



Technical application guide Tuneable White LED drivers

VS Tuneable White LED drivers – VS-Tuner4TRONIC®

187048, 187049

VS TUNEABLE WHITE LED DRIVERS – VS-TUNER4TRONIC®



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1 INTRODUCTION

1.1 VS LED Drivers with Tuneable White functionality

This application guide for dynamic Tuneable White LED systems with constant-current drivers informs about technical basics of light and necessary system components and configurations.

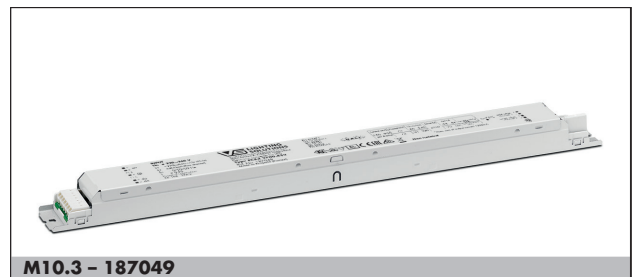
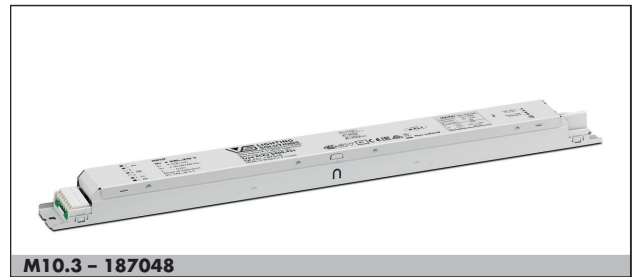
TW systems enable the creation of "white light" within a bandwidth of two different colour temperatures by using LED modules equipped with LEDs having two different colour temperatures.

TW systems provide basic technical components for Human Centric Lighting (HCL) solutions. The usage of such components and systems enables the generation of biologically effective white light in terms of dynamic brightness and variable colour temperature settings.

Targeted Human Centric Lighting solutions are the result of tailor-made lighting planning and realize a balance between visual comfort, emotional perception and biological effects.

Human Centric Lighting provides targeted and long-term support for health maintenance, well-being and efficiency of human beings through holistic planning and consideration of visual, emotional and especially biological effects of light. Each human being with his or her needs concerning life, work and leisure is set consistently in the focus of attention.

The interdisciplinary balance between the parameters of artificial lighting, natural daylight, architecture and technology creates the right light at the right time.



2 PHYSICAL AND TECHNICAL BACKGROUND/BASICS

2.1 Colour space

The colour space visualizes all visible colours that a human eye can perceive. Colour locations that lie on the Planck curve are designated as white light. This curve is characterized by the fact that the colour temperature corresponds to the light emission of a solid body at the respective temperature. Colour locations outside the Planck curve can also be referred to as white light; constant colour temperatures are located on the Judd straight lines. Colour locations being more than approx. 10 threshold units away from the Planck curve are usually not considered to be white light.

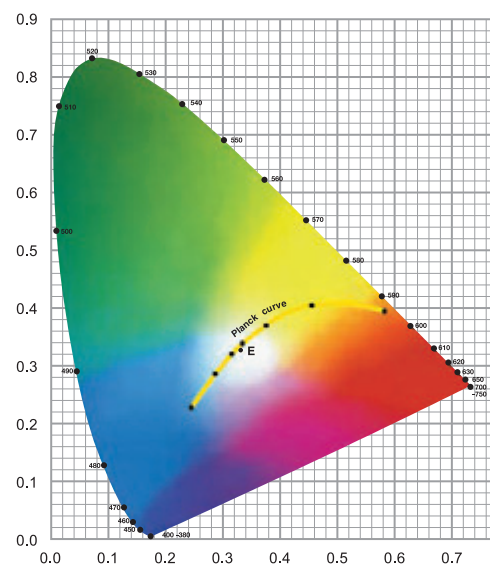


Figure 1: Colour mixing of two white tones

2.2 Fixed current mode

LED modules providing light with adjustable colour temperature are equipped with LEDs having two different colour temperatures. The adjustable colour locations are addressable by supplying suitable current levels to the respective LEDs.

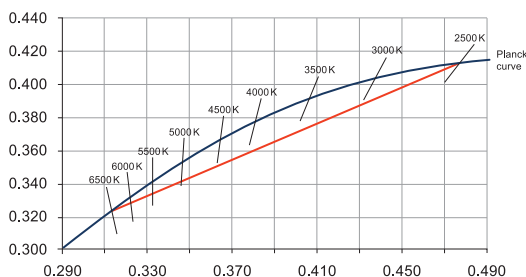


Figure 2: Colour mixing of two white tones

Principally, only colour locations lying on the connecting line between both LED colour locations can be addressed.

It should be considered that the colour coordinates of LEDs do not necessarily lie on the Planck curve.

The deviation between the cx/cy coordinates of the used LEDs and the intersection of the Judd line with the Planck curve can lead to colour coordinates of the mixed light that differ significantly from a desired target colour location.

The following picture exemplarily shows that the colour temperature of the mixed light depends on the actual colour coordinates of the LEDs although their nominal colour temperature and forward current are the same.

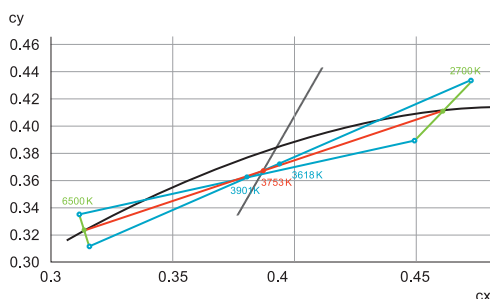


Figure 3: Deviation of the colour coordinates from LEDs with identical nominal colour temperature

2.3 Melanopic effect

The melanopic effect determines the circadian effect of a light source and influences the wellness of human beings. The melanopic values describe how strong the melanopin-containing retinal ganglion cells (ipRGC) are stimulated by light. In analogy to the definition of the $V(\lambda)$ curve for the spectral sensitivity of the photoreceptor cells, $S_{mel}(\lambda)$ expressing the spectral sensitivity for these photoreceptors was defined.

