SECTION 13410 - BASIC INSTRUMENTATION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General administrative and procedural requirements for instrumentation installations. Administrative and procedural requirements are included in this Section to expand on requirements specified in Division 1.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Sections 01300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. Product data for each product specified.
   2. Wiring diagrams, both elementary and schematic, differentiating between manufacturer installed and field-installed wiring.
   3. Digital Systems: Provide the following:
      a. Digital equipment layouts of input and output racks showing complete module model number and addressing assignment. Layouts of port pin assignment, connection schematic indicating cable types and port addresses.
   4. Software Programs: One fully annotated printed copy of program prior to factory test. In addition, provide required number of copies of latest revisions of program at time of acceptance by OWNER. Submittal of printouts, listings, and screen images shall be supplied on paper (hard copy). With concurrence of OWNER and ENGINEER, electronic copies may be supplied in addition to printed copies as a matter of convenience. Format of electronic copies shall be as mutually agreed with OWNER.
   5. Programmable Logic Controllers: Submits lists of input and output assignments, data file structures used, and internal data points. Show points used to communicate with between PLCs and the operator interface and data collection segments. Include complete, fully annotated ladder logic diagrams complete with cross-reference listings.
   6. Operator Interface and Supervisory Control: Submit "screen dump" images of each proposed operator interface screen. Describe color schema, mouse button use, function key controls and communication protocol with PLCs. Provide a flow diagram showing screen navigation. Show sample event and alarm log outputs.
   7. Data Collection: Submit details of data structures, communications protocols, data exchange formats, sampling intervals, and file storage space management. Provide "screen dump" images of historical trending.
   8. Data Management and Reporting: Includes process data management, laboratory management, and reporting. Submit data definitions, customization of base software, data entry screens, menus, and report formats. Describe data entry, collection, and reporting scenarios. Describe data file storage management including backup and archive operations.

B. Record Drawings: At Project closeout, submit record drawings of installed products, in accordance with requirements of Section 01770.
   1. CONTRACTOR shall furnish final recored drawings electronically to the ENGINEER and OWNER. These Drawings shall include changes made by Field Orders, Change Orders, Addenda, and errors discovered during start-up and acceptance.

2. Drawings shall include terminal numbers at each wiring termination and piping termination. A complete system diagram shall be included.

C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01782, operation and maintenance manuals for items included under this Section.
   1. Contractor needs to supply only the cut sheets that are directly related to the product and a summary sheet including regulatory agency compliance, manufacturer, model and applicable part # to identify options, and a summary of ratings and options with full manual to be submitted with as-builts.
   2. Instructions shall be concise, easy-to-understand directions specifically written for this Project describing various possible methods of operating equipment. Instructions shall include procedures for tests required, adjustments to be made, and safety precautions to be taken with equipment. These documents are to be submitted to ENGINEER's office.
   3. Provide 1 complete set of manufacturer's documentations covering programmable equipment supplied. Include hardware manuals and prints as manufacturer normally ships with programmable equipment.
      a. Include complete software manuals for operating system, as well as manuals for any other software. Written instructions for the operations and maintenance of software shall be provided. The instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating software.
      b. Include program listings, point/address lists, cross-reference listings, images of screens, data entry forms, and sample reports.
      c. Manuals shall include instructions for program users and instructions for maintenance programmers.

D. Warranty: Submit in accordance with requirements of Section 01770, warranties covering the items included under this Section.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. National Electric Code.
   2. National Fire Protection Association.
   3. Occupational Safety and Health Adminstration.
   4. Applicable State and local requirements.
   5. UL listing and labeling shall be adhered to.

C. CONTRACTOR shall provide permits and licenses, observe and abide by applicable laws, regulations, ordinances, and rules of State, territory or political subdivision thereof, wherein the Work is done. CONTRACTOR shall pay fees for permits, inspections, licenses, and certifications when such fees are required.

