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USACE / NAVFAC / AFCEC / NASA UFGS-26 09 23.00 40 (August 2016)  
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Preparing Activity: NASA Superseding  
UFGS-26 09 23.00 40 (August 2013)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2018

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#### DIVISION 26 - ELECTRICAL

#### SECTION 26 09 23.00 40

#### LIGHTING CONTROL DEVICES

08/16

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SECTION 26 09 23.00 40

LIGHTING CONTROL DEVICES  
08/16

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NOTE: This guide specification covers the requirements for photoconductive or other lighting control devices for use with interior or exterior lighting systems.

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

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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### PART 1 GENERAL

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NOTE: If Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

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Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

#### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide

specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

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

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

GREEN SEAL (GS)

GS-12 (1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY (IES)

IES LM-48 (2001) Guide for Testing the Calibration of Locking-Type Photoelectric Control Devices Used in Outdoor Applications

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE (2004) NASA Reliability Centered Building and Equipment Acceptance Guide

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.10 (2010) American National Standard for Roadway and Area Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles--Physical and Electrical Interchangeability and Testing

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15 Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 20	(2010; Reprint Feb 2012) General-Use Snap Switches
UL 773	(2016; Reprint Nov 2017) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2016) Standard for Nonindustrial Photoelectric Switches for Lighting Control
UL 98	(2016) UL Standard for Safety Enclosed and Dead-Front Switches

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Use the "S" Classification only in SD-11 Closeout Submittals. An "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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

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Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Photoconductive Control Devices; G[, [\_\_\_\_]]

Installation Drawings; G[, [\_\_\_\_]]

Light-Sensitive Control Devices; G[, [\_\_\_\_]]

Dimming Ballast Controls; G[, [\_\_\_\_]]

Light Level Sensor; G[, [\_\_\_\_]]

Dimmer Switch; G[, [\_\_\_\_]]

Lighting Contactor; G[, [\_\_\_\_]]

Time Switch; G[, [\_\_\_\_]]

Photocell Switch; G[, [\_\_\_\_]]

Occupancy Sensors; G[, [\_\_\_\_]]

Motion Sensors; G[, [\_\_\_\_]]

SD-06 Test Reports

System Operation Tests

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

1.3 QUALITY CONTROL

1.3.1 Predictive Testing and Inspection Technology Requirements

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NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS are MANDATORY for all NASA assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS for additional information regarding cost feasibility of PT&I.  
\*\*\*\*\*

This section contains systems and equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems have been installed properly and contain no identifiable defects that shorten the design life of a system and its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the work.

Perform PT&I tests and provide submittals as specified in Section  
01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Photoconductive Control Devices

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**NOTE: If automatic control of luminaires is desired, give first consideration to photo-control. If both photo-control and remote manual override are required for the lighting system, use a central contactor and a single system photo-cell. Do not use individual luminaire photo-control of security lighting systems where a remote manual override is required.**  
\*\*\*\*\*

Provide photoconductive control devices in accordance with UL 773. Control lighting luminaires [in banks by a single photo-control element mounted within each bank.] [individually by photo-control elements mounted [on] [or] [adjacent to] the heads of the luminaires.][ Provide molded housing from translucent butyrate or acrylic plastic materials for light-sensitive control devices and fasten to the base with screws.] Provide physically and electrically interchangeable light sensitive control devices with three-pole, 3-wire locking plug and receptacle connections to the line, load, and neutral conductors of the lighting circuit.

Provide photoconductive control devices for incandescent, fluorescent, and outdoor lighting luminaires. Include a photoconductive cell, thermal actuator, and snap-action switch in a weatherproof housing. Provide a control device which is, when attached to its mounting, weatherproof and constructed to exclude beating rain, snow, dust, and insects and capable of withstanding 96 percent relative humidity at 50 degrees C 122 degrees F for 48 hours under operating conditions.

