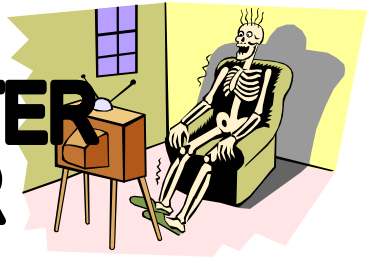# WIRELESS REMOTE REPEATER TRANSMITTER

Ramsey Electronics Model No.   RRW1A

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!

- **IR Receiver module with sensitive element can receive your remote control's signal up to 36 feet away before re-broadcasting it wirelessly!**

- **The separate 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.**
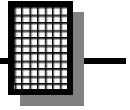
RAMSEY TRANSMITTER KITS
- **FM100B Professional FM Stereo Transmitter**
- **FM25B Synthesized Stereo FM Transmitter**
- **MR6 Model Rocket Tracking Transmitter**
- **TV6 Television Transmitter**

RAMSEY RECEIVER KITS
- **FR1 FM Broadcast Receiver**
- **AR1 Aircraft Band Receiver**
- **SR2 Shortwave Receiver**
- **SC1 Shortwave Converter**

RAMSEY HOBBY KITS
- **SG7 Personal Speed Radar**
- **SS70A Speech Scrambler**
- **BS1 "Bullshooter" Digital Voice Storage Unit**
- **AVS10 Automatic Sequential Video Switcher**
- **WCT20 Cable Wizard Cable Tracer**
- **LABC1 Lead Acid Battery Charger**
- **IG7 Ion Generator**
- **CT255 Compu Temp Digital Binary Thermometer**
- **LC1 Inductance-Capacitance Meter**

RAMSEY AMATEUR RADIO KITS
- **DDF1 Doppler Direction Finder**
- **HR Series HF All Mode Receivers**
- **QRP Series HF CW Transmitters**
- **CW7 CW Keyer**
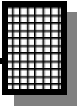- **CPO3 Code Practice Oscillator**
- **QRP Power Amplifiers**

RAMSEY MINI-KITS
Many other kits are available for hobby, school, Scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.

<div align="center">

RRW1A1 KIT INSTRUCTION MANUAL
Ramsey Electronics publication No. MRRW1A Rev 1.1
First printing: January 2002 MRW

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KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

RRW1A WIRELESS REMOTE REPEATER KIT (Transmitter)

