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USACE / NAVFAC / AFCEC / NASA **UFGS-25 10 10 (February 2019)**

Preparing Activity: USACE **Superseding**
UFGS-25 10 10 (November 2015)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 25 - INTEGRATED AUTOMATION

SECTION 25 10 10

UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION

02/19

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SECTION 25 10 10

UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION
02/19

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NOTE: This guide specification covers the requirements for a Utility Monitoring and Control System (UMCS) Front End using Open protocols (LonWorks, BACnet, Modbus, DNP and OPC), a UMCS using the Niagara Framework, and the integration of field control systems.

This specification includes tailoring options to select the protocol(s) required to be supported at the Monitoring and Controls Software (Front-end). Note that unselected protocols can be integrated through the use of a gateway.

This guide specification also includes tailoring options for service-specific requirements for the Air Force, Army and Navy as well as a "Service Generic" tailoring option for use on other projects. In order for this specification to be properly tailored one (and only one) of the services tailoring options (Air Force, Army, Navy, Service Generic) must be selected.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in the specific project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR). CCRs for this specification can be submitted through the Whole Building Design Guide page for this section:

http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufg
****

PART 1 GENERAL

****
NOTE: Use of this UFGS, and the UMCS design, must be in accordance with UFC 3-470-01 Utility Monitoring and Control System (UMCS) Front End and Integration. The release process for UFCs is longer than for UFGS. Once released UFC 3-470-01 will be available online at
http://www.wbdg.org/

Note that the previous (outdated) version of the UFC contains "LonWorks" in the title and should not be used.

Template Points Schedules in electronic format for use with this section are available online at the Whole Building Design Guide page for this section:
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufg
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NOTE: NOTE ON THE USE OF THIS SECTION WITH OTHER SECTION. When using this Section on the same project with specifications for building control systems (Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC, 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS, 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS) there may requirements that appear at first to be conflicting but which are actually designed to be complementary.

For example, Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC excludes a front end while this section (Section 25 10 10) requires a front end - this is to avoid getting multiple front ends.
****

****
NOTE: This specification makes use of SpecsIntact Tailoring Options. This note describes these options and how to use them.

"TAILORING OPTION NOTES" Tailoring Option
Each time tailoring options are used there is an accompanying designer note describing the text that is tailored. As this Section makes heavy use of tailoring options there are many of these notes and they can distract from designer notes describing other decisions. The designer notes describing tailoring options are all in a "TAILORING OPTION NOTES" tailoring option which can be hidden (in SpecsIntact select View-Tailoring Options and then

deselect "TAILORING OPTION NOTES") once this section is tailored and the tailoring option notes are no longer needed.

Protocol Tailoring Options

This specification includes tailoring options for selection of protocol, and whether the Niagara Framework is required. There are five tailoring options:

1) BACNET: A (non-Niagara Framework) BACnet front end (using a BACnet B-AWS)

2) LONWORKS: A LonWorks front end using LNS.

3) NIAGARA FRAMEWORK: A Niagara Framework front end

4) MODBUS: The front end must also support the MODBUS protocol.

5) OPC: The front end must also support OPC.

In general, it is recommended that only one of BACNET, LONWORKS or NIAGARA FRAMEWORK be selected. It is also recommended neither MODBUS and OPC be selected with BACNET.

You have currently selected the following options:

BACNET
LONWORKS
NIAGARA FRAMEWORK
MODBUS
OPC

If you don't see any text between dashes above, you have deselected all of the protocol tailoring options and this specification is not valid. Select at least one of the tailoring options.

If you see more than one line of text between the dashes above you have left multiple tailoring options related to protocol selected. This may result in conflicting requirements. See UFC 3-470-01 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION to determine if one or more tailoring options should be deselected.

Service Tailoring Option

This specification also includes tailoring options for the Service (Air Force, Army, Navy) the specification is used for. There is a "Service Generic" tailoring option that can also be used. Only ONE of the four tailoring options related to the services should be used. You have currently selected the following options:

AIR FORCE

ARMY
NAVY
SERVICE GENERIC

If more than one item appears between the dashes above you have left more than one services tailoring options selected and need to deselect all but one of them.
****

****
NOTE: WARNING - The BACNET tailoring option has been selected with another protocol tailoring option (LONWORKS, MODBUS, NIAGARA FRAMEWORK). As described in UFC 3-470-01, many of the Monitoring and Control Software packages which support BACnet support ONLY BACnet, so the inclusion of other protocol tailoring options may unnecessarily limit the number of vendors able to provide the UMCS. The need for supporting multiple protocols at the Monitoring and Control Software should be verified/checked with the project site. Note that any protocol can be integrated to the UMCS with the use of a gateway, so omitting a tailoring option does not prohibit the integration of systems using that protocol.

See UFC 3-470-01 for more information.
****

****
NOTE: WARNING - The NIAGARA FRAMEWORK tailoring option has been selected with the LONWORKS tailoring option. As described in UFC 3-470-01, LNS-based LonWorks (required by the LONWORKS tailoring option) is generally not compatible with the Niagara Framework.
****

1.1 SUMMARY

****
NOTE: Designer must add location and site specific requirements.
****

****
NOTE: This subpart uses tailoring options:

The sentence referring to only UFGS 23 09 23.01 will be included if the LONWORKS tailoring options is selected.

The sentence referring to only UFGS 23 09 23.02 will be included if the BACNET tailoring option is selected.

The sentence referring to both UFGS 23 09 23.01 and UFGS 23 09 23.02 will be included if the NIAGARA

FRAMEWORK tailoring option is selected.
****

Provide a Utility Monitoring and Control System (UMCS) which performs supervisory monitoring and supervisory control of base-wide building control systems and utility control systems using one or more of: CEA-709.1-D (LonWorks) with LonWorks Network Services (LNS), ASHRAE 135 (BACnet), MODBUS Protocol, MODBUS TCP/IP, OPC DA, or the Niagara Framework with Fox protocol as indicated and shown. Integrate CEA-709.1-D field control systems installed per Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS into the UMCS as specified and maintain the LNS database(s) for the entire network at the UMCS Front End. Integrate field control systems installed per Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS or Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS to the UMCS via Niagara Framework Supervisory Gateways as specified. Integrate ASHRAE 135 (BACnet) field control systems installed per Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS as specified.

1.1.1 System Requirements

****
NOTE: Select the appropriate text in the type specific communication system requirements to indicate whether or not the IP network will be Government furnished. If the IP network is *not* Government furnished be sure to include complete requirements for the IP network in the contract package. This specification does not provide sufficient requirements for the procurement of an IP network.

Use "[an IP network as specified in [_____] and]" only if the contractor is expected to install an IP network. In this case provide the information on the specification for the IP network in the "[_____]" provided.

For Army, coordinate with the installation (DPW and NEC) but the default selection will be "[the Government furnished IP network]"
****

Provide a UMCS as specified and indicated, and in accordance with the following characteristics:

1.1.1.1 General System Requirements

a. The system performs supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.

b. The system includes a Graphical User Interface which allows for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, and access to all supervisory monitoring and control functions.

c. All software used by the UMCS and all software used to install and configure the UMCS is licensed to and delivered to the installation.

d. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software is licensed to and otherwise remains with the Government such that the Government or their agents are able to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor. Software licenses must not require periodic fees and must be valid in perpetuity.

e. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor.

f. The UMCS interfaces directly to ASHRAE 135, CEA-709.1-D, MODBUS Protocol, MODBUS TCP/IP, OPC DA, and Niagara Framework field control systems as specified and may interface to field control systems using other protocols via an M&C Software protocol driver or a Gateway.

g. For UMCS systems with Monitoring and Control Software functionality implemented in Monitoring and Control (M&C) Controller Hardware, provide sufficient additional controller hardware to support the full capacity requirements as specified.

****

NOTE: The following TWO list paragraphs are included only when the NIAGARA FRAMEWORK tailoring option is selected.

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h. All Niagara Framework components have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "ALL" for "Station Compatibility In", "Station Compatibility Out", "Tool Compatibility In" and "Tool Compatibility Out". Note that this will result in the following entries in the license.dat file:

```
accept.station.in="*"
accept.station.out="*"
accept.wb.in="*"
accept.wb.out="*"
```

****

NOTE: Select the required version of the Niagara Framework. This choice must be carefully coordinated with the project site.

Niagara Framework is currently (2015) in a transition between two releases: "AX" and "Version 4". A Version 4 UMCS front end (e.g. as specified in Section 25 10 10) will work with either an AX or Version 4 Niagara Framework Supervisory Gateway, but an AX front end will ONLY work with an AX Niagara Framework Supervisory Gateway.

If this Section is being used to procure a new front

end AND sufficient local support for Version 4 exist, keep the bracketed text to require Version 4. Otherwise, if this section is being used for integration OR if there is insufficient local support to allow requiring Version 4 remove the bracketed text allow either Version 4 or AX.
****

[i. The version of Niagara Framework used on this project must be Version 4.0 or later.]

1.1.1.2 LonWorks Requirements

****
NOTE: This subpart is only included when the LONWORKS tailoring option is selected.
****

a. The UMCS must communicate using CEA-709.1-D over [the Government furnished IP network] [an IP network as specified in [_____] and][the Navy PSNet] in accordance with CEA-852-C as specified and must interface to CEA-709.1-D building control networks using LonWorks/IP Routers as specified.

b. All communication between the UMCS and LonWorks field control networks must be via the CEA-709.1-D protocol over the IP network in accordance with CEA-852-C.

c. Except for communication for device commissioning, configuration, and programming, all communication between the M&C Software and the field control system devices must be via SNVT.

1.1.1.3 BACnet Requirements

****
NOTE: This subpart is only included when the BACNET tailoring option is selected.

In addition, the reference to the Navy PSNet is included only when the NAVY tailoring option is selected.
****

a. The UMCS must communicate using ASHRAE 135 Annex J over [the Government furnished IP network][an IP network as specified in [_____] and][the Navy PSNet] as specified.

b. All communication between the UMCS and ASHRAE 135 field control networks must be via the ASHRAE 135 protocol over the IP network.

c. All communication between the M&C Software and the field control system devices must be via standard ASHRAE 135 services other than PrivateTransfer and ConfirmedPrivateTransfer except as follows:

(1) PrivateTransfer and ConfirmedPrivateTransfer may be used for device configuration and device programming.

(2) PrivateTransfer and ConfirmedPrivateTransfer may be used for communication between the M&C Software and the field control

system if and only if both the M&C Software and the field control system devices automatically (without requiring reconfiguration) revert to the use of other standard ASHRAE 135 services when one of the components is modified or replaced.

1.1.1.4 Modbus Requirements

****
NOTE: This subpart is included only when the MODBUS tailoring option is selected.

In addition, the reference to the Navy PSNet is included only when the NAVY tailoring option is selected.
****

The UMCS must communicate using MODBUS Protocol, MODBUS TCP/IP over [the Government furnished IP network] [an IP network as specified in [_____] and][the Navy PSNet] as specified.

Modbus communications must support all of the following Modbus data types:

****
NOTE: FYI - the four standard data types in Modbus are:
1) Discrete Input - a single bit (read only)
2) Coil - a single bit
3) Input Register - 16 bit (read only)
4) Holding Register - 16 bit

The Modbus standard does not define how the data is interpreted. For example it does not say if the 16 bits from a Holding register are 16 different binary flags, or an integer, or two ASCII characters or something else entirely. The below requirements specify how to format data for some common data types.
****

a. The four standard data types defined by MODBUS Protocol, MODBUS TCP/IP: Discrete Inputs, Coils, Input Registers, and Holding Registers. (Note that these four data types are included in the MODBUS Protocol, MODBUS TCP/IP standard. The remaining data types indicated in this Section are not included in the MODBUS Protocol, MODBUS TCP/IP standard but are defined by this Section to provide a standard for communication between systems.)

b. Character: Character data using a single Input Register or single Holding Register where that Modbus register is interpreted as two 8 bit ISO 8859-1 characters, with the low order bits representing the right-hand character.

c. Floating Point: Floating point data using two consecutive Input Registers or two consecutive Holding Registers where the resulting 32 bits are interpreted as a Binary32 (Single Precision Floating point) number as specified in IEEE 754. Use the first Register for the higher 16 bits, and the second Register for the lower 16 bits.

d. Integer Date: Date data using three consecutive Input Registers or

three consecutive Holding Registers where the resulting 48 bits are interpreted as a 48-bit unsigned big-endian integer. The value is the number of milliseconds, not including leap seconds, from 1970-01-01T00:00:00.000 (12AM, January 1, 1970). Use the first Register for the highest 16 bits and the third Register for the lowest 16 bits.

e. Character Date: Date data using the format specified in ISO 8601 of "YYYY-MM-DDTHH:MM:SS.SSS", where the individual characters are formatted as specified for character data.

1.1.1.5 OPC Requirements

****
NOTE: This subpart is included only when the OPC tailoring option is selected.
****

The UMCS must communicate using OPC DA over [the Government furnished IP network] [an IP network as specified in [_____] and][the Navy PSNet] as shown and specified.

1.1.1.6 Niagara Framework Requirements

****
NOTE: This subpart is included only when the NIAGARA FRAMEWORK tailoring option is selected.

In addition, this subpart used services tailoring options:
1) the reference to the Navy PSNet is included only when the NAVY tailoring option is selected.
2) The HTTP requirement is bracketed when the AIR FORCE, ARMY or SERVICE GENERIC tailoring options are selected.
****

****
NOTE: For the Navy, keep the bracketed text "and HTTP".

For other services keep the bracketed text "and HTTP" if the Niagara Framework Supervisory Gateways will be permitted to serve web pages. Remove the bracketed text "and HTTP" otherwise.

In general, for the Army remove the "and HTTP" text.
****

The UMCS must use the Niagara Framework and must communicate with Niagara Framework field control systems using the Fox protocol[and HTTP] over [the Government furnished IP network] [an IP network as specified in [_____] and][the Navy PSNet] as indicated and specified.

[1.1.2 General Cybersecurity Requirements

****
NOTE: This subpart uses tailoring options so include the Air Force document reference only when

the AIR FORCE tailoring option is selected and the Army document reference when the ARMY tailoring option is selected.
****

****
NOTE: The following paragraph provides a place to include general system-level Cybersecurity requirements above and beyond the requirements already incorporated into the Product and Execution parts of this specification. This paragraph may or may not be required depending on how Information Assurance is being addressed for the project and site.

Provide specific requirements for Cybersecurity - simply incorporating the references through the use of the default test is generally NOT sufficient.

Cybersecurity requirements for Army systems should be coordinated with the UMCS MCX.
****

Address cybersecurity in accordance with [AF ETL 11-1][DA AR 25-2][____].

]1.1.3 Symbols, Definition and Abbreviations

Use symbols, definitions, and engineering unit abbreviations indicated in the contract drawings for displays, submittals and reports. For symbols, definitions and abbreviations not in the contract drawings use terms conforming at a minimum to IEEE Stds Dictionary and the ASHRAE FUN SI ASHRAE FUN IP, as applicable.

1.1.4 System Units and Accuracy

****
NOTE: Accuracy of calculations and precision and resolution of displays for the UMCS is specified in terms of the accuracy of the sensors used in the building controls connected to the UMCS. Edit the brackets to indicate a reference to UFGS 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC to reference a different specification, or to include accuracy requirements.
****

Use [metric (SI)] [English (inch-pound)] units for displays, print-outs and calculations. Perform calculations with an accuracy of at least three significant figures. For displays and printouts present values to at least three significant figures.

1.1.5 Data Packages/Submittals Requirements

****
NOTE: Coordinate the review of all submittals with the project site. The site may have a System Integrator or other individual/office that should review all submittals before acceptance of the

system.

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 Defense Acquisition Regulation Supplement (DFARS). Those regulations as well as the Services implementations thereof should also be consulted to ensure that a delivery of critical items of technical data is not inadvertently lost. Specifically, DFARS 252.227-7013 Rights in Technical Data - Noncommercial Items 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.

****

Technical data packages consisting of computer software and technical data (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications must be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered must 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 Supplement (FARS) and must contain no proprietary information and must be delivered with unrestricted rights.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature

when you add a RID (Reference ID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print 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 INCITS 154	(1988; R 2004) Office Machines and Supplies - Alphanumeric Machines - Keyboard Arrangement

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

ASHRAE 135	(2016) BACnet—A Data Communication Protocol for Building Automation and Control Networks
ASHRAE FUN IP	(2017) Fundamentals Handbook, I-P Edition
ASHRAE FUN SI	(2017) Fundamentals Handbook, SI Edition

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification
CEA-709.3	(1999; R 2015) Free-Topology Twisted-Pair Channel Specification
CEA-852-C	(2014) Tunneling Device Area Network Protocols Over Internet Protocol Channels

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 754	(2008) Floating-Point Arithmetic - IEEE Computer Society
IEEE 802.11	(2016; AI 2017; AJ 2018; AK 2018; AQ 2018) Information Technology-Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks-Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
IEEE 1815	(2015; CORR 2016) Exchanging Information Between Networks Implementing IEC 61850

	and IEEE Std 1815 [Distributed Network Protocol (DNP3)]
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8601	(2004) Data Elements and Interchange Formats - Information Interchange - Representation of Dates and Times
ISO 8859-1	(1998) Information Technology - 8-Bit Single-Byte Coded Graphic Character Sets - Part 1: Latin Alphabet No. 1

INTERNET ENGINEERING TASK FORCE (IETF)

IETF RFC 4361	(2006) Node-specific Client Identifiers for Dynamic Host Configuration Protocol Version Four (DHCPv4)
IETF RFC 7465	(2015) Prohibiting RC4 Cipher Suites
RFC 821	(2001) Simple Mail Transfer Protocol (SMTP)

LONMARK INTERNATIONAL (LonMark)

LonMark Interoperability Guide	(2005) LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4
LonMark SNVT List	(2014) LonMark SNVT Master List; Version 15
LonMark XIF Guide	(2001) LonMark External Interface File Reference Guide; Revision 4.402

MODBUS ORGANIZATION, INC (MODBUS)

MODBUS Protocol	(2012) Modbus Application Protocol Specification; Version 1.1b3
MODBUS TCP/IP	(2006) Modbus Messaging on TCP/IP Implementation Guide; Version V1.0b

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 262	(2019) Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

OPC FOUNDATION (OPC)

OPC DA	(Ver 3.0; Errata) OPC Data Access (DA)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-606	(2017c) Administration Standard for the Telecommunications Infrastructure
TIA-607	(2015c; Addendum 1 2017) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

TRIDIUM, INC (TRIDIUM)

Niagara Framework	(2012) NiagaraAX User's Guide
Tridium Open NiCS	(2005) Understanding the NiagaraAX Compatibility Statement (NiCS)

U.S. AIR FORCE (USAF)

AF ETL 11-1	(2011) Civil Engineer Industrial Control System Information Assurance Compliance

U.S. ARMY (DA)

DA AR 25-2	(2007; RAR 2009) Information Assurance

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC EMC	(2002) FCC Electromagnetic Compliance Requirements
FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 1778	(2014; Reprint Sep 2017) UL Standard for Safety Uninterruptible Power Systems
UL 60950	(2000; Reprint Oct 2007) Safety of Information Technology Equipment

1.3 DEFINITIONS

The following list of definitions may contain terms not found elsewhere in this Section but are included here for completeness. Some terms are followed with a protocol reference in parenthesis indicating to which protocol the term and definition applies. Inclusion of protocol-specific

definitions does not create a requirement to support that protocol, nor does it relax any requirements to support specific protocols as indicated elsewhere in this section.

