

# ADVANCE

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The reliable, flexible  
choice for  
easy indoor  
luminaire design-in

SR FlexTune  
LED Driver

Design-in Guide



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# Introduction to Advance Xitanium SR FlexTune LED driver



Advance Xitanium SR FlexTune 40W linear driver



Advance Flextune LED modules



This guide contains information to help you design Advance Xitanium SR FlexTune LED driver into a luminaire. We advise you to consult our website for the latest up-to-date information.

## Information and support

If you require any further information or support please consult your local Advance sales representative or visit <https://www.signify.com/en-us/brands/advance/led-drivers>

## Application note

The Advance Xitanium SR FlexTune LED driver offers unparalleled flexibility for your next lighting project that utilizes correlated color temperature (CCT) tuning capability. This driver is equipped with our Sensor Ready (SR) interface and offers a means for digital control of the driver including CCT tuning and all the benefits of a wireless connected system, including its use in a luminaire-based networked lighting control system.

The Advance Xitanium SR FlexTune LED driver can be used with the different LED modules as part of the FlexTune system, or it may also be used with non-Signify modules by appropriately configuring the driver settings as described in this document.

With the Xitanium SR FlexTune LED driver you can precisely control the CCT and light output down to 1% minimum dim level and the driver will maintain compliance with the NEMA flicker requirements across the full range of its operation.

The Xitanium SR FlexTune LED driver is compatible with the requirements outlined in DALI 209 (device Type 8) as part of the DALI-2 standard, and can directly accept CCT and dim commands from an external sensor/network controller. This simplification offers an elegant system architecture to minimize complexity and maximize value to create the right digital foundation for your next connected lighting project. All of the configurable features within the Xitanium SR FlexTune LED driver (ALO, CLO, FlexTune parameters etc.) are described in the section Features of Advance Xitanium SR FlexTune LED drivers.

## Explanation of the commercial naming of the Xitanium LED Drivers

The names of the drivers are defined as shown in the example below:

### **Xitanium 40W 0.1-1.1A 54V 120-277V -T**

Xitanium	:	Concept name for highly efficient and reliable drivers
40W	:	Maximum output power
0.1-1.1 A	:	Adjustable output current range to meet specified max output current and dimming range
54V	:	Maximum output voltage
120-277V	:	Input voltage range
- T	:	Housing type

# Safety precautions



## Warnings

- Avoid touching live parts!
- Do not use drivers with damaged wiring!
- Turn off DALI power supply when using driver as standard DALI driver!

## Safety warnings and instructions to be taken into account during design-in and manufacturing.

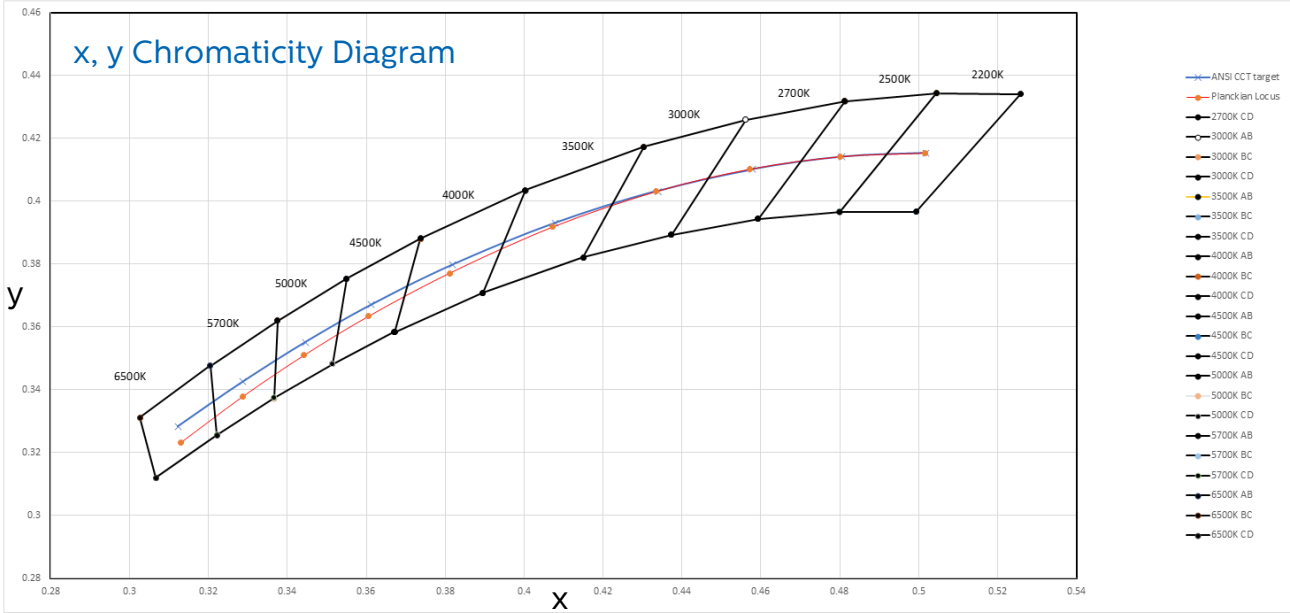
- Do not use damaged or defective contacts or housings.
- Do not service the driver when the mains voltage is connected; this includes connecting or disconnecting the LED load.
- Do not use damaged products.
- Cap off all unused wires to prevent accidental contact with the luminaire or driver housing.
- The luminaire manufacturer is responsible for its own luminaire design and has to comply with all relevant safety standards.
- The Xitanium SR LED Driver is intended for built-in use and should not be exposed to the elements such as snow, water and ice. Exposure will lead to corrosion of the driver housing and should be avoided. It is the luminaire manufacturer's responsibility to prevent exposure. Xitanium SR Indoor Drivers are specified for UL damp and dry locations.
- Driver must be installed in accordance with national and local electrical codes.
- Design-in support is available; please contact your Advance sales representative.

# Driver operation

## Chromaticity diagram

To understand how the Advance Xitanium SR FlexTune driver operates as a color control device, it is first necessary to understand the chromaticity diagram and how it relates to color correlated temperature (CCT).

Shown below is an abbreviated representation of the CIE 1931 x, y chromaticity diagram. The red line curve represents the Planckian locus, often referred to as the black body curve, that can be used to designate the relative color temperature of a light source and is expressed as absolute temperature (Kelvin). From this diagram we can see there can be an infinite number of chromaticity coordinates (x,y) that could represent any correlated or apparent color temperature. In order to better define color temperature, the American National Standards Institute (ANSI) has specified a range of chromaticities acceptable for a specific color temperature. The quadrangles in the diagram represent the boundaries ANSI has assigned for each CCT. The blue line curve is representative of a centerline of the ANSI quadrangles. It is easy to see that the black body curve and the ANSI centerline curve diverge from one another, mostly at what we indicate as cooler CCTs. Center points for each CCT are indicated for both the black body curve and ANSI centerline curve.



x,y chromaticity diagram

## CCT tuning

It is important to understand this diagram because the digital addressable lighting interface (DALI) standard adopted for color control uses the x, y coordinates representing each CCT. The DALI 209 standard, also known as DALI Type 8, defines a DALI compatible device (device Type 8), which allows a user to change color temperature and intensity to their preference within the same luminaire to achieve tunable white color changing. The Advance Xitanium SR FlexTune driver is a DALI type 8 device and uses x, y coordinates for color tuning.

