Common Systems: Motion Sensor Control of Lighting Fixtures – Retrofitting Network Equipment Lighting

Abstract
This practice provides the requirements and objectives for implementing dynamic switch control of equipment frame and aisle lighting in network facilities. The practice is being revised based upon field visits of Chicago Carrier Communications Workspace Installation.

Audience: Network and Corporate Real Estate employees and their contractors

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1. GENERAL

1.1 Motion Sensor technology is the default method for controlling equipment area lighting fixtures and shall be used unless other methods are given for specific installations within this document. Motion Sensor switching has been determined to be an appropriate and effective means of ensuring equipment lighting is turned on when and where needed and only for the duration of time needed for a specific work activity. For the purpose of this practice, a Motion Sensor refers to a device that uses Passive Infrared technology (not dual technology) to detect motion and switch the lights on in place of traditional toggle switches.

1.2 This practice shall be used when it has been determined that the retrofitting of motion sensor technology is required or desired in a network equipment environment and should be used when the retrofitting of motion sensor technology is desired or required in administrative buildings and administrative areas of network equipment buildings.

1.3 This issue 5 makes all previous issues of TP76406 invalid and must be used for equipment lighting retrofit work in a Carrier Communications Workspace.

2. Motion Sensor Description

2.1 Wired and Wireless Motion Sensors

2.1.1 Section 2.1 includes information on both wired and wireless motion sensors. Motion sensors detect movement via a change in ambient conditions using infrared technology. Lights are turned on when motion is detected and turned off when motion is not detected for a user specified delay time of a few seconds up to 30 minutes.

2.1.2 Motion sensors having a 360º throw pattern usually come with optional lens covers or masking so the sensors field of view can be restricted to a narrower pattern.

2.1.3 The throw pattern shall be adjusted to completely cover the work area.

2.1.4 Sensors shall be positioned such that every part of the aisle is within the “view” of a sensor and no point shall exceed 25’ from the “view” side of a sensor.

2.1.5 The minimum time delay setting on motion sensors shall be 10 minutes. Local Management may request a longer delay, not to exceed 20 minutes.

2.1.6 Lighting fixtures controlled by motion sensors shall not also have switches.

2.1.7 Emergency egress lighting shall not be controlled by motion sensors.

2.1.8 The use of sensors utilizing line voltage power sources (120/277 VAC) are preferred because they generally require less apparatus being added into equipment overhead arrangements. All motion sensors for use in AT&T equipment aisles must be approved by the Implementation Engineering and Common Systems (IECS) organization. The following motion
sensing products have been approved by IECS for use in AT&T facilities. Also listed are the applications considered appropriate for each product.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Voltage</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airey-Thompson</td>
<td>5511-S1</td>
<td>Line</td>
<td>Equipment aisles with Sentinel fixtures</td>
</tr>
<tr>
<td>Sensor Switch</td>
<td>CMRB series</td>
<td>Line</td>
<td>Side/end of box type fixtures.</td>
</tr>
<tr>
<td>Wattstopper</td>
<td>CI-355-1</td>
<td>Line</td>
<td>Short aisles and entry doors.</td>
</tr>
<tr>
<td>Wattstopper</td>
<td>CX-100-4</td>
<td>24 Volts</td>
<td>Equipment Aisles</td>
</tr>
<tr>
<td>Leviton</td>
<td>OSFHU</td>
<td>Line</td>
<td>Equipment Aisles</td>
</tr>
<tr>
<td>Airey-Thompson</td>
<td>551179S1</td>
<td>Line</td>
<td>Fixture w/sensors for equipment aisles</td>
</tr>
<tr>
<td>Airey-Thompson</td>
<td>551329S1</td>
<td>Line</td>
<td>Fixture w/sensors for equipment aisles</td>
</tr>
<tr>
<td>Airey-Thompson</td>
<td>552329S1</td>
<td>Line</td>
<td>Fixture w/sensors for equipment aisles</td>
</tr>
</tbody>
</table>

Table of Approved Wired Motion Sensors

2.1.9 Motions sensors shall be listed by a Nationally Recognized Testing Laboratory with a minimum five year warranty.

2.1.10. Motion sensors shall be compliant with FCC Part 15.

2.2 Information Specific to Wireless Motion Sensors

2.2.1 Wireless motion sensors facilitate retrofitting because they do not require any wiring to be placed between light fixtures and sensors. Wireless motion sensors communicate with the light fixtures using RF signals. Approved wireless motion sensors are manufactured by Lutron and listed in the table below.

