

## Multiple-zone Daylighting Control Sequences of Operation

**Topic:** DLM Operation with LMLS-500 Photosensor, v2.xx **Issue:** # TB186 **Date:** March 15, 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-500 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

Until an LMLS-500 is configured, it will not control the lighting. Once the photosensor is configured, daylighting control layers on top of the sequence of operation that has been established for a given room (e.g. Plug n' Go configuration for manual-on; auto-on to 50%; or on to previous level, when personal controls are included). The LMLS-500 may be configured to hold off daylighting loads to maximize energy savings (see page 8). See examples of daylighting control sequences of operation for switching, multi-level control and continuous dimming on the following pages.

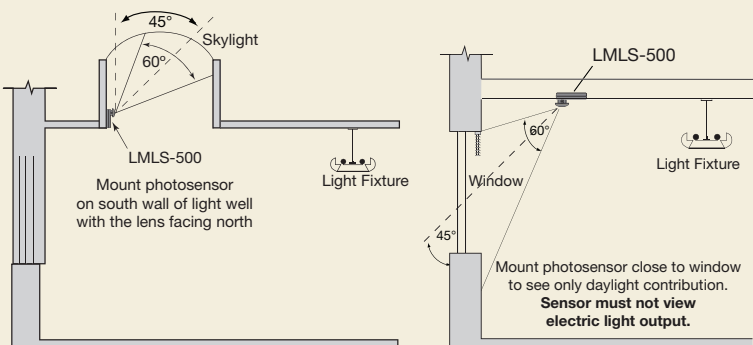
### Photosensor features and applications

The LMLS-500 is a multi-zone, open loop photosensor, characterized by the following attributes:

- Measures daylight level only
- Requires manual entry of target illuminance levels for calibration
- Features simplified commissioning
- Can automatically switch or dim up to three zones of lighting
- Ideal for single or multi-zone toplighting applications with skylights or clerestories, or multi-zone sidelighting applications

### Plug n' Go and Push n' Learn

The LMLS-500 does not participate in Plug n' Go, and Push n' Learn is not used to assign loads for daylighting control. Daylighting loads are assigned to an LMLS-500 using an LMCT-100 Wireless Configuration Tool after other DLM components have been configured.



### Photosensor configuration using LMCT-100

In addition to load binding, the LMCT-100 is used to set up LMLS-500 photosensors to control one to three zones, utilize the desired control strategy (switching, bi-level, tri-level, dimming) for each zone, and to adjust photosensor parameters. It is also used to configure the LMLS-500 and initiate calibration. Detailed information about setup options appears at the end of this bulletin, beginning on page 6, and in the LMLS-500 installation instructions.

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### Example 1: LMLS-500 Multi-zone Switching Control

- **Manual-ON (Loads 1, 2 & 3), Automatic-OFF**
- **Three Daylight Zones, 1 Load per Zone**

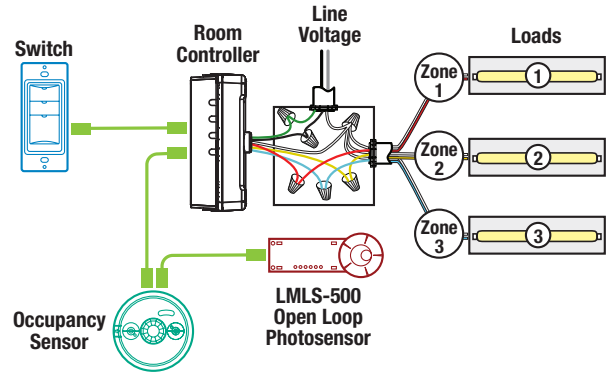
For this example, all loads were configured for Manual-ON operation using Push n' Learn. When an occupant turns a load assigned to daylight control ON, the photosensor takes control of that load.

If the photosensor determines that the light level in one or more of the daylight zones has exceeded the Off Setpoint for more than 10 minutes (Off Time Delay), it will turn the lights in those zones OFF.

