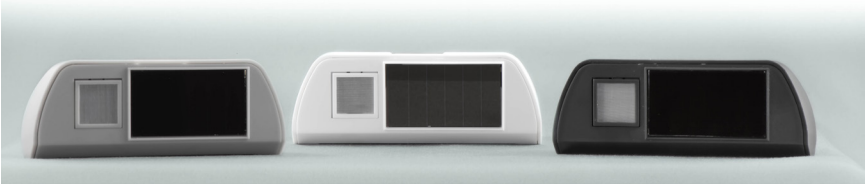# OPEN LOOP CCT SENSOR
## Installation Guide



## Overview

The package includes the open loop CCT light sensor and installation guide. This guide covers all models of FLS-41 sensors.

The FLS-41 product family includes:

FLS-41U* Open Loop CCT Sensor, 902 MHz radio

FLS-41Y* Open Loop CCT Sensor, 868 MHz radio

FLS-41J* Open Loop CCT Sensor, 928 MHz radio

The * symbol represents the color variant where W=White, B=Black and G= Aluminum

## Sensor Description

The FLS-41 Open Loop CCT Light Sensor, (also referred to as the sensor in this guide) is a wireless, energy harvesting sensors that monitor exterior light levels up to 100,000 Lux (9,290 fc). The sensor mounts on the interior window mullion facing outdoors and can be mounted on any of the four window edges.

The FLS-41 sensor monitors Correlated Color Temperature (CCT) and light intensity. The color temperature range is 2,000 to 7,500 degrees Kelvin with a resolution of ± 10 and an accuracy of ± 100 Kelvin. The FLS-41 supports standard and generic EnOcean profiles. The sensor transmits the monitored values in 100 second intervals or whenever the daylight level changes by more than 3%. Facilities wishing to deliver a superior office experience through automated adjustment of an LED fixture's tunable white color output and dimming capability, now have a solution that responds dynamically throughout the day.

These sensors are intended for indoor use only.

## Sensor Operation

The sensor transmits messages containing the data values. The sensor must be installed within 24m (80') of any linked receivers, gateways or lighting controllers. For applications exceeding this range, telegram repeating may be needed to extend the range.

The FLS-41 photo sensor supports the following standard EnOcean equipment profiles:

| | |
|---|---|
| EEP D2-14-25: Light Sensor and CCT | DB0 .. DB2.0 : 0-100,000 lux |
| | DB2.1 .. DB3: CCT 0-32,767° Kelvin |
| EEP A5-06-04: Curtain wall brightness sensor | DB0.4 - DB0.7: Battery Level 0-100% |
| | DB1 .. DB2: 0-65535 lux (6090 FC) |
| | DB3: Temperature, UNUSED |
| Generic Profile Telegram | DB0 .. DB1: CCT 0-10,0000 Kelvin |
| | DB2 .. DB3: 0-100,000 lux |

### Heartbeat and On-Change Behavior

The sensor will sample and record new sensor values based on current light levels and stored energy level. The sensor will repeatedly transmit data messages on a heartbeat timer. In normal operation the heartbeat period is ten times the sample rate. The sensor will also transmit the data message on-change when the data value exceeds 12.5% from an averaged value.

For a on-change telegram to be sent by the sensor, there needs to be sufficient power:

- Stored energy must exceed 3.5 V or
- Ambient light level must be above 300 lux

The sensor compares the current sampled value to an averaged reading. If the difference is greater than 12.5%, the sensor transmits the new value immediately.

The averaged reading is derived by using a formula*.

LUX avg = (3 * LUX avg + LUX new value) / 4

The equation assures  that if a large step change occurs, the sensor may send out several messages at its sample rate before returning to the normal heartbeat period.

If both the averaged lux reading and the current lux reading are less than 50 Lux, the on-change behavior will be disabled.

The FLS-41 will change its sample rate depending on current light levels. The sensor uses the greater of the two values, current sample or averaged lux value to generate the sample rate.

| Lux Value | Sample Rate | Heartbeat Period | FC value |
|---|---|---|---|
| < 50 | 128 seconds | > 21 minutes | < 5 |
| < 100 | 64 seconds | 10 minutes | < 10 |
| < 100-200 | 32 seconds | 320 seconds | 10-19 |
| > 200 | 16 seconds | 160 seconds | >19 |

