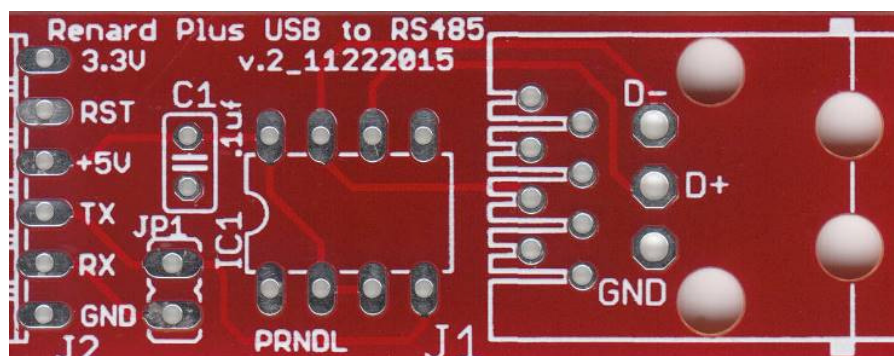




USB to RS485 Adapter



Dec 2015

Board Version 1 (v. 2_11222015)
Document Rev 1.0

Renard-Plus, Salem, Oregon 97302
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Published 2015. Printed in United States

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We wish to also thank the Do It Yourself Community for the inspiration it has given us in the development of this product.

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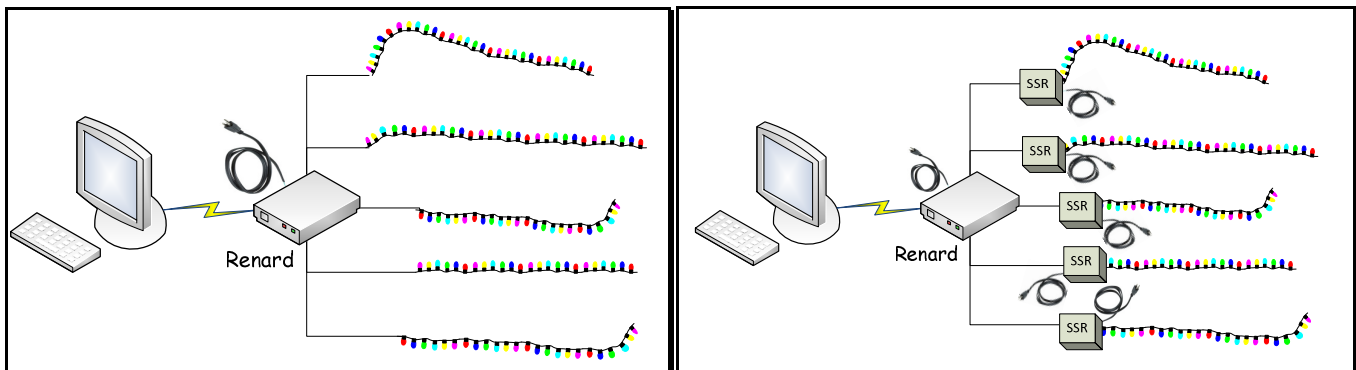
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1. Introduction to Renard

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](http://computerchristmas.com) '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 configurations

Output of the Renard can be control signals (to an SSR), direct AC line voltage (110, 100/220, or 220), DC voltage or a combination of these 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 ATX Adapter. 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 or www.renard-shop.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 USB to RS485 Adapter

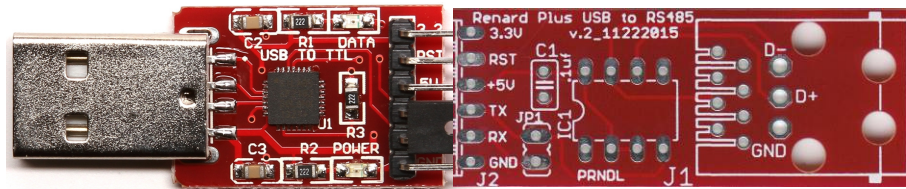
Renard Plus boards are flexible in their input configuration and can support a wide range of interconnect options including wired and wireless. For wired connections, the communications standard known as RS485 is used due to its long distance capability and robust noise immunity. However, there has been issues finding an affordable yet reliable interface to the show computer to connect to the Renard lighting control boards. Many USB to RS485 adapters are available, but not many properly implement RS485 signal protocol which can cause a variety of issues controlling the lighting controller.

