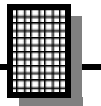# Walking Electronic Bug

Ramsey Electronics Model No.   WEB1

Watch the little bug scoot across the table and turn to avoid obstacles in this fun and very unique kit! Buy two bug kits and have your own "bug wars"!

- **Easy to build and fun to play with.**

- **Runs for a long time.**

- **Runs on 2 'N" batteries.**

- **Avoids obstacles or runs away from a flashlight.**

- **Adjustable sensitivity and speed.**

PARTIAL LIST OF AVAILABLE KITS:

RAMSEY TRANSMITTER KITS
- **FM10A, FM25B FM Stereo Transmitters**
- **AM1, AM25 Transmitter**

RAMSEY RECEIVER KITS
- **FR1 FM Broadcast Receiver**
- **AR1 Aircraft Band Receiver**
- **SR2 Shortwave Receiver**
- **AA7 Active Antenna**
- **SC1 Shortwave Converter**

RAMSEY HOBBY KITS
- **SG7 Personal Speed Radar**
- **SS70A Speech Scrambler/ Descrambler**
- **TT1 Telephone Recorder**
- **SP1 Speakerphone**
- **MD3 Microwave Motion Detector**
- **PH14 Peak hold Meter**
- **LC1 Inductance-Capacitance Meter**

RAMSEY AMATEUR RADIO KITS
- **HR Series HF All Mode Receivers**
- **DDF1 Doppler Direction Finder Kit**
- **QRP Series HF CW Transmitters**
- **CW7 CW Keyer**
- **QRP Power Amplifiers**
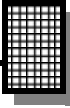
RAMSEY MINI-KITS
Many other kits are available for hobby, school, scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.

KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

Walking Electronic Bug

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INTRODUCTION

Here is a very unique little kit that's great for kids. The WEB1 is a little robot made completely out of electronic parts and wire. It's pretty easy to build, and once it's adjusted properly, it will entertain for hours. It has little pager motors in it that vibrate and propel it on its little wire feet. How fast it goes is adjustable by bending its feet and also by a pot that controls motor speed. When it approaches an obstacle such as a wall, it turns to avoid it. It does this with a second little pager motor.

WEB1 CIRCUIT DESCRIPTION

This is a fairly simple circuit, and easy to follow even for a beginning kit builder. The kit uses a 555 timer U1 to pulse the two pager motors. The 555 timer does not directly drive the motors, but instead turns them on through transistors Q1 and Q3. This is done because although the motors don't draw much current on average, they do when they initially start spinning. The 555 objects to these big current spikes, so the transistors take the beating instead. Normally only one motor is running and the WEB1 moves in a straight line. In this state, U1 is pulsing Q3 which drives the motor attached to pad P1. This motor's speed is adjustable via R2. When the WEB1 gets close to an obstacle, infrared light emitted from D1 bounces off the object and into the infrared phototransistor Q2. Then Q2 switches on and turns on transistor Q1 which drives the motor attached to pad P4. This motor causes the WEB1 to turn aside from the obstacle. The sensitivity of phototransistor Q2 is adjustable through R5. Without this adjustment, sometimes room lights would turn Q2 on and make the WEB1 turn all the time. Okay, let's get building.

RAMSEY Learn-As-You-Build KIT ASSEMBLY

There aren't that many solder connections on the WEB1 printed circuit board, but you should still practice good soldering techniques.

- Use a 25-watt soldering pencil with a clean, sharp tip.
- Use only rosin-core solder intended for electronics use.
- Use bright lighting; a magnifying lamp or bench-style magnifier may be helpful.
- Do your work in stages, taking breaks to check your work. Carefully brush away wire cuttings so they don't lodge between solder connections.

We have a two-fold "strategy" for the order of the following kit assembly steps. First, we install parts in physical relationship to each other, so there's minimal chance of inserting wires into wrong holes. Second, whenever possible, we install in an order that fits our "Learn-As-You Build" Kit building philosophy. This entails describing the circuit that you are building instead of just blindly installing components. We hope that this will not only make assembly of our kits easier, but help you to understand the circuit you're constructing.
 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.

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.

WEB1 PARTS LIST

Sort and "check off" the components in the boxes provided. We do our best to pack all our kits correctly but it is *possible* that a mistake has occurred and we missed a part. Please note that physical descriptions of parts are for those currently being shipped. Sometimes the parts in your kit may have a different appearance but still have the same values.