* On-change behavior for CCT is determined in a similar way as the LUX level. If a large step change of the color temperature occurs, the CCT in degrees Kelvin can be smoothed out using a higher sample rate with an average reading determined by a formula.
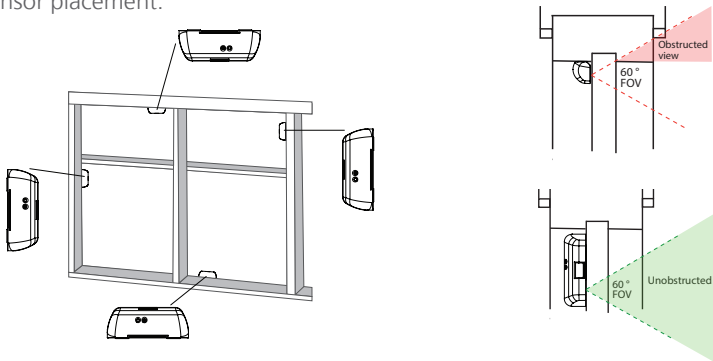
## Mounting the Sensor

The sensor is designed for open loop daylighting or color tuning operation and must be installed facing directly through the glass with no obstruction.

When determining an appropriate mounting location, refer to the *Wireless System Layout Hints* and the *Test Operating Modes* sections of this guide.

- Ensure the glass in front of the sensor is clean. Dirt can cause an obstructed view.

- Position the sensor right up against the window to ensure reflections from interior lights do not affect the sensor readings

- Consider the Field Of View (FOV) of the sensor (FOV - 60 ° cone angle - horizontal, vertical) and ensure no mullions or overhangs outside the window block or shadow the sensors FOV

The sensor mounts horizontally or vertically on the window mullion. The mounting location of the sensor is important as this will directly affect the receivers reception of the sensor messages.
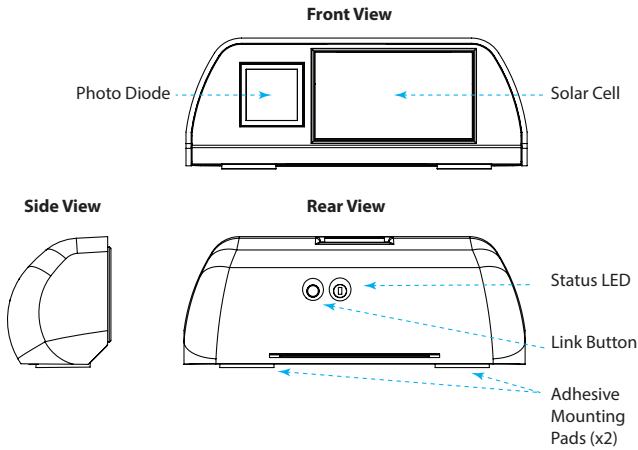
See the sections on *Light Level Test* and *Range Confirmation* in this guide to aid in optimal sensor placement.

## Installation Instructions

1. Clean the surface where the sensor is to be mounted with an alcohol wipe then ensure the surface is thoroughly dry before applying the sensor.

2. Remove the plastic film from the adhesive mounting pads and position the sensor over the planned mounting position.

3. Press down firmly on the sensor to adhere the pads to the cleaned surface. Hold the sensor in place with reasonable force for 30 seconds.

4. Refer to the next section titled *Linking the Sensor to a Receiver.*

## Linking a Sensor to a Lighting Controller or Receiver



**Front View**

Photo Diode

Solar Cell

**Side View**

**Rear View**

Status LED

Link Button

Adhesive Mounting Pads (x2)

Echoflex offers pre-commissioning services which includes linking sensors and switches to controllers before shipping to site.  If pre-commissioning was not performed, the sensor must be manually linked to the controller or receiver. This process requires the controller or receiver to be installed, powered and within range of the sensor.

1. Activate LEARN mode at the receiver/controller, if necessary refer to the devices documentation.

2. Tap the sensors LINK button once.

3. Deactivate LEARN mode at the receiver.

> **i** **Note:** *If the sensor is already linked to an Echoflex controller, repeating the link actions will UN-link the sensor from the controller*

## Wireless System Layout Hints

- Avoid locating transmitters and receivers on the same wall

- Avoid locating transmitters and receivers where the telegrams must penetrate walls at acute angles. This increases the material the telegram must pass through reducing the signals power

- Avoid large metal obstructions as they create radio shadows. Place receivers in alternate locations to avoid the shadow or use repeaters to go around the obstacle

- Do not locate receivers close to other high frequency transmitters

## Test Operating Modes

The following tests or modes can be selected:

1. Light level test
2. Range confirmation test
3. Daylight harvesting commissioning mode
4. EEP Select Mode

**Light Level Test:** This test indicates how much light is available for charging and how much time is required for charging.

1. To enter Light Level Test mode, press and hold the teach button until the green LED begins to blink (about 6 seconds - see diagram on page 4 for location of LED).

