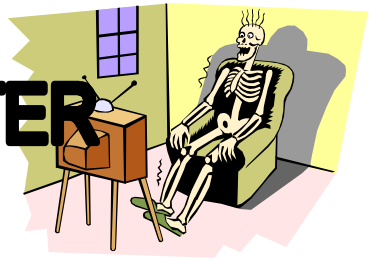
WIRELESS REMOTE REPEATER RECEIVER



Ramsey Electronics Model No. RRW1B

Have you ever been frustrated with the range of your remote controls? Tired of having to bounce your IR remote off of ceilings and walls? Do you want to run your system from another room or floor? Here is the answer to your prayers! Extend the range of your remote controls through walls, around corners, and even from outdoors!

- **The separate IR Receiver module (RRW1A) with sensitive element can receive your remote control's signal up to 36 feet away before re-broadcasting it wirelessly!**
- **The receiver (RRW1B) reconstitutes the radio signal using a PIC micro-controller to restore noisy or weak signals and then re-broadcasts the IR remote's signal to your components via a wired high-efficiency IR LED.**
- **Extend the range of your remote control to greater than 100 feet wirelessly beyond the receive range of the IR sensor. Greater than 300 feet with a directional antenna pair (available separately).**
- **Works with almost any remote control (38 kHz carrier), does not need to be programmed.**
- **Operate from 8V to 16V AC or DC. Use our AC125 wall adapters for long operation.**
- **LED indicator lets you know when you are receiving an IR signal or not.**

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RRW1B1 KIT INSTRUCTION MANUAL

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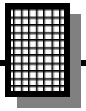


KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

RRW1B WIRELESS REMOTE REPEATER KIT (Receiver)

TABLE OF CONTENTS

RRW1B INTRODUCTION

Welcome to the RRW1B kit (and if you don't have the time, the wired and tested version). Let's take a moment to help you understand the basic workings of IR remote controls and how the RRW1 pair works. This will better help you understand what you are about to build. As simple as it may look, the RRW1 system is one of the best remote repeaters money can buy thanks to some specialized technology we have added to restore normally unusable signals. We will get more into that in the circuit description section.

The RRW1A and RRW1B system is used to extend the normal range of your IR remote controls. The RRW1A receives the signal from your IR remote control, converts it to an RF signal and then transmits it over the air. The RRW1B receiver then receives the RF signal, reconstitutes it, and then sends it to an IR LED to control your components.

Many stereo component manufacturers skimp on the IR receiver sections of their equipment so the range of the remote is very poor. Have you ever thrown your remote at the power switch because the darn thing wouldn't work from across the room?!. This system helps to surmount that very problem. Another common use is control your unsightly stereo components that are hidden within a cabinet while you're entertaining. The system allows your remote to control these items while they are tucked away inside of a cabinet (or even locked away for security reasons) with only the RRW1A exposed so it can relay the information!

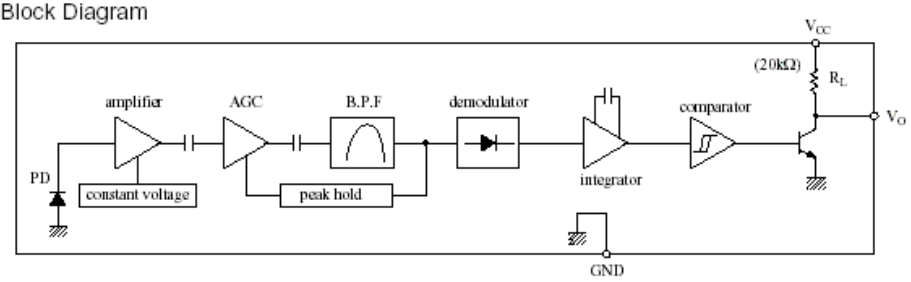
To use my house as an example, the stereo components are positioned behind the couch and it is very cumbersome to have to reach way up with the remote and beam it backwards in order to control them. Half the time it doesn't work even work for me because the batteries keep popping out of the remote (I lost the remote's back plate a long time ago in one of the many apartments I've rented in the past, but that's another story)! I don't want to have to re-arrange the room (that is the Wife won't let me!) just so the remote will work better. Instead I use the RRW1A in front of the couch someplace and have it relay the signal back to the RRW1B to control the equipment for me.

To increase the effectiveness of this kit, we take advantage of a high-sensitivity IR receiver element which claims on its specification sheet to work up to 11 meters (about 36 feet) away from the remote control (that's about 10.9 meters further than my VCR remote works!). Now I can truly atrophy on the couch when my favorite program comes on and feel the pounds start packing on! "Hey… another bag of chips when you get a chance Honey!!"

