Lighting Controls for Energy Efficiency

GREENWORX

The Ultimate Lighting Control for High-Bay Buildings and Parking Structures
**High-Bay Buildings**

High performance fluorescent lighting gives high lighting levels with minimum energy use.

**SYSTEM SIZE**

An installation can have up to and 250 user-defined zones, and up to 3,500 fixtures.

**MULTI-LEVEL ZONE CONTROL**

In every fixture each ballast is individually controlled to give each fixture, 6, 4, 2, and 0 lamp control. With this capability each zone can be controlled (stepped) to 100%, 66%, 33%, and 0% and set to any one of three user-defined preset scenes.

**ENERGY SAVINGS**

GreenWorx allows the designer to maximize savings from day-lighting and time-of-use scenarios. Most businesses don’t take advantage of the ambient light in their facility.

Even with skylights installed, the lights are on 100% while the business is open. The amount of energy wasted is typically enormous, often consuming up to 50% of the total lighting energy used.

**Stepped Control vs. Dimming Control?**

All GreenWorx fixtures include integral Fixture Control Modules (FCMs) that can produce any one of four-stepped lighting levels (0%, 33%, 66%, or 100%). Stepped-level control is far superior to 0-10v dimming control.

To produce the exact same reduced light output, dimming ballasts will always require more energy input than stepped control. For example, a 3-bulb, 96W T8 fixture with stepped-level control can produce one-third the light using only 32 watts, when a dimming ballast would require over 40 watts to produce the same light output.

**FULLY CUSTOMIZABLE**

The GreenWorx lighting system makes it easy for facilities managers to keep the lighting on only in areas where it is needed, based on day-lighting or occupancy controls, and minimize lighting usage after hours.

**RECONFIGURABLE**

The GreenWorx lighting system zones and scenes can be reconfigured at any time when the user’s needs change. This is accomplished with programming from the GreenWorx System Controller with a PC. There is no need for any wiring changes.

**Intelligent Lighting**

Have you ever wished you could turn off or dim the lights you actually need without having to turn off or dim an entire row of lights?

By making each fixture “intelligent”, like a DALI system, you control how that fixture acts as part of a zone instead of as part of a circuit. Circuit-level control provided by all relay-based panels depends 100% on the way a building is wired.

Buildings constructed over 10 years ago are likely not wired to implement day-lighting or time-of-use scenarios. Multi-level zone-control can save you more than just money on energy, it will make energy savings invisible to your staff, reducing complaints while increasing staff comfort within your workspace. Not to mention, allowing your security staff to control lighting during emergencies.
High-Bay Building Fixtures

GreenWorx-enabled fixtures are specifically designed and configured to maximize savings and simplify the design of your lighting systems. All GreenWorx-enabled fixtures include integral FCMs. Every fixture can be controlled to any one of four-stepped levels (0%, 33%, 66%, or 100%) to produce the most efficient stepped-level control and maximize savings from day-lighting and time-of-use algorithms.

RELIABILITY

Using T5 and T8 technology, proven over many years, GreenWorx incorporates ballasts and bulbs from major manufacturers, with guaranteed reliability, performance and lifetimes.

EFFICIENCY

Using stepped, ballast-level dimming, the highest reliability can be achieved. Stepped dimming is far superior to linear 0-10V dimming especially at lower light levels. For users desiring the highest reliability, specific combinations of very-high efficiency ballasts and bulbs can be specified.

ECONOMY

T5 and T8 technology is produced in such a large volume - at competitive pricing - that GreenWorx can achieve high performance at the lowest cost.
Parking Structures

The typical parking structure lighting package can be designed using GreenWorx fixtures, maximizing energy savings with daylight harvesting, time-of-use and occupancy control. Basing system programming on time-of-day and a photocell’s ability to measure light, you can save the maximum energy on any parking structure.

SYSTEM SIZE

Since each GreenWorx system can control up to 3,500 fixtures arranged in up to 250 zones, the architecture is perfect for large parking structures.

