CONVERGING SYSTEMS

TechNotes

Revision 10/17/2022

Circadian Lighting with ELAN (Nice)

Converging Systems LED Lighting Controller Systems

Min. Requirements

- e-Node/4000
- ILC-400/450
- Latest Elan driver packet for e-Node (v1.0.45 or later)
- ELAN OS (v8.6 or later)

Driver Backgrounder

Converging Systems has developed a suite of Elan field-tested drivers for its ILC-xx0 family of LED lighting controllers. The firm's IP-based communication device (e-Node) fully supports Converging Systems' own CSDDP (Converging Systems Device Discovery Protocol) for the individual discovery of connected lighting controller. Converging Systems continually updates its lighting controller offerings as well as its ELAN driver suite to enable installers to enjoy these new features. One such feature is **Circadian lighting** (see below).

Note: Converging Systems as a corporate policy makes available all of its device drivers for no charge to Converging Systems' dealers who are integrating the firm's hardware. Please refer to the this link for more information https://www.convergingsystems.com/inres_elan_lua.php

Although all Converging Systems drivers are hosted on the ELAN (Nice) dealer website (through the Management Cloud), latest drivers can always be downloaded here.
http://www.convergingsystems.com/software/local_profiles_library.php#elan

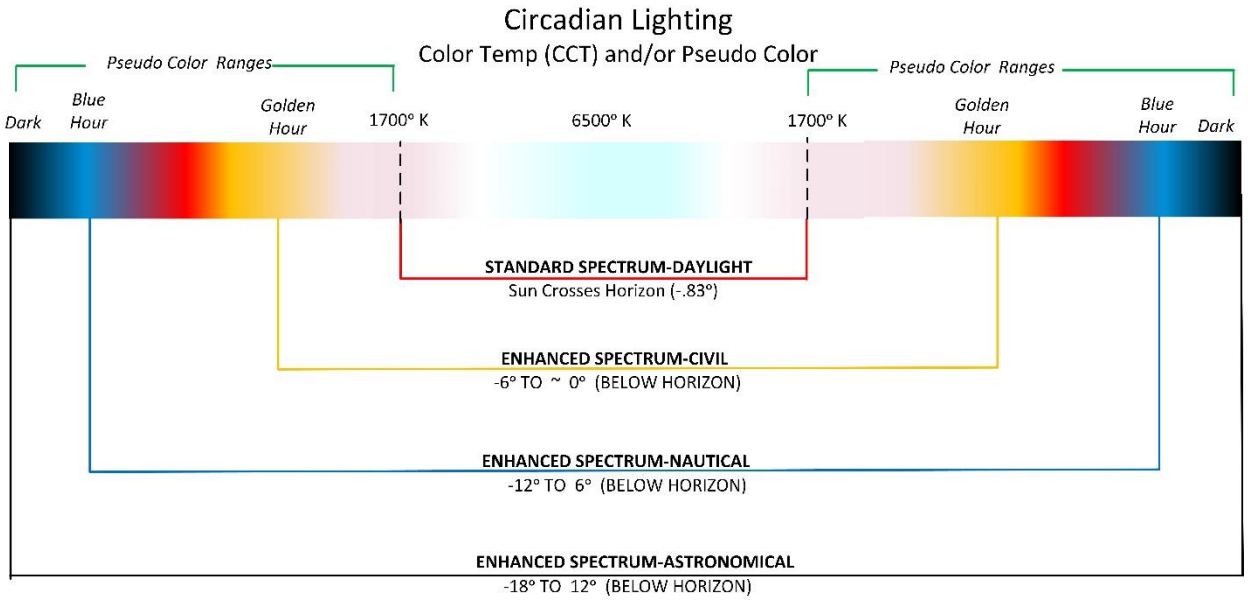
Circadian Lighting

Circadian Lighting is a corollary to human circadian rhythm. Circadian rhythm is a 24-hour clock controlled by the hypothalamus, an area of the brain, that controls each person's circadian rhythm by receiving stimuli from the eyes and signaling when it is daytime and nighttime. Cooler temperatures are used in spaces when it is appropriate to promote alertness and attention. Warmer temperatures (seen when the sun is rising or setting) are used when people are waking up or falling asleep. The concept of using light to influence human circadian rhythm is a relatively new idea in the lighting industry and research continues to provide new findings. Converging Systems has mapped the chromaticity values of the sun on the Big Island of Hawaii (where the atmospheric interference is often less intense and/or impacted by pollution/cloud cover) over a course of a week from total darkness to mid-day sun and then all the wall back to darkness over a number of successive days. (This is one of the reasons the Mauna Kea observatory was built at that location). Converging Systems then mapped those values along with proprietary algorithms into a number of our own Circadian-compatible ILC-4xx controllers leveraging off of the e-Node 4000 family's most powerful front-end processor which enables the feature set documented within this Tech Note.

