WattStopper®

TechBulletin

FOR GENERAL DISTRIBUTION

Single-zone Daylighting Control Sequences of Operation

Topic: DLM Operation with LMLS-400 Photosensor, v2.xx **Issue:** # TB185 **Date:** March 10, 2012

Understanding the capabilities of Digital Lighting Management (DLM) photosensors, and how to configure the sensors for the desired control strategy is one key to successful daylighting controls projects. This bulletin describes typical sequences of operation for different LMLS-400 operating modes, and explains how to change zone and sensor parameters to modify the sequence of operation.

Please note that all DLM jobs with LMLS photosensors must be submitted to WattStopper Project Management for review and approval.

Sequences of operation

When a DLM local network (room) is first energized, Plug n' Go establishes the most energy efficient sequence of operation based on the installed controls (e.g. manual-on; auto-on to 50%; or on to previous level, when personal controls are included). Daylight control layers on top of the sequence of operation that is established for a given room. The LMLS-400 may be configured to hold off daylighting loads (see page 8). See examples for daylighting control using switching, multi-level control and continuous dimming on the following pages.

Photosensor features and applications

The LMLS-400 is a single zone, closed loop photosensor, characterized by the following attributes:

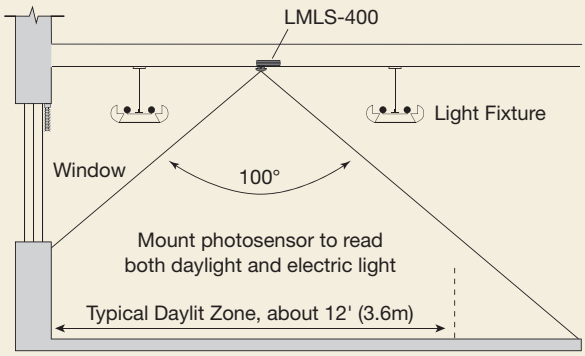
- Measures ambient light level (combination of daylight and electric light)
- Features automatic commissioning option
- Can automatically switch or dim one zone of lighting
- Because sensor measures ambient light, works when multiple sources of daylight enter the room
- Suitable for mounting heights up to 15'

Plug n' Go

If there is only one LMLS-400 photosensor on a DLM local network, it is automatically assigned to control Load 1. It will configure itself for switching or dimming based on the attributes of the assigned room controller. If the local network includes more than one LMLS-400, none of them is assigned to any load.

Push n' Learn

Push n' Learn is not used to assign loads for daylighting control. Daylighting loads are assigned to an LMLS-400 using an LMCT-100 Wireless Configuration Tool after other DLM components have been configured.



Sensor placement is the first step to ensuring proper opration. The rule of thumb for the LMLS-400 is to place the sensor two window heights deep into the space, in a location that will not be affected by uplight contributions from nearby fixtures.

Photosensor configuration using LMCT-100

In addition to load binding, the LMCT-100 is used to set up DLM photosensors to utilize the desired control strategy (switching, bi-level, tri-level or dimmed) and to adjust photosensor parameters. It may also be used to initiate automatic calibration, or calibrate the sensor manually.

Detailed information about setup options appears at the end of this bulletin, beginning on page 6, and in the LMLS-400 installation instructions.

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Single-zone Daylighting Control Sequences of Operation

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Example 1: LMLS-400 Switching Control

- **Manual-ON (Load 1), Automatic-OFF**
- **One Daylight Load**

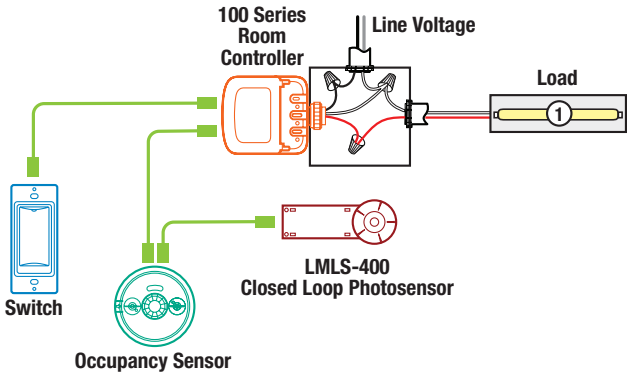
Manual-ON operation is established by Plug n' Go configuration of the core DLM components: single relay room controller, occupancy sensor and 1-button switch.

