Renard Plus DC SSR – DCSSRhc

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Table of Contents

1. Introduction to Renard

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 M. Macmillan, D. Davis, P. Rogers, T. Straub, D. Haberle, A. Williams and 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).
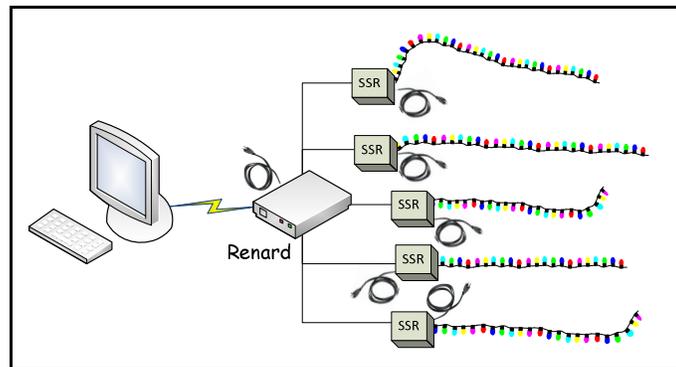
Example Renard configuration for SSR

Output of the Renard can be either control signals (to an SSR as is documented in this document), 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).

2. Overview of Renard Plus DC SSR

This guide covers the Renard Plus DCSSRhc. These boards are designed to take SSR control signals, including dimming control, from a Renard designed for SSR operation, and output a DC (direct current) voltage to directly power lights and light strings. The SSR is the board that actually controls the power to the lights as directed by the Renard controller.

The DCSSRhc ("hc" stands for "High Current") is like other Renard SSR modules and takes in a typical Renard control signal RJ45 cable and outputs 4 channels of DC voltage. The DC voltage can be between 5v and 24v as determined by the V+/V- input. Each channel is capable of handling up to 3 Amps. The board features heavier copper traces, and higher power triacs for heavier DC current situations.
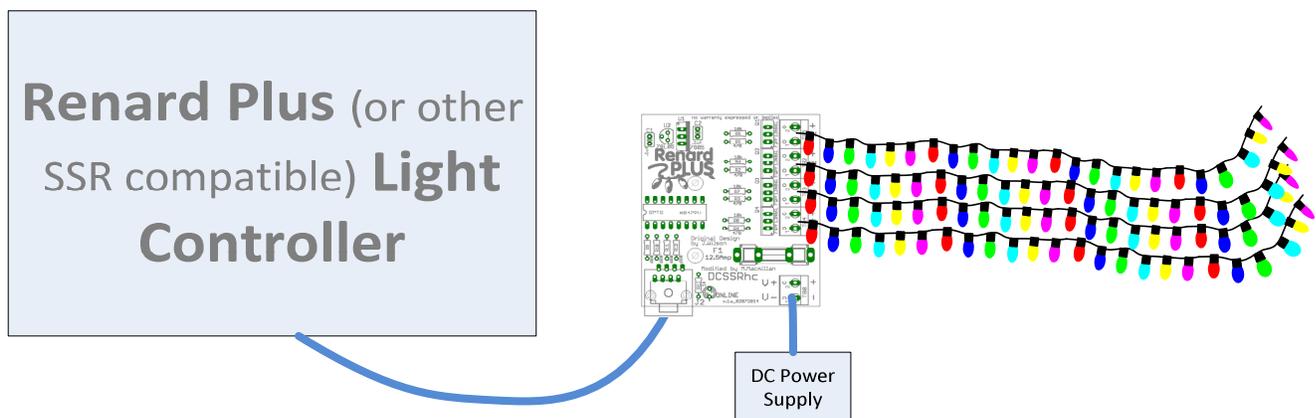
Feature	DCSSRhc Detail
Name	Renard Plus DCSSRhc High Current
Target use	DC line level light control "solid state relay"
Channel Count	4 MOSFET controlled DC outputs
Power input	DC 5* – 24v
Power output	Yes –DC out – 4 channels @ 3A max each (without heat sync), or total across all channels of 10A max
Dimmable?	YES – based on controller capability
Status Indicators?	YES – "Online" indicator
Channel Indicators?	NO
Control Input	YES – Standard Renard SSR control (RJ45)
Daisy-chain output	No
Wireless	Not Applicable
On board programming	Not Applicable
Suggested Case	TA-200