COMMUNICATION RELIABILITY

Powerline Control Systems (PCS) has tested the communication on a circuit 5,000 feet long with perfect reliability. The Industrial Powerline Communication (IPC) is not like wireless systems. RF wireless communication signal strength decreases as the square of the distance: every 20 feet the signal strength is ¼ as strong as the previous location. A GreenWorx signal has no problem traveling 1,000 feet from the circuit breaker panel if that is where the fixture is located. The Cal State University parking structure (pictured) has the footprint equivalent to one football field wide by two football fields long, and the communication is very strong to every fixture.

DAYLIGHT SAVINGS

It is not uncommon to find older parking structures set to be on 100% all day, every day. Since GreenWorx fixtures can be arranged in up to 250 zones, it is simple to set up the correct zone’s day-lighting. Depending on how exposed a parking structure is, the energy savings from day-lighting can be up to 50%.

With GreenWorx, it is very easy to setup and control all sorts of day-lighting zones. Using two zones for day-lighting (daylight high and low) you can achieve two-stage day-lighting to fine-tune the system. With GreenWorx, you can also construct East and West daylight zones. Imagine being able to set up day-lighting zones any way you want, and reconfigure them later.

TIME-OF-USE SAVINGS

New regulations will require parking structures to reduce light-levels during times of low-use or no-use. With GreenWorx, you can reduce any zones to 66% or 33% to save energy during low-use periods. You can also use the built-in scenes to construct scenarios where every other fixture is on – or every third fixture, or any pattern you desire.

SCHEDULES WITH ASTRONOMICAL CLOCK

Quickly adjust schedules and zone control to meet changing needs or tenant requirements based on sunrise-sunset with offsets. The GNC internal time clock also includes auto daylight savings time adjustments. The 20-year calendar with four different daily schedules meets the need of any parking structure or high-bay lighting designer.
Parking Structure Fixtures

GreenWorx-enabled fixtures are specifically designed and configured to maximize savings and simplify the design of your lighting systems. All GreenWorx-enabled fixtures include integral FCMs. Every fixture can be controlled to any one of four-stepped levels (0%, 33%, 66%, or 100%) to produce the most efficient stepped-level control and maximize savings from day-lighting and time-of-use algorithms.

RELIABILITY

Using T5 and T8 technology, proven over many years, GreenWorx incorporates ballasts and bulbs from major manufacturers, with guaranteed reliability, performance and lifetimes.

EFFICIENCY

Using stepped, ballast-level dimming the highest reliability can be achieved. Stepped “dimming” is far superior to linear 0-10V dimming especially at lower light levels. For users desiring the highest reliability specific combinations of very-high efficiency ballasts and bulbs can be specified.

ECONOMY

T5 and T8 technology is produced in such large volumes - at competitive commodity pricing - that GreenWorx can achieve high performance at the lowest cost.
System Overview

**OCCUPANCY SENSOR (OCC)**
Provides four programmable zone presets (High, Medium, Low and Off), plus four low-voltage programmable contact closure inputs.

**ZONE LIGHTING CONTROLLER (ZLC)**
Provides four programmable zone presets (High, Medium, Low and Off), plus four low-voltage programmable contact closure inputs.

**GREENWORX SYSTEM CONTROLLER (GSC)**
The GSC is the main processor for the entire GreenWorx system. The Schedules, Calendar, and Astronomical Time Clock features are stored in the GSC. The GSC is wired to any three-phase breaker in the lighting circuit breaker panel. The programming of the GCS is done through the front RS-232 connector.

**VOLTAGE SENSE MODULE (VSM)**
VSM has four independent programmable line-voltage trigger inputs that can be connected to any high voltage occupancy, photo sensor or simple remote wall switch.

**PC NETWORKING**
The RS-232 connection on front of GSC allows for communications with a PC/laptop for system programming and reporting. This connection can be linked to an Ethernet converter so that the GSC can be accessed by PCS or the facility staff for system control or configuration purposes.
GREENWORX SYSTEM EXTENDER (GSX)
The GSX extends the GreenWorx system to multiple circuit breaker panels. This enables up to 7 additional lighting circuit breaker panels to communicate to the main GSC for complete system control.