1.3.1 Alarm Generation

The process of comparing a point value (the point being alarmed) with a pre-defined alarm condition (e.g. a High Limit) and performing some action based on the result of the comparison.

1.3.2 Alarm Handling

see Alarm Routing

1.3.3 Alarm Routing

Alarm routing is M&C software functionality that starts with a notification that an alarm exists (typically as the output of an Alarm Generation process) and sends a specific message to a specific alarm recipient or device.

1.3.4 Application Generic Controller (AGC)(LonWorks)

A device that is furnished with a (limited) pre-established application that also has the capability of being programmed. Further, the ProgramID and XIF file of the device are fixed. The programming capability of an AGC may be less flexible than that of a General Purpose Programmable Controller (GPPC).

1.3.5 Application Specific Controller (ASC)(LonWorks)

A device that is furnished with a pre-established built in application that is configurable but not re-programmable. An ASC has a fixed factory-installed application program (i.e Program ID) with configurable settings.

1.3.6 BACnet (BACnet)

The term BACnet is used in two ways. First meaning the BACnet Protocol Standard - the communication requirements as defined by ASHRAE 135 including all annexes and addenda. The second to refer to the overall technology related to the ASHRAE 135 protocol.

1.3.7 BACnet Advanced Application Controller (B-AAC)(BACnet)

A hardware device BTL Listed as a B-AAC. A control device which contains BIBBs in support of scheduling and alarming but otherwise has limited resources relative to a B-BC. It may be intended for specific applications and supports some degree of programmability.

1.3.8 BACnet Advanced Operator Workstation (B-AWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as an Advanced Operator Workstation and includes the ability to manage scheduling, alarming and trending in an open manner. The B-AWS is the advanced operator's window into a BACnet system. It is primarily used to monitor the performance of a system and to modify parameters that affect the operation of a system.

1.3.9 BACnet Application Specific Controller (B-ASC)(BACnet)

A hardware device BTL Listed as a B-ASC. A controller with limited resources relative to a B-AAC. It is intended for use in a specific application and supports limited programmability.

1.3.10 BACnet Building Controller (B-BC)(BACnet)

A hardware device BTL Listed as a B-BC. A general-purpose, field-programmable device capable of carrying out a variety of building automation and control tasks including control and monitoring via direct digital control (DDC) of specific systems and data storage for trend information, time schedules, and alarm data. Like the other BTL Listed controller types (B-AAC, B-ASC etc.) a B-BC device is required to support the server ("B") side of the ReadProperty and WriteProperty services, but unlike the other controller types it is also required to support the client ("A") side of these services. Communication between controllers requires that one of them support the client side and the other support the server side, so a B-BC is often used when communication between controllers is needed.

1.3.11 BACnet Internetwork (BACnet)

Two or more BACnet networks connected with BACnet routers. In a BACnet Internetwork, there exists only one message path between devices.

1.3.12 BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more BACnet services intended to define a higher level of interoperability. BIBBs are combined to build the BACnet functional requirements for a device in a specification. Some BIBBs define additional requirements (beyond requiring support for specific services) in order to achieve a level of interoperability. For example, the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by an M&C client, not only requires the client to support the ReadProperty Service, but also provides a list of data types (Object / Properties) which the client must be able to interpret and display for the user.

1.3.13 BACnet Operator Display (B-OD)(BACnet)

A hardware device BTL Listed as a B-OD. A basic operator interface with limited capabilities relative to a B-OWS. It is not intended to perform direct digital control. The B-OD profile could be used for wall-mounted LCD devices, displays affixed to BACnet devices; hand-held terminals or other very simple user interfaces.

1.3.14 BACnet Operator Workstation (B-OWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as a B-OWS. An operator interface with limited capabilities relative to a B-AWS. The B-OWS is used for monitoring and basic control of a system, but differs from a B-AWS in that it does not support configuration activities, nor does it provide advanced troubleshooting capabilities.

1.3.15 BACnet Smart Actuator (B-SA)(BACnet)

A hardware device BTL Listed as a B-SA. A simple control output device with limited resources; it is intended for specific applications.

1.3.16 BACnet Smart Sensor (B-SS)(BACnet)

A hardware device BTL Listed as a B-SS. A simple sensing device with very limited resources.

1.3.17 BACnet Testing Laboratories (BTL)(BACnet)

Established by BACnet International to support compliance testing and interoperability testing activities and consists of BTL Manager and the BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.3.18 BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been certified by BACnet® Testing Laboratory. Devices may be certified to a specific device profile, in which case the certification indicates that the device supports the required capabilities for that profile, or may be certified as "other".

1.3.19 Binary

A two-state system or signal; for example one where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

1.3.20 Binding (LonWorks)

The act of establishing communications between CEA-709.1-D devices by associating the output of a device to the input of another so that information is automatically (and regularly) sent without being requested by the recipient.

1.3.21 Broadcast

Unlike most messages, which are intended for a specific recipient device, a broadcast message is intended for all devices on the network.

1.3.22 Building Control Network (BCN)

The network used by the Building Control System. Typically the BCN is a BACnet ASHRAE 135 or LonWorks CEA-709.1-D network installed by the building control system contractor.

1.3.23 Building Control System (BCS)

One type of Field Control System. A control system for building electrical and mechanical systems, typically HVAC (including central plants) and lighting. A BCS generally uses Direct Digital Control (DDC) Hardware and generally does NOT include its own local front end.

1.3.24 Building Point of Connection (BPOC)

A FPOC for a Building Control System. (This term is being phased out of use in preference for FPOC but is still used in some specifications and criteria. When it was used, it typically referred to a piece of control hardware. The current FPOC definition typically refers instead to IT hardware)

1.3.25 Channel (LonWorks)

A portion of the control network consisting of one or more segments connected by repeaters. Channels are separated by routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 128 devices per channel.

1.3.26 Commandable (BACnet)

A point (Object) is commandable if its Present_Value Property is writable and it supports the optional Priority_Array Property. This functionality is useful for Overrides.

1.3.27 Configuration Property (LonWorks)

Controller parameter used by the application which is usually set during installation/testing and seldom changed. For example, the P and I settings of a P-I control loop. Also see 'Standard Configuration Property Type (SCPT)'

1.3.28 Control Logic Diagram

A graphical representation of control logic for multiple processes that make up a system.

1.3.29 Device Object (BACnet)

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object_Identifier number on the BACnet Internetwork. This number is often referred to as the device instance or device ID.

1.3.30 Explicit Messaging (LonWorks)

A non-standard and often vendor (application) specific method of communication between devices.

1.3.31 External Interface File (XIF) (LonWorks)

A file which documents a device's external interface, specifically the number and types of LonMark objects, the number, types, directions, and connection attributes of network variables, and the number of message tags.

1.3.32 Field Point Of Connection (FPOC)

The FPOC is part of the UMCS IP network and acts as the point of connection between the UMCS IP Network and the field control IP network. The FPOC is an IT device such as a switch, IP router, or firewall, typically managed by the site IT staff. (Note that the field control IP network may consist of a single IP device, or that integration may require installation of a field control network IP device.)

1.3.33 Field Control Network

The network used by a field control system.

1.3.34 Field Control System (FCS)

A building control system or utility control system.

1.3.35 Fox Protocol (Niagara Framework)

The protocol used for communication between components in the Niagara Framework. By default, Fox uses TCP port 1911

1.3.36 Functional Profile (LonWorks)

A standard description, defined by LonMark International, of a LonMark Object used to classify and certify devices.

1.3.37 Gateway

A device that translates from one protocol to another. Devices that change only the transport mechanism of the protocol - "translating" from LonWorks over TP/FT-10 to LonWorks over IP for example - are not gateways as the underlying protocol (data format) does not change. Gateways are also called Communications Bridges or Protocol Translators.

1.3.38 General Purpose Programmable Controller (GPPC) (LonWorks)

Unlike an ASC or AGC, a GPPC is not furnished with a fixed application program and does not have a fixed ProgramID or XIF file. A GPPC can be (re-)programmed, usually using vendor-supplied software. When a change to the program affects the external interface (and the XIF file) the ProgramID will change.

1.3.39 Internetwork (BACnet)

See BACnet Internetwork.

1.3.40 JACE (Niagara Framework)

Java Application Control Engine. See Niagara Framework Supervisory Gateway

1.3.41 LonMark Object (LonWorks)

A collection of network variables, configuration properties, and associated behavior defined by LonMark International and described by a Functional Profile. It defines how information is exchanged between devices on a network (inputs from and outputs to the network).

1.3.42 LNS Plug-in (LonWorks)

Software which runs in an LNS compatible software tool, typically a network configuration tool. Device configuration plug-ins provide a 'user friendly' method to edit a device's configuration properties.

1.3.43 LonMark (LonWorks)

See LonMark International. Also, a certification issued by LonMark International to CEA-709.1-D devices.

1.3.44 LonMark International (LonWorks)

Standards committee consisting of independent product developers, system

integrators and end users dedicated to determining and maintaining the interoperability guidelines for LonWorks. Maintains guidelines for the interoperability of CEA-709.1-D devices and issues the LonMark Certification for CEA-709.1-D devices.

1.3.45 LonWorks (LonWorks)

The term used to refer to the overall technology related to the CEA-709.1-D protocol (sometimes called "LonTalk"), including the protocol itself, network management, interoperability guidelines and products.

1.3.46 LonWorks Network Services (LNS) (LonWorks)

A network management and database standard for CEA-709.1-D devices.

1.3.47 LonWorks Network Services (LNS) Database (LonWorks)

The standard database created and used by LonWorks Network Services (LNS) compatible tools, such as LNS Network Configuration tools.

1.3.48 Modbus

A basic protocol for control network communications generally used in utility control systems. The Modbus protocol standard is maintained by The Modbus Organization.

1.3.49 Master-Slave/Token Passing (MS/TP)(BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds (data rates) are permitted by the BACnet MS/TP standard.

1.3.50 Monitoring and Control (M&C) Software

The UMCS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

1.3.51 Network (BACnet)

In BACnet, a portion of the control internetwork consisting of one or more segments of the same media connected by repeaters. Networks are separated by routers.

1.3.52 Network Variable (LonWorks)

See 'Standard Network Variable Type (SNVT)'.

1.3.53 Network Configuration Tool (LonWorks)

The software used to configure the control network and set device configuration properties. This software creates and modifies the control network database (LNS Database).

1.3.54 Niagara Framework

A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The Framework consists of front end (M&C) software, web based clients, field level control hardware, and engineering tools. While the Niagara

Framework is not adopted by a recognized standards body and does not use an open licensing model, it is sufficiently well-supported by multiple HVAC vendors to be considered a de-facto Open Standard.

1.3.55 Niagara Framework Supervisory Gateway (Niagara Framework)

DDC Hardware component of the Niagara Framework. A typical Niagara architecture has Niagara specific supervisory gateways at the IP level and other (non-Niagara specific) controllers on field networks (TP/FT-10, MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara specific controllers function as a gateway between the Niagara framework protocol (Fox) and the field network beneath. These supervisory gateways may also be used as general purpose controllers and also have the capability to provide a web-browser based user interface.

Note that different vendors refer to this component by different names. The most common name is "JACE"; other names include "EC-BOS", "FX-40", and "UNC".

1.3.56 Node (LonWorks)

A device that communicates using the CEA-709.1-D protocol and is connected to a CEA-709.1-D network.

1.3.57 Node Address (LonWorks)

The logical address of a node on the network, consisting of a Domain number, Subnet number and Node number. Note that the "Node number" portion of the address is the number assigned to the device during installation and is unique within a subnet. This is not the factory-set unique Node ID (see Node ID).

1.3.58 Node ID (LonWorks)

A unique 48-bit identifier assigned (at the factory) to each CEA-709.1-D device. Sometimes called the Neuron ID.

1.3.59 Object (BACnet)

A BACnet Object. The concept of organizing BACnet information into standard components with various associated Properties. Examples include Analog Input objects and Binary Output objects.

1.3.60 Override

To change the value of a point outside of the normal sequence of operation where this change has priority over the sequence. An override can be accomplished in one of two ways: the point itself may be Commandable and written to with a priority or there may be a separate point on the controller for the express purpose of implementing the override.

Typically this override is from the Utility Monitoring and Control System (UMCS) Monitoring and Control (M&C) Software. Note that this definition is not standard throughout industry.

1.3.61 Point, Calculated

A value within the M&C Software that is not a network point but has been calculated by logic within the software based on the value of network

points or other calculated points. Calculated points are sometimes called virtual points or internal points.

1.3.62 Point, Network

A value that the M&C Software reads from or writes to a field control network.

1.3.63 Polling

A requested transmission of data between devices, rather than an unrequested transmission such as Change-Of-Value (COV) or Binding where data is automatically transmitted under certain conditions.

1.3.64 Program ID (LonWorks)

An identifier (number) stored in the device (usually EEPROM) that identifies the node manufacturer, functionality of device (application & sequence), transceiver used, and intended device usage.

1.3.65 Property (BACnet)

A BACnet Property - a data element associated with an Object. Different Objects have different Properties, for example an Analog Input Object has a Present_Value Property (which provides the value of the underlying hardware analog input), a High_Limit Property (which contains a high limit for alarming), as well as other properties.

1.3.66 Protocol Implementation Conformance Statement (PICS)(BACnet)

A document, created by the manufacturer of a device, which describes which potions of the BACnet standard are implemented by a given device.

1.3.67 Repeater

A device that connects two control network segments and retransmits all information received on one side onto the other.

1.3.68 Router (LonWorks)

A device that connects two channels and controls traffic between the channels by retransmitting signals received from one subnet onto the other based on the signal destination. Routers are used to subdivide a control network and to control bandwidth usage.

1.3.69 Router (BACnet)

A device that connects two or more BACnet networks and controls traffic between the networks by retransmitting signals received from one network onto another based on the signal destination. Routers are used to subdivide an internetwork and to control bandwidth usage.

1.3.70 Segment

A 'single' section of a control network that contains no repeaters or routers. There is generally a limit on the number of devices on a segment, and this limit is dependent on the topology/media and device type. For example, a TP/FT-10 segment with locally powered devices is limited to 64 devices, and a BACnet MS/TP segment is limited to 32 devices.

1.3.71 Service (BACnet)

A BACnet Service. A defined method for sending a specific type of data between devices. Services are always defined in a Client-Server manner, with a Client initiating a Service request and a Server Executing the Service. Some examples are ReadProperty (a client requests a data value from a server), WriteProperty (a client writes a data value to a server), and CreateObject (a client requests that a server create a new object within the server device).

1.3.72 Service Pin (LonWorks)

A hardware push-button on a device which causes the device to broadcast a message containing its Node ID and Program ID. This broadcast can also be initiated via software.

1.3.73 Standard BACnet Object/Property/Service (BACnet)

BACnet Objects, Properties, or Services that are standard Objects, Properties, or Services enumerated and defined in ASHRAE 135. Clause 23 of ASHRAE 135 defines methods to extend ASHRAE 135 to non-standard or proprietary information. Standard BACnet Objects/Properties/Services specifically exclude any vendor specific extensions.

1.3.74 Standard Configuration Property Type (SCPT) (LonWorks)

Pronounced 'skip-it'. A standard format type (maintained by LonMark International) for Configuration Properties.

1.3.75 Standard Network Variable Type (SNVT) (LonWorks)

Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

1.3.76 Subnet (LonWorks)

Consists of a logical grouping of up to 127 nodes, where the logical grouping is defined by node addressing. Each subnet is assigned a number which is unique within the Domain. See also Node Address.

1.3.77 Supervisory Controller

A controller implementing a combination of supervisory logic (global control strategies or optimization strategies), scheduling, alarming, event management, trending, web services or network management. Note this is defined by use; many supervisory controllers have the capability to also directly control equipment.

1.3.78 Supervisory Gateway

****

NOTE: This subpart uses tailoring options: The

phrase ", such as a Niagara Framework Supervisory Gateway" is only included when the NIAGARA FRAMEWORK tailoring option is selectedT
****

A device that is both a supervisory controller and a gateway, such as a Niagara Framework Supervisory Gateway.

1.3.79 TP/FT-10 (LonWorks)

A Free Topology Twisted Pair network (at 78 kbps) defined by CEA-709.3. This is the most common media type for a CEA-709.1-D control network.

1.3.80 TP/XF-1250 (LonWorks)

A high speed (1.25 Mbps) twisted pair, doubly-terminated bus network defined by the LonMark Interoperability Guidelines. This media is typically used only as a backbone media to connect multiple TP/FT-10 networks.

1.3.81 UMCS Network

An IP network connecting multiple field control systems to the Monitoring and Control Software using one or more of: LonWorks (CEA-709.1-D and CEA-852-C), BACnet (ASHRAE 135 Annex J), MODBUS Protocol, MODBUS TCP/IP or OPC DA.

1.3.82 User-defined Configuration Property Type (UCPT) (LonWorks)

Pronounced 'u-keep-it'. A Configuration Property format type that is defined by the device manufacturer.

1.3.83 User-defined Network Variable Type (UNVT) (LonWorks)

A network variable format defined by the device manufacturer. Note that UNVTs create non-standard communications (other vendor's devices may not correctly interpret it) and may close the system and therefore are not permitted by this specification.

1.3.84 Utility Control System (UCS)

One type of field control system. Used for control of utility systems such as an electrical substation, sanitary sewer lift station, water pump station, etc. Building controls are excluded from a UCS, however it is possible to have a Utility Control System and a Building Control System in the same facility, and for those systems to share components such as the FPOC. A UCS may include its own local front-end.

1.4 SUBMITTALS

****
NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other

submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
****

****
NOTE: Coordinate the review of all submittals with the project site. The site may have a Building Automation System (BAS) Manager or other individual/office that should review all submittals before acceptance of the system.
****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES and TABLE 1: PROJECT SEQUENCING:

****
NOTE: The submittals included in this guide specification are critical and require Government review. Any added submittals normally should be for information only and reviewed through the Contractor Quality Control system.
****

SD-02 Shop Drawings

****
NOTE: Either indicate drawing size, or leave both options to allow the contractor to decide.

When selecting format for electronic drawings

coordinate with the project site. Be sure to require drawings in a format that is usable by the site maintenance staff. This may require including multiple format requirements here.