##### 2.1.1.1 Photoconductive Limit Settings

Provide device that turns on within the limits of plus 100 to minus 50 percent of its setting, over a range of input voltage from 105 to 130 volts at rated frequency and ambient temperature. Device also performs at rated voltage and frequency over a temperature range from minus 29 to plus 50 degrees C 85 to plus 122 degrees F, with relative humidities up to 96-percent throughout the temperature range.

Adjust the device to operate within the limits of 9 to 13 lux 0.8 to 1.2 foot-candles. The device is capable of calibration of the turn-on light level over a minimum range from 5 to 32 lux 0.5 to 3.0 foot-candles, and

adaptable for calibration up to 108 lux. 10 foot-candles. Do not use a device that has a turn-off light level to turn-on light level ratio that exceeds 5.

#### 2.1.1.2 Device Rating and Accuracy

Rate the devices at 120 or 277 volts, 60 hertz, at a rated ambient temperature of 25 plus or minus 5 degrees C 77 plus or minus 41 degrees F.

Maintain instrument accuracy by proper calibration in accordance with IES LM-48.

### 2.2 COMPONENTS

#### 2.2.1 Time Control Switches

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**NOTE: If automatic control of luminaires is desired and photo-control is not used, provide operation by timer control to ensure that luminaires come on automatically. Normally, the astronomic dial timer control switch is of the automatically wound spring mechanism type. A battery backed electronic switch capable of maintaining accurate time for 7 hours following a power failure may be substituted.**  
\*\*\*\*\*

Install switches with not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

[ Provide switches with a time delay in excess of 5 seconds as an available option.

#### ]2.2.2 Manual and Safety Switches

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**NOTE: Delete NEMA ICS 6 enclosures when not required.**  
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Provide Astronomic dial type arranged to turn "ON" at sunset, and turn "OFF" at a pre-determined time between [2030 hours] [\_\_\_\_\_] hours and [0230 hours] [\_\_\_\_\_] hours or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide a switch rated at [\_\_\_\_\_] volts, having [automatically wound spring mechanism] [battery backed electronic clock] to maintain accurate time for a minimum of 7 hours following a power failure, with a time switch that includes a manual on-off bypass switch. Provide surface mounted housing for the time switch, type NEMA [3R] [1 (indoor)] [4 (outdoor)] enclosure[ conforming to NEMA ICS 6].

\*\*\*\*\*  
**NOTE: Use manual switches for control of the lighting system when controls are located in a space that is continuously supervised, such as a guardhouse, gatehouse, or watchtower.**  
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Provide a switch mechanism consisting of a heavy-duty general-purpose



precision snap-acting switch[, with NEMA ICS 6 Type [1] [4] enclosures,], single-pole, single-throw,[ with a minimum rating of 1,000-watts incandescent-lamp load and 1,200-volt-amperes reactive for vapor-lamp load at rated voltage and frequency][ suitable for operation on a [480Y/277] [208Y/120] [480] [277] [240] [120] volt, 60 Hz, [three-phase] [single-phase] system]. Provide with a selector switch having a minimum of three positions: ON, OFF, and AUTOMATIC. Use the automatic position when photoelectric or timer control is desired. Interface the selector switch with the lighting system magnetic contactor to control system activity.

Ensure switches conform to UL 98. Provide a quick-make, quick-break type switch such that a screwdriver is required to open the switch door when the switch is on, with blades visible when the door is open. Coordinate terminal lugs with the wire size.

#### [2.2.3 Dimming Ballast Controls

Provide a single slide dimming ballast control dimmer with on-off control, compatible with the ballast. Control the ballast light output over the full dimming range. Provide a dimmer ballast control which is approved by the ballast manufacturer.

#### ]2.2.4 Light Level Sensor

Provide UL listed light level sensor capable of detecting changes in ambient lighting levels, with a dimming range of 20 percent to 100 percent, minimum. Ensure sensor is designed for use with dimming ballast and voltage system to which they are connected. Provide a sensor capable of controlling 40 electronic dimming ballasts, minimum, with a sensor light level adjustable with a set level range from 100 to 1000 lux 10 to 100 foot-candles, minimum. Provide a sensor with a bypass function to electrically override the sensor control.

