

## Motion Controlled Lighting Using with Phocos CIS Family Charge Controllers and LED Drivers

Prepared by: **Daniel Allen**, Electronics Technician  
Phocos North America, Inc.



### Abstract

This document is intended to provide solutions for a system utilizing commonly found, 3<sup>rd</sup> party motion sensors with the Phocos CIS –N/CIS-MPPT series charge controllers and CIS-DR LED buck/boost drivers to drive LEDs at specified levels based on motion sensing. Adding motion sensing to a standalone LED lighting system saves energy by utilizing the dimming function of the CIS-N/CIS-MPPT series charge controllers by providing additional light when motion is detected and saving energy when the light is less needed. This practice has the effect of extending battery life and increasing system efficiency which may allow the reduction of PV array and battery bank sizes, thereby lowering upfront installation costs.



## Table of Contents

Motion Controlled Lighting Using with Phocos CIS Family Charge Controllers and LED Drivers.....	1
Motion Sensors Tested .....	3
Motion Sensing with the CIS-DR (Driver Only).....	5
12V Systems.....	5
24V Systems.....	6
Adding Motion Sensing with the CIS-N and CIS-DR (Controller and Driver).....	7
12V Systems.....	7
24V Systems.....	8
Adding Motion Sensing with the CIS-MPPT and CIS-DR (controller and driver).....	9
12V Systems.....	9
24V Systems.....	10
Other System Configuration Options.....	11

## Motion Sensors Tested

### 1. [12V SYSTEMS: SENSOR SWITCH, SBO 10 OEX/SBO 6 OEX \(Datasheet\)](#)

The first motion sensor tested successfully by Phocos is Sensor Switch, SBO 10 OEX or the SBO 6 OEX with standard wiring (no dimming or photocell). The only difference between the two sensors is the coverage pattern which should be considered for each specific application.

The SBO xx OEX motion sensor will be used to override the dimming function and provide light when motion is detected. The amount of time the LEDs will remain on is programmable by using the push button. The only programmable functions available in the standard wiring model are listed below.

- Occupancy Time Delay
- Auto Set Point
- Minimum On Time
- Dual Tech (Microphonics)
- Lamp Information

(See [Complete Programming Instructions](#) for more detail)



Courtesy: Acuity Brands

#### a) Requirements

Other than the SBO xx OEX, the system described in this document uses either a CIS-N or CIS-MPPT charge controller in a 12 volt nominal battery system with the CIS-DR to drive the LEDs.

#### b) Specifications

In the standard wiring model motion sensor there are three wires: red, black, and white. The red wire is the low voltage power input and can connect directly to a 12 volt DC power source. The black wire is the low voltage common. The white wire is the motion state output which switches to high VDC when motion is detected and is low otherwise.

The white wire (AKA motion state output) is capable of driving up to a 200mA load. The drive current is high enough to override the sink current of both the CIS-N and CIS-MPPT to provide a high VDC to the LED driver when motion is detected.

The maximum sink current of the motion sensor is approximately 0.1mA. This allows the charge controller to override the low VDC motion state of the sensor to turn on the LEDs. In this configuration, the component with the higher dimming output will drive the dimming input of the LED driver.

	Max Drive Current	Max Sink Current
<b>SBO xx OEX</b>	200 mA	0.1 mA
<b>CIS-N and CIS-MPPT</b>	2 mA	2 mA

2. [24V SYSTEMS: WATT STOPPER, EW-205-24W \(Datasheet\)](#)

The second motion sensor tested successfully by Phocos is the Watt Stopper EW-205-24-W. The control output of this sensor is able to override the dimming output of the CIS series controllers to allow full motion control of a 24 Volt outdoor LED lighting system. This motion sensor allows has a Light Level feature which allows you to control what time of the day the sensor is active by the amount light received by the motion sensor.

The motion sensor has two programmable settings which can be adjusted by dials. The two settings are listed below.

- Time Delay
- Light Level

(See [website](#) for more details)



Courtesy: Legrand

a) **Requirements**

Other than the EW-205-24-W, the system described in this document uses either a CIS-N or CIS-MPPT charge controller in a 24 volt nominal battery system with the CIS-DR to drive the LEDs.

b) **Specifications**

This sensor consists of three wires: red, black, and blue. The red wire is the 24 Volt DC supply line for the sensor. The black wire is the common voltage for the system. And the blue wire is the control output of the motion sensor which goes high (+24V) when motion is detected and stays low (0V) when no motion is detected.

