SECTION I1

SELLER FURNISHED PROGRAMMABLE LOGIC CONTROLLERS

1. GENERAL: This Section details the requirements for Seller furnished programmable logic controllers (PLC) supplied with Seller furnished Equipment when specified.
2. PROGRAMMABLE LOGIC CONTROLLER SELECTION: An Allen-Bradley ControlLogix PLC shall be used on all Seller furnished Equipment. The 1756-L7x series PLCs shall be utilized. An Allen-Bradley CompactLogix 1769-L35E PLC may be allowed on systems with less than 100 I/O points and do not require any communication interface with plant systems. Use of the Compactlogix will be only with Engineer Approval. Engineer Note: CompactLogix is acceptable as long as redundant PLCs are not required, Communication will be either Ethernet or Modbus, no GPS time sync is required, or any other special condition required by the Contract.
3. PLC SYSTEM CONFIGURATION: This Article covers the PLC System/Rack configuration to be used on all Seller furnished Equipment.
   1. Rack Power supplies shall be sized so that no more than 60% of the available current of the power supply is utilized. Rack mounted power supplies shall be 1756 series and be rated with the proper incoming voltage. The 1756-PA75 power supply with 120VAC input shall be utilized when no specific input voltage requirements are provided.
   2. PLC Chassis shall be selected to provide a minimum of 20% spare Slots available. The 1756-Ax series chassis shall be utilized,(1756-A7 chassis) with seven (7) Slots shall be the minimum size utilized. PLC chassis mounting and grounding in the control panel shall follow Allen-Bradley requirements provided with the installation instructions.
   3. The PLC Controller shall be mounted in the furthest Slot to the left (Slot 0). Reference Figure 1 for typical rack configuration.
   4. A minimum of one (1) Ethernet card shall be provided with every PLC system. A 1756-EN2T shall be utilized. If the utilized bandwidth of any module exceeds 75% an additional Ethernet card shall be provided. Ethernet cards shall be mounted in the rack next to the PLC controller (e.g. Slot 1). Reference Figure 1 for typical rack configuration. Engineer Note: If CompactLogix is used the L32E and L35E models have built-in Ethernet modules.
   5. When Modbus protocol is required for communication to the DCS system, redundant PROSOFT modules shall be provided. The MVI56E-MNET module shall be utilized. The Modbus cards shall be mounted in the rack next to the Ethernet cards (e.g. Slots 3 & 4). A dedicated Ethernet switch with two (2) 100BaseFX ports shall be provided for the Modbus network (N-Tron 308FX2 or Engineer approved equal). Reference Figure 1 for typical rack configuration. Engineer Note: If communication is going to be via Ethernet not Modbus this section does not apply. If redundant modules are not required in the Contract then remove the redundant requirement. Preferred method is Allen-Bradley Ethernet using Emerson ELC module. Emerson is also able to communicate via Ethernet if MAP PLC/SLC Messaging is used in the PLC. For other DCS manufacturers verify their capability to communicate to Allen-Bradley PLCs. The 308FX2 is unmanaged. Verify any NERC/CIP requirements for managed switches. Consider N-Tron 708FX2
   6. Analog modules shall be installed in the same rack with the controller when possible. The 1756 series analog modules shall be utilized. All analog points shall be wired to terminals for field wiring, including spare points. A dedicated shield terminal shall be provided for each analog point and connected to the instrument ground bus. A minimum of 20% spare points of each type included in the panel shall be provided. Reference Figure 1 for typical rack configuration.
   7. Temperature modules shall be installed in the same rack with the controller when possible. Wiring from temperature devices should wire directly to the card to reduce any noise or signal loss from terminals. The 1756 series temperature modules shall be utilized. A minimum of 20% spare points of each type included in the panel shall be provided. Reference Figure 1 for typical rack configuration.
   8. Digital modules shall have a minimum of 16 points per module. Use of 32 point modules shall be only with Engineer Approval. All digital points shall be wired to terminals for field wiring, including spare points. A minimum of 20% spare wired points of each type shall be provided.
   9. All spare Slots shall have Slot covers installed. The 1756-N2 Slot filler module shall be utilized. A minimum of 20% spare Slots shall be provided for future expansion.
   10. When multiple chassis’ are needed, communications to the remote racks shall be done by either Ethernet or ControlNet. The communication module mounted in remote racks shall be installed in the furthest Slot to the left (Slot 0). Reference Figure 1 for typical rack configuration.

