

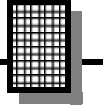
CABLE WIZARD CABLE TRACER



Ramsey Electronics Model No. WCT20

Did you ever need to identify the “other end” of that cable? Put away the ohmmeter; with the Cable Wizard you can quickly find it without even touching the other end! Sniff out cables nearby or across the building!

- Super fast and easy to use
- Locate and identify any cable from telephone pairs, ethernet, coax, or even your own doorbell!
- Find that ONE cable in the bundle of spaghetti QUICK!
- Fully compatible with other commercial “Fox & Hound” Tone Tracers
- Transmitter is equipped with an RJ45 Telco connector & Alligator Clips for universal connections
- Powered by standard 9 volt batteries
- Compact and lightweight to go anywhere
- Rugged matching case set available ensuring years of trouble free use



PARTIAL LIST OF AVAILABLE KITS

RAMSEY TRANSMITTER KITS

- FM10A FM Stereo Transmitter
- FM100B Professional Synthesized FM Stereo Transmitter
- FM25B Synthesized FM Stereo Transmitter
- AM25 Synthesized AM Transmitter
- AM1 AM Transmitter

RAMSEY RECEIVER KITS

- FR1 FM Broadcast Receiver
- AR1 Aircraft Band Receiver
- AA7 Active Antenna
- SC1 Shortwave Converter

RAMSEY HOBBY KITS

- PG13 Plasma Generator
- SS70A Speech Scrambler
- TT1 Telephone Recorder
- ECG1 Heart Monitor
- MD3 Microwave Motion Detector
- TFM3 Tri-Field Meter

RAMSEY AMATEUR RADIO KITS

- DDF1 Doppler Direction Finder
- HR Series HF All Mode Receivers
- QRP Series HF CW Transmitters
- VLF1 Low Bander Low Frequency SWL Converter
- 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.

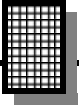
CABLE WIZARD CABLE TRACER KIT INSTRUCTION MANUAL

Ramsey Electronics publication No. MWCT20 Revision 1.1

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INSTRUCTION MANUAL FOR

CABLE WIZARD CABLE TRACER

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INTRODUCTION

If you've ever had to run cable in your home or office, or trace someone else's cable runs, you know the scenario. You have one end of the cable identified but when you get to the other end, you see several cables that all look exactly the same. Any one of those could be it so which is the right one? You've probably wished you could push a magic button and have the "mystery" cable identify itself. The Cable Wizard makes it that simple!

Here at the shop we've run so many cables and wires so many times that the ceiling is full of them. Instead of taking the amount of time that would be necessary to pull the cable back out and discard it, we just leave the obsolete cables up there and pile on the new ones. Besides, we always hope we won't be the next one up in the ceiling running more cable! Anyway, now when we have to trace out a cable it's a nightmare, so we put one of our engineers on the problem and the result is the kit you hold in your hands. He designed a simple circuit that we seem to be finding use for all the time, and much more inexpensively than the high priced commercial types that are available. We hope you'll get as much use out of your Cable Wizard as we have. Just remember, if you want to have it there when you need it, don't let all your friends borrow it and forget where they got it! Tell them to get their own!

CIRCUIT DESCRIPTION

The Wizard Cable Tracer consists of a transmitter and a receiver unit. We will take each one separately, starting with the transmitter.

The transmitter unit has 3 main sections: a 2 Hz oscillator, a 2 KHz oscillator, and an output buffer/limiter. We use CMOS oscillators to generate our tracing tone, the following is a brief explanation of how they work.

When power is first applied to the unit we must make a few assumptions about what is going on. Note the sections on Figure 1 marked "A", "B", and "X". We will be referencing these points to make the circuit description simpler. We assume initially that:

1. Point "A" is HIGH
2. Point "B" is LOW
3. Point "X" is HIGH

As power is applied, C1 begins charging through R1. The charge time will be dependant on the values of R and C. Since the capacitor cannot charge instantaneously, point "A" will drop to a LOW level. The Nand gate configuration tying both input terminals together sets up the devise for operation as an inverter. This means the output of each gate will be the opposite of whatever is on the input, i.e. Input = HIGH so Output = LOW.

