
USACE / NAVFAC / AFCEA UFGS-13801 (-TBD- 2003)

Preparing Activity: USACE Superseding
UFGS-13801A (December 2001)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13801

UTILITY MONITORING AND CONTROL SYSTEM (UMCS)

-TBD-/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 System Requirements
 - 1.2.2 Symbols, Definition and Abbreviations
 - 1.2.3 System Units and Accuracy
- 1.3 SUBMITTALS
- 1.4 OPERATION AND MAINTENANCE (O&M) MANUAL
- 1.5 MAINTENANCE AND SERVICE
 - 1.5.1 Work Coordination
 - 1.5.2 Work Control
 - 1.5.3 Working Hours
 - 1.5.4 Equipment Repairs
 - 1.5.5 Replacement, Modernization, Renovation
 - 1.5.6 Access To UMCS Equipment
 - 1.5.7 Records, Logs, and Progress Reports
 - 1.5.7.1 Service Call Reporting Requirements
 - 1.5.7.2 Maintenance Reporting Requirements
 - 1.5.8 Preventive Maintenance Requirements
 - 1.5.8.1 Preventive Maintenance Work Plan
 - 1.5.8.2 Semiannual Maintenance
 - 1.5.8.3 Maintenance Procedures
 - 1.5.9 Service Call Reception
 - 1.5.10 Service Call Work Warranty
 - 1.5.11 System Modifications
 - 1.5.12 Telephone Consultation and Remote Software Service
- 1.6 UMCS Network

PART 2 PRODUCTS

- 2.1 EQUIPMENT REQUIREMENTS
 - 2.1.1 Product Certifications
 - 2.1.2 Product Sourcing
 - 2.1.3 Environmental Requirements
 - 2.1.4 Product Data Sheets
- 2.2 NETWORK HARDWARE

- 2.2.1 Nameplates
- 2.2.2 Building Point of Connection (BPOC) Hardware
 - 2.2.2.1 ANSI-709.3 to IP Router
 - 2.2.2.2 ANSI-709.1 Gateway
- 2.2.3 IP Network Hardware
 - 2.2.3.1 Wire and Cables.
 - 2.2.3.2 Fiber Optic Patch Panel.
 - 2.2.3.3 Fiber Optic Media Converter
 - 2.2.3.4 Ethernet Switch
 - 2.2.3.5 IP Router
- 2.3 COMPUTER HARDWARE
 - 2.3.1 Nameplates
 - 2.3.2 Server Hardware
 - 2.3.3 Workstation Hardware
 - 2.3.4 PRINTERS
 - 2.3.4.1 Alarm Printer
 - 2.3.4.2 Laser Printer
 - 2.3.4.3 Color Printer
- 2.4 COMPUTER SOFTWARE
 - 2.4.1 Operating System (OS)
 - 2.4.2 Office Automation Software
 - 2.4.3 Virus Protection Software
 - 2.4.4 ANSI/EIA-852 Configuration Server
 - 2.4.5 LonWorks Network Configuration Tool
 - 2.4.6 Monitoring and Control (M&C) Software
 - 2.4.6.1 Passwords
 - 2.4.6.2 Protocol Drivers
 - 2.4.6.3 System Graphic Displays
 - 2.4.6.4 Scheduling
 - 2.4.6.5 Alarms
 - 2.4.6.6 Trending
 - 2.4.6.7 Electrical Power Demand Limiting
 - 2.4.6.8 Demand Limiting with Real-Time Pricing
 - 2.4.6.9 Programming Language
 - 2.4.6.10 Report Generation
- 2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)
- 2.6 RACKS AND ENCLOSURES
 - 2.6.1 Enclosures
 - 2.6.2 Equipment Racks
- 2.7 FACTORY TEST

PART 3 EXECUTION

- 3.1 PROJECT TIMING
- 3.2 DRAWINGS AND CALCULATIONS
 - 3.2.1 Network Bandwidth Usage Calculations
 - 3.2.2 UMCS Contractor Design Drawings
 - 3.2.3 As-Built Drawings
- 3.3 INSTALLATION REQUIREMENTS
 - 3.3.1 Installation
 - 3.3.1.1 Isolation, Penetrations of Buildings and Clearance from Equipment
- 3.4 INSTALLATION OF EQUIPMENT
 - 3.4.1 Wire and Cable Installation
 - 3.4.2 Grounding
 - 3.4.3 Computer Hardware and Software
 - 3.4.3.1 Hardware Installation
 - 3.4.3.2 Software Installation
 - 3.4.4 Network Hardware

- 3.4.5 IP Addresses
- 3.4.6 IP Network Installation
- 3.5 INTEGRATION OF BUILDING LEVEL CONTROLS
 - 3.5.1 Integration of LonWorks (per Section 15951) Systems
 - 3.5.2 Integration of Legacy (not per Section 15951) LonWorks Systems
 - 3.5.3 Integration of Legacy non-LonWorks Systems at Building via Gateway
 - 3.5.4 Integration of Legacy non-LonWorks Systems at M&C Server via Protocol Driver
- 3.6 START-UP AND TESTING
- 3.7 PERFORMANCE VERIFICATION TEST (PVT)
 - 3.7.1 PVT Phase I Procedures
 - 3.7.2 PVT Phase I
 - 3.7.3 PVT Phase II
- 3.8 TRAINING
 - 3.8.1 Training Documentation
 - 3.8.2 Basic Operator Training
 - 3.8.3 Advanced Operator Training
 - 3.8.4 Operator Refresher Training

-- End of Section Table of Contents --

USACE / NAVFAC / AFCESA UFGS-13801 (-TBD- 2003)

Preparing Activity: USACE Superseding
UFGS-13801A (December 2001)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

SECTION 13801

UTILITY MONITORING AND CONTROL SYSTEM (UMCS)
-TBD-/03

NOTE: This guide specification covers the requirements for [statement of section scope].

Comments and suggestions on this guide specification are welcome and may be submitted through the Techinfo website at:
<http://www.hnd.usace.army.mil/techinfo/>

This guide specification uses the English/metric tags only for the determination of which type of units to display on Graphical User Interface displays.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

NOTE: This section will be used in conjunction with Section 16415A ELECTRICAL WORK, INTERIOR; Section 16370A ELECTRICAL DISTRIBUTION SYSTEM, AERIAL; Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND; Section 16721A INTERCOMMUNICATION SYSTEM; Section 15951 DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS; and any other guide specification sections required by this design.

NOTE: If it is necessary to remove a subpart from this document, retain the subpart number, replace the title with the word 'Omitted', and remove the text of the subpart.

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change to the guide specification.

The listed references should not be manually edited except to add new references. References not used in the text will be deleted from this paragraph during the SpecsIntact reference reconciliation process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI X3.154 (1999) Office Machines and Supplies -
Alphanumeric Machines-Keyboard Arrangement
- ANSI/TIA/EIA-568-A (2000) Commercial Building
Telecommunications Cabling Standard
- ANSI/TIA/EIA-606 (1993) Administration Standard for the
Telecommunications Infrastructure of
Commercial Buildings
- ANSI/TIA/EIA-607 (1994) Commercial Building Grounding and
Bonding Requirements for Telecommunications
- ANSI/EIA-709.1B (2002) Control Network Protocol
Specification
- ANSI/EIA-709.3 (1998) Free-Topology Twisted-Pair Channel
Specification
- ANSI/EIA-852 (2001) Tunneling Component Network
Protocols Over Internet Protocol Channels

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

- ASHRAE Handbook (2001) Handbook, Fundamentals

FEDERAL COMMUNICATIONS COMMISSION (FCC)

- FCC EMC (2002) FCC Electromagnetic Compliance
Requirements
- FCC Part 15 (2002) FCC Rules and Regulations Part 15:
Radio Frequency Devices (Volume II)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE 802.1D	(1998) Media Access Control Bridges
IEEE 802.2	(1998) Standards for Local Area Networks: Logical Link Control
IEEE 802.3	(2001) Standards for Local and Metropolitan Area Networks: CSMA/CD Access Method and Physical Layer Specifications

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO OSI Model	Open Systems Interconnection Reference Model
---------------	--

THE INTERNET ENGINEERING TASK FORCE (IETF)

RFC 1812	(1995) Requirements for IP Version 4 Routers
RFC 1918	(1996) Address Allocation for Private Internets
RFC 2030	(1996) Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI
RFC 821	(2001) Simple Mail Transfer Protocol (SMTP)
RFC 792	(1981) Internet Control Message Protocol (ICMP)
RFC 791	(1981) Internet Protocol (IP)
RFC 1112	(1989) Host Extensions for IP Multicasting (IGMP)
RFC 793	(1981) Transmission Control Protocol (TCP)
RFC 768	(1980) User Datagram Protocol (UDP)
RFC 826	(1982) Ethernet Address Resolution Protocol (ARP)
RFC 2784	(2000) Generic Routing Encapsulation (GRE)

THE LONMARK INTEROPERABILITY ASSOCIATION (LIA)

LonMark SNVT List	(2002) LonMark SNVT Master List; Version 11 Revision 2
-------------------	--

LonMark XIF Guide (2001) LonMark External Interface File Reference Guide; Revision 4.0B

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 478 (1984) Information Processing and Business Equipment

UL 1778 (2003) Standard for Uninterruptible Power Supply Equipment

UL 910 (1991) Test Method for Fire and Smoke Characteristics of Electrical and Optical Fiber Cables Used in Air Handling Spaces

UL 916 (2002) Energy Management Equipment

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-HDBK-4 Military Handbook for Metal-Matrix Composites

MIL-STD-2202 (Rev A) Energy Monitoring and Control Systems, Factory Tests

MIL-STD-2203 (Rev A) Energy Monitoring and Control Systems, Performance Verification and Endurance Tests

MIL-STD-454N (1993) Standard General Requirements for Electronic Equipment

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15 Radio Frequency Devices

1.2 SYSTEM DESCRIPTION

NOTE: Designer is to add location and site specific requirements.

The Utility Monitoring and Control System (UMCS) shall perform supervisory control and monitoring of a basewide LonWorks network using

LonWorks Network Services (LNS) as specified and shown. The UMCS shall interface to local LonWorks building controls installed per Section 15951 DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS, as well as existing legacy systems. The UMCS shall maintain the LNS database(s) for the entire network.

1.2.1 System Requirements

The Contractor shall furnish a UMCS in accordance with UL 916 and with the following characteristics:

- a. The UMCS shall include an IP network as shown and specified and shall interface to building level control networks using ANSI-709.1 to IP Routers or IP Routers as specified.
- b. The system shall provide a user interface and shall perform supervisory monitoring and control functions as specified.
- c. All software used by the UMCS shall be licensed to the installation, and shall be provided to the installation as specified.
- d. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the government such that the government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the contractor.
- e. The contractor shall provide sufficient documentation and data, including rights to documentation and data, such that the government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the contractor.
- f. All communication between the UMCS and building networks shall via the ANSI/EIA 709.1B protocol over the IP network in accordance with ANSI/EIA 852.

1.2.2 Symbols, Definition and Abbreviations

Symbols, definitions, and engineering unit abbreviations used in information displays, submittals and reports shall be as shown in the contract drawings. Symbols, definitions and abbreviations not in the contract drawings shall conform at a minimum to IEEE 100 and ASHRAE Handbook, as applicable.

