

SECTION 13445COMMUNICATION NETWORKPART 1- GENERAL1.1 DESCRIPTION

- A. Work Included: Furnish, configure and test a new Ethernet/DH+ communication network consisting of the following:
 - 1. Provide a new communication panel (COM-1) to be installed in the Hypochlorite Building as shown on the Network Diagram and on the Electrical Drawings. COM-1 will include a Modular Industrial Ethernet Switch and ancillary equipment to allow communication between each of the new programmable logic controllers (PLCs), the operator terminals, and the existing control network using Allen Bradley DH+ protocol. Refer to Section 13440 for additional information.
 - 2. Supervise the installation of the communication panels and fiber optic cables. Configure the new Ethernet switches to communicate with each of the existing and new equipment. Terminate each fiber and provide a testing report of fiber losses.
- B. Related Work Specified Elsewhere.
 - 1. Programmable Logic Controllers: Section 13442
 - 2. Instrumentation and Process Control: Section 13440
 - 4. Control Panels and Enclosures: Section 16160
- C. Tests and Procedures Prior to Start-up
 - 1. The supervisory services of a factory-trained service engineer/technician who is specifically trained on the type of equipment herein specified, shall be provided during construction to assist the CONTRACTOR in methods of installing conduit and special cable; mounting, piping, and wiring of each device, and the methods of protecting all of the equipment prior to placing it into service. Upon completion of the installation, provide the services a trained service engineer/technician to configure, calibrate, test and startup the equipment and provide instruction and training for the operating personnel. A sufficient number of service days shall be provided to place the system in satisfactory operation.
- D. Demonstration of the Complete Network System
 - 1. After the Communication Network is completed, demonstrate that each of the communication ports on the network is functioning and make final adjustments to the system. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration as directed by the Engineer.

2. Pay all charges or fees, including the cost of any special test equipment, factory engineers, etc., necessary for the proper performance of the specified tests, demonstrations and instructions.
3. All demonstrations and instructions referred to shall be scheduled at the convenience of the Engineer and the Owner and in no case shall be scheduled without at least seventy- two (72) hours written notice.

1.2 QUALITY ASSURANCE

- A. All materials provided under this Contract shall be equal in quality, appearance and performance to that specified herein and shall be subject to the approval of the Engineer. Verify the availability of all materials proposed to be used in the execution of the work prior to submitting same for the Engineer's approval. The discontinuance of production of any material or product after approval has been granted shall not relieve the Contractor from furnishing an Engineer approved alternate of comparable quality and design without additional cost.
- B. Materials and equipment furnished under this Contract shall be standard products of manufacturers regularly engaged in manufacture of such products and shall be manufacturer's latest standard design that complies with Specification requirements. Products shall essentially duplicate material and equipment that have been in satisfactory local use at least three years.
- C. The Network Supplier shall have supplied comparable systems to those specified herein and shall maintain engineering and service departments capable of designing and maintaining these systems. Provide, for a period of twelve (12) months from the date of final acceptance of the work, all necessary supervision, labor, materials, and equipment, in order to correct any defects in any system due to faulty materials, equipment, or workmanship and consequent damage resulting from such defects. This work shall be scheduled during normal working hours and at the convenience of the Owner.
- D. Network Supplier:
 1. The communication network shall be furnished by one supplier, who shall provide all of the equipment and appurtenances regardless of manufacture, and be responsible to the Owner for satisfactory operation of the entire system.
 2. All necessary provisions will be made to ensure a proper interface between the existing control systems and new control panels.

1.3 SUBMITTALS TO THE ENGINEER

- A. Shop Drawings and Samples:
 1. Submit Shop Drawings in accordance with General Conditions Section 01340 and as indicated herein.
 2. Shop Drawings shall be thoroughly checked for compliance with the Contract Documents. Verify that all furnished equipment and materials will fit into available space and maintain specified clearances, and that all equipment is compatible with the system operation.
 3. Shop Drawings Shall Consist Of:

- a. Project name and location
 - b. Contractor's name
 - c. Index Sheet - Listing the equipment being submitted utilizing equipment designations, or symbols, indicated on the Contract Documents together with the proposed manufacturer, style/type and catalog number.
 - d. Manufacturer's scale or dimensioned drawings along with standard catalog number.
 - e. Equipment ratings, service clearances and configuration.
 - f. Listing of accessories to be furnished.
 - g. Single-line and schematic diagrams of all required piping and electrical work.
 - h. Layout diagrams of the communication panels, electrical schematics, terminal block loop diagrams and point to point diagrams.
4. All material shall be contained in one submission.
 5. Submissions shall be in the form of a binder. Each equipment type shall be separated by index tabs with typewritten titles.
 6. Provide samples of instruments, devices, graphics, etc., within ten (10) days upon receipt of request from the Engineer.
- B. Maintain properly documented and witnessed test and checkout reports and submit these to the Engineer. These shall include the proper termination and testing of each of the fiber optic cables. No form of energy shall be applied to any part of the communication system prior to receipt by the Engineer of the supplier's certified statement of approval of the installation and containing his authorization to energize the system, except that the supplier's serviceman may do so for the purpose of check-out as described herein.
- C. Upon completion of the work and before request for final payment, deliver to the Engineer six (6) bound sets of full and complete directions pertaining to the operation and maintenance of all equipment and systems installed under this Contract. These directions shall be on 8-1/2" x 11" sheets neatly bound with index tabs, and shall be accompanied by plans, diagrams, etc., of the work installed, parts lists, etc., necessary for the guidance of the Owner in operating, altering or repairing the installation. In addition to the foregoing, furnish the Engineer with a written statement from the Owner indicating that he is satisfied with the operating instructions given.
- D. Provide the Owner with a list of local service departments of duly authorized distributors of materials and equipment of the type installed, which will stock the manufacturer's standard parts, etc.
- E. At the completion of the installation, provide reproducible Record Drawings indicating the final configuration of all systems as they were installed. Symbols, equipment designations, etc., shall be consistent with the Contract Documents. Provide exact locations of all work which has been concealed in concrete, masonry or underground.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Coordinate material and equipment delivery with the project schedule. Notify the Engineer immediately, in writing, if material or equipment delivery will adversely affect the project schedule, include documentation from equipment suppliers indicating the revised delivery dates and the reason for the delay.
- B. Coordinate delivery of equipment directly to other vendors where instrumentation supplied under this section has to be installed in panels supplied under other specification sections.
- C. Exercise care during loading, transporting, unloading and handling of materials to prevent damage.
- D. Check for defective or damaged materials, and for incomplete equipment shipments within seven (7) days after equipment delivery to the project site.
- E. Store materials and equipment on the construction site in enclosures or under protective covering in order to assure that materials and equipment are kept undamaged, clean and dry.
- F. Replace or repair, to the satisfaction of the Engineer, all materials and equipment that are defective or that have been damaged during installation, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 COMMUNICATION NETWORK

- A. General:
 1. Provide a PLC communication network to allow communication between each PLC, operator terminal, existing SCADA Systems and other Ethernet device as shown on the Network Diagram on Drawing I-2.
 2. The network architecture will consist of a centralized Ethernet Switch located in COM-1 connected to each new PLC and operator terminal (OPT). A new Gateway will be provided to allow communication between the existing DH+ network and the new Ethernet network.
 3. The network will use Ethernet protocol and meet 10/100BaseT IEEE 802.3 (UTP), 802.11b (wireless) and 100Base-FX multimode (fiber optic).
 4. Panels shall be UL 508 listed.
 5. The communication panel (COM-1) will include the following:
 - a. Modular Industrial Ethernet Switch
 - b. Ethernet/DH+ Gateway
 - c. 120VAC/24VDC Power Supplies
 - d. 120 V Surge Protection
 - e. Fiber Optic Breakout Box
 - f. Lamacoid Panel label
 - g. NEMA 4X Fiberglass Enclosure with quick release latches.
 - h. UPS Power Supply
 - i. Indicator lights on the front of the panel for Power (green) and UPS Power (amber) and UPS Fail (red).

