

## PROCUREMENT SPECIFICATION

# Programmable Logic Controllers Micro850

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## SECTION XX XX XX

### PROGRAMMABLE LOGIC CONTROLLER

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. The Programmable Logic Controllers (PLC) shall meet the criteria of this specification for control of process equipment, machinery, and systems.

##### 1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract apply to this section.
- B. The following sections contain requirements that relate to this section:
  - 1. Section 40 90 00 – Process Control System General Requirements
  - 2. Section 40 95 13 – Process Control Panels and Hardware
  - 3. Section 01 33 00 – Submittal Procedures
  - 4. Section \_\_\_\_\_

##### 1.03 REFERENCES

- A. The PLC shall be listed or recognized by the following registrations:
  - 1. cULus Listed
  - 2. CE marked
  - 3. RCM/C-Tick marked
  - 4. Suitable for operation in Class 1 Division 2, Groups A, B, C, and D hazardous locations
- B. The PLC shall meet Institute of Electrical and Electronics Engineers, Inc. (IEEE) applicable standards.

##### 1.04 SUBMITTALS

- A. As specified in Section 01 33 00.
- B. The supplier shall provide product data for the PLC and any component equipment, including:
  - 1. Central Processing Unit (CPU) information
    - a) Memory
    - b) Input/Output (I/O) capacity
    - c) Nonvolatile program and data retention
  - 2. I/O Modules information
    - a) Type and rating
    - b) Standard wiring diagram
  - 3. Bill of materials for supplied equipment
  - 4. Spare parts list

### 1.05 QUALITY ASSURANCE

- A. The supplier shall provide PLC system components by a single manufacturer:
  - 1. Only communication modules for communication or network media functions that are not provided by the PLC manufacturer may be produced by third-party sources.
  - 2. Only PLC manufacturer-approved hardware, including cables, mounting hardware, connectors, enclosures, racks, communication cables, splitters, terminators, and taps, may be used.
- B. All PLC system components shall be new, free from defects, and produced by manufacturers regularly engaged in the manufacture of these products.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. The supplier shall deliver PLC components in packaging designed to prevent damage from static electricity and physical damage.
- B. The supplier shall store the equipment according to manufacturer requirements and in a clean and dry space at an ambient temperature range of -40 °C to 85 °C (-40 °F to 185 °F).
- C. The supplier shall protect the units from exposure to dirt, water, fumes, corrosive substances, and physical damage.

### 1.07 WARRANTY

- A. The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
- B. This warranty applies to PLCs.

### 1.08 MAINTENANCE

- A. As specified in Section 40 61 00.
- B. Provisions shall meet the following installed-spare requirements:
  - 1. I/O points – 25 percent spare I/O capacity for each type of I/O signal at every PLC and remote I/O location. All spare I/O shall be wired to field terminal blocks.
  - 2. PLC backplane – the greater of:
    - a) 25 percent spare capacity, or
    - b) 3 spare backplane slots.
  - 3. PLC memory – 50 percent spare program volatile memory.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Allen-Bradley – Micro850 Programmable Logic Controller (No substitutions)

## 2.02 CONSTRUCTION

- A. The programmable logic controller (PLC) shall be an embedded I/O design, with I/O expansion capability.
  - 1. A single chassis shall house CPU, memory, embedded I/O circuitry, communications, I/O expansion slot, and power supply.
  - 2. The PLC shall be designed to operate in an industrial environment with an ambient temperature of -20 °C to 65 °C (-4 °F to 149 °F) and with a relative humidity range of 5% to 95%, non-condensing.
  - 3. The PLC shall be designed to operate in a free airflow environment (convection cooling only, no fans or other air moving devices shall be required).
  - 4. The PLC shall be designed and tested to operate in high electrical noise environments.
  
- B. The system shall support up to 5 front expansion modules (input/output, discrete or analog, communication, memory backup, trim pot) and 4 side expansion I/O modules (input/output, discrete or analog) for a total of up to 132 discrete I/O.
  - 1. The plug-in and expansion modules shall be front accessible.
  - 2. Isolation shall be between all internal logic and external circuits.
  - 3. Each discrete input and output point shall have a visual indicator to display ON/OFF status.
  - 4. All user wiring to I/O modules shall be through a heavy-duty terminal strip. Pressure-type screw terminals shall be used to provide fast, secure wire connections.

## 2.03 CPU

- A. The CPU shall be a self-contained unit and will be capable of:
  - 1. Providing system timing and scheduling I/O updates.
  - 2. Controlling all I/O scanning and communications service.
  - 3. Performing internal diagnostic checks and providing visual indication by illuminating a “green” indicator when no fault is detected and a “red” indicator when a fault is detected.
  