Indicate quantities for submittals.
****

UMCS Contractor Design Drawings; G[, [_____]]

UMCS Contractor Design Drawings as a single complete package: [_____] hard copies and [_____] copies on CDROM. Submit hardcopy drawings on [ISO A1 841 by 594 mm 34 by 22 inches][or][A3 420 by 297 mm 17 by 11 inches] sheets, and electronic drawings in both PDF and [AutoCAD][Microstation][Bentley BIM V8][Autodesk Revit 2013] format.

Draft As-Built Drawings; G[, [_____]]

Draft As-Built Drawings as a single complete package: [_____] hard copies and [_____] copies on CDROM. Submit hardcopy drawings must on [ISO A1 841 by 594 mm 34 by 22 inches][or][A3 420 by 297 mm 17 by 11 inches] sheets, and electronic drawings in both PDF and [AutoCAD][Microstation][Bentley BIM V8][Autodesk Revit 2013] format.

Final As-Built Drawings; G[, [_____]]

Final As-Built Drawings as a single complete package: [_____] hard copies and [_____] copies on CDROM. Submit hardcopy drawings on [ISO A1 841 by 594 mm 34 by 22 inches][or][A3 420 by 297 mm 17 by 11 inches] sheets, and electronic drawings in both PDF and [AutoCAD][Microstation][Bentley BIM V8][Autodesk Revit 2013] format.

SD-03 Product Data

Product Data Sheets; G[, [_____]]

Computer Software; G[, [_____]]

The most recent versions of all computer software provided under this specification delivered as a Technical Data Package. Submit the user manuals for all software delivered for this project with the software.

Enclosure Keys

****
NOTE: Certificate of Networthiness Documentation is only required for Army projects and is only included when the ARMY tailoring options is selected.
****

Certificate of Networthiness Documentation; G[, [_____]]

Documentation of existing Certificates of Networthiness or completed Certificate of Networthiness "Application Checklist" [via e-mail and]on optical disc.

SD-05 Design Data

UMCS IP Network Bandwidth Usage Estimate; G[, [_____]]

[Four][_____] copies of the UMCS IP Network Bandwidth Usage Estimate.

SD-06 Test Reports

Pre-Construction QC Checklist; G[, [_____]]

[Four] [_____] copies of the Pre-Construction QC Checklist.

Post-Construction QC Checklist; G[, [_____]]

[Four] [_____] copies of the Post-Construction QC Checklist.

[
****
NOTE: If not requiring a Factory Test in PART 3 EXECUTION, remove the submittal requirements for Factory Test Procedures and Factory Test Report
****

Factory Test Procedures; G[, [_____]]

[Four] [_____] copies of the Factory Test Procedures. The Factory Test Procedures may be submitted as a Technical Data Package.

Factory Test Report

[Four] [_____] copies of the Factory Test Report. The Factory Test Report may be submitted as a Technical Data Package.

]

Existing Conditions Report; G[, [_____]]

[Four] [_____] copies of the Existing Conditions Report.

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

[Four] [_____] copies of the Start-Up and Start-Up Testing Report. The Start-Up and Testing report may be submitted as a Technical Data Package.

PVT Phase I Procedures; G[, [_____]]

[Four] [_____] copies of the PVT Phase I Procedures. The PVT Procedures may be submitted as a Technical Data Package.

PVT Phase I Report; G[, [_____]]

[Four] [_____] copies of the PVT Phase I Report. The PVT Phase I Report may be submitted as a Technical Data Package.

PVT Phase II Report; G[, [_____]]

[Four] [_____] copies of the PVT Phase II Report. The PVT Phase II Report may be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G[, [_____]]

[Four] [_____] bound O&M Instructions[and [_____] copies of the Instructions in PDF format on optical disc]. Index and tab bound instructions.[Submit instructions in PDF form as a single PDF file, or as multiple PDF files with a PDF file table of contents containing links to the other files.] O&M Instructions may be submitted as a Technical Data Package.

Preventive Maintenance Work Plan; G[, [_____]]

[Four] [_____] copies of the Preventive Maintenance Work Plan. The Preventive Maintenance Work Plan may be submitted as a Technical Data Package.

Basic Training Documentation; G[, [_____]]

Training manuals for Basic Training delivered for each trainee on the Course Attendance List with [two] [_____] additional copies delivered for archival at the project site. Submit [two] [_____] copies of the Course Attendance List with the archival copies. The Basic Training Documentation may be submitted as a Technical Data Package.

Advanced Training Documentation; G[, [_____]]

One set of training manuals delivered for each trainee on the Course Attendance List with [two] [_____] additional copies delivered for archival at the project site. Submit [two] [_____] copies of the Course Attendance List with the archival copies. The Advanced Training Documentation may be submitted as a Technical Data Package.

Refresher Training Documentation; G[, [_____]]

One set of training manuals delivered for each trainee on the Course Attendance List with [two] [_____] additional copies delivered for archival at the project site. Submit [two] [_____] copies of the Course Attendance List with the archival copies. The Refresher Training Documentation may be submitted as a Technical Data Package.

SD-11 Closeout Submittals

Closeout QC Checklist; G[, [_____]]

[Four] [_____] copies of the Closeout QC Checklist.

1.5 PROJECT SEQUENCING

****

NOTE: Table I provides bracketed text in which the number of days between items may be specified. In many cases this information will be specified elsewhere. When project schedule is specified elsewhere remove bracketed text and Table I will provide sequencing but not specific intervals. If

time intervals are to be specified here keep the bracketed text and enter the number of days in the space provided.
****

TABLE I: PROJECT SEQUENCING specifies the sequencing 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).

1.5.1 Sequencing for Submittals

The sequencing 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 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within [14] [_____] days of notification that the submittal has been rejected. Upon re-submittal there will be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

1.5.2 Sequencing for Activities

The sequencing specified for activities indicates the earliest the activity may begin.

1.5.3 Abbreviations

In TABLE I the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

****
NOTE:
If requiring a Factory Test in PART 3 EXECUTION, keep "Acceptance of Factory Test Report" in the DESCRIPTION column for item 1. If NOT requiring a factory test keep "Notice to proceed" or edit to indicate other starting condition.

Complete TABLE I by entering the appropriate number of days in the spaces provided in the SEQUENCING column.
****

****
NOTE: If this project includes work to be performed under Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC, that work will need to be coordinated with, and in many cases will need to be completed before, work specified in this Section under paragraph "Integration of Field Control Systems".
****

****
NOTE: This subpart uses tailoring options:
The Certificate of Networthiness Documentation is only required for Army projects and is only included

when the ARMY tailoring options is selected.
****

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1		[Acceptance of Factory Test Report][Notice to proceed][_____]	
2	S	Existing Conditions Report	[_____] days after #1
3	S	Design Drawings	[_____] days after #1
4	S	Product Data Sheets and Certificate of Networthiness Documentation	[_____] days after #1
5	S	UMCS IP Network Bandwidth Usage Estimate	[_____] days after #1
6	S	Pre-construction QC Checklist	[_____] days after #1
7	E	Install UMCS	AAO #2 thru #6
8	E	Start-Up and Start-Up Testing	ACO #7
9	S	Post-Construction QC Checklist	[_____] days ACO #8
10	S	Computer Software	[_____] days ACO #8
11	S	Start-Up and Start-Up Testing Report	[_____] days ACO #8
12	S	Draft As-Built Drawings	[_____] days ACO #8
13	S	PVT Phase I Procedures	[_____] days before scheduled start of #14 and AAO #11
14	E	PVT Phase I	AAO #13 and #12
15	S	PVT Phase I Report	[_____] days ACO #14
16	S	Preventive Maintenance Work Plan	AAO #11

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
17	S	O&M Instructions	AAO #11
18	S	Basic Training Documentation	AAO #11 and [_____] days before scheduled start of #19
19	E	Basic Training (PVT Phase II)	AAO #16, #17 and #18
20	S	PVT Phase II Report	[_____] days ACO #19
21	S	Final As-Built Drawings	[_____] days AAO #20
22	S	Advanced Training Documentation	[_____] days before schedule start of #23 and AAO #18
23	E	Advanced Training	ACO #19, [_____] days AAO #22, and no later than [60] days ACO #19
24	S	Refresher Training Documentation	[_____] days before #25 and AAO #18 and #22
25	E	Refresher Training	between [_____] and [_____] days ACO #19 and AAO #24
26	S	Closeout QC Checklist	ACO #23

1.6 QUALITY CONTROL (QC) CHECKLISTS

The Contractor's Chief Quality Control (QC) Representative must complete the QC Checklist in APPENDIX A, and must submit the Pre-Construction QC Checklist, Post-Construction QC Checklist and Closeout QC Checklist as specified. The QC Representative must verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative must sign and date the Checklist prior to submission to the Government.[

The APPENDIX A QC Checklist is available as an editable file at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-10-10
]

1.7 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Provide UMCS Operation and Maintenance Instructions which include:

a. Procedures for the UMCS system start-up, operation and shut-down.

b. Final As-Built drawings.

c. Routine maintenance checklist, arranged in a columnar format: The first column listing all installed devices, the second column stating the maintenance activity or stating that no maintenance required, the third column stating the frequency of the maintenance activity, and the fourth column providing any additional comments or reference.

d. Qualified service organization list including points of contact with phone numbers.

e. Start-Up and Start-Up Testing Report.

f. Performance Verification Test (PVT) Procedures and Reports.

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

2.1.1 Product Certifications

For computing devices, as defined in FCC Part 15, supplied as part of the UMCS provide devices which are certified to comply with the requirements of Class B computing devices.

2.1.2 Product Sourcing

For units of the same type of equipment, provide products of a single manufacturer. For each major component of equipment provide equipment with the manufacturer's name and the model and serial number in a conspicuous place. For materials and equipment, provide new standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products.

2.1.3 General Requirements

Provide components that meet the following requirements:

****

NOTE: In particularly hot or cold environments, increase the temperature range requirements for equipment in unconditioned space

****

a. Portions of the data communications equipment system installed in unconditioned spaces must operate properly in an environment with ambient temperatures between [0 and 49] [_____] degrees C [32 and 120] [_____] degrees F and ambient relative humidity between 10 percent and 90 percent noncondensing.

b. Components must accept 100 to 125 volts AC (Vac), 60 Hz, single phase, three wire with a three-pronged, dedicated circuit outlet or be provided with a transformer to meet the component's power requirements.

c. The equipment must meet the requirements of NFPA 70, UL 60950, NFPA 262, FCC EMC, and FCC Part 15.

2.1.4 Nameplates

Provide nameplates of laminated plastic identifying the function, network address, if applicable, and identifier of the device. Laminated plastic

must be at least 3 mm 0.125 inch thick, white with black center core. Nameplates must be a minimum of 25 by 75 mm 1 by 3 inch with minimum 6 mm 0.25 inch high engraved block lettering.

2.1.5 Product Data Sheets

****
NOTE: This subpart uses tailoring options: The sentence containing the PICS requirement is only included when the BACNET tailoring option is selected.
****

For all products (equipment) specified in PART 2 and supplied under this contract, submit copies of all manufacturer catalog cuts and specification sheets to indicate conformance to product requirements. For Monitoring and Control (M&C) Software also include the PICS verifying BTL Listing as a B-AWS.

2.2 CONTROL HARDWARE

2.2.1 Control Protocol Routers

2.2.1.1 LonWorks/IP Router

Provide LonWorks/IP Routers which perform layer 3 routing of CEA-709.1-D packets over an IP network in accordance with CEA-852-C. The router must provide the appropriate connection to the IP network and connections to the CEA-709.3 TP/FT-10 or TP/XF-1250 network. LonWorks/IP Routers must support the Dynamic Host Configuration Protocol (DHCP; IETF RFC 4361) for IP configuration and the use of an CEA-852-C Configuration Server (for CEA-852-C configuration), but must not rely on these services for configuration. LonWorks/IP Routers must be capable of manual configuration via a console RS-232 port.

2.2.1.2 BACnet/IP Router

****
NOTE: Include the bracketed text "[, or other ASHRAE 135]" as needed to allow for integration to non-MS/TP networks.
****

Provide BACnet/IP Routers which perform layer 3 routing of ASHRAE 135 packets over an IP network in accordance with ASHRAE 135 Annex J and Clause 6. The router must provide the appropriate connection to the IP network and connections to a ASHRAE 135 MS/TP[, or other ASHRAE 135] network. Devices used as BACnet/IP Routers must be BTL Listed and must support the Network Management-Router Configuration-B (NM-RC-B) BIBB.

2.2.1.3 Modbus/IP Router

Provide Modbus/IP Routers which perform layer 3 routing of MODBUS Protocol/ MODBUS TCP/IP packets over an IP network in accordance with MODBUS Protocol /MODBUS TCP/IP. The router must provide the appropriate connection to the IP network and connections to a non-IP MODBUS Protocol/MODBUS TCP/IP network. Modbus/IP Routers must support the Dynamic Host Configuration Protocol (DHCP; IETF RFC 4361) for IP configuration but must not rely on this service for configuration. Modbus/IP Routers must be capable of

disabling the capability for remote configuration of Modbus routing information from the IP network.

2.2.2 Monitoring and Control (M&C) Controller Hardware

****
NOTE: This subpart uses tailoring options: "a Niagara Framework Supervisory Gateway" is only included when the NIAGARA FRAMEWORK tailoring option is selected.
****

Provide Monitoring and Control (M&C) Controller Hardware which is a Niagara Framework Supervisory Gateway or a microprocessor-based direct digital control hardware and which communicates over the UMCS IP network using one of:

a. CEA-709.1-D in accordance with CEA-852-C and using only Standard Network Variable Types (SNVTs) as defined by the LonMark SNVT List.

b. ASHRAE 135 in accordance with ASHRAE 135 Annex J and using only Standard ASHRAE 135 services.

Monitoring and Control (M&C) Controller Hardware must either meet the requirements of the LonMark Interoperability Guide or be BTL Listed.

2.2.3 BACnet Supervisory Controller Hardware

****
NOTE: This subpart only applies to BACnet systems and is only included when the BACNET tailoring option is only included when the BACNET tailoring option is selected.
****

Provide BACnet Supervisory Controller Hardware which is direct digital control hardware and which:

a. is BTL Listed

b. communicates using ASHRAE 135 over an IP network in accordance with ASHRAE 135 Annex J

c. has a configurable Object_Name Property

d. supports the following BIBBS

(1) DS-RP-B (Data Sharing–Read Property–B) BIBB for Objects requiring read access from the M&C Software

(2) DS-WP-B (Data Sharing–Write Property–B) BIBB for Objects requiring write access from the M&C Software.

(3) SCHED-E-B (Scheduling-External-B)

(4) AE-N-I-B (Alarm and Event-Notification Internal-B)

(5) AE-ACK-B (Alarm and Event-ACK-B)

(6) T-VMT-I-B (Trending-Viewing and Modifying Trends-Internal-B)

(7) T-ATR-B (Trending-Automated Trend Retrieval-B)

e. has a Writable Recipient_List Property of the Notification Class Object

2.2.4 Control Protocol Gateways

****
NOTE: FYI: Except for the use of Niagara Framework Supervisory Gateways with Niagara Framework M&C Software, Gateways should be used only for the integration of legacy building control systems (HVAC, lighting etc) or for the integration of new or legacy utility control systems. Gateways should not be used to permit the installation of new building control systems which do not use,CEA-709.1-D or ASHRAE 135.

Indicate if additional capability may be required. Note that since the Legacy system should not change this requirement shouldn't be needed, and when used will normally be intended to cover the case of 'forgotten' points (when the mapping requirements from the legacy system have not been fully/properly identified). Requiring excess capacity may add cost.
****

****
NOTE: This subpart uses tailoring options. Fox Protocol is included in the protocol list only when the NIAGARA FRAMEWORK tailoring option is selected.
****

Provide Control Protocol Gateways which perform bi-directional protocol translation between two of the following protocols, or between one of the following protocols and another protocol: CEA-709.1-D, ASHRAE 135, MODBUS Protocol, MODBUS TCP/IP, Fox protocol, and OPC DA. Provide Control Protocol Gateways which also meet the following requirements.

a. Gateways must have two or more separate network connections, each appropriate for the protocol and media used. A single network connection must not be used for both protocols.

b. Gateways must be capable of being installed, configured and programmed through the use of instructions in the manual supplied by the Contractor.

c. Provide and license to the Government all software required for gateway configuration.

d. Gateways must retain their configuration after a power loss of an indefinite time, and must automatically return to their pre-power loss state once power is restored.

e. Gateways must provide capacity for mapping all required points as indicated[plus an additional [10 percent][_____]] between the two protocols it uses.

f. Gateways must, in addition, meet all requirements specified (in the following subparagraphs) for each of the two protocols it translates.

2.2.4.1 Gateway for CEA-709.1

For a gateways using CEA-709.1-D provide gateways which meet the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Network Variable Types (SNVTs) according to the LonMark SNVT List.

b. Gateways communicating CEA-709.1-D over an IP network must communicate in accordance with CEA-852-C.

c. It must allow of its standard network variables (SNVTs) and support transmitting data using the "min, max, and delta" (throttling and heartbeat) methodology.

d. It must provide the ability to label SNVTs.

e. It must supply a LonMark external interface file (XIF) as defined in the LonMark XIF Guide for use with LNS tools and utilities.

f. It must have a "service pin" which, when pressed, will cause the Gateway to broadcast its 48-bit NodeID and ProgramID over the network.

g. It must provide a configurable self-documenting string.

2.2.4.2 Gateway for ASHRAE 135

For gateways using ASHRAE 135 provide gateways which meets the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Objects as defined in ASHRAE 135.

b. All ASHRAE 135 Objects must have a configurable Object_Name Property.

c. It must be BTL Listed.

d. Gateways communicating ASHRAE 135 over an IP network must communicate in accordance with ASHRAE 135 Annex J.

****

NOTE: The following 2 requirements cover 2 ways in which the gateway can be used:

1) The gateway communicates with a BACnet building control system. In this case the gateway has to be able to read from and write to devices in the BACnet building control system.

2) The gateway communicates with a BACnet front-end (M&C Software). In this case the gateway must be able to be read from and be written to by the M&C Software. In addition, the gateway must provide scheduling, alarming and trending for the building system.

Note that it would be possible to have a BACnet-BACnet gateway that is used in both of these ways at the same time.
****

e. Gateways communicating ASHRAE 135 to a field control systems must support the DS-RP-A (Data Sharing–Read Property–A) BIBB and the DS-WP-A (Data Sharing–Write Property–A) BIBB.

f. Gateways communicating ASHRAE 135 to the M&C Software or to a BACnet Supervisory Controller must support the DS-RP-B (Data Sharing–Read Property–B) BIBB for Objects requiring read access from the M&C Software and the DS-WP-B (Data Sharing–Write Property–B) BIBB for Objects requiring write access from the M&C Software

2.2.4.3 Gateway for Modbus

****
NOTE: This subpart uses tailoring options. Requirements for the presentation of data in accordance with the MODBUS REQUIREMENTS paragraph is only included when the MODBUS tailoring option is selected.
****

For gateways that use MODBUS Protocol/MODBUS TCP/IP provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway to MODBUS Protocol/ MODBUS TCP/IP registers using the four standard Modbus register types (Discrete Input, Coil, Input Register,and Holding Register). Gateways communicating MODBUS Protocol/MODBUS TCP/IP to the M&C Software must communicate via MODBUS Protocol/MODBUS TCP/IP over TCP/IP and must present floating point values, character values, and date values using the appropriate data type as specified in paragraph MODBUS REQUIREMENTS.