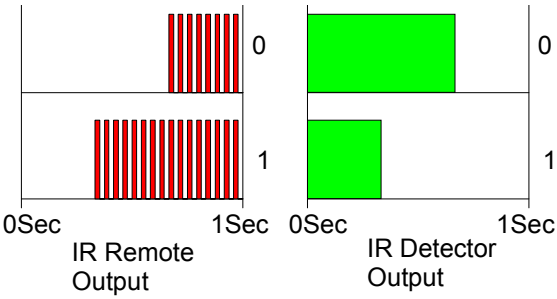
RRW1 PAIR THEORY OF OPERATION

The RRW1A (transmitter board) may look quite simple but there is actually quite a lot being done inside each one of the parts. Many individual components are packed inside of the IR receiver part (U2) itself; so many in fact that if it was built up with discrete components, it would never fit in this little kit case. Inside of the part there is an IR detector diode, amplifier, AGC circuit, bandpass filter, a peak-hold circuit, an integrator, comparators, and an output amplifier. Heck, the part is a kit in itself! Just be glad it's all in one nice module and ready to go.

■ Block Diagram



IR remote controls send out their data on a 38 kHz carrier much like the way your FM radio does. By modulating the carrier signal with the data you want to send, it is possible to increase the range of the transmission and decrease interference from other IR sources like ambient light (the sun pumps out lots of IR!!!). The modulation style used with remotes is called OOK (on off keying). In a nut shell, OOK modulation means the IR LED is switched on and off at a rate of 38 kHz in order to send the needed data. The digital data being sent (ones and zeros) is composed of a certain duration pulse for a one and a different duration pulse for a zero. There are pauses with no carrier in-between each one and zero data bit being sent for easy determination of the bit boundaries. A common format for this type of data transmission is called 60/30 PWM. While this may sound complex, it really is not. Let's take a closer look.



PWM stands for Pulse-Width-Modulation, meaning we change the on-time of the LED within a certain amount of time. If we send data at a rate of 1 bit per second (bps), each bit would take up a second of sending time. To represent a 1, the LED may be switched on and off at 38 kHz for 60% of the one second time frame (0.60 sec.) of it. For a 0, the LED will be switched on and off at 38 kHz for 30% of the time (0.30 sec.) of the entire second.

When the IR detector on the RRW1A (transmitter board) “sees” a 38 kHz IR signal, the output of the detector goes low (it is inverted). When there is no 38 kHz signal present the output idles high. On the output of the IR detector you won’t see the 38 kHz, just the data that the 38 kHz represents from your IR remote control. This data from the IR detector is then used to switch on and off a 433.42 MHz oscillator. Instead of switching an LED on and off at 38 kHz, we are now switching an electrical field on and off at a rate of 433.42 MHz. This acts as our new carrier frequency for the wireless part of the kit.

The oscillator section is a Colpitts style oscillator formed by Q2, C7, C8, R6, and X1. The oscillator is turned on and off by Q3 through resistor R4 in accordance with the received IR data. When a data pulse is detected by U1, its output goes low pulling the base of Q3 low to turn it off. When Q3 turns off, the collector (R3, R4, and Q3 junction) is pulled high so the needed bias voltage is applied to R4 causing Q2 to turned on and begin oscillating with the surrounding parts. Turning Q2 on and off performs the on-off data keying (OOK modulation) that we require to re-broadcast the IR signal.

The RRW1B (receiver board) has a specialized receiver chip which is also set at 433.42 MHz. The receiver detects whether or not a 433.42 MHz field is being broadcast and only sets its data output high if a signal is present. The RRW1B will replicate the transmitted data by turning its data out pin on and off at the received data rate. To re-send this data, we have to modulate a 38 kHz carrier again in accordance with the data the IR detector puts out. By using a micro-controller the data output from the IR detector can be sampled and a Pulse Width Modulated (PWM) signal at 38 kHz can be generated in accordance with the detected data.

By using this method with a micro-controller, we can add some intelligence to the regenerated signal as well. The sample IR remotes we have looked at send their data at a rate of around 2400 bits per second. This means that our minimum pulse length for a zero should be 1/2400 x 0.30 seconds long (125 uS). Consider this example, let’s say that the signal from the IR remote is weak and it fades out due to interference from some other IR source before the data pulse is finished (i.e. 80 uS instead of 125 uS). The micro-controller will continue to send the 38 kHz until 125 uS is up, not allowing the re-transmitted signal to drop out the way the original source did. This error correction feature can be disabled in case you have a strange remote that is not compatible (to this point we have yet to run across one that doesn’t work). Remove the jumper from J21 to disable this feature and have U21 blindly re-create the data it sees.