1.2.3 System Units and Accuracy

System displays, print-outs and calculations shall be performed in metric (SI) English (inch-pound) units. Calculations shall have accuracy equal to or exceeding sensor accuracy as specified in Section 15951 DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS. Displays and printouts shall have precision and resolution equal to or exceeding sensor accuracy as specified in Section 15951 DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS.

1.3 SUBMITTALS

NOTE: The submittals included in this guide specification are critical to the implementation of the project. Additional submittals should be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if an additional submittal for the item should be required.

Place a "G" within submittal tags following a submittal item if Government approval for that item is required. Government approval should be required only for items deemed sufficiently critical, complex, or aesthetically significant to merit such action. Note that all submittals included in this guide specification are critical and require government review.

For submittals requiring Government approval, a code of up to three characters within submittal tags may be used following the "G" designation to indicate the approving authority.

Submittal items not designated with a "G" are considered as being for information only.

NOTE: The acquisition of all technical data, data bases and computer software items that are identified herein will be accomplished strictly in accordance with the Federal Acquisition Regulation (FAR) and the Department of Defense Acquisition Regulation Supplement (DOD FARS). Those regulations as well as the Army and Corps of Engineers implementations thereof should also be consulted to ensure that a delivery of critical items of technical data is not inadvertently lost. Specifically, the Rights in Technical Data and Computer Software Clause, DOD FARS 52.227-7013, and the Data Requirements Clause, DOD FAR 52.227-7031, as well as any requisite software licensing agreements will be made a part of the CONTRACT CLAUSES or SPECIAL CONTRACT REQUIREMENTS. In addition, the appropriate DD Form 1423 Contract Data Requirements List, will be filled out for each distinct deliverable data item and made a part of the contract. Where necessary, a DD Form 1664, Data Item Description, will be used to explain and more fully identify the data items listed on the DD Form 1423. It is to be noted that all of these clauses and forms are required to ensure the delivery of the data in question and that such data is obtained with the requisite rights to use by the Government.

Include with the request for proposals a completed

DD Form 1423, Contract Data Requirements List. This form is essential to obtain delivery of all documentation. Each deliverable will be clearly specified, both description and quantity being required.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.

Technical data packages consisting of technical data and computer software (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications shall be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered 'shop drawings' under the Federal Acquisition Regulation (FAR) and shall contain no proprietary information and shall be delivered with unrestricted rights.

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES, the CONTRACT CLAUSES and DD Form 1423 and according to the timing specified in paragraph PROJECT TIMING:

SD-02 Shop Drawings

UMCS Contractor Design Drawings; G, [__]

Draft As-Built Drawings; G, [__]

Final As-Built Drawings; G, [__]

SD-03 Product Data

Product Data Sheets; G, [__]

Copies of all manufacturer catalog cuts and specification sheets for all products (equipment) specified in PART 2 and supplied under this contract shall be submitted. The cuts and specification sheets shall be in a bound, indexed volume organized by equipment type and manufacturer.

Computer Software; G, [__]

Computer software which are specifically identified in this project, and which may be defined/required in other specifications, shall be delivered as a Technical Data Package, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Manuals for all software identified in this project shall be submitted with the software.

SD-05 Design Data

Network Bandwidth Usage Calculations; G, [___]

SD-06 Test Reports

Factory Test Report; G, [___]

The Factory Test Report shall be submitted as a Technical Data Package.

Start-Up and Testing Report; G, [___]

Contractor shall submit a Start-Up and Testing Report certifying that the system has been tested and is functioning properly. The Start-Up and Testing report may be submitted as a Technical Data Package.

PVT Phase I Procedures; G, [___]

PVT Procedures may be submitted as a Technical Data Package.

PVT Phase I Report; G, [___]

PVT Phase I Report may be submitted as a Technical Data Package.

PVT Phase II Report; G, [___]

PVT Phase II Report may be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Preventive Maintenance Work Plan; G, [___]

Basic Operator Training Documentation; G, [___]

Training manuals for Basic Operator Training shall be delivered for each trainee on the Course Attendance List with [2][___] additional copies delivered for archival at the project site.

Advanced Operator Training Documentation; G, [___]

Training manuals for Advanced Operator Training shall be delivered for each trainee on the Course Attendance List with [2][___] additional copies delivered for archival at the project site.

Operator Refresher Training Documentation; G, [___]

Training manuals for Operator Refresher Training shall be delivered for each trainee on the Course Attendance List with [2][___] additional copies delivered for archival at the project site.

Operation and Maintenance (O&M) Manual; G, [___]

Contractor shall prepare and submit [__] bound O&M Manuals[and [___] copies of the manual in PDF format on CD-ROM]. Bound manuals shall be indexed and tabbed.[Manuals in PDF form shall be a single PDF file, or multiple PDF files with a table of contents containing links to the other files.]

1.4 OPERATION AND MAINTENANCE (O&M) MANUAL

The UMCS Operation and Maintenance manual shall include:

- a. HVAC control system sequences of operation.
- b. Procedures for the UMCS system start-up, operation and shut-down.
- c. Final As-Built UMCS system detail drawings.
- d. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.
- e. Qualified service organization list.
- f. Start-Up and Testing Report.
- g. Performance Verification Test (PVT) Procedures and Reports.

1.5 MAINTENANCE AND SERVICE

NOTE: The maintenance and service to be provided by the Contractor for the duration of the IDIQ or maintenance contract is specified in this paragraph. The Maintenance and Service may need to be a separate bid item funded by O&M funds. If the UMCS networking equipment and supporting infrastructure is government furnished equipment, it may be desirable to limit maintenance and service to contractor supplied items.

Requirements should be coordinated with "WARRANTY MANAGEMENT" in Section 01780A CLOSEOUT SUBMITTALS

The Contractor shall provide inspections and associated preventive maintenance, repair, normal and emergency service calls, labor, supervision, tools, materials, software, equipment, transportation, and management necessary, for the UMCS network hardware, computer hardware, computer software, printers, UPS, and other peripherals described in PART 2: PRODUCTS of this specification. This work includes inspection, testing, cleaning, and part or component replacement as specified. Work includes providing necessary preventive and unscheduled maintenance and repairs to keep the UMCS operating as specified, and accepted by the Government, and

other services as specified. Work shall comply with manufacturer's recommendations and industry standards. The Contractor shall provide technical support via telephone during Contractor's regular working hours.

1.5.1 Work Coordination

The Contractor shall schedule and arrange work to cause the least interference with the normal Government business and mission. In those cases where some interference may be essentially unavoidable, the Contractor shall coordinate with the Government to minimize the impact of the interference, inconvenience, equipment downtime, interrupted service and personnel discomfort.

1.5.2 Work Control

a. The Contractor shall implement work control procedures to ensure timely accomplishment of work requirements, as well as to permit tracking of work in progress. The Contractor shall plan and schedule work to ensure material, labor, and equipment are available to complete work requirements within the specified time limits and in conformance with the specifications. Verbal scheduling and status reports shall be provided when requested by the Government. Work shall meet the specified standards, and comply with manufacturer's recommendations and industry standards. The Contractor shall comply with user, local, state and federal standards and applicable building and safety codes.

b. When the Contractor completes work on a system or piece of equipment, that system or piece of equipment shall be free of missing components or defects which would prevent it from functioning as originally intended and designed. Corrective or repair/replacement work shall be completed, including operational checks and cleanup of the job site. Replacements shall conform to the same specifications as the original equipment. During and at completion of work, debris shall not be allowed to spread unnecessarily into adjacent areas nor accumulate in the work area itself. Such debris, excess material, and parts shall be cleaned up and removed at the completion of the job and/or at the end of each day that work is in progress.

1.5.3 Working Hours

Working hours are from [7:30 A.M.][____] to [4:00 P.M.][____] local time Mondays through Fridays except Federal holidays.

1.5.4 Equipment Repairs

Equipment repairs shall be initiated and completed within the following time periods following first notification:

- a) for non-redundant computer server hardware, initiate within 4 hours and complete within 8 hours
- b) for non-redundant computer workstation hardware, initiate within 4 hours and complete within 8 hours
- c) for redundant computer server hardware, initiate within 36 hours and complete within 5 days

d) for redundant computer workstation hardware, initiate within 2 days and complete within 5 days

e) for active network hardware, initiate within 4 hours and complete within 6 hours

f) for cabeling and other passive network hardware, initiate within 16 hours and complete within 5 days.

Repair is the restoration of a piece of equipment, a system, or a facility to such condition that it may be effectively used for its designated purposes. Repair may be overhaul, reprocessing, or replacement of nonfunctional parts or materials that have failed or deteriorated by action of the elements or usage and have not been corrected through maintenance, or replacement of the entire unit or system if beyond economical repair.

1.5.5 Replacement, Modernization, Renovation

The Government may replace, renovate, or install new equipment at Government expense and by means not associated with this contract. Replaced, improved, updated, modernized, or renovated systems and equipment interfaced to the system may be added to the Contractor's maintenance and service effort as a modification.

1.5.6 Access To UMCS Equipment

Access by the Contractor shall be in accordance with the following:

a. The Contractor shall be responsible for coordinating access to facilities and arranging that they be opened and closed during and after the accomplishment of the work effort. The Contractor should allow approximately [15] [___] minutes delay time per access to each security controlled or locked facility. For Contractor access to a controlled facility the Contractor shall contact the Government for assistance. Service calls must be completed within the time limits specified unless the cause of the problem is determined to be in UMCS equipment located within the controlled or locked facility which required a delay to obtain entry, in which case the required response time will be extended by the amount of time access to the controlled facility was denied.

b. The Government may provide keys for access to UMCS equipment where the Government determines such key issuance is appropriate. The Contractor shall establish and implement methods of ensuring that keys issued to the Contractor by the Government are not lost or misplaced, are not used by unauthorized persons, and are not duplicated. The Contractor shall develop procedures covering key control that shall be included in the quality control plan.

1.5.7 Records, Logs, and Progress Reports

The Contractor shall keep records and logs of each task, and shall organize cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for the UMCS. The log shall contain initial analog zero and span calibration values. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been

accomplished for the UMCS.

1.5.7.1 Service Call Reporting Requirements

The Contractor shall complete a service call work authorization form for each service call by close of business on the day when the service is completed.

1.5.7.2 Maintenance Reporting Requirements

The Contractor's progress reports shall include:

- a. Service call work authorization and completion forms (Emergency Service Call) to be delivered weekly.
- b. Service call work authorization and completion forms (Normal Service and Emergency Service Call) to be delivered monthly.
- c. Telephone consultation log to be delivered monthly.

1.5.8 Preventive Maintenance Requirements

The Contractor shall perform maintenance procedures as described below, or more often if required by the equipment manufacturer.

1.5.8.1 Preventive Maintenance Work Plan

NOTE: Designer will delete if not required by the user.

The Contractor shall prepare a Preventive Maintenance Work Plan to schedule all required preventive maintenance. Government approval of the Work Plan shall be obtained as specified in paragraph PROJECT TIMING. The Contractor shall strictly adhere to the approved work plan to facilitate Government verification of work. [If the Contractor finds it necessary to reschedule maintenance, a written request shall be made to the Government detailing the reasons for the proposed change at least five days prior to the originally scheduled date. Scheduled dates shall be changed only with the prior written approval of the Government.]