- B. Programming instructions shall include the following:
  - 1. Relay-Type (bit)
  - 2. Data Comparison (for example: Equal, Greater than or Equal, Less than or Equal)
  - 3. Data Manipulation (for example: Copy, Move)
  - 4. Math (for example: Add, Subtract, Multiply)
  - 5. Program Flow Control
  - 6. Application Specific (for example: PTO Motion)
  - 7. High-Speed Counters
  - 8. High-Speed Pulse Train Output (PTO) and Pulse Width Modulated (PWM)
  - 9. Communication (including EtherNet/IP™, Modbus, ASCII)
  - 10. Proportional Integral and Derivative (PID)
  - 11. Trigonometry
  - 12. Advanced Timing (for example: Read High-Speed Clock, Compute Time Difference)

- C. The system shall be capable of storing the following data:
  - 1. External Output Status
  - 2. External Input Status
  - 3. Timer Values
  - 4. Counter Values
  - 5. Integer Numbers (16-bit, 32-bit)
  - 6. Real Numbers
  - 7. Boolean Data
  - 8. String Data
  - 9. Internal Processor Status Information
- D. Data shall be distinguishable to the CPU by symbolic addressing. Management of the data into memory subsections shall be an automatic function of the CPU operating system.
- E. The CPU's ports shall include:
  - 1. One dedicated serial port which supports RS-232-C and RS-485 signals.
  - 2. One RJ-45 port which supports 10/100 Mbps EtherNet/IP.
  - 3. One USB port.
- F. The CPU shall have a Real Time Clock.

#### 2.04 MEMORY

- A. The program storage medium shall be a solid-state, non-volatile type.
  - 1. The PLC shall be capable of addressing up to a minimum of 20 KB of data.
  - 2. Available user memory shall consist of a minimum of 140 KB of program and data.
- B. Non-volatile memory shall store the operating system, user program, and all user data to protect against memory loss in the case of power loss or system shutdown.
- C. The memory module shall support:
  - 1. The ability to protect selectively multiple areas of user data from being overwritten if/when a download occurs.
  - 2. Automatic program download whenever power is applied.
  - 3. The ability to detect if a fault is present during the power-up sequence and, if a fault is present, download the program that is in the memory module and enter the RUN mode. If a fault is not present, the controller proceeds normally without memory module intervention.

#### 2.05 I/O CIRCUITRY

- A. The manufacturer shall have available a variety of I/O options for the PLC that include:
  - 1. Inputs: 120 VAC, 240 VAC, 24 VDC sink and source, 4-20 mA Analog, 0-10V Analog, RTD, and Thermocouple.

2. Outputs: Relay (some of which shall have individual isolation), 24 VDC, DC source, 4-20 mA Analog, 0-10V Analog, and TRIAC.
  - a) Relay outputs for DC devices which operate with 1A continuous current capacity.
  - b) Relay outputs for AC devices which operate with 2A continuous current capacity.
- B. Inputs shall have adjustable filter time constants to improve input performance in high-speed applications and to limit the effects of voltage transients.

## 2.06 PROGRAMMING ENVIRONMENT

- A. The programming port shall be USB, RS-232, or Ethernet.
- B. The PLC shall be programmable through Connected Components Workbench™ (CCW) software.
- C. The programming software shall run on Windows environments and shall be IEC-61131 compliant:
  1. Programming languages – Ladder, Function Block Diagram, Structured Text
  2. Project Tree navigation
  3. Run mode change
  4. Data Logging
  5. Drag-and-Drop Editing
  6. Diagnostics
  7. Database Editing
  8. Documentation

## 2.07 COMMUNICATION

- A. The PLC's dedicated serial port, which supports RS-232-C and RS-485 signals, shall be capable of local and remote (via modem) programming, troubleshooting, and data manipulation.
- B. The PLC's RJ-45 port, which supports 10/100 Mbps EtherNet/IP, shall be capable of local and remote programming, troubleshooting, and data manipulation.
- C. The PLC's USB port shall support programming, troubleshooting, and data manipulation.
- D. The PLC shall provide a mechanism to set the communication port to a known state manually (factory out-of-box preferred). Systems that do not provide a mechanism to set the communications port to a known state manually are not acceptable.
- E. The PLC shall support direct connection to a modem for remote programming functionality.
- F. The PLC shall support CIP Serial protocol for program upload/download, monitoring, and peer-to-peer (slave-to-slave) communications.
- G. The PLC shall support up to 16 simultaneous EtherNet/IP client and server connections.
- H. The PLC shall support Modbus RTU master and slave communication protocol.
- I. The PLC shall support up to 16 simultaneous Modbus TCP/IP client and server connections.
- J. The PLC shall support up to 8 simultaneous Sockets programming for communication to devices (that do not support EtherNet/IP or Modbus TCP/IP) and data exchange with PCs over Ethernet.