To solve that issue, Renard Plus has developed the Renard Plus USB to RS484 adapter. It utilizes a commercially available USB to TTL serial adapter (based on the industry standard CP2102 chip) and a high quality TTL to RS485 line driver (the 65176) to provide an affordable,

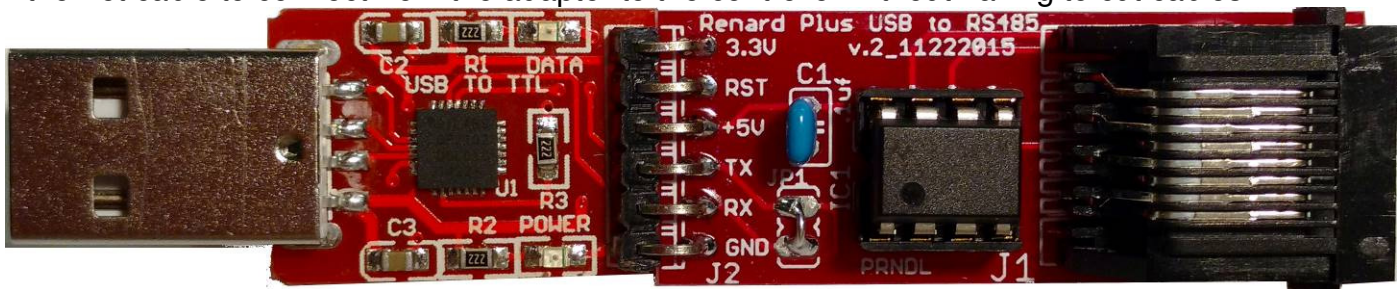


reliable and
PROPER

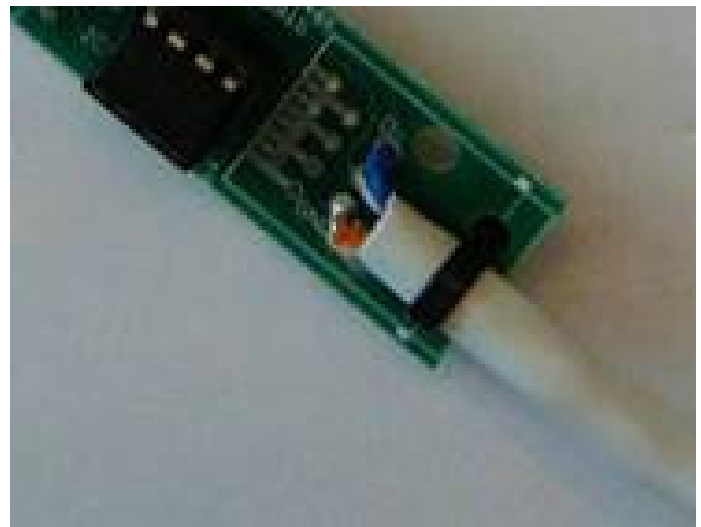
RS485 wired connection to your wired light controllers.



The output of the RP USB2RS485 can be a RJ45 connector allowing you to directly use a normal Ethernet cable to connect from the adapter to the controller without having to cut cables.



If you have an application where an RJ45 is not desired on the USB2RS485 adapter, the board provides a spot where wires can be soldered directly to the board and a zip-tie to secure the wire to the board. Details are provided in the Assembly section of this manual.



