LUTRON®

For Your Information ...

Hyperion™ with Cloudy Day Sensor Application Note

Reasons for Exterior Sensors

Daylight is a variable natural light source. The amount of harvestable daylight in a space varies in two ways:

- Predictably based on time of day, year and geographic location of a building.
- Unpredictably due to atmospheric light blocking by clouds and inclement weather.

Hyperion uses an astronomical clock and the geographic location information of a building to very accurately adjust shades to account for the rising and setting of the sun, its angle, and intensity throughout the day. Once programmed, this process does not require any outside input to operate accurately.

The unpredictable attenuations of daylight due to clouds and weather can be accounted for by adding an exterior light sensor to the system. When the daylight level no longer affects interior lighting, normal Hyperion shade movements will be paused and all shades will be sent to a visor position. If the daylight level rises again, Hyperion will activate and the shades will return to the optimum position.

By combining the astronomical clock of Hyperion with an external sensor, daylight will be more efficiently harvested and the occupants of the space will be more comfortable.

About Light Sensors

Sunlight is made up of only 50% visible light. Two types of sunlight sensors can be used in this application:

- Photosensors measure the light intensity of visible light only
- Radiometers measure total solar radiation, including visible, IR and UV light

Lutron recommends the use of photosensors to sense exterior light, because they are less affected by invisible infrared (IR) and ultraviolet (UV) light. IR and UV light are attenuated differently by moisture compared to visible light. This means that the sensor level will vary unpredictably in moist weather conditions when IR and UV light are absorbed, but visible light may not be. Sensing visible light only is the best approximation of daylight as seen by the human eye.

Sensor Position

To effectively measure exterior daylight levels, the sensors must have an uninterrupted view of the sun. Placing sensors in a location with an obstructed view will cause unreliable operation of the system that depends on the sensors signal.
The sensor must not be affected by the movement of the shades that are being controlled or the artificial light created by the building. If the sensor is affected by what it is controlling, the sensor will provide inaccurate and unreliable readings.

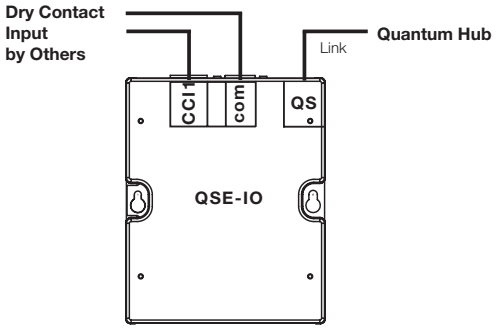
Rooftop structures (HVAC Units, etc) can cause inaccurate readings if they obstruct the view of the sky and cast shadows onto the light sensor.

Multiple sensors provide the best way to maintain a direct and uninterrupted view of the sun. Generally, one sensor should be placed facing in the direction of each façade of the building.

Snow, ice and condensation buildup can also affect the sensors view of the sun. Positioning and mounting the sensor correctly is the most important factor in achieving proper operation. Depending on the environment, the sensor may need to be cleaned periodically throughout its life.

Sensor Hardware

The interface to Quantum for the cloudy day sensor is made via dry CCI input. Any sensor that can provide a CCI output and has the appropriate range and sensitivity can be used to activate Cloudy Day mode. Lutron recommends the use of sensors and controllers made by PLC Multipoint. The sensors are available from Lutron under the model numbers QS-CES-R and GRX-LC8.



The LC8 is a single channel sensor controller that features individually adjustable ON and OFF set points. The controller features a single dead band to ensure lighting stability. Timing delays are programmable and adjustable through the Hyperion system. Instructions for using this sensor for cloudy day functionality are provided below.

The recommended sensor (QS-CES-R) has the following specifications:
- Minimum light level range: 0-2500 ft-candles (0-27000 lux)
- Minimum sensitivity: +/- 25 ft-candles
- Rated for continuous outdoor service.

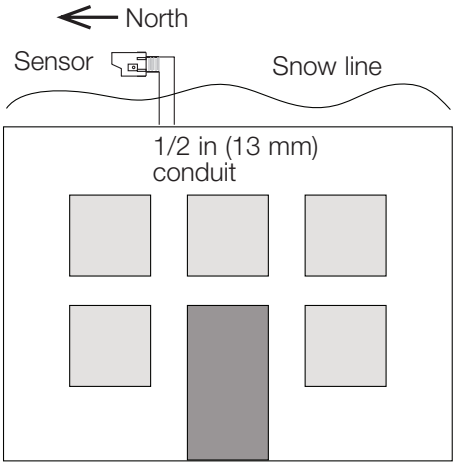
The recommended controller (GRX-LC8) has the following specifications:
- Individually adjustable on and off thresholds with analog adjustment screws
- Integrated dry contact closure relay
- Deadband operation – CCI opens when sensor value goes above off threshold and closes when it goes below on threshold.