Once the micro-controller on the receiver board has re-generated the 38 kHz carrier (modulated by the data), its output is buffered by a transistor stage that drives the high power IR LED used to control your equipment.

Wow! There’s a lot going on here!

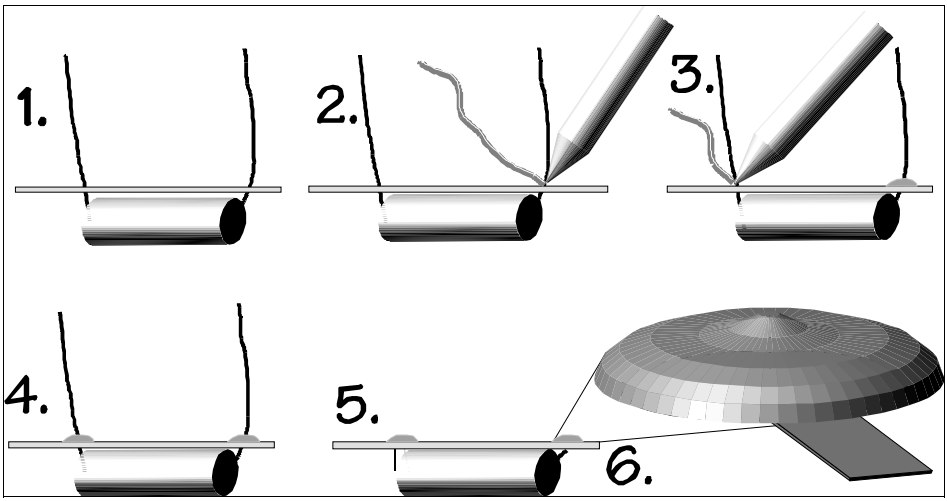
RAMSEY "LEARN-AS-YOU-BUILD" ASSEMBLY STRATEGY

Be sure to read through all of the steps, and check the boxes as you go to be sure you didn't miss any important steps. Although you may be in a hurry to see results, before you switch on the power check all wiring and capacitors for proper orientation. Also check the board for any possible solder shorts, and/or cold solder joints. All of these mistakes could have detrimental effects on your kit - not to mention your ego!

Kit building tips:

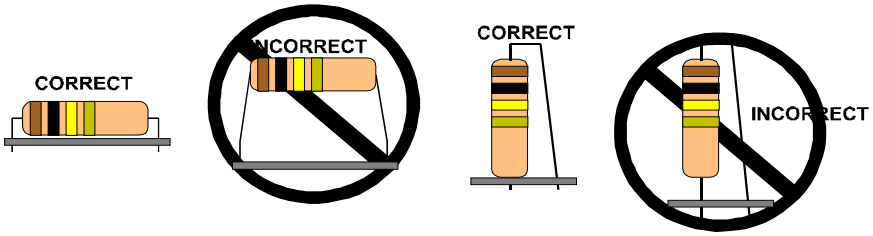
Use a good soldering technique - let your soldering iron tip gently heat the traces to which you are soldering, heating both wires and pads simultaneously. Apply the solder on the iron and the pad when the pad is hot enough to melt the solder. The finished joint should look like a drop of water on paper, somewhat soaked in.

Mount all electrical parts on the top side of the board provided. The top side is clearly marked with the word "TOP", you can't miss it. This is the side that has little or no traces on it, but is covered with mostly copper. When parts are installed, the part is placed flat to the board, and the leads are bent on the backside of the board to prevent the part from falling out before soldering (1). The part is then soldered securely to the board (2-4), and the remaining lead length is then clipped off (5). Notice how the solder joint looks on close up, clean and smooth with no holes or sharp points (6).



This project will not work as well as you may wish if you just slap it together without following good assembly techniques and all of the instructions. No matter how clear we may think our manual is, if you have any questions give us a call at the factory instead of jumping to conclusions. We will be happy to help you with any problems may run into.

It is always good practice to mount the parts AS LOW AS POSSIBLE to the board. A 1/4" lead length on a resistor not mounted close to the board can act as an inductor or an antenna, causing all sorts of problems in your circuit. Be aware though that there are stand up components in your circuit. They don't need to be squished to the board, but keep the portion of the resistor closest to the board mounted right on the board.



For each part, our word "Install" always means these steps:

- ☐ 1. Pick the correct part value to start with.
- ☐ 2. Insert it into the correct PC board location, making sure the part is mounted flush to the PC board unless otherwise noted.
- ☐ 3. Orient it correctly, follow the PC board drawing and the written directions for all parts - especially when there's a right way and a wrong way to solder it in. (Diode bands, electrolytic capacitor polarity, transistor shapes, dotted or notched ends of IC's, and so forth.)
- ☐ 4. Solder all connections unless directed otherwise. Use enough heat and solder flow for clean, shiny, completed connections.