Feature		Detail
Name	Renard Plus USB to RS485 Adapter	
Target use	Computer to lighting control interface for RS485	
Channel Count	n/a	
Input	Standard USB 5v	
Output	RS485 Renard Protocol (DMX may be possible)	
Dimmable?	n/a	
Status Indicators?	YES – power/signal	
Channel Indicators?	n/a	
Control Input – Renard	n/a	
Control Input – DMX	n/a	
Daisy-chain output	Supported at the Renard controller.	
Wireless	No	
On board programming	n/a	
Enclosure	depends	
Heatsink?	n/a	
Distance?	Up to 2000 feet at typical baud rates	
Speed?	TESTED up to 460800 bps	

3. Assembly Instructions

This section covers the construction of the Renard Plus USB to RS485 Adapter 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 power supply when you are done. Additional information and guides on techniques and tools can be found in the “Tools and Parts ID Guide” at:





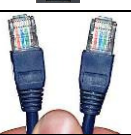





www.renard-plus.com/files/Tools_and_Parts_ID_Guide.pdf

3.1 BOM / Parts List

The following is the Bill Of Material for building this board. The link to the Mouser project is:

<http://www.mouser.com/ProjectManager/ProjectDetail.aspx?AccessID=051fa92bd8>

Note: If you did not obtain a complete parts kit, Mouser is the most convenient place to order your needed parts. However, Mouser is not always the most cost effective source for parts- you may want to check alternatives like Tayda Electronics, DealExtreme, EBay, or other sources for alternatives.

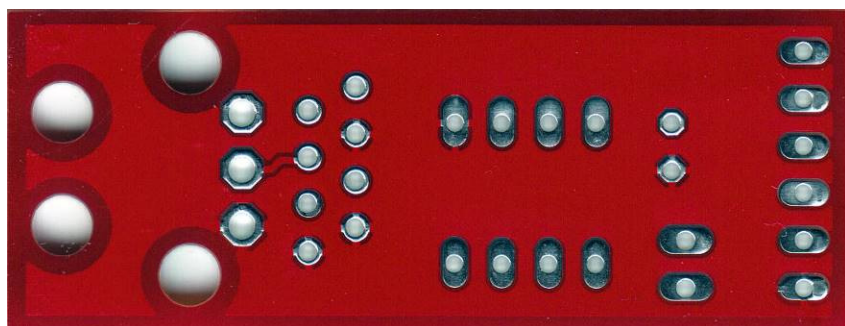
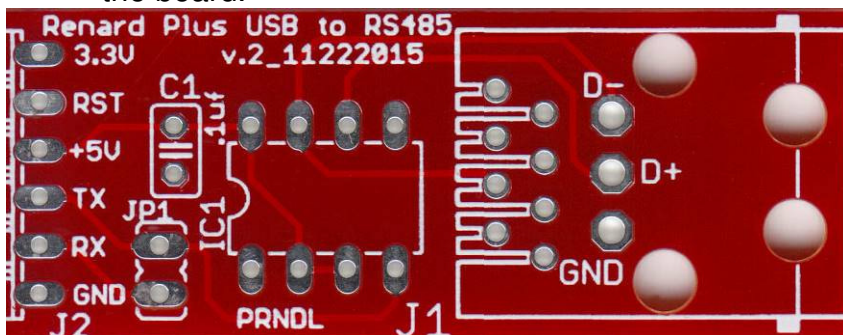
Picture	Description	ATX Adapter		Mouser P/N
		Qty	Location	
	100nf / .1uf cap	1	C1	81-RDER71H104K0S1C03
	8 pin DIP socket	1	IC1	517-4808-3004-CP
	SN65LBC176P	1	IC1	595-SN65LBC176P
	RJ45 side entry	1	J1	571-5520251-4
	(Optional) Ethernet Stub Cable	1	J1 (optional – included in kit)	<i>EBay, Aliexpress, etc.</i>
	USB to Serial TTL CP2102 Adapter	1	J2	<i>Aliexpress or EBay – Note: specific pinout of board is required to match the Renard Plus USB to RS485 adapter!</i>
	(Optional) 6 pin right angle Molex connector	1	J2 (optional – not in kit)	538-22-16-2061
	(Optional) 2.54mm 16 pin male header cut to fit JP1	1	JP1 (optional – not in kit)	571-16404526 http://www.taydaelectronics.com/connectors-sockets/pin-headers/40-pin-2-54-mm-single-row-pin-header-strip.html
	1” (25mm) wide Heat shrink tubing 2” long. If you plan to wrap the RJ45, then use 1.5” to 2” wide tubing and 2.75” long	1	Board assembly (optional – not in kit)	<i>EBay, Harbor Freight, etc.</i>
	(Optional) 3D printed case		(optional – not in kit)	http://www.thingiverse.com/thing:1106207