1.5.8.2 Semiannual Maintenance

- a. Clean Computer Hardware.
- b. Run system diagnostics and correct diagnosed problems.
- c. Perform fan checks and filter changes for UMCS hardware.
- d. Perform all necessary adjustments on printers.
- e. Resolve all outstanding problems.
- f. Install new ribbons, ink cartridges and toner cartridges into printers, and ensure that there is at least one spare ribbon or

cartridge located at each printer.

1.5.8.3 Maintenance Procedures

a. Maintenance Coordination: Any maintenance event that results in component downtime shall be coordinated with the Government as follows:

(1) for non-redundant computer server hardware, provide 14 days notice, components shall be off-line for no more than 8 hours

(2) for non-redundant computer workstation hardware, provide 7 days notice, components shall be off-line for no more than 8 hours

(3) for redundant computer server hardware, provide 7 days notice, components shall be off-line for no more than 36 hours

(4) for redundant computer workstation hardware, provide 4 days notice, components shall be off-line for no more than 48 hours

(5) for active network hardware, provide 14 days notice, components shall be off-line for no more than 6 hours

(6) for cabling and other passive network hardware, provide 21 days notice, components shall be off-line for no more than 12 hours.

b. Computer Workstations and Servers: The Contractor shall run utilities to verify the structure and consistency of the hard disk file systems, performed on each disk. The Contractor shall perform a complete backup of the system prior to running diagnostics; this backup shall be performed with the system online.

c. Printer: Printer maintenance shall include required lubrication and cleaning of the printing mechanism and the cleaning of the case, replacement of the ribbon or printing cartridge, complete testing and documentation. All work and material which is necessary for the printer to function properly shall be provided.

d. Software/Firmware: Software/firmware maintenance shall include operating systems, application programs, and files required for the proper operation of the UMCS regardless of storage medium. User developed software is not covered by this contract, except that the UMCS software/firmware must be maintained to allow user creation, modification, deletion, and proper execution of such user-developed software as specified. Software/firmware must be maintained to fully perform functions as specified in the manufacturer's documentation. The Contractor shall perform diagnostics and corrective reprogramming as required to maintain total UMCS operations as specified. The Contractor shall back up software before performing any computer hardware and software maintenance. In order to maintain the software/firmware in accordance with the requirements of this contract, the Contractor may provide and install software/firmware updates at the Contractor's expense upon obtaining written approval from the Government. Software/firmware updates and other modifications shall not degrade the performance or decrease the functionality of any part of the UMCS, and shall be provided with the same Rights in Technical Data and Computer Software as the original software/firmware. Documentation and magnetic

media shall be modified to reflect the updates and modifications. The Contractor shall not modify any database parameters without approval from the Government. Any approved changes and additions to the database shall be properly documented, and the appropriate manuals shall be updated.

NOTE: Network maintenance should only be required for contractor furnished networks. If using a Government furnished network delete the requirement.

- [e. Network: Network maintenance shall include testing transmission media and equipment to verify signal levels, system data rates, errors and overall system performance.]

1.5.9 Service Call Reception

NOTE: Designer should coordinate with the project site to determine if they want the contractor to be responsible for answering service calls only during working hours or 24-7.

- a. The Contractor shall have procedures for receiving and responding to service calls [24 hours per day, seven days a week, including weekends and holidays][during regular working hours]. A single telephone number shall be provided by the Contractor for receipt of service calls during regular working hours.[For service calls after regular working hours, the Contractor may provide a calling list of no more than three telephone numbers; the Contractor may alternatively provide a pager telephone number.]Telephone calls shall be answered within [30 seconds][___], or pager calls returned within [10 minutes][___], by an individual fully familiar with the maintenance and service procedures. Service calls shall be considered received by the Contractor at the time and date the telephone call is placed by the authorized Government representative.
- b. The Contractor shall separately record each service call request, as received. The form shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. The Contractor shall complete a service call work authorization form for each service call.
- c. The Contractor shall respond to each service call request within [two][___] working hours. The status of any item of work must be provided within [four][___] hours of the inquiry during regular working hours, and within [16][___] hours after regular working hours. Response time is defined as the time allowed the Contractor after initial notification of a work requirement to be physically on the premises at the work site with appropriate tools, equipment, and materials, ready to perform the work

required.

- d. A Government representative will advise the Contractor by phone or in person of all maintenance and service requests, as well as the classification of each based on the definitions specified. A description of the problem or requested work, date and time notified, location, classification, and other appropriate information will be placed on a Service Call Work Authorization Form by the Government and made available for pickup by the Contractor, or sent via fax to the Contractor by 12 noon the following Government workday.

1.5.10 Service Call Work Warranty

The Contractor shall provide a [1 year][___] unconditional warranty on service call work. The warranty shall include labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition. In the event that Contractor service call work causes damage to additional equipment, the Contractor shall be liable for labor and material to restore the system to full operation. Contractor response to service call warranty work shall be the same as required by the initial service call.

1.5.11 System Modifications

The Contractor shall make recommendations for system modification in writing to the Government. No system modifications shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. The Contractor shall make available to the Government operating and application software updates during the life of this contract. The Government will notify the Contractor if the updates can be installed. Maintenance releases of the UMCS system software shall be provided at no additional cost to the Government. These updates shall be accomplished in a timely manner, fully coordinated with the Government, and shall be incorporated into the operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the contract period, at which time the Contractor shall make available the latest released version of the Contractor's software, and shall install and validate it upon approval by the Government.

1.5.12 Telephone Consultation and Remote Software Service

The Contractor shall provide up to [48][___] hours per year of telephone consultation to Government personnel. The Government will initiate telephone consultation calls during regular working hours for the purposes of identifying and resolving apparent operational problems with the UMCS. The Contractor shall provide personnel fully familiar with the subject matter of the Government initiated call. Approximately 60% of telephone consultation will require a skill level equivalent to a system analyst, and approximately 40% of the telephone consultation will require a skill level equivalent to a computer programmer. The Contractor shall keep a log of the dates, times, names of Government personnel, and duration of each call, and shall advise the designated Government personnel when more than 4 hours of consultation time has been expended in any month. The Contractor shall not provide over 4 hours of consultation per month without authorization from the Government. The Contractor shall submit a copy of the log to the Government each month.

1.6 UMCS Network

NOTE: The designer must decide if the UMCS network is Government furnished or is to be installed by the contractor. If it is to be installed by the contractor, keep the text below. If it (or portions of it) is Government furnished replace the text with a brief description of the furnished network (or parts). Basic information to include is: media type, wiring location and access, network bandwidth, Project Site POC for coordination of shared network.

Note that similar editing is required in PART 3 IP Network Installation.

[The UMCS network shall provide end-to-end transmission speeds of at least 100 MBPS using the IP protocol. The Bit Error Rate (BER) of the data communications components shall be no greater than one error in 10E-9 for end-to-end subsystems.

The UMCS Network shall support ANSI/EIA-709.1B communications in accordance with ANSI/EIA-852 and all other necessary UMCS functionality. The Network shall use the following protocols for layers 1 through 7 as defined in the ISO OSI Model:

- a. OSI Layer 1. The physical layer shall be in conformance with IEEE 802.3 and operate at at least 100 megabits per second Mbps (100Base-T and 100Base-FX). Higher speed protocols may be used. If higher speed physical layers are used, bridging hardware shall be provided to ensure compatibility with 100 Mbps devices.
- b. OSI Layer 2. The data-link layer shall be the IEEE 802.2 Logical Link Control (LLC), Type 1, Class 1, in combination with the IEEE 802.3 Protocol.
- c. OSI Layer 3. The network layer shall be the Internet Protocol (IP; RFC 791), the Internet Control Message Protocol (ICMP; RFC 792), and the Address Resolution Protocol (ARP; RFC 826).
- d. Layers 4 - 7. Network shall support all layer 4 protocols supported by IP (RFC 791) including but not limited to ICMP (RFC 792), IGMP (RFC 1112), TCP (RFC 793), UDP (RFC 768), IGP, GRE (RFC 2784) and protocols required by ANSI/EIA-852.][____]

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

2.1.1 Product Certifications

Computing devices, as defined in 47 CFR 15, supplied as part of the UMCS shall be certified to comply with the requirements of Class B computing devices.

2.1.2 Product Sourcing

Contractor supplied units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be new standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products.

2.1.3 Environmental Requirements

The contractor shall provide components which will operate under the following environmental conditions:

- a. That portion of the data communications equipment system installed indoors shall operate properly in a controlled environment with ambient temperatures between +10 and +35 degreesC (+50 and 95 degreesF) and ambient relative humidity between 10% and 85% noncondensing.
- b. Electrical Power from 100 to 125 volts AC (VAC) , 60 Hz, single phase, three wire with a three-pronged, dedicated circuit outlet.
- c. The equipment shall meet NFPA 70, UL 478, UL 910, FCC EMC, MIL-STD-454N Requirements, and FCC Part 15.

2.1.4 Product Data Sheets

For each product specified in this contract manufacturer catalog cuts and sheets which indicate conformance to product requirements shall be available and shall be submitted as specified.

2.2 NETWORK HARDWARE

2.2.1 Nameplates

Laminated plastic nameplates shall be provided for all network hardware. Each nameplate shall identify the function, network address and identifier of the device. Laminated plastic shall be 3mm (.125inch) thick, white with black center core. Nameplates shall be a minimum of 25x75mm (1x3inches) with minimum 6mm (.25inch) high engraved block lettering. Nameplates for devices smaller than 25x75mm (1x3inches) shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the device in conspicuous location.

2.2.2 Building Point of Connection (BPOC) Hardware

2.2.2.1 ANSI-709.3 to IP Router

ANSI-709.3 to IP Routers shall perform layer 3 routing of ANSI/EIA-709.1B packets over an IP network in accordance with ANSI/EIA-852. The router shall provide the appropriate connection to the IP network and connections to the ANSI/EIA-709.3 TF/FT-10 network. ANSI-709.3 to IP Routers shall not rely on the Dynamic Host Configuration Protocol (DHCP) for their IP addresses, and shall be configurable via an ANSI/EIA-852 Configuration Server.

2.2.2.2 ANSI-709.1 Gateway

Gateways shall have the appropriate connection on the building-side (non-ANSI 709.1 side) to interface to the building DDC system, and shall meet the following requirements:

- a. It shall be capable of being installed, configured and programmed for the designated application and through the use of instructions in the manual supplied by the Contractor.
- b. All software required for gateway configuration shall be furnished.
- c. It shall provide protocol translation from the building level control protocol to ANSI/EIA-709.1B.
- d. It shall communicate on the ANSI/EIA-709.1B over an IP network in accordance with ANSI/EIA-852. Contractor may provide a second device co-located with the protocol translator to meet this requirement.
- e. It shall allow binding of its standard network variables (SNVTs).
- f. For the LonWorks network, it shall be capable of transmitting data using the "min. max. and delta" (throttling and heartbeat) methodology.
- g. It shall provide the ability to label SNVTs that are mapped from third party devices.
- h. It shall provide capacity for mapping all required points as shown plus an additional 50% from the legacy side as SNVTs on the LonWorks side.
- i. It shall be capable of supporting polled and synchronous modifiers for network variables.
- j. It shall supply a LonMark external interface file (XIF) as defined in the LonMark XIF Guide for use with LNS tools and utilities.
- k. It shall support have a "service pin" which, when pressed, will cause the Gateway to broadcast its 48-bit NodeID and ProgramID over the network.
- l. It shall provide a configurable self-documenting string.
- m. It shall retain its configuration after a power loss of an indefinite time, and shall automatically return to it's pre-power loss state once power is restored.