TABLE OF CONTENTS

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RRW1A INTRODUCTION

Welcome to the RRW1A 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
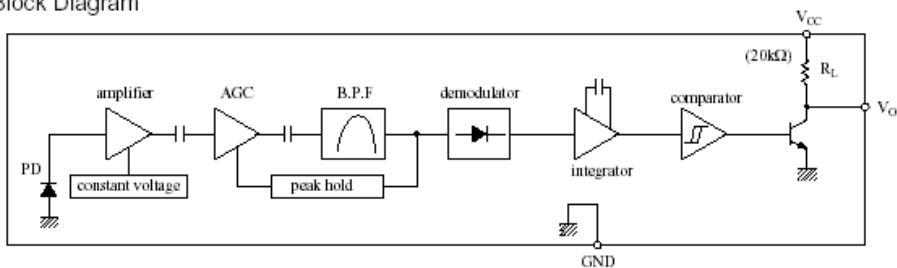
IR remote controls send out their data on a 38 kHz carrier much like the way your FM radio does. By modulating the carrier signal with the data you want to send, it is possible to increase the range of the transmission and decrease interference from other IR sources like ambient light (the sun pumps 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.
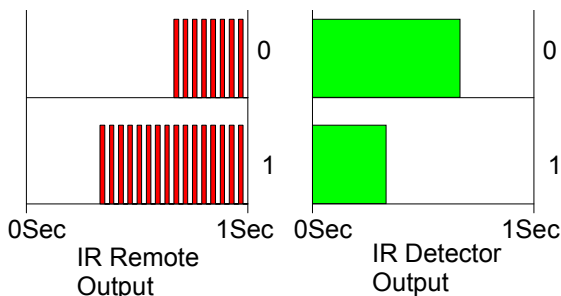
When the IR detector on the RRW1A (transmitter board) "sees" a 38 kHz IR signal, the output of the detector goes low (it is inverted). When there is no 38 kHz signal present the output idles high. On the output of the IR detector you won't see the 38 kHz, just the data that the 38 kHz represents from 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 ones. Although you may be in a hurry to see the end results, before you switch on the power be sure to check all wiring and components (especially 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 provided circuit board. The top side is silk screened with the part number reference designators for easy positing of the components. When a part is installed, it should be placed flat to the board with the leads slightly bent on the backside of the board to prevent it from falling out before soldering in position (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).
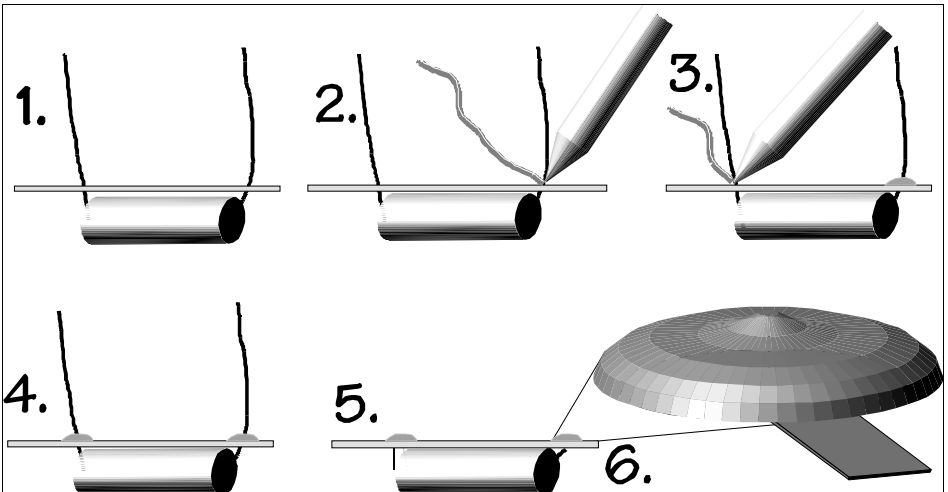
This project will not work as well as you may wish if you just slap it together without following good assembly techniques and all of the instructions. No matter how clear we may think our manual is, if you have any questions give us a call at the factory instead of jumping to conclusions. We will be 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.
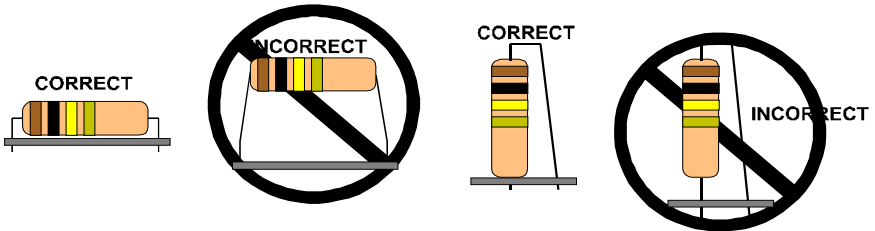
For each part, our word "Install" always means these steps:

☐ 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 RRW1A (TRANSMITTER) KIT

Capacitors
- ☐ 1 2.2 pF ceramic capacitor (marked 2.2) [C7]
- ☐ 1 8.2 pF ceramic capacitor (marked 8.2) [C8]
- ☐ 3 47 pF ceramic capacitors (marked 47) [C1,4,6]
- ☐ 1 0.001 uF ceramic capacitor (marked .001 or 102 or 1 nF) [C3]
- ☐ 1 0.01 uF ceramic capacitor (marked .01 or 103 or 10 nF) [C2]
- ☐ 1 0.1 uF ceramic capacitors (marked .1 or 104 or 100 nF) [C5]
- ☐ 1 10 uF electrolytic capacitors [C9]
- ☐ 1 1000 uF electrolytic capacitor [C10]