D. Calibration Equipment and Testing Apparatus: Equipment supplier shall have available appropriate test and calibration equipment for factory panel tests, installation, start-up, service contract, and maintenance or troubleshooting purposes.

1. CONTRACTOR shall have the appropriate certifications and level of training to properly calibrate all instrumentation according to industry standards and as required by the contract.

E. Component Requirements: For the purposes of uniformity and conformance to industry standards, signal transmission modes shall be either electronic 4-20 mA DC or via smartbus as indicated on drawings. No other signal characteristics are acceptable, except for remote temperature detector (RTD) and thermocouple (TC) sensing circuits; 4-20 mA DC signals shall be such that devices may be wired in parallel for 1-5 volt DC as required. 1-5 volt DC mode shall be employed only within control panel enclosures.

F. Responsibility and Coordination: Drawings and Specifications are intended to include details of a complete equipment installation for purposes specified. CONTRACTOR shall be responsible for details which may be necessary to properly install, adjust, and place in operation complete installation. Any error on Drawings or in Specifications which prevents proper operation of supplied system shall be shown correct at time of Shop Drawing submittal for approval or brought to attention of ENGINEER with or prior to submittal.

G. CONTRACTOR shall be responsible for costs incurred to correct aforementioned errors brought to ENGINEER's attention. CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Manufactured material shall be adequately packed to prevent damage during shipping, handling, storage, and erection. Material shipped to Site shall be packed in a container properly marked for identification. Blocks and padding shall be used to prevent movement.

B. CONTRACTOR shall inspect the material prior to removing it from carrier. If damage is observed, CONTRACTOR shall immediately notify carrier so that a claim can be made. If no such notice is given, material shall be assumed to be in undamaged condition; any subsequent damage that occurs to the equipment shall be the responsibility of CONTRACTOR. Repair and replacement of damaged parts will be done at no expense to OWNER.

C. CONTRACTOR shall be responsible for any damage charges resulting from handling of materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPLIERS

A. Subject to compliance with specified requirements, equipment suppliers shall be the following (no "or equals"):

1. ICS Integration Services LLC (Michael Bak).
2. Motor City Electric Technologies.
3. PCI Detroit.

B. References made in these Specifications to specific manufacturer’s products are intended to serve as a guide to type, construction, and materials. Listing of a manufacturer does not imply acceptance by

ENGINEER of a manufacturer's particular product, product line, or latest product revision if it does not meet Specifications.

C. Equipment Supplier: Equipment specified under Sections 13xxx and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to Site, and started up by one of the qualified and approved equipment suppliers listed under this Section. Intent is for unit responsibility.
   1. Equipment supplier shall not assign any of its rights or delegate any of its obligations under these Sections without prior written acceptance by ENGINEER.
   2. Direct purchase of any items in these Sections by CONTRACTOR that is not in compliance with this Specification and will not be permitted.
   3. When a Service Contract is included, it shall be performed by factory-trained personnel employed by equipment supplier or manufacture. Equipment supplier shall assign a qualified Engineer employed by the supplier as Project Engineer/Project Manager.
      a. Project Engineer/Project Manager's name shall be forwarded to CONTRACTOR and ENGINEER within 30 days after receipt of a purchase order by equipment supplier.
      b. Project Engineer/Project Manager shall be focal point for design, fabrication, Contract communications, and shall be responsible for start-up and acceptance. Project Engineer/Project Manager shall be at factory test at Site for start-up and at the Site during entire acceptance procedure. Only qualified and approved equipment suppliers shall be accepted as meeting this Specification.

2.02 EQUIPMENT

A. Transmitted electronic signals to equipment of other vendors and between control panels shall be a separate isolated-floating output for each item of equipment and shall conform to ISA Standard S50.1.

B. Enclosures shall be NEMA 1, 4, 4X, or 7 as indicated on Drawings. Intrinsically safe systems, as approved by Factory Mutual, shall be furnished when called for.

