

## Organic Response / BCA 2013 Applications Guide v1.0

March 2014

### THE BUILDING CODE OF AUSTRALIA

The Building Code of Australia (BCA) is a uniform set of technical provisions for the design and construction of buildings and other structures throughout Australia. Volume One pertains to the class of buildings in which Organic Response is most likely to be deployed and includes offices, multiple dwellings, educational buildings, Hospitals, retail units etc.

Section J of this document relates to energy efficiency in buildings. The sub-section of Section J that relates to both lighting and lighting controls is J6 titled, Artificial Lighting and Power.

This document sets out how the use of Organic Response lighting controls pertains to the requirements of BCA Volume One, Section J6. The document will be useful for Lighting Designers and Consulting Engineers engaged in the design of lighting systems.

### GENERAL REQUIREMENTS OF SECTION J6

Section J6 sets out the maximum illumination power density (W/m<sup>2</sup>) for numerous different types of illuminated space. For example, an office lit to an ambient level of 200lux or more, the maximum allowable illumination power density is 9W/m<sup>2</sup>.

It goes on to recommend an adjustment factor to these power density values to take account of 'Control Devices'. These control devices vary in nature from basic timers to programmable and dynamic dimming systems. Each different type of control device is allotted a different adjustment factor. If a control device or system design achieves more than one requirement, a formula is provided to enable a maximum of two power density adjustment factors to be taken into account.

### ORGANIC RESPONSE POWER DENSITY ADJUSTMENT FACTORS

BCA Volume One Table J6.2b sets out the adjustment factors available for control devices. These devices and how they pertain to Organic Response are summarised as follows;

| Item                         | Description                                                                     | Illumination Power Density Adjustment Factor                                                                             | Organic Response                                                                                                                    |
|------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Motion Detector              | Where up to 2 lights are switched as a block by one or more detectors           | 0.55                                                                                                                     | Organic Response includes a motion detector per luminaire and controls each luminaire individually, hence this factor is applicable |
| Manual Dimming System        | Where at least 75% of the space is controlled by manually operated dimmers      | 0.85                                                                                                                     | Organic Response is not manual so this factor does not apply                                                                        |
| Programmable dimming System* | Where at least 75% of the area of a space is controlled by programmable dimmers | 0.85                                                                                                                     | Organic Response falls in the category of 'programmable dimmer' so this factor applies. See definition below                        |
| Dynamic Dimming System**     | Automatic compensation for lumen depreciation                                   | The design lumen depreciation factor of not less than;<br>(i) Fluorescent Lights 0.9<br>(ii) High pressure discharge 0.8 | Organic Response includes automatic compensation for lumen depreciation so this factor applies                                      |

| Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Description                                                                                                                                                                                                                                                              | Illumination Power Density Adjustment Factor               | Organic Response                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Fixed dimming                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Where at least 75% of the area is controlled by fixed dimmers that reduce the overall lighting level and the power consumption of the lighting                                                                                                                           | % of full power to which the dimmer is set divided by 0.95 | This is available via 'set max' function so this factor is applicable                                                    |
| Daylight sensor and dynamic lighting control device, dimmed or stepped switching of lights adjacent to windows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | a. Lights within the space adjacent to windows other than roof lights for a distance from the window (other than roof lights) for a distance from the window equal to the depth of the floor to window head height<br>b. Lights within the space adjacent to roof lights | 0.5***<br><br>0.6***                                       | Organic Response provides the ability to dim according to daylight for every luminaire, hence this factor is applicable. |
| <p>* Programmable dimming system is defined by Section J as 'where pre-selected scenes or levels are automatically selected by the time of day, photoelectric cell or occupancy sensor'</p> <p>** Dynamic dimming is defined by Section J as 'where the lighting level is varied automatically by a photoelectric cell to either proportionally compensate for the availability of daylight or the lumen depreciation of the lamps'.</p> <p>***The illumination power density factor is only applied to lights controlled by that item (i.e. that daylight sensor). Since Organic Response includes daylight detection in all luminaires, all luminaires that fall within the zone detailed in the table can have the factor applied to them</p> |                                                                                                                                                                                                                                                                          |                                                            |                                                                                                                          |

The Organic Response system qualifies for all but one of the control adjustment factors. However, only two can be taken into account.

**Therefore, in an application without daylight or outside the daylight zone, the Organic Response total adjustment factor is;**  
 Taking motion detector adjustment of 0.55 (A – the lowest applicable factor) and programmable dimming system adjustment factor of 0.85 (B – the second lowest applicable factor) we get;  
 $A \times (B + [(1-B) / 2]) = 0.55 \times (0.85 + [(1-0.85)/2]) = \mathbf{0.4625}$

**And in an application with daylight or inside the daylight zone, the Organic Response total adjustment factor is;**  
 Taking a daylight dimming adjustment factor of 0.5 (A) and a motion detector adjustment factor of 0.55 (B) we get;  
 $A \times (B + [(1-B) / 2]) = 0.5 \times (0.55 + [(1-0.55)/2]) = \mathbf{0.3875}$

## PRACTICAL ADVANTAGES

In practical terms, this means the W/m<sup>2</sup> requirements of section J6 will increase when an Organic Response System is employed. For example an office lit to an ambient level of 200lux or more, the maximum allowable illumination power density was 9W/m<sup>2</sup>. In the area adjacent to the windows, with Organic Response, this will now be 23.22W/m<sup>2</sup> (9 / 0.3875). In all other areas where Organic Response is used in this office, the W/m<sup>2</sup> will be 19.46 (9 / 0.4625).

These factors can be applied to any areas where Organic Response is installed. While this initially feels contrary to our mission of reducing energy usage by lighting, what it allows is more freedom for lighting designers to shift the focus away from providing purely functional lighting to meet energy targets. With the extra W/m<sup>2</sup>, lighting can be designed that enhances occupant comfort – maybe uplighting, pelmet lighting or wall washing – with Organic Response, the choice is yours.