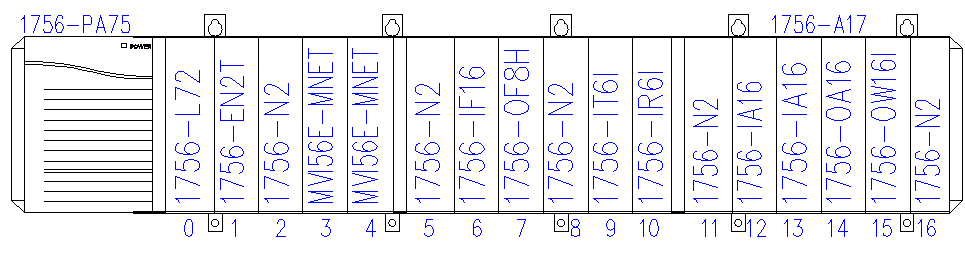


Figure 1: Typical PLC Rack Configuration

1. ETHERNET SWITCH: An Ethernet switch shall be provided for each Ethernet card in the system. The switches port configuration shall have a minimum of two (2) 100BaseTX ports available as spare ports for user programming. Each switch shall also have two (2) 100BaseFX Fiber ports available for connection to the plant network. Each switch provided shall have a minimum of six (6) 10/100BaseTX ports & two (2) 100BaseFX ports (N-Tron Model 308FX2 or Engineer approved equal). A Fiber Optic Patch Panel (Corning Model SPH-01P with CCH-CP12-15T connector panel insert) shall be provided in each PLC panel. Fiber optic patch cords shall be provided for connection of the patch panel to the switches. Engineer Note: Consider any NERC-CIP requirements if applicable in Contract.
2. REDUNDANT PLC CONFIGURATION: On systems that require redundant PLC controllers, the ControlLogix 1756-L7x PLCs must be used, CompactLogix does not support redundancy. Rack configuration for a redundant PLC system requires that each PLC be mounted in a separate chassis with a separate power supply. A 1756-A7 seven (7) Slot chassis shall be used for each PLC rack. Each rack shall have the communication cards configured identically and installed in the same Slots. A 1756-RM2 module shall be installed in Slot 6 of each PLC rack and connected directly with fiber optic cable. When using redundant PLCs, all modules except the main Ethernet card, ControlNet Card, PLC, processor and redundancy modules should be mounted in a remote rack.
   1. When redundant PLCs are used, at a minimum there shall be one (1) remote rack that is a 1756-A7 (or larger) chassis. The remote racks shall communicate with the redundant PLC network via redundant Ethernet using 1756-EN2TR modules. This module shall be mounted in Slot 0 of the remote rack. The remote rack shall have a minimum of 20% spare Slots available for future use.
   2. When using a redundant processor configuration, Allen-Bradley Publication 1756-UM523F-EN-P should be used as a reference to ensure proper configuration.
3. GPS TIME SYCHRONIZATION: When the PLC is required to be synchronized to a GPS time clock signal, a 1756HP-TIME module shall be used to allow connection from a provided IRIG-B signal. This module shall be located in the same chassis as the processor when possible. If a redundant PLC configuration is being used, the GPS module shall be installed in the remote rack, mounting in the processor racks is not allowed. Engineer Note: If not an Contract requirement GPS time synchronization to the PLC system is typically not required.
4. PROGRAMMING: This Article covers programming rules and guidelines that shall be followed on programming of Seller furnished Equipment.
   1. All PLC programming shall be done using Ladder Logic format. Sequential Function Chart, Structured Text, and Function Block Diagram formatting shall not be used without approval.
   2. Programs shall be written so that individual processes, equipment, etc. are in separate ladder routines. Areas or systems shall be divided into separate programs.
   3. Programs shall be fully annotated with descriptions, rung comments, etc. to provide full documentation of the program.
   4. No programs or any part of a program shall be password protected or locked to prevent access to logic diagrams.
   5. Each program within a PLC shall have a separate routine for mapping inputs that is called first in the scan before sequence logic is scanned. This routine shall map the raw inputs to a descriptive controller tag. The controller tag shall be used in the sequence logic, the raw input points (e.g. Local:8:I:Data.0) shall not be used except in the map inputs routine.
   6. Each program within a PLC shall have a separate routine for mapping outputs that is called last in the scan after sequence logic is scanned. This routine shall map a descriptive controller tag to the raw outputs. The controller tag shall be used in the sequence logic, the raw output points (e.g. Local:9:O:Data.0) shall not be used except in the map outputs routine.
   7. User Defined Datatypes (UDT) shall be utilized to the maximum extent possible to allow for a structured controller tag database. Individual processes, equipment, etc. should have a UDT developed to reduce the number of controller tags and to keep tag naming conventions the same between common devices.
