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SECTION 25000

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SECTION 25 00 00 - INTEGRATED AUTOMATION

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification section is to establish a set of guidelines to accurately and precisely define an Integrated Automation System. Such a system shall, at a minimum, offer the capabilities to:

1. Unite facility monitoring and control systems into a Centralized User Interface
2. Access historical, current, and projected operational data and analytics
3. Improve facility understanding, with an emphasis on the contexts of the assets, spaces, and actors of the building(s)
4. Enhance energy efficiency with the use of sophisticated performance modeling
5. Promote predictive maintenance and fault forecasting
6. Manage assets and their maintenance as well as work order creation, population, and completion with direct integration to CMMS, asset management, and work order systems
7. Continuously monitor user-defined Key Performance Indicators
8. Support ongoing retro-commissioning
9. Automatically suggest and, if permitted, enact changes to setpoints, schedules, etc, to realize improvements in energy efficiency

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details this Contractor's scope for the Integrated Automation System for the project.

B. Requirements outlined in section 25 00 00 - Integrated Automation System shall apply to all sections of the Division 25 specification

C. This Contractor is responsible to furnish and install all suitable, approved control and monitoring devices which comprise a complete system.

a. The complete system shall include, at a minimum:

i. A cloud-based platform

ii. A Centralized User Interface

iii. A locally installed server or other data aggregation device

iv. Local and/or cloud integration to 3rd Party Devices

v. All associated software, programming, and configuration

D. The system shall support communications between IAS and all systems and devices to be integrated, as outlined in this specification, using industry standard communications protocols.

E. All labor, material, equipment, and software not specifically referred to herein or on the plans, that is required to meet the functional intent of all sections of this specification, shall be provided without additional cost to the Owner.

F. Where the Drawings and Specifications differ, the more stringent requirement shall be applicable, unless stated otherwise.

G. It is the goal of the Owner, beyond this project, to fully realize an Integrated Automation System that facilitates flexibility for assorted manufacturers to be completely integrated into a unified system, to provide fluidity for expansion and preservation.

1.4 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.6 ABBREVIATIONS

- API: Application Programming Interface
- ANSI: American National Standards Institute
- ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers
- AWG: American Wire Gauge
- BMS: Building Management System
- CRAC: Computer Room Air Conditioning Unit
- CRAH: Computer Room Air Handling Unit

- CUI: Centralized User Interface
- DDC: Direct Digital Control
- FDD: Fault Detection and Diagnostics
- HVAC: Heating, Ventilating, and Air Conditioning
- KPI: Key Performance Indicators
- IA: Integrated Automation
- IAS: Integrated Automation System
- ID: Identification
- IT: Information and Communication Technology
- IEEE: Institute of Electrical and Electronic Engineers
- IP: Internet Protocol
- ISO: International Organization of Standardization
- ISA: Instrument Society of America
- LAN: Local Area Network
- MAC: Media Access Control
- MFA: Multi-Factor Authentication
- MQTT: Message Queuing Telemetry Transport
- NEMA: National Electric Manufacturers' Association
- NFPA: National Fire Protection Association (US Standards)
- OSHA: Occupational Safety and Health Administration
- OSS: Optimal Start and Stop
- OT: Operational Technology
- PC: Personal Computer
- RAID: Redundant Array of Inexpensive Disks
- RAM: Random Access Memory
- REST: Representative State Transfer
- SCADA: Supervisory Control and Data Acquisition
- SMS: Short Messaging Service
- SMTP: Simple Mail Transfer Protocol
- SNMP: Simple Network Management Protocol
- SSO: Single Sign-On
- UPS: Uninterruptible Power Supply

- UL: Underwriters Laboratories
- VPN: Virtual Private Network
- VLAN: Virtual Local Area Network

1.7 DEFINITIONS

- Actuator: Control device that opens or closes a valve or damper in response to control signal
- Algorithm: A software procedure for solving a recurrent mathematical or logical problem.
- Analog: A continuously varying signal or value (temperature, current, velocity, etc.).
- API: A set of rules and queries that allows different software applications to communicate and share data with each other. It defines the methods and data formats that applications can use to request and exchange information.
- BACnet: The Building Management and Control Network open protocol communication standard developed by ASHRAE (ASHRAE SSPC/135) and which is now an ISO and ANSI standard. BACnet can operate over multi-media including Ethernet and serial communication. BACnet components shall be UL listed; and shall be fully compliant with ASHRAE Standard SSPC/135 and all other applicable codes.
- BACnet/IP: The Building Management and Control Network open protocol communication standard using Internet Protocol (IP) complying with Annex J of the ASHRAE SSPC/135 standard.
- Binary: A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level.
- Component: Any individual element of the Integrated Automation System furnished under this sub-contract including hardware, software and materials.
- Configurable Device: A device that operates based on an established, built-in application. Configurable devices offer limited customizability
- Fault Detection and Diagnostics (FDD): Software that measures and provides diagnostics for the improvement of the operational performance of buildings by identifying anomalies (equipment faults, sensor faults, short cycling, simultaneous heating and cooling, etc.) in the performance of critical HVAC equipment.
- Furnish: Purchase and deliver to the appropriate installing sub-contractor, complete with every installed accessory, document, commissioning report, and warranty.
- Integration: The ability of control system components from different manufacturers to connect while providing coordinated control via real-time data exchange through a common communications data exchange protocol. Integration shall extend to the operator's workstation software, which shall support user interaction with all control system components. Methods of integration may include industry standard protocols

such as: BACnet, Modbus, Fox, MQTT, RESTful APIs, and integrator interfaces between cooperating manufacturer's systems.

- Interoperability: The ability of systems from different manufacturers and of different types to share information with each other without losing any of their independent functional capabilities and without the need for complex programming.
- Modbus Protocol: A serial communication protocol that gives a unique address to devices to allow for communication on the same network.
- MQTT: A lightweight messaging protocol designed for low-bandwidth, high-latency networks, commonly used in IoT devices to efficiently publish and subscribe to data topics. It enables devices to communicate through a central broker using minimal network overhead.
- Programmable Device: A device that does not have a pre-established built-in application. An application creation software tool is required for an application to be created and downloaded to the device.
- Provide: The term "provide" means "provide complete in place", That is, furnish, install, commission, test, warrant and ready for operation and use. Refer to the definition of "Furnish".
- REST: An architectural style for designing web services that emphasizes stateless communication, uniform interfaces, and the use of standard HTTP methods to interact with resources. It treats data and functionality as resources that can be accessed and manipulated using predictable URL patterns and HTTP operations.
- RESTful API: A web service that follows REST architectural principles, using standard HTTP methods (GET, POST, PUT, DELETE) to perform operations on resources identified by URLs. It enables stateless communication between client and server applications through standardized, predictable interfaces.
- Software: Programs that are executed by a digital IAS beyond the physical hardware of the computer system, encompassing any programs such as operating systems (OS), application programs, operating sequences, and data base. The term "Software" in this specification shall also include all firmware provided with read-only memory as part of the IAS to meet all applicable criteria detailed to meet sequence of operations.
- Switch: A device used to build a network connection between attached microprocessor equipment including servers and other network devices.

1.8 SCOPE OF WORK

A. This Contractor shall furnish all labor and materials to construct, install, test, verify, and commission a complete Integrated Automation system, as outlined in this specification

B. This Contractor shall furnish and install, as a part of the Integrated Automation system, integration to and monitoring and control of all facility systems, as detailed throughout this document, including, but not limited to:

   a. HVAC system(s)
   b. Electrical system(s)
   c. Plumbing system(s)
   d. Lighting system(s)
   e. Occupancy / people counting system(s)
   f. Energy storage system(s)
   g. Energy harvesting or generation system(s)
   h. EV charging system(s)
   i. Transportation system(s)
   j. Utility system(s)
   k. Security system(s)
   l. Fire Alarm system(s)
   m. Computerized Maintenance Management System(s)
   n. Work Order Management System(s)
   o. Miscellaneous Alarm Points

C. This Contractor shall review all relevant project submittals for systems to be integrated into the Integrated Automation System, and shall coordinate with the respective contractors for such systems, to ensure adherence to ontology, protocols, and data availability, in furtherance of delivering the specified Integrated Automation System.

