

Order Code 8191: 3-Channel RGB LED Controller

General Guidelines for Electronic Kits and Assembled Modules

Thank you for choosing one of our products. Please take some time to carefully read the important information below concerning use of this product. The assembly and operating instructions are on the following pages. Help with component identification can be found on our website at www.quasarelectronics.com/componentid.htm. If you are unsure about any aspect of the assembly or use of this product please contact our Support Team before proceeding.



WEEE Directive (Waste Electrical and Electronic Equipment)

Notice To All European Union Citizens. Important environmental information about this product.

The crossed out wheeled bin symbol on this product, package or documentation indicates that disposal of this product after its lifecycle could harm the environment. Do not dispose of this product (or batteries if used) as unsorted municipal waste. It should be disposed by a specialized company for recycling.

The unit should be returned to your distributor or to a local recycling service. Please respect the local environmental rules. If in doubt contact your local authorities about waste disposal rules.

Safety: General rules concerning safe use of our Kits or Modules.

To ensure your safety, please observe these safety measures. In no way are these complete. As safety requirements vary, please check with your local authorities, in order to comply with local requirements. If in doubt, seek the help of a qualified person.

Battery or wall-adaptor operated devices are safe devices. They do not require special attention unless mains voltage is connected to an output e.g. a relay.



To ensure electrical safety, and also protection from fire or personal injury, make sure your mains operated equipment complies with these safety hints:

- Use a suitable plastic enclosure. If a metal enclosure is used, make sure it is properly earthed.
- Use a power switch if the device consumes more than 10W. Use a double pole switch for mains operated, transformer-less kits.
- Mount a fuse in series with the mains switch. Use a slow blow (T) 50mA fuse for transformers up to 10W and a 100mA fuse for transformers up to 20W.
- Use a mains input connector, or a robust power cord with a clamp.
- Internal wiring carrying mains voltages must have a minimum cross-sectional area of 0.5mm².

If supplied, attach the power rating label near the power cord of the device and fill-out the mains voltage, frequency, power consumption and fuse values.

Troubleshooting and Support

90% of non working kits are due to poor soldering.

We operate a Get-You-Going service for non-working kits but there is a charge based on the time and components needed to complete the repair. Quite often it is not economically viable for us to repair and it is cheaper to supply a new ready made product at full cost.

Disclaimer

Quasar Electronics reserves the right to change product specifications or to discontinue products without notice. Quasar Electronics cannot be held responsible for any loss or damage, direct or indirect, which might occur from the use of a product. Quasar Electronics Kits or Modules are intended for educational and demonstration purposes only. They are not intended for use in commercial applications. If they are used in such applications the purchaser assumes all responsibility for ensuring compliance with all local laws. In addition, they are not suitable for use as or as a part of life support systems, or systems that might create a hazardous situation of any kind.

3 - Channel RGB LED Controller

Order Code 8191

User manual

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1 Introduction.

This kit has been designed to function as a versatile LED control module. The LED controller provides 3 high current channels to create light effects for the presentations, parties, etc. The module includes preprogrammed light sequences and can be used as a standalone LED controller. The module also supports a serial interface which uses only 2 wires to communicate with your microcontroller or PC. The simple command set allows easy module control from the microcontroller or PC.

The module is ideal for use with flexible LED light strips.

Key Features

- 3 high current channels with independent control.
- Suitable for common anode RGB LED strips, LEDs and incandescent bulbs.
- 6 preprogrammed light sequences with hard transition effects (running light, Strobo, random colors, etc...) and smooth fade effects (color change, slow on/off, etc...).
- Custom user-editable sequence.
- Wide-range effect speed adjust.
- Memory for last selected sequence and user-editable sequence.
- Serial TTL interface to control from your microcontroller or PC.
- Addressable. Multiple modules can be connected with independent control for each module.
- Windows software to control the module from PC and download the user-editable sequence.
- Small form factor (2.2" x 1.55", 56 x 39 mm).