INPUT SENSE MODULE (ISM)
ISM has four independent programmable trigger inputs that can be connected to any Class 2 Low Voltage sensor or EMS contact closure.

FIXTURE CONTROL MODULE (FCM)
High-Bay Fixture Wiring
Ballasts
Lamp Bulbs
Line Power
Neutral
System Components

**GREENWORX SYSTEM CONTROLLER (GSC)**
High-reliability central controller of the GreenWorx system.

- Supports up to 3,500 GreenWorx enabled fixtures
- Supports up to 250 wall controllers or input devices
- Astronomical Time Clock and supports a 20-year calendar
- Four individually configurable daily schedules with 255 actions per schedule
- Eight user-defined masks
- All data stored in non-volatile memory
- Timed Zone auto-blink lights-off feature
- Return-to-previous-light-level on power interruption feature
- Integrated RS-232 port for communications with a PC/Laptop for system programming and reporting
- Simple installation: mount and wire into any 3 phase breaker
- Small 8 x 6 x 4 NEMA 1 enclosure

**GREENWORX SYSTEM EXTENDER (GSX)**
When there is more than one lighting sub-panel in an industrial type lighting project. The GSX extends the communication to the rest of the electrical system where the fixtures are powered by additional circuit breaker panels.

- Wired to any 3 phase 20A circuit breaker
- System supports up to seven additional GSX units
- GSX units are connected to the main GSC unit with simple CAT3 or CAT5 low voltage cable
- Small 8 x 6 x 4 NEMA 1 enclosure

**VOLTAGE SENSE MODULE (VSM)**
Allows you to use low-cost high-voltage devices on your network, such as Occupancy Sensors, Photocells and simple toggle wall switches.

- Perfect for connecting remote toggle switches or occupancy sensors to the GWX system
- Senses a line voltage signal, which triggers the GSC which then activates the events, schedules or masks programmed for that input
- Four independent line-voltage inputs
- Each input has separate programmable close and open events
- Connects to any line-voltage occupancy sensor and/or to any line-voltage toggle switch for zone control or mask control
- Communicates on the powerline – no communication or control wiring
- Small 4.9 x 2.35 x 1.25 enclosure

**INPUT SENSE MODULE (ISM)**
Similar to the VSM except it senses UL Class 2 low voltage dry contact closures.

- Senses dry-contact closing (or opening) from any device, such as an occupancy sensor, energy management system, security system, or low-voltage wall switch and triggers the GSC which activates the corresponding pre-programmed events
- Four independent Class-2 low voltage contact closure inputs
- Each input has separate programmable close and open events
- Connect to any Class-2 low voltage occupancy sensor and/or to any Class-2 low voltage switch for zone control or mask control
- Communicates on the powerline – no communication or control wiring
- Small 4.9 x 2.35 x 1.25 enclosure
ZONE LIGHT CONTROLLER (ZLC)
Simple wall controller capable of manually controlling up to four zones.
- Mounts in any 3-gang box
- Wired to only line and neutral
- Control each Zone to 100%, 66%, 33% and 0% (High, Med, Low and Off)
- Can be masked so control is locked out or limited during selected time periods
- Can send Zone On commands with blinked-auto-timed-OFF period
- Four independent Class-2 low voltage contact closure inputs on rear
- Each input has separate programmable close and open events
- Communicates on the powerline – no communication or control wiring

FIXTURE CONTROL MODULE (FCM)
Small line voltage module capable of controlling up to two ballasts.
- Two individual ballast-control circuits
- Can produce 100%, 66%, 33% and 0% levels, giving a very graduated control which is perfect for optimizing energy savings
- Each relay rated to control up to eight 54W T5 lamps
- Zero-crossing based relay open/close timing to maximize relay life
- Auto all-on upon power-up feature to protect user liability
- Up to 16 zones with standard High, Med, Low and Off levels
- Can be part of up to 16 Zones stored in non-volatile memory
- 48 user-defined scenes (3 per zone) where different fixtures in a zone are set to different levels
- Responds to RETURN-TO-PREVIOUS-LIGHT-LEVEL command after power failure
- Fixture will go to 100% if no heartbeat command from GNC is received to protect user liability
- Built in programmable MINIMUM LIGHT LEVEL setting to protect user liability and for use on emergency lighting circuits
- Blink mode to identify fixtures
- Auto-off feature with programmable period and blink-before-off activated from GSC Zone activate commands
- Communicates on the power line – no communication or control wiring
- Small 4.9 x 2.35 x 1.25 enclosure