Installation:

Mount the LC8 controllers and QSPS power supply in the same location as the QSE-IO unit using the adhesive strips provided. Choose a location where the QSPS series power supply can be provided with power. Up to four controllers can be powered by one QSPS plug in power supply.

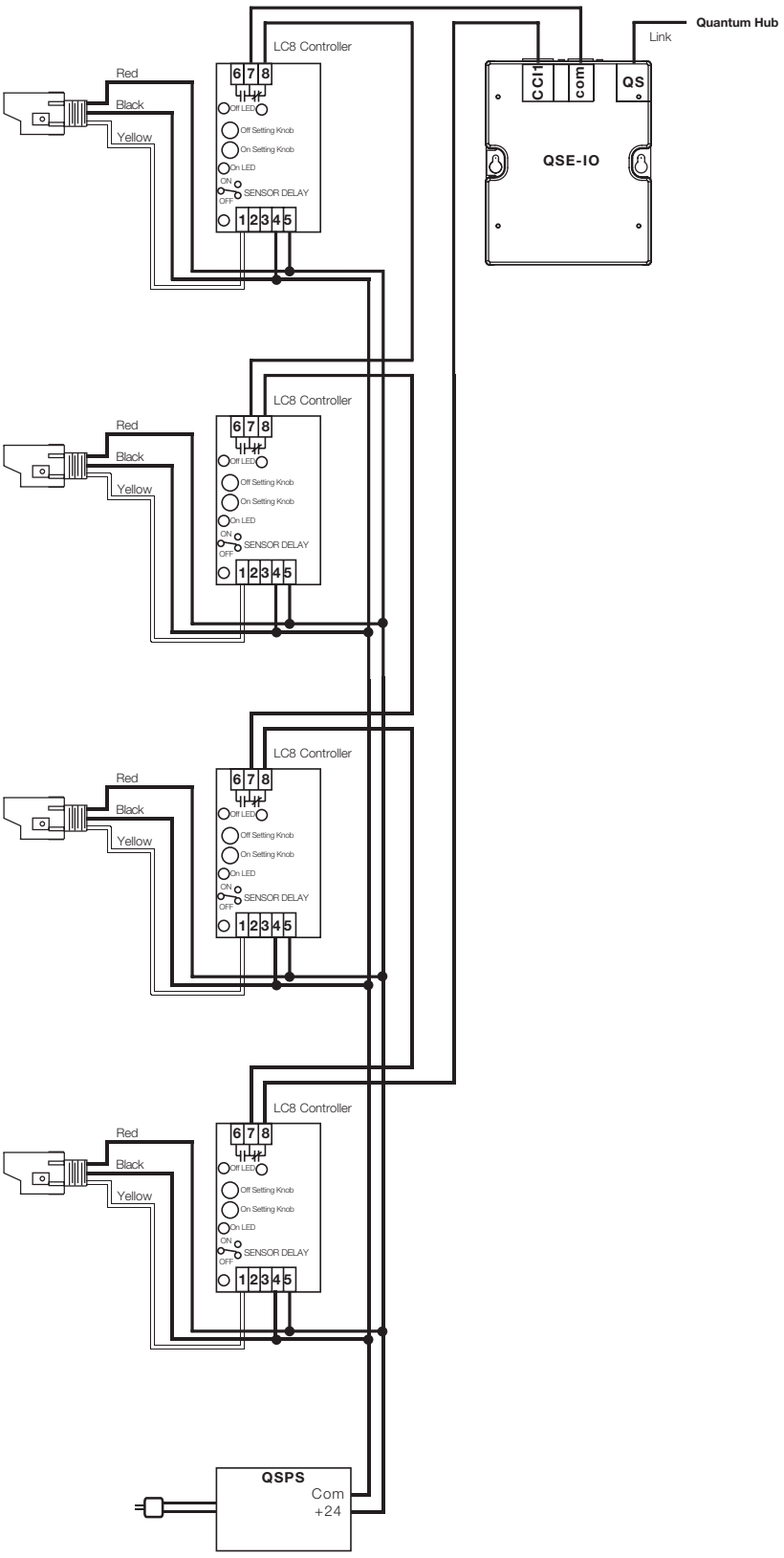
Install the QS-CES-R sensors on the roof of the building pointing in the direction of each façade. The sensors are designed to be screwed into ½" conduit facing the horizon with the hood protecting the sensor element from precipitation and dust.

