DLC-PDC

PHOTODIODE CONTROLLER

INSTALLATION AND OPERATION INSTRUCTIONS

1121 Highway 74 South Peachtree City, GA30269

Customer Service:
Telephone: (800) 553-3879 Fax: (800) 954-7016

DLC-PDC Rev. 2

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1 INTRODUCTON

1.1 General

Please read these instructions carefully to prevent any possible injury or equipment damage. For installation of the product, the installer must be a qualified and experienced technician. Prior to any installation, inspect the panel for damage and verify the product ratings to confirm that this product will satisfy your requirements and application.

The DLC-PD Sensor is a generic term used throughout this document to describe all variations of the sensor including but not limited to the indoor, outdoor, atrium, and skylight types.

1.2 Overview

The DLC-PDC Photodiode Controller automatically switches a dry contact in response to change in natural daylight. The DLC-PDC provides a maintained single pole, double-throw relay output to drive electrically held contactors or relays, or has the ability to provide inputs to Energy Management Systems (EMS). The DLC-PDC can control incandescent, fluorescent or HID lighting. The low voltage controller requires a remotely mounted DLC-PD sensor. The DLC-PDC controller provides Low and High setpoints, with a deadband to eliminate nuisance or intermittent changes.

2 INSTALLATION

The DLC-PDC controller can be mounted anywhere that 15VDC can be provided, and with a wiring distance within 500' of the DLC-PD sensor. The sensor should be mounted per its Installation and Maintenance Manual.

2.1 Power Connections

The DLC-PDC 15VDC power should be connected to Terminal 5 at the bottom of the controller board; DC Common should be connected to Terminal 4 (see Figure 1).

2.2 Load Connections

The DLC-PDC Form C output has Common connected to Terminal 7 (LOAD RATING 3A MAX), the Normally Open contact is connected to Terminal 6, and the Normally Closed contact is connected to Terminal 8 (see Figure 1).

2.3 DLC-PD Sensor Connections

The DLC-PD sensor has three (3) wires. The Yellow wire should be connected to Terminal 1 at the bottom of the controller board. The Black wire should be connected to Terminal 2 and the Red wire should be connected to Terminal 3 (see Figure 1).