Keeping this in mind, lets begin by sorting out our components and cross-checking them against the parts list to make sure we have received everything.

NOTE TO NEWCOMERS: If you are a first time kit builder you may find this manual easier to understand than you may have expected. Each part in the kit is checked off as you go, while a detailed description of each part is given. If you follow each step in the manual in order and practice good soldering / kit building skills, the kit is next to fail-safe. If a problem does occur, the manual will lead you through step by step in the troubleshooting guide until you find the problem and are able to correct it.

PARTS SUPPLIED WITH YOUR RRW1B (RECEIVER)

Capacitors

- ☐ 2 10 pF ceramic capacitor (marked 10 or 10K) [C27,28]
- ☐ 1 0.001 uF ceramic capacitor (marked .001, 102 or 1 nF) [C29]
- ☐ 1 0.01 uF ceramic capacitor (marked .01, 103 or 10 nF) [C20]
- ☐ 4 0.1 uF ceramic capacitor (marked .1, 104 or 100 nF) [C21,24,26,30]
- ☐ 1 1 uF electrolytic capacitor [C25]
- ☐ 3 10 uF electrolytic capacitor [C22,23,31]
- ☐ 1 1000 uF electrolytic capacitor [C32]

Resistors and Potentiometers

- ☐ 1 100 ohm resistor (brown-black-brown) [R23]
- ☐ 1 220 ohm resistor (red-red-brown) [R27]
- ☐ 1 470 ohm resistor (yellow-violet-brown) [R22]
- ☐ 1 1K ohm resistor (brown-black-red) [R25]
- ☐ 1 100K ohm resistor (brown-black-yellow) [R24]
- ☐ 1 1Meg ohm resistor (brown-black-green) [R21]
- ☐ 1 22Meg ohm resistor (red-red-blue) [R26]
- ☐ 1 100K ohm trimmer potentiometer (yellow top marked 104) [R20]

Semiconductors and Integrated Circuits

- ☐ 1 1N4000 series rectifier diode (black with white band) [D21]
  -Note that 1N4000-1N4007 diodes may used.
- ☐ 1 2N3904 NPN transistor (marked 2N3904) [Q21]
- ☐ 1 2SC2498 or 2SC2570 NPN transistor (marked C2498 or C2570) [Q20]
- ☐ 1 78L05 5V voltage regulator (three leads, marked LM78L05ACZ) [VR1]
- ☐ 1 Large Green LED [D20]
- ☐ 1 IR LED (Clear body) [D22]
- ☐ 1 MICRF001 data receiver IC (14 pin DIP marked MICRF001BN) [U20]
- ☐ 1 PIC12C509A pre-programmed micro-controller (8 pin DIP marked with a sticker labeled RR) [U21]

Miscellaneous Components

- ☐ 1 DPDT PC mount pushbutton switch [S20]
- ☐ 1 2.1 mm DC power jack [J22]
- ☐ 1 2-pin jumper header [J21]
- ☐ 1 2-hole screw terminal, .157 green jack [J20]
- ☐ 1 8 pin DIP socket used with U21
- ☐ 1 6” piece of #20 buss wire [ANT1]
- ☐ 2 33 nH 4-turn coils [L20,21]
- ☐ 1 3.3149 MHz crystal [X20]
- ☐ 2 feet of #24 two conductor hook-up wire for IR LED extension cable
- ☐ 1 1/8” diameter x 1” long heat shrink tubing for IR LED assembly
- ☐ 1 1/4” diameter x 1” heat shrink tubing for IR LED assembly

ASSEMBLY OF THE RRW1B

Assembly of the unit is straight forward but it does require some time and patience. To get our bearings, we will start by mounting the power jack and move on from there. It serves as a good reference point for the other parts.

