INTRODUCTION

General Information: Despite lurid tales of the FBI using electronic olives to spy on private citizens, most of us feel pretty safe from electronic surveillance in our homes and offices. But, perhaps we shouldn't! A quick scan of the electronic hobby magazines reveals an astonishing array of affordable micro-miniature VHF and UHF transmitters being sold for the sole purpose of "bugging" private conversations. And now, with the advent of low-cost microchip video cameras, even our most intimate and private acts are easily transmitted blocks away and committed to videotape! Who would do such a thing? Recent news reports suggest heavy-handed prosecutors, angry spouses, personal or political enemies, dishonest business competitors, internet smut hucksters, hired sleuths, insurance investigators, criminal sex offenders, and even curious adolescent snoops--to name only a few! It's not a comforting thought, but manufacturers are selling hundreds of millions of dollars worth of inexpensive amateur surveillance products yearly, and somebody out there is buying this stuff!

The VEC-8218K can help you fight back and reclaim your personal space by detecting signals from low-power bugging transmitters over a wide frequency range. Sweep an area, and if a signal is there, you can find its source and "crunch" the offending bug quickly--before sensitive words and private acts wind up in the wrong hands! As an added plus, your monitor also checks cellphones, cordless phones, RC transmitters, and garage-door openers for operation.

Circuitry: The VEC-8218 Counter-Surveillance Monitor consists of a high-gain wide-band RF amplifier coupled to a RF detector. This drives a sensitive VCO (voltage-controlled oscillator) that changes in pitch whenever nearby signals are picked up. The closer you get, the greater the change in pitch from the speaker--enabling you to move in quickly for the "kill". Sensitivity is adjustable down to -60 dBm, which ensures detection of even very-low power or well-hidden bugs.

TOOLS AND SUPPLIES

Construction Area: Kit construction requires a clean, smooth, and well-lighted area where you can easily organize and handle small parts without losing them. An inexpensive sheet of white poster board makes an excellent construction surface, while providing protection for the underlying table or desk. Diffused overhead lighting is a plus, and a supplemental high-intensity desk lamp is especially helpful for close-up work. Safety is always important! Use a suitable high-temperature stand for your soldering iron, and keep the work area free of clutter.

Universal Kit-building Tools: No special tools are required to complete this kit beyond common items normally used for bench construction. We recommend the following:

- ☐ Soldering Iron (grounded-tip and temperature-controlled preferred)
- ☐ High-temperature Iron Holder with Cleaning Sponge
- ☐ Solder, 60/40 or 37/63 with rosin or "no-clean" flux (.031" dia. is good size).
- ☐ Needle Nose Pliers or Surgical Hemostats
- ☐ Diagonal Cutters or "Nippy Cutters"
- ☐ Solder Sucker (squeeze or vacuum pump type), or Desoldering Braid
- ☐ Bright Desk Lamp
- ☐ Magnifying Glass

BEFORE YOU START BUILDING

Experience shows there are *four common mistakes* builders make. Avoid these, and your kit will probably work on the first try! Here's what they are:

1. **Installing the Wrong Part:** It always pays to double-check each step. A 1K and a 10K resistor may look *almost* the same, but they may act very differently in an electronic circuit! Same for capacitors--a device marked 102 (or .001 uF) may have very different operating characteristics from one marked 103 (or .01uF).
2. **Installing Parts Backwards:** Always check the polarity of electrolytic capacitors to make sure the positive (+) lead goes in the (+) hole on the circuit board. ICs have a notch or dot at one end indicating the correct direction of insertion. Always double-check--especially before applying power to the circuit!
3. **Faulty Solder Connections:** Inspect for cold-solder joints and solder bridges. Cold solder joints happen when you don't fully heat the connection--or when metallic corrosion and oxide contaminate a component lead or pad. Solder bridges form when a trail of excess solder shorts pads or tracks together (see solder tips below).
4. **Omitting or Misreading a Part:** This is easier to do than you might think! Always double-check to make sure you completed each step in an assembly sequence.