Specifications

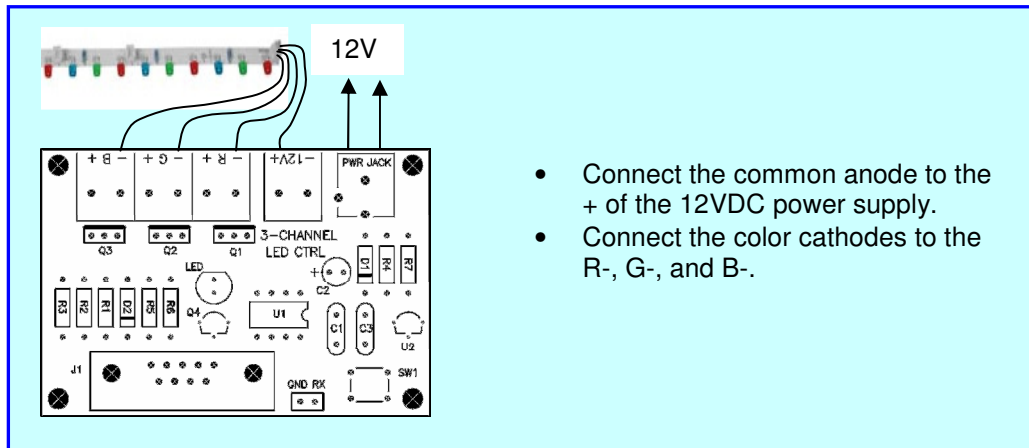
| | |
|--------------------------------|--|
| Operating Voltage | 12VDC (nominal) |
| Channel Current | 5A max, 12A max for all 3 channels |
| LED PWM frequency | 480 Hz |
| LED intensity control | 250 intensity levels/channel |
| Communication Interface | Serial RS232 and serial TTL interface, 9600 baud, 8 data bits, 1 stop bit, no parity, no handshaking |
| Dimension | 2.2" x 1.55" x 0.5", 56 x 39 x 12 mm |

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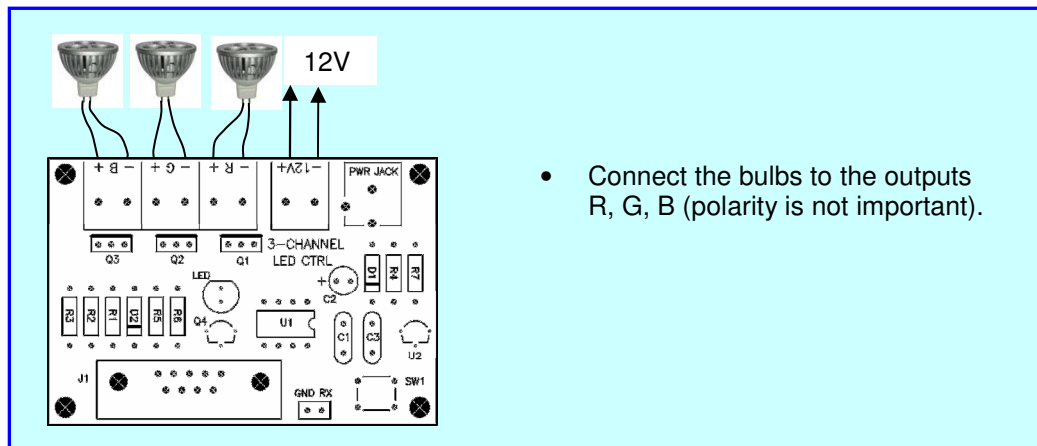
2 Description.

The module includes a microcontroller, 5V voltage regulator and high current MOSFETs. The microcontroller provides PWM control for the MOSFETs, the serial communication interface and includes 6 preprogrammed light effect sequences. Custom light sequences can be downloaded to the microcontroller memory. Press a button to switch the light sequences. The last selected sequence is saved in memory.

