# LED Lighting Controller DCC2404-1WS

Hardware Documentation



## © 2023 evotron GmbH & Co. KG Pfütschbergstraße 1 98527 Suhl / GERMANY ⊠ info@evotron-gmbh.de

🗞 +49 (0) 3681 80704 60

www.evotron-gmbh.de



## COPYRIGHT

The distribution or reproduction of this manual or parts of this manual in any form and the use of its contents are only permitted with written approval of evotron GmbH & Co. KG. Changes are reserved.

## TRADEMARK RIGHTS

The brands **evotron**® and **lumiSENS**® are registered trademarks of evotron GmbH & Co. KG. The naming of products and brands from other manufacturers or suppliers is for informational purposes only Information.





## TABLE OF CONTENTS

#### NOTES ABOUT THIS MANUAL

#### **PRODUCT DESCRIPTION**

Identification of the Product	8
Certification and Marking	9
Package Contents	9
Accesories	9

#### SEFETY INSTRUCTIONS

General information.									10
Electrostatic Safety									10
Staff Requirements .									11

#### **PRODUCT PROPERTIES**

Overview
Intended Use
Overview - functional elements
LED-Display
LED-Functions
OLED-Display
Display areas of the OLED display

#### INTERFACE DESCRIPTION

Operating Voltage connection
Function
Connector-Typ
Technical characteristics
Technical parameters
Operating Voltage – input
Operating Voltage – OUTPUT
Operating Voltage – Display
Connecting trigger and I/O signals
Funktion
Connector Typ
Technical characteristics
Technical parameters
INPUT – TRIGGER-IN
Continuous-Mode
Flash-Mode
I/O - Output Channels
Technical characteristics
Factory Setting
Technical Parameters



#### **USB-INTERFACE**

Connector-Typ								. 32
Technical characteristics								. 32
Technical parameters								. 32

#### INDUSTRIAL WLAN-INTERFACE

WLAN-Standard										. 3	4
WLAN-Channels					-	-				. 3	4
WLAN security					-	-				. 3	4
WLAN-factory setting.						-				. 3	5

#### TRIGGER-UNIT

TRIGGER-UNIT – Timing Parameter	. 36
TRIGGER-UNIT – Timing Diagram	. 37

#### **TECHNICAL SPECIFICATIONS**

Electrical Parameter								. 3	38
Mechanical Properties .								. 4	10
Mechanical dimensions .								. 4	11

## CHANGE REPORT

### DISPOSAL

Procedures																									43	3
------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----	---



## NOTES ABOUT THIS MANUAL

This manual describes the digital LED lighting controller DCC2404-1WS and is part of the product. It includes the safety instructions for operating the system and describes the functions as well as the assembly and maintenance of the LED lighting controller DCC2404-1WS.

During the life of the product, the manual must be kept accessible at all times for the personnel involved in the installation, operation and maintenance of the system.

If the product is resold or otherwise handed over, the manual must also be passed on to the next owner.

#### INTENDED AUDIENCE

This manual is intended for persons with knowledge in the fields of electrical engineering, electronics and industrial image processing - machine vision -.

#### TEXT STYLES

The following are shown in **bold**:

- Hardware controls (buttons, switches, etc.)
- display elements
- Signal names
- Software elements that are relevant for operation and setup (menus, buttons, windows, input fields, etc.)
- Brand names

Shown in *italics* are:

- Software messages
- References to figures and tables in the text.
- Proper names

In [square brackets] are shown:

• Keypad inputs that the operator has to make.

Blocked are displayed:

• Particularly important words and important notes in a statement.



#### NOTES ON THIS PDF DOCUMENT

You can print out this PDF document for your own internal use. For comfortable screen work, all indexes of the manual are linked to the text in such a way that a simple mouse click can be used to quickly navigate to the individual chapters.

You can find this manual and other technical information on the Internet at:



www.evotron-gmbh.de



## PRODUCT DESCRIPTION

#### **IDENTIFICATION OF THE PRODUCT**

There are the following versions of the LED lighting controller:

Туре	Item Number
DCC2404-1WS	11000211

#### SERIAL NUMBER

The serial number is printed on the controller housing as a data matrix code.

#### SERIAL NUMBER FORMAT

Serial-no. aaaaaaaaaaaaaaaxxxx-YY-zzzzz

88888888888	Type-ID
XXXX	Revision
YY	Year of manufacture
ZZZZZ	Current Number

#### NOMENCLATURE - TYPE-ID



#### Type – Digital Current Controller



#### CERTIFICATION AND MARKING

#### COMPLIANCE WITH STANDARDS

Low Voltage Directive	2014/35/EU
FCC-Identifier	Z64-CC3235MOD
IC	451I-C3235MOD

#### PACKAGE CONTENTS

The scope of delivery includes:

- LED lighting controller DCC2404-1WS
- Quick start Guide

#### ACCESORIES

Designation	Article no.
MOUNT-DCC24-RM-P Mounting bracket for LED controller Series DCC2404-x for DIN rail type TH15 / type TH35 and for wall mounting	11000215
CAB-M12-5P-FN00-2m-R-UL Connection cable M12 - open end, robotic cable, length 2.0 m, UL approval	12000110
CAB-M8-6P-FN00-1.5m-R-UL Connection cable M8 - open end, robotic cable, length 1.5 m, UL approval	12000114
CAB-M8-4P-MF-1m-R-UL Connection cable M8 - plug/socket, robotic cable, length 1.0 m, UL approval	12000105



## SEFETY INSTRUCTIONS

Follow the instructions in this chapter for your own safety, for the safety of other people and to avoid damage to your LED lighting controller and the technical equipment connected to it.