Soldering Tips: *Cleanliness* and good *heat distribution* are the two secrets of professional soldering. Before you install and solder each part, inspect leads or

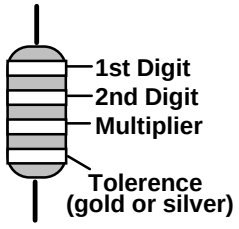
pins for oxidation. If the metal surface is dull, sand with fine emery paper until shiny. Allow the tip of your iron to contact both the lead and pad for about one second (count "one-thousand-one") before feeding solder to the connection. Surfaces must become hot enough for solder to *flow smoothly*. Feed solder to the opposite side of the lead from your iron tip--solder will wick around the lead toward the tip, wetting all exposed surfaces. Apply solder sparingly, and do not touch solder directly to the hot iron tip to promote rapid melting. Keep a damp sponge handy to wipe your soldering tip on. This removes excess solder, and keeps the tip properly tinned. If the iron is going to sit idling for long periods, wipe the tip, add some fresh solder, and unplug the iron.

Desoldering Tips: If you make a mistake and need to remove a part, follow these instructions carefully! First, grasp the component with hemostats, needle-nose pliers, or your fingers. Heat the pad beneath the lead you intend to extract, and pull gently. The lead should come out. Repeat for the other lead. Solder may fill in behind the lead as you extract it--especially if you are working on a double-sided board with plate-through holes. Should this happen, try heating the pad again and inserting a common pin into the hole. Solder won't stick to the pin's chromium plating. When the pad cools, remove the pin and insert the correct component. For ICs or multiple-pin parts, use desoldering braid to remove excess solder before attempting to extract the part. Alternatively, a low-cost vacuum-bulb or spring-loaded solder sucker may be used. Parts damaged or severely overheated during extraction should be replaced rather than reinstalled.

Work Habits: Kit construction requires the ability to follow detailed instructions and, in many cases, to perform new and unfamiliar tasks. To avoid making needless mistakes, work for short periods when you're fresh and alert. Recreational construction projects are more informative and more fun when you take your time. Enjoy!

Sorting and Reading Resistors: The electrical value of resistors is indicated by a color code (shown below). You don't have to memorize this code to work with resistors, but you do need to understand how it works:

Resistor Color Code

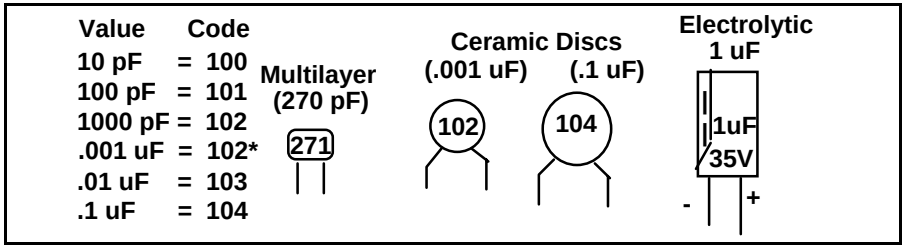


Black	= 0 (tens)	Blue	= 6
Brown	= 1 (hundreds)	Violet	= 7
Red	= 2 (K)	Gray	= 8
Orange	= 3 (10K)	White	= 9
Yellow	= 4 (100K)	Silver	= 10%
Green	= 5 (1Meg)	Gold	= 5%

When you look at a resistor, check its multiplier code first. Any resistor with a black multiplier band falls between 10 and 99 ohms in value. Brown designates

a value between 100 and 999 ohms. Red indicates a value from 1000 to 9999 ohms, which is also expressed as 1.0K to 9.9K. An orange multiplier band designates 10K to 99K, etc. To inventory resistors, first separate them into groups by multiplier band (make a pile of 10s, 100s, Ks, 10Ks, etc.). Next, sort each group by specific value (1K, 2.2K, 4.7K, etc). This procedure makes the inventory easier, and also makes locating specific parts more convenient later on during construction. Some builders find it especially helpful to arrange resistors in ascending order along a strip of double-sided tape.

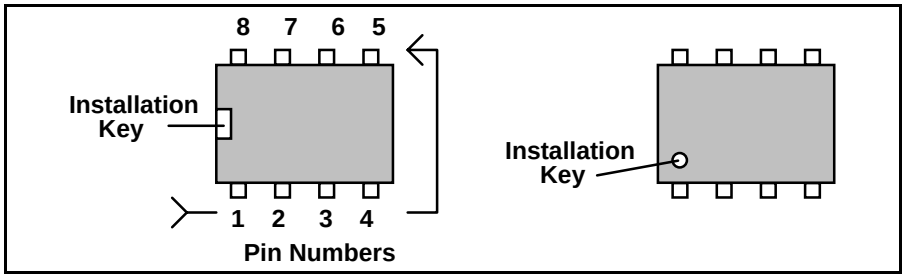
Reading Capacitors: Unlike resistors, capacitors no longer use a color code for value identification. Instead, the value, or a 3-number code, is printed on the body.



