RGB24 Strip Controller
RGB DCSSR

April 2013

Version 1.00 Board

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1. Introduction

Renard is the name of a "do-it-yourself" (DIY), computer-controlled, PIC-based dimmer light control concept. It also refers to a family of dimming controllers that have been designed and built based on this concept.

The Renard design concept was originally described by Phil Short in the Simple PIC-Based 8-Port Dimmer 'How-To' on the http://computerchristmas.com website. Since then there have been many enhancements and new designs based on this hardware. There have been many contributors to advancing Renard technology including P.Short, N7XG, DaveJZ, Mactayl/Phoenix, P.Rogers, Tstraub, DirkNerkle, LabRat and many others.

Renard controllers typically rely on a separate computer running a light sequencing program to send it real-time sequences of controller commands to sequence the lights. The computer communicates with the Renard via RS232, RS485, or wireless (depending on the design) and the Renard controls the lights either through built-in power control (power is output directly to the lights), or via separate "SSRs" (solid state relays supply the power when commanded by the controller).
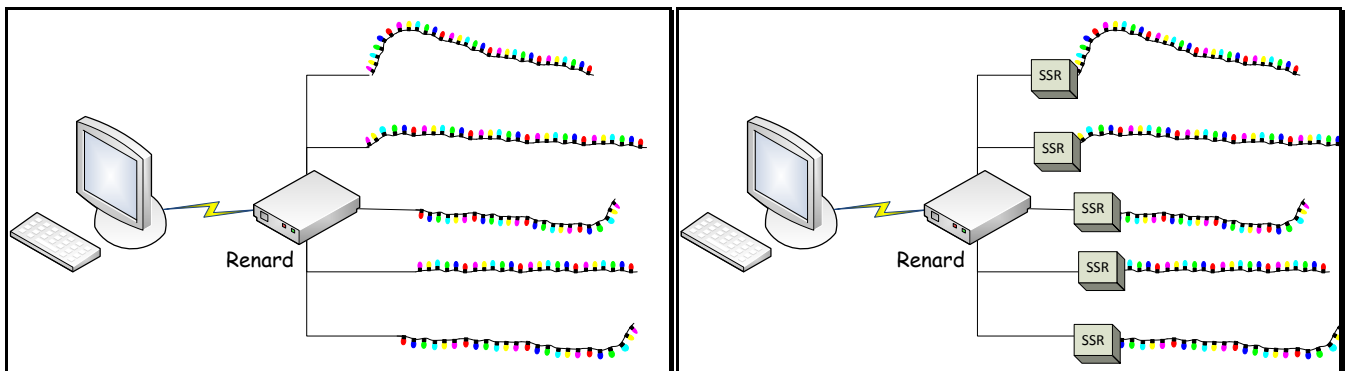
Example Renard configurations

Output of the Renard can be either control signals (to an SSR), direct AC line voltage (110, 100/220, or 220), or DC voltage depending on the design.

Renard is a DIY hobbyist effort and there is a vast amount of products and related peripherals to select from including the Renard Plus Strip Controller. To obtain a specific design, there might be "buy a parts kit and/or blank PCB" offering at a site (such as from www.renard-plus.com), "etch it yourself" files for true DIY, or coop/group buys for kits and PCBs also in forums (like DIYChristmas.org).

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2. Overview of Renard Plus RGB24 and DCSSR

This guide covers the RGB24 and companion DCSSR. This combination is designed primarily to drive sets of red, green, and blue DC lights like LEDs or "low voltage" DC incandescent lights. The RGB24 is designed to drive an external solid state relay thus each of its RJ45 output connectors controls 3 channels of "RGB" SSRs such as the DCSSR which in turn will power 1 set of RGB lights for a total of 3 channels per DCSSR.
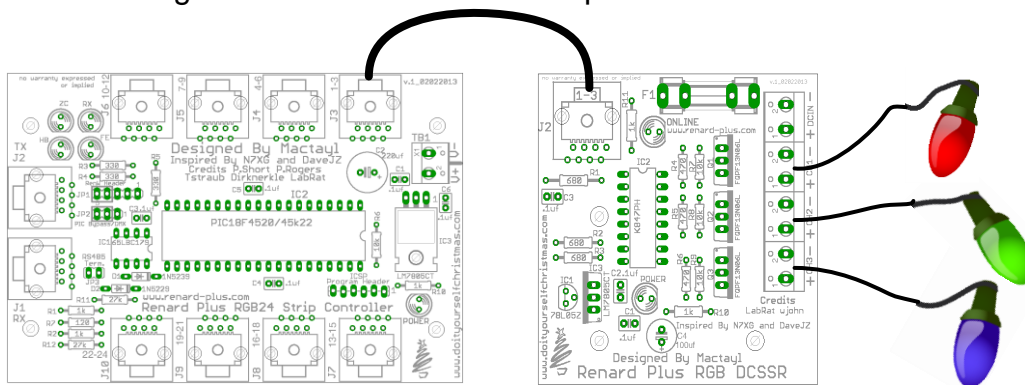
The RGB24 will control up to 8 DCSSRs for a total channel count of 24 channels (8 sets of RGB DC).

