WÜRTH ELEKTRONIK

Quick Start Guide
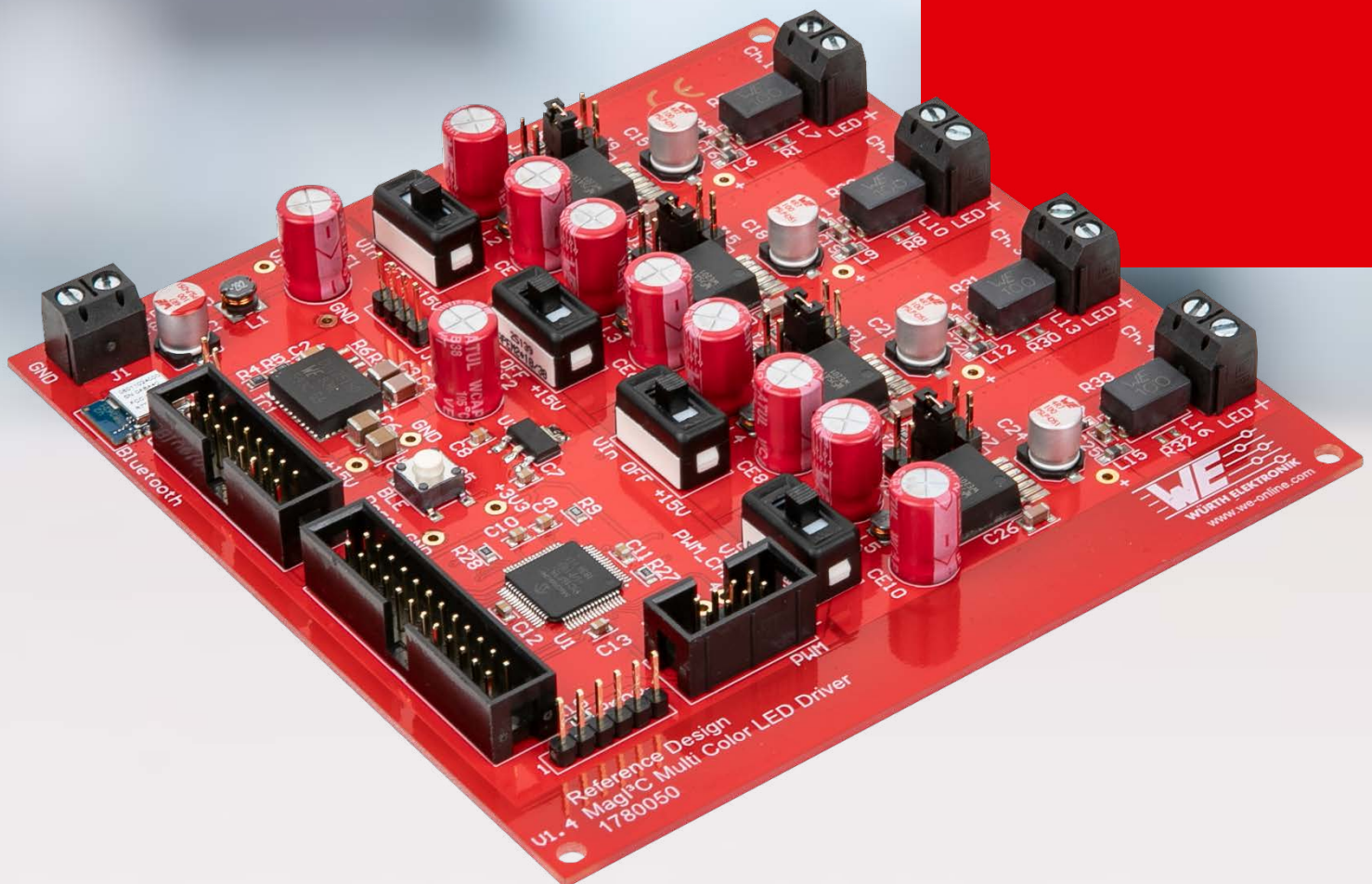## Lighting Development Kit

Table of Contents

Intended Use

WÜRTH ELEKTRONIK

Description

The all-in-one Lighting Development Kit provides an easy solution to either mix RGBW color for different lighting situations or amplify the growth of plants with the horticulture panel. The MagI³C Multi Color LED driver can power both panels. With four MagI³C LED Step Down High Current Modules (172946001) as its heart it is possible to control the intensity and color of each of the four LED strings individually to meet the applications needs.

The controlling is done via an app for iOS, which is developed to control the reference design using Bluetooth® LE. The board can be used for horticulture, mixing of different white color temperatures, mixing of RGBW LED combinations (red, green, blue, white) or just to change the intensity of one type of LED.

The board includes an EMI filter in order to comply with the limits of the EN55015 conducted lighting norm and the CISPR32 norm for radiated EMI (tested with 1m output cable length) even while dimming the LED strings.