The Advance Xitanium SR FlexTune driver meets the requirements of DALI 209 with the following two exceptions:

- 1) The DALI command, STORE\_COLOUR\_TEMPERATURE\_Tc\_LIMIT, used in conjunction with the DALI commands COLOUR\_TEMPERATURE\_PHYSICAL\_COOLEST\_Tc and COLOUR\_TEMPERATURE\_PHYSICAL\_WARMEST\_Tc, will have no effect for the Advance Xitanium SR FlexTune driver. These parameters, Cool LED\* and Warm LED\* are configured, through the MultiOne configurator, by the use of the LED string configuration feature\* in order to achieve the most accurate color temperature performance.
- 2) The factory defaults for the DALI commands, POWER\_ON\_COLOR and SYSTEM\_FAILURE\_COLOR, will return predefined values for both the Power on Tc\* and System failure Tc\*. The Advance Xitanium SR FlexTune driver is configured, through the MultiOne configurator, to use a CCT of 3500K for both the Power on Tc\* and System failure Tc\* features. The values for these features can be modified by the OEM or end user to their preference.

\*See the "SimpleSet configurable features: FlexTune specific features" section for an explanation and configuration settings of these features.

The MultiOne configurator allows for both x, y coordinate entry and CCT entry but for CCT entry, the CCT entry is converted to an estimated x, y coordinate. This conversion results in some error in accuracy and the direct x,y coordinate entry method is recommended for this reason. It is also important to note that MultiOne uses the ANSI centerline curve, and not the black body curve, for estimating the x, y coordinates when entry by CCT is made. All of the x, y coordinate calculations are done within the MultiOne tool and the resulting DALI values are transferred to the Advance Xitanium SR FlexTune driver. The Advance Xitanium SR FlexTune driver interprets these values and performs the correct CCT tuning.

Note: All x, y and CCT MultiOne configurator entries are values that have originated from the datasheets for the LED module being used with the Advance Xitanium SR FlexTune driver.

## MultiOne implementation

The Advance Xitanium SR FlexTune driver uses a subset of the DALI 209 variables to program the desired CCT behavior. These are shown below with the corresponding MultiOne GUI representations. These MultiOne GUI items are explained in more detail in the section: Features of Advance Xitanium SR FlexTune LED drivers. More information concerning MultiOne and its implementation is located here: <https://www.signify.com/en-us/portfolio/oem/tools-and-software/multione-configuration-system>

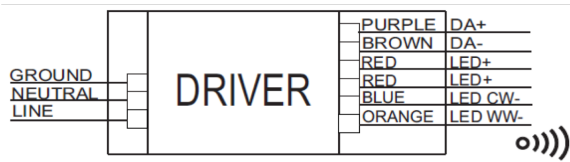
### DALI209 variable

COLOUR TEMPERATURE Tc PHYSICAL COOLEST  
COLOUR TEMPERATURE Tc PHYSICAL WARMEST  
POWER ON COLOUR VALUE  
SYSTEM FAILURE COLOUR VALUE  
COLOUR TEMPERATURE Tc COOLEST  
COLOUR TEMPERATUER Tc WARMEST

### MultiOne GUI item

Cool LED  
Warm LED  
Power on Tc  
System failure Tc  
Tc coolest  
Tc warmest

# Features of Advance Xitanium SR FlexTune LED driver



Connector terminal diagram

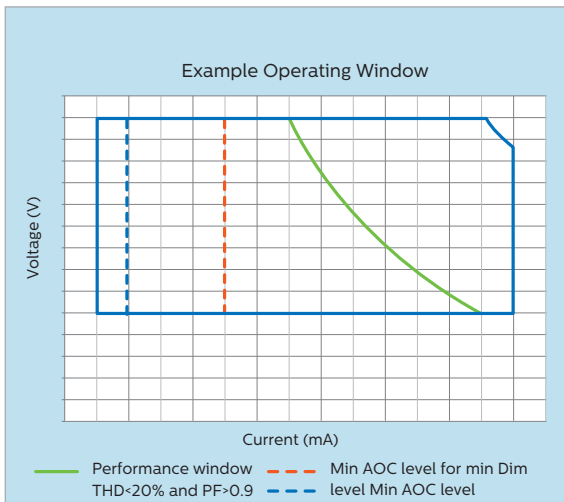
## Driver wiring

Connector terminals with their corresponding functions are shown, in the diagram to the left, for an Advance Xitanium SR FlexTune driver. The driver housing must be grounded (earth connection) via the metallic mounting tabs of the housing. The mains connections are accomplished via the black and white connections. The DA+ and DA- digitally addressable lighting interface (DALI) terminals are used for connecting the external DALI sensor. There are two sets of LED+ terminals provided for connection to the cool white positive (CW+) and warm white positive (WW+) terminals of the LED module. These can be used interchangeably. There are also two terminals, LED cool white negative (CW-) and LED warm white negative (WW-), that are not interchangeable and must be connected to the corresponding CW- and WW- terminals of the LED module.

The connectors used for the Advance Xitanium indoor LED drivers can only accommodate solid wire sizes of 16 AWG - 22AWG. Consult factory for any other wire types. Please ensure that the gauge of the wires inserted into the connectors comply to this specification. 18AWG solid wire is preferred for maximum performance and reliability of the wiring connection.

## Important wiring considerations

- Keep wiring between the driver and the LED module as short as possible. **Note: Due to the CCT tuning design of the driver, there is a maximum length of six feet for any connection between the driver output and the LED module to maintain CCT tuning accuracy.** Distances greater than six feet are permissible but CCT tuning accuracy cannot be guaranteed. There may be an impact on the electromagnetic compatibility (EMC) performance.
- Keep the sets (+/-) of CW and WW wires between the driver output and LED module the same length if possible for the best performance.
- Route the CW- and WW- wires closely together. Consider twisting the CW- and WW- wires, where possible, for the best overall performance.
- Remote mounting of the driver is not allowed using the Advance Xitanium SR FlexTune driver.



Example operating window (dimmable driver)

## Operating window

Drivers can deliver different levels of output power, depending on driver type, and a different output current/ output voltage window applies to each. The LED load current and voltage characteristics must be within the driver window (under steady state, full output or dim). The driver performance cannot be guaranteed outside the window. See the illustrated example of an operating window for a dimmable driver. Please consult the datasheet for the specified operating window for the driver you are using.

The LED load voltage is typically influenced by a number of factors such as the LED temperature, binning (tolerance), drive current and aging. It is important to consider these factors when determining the required voltage range for a certain LED load to ensure that the LED voltage stays within the operating window of the driver. The driver will limit the voltage available for the LEDs based on its operating window.

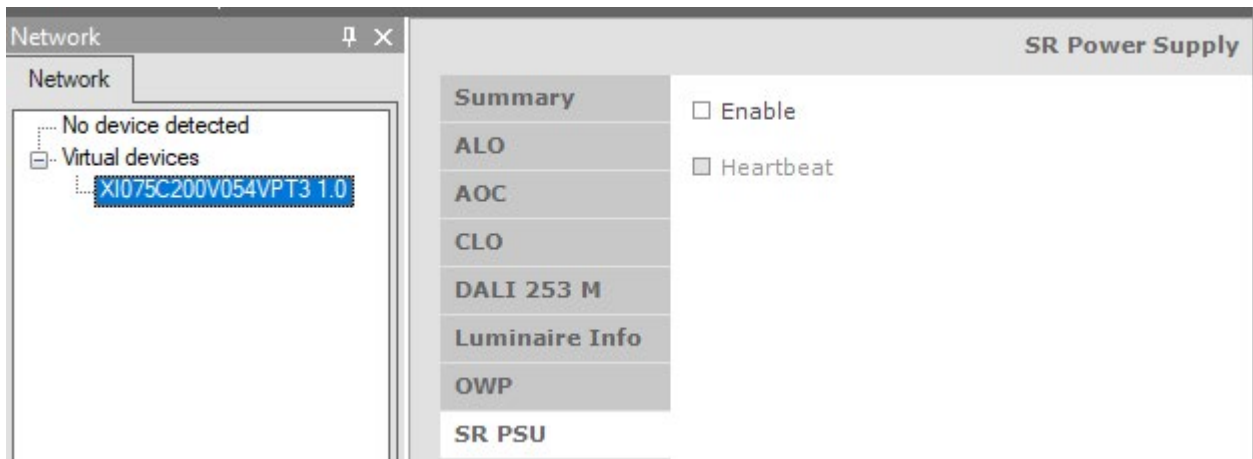
### Precautions for DALI network applications:

- > Length of wiring; using 18 AWG, the maximum length of the dim wiring, when used for DALI communication, should not exceed 1000 ft. (300 m.).