As with resistors, it's helpful to sort capacitors by type, and then to arrange them in ascending order of value. Small-value capacitors are characterized in pF (or pico-Farads), while larger values are labeled in uF (or micro-Farads). The transition from pF to uF occurs at 1000 pF (or .001 uF)*. Today, *most* monolithic and disc-ceramic capacitors are marked with a three-number code. The first two digits indicate a numerical value, while the last digit indicates a multiplier (same as resistors).

Electrolytic capacitors are always marked in uF. Electrolytics are polarized devices and must be oriented correctly during installation. If you become confused by markings on the case, remember the uncut negative lead is slightly shorter than the positive lead.

Integrated Circuits: Proper IC positioning is indicated by a dot or square marking located on one end of the device. A corresponding mark will be silk-screened on the PC board and printed on the kit's parts-placement diagram. To identify specific IC pin numbers for testing purposes, see the diagram below. Pin numbers always begin at "1" at the keyed end of the case and progress along the device, as shown:



PARTS LIST

Your kit should contain all of the parts listed below. Please identify and inventory each item on the checklist before you start building. If any parts are missing or damaged, refer to the manual's warranty section for replacement instructions. If you can't positively identify an unfamiliar item on the basis of the information given, set it aside until all other items are checked off. You may then be able to identify it by process of elimination. Finally, your kit will go together more smoothly if parts are organized by type and arranged by value ahead of time. Use this inventory as an opportunity to sort and arrange parts so you can identify and find them quickly.

☑	Qty	Part Description	Designation	VEC P/N
☐	1	22 ohm resistor (red-red-black)	R6	100-1220
☐	1	100 ohm resistor (brown-black-brown)	R16	100-2100
☐	2	220 ohm resistor (red-red-brown)	R1,R9	100-2220
☐	2	470 ohm resistor (yellow-violet-brown)	R4,R14	100-2470
☐	1	560 ohm resistor(green-blue-brown)	R5	100-2560
☐	1	1K resistor (brown-black-red)	R22	100-3100
☐	1	1.5K resistor (brown-green-red)	R8	100-3150
☐	1	4.7K resistor (yellow-violet-red)	R7	100-3470
☐	4	10K resistor (brown-black-orange)	R10,R11,R21 R23	100-4100

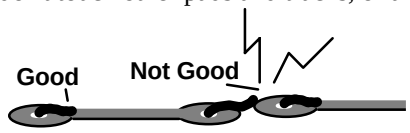
☑	Qty	Part Description	Designation	VEC P/N
☐	2	15K resistor (brown-green-orange)	R13,R17	100-4150
☐	1	39K resistor (orange-white-orange)	R3	100-4390
☐	3	47K resistor (yellow-violet-orange)	R15,R18,R19	100-4470
☐	2	100K resistor (brown-black-yellow)	R2,R20	100-5100
☐	1	1M resistor (brown-black-green)	R12	100-6100
☐	1	10K potentiometer w/switch	R24	
☐	1	.001 uF multilayer capacitor (102)	C1	220-1100
☐	1	.0047 uF multilater capacitor (472)	C8	220-1470

☐	6	.01 uF multilayer capacitor (103)	C2,C3,C4,C5 C6,C7	220-2100
☐	2	10 uF electrolytic capacitor	C9,C10	270-5100-1
☐	1	LM324 quad op-amp IC (14 pins)	U1	324-0324
☐	1	MRF901 transistor (4 leads)	Q1	306-5901
☐	2	PN2222 transistor	Q2,Q3	305-2222-1
☐	1	1N270 detector diode	D1	300-0034
☐	1	Sub-miniature speaker	SPK1	410-0011
☐	1	9V battery snap	BAT1	730-3005
☐	6	3" length of insulated wire		871-2444-0300
☐	1	Telescoping antenna	ANT	758-1120
☐	1	Solder lug		720-1213
☐	1	3.5 x .6 - 6mm screw		675-0006B
☐	1	Printed circuit board		861-VEC8218
☐	1	Owner's Manual		925-VEC8218K

