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Attachment X

Specifications

This specification document is part of a set of documents used for ARRA relighting projects. It is an attachment to the Statement of Work which is an attachment to the Commercial Item for Construction Contract. This document is used as applicable to the specific project scope.

Edit this document based on the blue guidance text.

INTERIOR LIGHTING CONTROL SYSTEM

1.1 SUMMARY

- A. The following specifications detail the minimum performance and related criteria for the digital lighting control system to be provided.
1. Controls, control stations and programming software.
 2. Building-wide and space-specific lighting controls, with input devices mounted to permanent buildings surfaces or integrated into luminaires.

1.2 REFERENCES AND STANDARDS

1. The standards referred to and required in this specification are:
 - a. ANSI/NFPA 70-2008 - National Electrical Code
 - b. NEMA WD 7-2000 (R2005) – Occupancy Motion Sensors
2. The standards and regulating committees referred in this specification and to which compliance with is required are:
 - a. UL Underwriters Laboratories
 - b. NEC National Electric Code
 - c. ANSI American National Standards Institute
 - d. NEMA National Electrical Manufacturers Association

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1.3 DEFINITIONS

- A. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a channel.
- B. Luminaire: Lighting fixtures with their lamps and all other components.
- C. DALI:
- D. BAS: Building Automation System.
- E. NRTL: Title 29 **Code of Federal Regulations** Section 1910.7 "Definition and Requirements for a Nationally Recognized Testing Laboratory".

1.4 SUBMITTALS

- A. Provide a comprehensive submittal package including devices, hardware, software, product specification, product installation instructions, product warranty, system software requirements, and roles & responsibilities of all persons and groups involved in the installation, execution and commissioning.
- B. Provide list of digital addresses for each digital ballast/driver/relay or other applicable component in the system to be verified.
- C. Provide written acceptance of specification package terms and roles & responsibilities.
- D. Provide floor plan showing location, orientation, and coverage area of each control device, sensor and controller/interface.
- E. Submit project specific one-line diagram of entire installation, and differentiate between manufacturer-installed and field-installed wiring.
- F. Provide a spreadsheet showing for digital ballasts device/ballast load calculations for each digital link including the rating of each digital power supply.
- G. Submittals shall include interpretation of sensor (daylight, occupancy, and other) performance expectation, operational requirements, and sequence of operation to meet GSA and specification intent.
- H. Verify acceptance of communication connection to building automation system..
- I. Define in writing the primary lighting control manufacturer field set-up and/or commissioning team selected with contact information and qualifications.
- J. Compatibility Documentation: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

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- K. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
- L. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
- M. Substantiate conformance to the Specifications by submitting a document indicating that equipment submitted meets each line item in the Specification. Note any exceptions with explanation of how the proposed system functions to achieve equivalent or superior performance. Submit all relevant test reports which cover the equipment submitted, to demonstrate compliance with the Specifications.
- N. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents and General Requirements. Lighting control system components shall not be shipped, stored or installed into the Work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other material submitted for approval.
- O. Samples: One for each type of group/scene control, manual control, sensor device and wall plate specified, in each color specified.
- P. Submit samples of all finishes and all visible faceplates, outlets, and trim for components installed in finished spaces, when requested by GSA.
- Q. Submit labeling templates for all group/scene controllers, ganged faceplates and other manual control cover plates.
- R. After final inspection, provide a complete set of as-built control drawings as part of the Operating and Maintenance Manual as described below. Include sequence of operation descriptions.

1.5

1.6

- A. Primary lighting control manufacturer shall have a minimum of five (5) years continuous experience in manufacturing architectural and energy saving lighting control products. Manufacturers with less than 5 years experience must guarantee performance, submit samples, participate in mockups and evaluations, and provide examples of successful installations with references, and be approved by the GSA.