2.1 Common anode LED strip connection.

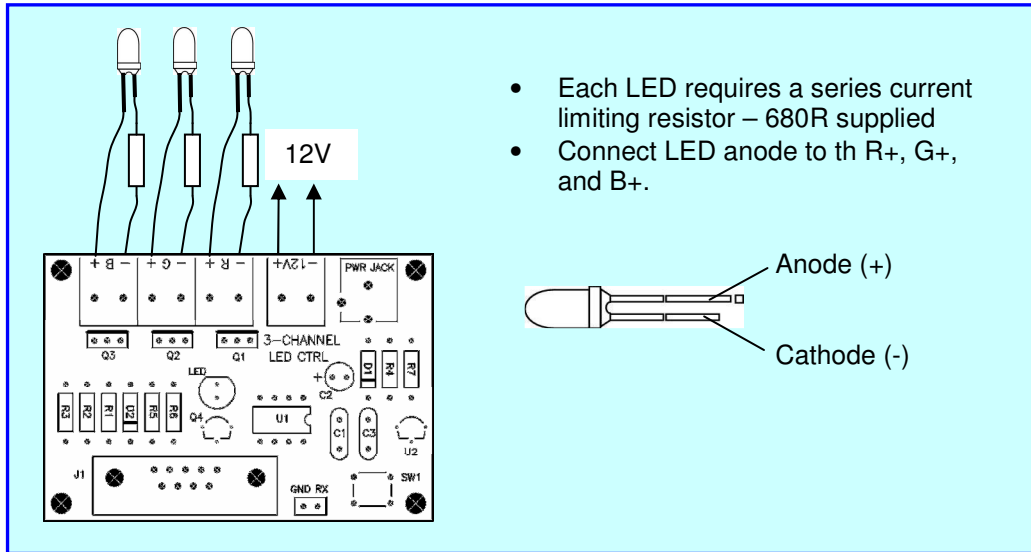


2.2 Incandescent (12V) light bulb connection.

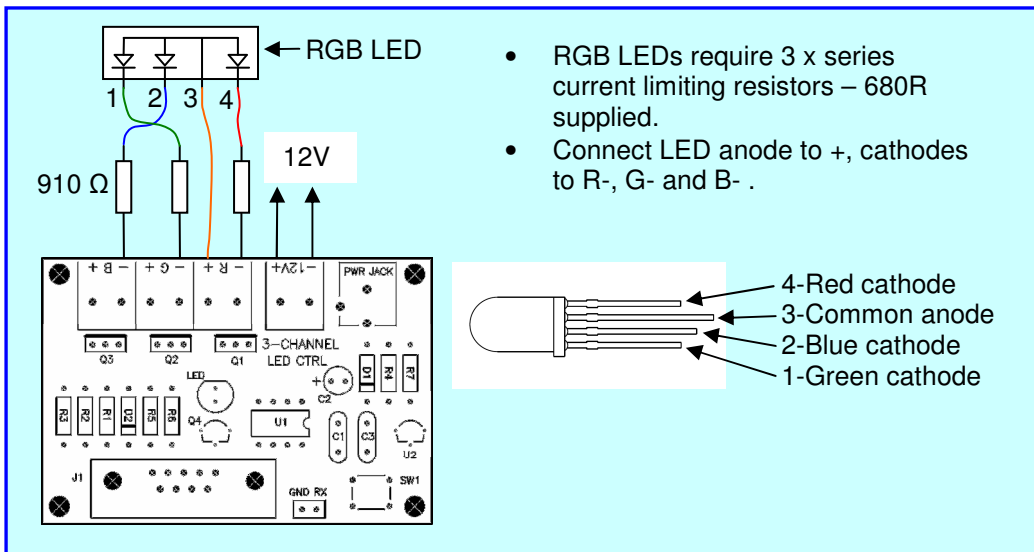


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2.3 LED connection.

