

SECTION 13452A

VENDOR-SUPPLIED PROGRAMMABLE LOGIC CONTROLLER SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The programmable controllers purchased under this Section are purchased by the vendor for installation in vendor-supplied equipment. The controllers described in this Section are integral to packaged equipment that is to be installed in the plant.

1.02 SUBMITTALS

- A. Shop Drawings and Product Data: Submit in accordance with Section 01300. Include description of components, methods of connecting components.
- B. Statement of Installation Engineer's Training and Experience: Submit in accordance with requirements for and with Product Data.
- C. Operating and Maintenance Manuals: Include the following:
 - 1. Loop diagrams for all added analog loops.
 - 2. Panel mechanical and wiring diagrams for all modified panels.
 - 3. Ten sets Submittal and O&M (Drawings only when the hardware supplied is identical to existing).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Programmable Logic Controllers Hardware:
 - 1. Allen-Bradley, no equal.

2.02 ACCEPTABLE PROCESSORS

- A. Additional or replacement of existing PLC-5 or SLC-500 processors should be accomplished using one of the following unless otherwise approved by the ENGINEER.
- B. PLC processors shall be of the SLC-5/05 family:
 - 1. Acceptable Catalog Numbers:
 - a. 1747-L552 or 1747-L553.
 - 1) 32 K or 64 K RAM.
 - 2) Capable of controlling 4096 I/O directly or distributed over three I/O chassis.
 - 3) One Ethernet channel, one RIO, one DF1-RS232 communications port.

2.03 FIELD WIRING CONNECTORS AND TERMINAL BLOCKS

- A. Field wiring to I/O modules shall be accomplished with manufacturer-supplied Removable Terminal Blocks attached directly to I/O housings so that modules can be quickly and easily removed without disturbing or flexing the field wiring; with screw terminals.
- B. Low- and High-Density Removable Terminal Blocks capable of holding two 14- to 22-AWG wires or one 12-AWG wire will be acceptable.
- C. Analog Removable Terminal Blocks capable of holding two 16-AWG wires or one 14-AWG wire will be acceptable.

2.04 I/O RACKS

- A. VENDOR shall provide sufficient rack space to accommodate I/O for this project plus 20 percent installed spare.
- B. Mounting of I/O Racks shall conform to the manufacturer's recommendations.

2.05 INPUT AND OUTPUT MODULES AND MISCELLANEOUS DEVICES

- A. SLC-500 processors shall use the 1746 I/O structure unless otherwise approved by the ENGINEER. Input and Output modules shall be of the following type and limited to:
 - 1. Allen-Bradley Analog Input module, Model 1746-NI16I.
 - 2. Allen-Bradley Analog Output module, Model 1746-NO8I.
 - 3. Allen-Bradley Discrete Input module, Model 1746-IA16.
 - 4. Allen-Bradley Discrete Output module, Model 1746-OA16.
 - 5. Allen-Bradley Power Supply, Model 1746-P2 or 1746-P4.
 - 6. Allen-Bradley Remote I/O Adapter, Model 1747-ASB.
- B. Absolutely no third party I/O modules will be used without approval of the ENGINEER.
- C. Terminals and fuses as referenced in Section 16050.
- D. Size the type and quantity of rack power supplies appropriately.

2.06 REMOTE I/O PANELS

- A. Furnish Remote I/O Panel(s), complete with Allen-Bradley hardware and miscellaneous devices to accommodate signals as shown on P&IDs per manufacturer's recommended installation procedures.
- B. I/O additions to existing remote I/O panels shall be permitted provided that a minimum of 10 percent of the I/O chassis I/O capacity be available as spares.

2.07 COMMUNICATIONS MODULES

- A. MODBUS TCP/IP Communications module provides connection between Allen-Bradley's PLC processor and Modbus TCP/IP network application.
 - 1. Manufacturer shall be Prosoft Technology, no equal.

