MODULE SPECIFICATION

GENERAL REQUIREMENTS

The Programmable Controller Modules (PAC) Modules, Networking Interfacing Modules, Power Supply Modules will be installed on critical propulsion plant applications such as main propulsion boilers, aircraft carrier catapults, and main reduction gear/main engine controls which service 1200 PSIG, 600 PSIG, 150 PSIG, 50 PSIG, and 5 PSIG steam, auxiliary machinery, and fuel pressure control applications. The modules must be extremely reliable to preclude any possibility of safety hazards and malfunction. The power supply modules need to be capable of redundancy and power sharing. The devices are being installed for the sole purpose of **controlling critical processes** and not just for process indication.

Items 0001 through 0055 cover the furnishing of multiple types of PAC Modules, Networking Interfacing Modules, Power Supply Modules, and spare parts. A module is an environmentally self-contained unit with specific functionality that can be assembled with other modules to create a node capable of controlling various processes. Nodes are the assembly of controllers, networking, power supplies, and other functional modules that can execute programs to control a process and interface with outside networks. The modules can have a mixture of digital and analog I/O connections.

All modules to be furnished shall have the ability to be self-mounting to bulkheads and gage boards without the use of second hand enclosures or non off-the-shelf mounts to pass military standards. Module mounting specifications shall be acceptable if they are in accordance with the latest version of Navy shock (MIL-S-901 Navy Grade A) and vibration (MIL-STD-167) requirements. Due to the limited manpower and funding, USN will not spend any time or money to perform such testing. PAC Modules, Networking Interfacing Modules, Power Supply Modules shall be capable of interlocking to each other electrically and mechanically without losing their military specification and environmental rating. The modules' circuit boards will be capable of hot swapping and self-configuring programming from the other modules of the same type in the node circuitry.

All modules shall be sealed enclosures meeting NEMA 4X (full body) specification as a minimum requirement. The multiple types of PAC Modules, Networking Interfacing Modules, and Power Supply Modules shall have a minimum operating temperature range of –20 degree Celsius to 65 degree Celsius.

All items shall be individually packaged using packaging foam for protection from bumps and rugged handling. Individually packaged units may be combined into larger shipping containers for delivery.

0001, 0018, & 0035	Base Configuration A Controller Module (with On-Board PID control)
0002, 0019, & 0036	Base Configuration B Controller Module (with On-Board PID control)
0003, 0020, & 0037	Base Configuration C Controller Module (with On-Board PID control)
0004, 0021, & 0038	Interfacing Module
0005, 0022, & 0039	AC Power Supply Module
0006, 0023, & 0040	DC Power Supply Module
0007, 0024, & 0041	Networking Module
0015, 0032, & 0049	Design Software

0016, 0033, & 0050 Networking Software

0017, 0034, & 0051 Downloading Software

Tests (except for software): All modules must pass the following:

- ✍ IEC IP 67 qualified
- ✍ MIL-STD-461E EMI/EMC qualified (latest revision)
- ✍ MIL-S-901D Navy Grade A shock qualified (latest revision)
- ✍ MIL-STD-167 Navy vibration qualified (latest revision)

Configuration:

- ✍ All controllers must communicate via a Laptop's serial port (USB Port, 9-pin, PCMCIA).
- ✍ All controllers must possess a software interface that must communicate via Windows 2000, and XP operating system on a laptop computer
- ✍ All Modules must be designed to meet the full body NEMA 4X housing specification and must continue to operate at 65°C.
- ✍ The Controller Modules, Networking Modules, Power Supply Modules are to support Hot Swapping of control boards.

SPECIFIC REQUIREMENTS

0001, 0018, & 0035
0002, 0019, & 0036
0003, 0020, & 0037 PAC Modules

1. Controller Capability: The controller shall have a minimum of the following programmable functions. There shall be no limit on the quantity of functions available for use.