#### **GENERAL INFORMATION**

The LED lighting controller DCC2404-1WS corresponds to the currently valid technical rules and regulations.

When installing the LED controller, the applicable electrical engineering regulations and the following information must be observed:

- Configure the application so that the controller is always operated within its specification.
- Before any installation work, the LED lighting controller must be disconnected from the operating voltage.
- Avoid electrostatic discharges during the installation of the controller and the connected components.
- Only operate the controller under the environmental conditions specified in the "Technical Specifications" chapter.

#### ELECTROSTATIC SAFETY

Electrostatic discharges can damage semiconductor components and electronic assemblies.

- Do not open the LED lighting controller! Electronic assemblies can be destroyed by improper intervention. Opening the LED controller will void the warranty.
- The applicable ESD guidelines must be observed when installing the LED controller.
- Only use ESD-compatible tools!

The electrostatic compatibility of the LED lighting controller DCC2404-1WS with regard to pulsed interference corresponds to the requirements of the following ESD standards:

IEC 61000-4-2	Electrostatic discharge air ±8 kV
IEC 61000-4-2	Electrostatic discharge contact ±6 kV
IEC 61000-4-4	Burst pulses (supply line) ±2 kV
IEC 61000-4-4	Burst pulses (signal line) ±1 kV



#### STAFF REQUIREMENTS

The LED lighting controller should only be used by professionals with knowledge in the fields

- Electrical engineering, electronics and
- Industrial image processing machine vision

be installed and configured.

The specialists must be familiar with the relevant regulations and safety instructions for working with electrical equipment and must have read and understood all safety and warning instructions in this manual.

#### REQUIRED SKILLS AND KNOWLEDGE

The ability to install electronic components in an industrial environment is required.

Knowledge in the field of industrial image processing is helpful.

#### NOTICE:

If required, we offer you technical support in the planning and implementation of your project.

A comprehensive education and training program is available to you via our evotron academy.



Figure 1: LED-Lighting Controller DCC2404-1WS



## PRODUCT PROPERTIES

#### **OVERVIEW**

Parameter		
Digitally controlled precision current source <sup>[1]</sup>		
Compact In-Cable Controller		
Accessories for cabinet mounting		
LED current up to 4 A LED forward voltage 0 V up to 24 V		
Fast adjustment of the LED current settling time t <sub>ion</sub> < 100 ns		
High reproducibility of the set LED current		
Exact LED current pulses without overshoot		
Highly efficient power FET amplifier, efficiency η > 92 %		
Current resolution 14 Bit		
Adaptive LED current limit		
Short-circuit proof		
Overvoltage protection		
Active temperature monitoring		

<sup>[1]</sup> The lighting controller DCC2404-1WS can be used universally for all machine vision LED lighting that corresponds to the performance class of the controller.

Feature	Parameter			
Operational	CONTINUOUS-Mode			
modes	LED continuous operation ON/OFF LED Current 0 A 4 A			
	FLASH-Mode			
	LED flash mode Light pulses from 1µs up to 85 s			
	Pulse adjustable in 20 ns steps			
	SEQUENCE-Mode			
	Automatic generation of freely pro- grammable LED pulse sequences and the Synchronous camera trigger signals			
TRIGGER- Input	Faster <b>TRIGGER-IN</b> for synchronous Image acquisition of moving measurement objects			
	Signal-Jitter < 5 ns			
	Input NPN, PNP, OC			
	Signal level TTL up to 24 V			
	Selection of the active TRIGGER-IN edge HL- or LH- transition			

Feature	Parameter		
TRIGGER- Output	TRIGGER-OUT – for synchronous trigge- ring of cameras, lighting controllers and other components		
	Signal-Jitter < 5 ns		
	Output driver programmable PNP, NPN, OC, Push-Pull		
	Output current I <sub>OUTmax</sub>	200 mA	
	Short-circuit proof		
TRIGGER Unit	System on Chip (SoC) Trigger-Unit based on an innovative Intel® FPGA Technology		
	Generates LED flash pulses and a synchronous trigger signal for the camera		
	Quartz stable time base		
	Signal-Jitter < 0.5 ns		
	Synchronised on TRIGGER-IN		
	32-Bit Time base		
	Programmable parameters:		
	- LED-Puls Duration - LED-Puls Delay - TRIGGER-OUT Delay - Puls-Frequency - Timing adjustable in	1 µs 85 s 40 ns 85 s 40 ns 85 s 0 Hz 500 kHz 20 ns Steps	

Feature	Parameter
LED Pulse Sequencer	Generates light sequences with defined LED pulses and the synchronous TRIGGER-OUT pulses for camera image capture
	Easy provision of fast running image sequences
	(e.g. Shape-from-Shading®)
	Up to 10.000 pictures/s
	Per sequence are 1 up to 16 steps
	programmable
	For each step are the active ones
	LED segments selectable <sup>[2]</sup>
	AUTOMATIC-Mode
	TRIGGER-IN edge starts a sequence
	SINGLE STEP MODE
	TRIGGER-IN edge starts the next step of the current sequence
	The <b>AUTOMATIC MODE</b> and the <b>SINGLE STEP MODE</b> can also be controlled by software using the <b>JSON REST API</b>

<sup>[2]</sup> With segmented evotron lumiSENS® lighting, the active LED segments of the lighting can be defined for each step in a sequence (see LED segment control).