Feature	Detail
Name	**Renard Plus RGB24**
Target use	DC RGB Light control
Channel Count	24 (8 sets of RGB)
Power input	5-24v DC
Power output	No – controls SSR
Dimmable?	YES – PWM
Status Indicators?	YES
Channel Indicators?	NO
Control Input – Renard	YES – RS485 or optional wireless
Control Input – DMX	TBD
Daisy-chain output	YES – Renard RS485 pinout
Wireless	With add-on Xbee Snap-In board
On board programming	Yes through ICSP connector

Feature	Detail
Name	**Renard Plus DCSSR**
Target use	Companion to RGB24
Channel Count	3 (1 set of RGB)
Power input	5-24v DC
Power output	YES – DC
Dimmable?	YES – PWM
Status Indicators?	YES
Channel Indicators?	NO
Control Input – Renard	YES – Renard SSR pinout
Daisy-chain output	NO

3. Assembly Instructions

This section covers the construction of the Renard Plus Strip controller board. It approaches these tasks as a learning exercise for new builders, so that they can develop proficiency and self-confidence. The project itself is quite simple and if you follow the steps *carefully*, you should have a working controller when you are done. Additional information and guides on techniques and tools can be found at www.renard-plus.com

3.1 BOMs

3.1.1 RGB24 Parts List

Picture	Designators	Description	Qty	Mouser P/N
	R1, R2, R10	1k ohm resistor ¼ watt	3	571-1k-RC
	R3, R4, R5	330 ohm resistor 1/4 watt	3	571-330-RC
	R7	120 ohm resistor 1/4 watt	1	571-120-RC
	R11, R12	27k ohm resistor 1/4 watt	2	571-27k-RC
	D1	1N5239 (9.1v) zener diode	1	78-1N5239B
	D2	1N5229 (4.3v) zener diode	1	78-1N5229B
	C1, C3, C4, C5, C6	.1uf cap	5	81-RPEF51104Z2S2A03A
	C2	220uf 25V Electrolytic Cap	1	647-UVZ1E221MPD
	TB1	Tyco Terminal Block vertical	1	571-7969492
	J1-J10	Modular Jacks 8 PCB TOP ENTRY	10	571-5556416-1
	IC1	IC & Component Sockets 40P	1	571-1-390261-9
	IC2	8 pin IC socket (Optional)	1	517-4808-3004-CP
	IC3	6 pin IC Sockets (Optional)	1	571-1-390261-1
	ICSP, JP1, JP2, JP3	16 pin header cut to fit: ICSP, JP1, JP2, JP3	1	571-16404526
		Shunts for Xbee header and Bypass	3	737-MSC-G
	IC4	LM7805CT voltage regulator	1	512-LM7805CT
	IC2	65LBC179	1	595-SN65LBC179P
	IC3	H11AA1	1	782-H11AA1
	IC1	PIC Microcontrollers (MCU) PIC18F4520 or 4620 and 4525	1	579-PIC18F4520-I/P
	Status	yellow 5 MM LED	1	78-TLHY5405
	Power, HB, ZC	Red 5 MM LED	3	78-TLHR5401
	RX	Green 5 MM LED	1	78-TLHG5401

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3.1.2 DCSSR Parts List

Picture	Designators	Description	Qty	Mouser P/N
	R1, R2, R3	680 ohm resistor 1 / 4 watt	3	571-680-RC
	R4, R5, R6	470 ohm resistor 1 / 4 watt	3	571-470-RC
	R7, R8, R9	19K ohm resistor 1 / 4 watt	3	291-10k-RC
	R10, R11	1k ohm resistor 1 / 4 watt	2	571-1k-RC
	C4	100uf 35V Electrolytic Cap	1	647-UVR1V101MED1TA
	C1, C2, C3	.1uf cap	3	81-RPEF51104Z2S2A03A
	DCIN, CH1, CH2, CH3	Tyco Terminal Block vertical	4	571-7969492
	J2	Modular Jacks 8 PCB TOP ENTRY	1	571-5556416-1
	IC2	16 pin IC socket (optional)	1	571-390261-4
	IC1*	Low Current 5 volt voltage regulator*	1	512-LM78L05ACZX*
	IC2	K847PH optocoupler	3	512-K847PH
	IC3*	LM7805CT voltage regulator*	1	512-LM7805CT*
	Q1, Q2, Q3	Power FET	3	512-FQPF13N06L
	Power	Red 5 MM LED	3	78-TLHR5401
	Online	Green 5 MM LED	1	78-TLHG5401
	F1	Fuse Holder	2	576-05200001N
	F1	Fuse 10amp fast acting	1	504-GMA-10

* See assembly instructions. Use either IC1 *or* IC3: 5 volt regulator not both!

3.2 Controller Board Assembly

The Renard Plus RGB24 Strip Controller and DCSSR are simple devices to assemble and test. It is easiest if you build the units by inserting the various components from smallest to tallest.