Features

- 4 Channel LED Driver
- Horticulture panel to grow plants (16 LEDs)
- RGBW panel for lightning solutions (4 LEDs)
- Intensity of each channel can be adjusted individually (dimming 0 – 100 %)
- Dimming via Bluetooth® LE control (2608011024000)
- App "WEilluminate" to perform dimming
- PWM dimming method – controlled by PIC16F1527 microcontroller
- Dimming profiles and colors can be stored
- LED Driver: MagI³C Power Module 172 946 001
- Conducted and radiated EMI compliant (EN55015 & EN55032)
- Good thermal behavior
- Integrated robust industrial Bluetooth® LE module based on Nordic nRF52832
- The Kit is Bluetooth® LE 4.2 qualified. The QDID is 90212

This Lighting Development Kit is not intended for usage in final applications. This Kit is also not intended for resale.

Hereby, Würth Elektronik declares that the product is in compliance with Directives 2011/65/EU and 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: **www.we-online.com/doc**

Cautions and Warnings

This product is highly sensitive to electrostatic discharge (ESD). As such, always use proper ESD precaution when handling. Failing to fallow the aforementioned recommendations can result in severe damage to the part.

If the switches S1 – S4 are not in position "OFF" it is possible that the LEDs will flash up for a few milliseconds (typically about 50 ms) due to the initialization of the µC when turning on the power supply!

The heat sink and LED panels can get hot during operation. Please don't touch these surfaces.

Before assembling or use of this product please read the attached terms of use.
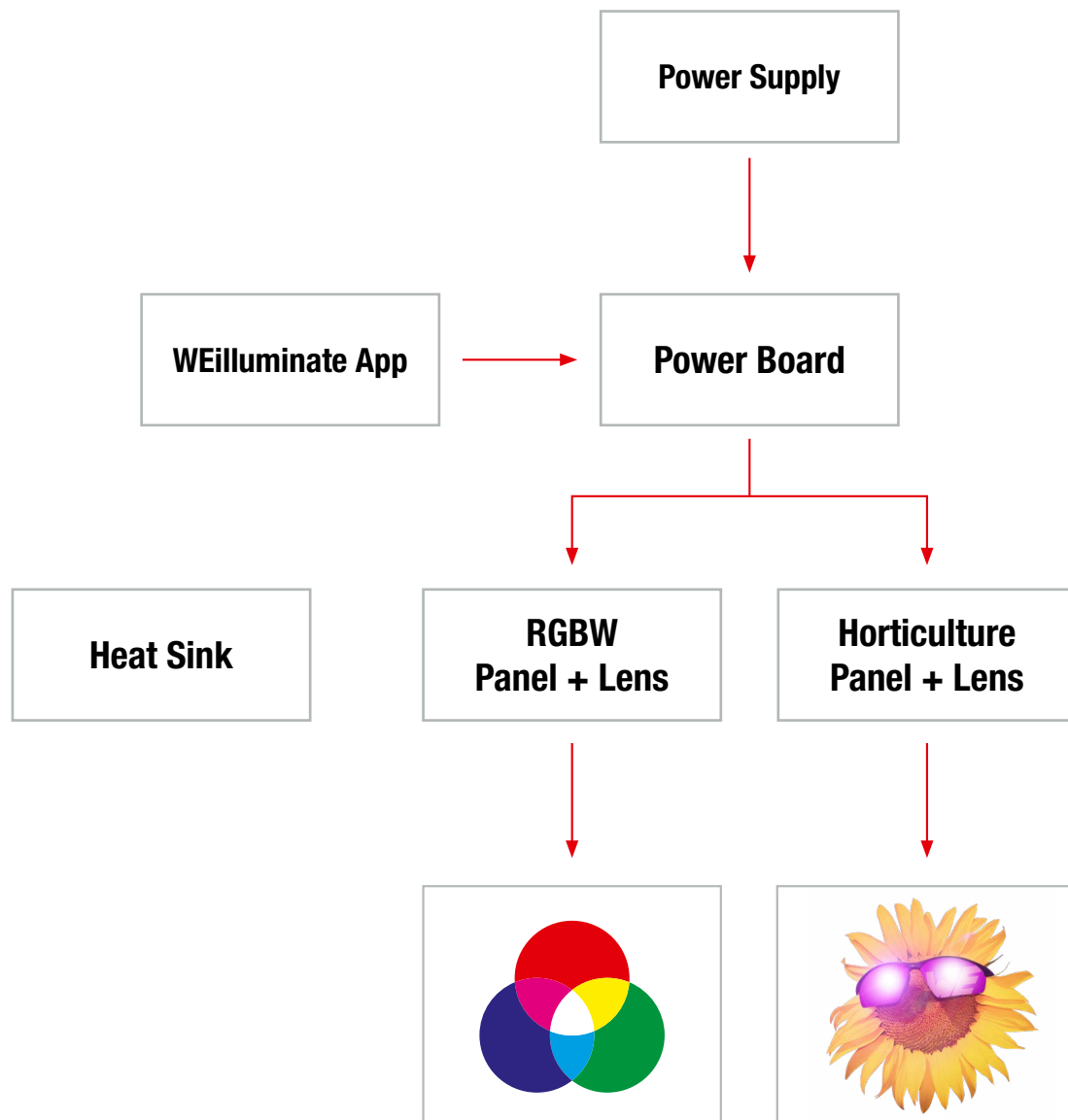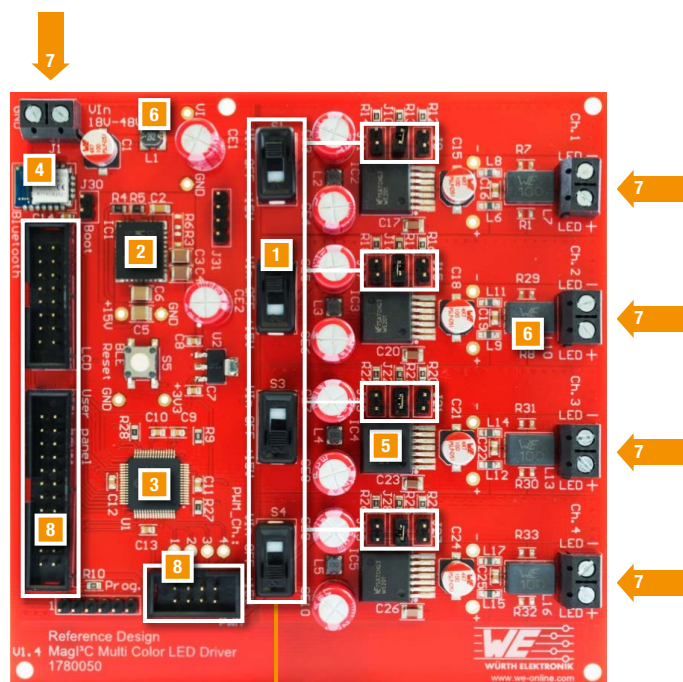**Note:** To ensure safety the assembly instructions must be followed in the described order!