Once an occupant turns the lights ON, the photosensor takes control of the assigned daylighting load (photosensor control is enabled).

If the photosensor measures more light than the value of the Off Setpoint for more than 10 minutes (Off Time Delay), it will turn the lights OFF. The default value for the Off Setpoint is 11 footcandles. When the sensor is calibrated, it will establish an application-specific value for the setpoint.

If the photosensor later detects that the light level is below the value of the On Setpoint for more than 20 seconds (On Time Delay), it will turn the lights ON. The default On Setpoint value is 7.5 footcandles. As with the Off Setpoint, when the sensor is calibrated, it will establish an application-specific value for the On Setpoint.

The occupant can turn the lights ON or OFF with the switch.



Turning the lights ON after the photosensor has turned them OFF in response to daylight (permitted by Allow Override setting of "Yes") overrides photosensor control for 2 hours (selected Override Time), or until the lights are turned OFF. Turning the lights OFF (via the switch or the occupancy sensor) disables photosensor control because the Hold Off setting is "No."

When the room is vacated, the occupancy sensor automatically turns all lights OFF. The entire sequence starts over the next time someone enters the area.

For additional information on optional photosensor settings, see pages 6 through 8 of this bulletin.

LMLS-400 Settings for Switching Control, Example 1			
LMCT-100 Menu	**Menu option**	**Default Setting**	**Application Setting**
Zone Setup (pg. 6)	Operating Mode	Switched	Switched (default)
	Load Assignment	Load 1 Daylight - yes	Load 1 (default)
Calibration (pg. 7)	Auto or Manual	n/a	initiate calibration
Zone Settings (pg. 7)	On Setpoint*	7.5 footcandles	fc per calibration
	Off Setpoint*	11 footcandles	fc per calibration
	On Time Delay	20 seconds	20 seconds (default)
	Off Time Delay	10 minutes	10 minutes (default)
Advanced Settings (pg. 8)	Allow Override	No	Yes
	Override Time	Infinity	2 hours
	Hold Off	No	No (default)

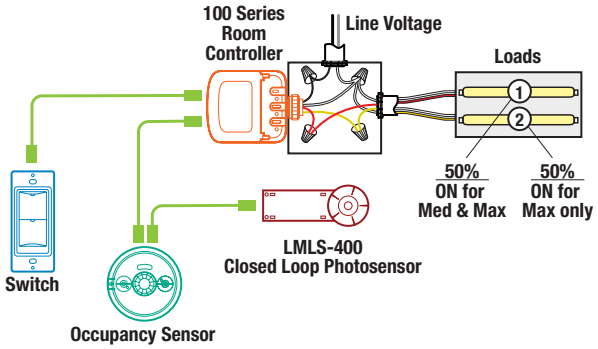
* LMLS-400 reads the light level at the sensor; generally 1/5 to 1/6 of task level reading. Setpoints are established accordingly.

Single-zone Daylighting Control Sequences of Operation

Topic: DLM Operation with LMLS-400 Photosensor, v2.xx **Issue:** # TB185 **Date:** March 10, 2012

Example 2: LMLS-400 Bi-level Control

- **Auto-ON (Load 1), Manual-ON (Load 2), Auto-OFF**
- **Two Daylight Loads**



Auto-ON to 50% operation is established by the Plug n' Go configuration of the core DLM components: dual relay room controller, occupancy sensor and 2-button switch.

The photosensor is configured to hold daylight loads off (Hold Off setting "Yes") unless it measures less light than the value of the On Setpoint (7.5 footcandles, or a footcandle value established by auto or manual calibration). When the occupancy sensor detects that someone has entered the room, Load 1 will only turn ON if needed. If the light level is still below the On Setpoint, the photosensor will allow the occupant to switch Load 2 ON.