The SR control interface terminals are isolated from mains and LED output terminals, and qualified as UL Class 2 circuit.

### Configuration options:

- > Disable SR/DALI power supply on each driver.



- > Maintain SR/DALI wiring polarity for the entire installation. Connect SR+ or DA+ to DALI +, and SR- or DA- to DALI -.
- > No mis-wiring of SR /DALI terminals to AC mains. Such miswiring will damage the driver and void warranty.
- > The DALI controller manufacturer must verify interoperability. Normally the network size is limited to 64 drivers per single DALI bus.
- > Staying below 64 drivers would also meet UL 8750 control circuit leakage current limit.

## SimpleSet configurable features: General features

Note: Please also refer to the Philips MultiOne configurator user manual for more information. More information concerning MultiOne and its implementation is located here: <https://www.signify.com/en-us/portfolio/oem/tools-and-software/multione-configuration-system>

Feature	Description of the feature	Notes and examples
<p><b>ALO (%)</b></p>	<p><b>Adjustable lumen output (ALO).</b> This feature gives installers the ability to select the output current as a percentage of adjustable output current (AOC). When ALO is 100%, the output current is the same as AOC. ALO is limited by ALO minimum.</p> <p>Note: The AOC function for the FlexTune driver is located in the FlexTune feature section.</p>	<p>ALO is expressed in percent and allows the OEM or end user to fine-tune the light output. For example, a luminaire with an initial light output of 4000 lumens could be adjusted to 3000 lumens if desired. This tuning can be accomplished without the addition of a dimming control.</p> <p>Note: The AOC function for the FlexTune driver is located in the FlexTune feature section.</p>
<p><b>ALO min (%)</b></p>	<p><b>Adjustable lumen output minimum (ALO min).</b> This feature gives the OEM the ability to select the minimum output current output as a percentage of adjustable output current (AOC). Setting the minimum current prevents end users from setting ALO outside of the intended LED driver performance window and helps ensure electrical performance conditions are met (for example, PF and THD specifications required by DLC). The default value is decided by the ratio of the minimum output current (I<sub>out</sub>) indicated in the driver datasheet and by the AOC.</p> <p>Note: The AOC function for the FlexTune driver is located in the FlexTune feature section.</p>	<p>ALO min is expressed in percent and is adjustable within the following range: maximum 100%; minimum (default value) minimum AOC value divided by maximum AOC values. (Both values are from the product datasheet.) For example, the maximum (default) AOC for the 40W linear driver with SimpleSet technology is 1.1A (1100mA) and the minimum AOC is 100mA. Therefore, the default ALO min is 100/1100, or about 9%.</p> <p>Note: The AOC function for the FlexTune driver is located in the FlexTune feature section.</p>

**Adjustable Light Output**

**Summary**

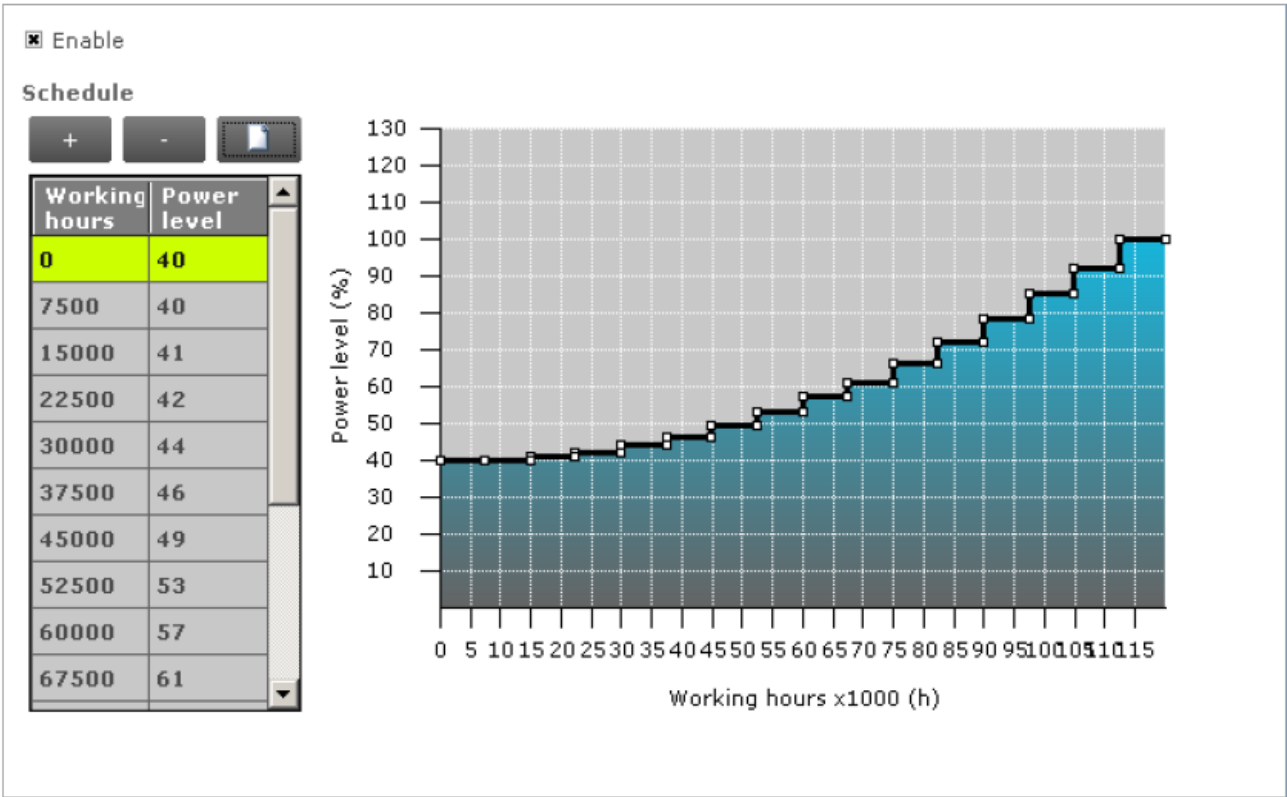
- ↑ ALO
- ↑ CLO
- ↑ FlexTune
- ↑ Luminaire ...
- ↑ OWP
- ↑ SR PSU

Enable

ALO:  %

ALO min:  %

Feature	Description of the feature	Notes and examples
CLO	<p>Constant light output (CLO). This feature accommodates for the gradual decrease of lumen output of a LED module as it ages over its lifetime. To compensate, a schedule can be created that gradually increases the LED current (driver power level) over time. A default schedule can be used or a custom schedule can be made to the luminaire manufacturer's own specification.</p>	<p>The luminaire manufacturer sets the CLO schedule by configuring the maximum working hours and the initial power level. A linear schedule is then created which consists of 16 scenes. The first scene starts at 0h and at the specified initial power level. The last scene starts at the specified working hours and at 100% power level.</p>