According to this, the melanopic luminous flux describes the radiant flux of a light source, evaluated with the spectral sensitivity of the melanopic (non-visual) photoreceptors.

The melanopic factor describes the ratio between the melanopic and the photometrically effective amount of radiation. This factor is higher when a light spectrum stimulates the non-visual system more strongly.

Daylight-equivalent values practically represent a benchmark with reference to natural daylight.

Thus, the melanopic daylight-equivalent luminous flux related to 1000 lm states how many lumen of daylight are needed to achieve an equally large non-visual stimulation as with the mentioned artificial light.

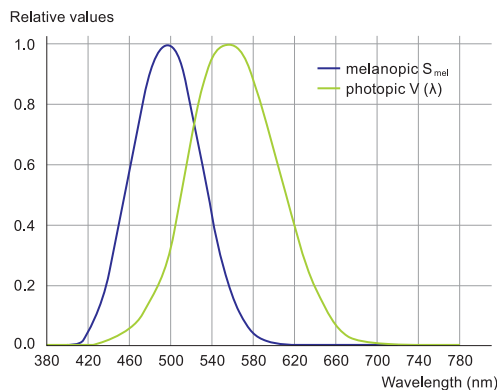


Figure 4: Spectral sensitivity – melanopic/photopic

2.4 Temperature and current dependency of colour coordinates and efficacy of LEDs

2.4.1 Typical properties of LEDs

The luminous flux and the colour coordinates of an LED are not only subject to manufacturing tolerances, but also depend on its operating conditions.

The following pictures show typical curves for the dependency of luminous flux and colour locations on forward current or temperature:

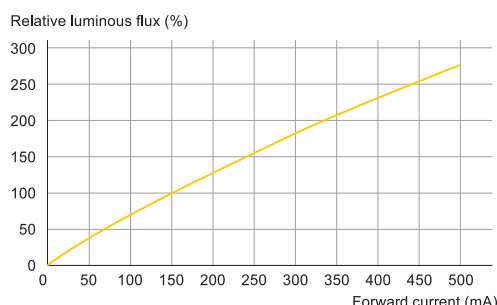


Figure 5: Relative luminous flux as a function of forward current

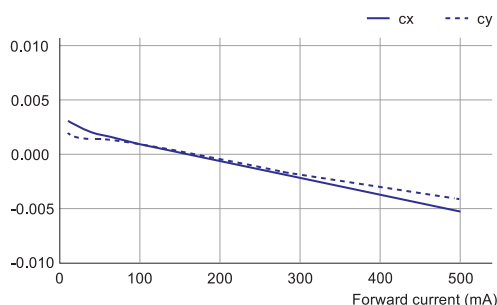


Figure 6: Colour coordinates as a function of forward current

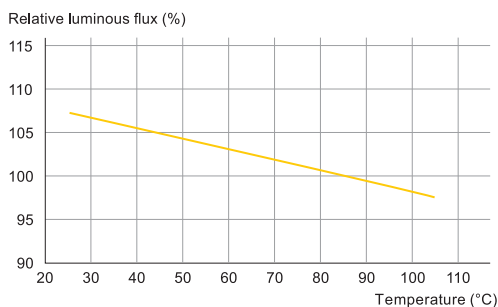


Figure 7: Relative luminous flux as a function of temperature

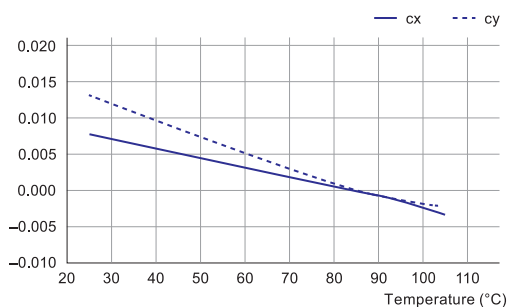


Figure 8: Colour coordinates as a function of temperature

To achieve the best possible match between the desired and the achieved colour coordinates of mixed light, non-linear dependencies must be considered when calculating the LED currents.

2.4.2 Data models for LED modules

To match the various requirements with regard to simple operation and high colour quality, three data modes for LED modules are available for configuring VS TW drivers.

The focus here is on enabling sufficient colour accuracies with a simple set-up as well as very good colour accuracies by using typical LED and module data.

Basic Mode

In the Basic Mode, the values of the colour temperatures of both used LED types must be entered, e.g. 2700 K and 6500 K. In addition, forward currents must be input for both channels that lead to luminous flux (100% values) equity.

The VS-Tuner4TRONIC® (VS-T4T) configuration software transmits these values to the drivers, which then adjust both output currents in dependence of the desired colour location following the ratio between the target colour location and the two LED colour temperatures.

However, this very simple model also shows some disadvantages:

1. Since the colour coordinates of LEDs are usually not exactly on the Planck curve, the input of the nominal colour temperature already implies deviations, see chapter 2.4.1.
2. A purely proportional setting of the LED currents causes a deviation from the target colour location because the connecting line between both LED colour locations is only an approximation to the Planck curve. Since the Judd straight lines do not vertically intersect the Planck curve and the connecting line, deviations of up to several 100 K are possible.
3. The dynamic behavior of the LEDs is not considered, which means that resulting colour coordinates may drift when the temperature changes, e.g. during dimming, see also chapter 2.4.1.

Advanced Mode

In the Advanced Mode, in addition to the nominal cx and cy coordinates of the LEDs, data representing the operating conditions of the LEDs in the projected application must also be used.

The calculation of the output currents is not carried out once in relation of the target colour coordinates to the nominal colour temperature of the used LEDs, but follows an iterative process. In this process, the currents are iteratively calculated as a function of the specified operating conditions, the colour coordinates of the LEDs and simplified LED characteristics.

Advantages of the Advanced Mode include:

1. Entering the real colour coordinates of the LEDs instead of the nominal colour temperature values eliminates colour deviations that already occur due to the deviation of the LED colour coordinates from the Planck curve.
2. By performing the iterative calculation process of the output currents of the driver, a higher colour accuracy is achieved by considering the positions of the intersections of the Judd lines with the connecting line.

