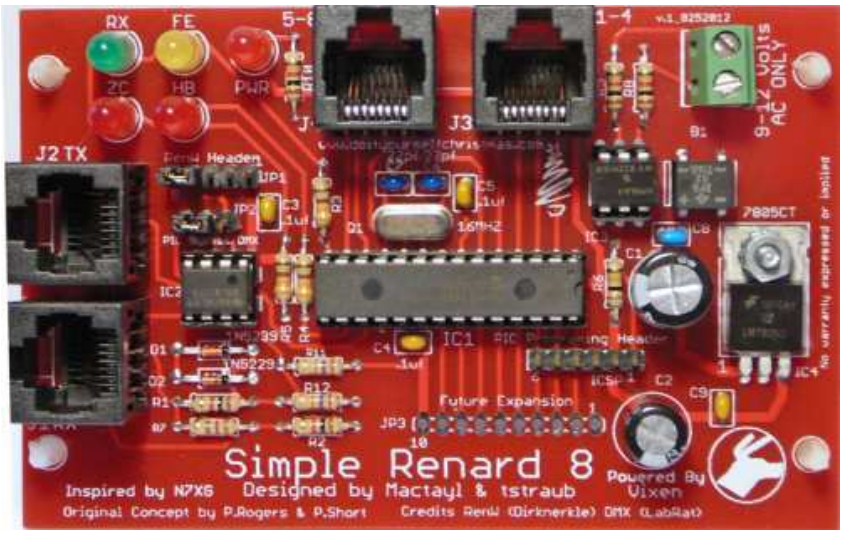
Renard Plus

Simple Renard
8 Channel Controller



January 2013

Version 1.00 Board

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Overview

Renard is the name of a computer-controlled, PIC-based dimmer scheme, and also refers to dimming controllers that people have built based on this scheme. The designs all use mid-range PIC micro-controllers, are generally modular in units of eight channels (dimmable circuits), and use medium-speed, daisy-chainable, one-direction serial communications for input. Renard controllers do not have stand-alone show sequencing capabilities, and rely on a separate computer (usually a PC) to send it real-time sequences of dimmer commands.

This design was originally described in the Simple PIC-Based 8-Port Dimmer 'How-To' on the http://computerchristmas.com website in a generic form. Since then various people have designed and built controllers based on this hardware, and there are likely to be coop buys of one or more of these designs. Renard is strictly a DIY, hobbyist effort at this time, with no commercial products available (either software or hardware).

Construction

This section covers the construction Simple RenardTR16 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 you will have a working controller..

Basic Tools

To build this board requires a few basic electronic hand tools. The tools listed below are recommended for anyone building these types of DIY boards.

Soldering Iron

The first is a suitable soldering iron. Anything between 25 and 40 watts is useable, with at least a 1/16-inch wide chisel tip. However, tips that are closer to 1/8-inch will provide better heating of the joint being soldered. While a temperature controlled soldering station is very nice, one can get by nicely with a much more modest solder iron setup. The iron shown in figure 1 is an inexpensive, adjustable 25-40 watt unit, and quite suitable for constructing this type of kit.


Figure 1: Soldering Iron

If you have never soldered any electronic parts, a little practice before starting on your kit might be in order. Go to your local Radio Shack, or other parts store, and buy a few small resistors and capacitors. If they have any sort of perforated PC board material available, get some of that too. You can practice putting the parts through the holes, bending the leads slightly, and soldering them in. Do not clip off the leads; the parts can be unsoldered and reused for more practice. If you can't find any perforated PC board material, buy a piece of blank PC board material, and drill several holes in it spaced the lead width of the parts you have available, and use that for practice. Another approach might be to take apart an old wireless telephone and remove the existing parts by heating the PC board with a small torch and rapping it on a solid surface to knock them out. Wear eye protection when using this method for parts removal!