Feature	Parameter	F
LED-Segment control	Patented control of all evotron segmented LED lights	9
	The 1-channel controller DCC2404-1WS can control the light segments of a segmented LED lighting individually or in combination <sup>[3]</sup>	l l
	Simple cabling Only a standard 4-pin M8 cable is required for segment control	
	Flexible exchange of different LED lighting types	
	No multi-channel controller required	
	Can be controlled in combination with the LED pulse sequencer mode <sup>[4]</sup>	_
	Saving for a 4-segment ring light: - material costs 75% - wiring effort > 75% - installation space - project planning time - service costs	-
	- storage area for spare parts	[

Feature	Parameter		
STATUS- Output	<b>STATUS-OUT</b> – binary output Signals the error status of the LED cont- roller or the connected lighting <sup>[5]</sup>		
User I/O	I/O3 – binärer IN/OUT-channel freely configurable		
lumiSENS®	evotron lumiSENS® Technology		
	Plug & Play of the LED lights		
	Real-time access to process parameters from the controller and lighting		
	LED brightness Auto-Calibration		
	Long-term stable and reproducible lighting parameters		
	LED lifetime monitoring		
WLAN	Industrial WLAN (IWLAN) Interface		
	Frequency band 2.4 GHz and 5 GHz		
	WPA2 encryption		
	Access Point 802.11a/b/g/n		
	Station-Mode 802.11a/b/g		
Displays	5 Status LEDs		
	Graphic OLED display		

<sup>[5]</sup> The current STATUS information is shown on the controller's OLED display and can be queried using the software.

<sup>[3]</sup> The LED controller DCC2404-1WS can control all segmented LED lighting with integrated  ${\it lumiSENS} \circledast$  technology in segment mode.

<sup>[4]</sup> See LED Pulse Sequencer



#### **INTENDED USE**

The LED lighting controller DCC2404-1WS is intended for controlling the brightness of LED lighting in the field of industrial image processing.

The fully digital design of the controller enables very precise regulation of the LED current and the illuminance.

An implemented **Intel®** FPGA takes over all time-critical functions and generates instantaneous trigger signals for the camera and lighting.

In **FLASH MODE**, synchronous light pulses from 1 µs up to the minute range can be generated. This makes the DCC2404-1WS particularly suitable for dynamic image acquisition of fast-moving objects.

A simple connection to existing control components is possible via the freely programmable digital inputs and outputs of the DCC2404-1WS.

The DCC2404-1WS has a standardized, industrial WLAN interface (IWLAN) for configuring, commissioning and monitoring the parameters of the controller and the connected LED lighting.

The implemented *application programming interface* (JSON REST API) enables the DCC2404-1WS controller to be easily integrated into the existing control software.

The current process parameters of the controller and the connected LED lighting can be read directly via the LED display elements and the graphic OLED display.

The integrated **lumiSENS**® technology monitors all relevant parameters of the LEDs online and reliably compensates for temperature and aging-related influences. The specified illuminance thus remains constant over the entire life cycle of the LED lighting and guarantees precise measurement results.

The **lumiSENS**® technology actively monitors and optimizes the service life of the LED lighting and, with the early detection of age-related failures, provides preventive protection against unexpected downtimes of production systems.

evotron

#### **OVERVIEW - FUNCTIONAL ELEMENTS**



Figure 2: DCC2402-1WS – View of the functional elements



#### DESCRIPTION OF THE FUNCTIONAL ELEMENTS

1	X1 – Operating voltage connection
2	X2 – Trigger- and I/O-Interface
3	Marker arrow for connector position
4	BUTTON 1 – Navigation through the pages of the OLED display – manual activation of the WLAN
5	X4 – USB 2.0 - connector / connector type USB-C
6	LED - Status display
7	OLED - Grafic display
8	Type designation
9	X3 – Connection for the LED lighting
10	Certificate - Markings
11	Data-Matrix – Type plate / Serial number



#### LED-DISPLAY

The LED display provides information on the current operating status of the LED controller and the connected LED lighting.



#### LED-FUNCTIONS

#### POWER-LED

- POWER OFF the controller is OFF or V-IN < 12 V
- POWER-ON the controller is ready for operation

#### STATUS-LED

- STATUS OK controller is active and working correctly
- WARNING<sup>[1]</sup> controller active warning message active
- ERROR<sup>[2]</sup> controller is OFF an error has occurred

The warning messages are displayed on the OLED display on the ERROR Page.
 The error messages are shown on the OLED display on the ERROR page.

#### TRIGGER-LED

- CONTINUOUS-MODE [1] TRIGGER-IN is aktive
- **FLASH-MODE**<sup>[2]</sup> the active TRIGGER edge was detected
  - FLASH-MODE <sup>[3]</sup> the triggered flash period expires

[1] Im CONTINUOUS-MODE, TRIGGER-IN is a static input.

[2] In FLASH and SEQUENCE MODE, the active TRIGGER-IN edge is displayed in GREEN for 10 ms. With TRIGGER-IN frequencies > 100 Hz, the TRIGGER-LED display appears as permanently active.

[3] In FLASH and SEQUENCE MODE, after the green TRIGGER pulse, the entire duration of the active flash period is displayed in YELLOW. TRIGGER-IN is blocked for this time.