1.9 PROJECT SUBMITTALS

a. All submittals, as with all project documentation, must be custom created solely for this project. Reuse of precursory documents shall not be permitted.

b. Project Specific Documentation

   i. Network topology diagram, indicating the devices and protocols to be integrated

   ii. Ontology and metadata approach for assets, spaces, etc.

   iii. List of expected integration points

c. Product Data: For each type of product.

i. Include Manufacturer-published technical literature, including data sheets and installation instructions

ii. Indicate dimensions, capacities, performance characteristics, materials, and finishes

iii. Detail any documented or known installation or performance limitations. Mis-applied products shall not be permitted, and must be replaced in kind at no expense to the Owner.

iv. Where a submitted product does not meet specifications, this Contractor shall submit a written statement, explaining and justifying the non-conformance, for review

d. Shop Drawings:

i. Three (3) copies of shop drawings of the entire Integrated Automation System shall be submitted, and shall consist of the following, at a minimum

1. Product data, as outlined above
2. Software descriptions, including functional programming and UX/UI programming
3. Proposed graphics for all major systems, as well as general navigability and utility

ii. Sample Warranty: For any applicable warranty that does not meet the standards outlined in the Warranty section of this specification.

1.10 COMMISSIONING PROCESS

A. This Contractor shall perform comprehensive commissioning of the Integrated Automation System to verify proper installation, configuration, and operation of all system components as specified herein.

B. Pre-Commissioning Requirements

a. Prior to commissioning activities, this Contractor shall verify that all IAS components are installed, configured, and operational, including:

i. Cloud platform deployment and accessibility

ii. Local server/data aggregation device installation and configuration

iii. Network connectivity and security implementation

iv. All integrated systems and devices connected and communicating

v. User accounts and access controls configured per Section 25 01 80

b. This Contractor shall provide complete system documentation including:

i. As-built network topology and addressing schemes

   ii. Complete points lists for all integrated systems
   iii. User manuals and system operation procedures
   iv. Cybersecurity implementation documentation

C. Functional Testing

   a. This Contractor shall verify proper communication between all system components:

      i. Test connectivity between local devices and cloud platform
      ii. Verify data transmission rates meet specification requirements
      iii. Confirm protocol compliance (BACnet, Modbus, Fox, MQTT, RESTful API)
      iv. Test network redundancy and failover capabilities where applicable
      v. Verify read/write capabilities for each data point, including, but not limited to, analog, binary, and multistate values and parameters, as well as schedules and other objects, at varying levels of priority

   b. This Contractor shall verify accurate data collection, processing, and storage:

      i. Confirm real-time data accuracy from all integrated points
      ii. Test historical data trending and archival functions
      iii. Verify data backup and recovery procedures
      iv. Test data export capabilities in required formats

   c. This Contractor shall verify complete functionality of the Centralized User Interface:

      i. Test all graphical displays and navigation elements
      ii. Verify mobile and desktop platform compatibility
      iii. Test user access controls and permission levels
      iv. Confirm alarm and notification delivery systems

   d. This Contractor shall test all control capabilities:

      i. Verify setpoint adjustments and schedule modifications
      ii. Test output overrides and manual control functions
      iii. Confirm optimal start/stop algorithm operation
      iv. Test emergency override and safety shutdown procedures

D. Integration Testing

a. For each integrated system, this Contractor shall verify:

i. Complete point mapping and data accuracy
ii. Proper alarm and fault detection
iii. Control command execution and feedback
iv. Integration with fault detection and diagnostics (FDD) algorithms

b. This Contractor shall verify system performance under various conditions:

i. Test system response times under normal and peak loads
ii. Verify concurrent user access capabilities
iii. Test system stability over extended operation periods
iv. Confirm scalability for future expansion

E. Acceptance Testing

a. This Contractor shall conduct formal acceptance testing with Owner representatives:

i. Demonstrate all specified system capabilities
ii. Verify compliance with all specification requirements
iii. Test emergency procedures and system recovery
iv. Confirm training completion for designated operators

b. In coordination with the Owner, this Contractor shall establish baseline performance metrics:

i. Document system response times and performance indicators
ii. Record initial energy consumption and efficiency metrics
iii. Establish fault detection sensitivity and accuracy baselines
iv. Document initial retro-commissioning results

F. Commissioning Documentation

a. This Contractor shall provide comprehensive documentation including:

i. Test procedures and results for all system components
ii. Performance verification data and benchmarks
iii. List of deficiencies and corrective actions taken
iv. Verification of specification compliance
v. Recommendations for ongoing operation and maintenance

b. This Contractor shall document all training activities:

   i. Training schedules and attendance records
   ii. Training materials and user guides provided
   iii. Competency verification for system operators
   iv. Ongoing support and training recommendations

1.11 CLOSEOUT SUBMITTALS

A. Before project closeout can be completed, this Contractor shall upgrade the firmware and software on every IAS manufacturer provided device, such that the latest possible version of all firmware and software is in place at the time of IAS turnover.

B. All submittals, as with all project documentation, must be custom created solely for this project. Reuse of precursory documents shall not be permitted.

C. Project Record Documentation for:

   a. Complete software documentation

   b. Complete system test procedures

   c. As-built network topology diagram

   d. Complete ontology and metadata mapping from integrated system points and static data, such as manufacturer, model, etc, conformed to ontology and metadata standard, with omissions from submitted list of expected integration points to be highlighted

1.12 QUALITY ASSURANCE

A. Manufacturer Qualifications:

   a. The IAS manufacturer shall offer full service as coordinated through their head office, with scheduling allowances made for time zone discrepancies.
   b. If the Contractor works independent of the manufacturer's head office, in the event that the Contractor experiences a catastrophic failure before the completion of the project, the manufacturer agrees to take over the entirety of the scope of the project, through completion, at no additional cost to the Owner.

B. Installer Qualifications:

   a. This Contractor shall be a manufacturer-trained vendor.

b. This Contractor shall have a full service office within 25 miles of the project jobsite.

c. The office shall be staffed with knowledgeable engineers and technicians, fully trained on all current manufacturer offerings.

d. The office shall maintain a suitable parts inventory and shall have all testing and diagnostic equipment necessary to support this work.

e. This Contractor shall be regularly engaged in the engineering, programming, installation, and service of IAS installations similar in scope and magnitude.

f. This Contractor shall be responsible for all fit and finish of installation and materials, for acceptance by Owner, Architect, and Engineer.

g. Single Source Responsibility of Supplier:

   i. This Contractor shall be responsible for the complete installation and correct operation of the complete Integrated Automation system.

   ii. During the installation process through the subscription period, this Contractor shall be the sole party responsible for any defects and liabilities. It is the responsibility of this Contractor to involve the manufacturers of supplied devices when required.

C. Quality Assurance Program

a. This Contractor shall implement a Quality Assurance Program according to the ISO standards.

b. This Contractor shall assign a single individual to serve as the Quality Assurance Manager.

c. All installation issues and concerns shall be brought to the attention of the Quality Assurance Manager.

d. It shall be the responsibility of the Quality Assurance Manager to keep all interested parties apprised of progress with regards to problems that were identified.

D. Governing Code Compliance

a. The IAS Contractor shall be responsible to research, understand, and comply with all current, relevant governing codes ordinances and regulations as specified within these specifications, including UL, NFPA, the local Building Code, local Electrical Code and any other codes which might be applicable.

E. FCC Regulation

a. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and Subpart J, governing Class A Computing Devices and be so labeled.

1.13 FIELD CONDITIONS

A. This Contractor shall perform, at no cost to the Owner, a site survey prior to bidding.

B. This Contractor shall coordinate with the Construction Manager and other major Contractors to fully assess field conditions before the start of this Contractor work.

C. This Contractor shall coordinate with all major Contractors on an ongoing basis to facilitate the work to be performed.

D. During construction, the Construction Manager shall have the final decision on all field-condition-related disputes.

E. This Contractor shall be responsible for repairing any damage caused, either intentionally or accidentally, to the site during the course of surveying, installation, commissioning, maintaining, or any other activity related to the Integrated Automation System.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Integrated Automation System shall comprise a cloud platform, one or more locally-installed servers or other data aggregation devices, graphics, and programming.

B. All equipment and materials shall be new and without any defect.

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, the IAS Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project shall include the following:

a. KODE Labs

2.3 INTEGRATED AUTOMATION SYSTEM ARCHITECTURE

A. The IAS shall use a cloud platform and a locally-installed server or other data aggregation device on a modular IP network, utilizing IT/OT industry standard networks and protocols.

B. Data communication protocols shall support HVAC and BMS industry standards, including BACnet, Modbus, Fox, MQTT, and RESTful API, and shall comply with ASHRAE 135.

   a. All IAS hardware that is required to support ASHRAE 135 shall be supplied with ASHRAE certification including the revision year of established compliance.

   b. Protocols other than those listed shall require prior authorization by the Engineer.