In order to understand the significance of these advancements, the following short section (not mandatory reading) has been created to explain the range of Circadian Lighting output choices available. The built-in intelligence and the user-entered geographical location is all that is required to trigger accurate Circadian lighting capability within this environment. Please note that for simplicity the following description relates to pre-dawn to mid-day sun events (but the concepts are equally applicable-yet reversed for pre-sunset through dusk to total darkness).

Understanding Night to Mid-day Sun Events (or Mid-day Sun to Night Events)

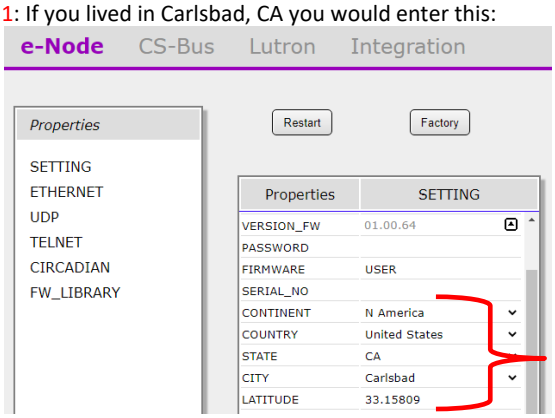
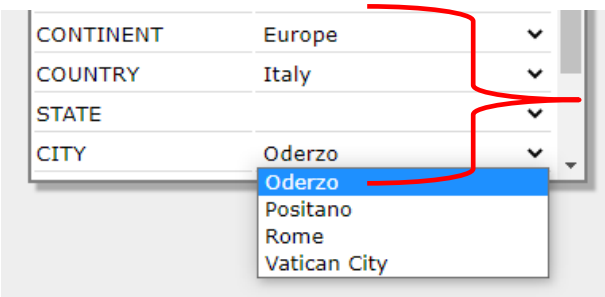
Note there are three major Periods (i.e., Astronomical Twilight (AT), Nautical Twilight (NT) and Civil Twilight (CT)) leading up to traditional DayLight (DL) sun. During each of these periods there are mid-to-wide variations in the chromaticity (**H**ue and **S**aturation) as well as **B**rightness levels perceived by an optical receiver (electronic equipment or the human eye). With proper replication of these variations within each Period, a lighting system can be used to provide a good approximation in many regards (but not all) to the target Sun's output. These periods and their associated light output are quite relevant to replicating Circadian cycles for health, comfort, marketing, or particular product differentiation needs. These Periods are represented by the following figure.

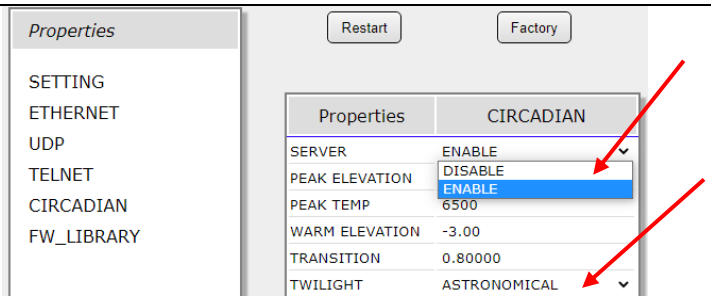
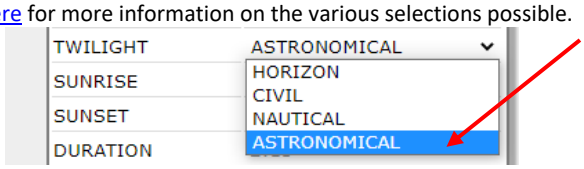


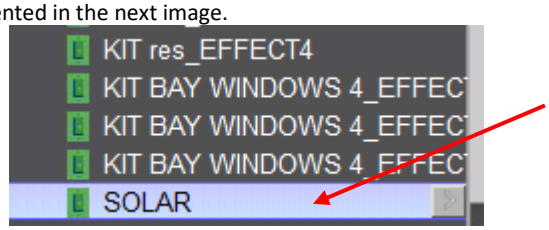
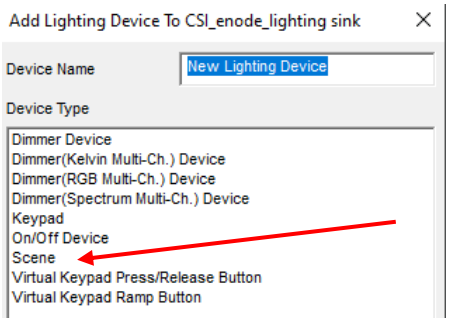
The selection and proper representation of these four types of Circadian cycles is implemented with the e-Node/4000 gateway. For more information, see a separate Tech Note here.