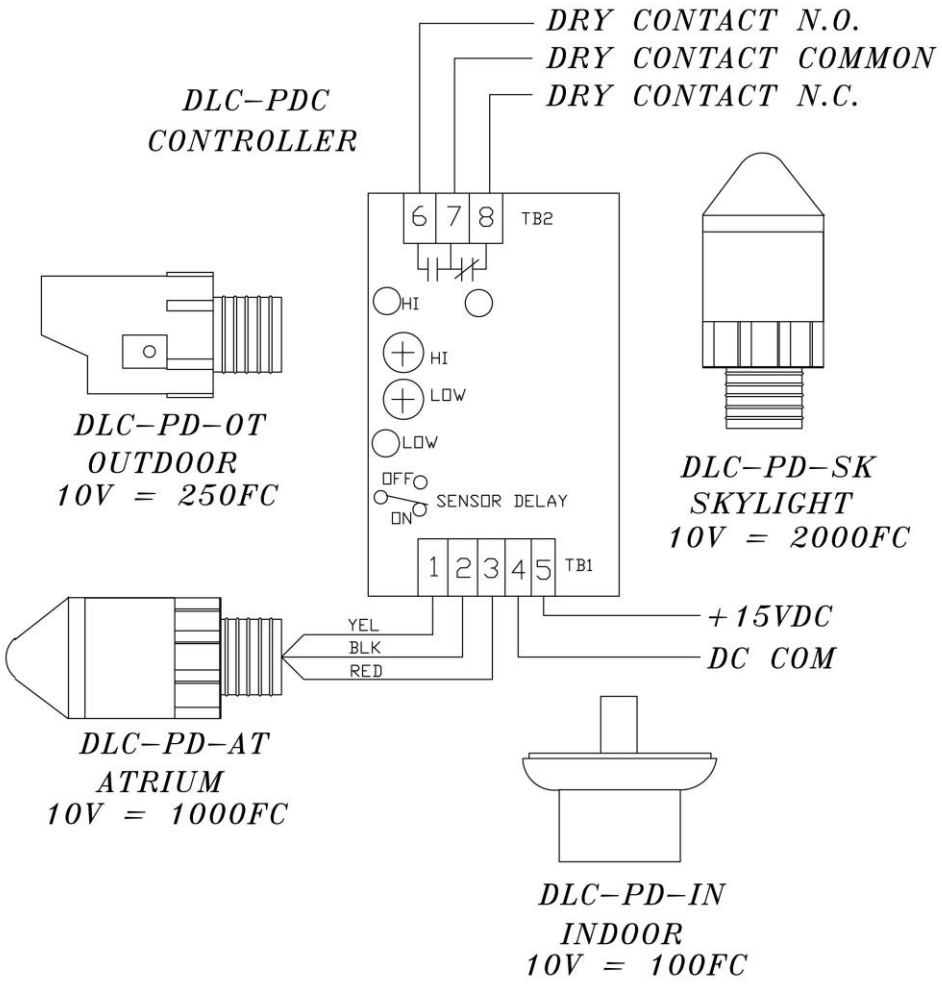

Figure 1: DLC-PDC with DLC-PD Sensor

3 OPERATION

After installation, the DLC-PDC will need to be properly calibrated if it was not ordered with pre-calibrated setpoints from the factory. In order to better understand the calibration procedures, a familiarity of the DLC-PDC controller's parts and operating principles would be useful. Therefore, this section will describe in detail the various indicator LEDs, switch functions, control options, and sequence of operations.

3.1 High Level Setpoint and LED Indicator

The top trimpot labeled "OFF" (see Figure 2) sets the High Level Setpoint which is the level commonly set for dawn. As the sun rises, the DLC-PDC will switch on both the relay and upper LED signifying that the lighting will be switched off. This setup is typical for most applications. Note that while the daylight is increasing the Low Level LED will illuminate, but this will be disregarded by the controller.

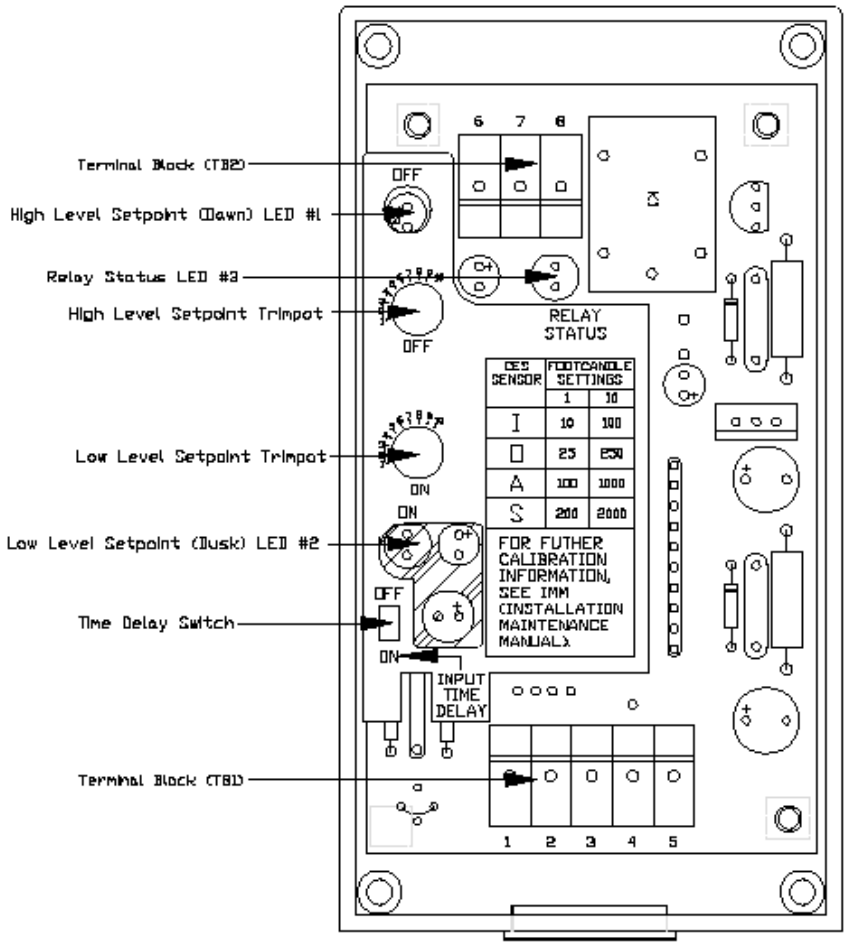

Figure 2: DLC-PDC Controller with Placard

3.2 Low Level Setpoint and LED Indicator

The bottom trimpot labeled “ON” (see Figure 2) sets the Low Level Setpoint which is the level commonly set for dusk. As the sun sets, the DLC-PDC will switch off both the relay and the lower LED signifying that the lighting will be switched on. This setup is typical for most applications. Note that while the daylight is decreasing the High Level LED will switch off, but this will be disregarded by the controller.