3.2.1 First things first

1. Begin by inspecting the PCBs to look for any defects such as cracks or breaks. The holes on the board should be open on both sides.
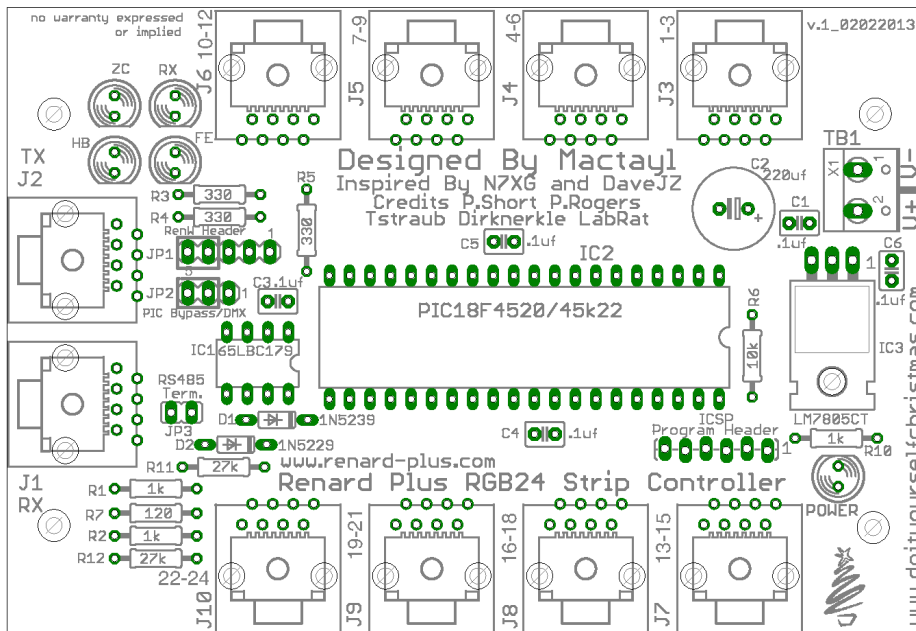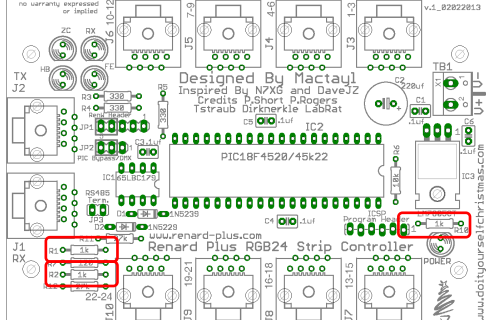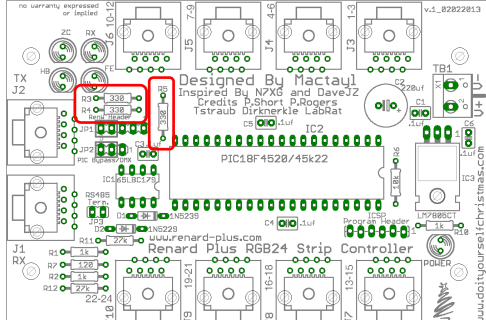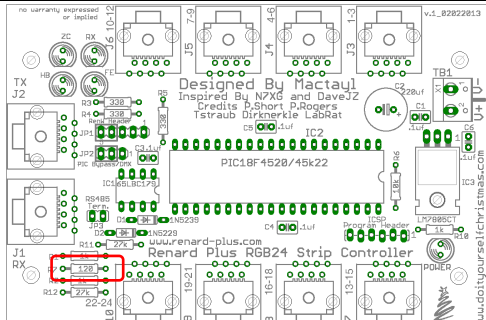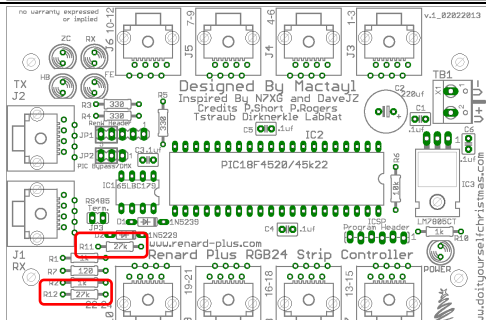
2. Next inspect and sort out the various parts for the board. Make sure you understand which parts are which, and things like resistor codes and component orientation. A separate document on these concepts is available at www.renard-plus.com and on other resource sites like Wikipedia.

3. Follow the assembly guide as follows in the next section.

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3.3 RGB24 Assembly Guide

3.3.1 Install the resistors and Diodes

Step No and check-boxes	Instructions	RGB24
1 ☐	Install 1K (brown-black-red) ohm resistors at locations R1, R2, R10 Solder and clip the leads.	
2 ☐	Install 330 (orange-orange-brown) ohm resistors at locations R3, R4, R5. Solder and clip the leads.	
3 ☐	Install the 120 (brown-red-brown) ohm resistor at location R7. Solder and clip the leads.	
4 ☐	Install 27K (brown-red-brown) ohm resistors at locations R11,R12. Solder and clip the leads.	

Step No and check-boxes	Instructions	RGB24
5 ☐	Install the 1N5239 diode at location D1. The diode is polarized and only works one way. The end with the band (cathode) goes towards the left side of the board just as the silkscreen indicates. Solder and clip the leads.	
6 ☐	Install the 1N5229 diode at location D2. The diode is polarized and it can only go one way. The end with the band (cathode) goes towards the left side of the board. Solder and clip the leads	

3.3.2 Install IC sockets

Even though these parts are optional we strongly recommend that sockets be used on all of the IC's.

> *Note: If you are not installing sockets, it is recommended you wait to install the ICs until AFTER you test power. Please see "Installing ICs" section later in this chapter.*

Pin 1 of the IC socket aligns to the square solder pad on the PCB. Also, if the socket has a notch at one end, that will align with the notch on the silkscreen for the IC location on the board.

Pin 1 of the IC socket is on the end, closest to the notch.

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Step No and check-boxes	Instructions	RGB24
7 ☐	Install the 8 pin socket at location IC1. Make sure the notched or dimpled end is lined up with the notched end of the silk screen board outline. The notch on the socket should face the right side of the board. Solder one pin and make sure the socket is firmly seated before continuing to solder the remaining pins. Solder all pins.	
8 ☐	Install the 40 pin socket at location IC2. Make sure the notched or dimpled end is lined up with the notched end of the silk screen board outline. The notch on the socket should face the right side of the board. Solder one pin and make sure the socket is firmly seated before continuing to solder the remaining pins. Solder all pins.	

3.3.3 Install the capacitors

Step No and check-boxes	Instructions	RGB24
9 ☐	Install 0.1uf Ceramic Capacitors (marked 104) at locations C1, C3, C4, C5, C6. Solder and clip the leads. Note these parts are NOT polarized.	