#### 2.2.5 Incandescent Dimmer Switch

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**NOTE: Do not specify central dimming systems with  
this specification.**  
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Provide a single-pole, [600][\_\_\_\_\_] watt, 120 volt ac, dimmer switch that conforms to UL 20. Ensure the switch is the full-range rotary on-off type with built-in electromagnetic interference filter.

#### 2.2.6 Lighting Contactor

[Provide NEMA ICS 2,[ electrically][ mechanically] held contactor, rated [\_\_\_\_\_] volts, [\_\_\_\_\_] amperes, and [\_\_\_\_\_] poles, with coils rated [\_\_\_\_\_] volts.][ Rate contactor as indicated.] Provide in a NEMA[ 4][ \_\_\_\_\_] enclosure conforming to NEMA ICS 6. Provide contactors with silver alloy double-break contacts [and coil clearing contacts for mechanically held contactor] requiring no arcing contacts.[ Provide contactor with[ hand-off-automatic][ on-off] selector switch[.][, hermetically sealed.]]

#### 2.2.7 Time Switch

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**NOTE: Do not always use photocells and time  
switches together. Use the following information as**

a guide:

1. Lights on/lights off by photocell: Street parking lots. Any facility or street that requires lighting after dark.
2. Lights on by photocell; lights off by time switch: Most administration facilities, commissaries, hobby shops, or clubs. Any facility that does not stay open all night.
3. Lights on/lights off by time switch: Service stations, snack bars, barracks, or officers' quarters. Facilities that are open to the public, or have personnel that report before daylight and after dark, but not continually through the night.
4. Other considerations: Time switches with a skip-a-day feature may be useful for facilities with a 5-day work week. (Program time switch to skip Saturday and Sunday.) For facilities that do not stay open all night, it may be desirable to have lighting at night for security. Consult area Engineering Field Division for local station policy and exceptions to these procedures.

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Provide astronomic dial type or electronic type, arranged to turn "ON" at sunset and turn "OFF" at a predetermined time between 8:30 p.m. and 2:30 a.m. or at sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide a [\_\_\_\_\_] volts rated switch, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 7 hours following power failure. Provide time switch with a manual on-off bypass switch. Surface mount the housing for the time switch, inside a NEMA [3R][\_\_\_\_\_] enclosure conforming to NEMA ICS 6.

#### 2.2.8 Photocell Switch

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**NOTE: Silicon diode type photocells are solid state devices and have limited sources. Therefore, cadmium-sulfide type cells cannot be deleted from the specification.**

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Ensure photocell switches conform to UL 773 or UL 773A. Provide hermetically sealed switches that use cadmium-sulfide or silicon diode type cells. Provide switches that are rated at [\_\_\_\_\_] volts ac, 60 Hz with [single-throw contacts] [single pole double-throw (spdt) contacts for mechanically held contactors rated 1000 watts] and designed to fail to the ON position. Provide switches that turn on at or below 32 lux 3 foot-candles and off at 43 to 107 lux 4 to 10 foot-candles. Provide time delay to prevent accidental switching from transient light sources. [Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.]

Provide a switch with the following:

- [ a. Integral to the luminaire, rated 1000W minimum.[ Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.]
- ]b. In a U.V. stabilized polycarbonate housing with swivel arm and adjustable window slide, rated 1800 VA, minimum.
- ]c. In a high-impact-resistant, noncorroding and nonconductive molded plastic housing with a locking-type receptacle conforming to ANSI C136.10, rated 1800 VA, minimum.
- ]d. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

#### ]2.2.9 Occupancy Sensors

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**NOTE: Occupancy sensors are useful in lighting control applications for private and open offices, restrooms, conference rooms, classrooms, utility areas, warehouses, and corridors. Additional design guidance can be found at the NAVFAC Criteria Office's website.**