RESISTORS
- ❒ 1   1K ohm resistor [brown-black-red] (R4)
- ❒ 1   68 ohm resistor [blue-gray-black] (R3)
- ❒ 1   330 ohm resistor [orange-orange-brown] (R1)
- ❒ 2   10K ohm potentiometer (R2,R5)

CAPACITORS
- ❒ 1   1 uF electrolytic capacitor (C2)
- ❒ 1   10 uF electrolytic capacitor (C1)

SEMICONDUCTORS

- ❒ 1   555 Timer IC [marked TS555CN] (U1)
- ❒ 2   2N3904 transistor [marked 2N3904] (Q1,Q3)
- ❒ 1   infrared phototransistor [black T1 case] (Q2)
- ❒ 1   infrared light emitting diode (D1)
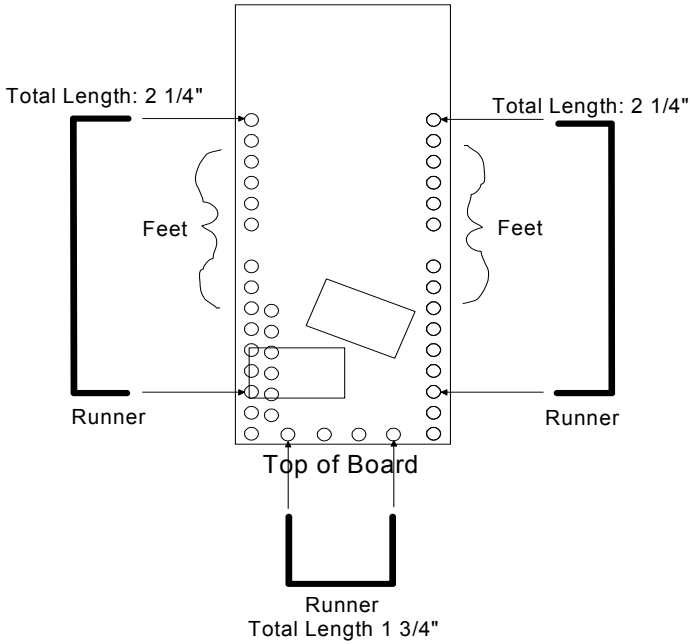- ❒ 2   blinking light emitting diodes (D2,D3)

MISCELLANEOUS

- ❒ 1   red/black twisted wire, 5 inches
- ❒ 1   20AWG tinned wire, 18 inches
- ❒ 2   "N" cell battery holders
- ❒ 1   length of double stickey foam tape
- ❒ 2   little motors
- ❒ 1   slide switch (S1)

WEB1 PC BOARD ASSEMBLY STEPS

- ☐ 1. Let's start with U1, the TS555 timer. The TS555 sits on the left side of the PC board, in the middle. Be sure the notch at one end lines up with the notch in the board diagram.

- ☐ 2. Next, install R4, 1K ohm resistor [brown-black-red], below U1.

- ☐ 3. Install switch S1 to the right of R4. It goes in either way.

- ☐ 4. Install R3, 68 ohm resistor [blue-gray-black].

- ☐ 5. Install C2, 1 uF electrolytic capacitor, right above S1. Electrolytic caps have a polarity and must be installed in the correct orientation. Make sure the band on the cap lines up with the right hole on the board. Only "+" is marked on the board; the band or stripe down the side of the cap is nor-mally negative or "-".Be sure to observe polarity. The "-" side goes in the hole that is NOT marked "+". To help you a bit, the positive lead is usually longer than the negative lead.

- ☐ 6. Install C1, 10 uF electrolytic capacitor, next to C2. Watch that polarity!

- ☐ 7. Install R2, 10K ohm potentiometer, next to C2.

- ☐ 8. Install R1, 330 ohm resistor [orange-orange-brown], next to R2.

- ☐ 9. Install R5, 10K ohm potentiometer, above R2.

- ☐ 10. Install Q1, 2N3904 transistor [marked 2N3904], above C2. Make sure the flat side lines up with the flat side on the board drawing.

- ☐ 11. Install Q3, the other 2N3904 transistor [marked 2N3904], in the upper right hand corner of the board. Watch the orientation of the flat spot again.