The blue wire is a control output designed to work with a lighting control system. Because of this, the control output should not be used to directly drive loads. The drive current is high

enough to override the sink current of both the CIS-N and CIS-MPPT to provide a high VDC to the LED driver when motion is detected. But the drive current is not high enough to drive an LED load.

	Max Drive Current	Max Sink Current
<b>EW-205-24-W</b>	100 mA	> 1 mA
<b>CIS-N and CIS-MPPT</b>	2 mA	2 mA

### Motion Sensing with the CIS-DR (Driver Only)

#### 1. 12V SYSTEMS- SENSOR SWITCH, SBO 10 OEX/SBO 6 OEX

This system uses the SBO xx OEX motion sensor with the CIS-DR LED driver. In the standard wiring model motion sensor there is limited functionality as the motion sensor will turn on when motion is detected whether it is day or night. Also there is no dimming function on the sensor itself.

	Function
1	Motion State Output
2	Positive Power Input
3	Negative Common
4	Negative LED Output
5	Positive LED Output
6	Dimming Input
7	Negative Common
8	Positive Power Input
9	Negative LED Input
A	Positive LED Input

#### a) Configuration

Figure 1 depicts the most basic configuration of the SBO 10 OEX with the most limited functionality. This diagram shows the standard wiring configuration of the CIS-DR (driver only) and the SBO 10 OEX along with a 12V battery and LED string with maximum drive current between 350mA 2800mA (mind the appropriate CIS-DR version for your LED string drive current). The optional features are described in section 5.

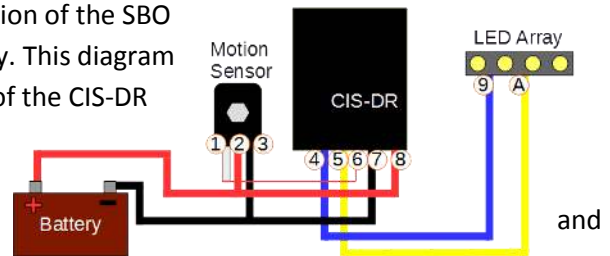


Figure 1- CIS-DR and SB XX OEX Motion Sensor (Driver Only) in a 12V System

## 2. 24V SYSTEMS- WATT STOPPER, EW-205-24-W

This system uses the EW-205-24-W motion sensor with the CIS-DR LED driver. Using this motion sensor with the CIS-DR directly is a viable option since the EW-205-24 has a built in photocell which can be adjusted so that the lights will only come on when the light is below a certain threshold.

This setup will not be able to take full advantage of the dimming capabilities since the motions sensor output can only be +24V or 0V. Also the battery would have to be charged by some other means.

### a) Configuration

Figure 2 depicts the most basic configuration of the EW-205-24-W with the most limited functionality. This diagram shows the standard wiring configuration of the CIS-DR (driver only) and the EW-205-24-W along with a 24V battery and LED string with maximum drive current between 350mA and 2800mA (mind the appropriate CIS-DR version for your LED string drive current). The optional features are described in section 5.