Feature	Description of the feature	Notes and examples
<b>Luminaire (fixture) information</b>	<p><b>Luminaire (fixture) information.</b> This feature gives the OEM the ability to add traceability information for the luminaire (fixture). Luminaire (fixture) Information contains three mandatory fields: the Content format ID to select the content format, the GTIN and the Identification number of the luminaire.</p> <ul style="list-style-type: none"> <li>• Content format ID: Select the format in which to store the information. Additional fields to fill are shown on the UI (or in some cases only their maximum allowed length change) when changing the Content format ID.</li> <li>• GTIN: Use the text box to change the value. The GTIN always contains 13 digits: if the value given by the user is less than 13 digits, leading 0s will be added till the number reach 13 digits.</li> <li>• Identification number: Use the text box to change the value. The Identification number can have up till 15 digits, however, the value given by the user shall not exceed the value shown above in the picture.</li> <li>• Select Use device UID check box to enable copy identification number at power-on. Note: If the check box is enabled, the field Identification number is not editable.</li> </ul>	<p>The OEM will enter luminaire information for the three mandatory fields: the Content format ID to select the content format, the GTIN and the Identification number of the luminaire. The OEM can also chose to select Use device UID check box to enable copy identification number at power-on. Note: If the check box is enabled, the field Identification number is not editable.</p> <p>Note: Depending on the selected Content format ID, additional fields are available for storing more detailed information. For example, when selecting 'Unformatted content' as Content format ID, the Additional info field can be used for additional control gear information.</p>

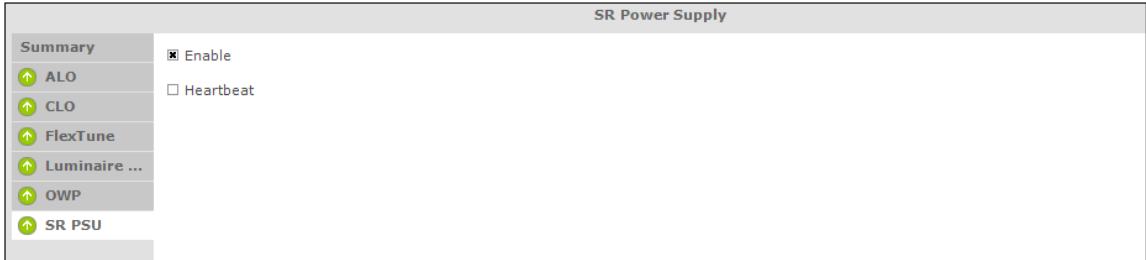
Luminaire (Fixture) Information	
<b>Summary</b>	
ALO	Content format ID: <input type="text" value="Unformatted content"/>
CLO	GTIN (EAN13): <input type="text" value="281474976710655"/>
FlexTune	Identification number: <input type="text"/> <input type="checkbox"/> Use device UID
Luminaire ...	Additional info (236): <input type="text"/>
OWP	
SR PSU	

Feature	Description of the feature	Notes and examples
OWP	<p>OEM write protection (OWP). This feature gives the OEM the ability to enable or disable OWP. When OWP is enabled, the following features are password protected: ALO, ALO min, CLO, FlexTune parameters, luminaire information and the SR power supply selection.</p> <p>Note: The Additional color configuration - Tc offset (+/-) feature is not OEM write protected.</p>	<p><b>Caution:</b></p> <p>If OWP is not enabled by the OEM, an end user with a programming interface (MultiOne) and access to the LED driver has the ability to change any or all of the following features: ALO, ALO min, CLO, FlexTune parameters, luminaire information and the SR power supply selection. Without OWP enabled, the end user also has the ability to enable OWP and password protect the feature settings. Passwords must be managed carefully by the OEM and cannot be recovered without returning the LED driver to Signify.</p>

**OEM Write Protection**

<b>Summary</b>	<p><b>OEM Write Protected features</b></p> <p><input type="checkbox"/> (De)select all</p> <p><input type="checkbox"/> SR PSU</p> <p><input type="checkbox"/> ALO</p> <p><input type="checkbox"/> ALO Min</p> <p><input type="checkbox"/> CLO</p> <p><input type="checkbox"/> Luminaire Info</p> <p><input type="checkbox"/> FlexTune</p>
<p><input type="checkbox"/> ALO</p> <p><input type="checkbox"/> CLO</p> <p><input type="checkbox"/> FlexTune</p> <p><input type="checkbox"/> Luminaire ...</p> <p><input type="checkbox"/> OWP</p> <p><input type="checkbox"/> SR PSU</p>	<p><b>Set the OEM Write Protection password</b></p> <p>New password: <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/></p> <p>Verify password: <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/> <input style="width: 20px; height: 15px; border: 1px solid gray;" type="text"/></p> <p>The password must contain 4 numbers (0-255).</p>

Feature	Description of the feature	Notes and examples
<p><b>SR PSU</b></p>	<p>SR PSU. This feature gives the OEM the ability to enable or disable the built-in SR power supply. There is an option to use the heartbeat function that monitors for a connected sensor fault.</p> <p>Heartbeat function: The SR driver continually monitors the transmission reception on the SR bus. In the event that a communication failure is present, the SR power supply is temporarily turned off and then restarted to allow for a hard reset of the sensor. In the event the communication failure is still present, this power supply on-off-on process will be repeated five times. In the event the communication failure is still present after these reset attempts are made, the SR power supply will remain turned on.</p> <p>Note: In the event that there are several luminaires connected with SR power supplies enabled during the reset process, a DALI command is sent to each driver to reset each driver's power supply at the same time. This will allow for the sensor to be reset and for the initiating driver to verify if communication has been restored. The individual driver timers are not synced and one driver will always initiate the reset sequence and, once initiated, will verify the communication status.</p> <p>Note: The SR power supply default is to be enabled so it will be turned on unless the selection is changed.</p>	<p>The OEM has the ability to enable or disable the built-in SR power supply by using the selection box. Note: The SR power supply default is to be enabled so it will be turned on unless the selection is changed. The OEM can also chose to use the heartbeat function.</p> <p>Note: This is an OEM write protected feature. The OEM may or may not want to use the write protection feature depending on the end use application. If the luminaire will be used with a single sensor installed in the luminaire, the SR power supply will be used to power only that sensor. If the luminaire will be used with a shared external (remote) sensor, it may be necessary to turn off the SR power supply depending on how many SR equipped luminaires are connected to the external sensor. If over four SR equipped luminaires are connected to the one sensor, it will become necessary to turn off the SR power supplies in the additional luminaires. For this reason, the OEM may chose not to use the write protected feature.</p> <p>If the luminaire is to be connected directly to an external network controller, the SR power supply should be turned off as the DALI bus power will be supplied by the controller. The OEM may chose not to use the write protected feature also for this reason.</p>



## SimpleSet configurable features: FlexTune specific features

Note: Please also refer to the Philips MultiOne configurator user manual for more information. More information concerning MultiOne and its implementation is located here: <https://www.signify.com/en-us/portfolio/oem/tools-and-software/multione-configuration-system>

The SimpleSet configurable features, as shown in the figure below, are specific to the FlexTune system. These features are:

- LED string configuration by x, y
- LED string configuration by Tc (CCT)
- Light level configuration - constant lumen output
- Light level configuration - flexible lumen output
- Additional color configuration - power on Tc
- Additional color configuration - system failure Tc
- Additional color configuration - Tc coolest
- Additional color configuration - Tc warmest
- Additional color configuration - Tc offset (+/-)

These features are explained in more detail in the following pages.

Note: The values in the figure below are the default setting for the Advance Xitanium SR FlexTune 40W driver.