Warning against optical radiation: Please avoid direct eye contact with the LEDs whilst using the LED panel at any time. The optical radiation may cause irreversible damage to eyesight.

Abbreviation

Abbreviation	Name	Description
App	Application	A smart device software programm
BTMAC	Bluetooth® LE Media-Access-Control	Bluetooth® LE conform MAC address of the module used on the RF-Interface
BLE	Bluetooth® LE	According to Bluetooth® LE specification
BT	Bluetooth®	A series of standards introduced by the Bluetooth® LE Special interest Group (BT SiG)
CCT	Correlated Color Temperature	The CCT is used to characterize the spectral distribution of optical radiation emitted by a light source. It is given in Kelvin (K)
EMI	Electromagnetic Interference	EMI is a disturbance generated by an external source that affects an electrical circuit
ESD	Electrostatic Discharge	The sudden flow of electricity between two electrically charged objects by contact
GAP	Generic Access Profile	The GAP provides a basic level of functionality that all the Bluetooth® LE devices must implement
I/O	Input/Output	
LED	Light Emitting Diode	
LPM	Low Power Mode	Mode for efficient power consumption
MAC	Media-Access-Control	Unique 6 byte address of the module
MTU	Maximum Transmission Unit	Maximum packet size of the Bluetooth® LE connection
Payload		The user's message in a UART or radio frame
PCB	Printed Circuit Board	
RF	Radio Frequency	Describes wireless transmission
RGBW	Red, Green, Blue, White	A LED setup of red, green, blue, white LEDs
RSSI	Receive Signal Strength Indicator	The RSSI indicates the strength of the RF signal. Its value is always printed in two's complement notation
RuntimeSettings		Volatile settings to configure the module. This setting are not retained through a reset or VCC loss
SMD	Surface-Mounted Device	Component mounted directly onto the surface of the PCB
UUID	Universally Unique Identifier	A 16 or 128 bit Bluetooth® LE profile identifier
UserSettings		Non-volatile settings to configure the module
UART	Universal Asynchronous Receiver Transmitter	Allows the serial communication with the module
µC	Microcontroller	A compact, energy efficient, performance adopted central processing unit

Short Description of the Kit Contents

WÜRTH ELEKTRONIK

Power Supply

WEilluminate App → Power Board

Heat Sink

RGBW
Panel + Lens

Horticulture
Panel + Lens

Short Description of the Kit Contents

WÜRTH ELEKTRONIK

Power Board 1780050

Getting startet: Switch S1 – S4
in middle position „OFF"

- Input voltage: $18\,V - 48\,V$
- Output voltage: $0\,V - V_{IN}$
- Current capability up to $450\,mA$

1 Switch between V_{IN}, OFF and $+15\,V$

2 VDRM Variable Step Down Regulator Module QFN-41 (171021501)

3 PIC16F1527 microcontroller

4 Bluetooth® LE 4.2 qualified module (2608011024000)

5 MagI³C LED Step Down High Current Module (172946001)

6 Input and output filter

7 Robust screw terminal for V_{IN} and V_{OUT}

8 Ribbon connectors for extended functionality, see DNS005 (not needed for this application)

The power board 1780050 consists of all the components needed for the Bluetooth® LE connection and the four LED control channels. It is meant to control the four LED strings individually or all channels in the same ratio at once. The power supply is connected to J1 and the LED strings at Ch.1 – Ch.4. Every LED channel has three current options (300 mA, 350 mA, 450 mA).