2. Module: MV171-MNET. The module is a single slot and shall support for the storage and transfer of up to 5,000-word registers to/from the PLC processor.
 - a. Ethernet Port:
 - 1) 10/100M.
 - 2) 10Base-T Connector.
 - 3) Link and activity LED indicators.
 - b. Backplane Current Load: 800 mA at 5 V.
 - c. Module shall provide LED indicators for module status, backplane transfer status, application status, serial activity status, and error status.
 - d. Configuration Serial Port:
 - 1) DB-9M PC compatible.
 - 2) RS-232.
 - 3) Hardware handshaking.
 - e. Application Serial Port:
 - 1) DB-9M PC compatible.
 - 2) RS-232, RS-422, RS-485.
 3. Module: MVI46-MNET: module is a single slot and shall provide an interface between Allen-Bradley's SLC processor and Modbus TCP/IP network applications.
 - a. Ethernet Port:
 - 1) 10/100 M.
 - 2) 10Base-T Connector.
 - 3) Link and activity LED indicators.
 - b. Backplane Current Load:
 - 1) 800 mA at 5V.
 - c. Module shall provide LED indicators for module status, backplane transfer status, application status, serial activity status, and error status.
 - d. Configuration Serial Port:
 - 1) DB-9M PC compatible.
 - 2) RS-232.
 - 3) Hardware handshaking.
 - e. Application Serial Port:
 - 1) DB-9M PC compatible.
 - 2) RS-232, RS-422.
- B. MODBUS RTU communication gateway: the module allows serial MODBUS RTU to communicate and interoperates with MODBUS TCP/IP based controllers.
1. Manufacturer:
 - a. General Electric (GE), Multinet, or equal.
 2. Ethernet:
 - a. Protocol: Modbus TCP/IP.
 3. RS485 Ports:
 - a. RS485 two-wire, half duplex, isolated.
 - b. Baud Rate: 300 bps to 115.2 Kbps.
 - c. Protocol: ModBus RTU.
 4. Power: 120 VAC, 60 Hz.
- C. MODBUS Master/Slave Communication Module allows Allen-Bradley PLC processors to interface with other Modbus protocol compatible device.
1. Manufacturer shall be Prosoft Technology, MVI71-MCM, no equal.
 2. The module shall support the storage and transfer of up to 5,000 registers to/from the PLC processor's data files.

3. Protocol: RTU.
 4. Single slot - 1771 chassis compatible.
 5. Backplane current load: 800 mA at 5 V.
 6. LED Indicators:
 - a. Module status.
 - b. Backplane transfer status.
 - c. Application status.
 - d. Serial activity and error LED status.
 7. Configuration Serial Port:
 - a. DB-9M PC compatible.
 - b. RS-232.
 - c. Hardware handshaking.
 8. Application Serial Ports (PRT1, PRT2):
 - a. RJ45 (RJ45 to DB-9M PC Compatible connector is supplied).
 - b. RS232/422/485 jumper selectable.
 - c. RS232 handshaking configurable.
- D. Remote I/O - Fiber Optic Communication Converters:
1. Manufacturer: Phoenix Digital - or equal.
 - a. P/N OCM-DPR-13-D-ST-XX suggested, to be confirmed by vendor and approved by the ENGINEER.
 - b. They shall use rack mount installation, plugs directly into Allen-Bradley 1771 system chassis - Single Slot.
 - c. Utilize ST Mating Connector.
 - d. Operating temperature range of 0 to 60 degrees C (32 to 140 degrees F).
 - e. 1.5 to 1.8 Amps, 5 VDC typical power usage.
 - f. Real Time Diagnostic Option, Required for UL rating.
 - g. Functions at up to 10 km apart in multimode operation (1,300 nm wavelength).
 - h. Multimode fiberoptic cable, Wavelength: 1,300.
 - i. UL Listed for Class 1, Division 2 Groups A, B, C, and D Hazardous Locations.