If the photosensor later determines that the light level in one or more of the zones has fallen below the On Setpoint for more than 20 seconds (On Time Delay), it will turn the lights back ON.

The On and Off Setpoints for each zone must be defined during calibration.

The occupant can turn the lights OFF and ON with the



switch at any time. 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 of the selected loads for 2 hours (Override Time). Turning one or more loads OFF disables photosensor control for those loads.

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

**See pages 6-8 for more details on photosensor settings.**

LMLS-500 Settings for Multi-zone Switching Control, Example 1				
LMCT-100 Menu	Menu option	Default Setting	Application Setting	
Zone Setup (pg. 6)	Number of Zones	1	3	
	Operating Mode (for each zone)	n/a	Switched	
	Load Assignment	Load 1 Daylight - no		Load 1 Daylight - yes, Zone 1
		Load 2 Daylight - no		Load 2 Daylight - yes, Zone 2
Load 3 Daylight - no			Load 3 Daylight - yes, Zone 3	
Calibration (pg. 7)	Calibration for each Zone	n/a	Enter light level for each zone	
Zone Settings (pg. 7)	On Setpoint	n/a	fc per calibration	
	Off Setpoint	n/a	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)	

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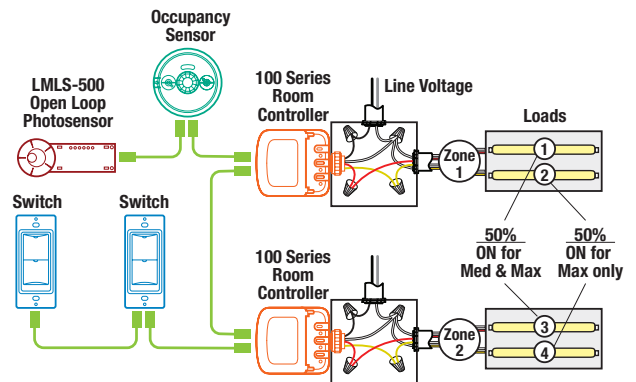
### Example 2: LMLS-500 Multi-zone Bi-level Control

- Auto-ON (1 & 3), Manual-ON (2 & 4), Auto-OFF
- Two Daylight Zones, 2 Loads per Zone

This room is configured for Auto-On to 50% (Plug n' Go). The photosensor is set up to hold daylight loads off (Hold Off setting "Yes") unless it determines there is less light than the value of the On Setpoint in one or more zones.

When the occupancy sensor detects that someone has entered the room, Loads 1 (Zone 1 Med) and 3 (Zone 2 Med) will only turn ON if needed. And, because Allow Override is "No," an occupant can only switch a Max level load (2 or 4) ON if the zone light level remains below the On Setpoint.

Once the lighting is on, the photosensor will switch lights from Max to Med or from Med to OFF in any zone where the level exceeds the Off Setpoint for more than 10 minutes (Off Time Delay). It will restore a higher light level if a zone is



below the On Setpoint for more than 20 seconds.

An occupant can use the switch to select a lower light level, or turn lights OFF, but can only switch lighting ON when the zone light level is below the On Setpoint.

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.

**See pages 6-8 for more details on photosensor settings.**

**LMLS-500 Settings for Multi-zone Bi-level Control, Example 2**

LMCT-100 Menu	Menu option	Default Setting	Application Setting	
<b>Zone Setup</b> (pg. 6)	Number of Zones	1	2	
	Operating Mode (for each zone)	n/a	Bi-level	
	Load Assignment	Load 1 Daylight - no		Load 1 Daylight - yes, Zone 1 On When - Med & Max
		Load 2 Daylight - no		Load 2 Daylight - yes, Zone 1 On When - Max
		Load 3 Daylight - no		Load 3 Daylight - yes, Zone 2 On When - Med & Max
Load 4 Daylight -no			Load 4 Daylight - yes, Zone 2 On When - Max	
<b>Calibration</b> (pg. 7)	Calibration for each Zone	n/a	Enter light level for each zone	
<b>Zone Settings</b> (pg. 7)	On Setpoint	n/a	fc per calibration	
	Off Setpoint	n/a	fc per calibration	
	On Time Delay	20 seconds	20 seconds (default)	
	Off Time Delay	10 minutes	10 minutes (default)	
<b>Advanced Settings</b> (pg. 8)	Allow Override	No	No (default)	
	Override Time	Infinity	Infinity (default)	
	Hold Off	No	Yes	