Step No and check-boxes	Instructions	RGB24
10 ☐	Install the 220uf Electrolytic Capacitor at location C2 which is polarized. Be sure that the (+) lead is installed in the hole marked with a "+" symbol. The (+) lead is usually longer than the (-) lead, and the (-) lead is identified by a black stripe on the capacitor. Solder and clip the leads.	

3.3.4 Install the light emitting diodes

LED's (light emitting diodes) must be installed according to the silk screen pattern on the board. In looking at an LED you will notice a flat spot on one side of the LED which indicates the cathode or negative leg of the LED.

Step No and check-boxes	Instructions	RGB24
11 ☐	Install the Red LEDs at the locations marked Power, HB, ZC. The LED is polarized. There is a flat side (cathode) that has a short lead and it faces towards the right side of the board. Solder and clip the leads.	Flat spot Short lead = Cathode = - Long lead = Anode = +
12 ☐	Install the Yellow LED at the location marked FE. The LED is polarized. There is a flat side (cathode) that has a short lead and it faces towards the right side of the board. Solder and clip the leads.	
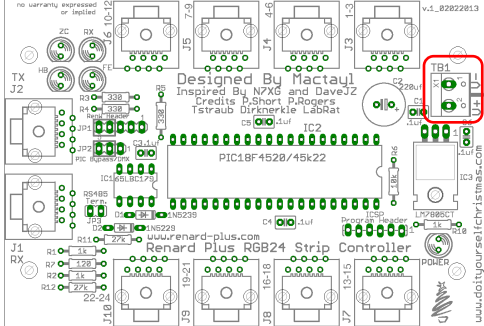
Step No and check-boxes	Instructions	RGB24
13 ☐	Install the Green LED at the location marked RX. The LED is polarized. There is a flat side (cathode) that has a short lead and it faces towards the right side of the board. Solder and clip the leads.	

3.3.5 Install Misc. Parts

You may have purchased either a single 16 pin header or headers cut according to the board specifications. When installing headers the short side of the header is installed into the board.

Step No and check-boxes	Instructions	RGB24
14 ☐	Install the 5 pin header at location JP1 (RENW header). Solder	
15 ☐	Install the 3 pin header at location JP2 (PIC bypass). Solder.	

Step No and check-boxes	Instructions	RGB24
16 ☐	Install the 2 pin header at location JP3 (RS485 Term). Solder.	
17 ☐	Install the 6 pin header at location ICSP (PIC programming header). Solder.	
18 ☐	Install the 5v linear regulator at location IC3 forming the leads as indicated below. Fold the pins over the shaft of a small screwdriver to create smooth bends. After inserting the leads into the proper holes, secure the IC with a 4-40 screw, #4 lock washer, and a 4-40 nut. _____ Solder	
19 ☐	Install the RJ45 jacks at locations J1-10. Gently align the eight wires with the matching holes and snap the connector to the board. Solder.	

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Step No and check-boxes	Instructions	RGB24
20 ☐	Install the 2 position terminal strip location TB1. The side where the wires enter under the screw should face the top of the board.	
21 ☐	Install the shunts on the headers according to the Jumper Settings / Header Settings section in a following chapter.	

3.3.6 RGB24 Initial Testing / Final Assembly

At this point you have completed the assembly of the board and you should gently clean the board of any residue and inspect for solder bridges. What you are looking for are any solder bridges especially around the IC's and other closely spaced parts.

Connect your 5-24vdc power supply to the TB1 terminal strip noting the polarity V+ and V-. It supplies power to controller portion of the board.

Turn on your power supply and verify the power LED lights up.

Using a DMM, measure the voltage across the C1 capacitor which should measure +5 volts. If the voltage does NOT measure +5, remove power and start troubleshooting. Look for solder bridges around the regulator, or around the TB1. Double check the regulator number to make sure it is what you expect (something like LM7805 or LM340T-5). Verify the input power supply is DC between 5v and 24v (measure at TB1).

If power is good, turn off your power supply and continue assembling.

3.3.7 Install the ICs:

After verifying the voltage, it is now safe to install the IC's. You should handle them carefully, and avoid static electricity or other rough handling. Try to avoid bending pins when inserting them in the sockets. You might want to slightly straighten the IC legs by placing the side of the IC against a flat surface and lightly bending them inward and straighter up and down than they typically are shipped from the manufacturer.

Step No and check-boxes	Instructions	RGB24
22 ☐	Install the PIC18F4520 in the 40 pin socket at location IC2. The IC is polarized. Gently install the IC so that the notch faces towards the right matching the socket and the silkscreen.	
23 ☐	Install the SN65LBC179P in the 8 pin socket at location IC1. The IC is polarized. Gently install the IC so that the notch faces towards the right matching the socket and the silkscreen.	