2.2.4.4 Gateway for OPC

For gateways that use OPC DA, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway using OPC DA tags and which communicate over an IP network in accordance with OPC DA.

2.2.4.5 Gateway for DNP3

For gateways that use DNP3, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway to DNP3 object groups and variations as defined by IEEE 1815. Gateways communicating DNP3 over an IP network must communicate in accordance with the LAN/WAN Networking volume of IEEE 1815.

2.2.4.6 Niagara Framework Supervisory Gateway

****
NOTE: This subpart is only required for Niagara Framework systems, or for Navy Projects and is only included when the NIAGARA FRAMEWORK or NAVY tailoring option is selected.
****

****

NOTE: FYI - The Niagara Framework Supervisory Gateway is known by many names within industry, and this specification uses the name "Niagara Framework Supervisory Gateway" in order to remain vendor neutral. Probably the most common term used for this device in industry is a "Java Application Control Engine", or JACE.

****

Niagara Framework Supervisory Gateway Hardware must:

a. be direct digital control hardware.

b. have an unrestricted interoperability license and a Niagara Compatibility Statement (NiCS) that follows the Tridium Open NiCS Specification.

c. manage communications between a field control network and the Niagara Framework Monitoring and Control Software and between itself and other Niagara Framework Supervisory Gateways. Niagara Framework Supervisory Gateway Hardware must use Fox protocol for communication with other Niagara Framework Components.

d. be fully programmable using the Niagara Framework Engineering Tool and support the following:

   (1) Time synchronization, Calendar, and Scheduling using Niagara Scheduling Objects

   (2) Alarm generation and routing using the Niagara Alarm Service

   (3) Trending using the Niagara History Service and Niagara Trend Log Objects

   (4) Integration of field control networks using the Niagara Framework Engineering Tool

   (5) Configuration of integrated field control system using the Niagara Framework Engineering Tool when supported by the field control system

e. meet the following minimum hardware requirements:

   (1) [One][Two] 10/100/1000 Mbps Ethernet Ports

   (2) One port compatible with the field control system to be integrated using this product.[

   (3) Central Processing Unit of 600 Mhz or higher.][

   (4) Embedded operating system.]

f. provide access to field control network data and supervisory functions via web interface and support a minimum of 16 simultaneous users

2.3 COMPUTER HARDWARE

****

NOTE: Coordinate with the project site to determine if the server(s) will be contractor supplied or Government Furnished. If Government Furnished remove the following bracketed text.

****

For computer hardware furnished under this specification provide standard products of a single manufacturer which advertises service in all 48 contiguous states, and provide only model currently in production. Except for PCI-E cards installed into expansion slots provided in a desktop or server computer in order to meet the requirements of this specification, do not modify computer hardware from the manufacturer configuration.

2.3.1 Server Hardware

****

NOTE: Coordinate with the project site to determine if the server(s) will be contractor supplied or Government Furnished.

If contractor supplied, coordinate with the Project Site's NEC (IT group) and include the sites 'standard' server redundancy requirements.

Note that computer technology changes quickly and these requirements should be edited to reflect current products. Default requirements (current as of 2012) have been provided in brackets.

****

Computer Server Hardware (server) [will be furnished by the Government] [must be a desktop or server computer meeting the following minimum requirements:]

[2.3.1.1 Processor

[_____][Quad-core processor designed for server applications. Processor speed must be at least 50 percent of the speed of the fastest Intel server processor commercially available].

2.3.1.2 Random Access Memory (RAM)

[_____][300 percent of the recommended requirements of the software to be installed on the server[and no less than 24GB].]

2.3.1.3 Communications Ports

[_____][Four USB ports.]

2.3.1.4 Hard Drives

2.3.1.4.1 Internal Hard Drives

[____][Hard drives with SATA-3 Controller providing at least [2TB][____] usable disk space. Hard drives must use RAID (Redundant Array of Inexpensive Disks) at levels 1 or 5 (RAID-1 or RAID-5).]

2.3.1.4.2 External Hard Drive

[____][[4TB][____] disk space with a USB 3.0 interface.]

2.3.1.5 Optical Drive

[____][Blueray burner drive.]

2.3.1.6 Video Output

[____][32-bit color at a minimum resolution of 1920 by 1080 at a minimum refresh rate of 70 Hz and a DVI or display port output.]

2.3.1.7 Network Interface

[____][[Two] integrated 1000Base-T Ethernet with RJ45 connector.]

2.3.1.8 Monitor

[____][Widescreen flat panel LCD monitor sized as indicated but no less than 24 inch nominal with a minimum resolution of 1600 by 1050 pixels and a minimum refresh rate of 70Hz.]

2.3.1.9 Keyboard

[____][101 key wired USB keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154 and an integral smart card reader compatible with a Department of Defense Common Access Card (CAC).]

2.3.1.10 Mouse

[____][2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.]

2.3.1.11 Power Supplies

[____][Hot-swappable redundant power supplies.]

]2.3.2 Workstation Hardware (Desktop and Laptop)

****

NOTE: Coordinate with the project site to determine if the workstation(s) will be contractor supplied or Government Furnished, or a mix where some workstations are Gov't furnished and others are contractor supplied:

"Replace Brackets" instructions
1) Government furnished only : Keep first bracketed text and remove the [as indicated].

2) Contractor supplied only: Keep the second bracketed text.

3) Combination of Government furnished and Contractor supplied: Keep all bracketed text.

When keeping bracketed text (Contractor supplied or combination of Government and Contactor supplied)

note that computer technology changes quickly and these requirements should be edited to reflect current products. Default requirements (current as of 2012) have been provided in brackets.
****

[The Government will provide the] [Provide a standard desktop computer or a laptop meeting the following minimum requirements for the] Computer Workstation Hardware (workstation) [as indicated].

[2.3.2.1 Processor

2.3.2.1.1 Desktop

Quad-core processor designed for desktop applications. Processor speed must be at least 75 percent of the speed of the fastest Intel desktop processor commercially available.

2.3.2.1.2 Laptop

Quad-core processor designed for laptop applications. Processor speed must be at least 50 percent of the speed of the fastest Intel laptop processor commercially available.

2.3.2.2 Random Access Memory (RAM)

[____][300 percent of the recommended requirements of the software to be installed on the server[and no less than 8GB].]

2.3.2.3 Communications Ports

2.3.2.3.1 Desktop

[____][Six USB ports.]

2.3.2.3.2 Laptop

[____][Two USB ports, plus a PCMCIA card slot or an additional USB port, plus an integral RS-232 serial port or an additional USB port and a USB to RS-232 serial adapter.]

2.3.2.4 Hard Drive and Controller

2.3.2.4.1 Desktop

[____][[1.5TB][____] or larger with a SATA-3 controller.]

2.3.2.4.2 Laptop

[____][[250GB][____] or larger solid state drive.]

2.3.2.5 Optical Drive

[____][DVD-RW drive]

2.3.2.6 Video Output

2.3.2.6.1 Desktop

[____][32-bit color with dual monitor support minimum resolutions of 1920 by 1080 at minimum refresh rates of 70 Hz and dual DVI or display port outputs.]

2.3.2.6.2 Laptop

[____][32-bit color with a minimum resolution of 1920 by 1080 at minimum refresh rates of 70 Hz and VGA or HDMI output.]

2.3.2.7 Network Interface

2.3.2.7.1 Desktop

[____][Integrated 1000Base-T Ethernet with RJ45 connector.]

2.3.2.7.2 Laptop

[____][Integrated 1000Base-T Ethernet with RJ45 connector and an integrated IEEE 802.11b/g/n wireless interface. The Laptop must have a physical switch for activation and deactivation of the wireless interface.]

2.3.2.8 Monitor

2.3.2.8.1 Desktop

[____][Dual widescreen flat panel LCD monitors sized as indicated but no less than600 mm 24 inch nominal with minimum resolutions of 1920 by 1080 pixels and a minimum refresh rate of 70Hz.]

2.3.2.8.2 Laptop

[____][LCD Screen sized as indicated but no less than 325 mm 13 inch nominal with a maximum supported resolution of no less than 1600 by 900 pixels.]

2.3.2.9 Keyboard and Smart Card Reader

2.3.2.9.1 Desktop

[____][101 key wired USB keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154 and an integral smart card reader compatible with a Department of Defense Common Access Card (CAC).]

2.3.2.9.2 Laptop

[____][Standard laptop keyboard. Internal smart card reader compatible with a Department of Defense Common Access Card (CAC).]

2.3.2.10 Mouse

2.3.2.10.1 Desktop

[____][2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.]

2.3.2.10.2 Laptop

[____][Integrated touch-pad plus a 2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.]

]2.3.3 Printers

Provide local or network printers as indicated. Provide local printers which have a USB interface. Provide network printers which have a 100Base-T or faster interface with an RJ45 connection and a firmware print spooler compatible with the Operating System print spooler.

2.3.3.1 Alarm Printer

Provide alarm printers which use sprocket-fed fanfold paper with adjustable sprockets for paper width up to 280 mm 11 inches. Alrm printers must have programmable control of top-of-form. [Provide floor stands with paper racks for alarm printers.]

2.3.3.2 Laser Printer

Provide laser printers as indicated meeting the following minimum requirements:

Resolution	600 by 600 dots per inch
Printing Time	10 pages per minute
Data Buffer Size	16 Megabytes
Media Type	Paper and transparency film
Media Size	ANSI A(216 by 279 mm 8.5 by 11 inches) and other sizes as indicated
Paper Cassette	250 sheet capacity

2.4 COMPUTER SOFTWARE

2.4.1 Operating System (OS)

****
NOTE: Coordinate with the project site to determine if the OS license will be contractor supplied or Government Furnished.
****

****
NOTE: This subpart uses tailoring options to indicate the Gold Master version to use.
****

Provide the latest version of the Army [DISA][____] Gold Master Windows Operating System. The Operating System media will be furnished by the Government. [Provide][The Government will provide] the Operating System license.

2.4.2 Office Automation Software

****
NOTE: Coordinate with the project site to determine if the Office Automation Software will be contractor supplied or Government Furnished.
****

[Provide Office Automation Software consisting of the [e-mail,] spreadsheet and word processing portions of the project site's standard office automation software.] [Office Automation Software will be furnished by the Government.]

2.4.3 Virus Protection Software

****
NOTE: Coordinate with the project site to determine if the Virus Protection Software will be contractor supplied or Government Furnished.
****

[Provide Virus Protection Software consisting of the project site's standard virus protection software complete with a virus definition update subscription] [Virus Protection Software will be furnished by the Government].

2.4.4 Disk Imaging (Backup) Software

****
NOTE: Coordinate with the project site to determine if the Disk Imaging (Backup) Software will be contractor supplied or Government Furnished.
****

[Provide Disk imaging (backup) software capable of performing a bare-metal restore (imaging and restoring to a new blank hard drive such that restoration of the image is sufficient to restore system operation to the imaged state without the need for re-installation of software).] [Provide Disk imaging (backup) software consisting of the project site's standard disk imaging software.] [Disk imaging (backup) software will be furnished by the Government.]

2.4.5 M&C Controller Hardware Configuration Software

Provide M&C Controller Hardware Configuration Software consisting of the software required to configure, program, or configure and program each Monitoring and Control (M&C) Controller Hardware provided for the functions it performs.

2.4.6 CEA-852-C Configuration Server

****
NOTE: This subpart only applies to LonWorks systems and is only included when the LONWORKS tailoring option is selected.
****

Provide CEA-852-C configuration server software meeting the requirements

of CEA-852-C.

2.4.7 CEA-709.1-D Network Configuration Tool

****
NOTE: This subpart only applies to LonWorks systems and is only included when the LONWORKS tailoring option is selected..
****

Provide a network configuration tool software which:

a. Solely uses LonWorks Network Services (LNS) for all network configuration and management of CEA-709.1-D devices.

b. Is capable of executing LNS plug-ins.

c. Is capable of performing network database reconstruction of an CEA-709.1-D control network, such that if connected to an existing CEA-709.1-D network it has the ability to query the network and create an LNS database for that network.

d. Allows 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. Includes the standard LNS Report Generator and is capable of generating and printing the following reports:

(1) A table containing domain/subnet/node address and node identifier for the entire network or any subset thereof, selected by the user.

(2) A table containing Standard Network Variable (SNVT) input and output details for any CEA-709.1-D device on the network.

(3) A table containing Standard and User-Defined Configuration Properties (SCPTs and UCPTs) for any CEA-709.1-D device on the network.

f. Is capable of merging two existing standard LNS databases into a single standard LNS database.

2.4.8 BACnet Network Browser

****
NOTE: This subpart only applies to BACnet systems and is only included when the BACNET tailoring option is selected.
****

Provide a BACnet Network Browser software that:

a. Can perform full discovery of a ASHRAE 135 system including but not limited to discovery of all ASHRAE 135 devices, the ASHRAE 135 Objects and Properties of each device, and the standard ASHRAE 135 services supported by each device.

b. Can read any ASHRAE 135 Property of any Object in any device. Proprietary Properties may be presented as read without further

interpretation.

c. Can write any Standard ASHRAE 135 Property of any Object in any device.

d. Supports segmentation.

e. Supports all of the following BIBBs:

(1) DM-ANM-A (Device Management-Automatic Network Management-A)

(2) DM-ADM-A (Device Management-Automatic Device Management-A)

(3) DM-DDB-A (Device Management-Dynamic Device Binding-A)

(4) DM-DOB-A (Device Management-Dynamic Object Binding-A)

(5) DS-RP-A (Data Sharing-Read Property-A)

(6) DS-RPM-A (Data Sharing-Read Property Multiple-A)

(7) DS-WP-A (Data Sharing-Write Property-A)

2.4.9 Niagara Framework Engineering Tool

****

NOTE: This subpart only applies to Niagara Framework systems and is only included when the NIAGARA FRAMEWORK tailoring option is selected.

****

Provide Niagara Framework engineering tool software which:

a. has unrestricted interoperability license and a Niagara Compatibility Statement (NiCS) which follows the Tridium Open NiCS Specification.

b. is capable of performing network configuration for Niagara Framework Supervisory Gateways and Niagara Framework Monitoring and Control Software.

c. is capable of programming and configuring Niagara Framework Supervisory Gateways and Niagara Framework Monitoring and Control Software.

d. is capable of discovery of Niagara Framework Supervisory Gateways and all points mapped into each Niagara Framework Supervisory Gateway and making these points accessible to Niagara Framework Monitoring and Control Software.

2.4.10 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. The initial number of points to be accommodated should be chosen such that it is sufficient to cover all current and known future projects. The total system expansion requirement should be based on potential/anticipated future

projects.

It's a good idea to obtain pricing for several price-points between the current specified points/clients and the future number of points/clients. Depending on the vendor the cost increase for system expansion may be drastically different.

For non-Niagara Framework systems, points means "points that the M&C software can read/write on the network". In general, points will be SNVTs for LonWorks and the Present Value Property of Objects for BACnet. Other examples of Points are other BACnet Properties or LonWorks configuration properties/configuration network variables. For Modbus, a point will generally be a Modbus register. For OPC, a point will be an OPC "tag".

For the Niagara Framework, point licensing only applies to points directly integrated to the M&C Software without first being brought into a Niagara Framework Supervisory Gateway. Discuss with the installation whether integration will generally be accomplished via Niagara Framework Supervisory Gateways (this is the normal method) or not before determining a point licensing requirement When integration will "always" be through a Niagara Framework Supervisory Gateway change the number of network points required below to zero or a very small number. When requiring network points indicate in the space provided the protocol drivers required and network points required to be licensed by each.

This UFGS requires the use of Web based clients (previous versions of this UFGS did not, but most vendors support web-browser based clients and this no longer overly restricts competition.)

FYI: The following paragraphs/pages (the M&C software requirements) specify functionality that is required for the M&C Software but that may not be achievable due to lack of data/support at the building level. In order to meet future needs these requirements should be kept. It is expected that they are usually part of the 'standard' capabilities of this type of software.

****

****

NOTE: This subpart uses tailoring options to indicate requirements for the M&C software in the first paragraph. Only requirements related to selected tailoring options are included.

****

Provide monitoring and control (M&C) software which is a client-server software package with a graphical user interface (GUI) using web-browser

based clients. Provide Niagara Framework monitoring and control software which communicates with Niagara Framework field control systems using the Fox protocol. Provide M&C Software which communicates via CEA-709.1-D, and ASHRAE 135, and MODBUS Protocol/MODBUS TCP/IP, and OPC DA. The M&C Software may support other field control protocols. Provide M&C Software which is BACnet Testing Laboratories Certified ("Listed") as a B-AWS.

Provide a single software package which implements the Scheduling, Alarming, Trending, Graphical System Display, and System Display Editor functionality. Other specified M&C functionality may be implemented in the same software package or in additional software packages. As specified in PART 3 EXECUTION, the M&C Software must operate on Server hardware, except that software for Point Calculations and Demand Limiting may operate on M&C Controller Hardware.

2.4.10.1 M&C Software License

License the M&C Software as specified. Use of multiple copies of M&C Server software working in coordination and sharing data between them such that they function as, and appear to an operator as, a single M&C Server is permitted to meet these requirements.

2.4.10.1.1 Network Points

****

NOTE: This subpart uses tailoring options:
1) The sentence referring to Niagara Framework systems is included only when the NIAGARA FRAMEWORK tailoring option is selected.

2) The sentence referring to NIAGARA FRAMEWORK M&C Software is only included when the NIAGARA FRAMEWORK tailoring option is selected.

****

For Niagara Framework systems, a network point is a point brought directly into the Web Supervisor M&C Software through a protocol other than the Fox Protocol and via a Niagara Framework Supervisory Gateway. Provide M&C Software and licensing to support no less than than [_____] network points, and to be capable of expansion to support no less than [50,000] [_____] network points. [Provide Niagara Framework M&C Software which includes the following drivers, each of which is licensed for a number of network points as follows: [____].]

2.4.10.1.2 Web Clients

Provide M&C Software and licensing to support no less than [10] [____] simultaneous web clients with no limit on the total number of web clients. M&C Software must be capable of expansion to support no less than [30] [_____] simultaneous web clients.

2.4.10.1.3 Calculations

Provide M&C Software and licensing to support no less than one calculated point for every ten network points (see "Network Points" above).