3.2 USB2RS485 Adapter

This board is a very simple device 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 PCBs 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](http://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.

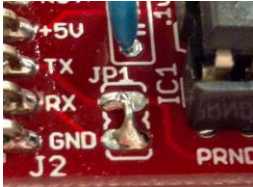
3.3 Assembly Guide

Generally, the following component assembly order is grouped from shortest to tallest parts to make assembly easier. Special instructions for component orientation should be listed if a component has any. Don't stress it- we try to make this as easy as possible!

3.3.1 Install Parts

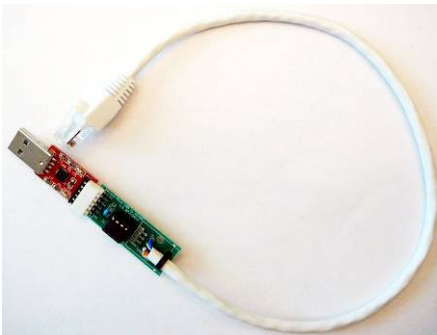
If a component has a required orientation, we will be sure to mention it in the Instructions section for the component. Things like resistors do not have a specific orientation and can be installed either direction. The VALUE is important and that is indicated by the colored strips or printed on it. Parts like LEDs, diodes, and electrolytic caps DO have a specific orientation and the Instructions will indicate so. See the Tools and Parts ID document on www.renard-plus.com for details.

Step	Instructions	ATX Adapter
1 <input type="checkbox"/>	Install the .1uf (usually marked 104) capacitors at locations C1. Solder and clip leads. <i>Note: Bypass caps do NOT have a specific orientation.</i>	
2 <input type="checkbox"/>	Install the 8 pin IC socket at location IC1. Solder <i>Pin 1 of the socket is closest to the notch</i>	
3a <input type="checkbox"/>	Install the RJ45 modular jacks at location J1 and J2. 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. <i>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.</i>	
-OR-		
3b <input type="checkbox"/>	Install the short one-ended Ethernet cable wire end onto J1 with the RS485 Data + attached to "D+", the RS485 Data - to "D-" and the ground to "GND" <i>Note: see details following this section in "Direct Wiring".</i>	