When point “A” becomes LOW, “B” is forced to switch HIGH, therefore “X” becomes LOW. The charge voltage polarity on C1 is now flipped and charging begins again in the opposite direction. This cycle continues as long the circuit is powered.

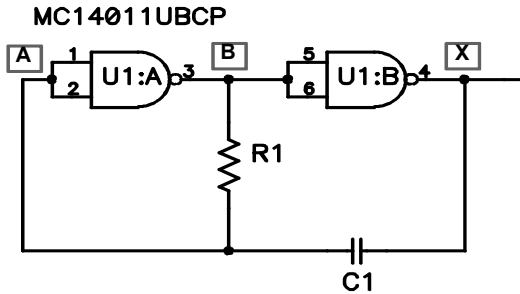


FIGURE 1

Our transmitter circuit takes advantage of two of these CMOS oscillators. By combining the two we can get a varying tone that is easy to identify with the receiver.

The final two stages of the transmitter circuit consist of Q1 (buffer amplifier) and D2 + D3 (voltage limiters) to condition the output signal and help to protect the oscillator stages from damage when hooked up to the external wire under test. **NOTE: ALL WIRES SHOULD BE DE-ENERGIZED BEFORE CONNECTING YOU WCT20.** The voltage limiters are only for accidental hook-up, at no time should any wire circuits under test be “Live” due to risk of personal injury.

The receiver unit uses a common JFET amplifier, the MPF102 (Q101) to detect faint RF signals. The incredible gain characteristics of Q101 is the real secret to the performance of the total system. The signal of our transmitter emanating from the wire under test is easily sniffed off by the receiver then passed through the LM386 audio amplifier (U101) giving us plenty of signal to listen to. By swinging the receiver over a bundle of wires, the operator can quickly determine the exact wire set by simply listening for the loudest sounding audio level when close to a pair of wires.

We have used the WCT20 kit set to track everything from telephone wires, coaxial cable, computer network drops, and single wire antenna feeds (use the red alligator clip for single wire tracking), to dashboard wiring while installing the boss’s stereo in his car!

Because the WCT20 has two separate parts, a transmitter and receiver, we will treat them as two separate kits. First we’ll build the transmitter, then the receiver. The parts list for the receiver is in the manual at the end of the transmitter construction section. Keep this in mind when sorting your parts.

PARTS LIST:

Transmitter Board (WTC20—TX)

RESISTORS

- 2 100 ohm resistors [brown-black-brown] (R5, R6)
- 1 470 ohm resistor [yellow-violet-brown] (R4)
- 1 2.2K ohm resistor [red-red-red] (R2)
- 1 2.2Meg ohm resistor [red-red-green] (R1)
- 1 50K ohm trimmer potentiometer [503] (R3)

CAPACITORS

- 1 0.01 μ F ceramic disc capacitors [marked .01, 103, or 10nF] (C2)
- 4 0.1 μ F ceramic disc capacitor [marked .1 or 104] (C1,C3, C4, C5)