C. Current-to-current converters shall be used as power boosters to provide sufficient signal power as required. It is equipment supplier's responsibility to determine under what circumstances and locations power boosters are required, provide them, and integrate them into the instrumentation system to make system function properly.

D. Separate power supplies shall be totally enclosed with solderless terminals for connections. They shall be short circuit current limiting type that will automatically resume regulation after removal of short circuit. They shall operate from 120 volt AC, plus or minus 10 percent power. Regulated voltage shall be fixed. Units with internal trim potentiometers will be accepted.

   1. Pneumatic instruments shall have an input and output range of 3-15 psig. Units shall require a 20 psi supply. Provide an air set for each pneumatic unit or for each 20 psi manifold. Bubbler air sets, regulators, valves, etc., must be factory assembled on a subplate as specified and detailed. All installations shall include an air-water separator filter with an automatic drain. All installations with outdoor components shall include a desicant drier.
   2. Instruments shall be panel-mounted or enclosed for wall mounting as shown on Drawings.

E. Size and style of instruments are defined in Specifications. Pneumatic panel-mounted units shall match in appearance similar electronic components.

F. Charts and scales are shown on Drawings. Standard scales shall not be accepted without ENGINEER's approval if it differs from those shown. Ratio station scales and other scales shall be graduated such that major graduations fall on whole numbers (i.e., 1, 2, 3, or 5, 10, 15, etc.) and minor graduations fall on 0.1 or 0.2 intervals (i.e., 1.1, 1.2 or 11, 12, etc.). If two scales are called for on ratio stations, each scale shall be indexed to meet Specification. Drawing of each scale for ratio stations shall be submitted with Shop Drawings for approval.

G. Solid-state output switches, where used, shall be overvoltage transient protected and not be damaged by dI/dT or dv/dt for their design application under this Contract.

H. Instruments shall be equipped with permanently attached identification tag. Tag shall be included on field- and panel-mounted devices. Tags shall include ENGINEER's tag identification and manufacturer's tag identification if different from ENGINEER's.

1. Tags shall be either 316 stainless or laminated phenolic with black letters engraved on a white background. Field-mounted devices shall have tags fastened with screws. Devices mounted in panels will be tagged inside panel on subplates or on device itself where it can be easily read.

I. All materials shall be 316SS in corrosive, hazardous and wet environments for all instruments and equipment. Finish on instruments and accessories shall provide protection against corrosion by elements in environment in which they are to be installed. Both the interior and exterior of enclosures shall be finished. Extra paint of each color used on material shall be provided by manufacturer for touch-up purposes.

J. Provide equipment identification nameplates complying with Section 16075. Nameplates shall contain ENGINEER's item designation and, for indicators and transmitters, design range and units of device shown.

2.03 SOURCE QUALITY CONTROL

A. Conduct preliminary testing prior to factory checkout by executing programs supplied for this Project. Exercise inputs to test logic for correct function and proper response of outputs. Verify correct interface with programs. Verify correct communications. Simulate automatic logic with software simulator/emulator.

B. PLCs, local operator computers, data management computers, and associated control panels shall be tested at the factory prior to shipment to the Site. OWNER/ENGINEER is to be given a minimum of 4 weeks notice before the factory test date; OWNER/ENGINEER will witness the tests. The purpose of factory testing is to verify correct functioning of equipment and conformity to Project requirements before shipment. A factory representative of the programmable equipment shall be at the factory checkout to certify that device settings have been properly set and the system is communicating properly.

C. Factory testing shall be used to validate fieldbus and plant LAN/WAN interconnections. Proper communication between devices and software components shall be demonstrated. Data Collection and Data Management Reporting (where appropriate) shall be demonstrated.

D. The equipment supplier shall make available 1 qualified person for entire duration of the factory test. This includes equipment supplier factory testing witnessed by OWNER/ENGINEER, and during the software checkout phase of the factory test listed below.