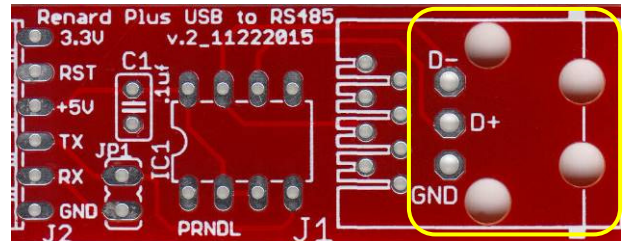
<p>4a <input type="checkbox"/></p> <p>-OR-</p>	<p>Remove the jumper from the pins of the USB to Serial TTL board (if installed), and install the pins onto J2 so that the pins stick through the holes about half their length and the two boards from a V with the components on both boards inside the V. Solder and trim the leads. Now carefully bend the two boards flat. The Renard board will be sitting slightly on top of the edge of the USB to Serial TTL board. Install in case or in heat shrink tube (not included).</p> <p><i>Note: See details following this section.</i></p>	
<p>4b <input type="checkbox"/></p> <p>Option</p>	<p>Install the optional 6 pin Molex (not included in kit- see Mouser link for availability) into J2. Insert pins of the USB to Serial TTL board into the connector. Install in case or in heat shrink tube (not included).</p>	
<p>5 <input type="checkbox"/></p>	<p>Bridge JP1 with a small length of wire and solder.</p> <p>Alternatively, you can install a two position Berg connector and reuse the jumper from the CP2102 that usually bridges the RX and TX pins of the USB adapter.</p> 	
<p>6 <input type="checkbox"/></p>	<p>Install 65LBC176P into socket at IC1.</p> <p>Note: IC's have a specific orientation, the dot on the top of the chip indicates pin 1 which goes near the "notch" indicated on the silkscreen on the board.</p>	

3.3.2 Direct Wiring Option

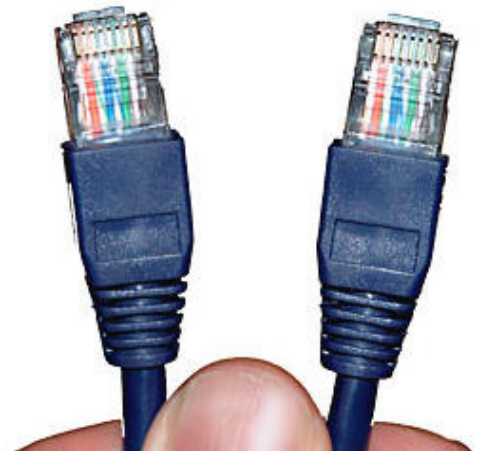
The board was designed to use an RJ45 connector to standard straight-thru Ethernet cable. However, in some cases, you might want a cable to come out directly. The kit normally includes a short Ethernet cable to allow you to setup your board this way.



The three pads at J1 (marked D-, D+, Gnd) are designed to allow you to wire your board this way if you decide. One of the keys to this step is identifying the proper wire colors to attach to which pad. Standard Ethernet



cables follow either EIA/TIA 568A or 568B wiring which determines what wire color goes where. Both wire orders are common, and some cables (called “crossover” cables actually have one of each style on the connector. What you need to do is hold the Ethernet cable near the connector(s) as shown to the right (connector end UP with the locking tab BEHIND). Observe the colors of the wires. See how in the example picture to the right, that the wire colors start with WHITE/ORANGE (white with orange stripe) and the next wire is ORANGE as the wires connected to pins 1 and 2 of the Ethernet connector. Note how this is the case on BOTH connectors in this example which means this is a “straight-thru” standard cable. This color pattern is EIA/TIA 568B wiring and in this case the wires on pin 1 and 2 are WHITE/ORANGE and ORANGE which are GND (ground) and are attached to the GND pad on the USB2RS485 board (bottom pad of the circled pads in the picture above).