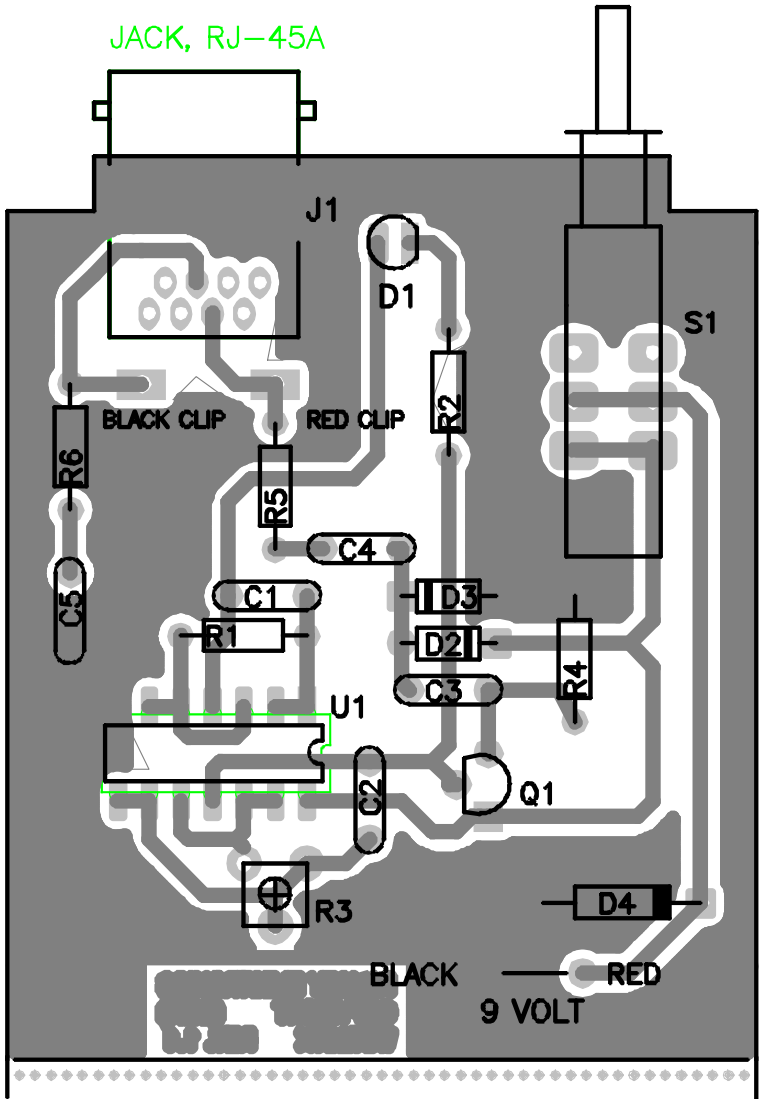
SEMICONDUCTORS

- 1 1N4004 diode [black with silver band] (D4)
- 2 1N4148 diode [glass bead with black band] (D2, D3)
- 1 Red LED (D1)
- 1 2N3904 NPN transistor (Q1)
- 1 MC14011UBCP Quad Nand Gate (U1)

HARDWARE AND MISCELLANEOUS

- 1 DPDT pushbutton switch (S1)
- 1 RJ-45 connector (J1)
- 1 4" piece of red and black twisted pair wire.

WCT20 PARTS LAYOUT DIAGRAM



ASSEMBLY INSTRUCTIONS

In ALL PC board assembly steps, our word "INSTALL" means to do this:

- Insert the part, oriented or "pointed" correctly, into its holes in the PC board.
- If helpful, gently BEND the part's wire leads or tabs to hold it in place, with the body of the part snugly against the top side ("component side") of the circuit board. The "component side" is silkscreened with the part numbers for easy parts location identification.
- Solder ALL wires or pins of the part.
- Trim or "nip" all excess wire lengths extending beyond each solder connection, taking care that wire trimmings do not become lodged in solder connections.

Follow the assembly instructions IN SEQUENCE and check off each step as understood and completed. Examine the schematic circuit diagram and PC Board parts layout diagram as you proceed.

Use good soldering techniques! Let your soldering iron tip heat both the component lead wire and PC board trace enough so that the wire itself AND the foil trace BOTH become hot enough TOGETHER to melt a bit of solder so that it flows smoothly from the pin to the PC board trace.

Enough said... Let's get building!

The first thing to do before soldering any parts on the board is to break the two circuit boards apart. The centerline between them is perforated making it a simple matter of holding the board with your thumbs on either side of the perforation and snapping the boards apart. Remember, for the protection of your eyes, point the boards away from you when breaking apart. We'll start with the board marked "WCT20TX" on the green solder side of the board.