<table>
<thead>
<tr>
<th>Lutron Product</th>
<th>Ceiling RPS</th>
<th>Wall RPS</th>
<th>Pico Control</th>
<th>Dual Voltage Switch</th>
<th>Neutral Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>LRF2-OCR2B-P</td>
<td>LRF2-OWLB-P</td>
<td>PJ-2B-L-xx</td>
<td>MRF2-8S-DV</td>
<td>MRF2-6ANS-MRF2-8ANS</td>
</tr>
<tr>
<td></td>
<td>LRF2-VCR2B-P</td>
<td>LRF2-OHLB-P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LRF2-OKLB-P</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Table of Approved Lutron Wireless Motion Sensors

Due to RF interference considerations, all components listed in this table must maintain the minimum separation stated below:
1. Ceiling RPS, Lutron models LRF2-OCR2B-P and LRF2-VCR2B-P
   A minimum 12" (one foot) separation from any equipment bay must be maintained in all
   network equipment areas.

2. Wall RPS, Lutron models LRF2-OHLB-P, LRF2-OWLB-P, and LRF2-OKLB-P
   A minimum 8" (eight inches) separation from any equipment bay must be maintained in all
   network equipment areas.

3. Pico Control, Lutron model PJ-2B-L-WG
   When the Pico Control is surface mounted on a metallic bay end plate (normal
   arrangement), a minimum setback of three inches from the nearest equipment mounting
   surface (front or back of bay) is required.
   If the Pico Control is mounted at other locations in network equipment areas, a minimum 8"
   (eight inches) separation from any equipment bay must be maintained.

4. Dual Voltage Switch, Lutron model MRF2-8S-DV
   For mounting in bay end closures, a closed metallic electrical box with metallic conduits
   attached and no un-used conduit knockouts removed is required for mounting the Dual
   Voltage Switch.
   If the Dual Voltage Switch is mounted at other locations in network equipment areas, a
   minimum 6" (six inches) separation from any equipment bay must be maintained.

5. Neutral Switch, Lutron models MRF2-6ANS and MRF2-8ANS
   A minimum 6" (six inches) separation from any equipment bay must be maintained in all
   network equipment areas.

These restrictions and separation requirements do not apply to other Lutron devices that do not
include RF transmitters.

3. Integration into Equipment Environments

3.1 The implementation of motion sensor technology into new equipment areas and growth to
existing environments equipped with motion sensor technology shall follow established business
processes and practices using the products described in section 2 and the installation
arrangements provided herein.

3.2 The retrofitting of motion sensor technology into existing lighting arrangements shall
follow the business processes and practices provided in this document.

Prioritization of Retrofits

3.3 Retrofitting existing equipment environments will occur based on a region specific list of
buildings compiled by corporate real estate (CRE). The list will be prioritized based on the
potential for energy savings within each region and will include estimated time lines for
implementing motion sensor technology in each building. Implementation of retrofits will be
undertaken by CRE contractors initially and may be expanded to include network installation operating territory vendor (OTV) contractors depending on personnel availability, logistics and local business plans.

Notifications

3.4 CRE will contact Central Office Layout and Design (COLD) planners to obtain two or more copies of the building’s equipment frame layout drawings and aisle lighting records (when available), and schedule a meeting and building walk-through with the building’s site manager, maintenance engineer, retrofit contractor, and/or the OTV contractor prior to authorizing switch retrofit activity. The purpose of the meeting(s) and walk-through(s) will be to:

a. Familiarize the retrofit contractor with the equipment environment and lighting arrangements,
b. Familiarize the OTV contractor with the changes being planned for the building,
c. Identify lighting installation anomalies that need to be resolved prior to work commencement,
d. Determine where motion sensors will be installed,
e. Develop an estimated time line for installation start and completion,
f. Establish contractor working hours and material logistics requirements,
g. Determine job method of procedure (MOP) requirements and responsibilities,
h. Determine the process to be used for updating office records after installation complete and, submit as-built drawings depicting locations of motion sensors on Carrier Communications Workspace layout drawing. (refer to figure 15 for illustration)
i. Determine who will verify the installation is complete as agreed upon, and to
j. Document contractor emergency procedures and AT&T contact information.