3.3 Relay

A single pole, Form C relay is provided with the DLC-PDC controller. The Common is connected to Terminal 7, the Normally Open contact is connected to Terminal 6, and the Normally Closed contact is connected to Terminal 8.

3.4 Relay Status Indicator

The third LED located beneath Terminal 8 (See Figure 2) indicates the status of the DLC-PDC’s relay. If the LED is lit, the relay is energized. Since this is a normally closed relay, energizing the relay will open its contacts. Therefore as described above if the LED is lit the lighting connected to the DLC-PDC is off in typical dusk to dawn applications and if the LED is off the lighting connected to the DLC-PDC is on in typical dusk to dawn applications.

3.5 Input Time Delay Switch

The Input Time Delay Switch (see Figure 2) when switched ON (Down Position), enables the time delay feature. With this feature enabled, a change of state must occur for a minimum of 30 seconds for the controller to react. This keeps transient lighting events such as lightning flashes or passing car headlights from switching the controlled lights OFF as well as temporary cloud cover from switching controlled lights ON.

3.6 Sequence of Operation

The DLC-PDC operating sequence will be described below referencing Figure 3.

1. At dawn the sensed light level increases approaching the High Level Setpoint through the Low Level Setpoint, the Low Level Setpoint LED will switch ON, while the High Level Setpoint LED remains OFF. The output relay is de-energized with the Relay Status LED OFF and the lighting circuit ON. (See Figure 3A)

2. As the sensed light level increases and passes through the High Level Setpoint, the High Level Setpoint LED will switch ON energizing the Relay, and thus switching ON the Relay Status LED, and switching OFF the lighting circuit. The Low Level Setpoint LED will remain ON. (See Figure 3B)

3. The above status remains through out the day as the sensor light level increases to the maximum light level and then starts to decrease towards dusk. As the light level passes through the High Level Setpoint the High Level Setpoint LED will switch OFF, leaving the Low Level Setpoint LED ON, and the Relay energized with the Relay Status LED ON. (See Figure 3C)

4. As the light level decreases through the Low Level Setpoint the Low Level Setpoint LED switches OFF. The relay de-energizes switching the Relay Status LED OFF, and thus switching ON the lighting circuit. (See Figure 3D).

5. As dawn approaches and the sensed light level again rises the lighting cycle is in position to repeat again.

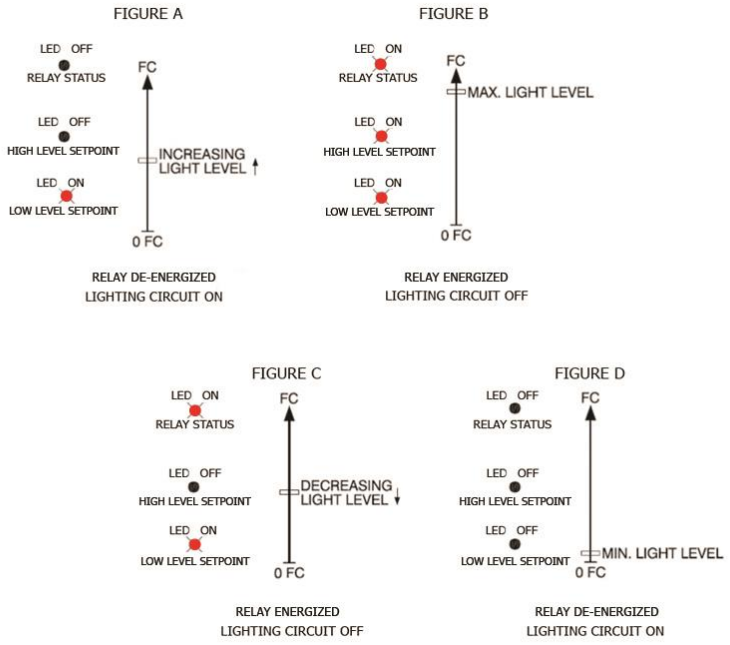

Figure 3: DLC-PDC Sequence of Operation

It is important to note that the output relay does not change state while the input signal is in the deadband. The output relay will only change state when the ambient light level crosses the far setpoint in the light level's direction of travel.