   8. When multiple rungs of logic are repeatable for multiple devices an Add-On Instruction shall be used to simplify the main sequence logic and reduce file size and memory usage.
   9. For “Fail In Place” 2-position devices (e.g. valves or dampers), device shall be programmed to require positive logic to change its state, not merely the absence of the opposite command (e.g. if not commanding a valve to open then command the valve to close). Devices shall also not change state from the fail-safe position solely on initialization of the controller.
   10. Programs shall be submitted for a 30% review and a 70% review. At the 30% review the program should have the program/routine file structure, controller tags, UDTs, and Add-On Instructions that are planning to be used. The IO configuration tree shall also be included in the 30% review submittal. At 70% review the program shall have sequence logic for at least one type of each equipment or systems. Duplicate systems can be added after the 70% review. Alarm structure shall be included in the 70% review logic.
   11. PLCs shall have a minimum of 50% spare memory available at completion of software Factory Acceptance Test (FAT) and/or program 100% approval and shipment of equipment to site.
   12. Rockwell Software RSLogix5000 software shall be used for all programming. Software revisions need to be approved by Engineer before any programming commences.
   13. Seller shall provide one (1) license of RSLogix5000 software at the same revision level of the provided PLC programming.
   14. Any programming software shall require a second step verification whenever attempting to download to the controller or transition between offline and online modes.
   15. Mapping of data using PLC5 messaging shall be included when needed for communication with other systems.
   16. A software Factory Acceptance Test (FAT) shall be performed with the Engineer to ensure proper system function and to verify all datalinks are programmed correctly to pass data to the DCS system. An FAT report including all AS BUILT datalink mapping shall be provided prior to shipment of equipment.
   17. Technical Field Assistance personnel should be experienced and qualified to validate and test datalinks with the DCS system. The TFA person should have any software needed for validation. The seller shall submit a resume for approval.
5. HUMAN MACHINE INTERFACE (HMI): This Article covers HMI selection, sizing, and programming for Seller furnished Equipment.
   1. HMI panels shall be Allen-Bradley Panelview Plus series 6 or higher.
   2. HMI graphics shall follow standard Power color conventions (e.g. stopped or open is green, running or closed is red).
   3. HMI panels shall be touchscreen with proper NEMA rating for the environment installed. If HMI is outdoors it shall have a sunshield provided. HMI panels shall be mounted at a height no less than 54” from ground level and no higher than 72” from ground level.
   4. HMI panels shall be color screens and have a minimum size of 12”. Engineer note: If not an Contract requirement the screen size can be determined as acceptable by the project group. Example: Most air compressors have a 6” HMI which is adequate, the added expense for a 12” screen is not necessary.
   5. HMI communication to the PLC shall be by Ethernet.
   6. HMI graphic and alarm screens shall be submitted for a 30% review and a 70% review. At the 30% review the general structure, background, header information and navigation menu shall be submitted before screen development begins. At 70% review all screens with graphics shall be submitted for review. Duplicate screens and tagging can be completed after the 70% review and prior to FAT.
   7. Rockwell Software FactoryTalkView Studio shall be used for HMI development. Software revisions must be approved by Engineer before any development commences.
   8. When Remote mounted HMI workstations are required, they shall be a windows-based computer with Windows 7 Pro 64 bit software installed. As a minimum, each workstation shall include a 20” flat panel color LCD, keyboard, mouse, speakers, and network interface card(s). The Seller shall provide all of the necessary hardware to connect the remote HMI to the PLC.

END OF SECTION