PARTS PLACEMENT

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

In these instructions, when you see the term *install*, this means to locate, identify, and insert the part into its mounting holes on the PC board. This includes pre-bending or straightening leads as needed so force is not required to seat the part. Once a component is mounted, bend each lead over to hold it in place. Use sharp side-cutters to clip off excess lead length before soldering. Make sure trimmed leads don't touch other pads and tracks, or a short circuit may result:



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☐	6	.01 uF multilayer capacitor (103)	C2,C3,C4,C5 C6,C7	220-2100
☐	2	10 uF electrolytic capacitor	C9,C10	270-5100-1
☐	1	LM324 quad op-amp IC (14 pins)	U1	324-0324
☐	1	IC socket (14 pins)	*for U1*	625-0014
☐	1	MRF901 transistor (4 leads)	Q1	306-5901
☐	2	PN2222 transistor	Q2,Q3	305-2222-1
☐	1	1N270 detector diode	D1	300-0034
☐	1	Sub-miniature speaker	SPK1	410-0011
☐	1	9V battery snap	BAT1	730-3005
☐	6	3" length of insulated wire		871-2444-0300
☐	1	Telescoping antenna	ANT	758-1120
☐	1	Solder lug		720-1213
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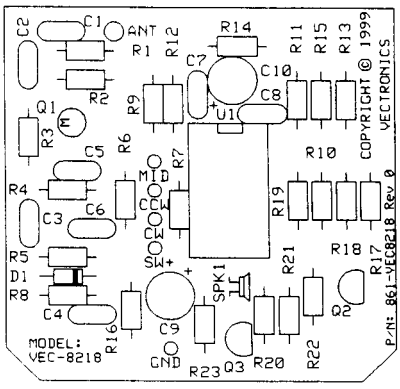
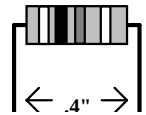
PARTS PLACEMENT



The term *solder* means to solder the part's leads in place, and to inspect both (or all) solder connections for flaws or solder bridges. Nip off excess protruding leads with a sharp pair of side cutters.

This kit has 23 fixed-value resistors. Mount these now, starting with the smallest value and moving to the largest. Before mounting each one, carefully bend both leads close to the resistor body to form right-angles, as shown.



☐ ☐ 1. Find a 22 ohm resistor (red, red, black). Install at R6 and solder.

☐ ☐ 2. Find a 100 ohm resistor (brown-black-brown). Install R16 and solder.

Locate two (2) 220 ohm resistors (red-red-brown).

☐ ☐ 3. Install a 220 ohm at R1 and solder.

☐ ☐ 4. Install a 220 ohm at R9 and solder.

Locate two (2) 470 ohm resistors (yellow-violet-brown).

☐ ☐ 5. Install a 470 ohm at R4 and solder.

☐ ☐ 6. Install a 470 ohm at R14 and solder.

☐ ☐ 7. Find a 560 ohm resistor (green-blue-brown). Install at R5 and solder.

☐ ☐ 8. Find a 1K resistor (brown-black-red). Install at R22 and solder.

☐ ☐ 9. Find a 1.5K resistor (brown-green-red). Install at R8 and solder.

☐ ☐ 10. Find a 4.7K resistor (yellow-violet-red). Install at R7 and solder.

Locate four (4) 10K resistors (brown-black-orange).

☐ ☐ 11. Install a 10K at R10 and solder.

☐ ☐ 12. Install a 10K at R11 and solder.

☐ ☐ 13. Install a 10K at R21 and solder.

☐ ☐ 14. Install a 10K at R23 and solder.

Locate two (2) 15K resistors (brown-green-orange).

☐ ☐ 15. Install a 15K at R13 and solder.

☐ ☐ 16. Install a 15K at R17 and solder.

☐ ☐ 17. Find a 39K resistor (orange-white-orange). Install at R3 and solder.

Locate three (3) 47K resistors (yellow-violet-orange).

☐ ☐ 18. Install a 47K at R15 and solder.

☐ ☐ 19. Install a 47K at R18 and solder.

☐ ☐ 20. Install a 47K at R19 and solder.

Locate two (2) 100K resistors (brown-black-yellow).