4 CALIBRATION

The general theory behind ON and OFF setpoint calibration is to set the ON setpoint at a lower footcandle level than the OFF setpoint. This way, the controlled lights will not switch OFF during a period when they should be ON. The difference between the ON and OFF setpoints is called the Deadband. In general, the deadband should be large enough (about 10% of the expected calibration range) to provide system stability.

In a dusk-to-dawn lighting application, it is important to have a deadband sufficient to prevent confusing the control board as the desired setpoint is reached. To insure that lights are ON when needed, the deadband should be biased to leaving the lights ON longer rather than switching them OFF too soon.

4.1 Dusk-To-Dawn Calibration Procedure

The Dusk-To-Dawn technique of calibration has been developed that, when followed, will work well for most calibration needs. Additionally, if you have a different lighting application other than dusk-to-dawn, you should be able to discern the method of this technique and apply it to your situation.

The DLC-PD sensors have a very linear response which makes it simple to predict the setpoints of the DLC-PDC Controller. Use of non-GREENGATE/COOPER LIGHTING SOLUTIONS sensor will likely make this task more difficult.

This procedure has been created in such a manner as to not require any sophisticated calibration equipment. Shown below are the tools needed for Dusk-To-Dawn calibration of the DLC-PDC.

- TOOLS NEEDED: SMALL FLATHEAD SCREWDRIVER 1/8”

- PROCEDURE: begin this procedure just before dawn

1. Switch the Input Delay Switch OFF (UP).
2. At the time during dawn when the daylight is at the level where you would want the lights to switch ON at dusk, turn both the High Level Setpoint and the Low Level Setpoint trimpots all the way counter clockwise so that both setpoint LEDs are ON. The Relay Status LED will be ON and the lighting circuit will be OFF.
3. Turn the Low Level Setpoint trimpot clockwise to the point that the Low Level Setpoint LED switches OFF. The Relay Status LED and lighting circuit will remain unchanged.
4. Wait for a period of time for the light level to increase (the Low Level Setpoint LED will switch back ON), and adjust the High Level Setpoint trimpot clockwise to the point that all LEDs switch OFF. The DLC-PDC should now be calibrated for a dusk-to-dawn application.
5. Return the Input Delay Switch to the ON (DOWN) position. Note; the lights will switch Off at dawn, but if a greater deadband is required set the High Level Setpoint trimpot ahead of the Low Level Setpoint trimpot (adjust as required). Should the Dusk-to-Dawn lighting cycle fail to switch the lights ON and OFF as planned, please refer to the Troubleshooting section of this manual.

4.2 Footcandle Settings Guide

The DLC-PDC has a placard attached to the front of the controller which can be used as a reference guide for a DLC-PD-IN sensor, which is the most common application. Included below is an expanded guide for the DLC-PD sensors.

TICK MARK GUIDES

DLC-PD SENSOR	1	2	3	4	5	6	7	8	9	10
Indoor DLC-PD-IN	10Fc	20Fc	30Fc	40Fc	50Fc	60Fc	70Fc	80Fc	90Fc	100Fc
Outdoor DLC-PD-OT	25Fc	50Fc	75Fc	100Fc	125Fc	150Fc	175Fc	200Fc	225Fc	250Fc
Atrium DLC-PD-AT	100Fc	200Fc	300Fc	400Fc	500Fc	600Fc	700Fc	800Fc	900Fc	1000Fc
Skylight DLC-PD-SK	200Fc	400Fc	600Fc	800Fc	1000Fc	1200Fc	1400Fc	1600Fc	1800Fc	2000Fc

Table 1: DLC-PD Sensor Footcandle Chart

EXAMPLE 1: If a DLC-PD-OT (Outdoor) sensor is providing the input signal and it is desired to switch lights ON at 30 Fc and back OFF at 50 Fc, the Low Level Setpoint trimpot should be set just slightly more than 1 and the High Level Setpoint trimpot should be set to 2.

EXAMPLE 2: If a DLC-PD-SK (Skylight) sensor is providing the input signal and it is desired to switch lights ON at 1200Fc and back OFF at 1400 Fc, the Low Level Setpoint trimpot should be set to 6 and the High Level Setpoint trimpot should be set to 7.

Note that this guide is provided for the convenience of our customers. It should be treated as a guide and each application will require tuning to obtain the best results.