The screenshot displays the 'FlexTune' configuration interface. On the left is a vertical navigation menu with options: Summary, ALO, CLO, FlexTune (selected), Luminaire Info, OWP, and SR PSU. The main content area is titled 'FlexTune' and is divided into three sections:

- LED string configuration:** A dropdown menu is set to 'X, Y'. Below are input fields for Cool LED (X: 0.31, Y: 0.327, Tc: 6671 K, Rated lumen: 2200 Lm @ 308 mA) and Warm LED (X: 0.457, Y: 0.408, Tc: 2717 K, Rated lumen: 2040 Lm @ 308 mA).
- Light level configuration:** A dropdown menu is set to 'Constant'. It features two sliders for AOC (Ambient Light Control). The Cool LED slider is set to 4636 Lm @ and 649 mA. The Warm LED slider is set to 4636 Lm @ and 700 mA.
- Additional color configuration:** Five sliders for Tc (Color Temperature) are shown: Power on Tc (3500 K), System failure Tc (3500 K), Tc coolest (6500 K), Tc warmest (2717 K), and Tc offset (+/-) (0 K).

Feature	Description of the feature	Notes and examples
<p><b>LED string configuration by x, y</b></p>	<p><b>LED string configuration using x and y coordinates.</b>  This feature allows the LED characteristics, based on the LED module cool and warm temperature x and y chromaticity coordinates, to be entered by the OEM into the configurator. These coordinates serve as the endpoints for the entire color range possible for the LED module. Using the LED modules x and y coordinates provides the most accurate CCT operating point. The rated lumens for the LED module is also entered along with the rated current at that specific lumen level for both the cool and warm temperatures. The information for the x and y coordinates, lumen and current ratings are included in the individual datasheet for the LED module being used.</p>	<p>The OEM enters the x and y coordinates for the cool and warm LED module characteristics as provided in the datasheet by the LED module manufacturer. The rated lumens for the LED module is also entered along with the rated current at that specific lumen level for both the cool and warm temperatures. This information is also entered from the LED module datasheet.</p> <p>Note: To provide a proper estimate of the lumen output from the luminaire, the user needs to enter the luminaire rated lumens and the rated current value related to that specific lumen level into the configurator for both the cool and warm LED. The lumen output from the luminaire must take into consideration the losses of the luminaire (lens, paint, etc.).</p> <p>Note: This is an OEM write protected feature.</p>

**LED string configuration**

Configuration by

	X	Y	Tc		Rated lumen	Rated current
Cool LED	<input type="text" value="0.31"/>	<input type="text" value="0.327"/>	<input type="text" value="6671"/> K		<input type="text" value="2200"/> Lm @	<input type="text" value="308"/> mA
Warm LED	<input type="text" value="0.457"/>	<input type="text" value="0.408"/>	<input type="text" value="2717"/> K		<input type="text" value="2040"/> Lm @	<input type="text" value="394"/> mA

Feature	Description of the feature	Notes and examples
<p><b>LED string configuration by Tc (CCT)</b></p>	<p><b>LED string configurations using Tc (CCT) values.</b></p> <p>This feature allows the LED characteristics, based on the LED module cool and warm temperature CCT values, to be entered by the OEM into the configurator. These CCT values serve as the endpoints for the entire color range possible for the LED module. Using the LED modules CCT values is not as accurate as using the X and Y coordinate method for CCT accuracy. Using the CCT value method, the X and Y chromaticity coordinates are estimated using the CCT values supplied. This process of estimation allows for more inaccuracy in the actual CCT operating point. The rated lumens for the LED module is also entered along with the rated current at that specific lumen level for both the cool and warm temperatures. The information for the CCT values, lumen and current ratings are included in the individual datasheet for the LED module being used.</p> <p>Note: The X and Y chromaticity coordinates are estimated as points on a centerline of the ANSI quadrangles and not points on the black body line.</p>	<p>The OEM enters the CCT values for the cool and warm LED module characteristics as provided in the datasheet by the LED module manufacturer. The rated lumens for the LED module is also entered along with the rated current at that specific lumen level for both the cool and warm temperatures. This information is also entered from the LED module datasheet.</p> <p>Note: To provide a proper estimate of the lumen output from the luminaire, the user needs to enter the luminaire rated lumens and the rated current value related to that specific lumen level into the configurator for both the cool and warm LED. The lumen output from the luminaire must take into consideration the losses of the luminaire (lens, paint, etc.).</p> <p>Note: This is an OEM write protected feature.</p>

**LED string configuration**

Configuration by

	X	Y	Tc		Rated lumen		Rated current
Cool LED	<input type="text"/>	<input type="text"/>	<input type="text" value="6671"/> K		<input type="text" value="2200"/> Lm	@	<input type="text" value="308"/> mA
Warm LED	<input type="text"/>	<input type="text"/>	<input type="text" value="2717"/> K		<input type="text" value="2040"/> Lm	@	<input type="text" value="394"/> mA

Note: When "Configuration by Tc" is selected, the X and Y values are estimated. This may result in lower Tc accuracy.

Feature	Description of the feature	Notes and examples
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**Light level configuration  
-constant lumen output**

Light level configuration with constant lumen output. This feature allows the LED module lumen output level to be held constant at a specified lumen level. The lumen level is determined from the module datasheet and only the cool LED current information corresponding to specified lumen level is entered into the configurator by the OEM. The warm LED current level will be automatically filled into the configurator as a calculated value by MultiOne based on the LED module information entered in the LED string configuration . The lumen levels for both the cool and warm LEDs will be shown and can be confirmed against the current level that was input as data. The driver will maintain the lumen output over the entire CCT range from coolest to warmest.

Note that the adjustable output current (AOC) feature is included as part of the Light Level Configuration feature. The AOC feature allows the maximum output current to be set within the stated range for the output current (Iout) as noted in the driver datasheet. For constant lumen output, the cool LED will always have a lower current value in comparison to the warm LED due to the increased efficiency of the cool LED. This means the maximum current provided by the driver will always be limited by the warm LED and minimum driver current will always be limited by the cool LED.

The OEM enters the current value for the cool LED as provided in the datasheet by the LED module manufacturer for a given lumen level. The lumen output information will be displayed by the configurator and can be verified for accuracy. The AOC level can then be set (slider or box entry) to whatever current is needed for the particular lumen output at the luminaire level.

Note: This is an OEM write protected feature.

**Light level configuration**

Light output over Tc range Constant

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Cool LED 4636 Lm @

AOC  649 mA

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Warm LED 4636 Lm @

AOC  895 mA

Feature	Description of the feature	Notes and examples
<p><b>Light level configuration - flexible lumen output</b></p>	<p><b>Light level configuration - flexible lumen output.</b>  This feature allows the LED module lumen output level to be flexible across a wide CCT range. A reference lumen level can be determined from the module datasheet from both the cool and the warm LED current information corresponding to a specified lumen level and both of these current values are entered into the configurator by the OEM. The lumen levels for both the cool and warm LEDs will be shown and can be confirmed against the current levels that were input as data. The user has the ability to tailor the current levels, either cooler or warmer, at either end of the LED module CCT range, affecting the lumen output at every specific CCT. The driver will vary the lumen output over the entire CCT range from coolest to warmest.</p> <p>Note that the adjustable output current (AOC) feature is included as part of the Light Level Configuration feature. The AOC feature allows the maximum output current to be set within the stated range for the output current (Iout) as noted in the driver datasheet. For flexible lumen output, either the cool or warm LED can have a higher or lower lower current level or possibly even the same current level. This means the maximum current provided by the driver will always be limited by the cool or warm LED with the most current and the minimum driver current will always be limited by the cool or warm LED with the least amount of current.</p>	<p>The OEM enters the current value for both the cool and warm LED as provided in the datasheet by the LED module manufacturer for a given lumen level. At this point the lumen output information will be displayed by the configurator and can be verified for accuracy. The AOC level can then be set (slider or box entry) to whatever current is needed for the particular lumen output at the luminaire level. The OEM has flexibility to tailor the lumen output at different CCT points as needed or required.</p> <p>Note: This is an OEM write protected feature.</p>