If the photosensor measures too much light for more than 10 minutes (Off Time Delay), it will switch one load OFF. If both loads are on, it will turn Load 2 OFF. If Load 1 is the only load that is on, it will turn OFF. Too much light is a footcandle reading above the Off Setpoint (11 footcandles, or a value established by auto or manual calibration.) If the light level falls below the On Setpoint for more than 20 seconds (On Time Delay), the photosensor will restore a higher level.

Because Allow Override is set to "No," an occupant cannot manually switch lighting above the level permitted by the photosensor. An occupant can always select a lower level, and this does not override the photosensor.

When the room is vacated, the occupancy sensor automatically turns all lights OFF. The entire sequence starts over the next time someone enters the area.

For additional information on optional photosensor settings, see pages 6 through 8 of this bulletin.

LMLS-400 Settings for Bi-Level Control, Example 2			
LMCT-100 Menu	**Menu option**	**Default Setting**	**Application Setting**
Zone Setup (pg. 6)	Operating Mode	Switched	Bi-level
	Load Assignment	Load 1 Daylight - yes	Load 1 Daylight - yes, On When - Med & Max
		Load 2 Daylight - no	Load 2 Daylight - yes, On When - Max
Calibration (pg. 7)	Auto or Manual	n/a	initiate calibration
Zone Settings (pg. 7)	On Setpoint*	7.5 footcandles	fc per calibration
	Off Setpoint*	11 footcandles	fc per calibration
	On Time Delay	20 seconds	20 seconds (default)
	Off Time Delay	10 minutes	10 minutes (default)
Advanced Settings (pg. 8)	Allow Override	No	No (default)
	Override Time	Infinity	Infinity (default)
	Hold Off	No	Yes

* LMLS-400 reads the light level at the sensor; generally 1/5 to 1/6 of task level reading. Setpoints are established accordingly.

Single-zone Daylighting Control Sequences of Operation

Topic: DLM Operation with LMLS-400 Photosensor, v2.xx **Issue:** # TB185 **Date:** March 10, 2012

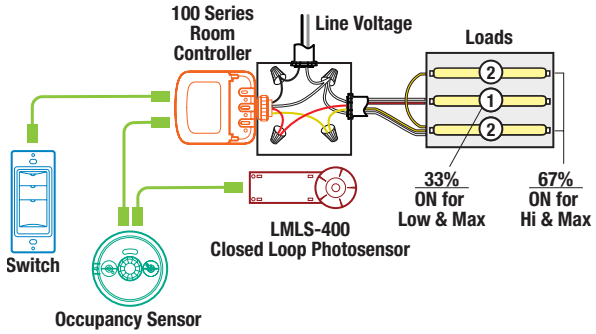
Example 3: LMLS-400 Tri-level Control

- **Auto-ON (Load 1), Manual-ON (Load 2), Auto-OFF**
- **Two Daylight Loads**

Auto-ON operation of Load 1 is established by the Plug n' Go configuration, and Push n' Learn is used to configure the third switch button to control both loads. Load 1 should be the 33% level. (This complies with ASHRAE 90.1-2010.)

The photosensor is configured to hold daylight loads off (Hold Off setting "Yes") unless it measures less light than the value of the On Setpoint (7.5 footcandles, or a footcandle value established by auto or manual calibration). When the occupancy sensor detects that someone has entered the room, Load 1 will only turn ON if needed. If the light level is still below the On Setpoint, the occupant can turn Load 2 ON without overriding photosensor control.

If the photosensor measures too much light for more than 10 minutes (Off Time Delay), it will decrease the lighting from Maximum (Loads 1 & 2 ON) to High (Load 2 ON, Load 1 OFF), or High to Low (Load 1 ON). Too much light is a footcandle reading above the Off Setpoint (11 footcandles, or



a value established by auto or manual calibration.) If the light level falls below the On Setpoint for more than 20 seconds (On Time Delay), the photosensor will restore a higher level.

The occupant can switch lighting above the level permitted by the photosensor, overriding daylighting control of the selected load (Allow Override "Yes"). An override is limited to 2 hours by the Override Time. An occupant can also select a lower level, and this does not override the photosensor.