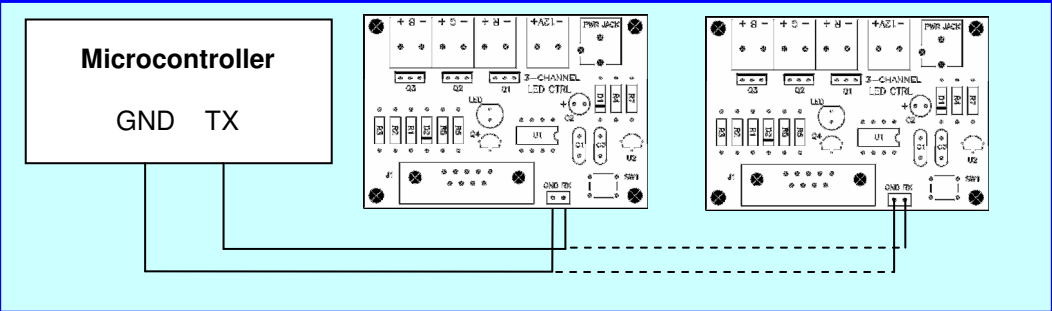


2.4 Common anode RGB LED connection.

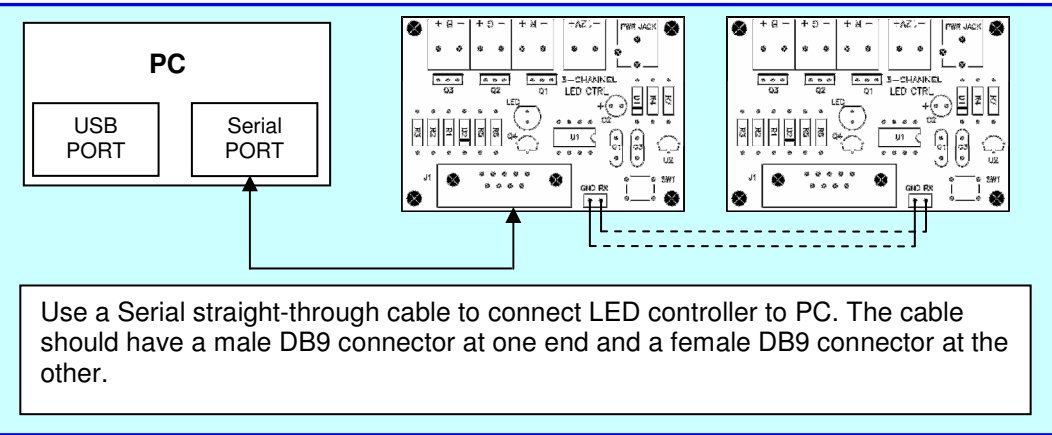


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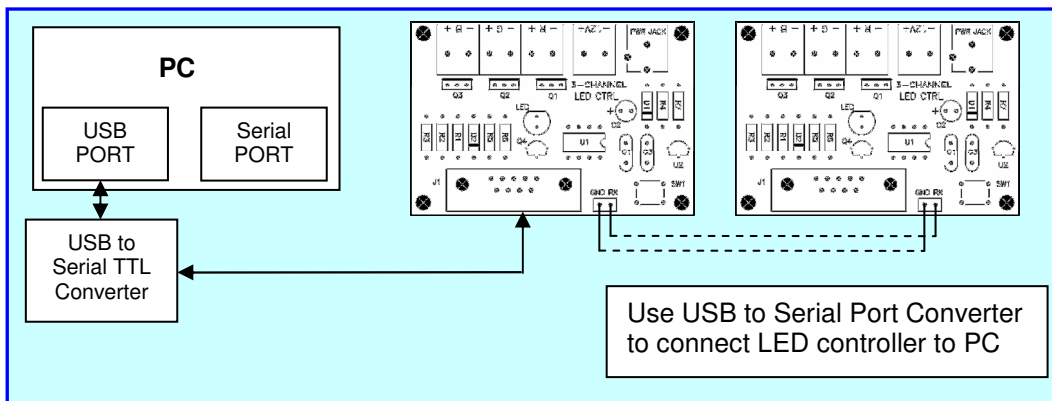
2.5 Module connection to a microcontroller (Serial TTL interface).



2.6 Module connection to a computer serial port.



2.7 Module connection to a computer USB port.

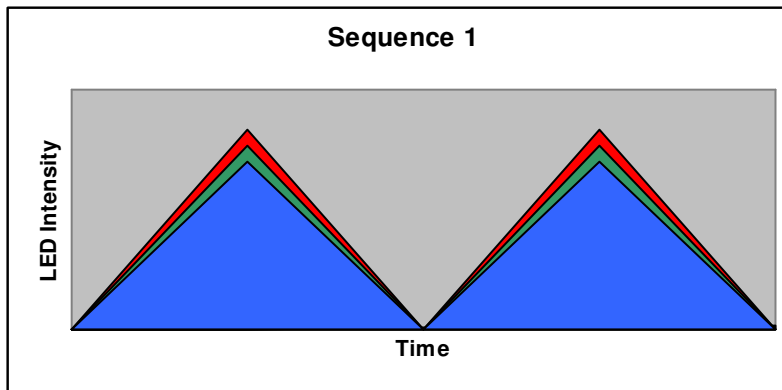


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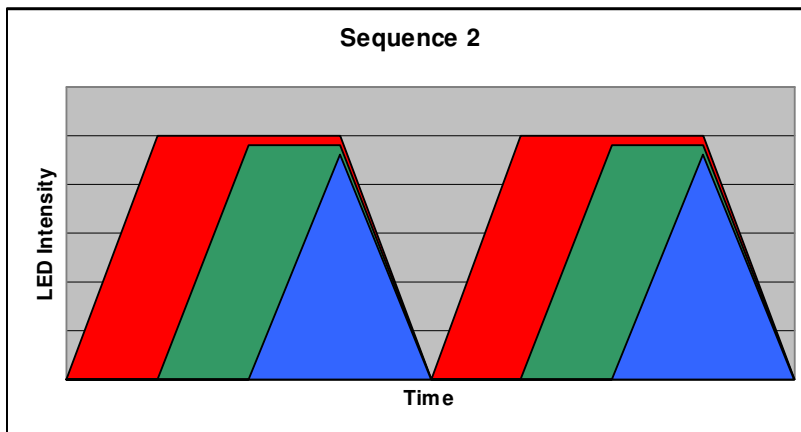
2.8 Preprogrammed Sequences.

The module includes 6 preprogrammed light sequences with smooth fade effects and hard transition effects. Press a button to switch the light sequences. The last selected sequence is saved in memory.

Sequence 1 - the channel light intensity increases and decreases synchronously for all channels.