High-Bay Fixtures
- HE Series (Premium)
- EH Series (Economy)

Parking Structure Fixtures
- VW Series (Premium)
- CS Series (Economy)
System Design Steps (Typical Small Factory)

- 132 high-bay T5 fixtures
- 12 rows of 11 fixtures
- Each row wired to one 20A 277V circuit breaker

**STEP 1**
The designer specifies what different zones are required. Zones are 100% independent of how the circuits are wired.

**STEP 2**
All zones are designed in the GreenWorx software.

**STEP 3**
Zones are programmed into FCMs previously installed in fixtures.

**STEP 4**
Each zone may be controlled individually and manually with a wall-mount ZLC, or by the schedules stored in the GNC, or by occupancy sensors/photo sensors communicated to the GSC.

**STEP 5**
Should changes need to be made by the staff of the facility, zones can easily be reconfigured by a computer connected to the GSC.
**20-Year Calendar**

- Pre-set calendar set up for 20 years
- Any one of four different daily schedules can be assigned to any day
- Auto leap-year built in
- Holidays can be set automatically
- Replicate programming year-to-year
- Stored in non-volatile memory – no battery

**Time Clock Schedule**

- Each Daily Schedule can contain up to 250 events
- Events may be time-based or sunrise/sunset-based with offsets
- The calendar and all schedules are stored in the GNC, not PC
- Auto adjustment for Daylight-Savings Time
- Auto adjustment of sunrise/sunset for Latitude
- Stored in non-volatile memory – no battery
The GreenWorx Difference

The GreenWorx powerline communication works when other powerline or RF methods don’t.

The powerline communication technology, IPC, evolved from our patented Universal Powerline Bus (UPB) technology used in our PulseWorx residential systems. There are also new patents pending protecting the multi-panel GWX system. Starting in 2005, IPC and the GWS system were specifically designed to address the high-bay and parking structure markets.

Both UPB and IPC use very large pulses to communicate, rather than modulated RF signals. All other communication on the powerline is some form of powerline carrier (PLC) modulated RF signals. These PLC signals typically in the range of 2-5Vpp. UPB and IPC use Pulse Position Modulation (PPM) with pulses in the range of 5-50Vp for UPB and 20-200Vp for IPC. Because of the fundamental nature of our PPM communication method IPC communication is more reliable on higher line-voltages than lower voltages.

IPC does not use any form of PLC modulation and should never be referred to as powerline carrier. Sportlight’s Pulsebloc™ system (licensed from PCS) utilizes a version of IPC. There are approximately 240 working Sportlite Pulsebloc installations that were installed from 2005 – 2011.

About Us

GreenWorx is built by Powerline Control Systems, Inc. – the undisputed leader in the powerline lighting control industry.

In 2004, after PCS had successfully established and tested its patented UPB® powerline communication technology for residential applications (known as PulseWorx®, www.pulseworx.com), PCS set their sights on tackling the three-phase multi-panel industrial/commercial environment. Up until that point, there had been NO successful retrofittable solutions, either powerline or RF, for the industrial (high-noise, high-attenuation) environment.

PCS designed a variation of UPB, called Industrial Powerline Communication (IPC), specifically for the three-phase multi-panel industrial lighting control environment. IPC™ is the first and only non-hard-wired solution to succeed in this environment. PCS products are designed to use standard high-voltage powerlines to communicate control signals without additional wiring, providing customers an affordable, flexible lighting control system.

Warranty

All GreenWorx products are all Made in the USA, designed with quality parts, and subjected to extensive testing and quality control, which allows Powerline Control Systems to offer an industry leading 5-year warranty.

19201 Parthenia St., Suite J
Northridge, CA 91324
888-701-9831
www.pcslighting.com

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