Premium Mode

In the Premium Mode, the output currents of the driver are calculated in the same way as in the Advanced Mode, but real dynamic LED characteristics are used instead of simplified LED characteristics.

As in the Advanced Mode, the operating conditions of the LED module in a projected application must be entered to enable a high colour accuracy.

In order to enter the LED characteristics, it is necessary to determine three operating points of a single LED for each criterion using the LED data sheets and to implement them by using the VS-T4T configuration software.

For each type of LED, the following data must be fixed:

1. Three value pairs each for cx and cy coordinates as a function of the forward current
2. Three value pairs luminous flux as a function of the forward current
3. Three value pairs each for cx and cy coordinates as a function of the LED temperature
4. Three value pairs of luminous flux as a function of the LED temperature

All value pairs to be entered can be selected completely independently from the operating conditions in a projected application since they only have to reflect the characteristics of the LEDs but not the operating points of the LEDs in an application.

When VS TW modules are used, the Premium Mode is always used. All necessary LED and module data are already stored in the VS-T4T.

If other TW modules being freely available on the market are used, the LED data required for the Premium Mode must be obtained.

In addition to the Advanced Mode, the Premium Mode offers the following advantages:

1. When calculating the output currents, the non-linear dependencies of the luminous flux and the colour coordinates of the LEDs on forward current and temperature are taken into account.

2. A high colour homogeneity is achieved in a system in which the modules are operated under different conditions, e.g. at different dimming levels or ambient temperatures.
3. The absolute colour accuracy essentially depends only on the tolerances of the LEDs used in relation to their nominal data. Usually, LEDs with a colour tolerance up to three MacAdam steps are available.

3 SYSTEM COMPONENTS

3.1 TW modules

3.1.1 TW module data

To allow balancing of driver and TW module in the Advanced or Premium Mode, several data of the TW module must be collected concerning its design and certain properties.

Such data can normally be derived from data sheets of TW modules that usually provide nominal values for luminous flux, colour coordinates and forward voltage depending on their nominal operating current.

To improve the performance of a TW system, TW modules may be measured to verify how far the nominal data are met. In case of significant differences between nominal and measured data, the measured data can be implemented in the VS-T4T.

3.1.2 LED data

For an optimal balancing of TW driver and TW module, it is necessary to check the temperature and current dependency of the colour coordinates and efficacy of the LEDs used for a TW module and to enter this information in the VS-T4T (chapter 2.4). When using the Premium Mode, the background calculations carried out in the VS-T4T and in the driver require the following information:

- The dependency of the colour coordinates (cx/cy) on the temperature of the LED
- The dependency of the colour coordinates (cx/cy) on the forward current through the LED
- The dependency of the luminous flux (lm) on the LED temperature
- The dependency of the luminous flux (lm) on the forward current through the LED

These data can be found in standard product documentations of the components, e.g. data sheets. These data must be entered as described in chapter 3.3 "Configuration tool VS-Tuner4TRONIC® (VS-T4T)".

In the Advanced Mode, these data are not required. There, the usual decrease of the luminous flux with increasing component temperature is taken into account with a fixed factor.

3.2 Drivers

The operation of TW constant-current drivers with TW modules offers even better colour accuracies than CV systems when using one of the LED data models in the VS-T4T.

1 INPUT 2 Un = 220...240 V 3 In = 200 mA 4 fn = 0/50/60 Hz 5 I = 0,95 6 da Range of application 7 da DC 198...276 V	VS LIGHTING SOLUTIONS Vossloh-Schwabe Deutschland GmbH Hohe Steinert 8, D-58509 Lüdenscheid Electronic converter for LED Type ECXd 2400.431 Ref.-No. 187048 Made in Bulgaria (Europe)	EN 61347-1 EN 61347-2-13 EN 62384 EN 61547 EN 55015 EN 61000-3-2	 Non isolated	OUTPUT (per channel) <table border="1"> <tr> <td>Irated [mA]</td> <td>75...400</td> </tr> <tr> <td>Urated[V]</td> <td>45...240</td> </tr> <tr> <td>Prated[W]</td> <td>38</td> </tr> <tr> <td>tc [°C]</td> <td>75</td> </tr> <tr> <td>ta [°C]</td> <td>-25...+60</td> </tr> <tr> <td>Uout [V]</td> <td><250</td> </tr> </table>	Irated [mA]	75...400	Urated[V]	45...240	Prated[W]	38	tc [°C]	75	ta [°C]	-25...+60	Uout [V]	<250	cold white channel 1 + - warm white channel 2 + - 						
Irated [mA]	75...400																						
Urated[V]	45...240																						
Prated[W]	38																						
tc [°C]	75																						
ta [°C]	-25...+60																						
Uout [V]	<250																						
1 INPUT 2 Un = 220...240 V 3 In = 390mA (Tunable White) 4 In = 400mA (Two channel) 5 fn = 0/50/60 Hz 6 da Range of application 7 da DC 198...276 V	VS LIGHTING SOLUTIONS Vossloh-Schwabe Deutschland GmbH Hohe Steinert 8, D-58509 Lüdenscheid Electronic converter for LED Type ECXd 2700.432 Ref.-No. 187049 Made in Bulgaria (Europe)	EN 61347-1 EN 61347-2-13 EN 62384 EN 61547 EN 55015 EN 61000-3-2	 Non isolated	<table border="1"> <tr> <th>Irated [mA]</th> <th>Prated [W]</th> <th>Urated[V]</th> <th>Uout [V]</th> <th>ta[°C]</th> <th></th> </tr> <tr> <td>150...700 per channel</td> <td>75</td> <td>50...240</td> <td><250</td> <td>-25...55</td> <td>Tunable white DT8</td> </tr> <tr> <td></td> <td>75</td> <td>50...240</td> <td></td> <td>-25...50</td> <td>Two channel DT6</td> </tr> </table>	Irated [mA]	Prated [W]	Urated[V]	Uout [V]	ta[°C]		150...700 per channel	75	50...240	<250	-25...55	Tunable white DT8		75	50...240		-25...50	Two channel DT6	cold white channel 1 + - warm white channel 2 + -
Irated [mA]	Prated [W]	Urated[V]	Uout [V]	ta[°C]																			
150...700 per channel	75	50...240	<250	-25...55	Tunable white DT8																		
	75	50...240		-25...50	Two channel DT6																		