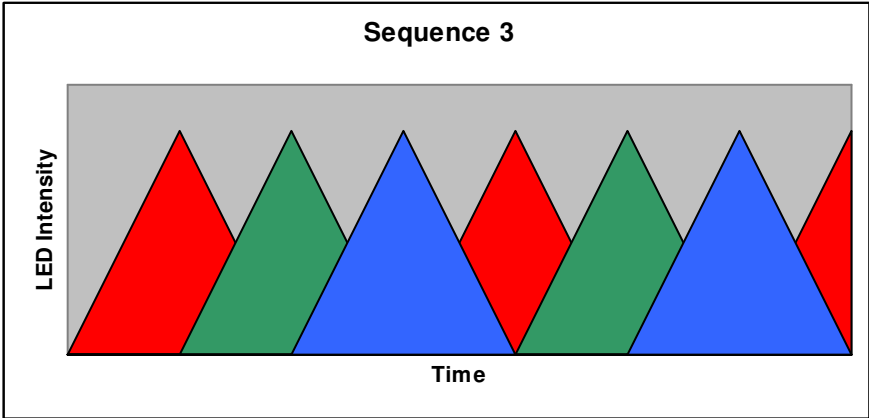


Sequence 2 - the channel 1 light intensity increases and stays at max value, next the channel 2 light intensity increases. Then the channel 3 light intensity increases.

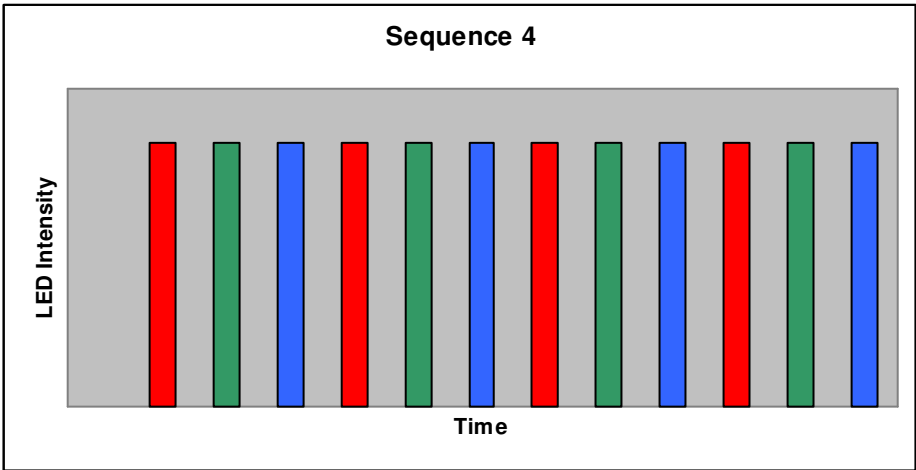


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Sequence 3 - the channel light intensity increases and decreases with the shift for each channel.

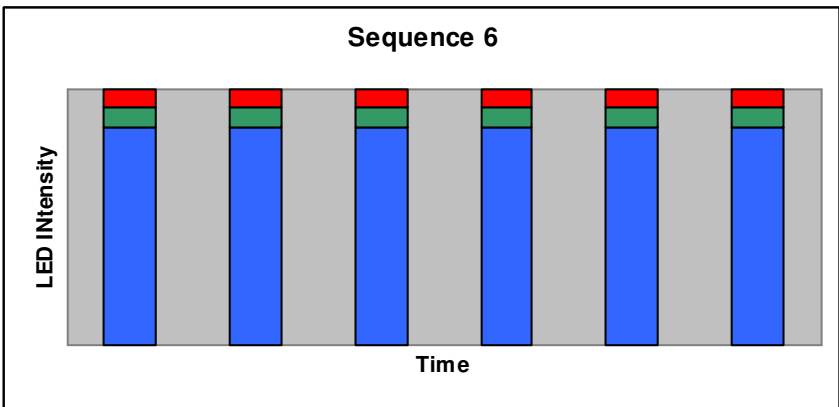


Sequence 4 – sequenced colors: red – green – blue with hard transition effects.



Sequence 5 – random colors with hard transition effects.

Sequence 6 – strobe effect: all outputs blink with 50% duty cycle.



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3 Commands.

3.1 Command Format.

The module is controlled using a simple command set. The character decimal 254 (0xFE) is a command prefix. All commands start with 0xFE and a device address byte. Then a one command code byte followed by the parameters.

Command Syntax: 0xFE [device address byte] [command byte] [parameter]

Command Summary

| Prefix | Command | Parameter | Description |
|--------|---------|-----------|--|
| 0xFE | 0x41 | 1 byte | Set the module address |
| 0xFE | 0x42 | 2 bytes | Set the channel intensity level |
| 0xFE | 0x43 | 1 byte | Start Sequence |
| 0xFE | 0x4C | 61 bytes | Download the custom sequence |
| 0xFE | 0x52 | 1 byte | Set the intensity level for all channels |
| 0xFE | 0x54 | 1 byte | Set sequence time |

3.2 Command Description.

Set the module address

Syntax hexadecimal 0xFE [device address] 0x41 [new address]

| Parameter | Length | Description |
|---------------|--------|--------------------|
| [new address] | 1 byte | New module address |

Description: This command sets the module address. The address range is 0x4C – 0x5A. Default module address is 0x4C. The address 0x00 is a common address for all modules. The module address is stored in internal module EEPROM.