Another alternative is the **Elenco Practical Soldering Project Kit** This kit can be purchased from Amazon for less than 10 dollars and has a well written set of instructions on learning to solder.
Soldering a part requires placing the tip of the soldering iron against the component lead and the PC board surface, heating it for a few seconds, and then adding a little bit of solder. If the joint is hot, the solder will flow quickly. Once the solder has flowed, remove the soldering iron and the solder, and let the joint cool. If the job was done correctly, the solder will have flowed smoothly, and the joint will look shiny. Later in this article are many examples of correctly soldered joints.

Solder

Solder plays a key role in electronics construction. The right kind will work well, and is easy to use. The wrong kind can be hellish! A suitable solder for electronics work will contain approximately 37% tin, and 63% lead. Anything around those two values, with a rosin flux core is suitable. Do not use "no lead" solders intended for plumbing; they will not work well. Nor will solders with acid flux cores. Also, stay away from solders with water-soluble (organic) fluxes. While they seem to work well while building, failure to remove all of the flux later will lead to corrosion where the flux remains. This is also true of any acid flux core solders.

The best solders also contain about 2% silver. This improves conductivity of the joint, and keeps it bright looking. Figure 2 shows a small roll of solder containing 2% silver, and readily

available from Radio Shack. Kester also makes a similar product that is available from Mouser and DigiKey.

Figure 2 - Solder available from Radio Shack

Side Cutters (also called Diagonal cutters or “dikes”)

The other basic tool that one needs, especially when soldering a PC board, is a pair of side cutters. A favorite is shown in figure 3. These are made by Xcelite, and are available from Mouser, DigiKey, and others supply sources. These cutters are used to clip off the excess lead length of parts soldered into the PC board.

Figure 3 - Side cutters are very useful in clipping off excess lead length

Third Hand Apparatus

Another tool that is very handy to have, but not a necessity, is a "third hand" apparatus of some kind. A commercial version is shown in figure 4. One of these will hold the PC board while parts are being soldered, or hold parts while leads are being attached. One could make the equivalent of this unit with a pair of "pincher" clothespins, a small block of wood, and a bit of fabricating.

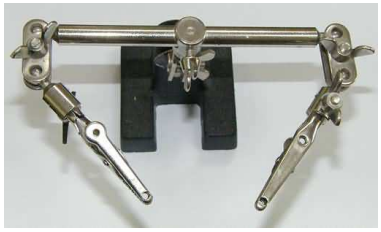


Figure 4: "Third Hand" holds PC board during assembly

Solder Braid

Solder Braid or solder wick is good to have on hand for those occasional mistakes. It is made of a braided copper wire that is impregnated with a rosin flux. If you bridge two solder points when soldering the PCB this can remove the excess solder. This is available Radio Shack, Mouser, DigiKey, and others supply sources

Figure 1 Solder Braid

Needle Nose Pliers

Although though not as vital as the above component, needle nose pliers will be invaluable in forming component leads and in helping straighten bent pins on ICs, This is available Radio Shack, Mouser, DigiKey, and others supply sources.

Figure 6 Needle Nose Pliers

Solder Iron Tip Cleaner

A clean solder iron tip is essential to good solder joints. The tip must be kept clean to ensure the best heat transfer between the iron the part and the solder. The dirt build up on a soldering iron is mostly due to rosin residue. The traditional method of cleaning the tip is with a damp sponge. This will clean off burnt rosin residue on the tip of the iron but will eventually lead to the tip corroding. The item pictured below is a much better method of cleaning the iron and doesn't require any water. Just plunge the tip into the metal mesh and withdraw it and the tip will be clean. This particular cleaner is available from Amazon for about 10 dollars and is well worth the investment.

Figure 7 Hakko Tip Cleaner

Digital Volt Meter (DVM)

This device is used as a diagnostic tool and can be used to troubleshoot as well as test for proper operation. You will need this item when powering the board up for the first time. There will be further instructions later in this manual.

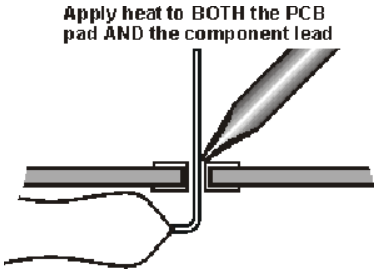
Digital Volt Meter (DVM)

PIC Programmer

The PIC chip on the PCB is used to control all the functions to create blinky flashy. When you order the part from the supplier (Typically Mouser) it will come in un-programmed. You will need a PIC programmer and the software for the board. There are several manufactures out there supplying PIC programmers. The one shown below is made by the original designer of the PIC chip, Microchip. The programming instructions are included later in this manual.