5 SPECIFICATIONS

Input Voltage:	15VDC
Output:	Standard – Form C SPDT Relay
Capacity:	3 Amps resistive @ 24VDC
Input Sensor Type:	DLC-PD Photodiode – 3 wire
Input Time Delay:	30 seconds (may be overridden with the Input Time Delay Switch)
Dead Band:	Adjustable - 5-95%
Operating Temperature:	-12°F to +140°F (-11°C to 60°C)
Accuracy:	+/-1% at 70°F (21°C)
	+/-5% above 120°F or below 0° F. (49° C /-18° C)
Enclosure Dimensions:	4.75”H x 2.25”W x 1.5”D

6 MAINTENANCE

Every 6 months inspect the wiring for broken or frayed connections. Occasionally, wipe clean the plastic enclosure.

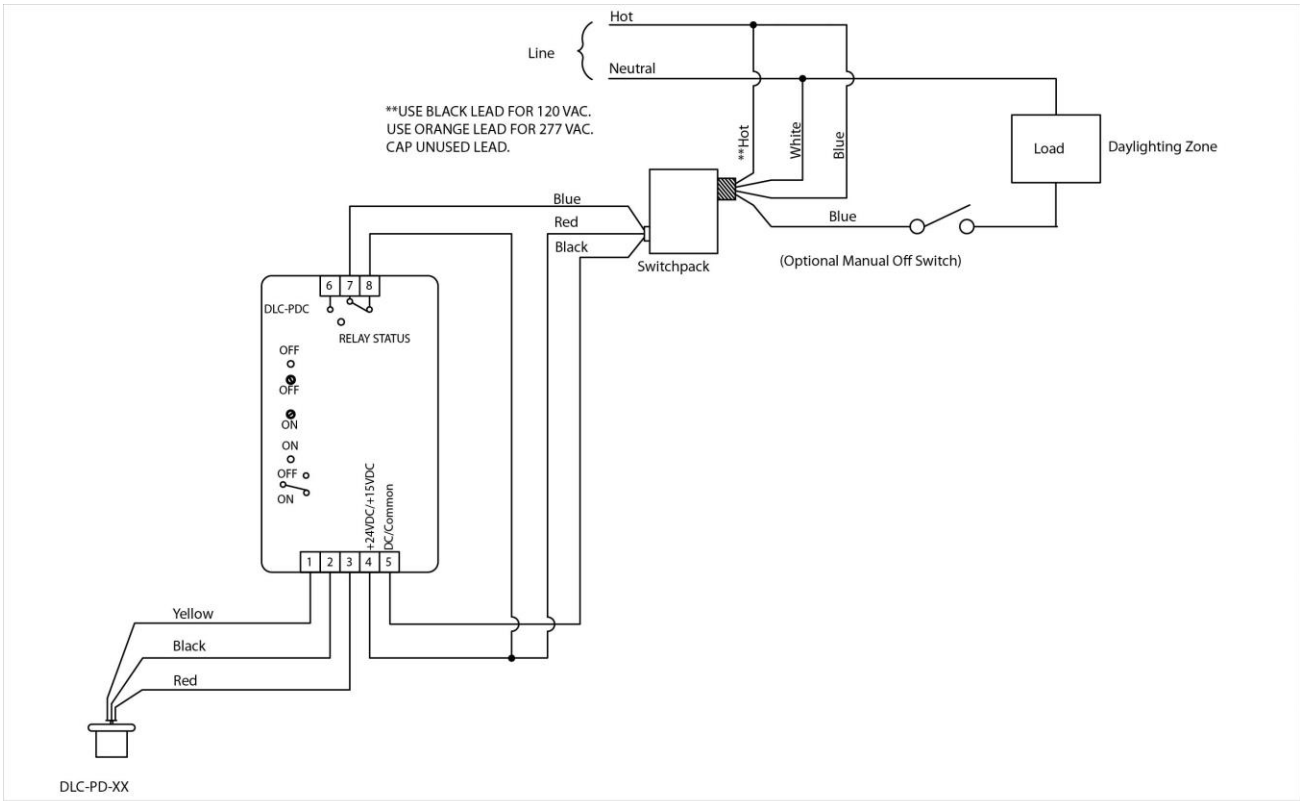

Figure 4: DLC-PDC WIRING CONNECTION DIAGRAM

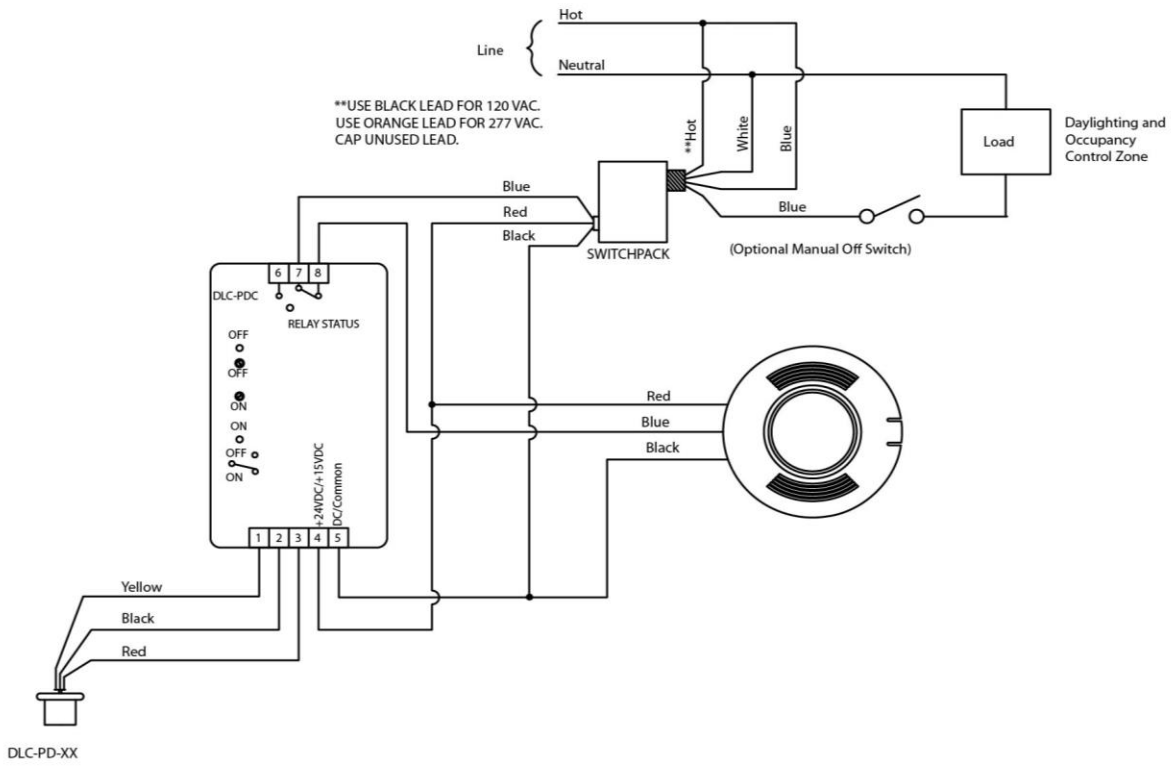

Figure 5: DLC-PDC AND OCCUPANCY SENSOR CONNECTION DIAGRAM

7 DLC-PDC TROUBLESHOOTING GUIDE

When a DLC-PDC does not function as expected, the solution can usually be isolated to one of four possible problems. This guide will help to determine which problem(s) is preventing the proper operation of the DLC-PDC.

Observed Behavior	Possible Cause	Troubleshooting Instructions
DLC-PDC does not switch state or the LEDs do not respond as expected.	Lack of Power	Connect a DC voltmeter between Terminal 4 and Terminal 5. The reading should be 15VDC for the DLC-PDC.
	Lack of Sensor Signal	Connect a DC voltmeter between the yellow and black wire (for DLC-PD). When the sensor is covered the reading should be 0VDC. When the sensor is exposed to bright light the reading should be approximately 10VDC.
	Faulty Controller	Examine the gross functionality of the DLC-PDC by doing the following: 1. Turn off the Input Time Delay Switch 2. Disconnect the Sensor – the lighting circuit should come on 3. Jumper Terminal 1 to Terminal 5 – the lighting circuit should go off
	Poor Calibration	Review the Calibration Procedure in Section 4
Lighting circuits cycling	Poor Calibration / Sensor Mounting	The deadband will likely need to be increased. It is common for the mounting of a sensor to result in the reading of the sensor being influenced by the lighting circuit that it is controlling. The additional light contribution of the circuit should not allow the lights to be turned back off.

Table 2: Troubleshooting Guide

NOTE: For additional technical support please call
Cooper Lighting Solutions at 770-486-4800