2.4 ONTOLOGY AND METADATA

A. The Integrated Automation System shall natively support an established, published ontology and metadata schema.

B. This Contractor shall utilize a suitable ontology to completely and accurately model the equipment, spaces, and groups or individuals relevant to the facility.

   a. Any expansions to the ontology for the project shall be included in a formal, published update to the ontology. Bespoke expansions to the ontology that will not be reflected in the published ontology shall not be allowed.

C. The ontology shall include the following data models, at a minimum:

   a. Assets
   b. Spaces
   c. Actors
   d. Space Assignments

D. The ontology shall include logical relationship types to establish relationships between each of the types of data models outlined above.

E. The ontology data models shall include metadata to fully capture all relevant parameters, including but not limited to design characteristics and physical attributes.

F. The ontology shall include the following data models

   a. Assets: Devices that perform functions
      i. Location installed
      ii. Location(s) served

        iii. Feeding equipment downstream
        iv. Fed by equipment upstream
    b. Spaces: Environments with varying characteristics
        i. Located in higher hierarchical level space
        ii. Is location for lower hierarchical level space(s)
        iii. Is served by asset(s)
        iv. Is location for asset(s)
        v. Is assigned to Actor
    c. Actors: Organizations, groups, or individuals
        i. Is part of higher hierarchical level actor
        ii. Has part(s) of lower hierarchical level actor(s)
        iii. Has space(s) assigned
    d. Space Assignments: Detailed relationships between actors and spaces
        i. Long term assignments between spaces and actors, including, but not limited to:
            1. Tenant leases
            2. Office assignments
        ii. Short term assignments between spaces and actors, including but not limited to:
            1. Conference room bookings
            2. Hot-desking

G. The ontology shall support the following:
    a. Digital twins of physical assets/spaces
    b. Purely virtual assets/spaces with no physical counterparts

2.5 FUTURE EXPANSION

A. The Integrated Automation System shall be easily scalable, to expand functionality to all equipment that may be added in future phases, Day 2, etc.

B. The scalability of the IAS shall also apply to the addition of future sites, facilitating the application of all IAS functionality to additional facilities in a portfolio in the future.

C. This scalability shall make use of templated graphics, such that the creation of new graphics for newly added systems or sites is minimized or eliminated by applying existing graphics templates.

D. This scalability shall make use of a comprehensive, published ontology to streamline the integration and analysis of newly added systems or sites, per the previous section.

E. Any algorithms developed or refined by AI and/or ML analysis of existing equipment shall automatically be applied to newly added systems of a similar type.

PART 3 - EXECUTION

3.1 PROJECT SCHEDULE

A. This Contractor shall submit a project schedule, with projected dates for software milestones.

B. Any deviations from the project schedule shall be submitted to the Owner and Engineer in writing as soon as the deviation is discovered, along with proposed solutions for remediation.

3.2 TESTING AND COMMISSIONING

A. Prior to full operation, this Contractor, in the presence of the Owner's representative and Engineer, shall perform a thorough and complete demonstration and testing of the system integrations, including monitoring and control functions. Upon successful completion of system operation, this Contractor shall submit a statement in writing stating that the full operation of all systems, functions, and notifications has been demonstrated and are operational as well as a listing of all systems, alarms, and functions that have been commissioned. All items shall be submitted for review and acceptance to the Owner, Owner's representative and Engineer before final acceptance can take place.

B. Commissioning shall include verification of the following, at a minimum:

a. All spaces have been implemented in the correct hierarchy and all assets are mapped to the correct physical locations installed and served

b. All assets are integrated into the IAS with the correct ontology and metadata

c. Where relevant, all actors have been created, along with space assignments for every actor

d. All points from each system have been mapped to their correct equipment and assigned their proper ontology and metadata

e. All graphics represent the equipment layouts

f. All fault detection rules listed in Division 25 have been verified

g. All KPIs listed in Division 25 have been programmed and calculated per design intent

h. All dashboards show the required information and have been configured correctly

3.3 DEMONSTRATION

A. This Contractor shall engage a manufacturer-trained service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

B. Training shall incorporate, at a minimum

a. User accounts, passwords, and user levels

b. Use of multi-factor authentication

c. UX/UI Navigation

d. Time-series data, including how to create new graphs

e. Fault creation, reception, and acknowledgement

f. Retro-commissioning control and results interpretation

g. Operation of Optimal Start and Stop

h. Creation, modification, and deletion of custom dashboards

C. Training shall take place over a period of 40 hours.

END OF SECTION 25 00 00

SECTION 25 01 80 - CYBERSECURITY GUIDELINES FOR INTEGRATED AUTOMATION

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification section is to establish a set of guidelines to accurately and precisely define the Cybersecurity requirements for the Integrated Automation System. Such requirements shall, at a minimum, offer the capabilities to:

a. Proactively prevent unauthorized access and network intrusions

b. Ensure end-to end data integrity, availability, and confidentiality

c. Maximize IAS capability while minimizing IAS vulnerability

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details this Contractor's scope for the Cybersecurity portion of the Integrated Automation System (IAS) for the project.

B. This Contractor is responsible to furnish and install all software, methods, and policies to fully secure the complete Integrated Automation System. The complete cybersecurity scheme shall include, at a minimum.

a. Multi-tiered user permissions
b. A robust, enforced user and password policy
c. Multi-factor authentication
d. Shift-left software development practices and CI/CD controls
e. Continuous and scheduled vulnerability scanning and remediation
f. Device and service level identity and access controls
g. Device-level security measures
h. SSO and other security integrations
i. Physical/logical network segregation from IT infrastructure (e.g., VPCs, firewall rules)
j. Traffic filtering based on protocols and addressing
k. Incident detection, response, and logging integrations

1.4 RELATED DOCUMENTS

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.6 SCOPE OF WORK

A. This Contractor shall furnish all labor and materials to create, deploy, and enforce a robust cybersecurity scheme, as outlined in this specification.

B. This cybersecurity scheme shall secure the complete Integrated Automation System.

C. For cloud or hybrid environments the Contractor shall ensure cybersecurity controls are fully integrated into the cloud-hosted IAS platform by:

a. Configuring user roles, permissions, and audit settings

b. Enabling all compliance-related features in a single source of truth for governance, risk, and compliance and maintaining evidence collection

1.7 PROJECT SUBMITTALS

A. Shop Drawings:

a. Three (3) copies of shop drawings of the entire Integrated Automation system shall be submitted, and shall consist of the following, at a minimum:

i. A complete cybersecurity architecture

ii. Information Security policy

iii. MFA and identity access management policy

iv. IAS Disaster Recovery Procedures

v. The most recent SOC2 or ISO 27001 certification

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documentation, including As-Builts, for:

a. Cybersecurity architecture (if cloud based, include tenant isolation)

b. Access control policy, information security policy and password policy

c. The latest IAS disaster recovery results

PART 2 - PRODUCTS

2.1 GENERAL

A. The Integrated Automation cybersecurity system shall maintain the security and integrity of a network of interoperable, stand-alone digital controllers, network controllers, graphics and programming, and other control devices for a complete system as specified herein.

B. All equipment and materials shall be new and without any defect.

C. For cloud based IAS the Integrated Automation cybersecurity design shall protect all services and communications across cloud-hosted resources, APIs, web UIs, and tenant data zones. All cloud components shall use secure configurations with version control and audit capabilities.

2.2 CLOUD COMMUNICATION

D. This Contractor shall provide detailed information to the party responsible for the network administration for the purposes of allowing communication between IAS network devices and the cloud platform.

a. For inbound connections, this Contractor shall provide, for each service, the following, at a minimum:

i. Service name

ii. Source address

iii. Port

iv. Protocol

b. For outbound connections, this Contractor shall provide, for each service, the following, at a minimum:

i. Service name
ii. Destination address
iii. Port
iv. Protocol

E. The party responsible for the network administration shall allow the detailed services and ports to communicate, in adherence with established cybersecurity standards

F. For cloud based IAS the Integrated Automation cybersecurity design shall protect all services and communications across cloud-hosted resources, APIs, web UIs, and tenant data zones. All cloud components shall use secure configurations with version control and audit capabilities.

2.3 NETWORK SEGREGATION

A. Unless otherwise specified, the Owner's OT network, upon which the locally-installed IAS hardware shall reside, shall be completely logically segregated from the Owner's IT infrastructure.

B. OT systems must reside in separate cloud VPCs, projects, or accounts, isolated from IT systems. Segregation must be maintained using subnet isolation, firewall rules, IAM policies, and service perimeters.

C. Any required SSO or identity service integration shall be routed through a secure proxy or gateway that allows only necessary, encrypted traffic and is monitored. This must follow least privilege and auditing principles.

D. In hybrid scenarios, secure connectivity such as VPNs, interconnects, or private service endpoints must be used to maintain integrity and security between cloud and on-prem environments.