2.2.3 IP Network Hardware

2.2.3.1 Wire and Cables.

- a. Interior LAN Copper Cable: Interior Copper LAN cable shall meet or exceed all requirements of Category 5 cable as specified in ANSI/TIA/EIA-568-A. Terminations, patch panels, and other hardware shall meet or exceed Category 5 specifications and shall be as specified in SECTION 16710A PREMISES DISTRIBUTION SYSTEM. Cabling products shall be tested and certified at frequencies up to at least 100 MHz for use at data speeds up to at least 100 Mbps.

Other types of cable commonly used within IEEE 802.3 LANs (e.g., thicknet and thinnet) shall be used only in cases to interconnect with existing coaxial cable plants. Short lengths of coaxial cable and coaxial transceivers may be used in these applications. The contractor shall provide separately orderable cable, taps and connectors.

b. Interior Fiber Optic Cable: Interior Fiber Optic Cable shall be [Multimode Fiber][___], [62.5/125][___] micron with [SC][ST][___] connectors as specified in ANSI/TIA/EIA-568-A. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in SECTION 16710A PREMISES DISTRIBUTION SYSTEM. The data communications equipment shall use the [850-nm range of multimode][1310-nm range of singlemode] fiber-optic cable. Fiber-optic cable shall be suitable for use with the 100Base-FX standard as defined in IEEE 802.3.

c. Exterior Fiber Optic Cable: Exterior Fiber Optic Cable shall be [Multimode Fiber][___], [62.5/125][___] micron with [SC][ST][___] connectors as specified in ANSI/TIA/EIA-568-A. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 16713N FIBER OPTIC (FO) OUTSIDE PLANT (OSP) MEDIA. The data communications equipment shall use the [850-nm range of multimode][1310-nm range of singlemode] fiber-optic cable. Fiber-optic cable shall be suitable for use with the 100Base-FX standard as defined in IEEE 802.3.

2.2.3.2 Fiber Optic Patch Panel.

This unit shall be wall or rack mountable and designed to provide termination facilities for up to 24 fibers. Unit shall also have capability to be equipped with spliced trays, six packs (for adapters), and blank panels for easy termination of the fiber bundles and tube cables. Fiber-optic terminating equipment shall provide for mounting of ST or SC connectors on an optical patch panel. Fiber-cable management and cable-routing hardware shall be provided by the contractor to assure conformance to minimum fiber and cable bend radii. Connectors on the patch panel shall be ST or SC feed through. Access to both sides of the panel shall be provided by the contractor. The patch panel for the connectors shall be mounted to facilitate rearrangement and identification. Each apparatus shall have cabling and connection instructions associated with it. The patch panels shall be either rack or wall mountable.

2.2.3.3 Fiber Optic Media Converter

Fiber Optic media converter shall provide media conversion between layer 1 copper and fiber media to support data rates equal to the greater of the physical layer or 100 Mbps as specified in IEEE 802.3.*

2.2.3.4 Ethernet Switch

Switches shall be IEEE 802.3 bridges which shall function as the center of a distributed-star architecture and shall be "learning" bridges with spanning tree algorithms per IEEE 802.1D. The switch shall support the connected media types and shall have a minimum of 150% the required ports and no fewer than 4 ports.

2.2.3.5 IP Router

The contractor shall provide IP router network equipment. The routers shall be fully configurable for protocol types, security, and routing selection of sub-networks. The router shall meet all requirements of RFC 1812 and I3A.

2.3 COMPUTER HARDWARE

2.3.1 Nameplates

Laminated plastic nameplates shall be provided for each server and workstation. Each nameplate shall identify the function, network address and identifier of the server or workstation. Laminated plastic shall be 3mm (.125inch) thick, white with black center core. Nameplates shall be a minimum of 25x75mm (1x3inches) with minimum 6mm (.25inch) high engraved block lettering. All nameplates shall be attached to the device in conspicuous location.

2.3.2 Server Hardware

NOTE: Coordinate with the Project Sites DOIM and include the sites 'standard' server redundancy requirements.

Computer Server Hardware (server) shall be a standard unmodified digital computer of modular design. The modular components of the server shall be products of a single manufacturer. Server hardware shall meet the following minimum requirements.

- a. Processor speed: Minimum 250% the stated requirements of the software to be installed on the server.
- b. Random Access Memory (RAM): Minimum 250% the stated requirements of the software to be installed on the server.
- c. Communications ports: One serial port, one enhanced parallel port and one USB port in addition to any ports required for the keyboard and mouse.
- d. Hard Drive and controller: [120GB] [___] formatted disk space with a maximum average seek time of 7 milliseconds.
- e. CD-RW Drive: 24x read; 12x re-write; 24x write
- f. Floppy Disk Drive and controller: High density disk drive 90mm (3.5inch) diameter size.
- g. Video output card: Support at least 16 bit color at a minimum resolution of 1024 by 768 at a minimum refresh rate of 70 Hz.
- h. Network Interface Card (NIC): Integrated [100Base-T Ethernet NIC with an RJ45 connector.] [100Base-FX Ethernet NIC with an [SC] [ST] [___] connector.]
- i. Monitor: Sized as shown but no less than 432mm (17inches) with a minimum resolution of 1024 by 768 pixels, noninterlaced, a maximum dot

pitch of 0.28 millimeters, and a minimum refresh rate of 70Hz.

j. Keyboard: 101 key keyboard having a minimum 64 character standard ASCII character set based on ANSI X3.154.

k. Mouse: 2-button mouse with a minimum resolution of 400 dots per inch.

2.3.3 Workstation Hardware

Computer Workstation Hardware (workstation) shall be a standard unmodified digital desktop computer of modular design or a laptop as shown. The modular components of the workstation or the laptop shall be products of a single manufacturer which advertises national service (service in all 48 contiguous states). Workstations shall meet the following minimum requirements.

a. Processor speed: 150% the stated requirements of the software to be installed on the workstation.

b. Random Access Memory (RAM): 150% the stated requirements of the software to be installed on the workstation.

c. Communications ports:

(1) Desktop: One serial port, one enhanced parallel port and one USB port in addition to any ports required for the keyboard and mouse.

(2) Laptop: One serial port, one enhanced parallel port, one USB port plus and least one PCMCIA card slot.

d. Hard Drive and controller:

(1) Desktop: [60GB] [___] formatted disk space with a maximum average seek time of 10 milliseconds.

(2) Laptop: [40GB] [___] formatted disk space with a maximum average seek time of 10 milliseconds.

e. CD-RW Drive: 24x read; 12x re-write; 24x write. For laptop workstations the CD-RW drive [shall be a fixed drive][may be a fixed or modular-bay drive][may be a fixed, modular-bay or external drive].

f. Floppy Disk Drive and controller: High density disk drive 90mm (3.5inch) diameter size. For laptop workstations the floppy disk drive [shall be a fixed drive][may be a fixed or modular-bay drive][may be a fixed, modular-bay or external drive].

g. Video output card:

(1) Desktop: Support at least 32 bit color at a minimum resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.

(2) Laptop: Support at least 16 bit color at a minimum resolution of 1024 by 768 at a minimum refresh rate of 60 Hz.

h. Network Interface Card (NIC):

(1) Desktop: Integrated [100Base-TX Ethernet NIC with an RJ45 connector.][100Base-FX Ethernet NIC with an [SC][ST][____] connector]

(2) Laptop: Integrated or PCMCIA 100Base-TX Ethernet NIC with an RJ45 connector.

i. Monitor:

(1) Desktop: Monitor sized as shown but no less than 482mm (19inches) with a maximum supported resolution of no less of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.24 millimeters.

(2) Laptop: LCD Screen sized as shown but no less than 305mm (12inches) with a maximum supported resolution of no less than 1024 by 768 pixels

j. Keyboard:

(1) Desktop: 101 key keyboard having a minimum 64 character standard ASCII character set based on [ANSI X3.154](#).

(2) Laptop: Standard laptop keyboard.

k. Mouse:

(1) Desktop: 2-button mouse with a minimum resolution of 400 dots per inch.

(2) Laptop: Integrated touch-pad.

2.3.4 PRINTERS

Printers shall be local or network printers as shown. Local printers shall have a parallel or USB interface. Network printers shall have a 100Base-TX interface with an RJ45 connection and shall have a firmware print spooler compatible with the Operating System print spooler.

2.3.4.1 Alarm Printer

The dot matrix alarm printers shall have a minimum 96 character standard ASCII character set based on [ANSI X3.154](#) and with graphics capability. The printers shall have adjustable sprockets for paper width up to 11 inches, print at least 80 columns per line and have a minimum speed of 200 characters per second. Character spacing shall be selectable at 10, 12 or 17 characters per inch. The printers shall use sprocket-fed fanfold paper. The units shall have programmable control of top-of-form. Printers shall include floor stands with paper racks.

2.3.4.2 Laser Printer

Laser printers shall meet the following minimum requirements:

- a. Resolution: 600 by 600 dots per inch.

- b. Printing Time: 6 pages per minute.
- c. Data Buffer Size: 10 Megabytes.
- d. Media Size: 8.5x11 inches as shown.
- e. Paper Cassette: 250 sheet capacity.

2.3.4.3 Color Printer

The color printer shall use ink jet technology, and shall meet the following minimum requirements:

- a. Resolution: 600 by 600 dots per inch.
- b. Printing Time: 2 pages per minute.
- c. Data Buffer Size: 16 Megabytes.
- d. Colors: Four-color print heads.
- e. Media Type: Paper and transparency film.
- f. Media Size: 8.5x11 inches and as shown.
- g. Paper Cassette: 250 sheet capacity.

2.4 COMPUTER SOFTWARE

2.4.1 Operating System (OS)

The operating system (OS) shall support time synchronization via Network Time Protocol (NTP) per RFC 2030, and shall support all installed software. The OS shall be able to obtain screen capture of the monitor display being viewed. The OS shall support all specified software.

2.4.2 Office Automation Software

Office Automation Software shall consist of the spreadsheet and word processing portions of the project site's standard office automation software.

2.4.3 Virus Protection Software

Virus Protection Software shall consist of the project site's standard virus protection software complete with a virus definition update subscription.