- 1. Install U1, the MC14011UBCP Quad Nand Gate on the top side of the board. To ensure that the part is seated flat on the PC board, mount the part and place the circuit board component side down on the table top before soldering the leads. This will keep the IC from moving while you solder it. Be sure to solder all pins.
- 2. Install R3, the 50K ohm trimmer potentiometer (marked 503).
- 3. Install C5, 0.1 μ F ceramic disc capacitor [marked .1 or 104].

- 4. Install R6, 100 ohms (brown-black-brown).
- 5. Install R1, 2.2 Meg ohms (red-red-green).
- 6. Install C1, 0.1 μ F ceramic disc capacitor [marked .1 or 104].
- 7. Install R5, 100 ohms (brown-black-brown).
- 8. Install C4, another 0.1 μ F ceramic disc capacitor [marked .1 or 104].
- 9. Install D1, the red LED. You will note that the silkscreen for this part shows a flat side and the LED has a flat side. Line up the flat side when installing this part. If installed incorrectly, it will not work. Leave the leads long so that you can bend them up and fit the LED into the case.
- 10. Install R2, 2.2K ohms (red-red-red).
- 11. Install D2 and D3, the two 1N4148 glass bead diodes. Note the band on the part and the band on the PC board silkscreen. These parts also must be installed with the correct polarity or they will not function properly. Recheck polarity before soldering these diodes in place.
- 12. Install C3, the last 0.1 μ F ceramic disc capacitor [marked .1 or 104].
- 13. Install C2, 0.01 μ F ceramic disc capacitors [marked .01, 103, or 10nF].
- 14. Install Q1, 2N3904 transistor. Follow the PC board silkscreen or parts layout diagram for proper orientation.
- 15. Install R4, 470 ohms (yellow-violet-brown).
- 16. Install D4, the 1N4004 diode (black with a silver band). This part also has a polarity and must be oriented as shown on the PC board silkscreen. The silver band should be lined up with the black band on the board.
- 17. Install J1, the RJ-45 connector. Be sure it is seated flat before soldering.
- 18. Install S1, the DPDT pushbutton switch. As with the connector, be sure to seat the switch properly before soldering.
- 19. Take one of the pieces of red and black twisted pair wire, strip and install in the board near D4, where the silkscreen says "9 VOLT". The holes are labeled "red" and "black". Solder the wires into place.

Except for the red and black alligator clips (covered on page16), you've completed construction of the transmitter half of your Cable Tracer kit. We'll move on to the receiver next, but take a moment to look over your parts placement and solder joints before setting aside the transmitter. Recheck polarity on the diodes and IC and look for clean, shiny solder connections.

PARTS LIST:

Receiver Board

RESISTORS

- 1 2 ohm resistor [red-black-gold] (R105)
- 1 220 ohm resistor [red-red-brown] (R101)
- 1 270 ohm resistor [red-violet-brown] (R103)
- 3 1K ohm resistors [brown-black-red] (R100,104,106)
- 1 10 Meg ohm resistor [brown-black-blue] (R102)

CAPACITORS

- 1 0.01 μ F ceramic disc capacitors [marked .01, 103, or 10nF] (C100)
- 1 0.1 μ F ceramic disc capacitor [marked .1 or 104] (C104)
- 2 10 μ F electrolytic capacitors (C101,102)
- 1 220 μ F electrolytic capacitor (C103)

