

PLC case study (fluorescent ballasts)

The PLC case study is an overview of the features of Phason's PLC-1 and PLC-2 Programmable Lighting Controls.

The case study briefly explains the features and electrical ratings of the controls and then shows an example of how to create a lighting program for DC-controlled fluorescent lights. This document is not meant as a replacement for following the instructions in the user manual.

PLC overview

The PLC allows you to control light duration and intensity and automatically adjust them during the birds' life cycle.

Designed primarily for poultry barns, the PLC is loaded with powerful and useful features. With multiple outputs and programs, the PLC allows you to easily design a lighting program that works for your operation.



PLC controls have variable AC outputs for dimming incandescent lights, general-purpose relays for turning lights on and off or operating devices such as feed augers, and variable 0 to 10 VDC outputs for operating DC-controlled fluorescent lights. Each control also includes an alarm relay for signaling power failures.

The LCD display shows status and setting information and the four-button keypad allows you to easily scroll through the information and program the control. The PLC's real-time clock and power-failure memory retention means you will never lose your settings and program status because of a power failure.

There are two models of Programmable Lighting Controls: the PLC-1 and the PLC-2.

Features

- ◆ Programmable lighting operation
 - Multiple lighting programs (multiple output staging)
 - Up to 365 days per program
 - Up to 20 segments (groups of days) per program
 - Up to 32 triggers (light/relay state changes) per day
- ◆ Two variable AC outputs (PLC-1), one variable AC output (PLC-2)
- ◆ Two variable DC outputs
- ◆ Two general-purpose relay outputs (PLC-1), one general-purpose relay output (PLC-2)
- ◆ One alarm relay
- ◆ Expandable capacity using slaves
- ◆ Sixteen character, two-line backlit LCD display
- ◆ Four-button keypad
- ◆ Real-time clock
- ◆ Power-fail memory protection
- ◆ Rugged enclosure (corrosion resistant, water resistant, and fire retardant)
- ◆ Two-year limited warranty

PLC-1 electrical ratings

- ◆ Input: 115/230 VAC, 50/60 Hz, 1 A
- ◆ Variable AC outputs: 10 A, 1150 W at 115 VAC
10 A, 2300 W at 230 VAC
- ◆ Relay outputs: 1/3 HP at 115 VAC, 1/2 HP at 230 VAC
- ◆ Variable DC output: 0 to 10 V, 30 mA
- ◆ Alarm relay: 0.2 A at 250 VAC, 0.4 A at 24 VAC, 2.0 A at 30 VDC
- ◆ Fuses: Input – 250 V, 1 A, fast-acting glass
Variable AC outputs – 250 V, 15 A, slow-blow ceramic
Relay outputs – 250 V, 12 A, slow-blow ceramic

PLC-2 electrical ratings

- ◆ Input: 115 VAC, 50/60 Hz, 1 A
- ◆ Variable AC output: 20 A, 2300 W at 115 VAC
- ◆ Relay output: 1 HP at 115 VAC, 2 HP at 230 VAC
20 A at 115 V tungsten, 20 A at 230 V ballast
- ◆ Variable DC output: 0 to 10 V, 30 mA
- ◆ Alarm relay: 0.2 A at 250 VAC, 0.4 A at 24 VAC, 2.0 A at 30 VDC
- ◆ Fuse: Input – 250 V, 1 A, fast-acting glass

Example

You operate a poultry house. You want to automatically adjust the light intensity each day.

Your barn uses DC-controlled fluorescent lights. The lights are powered by 120 VAC and controlled by a 0 to 10 VDC input signal. At 1%, the lights are at their lowest setting, but not off. They require a relay to turn them off when the light level goes below 1%.

Your head office gives you lighting requirements as follows:

Time	Light	Ramp time
8:00 AM	Go from 1% to 100%	5 minutes
9:00 AM	Go from 100% to 5%	3 minutes
10:00 AM	Go from 5% to 60%	4 minutes
11:00 AM	Go from 60% to 0%	5 minutes

Table 1: Light requirements

What do you do?