2.4.4 ANSI/EIA-852 Configuration Server

The ANSI/EIA-852 configuration server shall meet the requirements of ANSI/EIA-852

2.4.5 LonWorks Network Configuration Tool

The network configuration tool shall meet the following minimum

requirements:

- a. It shall solely use LonWorks Network Services (LNS) for all network configuration and management for LonWorks devices.
- b. It shall be capable of executing LNS plug-ins.
- c. It shall be capable of performing network database reconstruction of a LonWorks control network, such that if connected to an existing LonWorks network it has the ability to query the network and create an LNS database for that network and an associated network drawing.
- d. It shall allow configuration of the network while off-line such that an operator may set up changes to the network while disconnected from the network, and then execute all of them once connected.
- e. It shall have a graphics-based user interface, and be able to display and print a graphical representation of the control network.
- f. It shall be capable of generating and printing the following reports:
 - (1) Table containing domain/subnet/nodeID and node identifier for the entire network or any subset thereof, selected by the user.
 - (2) Table containing Standard Network Variable (SNVT) input and output details for any LonWorks device on the network
 - (3) Table containing Standard Configuration Properties (SCPTs) for any LonWorks device on the network.
- g. It shall be capable of merging two existing LNS databases into a single standard LNS database and creating a graphical representation for the combined database.

2.4.6 Monitoring and Control (M&C) Software

NOTE: Designer should choose the minimum number of points and clients the M&C software is required to accommodate based on the project site's master plan.

Web based clients are not addressed here. The Contractor may provide web-based or non-web-based clients as needed to meet the M&C software functional requirements. If web based clients are specifically required or are not allowed, edit the M&C Software requirements accordingly See the UFC for more information.

The monitoring and control (M&C) software shall be an LNS-compatible client-server software package. The software shall accommodate all points as shown and required and shall be expandable to accommodate up to [50,000][___] points. The server software shall support clients as specified and shown, with expansion capability to support no less than [50][___] total clients and no less than [20][___] clients simultaneously.

2.4.6.1 Passwords

NOTE: Designer must choose if password management for M&C software is performed by the OS or by the M&C software itself or if the decision is left to the contractor.

The M&C software shall provide user-based access to M&C functionality. The M&C Software shall [obtain user information from the OS][or][manage M&C user information] and shall recognize at least [100][___] separate users and have at least 4 levels of user permissions. User permission levels (from most restrictive to most permissive) shall include:

- a. Permission Level 1: View System Graphic Displays.
- b. Permission Level 2: Permission Level 1 plus acknowledge alarms and set up (configure) trends and reports.
- c. Permission Level 3: Permission Level 2 plus override SNVTs and set up (configure) alarms, schedules and demand limiting
- d. Permission Level 4: Permission Level 3 plus create and modify System Graphic Displays and create custom programs.

The system shall display the operator's user ID on the monitor while logged in. Passwords shall not be displayed. The system shall maintain a disk file logging all activity of the system. If the file format is not plain ASCII text, the contractor shall provide a means to export or convert the file to plain ASCII text. This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. Passwords shall not be logged. The activity log shall be maintained at the server hardware. The system shall automatically provide a mechanism for archiving the log files for long term record storage.

2.4.6.2 Protocol Drivers

NOTE: Reminder to designer: one of the integration methods for legacy systems is to use a protocol driver (a 'software gateway') in the M&C software to integrate the legacy system.

The M&C Software may include drivers to other (non-LonWorks) protocols. The protocol driver shall allow the M&C software to read and write values to and from points on the legacy system from all M&C functions. The M&C software shall support reading points from the legacy system and writing these values to SNVTs on the LonWorks network, and reading SNVTs from the LonWorks network and writing these values as points on the legacy network. Use of the driver to integrate additional legacy systems shall not require programming but may require configuration.

2.4.6.3 System Graphic Displays

The monitoring and control (M&C) software shall include graphical displays through which an operator, via client or server, can perform real-time access and manipulation of the M&C functions as specified and shown. The graphical displays shall consist of building-level system (air handler units, VAV boxes, chillers, boilers etc) graphic displays, alarm displays, scheduling displays, trending displays, and demand limiting displays. Data associated with an active display shall be updated every 5 seconds.

a. Navigation Scheme: System graphic displays of building-level systems and points shall be hierarchical displays using a building-to-equipment point-and-click navigation scheme. Each display shall show the building name and number. Each display shall show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

(1) Each building display shall show the building foot print and basic floor plan, and shall clearly show and distinguish between the individual zones and the equipment serving each zone and space. The building display shall also show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. The building display shall show the locations of individual pieces of monitored and controlled equipment.

(2) Each equipment display shall show a one-line diagram control schematic representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Different colors and textures shall be used for various components and real time data. Colors and textures shall be uniform on all displays.

(3) Each display shall clearly distinguish between the following point data types and information:

- (a) Real-time data.
- (b) User-entered data.
- (c) Overridden or operator-disabled points.
- (d) Devices in alarm (unacknowledged).
- (e) Out-of-range, bad, or missing data.

b. Navigation Commands: The system graphic displays shall support English language operator commands via point-and-click mouse and keyboard entry for defining and selecting points, parameters, graphics, report generation, and all other functions associated with operation. The operator commands shall be usable from any operator workstation with individual operator passwords as specified.

(1) Command Input: Operator's commands shall be full words and acronyms selected to allow operators to use the system without extensive training or any data processing backgrounds. The system shall prompt the operator in full words and acronyms for all required information, identifying acceptable command formats. The

operator's response shall be a point-and-click selection, word, phrase, or acronym including parameters where required.

(2) Command Input Errors: The system shall supervise operator inputs to ensure they are correct for proper execution. Operator input assistance shall be provided whenever a command cannot be executed because of operator input errors. The system shall explain to the operator why the command cannot be executed. Conditions for which operator error assist messages shall be generated include:

- (a) The command used is incorrect or incomplete.
- (b) The operator is restricted from using that command.
- (c) The command addresses an out-of-range or bad data point.
- (d) The command addresses a point that does not exist.
- (e) The command would violate constraints.

(3) Special Functions: The system shall provide the following point-and-click mouse functions, in addition to all other commands specified:

- (a) HELP: shall produce a display of all commands available to the operator. The HELP command, followed by a specific command shall produce context sensitive listing with a short explanation of the purpose, use, and system reaction to that command.
- (b) DISPLAY DIAGRAM: shall display diagrams of specific utility systems or other systems as specified.
- (c) DIAGRAM DEVELOPMENT: shall allow the user to develop diagrams of specific utility systems or other systems as specified.
- (d) PRINT REPORT: Shall allow the operator to initiate printing of reports.`

(4) Operator's Commands: The operator's commands shall provide the means for entry of control and monitoring commands, and for retrieval of information. Processing of operator commands shall commence within 5 seconds of entry, with some form of acknowledgment provided at that time. The operator's commands shall perform tasks, including:

- (a) Request a display of any SNVT or calculated point or any group of related SNVTs and calculated points
- (b) Startup and shutdown selected systems or devices.
- (c) Enable and disable individual points.
- (d) Override any SNVT point to operator selected value.

(Release override to return SNVT point to original value

(f) Modify time and event scheduling.

(g) Initiate reports.

(h) Generate and format reports.

(5) System Graphic Display Hierarchy: The system graphic display shall have a hierarchical structure with at least five levels:

(a) Unit: The unit that a point is associated with, such as an AHU.

(b) Building Sub-Area: A part of a building.

(c) Building: The building that a point is located in or near.

(d) Building Group: A group of buildings.

(e) Facility: Installation included in the UMCS.

c. Symbols Library: The M&C software shall include a library of the symbols listed. Symbols shall at a minimum conform to [ASHRAE Handbook](#) where applicable. The software shall allow the operator to create, modify, delete, call-up, list, and store display symbols. A library of callable display symbols shall be furnished, including: Pump, Two- and Three-way Valves, Flow Sensing Element, Temperature Sensor, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, Temperature Switch, Pressure Switch, Coil, Solenoid Valve, Filter, Condensing Unit, Cooling Tower.

d. Display Editor: The display editor shall enable the user to create, modify, and delete displays and symbols. The primary use shall be for adding and modifying one-line diagrams, status displays, system summaries, and system directories, as new controllers, points, data, and other necessary changes are made. The basic functions shall include:

(1) Create a new graphic.

(2) Group and ungroup graphic symbols.

(3) Modify a portion of a graphic.

(4) Save graphics and symbols as a library object.

(5) Rotate and mirror a graphic.

(6) Delete a graphic.

(7) Place a graphic symbol on a display.

(8) Cancel the display of a graphic.

(9) Assign conditions which automatically initiate the display.

- (10) Overlay alphanumerics and graphics.
- (11) Save new, modified, or existing graphics as new graphics.
- (12) Integrate real-time data with the display.
- (13) Define the background color.
- (14) Define the foreground color.
- (15) Locate the symbols.
- (16) Position and edit alphanumeric descriptors.
- (17) Establish connecting lines.
- (18) Establish sources of latest data and location of readouts.
- (19) Display analog values as specified.
- (20) Cursor control (up, down, right, left).
- (21) Create and display alphanumeric displays.
- (22) Assign graphics a depth such that when there are coincident graphics the one with the lower depth is displayed.
- (23) Modify graphic properties based on SNVT values.

2.4.6.4 Scheduling

NOTE: Reminder to designer: the M&C software must provide scheduling functionality in order to be able to configure temporary schedules at the building level for holidays and other exception-based schedules.

The M&C software shall support a minimum of [200][__] user-definable schedules, and be capable of scheduling any point on the LonWorks network via SNVT and any points available from a connected legacy system via the protocol driver. The specified scheduling functions shall be operator accessible and adjustable via graphics display. The graphics display shall include the following fields and functions:

- a. Current date and time. The O/S and M&C software shall automatically make Daylight Savings Time adjustments. Daylight savings time adjustment shall be capable of being turned off by the operator.
- b. Building name and number.
- c. System identifier and name.
- d. System group. System schedules shall be capable of being grouped by the user to perform according to a common schedule.

e. Weekly schedules. Each system shall have a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than [2] 'on' times and [2] 'off' times per day.

f. Holiday and special event schedules. System scheduling shall support holiday and special event calendar schedules independent of the daily schedule. Special event schedules shall include one-time events and recurring events. Scheduling of one-time events shall include the beginning and ending dates and times of the event. Holiday and special event schedules shall have precedence over device weekly schedules.

2.4.6.5 Alarms

The M&C software shall be capable of handling and managing no less than 10,000 alarm points.

a. Alarm Data. Alarm data to be displayed and stored, as applicable and as specified, shall include:

- (1) Identification of alarm including building, system (or sub-system), and device name.
- (2) Date and time to the nearest second of occurrence.
- (3) Alarm type.
- (4) Alarm set point (if analog).
- (5) Engineering units.
- (6) Current value or status of the alarm point.
- (7) Alarm priority.
- (8) Alarm Message: A unique message with a field of 60 characters shall be provided for each alarm. Assignment of messages to an alarm shall be an operator editable function. Secondary messages shall be assignable by the operator for printing to provide further information, such as telephone lists or maintenance functions, and shall be editable by the operator. The system shall provide for 100 secondary messages with a field of 25 lines of 60 characters each.
- (9) Acknowledgement status of the alarm and, where acknowledged, the time and date of acknowledgement.
- (10) User who acknowledged the alarm.

b. Alarm Types and Settings: Alarms types shall be high and low fail, and high and low alarms. Alarm settings shall be configurable from the alarm graphic display by the operator for:

- (1) High fail. Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.