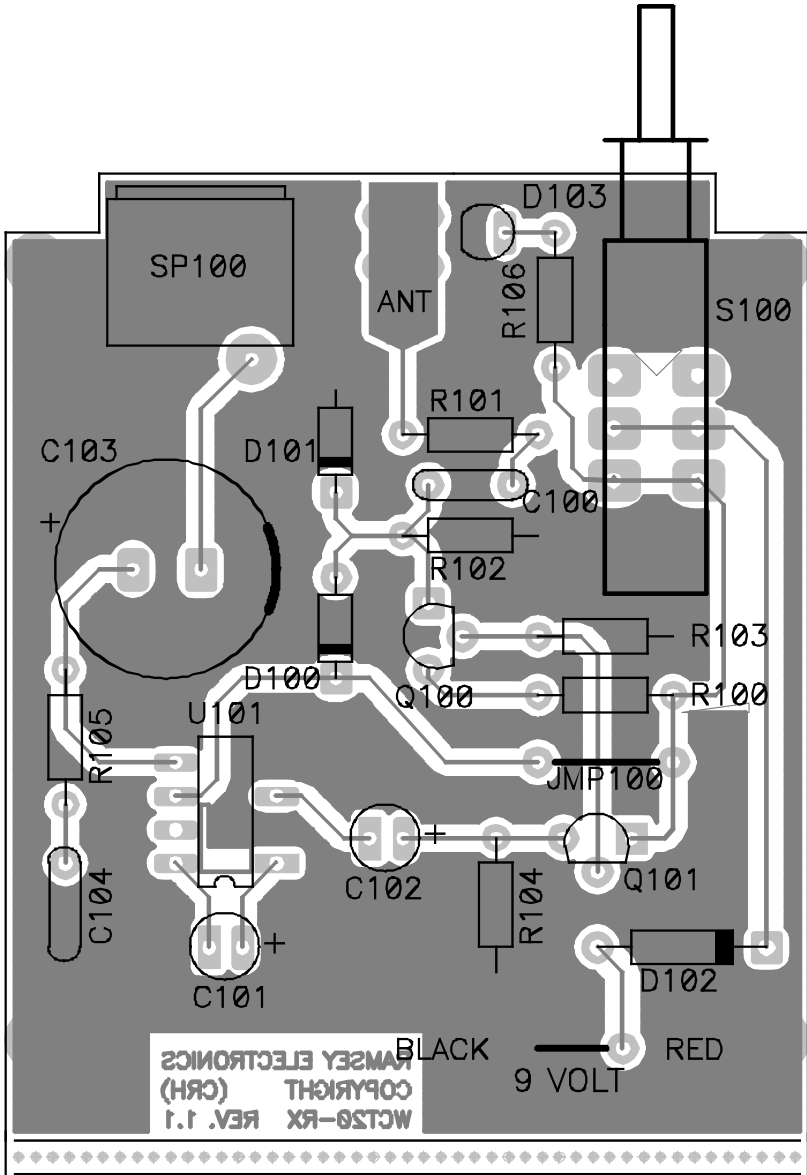
SEMICONDUCTORS

- 1 1N4004 diode [black with silver band] (D102)
- 2 1N4148 diode [glass bead with black band] (D100,101)
- 1 Red LED (D103)
- 1 MPF102 FET (Q100)
- 1 2N3904 NPN transistor (Q101)
- 1 LM386 audio amplifier IC (U101)

HARDWARE AND MISCELLANEOUS

- 1 DPDT pushbutton switch (S100)
- 1 Mini speaker (SP100)
- 1 3" piece of brazing rod with insulating heat shrink
- 1 4" piece of red and black twisted pair wire.

WCT20 PARTS LAYOUT DIAGRAM

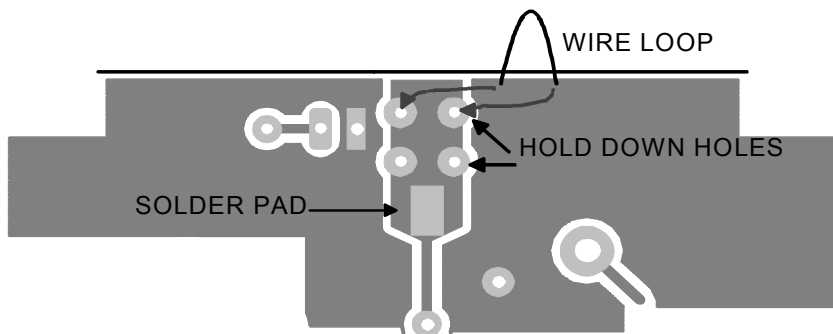


Now we're on to part 2 of your kit construction, the receiver board. All installation instructions are the same as they were for the transmitter board. Check off the steps as you go.