Figure 4: DCC2404-1WS – LED-Status Display

During the commissioning and test phase, the function of the connected trigger signals, the data connection and the transmission of the data can be easily checked via the LED display.

#### WLAN-LED

WLAN OFF <sup>[1]</sup> – the ii	ntegrated	WLAN	module i	s OFF
----------------------------------	-----------	------	----------	-------

WLAN ON – the integrated WLAN-Modul ist active

[1] The WLAN module can be activated manually using the controller BUTTON 1.

#### DATA-LED

ONLINE – the data connection is set up

DATA – the data connection is active

#### LEGEND FOR THE LED SYMBOLS

LED	LED-SYMBOLE					
	the LED is OFF					
	the LED is ON and lights up in the color shown					
0	The LED FLASHES in the color shown					
0	The LED FLASHES alternately in the colors shown					

#### **OLED-DISPLAY**

The device data, settings, operating parameters and status messages of the LED controller and the connected LED lighting are shown on the OLED display. The data is presented graphically on the corresponding display pages. **BUTTON 1** is used to navigate to the individual display pages.

#### DISPLAY AREAS OF THE OLED DISPLAY



#### Figure 5: OLED Display

- 1 HEADER Title of the page with status information
- 2 DATA FIELD Display of the system parameters
- 3 FOOTER Display of additional information
- 4 NAVIGATOR Display the current page position



## INTERFACE DESCRIPTION

#### **OPERATING VOLTAGE CONNECTION**



Figure 6: Plug X1 – Operating Voltage connection

Pin	Signal	Color	Description
1	V-IN	BN	Operating Voltage +24V
2	V-IN	WH	Operating Voltage +24V
3	GND	BU	Operating Voltage GND
4	(C/Q)	BK	reserved (nc)
5	GND	GY	Operating Voltage GND

#### FUNCTION

• Connection of the operating voltage for the LED lighting controller DCC2404-1WS.

#### CONNECTOR-TYP

• Plug - M12/5-pin/A-coded

#### **TECHNICAL CHARACTERISTICS**

- Active reverse polarity protection of the operating voltage
- Integrated ESD protection
- Pin assignment according to **IO-Link** Class B Power

#### **TECHNICAL PARAMETERS**

PARAMETER	MIN	NOM	MAX
Operating Voltage V-IN	+12 V	+24 V	+30 V
Current Consumption @ 24V idle	57 mA	60 mA	62 mA
Current Consumption @ 24V load	60 mA	-	4 A
Power Consumption @ 24V	1.4 W	1.5 W	90 W
Reverse polarity protection of the Operating Voltege	-	-	-60 V
Overvoltage Protection @ 1 ms	40 V	-	64 V

evotron

#### **OPERATING VOLTAGE – INPUT**

A DC voltage in the range of +12 V to +30 V is required to power the controller. The operating voltage is connected to the **PLUG X1** via the **V-IN** contact<sup>[1]</sup>.

The operating voltage input has an active reverse polarity protection that reliably prevents damage caused by wiring errors.

The connected operating voltage and the internal voltage level are actively monitored and displayed via the integrated voltage monitor.

#### **OPERATING VOLTAGE – OUTPUT**

The voltage **V-OUT** is available at **SOCKET X2** for the direct supply of a camera or other sensors and actuators that can be connected via the I/O interface<sup>[1]</sup>.

#### **OPERATING VOLTAGE – DISPLAY**

The blue **POWER LED** indicates that the controller is switched on.

The level of the current operating voltage V-IN of the controller is shown on the OLED DISPLAY<sup>[2]</sup>.



Figure 7: DCC2404-1WS - Connection of the operating voltage

[1] The operating voltage V-IN of the LED controller must be at least 2 V above the forward voltage of the connected LED lighting (see LED lighting data sheet).

[1] The voltage output V-OUT delivers a maximum current of 500 mA.

[2] If the operating voltage is outside the permissible range, the **STATUS-OUT** signal becomes active and the controller sends an error message.



#### CONNECTING TRIGGER AND I/O SIGNALS



Figure 8: Socket X2 – trigger and I/O interface

Pin	Signal	Color	Description
1	V-OUT	BN	+ I/O-Supply OUT
2	TRIGGER-IN	WH	Trigger signal – INO
3	GND	BU	GND - I/O-Supply OUT
4	STATUS-OUT	BK	Status signal – OUT1
5	TRIGGER-OUT	GY	Trigger signal – OUT2
6	IO-3	PK	I/O3 Digital-Signal – IN/OUT3

#### **FUNKTION**

- Interface for trigger, status and I/O signals
- Provision of the supply voltage V-OUT for cameras and other external components.

#### CONNECTOR TYP

• Socket - M8/6-Pin/A-coded

#### **TECHNICAL CHARACTERISTICS**

- Active I/O edges and the I/O voltage levels are freely programmable
- Integrated overcurrent and ESD protection

#### **TECHNICAL PARAMETERS**

Parameter	Min	Nom	Max
V-OUT / Output Voltage	+12 V	+24 V	V-IN
V-OUT / Output Current	0 mA	-	0.5 A
IN-Signals / Voltage Range	0 V	-	30 V
IN-Signals / Input Resistance	-	39 k	-
OUT-Signals / Voltage Range	0 V		V-IN
OUT-Signale / Current	0 mA	-	200 mA
Overvoltage protection @ 10 µs	40 V		64 V

#### INPUT - TRIGGER-IN

The controller synchronizes the activation of the LED lighting with the **TRIGGER-IN** signal and generates a synchronous **TRIGGER-OUT** signal.