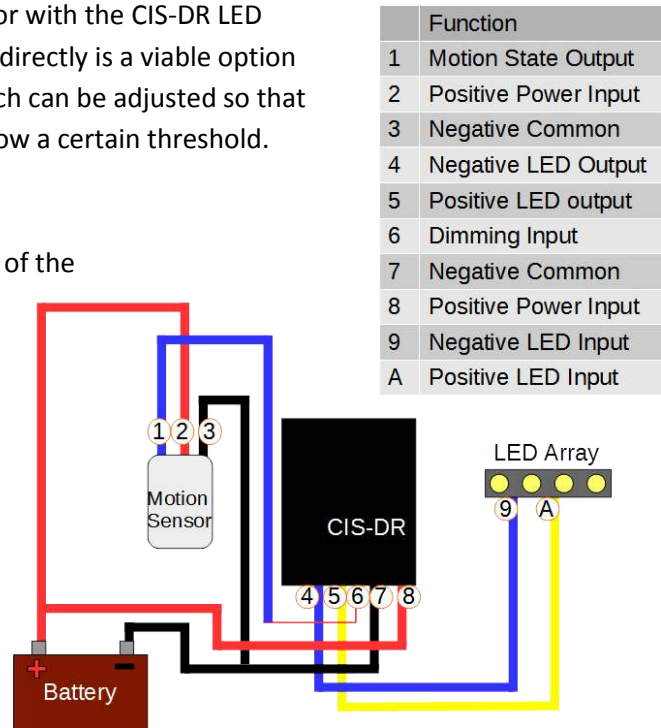


Figure 2- CIS-DR and EW-205-24-W Motion Sensor (Driver Only) in a 24V System

## 3. Advantages of CIS-DR (driver only) Configurations

- Motion activated lighting
- Simple setup

## 4. Disadvantages of CIS-DR (driver only) Configurations

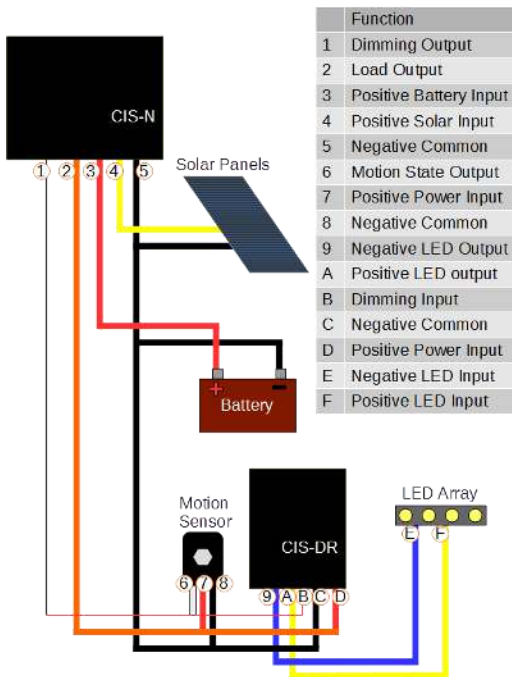
- No Day/Night detection with the standard wiring model SBO 10 OEX (LEDs will turn on during the day if motion detected. The EW-205-24-W has day/night detection)
- No Dimming (LEDs are either off or at 100%, no other options)

- No adjustable Low voltage disconnect

## Adding Motion Sensing with the CIS-N and CIS-DR (Controller and Driver)

### 1. 12V SYSTEMS- SENSOR SWITCH, SBO 10 OEX/SBO 6 OEX

This system adds the CIS-N charge controller to the Sensor Switch system with driver



only. The load output of the CIS-N is used to power the CIS-DR and SBO xx OEX. Since the load output is only “active” when night is detected, there is no chance of the motion sensor overriding the dimming output of the charge controller during daylight hours. The CIS-DR can be connected directly to the battery as long as the motion sensor is connected to the load output of the CIS-N.

#### a. Configuration

As shown in Figure 3, the CIS-DR and SBO xx OEX are powered by the load output of the CIS-N. The dimming output of the CIS-N and SBO xx OEX are both connected directly to the dimming input of the CIS-DR.

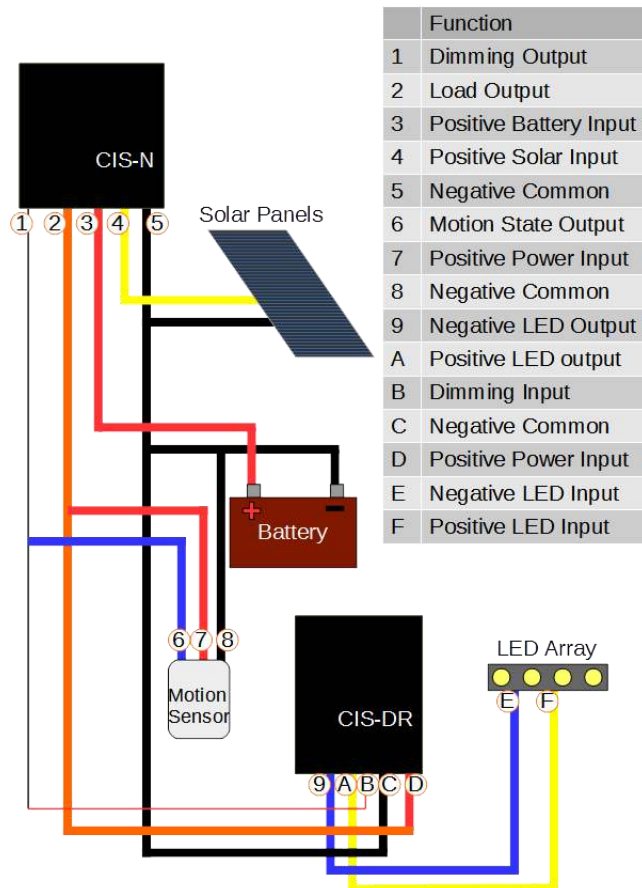
Figure 3 CIS-N/CIS-DR with Sensor Switch  
SBO xx OEX in 12V System

**WARNING:** Be sure to choose the proper LED driver for your application. You will need to match the LED driver to the amount of power consumed by the LEDs in order to avoid damaging the LEDs.