As you build your cable wizard kit save some clipped off leads from the capacitors or resistors. These will be needed later to form jumpers and provide mechanical connections for other parts. If you throw out your lead scraps you'll have to find buss wire to make these important connections.

- 101. Install U101, the LM386 audio amplifier IC. As with U1, mount the part and place the circuit board component side down on the table top before soldering the leads. This will keep the IC from moving while you solder it. Be sure to solder all pins.
- 102. Install C101, 10 μ F electrolytic capacitor. Note the "+" sign on the PC board silkscreen and be sure the positive lead is installed that way. Remember that the capacitor will show which lead is the negative.
- 103. Install C104, 0.1 μ F ceramic disc capacitor [marked .1 or 104].
- 104. Install R105, the 2 ohm resistor (red-black-gold).
- 105. Install C103, 220 μ F electrolytic capacitor. Again, watch the polarity when installing. If power is applied with one of these capacitors installed in reverse polarity, it could explode. Check it before soldering.
- 106. Install D100 and D101, the 1N4148 diodes (glass bead with black band). Follow the PC board silkscreen for proper orientation of the black band and solder in place.
- 107. Install C102, 10 μ F electrolytic capacitors. Watch the polarity!
- 108. Install R106, one of the 1K ohm resistors (brown-black-red).
- 109. Install D103, the red LED. Remember to orient the flat side as shown on the PC board silkscreen and parts layout diagram. Leave the leads long so the LED will fit through the hole in the case.
- 110. Install R101, 220 ohm resistor (red-red-brown).
- 111. Install C100, 0.01 μ F ceramic disc capacitors [marked .01, 103, or 10nF].
- 112. Install R102, 10 Meg ohms (brown-black-blue).
- 113. Install Q100, MPF102 FET. Be sure to place the part as shown on the silkscreen and parts layout diagram.
- 114. Install R103, 270 ohm resistor (red-violet-brown).
- 115. Install R100, 1K ohm resistor (brown-black-red).

- ❑ 116. Now is the time to use the clipped off lead that you saved in a previous step to use as JMP 100. Form the lead so that it looks like a staple and place it into the holes marked. Solder just as you would a resistor.
- ❑ 117. Install R104, 1K ohm resistor (brown-black-red).
- ❑ 118. Install Q101, 2N3904 transistor. Be sure to place the part as shown on the silkscreen and parts layout diagram.
- ❑ 119. Install D102, 1N4004 diode (black with silver band). Orient the silver band with the black band on the silkscreen.
- ❑ 120. Take the piece of red and black twisted pair wire and strip the ends. Install in the board near D102, where the silkscreen says “9 VOLT”. The holes are labeled “red” and “black”. Solder the wires into place.
- ❑ 121. Install the DPDT pushbutton switch, S100. Be sure it is seated flat on the PC board before soldering.
- ❑ 122. Install SP100, the mini speaker. This part will need to face the front (switch side) of the PC board so our saved leads will come in handy again. Stand up a lead that is at least 1/2 inch long in each of the holes marked for SP100 and solder in place. Next, take the speaker and line its leads up with the leads just soldered in so that the speaker faces the front of the PC board and hangs over the front edge slightly. Solder the speaker's leads to the standing leads, then trim off any excess from the standing leads. Mounting the speaker on its side ensures maximum volume when the circuit board is mounted in the case.
- ❑ 123. Now for the antenna. Take the piece of brazing rod and place the unsheathed, bare copper end on the solder side of the PC board in the place marked out for it. The space is between SP100 and D103 on the under side of the circuit board. You will note a solder pad and two sets of holes. Take another of your clipped off leads and make a loop that will pass through these holes, parallel to the front edge of the PC board. Solder the loops and solder the antenna to the solder pad. Turn the board over and clip off the excess on the top side of the PC board.