Resistors
- ☐ 1 220 ohm resistor (red-red-brown) [R7]
- ☐ 1 270 ohm resistor (red-violet-brown) [R6]
- ☐ 1 470 ohm resistor (yellow-violet-brown) [R1]
- ☐ 1 2.2K ohm resistor (red-red-red) [R2]
- ☐ 2 4.7K ohm resistors (yellow-violet-red) [R3,8]
- ☐ 1 10K ohm resistor (brown-black-orange) [R5]
- ☐ 1 22K ohm resistor (red-red-orange) [R4]

Semiconductors
- ☐ 1 IR Sensor Module [U1]
- ☐ 1 1N4000 series rectifier diode (black with white band) [D2]
  -Note that 1N4000-1N4007 diodes may used.
- ☐ 2 2N3904 NPN transistors (marked 2N3904) [Q3,4]
- ☐ 2 2SC2498 UHF NPN transistors (marked C2498 or C2570) [Q1,2]
- ☐ 1 78L05 5V voltage regulator (marked LM78L05ACZ) [VR1]
- ☐ 1 Large Green LED [D1]

Miscellaneous Components
- ☐ 1 33 nH 4-turn coil [L1]
- ☐ 1 DPDT PC mount pushbutton switch [S1]
- ☐ 1 2.1 mm DC power jack [J1]
- ☐ 1 433.42 MHz saw resonator (TO-39 Metal 3-pin case) [X1]
- ☐ 1 6" piece of #20 buss wire
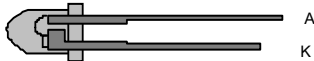
ASSEMBLY OF THE RRW1A

   Assembly of the RRW1A 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 J1, 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 R6, the 270 ohm resistor (red-violet-brown).

- ❑ 3. Install C7, the 2.2 pF ceramic capacitor (marked 2.2). C7 acts as the feedback path for our "Colpitts" style oscillator. This capacitor combined with the next one (C8) and the saw resonator (X1) make this circuit oscillate at the required frequency. Note that this is one of the rare exceptions to installing at 90 degree angles. This part is actually installed at a 45 degree angle to keep lead lengths as sort as possible. This goes to show how important it is to keep your lead lengths short! Even a small amount of trace can introduce inductance that may prevent our oscillator from working properly.

- ❑ 4. Install C8, the 8.2 pF ceramic capacitor (marked 8.2).

- ❑ 5. Install C3, a 0.001 uF ceramic capacitor (marked .001 or 102 or 1 nF).

- ❑ 6. Install L1, a 33 nH 4-turn inductor. Be careful not to distort or crush this when installing it.

- ❑ 7. Install Q1, one of the 2SC2498 transistors (marked C2498 or C2570). Pay close attention to the Parts Layout Diagram and the silkscreen on the circuit board for proper orientation (the flat side is a good indicator). Right next to Q1 is Q2 (another 2SC2498 transistor) so make certain to use the correct mounting holes.

- ❑ 8. Install Q2, another 2SC2498 transistor (marked C2498 or C2570). Again note the orientation of the flat side before soldering.

   Transistor Q2 provides the amplification needed to keep the 433.42 MHz RF oscillator going. Q1 and its surrounding parts form a special buffer stage which isolates the antenna from the oscillator. If it wasn't for this buffer stage, the oscillator could stop working whenever things like your fingers or a metal object are nearby. This pair working together forms a very stable oscillator which resists a lot of external changes to maintain performance!

- ❑ 9. Install X1, the saw resonator (TO-39 metal case). This is the component that determines the operating frequency of the oscillator by interacting with the feedback capacitors surrounding Q2. Note the silkscreen on the circuit board for proper orientation.

❑ 10. Install R4, a 22K ohm resistor (red-red-orange).

❑ 11. Install C4, a 47 pF ceramic capacitor (marked 47). This capacitor works with Q1 to isolate the antenna from the oscillator section. The capacitor value of 47 pF was chosen because it looks like a direct short to ground at 433 MHz so any RF on the base of Q1 is removed!

❑ 12. Install C1, a 47 pF ceramic capacitor (marked 47).