*Max. sum of output current 1200mA

3.2.1 Technical data

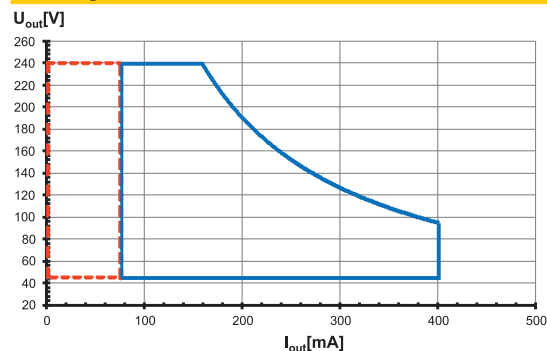
VS currently offers two non-isolated DALI drivers in a linear shape for power ranges up to 35 W and 75 W. The following table shows the electrical specifications of these drivers.

	Electrical features	ECXd 2700.432	ECXd 2400.431	Remarks
Input	Nominal voltage	220–240 V	220–240 V	
	Nominal frequency	0/50/60 Hz	0/50/60 Hz	
	AC voltage range	198–264 V	198–264 V	Alternating or rectified alternating voltage
	DC voltage range	198–276 V	198–276 V	Direct voltage; operation at 176–198 V DC for at least 1 h
	Maximum voltage	350 V AC	350 V AC	2 h max. duration, unit might not operate at voltages outside of the specified range
	Nominal current	0.39 A	0.19 A	
	Total Harmonic Distortion (THD)	≤ 10%	≤ 10%	Full load, 220–240 V, 50 Hz/see graphs
	Power factor	> 0.95	> 0.95	Full load, 220–240 V, 50 Hz/see graphs
	Efficiency up to	91%	90%	Full load, 220–240 V, 50 Hz/see graphs
	Starting time	≤ 0.6 s	≤ 0.6 s	
	Power losses	< 6 W	< 3 W	Full load
	Stand-by power	< 0.2 W	< 0.2 W	
	Protection class	I	I	PE has to be connected either to PE terminal or housing
	Inrush current	23 A pk	17 A pk	
	Max. units per circuit breaker	B16: 19 / B10: 11	B16: 28 / B10: 17	Grid impedance 800 mΩ, t _h = 290 μs / t _h = 220 μs
Output	PE current	< 0.5 mA	< 0.5 mA	Through PE
	Nominal voltage range	50–240 V	45–240 V	
	Maximum voltage	< 250 V	< 250 V	With open circuit
	Nominal current range	150–700 mA	75–400 mA	
	Current accuracy	± 3%	± 3%	DALI controlled, configured as DT8
	Current ripple	< 1%	< 1%	at 100 Hz, non-PWM operation
	Nominal power range	8.1–75 W	4–38 W	
	Maximum power	75 W	38 W	DT8 and DT6 (in 2-channel mode 75 W/38 W in total)
	DC output current (EL)	15%	15%	Preset value, adjustable via software, at DC or RAC (rectified alternating voltage)
	Galvanic isolation	No	No	Non-isolated
Dimming	Dimming control	Yes	Yes	DALI and PUSH function
	Dimming range	1–100%	1–100%	Analog/hybrid switchable by VS-Tuner4TRONIC® (factory setting: Complete analog dimming)
	Dimming standard	DALI	DALI	
Environment	Ambient temperature range	–25 to +55 °C	–25 to +60 °C	DT8 mode, 1 x DT6 mode
		–25 to +50 °C	–25 to +60 °C	2 x DT6 mode
	Maximum case temperature	75 °C	75 °C	Measured at t _c point
	Max. case temp. in fault condition	110 °C	110 °C	
	Storage temperature range	–25 to +85 °C	–25 to +85 °C	
	Relative humidity	5–85%	5–85%	Not condensing
	Surge transient protection	1 kV 2 kV	1 kV 2 kV	L/N LN/PE acc to. EN 61547 Clause 5.7
	Environmental rating	Indoor	Indoor	
	IP rating	IP20	IP20	
	Mains switching cycles	> 150,000	> 150,000	on/off = 30 s/30 s, max. 10% failure
Special features	Expected lifetime	100,000 h	100,000 h	t _c = 65 °C, 0.2%/1,000 h failure rate, 24 h ON
		50,000 h	50,000 h	t _c = 75 °C, 0.2%/1,000 h failure rate, 24 h ON
	No. of channels	Up to 2	Up to 2	
	Programming	Yes	Yes	
	Fine Tuneable White colour	Yes	Yes	
	Max. current per channel/independent programmable	700 mA	400 mA	ECXd2700.432 Max sum of output current 1200 mA ECXd2400.431 Max sum of output current 800 mA
	DALI device type	DT8 & 2 x DT6 or 1 x DT6	DT8 & 2 x DT6 or 1 x DT6	Ex factory DT8, other modes can be set via VS-T4T
	Dim to dark	Yes	Yes	
	Dim to warm	Yes	Yes	
	Soft switch off	Yes	Yes	
	Additional features	Yes	Yes	Constant Lumen Output (CLO), corridor function, PUSH function
	PUSH function	Yes	Yes	