- Right jumper position (J9, J15, J21, J27) is for $I_{OUT} = 300\,mA$
- Middle jumper position (J10, J16, J22, J28) for $I_{OUT} = 350\,mA$
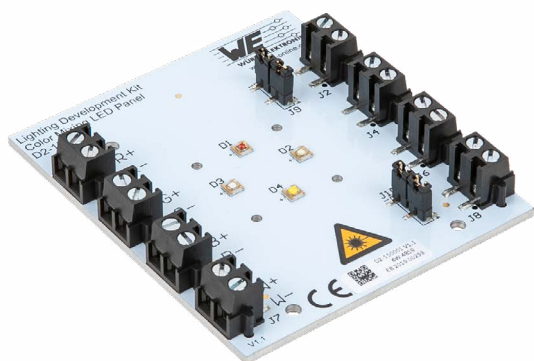- Left jumper position (J11, J17, J23, J28) for $I_{OUT} = 450\,mA$

At any time only one jumper per channel must be connected otherwise the desired way of functioning is not secured!

For further information please visit:
https://www.we-online.de/katalog/
datasheet/1780050.pdf

Short Description of the Kit Contents

RGBW Panel

CIE Color Diagram

Lens

The LEDiL® PMMA multi-lens was designed, so that every LED on its own gives the optimal light yield. Therefore inside the lens the LED light beam is steered. The angle of radiation is either 30° or 55° for the RGBW panel setup. Via pin by pin adhesive bonding the lense can be fastened to the RGBW panel.

RGBW Panel Info
R – 150353RS74500
G – 150353GS74500
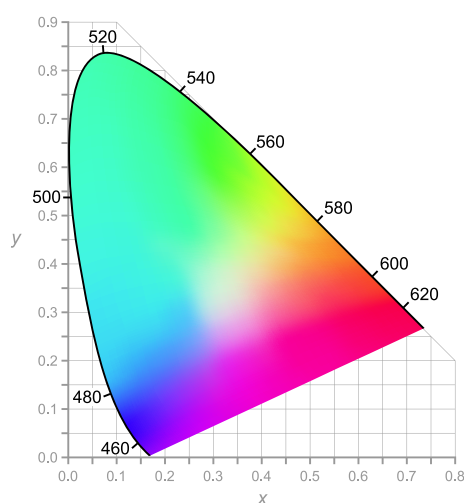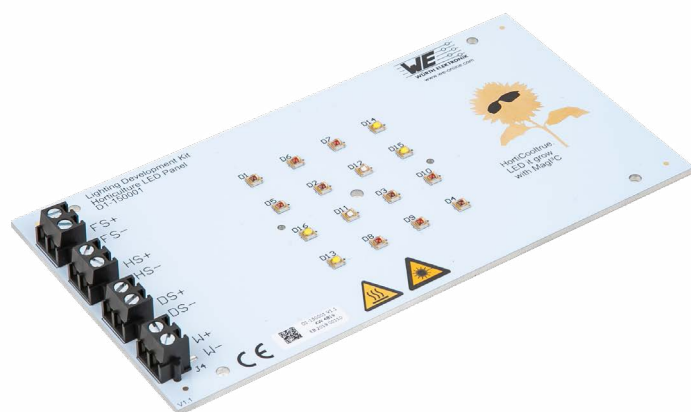**B** – 150353BS74500
W – 158353050

- RGB LEDs with 460 nm, 520 nm and 620 nm
- White LED with 5000 K CCT
- Cover most of the CIE color diagram

Description
- Experiment with different color solution
- Use WEilluminate app to make the color mixtures you need
- Make a color catalog with all the different colors
- Create different entertainment and ambient lights
- Connetct multiple panels in series to increase intensity and LED count

The RGBW panel consists of three WL-SMDC SMD Mono-color Ceramic LEDs with different colors (red, green, blue) and one WL-SWTC SMD White Ceramic LED. The RGBW panel gives the opportunity to experiment with different color solutions. If needed more RGBW panels can be connected in series.

For more information about the 55° lens please visit: www.we-online.com/55degreelens

For more information about the 30° lens please visit: www.we-online.com/30degreelens

Short Description of the Kit Contents

WÜRTH ELEKTRONIK

Horticulture Panel

**Perfect Quality –
Very High Efficacy**

- up to 3.0 µmol/J (Deep Blue)
- 3.6 µmol/J (Hyper Red)
- 4.0 µmol/J (Far Red)

The horticulture panel consists of four WL-SMDC SMD White Ceramic LEDs and 12 WL-SMDC SMD Monocolor Ceramic horticulture LEDs with different colors. The horticulture panel can be used to amplify the plant growth in horticulture applications. For the purpose the color ratio mix can be customized, depending on the given plant species.

Lens

The LEDiL® PMMA multi-lens was designed, so that every LED on its own gives the optimal light yield. Therefore inside the lens the LED light beam is steered. The angle of radiation is 60° for the horticulture panel setup. Using a M3 screw and M3 screw nut to counter the screw the lense can be mounted to the horticulture panel.