2.08 ETHERNET/FIBER OPTIC COMMUNICATION SWITCHES

- A. They shall be modular standalone industrial switches for Din-Rail, panel or Rack mount installation. Switches shall be a plug and play device. No configuration is required. Each port is automatically set for maximum speed and performance. In addition, each twisted pair port has an Auto MDIX feature, eliminating the need for crossover cables. LED's are provided to display the link status and activity of each port as well as power on/off status.
1. Level II Ethernet Managed Industrial Ethernet Switch.
 2. Incorporates store and forward architecture.
 3. Operating temperature range of -20 degrees C to +70 degrees C.
 4. Can utilize redundant Power Supplies 24VDC (10 to 30 VDC).
 5. Electrostatic Discharge Over voltage protection on all ports.
 6. Functions at up to 2 km apart in multimode operation.
 7. Functions at up to 15 km, 40 km, or 80 km apart; single-mode operation.
 8. Wavelength: 1,300 or 850 nanometers to be consistent with existing equipment.
 9. Full IEEE 802.3 Compliance.
 10. TUV Certified.

11. Function in star, tree, backbone or redundancy network Topologies.
 12. The process network will use a star topology.
 13. UL Listed for Class 1 Division 2 Groups A, B, C, D, T4A Hazardous locations.
 14. Support for Full/Half Duplex operation.
- B. The switches in the following panels: VCP-24.7101, VCP-24.7201, and MCP-24.7000 shall be, at a minimum: N-Tron 304TX or equal.
 1. At a minimum four 10/100Base TX ports.
 2. Network Media:
 - a. 10/100Base TX.
 - C. The switches in the following panels: VCP-26.5500 and VCP-26.5600 shall be N-Tron 509FX or equal.
 1. A minimum of eight 10/100BaseTX ports.
 2. One 100BaseFX port.

2.09 HUMAN MACHINE INTERFACE

- A. Manufacturer:
 1. Allen-Bradley.
 2. Advantech.
 3. Xycom Automation, Inc.
- B. HMI shall be 15-inch Color Active Matrix TFT Flat Panel Display and provide a touch screen with resistive antiglare.
- C. HMI shall be a high performance Pentium 4, 2.0-GHz processor with 512-MB DDR RAM and 40-GB hard drive.
- D. HMI shall come standard with an extensive array I/O ports: three serial ports, one parallel port, two USB ports, PS/2 mouse and keyboard ports, one 10/100-Mbps Ethernet port, one VGA port, Audio line in/line out, and Microphone.
- E. HMI shall be provided with side accessible 1.44-MB floppy drive and CD/DVD-R/W.
- F. HMI shall be preloaded with Window XP or other operating system that is compatible with the Intellution Fix 32 application software.
- G. HMI shall be preloaded with the Intellution Fix 32 software.

2.10 APPLICATION SOFTWARE

- A. Application software shall be of the same or less than two revisions earlier than that used by the DISTRICT unless approved by the ENGINEER.
- B. Programming will conform to the Process Control Strategies as described on the P&IDs unless otherwise approved by the ENGINEER.
- C. SCADA programming for monitoring, alarming, data collection, and supervision to support the above-mentioned PLC programming and will follow the requirements of the P&IDs unless otherwise approved by the ENGINEER.

- D. A hard copy of all PLC programming complete with documentation to include instruction comments, rung comments, analog I/O, dip switch settings, and rack configurations shall be provided by the programmer.
- E. A hard copy of all SCADA programming complete with documentation to include TAG comments, analog scaling, communications configuration, dip switch settings, screen printouts, and any specialty subroutine programming shall be provided by the programmer.
- F. Magnetic media for all PLC and SCADA programming and configuration shall be provided by the programmer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install the PLC and I/O hardware in accordance with the PLC manufacturer's instructions and recommendations, including grounding specifications.
- B. Non-Isolated analog signals leaving a building or entering a building from and outside source shall require isolation.
- C. Interposing relays will isolate all PLC outputs.
- D. Empty slot fillers (1771-N2, 1746-N2) to protect the I/O chassis from contaminants shall be provided.

3.02 CONTRACTOR'S FIELD QUALITY CONTROL

- A. Perform conducted susceptibility (RFI, EMI) test as outlined in NEMA ICS 2-230, NEMA ICS 3-304-42, Section 2 of IEEE 472-1974, and ANSI C37.90A-1974.