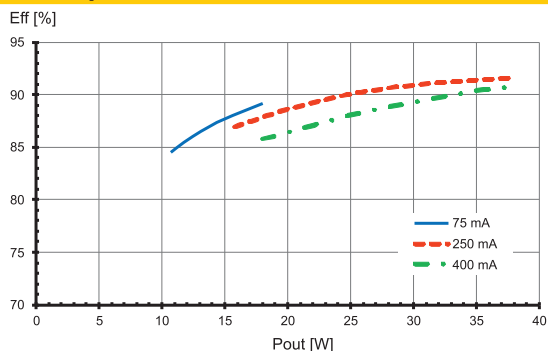
3.2.2 Typ. performance graphs

187048 / Type ECXd 2400.431

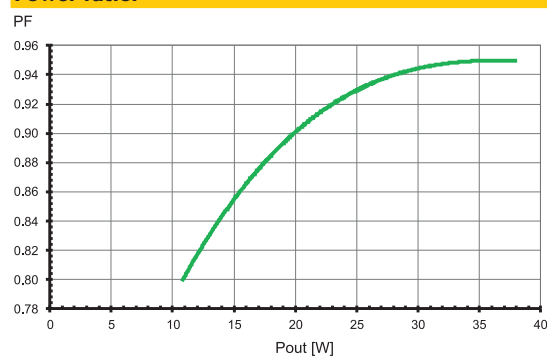
Working area



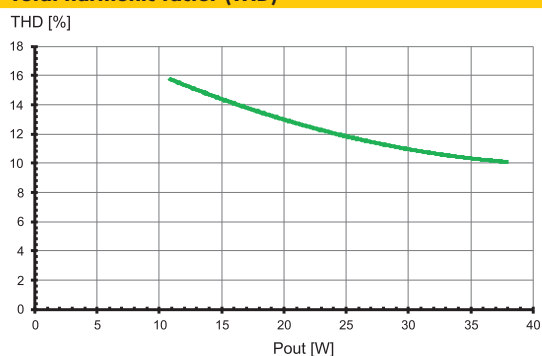
Efficiency



Power factor

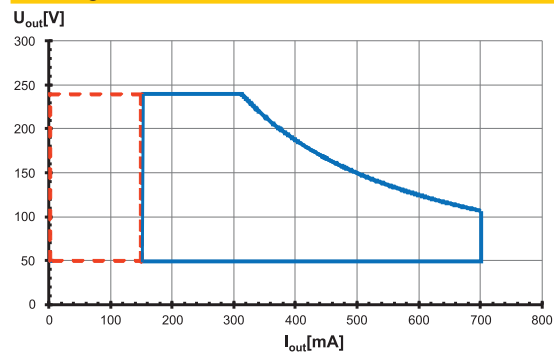


Total harmonic factor (THD)

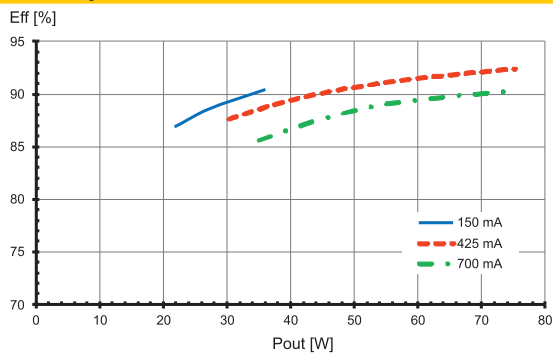


187049 / Type ECXd 2700.432

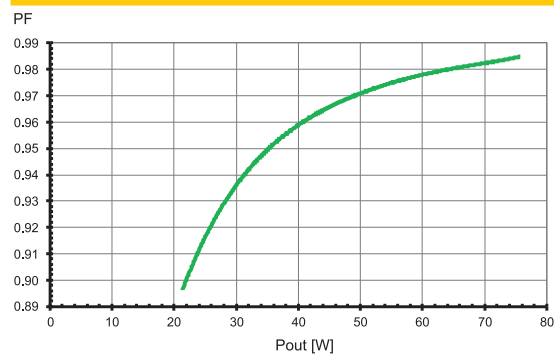
Working area



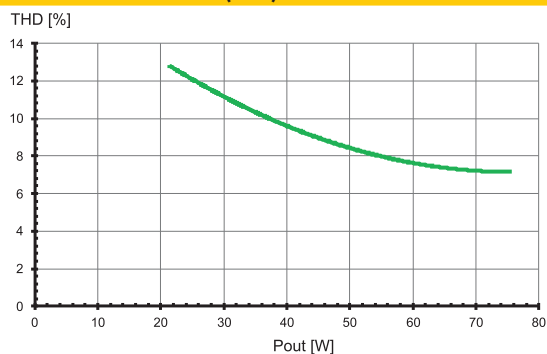
Efficiency



Power factor



Total harmonic factor (THD)



3.2.3 Technical features

Product features

- DALI DT8: TW or DALI 2 x DT6: 2 channel
- Analog or hybrid dimming
- Programmable by DALI/NFC
- DALI dimming range: 1...100%
- Very low ripple current: $\leq 1\%$
- 50,000 h lifetime at $t_c \text{ max.} = 75^\circ\text{C}$
- Very high efficiency of up to 90%
- Low stand-by power consumption: $< 0.2 \text{ W}$
- Suitable for emergency lighting

3.2.4 Amplitude/hybrid dimming

The VS TW drivers offer the possibility to choose the dimming mode between amplitude dimming (default) and hybrid dimming. The picture below shows the difference between these two dimming modes.

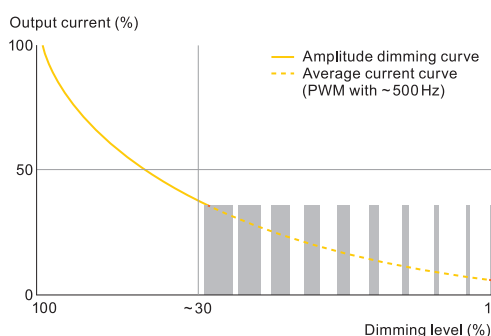


Figure 9: Hybrid dimming

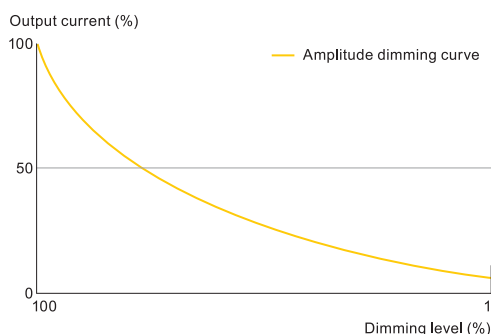


Figure 10: Amplitude dimming

At low dimming levels, amplitude dimming shows a significantly lower light modulation, while at the same time a higher efficiency is achieved.