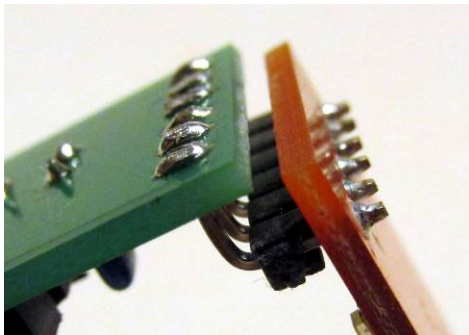
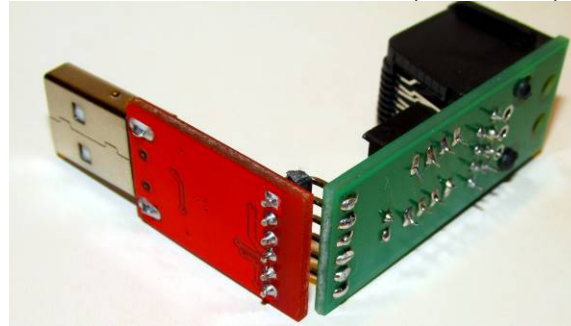
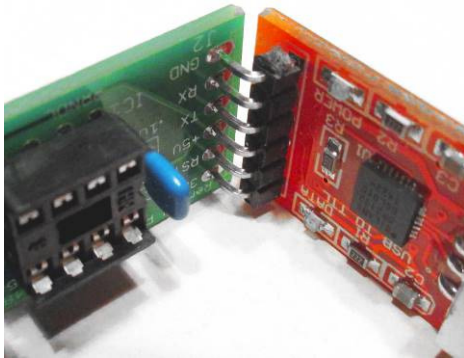
If those first two wires are WHITE/GREEN (white with green stripe) and GREEN on your cable, then those two wires would be the GND wires and you would use those to solder to the GND pads. The EIA/TIA 568A standard starts with the green wire pair.

Next count over from the left most pin on the connector and see that the wire there is BLUE and should be for either 568A or 568B. Pin 4 for Renard is D- and connects to the TOP pad of the circled pads above. The fifth (5th) wire should be WHITE/BLUE (white with a blue stripe) and that is soldered to the D+ pad (the middle one in the picture above). If you see different colors in your connector, you just need to use whichever wire is attached to 1 and 2 as GND, 4 as D- and 5 as D+ counting from left as shown in the cable picture.

This cable is ready to plug straight into a Renard light controller configured for RS485 operation.

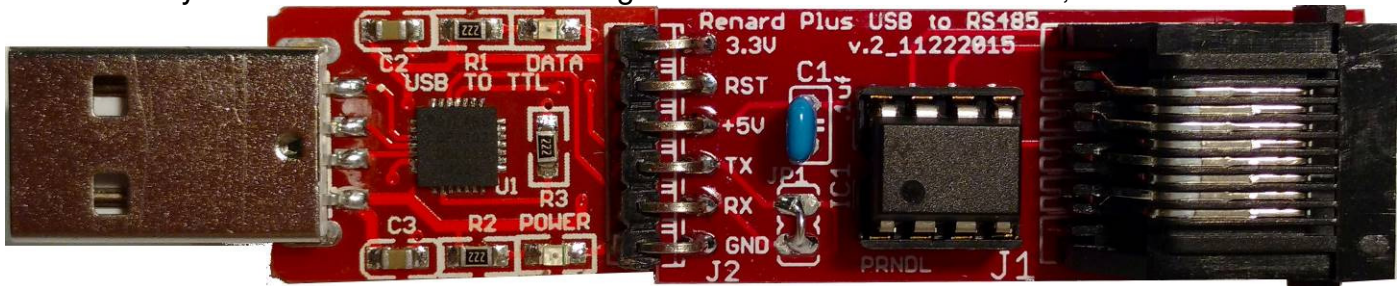
3.3.3 Attaching the boards: USB2RS485 to USB Serial TTL

Remove the jumper from the pins of the USB to Serial TTL board (CP2102) if installed, and install the pins from the CP2102 board onto J2 so that the pins stick through the holes a touch less than half their length and the two boards from a V with the components on both boards inside the V (as shown).



Once you are happy with the placement, solder and trim the leads at J2 as tight to the board as possible (as shown). You may want to solder the connection to J1 on the TOP side of the board as well so you can extremely trim the connector closely in the next step. If you soldered the top side, feel free to cut into the solder as closely to the board as possible. Normal diagonals will not trim as closely as you need, special lead trimmers are recommended if you have a set available.

Now carefully bend the two boards flat being careful not to break the board, or the connector.



The Renard board will be sitting slightly on top of the edge of the USB to Serial TTL board *as shown).

Note: USB Serial TTL board was inserted into the USB2RS485 board a little bit too much causing the slight "tweak" in the connector. This is OK as long as the boards are close together for strength.