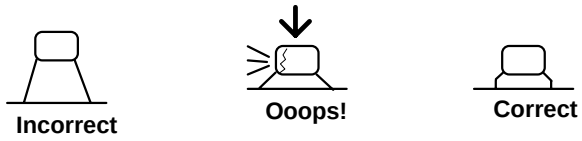
☐ ☐ 21. Install a 100K at R2 and solder.

☐ ☐ 22. Install a 100K at R20 and solder.

☐ ☐ 23. Find a 1M resistor (brown-black-green). Install at R12 and solder.

This concludes installation of the resistors provided in your kit. Double-check for placement, making sure each value is installed where it belongs.

Next, install the kit's 8 multilayer capacitors. Avoid using force or excessive heat when installing these. If the spacing isn't right, pre-form leads to the correct spacing before inserting into the PC board.



☐ ☐ 24. Find a .001 uF multilayer capacitor (marked 102). Install at C1 and solder.

☐ ☐ 25. Find a .0047 uF multilayer capacitor (marked 472). Install at C8 and solder.

Locate six (6) .01 uF multilayer capacitor (marked 103).

☐ ☐ 26. Install a .01 uF at C2 and solder.

☐ ☐ 27. Install a .01 uF at C3 and solder.

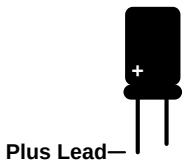
☐ ☐ 28. Install a .01 uF at C4 and solder.

☐ ☐ 29. Install a .01 uF at C5 and solder.

☐ ☐ 30. Install a .01 uF at C6 and solder.

☐ ☐ 31. Install a .01 uF at C7 and solder.

The last two capacitors in your kit are electrolytic. ***Electrolytic caps are polarized and must be installed the correct way in order to work.*** Each capacitor's plus (+) mounting hole is marked on both the circuit board and parts placement diagram. If the markings on the capacitor body are unclear, the plus (+) lead is always the longer of



the two.

Locate two (2) 10 uF electrolytic capacitors.

☐ ☐ 32. Install 10 uF at C9 and solder.

☐ ☐ 33. Install 10 uF at C10 and solder.

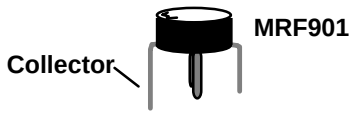
This completes capacitor installation. Before moving on, check each electrolytic for correct polarity.

Locate two (2) PN2222 plastic transistors. Like the electrolytic caps, transistors must be oriented correctly to work.

☐ ☐ 34. Install a PN2222 at Q2 and solder.

☐ ☐ 35. Install a PN2222 at Q3 and solder.

Locate the MRF 901. This device resembles a small black plastic pill with four leads. The longest lead is the collector, also distinguished by the letter "M". Carefully bend each lead down, forming a right-angle to the component body (make sure the "M" is on top).

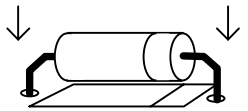


Now, locate the silk-screened footprint for Q1.

☐ ☐ 36. Gently insert all four leads into the board, making sure the collector lead is positioned correctly. The body should rest flush with the PC board surface. Turn the board over, keeping an index finger on Q1, and bend the leads to secure the device in place.

☐ ☐ 37. Solder all four leads of Q1.

Find the 1N270 diode (glass body). Like transistors, diodes are polarized devices that must be installed correctly. Always look for the banded end when installing.



☐ ☐ 38. Install the 1N270 diode at D1 and solder.

Find the LM324 IC. The IC is keyed at one end to indicate proper positioning. During installation, orient the IC so the notch corresponds to the key on the PC layout.

When installing ICs, make sure all pins enter the mounting holes and appear on the opposite side of the PC board (it's easy to fold one or more under the IC). Also, when soldering, make sure the IC remains flat against the board surface.

☐ ☐ 39. Observing the key, install the LM324 at U1 and solder.

Locate the 9V battery snap clip, and note the red+ lead and black- lead.

☐ ☐ 40. Install the red lead at SW (+) and solder.

☐ ☐ 41. Install the black lead at GND (-) and solder.