In the low dimming range, amplitude dimming can lead to (small) colour deviations and brightness differences on the LED module. This can be avoided with hybrid dimming, in which the driver changes from amplitude dimming to PWM dimming when the output current falls below 20 mA.

The picture below shows how the dimming mode can be set in the VS-T4T software:

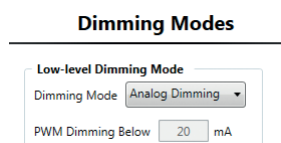


Figure 11: VS-Tuner4TRONIC®: Setting of dimming mode

3.2.5 Emergency lighting settings of TW drivers (ex factory)

Like all VS indoor drivers, the TW drivers provide an active DC detection and adjust the light level/luminous flux to 15% (DALI value 185) (ex factory mode). The colour temperature is always set to 4000 K, regardless if using VS TW modules or TW modules from other manufacturers.

If higher luminous fluxes are required for emergency lighting, this can be programmed using the VS-T4T configuration tool. Generally, the DC detection can be deactivated if required.

3.3 Configuration tool VS-Tuner4TRONIC® (VS-T4T)

It is only possible to install one version of the Tuner4Tronic (T4T) software. If you have already an existing installation please backup all existing projects before installing the new version. To achieve a good performance of a TW system with an intended colour precision, it is necessary to balance drivers with the operated LED modules. Therefore, the VS-T4T also supports data management for TW modules.

This balancing enables that the calculation of the output currents of the driver considers the specific behavior of the operated LED module in a projected application.

All necessary data such as LED module data and driver settings can be implemented and stored in the VS-T4T software. Data of VS TW modules are automatically provided by the VS-T4T and can simply be called up.

Since device descriptions of all TW drivers are also stored in the VS-T4T, all possibilities to configure these drivers are provided.

The configuration of a TW driver is always carried out in a project. To start a TW project, one of the stored TW drivers must be chosen and afterwards the operating mode "Tuneable White – DALI DT8" must be

Operating Modes

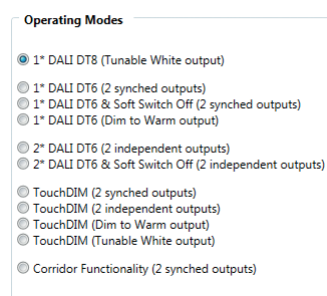


Figure 12: VS-Tuner4TRONIC®: Setting of driver operating mode

3.3.1 Administration of module data: Loading and creation of module data

To call up already stored LED modules that are planned to be used in a new project or to generate a new data set for LED modules, the sheet "LED Module Data" must be chosen.

3.3.1.1 Loading of stored TW modules

In case the required module is already stored, it can simply be selected in this pull-down menu:

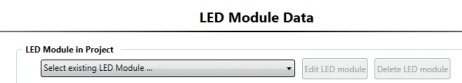


Figure 13: VS-Tuner4TRONIC®: Selection of the LED module

3.3.1.2 Creation of new TW modules

In case a new data set for an LED module is to be created, the button "Create new LED Module" must be clicked after having chosen the desired data model:



Figure 14: VS-Tuner4TRONIC®: Generation of a new LED module

As described in chapter 2.4.2, different types of data models for the description of a TW module can be selected.

Depending on the selected data model, a dedicated window pops up, where the data of the TW module can be implemented.

Independent of the selected data model, the newly created data set can be stored with an individual name and ID number (see also chapter 3.3.1.2.4).

3.3.1.2.1 Input data for data model "Basic Mode"

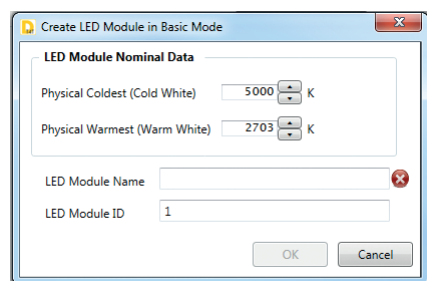


Figure 15: VS-Tuner4TRONIC®: Creation of data set for a new LED module in Basic Mode

In the Basic Mode, the CCT values of the two LED types assembled on a TW module must be implemented.

How to save newly created TW modules on the PC is described in chapter 3.3.1.2.4 Creation of new TW modules using the editing mode.

3.3.1.2.2 Data entry for the "Advanced Mode"

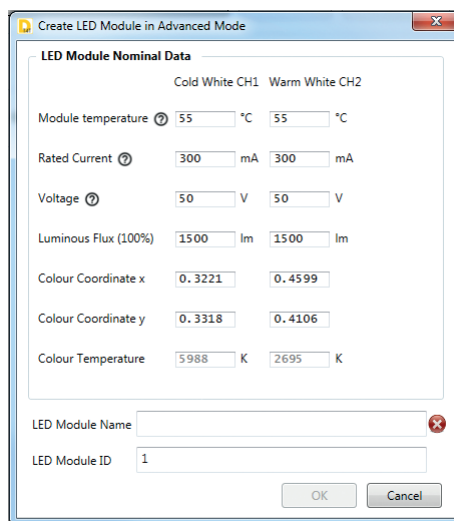


Figure 16: VS-Tuner4TRONIC®: Creation of data set for a new LED module in Advanced Mode

In the Advanced Mode, the data shown above, representing a specific operating point of the module, must be implemented.

- Module temperature: The values to be implemented should reflect the temperature that the module reaches when only one channel is operated at nominal (100%) light output. This allows the different efficacies of both channels to be considered by the current calculation of the driver. While producing equal light levels, the module temperature is usually slightly higher when light is produced by warm white LEDs (compared to cold white LEDs).
- The combination of all data shall describe one unique operating point of the TW module for each channel. It is advantageous to implement comparable values for the operating current of both channels.
- The correlated colour temperature (CCT) is calculated automatically by the VS-T4T, based on the implemented colour coordinates. How to save newly created TW modules on the PC is described in chapter 3.3.1.2.4 Creation of new TW modules using the editing mode.