- synchronous high-speed input
- Input levels from 5V TTL to 24V PLC signals
- Input signals PNP, NPN, Push-Pull
- active signal level and edge programmable

#### CONTINUOUS-MODE

In continuous light operation, **TRIGGER-IN** switches the LED lighting statically ON/OFF (*see Figure 10*).

#### **FLASH-MODE**

In FLASH MODE, the active **TRIGGER-IN** signal edge starts the internal pulse timer unit of the controller *(see Figure 11).* 

Timing Parameter	Min	Nom	Max
Trigger Frequency	0 Hz	-	500 kHz
Trigger Pulse Wide	1 µs	-	$\infty$
Delay - TRIGGER-IN to t <sub>Period-ON</sub>			120 ns
TRIGGER-IN Signal Jitter			5 ns



Figure 9: TRIGGER-IN – input circuit

TRIGGER-IN	
	 _
LED-ON/OFF	L

Figure 10: TRIGGER-IN - CONTINUOUS-MODE



Figure 11: TRIGGER-IN – FLASH-MODE



#### I/O - OUTPUT CHANNELS

Three binary I/O output channels **OUT1**, **OUT2** and **OUT3** are available for controlling and synchronously triggering external components.

The signals **STATUS OUT**, **TRIGGER OUT** or **USER OUT** can be assigned to each OUT Channel.

#### **TECHNICAL CHARACTERISTICS**

- Output current up to 200 mA per channel
- Optional driver mode:
  - PNP (see Figure 12)
  - NPN (see Figure 13)
  - **Push-Pull** (see Figure 14)
  - **FAST**<sup>[1]</sup> (see Figure 15)
- Monitoring of the I/O Output level<sup>[2]</sup>
- Status monitoring active fault reporting<sup>[3]</sup>
- All output drivers are short-circuit proof and thermally monitored.

#### FACTORY SETTING

- OUT1 STATUS-OUT NPN Driver
- OUT2 TRIGGER-OUT PUSH-PULL Driver
- OUT3 USER-OUT
  NPN Driver

#### NOTICE:

The sum of the driver currents of all OUT channels must not exceed the maximum value of 500 mA. In the event of an overload, the internal overcurrent protection trips.

To reset the fuse, the supply voltage must be interrupted.

#### **TECHNICAL PARAMETERS**

Parameter OUT-Channel	Min	Nom	Max
Output Current IOUT	0 mA	-	200 mA
Output Current total IOUT <sub>max<sup>[1]</sup></sub>	-	0.45 A	0.5 A
Output L level @ 200 mA	0 V	-	1.5 V
Output H level @ 200 mA	-	-	(V-IN)-1.5V
Output Delay Time		600 ns	800 ns
Output Delay - FAST-MODE	-	-	50 ns

[1] The sum of all output currents at the outputs OUT1, OUT2, OUT3 must not exceed the maximum value of 500 mA.

<sup>[1]</sup> Der FAST-MODE is only available for channel OUT2.

<sup>[2]</sup> The output level of the OUT channels can be read back and monitored via software.

<sup>[3]</sup> The status of the I/O channels is actively monitored. In the event of a fault, STATUS-OUT becomes active, the STATUS LED changes to RED, an error message appears in the OLED display and the controller sends the current error code via the API.

#### CONNECTION OF THE OUT CHANNELS



Figure 12: PNP Outout – H-active TRIGGER-OUT signal



Figure 13: NPN OUTPUT – L-active STATUS-OUT signal / 5 V TTL



Figure 14: Push-Pull – LH-active Output with 24 V signal level



Figure 15: FAST-MODE – L-active Output with 24 V signal level



#### **TRIGGER-OUT**

In the **FLASH MODE** the internal pulse timer unit of the controller generates a synchronous LED flash and a synchronous **TRIGGER-OUT** signal for each **TRIGGER-IN** event.

#### TECHNICAL CHARACTERISTICS

- TRIGGER-OUT synchronized to TRIGGER-IN
- DELAY time programmable from **TRIGGER-IN** to **TRIGGER-OUT**
- PULSE duration adjustable 1 µs to 85 seconds
- Timer setting resolution 20 ns
- Precision trigger for camera image capture
- Trigger signal for additional LED controllers

#### FACTORY SETTING

- OUT2 TRIGGER-OUT **PUSH-PULL**-Driver<sup>[1]</sup>
- OUT2 Driver Mode **FAST MODE** OFF

#### TRIGGER-OUT - FAST-MODE

For channel **OUT2**, the driver output can also be set to **FAST MODE**.

The **FAST MODE** has a very low signal delay time and is particularly suitable for providing highly synchronous **TRIGGER-OUT** signals.

In **FAST MODE**, the OUT driver always works as an **NPN** output *(see Figure 15)*.

The **TRIGGER OUT** signal is low-active in **FAST MODE** and synchronized to the HL edge.

#### **TECHNICAL PARAMETERS**

Timing Parameter	Min	Nom	Max
TRIGGER-OUT Frequency	0 Hz	-	500 kHz
TRIGGER-OUT Pulse Wide	1 µs	-	85 s
Trigger time resolution	-	20 ns	-
Output Delay Time	-	600 ns	800 ns
Output Delay Time FAST-MODE	-	-	50 ns
Signal Jitter	-	-	5 ns

<sup>[1]</sup> TRIGGER-OUT can be assigned to the I/O channels OUT1, OUT2 and OUT3.