Control Functions: proportional/integral/derivative (PID) Controller with selectable components (P, I, D, or any combination of the three), internal and external feedback option, input signal tracking, bumpless transfer, derivative on measure, selectable action (direct/indirect). Lead-Lag Controller with selectable components (lead, lag or both). Set-point track and Hold, Rate Limiting, Auto/Manual Functions

Analog Functions: A minimum of the following analog functions: Switch (2-input), Input Scaling, Output Scaling, Analog Variables/Constants, High/Low Alarm, Characterization (16 point min.), Unit conversion (y=mx+b), Deadband, Timer, Counter, Ramp Profile, Frequency to Analog Conversion, Binary to Analog Converter, Analog to Binary converter, High/Low Signal Selector.

Math Functions: Add, Subtract, Multiply, Divide, Exponential, Root, Absolute Value, Less Than, Greater Than, Equal To, Not Equal To, Less Than or Equal To, Greater Than or Equal To, Natural Logarithmic.

Boolean Functions: Not, And, Nand, Or, Nor, Xor, RS-Flipflop, Multiplexor, Demultiplexor

2. Input/Output Capability

Analog Inputs:

- ✍ Minimum of four (4) inputs for 0001, 0018, & 0035
- ✍ Minimum of two (2) inputs for 0003, 0020, & 0037

Current range supported: 0-20 mA and 4-20 mA
Voltage ranges supported: 0-20V, 0-10V, 0-5V, 1-5V, 0-2.5V, 0-1V, 0-500mV
Resistance ranges supported: 0-100K?
RTD Types supported: 3 Wire, 100? Platinum, 3 wire chemically pure Nickel (American and European Curve).

Thermocouple Inputs supported: Type E, J, K, R, S, or T.

Digital Inputs:
- ✍ Minimum of eight (8) inputs for 0002, 0019, & 0036
- ✍ Minimum of four (4) inputs for 0003, 0020, & 0037

Signal Support: 5VDC, 24VDC
Single–Input Operating mode: on/off, pulse counter, frequency counter
Dual–Input Operating mode: event timer, quadrature decoder

Analog Outputs:
- ✍ Minimum of four (4) outputs for 0001, 0018, & 0035
- ✍ Minimum of two (2) outputs for 0003, 0020, & 0037

Current range supported: 0-20 mA and 4-20 mA
Voltage ranges supported: 0-10V, 0-5V, and 0-1V

Digital Outputs:
- ✍ Minimum of eight (8) outputs (form C electromechanical relays) for 0002, 0019, & 0036
- ✍ Minimum of four (4) outputs (form C electromechanical relays) for 0003, 0020, & 0037

Signal Support: 5VDC, 24VDC
Operating mode: on/off, variable frequency square wave, pulse width modulations

3. Network Capability:

The controller must have network capability to directly connect to the following networks and be capable of communicating with the following defacto standard protocols:
TCP/IP and UDP/IP over Ethernet.
Meets the requirements for RS485, a multi-point communications network

4. Operator Interface Capability:

Controller must be equipped with a visual display capable of displaying up to 8 Analog variables (4 digit numeric) for 0001, 0018, & 0035, and 8 Discrete variables for 0002, 0019, & 0036 and 4 Analog variables and 4 Discrete variables for 0003, 0020, & 0037.

The digital display must be easily visible and not concealed within an enclosure. The display should be capable of displaying at least 4 floating point valves in the control mode simultaneously with a 4 digit minimum resolution. The selectable variables must include a minimum but not limited to the following: Process Variable (PV) in engineering units, PV%, Set Point (SP) in engineering units, SP %, milliamp (mA) output, millivolt (mV), and mV%

In addition to the selectable variables, it would be beneficial to display PID status, function, and units

Process controller must continue to operate normally if the display experiences either mechanical or electrical failure and ceases to operate.

0005, 0022, & 0039
0006, 0023, & 0040 Power Requirements

- ✍ Input voltage 75-123VAC at 40 to 400Hz for 0005, 0022, & 0039
- ✍ Input voltage 22-30VDC for 0006, 0023, & 0040

minimum of 25W output power
over current protection

0015, 0032, & 0049
0016, 0033, & 0050
0017, 0034, & 0051 Software

The software shall be furnished with a license pursuant to clause 252.227-7015, entitled "Technical Data – Commercial Items (NOV 1995)" of this solicitation. Software and Site license must be available either free of charge for distribution throughout the Naval fleet, or included in the cost of each controller, whereas each controller will be provided with its own software license. The same software and license must also be able to communicate with all units purchased.