The address change requires 50 ms to take effect; therefore, the subsequent input must have an appropriate delay.

Command Example:

0xFE 0x4C 0x41 0x52 – for module with address 0x4C set the new address 0x52.

Set the channel intensity level

Syntax hexadecimal 0xFE [device address] 0x42 [channel number] [intensity level]

| Parameter | Length | Description |
|-------------------|--------|---------------------------------|
| [channel number] | 1 byte | Channel number (1,2 or 3) |
| [intensity level] | 1 byte | Intensity level (from 0 to 250) |

Description: This command sets the channel intensity level.

Command Example:

0xFE 0x4C 0x42 0x02 0x82 – for module with address 0x4C set for the channel 2 the intensity level 0x82.

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Start Sequence

Syntax hexadecimal 0xFE [device address] 0x43 [sequence number]

| Parameter | Length | Description |
|-------------------|--------|-----------------|
| [sequence number] | 1 byte | Sequence number |

Description: Start the preprogrammed light sequence. The sequence range is from 1 to 7 (1 – 6 preprogrammed sequences, 7 – custom user-editable sequence).

Command Example:

0xFE 0x4C 0x43 0x04 – for module with address 0x4C start the sequence with number 0x04.

Download the custom sequence

Syntax hexadecimal 0xFE [device address] 0x4C [sequence time] [intensity data for channel 1, channel 2 and channel 3]

| Parameter | Length | Description |
|------------------|----------|--|
| [sequence time] | 1 byte | Sequence time (from 0 to 250) |
| [intensity data] | 60 bytes | Intensity data for the channel 1 (bytes from 1 to 20), channel 2 (bytes from 21 to 40) and channel 3 (bytes from 41 to 60) |

Description: Download the custom user-editable sequence to module memory. The download process requires 100 ms to take effect; therefore, the subsequent input must have an appropriate delay.

Command Example:

0xFE 0x4C 0x4C 0x20 <data byte 1> ... <data byte 60> – for module with address 0x4C download the custom sequence with sequence time 0x20.

Set the intensity level for all channels

Syntax hexadecimal 0xFE [device address] 0x52 [intensity level]

| Parameter | Length | Description |
|-------------------|--------|---------------------------------|
| [intensity level] | 1 byte | Intensity level (from 0 to 250) |

Description: This command sets the intensity level for all channels.

Command Example:

0xFE 0x4C 0x52 0x82 – for module with address 0x4C set the intensity level 0x82 for all channels.

Set sequence time

Syntax hexadecimal 0xFE [device address] 0x54 [sequence time]

| Parameter | Length | Description |
|-----------------|--------|-------------------------------|
| [sequence time] | 1 byte | Sequence time (from 0 to 250) |

Description: Set sequence time for the current sequence.

Command Example:

0xFE 0x4C 0x54 0x40 – for module with address 0x4C set time 0x40 for the current sequence.

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4 Windows software.

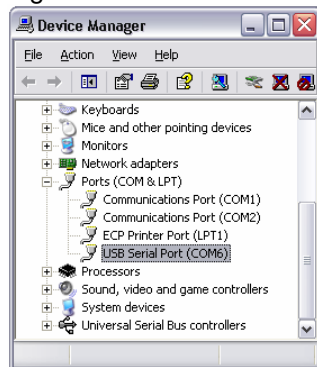
The Windows software provides module control from PC and is used to create custom user-editable sequences. Use a USB to Serial Converter **or** Serial straight-through 9-way cable to connect the LED controller to a PC.

The Windows software can be downloaded from "www.quasarelectronics.com/zip/8191.zip"

If you use the USB to Serial Converter:

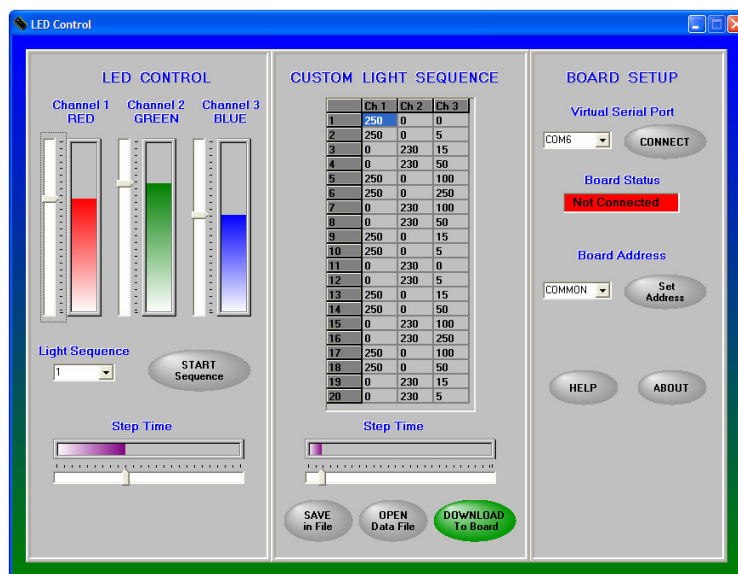
1. Install the Virtual Com Port Drivers. If you use the USB converter with FTDI FT232 chip the drivers are available directly from FTDI website (www.ftdichip.com). The drivers appear to the PC as an extra Com Port. Application software accesses the USB device in the same way as it would access a standard Windows Com Port. The serial data format is: one start bit, 8 data bits, and one stop bit. The baud rate is 9600 baud.
2. Connect the converter to computer USB port. To see which COM port has been assigned to module, right click on "My Computer" desktop icon and select the "Device Manager" tab. Now scroll down and open the "Ports (COM & LPT)" tab. You should see the USB serial port string with port number (Fig.1).

Fig.1



No installation required. Copy the LEDControl.exe and IniDat.ini files on your disk and double-click on LEDControl.exe to run the program.

4.1 Interface description.



The program graphical interface includes the 3 sections:

1. LED Control
2. Custom Light Sequence
3. Board Setup

LED Control section includes the tools to set the light intensity for the each channel. When you move the slide bar the program send the commands to set the channel intensity level. Also, you can select and start the preprogrammed sequence and set sequence time.

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Custom Light Sequence section provides the tools to create the custom sequence. The section includes a table with the 3 columns. The first column includes the intensity data for the channel 1, the second column – for the channel 2 and last column – for the channel 3. The each column includes 20 points (cells) to hold channel intensity data.

To create the custom sequence enter data in cells (like in Excel Spreadsheet). Move the slide bar to set the step time between points and click “Download to Board” button. The program will send custom sequence data to board and start the custom sequence automatically.

Click “Save to file” button to save custom sequence data. The program will open the Save Dialog form. Enter the file name and click OK button to save data in file.

You can also read custom sequence data from the file. Click “Open Data File” button and select the file. The program will read data and fill the table cells automatically.

Board Setup section provides the tools to select the virtual serial port, display the board connection status and set the board address.

If you run the program first time select the Virtual Serial Port number and click CONNECT button. Check the board connection with the board status indicator.

The board address provides the opportunity to connect the multiple boards with the independent control for each board. The address range is 0x4C – 0x5A. Default module address is 0x4C. The address 0x00 is a common address for all modules. The module address is stored in internal module EEPROM.

To set the board address select the address from drop-down box and click Set Address button. The program will send a command to set the board address.

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4.2 Module control from Microsoft Visual Basic.

Visual Basic is one of the easiest languages to use for serial port communications. The mscomm32.ocx driver controls all the serial port communications and it's included with Visual Basic. The example shows how you can control the RGB module using this serial port com driver.

```
Option Explicit

Private Sub Port_Init()
    With MSComm1
        .CommPort = 2          'set the active serial port
        .Settings = "9600,N,8,1" 'set the baud rate, parity, data bits, stop bits
        .PortOpen = True       'open the serial port
    End With 'MSComm1
End Sub

Private Sub Module_Control()
    With MSComm1
        If .PortOpen = False Then
            .PortOpen = True
        End If

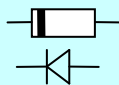
        ' for module wth address 0x4C set for the channel 2 the intensity level 0x82
        .Output = Chr$(&HFE) + Chr$(&H4C) + Chr$(&H02) + Chr$(&H82)
    End With 'MSComm1
End Sub
```

5 Kit Assembly.

Before starting, check the components supplied in the kit against the parts list.

It is recommended that components be soldered in following order:

1. Resistors R1 ... R7.
2. Diodes D1 and D2.



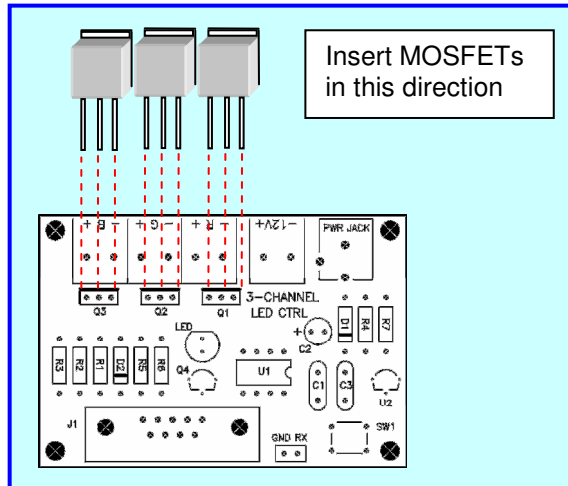
Match up the bar on the diode D1 with the diode image on the overlay.