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- B. Contractor shall provide and take responsibility for all input devices (occupancy, relay, scene controller, and daylight sensors), hardware and software to meet the specification criteria.
- C. Equipment, dimmers and assembled components shall be new, of good quality, and be approved by and bear the label of a NRTL.
- D. All system installations must comply with the NEC.
- E. Contractor shall have written manufacturing standard wiring practices to cover families of products, different manufacturing facilities, and verification of implemented wiring practice procedure and protocol per ISO standards.
- F. Contractor shall be responsible for calibration and programming sequences for input devices and systems in accordance with the requirements described in the Control Intent.
- G. Contractor shall utilize personnel for commissioning digital lighting systems with experience in the installation of 15 projects minimum or trained and endorsed by the manufacturers of the digital equipment being installed.
- H. Installer Qualifications: Electrical contractors shall have a well-established and demonstrated commitment to working with construction partners including building GSAs, developers, and general contractors. Qualifying Electrical Contractors must be capable of meeting the entire project electrical needs, including power supply, fiber optics, telecommunications, security systems, wireless networks, and lighting. Contractors must have a demonstrated record of developing engineered solutions to meet specific needs of the project. Electrical workers must have demonstrated successful experience with installation of lighting systems, lighting controls systems and devices.
 - 1. Upon approval by the Contract Officer, preference may be given to qualified electrical contractors who have completed a Registered Apprenticeship Program that meets the applicable provisions of 29 CFR Part 29. Electrical workers employed by qualified electrical contractors shall have completed a Registered Apprenticeship program or shall have demonstrated equivalent knowledge, skills and abilities consistent with the applicable Registered Apprenticeship Program.

1.8 WARRANTY

- A. Unless otherwise noted, Contractor shall provide a minimum of (5) five] year warranty on the complete system for all systems with factory commissioning. Warranty shall cover 100% of the cost of the Contractor's services and any replacement parts required over the first three [or five] years which are directly attributable to the Contractor. Repair parts shall be shipped overnight; service engineers shall be available with no more than 48 hours notice.

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- B. Manufacturers of ballasts shall offer a minimum of (5) five year warranty on all ballasts with the registration of the project with the ballast manufacturer.
- C. Input device shall have a minimum of (5) five years warranty against defect in workmanship or materials provided by device manufacturer.
- D. Control components attached to lighting fixtures shall have a minimum of (5) five year standard warranty against defect in workmanship or materials.
- E. Warranty coverage shall begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Commissioning and warranty service shall be performed by a factory-trained engineer or technician.

1.9 SOFTWARE SERVICE AGREEMENT

Software support should match that of the Warranty.

- A. Technical Support: Beginning with Substantial Completion, provide software support for **[five]** <Insert number> years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **[two]** <Insert number> years from date of Substantial Completion. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide **[30]** <Insert number> days notice to GSA to allow scheduling and access to system and to allow GSA to upgrade computer equipment if necessary.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Software: One CD-ROM version of the lighting control operating software.
- C. Controllers, Interfaces, Power Supplies: One of each type installed.
- D. Load Relays and dimmers: Equal to (5) five percent of amount installed, but no fewer than two relays.
- E. Fuses: Equal to (5) five percent of amount installed for each size installed, but no fewer than (3) three.
- F. Dimming Ballasts and DALI ballasts: Equal to (5) five percent of amount installed for each lamp, but no fewer than (2) two ballasts of each type.

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- G. Remote Controllers: (2) Two units with cradles.
- H. Sensors: Equal to (5) five percent of amount installed, but no fewer than (2) two for each installed type.

1.11 OFF-SITE TECHNICAL SUPPORT

- A. Hardware and Software: For two years from the date of Substantial Completion, provide unlimited response to user questions regarding software use and hardware and communication link troubleshooting, reconfiguring, and adjusting.
 - 1. Primary lighting control manufacturer shall provide technical support availability: 24 hours per day, 365 days per year.
 - 2. Responder Qualifications: Engineer or technician thoroughly familiar with the Lighting Control System.
 - 3. For networked systems, provide telephone, Internet, or other communication connection that allows offsite query, troubleshooting, control, monitoring, and configuration of the system by an authorized off-site engineer or technician.
 - 4. A connection to the GSA's telephone system will be provided by GSA.