3.5 The frame layout and aisle lighting records (when available), should be used to record motion sensor type and location decisions made during building walk-throughs and AT&T agreed upon changes made subsequent to the walk-throughs. These drawings will be used to prepare as-built drawings. The following is a suggested means of conveying changes to be made to arrangements depicted on office records during walk-throughs and for communicating as-built changes to the owner of the office records after installation is completed:

a. red should be used to indicate additions to office arrangements,
b. yellow should be used to indicate items removed from office lighting arrangements, and
c. green should be used to indicate items pertinent to the job omitted from the office records.

3.6 Using the above as an example, the “plus” sign used to indicate a switch located on a wall or end of an equipment frame should be yelloowed out to indicate the switch was removed.

3.7 The following is a suggested means of symbolically indicating on office records what is to be or was added to existing lighting arrangements: MS1, MS2, etc. can be used to indicate a
motion sensor with the numeric suffix indicating the type of sensor added.

3.8 A simple hash mark placed across a conduit run should be used to indicate the approximate location of where motion sensor or a related electrical box was added. A note on the office record, or affixed to it, should be used to communicate by manufacturer and model/part number the type of motion sensor added to the lighting arrangement.

4. Scope of Retrofit Activity

4.1 In some cases switching for low intensity lighting circuits may be located on equipment frame end guards. For these applications switch and circuit wiring should be routed to allocation above the equipment room point of entry where a motion sensor can be used to control low intensity lighting circuit(s). It is acceptable however to locate motion sensors along equipment main cross aisles if deemed more appropriate.

4.2 Where ambient or equipment lighting conditions are appropriate, low intensity fixtures at the ends of equipment aisles should be reassigned to the aisle’s regular lighting circuit so the entire aisle lighting is controlled by the dynamic technology. However, in some situations, a separate switch to control low intensity lighting (stumble lighting) may be allowed to provide coverage in gap areas and to allow a safe exit pathway.

4.3 The following activities are considered normal for integrating dynamic switching into existing network equipment areas:

4.3.1 Disassembly and reassembly of existing main and end aisle conduit configurations and the first/last two fixtures in an equipment line to access circuit and switch wiring leads and mount sensors,

4.3.2 Removal of toggle switches rendered inoperable by the addition of motion sensors from equipment frame end guards and covering the end guard opening with a blank switch plate.

4.3.3 Testing and adjusting sensor monitoring to ensure locally desired proper operation.

5. Ballast and Lamp replacement recommendations

5.1 General replacement of existing ballasts is not within the scope of this Practice. However, if during the retrofit activity it is determined that the existing ballast is potentially unsafe or very old (passed the normal life expectancy), the ballast shall be replaced at the same time that the dynamic switch is installed.

5.2 When it is determined that ballast needs replacement, the program rapid start electronic ballast for T8 lamps shall be used. When upgrading from T12 to T8 lamps, a label must be posted to specify the changes made from the previous ballast and lamp to the new product.

6. Reference is made to other TPs to which this TP may have impacts:

a) TP76300
b) TP 76400
7. Wiring and Installation References

Figure 1 – Traditional Fixture and Switch Wiring Schematic – Normal Lighting

Figure 2 – Traditional Fixture and Switch Wiring Schematic – Low Intensity Lighting

(otherwise same as Figure 1)

Figure 1 and 2 (above) illustrate how lighting fixtures are generally wired in equipment lineups having rolling ladder track type integrated lighting fixtures. Figure 1 and 2 are also generally applicable to equipment lineups having box type continuous or incrementally spaced lighting fixtures.
Figure 3 – Typical Airey Thompson Sentinel Lighting Fixture Wiring  
(fixture with dual loads shown)

Figure 4 – Typical Fixture and Switch Wiring Schematic of For Airey Thompson Sentinel  
Lighting Fixture  
(fixture with dual loads shown – otherwise same as Figure 3)

Figure 3 and 4 illustrate how equipment lineups having the Airey Thompson Sentinel Lighting  
brand of lighting fixtures are generally wired. The dual load arrangements shown in Figures 3 and  
4 are only applicable to equipment lineups setup for low intensity or emergency lighting conditions,  
generally every other equipment lineup. Fixtures are wired to “regular load” wiring in equipment  
lineups not setup for low intensity or emergency lighting conditions.
Figure 5 – Typical Low Voltage Sensor Wiring Schematic

Figure 6 – Typical Wiring of Low Voltage Sensors Into Lighting Arrangements

Figure 5 and 6 illustrate how low voltage motion sensors and their associated switch packs are generally wired. Wire colors may vary by manufacturer.
SENSORS WIRED IN PARALLEL

Figure 7 – Typical Wiring of Line Voltage Sensors

Note: The line/hot lead can be broken midway of very long aisles such as main distributing frames so only a portion of the fixtures are energized when the aisle is entered.