❑ 13. Install C2, a 0.01 uF ceramic capacitor (marked .01 or 103 or 10 nF). Both C1 and C2 are used as power bypass capacitors to keep RF signals out of the power supply. While a 47 pF capacitor looks like a short at 433 MHz, a 0.01 uF ceramic capacitor does not. Why do we use a 47 pF right next to this 0.01 uF ceramic capacitor? This bypasses the 433 MHz and any other low frequency signal that could be present. It is a good practice to bypass RF stages in this manner to remove any possible noise in the system.

❑ 14. Install R1, a 470 ohm resistor (yellow-violet-brown).

❑ 15. Install R2, a 2.2K ohm resistor (red-red-red). R1 and R2 form a bias network for Q1, which allows a certain amount of current to be available to Q2 when oscillation begins. They also work in conjunction with C4 above to isolate the oscillator from the antenna.

❑ 16. Install C6, a 47 pF ceramic capacitor (marked 47). This capacitor helps to keep any 433 MHz signal from feeding back on our data input circuit.

❑ 17. Install Q3, a 2N3904 NPN transistor (marked 2N3904). Pay attention to the flat side for orientation. This transistor is needed to invert the data output of the IR detector. If you remember from the circuit description, the output of the IR detector goes low when a signal is detected. We want to transmit a signal whenever that output goes low so we need to invert the low to a high to turn the oscillator stage on when the IR signal is seen.

❑ 18. Install R3, a 4.7K ohm resistor (yellow-violet-red).

❑ 19. Install JMP1 using a spare piece of component lead. Since this layout is on a single sided board, some routes just couldn't be performed without adding this jumper.

❑ 20. Install R5, a 10K ohm resistor (brown-black-orange).

❑ 21. Install U1, the IR detector. Pay attention to the orientation and make sure all leads are through the holes before soldering in place.

❑ 22. Install C5, a 0.1 uF ceramic capacitor (marked .1 or 104 or 100 nF). This bypass capacitor reduces any noise on the power supply line just before going into U1. We don't want any noise here to give us false data pulses!

❑ 23. Install R8, a 4.7K ohm resistor (yellow-violet-red).

❑ 24. Install Q4, a 2N3904 transistor (marked 3904). This transistor is used to amplify the small amount of current provided from the IR detector to a large enough amount to drive the LED indicator. The LED will blink OFF when a signal is seen, so it has a dual use of indicating power as well.

❑ 25. Install D1 (the Green LED). This LED will blink OFF when the IR detector sees data to let you

know that and IR signal has been seen and is being re-sent. D2 is polarity sensitive since it is a diode so correct orientation is a must! Look at the diagram above. The long leg of the LED indicates the Anode while the shorter is the Cathode; the Cathode is the larger fat section that you can see inside of the LED case. The Cathode is also indicated by the flat side of the LED body if you look at it on end. Note the silkscreen on the board and the Parts Layout Diagram show the flat edge of the LED for proper positioning. Orient the LED so its flat side is the same. Do NOT mount the LED flush to the board. Mount the LED as high as possible, about 1 1/4" off of the board. The LED will eventually be bent over to peek out of the front of a the case.

❑ 26. Install R7, a 220 ohm resistor (red-red-brown).

❑ 27. Install C9, a 10 uF electrolytic capacitor (small cylindrical component coated with plastic and marked 10). Electrolytic capacitors are polarized with a (+) and (-) lead and must be installed in the correct orientation. Ordinarily, only the negative side is marked on the capacitor body with a dark band and the (-) sign clearly shown. The PC boards will usually show the (+) hole location. Use care to ensure proper polarity. See the Parts Layout Diagram for proper placement. The capacitor should fit snugly down to the PC board.

❑ 28. Install VR1, the 78L05 voltage regulator. Make sure the flat side of this component is in the same orientation as shown on the silk screen and Parts Layout Diagram. This part works by "smoothing" out any ripple 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 input supply voltages.