PART 2 - PRODUCT

2.1 GENERAL SYSTEM REQUIREMENTS

- A. Provide materials, equipment, appurtenances and workmanship for the Work of this Section conforming to the highest commercial standards.
- B. Equipment is specified by acceptable performance to set minimum capacities and features. Said products form the basis of design. Submitted equipment shall provide these minimums and meet all specifications.
- C. System shall have power failure memory, maintaining all system information for a minimum of one year without power.
- D. All wall recessed panel boards, equipment, junction boxes, lighting devices, etc. larger than a four gang box are to be enclosed and sealed airtight in one hour fire rated construction using gypsum board or two pound per square foot sheet lead at sound-rated construction.
- E. Expansion Capability: Adequate to increase the number of control functions in the future by 20%. This expansion capability applies to equipment ratings, housing volumes, spare relays, terminals, number of conductors in control cables, and control software.

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- F. Power Supplies shall be compatible with the other components of the control system, designed for supplying Class 1 or 2 cabling, equipped with integral surge protective device.
- G. Power Supply panels shall offer Class 1 or 2 NEC separation, Ethernet RJ45 connectivity, fused line voltage receptacle for hardware operation.

2.2 SYSTEM DESCRIPTION

- A. The Lighting Control and Automation system as defined under this section covers the following equipment:
 - 1. Digitally addressable, ballasts- see Interior Lighting Specifications
 - 2. Panel and remote mounted load control relays and dimmers
 - 3. Power supplies
 - 4. Routers, controllers, processors and servers
 - 5. Analog and digital input and output modules
 - 6. Group/scene and manual zone controls.
 - 7. Occupant/vacancy sensors and controllers.
 - 8. Daylight responsive sensors and controllers.
 - 9. Integral timeclock control.
 - 10. Emergency lighting control.
 - 11. Utility “demand response” control.

2.3 SPECIFIC REQUIREMENTS FOR EQUIPMENT AND COMPONENTS

- A. Group/Scene Controllers - Scene controllers shall be compatible with the other components of the lighting control system and capable of Class 1 or 2 wiring strategies per the NEC and local codes. Devices shall contain on/off group, preset scene functions, or dim up/dim down interface through front panel. Programming of new scenes or zone assignments must be easily accomplished by authorized personnel from the space being controlled.
- B. Load Relays and Dimmers - When used for non-digital loads, devices shall be rated at 20 A inductive load, and be compatible with the control systems.
- C. Daylighting sensors shall not be combined in the same housing or location with occupancy or vacancy sensors if the proper location for one function compromises the success operation for the other function, or in any way reduces the system’s ability to meet the design intent.
- D. Occupancy/Vacancy Sensors
 - 1. Install and aim sensors in locations to achieve coverage of areas indicated. Coverage patterns shall be derated as recommended by manufacturer based on mounting height of sensor, furniture and partitions

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- locations, obstructions, and finish of interior surfaces. Do not simply use gross rated coverage in manufacturer's product literature.
2. General Description: Wall- or luminaire- or ceiling-mounting, solid-state units with an integral or separate relay switch.
 3. Operation: Turn lights off when area is unoccupied and energize scene selector for manual switch when room is occupied; provide a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes, in one minute increments. Shall be capable of temporary manual turn-off, without overriding the automatic-off function.
 4. Occupancy/vacancy sensors shall comply with NEMA Standard WD 7-2000 (R2005).
 5. Sensor shall be capable of distinguishing workstation occupancy and vacancy from adjacent corridor traffic.
 6. Occupancy / vacancy sensor must not false trigger or reactivate time delay due to adjacent corridor traffic.
 7. Occupancy/vacancy sensors may include the following types:
 - a. PIR Type: Wall-box, corner-, ceiling- or luminaire-mounted. Detects occupancy by sensing a combination of heat and movement in area of coverage.
 - b. Ultrasonic Type: Ceiling mounted. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
 - c. Dual-Technology Type: Ceiling mounted. Detect occupancy by using a combination of detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
 8. Occupancy sensor shall allow the adding or deleting of specific fixtures or zones to the assigned sensor without the use of ladders. Sensor should allow remote control adjustments of operational parameters (sensitivity, time delay), and should be able to transmit, receive, and store system information through the remote control.
 9. For sensors controlling "workstation specific" luminaires, the sensor shall be designed or programmed to turn off only the task lighting component in response to specific workstation vacancy, and not turn off ambient component of the luminaire.
 10. Sensors shall be located or shielded or controlled by internal logic to adjust sensitivity to avoid false triggering due to ambient temperature, air temperature variations or HVAC air movement.
 11. Sensor Output: Provides output compatible with digitally addressable ballasts, electronic ballasts, and analog dimming ballasts.
 12. Relay Unit: Contacts rated for 20-A ballast load at 120- and 277-V AC, for 20- A incandescent at 120-V AC, and for 1 hp at 120-V AC. Power supply to sensor shall be 24-V DC, 150-mA, Class 2 power source as defined by NFPA 70.
 13. Mounting: Sensor suitable for mounting in any position on a standard outlet box.