2.4.10.1.4 Other Points

For installations using M&C Software installed on M&C Controller Hardware

(as opposed to Server hardware), provide additional licensing to support additional network points for the communications between portions of the M&C Software installed on different hardware. For example, if the Calculations requirement is performed by M&C Software installed on Controller hardware, the M&C Software must be licensed for additional network points to cover the network points required for communication between the Controller hardware and the Server hardware.

2.4.10.1.5 Alarming

****
NOTE: This subpart uses tailoring options:
1) the phrase "alarm generation and" and the work "points" is included if the LONWORKS, MODBUS or OPC tailoring option is selected.

2) the phrase "ASHRAE 135 Alarm Event Notifications" is included if the BACNET tailoring option is selected.
****

Provide M&C Software and licensing to support alarm generation and the handling (routing) of alarms for no less than [10,000] [_____] points and ASHRAE 135 Alarm Event Notifications.

2.4.10.1.6 Trending

Provide M&C Software and licensing to support a minimum of [8,000] [_____] simultaneous trends.

[2.4.10.1.7 Scheduling

****
NOTE: This subpart only applies to LonWorks, Modbus, or OPC systems and is only included when the LONWORKS, MODBUS or OPC tailoring option is selected.
****

****
NOTE: When LonWorks tailoring is selected, this paragraph appears in brackets. This is due to changes in the requirements for LonWorks field control systems. Until recently LonWorks did not support an open means of configuring schedules in field control systems, so all scheduling was done at the M&C Software. The Simple Schedule Functional Profile now provides a standard means for schedule configuration in the field control systems, and is a requirement in Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Keep the bracketed text for Modbus or OPC, or to maintain compatibility with LonWorks systems which do not employ the Simple Scheduler and thus require scheduling at the M&C Software. If Modbus and OPC are not required and all LonWorks field control systems will use the Simple Scheduler, the bracketed text can be removed.

When uncertain, keep the bracketed text as most M&C Software can support this requirement and keeping the ability to perform scheduling at the M&C Software will support a wider range of field control systems.
****

Provide M&C Software and licensing to support a minimum of [200] [_____] user-definable schedules.

]2.4.10.1.8 Niagara Framework Open License

****
NOTE: This subpart only applies to Niagara Framework systems and is only included when the NIAGARA FRAMEWORK tailoring option is selected.
****

Provide M&C Software with an unrestricted interoperability license and a Niagara Compatibility Statement (NiCS) which follows the Tridium Open NiCS Specification.

2.4.10.2 M&C Software Update Licensing

****
NOTE: The installation may procure its own software update licensing or contract and thus need less than 5 years. Alternatively the installation may require longer than five years (although this will likely increase the costs significantly). Coordinate with the installation to determine if they have any specific requirement; if they don't then keep the 5 year requirement.
****

In addition to all other licensing requirements, provide M&C Software licensing which includes licensing of the following software updates for a period [of no less than 5 years][____]:

a. Security and bug-fix patches issued by the M&C Software manufacturer.

b. Security patches to address any vulnerability identified in the National Vulnerability Database at http://nvd.nist.gov with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or higher.

2.4.10.3 Supported Field Control Protocols

****
NOTE: FYI: 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, and these requirements permit the M&C Software to support protocols other than those specifically required in this specification.
****

****

NOTE: WARNING - The BACnet tailoring option has been selected with another protocol tailoring option (LonWorks, Modbus, OPC). As described in UFC 3-470-01, many of the Monitoring and Control Software packages which support BACnet support ONLY BACnet, so the inclusion of other protocol tailoring options may unnecessarily limit the number of vendors able to provide the UMCS. The need for supporting multiple protocols at the Monitoring and Control Software should be verified/checked with the project site. Note that any protocol can be integrated to the UMCS with the use of a gateway, so omitting a tailoring option does not prohibit the integration of systems using that protocol.

See UFC 3-470-01 for more information.
****

****
NOTE: WARNING - The Niagara Framework tailoring option has been selected with the LonWorks tailoring option. As described in UFC 3-470-01, LNS-based LonWorks (required by the LonWorks tailoring option) is generally not compatible with the Niagara Framework.

See UFC 3-470-01 for more information.
****

Provide M&C Software which supports field control protocols as follows:

****
NOTE: Due to the use of tailoring options in the following list of requirements not all requirements will be included in all projects and items may require renumbering.
****

****
NOTE: The following list paragraph is included only when the LONWORKS tailoring option is selected.
****

a. The M&C Software must include a driver to LNS, or a driver to an OPC interface to LNS, or a driver to CEA-852-C, and must be capable of reading and writing any SNVT on the CEA-852-C network. Software with a driver to LNS or a driver to an OPC interface to LNS must communicate with field control systems via LNS using this driver. Software with a driver to CEA-852-C must obtain all communication information (such as device addresses and network variable indices) from LNS and must automatically update this information whenever the LNS Database changes.

****
NOTE: The following list paragraph is included only when the BACNET tailoring option is selected.
****

b. The M&C Software must include a driver to ASHRAE 135 over IP in

accordance with ASHRAE 135 Annex J.

****

NOTE: The following list paragraph is included only when the MODBUS tailoring option is selected.

****

c. The M&C Software must include a driver to MODBUS Protocol/MODBUS TCP/IP over TCP/IP. The M&C Software must be capable of reading and writing the Modbus data types as defined in paragraph MODBUS REQUIREMENTS and must, in addition, be capable of manipulating and presenting arbitrary data formats derived from the four standard Modbus data types.

****

NOTE: The following list paragraph is included only when the OPC tailoring option is selected.

****

d. The M&C Software must be an OPC DA client.

****

NOTE: The following list paragraph is included only when the NIAGARA FRAMEWORK tailoring option is selected.

****

e. The Software must use the Niagara Framework and must communicate with Niagara Framework Supervisory Gateways using the Fox protocol.

f. The M&C Software may, in addition, include drivers to other protocols.

Provide M&C Software capable of reading values from and writing values to points via any supported field protocol, and capable of reading values from one field protocol and writing them to another. All points obtained from any field protocol must be available to all M&C Software functionality.

2.4.10.4 Supported Enterprise Protocols

Provide M&C Software which supports oBIX, BACnet Web Services or OPC as an enterprise protocol and which meets the following requirements:

a. It is able to read values from any point or collection of points (network point, internal point, trend log or schedule) and transmit these values via the enterprise protocol.

b. It is able to receive data via the enterprise protocol and use this data to change the value of any point.

c. License the enterprise protocol interface to the project site and document he interface such that any system capable of communicating with that protocol can be used to read and write data from the M&C Software.

2.4.10.5 Point Information

Every point, both network and internal, in the M&C Software must contain the following fields:

2.4.10.5.1 Name

A configurable name used for identification of the point within the M&C Software.

2.4.10.5.2 Description

A configurable description of no less than 80 alpha-numeric characters.

2.4.10.5.3 Value

A field containing the current point value.

2.4.10.5.4 Units

A field containing the engineering units.

2.4.10.5.5 Source

A field identifying the source of the point. For network points, this is generally the address or identification of the field device (for example, the Domain-Subnet-Node address for LonWorks field control devices or the DeviceID for BACnet devices).

2.4.10.6 Point Calculations

Provide M&C software capable of performing calculations and computing the value of a calculated point based on the values of two or more network points and calculated points. Mathematical operators must include: addition, subtraction, multiplication, division, exponentiation (y^x, power), square root, reciprocal, natural logarithm, sin, cos, tan, arcsin, arccos, arctan, and parenthesis. Pi and e must be available as constants for use in calculations.

2.4.10.7 Browser-Based Graphical User Interface (GUI)

****

NOTE: The contractor will require a certificate for the M&C Web Server (in order to use HTTPS as required here). Coordinate with the project site IT organization (NEC) to obtain this certificate.

****

Provide M&C Software which includes a web-browser based (client-server) graphical user interface through which all M&C Software functionality, except for the Graphics Editor, System Display Editor, report configuration, point calculation configuration, and enterprise protocol configuration, is accessible.

Provide graphical user interface web server and web clients meeting the following requirements:

a. The web server must use HTTPS based on the Transport Layer Security (TLS) Protocol in accordance with IETF RFC 7465 using a Government-furnished certificate.

b. The graphical user interface must be Common Access Card (CAC) enabled: It must support web client authentication using certificates obtained from a Department of Defense Common Access Card (CAC) Smart Card.

c. The web client must operate on any version of Windows currently supported by Microsoft.

d. The web client must function in the most recent three version of Internet Explorer [and [the most recent three versions of Firefox][____]].

e. The web client must not require a connection to any server other than the M&C Server.

f. The web client must function in a browser with Java, Shockwave, Silverlight, and Flash installed. The client may require a download of mobile code from the M&C Server, but must not require the download of additional browser plug-ins or add-ins and there must be no limit on the number of downloads. The client must not require ActiveX.

2.4.10.8 Passwords

****

NOTE: Designer must choose if password management for M&C software is performed

a) by the OS
or
b) by the M&C software itself
or
c) if the decision is left to the Contractor.

The password requirements here provide a simple basis for user authentication. More complex password schemes may be required by the installation. Coordinate with the installation and if they have more detailed or complex password requirements enter them in the space provided. Otherwise keep the bracketed defaults.

****

Provide M&C software with user-based access control to M&C functionality. The M&C Software must recognize at least [100] [_____] separate users and have [at least 4] [____] levels of user permissions. User permission levels (from most restrictive to most permissive) must include:[

a. Permission Level 1: View-only access to the graphical user interface.

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 points and set up (configure) alarms, schedules and demand limiting.

d. Permission Level 4: Permission Level 3 plus create and modify Graphical System Displays using the System Display Editor.][____]

Passwords must not be displayed and must not be logged. The system must maintain a disk file on the server hardware logging all activity of the system. This file must maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. If the file format is not plain ASCII

text, provide a means to export or convert the file to plain ASCII text. Provide a mechanism for archiving the log files for long term record storage.

2.4.10.9 Graphical System Displays

Provide graphical displays consisting of building system (air handler units, VAV boxes, chillers, cooling towers, boilers, etc.) graphic displays. Data associated with an active display must be updated at least once every 5 seconds.

2.4.10.9.1 Navigation Scheme

System graphic displays of building systems and points must be hierarchical displays using a building-to-equipment point-and-click navigation scheme which allows navigation from a garrison-wide display, through a building-wide display to the individual units. Each display must show the building name and number. Each display must show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

a. For each Building or Building Sub-Area display, show the building foot print and basic floor plan, and clearly show and distinguish between the individual zones and the equipment serving each zone and space. Show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. Show the locations of individual pieces of monitored and controlled equipment.

****

NOTE: Coordinate with the project site and select the style of representation for equipment.

When making this selection consider the effect that detailed graphics have on the performance of the user interface; the more complex the graphic, the longer it will take for the page to load.

****

b. For each equipment display show a [one-line diagram control schematic][3-dimensional] representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Use different colors and textures to indicate various components and real time data. Use consistent color and texture meanings across all displays.

c. Provide displays which clearly distinguish between the following point data types and information:

(1) Real-time data.

(2) Other user-entered data.

(3) Devices in alarm (unacknowledged).

(4) Out-of-range, bad, or missing data.

(5) Points which are overridden.

2.4.10.9.2 Navigation Commands

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

2.4.10.10 Graphic Editor

Provide a fully featured graphics editor and capable of creating custom graphics and graphic symbols for use by the System Display Editor.

2.4.10.11 System Display Editor

Provide a system display editor which allows the user to create, modify, and delete graphic displays. The display editor may have a separate user interface and is not required to be accessible via the web browser interface. Provide a display editor which includes the following functions:

a. Create and save displays. Save an existing or modified display as a new display (i.e. "save as")

b. Group and ungroup graphics, where graphics include both alphanumeric and graphic symbols, and where a grouped graphic is manipulated as a single graphic.

c. Place, locate, resize, move, remove, reposition, rotate and mirror a graphic on a display.

d. Overlay graphics over other graphics and assign depths such that when there are coincident graphics the one on top is visible.

e. Modify graphic properties based on the value of network points and create conditions governing the display of a graphics such that different graphics are visible based on the value of network points or calculated points

f. Integrate real-time data with the display.

g. Establish connecting lines.

h. Establish sources of latest data and location of readouts.

i. Display analog values as specified.

j. Assign conditions which automatically initiate a system display.

k. Include library of display symbols which include: Pump, Motor, Two- and Three-way Valves, Flow Sensing Element, Point and Averaging Temperature Sensors, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Chilled Water Piping, Steam Piping, Hot Water Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, High- and Low- Point and Averaging Temperature Switches, High- and Low- Pressure Switches, Coil, Solenoid Valve, Filter, Condensing Unit, Cooling Tower, Variable Frequency Drive (VFD), Heat Exchanger, Current Sensing Relays, Generator, Circuit Breaker,

Transformer, Tank. Symbols must at a minimum conform to ASHRAE FUN SI ASHRAE FUN IP where applicable.

2.4.10.12 Scheduling

****

NOTE: FYI: For BACnet systems it is expected that there will be Scheduling Objects in the field control system and the M&C Software will edit (configure) these schedules.

For LonWorks the M&C software will be the primary method of scheduling; building systems have 'backup' scheduling capability in the event of a loss of communication with the M&C Software Server.

For Niagara Framework systems it is expected that there will be Niagara Framework Scheduling Objects in the Niagara Framework Supervisory Gateway(s) and the M&C Software will edit (configure) these schedules.

In general it is expected that Modbus and OPC will be used for the integration of utility control systems which will likely have their own scheduling capability. In this case scheduling from the M&C Software will be for secondary/supervisory functions.

Due to the use of tailoring options in the following list of requirements not all requirements will be included in all projects and items may require renumbering.

****

****

NOTE: The following TWO list paragraph is included only when the LONWORKS, MODBUS or OPC tailoring option is selected.

****

a. Provide M&C software capable of changing the value of any network point according to a schedule. The M&C Software must be capable of scheduling points to any value, including a "null" or invalid value if one is defined for the data type of the point.

b. The specified scheduling functions must be operator accessible and adjustable via the graphical user interface. Each schedule must be able to change the value of multiple points. The M&C software must reinforce all schedules by transmitting the scheduled value no less than once every 30 minutes.

****

NOTE: The following list paragraph is included only when the BACNET tailoring option is selected.

****

c. The M&C software must be capable of performing time synchronization and configuring Schedule Objects in ASHRAE 135 field devices in accordance with the DM-MTS-A (Device Management-Manual Time Synchronization-A).

****

NOTE: The following list paragraph is included only when the NIAGARA FRAMEWORK tailoring option is selected.

****

d. The M&C software must be capable of performing time synchronization and configuring Niagara Framework Schedule Objects in Niagara Framework Supervisory Gateways.

e. The M&C Software must include a scheduling graphic display, accessible via the graphical user interface, with the following fields and functions:

(1) Current date and time.

(2) System identifier(s) and name(s), including location information such as Building name(s) and number(s).

(3) System group. Systems grouped by the user to perform according to a common schedule.

(4) Weekly schedules. For each system, a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than 6 value changes per day.

(5) Holiday and special event schedules. Support for holiday and special event calendar schedules independent of the daily schedule. Special event schedules include one-time events and recurring events. Scheduling of one-time events include the beginning and ending dates and times of the event. Holiday and special event schedules must have precedence over device weekly schedules.

2.4.10.13 Alarms

Provide M&C Software meeting the following minimum requirements for alarms:

****

NOTE: The following list paragraph uses tailoring options:
1) "generating alarms by comparing the value of any point from any connected system to user-configurable limits" is included when the LONWORKS, MODBUS or OPC tailoring option is selected

2) "configuring alarms in ASHRAE 135 field devices in accordance with the B-AWS BIBBs" is included when the BACNET tailoring option is selected.

3) "configuring alarms in Niagara Framework Supervisory Gateways using the Niagara Alarm Service" is included when the NIAGARA FRAMEWORK tailoring option is selected.

****

a. The M&C software must be capable of generating alarms by comparing the value of any point from any connected system to user-configurable limits, and configuring alarms in ASHRAE 135 field devices in accordance with the B-AWS BIBBs, and configuring alarms in Niagara Framework Supervisory Gateways using the Niagara Alarm Service.

****

NOTE: The following list paragraph uses tailoring options:
1) "alarms generated by the M&C Software" is included when the LONWORKS, MODBUS or OPC tailoring option is selected

2) "alarms received as an ASHRAE 135 Alarm Event Notifications" is included when the BACNET tailoring option is selected.

3) "alarms received from a Niagara Framework Supervisory Gateway" is included when the NIAGARA FRAMEWORK tailoring option is selected.

****

b. The M&C software must be capable of handling (routing) alarms generated by the M&C Software, and alarms received as an ASHRAE 135 Alarm Event Notifications, and alarms received from a Niagara Framework Supervisory Gateway.

****

NOTE: The following list paragraph is included only when the NIAGARA FRAMEWORK tailoring option is selected.

****

c. The M&C software must support Niagara Framework Alarm Classes.

d. The M&C software must support at least two alarm priority levels: critical and informational. Critical alarms must remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms must remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.

e. The creation, modification, and handling (routing) of alarms must be fully accessible and fully adjustable from the graphical user interface.

f. Alarm Data. Alarm data to be displayed and stored must 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:

(a) Unreliable: Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad

data.

(b) High Alarm.

(c) Low Alarm.

(4) Current value or status of the alarm point, including engineering units

(5) Alarm limits, including engineering units.

(6) Alarm priority.

(7) Alarm Message: A unique message with a field of at least 60 characters. Assignment of messages to an alarm must be an operator editable function.

(8) Acknowledgement status of the alarm including the time, date and user of acknowledgement.

****

NOTE: The following list paragraph uses tailoring options:
1) "ASHRAE 135 event notification" is included when the BACNET tailoring option is selected.

2) "network variable of type SNVT_alarm or SNVT_alarm_2" is included when the LONWORKS tailoring option is selected

3) "OPC alarm" is included when the OPC tailoring option is selected

4) "or upon generation of an alarm" is included when the LONWORKS, MODBUS or OPC tailoring option is selected.

****

g. Alarm Notification and Routing: The M&C software must be capable of performing alarm notification and routing functions. Upon receipt of ASHRAE 135 event notification, network variable of type SNVT_alarm or SNVT_alarm_2, OPC alarm, or upon generation of an alarm the M&C software must immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software must support at least 100 alarm routes, where an alarm route is a unique combination of any of the following activities:

(1) Generate a pop-up up active clients. The pop-up display must include the Alarm Data. Alarms must be capable of being acknowledged from the pop-up display by operators with sufficient permissions. Pop-up must be displayed until acknowledged.

(2) Send an e-mail message via simple mail transfer protocol (SMTP; RFC 821). The e-mail must contain a configurable message and all alarm data. The e-mail recipient and scripted message must be user configurable for each alarm route.