2.4 USER POLICY

A. Users shall be granted access on an as-needed basis by the designated Owner IAS Administrator.

B. A user's permission level shall be commensurate with role, level of experience, and level of authority.

a. Permission levels shall grant users no more access to monitor or control beyond what is required to perform their tasks.

b. Permission levels shall be consolidated via the use of roles, personas, or other use cases.

i. This Contractor shall coordinate with the Owner to establish logical roles for expected IAS use cases. These use cases may evolve as the project proceeds. This Contractor shall coordinate with the Owner to likewise evolve the roles.

C. Users must authenticate via provisioned AD SSO or username with strong credentials. Both options must be backed up with MFA.

D. Remote access shall be granted only on an as-needed basis, independent of user access or user level.

E. All elevated access (break-glass) is temporary, logged, and reviewed.

F. User sessions shall logout after a period of inactivity no greater than 10 minutes 1. Inactivity logouts for a single user that occur more than 3 times per day shall send a notification to the IAS administrator.

G. All use of RESTful APIs for the IAS shall require use of an established user account.

   a. The permission level for the user account shall place the same limitations on their API usage as their UX/UI usage.

2.5 PASSWORD POLICY

A. The Integrated Automation System shall not allow any use of hardcoded passwords.

B. Any default passwords in any portion of the IAS must be deactivated and removed prior to Substantial Completion.

C. Unless otherwise specified, this Contractor shall configure complete SSO integration between the OT and IT networks.

D. Unless otherwise specified, user sign-on shall employ multi-factor authentication.

E. If SSO integration cannot be performed, the passwords shall comply with the following regulations.

   a. Passwords shall be a minimum of 10 characters and a maximum of 20 characters in length.

   b. Passwords shall require at least one of each of the following

      i. Lowercase letter

      ii. Uppercase letter

      iii. Number

      iv. Special character

v. Password rotation follows risk-based policies rather than static expiration, but they shall expire no later than every 90 days.

c. New passwords cannot match any of the previous 12 passwords

i. New passwords cannot contain identical strings of more than 3 characters when compared to the previous 12 passwords.

F. The password policy shall be aggressively enforced.

G. MFA must be enforced for all accounts.

2.6 DEVICE LEVEL SECURITY

A. Each IAS network device shall be assigned a specific, configured port on the local network switch.

a. Configured ports shall only allow the network traffic required for the correct operation of the connected device.

b. All empty network switch ports shall remain unconfigured and shall offer no access to any portion of the network.

B. For connections to IAS cloud platform:

a. Firewall rules restrict traffic per service and environment.

2.7 PROTOCOL RESTRICTION

A. Owner's network equipment shall restrict network traffic to only pertinent protocols, including, but not limited to:

a. HTTPS

b. BACNET/IP

c. SNMP (secured)

d. SMTP

e. MODBUS TCP

f. MQTT

2.8 HTTPS RESTRICTION

A. Network equipment shall require the use of HTTPS requests for any server or other data aggregation device on the IAS network. HTTP requests shall not be allowed.

2.9 ADDRESS RESTRICTION

A. The Owner's OT network shall not use any sort of automatic addressing methods, such as a DHCP server. Each device on the network shall be assigned a specific IP address, in accordance with the IP address scheme.

B. Network equipment shall completely restrict the network usage of any device IP address not designated as assigned in the IP address scheme.

C. Network equipment shall completely restrict the network usage of any device MAC address which does not correlate to an approved manufacturer of IAS equipment.

2.10 ENCRYPTION

A. All locally-installed IAS devices shall communicate to the cloud platform with either encrypted protocols or an encrypted tunnel such as a VPN.

   a. HTTPS with TLS 1.2 shall be the minimum required protocol
   b. Data at rest is encrypted using AES-256
   c. Encryption keys are rotated at most every 90 days and immediately after upon suspicion of compromise
   d. Encryption shall be compatible with Owner issued security certificates

2.11 LOGGING AND MONITORING

A. EDR/XDR system shall be used to monitor user endpoint and behaviour analysis.

B. A centralized event logger shall track events and alerts relevant stakeholders on actions.

2.12 TENANT ISOLATION

A. Each platform tenant shall have physically/logically isolated storage (databases, buckets) and microservices.

B. IAM roles, RBAC/ABAC policies, and access controls shall enforce separation.

C. No cross-tenant access shall be possible via UI or API.

2.13 INCIDENT RESPONSE

A. This Contractor shall have a defined IR plan with escalation paths.

B. Regular tabletop exercises shall test and improve the IR playbook.

2.14 SUPPLY CHAIN SECURITY

A. All third-party libraries shall be scanned with Checkmarx SCA.

B. Vendor risk assessments shall be conducted for critical integrations.

2.15 SECURE SOFTWARE DEVELOPMENT & CI/CD SECURITY

A. All development pipelines shall include secure SDLC controls, including, but not limited to:

   a. Automated static code analysis (SAST), open-source dependency scanning (SCA), and Infrastructure-as-Code (IaC) checks (i.e. vendors like Checkmarx)

   b. Vulnerability remediation workflow, prioritizing critical vulnerabilities before merge and deployment.

B. All pull requests must undergo mandatory peer review and pass automated security gates before being merged.

C. Deployments are handled through a secure CI/CD pipeline with role-based permissions.

D. Production deployments are gated with approval workflows and audit trails.

2.16 ADJUSTING

A. Security policies shall be adjusted as needed during the project lifecycle in collaboration with the Owner.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Verification

   a. Verify that all cybersecurity measures are in place.

   b. Verify that cybersecurity methods do not place an undue burden on IAS network resources

   c. Verify that cybersecurity methods do not impede the correct operation of any components of the IAS

B. Prepare test and inspection reports.

3.2 ADJUSTING

A. Adjustments shall be made to the User categories, personas, and use cases, as established in the User Policy, if required.

END OF SECTION 25 01 80

SECTION 25 11 00 - INTEGRATED AUTOMATION NETWORK DEVICES

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification section is to establish a set of guidelines to accurately and precisely define the network devices that comprise the locally-installed hardware portion of the Integrated Automation System. Such devices shall, at a minimum, offer the capabilities to:

a. Aggregate data from connected systems and devices, and communicate such data to the cloud platform.

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details the scope for the Integrated Automation Network Devices for the project for both the Contractor and the Owner or designated contractor.

B. This Contractor is responsible to furnish and install all suitable, approved control and monitoring devices which comprise the network devices required to establish a complete Integrated Automation System. The network devices shall include, at a minimum.

   a. One or more central processing servers or other locally-installed data aggregation devices.

C. The network devices shall support communications between all systems and devices to be integrated into the IAS, using industry standard communications protocols.

D. All labor, material, equipment, and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

E. Where the Drawings and Specifications differ, the more stringent requirement shall be applicable, unless stated otherwise.

F. It is the goal of the Owner, beyond this project, to fully realize an Integrated Automation System that facilitates flexibility for assorted manufacturers to be completely integrated into a unified system, to provide fluidity for expansion and preservation.

1.4 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION

- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.6 SCOPE OF WORK

A. This Contractor shall furnish all labor and materials, with regards to network devices, so as to construct, install, test, verify, and commission a complete Integrated Automation system, as outlined in this specification.

B. This Contractor shall furnish and install, as a part of the Integrated Automation System, network devices for the complete IAS including, but not limited to:

a. Processing servers, as outlined in section 25 11 13.

b. Locally-installed data aggregation devices, as outlined in section 25 13 16.

c. Relevant accessories for the above, such as power supplies or transformers.

C. The Owner or designated contractor shall, if MQTT is to be utilized as a local integration protocol, furnish, install, and maintain a locally hosted MQTT broker as part of the OT infrastructure.

a. The MQTT broker is not part of IAS scope but must be accessible.

b. The MQTT topic and payload structures must conform to ontology and metadata standards defined in Section 25 00 00.

1.7 PROJECT SUBMITTALS

A. Product Data: For each type of product.

a. Include Manufacturer-published technical literature, including data sheets and installation instructions.

b. Indicate dimensions, capacities, performance characteristics, materials, and finishes.

c. Detail any documented or known installation or performance limitations. Mis-applied products shall not be permitted, and must be replaced in kind at no expense to the Owner.

B. Shop Drawings:

a. Network topology

i. Three (3) copies of a comprehensive network topology, detailing the entirety of the proposed integrations, including any required VLAN or subnet traversals.

1.8 CLOSEOUT SUBMITTALS

A. Before project closeout can be completed, this Contractor shall upgrade the firmware and software on every IAS manufacturer provided network device, such that the latest possible version of all firmware and software is in place at the time of IAS turnover.