3.3.1.2.3 Input data for data model "Premium Mode"

Create LED Module in Premium Mode

Nominal Data

	Cold White CH1	Warm White CH2
Module temperature	55 °C	55 °C
Rated Current	300 mA	300 mA
Rated Voltage	50 V	50 V
Luminous Flux	1500 lm	1500 lm
Colour Coordinate x	0.3221	0.4599
Colour Coordinate y	0.3318	0.4106
Colour Temperature	5988 K	2695 K

Module Architecture

	Cold White CH1	Warm White CH2
Number of LED strings	2	2
Number of LEDs per string	16	16

Thermal characteristics of LEDs

Thermal resistance junction to solder RthJS	10 K/W
---	--------

Current dependencies

	Cold White CH1			Warm White CH2		
	Minimum	Medium	Maximum	Minimum	Medium	Maximum
Current	20 mA	100 mA	400 mA	20 mA	100 mA	400 mA
Luminous Flux	10 lm	50 lm	200 lm	10 lm	50 lm	200 lm
Colour Coordinate x	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333
Colour Coordinate y	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333

Temperature dependencies

	Cold White CH1			Warm White CH2		
	Minimum	Medium	Maximum	Minimum	Medium	Maximum
Temperature	25 °C	55 °C	85 °C	25 °C	55 °C	85 °C
Luminous Flux	10 lm	9.25 lm	8.5 lm	10 lm	9.25 lm	8.5 lm
Colour Coordinate x	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333
Colour Coordinate y	0.3333	0.3333	0.3333	0.3333	0.3333	0.3333

LED Module Name

LED Module ID

4

OK

Cancel

Figure 17: VS-Tuner4TRONIC®: Data set creation for a new LED module in Premium Mode

In the Premium Mode, the data listed above must be implemented. The operating point of the module must be implemented in the same way as in the Advanced Mode (see chapter 3.3.1.2.2). Additionally, characteristic data of the used LEDs must be derived from the relevant LED data sheets and implemented. Therefore, data points must be collected from the characteristic curves of the LEDs (see chapter 2.4.1).

Example: Three value pairs for the colour coordinate cx are derived from the LED data sheet and implemented in the VS-T4T ($cx1/I_1$, $cx2/I_2$, $cx3/I_3$).

How to save newly created TW modules on the PC is described in chapter 3.3.1.2.4 Creation of new TW modules using the editing mode.

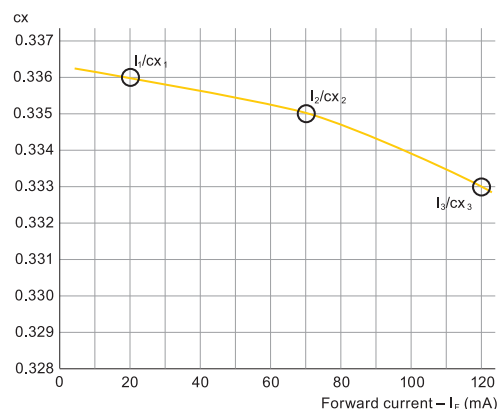


Figure 18: Example: Three value pairs (cx) are implemented in VS-T4T

Current dependencies

	Cold White CH1	
	Minimum	Medium
Current	20 mA	100 mA
Luminous Flux	10 lm	50 lm

Figure 19: VS-Tuner4TRONIC®: Input of cx coordinates as a function of the forward current

3.3.1.2.4 Creation of new TW modules using the editing mode

The data set of a new TW module can also be generated by editing an already stored module. For this, the button "Edit LED module" must be clicked after having selected a stored module:

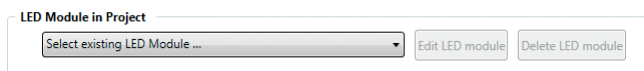


Figure 20: VS-Tuner4TRONIC®: Editing a stored LED module

VS-T4T then opens a window in which all parameters of the selected module are displayed and can be edited. Once all the changes have been made, the "OK" button must be clicked. The changed data will now be used for the configuration of the driver in the current project. The generated TW module is now part of the list "LED Module in Project" and is marked with a *.

To save the newly created TW module on the PC, the button "Export LED module" must be clicked:

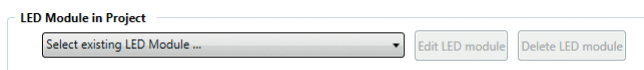


Figure 21: VS-Tuner4TRONIC®: Saving the data set of an LED module

VS-T4T then opens a window to determine how the newly created TW module should be stored:

The newly created TW module can be stored using the same name and the same ID as the originally chosen TW module. This should be done if the changes were corrections of incorrectly entered data. To do so, the button "Overwrite" must be clicked.

Alternatively, a new name and ID can be entered to be assigned to the newly created module. This should be done when the originally selected TW module and also the newly created TW module must be available in the database. To do so, the button "Save As" must be clicked.

As default setting for the module ID, VS-T4T always shows the lowest number that is not in use in the database of the PC. If already used module names or module IDs are entered, VS-T4T displays a warning. In this case, alternative entries shall be made.

Activation of the VS-T4T Premium license

To edit and create LED modules using the Premium Mode data model, a VS-Tuner4TRONIC® Premium software license must be purchased from a local VS sales representative.

The VS-Tuner4TRONIC® Premium license bundles the following new premium functionalities:

- Luminaire Info
- Monitoring Data Premium
- Tuneable White Premium Mode
- Service Key

To get access to the VS-Tuner4TRONIC® Premium license, open VS-Tuner4TRONIC® Development and choose the menu Help » About » License Key(s):

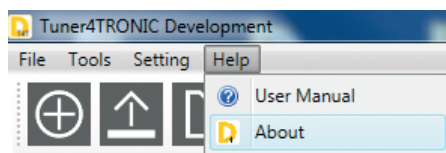


Figure 22: Access to the VS-Tuner4TRONIC® Premium license

VS-T4T displays the unique machine ID of your computer in this window:

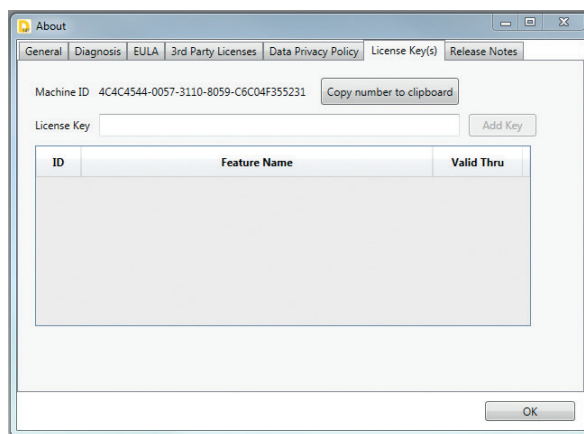


Figure 23: VS-Tuner4TRONIC®: Retrieving the machine ID/entering the license key

When ordering a license, this machine ID needs to be sent to the local VS sales representative.