- ❑ 1. Install J22, the 2.1 mm power jack. Be sure to get a solid connection to all three pads as this will have to take some mechanical strain during normal use. Use ample solder (without 'globbing' it on of course).
- ❑ 2. Install J20, the screw terminal connector. Make sure and install this so the mounting holes are facing the edge of the board. This is where you will be connecting your Infra-Red LED at the end of the assembly steps.
- ❑ 3. Install R23, a 100 ohm resistor (brown-black-brown).
- ❑ 4. Install Q21, a 2N3904 type transistor (marked 2N3904).
- ❑ 5. Install C23, a 10 uF electrolytic capacitor. Electrolytic capacitors are polarity sensitive so you need to install them with the side of the cap that is marked minus (-) away from the plus (+) marked side indicated on the PC board silkscreen and the Parts Layout Diagram.
- ❑ 6. Install C24, a 0.1 uF ceramic capacitor (marked 104).
- ❑ 7. Install R25, a 1K ohm resistor (brown-black-red).
- ❑ 8. Install D20, a green LED. D20 is polarity sensitive so it only works in one direction. The long leg of the LED indicates the Anode (A) and the shorter is the Cathode (K). The Cathode is also indicated by the flat side of the LED if you look at it end-on. The silkscreen and Parts Layout Diagram show a flat side for easy positioning of the LED. Orient the LED so its flat side is the same as shown. Do NOT mount the LED flush to the board. Mount it as high as possible (about 1 1/4" off of the board). It will be bent over out of the front of a case later.

- ❑ 9. Install R27, the 220 ohm resistor (red-red-brown).
- ❑ 10. Install J21, the two pin jumper header. This header allows you to choose if you want smart data restore turned on or not during reconstitution of the IR data. It is a tight fit so make sure the leads are through the board before soldering.
- ❑ 11. Install the 8-pin DIP Socket used to mount U21. It doesn't matter which way the socket is oriented, as long as the IC chip is inserted correctly in relation to the silkscreen on the circuit board. You can bend two of the corner leads out slightly to hold the socket in place when you flip the board over to solder it in. Be sure to solder all eight pins!

- ❑ 12. Install U21, the PIC12C509A (marked RR). Make sure the notch indicating pin one is in the same orientation as shown on the silkscreen and Parts Layout Diagram. This is the “brains” of the RRW1B, generating your 38 kHz signal depending on the data seen from the receiver.
- ❑ 13. Install C26, a 0.1 uF ceramic capacitor (marked 104).
- ❑ 14. Install JMP1 using a spare piece of component lead formed into a staple like shape. Since this layout is on a single sided board, some routes just couldn’t be performed without adding this jumper.
- ❑ 15. Install U20, the MIRCF001 IC (14-pin). Note the orientation of pin 1, it is opposite of U21. Use the notch to align with the pin one indicator on the IC itself. Make sure all 14 pins are through the holes before soldering.
- ❑ 16. Install R21, a 1M ohm resistor (brown-black-green) just above U20.
- ❑ 17. Install R20, a 100K ohm trimmer potentiometer (yellow top marked 104). This trimmer is used to set the squelch of the receiver so that constant noise isn’t sent while data is not being received.
- ❑ 18. Install C25, a 1 uF electrolytic capacitor. Again check polarity before soldering.
- ❑ 19. Install X20, the 3.3149 MHz crystal. This crystal is used as reference by the receiver to set it to receive 433.42 MHz. Internal to this part there is a Colpitts oscillator much like the one used in the RRW1A transmitter board used to make the crystal oscillate.
- ❑ 20. Install C22, a 10 uF electrolytic capacitor. Again note polarity.
- ❑ 21. Install R26, a 22M ohm resistor (red-red-blue). Yes this resistor value is very large. It is a “tweak” which prevents the data detect output from swinging to the wrong direction when no signal is present and making it look like it is always receiving a signal (a little quirk U20 tends to have).
- ❑ 22. Install C21, a 0.1 uF ceramic capacitor (marked 104).
- ❑ 23. Install C30, another 0.1 uF ceramic capacitor (marked 104).
- ❑ 24. Install C27, a 10 pF ceramic capacitor (marked 10 or 10K).
- ❑ 25. Install L20, a 33 nH four turn inductor. Be careful not to distort the shape of the coil when installing it.
- ❑ 26. Install R24, a 100K ohm resistor (brown-black-yellow).
- ❑ 27. Install Q20, a 2SC2498 or C2570 UHF NPN transistor. This transistor is used to help increase the reception range of your receiver by boosting the signal seen at the antenna a bit more before going to the receiver IC.