3.03 SERVICES

- A. Modify existing panels to add all hardware as required to provide the functionality as described in the P&IDs. All signals will be wired to terminal blocks and identified on Drawings.
- B. 10 days for control system and loop acceptance testing, modification, and start-up assistance in coordination with CONTRACTOR. It is assumed that this will take place on no more than 10 trips. If additional trips are required, they will be charged at our normal per diem rates for labor and travel.
- C. On-site training will consist of 8 hours for operators and 8 hours for control technicians. Note: No factory training has been included.

3.04 ACCEPTANCE TESTING

- A. All basic functions shall be demonstrated, including I/O processing, communications, alarm handling, operator display functions, and alarm logging, as well as the specific functions listed herein.
 - 1. Hardware Test: The test shall demonstrate proper operation of each hardware device and communications among devices, and shall include verification of selected analog and discrete inputs and outputs.
 - 2. Software Test: All system software routines resulting from the process control descriptions as described per the P&IDs shall be demonstrated by CONTRACTOR and tested by DISTRICT's programmer. Software "patches" or changes to bypass failed or flawed modules during the test will not be acceptable.

END OF SECTION

SECTION 13452B

VENDOR-SUPPLIED PROGRAMMABLE LOGIC CONTROLLER FOR ELECTRICAL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: The programmable controllers purchased under this Section are purchased by the vendor for installation in vendor-supplied electrical equipment. The controllers described in this Section are integral to packaged equipment that is to be installed in the plant. All panels and any other equipment provided shall be in accordance with all the pertinent specifications in Section 13000.

1.02 SUBMITTALS

- A. Shop Drawings and Product Data: Submit in accordance with Section 01300 and Section 13000. Include description of components, methods of connecting components.
- B. Statement of Installation Engineer's Training and Experience: Submit in accordance with requirements for and with Product Data.
- C. Operating and Maintenance Manuals: Include the following:
 - 1. Loop diagrams for all added analog loops.
 - 2. Panel mechanical and wiring diagrams for all modified panels.
 - 3. Ten sets Submittal and O&M (Drawings only when the hardware supplied is identical to existing hardware).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Programmable Logic Controllers Hardware: Allen-Bradley, or GE Fanuc equivalent, no other equal accepted without approval by the ENGINEER.

2.02 ACCEPTABLE PROCESSORS

- A. The electrical control system should be built using the following components unless otherwise approved by the ENGINEER.
- B. PLC processors shall be of the Allen-Bradley ControlLogix Family or GE Fanuc PAC Systems.
 - 1. Allen-Bradley Acceptable Catalog Numbers:
 - a. 1756-L62:
 - 1) 4,096 KB RAM, 478 KB of I/O memory.
 - 2) 128,000 I/O max in any mix (4000 analog I/O max).
 - 3) 64 MB Compact Flash. (1784-CF64).

- b. 1756-L63:
 - 1) 8,192 KB RAM, 478 KB of I/O memory.
 - 2) 128,000 I/O max in any mix (4000 analog I/O max).
 - 3) 64 MB Compact Flash (1784-CF64).
- C. 2.GE Fanuc Acceptable Catalog Numbers:
 - a. IC698CRE020, 700 MHz Pentium III:
 - 1) 10 MB RAM.
 - 2) 128K I/O max, 32000 each digital in, digital out, analog in, analog out.
 - 3) 10 MB on-board flash.
 - b. IC698CRE030, 600MHz Pentium M:
 - 1) 64 MB RAM.
 - 2) 128K I/O max, 32000 each digital in, digital out, analog in, analog out.
 - 3) 64 MB on-board flash.

2.03 FIELD WIRING CONNECTORS AND TERMINAL BLOCKS

- A. Field wiring to I/O modules shall be accomplished with manufacturer-supplied Removable Terminal Blocks attached directly to I/O housings so that modules can be quickly and easily removed without disturbing or flexing the field wiring; with screw terminals.
- B. Low- and High-Density Removable Terminal Blocks capable of holding two 14 to 22 AWG wires or one 12 AWG wire will be acceptable.
- C. Analog Removable Terminal Blocks capable of holding two 16 AWG wires or one 14 AWG wire will be acceptable.