(3) Print alarms to designated alarm printers. The printed message

must be the same as the pop-up message.

h. Alarm Display and Acknowledgement. The M&C software must include an alarm display. Alarms must be available for display at each workstation as shown, along with all associated alarm data. Alarms must be capable of being acknowledged from this display. Multiple alarms must be capable of being acknowledged using a single command. Operator acknowledgment of one alarm must not automatically be considered as acknowledgment of any other alarm nor may it inhibit reporting of subsequent alarms.

i. Alarm Storage and Reports: The M&C software must store each alarm and its associated alarm data to hard disk and retain this information after the alarm no longer exists. The stored data must be sortable, searchable, and printable.

2.4.10.14 Trending

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

****
NOTE: The following list paragraph uses tailoring options:
1) "of creating, modifying, uploading and archiving ASHRAE 135 Trend Objects in field devices in accordance with the B-AWS BIBBs" is included when the BACNET tailoring option is selected.

2) "of performing real-time trending with a minimum trending rate of 100 points per second " is included when the LONWORKS, MODBUS or OPC tailoring option is selected.

2) "of using the Niagara history service to create, modify, upload and archive trend log objects in Niagara Framework Supervisory Gateways" is included when the NIAGARA FRAMEWORK tailoring option is selected
****

Provide M&C software capable of creating, modifying, uploading and archiving ASHRAE 135 Trend Objects in field devices in accordance with the B-AWS BIBBs and of performing real-time trending with a minimum trending rate of 100 points per second and of using the Niagara history service to create, modify, upload and archive trend log objects in Niagara Framework Supervisory Gateways.

a. The M&C Software must include a graphical display for trend configuration, creation and deletion accessible through the graphical user interface. Each trend must be user-configurable for:

(1) Point to trend.

(2) Sampling interval: adjustable between 1 second and 1 hour.

(3) Start and Stop Time of Trend: Start and stop times determined by

one or more of the following methods:

(a) Start time and stop time

(b) Start time and duration

(c) Start time and number of samples

b. The M&C software must be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software must be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, provide a means to export or convert the file to plain ASCII text in a CSV format.

2.4.10.15 Electrical Power Demand Limiting

****

NOTE: The critical alarm for actual demand exceeding the Electrical Demand Target (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 billing structure should be obtained from the utility supplying electrical service in order to coordinate equipment demand limit priorities with the project site's Energy Manager.

If real-time pricing is a part of the billing structure it will require coordination with the demand limiting program. Also, real-time pricing will require a connection to the Internet to obtain the pricing information from the utility. This connection may not exist and may be difficult or impossible to obtain due to Information Assurance requirements.

****

Provide M&C software which includes demand limiting functionality capable of performing electrical demand limiting such that it can change the occupancy mode or setpoint of field control system hardware via a network point based on a projected demand in order to maintain demand below a configured target.[The demand target must incorporate real-time pricing data.] The demand limiting algorithm must incorporate priority levels such that low priority equipment is adjusted before high-priority equipment. The demand limiting algorithm must generate a critical alarm when it begins to impact the system and a critical alarm if the demand target is exceeded.

2.4.10.16 Report Generation

****

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.

****

Provide M&C Software capable of generating, saving and printing reports. Dynamic operation of the system must not be interrupted to generate a report. The report must contain the time and date when the samples were taken, and the time and date when the report was generated. The software must be capable of saving reports to a PDF file and to a file compatible with the provided Office Automation Software.

The software must allow for automatic and manual generation of reports. For automatic reports an operator must 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. Manual report generation must allow for the operator to request at any time the output of any report.

2.4.10.17 Custom Report Generation

Provide M&C software capable of generating custom reports, including but not limited to the following standard reports:

2.4.10.17.1 Electrical Power Usage Report

An electrical power Usage 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 must 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 must be automatically printed at the end of each summary period and include:

a. Total period consumption.

b. Demand interval peak for the period, with time of occurrence.

c. Energy consumption (kWh) over each demand interval.

d. Time-of-use peak, semi-peak, off-peak, or baseline total kWh consumption.

e. Reactive power during each demand interval.

f. Power factor during each demand interval.

g. 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 must also be recorded.

h. Calculated heating and cooling degree days based on a 18.3 degrees C 65 degrees F balance point.

2.4.10.17.2 Electrical Peak Demand Prediction Report

A report based on the demand limiting program, which includes:

a. Electrical Demand Target (EDT).

b. Actual peak and predicted peak for each demand interval for that day.

c. Predicted demand for the next demand interval.

2.4.10.17.3 Energy usage Report

An energy usage summary, operator selectable, for a unit, building, area, installation, and the entire UMCS. The report must be divided by utility, and must be capable of reporting on at least four separate utilities. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy usage for each utility for the current and previous day.

c. Total energy usage for each utility for the current and previous month.

d. Maximum 15-minute interval average rate of consumption for each utility for the current and previous day and current and previous month.

e. Outside air (OA) temperature and OA humidity for current and previous month and current and previous day:

(1) Average temperature and humidity.

(2) Temperature and humidity at maximum and minimum OA temperature with time and date of occurrence.

(3) Temperature and humidity at maximum and minimum humidity with time and date of occurrence.

(4) Temperature and humidity at the installation's peak demand interval with the time and date of occurrence

f. Calculated degree days. Reports which include humidity must be configurable to report either dewpoint or relative humidity.

2.4.10.17.4 Water Usage Report

A water usage summary, operator selectable, for a unit, building, area, installation, and the entire UMCS. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy water usage for the current and previous day.

c. Total water usage for the current and previous month.

2.4.10.17.5 Alarm Report

Outstanding alarms by building or unit, including time of occurrence.

2.4.10.17.6 M&C Software Override Report

Points overridden by the M&C Software, including time overridden, and identification of operator overriding the point.

2.4.10.17.7 Run Time Reports

A report totalizing the accumulated run time of individual pieces of equipment. The operator must be able to define equipment groupings and to generate reports based on these groupings.

2.4.10.17.8 Cooling Tower Profiles

A cooling tower profile for each cooling tower as indicated, including:

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

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

c. Maximum and minimum daily condenser water temperature and the time of occurrence for the current and previous months.

d. Total daily and monthly makeup water consumption.

2.4.10.17.9 Chiller usage Report

A report of the operation of each chiller as shown on a daily and monthly basis, for each of at least 10 discrete loading levels. The report must include:

a. Average power for the month at each level in kW

b. Total monthly energy use in kWh at each level

c. Total monthly energy use in kWh for the chiller (all levels)

d. Total daily run hours at each level

e. Total Monthly run hours at each level

2.4.10.17.10 Device Offline Report

****

NOTE: This subpart is included when the BACNET, LONWORKS or NIAGARA FRAMEWORK tailoring option is selected and uses tailoring options:

1)"CEA-709.1-D" is included if the LONWORKS tailoring option is selected

2) "ASHRAE 135" is included if the BACNET tailoring option is selected.

3) "all offline Niagara Framework Supervisory Gateways" is included if the NIAGARA FRAMEWORK tailoring option is selected

****

A report listing all offline devices in all CEA-709.1-D or ASHRAE 135 building control systems integrated to the M&C Software and all offline Niagara Framework Supervisory Gateways.

2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

Provide uninterruptible power supplies (UPS) as self contained devices suitable for installation and operation at the location of Server and Workstation hardware and sized to provide a minimum of 20 minutes of operation of the connected hardware. Equipment connected to the UPS must not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. Provide the UPS complete with all necessary power supplies, transformers, batteries, and accessories. Provide UPS which include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power. Provide UL 1778 approved UPS. UPS powering Server Hardware must notify the server via USB interface of impending battery failure.

2.6 RACKS AND ENCLOSURES

2.6.1 Enclosures

****

NOTE: NOTE: In outdoor applications specify Type 3 unless hosedown of the enclosure is anticipated, in which case specify Type 4.

For retrofit projects in older mechanical rooms or where hosedown of the enclosure is anticipated specify Type 4 enclosures. Type 4 provides a greater degree of protection in dirty and wet environments than does Type 2.

****

Enclosures supplied as an integral (pre-packaged) part of another product are acceptable. Provide two Enclosure Keys for each lockable enclosure on a single ring per enclosure with a tag identifying the enclosure the keys operate. Provide enclosures meeting the following minimum requirements:

2.6.1.1 Outdoors

For enclosures located outdoors, provide enclosures meeting NEMA 250 [Type 3][Type 4] requirements.

2.6.1.2 Mechanical and Electrical Rooms

For enclosures located in mechanical or electrical rooms, provide enclosures meeting NEMA 250 [Type 2][Type 4] requirements.

2.6.1.3 Other Locations

For enclosures in other locations including but not limited to occupied spaces, above ceilings, and in plenum returns, provide enclosures meeting NEMA 250 Type 1 requirements.

2.6.2 Equipment Racks

Provide standard 482 mm 19 inch equipment racks compatible with the electronic equipment provided. Racks must be either aluminum or steel with bolted or welded construction. Steel equipment racks must be painted with a flame-retardant paint. Guard rails must be included with each equipment rack and have a copper grounding bar installed and grounded to

the earth.

PART 3 EXECUTION

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NOTE: Determine the applicability and need for a Factory Test and remove the Factory Test requirements if a Factory Test is not needed.

For Army projects, contact the UMCS MCX (Huntsville Center) for a list of systems which have already been through a Factory Test.

****

[3.1 FACTORY TEST

****

NOTE: Include the reference to section 25 08 10 UTILITY MONITORING AND CONTROL SYSTEM TESTING if appropriate. Otherwise indicate another basis for the Factory Test Procedures.

****

Perform factory testing of the UMCS as specified. The Contractor is responsible for providing personnel, equipment, instrumentation, and supplies necessary to perform required testing. Provide written notification of planned testing to the Government at least 21 days prior to testing, and do not give this notice until after receiving written Government approval of the specific Factory Test Procedures. Provide Factory Test Procedures which define the tests required to ensure that the system meets technical, operational, and performance specifications. Within the Procedures define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. Provide procedures which test all capabilities and functions specified and indicated. Develop Procedures from the design documentation and in accordance with [Section 25 08 10 UTILITY MONITORING AND CONTROL SYSTEM TESTING][____]. Perform the Factory Test using equipment and software of the same manufacturer, model and revision as will be used for the specified project. Include detailed instructions for test setup, execution, and evaluation of test results in the Procedures. Upon completion of the test, prepare a Factory Test Report, documenting the results of the Test, and submit it as specified.

Perform the Factory Test and provide Factory Test Submittals as shown in TABLE II. FACTORY TEST SEQUENCING.

TABLE II. FACTORY TEST SEQUENCING

ITEM #	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1	Submit Factory Test Procedures	[[_____] days after notice to proceed][_____]
2	Perform Factory Test	After Approval Of #1

TABLE II. FACTORY TEST SEQUENCING

ITEM #	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
3	Submit Factory Test Report	[_____] days After Completion Of #2

]3.2 EXISTING CONDITIONS SURVEY

Perform a field survey, including but not limited to testing and inspection of equipment to be part of the UMCS, and submit an Existing Conditions Report documenting the current status and its impact on the Contractor's ability to meet this specification. For field control systems to be integrated to the UMCS which are not already connected to the UMCS IP network, verify the availability of the building network backbone at the FPOC location, and verify that FPOCs shown as existing are installed at the FPOC location.

3.3 DRAWINGS AND CALCULATIONS

3.3.1 UMCS IP Network Bandwidth Usage Estimate

Provide a UMCS IP Network Bandwidth Usage Estimate for a small, medium or large systems. In this estimate account for field control systems using all M&C required protocols and the integration of field control system via gateways. Define all assumptions used to create the estimate, including but not limited to: trending, fast trends for commissioning, schedules, alarms, display of system graphics and load shedding.

3.3.2 Certificate of Networthiness Documentation

****
NOTE: This subpart is only required for Army projects and is only included when the ARMY tailoring option is selected.
****

****
NOTE: Include a copy of a blank Certificate of Networthiness (CoN) "Application Checklist" in the contract package. This document is available at https://army.deps.mil/netcom/sites/nw/CoNApproval/Lists/Networthiness%20Data (Note that this page may require CAC login)
****

For all software provided, provide documentation that an Enterprise Certificate of Networthiness exists, that a Limited Certificate of Networthiness applicable to the project site exists, or provide a completed Certificate of Networthiness "Application Checklist".

3.3.3 UMCS Contractor Design Drawings

Revise and update the Contract Drawings to include details of the system design and all hardware components, including contractor provided and Government furnished components. Details to be shown on the Design

Drawing include:

****
NOTE: The following list paragraph uses tailoring options:
1) "BACnet Supervisory Controller" is included only if the BACNET tailoring option is selected

2) "Niagara Framework Supervisory Gateway" is included only if the NIAGARA FRAMEWORK tailoring option is selected.
****

a. The logical structure of the network, including but not limited to the location of all Control Hardware (including but not limited to each BACnet Supervisory Controller, Control Protocol Gateway, Control Protocol Router, Niagara Framework Supervisory Gateway and Monitoring and Control (M&C) Controller).

b. Manufacturer and model number for each piece of Computer Hardware and Control Hardware.

c. Physical location for each piece of Computer Hardware and Control Hardware.

d. Version and service pack number for all software and for all Control Hardware firmware.

3.3.4 As-Built Drawings

****
NOTE: The Points Schedule is a submittal from Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC contracts and is a contract drawing for this Section. The Contractor updates the Points Schedule and submits it as an as-built.

Where projects require integration to systems not installed under Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC, or where the Points Schedules for the system are not available, create Points Schedules for inclusion in the Contract Drawings.
****

Prepare draft as-built drawings consisting of Points Schedule drawings for the entire UMCS, including Points Schedules for each Gateway, and an updated Design Drawing including details of the actual installed system as it is at the conclusion of Start-Up and Start-Up Testing. Provide As-Built Drawings which include details of all hardware components, including contractor provided and Government furnished components. In addition to the details shown in the design drawings, the as-built drawing must include:

****
NOTE: The following paragraph uses tailoring options:
1) "BACnet Supervisory Controller" is included only when the BACNET tailoring option is selected.
2) "Niagara Framework Supervisory Gateway" is

included only when the NIAGARA FRAMEWORK tailoring option is selected.
****

a. IP address(es) and Ethernet MAC address(es) as applicable for each piece of Control Hardware (including but not limited to each BACnet Supervisory Controller, Niagara Framework Supervisory Gateway, Control Protocol Gateway, Control Protocol Router, and Monitoring and Control (M&C) Controller).

b. IP address and Ethernet MAC address for each computer server, workstation, and networked printer.

c. Network identifier (name) for each printer, computer server and computer workstation.

d. List of ports, protocols and network services for each device connected to an IP network.

****
NOTE: The following paragraph uses tailoring options for BACNET, LONWORKS, MODBUS and NIAGARA FRAMEWORK and includes requirements only when the associated tailoring option is selected.
****

e. Network Addresses: CEA-709.1-D address (domain, subnet, node address) for all Control Hardware using CEA-709.1-D.ASHRAE 135 address and Object_ID of the Device Object for all Control Hardware using ASHRAE 135. MODBUS Protocol/MODBUS TCP/IP address for all Control Hardware using MODBUS Protocol/MODBUS TCP/IP. Niagara Framework Station ID for all Niagara Framework components including but not limited to Niagara Framework Supervisory Gateways and the Niagara Framework M&C Software.

Prepare Draft As-Built Drawings upon the completion of Start-Up and Start-Up Testing and Final As-Built Drawings upon completion of PVT Phase II.

3.4 INSTALLATION REQUIREMENTS

3.4.1 General

****
NOTE: Indicate the location of telecommunications closets on the contract drawings.
****

Install system components as shown and specified and in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Install communication equipment and cable grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. Install Fiber Optic cables and wiring in exposed areas, including low voltage wiring but not including network cable in telecommunication closets, in metallic raceways or EMT conduit as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Do not install equipment in any space which experiences temperatures or humidity outside of the rated operating range of the equipment.

3.4.2 Isolation, Building Penetrations and Equipment Clearance

Provide dielectric isolation where dissimilar metals are used for connection and support. Make all penetrations through and mounting holes in the building exteriors watertight. Drill or core drill holes in concrete, brick, steel and wood walls with proper equipment. Seal conduits installed through openings with materials which are compatible with existing materials. Seal openings with materials which meet the requirements of NFPA 70 and SECTION 07 84 00 FIRESTOPPING.

3.4.3 Nameplates

Provide Nameplates for all Control Hardware and all Computer Hardware. Attach Nameplates to the device in a conspicuous location.

3.5 INSTALLATION OF EQUIPMENT

3.5.1 Wire and Cable Installation

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as indicated. Provide necessary interconnections, services, and adjustments required for a complete and operable signal distribution system. Label components in accordance with TIA-606. Firestop Penetrations in fire-rated construction in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets and raceways in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install wiring in accordance with TIA-568-C.1 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Mark wiring terminal blocks and outlets in accordance with TIA-606. Do not install non-fiber-optic cables in the same cable tray, utility pole compartment, or floor trench compartment with power cables. Properly secure and install neat in appearance cables not installed in conduit or raceways.

3.5.2 Grounding

Install signal distribution system ground in accordance with TIA-607 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Connect equipment racks to the electrical safety ground.

3.5.3 Power-Line Surge Protection

Protect equipment connected to ac circuits must be protected against or withstand power-line surges. Provide equipment protection which meets the requirements of IEEE C62.41. Do not use fuses for surge protection.

3.5.4 IP Addresses

****

NOTE: Select the appropriate option to do one of the following:
1) require the contractor to coordinate IP Addresses with NEC (the IT group)

2) require the contractor use IP addresses from a list of supplied IP addresses. In this case, include a list of IP addresses.

3)(not applicable to Air Force) require the

contractor to configure control hardware to obtain IP addresses from a DHCP server.
****

For all Control Hardware requiring an IP address on the UMCS IP Network, [coordinate with the [NEC] [_____] to obtain IP addresses] [use the following IP addresses:[_____]][obtain static IP addresses from a DHCP server].

3.5.5 Computer Hardware and Software

****
NOTE: If computer hardware is Government installed remove the bracketed text requiring hardware installation.
****

[3.5.5.1 Hardware Installation

Install Computer Hardware as specified and indicated. Power Computer Servers through a UPS, and install and configure them such that the server automatically undergoes a clean shutdown upon low battery signal from the UPS.

]3.5.5.2 Software Installation

Install software as follows:

****
NOTE: Due to tailoring options the numbering of the following items may be incorrect and require editing.
****

****
NOTE: The following TWO list paragraphs are included only if the LONWORKS tailoring option is selected
****

a. CEA-852-C Configuration Server: Install and configure one CEA-852-C Configuration Server. Install the he CEA-852-C Configuration Server on Server Hardware or on an CEA-709.1-D TP/FT-10 to IP Router.

b. CEA-709.1-D Network Configuration Tool: Install the CEA-709.1-D Network Configuration Tool software as shown. Install the CEA-709.1-D Network Configuration Tool on workstation or server hardware.