Step 1: Convert the percentages to PLC light levels

For the PLC, light intensity is a number between 0 and 100, not a percentage. Zero is off, 100 is fully on. The PLC's system makes every change in light level equal.


For example, if you change the light intensity from 1% to 2%, you have doubled the intensity. Likewise, if you change the intensity from 50% to 100%, you have doubled the intensity. If you were to use percentage as a scale, there would only be 1 level between 1 and 2 percent, but 50 levels between 50 and 100 percent.

With the PLC's light levels, every doubling (or halving) of the light intensity has ten equal levels. This makes changes in light intensity almost undetectable.

Light intensity	
Percentage	PLC level
100	100
60	92
5	56
1	32
0	0

Table 2: Light percentage converted to PLC light levels

Now that you know your light levels, you are ready for the next step.



Many lighting programs use foot-candles or lux for light intensity. Light intensity depends on the amount and brightness of the lights installed in the barn.

The best way to convert light intensity to PLC light levels is to manually adjust the lights using the control and then read the light intensity using an ambient light meter. When the light meter reads the desired light intensity, check the PLC display and write down the light level.

Ambient light meters are available from many different sources. Searching the internet for “*ambient light meter*” or checking your local camera shop is a good place to start looking. A meter with a digital display that reads low light levels works best.

Step 2: Assigning the outputs

The PLC has three types of outputs: variable AC, variable DC, and relay (AC). The PLC-1 has two variable AC, two variable DC, and two relay outputs. The PLC-2 has one variable AC, two variable DC, and one relay output.

You need to assign the outputs to the lighting program. Because the lights are controlled by a 0 to 10 VDC signal, you will need to assign a variable DC output to the program. In addition, because the lights require 120 VAC to switch them on or off, you will need a relay output.

In this example, you will assign Variable3 (DC) and Relay1 to GroupA.

To assign the outputs to a group

1. Scroll to the Configuration menu and then press **Select**.
2. Scroll to **Assign Outputs** and then press **Select**.
3. Scroll to **Variable3 (DC)** and then press **Select**.
4. Scroll to **GroupA** and then press **Select**.
5. Repeat steps 3 and 4 for Relay1 and then press **Back** twice to return to the main menu.

Configuration
1 Assign Outputs

Variable3 (DC)
GroupA

Relay1
GroupA

Step 3: Setting relay trip levels

If a relay is assigned to program Group A or Group B, you can set it to turn on at a certain light level and off at another light level. The level can be between 0 and 100.

In step 2, you assigned Relay1 to GroupA. Now you need to set it to turn on and off at certain levels.

Because the lowest setting for the lights is 1%, you need to set the relay to switch off when you want the lights to be off. To do this, set the relay to be off when the level is 0 and on when the level is at or above 1.

To set the relay trip levels

1. Scroll to the Configuration menu and then press **Select**.
1. Scroll to **Set Trip Level** and then press **Select** twice.
2. Press **Up** or **Down** to adjust the relay ON level to **001** and then press **Select**.
3. Press **Up** or **Down** to adjust the relay OFF level to **000** and then press **Select**.
4. Press **Back** twice to return to the main menu.



```
Relay1   GroupA
ON-L001 OFF-L000
```

Step 4: Designing your lighting program

A lighting program is the settings the PLC uses to control the lights. The settings consist of segments and triggers. A program can be up to 365 days long.

Segments are parts of the lighting program where all the days have the same triggers. In other words, all days during a segment will have the same amount of light and dark hours and the same light levels. There can be up to 20 segments per lighting program.

Triggers are events in the lighting program that cause the light level to increase or decrease, or a relay to change position (ON/OFF). There can be up to 32 triggers per segment.

Segments

The only setting for a segment is the start day. A segment begins on the start day and lasts until the start day of the next segment. When the last segment ends, the lighting program is over.

In your lighting program, because all the days have the same light settings, you have only one segment: Segment 1, start day 1.

