Enclosure shall have a heater which operates continuously to prevent condensation build-up. A freeze protective heater and thermostat shall also be provided at those outdoor locations containing hydraulics or sensitive electronic equipment subject to freezing conditions.

4. All power supplies required for operation shall be provided. Power supplies shall be sized to have a minimum of 40% spare capacity providing increased reliability and allowing for the addition of future equipment.
5. All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

#### B. Battery Back Up System

1. Included with each remote and master PLC, 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. 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. Battery health logic module shall individually monitor main DC power supply, battery and converter voltages for low voltage conditions, and provide low voltage cutoff to protect battery from an unrecoverable depletion. An on board LED, or local Operator Interface (OI) if provided shall locally indicate detection of an alarm condition. In addition to local indication, all battery health and voltage information shall be transmitted to the Master PLC for centralized monitoring and alarm detection.
2. Battery system shall be of sufficient capacity to provide a minimum of four (4) 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 PLC shall be inhibited from operation. Recovery shall be automatic upon restoration of normal power. 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.

#### C. UL Labeling (Select 508A or 968A/913)

##### SERIALIZED UL LABEL REQUIREMENT (508A)

1. 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".
2. 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. 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. Only the labeled products of U.L.508A/"Enclosed Industrial Control Panel" recognized panel manufacturer shall be considered acceptable for use on this project.

##### SERIALIZED UL LABEL REQUIREMENT (698A/913) -

NOTE: Use the following spec for applications requiring intrinsic safety barriers to render sensors located in hazardous sewage wetwell environments (N.E.C. Class I, Groups C & D) "explosion proof".

1. 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".
2. 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. 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. 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. PLC Control/Telemetry System

##### 1. General:

- a. The main site and each remote location shown on the plan drawings and as described herein shall be of the PLC type with adequate memory and instruction sets required to make the unit perform all of the functions required by this specification. Units shall communicate with the Master PLC over the previously specified telemetry medium. Systems using a PC for master communications shall not be acceptable.
- b. All control signals, status signals, alarm and process variable data shall be transmitted and received between the central location and the remote sites via the SCADA system. The system shall convert commands, alarms and variable analog data to digital blocks and transmit this information between the Central and the multiple remote locations. The master and remote PLCs shall be capable of stand-alone control to maintain programmed logic.
- c. Units shall be furnished completely configured and tested providing the specified communication, monitoring, display, input/output, annunciation, computational and other requirements for operation of the SCADA system. Any additional components required for operation, whether specifically referenced herein or not, shall be provided.
- d. The PLC system shall be based on a scalable modular multi-use open architecture platform that can be efficiently applied to perform the necessary functions at each location. Each controller/telemetry unit shall be a modular hardware style PLC consisting of a CPU with adequate memory and instructions, power supply, local and remote input/output modules, communications ports, and all other components required to make the unit perform all of the functions required in this specification.
- e. It is required that the same model PLC device be used throughout the SCADA system including; RTU, MTU and IRTU (repeaters) sites providing a complete solution with one common technology. This is to insure complete system continuity, compatibility between like devices, enhancing overall system efficiency by the reduced need to learn, maintain, support and carry spare parts for multiple technologies.
- f. The PLC system shall support true system open architecture allowing use of specialized for water and wastewater hardware and software and 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.

2. Hardware:

a. The PLC system 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. The PLC system shall be modular and scalable to be efficiently applied at each of the specified sites within the system.

b. The PLC system 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.

c. The PLC 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. Sufficient non-volatile memory must be provided to protect at least 8,000 variables. The PLC shall also provide enough protected memory for time stamped data logging of up to 200,000 process values. This data shall be unaffected by power interruptions.

d. The PLC shall have enough processing power and working (DRAM) memory to enable high level programs such as Internet Web Servers to operate efficiently without affecting other simultaneous multitasking operations.

e. The PLC shall be furnished with a minimum of 6 communication ports with true multitasking and allow simultaneous support of all ports. Ports can be configured for local I/O, Operator Interface/display support, LAN/WAN, etc..

f. The PLC processor shall meet the following as a minimum:

1. CPU - True 32 Bit running at 50 MHz.
2. 16 MB – 32 bit Dynamic RAM
3. 16 MB FLASH
4. 512 KB Static RAM
5. 1 (One) Ethernet 10/100 BaseT port (RJ45)
6. 2 (Two) RS-232 Serial Communications (115 KB PS) (RJ45)
7. 1 (One) RS485 Serial Multi-Drop Communications
8. 1 (One) Local I/O port
9. 1 (One) Display Serial Communications Port

g. The PLC shall not require any specialized tools for removal of the unit. System components including PLC, power supplies, etc. shall be DIN rail mounted. Terminations shall be via plug in connectors facilitating quick field replacement.

h. PLC's and associated 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 PLC system components shall also meet IEEE-472 (ANSI C37.90) surge withstand and IEC68-2-6 Vibration standards.

i. The PLC shall operate from a 10-30 VDC power source. A battery and charger as previously specified shall be supplied to power the master & remote unit during 120 Volt service power outage conditions.

j. The PLC's shall have an operational temperature range of -40°C to 70°C (-40°F to 158°F) under relative humidity conditions of 5 to 95% non-condensing. Storage temperature range up to 85°C (185°F)

3. Software:

a. The PLC 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 modules. 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 Display. The architecture shall permit all system components to be configured, simulated, tested and downloaded from one terminal to all system components.

b. The operating system shall be multitasking and allow a minimum of two separate programs to run simultaneously without affecting each other.

c. To provide for and insure multiple source support, the PLC 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 Windows™ 95, 98, NT, 2000, Millennium and XP operating systems.

d. PLC's provided under this specification shall be capable of performing the necessary logic to control the system as previously defined. These 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                  |

e. PLC's shall be capable of performing diagnostic functions. CPUs shall continuously monitor the functionality of the system and record errors and specific system events. A diagnostic buffer shall retain fault and interrupt events.

f. Communications between the Master PLC and the computer shall be accomplished using standard off-the-shelf drivers allowing use of standard Windows DDE and or OPC software drivers. The PLC system configuration software shall allow the MTU tagname data base to be exported to the computer HMI software providing continuity between PLC and HMI tagnames and making future changes/upgrades more efficient and less prone to database tagname error. Communications between the Computer and Master unit and the Master unit and the remote (off-site) units shall be via high speed communications port (RS-232 (up to 115 Kbps) or Ethernet 10/100 BaseT (10/100 Mbps) in conjunction with a modem over the previously specified telemetry medium.

g. Each PLC shall have memory protected built in historical archiving/data logging of system alarms & events and process variables. Data logger shall be able to log data based on time or an event. PLC shall have enough memory allocated to allow 200,000 time and date stamped discrete and/or analog values to be archived. The historical archive shall allow the oldest data to roll off the system as memory is used keeping the 200,000 most current data points available. Process point time stamping frequency shall be selectable within the configuration software. It shall be possible for the archived data to be exported in CSV format allowing use with standard spreadsheet and data base software applications.

4. Communications:

a. The PLC telemetry system shall utilize Control Systems "open" 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 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 and or PLCs.

b. The telemetry system must be able to simultaneously support multiple communications protocols. The 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.

c. The PLC system shall allow telemetry operations over multiple (LAN/WAN) communication media affording the most efficient and reliable solution including; DC metallic wire pair, dedicated leased voice grade phone line, standard dial up phone line, wireless cellular dial up system, cable TV, Fiber optics, Ethernet 10/100 BaseT, VHF Radio, UHF Radio, Dedicated Microwave Radio, and Ethernet Wireless. 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. This system shall be based on the use of \_\_\_\_\_ as the primary communication media(s).

d. 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). System communication architecture can be based on any one or a combination of these modes of operation. This system shall utilize \_\_\_\_\_ mode(s) of operation.

e. The PLC telemetry system shall employ a high level, efficient, secure communications protocol for communications between Master Telemetry Unit (MTU) and Remote Telemetry Unit(s) (RTU). As a minimum the telemetry system shall utilize BCH, CRC16 or other high level error detection/rejection protocol to ensure true transmission/reception of data. Systems utilizing communications protocols with less capable error detection/rejection capabilities shall not be suitable for this application and will be summarily rejected.