B. All submittals, as with all project documentation, must be custom created solely for this project. Reuse of precursory documents shall not be permitted.

C. Project Record Documentation for:

a. As-Built Network Topology

b. Comprehensive network device spreadsheet, in an Excel-friendly format, including, at a minimum:

i. Names
ii. Locations
iii. Locations on drawings
iv. Manufacturers
v. Serial numbers
vi. IP addresses
vii. MAC addresses

c. Operation and Maintenance Data, and Warranty Data for

i. All furnished Integrated Automation network devices, to include operation and maintenance manuals. Where applicable, emergency operation manuals shall also be provided.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each network device.

B. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage.

C. Deliver, store, protect, and handle products to site under provisions of the contract Documents.

D. Coordinate all site deliveries with the Construction Project Manager.

E. Accept products on-site and verify equipment condition.

F. Damaged equipment shall be re-ordered/replaced immediately and without cost to the Owner.

G. Protect products from construction operations, dust, and debris, by storing materials inside, protected from weather in a conditioned space.

1.10 CODES, PERMITS, STANDARDS, GUIDELINES AND APPROVAL

A. All work shall conform to the following Codes and Standards, where applicable:

a. Local Electrical Codes.
b. National Fire Protection Association (NFPA) Standards, as specified.
c. National Electrical Code (NEC)
d. Underwriters Laboratories (UL) listing and labels, as specified.
e. American National Standards Institute (ANSI).
f. National Electric Manufacturers' Association (NEMA).
g. Building Automation and Control Network (BACnet) open protocol communication standard developed by ASHRAE (ASHRAE SSPC/135).
h. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
i. American Society of Mechanical Engineers (ASME).
j. Air Movement and Control Association (AMCA).
k. Institute of Electrical and Electronic Engineers (IEEE).
l. American Standard Code for Information Interchange (ASCII).
m. Electronics Industries Association (EIA).
n. Occupational Safety and Health Administration (OSHA).
o. American Society for Testing and Materials (ASTM).
p. State Energy Code.
q. State Building Code and applicable local Building Code.
r. ANSI/TIA/EIA-862, Building Automation Systems Cabling Standards for Commercial Building.

1.11 WARRANTY

A. Integrated Automation System Network Device Warranty: This Contractor shall agree to repair or replace, without cost to the Owner, any controller, device, wire, or any other component of the Integrated Automation System network devices that fail(s) in materials or workmanship for the duration of the IAS subscription.

B. Any componentry, or parts thereof, furnished by this Contractor that fail(s) during the period prior to the date of Substantial Completion shall be repaired or replaced by this Contractor, without cost to the Owner.

C. Repair work shall only be undertaken at times approved by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Integrated Automation System shall comprise a cloud platform and one or more locally-installed servers or other data aggregation devices in the support of a complete Integrated Automation System as specified herein.

B. All equipment and materials shall be new and without any defect.

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, the IAS Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

2.2 VIRTUALIZATION

A. Virtualization Software

  a. Integrated Automation System processing servers and integration devices shall be completely virtualized

  b. Approved manufacturers

    i. VMWare, or approved equal

2.3 UNINTERRUPTIBLE POWER SUPPLY

A. An Uninterruptible Power Supply shall be provided and installed by this Contractor for each of the Integrated Automation System servers or devices, unless otherwise specified.

B. Each UPS shall power the complete server or device for a minimum of 30 minutes, in the case of power interruption.

C. The UPS shall be an on-line type and shall transfer from normal to battery power, and back, seamlessly.

D. The UPS shall emit a purely sinusoidal power waveform.

E. The batteries shall be of the totally enclosed type. Batteries that can leak gas shall not be acceptable.

F. There shall not be any damages should the emergency outage of line power exceed the maximum operation time of the UPS.

2.4 PERFORMANCE REQUIREMENTS

A. Provide equipment and devices for interior and exterior applications that shall be capable of withstanding and operating satisfactorily at the following ambient conditions, at a minimum.

   a. Temperature and Humidity:

      i. 32° F to 120° F, 10% to 90% RH.

2.5 SAFETIES

A. All materials supplied as a part of the IAS shall be non-hazardous in nature. Where suitability of specific components or devices are called into question, this Contractor shall supply the relevant Materials Safety Data Sheet to the Owner and/or Engineer.

2.6 UNIT PRICES

A. This Contractor shall provide a list of unit prices for all material, devices, and equipment provided for the project.

B. Unit prices shall be valid for a period after the date of Substantial Completion

   a. Valid period shall be 5 years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This Contractor shall be responsible for the installation of all network wiring directly connected to IAS network devices, including servers and integration panels specified in sections 25 11 13 and 25 13 16, respectively, between those devices and the Owner designated network switch and port.

B. Unless otherwise specified, the OT network shall be fully deployed at project inception, to support the installation, testing, and commissioning of the IAS as it is constructed.

C. Unless otherwise specified, all conduit, wiring, accessories, and wiring connections required for the installation of the Integrated Automation System network devices, as specified herein, shall be provided by this Contractor.

D. All wiring shall comply with all applicable national, state, and local codes, unless otherwise specified.

E. Maintain minimum clearances and workspaces at equipment according to manufacturer's written instructions and NFPA 70.

F. Power wiring 120VAC and greater shall be provided by the Electrical Contractor. Refer to contract documents for junction box locations.

G. All system wiring shall adhere to all manufacturer's guidelines.

H. Install equipment level and plumb.

3.2 SERVICE

A. Component Replacement

   a. During the subscription period, this Contractor shall repair or replace all covered failed or worn network device components.

   b. Replacement components shall be new. Reconditioned components shall be approved by the Owner's Agent prior to installation.

   c. The Contractor to provide the same warranty for reconditioned components as the manufacturer would provide for such components.

B. Emergency Service

   a. Emergency service, defined as service or maintenance provided during other than regular business hours in the event of a critical system failure rendering the system inoperative.

   b. If emergency service is included in this contract, upon the Owner's request, this Contractor shall provide emergency service required to restore the system to operation at any time, 24 hours a day, 7 days a week, with a 4 hour response time to the location above.

3.3 IDENTIFICATION

A. Identification Standards

a. All network devices shall be identified, with name, IP address, and MAC address, with a plastic, engraved nameplate securely fastened to the inside of the enclosure.

3.4 FIELD QUALITY CONTROL

A. Verification

a. Verify that network device power supply is from emergency power supply, if applicable.

b. Verify that network devices are protected from power supply surges.

B. Tests and Inspections

a. Comply with manufacturer's written instructions.

b. Inspect interiors of enclosures, including the following:

i. Integrity of electrical connections.

C. Test communication of network through network devices

D. Prepare test and inspection reports.

END OF SECTION 25 11 00

SECTION 25 11 13 – INTEGRATED AUTOMATION NETWORK SERVERS

PART 1 – GENERAL

1.1 INTENT

A. Defines requirements for enterprise servers, running direct or virtualized environments, to aggregate and forward data to the cloud platform.

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details this Contractor's scope for the Integrated Automation System network servers for the project.

1.4 SCOPE OF WORK

A. Furnish, configure, and commission servers installed in IT rooms or approved spaces.

B. Include RAID storage, redundant power, and virtualization if specified.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.6 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.7 PROJECT SUBMITTALS

C. Product Data: For each type of product.

a. Include Manufacturer-published technical literature, including data sheets and installation instructions.

b. Indicate dimensions, capacities, performance characteristics, materials, and finishes.

c. Detail any documented or known installation or performance limitations. Mis-applied products shall not be permitted, and must be replaced in kind at no expense to the Owner.

D. Shop Drawings:

a. Three (3) copies of each of the following:

i. Complete, fully detailed wiring diagrams

1.8 CLOSEOUT SUBMITTALS

A. Before project closeout can be completed, this Contractor shall upgrade the firmware and software on every IAS manufacturer provided network server, such that the latest possible version of all firmware and software is in place at the time of IAS turnover.

B. All submittals, as with all project documentation, must be custom created solely for this project. Reuse of precursory documents shall not be permitted.

C. Project Record Documentation for:

a. As-Built wiring diagrams

b. Comprehensive network server spreadsheet, in an Excel-friendly format, including, at a minimum:

ii. Names

iii. Locations

iv. Locations on drawings

v. Manufacturers

vi. Serial numbers

vii. IP addresses

viii. MAC addresses

d. Operation and Maintenance Data, and Warranty Data for

i. All furnished Integrated Automation network servers, to include operation and maintenance manuals. Where applicable, emergency operation manuals shall also be provided.