- j. Terminals, fuses, grounding and other ancillary equipment required for proper operation.
- B. Fiber Optic Cable:
- 1. Provide indoor/outdoor type fiber optic cable with a minimum bending radius of 4 inches and a minimum tensile strength of 300 lb.
 - 2. Transmission Distance: up to 2000 km
 - 3. Construction: The cable shall be loose tube type design with an inner PVC tube containing the optical fibers and an outer UV resistant, flame retardant Poly jacket.
 - 4. Cables shall be outdoor/indoor rated and suitable for installation in buried conduit.
 - 5. Optical Fibers: A minimum of eight (8) multimode, 62.5/125 fibers per cable compatible with IEEE 802.3 10/100BaseF standard.
 - 6. Termination: ST connector type to be coordinated with Ethernet devices. Field terminations shall be fused using a splicing device specifically designed for joining fiber optic cable. Chemical fusing shall not be acceptable. The dB loss of each fiber segment shall be tested and a report shall be submitted to the Engineer of the testing results.
 - 7. Each pair of fibers shall be color coded and tagged and Channel A, B, C and D (Tx and Rx).
 - 8. Provide a fiber optic breakout box to be mounted in each control panel, in the communication panel and at the Dechlorination Control Panels (DCP and TDCP). The breakout box shall be constructed of PVC or ABS plastic and include section dividers and separate hinged access doors. One section shall be used to break out and connect each fiber optic strand to a ST type splice connector. The user access side of the box shall provide access to the ST adapters. Provide Fiber Optic Patch Cables from the breakout box to the Ethernet switch. Each breakout box will have a minimum of four (4) fiber optic channels. The breakout box in the communication panel will have a minimum of 4 channels.
 - 9. Equivalent to:
 - a. Berk-Tek Advetum
 - b. Corning Fiber Optic Freedom Cable
 - c. Hitachi Cable
 - d. Or equal
- C. Ethernet Cable (CAT5): refer to Division 16
- D. Modular Industrial Ethernet Switch:
- 1. Provide an industrial Ethernet switch DIN Rail mounted in the communication panel as shown on the Network Diagram. Switch shall be modular and allow for additional expansion using modules.
 - 2. Each switch will have the ability to be monitored from a PC on the network at a remote location. Provide all required software for remote monitoring.
 - 3. Power: Dual 24 VDC power supplies. Provide a 120 VAC to 24V DC power supplies in each COM panel to provide power for the switch from the UPS

- power supply. Power supplies shall be rated for minimum 1.3A at 24V DC with an input power supply of 120 VAC at 60 Hz. Power supplied will be equal to Idec or Sola SDP series.
4. Compliance: Ethernet IEEE 802.3 and compatible with the communication protocol of the PLC to be provided.
 5. Communication Ports:
 - a. Provide a minimum of eight (8) auto sensing 10/100 BaseT (half/full duplex) RJ-45 ports at each location.
 - b. Provide two (2) multimode fiber optic ports with ST connectors at each location.
 6. Equivalent to:
 - a. N-TRON 900 Series Modular Ethernet Switch.
 - b. or equal.
- E. Industrial Ethernet Switch:
1. Provide an industrial Ethernet switch, to be DIN Rail mounted in each of the Control Panels (DCP and TDCP) as shown on the Network Diagram.
 2. Power: 24 VDC. Provide a 120 VAC to 24V DC power supply to provide power for the switch from the UPS power supply in the control panel. Power supplies shall be rated for minimum 1.3A at 24V DC with an input power supply of 120 VAC at 60 Hz. Power supplied will be equal to Idec or Sola SDP series.
 3. Compliance: Ethernet compatible with the communication protocol of the PLC to be provided.
 4. Communication Ports:
 - c. Provide a minimum of four (4) auto sensing 10/100BaseT (autosensing half/full duplex) RJ-45 ports.
 - d. Provide a minimum of one (1) fiber optic ST channel (2 ports).
 5. Provide firmware and software required for monitoring, configuring and receiving diagnostics information from each switch.
 6. Furnish and install the Ethernet Switch, DIN Rails, power and control wiring and additional terminal in the existing local control panels.
 6. Equivalent to:
 - a. N-TRON 405FX-N-ST Series Ethernet Switches
 - b. or equal.
- F. Ethernet/DH+ Gateway:
1. Provide a new Ethernet to DH+ Gateway to be mounted in CCP-1. The Gateway will be configured by the Owner's SCADA/PLC Programmer to allow communication between the new Ethernet network and the existing DH+ network at the facility.
 2. The Gateway will consist of the following Allen Bradley ControlLogix equipment:
 - a. Backplane (1756-A4)
 - b. Power Supply (1756-PA72)
 - c. Ethernet Module (1756-ENBT)

- d. DH+ Module (1756-DHRIO)
- G. Enclosures: Provide a NEMA 12 FRP enclosure with quick release hatches for each COM panel. Refer to Section 16160

END OF SECTION