When the room is vacated, the occupancy sensor automatically turns all lights OFF. The sequence starts over the next time someone enters the area.

For additional information on optional photosensor settings, see pages 6 through 8 of this bulletin.

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LMLS-400 Settings for Tri-Level Control, Example 3			
LMCT-100 Menu	**Menu option**	**Default Setting**	**Application Setting**
Zone Setup (pg. 6)	Operating Mode	Switched	Tri-level
	Load Assignment	Load 1 Daylight - yes	Load 1 Daylight - yes, On When - Low & Max
		Load 2 Daylight - no	Load 2 Daylight - yes, On When - Hi & Max
Calibration (pg. 7)	Auto or Manual	n/a	initiate calibration
Zone Settings (pg. 7)	On Setpoint	7.5 footcandles	fc per calibration
	Off Setpoint	11 footcandles	fc per calibration
	On Time Delay	20 seconds	20 seconds (default)
	Off Time Delay	10 minutes	10 minutes (default)
Advanced Settings (pg. 8)	Allow Override	No	Yes
	Override Time	Infinity	2 hours
	Hold Off	No	Yes

* LMLS-400 reads the light level at the sensor; generally 1/5 to 1/6 of task level reading. Setpoints are established accordingly.

Single-zone Daylighting Control Sequences of Operation

Topic: DLM Operation with LMLS-400 Photosensor, v2.xx **Issue:** # TB185 **Date:** March 10, 2012

Example 4: LMLS-400 Dimmed Control

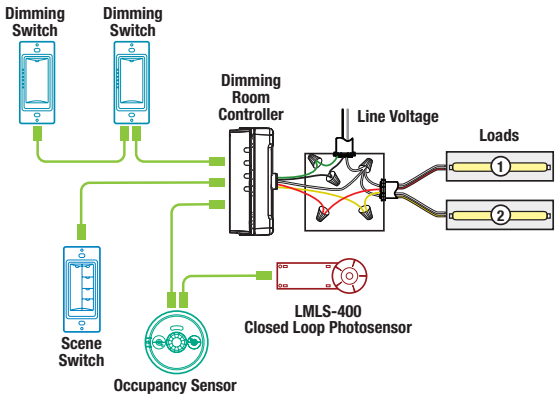
- **Auto-ON (Load 1), Manual-ON (Load 2), Auto-OFF**
- **Two Daylight Loads**

Load 1 Auto-ON to the last non-zero level, and Load 2 Manual-ON operation is established by Plug n' Go.

When the occupancy sensor detects motion, Load 1 turns ON to the previous level. After 3 seconds, daylighting control will adjust the level. If the occupant then turns Load 2 ON the photosensor will adjust the level to that of Load 1.

If the room is too dark, the photosensor will raise the level of the daylighting loads that are ON at the Ramp Up rate. If the room is too bright, the photosensor will dim the lighting at the Ramp Down rate. If the lighting reaches its minimum level, and the light level measured at the photosensor exceeds the Day Setpoint level for more than 10 minutes (Cut Off Delay), the photosensor will switch the load(s) OFF.

To ensure that the occupant can increase or decrease the light level with the dimming switches, Allow Override is configured as "Yes." If either load is overridden or switched



OFF, daylighting control for that load is disabled.

If the occupant selects a scene that includes daylighting loads, the scene will not stop the LMLS-400 from controlling those load(s), but the loads will not go above the levels established by the scene. This response is set by the Scenes Stop DL option (No).

When the room is vacated, the occupancy sensor turns all lights OFF and disables photosensor control. The sequence starts over the next time someone enters the area.

For additional information on optional photosensor settings, see pages 6 through 8 of this bulletin.