*At 5 volts input for 5v output, leave off the voltage regulator and jumper pin 1 to 3

3. Assembly Instructions

This section covers the construction of the Renard Plus DCSSR boards. The assembly task is approached 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 board when you are done. Additional information and guides on techniques and tools can be found in the "Tools and Parts ID Guide" at:
www.renard-plus.com/files/Tools_and_Parts_ID_Guide.pdf

3.1 Renard Plus DC SSR BOM / Parts List

The following is the Bill Of Material (BOM) for building the Renard Plus DC SSR boards. The link to the Mouser project is:
http://www.mouser.com/ProjectManager/ProjectDetail.aspx?AccessID=7bcc325fdf

3.1.1 BOM

Picture	Description	Mouser P/N	DCSSRhc Designator	Qty
	470 ohm resistor 1/4 watt	291-470-RC	R1, R2, R3,R4	4
	10K ohm resistor 1/4 watt	291-10k-RC	R5, R6, R7, R8	4
	680 ohm resistor 1/4 watt	291-680-RC	R9, R10, R11, R12	4
	1K ohm resistor 1/4 watt	291-1k-RC	R13	1
	.1uf 50v bypass cap	81-RDER71H104K0K103B	C1, C2	2
	Terminal Blocks 5.08MM PCB	571-7969492	DCIN, CH1, CH2, CH3, CH4	5
	Modular Jacks 8 PCB TOP ENTRY	571-5520251	RJ45	1
	16 pin IC socket	571-1-2199298-4	OPTO	1
	Optocoupler K847PH	782-K847PH	OPTO	1
	MOSFET FQPF13N06L	512-FQPF13N06L	Q1-Q4	4
	Low Current 5v regulator 78L05 --OR--	512-LM78L05ACZX	U2 --OR--	1
	1Amp 5v regulator LM7805CT (optional in place of 78L05)	512-LM7805CT	(U1)	1 Opt
	Red 5 MM LED	78-TLHR5401	Online	1
	Fuse Clips and Holders PC FUSE CLIP 5 MM	534-3517	F1	2
	5mm x 20mm Fast Acting Fuse 125VAC 10Amp	504-GMA-10	F1	1
	Fuse Cover (optional)	534-3527C	(F1)	1 Opt

3.1.2 Heatsink (See template on: www.renard-plus.com)

DCSSRhc
TBD

3.1.3 Enclosure (recommended)

|	DCSSRhc
	TA-200

3.2 Parts Assembly

Renard Plus DCSSRhc boards are very simple boards to assemble and test. It is easiest if you follow these instructions, checking off steps as they are performed. This will lead you through the assembly installing components from shortest/smallest to tallest.