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14. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
15. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind door. Time delays shall be self-adaptive.
16. Indicator light: to show when motion is being detected during testing and normal operation of the sensor.
17. Bypass Switch: Override the on function in case of sensor failure.
18. Walk through mode: Occupancy sensor shall have a 'walk through mode' that enables an independent short time delay for applications where a person walks quickly in and out of a room

E. Daylight Harvesting / Light Level Sensor

1. Shall be supported by the lighting control system and allow the adding or deleting of specific fixtures to the assigned sensor without the use of ladder.
2. Shall detect changes in ambient lighting level and enable dimming as required by sequence of operation.
3. Daylight harvesting control strategies shall be programmed to minimize lamp cycling and occupant distraction. Daylight level sensor design shall be appropriate for the control strategy.
4. Lighting control system shall be capable of recalibration to accommodate changes in environment.
5. Sensors shall have a detection "cone", where the base of the cone may be circular or an elongated shape, and where the smallest angle between the edge and the axis of the cone is between 20 and 50 degrees. The cone axis may be tilted to the vertical when installed to give the sensor preferred directionality.
6. Sensors shall be ceiling- or wall- or luminaire-mounted with sensitivity, filtering, range and viewing angle to meet requirements of sequence of operation, control intent and construction documents.
7. Time Delay: Adjustable from 1 to 30 seconds ON delay, and 1 to 30 minutes OFF delay to prevent cycling, with deadband adjustment of 25% to 100% above lower setpoint.
8. Indicator: Indicators and/or remote reporting required to track and verify that daylight sequence is working properly.
9. The control system with the sensors shall be calibrated using at least two set points, a night set point and a day set point. The system shall use these set points to define its response for varying daylight conditions.
10. Response: Output dimming signal is linear to light level with less than 1% variation. Cadmium sulfide photo-resistors are not acceptable.
11. The daylight control system shall be capable of controlling multiple zones utilizing the input from a single light sensor, allowing separately adjustable settings for each control zone.
12. Control system shall be capable of using photosensor input to trigger preset scenes in spaces with multiple scene preset controls.

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13. Lighting Control System shall provide Remote Monitoring and Reporting. Sensor value and status shall be remotely queriable.
14. Adjustments and Setpoints: All adjustments with exception of sensor range shall be made via the communication line, or via a remote control device. Units that require the use of unit mounted manual adjustments or which must be programmed at the unit are not acceptable.