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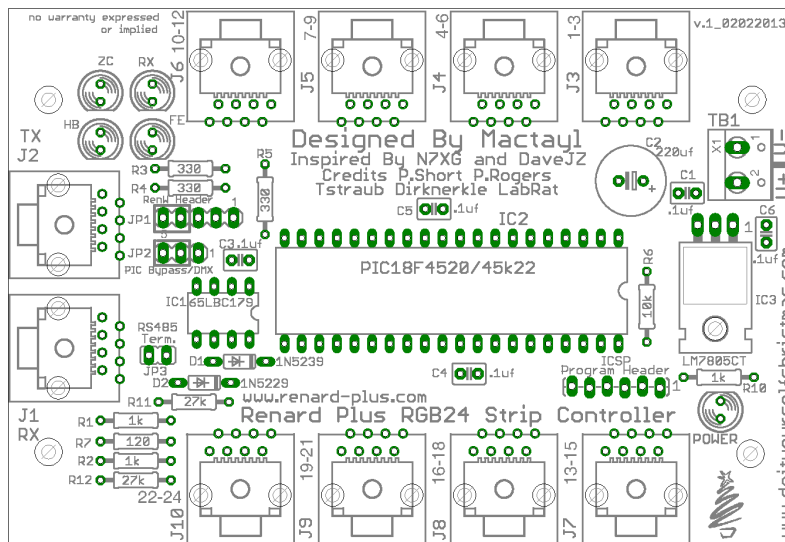
3.4 DCSSR Assembly Guide
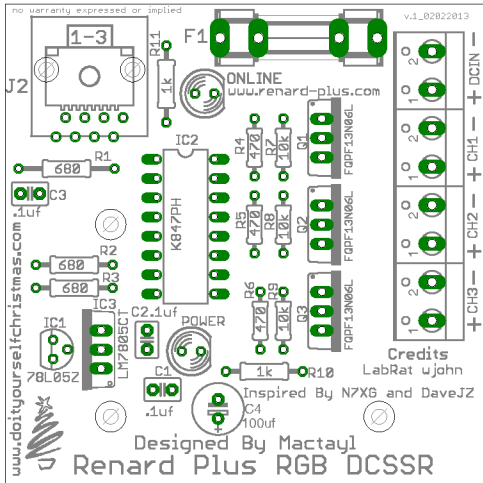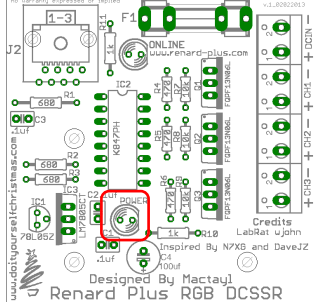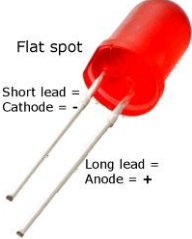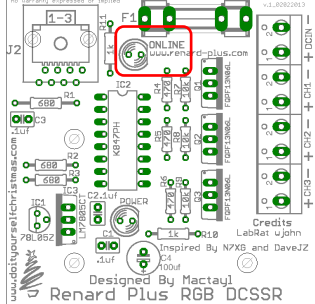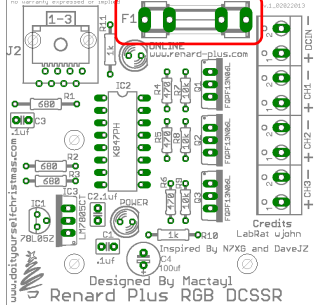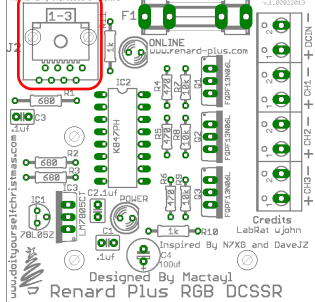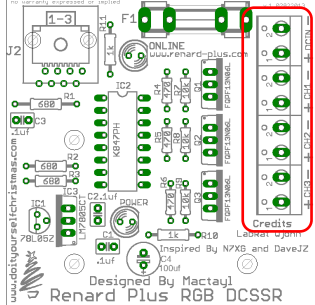
3.4.1 Install Parts Group 1 and 2

Step No and check-boxes	Instructions	DCSSR
1 ☐	Install 680 (blue-gray-brown) ohm resistors at locations R1, R2, R3. Solder and clip the leads.	
2 ☐	Install 470 (yellow-violet-brown) ohm resistors at locations R4, R5, R6. Solder and clip the leads.	
3 ☐	Install 10K (brown-black-orange) ohm resistors at locations R7, R8, R9. Solder and clip the leads.	

Step No and check-boxes	Instructions	DCSSR
4 ☐	Install 1K (brown-black-red) ohm resistors at locations R10, R11. Solder and clip the leads.	
5 ☐	Install 0.1uf Ceramic Capacitors (marked 104) at locations C1, C3, C4. Solder and clip the leads.	
6 ☐	Install the 100uf Electrolytic Capacitor at location C4 which is polarized. Be sure that the (+) lead is installed in the hole marked with a "+" symbol. The (+) lead is usually longer than the (-) lead, and the (-) lead is identified by a black stripe on the capacitor. Solder and clip the leads.	
7 ☐	Install the 16 pin socket at location IC2. (*see instructions*) Make sure the notched or dimpled end is lined up with the notched end of the silk screen board outline. The notch on the socket should face the right side of the board. Solder one pin and make sure the socket is firmly seated before continuing to solder the remaining pins. Solder all pins.	 Pin 1 of the IC socket is on the end, closest to the notch.

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Step No and check-boxes	Instructions	DCSSR
8 ☐	Install the Red LED at the location marked Power. The LED is polarized. There is a flat side (cathode) that has a short lead and it faces towards the right side of the board. Solder and clip the leads.	Flat spot Short lead = Cathode = - Long lead = Anode = +
9 ☐	Install the Green LED at the location marked Online. The LED is polarized. There is a flat side (cathode) that has a short lead and it faces towards the right side of the board. Solder and clip the leads.	
10 ☐	Install fuse holder at location F1. The clips have dimples on one side of then and these must be facing towards the sides of the board and not the center. Solder. Install the fuse into the fuse holder. The fuse does not get soldered.	
11 ☐	Install the RJ45 jack at locations J2. Gently align the eight wires with the matching holes and snap the connector to the board. Solder all pins.	
12 ☐	Install 4 terminal blocks at locations CH3, CH2, CH1, and DCIN. Before installing in board the 4 terminal blocks must be locked together. *The terminal blocks must be oriented facing outward.*	