2.04 I/O RACKS

- A. Vendor shall provide sufficient rack space to accommodate I/O for this project plus 20 percent installed spare.
- B. Mounting of I/O Racks shall conform to the manufacturer's recommendations.
- C. At a minimum I/O Rack shall have seven slots.

2.05 INPUT AND OUTPUT MODULES AND MISCELLANEOUS DEVICES

- A. ControlLogix processors shall use the 1756 I/O structure, GE Fanuc processors shall use IC694/5 I/O structure, unless otherwise approved by the ENGINEER. Input, Output, and Miscellaneous modules shall be of the following type and limited to:
 - 1. Allen-Bradley Analog Input module, Model 1756-IF6I.
 - 2. GE Fanuc Analog Input module, Model IC695ALG106.
 - 3. Allen-Bradley Analog Input module, Model 1756-IF6CIS.
 - 4. GE Fanuc Analog Input module, Model IC695ALG106.
 - 5. Allen-Bradley Analog Output module, Model 1756-OF6CI.
 - 6. GE Fanuc Analog Output module, Model IC695ALG808.

7. Allen-Bradley Discrete Input module, Model 1756-IA16I.
8. GE Fanuc Discrete Input module, Model IC694MDL250.
9. Allen-Bradley Discrete Input module, Model 1756-IB16I.
10. GE Fanuc Discrete Input module, Model IC694MDL241.
11. Allen-Bradley Discrete Output module, Model 1756-OA16I.
12. GE Fanuc Discrete Output module, Model IC694MDL350.
13. Allen-Bradley Discrete Output module, Model 1756-OB16I.
14. GE Fanuc Discrete Output module, Model IC694MDL916.
15. Allen-Bradley Discrete Output module, Model 1756-OW16I.
16. GE Fanuc Discrete Output module, Model IC694MDL916.
17. Allen-Bradley Discrete Output module, Model 1756-OX8I.
18. GE Fanuc Discrete Output module, Model IC694MDL931.
19. Allen-Bradley Redundant Power Supply Bundle, Model 1756-PAR2.
20. GE Fanuc Redundant Power Supply (2 ea.), Model IC695PSA140.
21. Allen-Bradley Power Supply, Model 1756-PA72.
22. GE Fanuc Power Supply, Model IC698PSA100.
23. Allen-Bradley Ethernet Adapter, Model 1756-ENBT.
24. GE Fanuc Ethernet Adapter (2 ea.), Model IC698ETM001.
25. Allen-Bradley Redundancy Adapter, Model 1757-SRM.
26. GE Fanuc Reflective Memory module (2 ea.), Model IC698RMX016.
27. Allen-Bradley Redundancy Cable, Model 1757-SRC1.
28. GE Fanuc 62.5 micron Multimode Fiber-Optic Jumper Cable.
29. Allen-Bradley ControlNet Adapter, Model 1756-CNB.
30. GE Fanuc Ethernet Remote I/O Adapter, Model IC695NIU001.
31. Allen-Bradley ControlNet Adapter Redundant Media, Model 1756-CNBR.
32. GE Fanuc Ethernet Adapter (2 ea.), Model IC695ETM001.

- B. Absolutely no third party I/O modules will be used without approval of the ENGINEER.
- C. Terminals and fuses as referenced in Section 16050.
- D. Size the type and quantity of rack power supplies appropriately.

2.06 REMOTE I/O PANELS

- A. Furnish Remote I/O Panel(s) using ControlNet or Ethernet, complete with Allen-Bradley or GE Fanuc hardware and miscellaneous devices to accommodate signals as shown on P&IDs per manufacturer's recommended installation procedures.
- B. I/O additions to existing remote I/O panels shall be permitted provided that a minimum of 10 percent of the I/O chassis I/O capacity be available as spares.