- K. The PLC shall support bi-directional ASCII communications to send initialization strings to a modem, send text with embedded data to a printer or terminal, and receive ASCII from smart scales, bar code devices, etc.
- L. The PLC shall provide the ability to change the RS-232/RS-485 communications port between the out-of-box factory default settings and the user configuration settings. This operation shall be allowed to occur at any time.
- M. The PLC shall support serial port baud rates from 1.2k to 38.4k.

## 2.08 OPERATING POWER

- A. The PLC shall operate in compliance with one of the following types of electrical service:
  - 1. 120/240 VAC, single-phase in power systems that operate on 50/60 Hz. It shall be capable of auto-detect to operate with either of these AC voltages or frequencies without the user needing to jumper or set up the unit.
  - 2. 24 VDC Class 2 SELV.
- B. The onboard power supply shall be capable of supplying all necessary power to all subsystems (CPU, memory, local I/O, etc.) in addition to a minimum of 5 front expansion and 4 side expansion I/O modules, without external wiring.
- C. The power supply shall provide surge protection, isolation, and power outage carryover of at least 1 cycle of the AC line.
- D. In cases where the AC line is especially unstable or subject to unusual variations, it shall be possible to install a constant voltage transformer having a sinusoidal output waveform.
- E. At the time of power-up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages are within specifications.

## 2.09 OPERATING MODES AND DIAGNOSTICS

- A. The main front panel of the PLC shall include the following indicators: Power, Run, Fault, Force, and Comm.
- B. Processor mode shall be selected by a command from a programming device. Available settings shall include modes:
  - 1. RUN – Control program executing.
  - 2. PROGRAM – Controller not executing, user program can be uploaded or downloaded.
  - 3. RUN MODE EDIT and TEST – User can edit the user program while controller is executing. Test edit feature allows the user to test the edit before finalizing the edit in the program.

## 2.10 RATINGS

- A. The PLC shall be able to withstand conducted susceptibility tests as outlined in:
  - 1. ESD Immunity                      EN 61000-4-2  
6 kV contact, 8 kV air



2. Radiated RF Immunity EN 61000-4-3  
10 V/m with 1 kHz sine-wave 80% AM from 80 to 2000 MHz  
10 V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz  
10 V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz  
10 V/m with 1 kHz sine-wave 80% AM from 2000 to 2700 MHz
3. Fast Transient Immunity EN 61000-4-4  
Power Supply, I/O: 2 kV, 5 kHz  
Communications Cable: 1 kV, 5 kHz
4. Surge Transient Immunity EN 61000-4-5  
 $\pm 1$  kV line-line (DM) and  $\pm 2$  kV line-earth (CM) on AC power ports  
 $\pm 1$  kV line-line (DM) and  $\pm 2$  kV line-earth (CM) on signal ports  
 $\pm 1$  kV line-earth (CM) on communication ports
5. Conducted RF Immunity EN 61000-4-6  
10 Vrms with 1 kHz sine-wave 80% AM from 150 kHz to 80 MHz
6. Emissions CISPR 11  
Group 1, Class A

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. The supplier shall verify that jobsite is ready to receive equipment.
- B. The supplier shall verify that the jobsite environment can be maintained during and after installation within the service conditions required by the manufacturer of the programmable logic controller (PLC).

### 3.02 INSTALLATION

- A. Installation shall be in compliance with all manufacturer requirements, instructions, and contract drawings, including:
  1. Space surrounding the PLC to maintain adequate cooling.
  2. Conditioning of space surrounding the PLC enclosure to maintain the manufacturer's ambient temperature and humidity ranges.
  3. Accessibility of PLC diagnostic lights, communication ports, and memory modules – these components shall be free from obstructions at all times.

B. Control Panels

1. As specified in Section 40 95 13 – Process Control Panels and Hardware.
2. The supplier shall provide all required cables and connectors to interface with other control system equipment.
3. The supplier shall ensure that communication media, analog signals, and discrete I/O wiring are properly protected in accordance with manufacturer recommendations.

**END OF SECTION**