- ☐ 12. Install D1, infrared light emitting diode [clear T1-3/4 package], above Q3. Line up the flat edge with the flat edge on the PC board drawing. This flat side should be toward the outside of the PC board when oriented cor-rectly. Let the LED stick up about 3/8" above the board.

- ☐ 13. Install D3, blinking LED to the left of D1. These LEDs have a flat side or corner. Line this up with the flat side on the PC board drawing. The cut-off corner should be toward the front of the board and to the right if you're looking at the board with the battery pack at the bottom toward you and the power switch toward the right side of the board. Let the LED stick up 5/8" above the board.

- ☐ 14. Install D2, the other blinking LED, next to D3. Line it up just like the other one and let it stick up 5/8" above the board.

☐ 15. Install Q2, infrared phototransistor [black T1 case], to the left of D2. Make sure the flat spot faces the inside of the board. Let Q2 stick up 3/8" above the board.

Total Length: 2 1/4"   Total Length: 2 1/4"

Feet   Feet

Runner   Runner

Top of Board

Runner
Total Length 1 3/4"

☐ 16. Now we need to cut up little pieces of wire that will be the WEB1's feet. Use the tinned 20AWG wire. Cut 20, 3/4 inch pieces.

☐ 17. Solder the feet in the holes on the sides of the board using the picture as a guide. They should stick out the BOTTOM of the PC board, the side opposite the one that all the components are already soldered to. Be sure to snip off the ends of the leads on the TOP side of the board as flush as you can. These feet are pretty much decorative and you can bend them in any way that you think looks good. I bent mine a little out to the side.

Back   1/4"   1/2"   Front

(Side View)
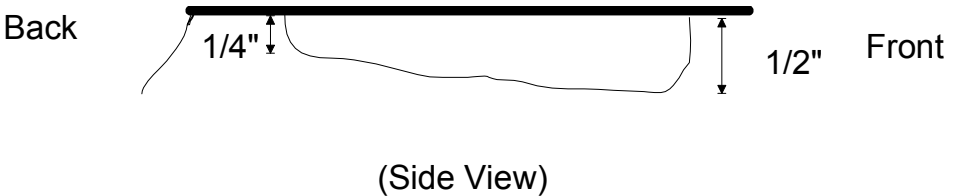
☐ Cut three pieces of wire that will be the runners that the WEB1 slides on. The two side runners are 2 1/4" long. The back runner is 1 3/4" long. The side runners need to be bent into a "U" shape with the front part about 1/2" long and the back part should be about 1/4" long. These act kind of like a sled that the WEB1 slides across the floor on. The back runner is sort of like a big foot that pushes the WEB1 from behind. It should be bent into a square shape and soldered into the holes as shown in the picture.

☐ 18. Now you need to install the little motors on the circuit board. The motors come with a silicone thingy on them. This will help keep the motor in place when it is running.

☐ 19. Now you need to determine where you're attaching the motors to the PC board. To do this, take one of the motors and hold it under the BOTTOM of the board so that it roughly lines up with the rectangular outline on the TOP of the board. This is just to help you place the motor in the right spot. Take a look at the picture below or the parts layout diagram and note that one pattern is at an angle while one is straight. The one at an angle is for steering the bug when it approaches an obstacle, the straight one propels your electronic friend forward. It isn't critical that the steering motor be angled, but this may improve the steering performance. There are many holes on the board for you to solder the hold-down wire into. Just pick ones that are conveniently close to the motor so that the wire has a snug hold on it. Now, cut 2, 3/4" pieces of tinned wire and place one end of each piece in a hole that you intend to use to mount the motor. Solder this end in place on each of the wires. Now wrap each piece of wire one by one around the motor making sure that the pads on the motor are facing out where you can solder the wires to them and run each wire back up through the board. Solder each wire on the top of the circuit board so that