PART 2 – PRODUCTS

2.1 HARDWARE SPECIFICATIONS

A. Servers

a. Processing servers shall meet the following technical requirements, at a minimum:

i. Dual Intel Xeon Processors, minimum 8 cores each

ii. 64GB of ECC DDR4 RAM

iii. Dual 7200RPM hard disks, in RAID1 array, minimum 4TB in size

iv. 800W power supply

v. Dual LAN ports

vi. Rack-mountable chassis

b. Approved manufacturers

i. Dell, or approved equal

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install level and plumb in enclosures, label and test all connections.
B. Provide documentation and credentials at turnover.

END OF SECTION 25 11 13

SECTION 25 13 00 - INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification section is to establish a set of guidelines to accurately and precisely define an optimized Operational Technology network as a part of an Integrated Automation System. Such a network shall, at a minimum, offer the capabilities to:

   a. Support the swift transmission and reception of large volumes of IAS data between systems and devices.

   b. Encourage the ongoing development of the Integrated Automation System through the use of logical networking and addressing.

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details the Owner's scope for the Integrated Automation System network for the project, hereafter referred to as the Operational Technology network, or OT network.

B. The Owner or designated contractor is responsible to furnish and install a robust, efficient, expandable OT network. The complete network shall include, at a minimum:

   a. Cabling
   b. Logical IP addressing
   c. Dedicated Subnets/VLANS
   d. Modernized security considerations
   e. Optimized network architecture(s)

C. The system shall support communications between all devices and controllers, using industry standard communications protocols

1.4 RELATED DOCUMENTS

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.6 SCOPE OF WORK

A. The Owner or designated contractor shall design, construct, install, test, verify, and commission a complete Operational Technology network, as outlined in this specification.

1.7 PROJECT SUBMITTALS

A. Shop Drawings:

a. Three (3) copies of shop drawings of the entire OT network shall be submitted, and shall consist of the following, at a minimum.

i. Complete network architecture diagram(s).

ii. Complete IP addressing scheme, if static addresses or a static DHCP scheme is used.

iii. Complete Subnet/VLAN scheme.

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documentation, including As-Builts, for:

a. Network architecture

b. Network device spreadsheet, in an Excel-friendly format, including, at a minimum:

i. IP addresses, if static addresses or a static DHCP scheme is used.

ii. MAC addresses.

iii. Floor plans indicating network segment runs.

PART 2 - PRODUCTS

2.1 ADDRESSING

A. Unless otherwise instructed, the Owner or designated contractor shall design and implement a static IP address scheme, which intelligently distributes subnets and addresses thereof.

2.2 ETHERNET CABLING

A. Copper:

a. Approved Manufacturer:

i. Belden, or approved equal.

b. Copper ethernet cabling shall be Cat6e, and shall have the following properties, at a minimum:

i. 23AWG solid bare copper conductors.

ii. Insulated and jacketed.

2.3 ARCHITECTURE

A. The OT network shall use a Client/Server architecture based on a modular PC network, utilizing industry standard operating systems, networks, and protocols.

B. Data communications shall be enabled via the network protocols detailed in section 25 01 80 and 25 00 00.

2.4 CYBERSECURITY

A. The OT network shall implement the relevant measures detailed in section 25 01 80, at a minimum.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Verify that all network cabling and conduit is labeled as required.

B. Tests and Inspections:

   a. Comply with manufacturer's written instructions.

   b. Test effective length of OT network cable segments with appropriate, calibrated equipment.

C. Replace damaged or malfunctioning cabling and conduit.

D. Prepare test and inspection reports.

END OF SECTION 25 13 00

SECTION 25 13 16 – INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS

PART 1 – GENERAL

1.1 INTENT

A. Define requirements for integration panels used as protocol gateways.

B. Integration panels do not act as standalone DDCs.

C. Requirements for network devices outlined in Section 25 11 00 also apply to devices specified in this section.

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details this Contractor's scope for the Integrated Automation System control and monitoring network integration panels for the project.

1.4 SCOPE OF WORK

A. Furnish, configure, and commission integration panels in approved spaces.

B. Include UPS power, and virtualization if specified.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.6 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.7 PROJECT SUBMITTALS

A. Product Data: For each type of product:
   a. Include Manufacturer-published technical literature, including data sheets and installation instructions.
   b. Indicate dimensions, capacities, performance characteristics, materials, and finishes.
   c. Detail any documented or known installation or performance limitations. Mis-applied products shall not be permitted, and must be replaced in kind at no expense to the Owner.

B. Shop Drawings:

a. Three (3) copies of each of the following:
   i. Complete, fully detailed wiring diagrams.
   ii. Details of control panel faces, including labeling.

1.8 CLOSEOUT SUBMITTALS

D. Before project closeout can be completed, this Contractor shall upgrade the firmware and software on every IAS manufacturer provided integration panel, such that the latest possible version of all firmware and software is in place at the time of IAS turnover.

E. All submittals, as with all project documentation, must be custom created solely for this project. Reuse of precursory documents shall not be permitted.

F. Project Record Documentation for:

   a. As-Built wiring diagrams.

   b. As-Built details of control panel faces, including labeling.

   c. Comprehensive integration panel spreadsheet, in an Excel-friendly format, including, at a minimum:

      i. Names
      ii. Locations
      iii. Locations on drawings
      iv. Manufacturers
      v. Serial numbers
      vi. IP addresses
      vii. MAC addresses

   d. Operation and Maintenance Data, and Warranty Data for:

      i. All furnished Integrated Automation integration panels, to include operation and maintenance manuals. Where applicable, emergency operation manuals shall also be provided.

PART 2 – PRODUCTS

2.1 HARDWARE

A. Locally installed data aggregation devices, or integration devices, shall be JACE 8000 controllers, NUCs, or other manufacturer approved mini PCs.

B. The locally installed integration devices shall be compatible with the Niagara Framework.

C. The locally installed integration devices shall integrate to locally installed systems and devices via the protocols outlined in section 25 00 00.

D. Approved manufacturers:

a. VYKON

b. SimplyNUC

2.2 DEVICE ENCLOSURES

A. Where JACEs/NUCs/Mini PCs are installed as a part of the Integrated Automation Software, they shall be installed in fully enclosed, steel-rack-type cabinets with locking doors or locking removable backs, unless otherwise specified. Match finish of panels and provide laminated as-built wiring diagrams, flow diagrams, etc. related to the system being controlled inside the associated cabinet. Each control panel shall be clearly and permanently labeled with the controller designation and indication of the mechanical equipment served.

B. Coordinate installation of the control panels with the Engineer/Architect. Coordinate power for the panels with the Electrical Contractor.

C. Panels should be ventilated or mechanically cooled to prevent excessive heat build-up.

PART 3 – EXECUTION

3.1 INSTALLATION & COMMISSIONING

A. Install per manufacturer requirements, test all integrations, and submit commissioning reports.

END OF SECTION 25 13 16

SECTION 25 15 00 - INTEGRATED AUTOMATION SOFTWARE

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification section is to establish a set of guidelines to accurately and precisely define the requirements of the Integrated Automation Software. Such software shall, at a minimum, offer the capabilities to:

a. Facilitate monitoring, control, analysis, and comprehension of all integrated facility systems into a Centralized User Interface.

b. Fully integrate locally installed and cloud-based systems and devices into the Integrated Automation System through the use of industry standard protocols

c. Establish fault criteria and generate notifications for individual faults and incidents, composed of multiple, related faults.

d. Enable ongoing, automated retro-commissioning.

e. Suggest and enact energy and cost savings measures automatically.

f. Foster detailed and nuanced comprehension of performance metrics and comparisons of realized performance to those metrics.

g. Ensure rapid restoration of the IAS in the event of a catastrophe

1.2 TABLE OF CONTENTS

1.3 SUMMARY

A. This section details this Contractor's scope for the Integrated Automation Software for the project.

B. This Contractor is responsible to furnish and install all suitable, approved control and monitoring software as a part of a complete system. The software shall include, at a minimum.

a. A Centralized User Interface, accessible to Desktop and Mobile platforms.

b. Complete conformance with industry-standard protocols.

c. Integration to locally installed and cloud-based systems and devices.

d. All associated installation, programming, and configuration.

1.4 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.5 RELATED SECTIONS

- 25 00 00 INTEGRATED AUTOMATION
- 25 01 80 CYBERSECURITY GUIDELINES FOR OPERATION AND MAINTENANCE OF INTEGRATED AUTOMATION NETWORK
- 25 11 00 INTEGRATED AUTOMATION NETWORK DEVICES
- 25 11 13 INTEGRATED AUTOMATION NETWORK SERVERS
- 25 13 00 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK
- 25 13 16 INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK INTEGRATION PANELS
- 25 15 00 INTEGRATED AUTOMATION SOFTWARE

1.6 SCOPE OF WORK

A. This Contractor shall furnish all labor and materials to construct, install, test, verify, and commission a complete software platform and user experience in support of Integrated Automation System, as outlined in this specification.