Figure 8 – Typical Wiring of Line Voltage Sensors Into Traditional Lighting Arrangements
Figure 9 – Typical Wiring of Multiple Line Voltage Sensors Into Airey-Thompson (Sentinel) Fixtures. This diagram is for very long isles where multiple sensors are required. The Airey-Thompson 5507 (Circuit Reassignment Kit) may be used to reassign any existing low intensity fixtures to the aisle’s regular lighting circuit (Reference Paragraph 4.2). When all fixtures are assigned to the regular lighting circuit (Black & White wires), the existing red wire is available for use to provide line power to the un-switched side of the sensors.

Figure 10
Typical wiring of a single sensor controlling all the Airey-Thompson fixtures in a row

The incoming feed for the High Level circuit is connected to the sensor upstream from the fixtures. Connect the black and red fixture wires to the 'Load' side of the sensor. Combine all neutrals. Now the High Level and Low intensity circuits have been combined into a single circuit controlled by the sensor.
Figure 11

Typical wiring of a single sensor controlling high level Airey-Thompson fixtures and allowing a separate Low Intensity (stumble lighting) circuit

The incoming feed for the High Level circuit is connected to the sensor upstream from the fixtures. The 'Load' side of the sensor is connected to the black wire. If a Low Intensity circuit is being preserved, it may remain unchanged. If a stumble light is being added to the row, it may be wired as shown.
Figure 12 – Typical Wiring of Mechanical Timers Into 3-Way Switched Lighting. This is a wiring diagram for use with a Single sensor that allows a low intensity circuit. It illustrates the typical wiring of mechanical timers. The red runners shown through fixtures will be yellow for the Airey Thompson's Sentinel Lighting fixtures.

Figure 13 – Typical Mounting of Fixture Mount Sensors (Airey-Thompson 5511-S1 shown)

Generally, fixture mount sensors have an integral 1/2-inch chase nipple and nut for mounting to a box or surface with a 1/2-inch knockout (13/16” hole).
Figure 14 – Typical 55 Series Retrofit Sensor Kit
(Airey-Thompson 5511-S1 shown)
Figure 15a and 15b - below illustrates dynamic switch layout of job done at AT&T Mobility in Phoenix, Arizona (Example).

Figure 15a represents typical central office equipment layout and aisle lighting record drawing with dynamic switch locations.
Figure 15b (below) provides a close look of dynamic switches and wiring layout

Below provides general construction notes:

1. COORDINATE FIXTURE LOCATION WITHIN AISLE ON AN AISLE-BY-AISLE BASIS WITH AT&T MOBILITY PRIOR TO ROUGH-IN AND MOUNT FROM EXISTING AUXILIARY FRAMING. COORDINATE WITH AIREY-THOMPSON FOR APPROPRIATE MOUNTING HARDWARE.

2. INDICATES LUMINAIRE WITH INTEGRAL MOTION SENSOR.

3. INDICATES AN UNSWITCHED LUMINAIRE (BASED ON MODEL SPECIFIED AND WIRING SHOWN).

4. INTEGRATE CEILING MOUNTED OCCUPANCY SENSOR (WATTSTOPPER UT-355-1) WITH EXISTING LIGHTING IN THIS ROOM.

5. REPLACE LAMPS AND BALLAST IN EXISTING LUMINAIRE WITH NEW TO MATCH THAT SPECIFIED FOR SIMILAR NEW LUMINAIRE TYPE "L36".

6. EXISTING INVERTER CONDUIT INSTALLED LOW IN THIS AREA AREA SHALL BE RELOCATED TO A HIGHER ELEVATION. TRACE CIRCUIT AND COORDINATE CUT-OVER WITH AT&T MOBILITY. FOR BID PURPOSES ASSUME THAT COMPLETELY NEW CONDUIT/WIRING WILL BE INSTALLED FOR SHORT DURATION CUT-OVER AT THE TERMINATION POINTS.

(Figures will be updated and/or expanded to agree with final product selection and installation decisions).