Figure 16: TRIGGER-OUT – Connection of a camera



Figure 17: TRIGGER-OUT synchronizes a 2nd LED controller

#### TRIGGER-OUT – CAMERA CONTROL

With the **TRIGGER-OUT** signal and the supply voltage **V-OUT** provided at the I/O port, a camera can be connected very easily *(see Figure 16).* 

Image capture can be precisely synchronized with the LED flash via TRIGGER-OUT. This enables a very precise image acquisition with exposure times in the range of 1 µs, even with commercially available cameras.

#### TRIGGER-OUT – TRIGGER LED-CONTROLLER

The **TRIGGER-OUT** signal can control the **TRIGGER-IN** input of another LED controller.

This makes it easy to create complex lighting scenes with several LED lights.



The first LED controller then works as a master controller and synchronizes all chained LED controllers<sup>[1]</sup> to its **TRIGGER-IN** signal. The individual LED lights then generate precisely defined light pulses according to the locally set timing parameters (*see Figure 17*).

<sup>[1]</sup> LED controllers from other manufacturers can also be controlled and synchronously triggered via the TRIGGER-OUT signal.

evotron

#### STATUS-OUT - ERROR MESSAGE

The **STATUS-OUT** signal reports the operating status of the LED controller and the connected LED lighting.

In the event of an error, the controller switches OFF the LED lighting and activates the **STATUS-OUT** signal.

Once the cause of the error has been removed, the controller clears the error display, deactivates the **STATUS-OUT** signal and automatically switches back to regular operating mode.

#### IN THE EVENT OF A FAULT:

- the LED lighting is switched **OFF**
- the **STATUS-OUT** signal becomes active
- the **STATUS LED** changes from GREEN to RED
- Display of the error message in the OLED display
- the error code is sent via the API

#### FACTORY SETTING

• OUT1 – STATUS-OUT **NPN**-Driver<sup>[1]</sup>

## USER OUT3 – CHANNEL I/O3

I/O channel 3 is available to the user for extensions.

#### CONFIGURATION OPTIONS<sup>[1]</sup>:

- digital Input IN3
- digital Output OUT3
- NPN-Driver
- PNP-Driver
- Push-Pull-Driver

#### POSSIBLE OUTPUT SIGNALS:

- STATUS-OUT
- TRIGGER-OUT
- USER-OUT3

<sup>[1]</sup> STATUS-OUT can be assigned to the I/O channels OUT1, OUT2 and OUT3.

<sup>[1]</sup> The I/O channels are configured with the evotron app DCCconfig

## I/O SUPPLY VOLTAGE V-OUT

The voltage **V-OUT** with a maximum output current of 500 mA is available for the power supply of a camera or other sensors and actuators that are connected to the I/O interface.

The voltage output **V-OUT** is short-circuit proof and protected with a self-resetting fuse<sup>[1]</sup>.

Each output channel **OUT1**, **OUT2** and **OUT3** can provide a drive current of **200 mA**. The sum of all three driver currents must not exceed the maximum value of **500 mA**.

The output drivers of the I/O channels are short-circuit proof and protected with a separate self-resetting fuse *(see Figure 18)*.



Figure 18: I/O Interface – power supply

#### NOTICE:

The sum of the driver currents of all OUT channels must not exceed the maximum value of 500 mA. In the event of an overload, the internal overcurrent protection trips.

To reset the fuse, the supply voltage must be interrupted.

<sup>[1]</sup> To reset the fuse, the operating voltage of the LED controller must be interrupted.



#### CONNECTION OF THE LED LIGHTING



Figure 19: Socket X3 – connection LED lighting

Pin	Signal	Color	Description
1	+I-LED	BN	+LED-Lighting (Anode)
2	SD	WH	Sensor-Data <sup>[1]</sup>
3	GND	BU	- LED-Lighting (Cathode)
4	SG	BK	Sensor Ground

[1] The signals SD and SG are only to be used for lightings with evotron **lumiSENS®** technology. For all other LED lighting types, leave the SD / SG signals open.

#### **FUNCTION**

• Connection for the LED lights.

#### CONNECTOR-TYP

• Socket - M8/4-Pin/A-Coded

#### SOCKET - M8/4-PIN/A-CODED

- The LED lighting is controlled via a programmable constant current source.
- LED current outputs short-circuit proof
- Integrated ESD protection

#### NOTICE:

Always switch off the LED controller before connecting or changing the LED lighting.

#### **TECHNICAL PARAMETERS**

PARAMETER	MIN	NOM	MAX
LED forward voltage	+5 V	-	(V-IN)-2V
LED current	0 mA	-	4 A
Overvoltage protection @ 100 µs	33 V	-	36 V



#### LED LIGHTING WITH LUMISENS

LED lightings with integrated **lumiSENS**<sup>®</sup> technology are automatically configured by the LED controller via **Plug & Play**.

- automatic setup of operating parameters
- Online monitoring of the LED limit values
- Compensation of LED brightness fluctuations due to ageing and thermal effects



Figure 20: Connection of an evotron lumiSENS® LED lighting

#### LED LIGHTING - GENERAL

The LED controller can be used universally to control any LED lighting. The configuration is done via the graphical user interface of the configuration software.

