Overview

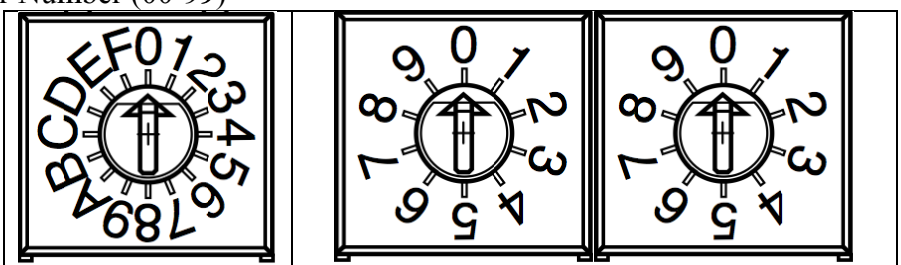
Stairwell LED lighting compliant with modern standards, with occupancy sensor, battery backup, and RF system for linking multiple lights.

Goal

- Compliant with ASHRAE 90.1-2010
- Compliant with NYC LOCAL LAW 47
- Vandal-resistant
- Easy to install
- Occupancy Sensor
- Wireless RF system to link multiple fixtures for occupancy sensing
- Battery backup

Requirements

- Use occupancy sensor to reduce lighting to 6W when unoccupied
  - Adjustable timeout (after last occupancy, light level returns to dimmed(Range 15 Seconds to 15 Minutes)
- Max Power 40W
- Ability to work with wireless remote PIR (To be developed later)
- Use wireless RF system to link fixtures
  - Use rotary (screwdriver set) switches on fixture to set Stairwell Number (0-F) and Floor Number (00-99)



Stairwell Number | *Floor Number*

  - Occupancy on one floor triggers one floor above and one floor below within same Stairwell.
- Battery backup
  - Operate for 90 minutes at 50% light output
  - Occupied & RF functionality the same as while on mains (dimming).
  - 8-12H battery charge time
- Test switch
  - Disconnects main supply via relay (on 10VDC line) for 30 seconds (or more

if pressed for longer). Controller monitors battery voltage etc and returns status of test on test LED.
Labeled according to UL ("Diagnostic")

- Status LED(s)
  - One LED for self-diagnostic result
  - One LED for status (AC/battery charging)
- Agency approvals
  - UL 924 rated - EMERGENCY LIGHTING AND POWER EQUIPMENT
    - NFPA 101 compliant (UL rating covers this)
  - FCC certified (RF transmitter& EMC)
- AC input: 90-277VAC 50/60Hz.
- Meets DLC requirements
  - Power Factor >0.9
  - THD<20%.
  - Min. lumen output :2000 lm
  - Zonal lumen: >85% 0-90°
  - Min. efficacy: 70LPW
  - CCT<5700K
  - Min CRI: 65
  - L70: 50,000hours
  - Warranty: 5years

Power Supply Components

Light Engine

Use up to 32W light engine:

- 12x9 LEDs
- Vf< 36V
- If =<900mA

New power supply design to support charging battery and powering LEDs. Combining the functions to save cost.

Wireless

New low-cost sub-GHz wireless system to be developed using CC430. Same micro will act as system controller.

Occupancy Sensor

Use AS081 chip and new lens from XCO-100.

Functional Specification

Normal (AC mains) operation

- LEDs always on at 6W level
- Occupancy sensed – LEDs on to Max power with adjustable timeout.
- RF system (Microcontroller) broadcasts occupancy sensing to all fixtures on same channel code – all fixtures respond to all occupancy events.
- Battery charging
  - Microcontroller monitors battery, applies maintenance trickle charge when fully charged.
- Test switch
  - Momentary switch
  - Test controlled via Microcontroller
  - Test lasts at least 30 seconds, but longer if switch is held down longer
  - Internal relay interrupts DC side of PSU for test
- Test LED – bi-color Red/Green

Test LED function	RED	GREEN
Diagnostic FAILED	ON	OFF
Diagnostic PASSED	OFF	ON
Diagnostic in progress	Alt-flash	Alt-flash

- Status LED – bi-color Red/Green

Status LED function	RED	GREEN
AC Good, battery charged	OFF	ON
AC Good, battery charging	OFF	Flash
AC off, on good battery	ON	OFF
AC off, battery low	Flash	OFF
Battery FAULT	Alt-flash	Alt-flash

Battery fault can be:

- Battery is failing to charge. Determined by microcontroller that battery voltage is too low and not increasing at all or fast enough
- Battery voltage is too high, indicating an open circuit or bad cell or disconnected battery pack
- Battery Temp too high or too low.
- If battery fault continues for more than one minute, it's assumed there's no battery in the fixture (non-backup version) and the Test light is turned off.