Soldering

Proper positioning of the soldering iron tip and solder are essential in obtaining a well-made soldered joint. The tip must be in contact with both the lead to be soldered and the PC board pad.



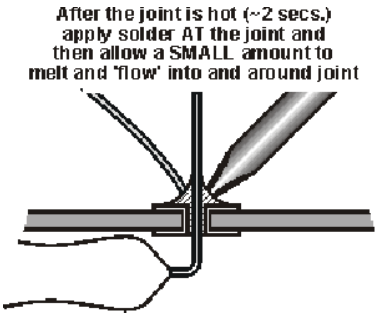
Important!

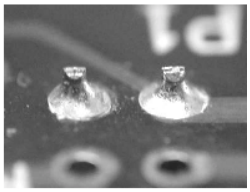
A clean soldering iron tip is essential to heat transfer.

Be aware that it is possible to damage the board and the component if they are heated for too long.

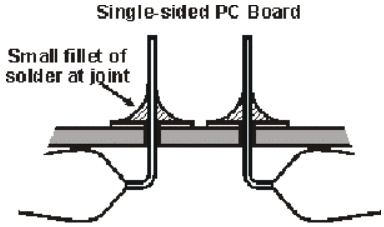
Once the tip has heated the pad and lead apply solder to the **OPPOSITE** side of the joint. The solder should flow evenly around the pad and the lead. Remove the solder iron and give the joint a minute to cool.

DO NOT blow on the joint or move the component as this can cause a poor solder joint (called a cold solder joint). A cold solder joint will not conduct electricity properly and will cause problems during operation.

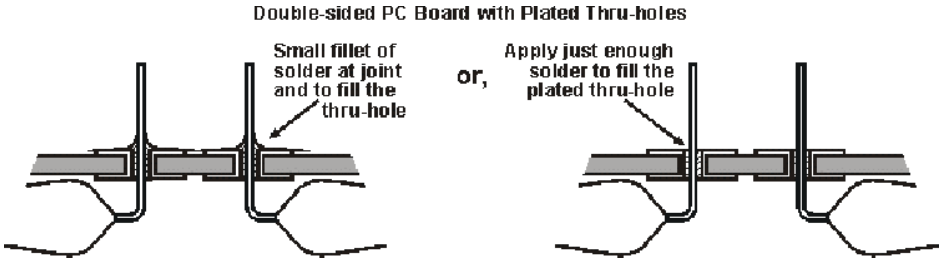




This shows a well-made connection to a single-sided PC board. A small amount of solder has been melted by the heat from the component lead and the PC board pad. A small additional amount of solder has been added to the joint to form a small rising *fillet* around the lead



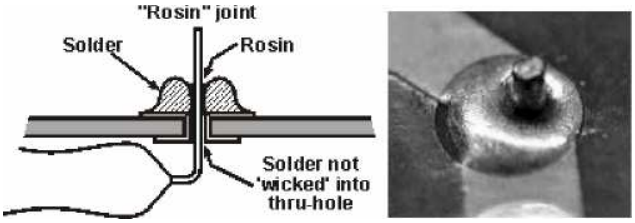
If the PC board was of the plated-thru hole type, capillary action of the lead in the *plated-through hole* has drawn the solder down into the hole. (**left**)



Note that some soldering requirements may dictate that *no fillet* be created when soldering to plated-thru holes. (**right**) In this instance, apply only enough solder to *fill* the plated thru hole. Use of .020" diameter solder greatly enhances your ability to perform this operation. Use of .03" or larger diameter solders will generally cause more solder than required to be applied the instant the solder is applied to the joint.

When soldering plated-thru holed which are to only be filled, apply a small amount of solder and allow your iron to remain a short while longer. This will ensure that the solder is 'wicked' down into the hole. You will be able to *see* the solder as it flows into the hole.