- ❑ 28. Install C20, a 0.01 uF ceramic capacitor (marked 103).
- ❑ 29. Install R22, a 470 ohm resistor (yellow-violet-brown).
- ❑ 30. Install C29, a 0.001 uF ceramic capacitor (marked 102).
- ❑ 31. Install L21, the other 33 nH four turn inductor. This coil combined with C28 makes the amplifier of Q20 selective, so it only amplifies the desired frequency area of 433.42 MHz.
- ❑ 32. Install C28, a 10 pF ceramic capacitor (marked 10 or 10k).
- ❑ 33. Install C31, a 10 uF electrolytic capacitor. Check its orientation before soldering into place.
- ❑ 34. Install VR20, the 78L05 voltage regulator. Make sure the flat side of this component is in the same orientation as shown on the silkscreen. This part works by “smoothing” out any junk that may reside on the non-regulated input side of the part. It also allows you to run this kit from a wide range of supply voltages while it keeps the output fixed at 5V.
- ❑ 35. Install D21, the large 1N4002 regulator diode. If you are using an AC power supply, this diode helps to convert the AC source voltage to pulsed DC. C32 (which we install last for mechanical reasons) accumulates the pulsed DC and smoothes it out so that regulator VR20 can process it the rest of the way and provide us with a clean power source. Make sure the line which indicates the Cathode is installed in the same orientation as shown on the silk screen and Parts Layout Diagram.
- ❑ 36. Install S20, the power switch. Solder only one pin until you are sure the switch is flush to the board. Then solder the rest.
- ❑ 37. Install C32, the large 1000 uF electrolytic capacitor. Double check its orientation before soldering as this is especially critical with this part.
- ❑ 38. Install ANT1, the 6” piece of bus wire. Solder the wire in place where the circuit board has been marked “ANT1” for easy identification. Use a ruler and trim off any extra wire if longer then 6” (5.75 to 6.5” works great).

It looks like we have all of the holes stuffed with components now so I guess we are finished, right? Actually we aren’t quite done yet. Take a moment to go back through the steps you’ve completed and check the orientation of all the installed devices before plugging in the power. This will help you to avoid damaging any critical components by accident when you fire-it-up the first time (note: we are trying to avoid the “fire” in fire-it-up). Make sure to check all the capacitors for proper orientation, the micro-controller IC, as well as the rectifier diode and VR20.

- ❑ 39. The IR LED wiring offers you a bit of flexibility to custom match the RRW1B to your application. You will need to determine how long of a wire you will actually need to fit the job at hand and then cut it to length. The 2 foot piece of wire that is supplied with the kit is more than enough for most of the common component cases available today (we didn't want to include an entire 1000 foot spool with every kit either!). The RRW1B has been tested with upwards of 750 feet of extension wire for D22 so custom wiring jobs can really increase the range of your system!
- ❑ 40. Trim both the red and black hook-up wires on each end to 1/4". Tin all four ends with solder to prevent them from fraying.
- ❑ 41. Cut the 1/8" piece of heatshrink in half and slide a piece onto one end of the red wire. On the same end, slide the other piece onto the black wire. These will keep the leads of the IR LED from shorting together later.
- ❑ 42. Bend the leads of the IR LED outward in a slight 'Y' formation to give yourself some space between the two leads to solder the hook-up wires.
- ❑ 43. Attach the IR LED to the hook-up wire by soldering the black wire to the Cathode (K) and the RED wire to the Anode (A). Use the end with the 1/8" heat shrink tubing in place so you can slide them over the junctions later. Look at the LED diagram of D20 for clarification if needed. A pair of needle-nose pliers work well to make small loops in the wire ends to slide the IR LED leads through. After you slide the leads through the loops, tighten them down so the IR LED leads are held in place for soldering.
- ❑ 44. Trim back the excess IR LED lead wire for a nice, clean assembly and slide the heat shrink tubing up and over the leads to the base of the IR LED. You may need to trim any sharp edges off of the solder joint before the tubing will slip over.
- ❑ 45. Install the other end of the Black wire into the J20 terminal jack closest to the corner (labeled BLACK) and the Red wire into the other hole (labeled RED). Use a small screwdriver to gently tighten the down screws.

FINISHED!!! Now we are ready to begin testing our handiwork!

TESTING THE RRW1B

To test the RRW1B receiver, you will need to use a functional RRW1A transmitter. You just need to have faith that you have assembled everything correctly up to this point! It can be very difficult to troubleshoot this item without some good equipment so we will have to do it the old fashion way if it comes to it. See the troubleshooting section for more details if you need to.

For now you will need:

- An IR remote and equipment this goes to (Cable box or something).
- Two “wall wart” power supplies, one for each the transmitter and receiver.
- A working RRW1A transmitter.

Begin by setting up the transmitter and receiver where you would like to use them. The receiver is usually set on top of the components you wish to control with the IR LED positioned so that it will beamed downward into the face of the components where their IR sensors are located. The transmitter can be set up wherever you are planning on using the remote control. For now, keep it in the same room so you can see the Data LED on the front panels of both units. Keep in mind that you do not want your remote control directly activating the target equipment without being repeated through the RRW1 system first!