3.2.1 First Things First

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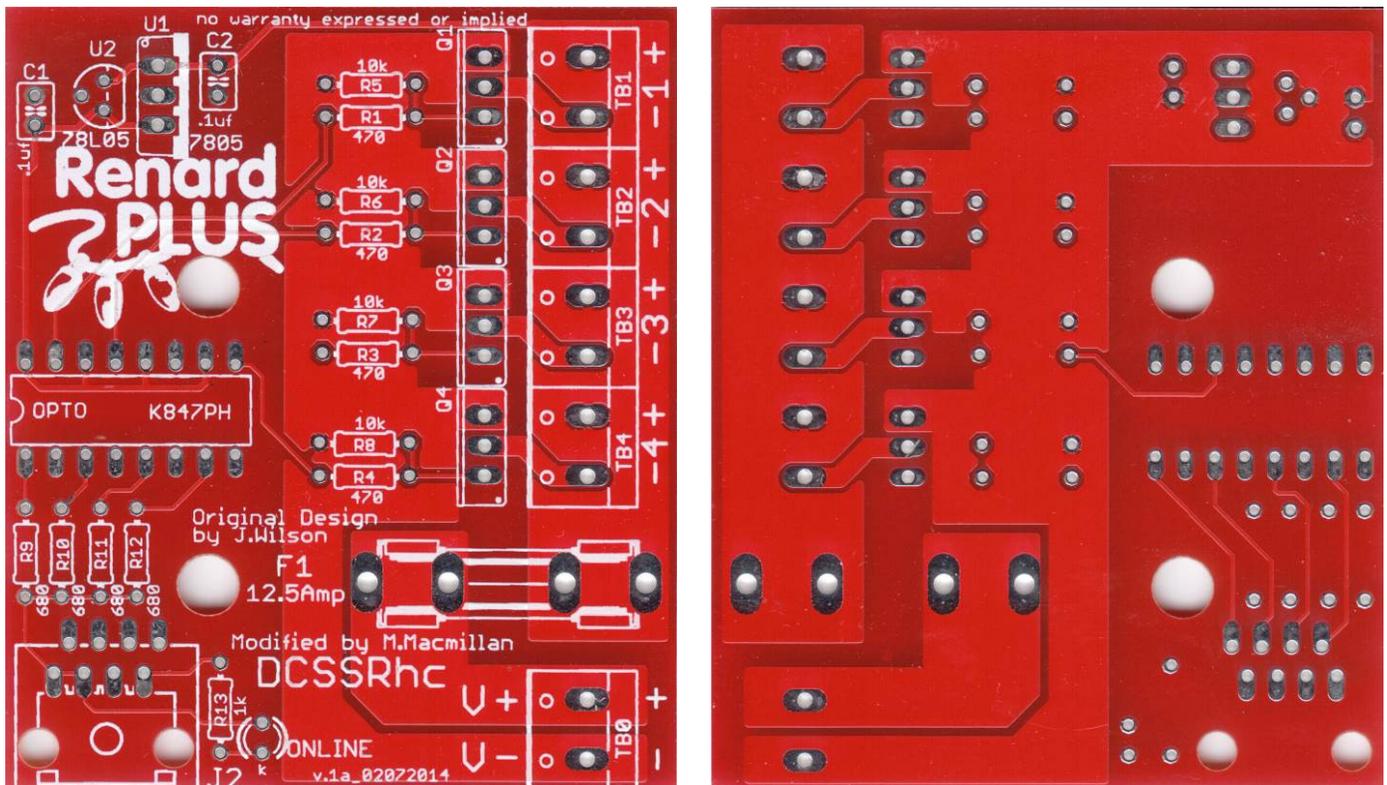
2. Next inspect and sort out the various parts for the board. Make sure you understand which parts are which, and things like resistor codes and component orientation. A separate document on these concepts is available at:
    www.renard-plus.com/files/Tools_and_Parts_ID_Guide.pdf
    and on other resource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

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

3.3 DCSSRhc Assembly Guide

This section covers the assembly of the DCSSRhc board.

3.3.1 DCSSRhc Install Resistors

Resistors do not have a specific orientation and can be installed either direction. The VALUE is important and that is indicated by the colored strips. See the Tools and Parts ID document on www.renard-plus.com for details.

Step	Instructions	SSRHC
1 ☐	Install 4 of 470 ohm resistors (yellow-violet-brown) at locations R1-R4. Solder and clip leads.	
2 ☐	Install 4 of 10k ohm resistors (brown-black-orange) at locations R1-R4. Solder and clip leads.	
3 ☐	Install 4 of 680 ohm resistors (blue-gray-brown) at locations R9-R12. Solder and clip leads.	
4 ☐	Install 1 of 1k ohm resistor (brown-black-red) at location R13. Solder and clip leads.	

3.3.2 DCSSRhc Install IC Sockets

Even though sockets are optional we strongly recommend that sockets be used on all of the IC's. This allows easier testing, debug and repair down the road. Sockets should be installed with the Pin 1 of the socket aligned to the square solder pad on the PCB. The silkscreen also indicates a notch on the socket outline that the notch on the socket should match. If you get a socket backwards, it will work, but later you will need to be careful to install the IC properly per the board indication of pin 1, not the socket. See diagram below.
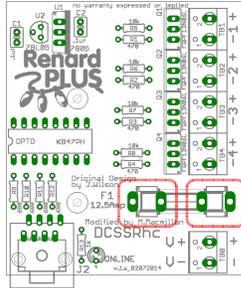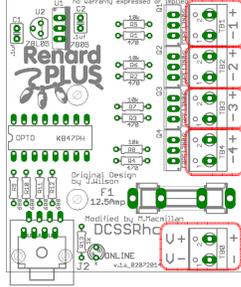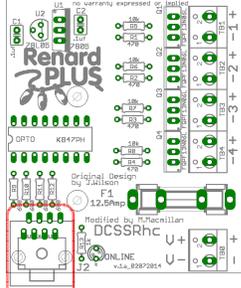
Pin 1 of the IC socket is on the end, closest to the notch.