These figures show what can happen if the component lead is not heated along with the PC board pad. A rosin joint will result. The solder flows onto the PC board pad, but since the component lead is not hot enough to melt solder, rosin accumulates around the wire. The solder then forms around the rosin coating on the component lead, and there is no connection. Generally, joints of this type can be corrected by reheating the joint.



Similarly, a poor joint will result if you do not properly strip and tin the enameled wire leads of inductors *before* the lead is inserted into the PC board for soldering. Enamel coating allowed to remain on the inductor lead can create a joint similar to the rosin joint, preventing the lead from being adequately heated by the soldering iron. Such a joint *cannot* normally be restored by reheating. Remove the lead from the PC board, strip it of all enamel and tin it. Then resolder the joint.

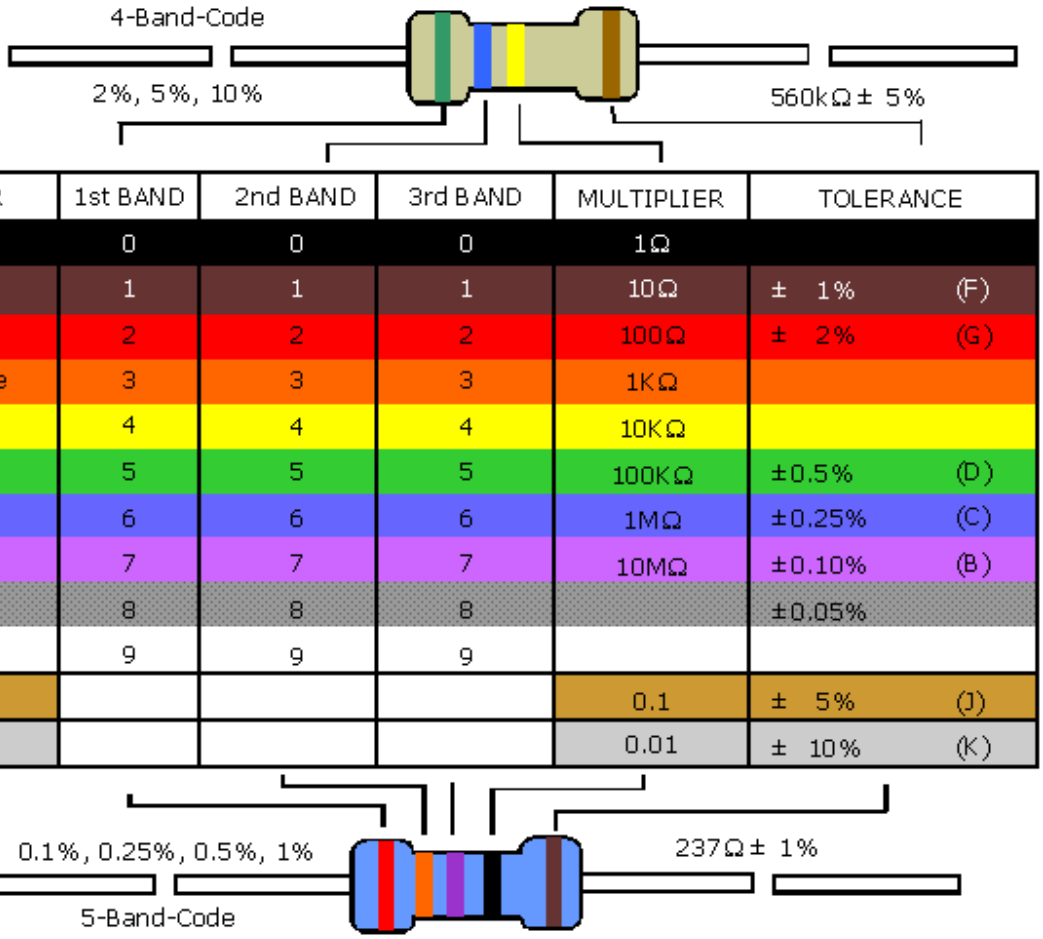
Identifying Components Used in Construction

There are many different types of components used in construction of this board. Below is a list of the types of components and how to identify them.