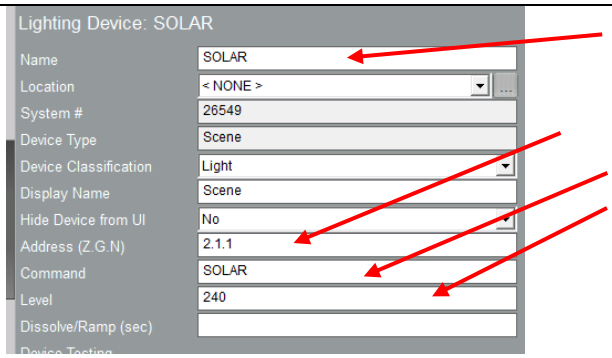
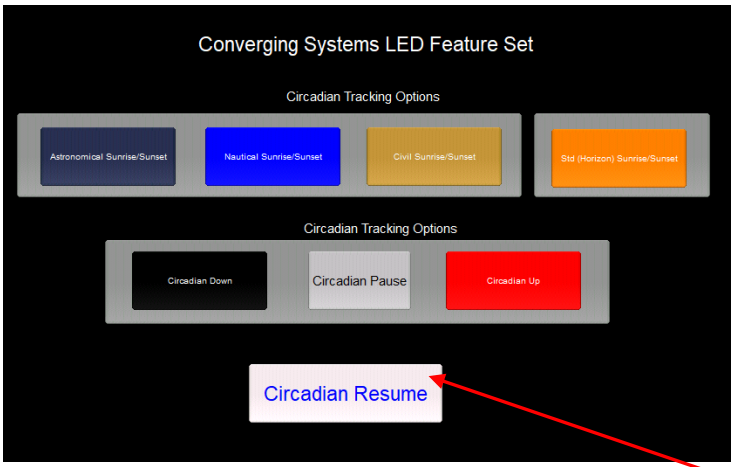
Quick Steps

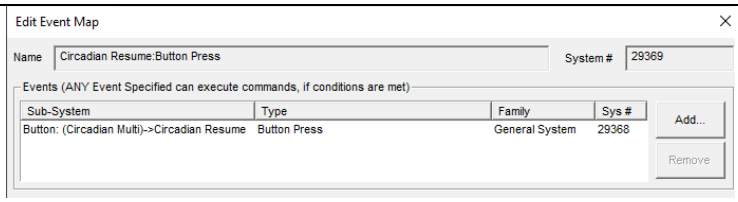
We have created this Tech Note for installers interested in experimenting and implementing Circadian Lighting from ELAN (Nice) platforms. You are free to modify the assumptions given above for the particulars of your installation.

Step #	Overview	Steps
1	Set-up your location within the e-Node/Settings page. **Note**: This feature requires that you are initially connected to the internet to access the pre-programmed database of cities and time zones After the initial setup, it is often not necessary to be internet-connected for proper operation.	Within the e-Node 4000 **Settings** tab, enter your city or city close to your location or alternatively your Latitude/Longitude (negative sign for West or South entries). Example 1: If you lived in Carlsbad, CA you would enter this:  Example 2: If you lived in Oderzo, Italy you would enter this:  **Note**: Since there is a vast set of cities throughout the world accessible and selectable through the scroll down menu within this setup feature, if your city is not listed, it is generally sufficient only to select the closet city to your location (provided it is within the same time zone as your location).
2	Invoke the Circadian Server's functionality (within the e-Node)	**Step 2a**. Invoke the Circadian Server. Within the e-Node 4000 **Circadian** tab, set Server to **Enabled** (see image 4 below). This sets up the e-Node internally to track all the metrics for the solar cycle for the specific programmed location. However, not until a linkage between a specific **Z**one/**G**roup/**N**ode (**Z.G.N**) Device address and the Circadian server (enabled in this Step 2) is set up, will any particular lighting element be considered "Circadian Active." Now proceed to Step 3 to make that linkage. **Note**: there are additional settings below the **Server** entry. These are more advanced in concept and can simply be left as is for now.