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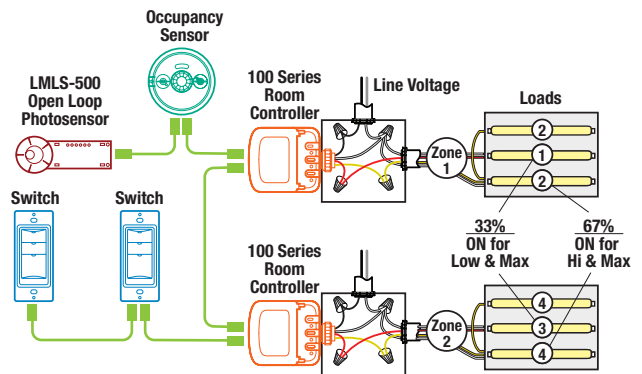
### Example 3: LMLS-500 Multi-zone Tri-level Control

- Auto-ON (1 & 3), Manual-ON (2 & 4), Auto-OFF
- Two Daylight Zones, 2 Loads per Zone

This room is configured for Auto-On to 33%. The photosensor is set to hold daylight loads off (Hold Off setting "Yes") in each zone unless it determines there is less light than the value of the On Setpoint.

When the occupancy sensor detects that someone has entered the room, Loads 1 and 3 will only turn ON if needed. If the zone levels are still below the On Setpoint the occupant can turn Loads 2 and 4 ON without overriding the sensor.

When enabled, photosensor control will reduce the lighting level in any zone that remains above the Off Setpoint for more than 10 minutes (Off Time Delay). 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 control of selected loads (Allow Override "Yes"). The 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 entire sequence starts over the next time someone enters the area.

**See pages 6-8 for more details on photosensor settings.**

**LMLS-500 Settings for Multi-zone Tri-level Control, Example 3**

LMCT-100 Menu	Menu option	Default Setting	Application Setting	
<b>Zone Setup</b> (pg. 6)	Number of Zones	1	2	
	Operating Mode (for each zone)	n/a	Tri-level	
	Load Assignment	Load 1 Daylight - no		Load 1 Daylight - yes, Zone 1 On When - Low & Max
		Load 2 Daylight - no		Load 2 Daylight - yes, Zone 1 On When - Hi & Max
		Load 3 Daylight - no		Load 3 Daylight - yes, Zone 2 On When - Low & Max
Load 4 Daylight -no			Load 4 Daylight - yes, Zone 2 On When - Hi & Max	
<b>Calibration</b> (pg. 7)	Calibration for each Zone	n/a	Enter light level for each zone	
<b>Zone Settings</b> (pg. 7)	On Setpoint	n/a	fc per calibration	
	Off Setpoint	n/a	fc per calibration	
	On Time Delay	20 seconds	20 seconds (default)	
	Off Time Delay	10 minutes	10 minutes (default)	
<b>Advanced Settings</b> (pg. 8)	Allow Override	No	Yes	
	Override Time	Infinity	2 hours	
	Hold Off	No	Yes	