Resistors

Resistors are small tubular shaped components with wire leads coming out each end. Resistors will have different values depending on where they are used in the circuit. The values are defined by a color code marked on the resistors. The table below can be used as a reference to determine the resistor value.

Resistor Color Code



COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

Capacitors

Capacitors come in various forms and makes. The ones in this kit include electrolytic and MLCC (multilayer ceramic capacitor. These are radial style which means both leads come out the same end of the component.

The electrolytic caps are polarized, which means that have to be installed in the correct orientation. The side of the cap will have a minus sign and must be installed in the board with the unmarked side in the hole with the plus indication on the board. The cap will be labeled with the value and voltage rating.

Electrolytic Capacitor

The MLCC caps will simply have a number on it. For example 102 this stands for a 1000pf capacitor. The 10 is the first 2 numbers of the value and the 2 represents the number of following zeros. Thus 10 with 2 zeros equals 1000.

Radial MLCC Capacitor (value 47000pf)

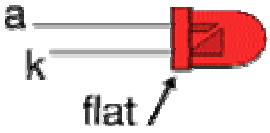
Diodes

Both conventional diodes and light emitting diodes are used in this project.

Conventional diodes are similar in shape to resistors small tubular shaped components with wire leads coming out each end. Diodes are polarized and must be installed in the correct direction. The diode will have a stripe on one end and this must be oriented to the stripe on the printed circuit board. Failure todo so will damage the diode and possibly other components when power is applied.

Conventional Diode

Light Emitting Diodes or LEDs are diodes that emit light. These diodes are typically radial in design and look like small light bulbs. As with all diodes LEDs must be oriented properly. Typically the diode will have a flat side cut into the plastic bulb indicating its polarity. This flat will be indicated on the PCB.

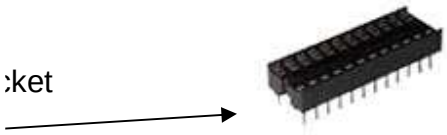


Light Emitting Diode

Integrated Circuits

There are several different types of ICs used in this project. ICs also require proper orientation when installing them on the PCB. They are usually marked with either a notch or a dot at the end nearest pin one. In addition to orientation it is important to remember that ICs are sensitive to heat and are easily damaged. Limiting the the time your soldering iron is used to solder the connections reduces the likelihood that the part will be damaged. In this kit it is recommended that sockets be used for the ICs so they can be easily replaced in the event of a failure.

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



8 Pin IC (Note notch on left side of chip indicating the end with pin one.)

Assembly

The Simple renard 8is a simple device to assemble and test. It is easiest if you build the units by inserting the various components from smallest to tallest .

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.

Install the resistors

☐ Install the 1K (brown-black-red) ohm resistors at locations R1, R2, R8, R9, R10. The resistor are not polarized, so they can go either way.

☐ Install the 330 (orange-orange-brown) ohm resistors at locations R3, R4, R5. The resistor are not polarized, so they can go either way.

☐ Install the 10K (brown-black-orange) ohm resistor at location R6. The resistor is not polarized, so it can go either way.

☐ Install the 120 (brown-red-brown) ohm resistor at location R7. The resistor is not polarized, so it can go either way.

☐ Install the 27K (red-violet-orenge) ohm resistors at locations R11, R12. The resistor are not polarized, so they can go either way.

Install the diodes

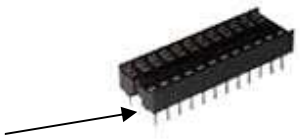
☐ Install the 1N5239 diode at location D1. The diode is polarized and it can only go one way. The end with the band (cathode) goes towards the left side of the board.

☐ 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.

Install the IC sockets

Even though these parts are optional we strongly recommend that sockets be used on all of the IC's. Pin 1 of the IC aligns to the square solder pad on the PCB.

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



☐ Install the 6 pin socket at location IC3. The notch on the socket should face the right side of the board, matching the silkscreen image.