Horticulture Panel Info
6 Hyper Red – 150353HS74500
4 Far Red – 150353FS74500
2 Deep Blue – 150353DS74500
4 White – 158353050

Standard Distribution
3:2:1:2 – Hyper Red:Far Red:Deep Blue:White

Total Output @ 350 mA
~ 6 W Optical power
~ 30 µmol/s (calculated from 400 – 780 nm)
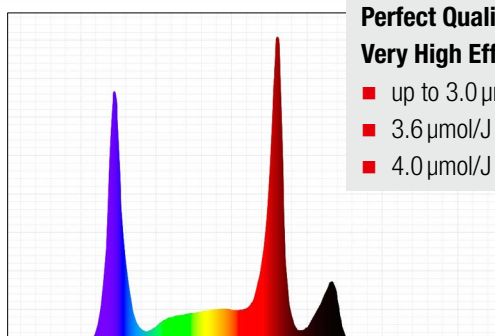
Secondary Optic Possibilities
Viewing angle from 120° down to 30°
(current model with 60°)

Description
- Test your own growing recipie
- Adjust blue:red ratio for the plants – from 50:50 to 10:90
- Use the WEilluminate app, to adjust, test and store your recepts
- Easily scalable for bigger projects.
- Spectrum and power outputs can be compared to simulation data in **RED**EXPERT
- Results are strongly dependent on ambience, watering and nutrion

**For further information please visit:
www.we-online.com/horticulturelens**

**Try it out:
www.we-online.com/redexpert-horticulture**

**!** **Develop your own LED panel!
If you wish to design your own LED panel please
consider the following Reference Design Notes:**

Short Description of the Kit Contents

Heat Sink

The heat sink ensures the user safety as well as the protection of the LEDs against damage due to overheating. The heat sink is prepared, so that it is possible to mount either the horticulture panel, one RGBW panel or two RGBW panels in series on it.
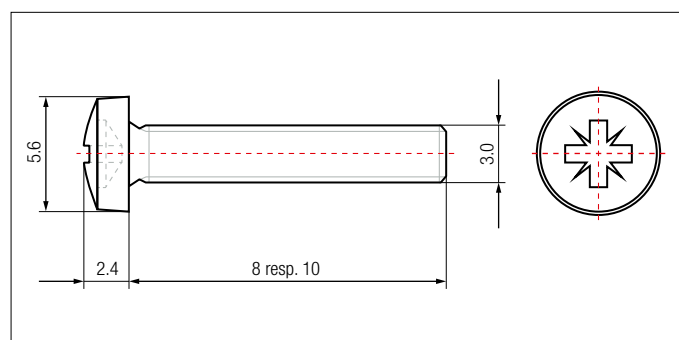

Mounting

The M3x8 screws are meant to mount the used LED panel to the heat sink. For mounting the lens on the horticulture panel an extra M3x10 screw is included to the development kit. For every screw a M3 screw nut is given to counter the screw.

5.6   3.0   2.4   8 resp. 10
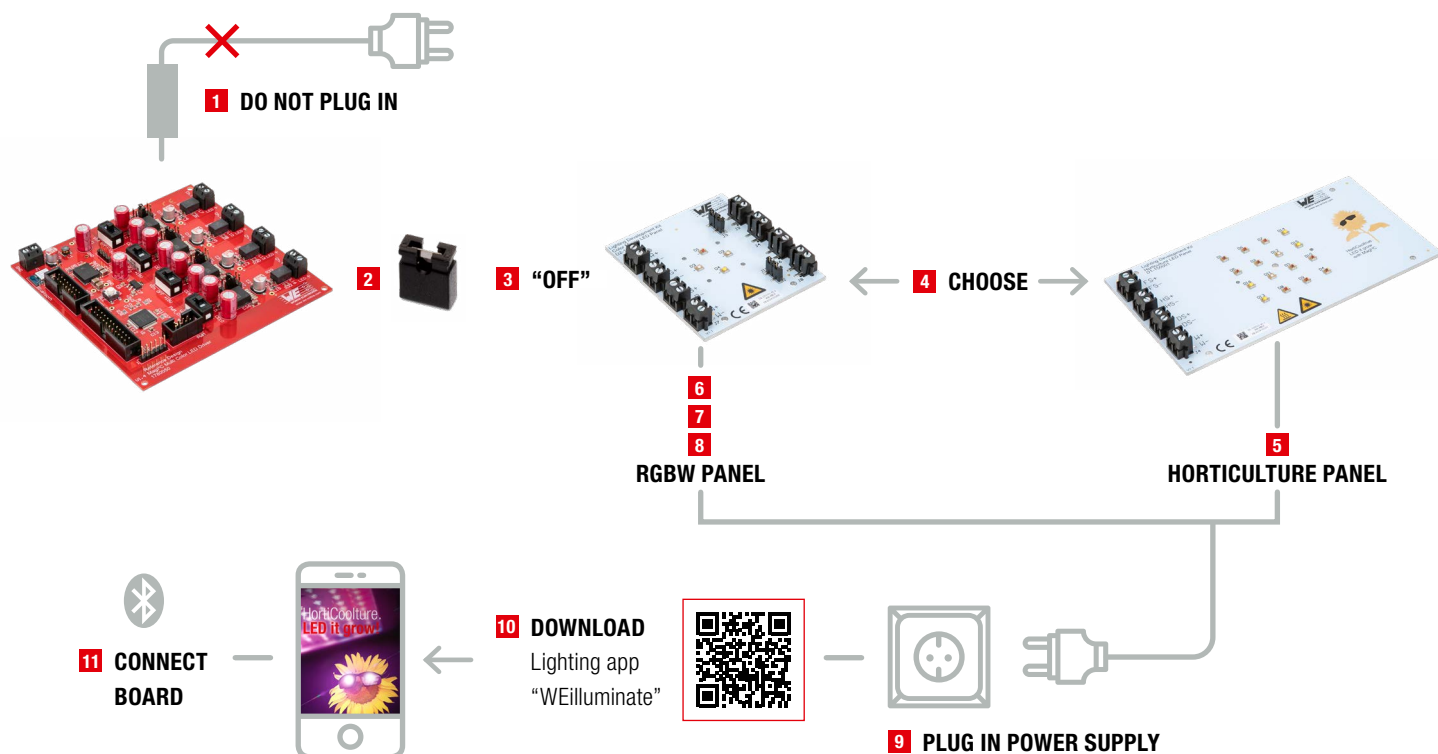
LED Panel Connection Lead