LMLS-400 Settings for Dimming Control, Example 4			
LMCT-100 Menu	**Menu Options**	**Default Setting**	**Application Setting**
Zone setup (pg. 6)	Operating Mode	Dimmed	Dimmed (default)
	Load Assignment	Load 1 Daylight - yes	Load 1 Daylight - yes
		Load 2 Daylight - no	Load 2 Daylight - yes
Calibration (pg. 7)	Auto or Manual	n/a	initiate calibration
Zone Settings (pg. 7)	Day Setpoint	50 footcandles	fc per calibration
	Night Setpoint	10 footcandles	fc per calibration
	Ramp Up	20%/second	20%/second (default)
	Ramp Down	2%/second	2%/second (default)
	Cut Off Delay	Never	10 minutes
Advanced Settings (pg. 8)	Allow Override	No	Yes
	Override Time	Infinity	2 hours
	Hold Off	No	No (default)
	Scenes Stop DL	No	No (default)

* LMLS-400 reads the light level at the sensor; generally 1/5 to 1/6 of task level reading. Setpoints are established accordingly.

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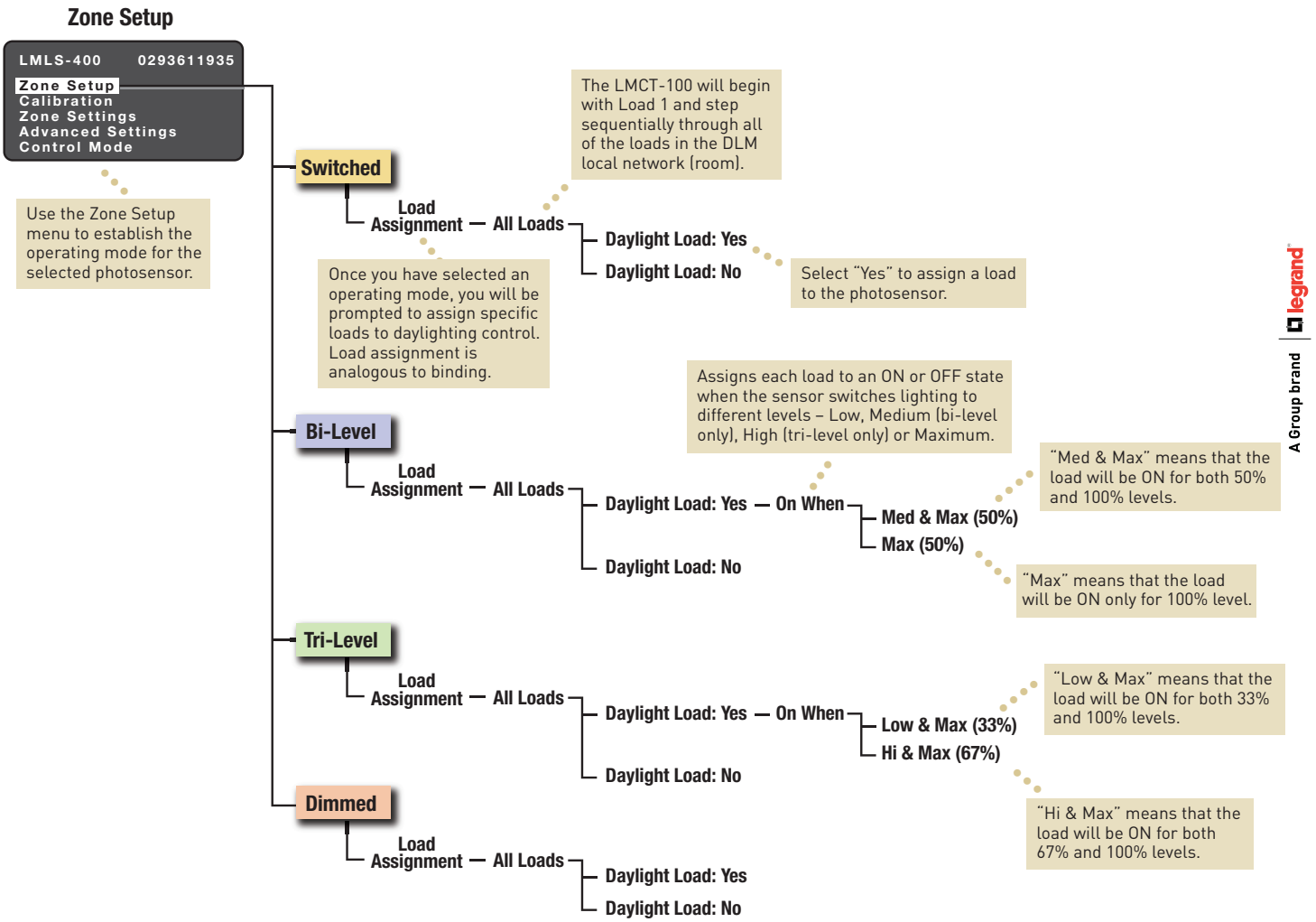
LMCT-100 Daylighting Menus and Menu Options