2.07 COMMUNICATIONS MODULES

- A. MODBUS TCP/IP Communications module provides a connection between Allen-Bradley's ControlLogix or GE Fanuc's PAC System processors and Modbus TCP/IP networks.
 1. Manufacturer shall be Prosoft Technology or GE Fanuc, no equal.

2. Module: MVI56-MNETR or IC695ETM001. The module is a single slot and shall support for the storage and transfer of up to 5,000-word registers to/from the PLC processor. The MVI56-MNETR and IC695ETM001 reduces network congestion and is ideal for remote rack locations.
 - a. Ethernet Port (if not connected via PCI bus):
 - 1) 10/100M.
 - 2) 10Base-T Connector.
 - 3) Link and activity LED indicators.
 - b. Backplane current load:
 - 1) MV156-MNETR: 800 mA at 5 V.
 - 2) IC695ETM001: 840 mA @ 3.3V, 614 mA @ 5 V.
 - c. Module shall provide LED indicators for Module status, Backplane transfer status, application status, serial activity status, and error status.
 - d. Configuration Serial Port:
 - 1) MV156-MNETR:
 - a) DB-9M PC compatible.
 - b) RS-232.
 - c) Hardware handshaking.
 - 2) IC695ETM001:
 - a) Configuration across backplane. IP address can be set using SETIP utility over the network.
 - e. Application Serial Port:
 - 1) MV156-MNETR:
 - a) DB-9M PC compatible.
 - b) RS-232.
 - 2) IC695ETM001 – used to access Station Manager:
 - a) RJ-45.
 - b) RS-232.
- B. MODBUS RTU communication gateway: the module allows serial MODBUS RTU to communicate and interoperates with MODBUS TCP/IP based controllers.
1. Manufacturer:
 - a. General Electric (GE), Multinet, or equal.
 2. Ethernet:
 - a. Protocol: Modbus TCP/IP.
 3. RS485 ports:
 - a. RS485 2-wire, half duplex, isolated.
 - b. Baud Rate: 300 bps to 115.2 Kbps.
 - c. Protocol: ModBus RTU.
 4. Power: 120 VAC, 60 Hz.
- C. MODBUS Master/Slave Communication Module allows Allen-Bradley ControlLogix processors to easily interface with other Modbus protocol compatible devices.
1. Manufacturer shall be Prosoft Technology MVI56-MCMR or GE Fanuc IC695CMM002, no equal.
 2. The MVI56-MCMR and IC695CMM002/004 reduces network congestion and is ideal for remote rack locations.
 3. The module shall support for the storage and transfer of up to 5,000-word registers to/from the PLC processor's data files.
 4. Protocol: RTU.
 5. Single slot - 1756 or Rx3i chassis compatible - local or remote rack.
 6. Backplane current load: 800 mA at 5 V.

7. LED Indicators:
 - a. Module status.
 - b. Backplane transfer status.
 - c. Application status.
 - d. Serial activity and error LED status.
 8. Configuration Serial Port:
 - a. DB-9M PC compatible.
 - b. RS-232.
 - c. Hardware handshaking.
 - d. Configuration serial port not applicable for GE Fanuc. Configuration done via the programming software.
 9. Application Serial ports (PRT1, PRT2):
 - a. Application port to DB-9M PC Compatible connector is supplied.
 - b. RS232/422/485 jumper selectable.
 - c. RS232 handshaking configurable.
 - d. For GE Fanuc, Application serial ports are RJ-45; configurable for RS232/422/485 via programming software.
- D. ControlNet/Fiber Optic Communication Converters:
1. Manufacturer: Phoenix Digital - no equal.
 - a. P/N OCX-CTN-13-D-ST-XX or OCX-ETH-13-D-ST-XX/OCX-ETH-13-P-D-ST-XX suggested, to be confirmed by vendor and approved by the ENGINEER.
 - b. They shall utilize rack mount and/or panel installation, ~~plugs~~ works directly ~~into~~ with Allen-Bradley 1756 or GE Fanuc RX7i/Rx3i system chassis - Single Slot or panel mount.
 - c. Use ST Mating Connector.
 - d. Operating temperature range of 0 to 60 degrees C (32 to 140 degrees F).
 - e. 1.5 to 1.8 Amps, 5VDC typical power usage.
 - f. Real Time Diagnostic Option, Required for UL rating.
 - g. Functions at up to 10 km apart in multimode operation (1,300 nm wavelength).
 - h. Multimode fiber optic cable, Wavelength: 1,300.
 - i. UL Listed for Class 1, Division 2 Groups A, B, C, and D Hazardous Locations.