For the connection of the power board 1780050 to the LED panel (horticulture panel, RGBW panel) eight 1 m superflexible 0,5 mm² connection leads are used. Every connection lead is preassembled with ferrules and can therefore be used without further needed preparations. For LED+ please take the red leads, for LED- the blue leads.
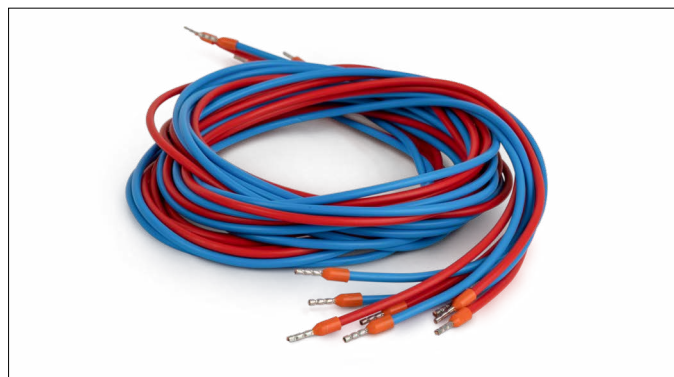
Power Supply

The 48V/2A power supply is meant to connect to the power board 1780050 (J1). It is an AC/DC power supply and therefore it needs to be connected to 230V AC on the primary side. The secondary voltage of 48V falls within the safety extra-low voltage, so that the user safety is ensured. At the output V_{IN} is marked red, ground is marked black.

Initial Start-Up

WÜRTH ELEKTRONIK

1 DO NOT PLUG IN

2　　**3** "OFF"　　**4** CHOOSE

6
7
8
RGBW PANEL

5
HORTICULTURE PANEL

11 CONNECT
BOARD

10 DOWNLOAD
Lighting app
"WEilluminate"

9 PLUG IN POWER SUPPLY

Step-by-Step Manual

1 Screw in power supply to power board – Don't plug in the primary side to AC mains!

2 Ensure that only one jumper for the current limit is set per channel (default: middle = 350 mA)

3 Put switches in "OFF" position (switches S1 – S4)

4 Choose between horticulture panel or RGBW panel and screw connection leads between power board and LED panel

5 Mount horticulture panel with lens to heat sink

6 Screw connectors between the two RGBW panels

7 Ensure that only the last RGBW panel has jumpers on J9 and J10

8 Optional: Mount both RGBW panels to heatsink and mount lenses

9 Plug in power supply to AC mains (common AC socket) and turn switches to +15 V

10 Download the lighting app "WEilluminate"

11 Connect board via Bluetooth® LE and set your prefered intensities

Get your App:
www.we-online.com/lightingapp

Assembly

Heat Sink Mounting

Before powering the development kit please consider which LED Panel use is desired. Mount the desired LED panel (RGBW panel or horticulture panel) to the heat sink by using the prepared drills on the heat sink and the suitable holes on the LED panel. Just pass the M3x8 screws through both holes and counter the screw with a M3 screw nut. To tighten the screws a suitable screwdriver is needed.

LED Panel Connection

The LEDs are arranged in four channels witch are built the same way. To connect the power board to the LED panel use the included 8 superflexible 0,5 mm² connection leads with ferrules. In opposite to the plug in connectors robust screw terminals are used. On the power board every connection to the cathode of the LEDs is at LED- and on the horticulture panel at W-, FS-, HS- and DS-. The connection to V_{OUT} is therefore at LED+ on the power board and W+, FS+, HS+ and DS+ on the LED panel. Please consider that it is possible to connect these terminals in a wrong way and damage the LEDs. In order to aid clarity it is recommended to use the four red connection leads for every positive pole connection and the four blue connection leads for every negative pole connection. After the connection is done please check if the switches S1 – S4 are in position "OFF" and just one jumper per LED channel is set.

Please check every connection before plugging in the power supply. If the right way of connection is secured please start to connect the power supply. First connect the secondary side of the power supply to the power board. Therefore screw in the connection lead into the terminal block J1. Afterwards plug in the primary side of the power supply to a conventional 230 V AC socket.