Prior to implementation, the government must approve software version changes. Software changes cannot be detrimental to the government.

Software must have graphical interface for process control, tuning, and troubleshooting. This graphical interface must simultaneously display the process variable and manipulated variable in numerical and/or graphical form. PID status and tuning settings must be displayed and the operator must be able to change any of these in this window, live, while the process is ongoing without disruption of the process. This graphical interface must be able to display both the process and manipulated variable in selectable intervals ranging from .5 to 10 minutes. Updates for variables at a rate of 2Hz or faster.

0004, 0021, & 0038 Interfacing Module

Features: Module is to be used to utilize outside devices that the Navy wishes to tie into the controller circuitry, (such as: toggle and on/off switches, indicators, alarms….)

SPARE PARTS

0008, 0025, & 0042 Circuit Card For Base Configuration A Controller Module
The circuit card to be furnished under this item shall be same component used in Items 0001, 0018, 0035.

0009, 0026, & 0043 Circuit Card For Base Configuration B Controller Module
The circuit card to be furnished under this item shall be same component used in Item 0002, 0019, 0036.

0010, 0027, & 0044 Circuit Card For Base Configuration C Controller Module
The circuit board to be furnished under this item shall be same component used in Items 0003, 0020, 0037.

0011, 0028, & 0045 Circuit Card For Interface Module
The display board to be furnished under this item shall be same component used in Item 0004, 0021, 0038.

0012, 0029, & 0046 Circuit Card For AC Power Supply Module
The display board to be furnished under this item shall be same component used in Item 0005, 0022, 0038.

0013, 0030, & 0047 Circuit Card For DC Power Supply Module
The display board to be furnished under this item shall be same component used in Item 0006, 0023, 0039

0014, 0031, & 0048 Circuit Card For Networking Module
The display board to be furnished under this item shall be same component used in Item 0007, 0024, 0040.

LOGISTICS MANAGEMENT INFORMATION (LMI)

0052, 0053

The contractor shall provide Logistics Management Information (LMI) in accordance with the requirements contained in the DD Form 1423, Contract Data Requirements List (CDRL).

Engineering Data For Provisioning (EDFP) is required for all systems or equipment that are acquired for Navy use and for which Provisioning Technical Documentation (PTD) is being acquired. EDFP is the data acquired to support Line Material Item supportability analysis. It is the technical data that provides definitive identification of dimensional, material, mechanical, electrical, or other characteristics adequate for provisioning of the support items of the end article(s) on contract. EDFP consists of but is not limited to data such as specifications, standards, drawings, photographs, sketches and descriptions, and the necessary assembly and general arrangement drawings, schematics, drawings, schematic diagrams, wiring and cable diagrams, etc. This data is necessary for the assignment of Source, Maintenance, and Recoverability (SMR) codes to assignment of Item Management Codes, prevention of proliferation of identical items in the Government inventory, maintenance decisions, and item identification necessary in the assignment of a National Stock Number (NSN).

TECHNICAL MANUALS

0054, 0055

The contractor shall provide Commercial Off-The-Shelf manuals for Items 0001 through 0007.

The manuals will explain the use, operation, calibration procedures, and technical specifications in commercial format for the items as well as preservation, packing, and packaging requirements. There shall also be drawings which include a detailed breakdown of replaceable/repairable parts provided in the manual for logistics support.

TESTING REQUIREMENTS

0056 THROUGH 0061

The contractor shall perform First Article testing of a quantity of one for each module. First Article shall consist of shock and vibration testing and electromagnetic interference testing as the items must meet the latest version of MIL-S-901D Navy Grade A shock specifications, MIL-STD-167 Navy vibration, and MIL-STD-461E EMI/EMC specifications.

Prior to conducting the First Article Test, the contractor shall furnish a First Article Test Procedure for each module. The procedure will demonstrate how the modules will perform as described during the tests. Upon completion of the First Article Test, the contractor shall furnish a First Article Test Report.