**Light level configuration**

Light output over Tc range Flexible

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Cool LED 4636 Lm @

AOC 

 649 mA

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Warm LED 4634 Lm @






AOC 

 895 mA

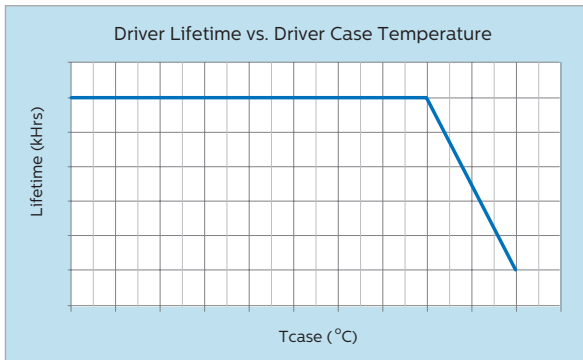
Feature	Description of the feature	Notes and examples
<b>Additional color configuration - power on Tc output</b>	<p>Additional color configuration - power on Tc. This feature allows the ability for the OEM to specify an initial CCT at power on of the system (driver plus LED module). Selection of the CCT is limited to the available range of the LED module as initially entered into the LED string configuration settings.</p>	<p>The OEM can set the initial CCT by slider or box entry to what is desired at system power on.</p> <p>Note: This is an OEM write protected feature.</p>
<b>Additional color configuration -system failure Tc</b>	<p>Additional color configuration -system failure Tc. This feature allows the ability for the OEM to specify a CCT in the instance of failure of the system. System failure is defined here as a DALI bus communication failure. Selection of the CCT is limited to the available range of the LED module as initially entered into the LED string configuration settings.</p>	<p>The OEM can set an expected CCT by slider or box entry to what is desired in the event of a DALI bus communication failure.</p> <p>Note: This is an OEM write protected feature.</p>
<b>Additional color configuration -Tc coolest</b>	<p>Additional color configuration -Tc coolest. This feature allows the ability for the OEM to specify a cool CCT lower limiting endpoint other than the CCT cool LED limit set by the LED module parameters. Selection of the cool CCT endpoint is limited to the available range of the LED module as initially entered into the LED string configuration settings.</p>	<p>The OEM can set a lower limiting endpoint for the coolest CCT by slider or box entry to what is desired. The limiting endpoint will not allow operating at a CCT below the chosen setting.</p> <p>Note: This is an OEM write protected feature.</p>
<b>Additional color configuration -Tc warmest</b>	<p>Additional color configuration -Tc warmest. This feature allows the ability for the OEM to specify a warm CCT upper limiting endpoint other than the CCT warm LED limit set by the LED module parameters. Selection of the warm CCT endpoint is limited to the available range of the LED module as initially entered into the LED string configuration settings.</p>	<p>The OEM can set an upper limiting endpoint for the warmest CCT by slider or box entry to what is desired. The limiting endpoint will not allow operating at a CCT above the chosen setting.</p> <p>Note: This is an OEM write protected feature.</p>

Feature	Description of the feature	Notes and examples
<b>Additional color configuration - TC offset (+/-)</b>	<p>Additional color configuration - Tc offset (+/-). This feature allows the user to enter a positive or negative CCT offset in Kelvin. This may be used to offset for color shifts caused by secondary optics or light guides or even external influences such as non-white painted surfaces near the light source. This feature can also be used for field tuning of fixtures.</p>	<p>The OEM can use this feature by entering positive or negative value using the slider or box entry to create a CCT offset for color tuning.</p> <p>This feature can also be used for field tuning of fixtures where differences might be noted between luminaries in close proximity to one another.</p> <p>Note: This is <b>not</b> an OEM write protected feature.</p>

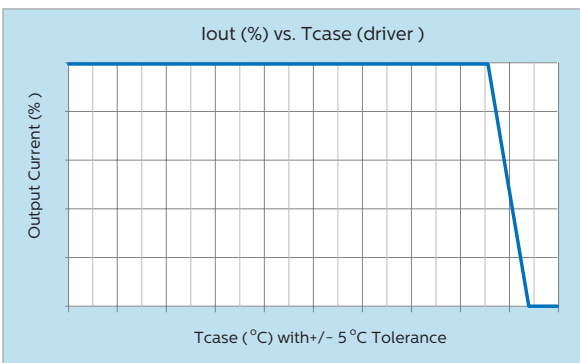
**Additional color configuration**

Power on Tc		<input type="text" value="4000"/> K
System failure Tc		<input type="text" value="3500"/> K
Tc coolest		<input type="text" value="6500"/> K
Tc warmest		<input type="text" value="2717"/> K
Tc offset (+/-)		<input type="text" value="0"/> K

# Thermal management



Example lifetime versus Tcase



Example thermal fold back (TFB)

The following section covers the critical thermal management points to facilitate design-in. Taking thermal considerations into account will help ensure optimum performance and lifetime of an LED system. The maximum case temperature ( $T_{c \max}$ ) of the driver should not be exceeded. It is mandatory to keep driver  $T_{c \max}$  within specification to meet driver lifetime and failure rate specifications.

## Driver Lifetime

The driver maximum case temperature allowed may not give a lifetime that meets warranty requirements. It is important to note the case temperature that provides the necessary lifetime for warranty. The maximum case temperature is provided to allow short excursions to a higher temperature without immediate failure of the product. Extended operation at temperatures approaching the maximum case temperature may shorten the life of the product. Please refer to individual product datasheets for specific driver lifetime performance

## Thermal fold back (TFB) of driver

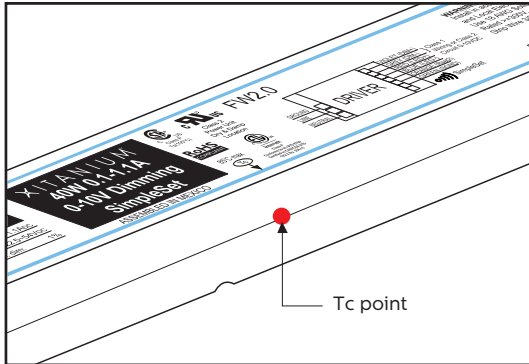
The driver will reduce the current to the LED module if the driver itself is overheating. The driver will limit the current when the driver case temperature exceeds the maximum specified temperature. Refer to the individual driver datasheet for the specific fold back performance.

Note: CCT will be maintained during thermal fold back.

## Temperature case point

To achieve optimal lifetime and reliability, it is critical that the temperature of the components in the driver remains within its rating.

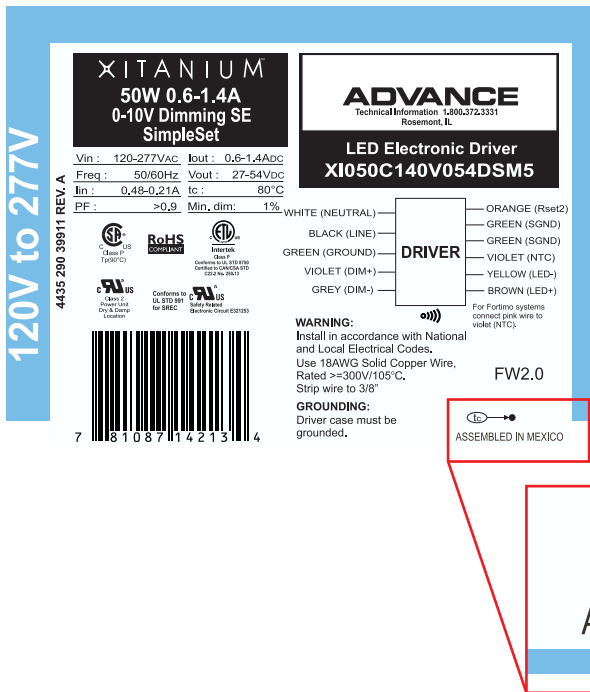
Tc point temperature is a proxy for the temperatures of the critical internal driver components. The location of the Tc point is identified on the product label. The Tc point on the drivers is on the dot indicated by the arrow as shown in the figures to the left. For some of our drivers, the Tc arrow points to a location on the side of the driver housing. In this instance the thermocouple is intended to be placed midway down on the sidewall of the driver housing.