Turn on the power to both the receiver and transmitter. The Data LED on the transmitter (RRW1A) should be on by default while the Data LED on the receiver (RRW1B) should be off. If the Data LED on the receiver is flashing or continually on (without sending data through the transmitter of course), R20 (on the receiver) will need to be re-adjusted. Use a small screwdriver to adjust R20 on the RRW1B if needed so that the LED just turns off. It may slightly flash a little due to noise in the receiver being seen on the data line. Adjust R20 until the LED just goes out and stays out; leave it at this setting. The best possible adjustment is where the LED is out, but it is really close to the point where it turns on again. You have successfully adjusted the squelch setting!

With the receiver properly tuned, aim the remote at the transmitter and press a button. The Data LED should flicker on the transmitter from the remote’s data. The Data LED on the receiver should begin blinking at the same time. This means your wireless link is working!

Now just test some functions on the remote to see if it controls your device and your off to the races! Try moving the transmitter to another room now and see if everything still works. You should get a fairly decent range that should more than enough to cover most people’s homes.

USING THE RRW1

There really is no secret to using the RRW1 system. You primarily want to position the RRW1B in the stereo cabinet or on top of your components so the antenna can stick up. The RRW1A should be placed so that the IR sensor can see your remote control's IR signal and is in the location you want your remote to work from. Put the receive on top of a book shelf or even between books to hide it. I am sure you will think of something clever.

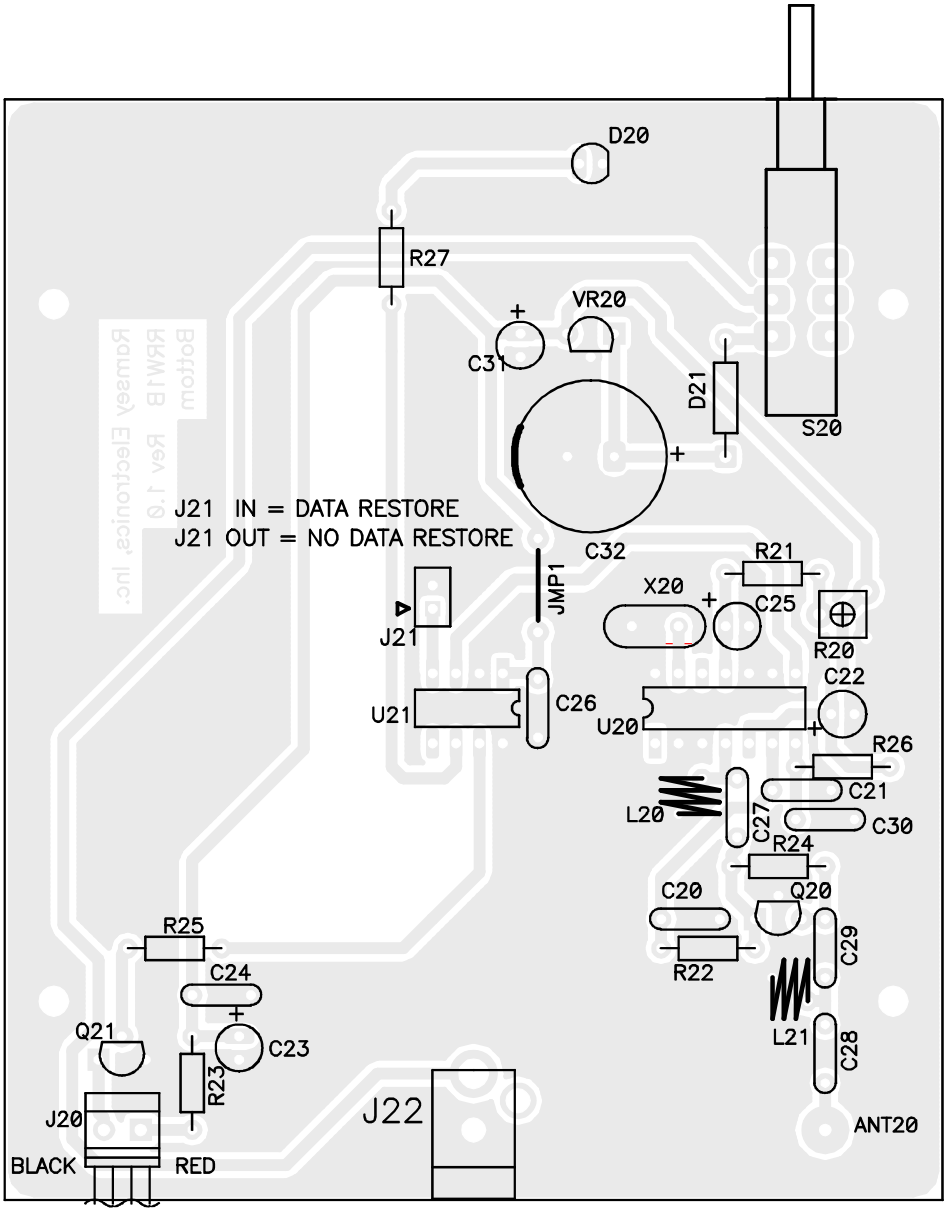
The real trick is how to get the IR LED on the RRW1B mounted so that all of your components can its relayed signal. The optimum way would be to use a coat hanger to suspend the LED out in front of the components and have it shine back at them. Unfortunately this is quite ugly and could poke out too far to be able to close the doors of a cabinet. If it will be inside of a cabinet, you can conveniently bounce the light off of some small pieces of aluminum foil mounted to the back sides of the doors and reflect the IR down to the components. With a little work, you could even permanently mount the IR LED on the inside of one of the doors. This configuration might take a bit of wire however in order to discreetly snake the hook-up from the RRW1B receiver down through the cabinet and along the door. So far the longest piece of wire we've tried was about 750 feet… no problem!! However the output of the IR LED is intense enough that it will probably activate all of your components just by reflecting around inside of the cabinet.