3.3.4 Initial Testing

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 or cold solder joints. What you are looking for are any solder bridges especially around the connectors and other closely spaced parts, or pins that are not fully and cleanly soldered. Look carefully for solder connections that did not flow to the pad properly- connections should be smooth and even, not “blobby”.

There is no additional testing that can be done besides just sort of giving it a try. Check out the next chapter “Final Steps” for additional details:

- Plug the USB connector into a PC and assure you get “happy beeps” of a USB recognition.
- Check the Control Panel / Device Manager to see if you have a new serial port.
- Attach to a Renard board via Ethernet cable
- Run your Light Animation package setting up to use the serial port discovered in the Device Manager check.
- Run a test sequence.

3.3.5 Troubleshooting

Things aren't working- what can you do?

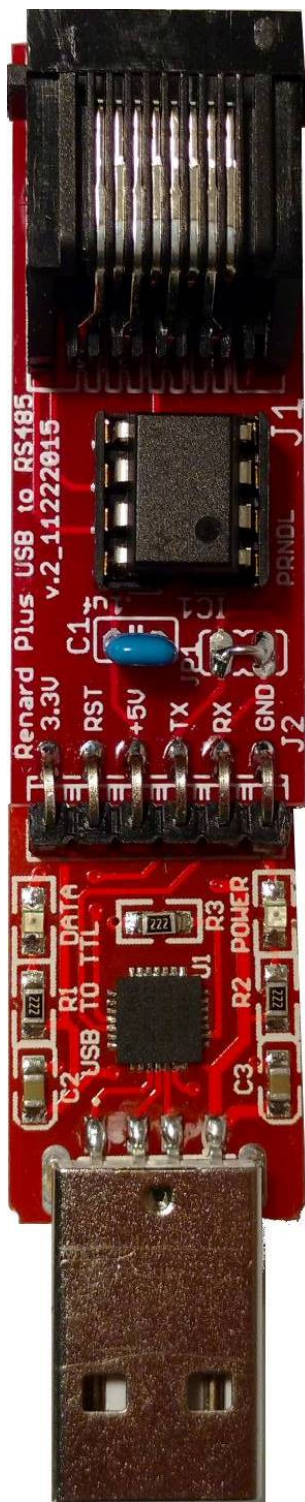
No New serial port after plugging in:

- If you see a USB device with a yellow exclamation mark in Device Manager, this usually indicates you need to provide drivers for the CP2102 that can be found here:
www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx
- This could also indicate the USB Serial TTL adapter is blown.

Serial port is recognized but no data gets out to the light controller:

- 65LBC176P installed backwards or with a pin bent under.
 - o If the 65LBC176P is powered backwards, it can destroy the part. It won't hurt to put it in the correct way and try it, but don't hold your breath- you may need to obtain a replacement.
 - o If a pin is bent under and powered, it usually will not hurt the chip. Straighten the pin and try again.
- Bad Ethernet cable
 - o Try a different cable
- You hard wired the short cable to the board and no data getting out.
 - o Double check you wired the right wires in the cable as described in a previous section. There are differently wired cables used on the market but you need to either look at the colors of the attached wires, OR “ohm out” which wire attaches to which pin on the connector with you multi-meter OHM or BEEP function.
 - o Make sure D+ and D- are not reversed.
- Configuration in your animation software is wrong.
 - o Check you configured the correct COM port (found in your Device Manager or equivalent).
 - o Check you enabled the correct data output (Renard is the typical output).
 - o Make sure your COM port baud rate matches the baud rate set in the firmware of your controller. Typical is 576000 but other rates are possible. Make them match and try again.