## 2. 24V SYSTEMS- WATT STOPPER, EW-205-24W

This system adds the CIS-N charge controller to the Sensor Switch system with driver only. The load output of the CIS-N is used to power the CIS-DR and EW-205-24-W. Since the load output is only “active” when night is detected, there is no chance of the motion sensor overriding the dimming output of the charge controller during daylight hours. The CIS-DR can be connected directly to the battery as long as the motion sensor is connected to the load output of the CIS-N.

### a. Configuration



As shown in Figure 4, the CIS-DR and EW-205-24-W are powered by the load output of the CIS-N. The dimming output of the CIS-N and EW-205-24-W are both connected directly to the dimming input of the CIS-DR.

**WARNING:** Be sure to choose the proper LED driver for your application. You will need to match the LED driver to the amount of power consumed by the LEDs in order to avoid damaging the LEDs.

Figure 4 – CIS-N/CIS-DR with WattStopper EW-205-24-W in a 24V System



### 3. Advantages of CIS-N and CIS-DR system with Motion Sensor

- Day/night Detection prevents light from coming on during daylight hours
- Adjustable Low Voltage Disconnect prevent deep-discharge of battery
- Dimming Functionality of CIS-N allows the CIS-DR to drive LEDs at a lower state of light (rather than off) and switch to 100% when motion sensor is tripped.

## Adding Motion Sensing with the CIS-MPPT and CIS-DR (controller and driver)

### 1. 12V SYSTEMS- SENSOR SWITCH, SBO 10 OEX/SBO 6 OEX

This system uses the CIS-MPPT charge controller. The load outputs from the CIS-MPPT are used to power the CIS-DR and SBO xx OEX. Since the load output is only on when night is detected, there will be no chance of the motion sensor overriding the dimming output of the charge controller during daylight hours. The CIS-DR can be connected directly to the battery as long as the motion sensor is connected to the load output of the CIS-N.

- a) **Configuration:** As shown in Figure 5 to the right, the CIS-DR and SBO xx OEX are powered by the load output of the CIS-MPPT. The dimming output of the CIS-N and SBO xx OEX are both connected directly to the dimming input of the CIS-DR

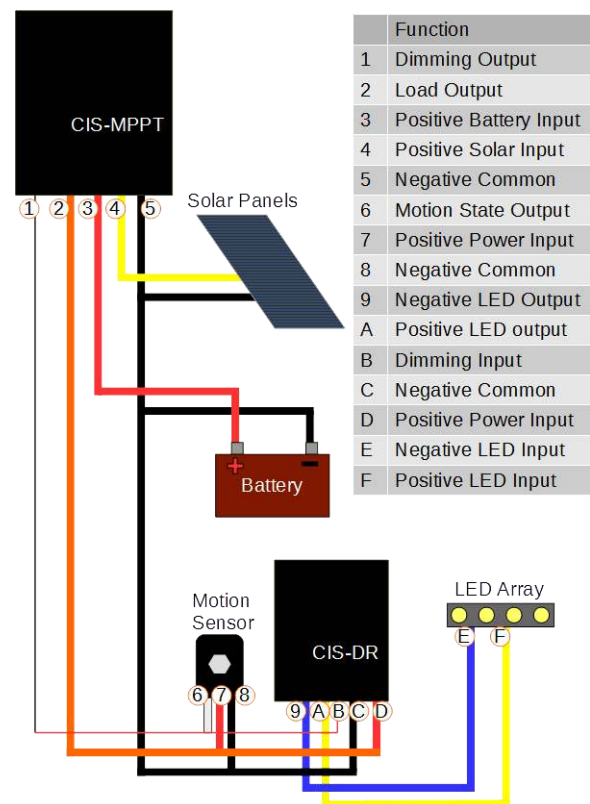


Figure 5- CIS-MPPT/CIS-DR with Sensor Switch SBO xx OEX in a 12V System

**WARNING:** Be sure to choose the proper LED driver for your application. You will need to match the LED driver to the amount of power consumed by the LEDs in order to avoid damaging the LEDs.