If you do not have doors to reflect the RRW1B's emitted IR signal from, try angling the light from above somewhere. This usually works well also. In my case my components are currently sitting on a coffee table behind the couch until we save enough pennies to buy a cabinet. In this case I can actually mount the IR LED in a crack in the couch to aim it at the components. This worked out quite well for me since the IR LED is now all but hidden from view. Hopefully it doesn't get yanked out the next time I'm scrambling through the cushions for change to tip the pizza delivery guy!

To determine the maximum range of the entire system, add up all of the individual component ranges that make up the entire system. Your remote's signal can be picked up by the IR receiver (RRW1A) up to 36 feet away. It can then broadcast that signal with the included antenna more than 100 feet. Now run the IR LED emitter wire from the RRX1B as long as you like up to 300 feet or so (I've used up to 750 feet while testing!). The output of the IR LED will then span another 20 feet to give you over 450 feet more of extended range!

Change the stock whip antennas to one of our 433 MHz directional antennas (RMZ# 4004 or LPY41) and you may be able to reach 1/4 mile or more! I can't imagine a scenario where you would want to do that, but it can be done. Notice how the ground area on the bottom side of the circuit board near the antenna position has been left open for your to attach the ground shield of the coax should you choose this optional configuration.

RRW1B PARTS LAYOUT DIAGRAM



TROUBLESHOOTING THE RRW1B

PROBLEM: No matter how I adjust R20, the LED will not light.
SOLUTION: Check the orientation of D20, it may be you installed it backwards. If not, check your power, you should see +5V on pins 5 and 6 of U20. If you have no power, check the wall transformer to make sure the center lug is plus, and the ring is minus. AC transformers like the AC125 should be no problem.

PROBLEM: The green LED doesn't light up and blink when I aim my remote at it.
SOLUTION: There is a lot that can go wrong here, so we will go from the most likely to the least. We will assume D20 has lit up at some point before you adjusted R20. 1. If you have not tested the RRW1A, do so at this point, it may not be transmitting. 2. You are too far away from the transmitter, bring them closer together. 3. You have the squelch control (R20) turned too far up, try turning it back to where the LED is just flickering, and see if the remote begins to make it blink or not. 4. The receiver has a assembly problem. Check part installation and orientation.

PROBLEM: Everything else is working, but my devices aren't responding to the remote signals.
SOLUTION: You will need to check your IR LED installation. It is easy enough, just swap the red and black wires on the screw terminal. Things should start working nicely unless there is an assembly error on the board.

RRW1B SPECIFICATIONS

Power Supply:

- AC supply = 6 to 12 VAC or DC supply = 8 to 16 VDC @ 100 mA (+ tip)
- Current draw with a 12VDC source averages about 20 mA (RRW1B).

Dimensions:

- PCB size: 4.0" x 4.7"
- Max component height: 7/8"

Miscellaneous:

- Works with any standard 38 kHz carrier IR remote.
- Max effective BAUD rate: 2400 bps – standard for remotes.
- IR receiver module has an effective pick-up range of 11 meters (36 feet!).
- Max IR LED (D22 of RRW1B) wire extension length: Unknown!! Tested over 750 feet and still going!

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the l ke. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is $50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

RRW1B REMOTE REPEATER KIT
Quick Reference Page Guide

REQUIRED TOOLS

- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04

<OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

Price: $5.00
Ramsey Publication No. MRRW1B
Assembly and Instruction manual for:
RAMSEY MODEL NO. RRW1B

TOTAL SOLDER POINTS
23

ESTIMATED ASSEMBLY TIME
Beginner.....1 hrs
Intermediate.....0.5 hrs
Advanced.....0.5 hrs