3.3.6 Picture of Finished Board (recommended configuration)

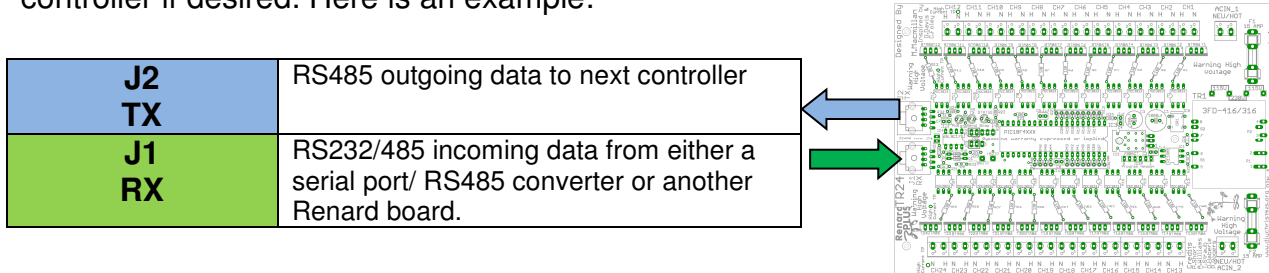


4. Final Steps

At this point you will have now completed the installation of all of the parts to the controller. Again, 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.

4.1 Connecting the Renard to your PC

This board contains 1 RJ45 connector (typical configuration) that used to transmit RS485 to the controller. Most Renard controllers such as those from Renard Plus will normally have TWO RJ45's, one an input from the RP USB2RS485 board and the other to daisy-chain to another controller if desired. Here is an example:



The data wiring of Renard Plus controllers following the wiring established by the original Renard design including the Renard SS series boards so you can follow the same cabling requirements between other Renards and Renard Plus boards as follows:

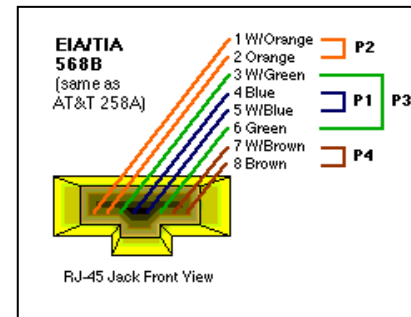
4.1.1 RJ45 Wiring

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

1. Your PC RS485 adapter
2. Another Renard for daisy chain operation or
3. SSRs if your board requires the use of SSRs (TR24 does not).

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 diagram 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.



4.1.1 DMX wiring

If you are using Renard Plus DMX firmware on your board, and will be using a “standard” DMX source, you may need to create a special interconnect cable, or adapter to get the DMX data into the correct pins on your Renard Plus. DMX adapters with an RJ45 output typically have data on pins 1(data+) & 2(data-) with GND on 7 or 8 of the connector, and Renards have data on pins 4 (data-) & 5 (data+) with GND on pins 1 & 2. DMX configurations will vary so check carefully!

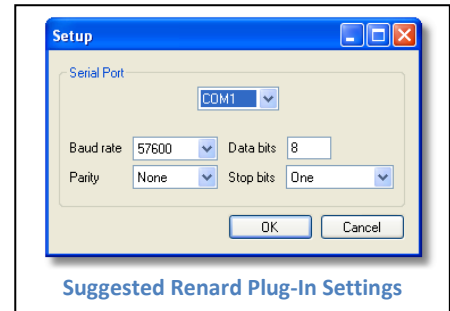
Signal	Renard RJ45	DMX RJ45
Data +	5	1
Data -	4	2
GND	1	8
GND	2	7

4.1.2 Computer Setup

If you are using the Vixen sequencing software to drive your Renard Plus, it will require either one of the following plugins:

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

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



4.1.3 Test Procedure

The data wiring of this board is the same as other Renard boards. Standard Ethernet non-crossover CAT5 network cables can be used to connect the USB2RS485 to controllers. Connect your Renard Plus to your PC using a standard CAT5 cable from the controller RX jack to the USB2RS485 connection installed on your PC. Attach one set of dimmable lights. 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 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 board and are ready for the wonderful world of light animation sequencing!