Plug in the Power Supply
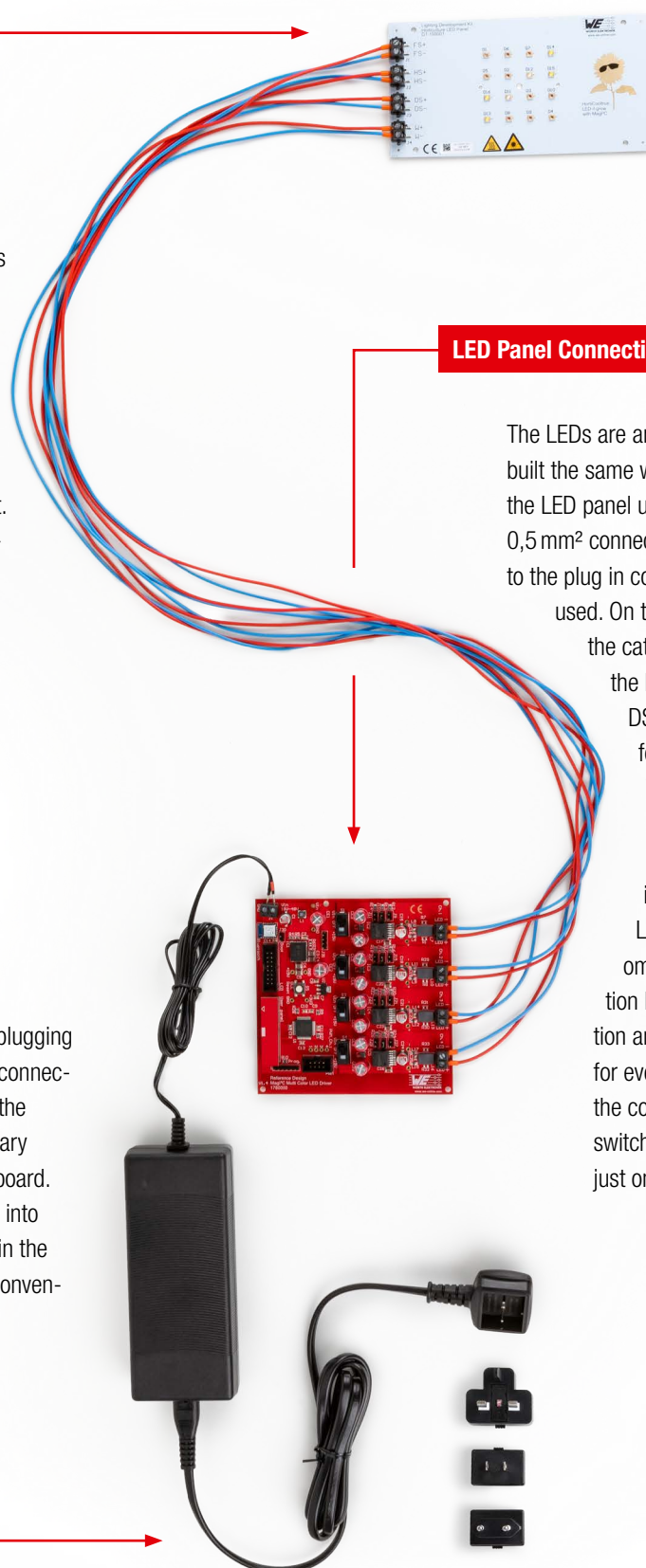
WEilluminate App Description

Overview

The WEilluminate app can be used to control the MagI³C Multi Color LED Driver reference design via radio. It uses the Bluetooth® LE connection of the mobile device to establish a connection to the Proteus-I (2608011024001) Bluetooth® LE module on the reference design board. Once connected, changes of the LED channel brightness and color distribution can be performed using the sliders in the app.

> ⚠️ The WEilluminate app is an evaluation tool that is intended for development purposes only. It is recommended to check regularly for available updates. It does not underly the PCN notification process of Würth Elektronik eiSos.

System Requirements

This app is intended to run on an Apple mobile device, smartphone or tablet, with integrated Bluetooth® LE capabilities. Please make sure your device has installed the most recent iOS updates, security patches and the most recent app version. This app is optimized for portrait mode and was tested with iPad mini 2 and iPhone XS, each with iOS v12.4.1 and iOS 13.3.1.

In order to use the app the user is required to grant the corresponding requested rights, e.g. to use the Bluetooth® LE interface of the smart device.

Compatible Bluetooth® LE Devices

The WEilluminate app supports connection to the Würth Elektronik eiSos Proteus module implemented in the reference design.

Internet Connection

The WEilluminate app works offline and requires no internet connection to be used. However, the links provided in the info tab require an internet connection to be opened by the system internet browser.

Installation

The WEilluminate app can be found in the official App Store or on our website.

WEilluminate App
www.we-online.com/lightingapp

WEilluminate App Description

Operation

This chapter provides operational instructions for the WEilluminate app.

App icon

Starting the Program

After successful installation, click the WEilluminate app icon on the home screen of your mobile device to start the application.

Splash Screen

During the application startup phase your mobile device shows the following splash screen and then proceeds to the scan tab of the app.

Scan Tab

This tab lists all Bluetooth® LE devices supported by this app within range. Currently, only Würth Elektronik eiSos Bluetooth® LE modules of the Proteus family are supported by the app. In addition a demo device is always the topmost entry in the found devices list. This device enables the user to try the app even in case no suiting Bluetooth® LE device is available in radio range.