☐ Install the 8 pin socket at location IC2. The notch on the socket should face the right side of the board, matching the silkscreen image.

☐ Install the 28 pin socket at location IC1. The notch on the socket should face the right side of the board, matching the silkscreen image.

Install the bridge rectifier at location BR1. The bridge rectified is polarized and it can only go one way. The side with the "+" and the "-" goes towards the bottom of the board and the side with the 2 "~" go towards teh top side of the board.

Install the capacitors

☐ Install the 470uf Electrolytic Capacitors at locations C1. The capacitor 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.

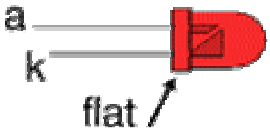
☐ Install the 220uf Electrolytic Capacitors at locations C2. The capacitor is polarized. Be sure that the (+) lead is installed in the hole marked with a "+"

symbol. The (+) lead is usually longer than the (-) lead, and the (-) lead is identified by a black stripe on the capacitor.

☐ Install the 0.1uf Ceramic Capacitors at locations C3, C4, C5, C8, C9. The capacitors are not polarized, so they can go either way.

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:



☐ 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.

☐ Install the Yellow LED at the location marked Status. 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.

☐ Install the Green LED at the location marked RX/TX. 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.

Install Misc. Parts (group 1)

You may have purchased either a single 16 pin header or headers cut accord to the board specifications

☐ Install the 5 pin header at location JP1 (RENW header). The short side of the header strip goes into the board.

☐ Install the 3 pin header at location JP2 (PIC bypass). The short side of the header strip goes into the board.

☐ Install the 6 pin header at location JP3 ICSP (PIC programming header). The short side of the header strip goes into the board.

☐ Install the 5v linear regulator at location IC4. The voltage regulator is polarized and goes only one way. Gently bend the leads of the regulator at the location on the leads where it changes size down at a 90 degree angle towards the flat side of the regulator. Apply thermal grease to the flat heat sink side of the regulator and fasten it to the pcb using a #4 screw and nut.

☐ Install the RJ45 jacks at locations J1-J4. Gently align the eight wires with the matching holes and snap the connector to the board. Solder the connector to the circuit board being careful to not short out the connectors.

☐ Install the 2 terminal strip1 at locations P1. The side where the wires enter under the screw should face the top of the board.

Install the jumper shunts:

☐ Install the shunts on the headers according to the Header Settings listed below.

Initial Testing / Final Assembly

The first thing you will want to do in any PCB construction project is to double check that you have all components installed and in the proper orientation. You will then want to inspect the board for any cold/bridged solder joints. Take your time with this step and go over each and every joint.

If you have any of the IC's (IC1, IC2, IC3) installed – remove them now.

Connect your 9-12 vac power supply to the P1 terminal strip. It supplies power to controller portion of the board as well as outputs 1-32.

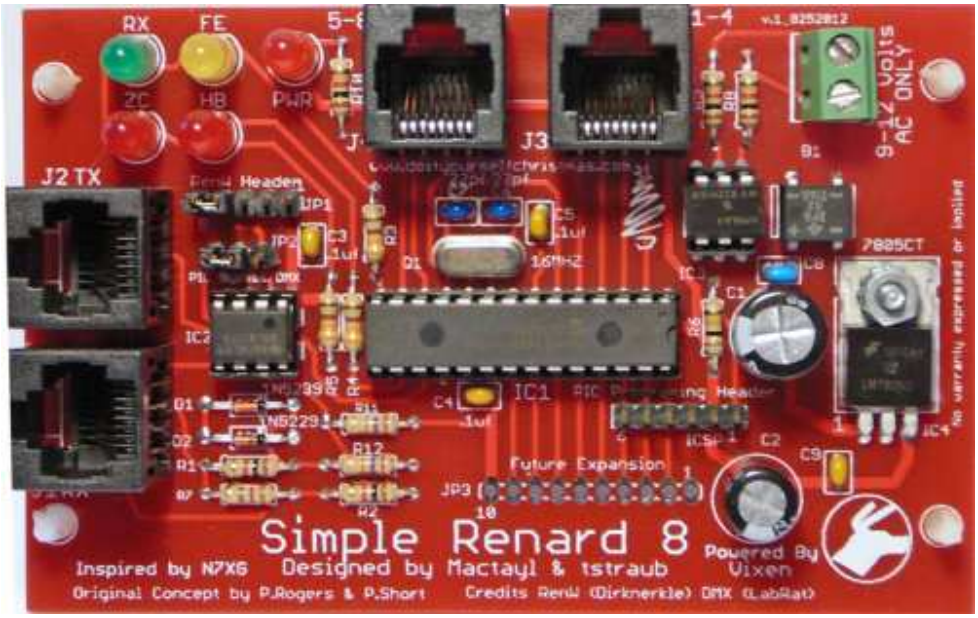
Turn on the supply and verify the power LED lights up. Verify you have 5v between pins 11 and 12 on the PIC socket as well as between pins 1 and 4 on the 485 chip socket. Install all of the IC's if this passes.