**Also, most occupancy sensor manufacturers offer design services for their products.**

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**NOTE: Typical sensor applications are:  
 Ultrasonic - Restrooms, Hallways  
 Infrared - Warehouses, Open Offices  
 Combination Sensor - Classrooms, Conference Rooms**

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Provide UL listed occupancy sensor complying with FCC Part 15 and GS-12. Design occupancy sensors and power packs to operate on the voltage indicated. Provide sensors and power packs with circuitry that only allows load switching at or near zero current crossing of supply voltage, with mounting as indicated. Provide sensor with an LED occupant detection indicator, adjustable sensitivity, and adjustable delayed-off time range of 5 minutes to 15 minutes. Provide[ ivory][ white][ color matching the adjacent wall plates] wall mounted sensors, and white ceiling mounted sensors. Provide ceiling mounted sensors with 6.28 rad 360 degree coverage unless otherwise indicated.

Provide sensors with:

- [ a. A crystal controlled ultrasonic sensor which does not cause detection interference between adjacent sensors.
- ]b. Infrared sensors with a daylight filter, and a fresnel lens that is applicable to the controlled space.
- ]c. Ultrasonic/Infrared Combination Sensor
- [ (1) Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection, such that the lights remain on if either the ultrasonic or infrared sensor detects movement.

Provide infrared sensor with a lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Provide crystal controlled ultrasonic sensor frequency.

]ld. Microwave and audiophonic sensors.

]2.2.10 Equipment Identification

2.2.10.1 Manufacturer's Nameplate

Provide each item of equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in an inconspicuous place; the nameplate of the distributing agent is not acceptable.

2.2.10.2 Labels

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NOTE: Labeling of lighting components is an inexpensive and effective method for helping facilities personnel properly operate and maintain the lighting systems. Use labels which are easy to read when standing next to the equipment, and durable to match the life of the equipment to which they are attached.  
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Provide labeled control devices, clearly marked for operation of specific lighting functions according to type. Note the following devices characteristics in the format "Use Only [\_\_\_\_]."

Locate markings where readily visible to service personnel, but unseen from normal viewing angles when devices are in place.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Submit installation drawings for [light-sensitive] [occupancy sensitive] [motion sensitive] control devices in accordance with the manufacturer's recommended instructions for installation.

#### 3.1.1 Photoconductive Control Devices

Install [photoconductive] [\_\_\_\_] control devices in accordance with the manufacturer's installation instructions.

#### 3.1.2 Time Control Switches

Install switches with not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

#### 3.1.3 Manual and Safety Switches

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

### 3.1.4 Magnetic Contactors

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**NOTE: Use mechanically held, electrically operated magnetic contactors to control operation of the lighting system circuits.**  
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Install magnetic contactors, mechanically held, electrically operated, conforming to NEMA ICS 1 and NEMA ICS 2, suitable for [480] [277] [240] [208] [120] volts, [single] [3] phase, 60 Hz, with coil voltage of [120] [277] [208] [240] volts. Provide contactors with maximum continuous ampere rating and number of poles as indicated on drawings. For contactors mounted indoors, provide enclosures conforming to NEMA ICS 6, Type 1. Provide each contactor with a spare, normally open auxiliary contact.

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 6.4 mm 1/4 inch bolts. Do not use sheet metal screws.

### 3.2 FIELD QUALITY CONTROL

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**NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS to establish predictive and acceptance testing criteria, above and beyond that listed below.**  
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Perform PT&I tests and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

Perform system operation tests in accordance with referenced standards in this section.

Demonstrate that photoconductive control devices operate satisfactorily in the presence of the Contracting Officer.

### 3.3 CLOSEOUT ACTIVITIES

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**NOTE: Require O&M manuals for lighting control systems that use low voltage control circuits.**  
**Example: Light level sensors used with dimming ballast, occupancy, and motion sensors used with power packs.**  
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Submit operation and maintenance data, lighting control system, data package 5, in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. Show information for all lighting fixtures, control modules, control zones, occupancy sensors, motion sensors, light level sensors, power packs, dimming ballasts, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

-- End of Section --