Top of Board

Wire

Motor Under Board
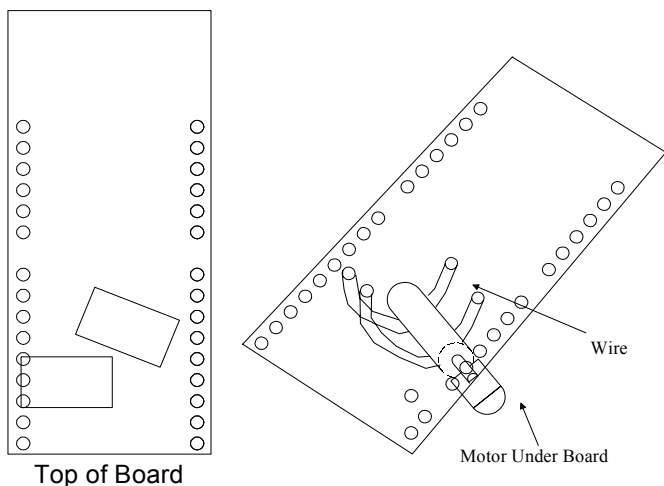
WEB1 BOARD PARTS LAYOUT DIAGRAM
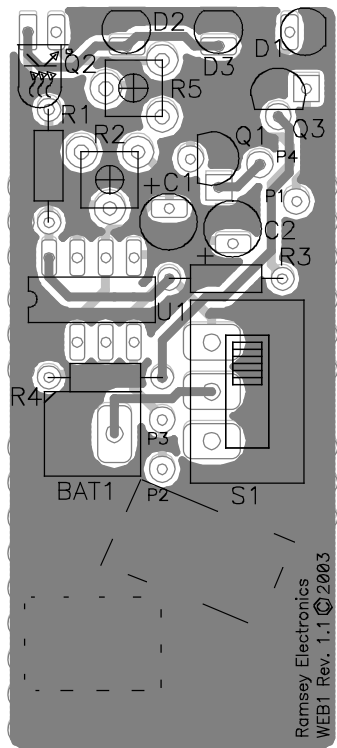
the motor is tightly held in place. I found that pulling the wire taut with my needle nose pliers helped me snug it up into its proper position. Repeat this procedure for the other motor using the other outline on the top of the board as a guide.

☐ 20. It's time to solder the wires to the little pads at the end of the motor. The motor should be held still by the hold-down wires you just installed so it shouldn't roll while you solder the power wires on. Cut 2 pieces of the red/black twisted wire, each about 2 inches long. Strip back one end of each wire about 1/16". Now soldering the ends onto a motor is a little tricky. Once you're sure that the motor is secured, tin a red wire end really well so that you have a good amount of solder on it. Next, hold the tinned end on the right side pad and heat it with your iron until the solder flows onto the pad. It doesn't take much heat. Be careful when heating the pads
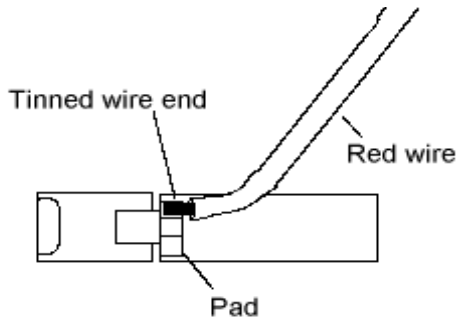
up. The motors are a little sensitive to the heat and can't be baked to death like most other components. Solder the black wire to the other pad, and then repeat this whole process for the other motor.

☐ 21. Let's solder the other end of the motor wires to the PC board. Each has a red and a black wire that you just soldered correctly to the motor in the last step. We'll start with the motor closest to the bottom edge of the board. Solder its red wire up through the bottom of the board into pad P4. Solder its black wire up through the bottom of the board into pad P3. The other motor's red wire goes into pad P1. Its black wire goes into pad P2. As a last step it's best to snug up the motor closest to the back of the bug by putting a little piece of snipped off component lead

☐ 22. Solder in the battery pack wires into pads BAT1. If you place the board so you can read the BAT1 rightside up, the left hand hole of the two holes is the negative. Solder the black wire here. The right hand hole is positive;