- convenient configuration of lighting
- online monitoring of  $I_{\text{\tiny LED}}$  und  $V_{\text{\tiny LED}}$
- Saving and loading the parameter sets



Figure 21: Connection of any LED lighting



## **USB-INTERFACE**



X4 Figure 22: USB Type C connection socket X4

EL	IN	СТ		N
10	<b>VIN</b>	CI	10	N

• Configuration of the DCC2404-1WS

#### CONNECTOR-TYP

• USB Typ C Plug

#### **TECHNICAL CHARACTERISTICS**

- Communication interface USB 2.0 standard
- USB interface, galvanically decoupled
- Integrated ESD protection

#### **TECHNICAL PARAMETERS**

PARAMETER	MIN	NOM	MAX
Bus voltage	+4.8 V	+5 V	+5.2 V
USB current consumption			
USB 2.0 data rate	-	-	3 Mbit
USB – galvanic isolation	-	-	8 kV
Overvoltage protection @ 10 µs	8.0 V	-	21 V

Pin	Signal	Description
A1, B1	GND	Ground
A4, B4	V-BUS	Bus voltage / +5 V
A6, B6	+D	USB 2.0 - positive Data-Line
A7, B7	-D	USB 2.0 - negative Data-Line
A9, B9	V-BUS	Bus voltage / +5 V
A12, B12	GND	Ground





## INDUSTRIAL WLAN-INTERFACE

The LED lighting controller DCC2404-1WS is equipped with an *Industrial Wireless LAN Interface* (IWLAN). This provides fast communication channels that enable secure data exchange between the LED controller and other, modern Wi-Fi automation components via standardized transmission protocols.

The following operating functions are provided via the WLAN interface:

- Commissioning of the LED controller<sup>[1]</sup>
- Online configuration and software update
- Monitoring of the controller and the lighting
- Direct process integration of the LED controller via the *Application Programming Interface* (API)<sup>[2]</sup>
- Remote maintenance

Up to four active Wi-Fi connections can be established simultaneously to an LED lighting controller.

The current status of the WLAN interface is displayed via the **WLAN-LED** and the **DATA-LED** on the controller.

#### WLAN-STANDARD

The LED controller can be operated as a WLAN access point or as a WLAN station<sup>[1]</sup>.

Mode	WLAN-Standard
Access-Point	802.11a/b/g/n
Station-Mode	802.11a/b/g

#### WLAN-CHANNELS

The WLAN interface supports the following Wi-Fi Channels:

Frequency	Channel
2.4 GHz	1 – 13
5.0 GHz	36, 40, 44, 48, 149, 153, 157, 161, 165

Up to four active connections to an LED lighting controller can be established simultaneously via the WLAN interface.

#### WLAN SECURITY

Mode	Encryption Standard
WPA-Mode	WPA2

[1] In the factory setting, the LED controller works as a WLAN access point

<sup>[1]</sup> The *DCCConfig* software tool is available under Windows for commissioning and configuring the DCC2404-1WS.

<sup>[2]</sup> A JSON REST API is available for integrating the DCC2404-1WS into the user's software environment.



#### WLAN-FACTORY SETTING

WLAN-Mode	Access-Point
Adressraum	IPv4
Adress-Mapping	static address mapping
IP-Adress	10.123.45.1
Subnet Mask	255.255.255.0
Default Gateway	10.123.45.1
DNS-Server	10.123.45.1
Country Code	EU
Frequency Band	2.4 GHz
Channel	1
SSID	DCC2404-1WS-000xxxxxx <sup>[2]</sup>
Password	evotronLight

The currently set WLAN parameters can be called up via the **OLED -DISPLAY** of the controller.

<sup>[2]</sup> xxxxxx corresponds to the current serial number of the LED lighting controller

## **TRIGGER-UNIT**

TRIGGER-UNIT - TIMING PARAMET	ER			
TRIGGER-IN		MIN	NOM	MAX
TRIGGER-IN Pulse wide	t <sub>PW_TI</sub>	300 ns	-	-
TRIGGER-IN Frequency	f <sub>TI</sub>	0 Hz	-	500 kHz
TRIGGER-IN Wait Time after TRIGGER-PERIOD	t <sub>W_TI</sub>	40 ns	-	-
TRIGGER-PERIOD		MIN	NOM	MAX
TRIGGER-PERIOD Delay after TRIGGER-IN	t <sub>D_TI</sub>			220 ns
TRIGGER-PERIODE Duration	tperiod	2.0 µs	-	85899346 µs
TRIGGER-PERIOD Resolution	1 Digit @ 32 Bit	-	20 ns	-
LED-PULSE		MIN	NOM	MAX
LED-PULSE programmable Delay	tpuls-delay	40 ns	-	85899345 µs
LED-PULSE Width	tpuls-pw	1 µs	-	85899345 µs
LED-PULSE Resolution	1 Digit @ 32 Bit	-	20 ns	-
LED-PULSE Jitter to TRIGGER-IN	t <sub>PULS_JTI</sub>	-	5 ns	7 ns
LED-PULSE Frequency	F <sub>PULS</sub>	0.0116415 Hz	-	500 kHz
LED-FLASH Delay after LED-PULSE	t <sub>D_LED-FLASH</sub>	-	-	100 ns
TRIGGER-OUT				
TRIGGER-OUT programmable Delay	t <sub>to-delay</sub>	40 ns	-	85899345 µs
TRIGGER-OUT Width	t <sub>TO-PW</sub>	1 µs	-	85899345 µs
TRIGGER-OUT Resolution	1 Digit @ 32 Bit	-	20 ns	-
TRIGGER-OUT Jitter to TRIGGER-IN	t <sub>to_JTI</sub>	-	5 ns	7 ns
LED-PULSE Frequency	f <sub>TO</sub>	0.0116415 Hz	-	500 kHz

evotron

#### TRIGGER-UNIT – TIMING DIAGRAM

With each **TRIGGER-IN** pulse, the integrated TRIGGER-UNIT starts a TRIGGER-PERIOD. In each TRIGGER-PE-RIOD a **LED-PULSE** and a synchronous **TRIGGER-OUT**  signal is generated. During an active TRIGGER-PERIOD further **TRIGGER-IN** signals suppressed.