Install the ICs:

- ☐ Install the PIC18F2525 in the 28 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.

- ☐ Install the SN65LBC179P in the 8 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.

- ☐ Install the H11AA1 in the 6 pin socket at location IC3. The IC is polarized. Gently install the IC so that the notch faces towards the right matching the socket and the silkscreen.



Congratulations! That completes the construction of the Simple renard 8!

At this point you will have now completed the installation of all of the parts to the controller. Before you go ahead and insert the IC's into their sockets, we suggest you 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. We would also recommend cleaning the copper side (bottom) of the PCB with a quality board cleaner to remove and resin residue after soldering.

Programming the PIC18F2525

The Simple Renard 8 does not use the default Renard firmware used on other Renard devices. You must program the Simple Renard 8 with the special firmware listed below. You can plug your PICKIT programmer directly on the ICSP header making sure to align Pin1 on the ICSP header with Pin 1 of the PICKIT.

Jumper Settings / Headers

JP1 XBee Header

This header is used to connect a XBee Wireless module directly to the Simple Renard 8. If you are not using a XBee Wireless module, the default jumper position is a jumper across pins 4/5.

Pin Layout
1 = +5VDC
2 = N/C
3 = GND
4 = RX from 485 chip
5 = RX in to PIC

JP2 PIC Bypass

If you are using Start Address Programming, you can use the PIC bypass to allow the data to flow thru the Simple Renard 8 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 Simple Renard 8. 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

JP3 RS485 Terminator

ICSP

This header allows the PIC to be programmed or reprogrammed while still plugged into the circuit board. To use the ICSP header plug your PICKIT programmer directly onto the header, making note to align pin 1 of the header with pin1 of the PICKIT.

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

Final Testing

The Simple Renard 8 has 3 diagnostic LED status lights:

Diagnostic LED Status Lights

 RX	**RX/TX** – Active when sequence is running
FE	**Status** – Will blink every few seconds to indicate the microprocessor is active
 PWR	**Power** - Will be on when power is applied

The design is fairly straight-forward and as long as you are sure of the voltage inputs and the PIC is flashed properly you should not have any issues if your soldering is good.

The data wiring of the Simple Renard 8 is the same as other Renard boards including the Renard SS series so you can follow the cabling requirements for that.

Connect the Simple Renard 8 to your PC using standard wiring practices listed below for other Renard controllers. Develop a Vixen sequence to turn on/off each channel in groups of four using the appropriate Renard plug-in. Channels 1, 5, 9, etc should have the same programming but only have 1 channel in the group (1,2,3,4) on at a time. This helps ensure you have unique channel addressing from each RJ45 output.

Connect a SSR board to each of the channels J3-J4 using CAT5 cable and connect lights to the SSR boards. Once that is complete you change the on/off to ramp up/downs to verify dimming operation.