(2) High Alarm. Analog alarms shall also include the alarm set point value.

(3) Low Alarm. Analog alarms shall also include the alarm set point value.

(4) Low fail. Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.

(5) Alarm deadband. For high and low analog alarms, this is the magnitude of the differential, above and below the set point, that causes the alarm to change state.

(6) Alarm priority. There shall be two alarm priority levels; critical and informational. Critical alarms shall require acknowledgement by an operator; informational alarms shall not.

c. Alarm Notification and Routing: The M&C software shall be capable of performing alarm notification and routing functions. Upon receipt or generation of an alarm the M&C software shall immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software shall support at least [500][___] alarm routes; an alarm route shall be a unique combination of any of the following destinations:

(1) Generate a pop-up up display on designated workstation monitors. The pop-up display shall include identification of the alarm, date and time of the alarm, alarm message, and current value/status of the alarm point. Alarms shall be capable of being acknowledged from the pop-up display.

(2) Dial a numeric paging system and leaving a numeric message. The paging system number and numeric message shall be user configurable for each alarm.

(3) Send an email message via simple mail transfer protocol (SMTP); RFC 821. The email shall contain a scripted message and all alarm data. The email recipient and scripted message shall be user configurable for each alarm.

(4) Print designated alarms to local and networked alarm printers. The printed message shall be the same as the pop-up message.

d. Alarm Display and Acknowledgement. The M&C software shall include an alarm display. A minimum of the most recent [100][___] system alarms shall be available for display at each workstation as shown, along with all associated alarm data. Alarms shall be capable of being acknowledged from this display. Multiple alarms shall be capable of being acknowledged using a single command. Operator acknowledgment of one alarm shall not automatically be considered as acknowledgment of any other alarm nor shall it inhibit reporting of subsequent alarms.

e. Alarm Storage and Reports: The M&C software shall store each alarm and its associated alarm data to hard disk. The stored data shall be user-sortable and formatted for printing.

2.4.6.6 Trending

NOTE: Designer should determine required number of points M&C software is capable of trending based on the project site's master plan.

The M&C software shall be capable of performing real-time trending on a minimum of [5,000][___] points simultaneously with a minimum trending capacity of 100 points per second. The M&C software shall be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software shall be capable of saving trend logs to a comma delimited (.CSV) format. Each trend shall be user-configurable for:

- a. Point to trend.
- b. Sampling interval with a minimum sampling interval no greater than 1 second, and a maximum sampling interval no less than 1 hour.
- c. Start and Stop Time of Trend: Either Start Time and Stop Time or Start Time and Duration.

2.4.6.7 Electrical Power Demand Limiting

NOTE: The critical alarm for actual demand exceeding EDT should be routed such that it is received as soon as possible.

Designer must decide if actual demand exceeding EDT causes the EDT to be reset to a higher value.

The UMCS shall monitor and limit the electrical demand using a demand limiting program. The demand limiting program shall operate continuously and shall execute at the Monitoring and Control server. It shall obtain electrical demand from the installation electric utility meters a minimum of once per minute and predict the electrical peak demand [30][___] minutes into the future. This predicted peak demand value shall be recalculated at a minimum of [one (1)][___] minute intervals. The electrical demand target (EDT) and predicted demand shall be used by the demand limiting program to determine demand limit priority. The EDT shall be user configurable. When the actual demand exceeds the EDT[, the EDT shall be automatically reset to a higher value for the duration of the billing cycle and] a critical alarm shall be broadcast.

- a. Demand limit priority level: The Demand limit priority level is a calculated value which is used by the M&C server to determine the group or groups of equipment to be shut off or set points adjusted (Chillers). Six (6) levels of demand priority (zero (0) through five (5)) shall be defined. When no loads are to be shut down the system shall be at demand limit level zero (0). When the predicted demand first exceeds the base-wide demand limit target, the demand limiting program shall designate the demand limit priority to have a value of 1. Successive levels of demand limit priority shall be based upon the

amount of time that the predicted demand exceeds the demand limit preset value and the amount it exceeds the preset value. This time between changing demand limit priority shall be operator assignable with a default value of [15][__] minutes.

b. Demand Limit Schedule and Monitoring Screen: The demand limit software shall use a spreadsheet type table which shall include the following information:

- (1) Current demand, predicted demand
- (2) Base-wide demand limit target
- (3) Time of day
- (4) For each system
 - (a) Equipment Description
 - (b) Equipment demand limit priority
 - (c) SNVT name used to shut equipment off, or adjust setpoint (for chillers)
 - (d) Maximum off time
 - (e) Maximum shut-down or setpoint reset intervals per day
 - (f) Equipment status

This screen and associated table used for implementing the electrical power demand limiting algorithm shall have a user interface which allows the user to edit, add, and delete all items in the table.

c. Equipment shut down and chiller reset. Each mechanical system (air handler, chiller, fan coil unit, etc) shall have associated with it a demand limit priority from 1 to 6. A system with a priority of 6 shall never be shut down by the demand limiting program. Equipment whose demand limit priority is less than or equal to the base-wide demand limit priority level shall be shut down for a maximum time period of time as shown. Chillers shall have their setpoint reset or shall be shut down as shown. This shall be accomplished by changing the value of the System Enable or Chiller Setpoint SNVT for of the mechanical system. When a new demand priority is reached equipment with that priority level shall be stopped or started at a user selectable interval so that no two systems are ever stopped or started simultaneously

d. Equipment re-start: When predicted demand transitions from greater than to less than the base-wide demand limit preset value by a deadband amount, the demand limit priority level shall be decremented and the appropriate equipment (equipment with a demand limit priority level less than or equal to the base-wide demand limit priority) shall have their system enable SNVTs reset in a staged manner. Chillers that have had setpoint reset shall have their chiller setpoint SNVT returned to their default value.

e. Manual initiation of demand limiting: The demand limiting program shall be configured to allow an operator to manually override the demand limit priority regardless of predicted demand. This override shall remain until manually released.

f. Program Inputs

- (1) Calculated Equipment Demand Limit Priority Level.
- (2) Time-of-day.
- (3) Equipment maximum off time.
- (4) Base-wide electrical power sliding window demand limit peak value.
- (5) Beginning and ending dates of winter and summer billing periods.
- (6) Length of sliding window interval.
- (7) Total demand.
- (8) Operating setpoint (current).
- (9) Beginning and ending dates for each billing cycle.

g. Program Output.

- (1) System Enable SNVT for each system.
- (2) Setpoint SNVT for each chiller with setpoint reset.
- (3) Predicted Demand.

2.4.6.8 Demand Limiting with Real-Time Pricing

Demand Limiting with Real-Time Pricing shall perform Electrical Power Demand Limiting as specified except that demand limit priority shall be determined by real-time pricing data.

2.4.6.9 Programming Language

The M&C Software shall incorporate a programming (scripting) language for creating custom applications. Actions that shall be available through the programming language shall include the following functions:

- a. Override SNVTs
- b. Monitor SNVTs
- c. Clock / Timer Functions
- d. PID blocks
- e. Math Functions: Addition, subtraction, multiplication, division,

powers, trig and log.

- f. Loops ("for" and "while")
- g. Conditional Branches ("if-then-else")
- h. Variable Define / Assignment / Use
- i. Provide data to a graphic display
- j. Get data from a graphic display
- k. Initiate alarm conditions
- l. Initiate Reports
- m. Logic Functions: ("and", "or" and "not")
- n. Bitwise logic functions.
- o. User defined subroutines and functions.

2.4.6.10 Report Generation

Software shall be provided with commands to generate and format reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. The destination of each report shall be selectable by the operator. Reports shall use current system values. Database parameters used in reports shall be assignable by the operator. Dynamic operation of the system shall not be interrupted to generate a report. The report generation mode, either automatic or request, shall be operator assignable. The report shall contain the time and date when the sample was taken, and the time and date when the report was generated. Software shall be provided to format and store on a removable diskette all data, trends, profiles, reports and logs specified herein in a comma-delimited text format. Data transfer function shall be accessible by operator command from any workstation, subject to password.

The software shall allow for automatic or manual generation of reports. For automatic reports the operator shall be able to specify the time the initial report is to be generated, the time interval between reports, end of period, and the output format for the report. The operator shall be able to modify, or inhibit a periodic report. Manual report generation shall allow for the operator to request at any time the output of any report.

**NOTE: The list of standard reports should be edited
by the designer to remove any reports or sub-items
of individual reports not required by the project.**

The software shall be capable of generating the following standard reports:

- a. Electrical Power usation Report: An electrical power usation

summary, operator selectable for substations, meters, or transducers, individual meters and transducers, any group of meters and transducers, and all meters for an operator selected time period. The report shall include the voltage, current, power factor, electrical demand, electrical power consumption, reactive power (Kvar) for each substation, facility, system or equipment as selected by the operator. The report shall be automatically printed at the end of each summary period and shall include:

- (1) Total period consumption.
- (2) Demand interval peak for the period, with time of occurrence.
- (3) Power consumption (kWh) over each demand interval.
- (4) Average (kW) demand during the 5 to 60 minute user definable interval containing the installation's peak demand.
- (5) Time-of-use peak, semi-peak, off-peak, or baseline total kWh consumption.
- (6) Reactive power during each demand interval.
- (7) Power factor during each demand interval.
- (8) Outside air (OA) temperature and relative humidity (RH) taken at the maximum and minimum of OA temperature of the report period with the time and dates of occurrence. At the installation's peak demand interval, the OA temperature and RH shall also be recorded.
- (9) Calculated heating and cooling degree days on a 18.3 degreesC (65 degreesF) balance point. Heating and cooling degree day balance point may be operator adjustable.

b. Electrical Peak Demand Prediction Report: A report based on the demand limiting program. The report shall include:

- (1) Target.
- (2) Actual peak and predicted peak for each demand interval for that day.
- (3) Predicted demand for the next demand interval.

c. Energy usation Report: An energy usation summary, operator selectable, for a, unit, building, area, installation, and the entire UMCS. The report shall include:

- (1) Beginning and ending dates and times.
- (2) Total energy usage for the current and previous day.
- (3) Total energy usage for the current and previous month.
- (4) Maximum rate of consumption for the current and previous day.
- (5) Maximum rate of consumption for the current and previous

month.

- (6) Outside air (OA) temperature high, low, and average.
- (7) OA relative humidity (RH) or dew point high, low, and average.
- (8) Calculated degree days.
- (9) OA temperature and RH taken at the maximum and minimum of OA temperature with the time and dates of occurrence. At the installation's peak demand interval, the OA temperature and RH shall also be recorded.

d. Equipment Electrical Consumption Report: An equipment electrical consumption report shall be provided for monitoring the electrical parameters and energy consumption from equipment instrumented or metered. Report shall obtain data for equipment, facility, system, substation metered for power and associated electrical parameters. Report shall be correlated to equipment, systems, facility or substation. Report shall monitor the power consumption (kWh), power factor, reactive power (kvar), current, voltage, and instantaneous demand (kW) of each device and provide high and low level alarm points. Report shall also totalize and report system, facility, substation and equipment energy consumption and other electrical parameters at operator selectable intervals. Report shall provide data for the following intervals as a minimum:

- (1) Minutes (operator selectable from 0-60).
- (2) Hourly.
- (3) Daily.
- (4) Weekly.
- (5) Monthly.
- (6) Yearly.