3. Capacitors C1, C3 (polarity is not impotent).
4. U1 socket.
5. 78L05 voltage regulator.
6. Transistor Q4.
7. Capacitor C2.

C2 – Electrolytic capacitor is polarized. The positive lead is market on the overlay, the negative is marked on the body of the capacitor.

8. Tactile switch.
9. LED.
10. MOSFETs.

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11. Power and LEDs connectors.
12. Header J2.
13. DB9 connector.

Pre-test. Do not insert the microcontroller chip into socket yet. Connect a 12VDC supply to power connector and measure the voltage across pin V and ground pin of the serial interface connector J1. If this voltage is approximately 5 volts, **remove power** and insert the microcontroller chip U1.

Three LEDs, 1 x red, 1 x green and 1 x blue, together with 3 x 680R current limiting resistors have been included with the kit. These components can be connected to the controller for testing. The microcontroller chip includes a test program that flashes each LED in turn.

First connect all the LEDs and resistors to module according to Fig 2.3. Connect the power supply and turn on – each LED will flash in turn.

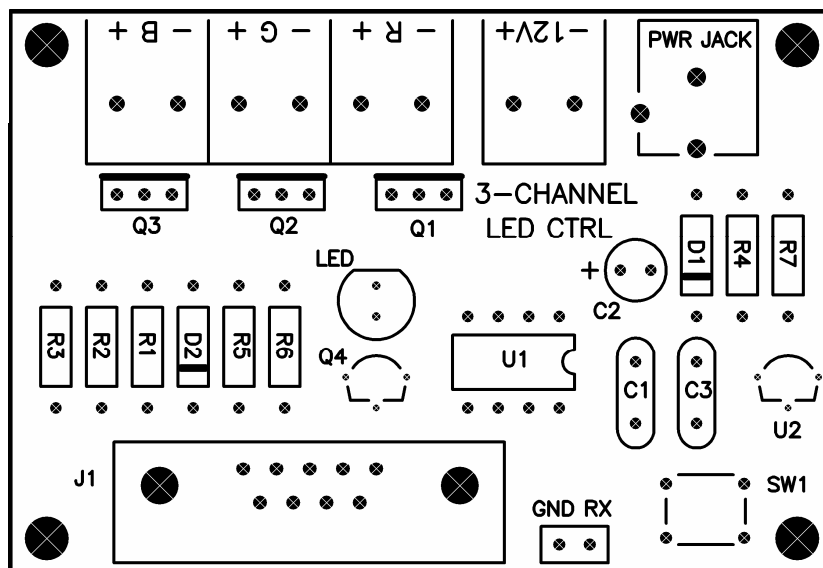
- Never short the module outputs.
- Do not connect LEDs if power supply is connected to module.

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5.1 Parts List.

| Ref Des | Qty | Type |
|-----------------------|-----|--|
| Capacitors | | |
| C1 | 1 | 0.33uF ceramic |
| C2 | 1 | 10uF 16V electrolytic |
| C3 | 1 | 0.1uF ceramic |
| Resistors | | |
| R1, R2, R3, R7 | 4 | 470R 0.25W carbon film |
| R4, R5 | 2 | 5.1K 0.25W carbon film |
| R6 | 1 | 10K 0.25W carbon film |
| Resistors for testing | 3 | 680R 0.25W carbon film |
| Semiconductors | | |
| D1, D2 | 2 | 1N4148 diode |
| U1 | 1 | CY8C24124A-24PXI MCU |
| U2 | 1 | 78L05, 5V regulator |
| Q1, Q2, Q3 | 3 | FDU8782 n-channel MOSFET |
| Q4 | 1 | 2N3904 transistor |
| Miscellaneous | | |
| IC socket, 8 pin | 1 | Socket for U1 |
| PWR,R,G,B | 4 | Terminal block, 2 pin, 5.08mm step |
| J1 | 1 | DB9 female connector |
| J2 | 1 | Header 2 pin |
| PWR JACK | 1 | Power jack, 2.5mm central positive pin |
| SW1 | 1 | Tactile switch |
| LED1 | 1 | LED 5mm |
| LEDs for testing | 3 | 5mm - 1 x Red, 1 x Green, 1 x Blue |

5.2 PCB.



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5.3 Module Schematic.