Example product label indicating that the Tc point is on the side of the driver and the red dot showing where the actual TC point is located

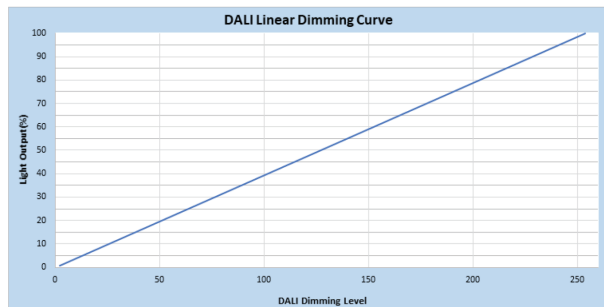
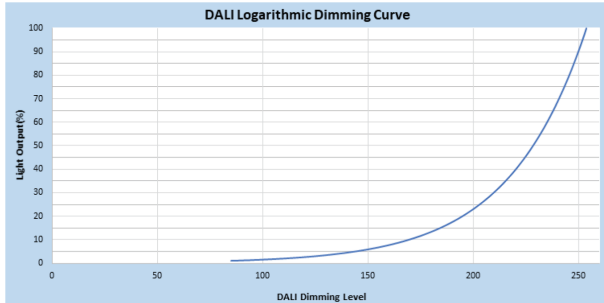
### Note:

The specified Tc max of the driver must NEVER be exceeded. A measurement using a thermocouple placed on the Tc location is necessary. The thermocouple must maintain good contact with the driver housing for the duration of the test. In order to help ensure accurate Tc test results, the case temperature should not vary by more than 1°C for a period of at least 30 minutes after a stable temperature has been achieved. The Tc point and the driver surface surrounding the Tc point of at least 1/2 radius should not be touching anything when mounted in the luminaire/enclosure. If the Tc point comes in contact with anything during normal installation of the LED driver, it will become necessary to measure a different unobstructed location and correlate this to the original Tc point with the driver operated in free air.



Example product label indicating the Tc point on the label surface

# Dimming method



Dimming is accomplished and configured through the two-wire standard DALI interface to the external sensor/network controller based on DALI 2.0 (IEC 62386-102 Ed2. and IEC 62386-107 Ed1.). Both logarithmic and linear dimming curve options are available. DALI standard IEC 62386-102 Ed2. defines the logarithmic dimming curve. DALI standard IEC 62386-107 Ed1. defines the linear dimming curve as well as the command for switching between logarithmic and linear curves (default = logarithmic). The possible dimming range is 1% - 100%. Dimming curves are shown.

Note: The output current at 100% level is determined by the driver. The minimum current that can be supplied by the driver is specified in the datasheet. The lowest dim level is defined by the higher of the two values: driver minimum output current or 1% dim level.

# Standard digital interface (SR)

The Xitanium SR FlexTune LED driver reduces complexity and cost of light fixtures used in (wireless) connected lighting systems. The Xitanium SR FlexTune LED Driver features an open standard digital interface (SR: sensor ready) to enable direct connection to any suitable RF sensor. Functionality integrated into the SR FlexTune driver eliminates auxiliary components such as power supplies and relay boxes used today in many typical applications. The result is a simpler less expensive luminaire that enables turning every luminaire into a wireless node.

## SR interface functions

The simple two-wire digital interface supports these key functions:

- Switchable built-in bus power supply to provide power to the connected control device (e.g. an RF sensor)
- Two-way digital communication between the SR FlexTune driver and control device using standard DALI 2.0 protocol. This includes standard DALI dimming, ON/ OFF and control functions, power and energy reporting utilizing the power monitoring integrated into the driver, and diagnostic information. These functions are described in detail below:

### Built-in SR power supply

The SR driver has the ability to supply the SR bus with a built-in power supply that can be turned ON/OFF. By default, the power supply is turned on and ready to be used with an external control device (e.g. RF sensor).

The internal power supply can be turned ON/OFF with the MultiOne configuration software using the SimpleSet tool or the SR interface (DALI) tool.

The built-in SR supply is capable of delivering a minimum current of 52mA (ISR) to the SR bus and the connected device(s).

The built-in SR supply will never supply more than 60mA (ISR\_MAX).

The SR bus voltage will be between 12VDC and 20VDC depending on the connected device load and the amount of SR supplies put in parallel. See the graph below for the typical VI curve for one SR supply.

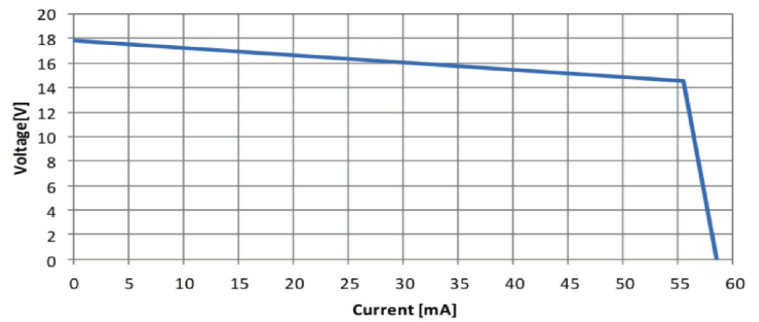
When the internal SR supply is switched OFF the SR driver will extract a maximum of 2mA from the SR bus (like standard DALI gear).

### Control device(s) power consumption considerations

Most control devices intended to be used in an SR system will be powered from the SR bus.

When communication is present on the SR bus, the bus gets pulled down by the data packages. This reduces the average current available for the power consuming control device. When communicating, the average available current can drop up to 50%. This should be taken into account when designing the control device.

The extracted peak current (ISR\_EXTRACTED) should be limited by the control device.



Example of a typical VI curve for SR interface

### Power supply rules for building an SR system

- Respect SR bus polarity when more than one SR supply is connected in parallel.
- The total maximum SR bus current (ISR\_MAX\_TOTAL) must be  $\leq 250\text{mA}$ .  
This current can be determined by adding ISR\_MAX of all SR supplies. As a consequence maximum 4 SR supplies can be connected in parallel.
- The total current delivered to the SR bus (ISR\_DELIVERED) can be determined by adding ISR of all SR supplies.
- The total current extracted from the SR bus (ISR\_EXTRACTED) can be determined by adding consuming devices like SR drivers with switched OFF SR supply, other DALI gear and control devices.
- To guarantee good communication, a margin of 8mA is needed to drive the SR bus itself (ISR\_MARGIN).
- The following rule should be respected:  $\text{ISR\_EXTRACTED} + \text{ISR\_MARGIN} \leq \text{ISR\_DELIVERED}$ .

**Caution: When the above rules are not taken into account, communication cannot be guaranteed and damage to components may occur.**

### Typical examples:

Example #1: One SR driver is connected to a control device. The internal SR supply of this driver is switched ON. The specification of the control device states that the extracted peak current is 40mA. Will this SR system have good communication?

One SR supply is involved, so BUS polarity is not an issue.

$\text{ISR\_MAX\_TOTAL} = 60\text{mA}$ . This is  $\leq 250\text{mA}$  ✓

$\text{ISR\_DELIVERED} = 52\text{mA}$   
 $\text{ISR\_EXTRACTED} = 40\text{mA}$   
 $\text{ISR\_MARGIN} = 8\text{mA}$   
 $40+8\text{mA} \leq 52\text{mA}$  ✓

Example #2: Is it allowed to add an SR driver with switched OFF SR supply to this SR system? Yes, an SR driver with switched OFF SR supply extracts 2mA from the SR bus.