The timing parameters of the TRIGGER-UNIT are freely programmable.





## TECHNICAL SPECIFICATIONS

ELECTRICAL PARAMETER				
Power supply		MIN	NOM	MAX
operating voltage V-IN		+12 V	+24 V	+30 V
current consumtion @ V-IN=24 V	idle mode	57 mA	60 mA	62 mA
	LED lighting active	60 mA	-	4.1 A
power consumtion @ V-IN=24 V		1.5 W	-	90 W
reverse polarity protection – V-IN	permanent	-	-	- 60 V
over voltage protection – V-IN	overvoltage pulse 1ms	-	-	+64 V
Power output current source - connection LED ligh	nting	MIN	NOM	MAX
output current of the LED current source	closed loop current source	0 mA	4.0 A	4.0 A
output Current - Resolution	range 0.0 mA 70 mA	-	0.05 mA	-
	range 70 mA 1000 mA	-	0.16 mA	-
	range 1 A 4 A	-	0.32 mA	-
output voltage - LED forward voltage		0 V	-	(V-IN) - 2 V
efficiency $\eta$ of the Power-FET Amplifier		-	92 %	96 %
I/O-Interface – TRIGGER-IN (TRIG-IN)		MIN	NOM	MAX
input voltage range ( $R_{_{\rm IN}}$ = 39 kΩ)		-0.2 V	5.0 V	V-IN
input – switching threshold Logic LOW		1.5 V	-	3.0 V
input – switching threshold Logic HIGH		2.8 V	-	3.5 V
input – hysteresis		-	0.75 V	-
minimum TRIGGER-IN Pulse Width		100 ns		
trigger frequency		0 Hz	-	500 kHz

ELECTRICAL PARAMETER				
I/O-Interface – Digital Outputs STATUS, TRIGGER-O	DUT, OUT3	MIN	NOM	MAX
output voltage		0 V	24 V	V-IN
output Logic LOW-Pegel @ I <sub>OUT</sub> = 200 mA	NPN-Type	-	-	1.5 V
output Logic HIGH-Pegel @ I <sub>OUT</sub> = 200 mA	PNP-, Push-Pull Type	-	-	(V-IN) - 1.5 V
output current I <sub>OUT</sub>	NPN-, PNP-, Push-Pull Type	0 mA	200 mA	200 mA
output current - totoal		-	-	0.45 A
electronic fuse - tripping current		0.5 A	-	-
output Delay-Time		-	600 ns	800 ns
output Rise-Time	HL-, LH-Flanke	-	-	150 ns
TRIGGER-OUT Pulse-Time		1 µs	-	85 s
TRIGGER-OUT frequency		0 Hz	-	500 kHz
I/O-Interface – Digital INPUT IN3		MIN	NOM	MAX
Input switching threshold Logic LOW @ V-IN > 18 V		8.0 V	-	11.5 V
Input switching threshold Logic HIGH $@$ V-IN > 18 V		10.5 V	-	13.0 V
input hysteresis @ V-IN > 18 V		-	0.75V	-
input Delay-Time		-	150 ns	300 ns
I/O-Interface – Voltage Output V-OUT		MIN	NOM	MAX
output Voltage V-OUT		12 V	24 V	V-IN
output current IOUT @ 24 V		-	0.45 A	0.45 A
Electronic fuse - tripping current		0.5 A	-	-



MECHANICAL PROPERTIES			
total length with connector L <sub>total</sub>	177.9 г	mm	
dimensions housing - length x width	158.5 mm x	32.3 mm	
housing tube diameter	30.0 n	nm	
weight	100	g	
case material - Tube / Caps / Display	Aluminum / PA	12 / PMMA	
housing surface / lettering	black anodized / laser lettering		
protection class	IP50		
Operating, Storage and Transport Conditions	MIN	NOM	MAX
ambient temperature during operation	-20 °C	+25 °C	+40 °C
storage temperature	-20 °C	+20 °C	+50 °C
transport temperature	-25 °C	+20 °C	+85 °C
relative humidity - non-condensing	5%	-	95%



#### MECHANICAL DIMENSIONS





Figure 24: DCC2404 mechanical dimensions – all dimension in mm



## CHANGE REPORT

Date	Modification
2023-04-04	Publication of Hardware Documentation - Basic version



## DISPOSAL

#### CONFORMITY

This device is RoHS compliant.



#### PROCEDURES

Instructions for the professional disposal of old devices are available from the manufacturer, the local sales partner or the relevant national authority.

Alternatively, this product can be returned to the manufacturer for proper disposal.

Packaging and packaging aids are recyclable and should always be sent for recycling.

The device itself must not be disposed of with household waste.



#### WEEE-Reg.-Nr. DE85473784