Step	Instructions	SSRhc
5 ☐ **OPT**	If you choose, install the one 16 pin IC socket at location OPTO Solder. *Note: The notch goes to the left as shown on the silkscreen. It is OK if a socket is soldered in backwards; just remember to put the component in the correct way.*	

3.3.3 DCSSRHC Install Misc. Parts

Step	Instructions	SSRhc
6 ☐	Install the 2 .1uf (100nf) bypass caps at location C1, C2. Solder and clip leads. *Note: these parts do not have a specific orientation.*	
7 ☐	Install the 1 red LED's at location LED. Solder and clip leads. *Note: These parts have a specific orientation. The flat side of the LED is negative and goes toward the flat side on the silkscreen (in the upper hole as shown).*	

Step	Instructions	SSRhc
8 ☐	Install the 2 fuse <u>clips</u> at location F1. Solder. Install Fuse into clips. Fuses do NOT get soldered into the clips! *Note: The fuses can be used to align the fuse clips for soldering as long as you do not overheat them.*	
9 ☐	Install the five terminal blocks at locations TB0 – TB4 as indicated. Solder. *Note: The terminal blocks must be oriented facing outward toward the right edge of the board as shown. TB0 is the connector used for the input DC voltage that will be switched on the outputs.*	
10 ☐	Install the one RJ45 modular jacks at location RJ45. Be careful as the pins are somewhat close together making alignment difficult. Once the pins are lined up, pop the jack onto the board. Solder. *Note: Please inspect the jacks BEFORE installing to make sure all the pins and wires inside the connector look straight and nothing is out of place.*	
11 ☐	Install the 4 MOSFETs in locations Q1 – Q4. Solder and clip leads. *Note: These parts have a specific orientation. The tab side of the Triac should face AWAY from the terminal blocks and be closer to center of the board. If you will be adding the optional heat sink for the MOSFETs, you will want to do so BEFORE soldering them in place. A heat sink makes a great transistor installation tool to keep them straight for soldering. DO NOT OVERHEAT when soldering!*	
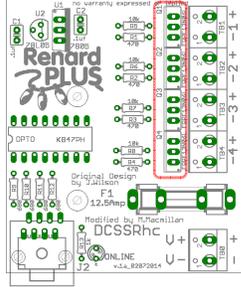
3.3.4 DCSSRhc Voltage Regulator Option

The board needs a low current 5v voltage source to operate the logic/optocouplers. To do this, it takes the input DC power (5.7 – 24v) and regulates it via a low power 5v regulator (TO-92 package) at U2. If you wish, you can optionally use a higher power 5v regulator (TO-220 package) at U1. Use only one or the other to prevent dueling regulators.

Step	Instructions	SSRHC
12a ☐	Install the 78L05 5v regulator (TO-92 package) [image] in location U2. Solder and clip leads. *Note: These parts have a specific orientation. The flat side of the regulator should face AWAY from the left edge of the board like the silk screen indicates. DO NOT OVERHEAT when soldering* *Omit this part if you will be using the more powerful 7805 regulator at location U1, or will be using a 5 volt input voltage.* --OR --	
12b ☐	Instead of installing U2, install a 1amp 7805 5v regulator (TO-220 package) at U1. Solder and clip leads. *Note: These parts have a specific orientation. The tab side of the regulator should face AWAY from the left edge of the board toward on the side of the dark line on the silk screen. DO NOT OVERHEAT when soldering.* *Omit this part if you will be using the lower power 78L05 regulator at location U2, or will be using a 5 volt input voltage.* --OR --	
12c	**5 Volt operation** If you will be operating your DCSSRhc with a 5 volt input to control 5 volt DC devices, you must follow these special steps: 1 Leave off or remove the 5 volt regulator detailed above. 2 Jumper pin 1 to pin 3 of the U2 regulator spot	
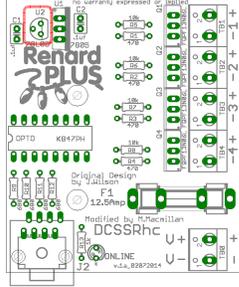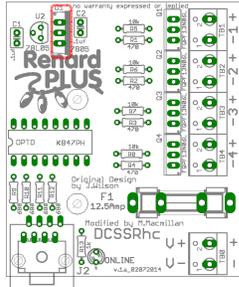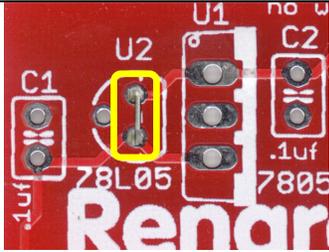
3.3.5 Electrical Test