Reports shall include the starting and ending time of the reporting interval. Longer reporting intervals shall be accumulated by totalizing the results of shorter intervals.

e. Alarm Report: Outstanding alarms by building or unit, including time of occurrence.

f. Override Report: Points overridden, including time overridden, and identification of operator overriding the point.

g. Run Time Reports: A report totalizing the accumulated run time of individual pieces of equipment. The operator shall be able to select the following subsets of equipment:

- (1) Individual equipment items without status feedback.
- (2) Individual equipment items with analog or digital status feedback.

(3) Equipment type, such as air handling units.

(4) Specific equipment sizes by types, such as all motors over 15 kilowatts (20 hp).

(5) Equipment by physical grouping. The system shall maintain statistics on a number of equipment items equal to the number of digital inputs and outputs. Run time shall be totaled up to 9999 hours. Reports shall be generated on equipment which has reached the target run time specified in the database. The software will provide for manual and automatic reset, operator selectable and settable for each individual run time totalized, reset to zero upon generation of the report, as necessary.

h. Cooling Tower Profiles: A cooling tower profile for each cooling tower as shown, including:

(1) Total daily and monthly on-time (each fan).

(2) Number of on and off transitions (each fan).

(3) Maximum and minimum daily condenser water temperature and the time of occurrence.

(4) Maximum and minimum daily condenser water temperatures for the current month.

i. Chiller usation Report: A report of the operation of each chiller as shown on a daily and monthly basis, including:

(1) Daily run-time in each one of at least 10 discrete loading levels.

(2) Daily run-time average for the above discrete loading levels.

(3) Total on-time for each level for the current month.

(4) Monthly average energy use in Mjoules, kWh or btuh for total on-time at each level.

2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

The uninterruptible power supply (UPS) shall be a self contained device suitable for installation and operation at the location of Server and Workstation hardware and shall sized to provide a minimum of 20 minutes of operation of the connected hardware. Equipment connected to the UPS shall not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of low battery power. The UPS shall be [UL 1778](#) approved. UPS powering Server Hardware shall support notification to the server via serial interface of impending battery failure.

2.6 RACKS AND ENCLOSURES

2.6.1 Enclosures

Enclosures shall meet NEMA 250 requirements for the installed location. All enclosure penetrations shall be from the bottom of the enclosure, and shall be sealed to preclude entry of water using a silicone rubber sealant.

2.6.2 Equipment Racks

Equipment racks shall be available in different sizes and shall be either aluminum or steel with bolted or welded construction. Steel equipment racks shall be painted with a flame-retardant paint. Guard rails shall be included on each equipment rack and have a copper grounding bar installed and grounded to the earth. These equipment racks shall be compatible with the electronic equipment furnished and installed under this contract in accordance with MIL-HDBK-4

2.7 FACTORY TEST

NOTE: The bracketed text in the below paragraph references the 'old' MIL standards for factory tests. The Corps of Engineers is developing a new factory test procedure, which should replace the MIL standards once available.

The Contractor shall perform factory testing of the UMCS as specified. The Contractor is responsible for providing personnel, equipment, instrumentation, and supplies necessary to perform required testing. Written notification of planned testing shall be given to the Government at least 21 days prior to testing, and in no case shall notice be given until after the Contractor has received written Government approval of the specific test procedures. The test procedures shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test procedures shall define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. The test procedures shall provide for testing all capabilities and functions specified and shown. The test procedures shall be developed from the design documentation[, using the requirements of MIL-STD-2202 and MIL-STD-2203 as a technical and format requirement][____]. The procedures shall cover actual equipment to be used by the Contractor for the specified project and shall consist of detailed instructions for test setup, execution, and evaluation of test results. The Factory Test Report shall document the test procedures and results. Reports shall be delivered to the Government within 7 days after completion of each test.

PART 3 EXECUTION

3.1 PROJECT TIMING

TABLE I: PROJECT TIMING specifies the sequencing and timing of submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column) and activities as specified in PART 3: EXECUTION (denoted by an 'E' in the 'TYPE' column).

- a. Timing for submittals: The timing specified for submittals is the deadline by which the submittal must be initially submitted to the government. Following submission there will be a government review period as specified in Section 01330 SUBMITTAL PROCEDURES. If the

submittal is not accepted by the government, the contractor shall revise the submittal and resubmit it to the government within [14][__] days of notification that the submittal has been rejected. Upon re-submittal there shall be an additional government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

b. Timing for Activities: The timing specifies for activities indicates the earliest the activity may begin.

TABLE I. PROJECT TIMING

ITEM	TYPE	DESCRIPTION	START OF ACTIVITY or DEADLINE FOR SUBMITTAL
1	S	Design Drawings	
2	S	Product Data Sheets	
3	S	Network Bandwidth Calculations	
4	S	Factory Test Report	
5	E	Install UMCS	after approval of 1,2,3,4
6	E	Start-Up and Testing	after 5
7	S	Start-Up and Testing Report	[15] days after 6
8	S	Draft As-Built Drawings	[15] days after 6
9	S	PVT Phase I Procedures	[30] days before scheduled start of 10 and after approval of 7
10	E	PVT Phase I	after approval of 7,8,9
11	S	PVT Phase I Report	[15] days after 10
12	S	Preventive Maintenance Work Plan	after approval of 1,2,3,4
13	S	Basic Operator Training Documentation	after approval of 1,2,3,4
14	S	Computer Software	after approval of 1,2,3,4
15	E	Basic Operator Training (PVT Phase II)	after approval of 12,13,14
16	S	PVT Phase II Report	[15] days after 15
17	S	Final As-Built Drawings	[15] days after 15
18	S	O&M Manual	[15] days after 15
19	S	Advanced Operator Training Documentation	[30] days before before scheduled start of 20 and after approval of 1,2,3,4
20	E	Advanced Operator Training	[__] days after 15 and after approval of 19 and no later than [60] days after 15
21	S	Operator Refresher Training Documentation	[30] days before 22 and after approval of 13,19
22	E	Operator Refresher Training	between [__] and [__] days after 15 and after approval of 21

3.2 DRAWINGS AND CALCULATIONS

3.2.1 Network Bandwidth Usage Calculations

The Contractor shall perform UMCS Network Bandwidth Usage Calculations for a heavily loaded UMCS. A heavily loaded UMCS is characterized as one

performing the following activities simultaneously:

- a. Trending a number of points equal to the specified minimum M&C software trending capacity at 15 minute intervals.
- b. Trending (for loop tuning) 20 points at 2 second intervals.
- c. Viewing 500 points (via workstations) with a 5 second update interval.
- d. Transmitting load shed commands (via SNVTs) to 2,000 controllers in over 1 minute interval.
- e. Viewing of 10 system display graphics screens via browsers.

3.2.2 UMCS Contractor Design Drawings

Contractor shall revise and update the Contract Drawings to include details of the system design. Details to be shown on the Design Drawing include:

- a. Details on logical structure of the network. This includes logical location of all network hardware.
- b. Manufacturer and model number for each piece of computer and network hardware.
- c. Physical location for each piece of network or computer hardware.

3.2.3 As-Built Drawings

The Contractor shall prepare draft as-built drawings consisting of points schedule drawings for the entire UMCS and an updated Design Drawing including details of the actual installed system as it is at the conclusion of Start-Up and Testing. In addition to the details shown in the design drawings, the as-built drawing shall include:

- a. IP address for each piece of network hardware.
- b. IP address for each computer server and workstation.
- c. Network identifier (name) for each printer, computer server and computer workstation.
- d. LonWorks address for each LON to IP router.

Contractor shall prepare [Draft As-Built Drawings](#) upon the completion of Start-Up and Testing and [Final As-Built Drawings](#) upon completion of PVT Phase II.

3.3 INSTALLATION REQUIREMENTS

3.3.1 Installation

The Contractor shall install system components as shown and specified and in accordance with the manufacturer's instructions and shall provide necessary interconnections, services, and adjustments required for a complete and operable system. Communication equipment and cable grounding

shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. Wiring in exposed areas, including low voltage wiring, shall be installed in metallic raceways or EMT conduit as specified in SECTION 16415A ELECTRICAL WORK, INTERIOR.

3.3.1.1 Isolation, Penetrations of Buildings and Clearance from Equipment

The UMCS shall be completely installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exteriors shall be made watertight. Holes in concrete, brick, steel and wood walls shall be drilled or core drilled with proper equipment; conduits installed through openings shall be sealed with materials which are compatible with existing materials. Openings shall be sealed with materials which meet the requirements of NFPA 70 and SECTION 07840A FIRESTOPPING.

3.4 INSTALLATION OF EQUIPMENT

text

3.4.1 Wire and Cable Installation

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with ANSI/TIA/EIA-606. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840A FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with ANSI/TIA/EIA-568-A and as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with ANSI/TIA/EIA-606. Non fiber-optic cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or raceways shall be properly secured and neat in appearance.

3.4.2 Grounding

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with ANSI/TIA/EIA-607 and Section 16415A ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4.3 Computer Hardware and Software

3.4.3.1 Hardware Installation

Computer Hardware shall be installed as shown. Computer Servers shall be powered through a UPS, and shall be installed and configured such that the server will automatically undergo a clean shutdown upon low battery signal from the UPS.

3.4.3.2 Software Installation

Contractor shall install software as follows:

- a. Operating system: The contractor shall install the OS on each Server and Workstation and configure user names and passwords.
- b. Office Automation Software: The contractor shall install the office automation software on each server and workstation.
- c. Virus Protection software: The contractor shall install the virus protection software on each server and workstation and shall configure weekly virus scans.
- d. ANSI/EIA-852 Configuration Server: The contractor shall install and configure the ANSI/EIA-852 Configuration Server. The ANSI/EIA-852 Configuration Server may be installed on Server Hardware, Workstation Hardware, or an ANSI-709.3 to IP Router.
- e. Network Configuration Tool: The contractor shall install the network configuration tool software as shown. The server version of the software shall be installed on server hardware, and client versions shall be installed on client or server hardware.
- f. Monitoring and Control Software: The contractor shall install the monitoring and control software as shown. The server version of the software shall be installed on server hardware, and client versions shall be installed on client or server hardware.

3.4.4 Network Hardware

The contractor shall install all network hardware in an enclosure or a telecommunication closet as defined by the project site. IP Network Hardware shall be powered through a UPS.

3.4.5 IP Addresses

For equipment requiring IP addresses, the contractor shall [coordinate with the DOIM to obtain IP addresses][choose IP addresses from the list of private IP addresses specified in RFC 1918].

3.4.6 IP Network Installation

NOTE: Part of the UMCS is an IP network which is used to connect the BPOCs, computer servers, computer workstations, and printers. There are three approaches to getting this IP network; the designer must coordinate with the installation DOIM (or equivalent) and select one of the following three options:

- a) Share existing basewide IT LAN operated by the DOIM. For purposes of discussion with the DOIM, assume that the UMCS will require network bandwidth not to exceed 10 Mbps. DOIM should provide IP addresses to show on contract drawing.
- b) use spare existing IT infrastructure (primarily

spare inter-building fiber optic cable and physical space in telecommunications closets) to install a physically independent IP network.

c) Install all new networking.