You've completed construction of your WCT20 cable tracer kit! We know you're anxious to plug in the batteries and turn on the units but before you do, take a moment to look over your work. Check your solder joints, parts placement and polarity of electrolytic capacitors, diodes and ICs. The mistake you catch now will save you a lot of heartache later.

CASE INSTALLATION

Mounting the circuit boards into the custom case sets is pretty easy. Here are a few guidelines to observe.

- ❑ 124. Match the pre-punched face plates of the cases to the end of each circuit board that has the power switches (TX Board— S1, RX Board— S100).
- ❑ 125. Slide the face plate in position over the components on the end of each respective boards prior to installing them in their cases.
- ❑ 126. Insert the black rubber grommet into the center hole of the TX face plate. It will be a snug fit after the alligator clip wires are inserted.
- ❑ 127. Pass the end of the red and black alligator clip wires through the open grommet hole in the transmitter face plate. Loop a knot together in the red and black alligator clip wires about 2" from the open end of the wires. This will act as a strain relief keeping your wires from coming off the circuit board with repeated use.
- ❑ 128. Install the black alligator clip wire through the top of the circuit board in the hole closest to R6 (reference the WCT20 Parts Layout Diagram on page 7).
- ❑ 129. Install the red alligator clip wire through the top of the circuit board in the hole closest to R5 (reference the WCT20 Parts Layout Diagram on page 7).
- ❑ 130. The red and black twisted power wires should be soldered to the battery terminals that are built into the case sets. Note that the position of the battery symbol in the battery compartment shows the tab closest to the bottom of the case is negative, solder the black wire here after the tab is inserted into the slot from the back side of the case. The red wire should be attached in the same manor to the positive tab.
- ❑ 131. Match the self-adhesive case stickers to the respective boards and adhere them to the front of the case sets. Note that the arrow indicators should line up with the proper positions of the antenna, power jack, etc.

INITIAL TESTING

If any of the following steps fail to produce the desired result, turn to the next section of the manual dealing with troubleshooting.

- Connect a fresh, 9 volt battery to both the transmitter and receiver units. Make certain the battery is connected with the proper polarity.
- Turn on the receiver unit. The red LED should light.
- Turn on the transmitter unit. The red LED should flash or blink.
- Place the receiver unit near the wires on the transmitter unit. You should hear an audio tone that increases in volume as you get closer to the wire.
- Adjust R3 for the desired tone. You will observe that as you adjust the pot the volume will change. Tune for the best mix of enough volume and a pleasing tone. The speakers best dynamic response is at 2 KHz.
- Try connecting a section of standard phone line (RJ-11 connectors normally) with at least two conductors to the transmitter unit. Follow the wire with the receiver to hear the audio tone and see how the volume changes as you move away from the wire.
- That's it! Your Cable Tracer is ready to be put to work for you!

TROUBLESHOOTING GUIDE

If your WCT20 does not work at all, recheck the following:

- Watch the orientation of your 9 volt batteries. The battery compartment is not keyed so verify the battery position with that of the symbol on the case.
- Correct orientation of ICs (see PC board layout diagram).
- Correct polarity of all electrolytic capacitors.
- Correct orientation of diodes.

If you still cannot get the unit to function, read the warranty instructions on page 19. A simple recheck of your construction will usually solve any problems.

Enjoy your Wizard Cable Tracer!!!



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.

WCT20 AUTOMATIC VIDEO SWITCHER Quick Reference Page Guide

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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

Manual Price Only: \$5.00

Ramsey Publication No. MWCT20

Assembly and Instruction Manual for:

RAMSEY MODEL NO. WCT20 CABLE WIZARD CABLE TRACER



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