****
NOTE: The following designer note and list paragraph are included only if the BACNET tailoring option is selected
****

****
NOTE: The BACnet Network Browser may or may not be needed by the installation. The M&C Software already has this functionality, but in general a copy of a BACnet Network Browser installed on a laptop is beneficial for the installation for O&M, troubleshooting and commissioning.

Keep the bracketed option and show the BACnet Network Browser on the drawings to require it.
****

[c. BACnet Network Browser: Install the BACnet Network Browser software as indicated. Install the BACnet Network Browser on workstation hardware.
]

****
NOTE: The following designer note and list paragraph are included only if the NIAGARA FRAMEWORK tailoring option is selected
****

****
NOTE: The Niagara Framework Engineering Tool must be installed on the M&C Software server. It may or may not need to be installed on more than the M&C Software server.

Keep the bracketed option and show the Niagara Framework Engineering Tool on the drawings to require it to be installed on more the M&C Software server.
****

d. Niagara Framework Engineering Tool: Install the Niagara Framework Engineering Tool on the M&C Software Server[and as indicated. Install the Niagara Framework Engineering Tool on workstation hardware].

****
NOTE: The following list paragraph uses tailoring options.

The sentence "Install M&C Software in a manner consistent with its B-AWS listing such that it provides all functionality of a B-AWS." is included only if the BACNET tailoring option is selected
****

e. Monitoring and Control Software: Install the monitoring and control (M&C)software as shown. Except for M&C Software performing Point Calculations or Electrical Peak Demand Limiting, install M&C Software on server hardware. Install M&C Software performing Point Calculations or Electrical Peak Demand Limiting on either server hardware or Monitoring and Control (M&C) Controller Hardware. Install M&C Software in a manner consistent with its B-AWS listing such that it provides all functionality of a B-AWS.

Provide sufficient computer hardware and M&C Controller Hardware and install M&C Software to support the number of points required in PART 2 (PRODUCTS), regardless of the number of points integrated under this project specification. Note that meeting this requirement may entail the installation of unused hardware or spare point licenses to accommodate the full number of required points in order to allow for integration of future field control systems.

f. M&C Controller Hardware Configuration Software: Install the M&C Controller Hardware Configuration Software on server hardware.

****

NOTE: Remove the bracketed text if the software is Government installed. Coordinate with the project site and project site IT organization to determine which software will be Government installed, and to determine the information required to complete the brackets.

Note that if some software is Government installed but others are required the items may need to be renumbered.

If the Operating System is installed by the contractor provide a point of contact for user names and passwords.

If the Virus Protection Software is installed by the contractor indicate whether an update server is available and provide server information or a POC to obtain server information.

****

[g. Operating system: Install the OS on each Server and Workstation and configure user names and passwords. Coordinate with [____] for user names and passwords.

][h. Office Automation Software: Install the office automation software on each server and workstation.

][i. Virus Protection software: Install the virus protection software on each server and workstation and configure weekly virus scans. [Configure the virus protection software to update virus definitions automatically [from the update server at [____]][. Coordinate with [the NEC][____] to obtain update server information.]]

][j. Disk Imaging (Backup) Software: Install the disk imaging (backup) software on each server and configure for imaging the internal hard drive to external hard drive.]

****

NOTE: Indicate who to coordinate with to get connections outside of the UMCS. Note that connections to non-government servers are not required by the UMCS and should not be permitted.

****

Where software requires connection to an IP device outside of the UMCS, coordinate with [the project site NEC][____] to obtain access to a Government-furnished server to provide the needed functionality. Do not connect to any device outside of the UMCS without explicit permission from [the project site NEC][____].

3.5.5.3 Monitoring and Control (M&C) Software Configuration

Configure the Monitoring and Control (M&C) Software as specified, as

indicated and as follows:

****

NOTE: Indicate who to coordinate user accounts with.

If in the product section you selected that the M&C software uses Windows for user authentication then remove the bracketed text (3 places) concerning passwords. Otherwise keep the bracketed text concerning passwords.

****

a. Set up M&C Software user accounts[and passwords]. Coordinate user accounts[, passwords] and permissions with [the [Controls] [HVAC] [Electrical] shop supervisor][____].

b. Change the default password on all accounts. Remove or disable any accounts which do not require authentication (such as guest accounts).

****

NOTE: Either provide SMTP (e-mail) server information or a POC for the contractor to obtain this information.

****

c. Configure e-mail capability to use [the government furnished SMTP server using the following server information[____].][a Government furnished SMTP server. Coordinate with [the project site NEC] [____]for SMTP server information.]

d. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet and SSH.

****

NOTE: Indicate where contractor should obtain certificate.

****

e. Install web server certificate. Obtain certificate from [the project site NEC][____].

3.5.5.4 Control Hardware Installation

****

NOTE: Select if Control Hardware must be installed in an enclosure. Hardware in telecommunication closets will generally not require an enclosure unless necessary to secure the Hardware (i.e. a locked enclosure).

FYI - the requirements for which (if any) Control Hardware to install and where to install it is covered below in the integration requirements.

If permitting Niagara Framework Supervisory Gateways to serve web pages, keep the bracketed text allowing HTTP from Niagara Framework Supervisory Gateways.

****

Install Control Hardware [in an enclosure] [in a lockable enclosure] and as specified. Configure Control Hardware as specified, as required to meet the functions for which the hardware is used and as follows:

****

NOTE: The following list paragraph uses tailoring options.

The text "[except for HTTP originating in Niagara Framework Supervisory Gateways]" is included only if the NIAGARA FRAMEWORK tailoring option is selected.

****

a. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet, SSH, and HTTP[except for HTTP originating in Niagara Framework Supervisory Gateways]. When disabling of ports, protocols and services is not supported by a product, obtain an exception from this requirement prior to using the product and document non-compliance on the Product Data Sheets and As-Built drawings.

****

NOTE: Indicate who the contractor should coordinate with to determine passwords.

****

b. Change the default passwords in all Control Hardware which have passwords. Coordinate new passwords with [the [Controls] [HVAC] [Electrical] shop supervisor][____].

3.6 INTEGRATION OF FIELD CONTROL SYSTEMS

****

NOTE: For complete integration the contract package must include the following:

1. Points Schedule - make sure Points Schedule includes:
- **points to be displayed by the M&C Software**
- **points that can be overridden by the M&C Software**
- **trend points.**
- **Alarm routing (also make sure to include the Alarm Routing Schedule)**

2. Alarm Routing Schedule drawings. Identify and assign priorities, e-mail addresses (for e-mail and text notification), and alarms to be printed.

3. Demand Limit schedule drawing. Make sure it includes system name, load shed priority and point needed for shut-down or setpoint reset.

4. Control System Schematics for each field

control system (This may be an as-built drawing from the field control system specification - such as Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC)

5. Occupancy Schedules for each field control system. (This may be an as-built drawing from the field control system specification - such as Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC)

While integration *may* be able to be performed without the other drawings, the Points Schedule is required for successful integration of any system and must be provided.

Note that the necessary Points Schedule drawing should be part of the as-built submittal for building control systems - particularly those installed using Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. If a points schedule for the system is not available one must be created and included in the contract package. Alternatively, a requirement can be manually added here (along with appropriate edits to the submittals and project sequencing paragraphs) to include a site survey of the system prior to integration, the results of which the Government must then use to provide actual integration requirements such as identifying points to be displayed, overridden, trended etc (thus creating a Points Schedule as part of the project).

****

****

NOTE: Contract drawings must indicate the FPOC location or FPOC location must be provided in the empty bracket.

Coordinate with the project site to ensure there is an FPOC available for connection of the building control network to the UMCS IP Network..

****

Fully integrate the field control systems in accordance with the following three step sequence and as specified and shown.

STEP 1: Install and configure Control Hardware as necessary to connect the field control system to the FPOC, which is part of the UMCS IP network, and to provide control protocol translation and supervisory functionality.

STEP 2: Add Field Control System to M&C Software: Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to the field control system.

STEP 3: Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and

trending.

3.6.1 Integration Step 1: Install Control Hardware

****
NOTE: Step 1 requires connecting to the FPOC, which is typically managed by the project site IT staff. Provide a POC for making this connection.
****

Install Control Hardware as specified at the FPOC location [as shown][____] to connect the field control system to the UMCS IP network via the FPOC and, if necessary, to provide control protocol translation and supervisory functionality. Coordinate all connections and other activities related to an FPOC with [____]. Depending on the field control system media and protocol this must be accomplished through one of the following:

a. Connect the existing field control network hardware at the FPOC location to the FPOC.

****
NOTE: The following list paragraph uses tailoring options.
1) "Control Protocol Gateway" is included if the BACNET, LONWORKS, MODBUS or OPC tailoring option is selected.

2) "Niagara Framework Supervisory Gateway" is included if the NIAGARA FRAMEWORK tailoring option is selected.

3) The "either" and "or" are included if the NIAGARA FRAMEWORK tailoring option AND any of the other 4 protocol tailoring options are selected.

****

b. Install either a Control Protocol Gateway or Niagara Framework Supervisory Gateway connected to both the field control network and the FPOC.

****
NOTE: The following TWO list paragraphs are included if the BACNET, LONWORKS, MODBUS or OPC tailoring option is selected.

****
c. Install a Control Protocol Router connected to both the field control network and the FPOC.

d. Install a Control Protocol Gateway connected to the field control network. Then install a Control Protocol Router connected to both the Control Protocol Gateway and the FPOC.

****
NOTE: The following paragraph is included if the BACNET tailoring option is selected.

****

In addition, for integration of field control systems via ASHRAE 135, also install a BACnet Supervisory Controller as needed to implement scheduling, alarming and trending in the field control system. The BACnet supervisory controller may be the same device as the control protocol gateway or router.

3.6.1.1 Installation of Control Protocol Gateway

****

NOTE: This subpart is included only if the BACNET, LONWORKS, MODBUS or OPC tailoring option is selected.

This subpart also uses tailoring options to:
1) include the references to the protocol only if the corresponding tailoring option is selected

2) include the protocol routers only when the corresponding tailoring option is selected

****

If the field control system uses a protocol which is not supported by the M&C Software, install a gateway to convert the field control system protocol to ASHRAE 135, or to CEA-709.1-D, or to MODBUS Protocol/ MODBUS TCP/IP, or to OPC DA. Install additional field control system network media and hardware as needed to connect the Gateway to the field control system. Connect the Gateway according to one of the two following methods:

a. Connect the Gateway to the field control network and to the FPOC. .

b. Connect the Gateway to the field control network and to a BACnet/IP Router, or to a LonWorks/IP Router, or to a Modbus/IP Router installed as specified.

Create and configure points and establish network communication between the Control Protocol Gateway and the field control system to provide points from the field control system to the M&C software.

3.6.1.2 Installation of Niagara Framework Supervisory Gateway

****

NOTE: This subpart only applies to Niagara Framework systems and is only included when the NIAGARA FRAMEWORK tailoring option is selected.

****

Install Niagara Framework Supervisory Gateway hardware to connect the field control network to the FPOC. Install additional field control system network media and hardware as needed to connect the Niagara Framework Supervisory Gateway to the field control system.

3.6.1.3 Installation of Control Protocol Router

****

NOTE: This subpart is included only if the BACNET, LONWORKS, MODBUS or OPC tailoring option is selected.

This subpart uses tailoring options to include the

protocol routers only when the corresponding tailoring option is selected

****

If there is not an existing connection between the FPOC and the field control network, install a BACnet/IP Router, or a LonWorks/IP Router, or a Modbus/IP Router to connect the field control network to the FPOC. Install additional field control system network media as needed to connect the Router to the field control system.

3.6.1.4 Installation of BACnet Supervisory Controller

****

NOTE: This subpart only applies to BACnet systems and is only included when the BACNET tailoring option is selected.

****

If required for implementation of scheduling, alarming and trending, install a BACnet Supervisory Controller connected to the building control system IP network and configure it to provide scheduling, alarming and trending functions for the field control system. When the BACnet Supervisory Controller is the same device as a control protocol router or gateway, install it in accordance with the installation requirements for a router or gateway.

3.6.2 Integration Step 2: Add Field Control System to M&C Software

Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to points and data in the field control system.

3.6.2.1 Integration of Field Control Systems Via ANSI-709.1-C

****

NOTE: This subpart only applies to integration via LonWorks and is only included when the LONWORKS tailoring option is selected.

****

a. When a LNS Database of the field control system is not available, use the Network Configuration Tool software to discover the field control system and create an LNS Database for the field control system.

b. When the UMCS does not already contain an LNS Server, provide an LNS Server to support the UMCS LNS Database.

c. When there is no existing UMCS LNS Database, use the field control system database as the UMCS Database.

d. When there is an existing UMCS LNS Database, merge the field control system with the UMCS LNS database.

3.6.2.2 Integration of Field Control Systems Via ASHRAE 135

****

NOTE: This subpart only applies to integration via BACnet and is only included when the BACNET tailoring option is selected.

****

Use the M&C Software to fully discover the field control system. Full discovery of a field control system includes but is not limited to discovery of all ASHRAE 135 devices, all standard ASHRAE 135 Objects and Properties of each device, and all standard ASHRAE 135 services supported by each device.

3.6.2.3 Integration of Field Control Systems Via Niagara Framework

****

NOTE: This subpart only applies to integration via Niagara Framework and is only included when the NIAGARA FRAMEWORK tailoring option is selected.

****

For each Niagara Framework Supervisory Gateway installed in integration step 1 for this project do both of the following:

a. Use the Niagara Framework Engineering Tool to fully discover the field control system and make all field control system information available to the Niagara Framework Supervisory Gateway.

b. Create and configure points and establish network communication between the Niagara Framework Supervisory Gateway and the field control system to provide points from the field control system to the M&C software and to provide support for supervisory functions, including but not limited to schedule objects, trend logs and alarming.

For each Niagara Framework Supervisory Gateway to be integrated as part of this project, make all information in the Niagara Framework Supervisory Gateway available to the M&C Software.

3.6.2.4 Integration of Field Control Systems Via Modbus

****

NOTE: This subpart only applies to integration via Modbus and is only included when the MODBUS tailoring option is selected.

****

****

NOTE: Detailed documentation will be required for the integration of Modbus systems as there is no standard database (like there is in LonWorks) or no standard means for device discovery (like there is in BACnet).

Keep the first large set of bracketed text if this point information does not exist and the contractor must survey the building to determine the appropriate point information. When using this option, consider providing a POC at the project site who can assist the contractor with this survey.

Keep the second large set of bracketed text if this point information is available, and indicate the source of this point information:

Use [contract document Points Schedule] if the Points Schedule exists and will be included in the contract package

Use [field control system documentation Points Schedules] if the integrating contractor is also providing the Modbus system at the same time.

Use [____] to indicate other ways this information is being conveyed.

If the points required by the M&C Software (for display, trends, alarms etc) are shown on a Points Schedule keep [as shown on the Points Schedule], otherwise remove this bracketed text to require all points be available.

****

[Survey the field control system to create Points Schedules. Using these Points Schedules][Using the [contract document Points Schedule][field control system documentation Points Schedules][____],] make all points[as shown on the Points Schedule] from the field control system available in the M&C Software.

3.6.2.5 Integration of Field Control Systems Via OPC DA

****

NOTE: This subpart only applies to integration via OPC and is only included when the OPC tailoring option is selected.

****

****

NOTE: If the points required by the M&C Software (for display, trends, alarms etc) are shown on a Points Schedule keep [as shown on the Points Schedule], otherwise remove this bracketed text to require all points be available.

****

Establish a connection between the M&C Software OPC DA client and the field control system OPC DA server and make all points[as shown on the Points Schedule] from the field control system available in the M&C Software.

3.6.2.6 [Enter Appropriate Subpart Title Here]Integration of Field Control Systems Via Other (non-Niagara Framework (Fox Protocol), non-ASHRAE 135, non-CEA-709.1-D, non-Modbus, non-OPC DA) Protocols

****

NOTE: If the points required by the M&C Software (for display, trends, alarms etc) are shown on a Points Schedule keep [as shown on the Points Schedule], otherwise remove this bracketed text to require all points be available.

The requirement here for making points available to the M&C Software are broad since it is not possible

to specify how perform these tasks without details about the field control system and M&C Software.
****

Perform all actions necessary to make all points[as shown on the Points Schedule] from the field control system available in the M&C Software.

3.6.3 Integration Step 3: Configure M&C Software

Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.6.3.1 Configure M&C Software Communication

Create and configure points and establish network communication between M&C Software and Field Control Systems as specified to support M&C Software functionality:

a. Update points on currently active displays via polling as necessary to meet M&C Software display refresh requirements.

****
NOTE: The following list paragraph uses tailoring options.
1) LonWorks requirements are included only when the LONWORKS tailoring option is selected.
2) BACnet requirements are included only when the BACNET tailoring option is selected.
****

b. Send points used for overrides to the device receiving the override as shown on the Points Schedule. For LonWorks systems, for points used for overrides use the network variable and SNVT type indicated on the Points Schedule. For SNVTs for overriding schedules (via the Simple Scheduler) use SNVT type SNVT_occupancy and support the following values: OC_OCCUPIED, OC_UNOCCUPIED, OC_STANDBY and OC_NUL. For SNVTs used to override schedules or setpoints for Demand Limiting functions use the acknowledged service. For BACnet systems write operator overrides with a priority of 8 and demand limiting overrides with a priority of 10.

****
NOTE: The following list paragraph uses tailoring options.
1) BACnet requirements are included only when the BACNET tailoring option is selected.
2) LonWorks requirements are included only when the LONWORKS tailoring option is selected.
3) MODBUS requirements are included only when the MODBUS tailoring option is selected.
4) OPC requirements are included only when the OPC tailoring option is selected.
****

c. For Notification Class Objects used for Alarms, configure the Recipient_List Property to point to the appropriate M&C Software process. Use the ConfirmedEventNotification service for events from

ASHRAE 135 field control systems used for alarms. Bind points from CEA-709.1-D field control systems used using acknowledged service or poll the point at 5 minute intervals. Poll points from MODBUS Protocol /MODBUS TCP/IP field control systems used for alarms at 5 minute intervals. For points from OPC DA field control systems used for alarms use a subscription or poll the point at 5 minute intervals.

****

NOTE: The following TWO list paragraphs are included only when the LONWORKS, MODBUS or OPC tailoring option is selected.

Requirements for LonWorks field control system are only included when the LONWORKS tailoring option is selected.

****

d. Update points used for currently active trends via polling as necessary to meet trend interval requirements.

e. Send points used for scheduling to the field control system with a maximum time between subsequent transmissions of the point of 30 minutes. For LonWorks field control systems, send points used for scheduling to the appropriate System Scheduler using SNVTs of type SNVT_occupancy which support the following values: OC_OCCUPIED, OC_UNOCCUPIED and OC_STANDBY.

****

NOTE: Future upward reporting to an enterprise system will likely require that Real Property Unique IDs (18 digits numeric) be included when point information is transmitted to the enterprise. The following requires that the contractor include the Real Property Unique IDs (RPUID) in a description field of the M&C Software point when performing integration. Coordinate with the project site to determine whether to include this requirement. If including this requirement show the RPUID on the Points Schedule.