Step No and check-boxes	Instructions	DCSSR
13 ☐	Install the K847PH optocoupler into socket at location location IC2. The IC is polarized. Gently install the IC so that the notch lines up with notch in the 16 pin socket.	
14a ☐ Low Current Option	The DCSSR may either built for low current or high current strips. Select either this option or the next but **NOT BOTH!** For Low Current - Install LM78L05 (low current) at location IC1. The LM78L05 is installed with the flat side if the IC toward the side of the board.Solder and clip leads.	
14b ☐ High Current Option	The DCSSR may either built for low current or high current strips. Select either this option or the previous, but **NOT BOTH!** For High Current - Install LM7805CT (high current) at location IC3. The LM7805 is installed with the tab side toward the side of the board. Solder and clip leads.	
15 ☐	Install the FQPF13N06L power FETs at location Q1, Q2, Q3. The FETs should be installed with the tabs facing the terminal blocks. Solder and clip the leads.	

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4. Final Steps

4.1 Programming the PIC

Programming the PIC can be done with the PIC chip plugged into a PIC programmer such as the PICStart from MicroChip or onboard using a programmer like a PicketIII or PicKit2. Programming PIC's using standard assembly is written up in our PIC Programming Manual available on www.renard-plus.com.

4.2 RGB24 Jumper Settings / Headers

4.2.1 JP1 XBee Header

This header can be used to connect a XBee Wireless module directly to the Renard Plus Strip using a Xbee Snap-in board or indirectly using 3 wires to a board such as the REN-W. If you are not using XBee Wireless then you must jumper pins 4/5 using a shunt jumper. The following are the pinouts for the Xbee header:

1 = +5VDC
2 = N/C
3 = GND
4 = RX from 485 chip
5 = RX in to PIC
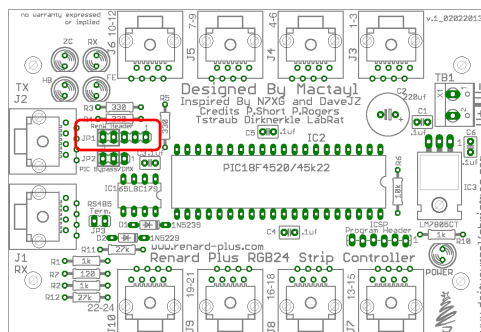
4.2.2 JP2 PIC Bypass

If you are using Start Address Programming, you can use the PIC bypass to allow the data to flow thru the Renard Plus Strip without the usual Renard "address eating". If you use a jumper across pins 1/2 then the data stream that comes into the device goes out exactly as it came in with no addresses consumed by the Renard Plus 32. The default position is a jumper across pins 2/3.

Pin Layout
1 = Data In From RS485 IC
2 = Data Out to RS485 IC
3 = Data Out from PIC
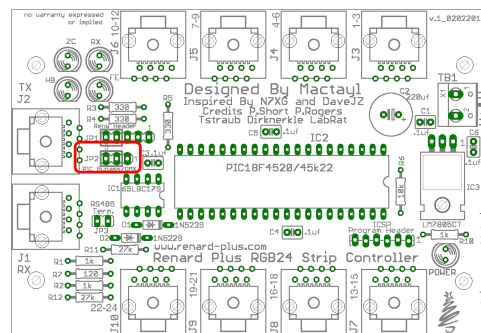
4.2.3 JP3 RS485 Terminator

There are situations where the communications from the computer might require termination. Usually line reflections or other environmental conditions might disrupt communications to the controller. You mig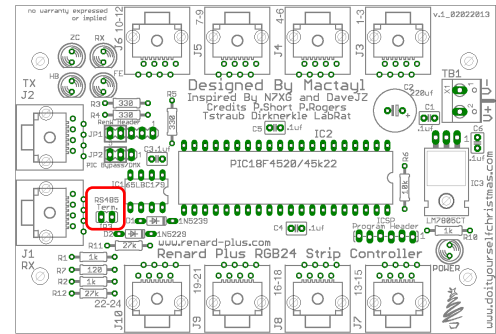ht see missed light transitions, jumpy animation, or complete no operation. In this case, adding termination *may* return reliable communications assuming everything else is working right.
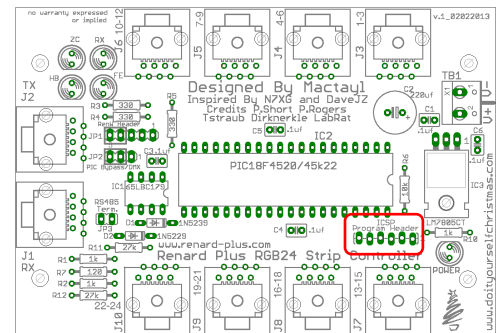
4.2.4 Programming- ICSP Header

This header allows the PIC to be programmed while the PIC is installed on the board

The following are the pin-outs for this header:

Pin 1 = MCLR
Pin 2 = +5 volts
Pin 3 = GND
Pin 4 = PGD
Pin 5 = PGC
Pin 6 = PGM/RB5

4.3 Connecting the Renard to your PC

This board contains 2 RJ45 connectors that are used to receive data and pass data to the next controller.

J1 RX	RS485 incoming data from either a RS485 converter or another controller
J2 TX	RS485 outgoing data to next controller

There are many options to connect your computer to the Simple Renard 32. Below is a picture of the Hexim HXSP-2018F USB to RS485 adapter:

When selecting an adapter look for ones that have an easy to use screw terminal like this one.