A single project may require a mixture of options, since use of the IT LAN or existing cables may be an option at some buildings and not others. In any case, network must provide end-to-end transmission speeds of at least 100 Mbps using the IP protocol.

NOTE: The following bracketing text is for Option a) as described above; remove if not needed.

[Government will provide IP network functioning at at least 100 Mbps. Contractor installed UMCS network bandwidth requirements calculated as specified in Paragraph DRAWINGS AND CALCULATIONS shall not exceed [10 Mbps][____].]

NOTE: The following bracketed text is for Option b) as described above; remove if not needed.

If Option b) is selected, be sure to include the next bracketed text as well.

[Government will provide equipment as shown in support of an IP Network functioning at at least 100 Mbps.]

NOTE: The following bracketed text is for Option b) or Option c) as described above; remove if not needed.

If Option b) or c) is chosen along with Option a), designer should coordinate with DOIM to ensure that contractor installed network is compatible with existing IT LAN. (including assignment of IP addresses.)

[The contractor shall:

a. Determine requirements for and install interior copper LAN cable in accordance with Section 16710A PREMISES DISTRIBUTION SYSTEM as needed to meet contract requirements.

b. Determine requirements for and install interior fiber optic cable in accordance with Section 16710A PREMISES DISTRIBUTION SYSTEM as

needed to meet contract requirements.

c. Determine requirements for and install exterior fiber optic cable in accordance with Section 16713N FIBER OPTIC (FO) OUTSIDE PLANT (OSP) MEDIA as needed to meet contract requirements. All exterior cable shall be buried. When installing fiber, Contractor shall provide at least 6 pairs of fiber.

d. Determine requirements for and install Network Hardware as shown and as needed to meet contract requirements.]

3.5 INTEGRATION OF BUILDING LEVEL CONTROLS

NOTE: Make sure contract drawing package includes:

1. Points schedule; make sure points schedule includes:
 - the SNVTs (points) to be displayed at the OWS
 - SNVTs that can be overridden by the OWS
 - SNVT alarm points
 - SNVT alarm condition
 - SNVT trend points.
 - Alarm routing (also make sure to include the Alarm Routing Schedule)
2. Alarm Routing Schedule drawings.
 - Identify and assign priorities, pager telephone numbers, email addresses, and alarms to be printed.
3. Demand Limit schedule drawing.
 - Make sure it includes system name, load shed priority and SNVT needed for shut-down or setpoint reset.
4. Riser Diagram Drawing
 - Show the details and location of servers, workstations, printers and other equipment.
5. Control System Schematics for each building-level control system (The as-built drawings from Section 15951)

3.5.1 Integration of LonWorks (per Section 15951) Systems

The contractor shall perform the following tasks to integrate the building system into the UMCS:

- a. If the building control network contains an IP backbone, install and configure an IP router to connect the building IP network to the UMCS IP Network. Re-configure ANSI-709.3 to IP Routers in the building to use the UMCS ANSI/EIA-852 Configuration Server. Otherwise, install

and configure an ANSI-709.3 to IP Router to connect the building level TP/FT-10 network to the UMCS IP Network

b. Update the UMCS LNS Database and update UMCS Network representation (drawings) in the Network Configuration Tool. The LNS database shall be updated by merging the building database with the UMCS database. In cases where the building database is not available the Contractor shall use the Network Configuration Tool software to discover the building network and create an LNS Database for the building and then merge the building database and the UMCS database.

c. Establish network variable bindings for all alarms as shown.

d. Establish network variable bindings for UMCS demand limit and operator overrides via occupancy SNVTS.

e. Configure M&C functionality

(1) Create graphical pages for System Graphic Displays as shown and specified. SNVTS for monitoring shall be polled from the M&C Software via the LNS Server, and shall be updated while the monitoring graphic for that SNVT is active.

(2) Configure alarm handling for required alarm SNVTS as shown on the Points Schedule and Alarm Routing Schedules and as specified.

(3) Configure the scheduling function of the M&C software to schedule systems (SNVTS) as shown on the Points Schedule and as specified. SNVTS used for scheduling shall be bound with a maximum send time (minimum time between subsequent transmissions of the SNVT) of 45 minutes. Label schedules and schedules points with full English-language descriptors.

(4) Create trends for required SNVTS as shown on the Points Schedule and as specified. Trends SNVTS at [15][__] minute intervals. SNVTS used for trends shall be polled by the M&C Software.

(5) Configure Demand Limiting as shown on the Demand Limit Schedule and Points Schedule and as specified.

3.5.2 Integration of Legacy (not per Section 15951) LonWorks Systems

The Contractor shall perform all tasks required to integrate a LonWorks System installed per Section 15951, and shall complete Point Schedules for the building level network.

3.5.3 Integration of Legacy non-LonWorks Systems at Building via Gateway

**NOTE: Designer must provide a points schedule
drawing for the legacy system building.**

When integrating a non-LonWorks Legacy system using a LonWorks Gateway the

Contractor shall perform the following tasks:

- a. Install and configure the LonWorks Gateway, including adding the gateway to the LNS database and network drawing. The gateway shall be configured such that the required data (points) as shown from the Legacy system are available as SNVTs on the LonWorks side of the gateway and that required commands as shown on the legacy side of the gateway can be written as SNVTs on the LonWorks side of the gateway.
- b. When the Gateway performs protocol translation to ANSI/EIA-709.1B, a LON to IP Router shall be installed on configured to connect the gateway to the UMCS IP Network.
- c. Establish network variable bindings for all alarms as shown.
- d. Configure M&C functionality as specified in paragraph Integration of LonWorks (per Section 15951) Systems.

3.5.4 Integration of Legacy non-LonWorks Systems at M&C Server via Protocol Driver

NOTE: Designer must provide a points schedule drawing for the legacy system building.

When integrating non-LonWorks legacy systems at the M&C Server the Contractor shall:

- a. Extend the legacy system to the M&C Server
- b. Configure the M&C software protocol driver to provide access to required legacy system data as shown.
- c. Configure M&C functionality as specified in paragraph Integration of LonWorks (per Section 15951) Systems

3.6 START-UP AND TESTING

Contractor shall test all equipment and perform all other tests necessary to ensure the system is installed and functioning as specified. Contractor shall prepare a [Start-Up and Testing Report](#) documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

3.7 PERFORMANCE VERIFICATION TEST (PVT)

NOTE: A set of Field Test Procedures are being developed by an A/E under contract with Huntsville Center. Once complete, these Test Procedures will be included or referenced here.

Brief interim guidance is provided here.

3.7.1 PVT Phase I Procedures

PVT Procedures shall include:

- a. Network bandwidth usage and available bandwidth (throughput) measurements. Network bandwidth usage shall reference the heavy usage numbers in paragraph Bandwidth Usage Calculation.
- b. Test System Reaction during PVT: Under system normal heavy load {as defined in paragraph Bandwidth Usage Calculation), no more than 10 seconds shall lapse from the time an alarm is generated at a node until the M&C software provides notification and the alarm is displayed. The total system response time from initiation of a control action command from the workstation, to display of the resulting status change on the workstation shall not exceed 20 seconds under system normal heavy load conditions assuming a zero response time for operation of the node's control device.
- c. Verification of IP Connectivity.
- d. Verification of configuration of M&C Software functionality.

3.7.2 PVT Phase I

The Contractor shall demonstrate compliance of the control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. Upon completion of PVT Phase I and as specified the Contractor shall prepare and submit the [PVT Phase I Report](#) documenting all tests performed during the PVT and their results. The PVT report shall include all tests in the PVT Procedures and any other testing performed during the PVT. Failures and repairs shall be documented with test results.

3.7.3 PVT Phase II

PVT Phase II shall consist of Basic Operator Training. Failures or deficiencies of the UMCS during Basic Operator Training shall be considered PVT failures. Upon completion of PVT Phase II and as specified the Contractor shall prepare and submit the [PVT Phase II Report](#) documenting any failures which occurred and repairs performed during PVT Phase II

3.8 TRAINING

NOTE: Training duration and content should be modified to fit the requirements of the specific job. For example, if this specification is to be used to add to an existing UMCS or to replace a portion of an existing UMCS the training requirements should be relaxed.

The Contractor shall conduct training courses for designated personnel in the maintenance, service, and operation of the system as specified, including specified hardware and software. The training shall be oriented

to the specific system provided under this contract. The Contractor is responsible for furnishing audiovisual equipment and other training material and supplies. When training is conducted at Government facilities, the Government reserves the right to videotape the training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor should assume that attendees will be tradesmen such as electricians or boiler operators. Approval of the Contractor's training schedule shall be obtained from the Government at least [30][___] days prior to the first day of training.

3.8.1 Training Documentation

The Contractor shall prepare training documentation for each course. [Basic Operator Training Documentation](#), [Advanced Operator Training Documentation](#), and [Operator Refresher Training Documentation](#) shall each consist of:

- a. Course attendance list: A list of course attendees shall be developed in coordination with and signed by the [Controls][HVAC][Electrical] shop supervisor.
- b. Training Manuals: Training manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government as a part of the printed training manuals.

3.8.2 Basic Operator Training

The Basic Operator Training course shall be taught at the project site on the installed system for a period of no less than [5][___] training days during Phase 2 of the PVT. A maximum of [ten][___] personnel will attend this course. This training shall be targeted towards training personnel in the day-to-day operation and basic maintenance of the system. Upon completion of this course, each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware architecture and operation of the system. This course shall at a minimum include:

- a. General system architecture.
- b. Functional operation of the system, including workstations.
- c. System start-up procedures.
- d. Failure recovery procedures.
- e. Schedule configuration.
- f. Trend configuration.
- g. Reports generation.
- h. Alarm reporting.

- i. Diagnostics.
- j. Historical files.
- k. Maintenance procedures:
 - (1) Physical layout of each piece of hardware.
 - (2) Troubleshooting and diagnostic procedures.
 - (3) Preventive maintenance procedures and schedules.

3.8.3 Advanced Operator Training

The advanced operator course shall be taught off-site or at the project site for a period of not less than [five][__] days. A maximum of [ten][__] personnel will attend this course. The course shall consist of "hands-on" training under the constant monitoring of the instructor. The instructor shall be responsible for determining the appropriate password to be issued to the student commensurate with each student's acquired skills at the beginning of each of these individual training sessions. Advanced Operator Training shall include training on the M&S Software and the LonWorks Network Configuration Tool. Upon completion of this course, the students should be fully proficient in the operation and management of all system operations. The Contractor shall report the skill level of each student at the end of this course.

3.8.4 Operator Refresher Training

NOTE: Operator Refresher Training should be timed to take place near the end of the 1-year warranty period. If the UMCS is contracted out via an IDIQ process, it may be desirable to repeat the operator refresher training periodically.

The refresher course shall be taught at the project site for a period of [two][__] training days when approved by the Government and as specified in paragraph PROJECT TIMING. A maximum of [ten][__] personnel will attend the course. The course shall be structured to address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed UMCS.

Any system failures discovered during the Operator Refresher Training shall be corrected by the Contractor at no cost to the Government.

-- End of Section --