Use 18 gauge wire minimum for connecting the sensors on the roof.



Mounting QS-CES-R

Wiring Diagram:



Programming:

Cloudy day functionality will be added to the Hyperion software package when the system is set up. To add cloudy day to an existing Hyperion system, contact the Lutron Field Service to have Hyperion updated.

Calibration:

The goal of sensor calibration is to pick a set point level that corresponds to the threshold of comfort for natural light inside the building. Each installation will have a different threshold value depending on its mounting location relative to the building and the occupants. Since the optimum set points will vary from job to job, the starting point is only used as a guideline. The sensors should be calibrated to meet the preference of the customer during the initial occupancy. The controller(s) should be mounted where they will be easily accessible to the building administrators and maintenance personnel for adjustment.

The QS-CES-R sensor is pre-calibrated to the light levels required for rooftop operation. No adjustments can be made on the QS-CES-R.

Calibration can be made with either an iterative process or during a predictable transition in sunlight, like sunrise or sunset.

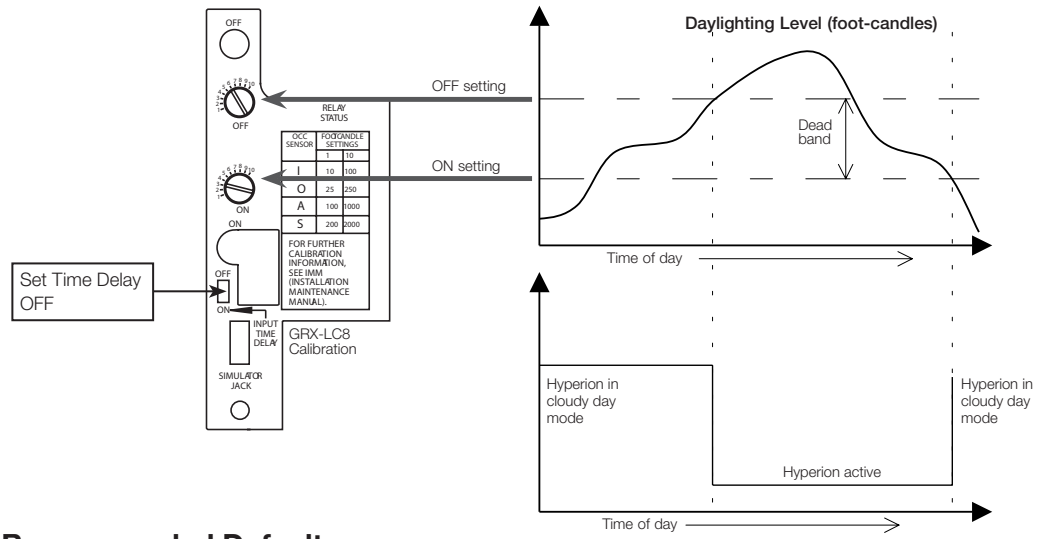
Iterative Calibration:

Calibration in the field is performed by adjusting the knobs labeled “On” and “Off” inside the QS-LC8. Below is a legend showing the foot-candle values, which correspond to the positions on the adjustment knobs inside the GRX-LC8. Each GRX-LC8 will have to be calibrated to the conditions of the location.

Adjustment Knob Setting (volts)	Corresponding Foot-Candle Set point
1	250
2	500
3	750
4	1000
5	1250
6	1500
7	1750
8	2000
9	2250
10	2500

In order to accurately adjust the GRX-LC8 for use with the Cloudy Day sensor, it is recommended to use a PC Simulator. The PC Simulator plugs into the port labeled “SIMULATOR JACK.” A digital voltmeter plugged into the PC Simulator will show the accurate calibration voltage, which corresponds to the knob setting and a foot-candle value. Use the following steps to adjust the On and Off threshold to the starting values given below.