f. The PLC system shall allow local or remote configuration or RTU troubleshooting without the need to be onsite. The system protocol shall support remote upload and down load file transfers between the master unit and associated RTUs. File transfer function shall provide reliable means of remotely transferring RTU configuration files so that any RTU configuration can be uploaded through the selected telemetry communications media to the online PC via the MTU, modified and then downloaded to the RTU. The system shall support transfer of RTU historical files for recovery of

historical data stored at each RTU in the event of communication or MTU failure. Historical files can be reassembled at the MTU/PC so that no loss of data occurs due to temporary communications interruptions. The Main PLC shall be supplied with a standard dial up modem allowing remote system access for factory service and technical support.

5. I/O Systems:

a. The PLC system shall have I/O resources to support a wide variety of applications without needing to depend upon alternate technologies to meet various system data requirements. Each PLC shall be supplied with the required I/O to meet the specified requirements and allow for a minimum of 100% spare capacity for future expansion. The PLC system shall be easily scaled from a stand alone unit capable of supporting up to 1,024 local, 1,024 remote I/O, and 10,000 Ethernet networked I/O points or one of 254 RTUs with a total system data handling capability of 50,000 points.

b. The PLC 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. I/O modules shall be available for local I/O (within control panel), remote I/O (RS-485 based distributed outside of the control panel) and Ethernet based I/O (Distributed I/O on high speed in plant network or wireless Ethernet). 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. Each module shall include diagnostic LEDs indicating module operational and I/O status. 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. Each module shall be safety keyed to insure proper installation. 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.

c. Local I/O modules shall be connected to the PLC by a dedicated high speed serial communications port and shall allow local networking of 128 I/O modules for a total of 1024 I/O points via 2 twisted shielded wire pairs separated by up to 50 Ft. Local I/O to PLC update time shall not exceed 150 mS.

d. Remote I/O modules shall be connected to the PLC by a dedicated high speed isolated serial communications port and shall allow networking of 32 I/O modules directly or with up to 4 gateway I/O expansion modules allow 128 I/O modules for a total of 1,024 I/O points via RS-485 multidrop communications network separated by up to 10,000 ft. Remote I/O modules shall support multiple communications protocols including Modbus ASCII and RTU allowing connection to any device supporting these protocols

e. Ethernet I/O modules shall be connected to the PLC by on board Ethernet 10/100 BaseT connection port. Ethernet I/O modules shall support multiple communications including TCP/IP and Modbus ASCII and RTU allowing connection to any device supporting these protocols over standard Ethernet backplane.

f. Master & Remote PLCs shall be IntraLink LC3000 as manufactured by Siemens Water Technologies, Control Systems Products or pre-approved equal.

6. Operator Interface Panel (**Optional**)

a. An Operator Interface/Keyboard Display shall be supplied for the Master PLC and (**Remote PLCs**) and is to be mounted on the door of the enclosure. Keypad/Display shall allow the Operator to view and modify system variables within the PLC. 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. 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. The display shall incorporate a power save feature that shuts down the display after 5 minutes of keyboard inactivity.

c. The system display shall be preconfigured to reflect system parameters. The display shall support a minimum of 50 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. 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 hierarchal security password system affording a minimum of three (3) levels of password protected access to the system.

d. The display system shall incorporate a basic trending package that shall allow sixty samples of time based data for a single discrete or analog based data point to be displayed. The system shall allow trend display of any data point in the system.

e. 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.

f. The Operator Interface shall provide locally viewable system diagnostics for the PLC system to permit an on site method of troubleshooting the system without the need for specialized tools or knowledge. Diagnostics indicating system processor and communication errors and CPU performance/loading shall be viewable when in this mode.

g. Unit shall be capable of displaying process variables, provide management and processing of status and fault messages, and provide process control using soft keys, function keys or system keys. Keypad/Display programming shall be via Microsoft Windows based software as described above in the software section of this specification.