2. Press and hold the teach button again until the green LED stops blinking, about 6 seconds. The green LED will start blinking faster in accordance to the light level it is detecting. In this mode the unit will indicate how much light is available for charging.  The green LED will blink a number of times to indicate the light level available. See table below.

| Blinks | Description | Lux | Hours to full charge | Hours /day to maintain charge |
|--------|-------------|-----|----------------------|-------------------------------|
| None | Below operating level | <80 | N/A | N/A |
| 1 | Min. Level for operation | > 80 | N/A | N/A |
| 2 | Operational, charging | > 200 | 30-60 | 8 |
| 3 | Operational, charging | >400 | 15-30 | 4 |
| 4 | Operational, charging | 800 | 7-15 | 2 |
| 5 | Operational, charging | 2000 | 3-6 | 1 |

The test will repeat every 2 seconds and run for a duration of 100 seconds. You may quit the test at any time by pressing the teach button for 6 seconds.

**Range Confirmation® Test\*:** Provides visual feedback of the sensors signal strength by a linked Echoflex controller.

| | **Note:** | • *The sensor must be at full charge before running this test* <br> • *Disable all repeaters in range* <br> • *The sensor should only be linked to one controller when running the test* |
|---|---|---|

1. To enter Range Confirmation® Test mode press and hold the teach button until the green LED begins to blink (about 6 seconds)

2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the blue LED is blinking, go to step 3

3. Press and hold the test button again for 6 seconds to select Range Confirmation Test

All three LED's will blink on and off quickly for a second followed by a pause, then repeat. When the sensor receives a range confirmation message from the linked controller, the sensor displays the signal strength status for 2 seconds, see table below.

| LED - blinking | Signal Strength | Status |
|---|---|---|
| Green | -41 to -70 dBm | Best |
| Blue | -70 to -80 dBm | Good |
| Red | -80 to -95 dBm | Not ideal, try moving sensor closer |
| None | No linked controllers detected. Move sensor closer or add telegram repeating | |

\* Requires an Echoflex Solutions controller with Range Confirmation®  capability.

The test will repeat every 10 seconds and run for a duration of 50 seconds. You may quit the test at any time by pressing the test button for 6 seconds.

**Commissioning Test Mode:** This demonstration mode accelerates the heartbeat period for telegrams to 16 seconds for a duration of 100 seconds, then goes back to normal operation

| | **Note:** | *The sensor must be at full charge before running this test* |
|---|---|---|

1. To enter Commissioning Test Mode, press and hold the teach button until the green LED begins to blink (about 6 seconds).

2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the red LED is blinking, go to step 3.

3. Press and hold the test button again for 6 seconds to select Commissioning Test Mode.

**EEP Select Mode:** EEP select mode allows the operator to change the telegram type. The FLS-41 model allows selection between Curtain Wall Brightness Sensor, the standard EnOcean profile with light intensity and correlated color temperature or a Generic Profile type that includes the intensity and CCT plus supply voltage.

To enter EEP selection mode:

1. Press and hold the teach button until the green LED begins to blink (about 6 seconds).

2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the blue and red (violet appearance) LED are blinking, go to step 3.

3. Press and hold the test button again for 6 seconds to select EEP selection mode. The blue LEDs will blink between 1 and 3 times depending on the EEP selected.

4. A quick press and release of the button at this point will allow you to cycle through the EEP modes. Press and hold the test button again for 6 seconds to select the desired mode.

| Mode | EEP Selection - see Sensor Operation section for details | Blue LED blinks |
|:---:|---|:---:|
| 1 | EEP A5-06-04: Curtain Wall Brightness Sensor | 1 |
| 2 | EEP D2-14-25: Light Sensor and CCT | 2 |
| 3 | Generic Profile | 3 |

You may quit EEP select mode at any time by pressing the test button for 6 seconds.

## Energy Code Compliance

California Energy Commission Title 24
Washington State Energy Code
ASHRAE 90.1-2013
IECC 2015
The FLS sensor is built in an ISO9001 certified facility and is RoHS compliant

## Agency Listings

FCC Part 15.231 (902 MHz models only)

Contains FCC ID: TCM300U

The enclosed device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

(I.) this device may not cause harmful interference and

(ii.) this device must accept any interference received, including interference that may cause undesired operation.

IC RSS-210 (902 MHz models only)

Contains IC: 5713A-STM300U

CE (868 MHz models only)

CE Marking

ARIB STDT108 (928MHz models only)

Complies with the Japanese radio law and is certified according to ARIB STDT108. This device should not be modified (otherwise the granted designation number will become invalid)

**R 206-000372**

End of life: Must be taken apart to recycle: Plastic case - 7 / Remove PCB assembly