1.7 PROJECT SUBMITTALS

A. Shop Drawings:

a. Three (3) copies of shop drawings of the entire Centralized User Interface & Experience shall be submitted, and shall consist of the following, at a minimum:

i. Graphics, including Space-based graphics and Equipment-based graphics.

ii. Navigation.

iii. Point, Device, and Controller nomenclature.

iv. Fault and incident notifications, including distribution capabilities.

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documentation, including As-Builts, for:

a. Complete software documentation

B. Operation and Maintenance Data, and Warranty Data for:

a. All furnished Integrated Automation software. Where applicable, emergency operation manuals shall also be provided.

C. Digital Time Capsule:

a. At the time of IAS turnover, this Contractor shall provide a "time capsule" of all software and configurations, as well as hardware operating state, for complete system restoration in the event of a catastrophic failure.

PART 2 - PRODUCTS

2.1 UNIFIED DATA LAYER

A. The Integrated Automation System shall support centralized command and control of multiple buildings or sites. Provide single sign-on (SSO) and unified monitoring dashboards across distributed assets.

2.2 CENTRALIZED USER INTERFACE

A. The Integrated Automation System shall include, natively, a Centralized User Interface.

B. The Centralized User Interface shall meet the following requirements, at a minimum:

   a. Platform agnostic, fully accessible on desktop and mobile platforms.

   b. Capable of being fully displayed and utilized in any HTML5-capable web browser.

   c. Shall require no third-party applications or software on the Owner device for any aspect of functionality.

C. The Centralized User Interface shall utilize SSO, as described in Section 25 01 80.

   a. The scope of an individual Operator's view and control over the IAS shall be limited by their account and access level.

D. The Centralized User Interface shall allow complete operability of the Integrated Automation System and any systems integrated with the Integrated Automation System including such functionality as, but not limited to:

   a. Fault and incident management, including creating or modifying fault criteria.

   b. Scheduling.

   c. Setpoint adjustments.

   d. Output overrides.

   e. Historical time-series data viewing, including custom graph generation

   f. Mass writing of setpoints and other control points

E. The Centralized User Interface shall offer logical, intuitive, relational navigation of both the physical spaces that the Integrated Automation System serves and the equipment that the Integrated Automation System controls.

F. The Centralized User Interface shall offer navigation of physical spaces at any level within the ontological space hierarchy, including real estate portfolio, campus or site, building, floor, etc

G. Each system shall have dedicated graphical pages, either templated or bespoke, including but not limited to:

  a. Equipment operation summary.
  b. Equipment graphic.
  c. Schedule.
  d. Any active or recently resolved faults.
  e. Equipment relational summary.
  f. Links to O&M manuals and Sequence of Operations documentation

2.3 INTEGRATION

A. The software shall offer complete integration to locally installed or cloud-based third party systems, devices, and software, through the use of industry standard protocols.

2.4 FAULT DETECTION AND DIAGNOSTICS

A. The Integrated Automation System shall have a native Fault Detection and Diagnostics (FDD) module.

B. The FDD module shall allow creation, modification, and deletion of fault criteria.

  a. The FDD module shall provide standard logic blocks for no-code rule creation including standard mathematical functions such as average, minimum, maximum, standard deviation, etc., as well as inputs and outputs for various point times such as analog and binary.

C. The FDD module shall reference both a global library of rules and criteria, applicable to all assets and contexts of common type, as well as a local library of rules and criteria, for storage of project-specific FDD rules and criteria.

D. The standard FDD criteria shall include the following, at a minimum:

  a. Determine the stability of control devices (valves/actuators/speed drives).
  b. Determine the degree of error above reasonable thresholds.
  c. Compare sensor readings to setpoint and flag out-of-range errors from faulty sensors.
  d. Compare outputs (controllers) setpoints to actual conditions to find failed devices.

E. Fault analysis shall automatically be applied to all assets with matching telemetry.

   a. Users shall be able to exclude specified assets from fault analysis temporarily or permanently.

F. Where faults are likely related, the FDD module shall logically group them into an incident and create one or more notifications for the incident, not the individual faults.

G. The FDD module shall create a single notification for each fault or incident, unless otherwise specified. The FDD module shall distribute such notifications in such a way as to combat "alarm fatigue".

   a. Specifics of "alarm fatigue" mitigation strategy to be made clear by this Contractor.

H. The FDD module shall allow multiple notification delivery options, including, but not limited to:

   a. E-mail
   b. SMS
   c. In-app notification

I. The FDD module shall have a dedicated page for the display of a prioritized list of faults and incidents, with built in filtering and adjustments for prioritization criteria

J. The accrued and potential ongoing energy costs for each fault or incident shall automatically be calculated.

2.5 AUTOMATIC RETRO-COMMISSIONING

A. The Integrated Automation System shall have a native retro-commissioning module.

B. The retro-commissioning shall exercise integrated assets through functional tests.

C. Retro-commissioning shall have the option of being manually initiated, manually scheduled, or automatically scheduled.

D. The results of the retro-commissioning shall be compared to initial commissioning results, with any deficiencies highlighted.

2.6 OPTIMAL START AND STOP

A. The Integrated Automation System shall have a native Optimal Start and Stop (OSS) module.

B. The OSS module shall calculate the optimal start and stop times for select, integrated assets.

   a. If enabled, the OSS module shall automatically modify schedules to follow the calculated start and stop times.

2.7 DASHBOARDS

A. The Centralized User Interface of the Integrated Automation System shall provide web-based analytics dashboards as part of the Integrated Automation Software. The system shall transform raw building data into interactive charts, dashboards, and reports for end-users.

B. The Centralized User Interface of the Integrated Automation System shall provide users capability to configure custom dashboards with key performance indicators (KPIs), view time series data, and generate reports on system performance.

C. The interface shall support intuitive data visualization (e.g. graphs, heatmaps) and filtering.

D. Dashboards shall be capable of exportation as reports, including scheduling report delivery on a scheduled cadence

E. Standard dashboards shall include, at a minimum:

   a. Operations dashboard, for overall operational comprehension and assessment

   b. Comfort dashboard, for comparisons of space conditions to comfort metrics

   c. Override dashboard, for a detailed listing of equipment with active overrides

   d. Network health dashboard, for a concise review of network and device outages

2.8 WORK ORDER MANAGEMENT

A. The Integrated Automation System shall have a native work order management module.

B. The Integrated Automation System shall automatically generate work orders related to each fault or incident detected.

C. The Integrated Automation System shall allow users to add information to and modify the status of existing work orders.

2.9 SMART METRICS

A. The Integrated Automation System shall offer a native, low-code metric builder module. Such a module shall have a drag-and-drop interface that allows users to create and customize KPIs and metrics without needing advanced coding or data science expertise.

B. The module shall allow data transformation workflows and pipelines. It shall apply calculations, filtering, and gap-filling directly within the tool, with real-time previews to validate results before publishing.

C. The module shall incorporate a centralized metric catalog, which shall allow users to access a curated library of standard analytics and build an internal catalog of custom metrics for reuse and collaboration across teams.

D. The module shall enable flexible scheduling and deployment. It shall allow users to publish metrics on demand or schedule them for specific buildings or operational contexts, ensuring relevance and timeliness.

E. The module shall foster empowered operations. It shall enable operators, owners, and engineers to generate actionable insights independently, accelerating decision-making and reducing reliance on external specialists.

F. The module shall be scalable across portfolios. It shall standardize metrics such as comfort scores, energy KPIs, or occupancy analytics across multiple properties with consistent data governance.

2.10 API CAPABILITIES

A. Device and Point Access: The Integrated Automation System shall provide a RESTful API that exposes:

   a. Complete device inventory with identification and status information
   b. Real-time point values for all integrated data points
   c. Device metadata including location, type, and operational parameters
   d. Point metadata including units, data types, and update timestamps

B. Authentication and Security: API access shall be secured through:

   a. Token-based authentication mechanisms
   b. Role-based access controls consistent with user permission levels

c. Encrypted connections using HTTPS/TLS protocols

d. Rate limiting to prevent unauthorized usage

C. Data Format and Standards: The API shall provide data in:

a. JSON format for structured data exchange

b. Industry-standard naming conventions and data structures

c. Consistent error handling and response codes

2.11 DATA STORAGE AND MANAGEMENT

A. Database Infrastructure

a. The system shall employ a tiered database cluster that includes:
i. BigQuery for petabyte-scale cloud warehousing and analytics.
ii. ClickHouse for sub-second, real-time columnar queries on telemetry data.
iii. MongoDB Atlas for operational, document-oriented storage.

b. The system shall scale compute and storage resources automatically—without service interruption—as data volumes or query loads grow.

c. c. The system shall sustain sub-second response times for real-time queries while supporting thousands of concurrent sessions and API calls.