$\text{ISR\_EXTRACTED} = 40+2=42\text{mA}$ .

$42+8\text{mA} \leq 52\text{mA}$  ✓

Can this SR supply also be switched on?

Yes, but you should check the polarity of both SR supplies.

$\text{ISR\_TOTAL} = 2*60=120\text{mA}$ . This is  $\leq 250\text{mA}$ .

### Digital communication

The Advance Xitanium SR FlexTune driver has built-in energy measurement capability and can report energy and actual power consumption. Accuracy of the power measurement is higher of the following two values: 0.5W or +/-4 % of the measured input power. This feature stores parameters in the memory bank provision as specified in the DALI 2.0 standard.

The Advance Xitanium SR FlexTune driver also supports many diagnostic features/parameters which can be accessed via the SR interface.

Dimming is possible through the open standard digital interface based on DALI 2.0. For more information refer to the previous Dimming methods section in this guide.

### Configuration options

Configurable Parameter within the Driver	Configuration Interface	
	SimpleSet	SR (DALI) Interface using MultiOne Tool
Adjustable Output Current (AOC)*	✓	✓
Auxiliary Power Supply (ON/OFF)	✓	✓
Standard DALI I/O Configurable Parameters		✓
Dimming Selection (Log vs. Linear)		✓

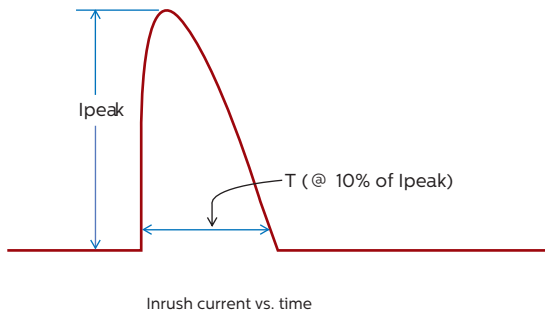
\* AOC is defined in the MultiOne FlexTune configuration section

### Other considerations for the SR interface

Length of wiring: Using 18 AWG, the maximum length of the dimming wiring, when used for DALI communication, should not exceed 1000 ft. (300 m.).

The SR control interface terminals are isolated from mains and output terminals and meet UL Class 2 isolation requirement.

# Inrush current



Inrush current refers to the brief high-input current that flows into the driver during the initial start-up to charge the capacitors on the input side. Typically, the amplitude is much greater than the operating or steady-state current, as illustrated in the figure to the left.

Advance Xitanium LED drivers meet the inrush specification values per NEMA 410.

The peak and duration values are given in the individual product datasheet.

The best way to reduce inrush is to turn on relays or switches at the zero crossing of the mains. Many controllers do this to reduce the large inrush currents.

What does inrush current do? High inrush currents can cause circuit breakers or fuses to open if not designed to handle this current. It can limit how many drivers can be connected to a circuit breaker (CB) or fuse.

# Surge protection

**Note:**

Please consult the fuse and circuit breaker manufacturer recommendations when selecting appropriate fuse and/or circuit breakers in conjunction with LED luminaires.

Advance Xitanium LED drivers have limited built-in surge protection (in accordance with IEEE /ANSI C82.77-5 Transient Surge Requirements). Additional protection against excessive high surges can be achieved by adding a surge protection device. The actual limit can differ per driver and can be found in the driver's datasheet in the download section on <https://www.na.mytechnology.portal.signify.com/public-dashboard/public-download-center.html>

# Leakage current

Advance Xitanium LED drivers are designed to meet leakage current requirements per UL 8750 standards. In a luminaire, leakage current may be higher since the LED load introduces additional parasitic capacitance. As such, precautions should be taken at the luminaire level and also if multiple drivers are used in the luminaire.

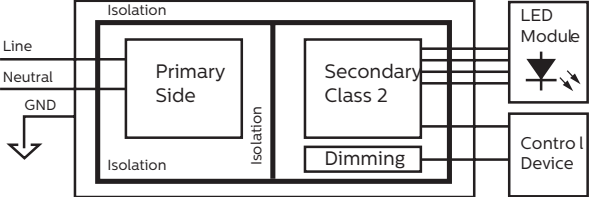
# Electromagnetic compatibility (EMC)

Advance Xitanium LED drivers are designed to meet EMC requirements per FCC Title 47 Part 15 Class A. Compliance to this standard means our products are suitable for commercial and industrial lighting applications.

**Consumer Information for Class A Compliance:**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# Electrical isolation



Example Isolation scheme for Class 2 drivers

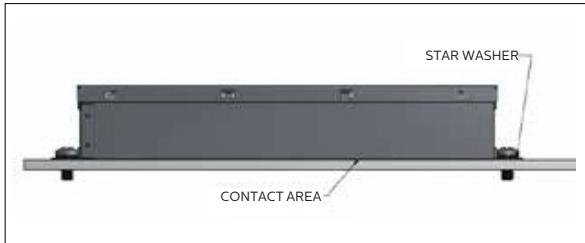
The Advance Xitanium LED driver's output (secondary) is isolated from the input (primary) for isolated Class 2 drivers – see the individual driver datasheet for the particular isolation type used.

Isolation is also provided between all the electronic circuits and the chassis. The figure shown to the left illustrates the isolation scheme for Class 2 drivers.

Xitanium LED drivers are designed to meet the UL 8750 safety standard. Xitanium Class 2 drivers are also designed to meet UL1310 Class 2 safety standard.

All of the wires in the Advance Xitanium LED drivers are designed to meet the UL1452 safety standards.

# Mechanical mounting



Example of chassis mounting

Mounting of the LED driver must satisfy three critical criteria:

**1. Solid fastening of the driver in order to avoid movement of the driver relative to luminaire** The size of mounting screws/bolts needs to be the maximum allowed by the size of driver mounting holes/slots. The tightening torque has to be per screw/bolt manufacturer recommendations.

**2. Electrical grounding of the driver**

The driver enclosure is painted. It is recommended to use star washers under the head of the mounting screws – the teeth of the star washer breaks through the paint to ensure electrical connection to the grounded fixture.

**3. Maximum interface area between driver enclosure surface and luminaire mounting surface (cooler) for best possible driver Tcase temperature (lowest)**

The recommended mounting of the driver is shown by the figure on the left. Thermally conductive gap pads (or other thermally conductive grease, paste, etc.) may be used between driver and luminaire surface to eliminate air gaps and further improve driver thermal performance (lower Tcase temperature).

# Design-in support terms and conditions for North America

These Design-in Support Terms and Conditions ("these Terms") apply to all design-in support ("Support") provided by Signify N.V. and its affiliates ("Signify") to a customer requesting the Support ("Customer"). Any report provided by Signify in connection with the Support is not an official testing certificate and cannot be used or construed as a document authorizing or otherwise supporting an official release of the luminaire. The Customer remains at all times liable and responsible for any and all required testing and approbation prior to the manufacture and sale of the luminaire in question.

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The laws of the State of New York govern these Terms without regard to its choice-of-law or conflict-of-law principles, and any disputes that cannot be settled through consultation in good faith within thirty (30) days after notice from either the Customer or Signify that a dispute exists, will be referred to and finally resolved by the exclusive jurisdiction of the courts of the state and/or federal courts of New York.

These Terms shall constitute the entire agreement between Signify and the Customer relating to the subject matter hereof. Any waiver of these Terms shall only be effective if it is in writing and signed by Signify. If any part of these Terms is found invalid or unenforceable by a court of competent jurisdiction, the validity and enforceability of the remaining provisions or portions of them, will not be affected.