		 **Step 2b**. Select the type of **Twilight** desired. Invoke the Circadian Server. See link here for more information on the various selections possible.  Note: for the most vibrant (and most complete) twilight, select **Astronomical**.
3	Make any target **Z**one/**G**roup/**A**ddress (address for any ILC-xxx controller) **Circadian Active**.	In order to make a specific Device (with a **Z.G.N** address) **Circadian Active**, the **SOLAR** command needs to be invoked for each Device. A Device here shall be considered one with a unique **Z**one/**G**roup/**N**ode address (**Z.G.N**). Wildcards can be used to trigger an entire range of devices where a "0" within a specific octet, controls all devices with numbers between 1 and 254 (in that octet). **EXAMPLE 1**. This is an example of a command that is required to invoke the Circadian Server for a lighting controller with a ***Z.G.N*** of 2.1.1 and a peak brightness of 100% (referring to the maximum brightness of the Circadian cycle when the sun is at its highest apogee). **Note**: The range for the Circadian Cycle maximum brightness level can range from >0 to 240 which equates to >0 to 100%--therefore, a value of "240" means 100% brightness at the cycle's midpoint. String: **#2.1.1.LED=SOLAR,240;<cr>** Detail: This above string will trigger a LED controller with a **Z**one/**G**roup/**N**ode address of 2.1.1. that includes (i) the trigger command **(SOLAR)** to invoke the Circadian Server and (ii) the peak brightness value of 240 (i.e., 100% at mid-day peak) for the circadian cycle. **EXAMPLE 2:** If you wanted to adjust the maximum brightness intensity (for mid-day sun to 75% of the available brightness) for your luminaries you would enter: String: **#2.1.1.LED=SOLAR,180;<cr>** **(since "180" is 75% of 240)** Note: Different fixtures can have their own level of brightness. **EXAMPLE 3:** This is an example of a command that is required to invoke the Circadian Server for a bank of lighting controllers with the same Zone and **G**roup address but with differing **N**ode addresses (i.e., three devices with addresses 2.1.1 for the first device, 2.1.2 for the second device, and 2.1.3 device for the third device). Here a wildcard address of **Z.G.N of** 2.1.0

		can be used. Again, a peak brightness of 100% or "240" (referring to the maximum brightness of the Circadian cycle's when the sun is at its highest apogee) will be used. String: **#2.1.0.LED=SOLAR,240;<cr>** Detail: This above string will trigger LED Devices (controllers) with a **Z**one/**G**roup/**N**ode address of 2.1.0. that includes (i) the trigger command name (**SOLAR)** which triggers the targeted device(s) to be **Circadian Active** with (ii) its peak brightness value of 240 (i.e., 100% at mid-day peak) for the circadian cycle. Now proceed to Step 4 to implement this **Circadian Active** function.
4	"SOLAR" command discovery or creation within Configurator.	Depending upon the release of the ELAN driver for the e-Node, a device entry named **Solar** may or may not be auto-discovered. If is has been auto-populated through an ELAN driver update, it will appear similar to that represented in the next image.  However, if it does not auto-populate for any devices that can support Circadian (i.e., ILC-400/ILC-450 currently are the only supported controllers), then it can be easily added within Configurator as shown below: **Step 4a**. Under the e-Node (to which the targeted Device is connected), create a new **Scene** Device  **Step 4b**. Enter the following parameters: -**Name** the new device appropriately -Enter applicable **Address** in **Z**one/**G**roup/**N**ode format **(with dots)** -For **Command**, enter **SOLAR (uppercase)** -For **Level**, typically enter 240 (unless you want peak brightness to be less)

		
5	GUI/UI control within Elan	**Background on Operation**. Once a **Z.G.N** address (Device) has been made **Circadian Active** (through initially turning on the Circadian server-ENABLE within e-Node, and a subsequent triggering of the **SOLAR** command for the particular **Z.G.N** address has been issued, the targeted **Z.G.N** Device will continue to operate outputting a Circadian cycle daily until interrupted. Interrupted means that the Z.G.N Device receives any command (i.e., OFF, ON or any other CCT or Color setting or brightness-SET command). At the point of interruption, the Circadian tracking is temporarily suspended until one of the following events occurs: -The next calendar day occurs when the e-Node Circadian Server will automatically retrigger a Circadian active state as if nothing ever stopped or interrupted it, or -The SOLAR,n command is once again transmitted to the targeted device. Now, let's implement a GUI object to re-trigger the Circadian operation in case it is desired to restart after an interruption. **Step5a**. Creating a GUI object to restart Circadian, if desired  -The above example shows a "Circadian Resume" button. Just create a Button (standard) and name it appropriately. -Then create an event map for that button to the device created in Step 4b above.

		 Now, whenever you re-start (at the current time) the Circadian Service for a targeted **Z.G.N** device, all you need to do is press the Circadian Resume button.