2.08 ETHERNET/FIBER OPTIC COMMUNICATION SWITCHES

- A. They shall be modular standalone industrial switches for Din-Rail, panel or Rack mount installation. Switches shall be plug and play devices. No configuration is required. Each port is automatically set for maximum speed and performance. In addition, each twisted pair port has an Auto MDIX feature, eliminating the need for crossover cables. LEDs are provided to display the link status and activity of each port as well as power on/off status.
 1. Level II Ethernet Managed Industrial Ethernet Switch.
 2. Incorporates store and forward architecture.
 3. Operating temperature range of -20 degrees C to 70 degrees C.
 4. Can utilize redundant Power Supplies 24VDC (10 to 30 VDC).
 5. Electrostatic Discharge Over voltage protection on all ports.
 6. Functions at up to 2 km apart in multimode operation.
 7. Functions at up to 15 km, 40 km, or 80 km apart; single mode operation.

8. Wavelength: 1,300 or 850 nanometers to be consistent with existing equipment.
 9. Full IEEE 802.3 Compliance.
 10. TUV Certified.
 11. Function in star, tree, backbone or redundancy network Topologies.
 12. The process network will use a star topology.
 13. UL Listed for Class 1 Division 2 Groups A, B, C, D, T4A Hazardous locations.
 14. Support for Full/Half Duplex operation.
- B. The switch located at the Operations center that is dedicated to the Electrical Control System (ECS) and the switch located in VCP-33A shall be: N-Tron 305FX, Phoenix Contact Factory Line SFN 4TX/FX, Hirschmann MS 2/30 or equal.
1. At a minimum four 10/100Base TX ports.
 2. At a minimum one 100Base FX ports, ST connectors.
 3. Network media:
 - a. 10Base T.
 - b. 100Base TX.
 - c. 100Base FX.

2.09 OPERATOR INTERFACE PANEL (OIP)

- A. Manufacturer:
1. Allen-Bradley.
 2. GE Fanuc.
 3. Xycom Automation, Inc.
- B. OIP shall be 15-inch Color Active Matrix TFT Flat Panel Display and provide a touch screen with resistive antiglare.
- C. OIP shall be a high performance; Pentium 4, 2.0-GHz processor with 512-MB DDR RAM and 40-GB hard drive.
- D. OIP shall come standard with an extensive array I/O ports; three serial ports, one parallel port, two USB ports, PS/2 mouse and keyboard ports, one 10/100-Mbps Ethernet port, one VGA port, Audio line in/line out, and Microphone.
- E. OIP shall be provided with side accessible 1.44-MB floppy drive and CD/DVD-R/W.
- F. OIP shall be preloaded with Window XP or other operating system that is compatible with the Intellution Fix 32 application software.
- G. OIP shall be preloaded with the Intellution Fix 32 software.

2.10 PC FOR WORK STATIONS

- A. Manufacture: one of following or equal:
1. DELL, Precision 390.
 2. Hewlett-Packard.

- B. System:
 - 1. Processor: Intel Core 2 Duo E6300 1.86GHz/1,066MHz/2MB L2/Dual-core/VT.
 - 2. Operating System: Genuine Window XP Professional, SP2 with Media, or most recent version of Windows for workstation applications that is compatible with the software to be installed.
 - 3. Memory: 2GB, 667MHz, DDR2 SDRAM Memory, ECC (2 DIMMS).
 - 4. Keyboard: Entry level, USB, no Hot Keys.
 - 5. Mouse: USB 2-Button Optical Mouse with Scroll.
 - 6. Hard Drive Configuration: Non-RAID, 1 drive total configuration 250GB SATA, 3.0GB/s with NCQ and 8MB DataBurst Cache.
 - 7. CD-ROM, DVD, and Read-Write Devices: 16XDVD and 16XDVD+/-RW.
 - 8. Floppy Drive and Media Card Reader: Internal USB Media card reader.