B. Data Backup and Recovery

a. The system shall perform continuous or hourly incremental backups with point-in-time recovery across all databases.

b. Backup data shall be replicated to at least two geographically separate regions.

c. Full restoration tests shall be executed and documented at least quarterly.

d. BigQuery time-travel features shall permit querying and restoring any table state within the preceding 7 days, even if the table has been modified, expired, or deleted.

e. A non-configurable 7-day fail-safe period shall retain deleted BigQuery data exclusively for emergency recovery, providing an additional safety net beyond the time-travel window.

f. ClickHouse snapshot streaming shall generate immutable part-level snapshots on an hourly schedule (default retention: 7 days), enabling restoration to any snapshot without disrupting live queries.

g. MongoDB Atlas continuous cloud backup shall provide point-in-time restores with 1-second granularity for the most recent 24 hours and default snapshot retention of 7 days, all replicated automatically across regions for resilience.

C. Data Retention

a. All operational telemetry, historical time-series, fault/event/audit logs, and analytical datasets shall be retained for the lifetime of the deployment. Tiered storage and automated roll-ups shall be employed as needed to optimise cost while preserving queryability and full-fidelity reconstruction.

b. Archived datasets shall remain restorable and queryable within 48 hours of request at any point during their lifetime retention window.

D. Data Ownership and Portability

a. The building owner shall retain full ownership of all operational data, configurations, and system information throughout the subscription period and following termination.

b. Upon subscription termination, the service provider shall:

i. Provide complete data export in industry-standard formats

ii. Assist with data migration for a period of ninety (90) days at no additional cost

iii. Maintain data accessibility for export purposes for thirty (30) days following termination

2.12 LICENSING

A. Licensing Model

a. The Integrated Automation System shall be provided under a Software-as-a-Service (SaaS) subscription model with the following requirements:

i. All software licenses included in the subscription fee

ii. No additional licensing fees for individual users or devices

iii. Scalable licensing that accommodates system expansion without penalty

iv. Multi-tenant architecture ensuring data isolation between subscribers, as detailed in section 25 01 80

b. The subscription shall include:

i. Minimum subscription period of one (1) year following system commissioning

ii. Automatic renewal terms with advance notification requirements

iii. Fixed pricing for the initial subscription term with annual escalation limits

iv. Service level agreements (SLA) guaranteeing minimum uptime and performance

B. Included Services

a. The subscription shall provide:

i. Unlimited access to all specified software functionality

ii. Regular software updates and feature enhancements at no additional cost

iii. Cloud infrastructure hosting and maintenance

iv. Data backup and disaster recovery services as specified in the Storage section

b. The subscription shall include:

i. Technical support during business hours with defined response times

ii. System monitoring and proactive issue resolution

iii. Software maintenance and security updates

iv. Access to user documentation and training materials

2.13 SAFETIES

A. The software shall make use of automatic, high priority safety algorithms and overrides where pertinent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This Contractor shall program all systems at the time of installation with logical relations to spaces, locations, and related equipment.

B. This Contractor shall program these relations, names, tags, and descriptions from inception, such that the CUI navigation and querying, both explicit and implicit, shall be automatically generated and populated.

3.2 IDENTIFICATION

A. During engineering and programming, this Contractor shall adhere to standard, logical, intuitive point naming and metadata tagging standards.

  a. Standards shall explicitly and exclusively incorporate ontology as detailed in section 25 00 00.

3.3 FIELD QUALITY CONTROL

A. Verification:

  a. Verify that all UX/UI elements, including but not limited to, graphics, links, references, addresses, and configurations are installed prior to project completion.

  b. Verify that all Operator controllable UX/UI elements are clearly identified as such, and are suitably responsive.

  c. Verify that all data is displayed with correct units.

  d. Verify all navigability.

B. Test communication of status and alarms to remote monitoring and annunciation equipment and devices.

C. Replace or correct malfunctioning software.

D. Prepare test and inspection reports.

END OF SECTION 25 15 00

APPENDIX: APPLICATION GUIDE

The Division 25 specification section should not simply be added to project documents, it should first be tailored. In addition, other specification sections should be modified, with new language added, and the sections to be modified will depend on the tailoring of the Division 25 specification document.

⬇️ To get the editable version of the template, please reach out to marketing@kodelabs.com

IAS Device Form

Does the Owner/Client want the locally-deployed data aggregation device to be physical or virtualized?

- If physical, is a blade server preferred, or a JACE/NUC/Mini PC?
    - If a blade server, remove paragraph 2.2 Virtualization from section 25 11 00 and completely remove section 25 13 16
    - If a JACE/NUC/Mini PC, remove paragraph 2.2 Virtualization from section 25 11 00 and completely remove section 25 11 13
- If virtual, will the Contractor provide the hardware that the virtual environment runs on, or will the Owner/Client?
    - If the Contractor is providing the hardware, completely remove section 25 13 16
    - If the Owner/Client is providing the hardware, completely remove sections 25 11 13 and 25 13 16

Integrated Systems

For each of the following systems available for integration, if to be integrated, the system should be listed in 1.8.B of section 25 00 00 while systems not to be integrated should be removed from the same list, the corresponding specification section(s) for each system to be integrated should be added to each "Related Sections" listing, and the "Integrated Automation System Coordination" statement, included below, should be added to the same corresponding specification section(s). It is also strongly encouraged to add language to the 23 00 00 and 23 09 00 sections that states "all systems, except for CRAC/CRAH units and individual Chillers, are to be outfitted with BMS controls that are fully software programmable, and packaged controls that are merely configurable are not acceptable. Equipment controllers that expose, for integration, any data points that relate to components or functions for which the controlled equipment is not physically configured shall be expressly forbidden."

System	Section to add coordination statement to
Mechanical System(s)	23 00 00
Electrical System(s)	26 00 00
Plumbing System(s)	22 00 00
Lighting System(s)	26 09 43, 26 09 00, or 26 00 00
Occupancy/People Counting System(s)	If part of the lighting system, 26 09 43, 26 09 00, or 26 00 00 If part of the building automation system, 23 09 00 or 23 00 00 If part of a security system, 28 00 00
Energy Storage System(s)	If electrical, 26 33 00 or 26 00 00 If mechanical, like phase change systems, 23 71 00 or 23 00 00
Energy Harvesting or Generation System(s)	If solar, 26 31 00 or 26 00 00 If wind, engine, or turbine, 26 32 00 or 26 00 00
EV Charging System(s)	26 33 00 or 26 00 00 And 34 60 13 or 34 00 00
Transportation System(s)	34 00 00
Utility System(s)	33 00 00
Security System(s)	28 00 00

System	Section to add coordination statement to
Fire Alarm System(s)	21 00 00
Computerized Maintenance Management System(s)	N/A
Work Order Management System(s)	N/A

INTEGRATED AUTOMATION SYSTEM COORDINATION

A. **Ontology and Metadata Compliance**: This Contractor shall coordinate with the Division 25 Integrated Automation System (IAS) Contractor to ensure all installed systems, devices, and equipment fully conform to the established ontology and metadata schema as specified in Section 25 00 00. All asset naming, tagging, and data structuring shall adhere to the published ontology requirements provided by the Division 25 Contractor.

B. **Integration Readiness**: All systems and devices installed under this Division that are designated for integration with the IAS shall be configured to support the communication protocols specified in Section 25 00 00, including but not limited to BACnet, Modbus, Fox, MQTT, and RESTful API protocols. This Contractor shall provide all necessary gateways, protocol converters, and communication interfaces required for seamless integration.

C. **Commissioning Data Turnover**: Upon completion of commissioning activities, this Contractor shall provide complete commissioning documentation to the Division 25 Contractor in digital format, including:

a. As-built drawings and system documentation

b. Equipment schedules with manufacturer, model, and serial number information

c. All commissioning test results and performance verification data

d. Operational parameters, setpoints, and configuration settings

e. Maintenance schedules and equipment lifecycle information

f. Any system-specific fault detection criteria and operational limits

D. **Coordination Requirements:** Coordinate installation and testing activities with the Division 25 Contractor to ensure proper system integration and avoid conflicts. Provide advance notice of any changes to equipment specifications, locations, or configurations that may affect IAS integration.

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