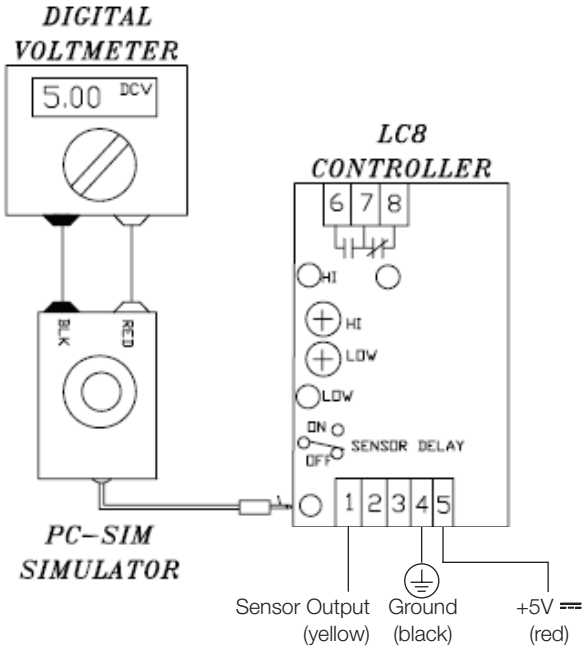
During initial occupancy, adjust all 8 set points up or down by 0.25 volts at a time depending on comfort. If the shades are closed too often on cloudy days, adjust the levels up. If the shades are open too often on cloudy days, adjust the levels down.



Recommended Defaults:
On set point: 2.25 V (565 ft-candles)
Off set point: 2.50 V (625 ft-candles)

Iterative Calibration (continued):

1 Connect the power to the GRX-LC8 Controller as shown in the wiring diagram
2 Remove the cover of the GRX-LC8 and connect the PC Simulator and digital voltmeter as shown in the diagram below
3 Set the voltmeter to a range that will show 0-10 VDC with resolution to at least 1/10th of a volt (0.0v) or better.
4 Adjust the knob on the PC-simulator until the voltmeter shows the On setting desired
5 Using a small flat head screwdriver, adjust the knob labeled “On” to zero
6 Turn the knob slowly clockwise until the light adjacent to the knob turns on. Adjust the screw to as close to the position where the light goes from off to on as possible.
7 Repeat steps 4-6 using the Off set point and the knob labeled “Off.”
8 Remove the PC-Simulator and replace the cover of the GRX-LC8
9 Repeat for remaining LC8 controllers.



Sunrise or Sunset Calibration (Optional):

The sensors may be calibrated during sunrise or sunset on a sunny day to quickly and accurately determine the optimum threshold values for each job.

Sunrise:

- Have an observer sit at a workstation near an eastern facing window that will have direct sunlight exposure during sunrise.
- Connect a digital voltmeter directly to the sensor output between terminal 1 and 4 on the LC8 controller for the east facing sensor.
- When the sunlight exposure begins to become uncomfortable to the observer, record the reading from the sensor that is shown on the voltmeter.
- Use the calibration procedure above to reset the On and Off set points. Use the observed reading as the Off set point. Subtract 0.25 volts for the On set point.

Sunrise or Sunset Calibration (Continued) (Optional):

Sunset:

- Have an observer sit at a workstation near a western facing window that will have direct sunlight exposure during sunset.
- Connect a digital voltmeter directly to the sensor output between terminal 1 and 4 on the LC8 controller for the west facing sensor.
- When the sunlight exposure is no longer uncomfortable to the observer, record the reading from the sensor that is shown on the voltmeter.
- Use the calibration procedure above to reset the On and Off set points. Use the observed reading as the On set point. Add 0.25 volts for the Off set point.

Troubleshooting

Symptom	Probable Cause and Action
If the shades are closed too often on cloudy days	Adjust all 8 set points up in 0.25 volt increments until desired operation is observed.
If the shades are open too often on cloudy days	Adjust all 8 set points down in 0.25 volt increments until desired operation is observed.
If your system is not functioning, check for the following problems:	Check the controller power: On the GRX-LC8 controller, you should be able to measure 24 VDC between the terminals 4 and 5.
	Check the sensor power: Connect a voltmeter between its yellow and black wires. When the sensor is covered it should produce 0 V, and when it is in very bright light it should produce around 10 V. If this is not the case, replace the sensor.
	Check the controller function: The input delay switch should be off (up) With no sensor connected, all three LED's should be lit; when you short terminals 1 and 2 together, the LED's should turn off. If this is not the case, replace the controller.
	Check the controller settings: On the GRX-LC8 controller, the adjustment knob settings may be faulty. Follow the above calibration instructions to reset.

Worldwide Technical and Sales Assistance
If you need assistance call the toll-free ***Lutron Technical Support Center.*** Please provide exact model number when calling.
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