2.4 LIGHTING CONTROL SOFTWARE FEATURES AND FUNCTIONS

- A. The digital lighting control shall be programmable, PC-based unit with at least 17 inch graphic LCD color display, with peripherals and memory sized to provide the specified functions of the lighting control system. The control shall provide for programming the system and provide diagnostic information. If digital lighting control includes emergency lighting units, the PC shall be connected to an uninterruptible power supply and shall indicate failure of normal power at controlled lighting and that the lighting units are, or are not, powered by the alternate power source.
- B. Includes password protection: minimum of two configurable security levels.
- C. Operates in multitasking and multi-user environment.
- D. Coordinates the communications of the network. Alternatively, the system may include a lighting control processor which coordinates network communication Provides graphic interface which gives control and monitor capability on an area by area basis.
- E. Provides interactive color-graphics to show status and properties of individual areas on both floor plans and optional single-line diagrams.
- F. Logs user-defined power monitoring and activity events including log on/off; attempted log on/off; and; equipment operations; with date and time stamps.
- G. Exports data to Microsoft Excel spreadsheet.
- H. Reports Trends: energy and power trended historical bar-chart format, by area or by selected time periods which include daily, weekly and monthly.
- I. Programs: Provide custom program for the operation of the lighting control system based upon the sequence of operation and control schedules for the project.
- J. Workstation Specific control: Lighting control shall be configured to allow individual users, in individual workstations, to dim or turn on/off the dedicated downward lamp in their individual “workstation specific” luminaires, using PC

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applications, Infra Red control devices, voice over IP telephones, or other convenient control devices.

- K. System Memory: Nonvolatile. System shall reboot program and reset time automatically without errors after power outages up to 90 days' duration.
- L. Lighting control software shall be capable of linking switch and sensor inputs to relay and ballast outputs, retrieving links, viewing relay and ballast output status, controlling relay and ballast outputs, simulating switch and sensor inputs, setting device addresses, and assigning switch and sensor inputs and relay and ballast output modes.
- M. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight saving time and shall provide weekly routine and annual holiday scheduling.
- N. Astronomic Control: Automatic adjustment of dawn and dusk switching based on location of project site.
- O. Future Remote Communication Capability: Allow programming, data-gathering interrogation, status display, and controlled command override from a PC at a remote location over the Internet. System shall include firewalls and control software, and remote computer compatibility verification for this purpose.
- P. Control software shall permit commands that change preset scenes and dimmer settings according to programmed time signals and photosensor or occupancy sensor input.
- Q. Diagnostics: When system operates improperly, software shall initiate factory programmed diagnosis of failure and display messages identifying problem and possible causes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions are as shown on the drawings.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

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3.2 INSTALLATION

- A. All lighting control devices and systems shall operate 'out of the box' and shall be factory preset to operate at the most energy efficient operation.
- B. Wiring by the electrical contractor shall follow the loop drawings provided.
- C. Lighting control system Class 1 wire shall be 600V 14 gauge stranded, purple jacket.
- D. Upon completion and final installation of all lighting fixtures, 12 hour burn in for all fluorescent lamps is required.
- E. Contractor shall furnish all equipment labor, and hardware required for the installation of the hardware per manufacturer specifications and the intent of the drawing.
- F. Installation shall be considered complete when the final commissioning is executed and completed by the commissioning agent and signed off by the GSA.
- G. Upon completion and final installation of all lighting fixtures, all digital links must be tested for:
 - 1. Line voltage on the loop; line voltage would be anything above 100 volts AC.
 - 2. Continuity of the loop (should be no continuity).
 - 3. Continuity of the loop to group (should be no continuity).
- H. Lighting control sensors shall be wireless or provided with slack Class II wiring to enable easy relocation in the field up to 6 feet in any direction from the location shown on the drawings and approved by the manufacturer. This shall provide reasonable flexibility to optimize field relocation needs, and the calibration and commissioning of the system, initially and in response to GSA occupancy.

3.3 COORDINATION

- A. The lighting control system is independent of, but capable of communicating with the BAS.
- B. Design display graphics showing building areas controlled by this system; include the status of lighting controls in each area.
- C. Coordinate lighting control components specified in this Section with components specified in other Sections, including the GSA Interior Office Lighting Fixture Performance Specifications.