- C. Multi-Media:
 - 1. Graphics Card: 128MB PCIe x16 nVidia Quadro FX550, or FX560, or equal.
 - 2. Monitors: 21-inch Flat Panel.

- D. Internet/Networking:
 - 1. Modem: Data/Fax PCI Modem.
 - 2. Second Ethernet Controller: Broadcom NetXtreme 10/100/1000 Gigabit Ethernet controller-PCI Express card.

- E. Software:
 - 1. PC shall be preloaded with the Intellution Fix 32 software.

- F. Local UPS/Power Protection:
 - 1. Provide Individual UPS for each PC Provided.
 - 2. Refer to specification section 13427 for UPS specification.

2.11 APPLICATION SOFTWARE

- A. Application software shall be of the same or **no** less than two revisions earlier than that used by the DISTRICT unless approved by the ENGINEER.

- B. Programming will conform to the Electrical Control Strategies as described in Section 16346 and Section 16213 unless otherwise approved by the ENGINEER.

- C. SCADA programming for monitoring, alarming, data collection, and supervision to support the above-mentioned PLC programming and will follow the requirements of the Section 16346 and Section 16213 unless otherwise approved by the ENGINEER.

- D. A hard copy of all PLC programming complete with documentation to include instruction comments, rung comments, analog I/O, dip switch settings and rack configurations shall be provided by the programmer.

- E. A hard copy of all SCADA programming complete with documentation to include TAG comments, analog scaling, communications configuration, dip switch settings, screen printouts, and any specialty subroutine programming shall be provided by the programmer.
- F. Magnetic or optical media for all PLC and SCADA programming and configuration shall be provided by the programmer.

2.12 UPS FOR ELECTRICAL CONTROL SYSTEM PANELS

- A. UPS for ECS Panels shall conform to Specification Section 16268A.
- B. All available alarms from UPS in each panel shall be wired to the ECS PLC.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install the PLC and I/O hardware in accordance with the PLC manufacturer's instructions and recommendations, including grounding specifications.
- B. Non-isolated analog signals leaving a building or entering a building from an outside source shall require isolation.
- C. Interposing relays will isolate all PLC outputs.
- D. Empty slot fillers (1756-N2 or IC698ACC735/IC694ACC310) to protect the I/O chassis from contaminants shall be provided.

3.02 CONTRACTOR'S FIELD QUALITY CONTROL

- A. Perform conducted susceptibility (RFI, EMI) test as outlined in NEMA ICS 2-230, NEMA ICS 3-304-42, Section 2 of IEEE 472-1974 and ANSI C37.90A-1974.

3.03 SERVICES

- A. Modify existing panels to add all hardware as required to provide the functionality as described in Section 16346 and Section 16213. All signals will be wired to terminal blocks and identified on the Drawings.
- B. 10 days for control system and loop acceptance testing, modification, and startup assistance in coordination with vendor. It is assumed that this will take place on no more than two trips. If additional trips are required, they will be charged at our normal per diem rates for labor and travel.
- C. On-site training will consist of 8 hours for operators and 8 hours for control technicians. Note: No factory training has been included.

3.04 ACCEPTANCE TESTING

- A. All basic functions shall be demonstrated, including I/O processing, communications, alarm handling, operator display functions, and alarm logging, as well as the specific functions listed herein.
 - 1. Hardware Test: The test shall demonstrate proper operation of each hardware device and communications among devices, and shall include verification of selected analog and discrete inputs and outputs.
 - 2. Software Test: All system software routines resulting from the electrical control descriptions as described per Section 16346 and Section 16213 shall be demonstrated by vendor. Software "patches" or changes to bypass failed or flawed modules during the test will not be acceptable.
 - 3. Acceptable testing shall be preformed in accordance with Section 16346 and Section 16213.

END OF SECTION