On-Battery operation

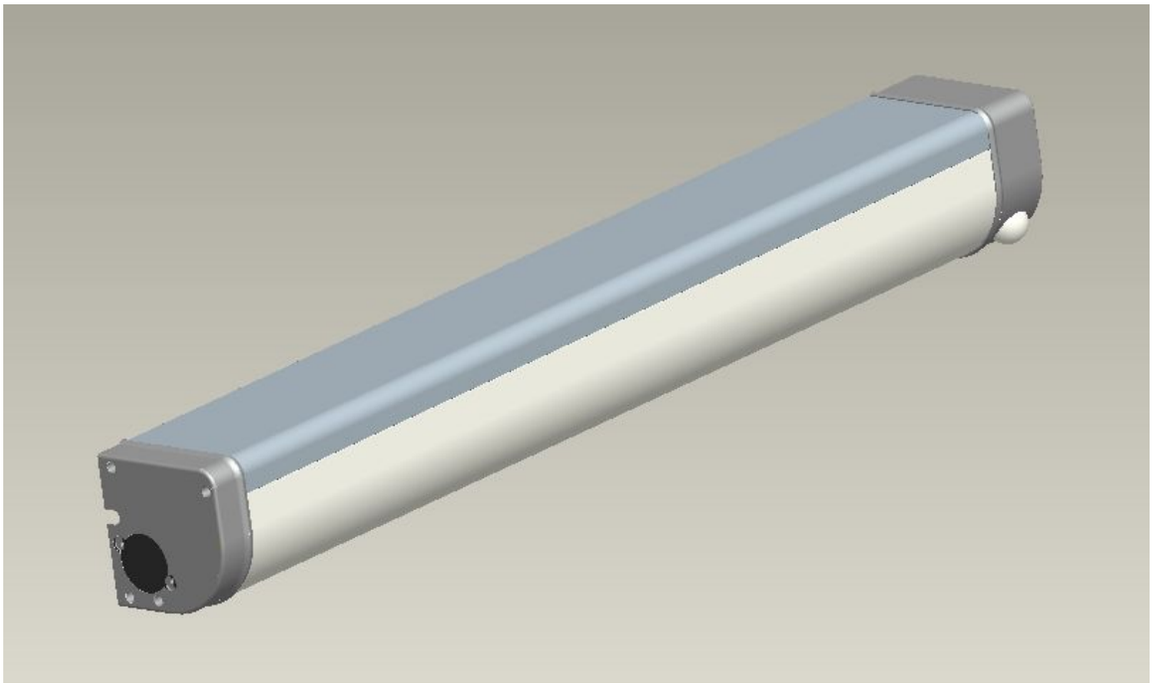
- LEDs always on at 6W
- Occupancy sensed – LEDs on at 50% power level with variable timeout.

- RF system – same as on AC.
- Test switch
  - Non-operational
- Test LED – bi-color Red/Green
  - Indicates status of last test – see function table above
- Status LED – bi-color Red/Green
  - See function table above

RF operation

- Three encoders
  - Encoder one actually sets one of 16 RF channels
  - Encoder two and three sets an 8-bit address.
  - The user just treats this as a two-digit 'channel code', in this case the same as the floor number.
  - Depending on system testing, we may change the functionality (for example, keep all traffic on one RF channel…) so it's better not to expose this detail to the user
  - A fixture will respond to motion events from fixtures on the same floor, or one floor above or below.
- Uses CC430 with integrated CC1101 radio
  - Implement simple broadcast flood meshing
    - Packet has a hop-count field, we have a fixed system hop-count 5 max.
    - When radio rx's a packet it decrements the hop count and retransmits the packet unless the hop count is 0.
    - Use collision avoidance built into radio
  - Proprietary XRF packet format
    - Allow for future options
    - Allow for gathering status from fixtures
    - Allow for use of broadcast address for queries
    - Broadcast 'groups' are the floor number settings
    - Motion events are broadcast to cut down on-air time
    - Flexible 'report' packets, i.e. power status
  - CC430 has built in UID, use it for our network UID.
- Production test support
  - serial port status output

Mechanical



End caps to comply with UL HB or ar required by UL/NFPA

End cap Color Gray similar to Pantone 429U

IC NOTE:

This device complies with Industry Canada licence-exampt RSS standard(s):Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device."

FCC NOTE：

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV

INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS OR CHANGE

TO THIS EQUIPMENT. SUCH MODIFICATIONS OR CHANGE COULD VOID AND

CHANGE ANNTENA WHICH THE MANUFACTURER PROVIDES.

IT IS THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a resi dential installation. This equipment generates, uses and can radiate radio frequenc y energy and, if not installed and used in accordance with the in structions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular insta llation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to corr ect the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experien ced radio/TV technician for help.

To maintain compliance with FCC’s RF exposure guidelines, this equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.