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

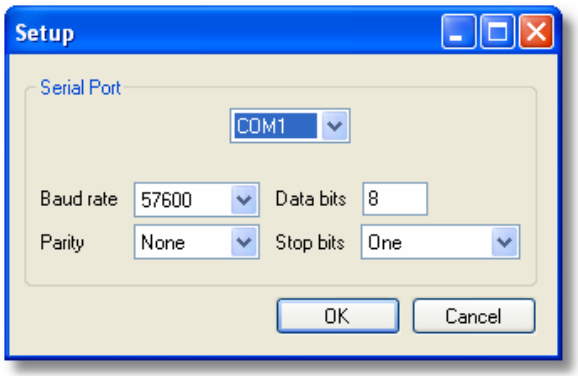
There are many options to connect your computer to the Simple Renard 32. Below is a picture of the Hexim HXSP-2018F USB to RS485 adapter:

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

Computer Setup

VIXEN Settings the Simple Renard 32 Combo requires the Renard Dimmer [Vixen 1.1.*] or Renard Dimmer (modified) [Vixen 2.*] Plug-In.

Renard Dimmer Plug-In Settings:

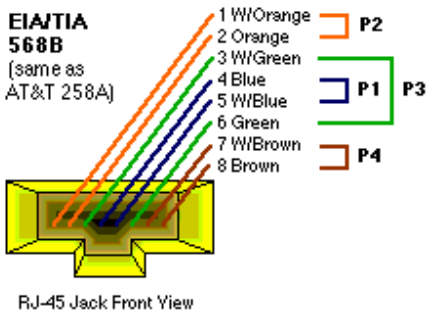


If you are using Xbees the baud rate must be 57600.

RJ45 Wiring

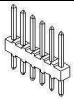
A standard RJ 45 networking cable can be used to connect the Renard to your SSRs. Just check and make sure that the pins on one end of the cable connect to the same pin on the other end of the cable.

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

Simple Renard 32 Parts List

Picture	Designators	Description	Qty	Mouser P/N
	R1, R2, R8, R9, R10	1k ohm resistor ¼ watt	5	291-1k-RC
	R3, R4, R5	330 ohm resistor 1/4 watt	3	291-330-RC
	R6	10k ohm resistor 1/4 watt	1	291-10k-RC
	R7	120 ohm resistor 1/4 watt	1	291-120-RC
	R11, R12	27k ohm resistor 1/4 watt	2	291-27k-RC
	D1	1N5239 (9.1v) zener diode	1	78-1N5239B
	D2	1N5229 (4.3v) zener diode	1	78-1N5229B
	C1	470uf 25V Electrolytic Cap	1	647-UVZ1E471MPD
	C2	220uf 25V Electrolytic Cap	1	647-UVZ1E221MPD
	C3, C4, C5, C8, C9	.1uf cap	5	81-RPEF51104Z2S2A03A
	P1	Tyco Terminal Block vertical	1	571-7969492
	J1-J1-	Modular Jacks 8 PCB TOP ENTRY	4	571-5556416-1
		IC Sockets 6P ECONOMY TIN (Optional)	1	571-1-390261-1
		8 pin IC socket (optional)	1	517-4808-3004-CP
	IC1	IC & Component Sockets 28P	1	571-1-390261-9
		16 pin header cut to fit: ICSP, JP2 PIC Bypass, JP1 RenW, JP3 RS485 term.	1	571-16404526
		Shunts for XBheader and Bypass	3	737-MSC-G

	IC4	LM7805CT voltage regulator	1	512-LM7805CT
	IC2	65LBC179	1	595-SN65LBC179P
	IC3	H11AA1	1	782-H11AA1
	BR1	BR1 4 pin Bridge rectifier 1amp dip	1	625-DF02MA-E3
	IC1	PIC Microcontrollers (MCU) PIC18F4520 or 4620 and 4525	1	579-PIC18F4520-I/P
	Status	yellow 5 MM LED	1	78-TLHY5405
	Power	Red 5 MM LED	3	78-TLHR5401
	RX/TX	Green 5 MM LED	1	78-TLHG5401

Optional Parts

Picture	Designators	Description	Qty	Mouser P/N
	C6, C7	22 pf capacitor	2	581-SA102A220JAR
	Q1	16mhz Oscillator	1	520-160-18-4XEN

Parts Placement Diagram