Triggers

Each segment has its own triggers. The settings for a trigger include start time, ramp time, and light level.

Start time is the time at which the PLC starts to change the light level. The PLC use 24-hour time.

Light level is the intensity to which the PLC needs to adjust the lights.

Ramp time is the amount of time the PLC takes to adjust from one light level to the next.

If you take your light requirements from table 1, and convert them to triggers, you get a lighting program like the one in table 3.

	Time	Light	Ramp time
	8:00 AM	Go from 1% to 100%	5 minutes
	9:00 AM	Go from 100% to 5%	3 minutes
	10:00 AM	Go from 5% to 60%	4 minutes
	11:00 AM	Go from 60% to 0%	5 minutes

Trigger	Start time (hh:mm)	Light level (0 to 100)	Ramp time (h:mm)
1	08:00	100	0:05
2	09:00	56	0:03
3	10:00	92	0:04
4	11:00	0	0:05




Table 3: Your lighting program

Below is an image showing the PLC display and your lighting schedule.

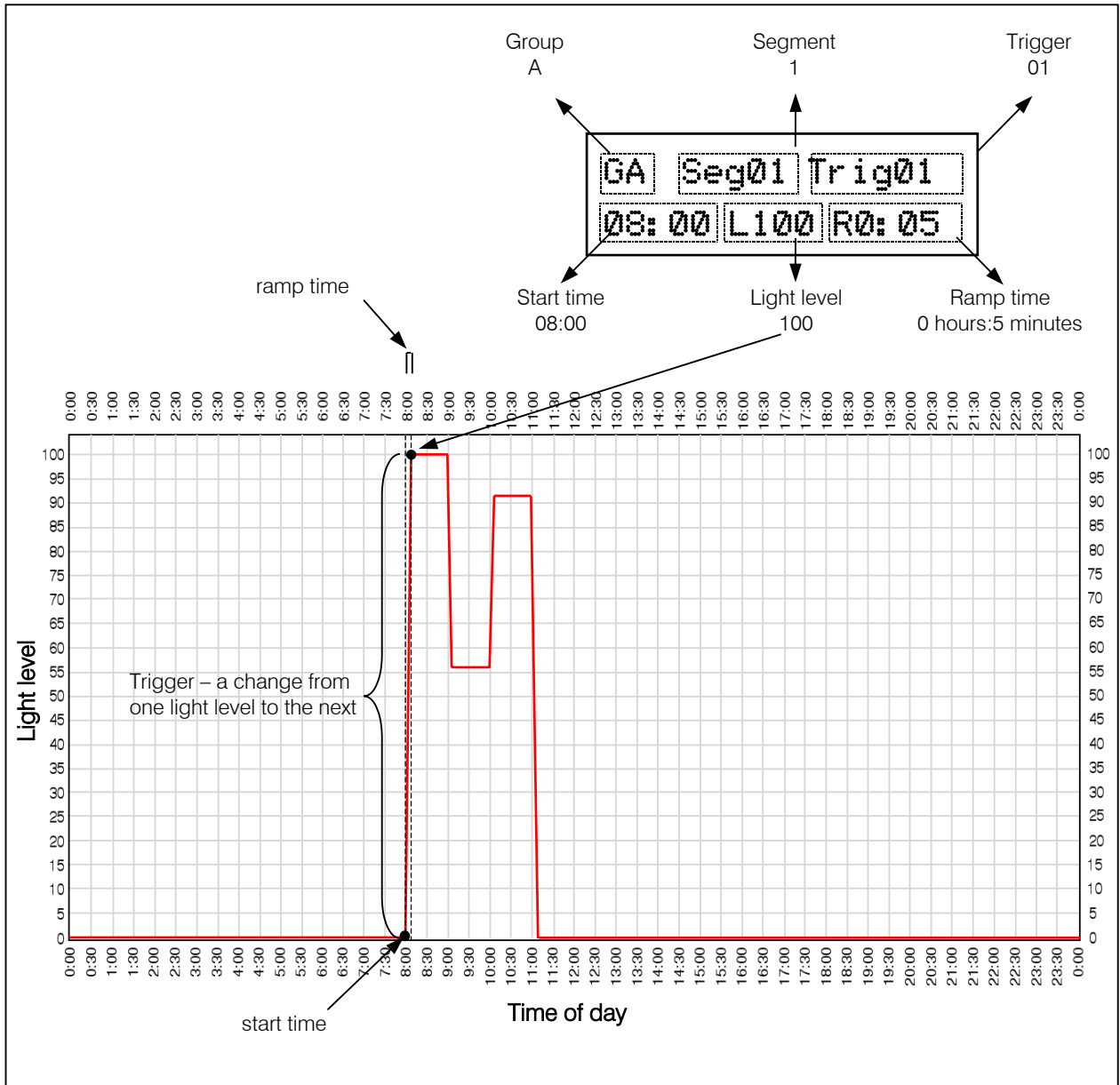


Figure 1: Triggers in a lighting program

Now that you have designed your lighting program, you are ready for the next step.

Step 5: Programming the PLC

You have designed your lighting program and written down the information on the PLC worksheets (included in the PLC user manual). The final step is to program your settings into the PLC. The PLC's LCD display, simple menu structure, and 4-button keypad make this easy to do.

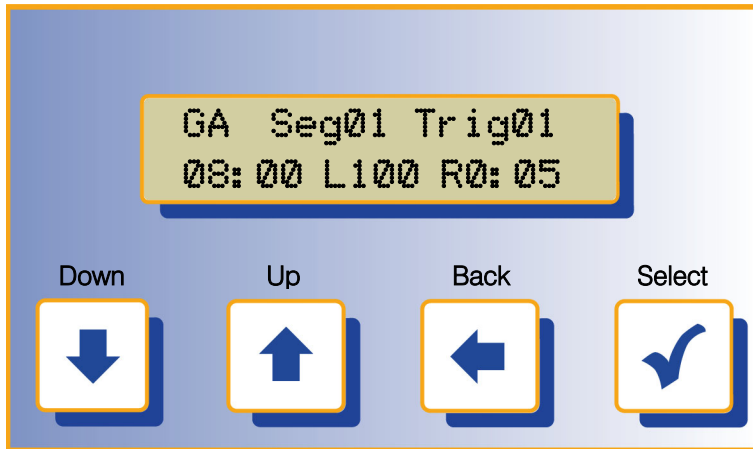


Figure 2: The PLC display and buttons

To program the segment