the red wire goes here. Now tape the battery pack to the top of the board using the double-sided foam tape provided.
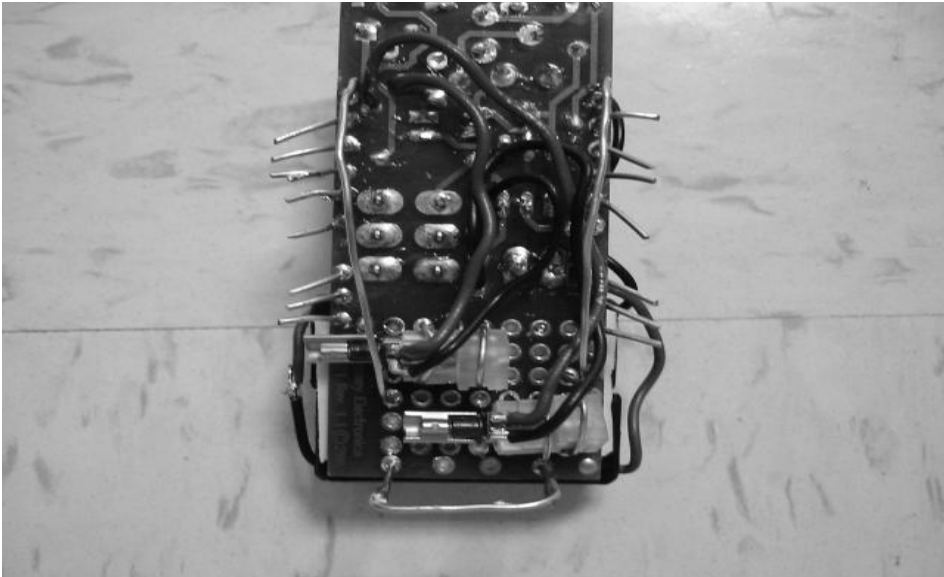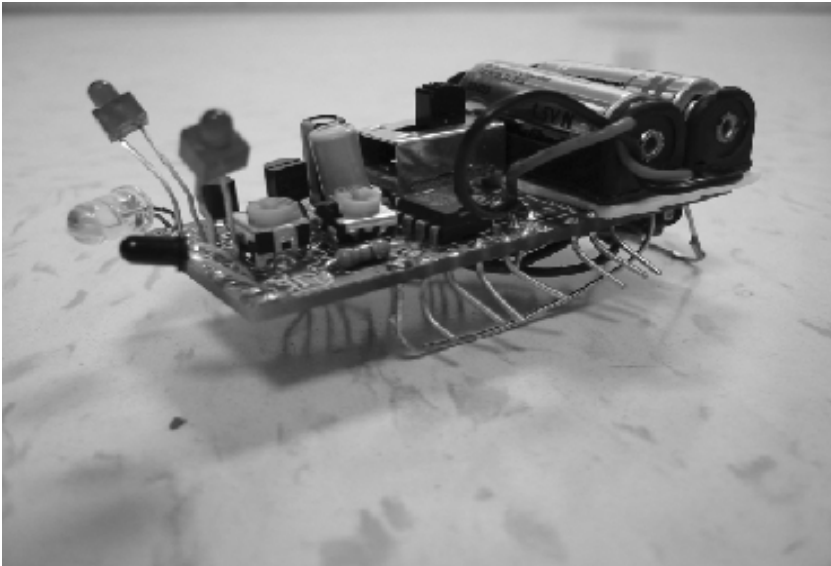
SETUP AND TESTING

If you would like, you can go ahead and put the batteries in their holders and flip on the switch. The little flashing LEDs should blink, and at least one of the motors should be buzzing away. At this point you can bend the flashing LEDs in a way that you think is cute. I bent mine kind of off to the side, so they look like eyeball stalks or something. It is possible that you have skillz and your WEB1 will not need any adjustment. Go ahead and place it on a hard smooth surface like a wooden desktop. It's best that it is not completely smooth like glass; the wire feet need a little texture to push against. If it zooms straight ahead, then all three runners are perfectly adjusted and nothing else is necessary. But, more likely it turns in a circle or just buzzes. In this case, the adjustment procedure is necessary.

ADJUSTMENT PROCEDURE

1. Forward motion adjust:
    A. If the bug does not move forward at all, bend the back runner to make it a little more straight or a little more angled. When you get the angle right, your bug will move.
    B. Once the bug moves forward you can make it move straight by tweaking the side runners. They should be roughly straight about the same height, so that the bug isn't leaning to one side. If the bug veers to one side, try twisting the back runner a bit in either direction. It kind of acts like a rudder on a boat. IF you still can't get the bug to go straight, you may have to bend the side runners a little differently. Try making one a little taller than the other, or change the shape a bit. Don't be discouraged if your bug isn't perfect right away. Some adjustment is normal.
    C. The last adjustment you can make is the motor speed adjust R2. It will make your bug go faster or slower. It's also useful because usually the bug performs differently on different types of surfaces. It's best to adjust the speed to get the results you like for whatever surface you're running on.