The following sections describe LMLS-400 configuration options, and illustrate the LMCT-100 main daylighting menu selections you will use to set up each sensor for the desired sequence of operation. Refer to the LMLS-400 installation instructions for additional information.

Zone Setup

After configuring the room using Plug n' Go or Push n' Learn, begin the setup process by selecting a specific LMLS photosensor to configure. The Zone Setup options establish the operating mode and load binding for the LMLS-400 photosensor. Each photosensor must be configured individually.



Single-zone Daylighting Control Sequences of Operation

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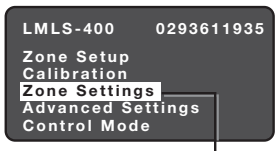
Calibration

Calibration establishes a relationship between workplane illuminance and the light level measured by the sensor. The LMLS-400 may be calibrated automatically or manually. As part of the process, the sensor establishes application-appropriate setpoints based on the illuminance levels detected at the photosensor. If the sensor is not calibrated, the default setpoints will work well for most applications.

Zone Settings

The Zone Settings menu options enable adjustments of parameters for the lighting zone. The options are dependent on the operating mode (switching, bi-level, tri-level or dimmed) selected during Zone Setup. Both the switching and dimming options are illustrated below.

Zone Settings for Switched, Bi-Level and Tri-Level



On Setpoint: Established by calibration, or selected footcandle setting (Default: 7.5 fc)

Target illuminance measured at the sensor below which daylighting loads will turn ON.

Off Setpoint: Established by calibration, or selected footcandle setting (Default: 11 fc)

Target illuminance measured at the sensor above which daylighting loads will turn OFF.

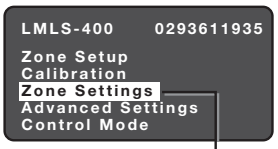
On Time Delay: Range: 1 to 60 seconds (Default: 20 sec.)

Amount of time sensor must detect footcandle level below ON setpoint before lights turn ON.

Off Time Delay: Range: 3 to 30 minutes (Default:10 min.)

Amount of time sensor must detect footcandle level above OFF setpoint before lights turn OFF.

Zone Settings for Dimmed



Day Setpoint: Established by calibration, or setting from 1 to 255 fc (Default: 50 fc)

Desired daytime light level at the sensor.

Night Setpoint: Established by calibration, or setting from 2 to 255 fc (Default: 10 fc)

Desired nighttime light level at the sensor.

Ramp Up: Range: 1% - 100% per second (Default: 20%)

Rate at which light level increases.

Ramp Down: Range: 1% - 100% per second (Default: 2%)

Rate at which light level decreases.

Cut Off Delay: Never, or 1 to 30 minutes (Default: Never)

Amount of time the controlled lighting will remain at the minimum level before switching OFF. "Never" prevents lights from switching OFF automatically due to high daylight levels.

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Advanced Settings

Complete the LMLS-400 setup by using the Advanced Settings menu options to adjust sensor parameters. Use these powerful options to further customize the daylighting sequence of operation for each sensor on each project.

Control Mode

The final menu option is Control Mode. Options include Normal (default), Test, Demo and Disable. Test Mode shortens time delays and speeds ramp rates to allow quick verification of operation. Demo Mode is precalibrated for sales demonstrations. Disable is useful for troubleshooting.

Project Support

Please remember that all DLM jobs with LMLS photosensors must be submitted to WattStopper Project Management for review and approval.

Advanced Settings