3.4 COMMISSIONING

A. Field Quality Control

1. Ensure that all luminaires (including emergency lighting) are installed and operating as specified before conducting set-up, calibration and commissioning of lighting control systems and components.
2. Electrical contractor shall perform the following field tests and inspections and prepare written test reports:
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Test each circuit for circuit continuity, open, shorts and/or other tests as recommended by manufacturer. Document all test settings and results.
 - c. Check operation of all control devices.
 - d. Verify that the control system features are operational, and function according to the specified Control Intent.
 - e. Ensure that system operates in a fail safe condition when power is interrupted to the circuit.
 - f. Operational Tests: Set and operate controls at all required control stations to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by the manufacturer. Note response to each test command and operation
3. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
 - a. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
4. Reports: Prepare written reports of tests, inspections, verifications and observations indicating and interpreting results. Record defective materials, workmanship, and unsatisfactory test results. Record repairs and adjustments.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - b. Verify normal operation of each lighting control device and component after installation.
 - c. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to backup source and retransfer to normal.

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- d. Test and document changes made as a result of field conditions and conflicts to demonstrate compliance with specifications and Control Intent.
- e. Upon completion of the formal checkout, a factory-trained engineer or technician shall demonstrate operation and maintenance of the system to the contracting officer as described below.

B. Standard On-Site Start-Up, Calibration. And Performance Verification

1. When lighting control systems are completely installed and tested, and final adjustments have been made to the satisfaction of the Contractor, systems shall be inspected by a factory-trained engineer or technician representing the primary lighting control manufacturer, in the presence of GSA. Systems and devices shall be calibrated per the plans and specifications, submittal responses and per the initial setting of the Control Intent. This shall involve at least xx (fill in by specifier) visits, pre-arranged by the Contractor at least xx (fill in by specifier) weeks in advance. If the equipment cannot be calibrated due to incomplete or incorrect work on the part of the Contractor, the Contractor is responsible for additional visits and the associated additional fees of contracting officer's designated representatives

C. Final Design Calibration and Fine Tuning with Design Team and GSA (and Independent Commissioning Agent if provided by GSA).

1. Primary Lighting Control Manufacturers' Factory-trained engineers or technicians shall be engaged by the Contractor to participate in up to xx (fill in by specifier) hours of assistance with final calibration of the lighting control systems and devices Calibration for all unique or prototypical spaces shall be done in the presence of the GSA, Lighting Control Specifier and Independent Commissioning Agent if provided by GSA. Provide labor and tools as necessary for the final inspection and adjustments, whether the inspection is scheduled within or outside of normal working hours, at no additional cost to the GSA. If subsequent inspections are required due to significant failure of the Contractor to meet the requirements of the Specifications, or to prepare adequately for the inspection, Contractor will reimburse design team for time and expenses, including travel costs, to make any subsequent inspections. Manufacturer's factory-trained engineer or technician shall be present at any subsequent inspections. Promptly correct any deficiencies found during final inspection.
2. Proper execution of the final calibration and compliance with the Control Intent and submittal responses will be the responsibility of the primary lighting control manufacturer and/or system integrator.
3. Documentation of the final settings shall be provided by Contractor in the form of printouts or data files inherent in their systems of the primary Lighting Control Manufacturer. If such documentation is not an inherent

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part of the system, the GSA shall designate the party responsible for documentation of final commissioning settings.

D. Verification of Similar Spaces by Independent Commissioning Agent.

1. All other spaces similar or identical to the prototypical spaces shall be commissioned by the Electrical Contractor, based on the final criteria established during the final calibration above.
2. The GSA or an Independent Commissioning Agent shall verify that all other rooms meet the final commissioning criteria.

E. Training Of GSA Personnel

1. On-site training shall be considered a part of the commissioning process and will include a xx (fill in by specifier) hour on-site training session at the conclusion of the initial commissioning, and a second xx (fill in by specifier) hour on-site training session within 6 months of the final commissioning.
2. Engage a factory-authorized engineer or technician to train GSA's maintenance personnel to adjust, operate, and maintain systems.
3. Train GSA's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Train them in troubleshooting, servicing, adjusting, and maintaining equipment.
4. Training Aid: Use the approved final versions of software and maintenance manuals as training aids.
5. Video tape or film the training sessions and provide same to GSA for permanent record, in DVD or electronic format established by the GSA.
6. Occupancy Adjustments: Within one year of date of substantial completion, provide up to three additional project site visits, when requested by GSA, to adjust and calibrate components and to assist GSA's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

END OF SECTION