❑ 29. Install D2, 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. C10 (which we install last for mechanical reasons) accumulates the pulsed DC and smoothes it out so that regulator VR1 can process it the rest of the way and provide us with a clean power source. If a DC power source is used, the diode provides you with reverse power protection should the supply not be setup with a positive tip like it should.

❑ 30. Install S1, the power switch. Solder one pin and make sure the switch

is straight and flush to the board. Then solder the rest before moving on.

❑ 31. Install C10, the large 1000 uF electrolytic capacitor. Double check the orientation before soldering as this is especially critical with this component. Follow the same guidelines you used to install C9!

❑ 32. Install ANT1, the 6" piece of buss 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 3/4" to 6" works great).

FINISHED!! 32 steps may not seem like a lot but we are done with the transmitter! You should go back through the steps before moving on and check for proper orientation of devices before plugging in the power however. This will prevent damaging anything by accident. Check capacitors for orientation, the IC, and also the rectifier diode as preventative measures.

TESTING THE RRW1A
Method #1

To begin testing the RRW1A you will need the following items:

○ AC Power supply between 6 and 12VAC or..

○ DC power supply between 8 and 14VDC.

○ A known functional IR remote control

Apply power to J1 and turn on the power switch (S1). The Data LED (D1) should turn on and stay on, acting as a dual purpose power LED. The only time D1 will turn off (or become very dim) is when an active 38 kHz data stream is being received by the IR detector module (U1).

A quick functional test is to verify that the Data LED flashes off when you point an IR remote at the IR sensor (U1). The flashing indicates that the data from the remote control is being seen.

If you wish to go one step further and you have a radio which can tune to 433.42 MHz (AM mode), you can verify that the oscillator is working. Tune the radio for 433.42 MHz and turn on the RRW1A power switch (S1). Press a button on the remote control and you should be able to hear the data stream being transmitted from the RRW1A. The selectivity of your monitoring radio may be much tighter than that of the receiver (RRW1B) so you may need to tune up or down a bit on the dial to find the signal. Adjusting the frequency of the transmitter for exactly 433.42 MHz will not be needed due to the front end characteristics of the mating RRW1B series receivers. This makes life easy!

Method #2

If you are not lucky enough to have a radio that can receive 433.42 MHz, the next best way to check the RRW1A transmitter is by using an RRW1B receiver. 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.

Here is what you will need:

- ❍ An IR remote and the equipment it works with (cable box, stereo system, or something similar).

- ❍ A working RRW1B (receiver).

- ❍ Two "wall wart" power supplies, one for the RRW1A transmitter and one for the RRW1B receiver.

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.