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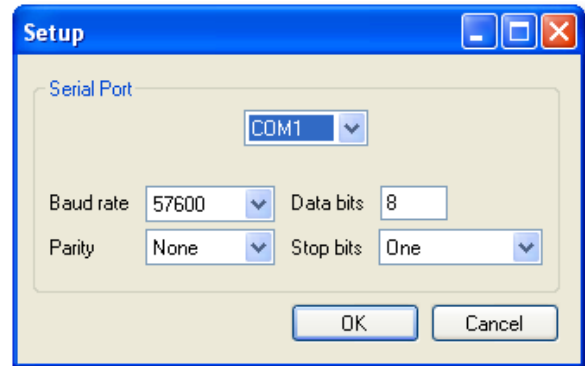Page 21 of 26

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4.4 Computer Setup

If you are using the Vixen sequencing software for the Simple Renard Plus 32 it will require either one of the following plugins:

- Renard Dimmer [Vixen 1.1.*]
- Renard Dimmer (modified) [Vixen 2.*]

Renard Dimmer Plug-In Settings:

If you are using Xbee wireless, the baud rate must be 57600.

4.5 Final Testing

The Renard Plus Strip Controller has 3 diagnostic LED status lights:

4.5.1 Diagnostic LED Status Lights

RX	**RX** – Active when sequence is running
FE	**FE** – Will blink every few seconds to indicate the microprocessor is active
PWR	**Power, HB, and ZC** - Will be on when power is applied

For normal operation you should have the power LED lighted and the status LED blinking every few seconds (the PIC must be programmed). If you are running a sequence you will also see the RX LED flashing as well.

The data wiring of the Renard Plus Strip Controller is the same as other Renard boards. Standard CAT5 cables can be used to inter-connect other controllers

Connect the Renard Plus Strip to your PC using a standard CAT5 cable from the controller to a RS485 connection on your PC.
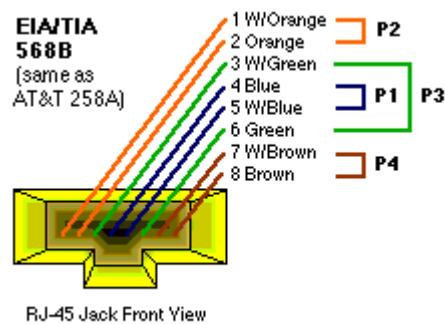
Program a Vixen sequence to turn on/off each of the channels on the controller. We would suggest that each channel is turned on for 4 or 5 seconds.

4.6 RJ45 Wiring to SSR

Connect a DCSSR board to each of the channels J3-J10 using CAT5 cable and connect lights to the SSR boards. Once that is complete you should run your test sequence to verify that all of the channels are working correctly.