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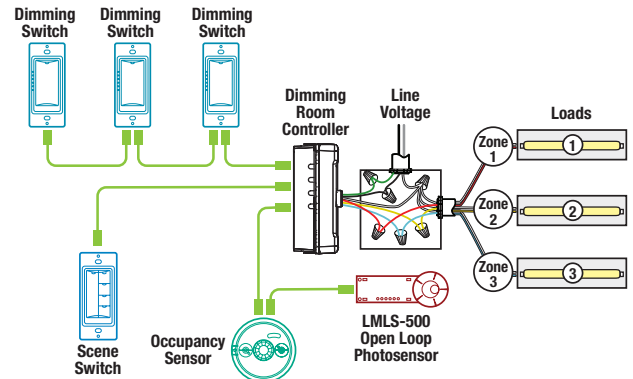
### Example 4: LMLS-500 Multi-zone Dimming Control

- **Auto-ON (Loads 1, 2 & 3), Automatic-OFF**
- **Three Daylight Zones, 1 Load per Zone**

For this example, all loads are configured for Auto-ON. When the occupancy sensor detects motion, all the daylighting loads turn ON to their last non-zero levels. After 3 seconds, the photosensor will adjust the loads to reach the setpoint level for each zone. The setpoints are established by calibration.

If a zone is too dark, the photosensor will raise the lighting level at the Ramp Up rate. If a zone 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 exceeds the Day Setpoint level for more than 10 minutes (Cut Off Delay), the photosensor will switch the load(s) OFF.

An occupant can manually increase the light levels, overriding daylighting control for selected loads (Allow Override "Yes."). An Override Time of 2 hours is permitted.



The Scenes Stop DL option has been set to "Yes," so that if an occupant selects a scene that includes daylighting loads, daylighting control of those loads is suspended. The photosensor will resume control of the loads when the scene level, or the level of any load in the zone is changed.

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.

**See pages 6-8 for more details on photosensor settings.**

LMLS-500 Settings for Multi-zone Dimming Control, Example 1				
LMCT-100 Menu	Menu option	Default Setting	Application Setting	
<b>Zone Setup</b> (pg. 6)	Number of Zones	1	3	
	Operating Mode (for each zone)	n/a	Dimmed	
	Load Assignment	Load 1 Daylight - no		Load 1 Daylight - yes, Zone 1
		Load 2 Daylight - no		Load 2 Daylight - yes, Zone 2
Load 3 Daylight - no			Load 3 Daylight - yes, Zone 3	
<b>Calibration</b> (pg. 7)	Calibration for each Zone	n/a	Enter light level for each zone	
<b>Zone Settings</b> (pg. 7)	Setpoint	n/a	fc per calibration	
	Ramp Up	20%/second	20%/second (default)	
	Ramp Down	2%/second	2%/second (default)	
	Cut Off Delay	Never	10 minutes	
<b>Advanced Settings</b> (pg. 8)	Allow Override	No	Yes	
	Override Time	Infinity	2 hours	
	Hold Off	No	No (default)	
	Scenes Stop DL	No	Yes	