1. Scroll to the Light Programs menu and then press **Select** twice.
2. Scroll to **GroupA** and then press **Select**.
3. Scroll to **Segment01** and then press **Select**.
4. Press **Up** or **Down** adjust the start day to **01** and then press **Select**.
5. Press **Back** twice to return to the main menu.

```
GroupA Segment01
Start Day      01
```

To program the triggers

1. Scroll to the Light Programs menu and then press **Select**.
2. Scroll to **Set Triggers** and then press **Select**.
3. Scroll to the trigger you want to set up and then press **Select**.
4. Press **Up** or **Down** to adjust the start hour (in 24-hour time) and then press **Select**.
5. Press **Up** or **Down** to adjust the start minute and then press **Select**.
6. Press **Up** or **Down** to adjust the light level and then press **Select**.
7. Press **Up** or **Down** to adjust the ramp time and then press **Select**.
8. Repeat steps 3 to 7 for each trigger and then press **Back** twice to return to the main menu.

```
GA Seg01 Trig01
08:00 L100 R0:05
```

```
GA Seg01 Trig02
09:00 L056 R0:03
```

```
GA Seg01 Trig03
10:00 L092 R0:04
```

```
GA Seg01 Trig04
11:00 L000 R0:05
```

Your PLC is now ready to control your lights!

For information about stopping and starting your lighting program and other PLC features, see the PLC user manual.

If you have questions about the PLC, or any Phason product, contact us. We will be happy to answer your questions and provide the solution that is right for you.

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