RRW1A PARTS LAYOUT DIAGRAM
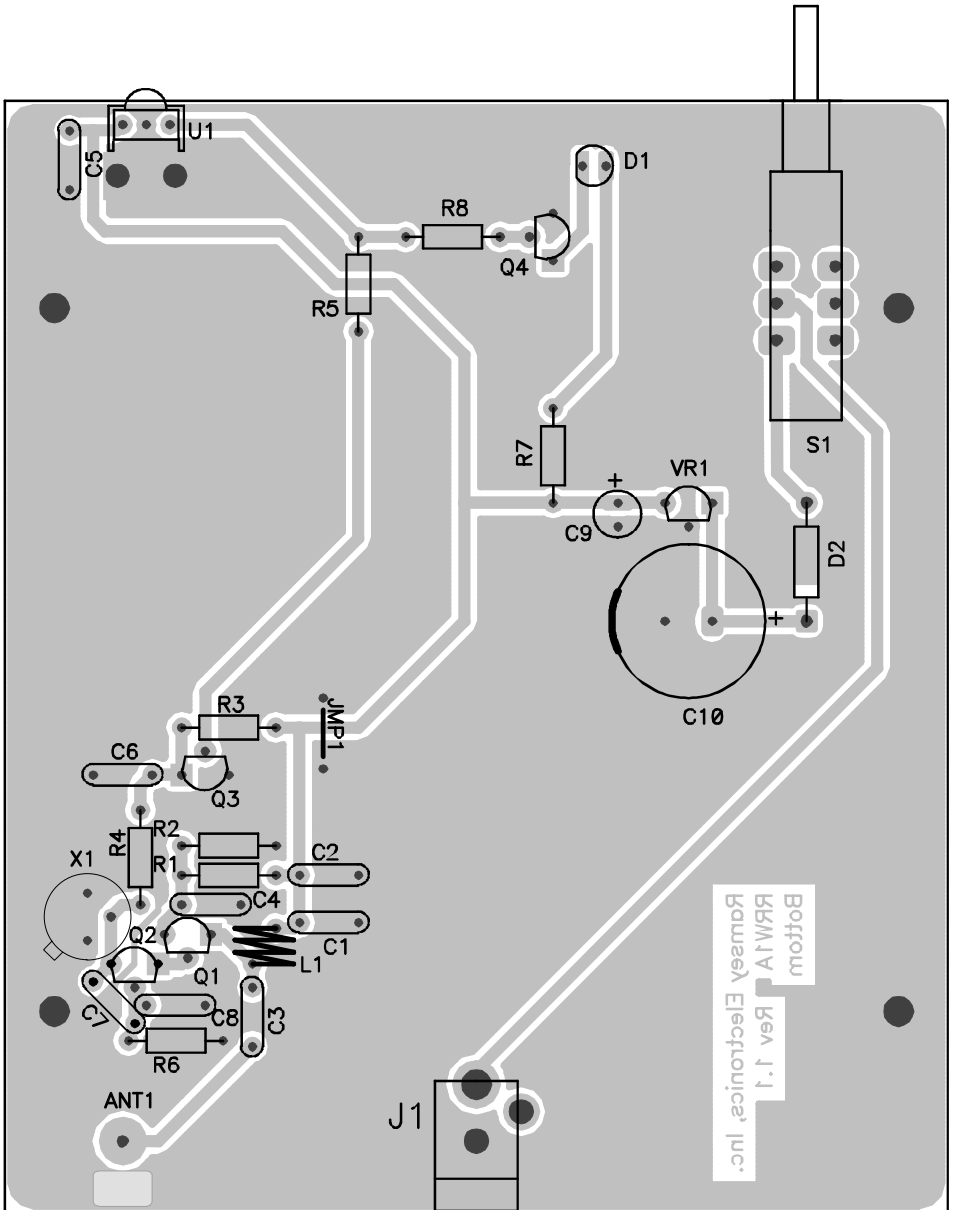
TROUBLESHOOTING GUIDE

PROBLEM: The green Data LED does not light.
SOLUTION: 1) The LED (D1) may be installed backwards. Re-check its orientation as described in the assembly steps. 2) Check pin 3 of U1 for +5V. If you have no power here, check the wall transformer to make sure the center lug is positive and the ring is negative for a DC supply. The polarity is not a factor if you are using an AC transformer.

PROBLEM: The green LED doesn't flicker off when I aim my remote at it.
SOLUTION: You are trying to relay an IR remote that is modulated at some other frequency than 38 kHz. There is a variety of ranges available, but 38 kHz is by far the most common. Most consumer components operate at 38 kHz. This system ONLY works 38 kHz carrier signal remotes.

PROBLEM: I'm using a radio tuned to 433.42 MHz and I can't hear the remote control's signal being re-broadcasted.
SOLUTION: Check to make sure your radio is set to receive AM signals and that your receiver isn't so narrow you are missing the signal. Tune around a bit and you will probably find it. If not, it's possible you made a mistake during assembly of the sections surrounding Q1 and Q2. Please check your work and make sure components are mounted flush to the board.

PROBLEM: I just can't make the darn thing work!
SOLUTION: Call Ramsey Support at 1-585-924-4560 and look at the warranty information at the end of this manual.

RRW1A 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 (RRW1A).

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 like. 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.

RRW1A 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. MRRW1A
Assembly and Instruction manual for:
RAMSEY MODEL NO. RRW1A

TOTAL SOLDER POINTS
80

ESTIMATED ASSEMBLY TIME
Beginner .... 1.5 hrs
Intermediate .... 1.0 hrs
Advanced............. 0.5 hrs

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