The list will show the device names of the detected Bluetooth® LE devices, which are specified in the devices itself and only interpreted by the app. The names can not be changed from the app. For the Proteus modules that short device name in the list defaults to either A2621 for Proteus-I or A2623 for Proteus-II.

The user can select a device from the list and initiate the connection process by clicking on it. The Bluetooth® LE connection will be established automatically. The security option of the Proteus module is set to open, which means no pin code has to be entered and anyone can connect to it. If another security option is set the app prompts to enter a pin code to establish the Bluetooth® LE connection. It is not possible to change the security option from within the app. After a successful connection establishment the app switches automatically to the channels tab.
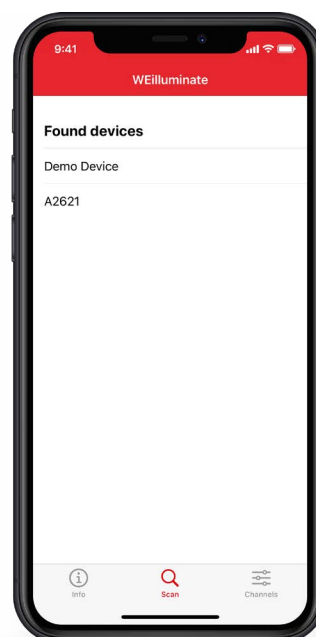
Then swiping back to the scan tab the connected device is indicated with a red check icon as shown in the following screenshot. A gray check icon shows the last connected device but the gray indicates that the connection is not active.
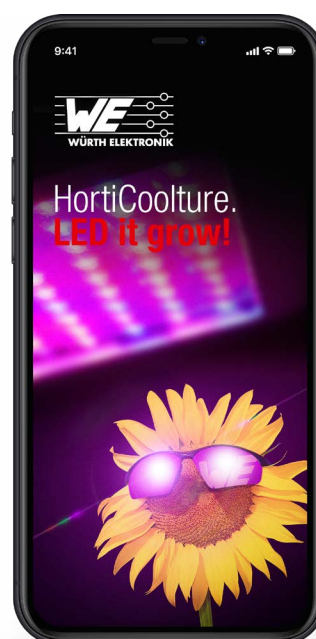
Splash screen

Scan tab

WEilluminate App Description

Channels Tab

The channel tab allows to control the LED brightness of the reference design. Each of the four channels can be controlled individually and the additional brightness slider works as a global multiplier for all four channels. The % values shown for each channel are the percentages with brightness already calculated in and rounded down. Whereas the brightness % value is representing its slider value.

If the brightness slider is set to 0 % none of the channels will be active. This means for example a value of 50 % for the channel1 on the reference design can be created by a multitude of slider positions of channel 1 slider value and brightness slider value.

For example:
- Brightness slider 100 % and channel 1 slider 50 %
  resulting in channel 1 overall value 50 %
- Brightness slider 50 % and channel 1 slider 100 %
  resulting in channel 1 overall value 50 %
- Brightness slider 71 % and channel 1 slider 71 %
  resulting in channel 1 overall value 50 %

This means whenever the brightness slider is set to 0 % any LED channel will be disabled independent of their slider's value. The app is restricted to a certain number of radio frames per second (in BLE terms: connection interval) which means that not any step of a (fast) change will be transmitted on the radio. The value for the responsiveness is chosen so a good user experience is created but can be easily modified.

Info Tab

Users can slide most left or touch the info tab symbol at the bottom to switch view to the info tab. This tab gives general app version information and allows accessing the privacy policy, contact information and imprint by forwarding a link to the system's default web browser.
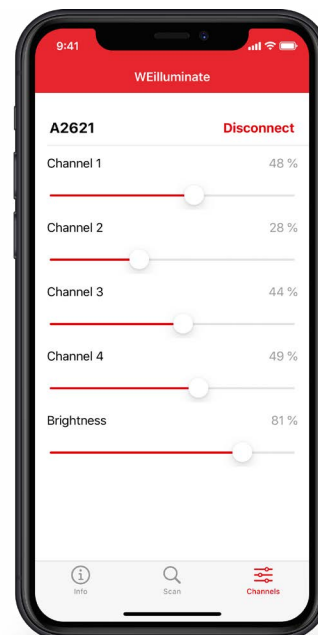
Software History

Version 1.0 "Release"
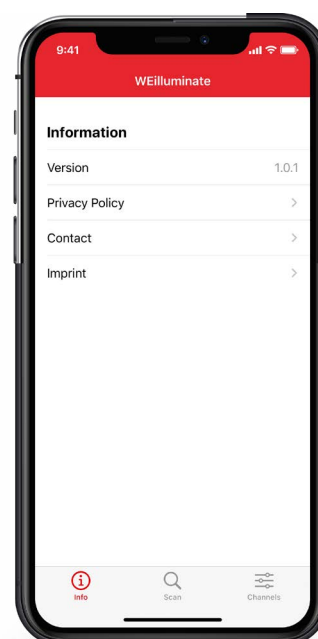- First released version of the iOS App.
  Fixes:
  – Icon color and size adjusted for iOS 13

Channels tab

> ⚠ If the brightness slider is set to 0 % none of the channels will be active.

Info tab

more than you expect

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  [150001](#)