At this point the board is complete except for the IC chips. It is a good idea to gently clean off any final soldering residue and then visually inspect the board and check to make sure there are no solder bridges between the solder pads, and that the solder joints are all a good quality. If you are going to do any electrical checks, now is a good time to do so. You should see +5 at pin 16 (directly across from pin1) of the 16 pin OPTO as long as you are inputting enough voltage on TB0 Vin. Remember there is LIVE current on the board when plugged into the DC power supply so be careful!

Once you have verified that you are getting 5v to the opto, you are ready to finish the build.

3.3.6 DCSSRhc Install IC

IC pins are numbered from 1 to the number of pins counter clockwise with pin 1 being just to the right of either a notch or dimple on the IC.

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

Note: Before handling any IC, touch the bottom of the board or use a conductive wrist-strap attached to the board.

Step	Instructions	SSR8
13 ☐	Install 1 of the 16 pin K847PH optocoupler at location OPTO in the socket. If you optioned to omit the socket, solder the opto directly in the board. *Note: Pin one goes toward the pin one / notch on the silkscreen. That is toward the left edge of the board as shown.*	

3.3.1 Picture of Finished DCSSRhc Board
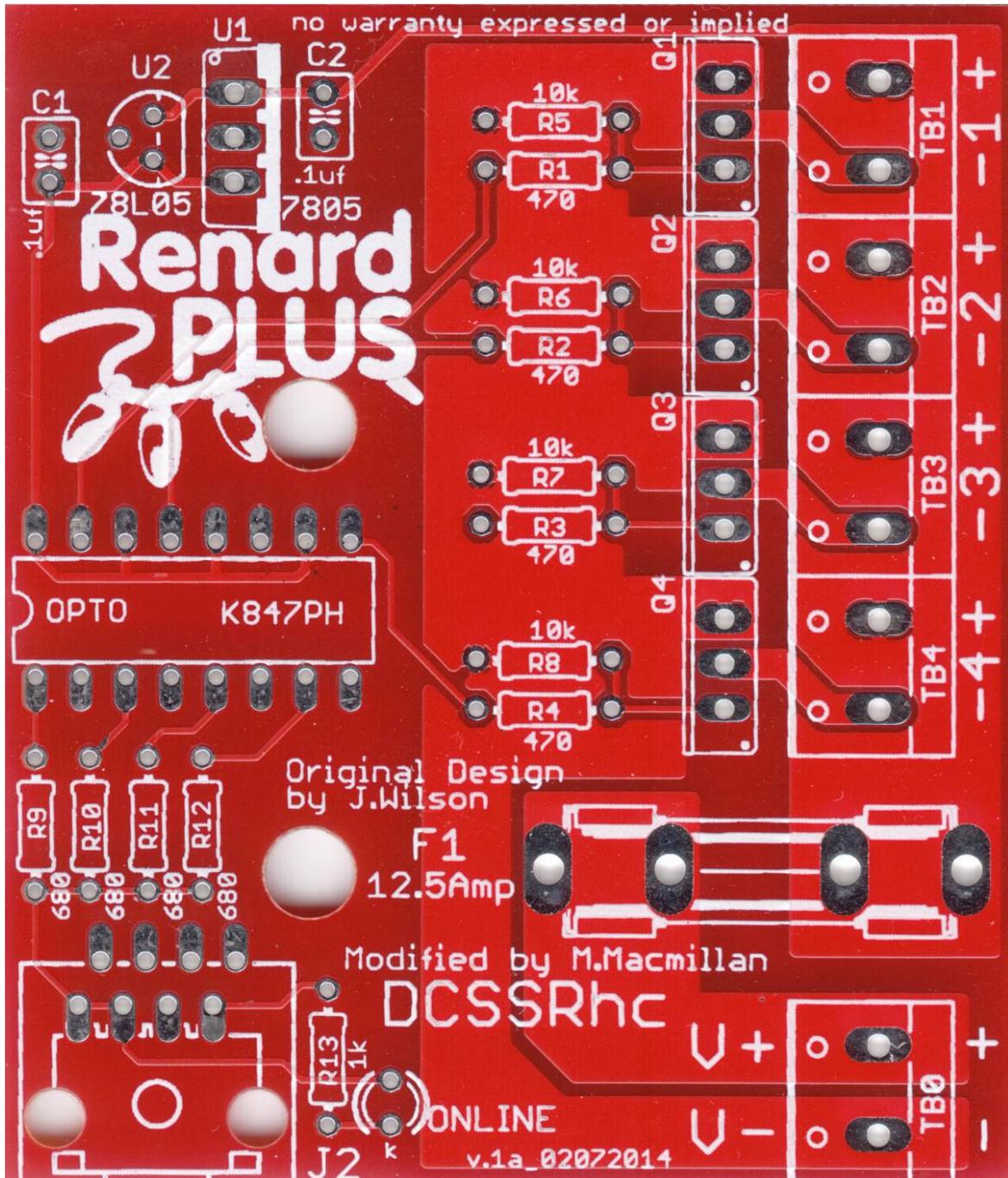
3.4 Connecting a Renard

A Renard light controller board will normally contain 2 RJ45 connectors that are used to receive data and pass data to the next controller. On controllers designed for SSR operation, there will also be RJ45 connectors to drive SSRs.

The data wiring of a Renard-Plus controller is the same as other Renard boards including the Renard SS series so you can follow the same cabling requirements.

3.4.1 RJ45 Wiring

A standard CAT5 (or better) RJ45 network cable can be used to connect the Renard controller to:

1. **SSRs (as is needed for the SSRs discussed in this document). The SSR will have either ONE RJ45 input per 4 channels (one RJ45 for a 4 channels like the DCSSRhc), or TWO RJ45 connectors (4 channels per connector for a total of 8 channels like on the SSR8) and those connect to the Renard controller outputs FOR SSRs.**

EIA-568B RJ45 Socket

2. Your PC RS485 or DMX adapter (for PC to controller).
3. Another Renard controller for daisy chain operation (controller to controller, NOT SSR!)
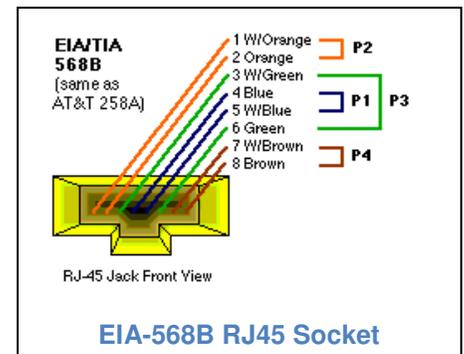
The cable must be a straight thru style and NOT a cross-over type cable. Just check and make sure that the pins on one end of the cable connect to the same pin on the other end of the cable (the wire colors in the connector are a way to tell- look for the same color pattern on both connectors).

The drawing 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.

3.4.2 Test Procedure

The data wiring of this board is the same as other Renard boards. Standard non-crossover CAT5 network cables can be used to connect to the SSRs, other controllers, and/or the PC. Connect your Renard Plus to your PC using a standard CAT5 cable from the controller RX jack to a RS485 connection on your PC. Attach at least one set of dimmable lights to the SSR. Program a Vixen sequence to turn on/off each of the channels on the controller and run it. We would suggest that each channel is turned on for 4 or 5 seconds.   Observe that the connected channel responds as programmed. Next, do a full load test by attaching lights to the rest of the SSR outputs and observe all lights are being controlled. Next, change the sequence from on/off to slow ramp up/downs to verify dimming.

Congratulations, with a successful test, you have completed your build of your Renard Plus controller/SSR and are ready for the wonderful world of light animation sequencing! Blink On!!

4. Notes

Use this page for YOUR notes about the boards.