****

[Edit the Description field of each point to include the Real Property Unique IDs (RPUID) associated with that point as shown on the Points Schedule

]3.6.3.2 Configure M&C Software Functionality

Fully configure M&C Software functionality using the M&C Software capabilities specified in PART 2 of this Section.

****

NOTE: Indicate if the installation has sample graphic pages. Indicate how points on graphic pages should be labeled. Coordinate with the project site to determine if they have a naming convention.

Indicate who the contractor should coordinate with for user permissions.

****

a. Create System Displays [using the [project site] sample displays,]including overrides, as shown on the Points Schedule and as specified. Label all points on displays with [full English language descriptions][the point name as shown on the Points Schedule][the point description as shown on the Points Schedule][____]. Configure user permissions for access to and executions of action using graphic pages. Coordinate user permissions with [the [Controls] [HVAC] [Electrical] shop supervisor][____]

****

NOTE: The following list paragraph uses tailoring options:
1) the phrase "alarm generation and" is included only when the LONWORKS, MODBUS or OPC tailoring option is selected.
2) The requirements for configuring alarming in BACnet ("Create and configure... and all others as critical.") are included only when the BACNET tailoring option is selected

****

b. Configure alarm generation and alarm handling as shown on the Points Schedule, as shown on the Alarm Routing Schedule, and as specified. Create and configure Objects in BACnet Supervisory Controllers and in the field control system to support alarming as shown on the Points Schedule and as specified. Alarm events with priority 112 are critical and events with priority 224 are non-critical. For alarm events with other priorities, treat events with priorities of 200 or above as non-critical, and all others as critical. For alarms requiring notification via text message or e-mail, configure the alarm notification to use the specified Government furnished SMTP server to send the alarm notification.

****

NOTE: The following 2 list paragraphs use tailoring options to include requirements for the selected protocol tailoring options only.

****

c. Configure scheduling as indicated and as shown on the points schedule. Configure M&C Software scheduling functionality to schedule Modbus systems andOPC systems. Configure M&C Software scheduling functionality for LonWorks field control systems which do not use the Simple Scheduler Object. For LonWorks field control systems which do use the Simple Scheduler Object, configure the Simple Scheduler Objects in the field control system. Create and configure Schedule Objects in BACnet Supervisory Controllers or in the field control system.

Create and configure displays for configuration of M&C Software schedules and Simple Scheduler Objects in the field control system and Schedule Objects in the field control system. Label schedules and scheduled points with full English-language descriptors. Provide a separate configuration capability for each schedule. A single configuration display may be used to configured multiple schedules, provided that each schedule is separately configurable from the display.

****

NOTE: The following list paragraphs uses tailoring options:

1) "Create M&C Software trends for required points as shown on the Points Schedule and as specified." is included when the LONWORKS, MODBUS or OPC tailoring option is selected.

2) "Create and configure Trend Objects in BACnet Supervisory Controllers and in the field control system as shown on the Points Schedule and as specified" is included only when the BACNET tailoring option is selected.

****

d. Create M&C Software trends for required points as shown on the Points Schedule and as specified. Create and configure Trend Objects in BACnet Supervisory Controllers and in the field control system as shown on the Points Schedule and as specified. Trend points at [15] [_____] minute intervals.

Create and configure displays for creation and configuration of trends and for display of all trended points.

e. Configure Demand Limiting as shown on the Demand Limit Schedule and Points Schedule and as specified.

f. Configure M&C Software standard reports.

3.7 START-UP AND START-UP TESTING

Test all equipment and perform all other tests necessary to ensure the system is installed and functioning as specified. Prepare a Start-Up and Start-Up Testing Report documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

3.8 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.

****

3.8.1 PVT Phase I Procedures

Provide PVT Procedures which include:.

a. Network bandwidth usage and available bandwidth (throughput) measurements. Network bandwidth usage must reference the normal usage network Bandwidth Calculations.

b. Test System Reaction during PVT: 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 must 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.

3.8.2 PVT Phase I

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures previously approved by the Government, demonstrate all physical and functional requirements of the project. Upon completion of PVT Phase I and as specified, prepare and submit the PVT Phase I Report documenting all tests performed during the PVT and their results. In the PVT report, include all tests in the PVT Procedures and any other testing performed during the PVT. Document failures and repairs with test results.

3.8.3 PVT Phase II

Include Basic Training as part of PVT Phase II. Failures or deficiencies of the UMCS during Basic Training are considered PVT failures. Upon completion of PVT Phase II, and as specified, prepare and submit the PVT Phase II Report documenting any failures which occurred and repairs performed during PVT Phase II.

3.9 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.

Some/many of these Maintenance and Service requirements may not apply if the UMCS networking equipment and supporting infrastructure is Government furnished equipment and maintained by the Government.The requirements here generally assume that the contractor is permitted access to the system and equipment, but the applicability of this assumption will vary site-by-site. It's critical to coordinate with the project site to determine to what extent the contractor will be responsible for system and equipment maintenance. Some notes have been included with bracketed text to provide general guidance, but careful editing of this entire subpart is needed.

Requirements should be coordinated with "WARRANTY MANAGEMENT" in Section 01 78 00 CLOSEOUT SUBMITTALS

****

Perform inspection, testing, cleaning, and part or component replacement as specified and as required to maintain the warranty. 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. Perform work in compliance with manufacturer's recommendations and industry standards. Provide technical support via telephone during regular working hours.

3.9.1 Work Coordination

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, coordinate with the Government to minimize the impact of the interference, inconvenience, equipment downtime, interrupted service and personnel discomfort.

3.9.2 Work Control

Upon completion of work on a system or piece of equipment, that system or piece of equipment must be free of missing components or defects which would prevent it from functioning as originally intended and designed. Replacements must conform to the same specifications as the original equipment. During and at completion of work, do not allow debris to spread unnecessarily into adjacent areas nor accumulate in the work area itself.

3.9.3 Working Hours

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

[3.9.4 Equipment Repairs

****

NOTE: Coordinate with the project site to determine if equipment (computers and control hardware) repair will be done by the contractor or by local staff, and to what extent. If the equipment is Government furnished then the contractor may not be allowed access to some/all of the equipment for repair. Address Information Assurance (IA) or other equipment access requirements in "Access To UMCS Equipment" below.

Select repair times below.

****

Initiate and complete equipment repairs within the following time periods, where time periods are measured as actual elapsed time from first notification, including working and non-working hours:

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 (powered) control hardware, initiate within [4] [_____] hours and complete within [6] [_____] hours.

f. for cabling 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 or replacement of the entire unit or system.

]3.9.5 Replacement, Modernization, Renovation

The Government may replace, renovate, or install new equipment as part of the UMCS at Government expense and by means not associated with this contract without voiding the system warranty. 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.

3.9.6 Access To UMCS Equipment

****

NOTE: Coordinate with the project site to determine any additional access requirements. Specifically, computer and/or control hardware access will likely require meeting certain Information Assurance (IA) requirements.

****

Access to UMCS equipment must be in accordance with the following:

a. Coordinate access to facilities and arrange that they be opened and closed during and after the accomplishment of the work effort. For access to a controlled facility contact the Government for assistance.

b. The Government may provide keys for access to UMCS equipment where the Government determines such key issuance is appropriate. Establish and implement methods of ensuring that keys issued by the Government are not lost or misplaced, are not used by unauthorized persons, and are not duplicated.

c. The Government may provide passwords or issue Common Access Cards (CAC) for access to UMCS computer equipment where the Government determines such issuance is appropriate. Establish and implement methods of ensuring that passwords and Common Access Cards issued by the Government are not used by unauthorized persons.

3.9.7 Records, Logs, and Progress Reports

Keep records and logs of each task, and organize cumulative chronological records for each major component, and for the complete system. Maintain a continuous log for the UMCS. Keep complete logs and be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the UMCS.

3.9.8 Preventive Maintenance Requirements

****

NOTE: If the contractor will not be responsible for Preventive Maintenance keep only the bracketed text requiring a plan "detailing" preventive maintenance (note this may include software maintenance as well as hardware maintenance). Otherwise remove "[detailing]" and keep the other bracketed text.

Delete the requirement for written requests to reschedule maintenance if not required by the project site.

****

[Perform maintenance procedures as described below, or more often if required by the equipment manufacturer.] [Prepare a Preventive Maintenance Work Plan as specified.]

3.9.8.1 Preventive Maintenance Work Plan

Prepare a Preventive Maintenance Work Plan [to schedule] [detailing] all required preventive maintenance. Obtain Government approval of the Work Plan as specified in paragraph PROJECT SEQUENCING.[Strictly adhere to the approved work plan to facilitate Government verification of work.][If it is necessary to reschedule maintenance, make a written request to the Government detailing the reasons for the proposed change at least five days prior to the originally scheduled date. Scheduled dates will be changed only with the prior written approval of the Government.]

[3.9.8.2 Semiannual Maintenance

****

NOTE: Coordinate with the project site to determine whether or not to include the requirements for Semiannual Maintenance. See also above notes regarding maintenance of Government furnished equipment and access requirements.

****

Perform the following Semiannual Maintenance as specified:

a. Perform data backups on all Server 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.

][3.9.8.3 Maintenance Procedures

****

NOTE: Coordinate with the project site to determine whether or not to include the Maintenance Procedures requirement (in whole or in part). See also above notes regarding maintenance of Government furnished equipment and access requirements.

Select whether notice must be given for maintenance that will result in downtime (off-line) or for any maintenance that MAY result in downtime. A selection of 'will' is recommended unless the project site requests otherwise.

Select appropriate down-times and notice times.
****

3.9.8.3.1 Maintenance Coordination

Coordinate any scheduled maintenance event that [will][may] result in component downtime with the Government as follows, where time periods are measured as actual elapsed time from beginning of equipment off-line period, including working and non-working hours:

a. For non-redundant computer server hardware, provide [14] [_____] days notice, components must be off-line for no more than [8] [_____] hours.

b. For non-redundant computer workstation hardware, provide [7] [_____] days notice, components must be off-line for no more than [8] [_____] hours.

c. for redundant computer server hardware, provide [7] [_____] days notice, components must be off-line for no more than [36] [_____] hours.

d. For redundant computer workstation hardware, provide [4] [_____] days notice, components must be off-line for no more than [48] [_____] hours.

e. For active (powered) control hardware, provide [14] [_____] days notice, components must be off-line for no more than [6] [_____] hours.

f. For cabling and other passive network hardware, provide [21] [_____] days notice, components must be off-line for no more than [12] [_____] hours.

3.9.8.3.2 Software/Firmware

Software/firmware maintenance includes [____] [operating systems,]application programs, and files required for the proper operation of the UMCS regardless of storage medium. User (project site) 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. Perform diagnostics and corrective reprogramming as required to maintain total UMCS operations as specified. Back up software before performing any computer hardware and software maintenance. Do not modify any parameters without approval from the Government. Properly document any approved changes and additions, and update the appropriate manuals.

[3.9.8.3.3 Network

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

Network maintenance includes testing transmission media and equipment to verify signal levels, system data rates, errors and overall system performance.

]]3.9.9 Service Call Reception

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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. 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.

b. Submit procedures for receiving and responding to service calls [24 hours per day, seven days a week, including weekends and holidays] [during regular working hours]. Provide a single telephone number for receipt of service calls during regular working hours; service calls are to be considered received at the time and date the telephone call is placed by the authorized Government representative.

c. Separately record each service call request, as received on the Service Call Work Authorization form and complete the Service Call Work Authorization form for each service call. Include the following information in the completed form: 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.

d. Respond to each service call request within [two] [_____] working hours. Provide the status of any item of work within [four] [_____] hours of the inquiry during regular working hours, and within [16] [_____] hours after regular working hours or as needed to meet the Equipment Repair requirements as specified.

3.9.10 Service Call Work Warranty

Provide a [1 year] [_____] unconditional warranty on service call work which includes labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition. In the event that service call work causes damage to additional equipment, restore the system to full operation without cost to the Government. Provide response times for service call warranty work equivalent to the

response times required by the initial service call.

3.9.11 System Modifications

Make recommendations for system modification in writing to the Government. Do not make system modifications without prior approval of the Government. Incorporate any modifications made to the system into the Operations and Maintenance Instructions, and any other documentation affected. Make available to the Government software updates for all software furnished under this specification during the life of this contract. Schedule at least one update near the end of the contract period, at which time make available the latest released version of all software provided under this specification, and install and validate it upon approval by the Government.

3.10 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.

****

Conduct training courses for designated personnel in the maintenance, service, and operation of the system as specified, including specified hardware and software. The training must be oriented to the specific system provided under this contract. Provide audiovisual equipment and other training material and supplies required for the training. When training is conducted at Government facilities, the Government reserves the right to record 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. Obtain approval of the training schedule from the Government at least [30] [_____] days prior to the first day of training.

3.10.1 Training Documentation

Prepare and submit one set of Training manuals for each of Basic Training Documentation, Advanced Training Documentation, and Refresher Training Documentation, where each set of documentation consists of:

3.10.1.1 Course Attendance List

Course Attendance List developed in coordination with and signed by the [Controls] [HVAC] [Electrical] shop supervisor.

3.10.1.2 Training Manuals

Include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson in the training manuals. Where portions of the course material are presented by audiovisuals, include copies of those audiovisuals as a part of the printed training manuals.

3.10.2 Basic Training

Conduct a Basic Training course 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. Design training 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. Include the following topics at a minimum:

a. General system architecture.

b. Functional operation of the system, including workstations and system navigation.

c. System start-up procedures.

d. Failure recovery procedures.

e. Schedule configuration.

f. Trend configuration.

g. Perform point overrides and override release.

h. Reports generation.

i. Alarm reporting and acknowledgements.

j. Diagnostics.

k. Historical files.

l. Maintenance procedures:

(1) Physical layout of each piece of hardware.

(2) Troubleshooting and diagnostic procedures.

(3) Preventive maintenance procedures and schedules.

3.10.3 Advanced Training

****
NOTE: This subpart uses tailoring options to include requirements for selected protocols only.
1) CEA-709.1-D Network Configuration Tool is included only when the LONWORKS tailoring option is selected.
2) BACnet Network Browser is included only when the BACNET tailoring option is selected.
3) Niagara Framework Engineering Tool is included only when the NIAGARA FRAMEWORK tailoring option is selected.
****

****

NOTE: Coordinate with the project site to select the location of the Advanced Training (or leave it up to the Contractor). Select the duration of the training and the number of attendees.

****

Conduct an Advanced Operator Training course [at the project site] [off-site or at the project site] for a period of not less then [five] [_____] days. A maximum of [ten] [_____] personnel will attend this course. Structure the course to consist of "hands-on" training under the constant monitoring of the instructor. Include training on the M&C Software, and the CEA-709.1-D Network Configuration Tool , and the BACnet Network Browser, and the Niagara Framework Engineering Tool. Upon completion of this course, the students should be fully proficient in the operation and management of all system operations and must be able to perform all tasks required to integrate a field control system into the UMCS. Report the skill level of each student at the end of this course. Include the following topics at a minimum:

a. A review of all topics in Basic Training

b. Using the CEA-709.1-D Network Configuration Tool for Network Management and using the BACnet Network Browser for network discovery

c. M&C Software configuration, including but not limited to: creating and editing system displays, alarms, schedules, trends, demand limiting and calculations.

3.10.4 Refresher Training

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NOTE: 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 Refresher Training periodically.

****

Conduct a Refresher Training course at the project site for a period of [two] [_____] training days when approved by the Government and as specified in paragraph PROJECT SEQUENCING. A maximum of [ten] [_____] personnel will attend the course. Structure the course 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. Correct any system failures discovered during the Refresher Training at no cost to the Government.

APPENDIX A

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NOTE: The QC Checklist table may not display properly in SpecsIntact. If it appears empty right-click on the table and select "Make All Rows Same Height" to make the entire table appear and then adjust row heights as needed (such as reducing row height for rows with less text).

****

	QC CHECKLIST	
This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.		
This checklist is for (check one:)		
	Pre-Construction QC Checklist Submittal (Items 1-2)	( )
	Post-Construction QC Checklist Submittal (Items 1-6)	( )
	Close-out QC Checklist Submittal (Items 1-14)	( )
Instructions: Initial each item in the space provided (|____|) verifying that the requirement has been met.		
Verify the following items for Pre-Construction, Post-Construction and Closeout QC Checklist Submittals:		
1	Contractor Design Drawing Riser Diagram includes location and types of all Control Hardware and Computer Hardware.	|____|
2	M&C Software supports the Niagara Framework, and ASHRAE 135, and CEA-709.1-D, and MODBUS Protocol/MODBUS TCP/IP, and OPC DA. M&C Software is BTL Listed as a B-AWS. M&C Software is LonWorks Network Services (LNS) based.	|____|
Verify the following items for Post-Construction and Closeout QC Checklist Submittal:		

QC CHECKLIST			
3	Communication between the M&C Software and Niagara Framework field control systems uses only Fox protocol.Communication between the M&C Software and ASHRAE 135 field control systems uses only ASHRAE 135. Communication between the M&C Software and CEA-709.1-D field control systems uses only CEA-709.1-D. Communication between the M&C Software and MODBUS Protocol/MODBUS TCP/IP field control systems uses only MODBUS Protocol/MODBUS TCP/IP. Communication between the M&C Software and OPC DA field control systems uses only OPC DA.		|_____|
4	Connections to field control systems are via Niagara Framework Supervisory Gateways. [The following is NOT permitted when Niagara Framework is used and therefore IS NOT PERMITTED for this project: Connections to non-ASHRAE 135, non-CEA-709.1-D, non-Modbus, non-OPC DA field control systems are via a Gateway from the field control system to ASHRAE 135, or to CEA-709.1-D, or to Modbus, or to OPC DA, or via a UMCS supported protocol without the use of a hardware Gateway.]		|_____|
5	Computer workstations and servers are installed as shown on the UMCS Riser Diagram.		|_____|
6	Training schedule and course attendee lists have been developed and coordinated with shops and submitted.		|_____|
Verify the following items for Closeout QC Checklists Submittal:			
7	LNS Database is up-to-date and accurately represents the final installed system. All points in field control systems have been discovered using the Niagara Framework Engineering Tool and are available at the M&C Software.		|_____|
8	All software has been licensed to the Government.		|_____|

QC CHECKLIST			
9	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.		|____|
10	Final As-built Drawings accurately represent the final installed system.		|____|
11	Default trends have been set up (per Points Schedule drawings).		|____|
12	Scheduling has been configured at the M&C Software (per Occupancy Schedule drawing).		|____|
13	O&M Instructions have been completed and submitted.		|____|
14	Basic Operator and Advanced Training courses have been completed.		|____|
_____		_____	
	(QC Representative Signature)	(Date)	

-- End of Section --