E. Once the PLCs, etc., are connected at the equipment supplier's factory, and it has been demonstrated that the equipment properly communicates, the panels shall remain at the supplier's facility for up to 4 weeks to allow OWNER/ENGINEER/INTEGRATOR to check out (test) the PLC software and operator interface software. OWNER/ENGINEER has the right to attend any and/or all check out sessions during the duration of the factory testing period.

F. Control panels and programmable equipment shall not be shipped to Site until logic conforms to Contract requirements, physical changes required by testing are made, and tags conform to factory test corrections. Equipment delivered to Site without factory test or corrections will be returned to factory at CONTRACTOR's expense.

G. Test Procedures:
   1. Hardware testing to verify system wiring, layout, workmanship, and appearance. Demonstrate correct function of inputs and outputs (analog & discrete) using a switch and lamp "mimic board." Perform a PLC load test to verify that outputs can be driven at full load simultaneously.
   2. Communications tests to verify inter-processor messaging via data highway, serial links, data management computer, and modems.
   3. Control logic tests begin with loading ENGINEER-developed ladder logic software. Control logic and sequences shall be tested and verified using a switch and lamp "mimic board."
   4. Operator interface integration test builds upon previously completed phases by exercising entire system from the data management computer.

H. At completion of tests, system shall remain intact for a period of at least 2 weeks for ENGINEER's use correcting software errors found during the course of test.

I. Unless appoved and agreed to by OWNER schedule factory test not before 20 weeks after Shop Drawing status of deliverable items under this Section is either No Exceptions Taken (N.E.T.) or Furnish as Corrected (F.A.C.)

J. Provide services of PLC manufacturer's application engineer at factory test for up to 5 days as approved by OWNER/ENGINEER.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer as approved by ENGINEER.

B. Install equipment as indicated, in accordance with manufacturer's written instruction, and in compliance with recognized industry practices to ensure that products fulfill requirements.

C. Elements that are supported by plumbing or piping, or that have only plumbing or piping connections shall be installed under those Sections.

D. Plumbing, piping, or pneumatic signal connections to elements requiring such connections shall be made under those Sections. Control panels shall be installed in accordance with Division 16

Sections, with piping connections to control panels installed under Division that covers mechanical components.

E. Drawings are not intended to show every detail of construction or location of piping, ductwork, or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment, air ducts, or other equipment, CONTRACTOR shall so inform ENGINEER for his approval and permission.

3.02 FIELD QUALITY CONTROL

A. Calibrate equipment in accordance with manufacturer's instructions to ranges or set points indicated on Drawings.

B. Installation and Start-up: Equipment supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than 6 hours travel time from Site.

1. Equipment supplier shall provide an experienced, factory-trained, competent, and authorized service representative for a minimum of 3 times at Site, including once during installation and start-up and once during acceptance to inspect, check, and calibrate any part of system. Supplier's service representative shall revisit Site for 8 hours per day as often as necessary after installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to ENGINEER.

2. Equipment supplier shall demonstrate testing for 3 full cycles of instrument or device to OWNER/ENGINEER to fully confirm satisfactory operation.

3. Third trip is after equipment has been accepted and shall be used to instruct OWNER's personnel in aspects of operation and maintenance, such as fuse locations, use of controls, instruction manuals, training, etc. Third trip shall be for duration of two, 8-hour days at OWNER's facility.

C. Digital Equipment Field Training: At conclusion of field acceptance tests, CONTRACTOR shall conduct a training course for OWNER's personnel in use of system.
1. Course shall be 1 weeks duration and shall consist of hands-on use of system as well as lectures.
2. Written course materials shall be provided to each participant for use during instruction and to serve as a basic reference document after training.

3.03 TRAINING

A. CONTRACTOR shall provide to OWNER a list of applicable training available from each manufacture of equipment for the programmable controller, operator interface, computers, and software packages supplied under this contract. CONTRACTOR has no other obligations other then to supply this list in electronic or paper form.