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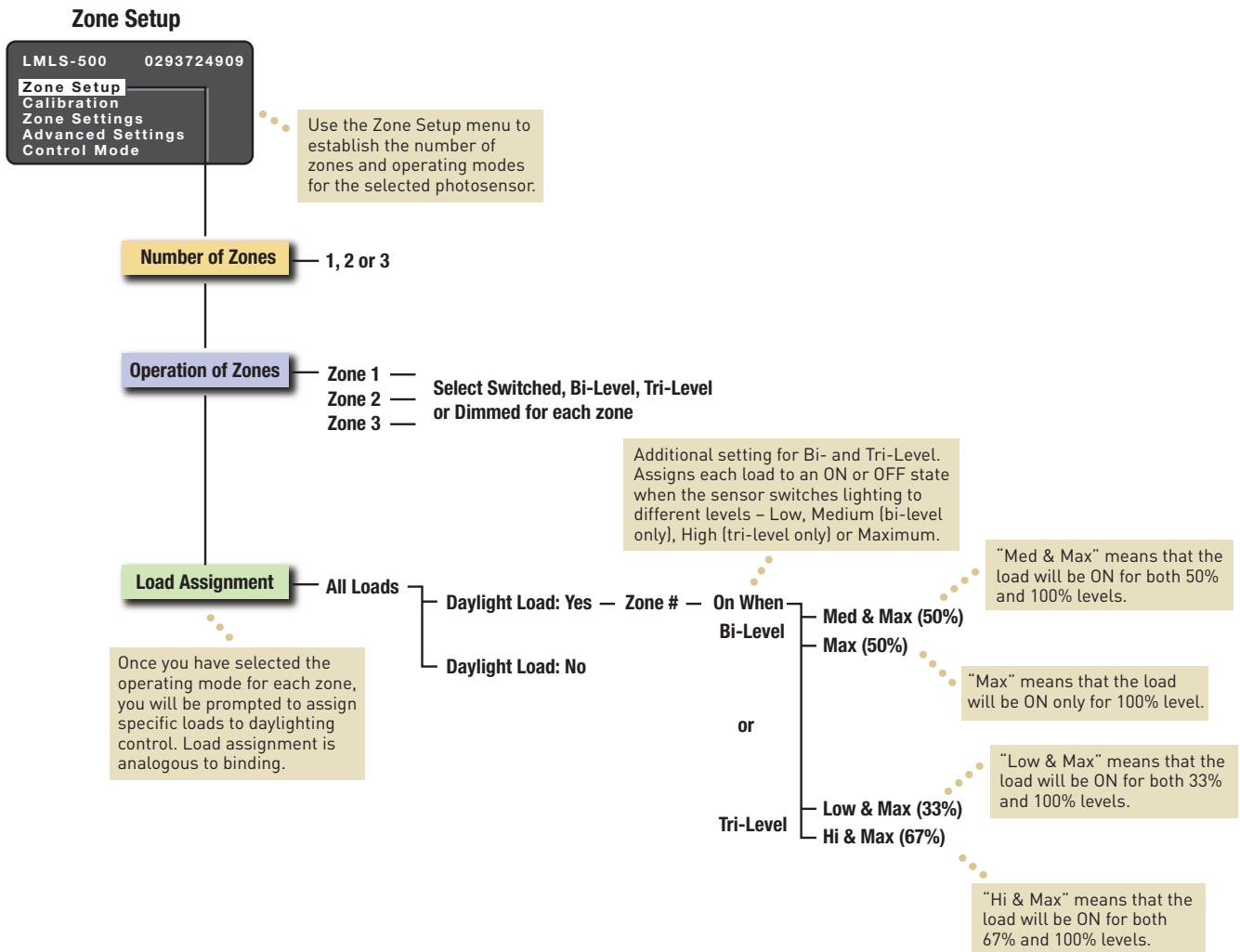
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### LMCT-100 Daylighting Menus and Menu Options

The following sections describe LMLS-500 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-500 installation instructions for additional information.

### Zone Setup

Begin the setup process by selecting a specific LMLS photosensor to configure. The Zone Setup options establish number of zones, the operating mode for each daylighting zone and the load binding. Each photosensor must be configured individually.



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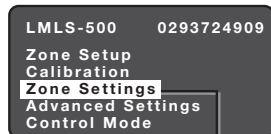
### Calibration

Calibration establishes a relationship between workplane illuminance and the light level measured by the sensor. The LMLS-500 is calibrated manually. As part of the calibration process, the sensor establishes application-appropriate setpoints based on the illuminance levels detected at the photosensor. See the LMLS-500 instructions for additional information.

### Zone Settings

Use the Zone Settings menus to establish setpoints and control parameters for each daylighting zone that was configured during zone setup. The menu options are dependent on the operating mode for each zone (switching, bi-level, tri-level or dimming). 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

Target illuminance below which daylighting load will turn ON.

**Off Setpoint:** Established by calibration, or selected footcandle setting

Target illuminance above which daylighting load 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



**Setpoint:** Established by calibration, or setting from 5 to 200 fc

Desired light level at task surface.

**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-500 setup by using the Advanced Settings menu options to establish control parameters for the photosensor (applicable to all zones). These powerful options help 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