It is recommended to use the "Copy to clipboard" button to copy the machine ID and insert it into your e-mail to avoid any typing errors. Based on this machine ID, VS generates a unique license key specifically designed for this computer. This means that the license key can only be used on this computer.

Once you have the license available, please enter it into the "License Key" field and click the "Add Key" button to activate the license. The corresponding features will be available now for use in VS-Tuner4TRONIC®.

All entered licenses are shown comprehensively in the window shown above, including their expiration dates.

3.3.2 Configuration of TW drivers

3.3.2.1 Adjustment of 100% operating current and balancing with TW module

To configure the driver according to the application (project) and to enable the balancing of driver and TW module, a LED module must be selected for each project. Balancing is then provided automatically by the VS-T4T. Based on the selected TW module, the VS-T4T displays the characteristic data that can be expected in this project, depending on the implemented operating currents (100% values) and temperatures. Each time an editable value is changed, VS-T4T recalculates all depending data.

To fulfill the requirements of the DALI standard, current values shall be chosen that lead to a flux equity of both channels. Otherwise, a change of the CCT would lead to a different total light output of the TW module. If compliance with the DALI standard is not intended, different current values can also be implemented. This can be done when, for example, an application requires a higher luminous flux with cold white light than with warm white light.

LED Module Data

Figure 24: VS-Tuner4TRONIC®: Input of the operating parameters of the LED module used in the project

The implemented current values shall represent the nondimmed operation of the two channels.

3.3.2.2 Additional DALI settings for LED drivers supporting Tuneable White

LED drivers that support Tuneable White provide the ability to maintain or set the colour temperature and the dimming level when the driver is turned on and after a system failure has occurred.

Figure 25: VS-Tuner4TRONIC®: Input of initial operating conditions

3.3.2.3 Operation of driver in single-colour operation modes

The driver can also be set for the 2-channel or 1-channel mode for standard applications that only provide light in one colour. The appropriate selection must be done in the "Operating Modes" sheet of the VS-T4T.

Operating Modes

Figure 26: VS-Tuner4TRONIC®: Setting of the driver operating mode

Different types of DALI drivers are defined in the DALI standard as Device Types DTx. Relevant types for LED applications are:

- DALI DT6: for "standard" LED drivers (one DALI address is used for each DALI driver/each channel, DALI only provides dimming and switching commands).
- DALI DT8: for colour control (2-channel control gear, one DALI address per driver, DALI provides commands for dimming, switching and colour temperature).

Typical applications for 2 x DT6 are: direct/indirect luminaire (2 channels, independently controllable). In this operating mode, the LED driver behaves like two individual LED drivers. Both output channels can be operated almost independently. In function tabs (e.g. operating current), the settings for each channel can be defined individually.

4 HANDLING

4.1 Possible combinations (non-isolated)

VS DALI TW driver – non-isolated

Linear TW LED modules are designed for operation with VS DALI drivers. To avoid deviating colour temperatures or brightness levels of the TW modules, a driver shall only operate them in series connection. The current setting of VS DALI drivers is done with the VS-Tuner-4TRONIC® configuration tool.

4.2 NFC programming

The NFC programmer must be positioned as shown. NFC programming is only possible while mains voltage is not connected at the LED driver. Further information can be found in the VS-T4T manual (www.vossloh-schwabe.com/uploads/tx_perfonimporter/Technical_application_guide_Multi-Dim_EN.pdf)

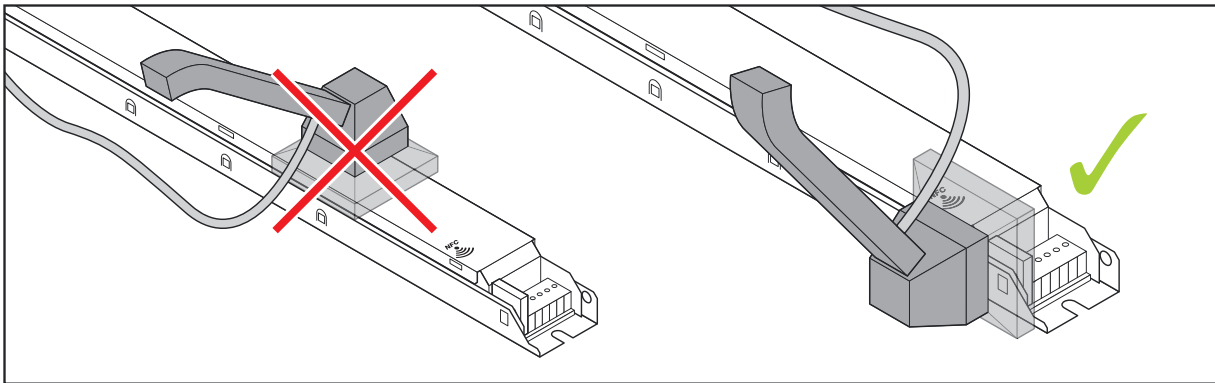


Figure 27: Positioning of the NFC device on the LED driver

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Headquartered in Germany, Vossloh-Schwabe counts as a technology leader within the lighting sector. Top-quality, high-performance products form the basis of the company's success.

The product range includes the entire spectrum of lighting components from LED systems with matching control gear, modern control systems (Blu2Light und LiCS) as well as electronic and magnetic ballasts and lampholders.

For the future, the company is geared towards the topic of smart lighting.

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