3.04 DEMONSTRATION

A. Upon completion of installation and calibration, CONTRACTOR shall submit a detailed demonstration plan to the OWNER/ENGINEER. The plan shall detail how the CONTRACTOR is

going to demonstrate the functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new or repaired units, and retest to demonstrate compliance.

3.05 SPARE PARTS

A. The Contractor shall provide labor, equipment, materials, and incidentals required to deliver spare parts, maintenance items, tools, and other items specified in the Specifications and shown on the Drawings.

B. OWNER will notify the Contractor of the exact location that the spare parts, maintenance items, tools, and other items shall be delivered to by the Contractor. Locations may be located at a OWNER facility that is different from this Contract and the Contractor is responsible for bearing the cost of delivery to whatever location selected by OWNER.

C. Unless otherwise specified, spare parts, maintenance items, tools, and other items specified in the Contract Documents shall be new from the original manufacturer and shall not be more than 1-year old from the date of manufacture upon delivery to the site. The date of manufacture shall be permanently stamped or otherwise permanently displayed on each spare part for inspection by the OWNER/ENGINEER. Re-furbished, salvaged, or recycled spare parts, maintenance items, tools and other items from another project or facility are not acceptable. Spare parts, maintenance items, tools and other items delivered to the site that are not new will be rejected by the OWNER/ENGINEER. Spare parts, maintenance items, tools and other items that are rejected shall be immediately removed from the site by the Contractor and replaced with new as specified in the Contract Documents.

D. The Contractor shall submit a written deviation request when the manufacturer cannot meet these requirements. The deviation request shall be submitted to the OWNER/ENGINEER at least fourteen days before product delivery and shall provide written justification for each requirement that cannot be meet. It is recommended that these deviation requests be clearly listed and included within the initial product submittal to mitigate schedule impacts from disapproval of nonconforming products. The Contractor shall not deliver the product until receiving written approval from the OWNER/ENGINEER.

E. Provide products, spare parts, maintenance and extra materials as specified in individual specifications sections.

F. In addition, the contractor shall deliver to the Project site and turn over to Owner the following spare parts:

Quantity	Manufacture	Description	Model#
2	Rockwell	ControlLogix Processor	1756-L72
6	Rockwell	EtherNet 10-100M Bridge Module	1756-EN2TR
1	Rockwell	Redundancy Module	1756-RM2
6	Rockwell	85-265V AC Power Supply	1756-PA75
1	Rockwell	1756 Chassis 7 slots	1756-A7
1	Rockwell	1756 Chassis 17 slots	1756-A17
2	Cisco	Cisco 3850 Switch	WS-3850-24-XS-S
4	Cisco	Cisco 3850 Switch Module	3850-NM-8-10G

14	Cisco	Cisco SFP Module	GLC-LH-SMD
4	Rockwell	L33 CompactLogix Controller	1769-L33ER
4	Rockwell	CompactLogix 8-channel Discrete Input Isolated	1769-IA8I
4	Rockwell	CompactLogix 8channel Discrete Output	1769-OW8I
4	Spectrum Controls	Spectrum Controls 4channel HART Analog In	1769sc-IF4IH
4	Rockwell	CompactLogix 4channel Analog In	1769-IF4
4	Rockwell	CompactLogix Power Supply	1769-PA2
2	Rockwell	ControlLogix Isolated Input	1756-IA16I
2	Rockwell	ControlLogix Analog Input	1756-IF16
2	Rockwell	ControlLogix Isolated Relay Output	1756-OW16I
2	Rockwell	ControlLogix Analog Output	1756-OF8
2	Rockwell	Stratix 8300 Switch	1783-RMS10T
2	Rockwell	Stratix 8300 Fiber Expansion Module	1783-MX08F
2	Rockwell	Stratix 5700 Switch	1783-BMS06SGA
6	Rockwell	36 Pin Screw Clamp Housing	1756-TBCH
6	Rockwell	20 Position Screw Clamp Housing	1756-TBNH

END OF SECTION