A standard RJ45 networking cable can be used to connect the Renard to your SSRs. Just check and make sure that the pins on one end of the cable connect to the same pin on the other end of the cable.
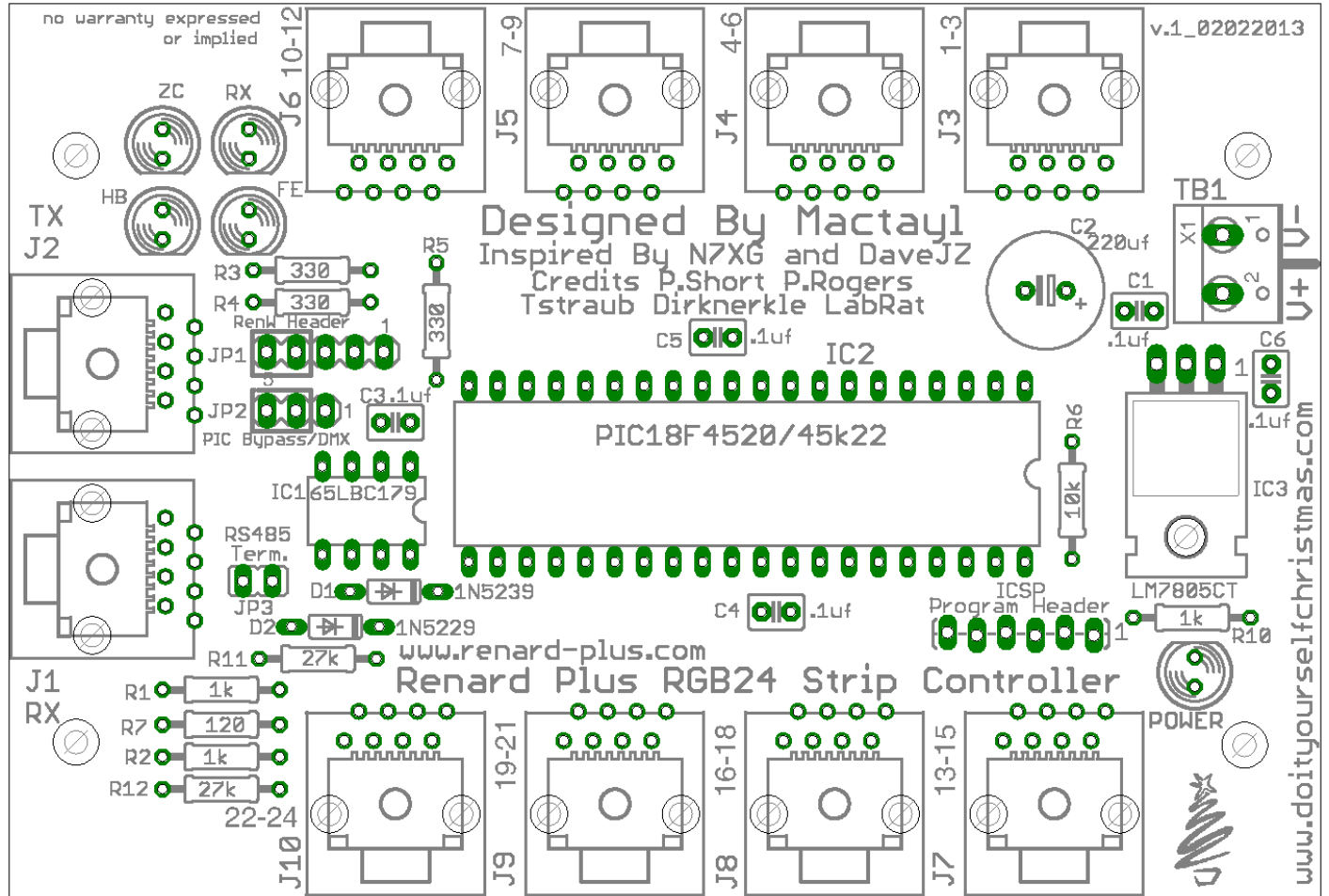
Here is an example of a data cable wired to the EIA-568B standard. There are eight pins, numbered from left to right, looking at the jack. While you only need six wires in your in SSR interface cable, it is just easier to wire up all eight as per the cabling standard.
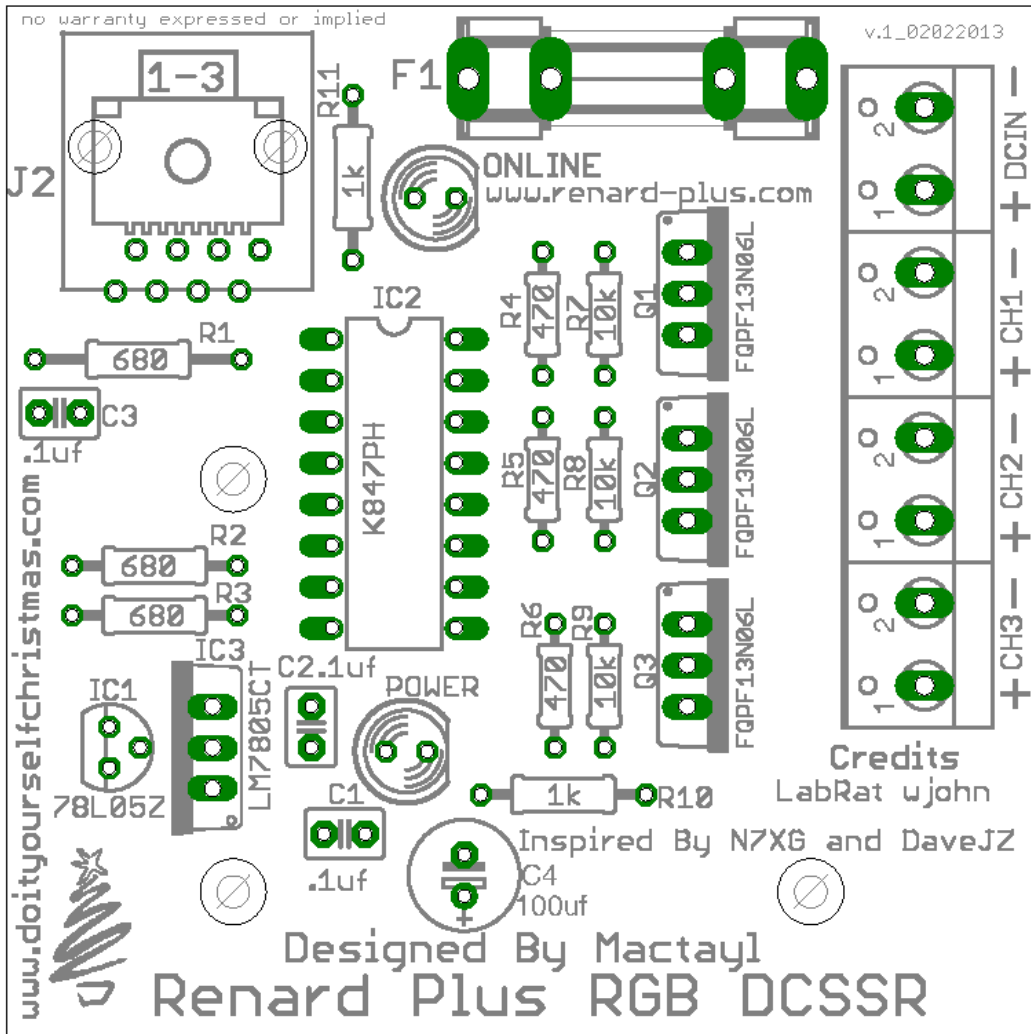

EIA-568B RJ45 Socket

5. Parts Placement Diagram

no warranty expressed or implied

1-3

J2

R11
1k

F1

ONLINE
www.renard-plus.com

R1
680

C3
.1uf

www.doityourselfchristmas.com

R2
680

R3
680

IC2

K847PH

R4
470

R7
10k

Q1

FQPF13N06L

R5
470

R8
10k

Q2

FQPF13N06L

R6
470

R9
10k

Q3

FQPF13N06L

IC3
LM7805CT

IC1
78L05Z

C2 .1uf

POWER

C1
.1uf

C4
100uf

1k R10

Inspired By N7XG and DaveJZ

Credits
LabRat wjohn

Designed By Mactayl
Renard Plus RGB DCSSR

DCIN − +

CH1 − +

CH2 − +

CH3 − +

Renard Plus
www.renard-plus.com

Renard Plus RGB24 Strip Controller
Renard Plus RGB DCSSR
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April 2013

6. Notes

Use this page for notes about the boards.