2. Steering adjust:

    A. The first step in adjusting the steering is to get the steering motor, (the one that's mounted at an angle) to come on when the bug approaches an obstacle, or when someone shines a flashlight at it. The first thing is to bend the Infrared phototransistor Q2, and Infrared LED D3 as shown in the picture. Bend them down and inward towards each other so they kind of look like the bug's mandibles or something, ha ha. These two components are how the WEB1 detects an object. The infrared LED emits infrared light, and the infrared phototransistor detects infrared light. Hmm, how could these two be used as an obstacle detector? Well, normally the LED is shining out into the room and Q2 is off. When the bug gets close to a wall (important note: not a BLACK wall), some of the infrared light from the LED bounces off of the obstacle and hits Q2. Then Q2 turns on, and the angled motor turns on and makes the bug turn. A black or very dark obstacle may not cause the bug to turn because it absorbs the infrared light instead of reflecting it.

    B. The next step is to bring your hand or other everyday object near the front of the bug when it is switched on. What should happen is that the turning motor (the angled one) should come on when the object gets close. If it's on already, that means that Q2 and D3 are too close. Just move them apart a little. If the turning motor is on no matter what you do, THEN ALL IS LOST!!!!!!!!!! Well, actually no, just turn down the sensitivity (adjust R5 counterclockwise). Then adjust the distance between Q2 and D3 until the motor turns on only when an obstacle is in front of the WEB1. An important note here is that adjusting the sensitivity will be more critical if there is bright incandescent light or a lot of sunlight at your location. This is because they give off infrared light that Q2 picks up. Fluorescent lights give off very little if any infrared light and hardly affect the WEB1 at all. Further, a HeNe laser doesn't give off *any* infrared light, so if your school or home is lit with laser light you're all set!

Top of Board
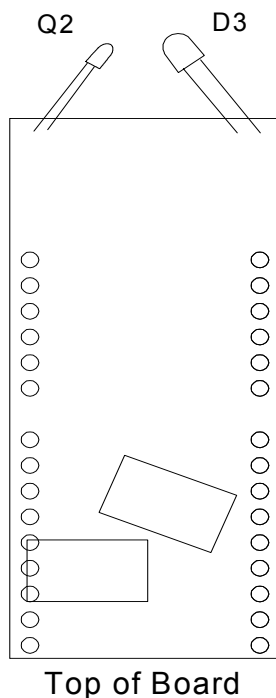
TROUBLESHOOTING GUIDE

If your WEB1 isn't working correctly just refer to the steps below:

Problem	Solution
No blinking, no buzzing	Check parts placement, specifically U1 and transistor orientation.
Motor buzzes, but bug just sits there or drifts	Readjust wire runners, especially the back one. See page 14.
Bug keeps turning even though only one motor is on.	Readjust the side runners. See page 13.
Both motors are always on	Turn R5 counter-clockwise and/or move Q2 and D3 farther apart.

Bug moves forward, turning motor comes on at obstacle, but bug does not turn	Some tweaking of the side runners is needed. Adjust R2 up and down. Try a different surface
Bug jumps up and attacks	Unforeseen emergent property. Call tech support immediately!

CONCLUSION

We sincerely hope that you will enjoy the use of this Ramsey product. As always, we have tried to compose our manual in the easiest, most "user friendly" format that is possible. As our customers, we value your opinions, comments, and additions that you would like to see in future publications. Please submit comments or ideas to:

Ramsey Electronics Inc.
Attn. Hobby Kit Department
590 Fishers Station Drive
Victor, NY 14564

or email us at: techsupport@ramseymail.com

And once again, thanks from the folks at Ramsey!

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! However, customer satisfaction is our goal, so in the event that you do have a problem, take note of the following.

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 its 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.

TABLE OF CONTENTS

REQUIRED TOOLS

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

ADDITIONAL SUGGESTED ITEMS

- Helping Hands Holder for PC Board/Parts (HH3)
- Technician's Tool Kit (TK405)
- Desoldering Braid (RTS08)

TOTAL SOLDER POINTS
60
ESTIMATED ASSEMBLY TIME

Beginner...............2 hrs
Intermediate.........1 hrs
Advanced ....30 min

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