## 2. 24V SYSTEMS - WATT STOPPER, EW-205-24-W

This system also uses the CIS-MPPT charge controller. The load outputs from the CIS-MPPT are used to power the CIS-DR and EW-205-24-W. Since the load output is only on when night is detected, there will be no chance of the motion sensor overriding the dimming output of the charge controller during daylight hours. The CIS-DR can be connected directly to the battery as long as the motion sensor is connected to the load output of the CIS-N.

Since the EW-205-24-W has the ability to turn on and off based on the light outside, there are other configurations that would also work. This configuration is the most simple and requires the least amount of setting changes on the motion sensor.

### b) Configuration

As shown in Figure 6 to the right, the CIS-DR and EW-205-24-W are powered by the load output of the CIS-MPPT. The dimming output of the CIS-N and EW-205-24-W are both connected directly to the dimming input of the CIS-DR.

**WARNING:** Be sure to choose the proper LED driver for your application. You will need to match the LED driver to the amount of power consumed by the LEDs in order to avoid damaging the LEDs.

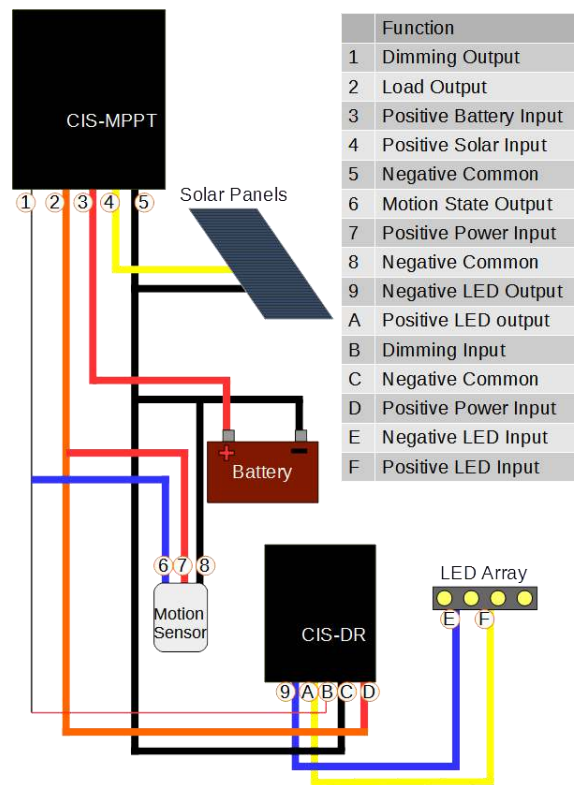


Figure 6 CIS-MPPT/CIS-DR with Watt Stopper EW-205-24-W in a 24V system



## 2. Advantages of CIS-DR and CIS-MPPT System with Motion Sensing

- Day/night Detection prevents light from coming on during daylight hours
- Adjustable Low Voltage Disconnect prevent deep-discharge of battery
- Dimming Functionality of CIS-N allows to drive LEDs at a lower state of light (rather than off) and switch to 100% when motion sensor is tripped
- Maximum Power Point Tracking (MPPT) allows up to 98% charge efficiency, especially cold climates where PV voltage is higher.
- MPPT allows for the use of lower-cost, 60-cell panels in 12 or 24V systems

## Other System Configuration Options

### 1. Photocell Option for SBO xx OEX

When purchasing the SBO xx OEX there is an optional photocell feature which allows the motion sensor to detect day and night conditions. With this feature installed the sensor can be directly connected to battery power instead of the load output of the charge controller. This may be a desired feature in situations where there is no charge controller to provide daylight detection.

### 2. Dimming Option for SBO xx OEX

There is also the option of a dimming output for the SBO xx OEX. With this feature you can connect the dimming output of the motion sensor to the dimming input of the LED driver and program the motion sensor settings to dim before shutting off completely when motion is no longer detected. If the system is separate from the charge controller then adding this feature with the photocell option will provide the maximum functionality. In this system the motion state output (white wire) is not used.

For more information/advice, please contact Phocos North America Technical Support at [tech.na@phocos.com](mailto:tech.na@phocos.com) or +1 (520) 777-7906 (Option 2).