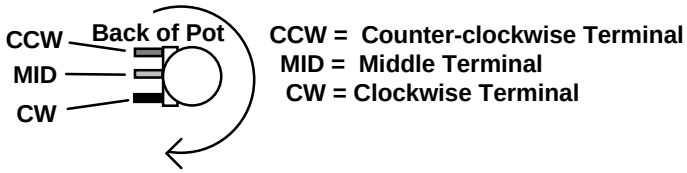
Locate three (3) lengths of insulated wire. These will be installed at the mounting points next to R7.

☐ ☐ 42. Install an insulated wire at MID and solder.

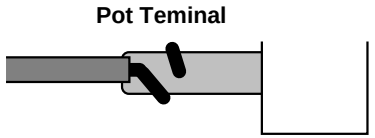
☐ ☐ 43. Install an insulated wire at CCW and solder.

☐ ☐ 44. Install an insulated wire at CW and solder.

Next, locate the 10K 16mm potentiometer (with off/on switch). Position as shown, and connect the control leads as follows:



Be sure to wrap the lead end around the pot terminal before soldering:



☐ ☐ 45. Connect the lead from MID to the middle terminal of the 10K pot and solder.

☐ ☐ 46. Connect the lead from CCW to the top lead of the 10K pot and solder..

☐ ☐ 47. Connect the lead from CW to the bottom lead of the 10K pot and solder.

Locate the red (+) lead going from the battery snap connector to SW (+) on the PC board. Perform the following steps:

☐ ☐ 48. Measure back 2" from the SW (+) end and snip the wire.

☐ ☐ 49. Dress both ends, removing 1/4" of insulation and tinning the leads.

Find the two off/on switch terminals on the back of 10K pot R24:

☐ ☐ 50. Install the snap-clip end of the red lead to one switch terminal.

☐ ☐ 51. Install the SW (+) red battery lead to the other switch terminal.

Locate the small 8 ohm speaker supplied with your kit. Also, find two (2) equal lengths of insulated wire:

☐ ☐ 52. Solder a lead to each of the two (2) speaker connections on the plastic frame.

☐ ☐ 53. Install one speaker lead at SPK1 on the PC board (either hole).

☐ ☐ 54. Install the second lead at the other SPK1 hole on the PC board.

Find one last length of hook-up wire. This will be used for connecting the collapsible whip later on.

☐ ☐ 55. Install one end of the wire at ANT on the PC board.

This concludes wiring of your VEC-8218 Surveillance Monitor Kit. Before moving on to the next section, give your kit a thorough QC (quality control) inspection. This will help you discover accidental assembly errors that might prevent it from working properly--or that might cause damage to sensitive parts when you apply power. Follow this procedure:

1. Compare parts locations with the parts-placement diagram. Was each part installed where it is supposed to be? Was the correct value used? Start at one side of the board and work your way across in an organized pattern.
2. Inspect the solder side of the board for cold-solder joins and solder bridges between tracks or pads. Use a magnifying glass to obtain a clear view of the track area. If you suspect a solder bridge, hold the board in front of a bright light for a better view. All joints should be smooth and shiny, indicating good solder wetting and flow. Resolder any beaded or dull-appearing connections. Also, check the front-panel jacks, switches, and connectors for defective solder connections.
3. Finally, check electrolytic capacitors and diodes for correct polarity. Does the plus (+) polarity symbol on the part agree with the pictorial and with the pattern on the PC board? Is the banded end of each diode positioned correctly? Were all ICs and transistors installed correctly?

Be sure to correct *all* errors before moving on.

TESTING AND ALIGNMENT

This kit has no internal alignment adjustments. To test the circuit board for proper operation prior to installation in its case, begin as follows:

1. Temporarily connect the monitor's collapsible antenna with the hardware provided.
2. Turn the power switch off (pot fully counter-clockwise).
3. Install a fresh 9V alkaline battery on the battery snap clip.
4. Collapse the antenna for minimum length.
5. Turn the power switch on and advance the control slowly clockwise.

With no strong nearby radios signals present, you should hear a steady low-frequency tone in the speaker that increases in pitch as you advance the sensitivity control. If you fail to hear the oscillation, check battery condition. If the battery's okay, re-check for construction errors.

To check the RF detector for proper operation, you'll need a signal source in the 1-1000 MHz range. A cordless phone, RC-model transmitter, garage door opener, cellphone, baby monitor, ham-radio HT, CB rig, or PCS walkie-talkie should work fine for this purpose.

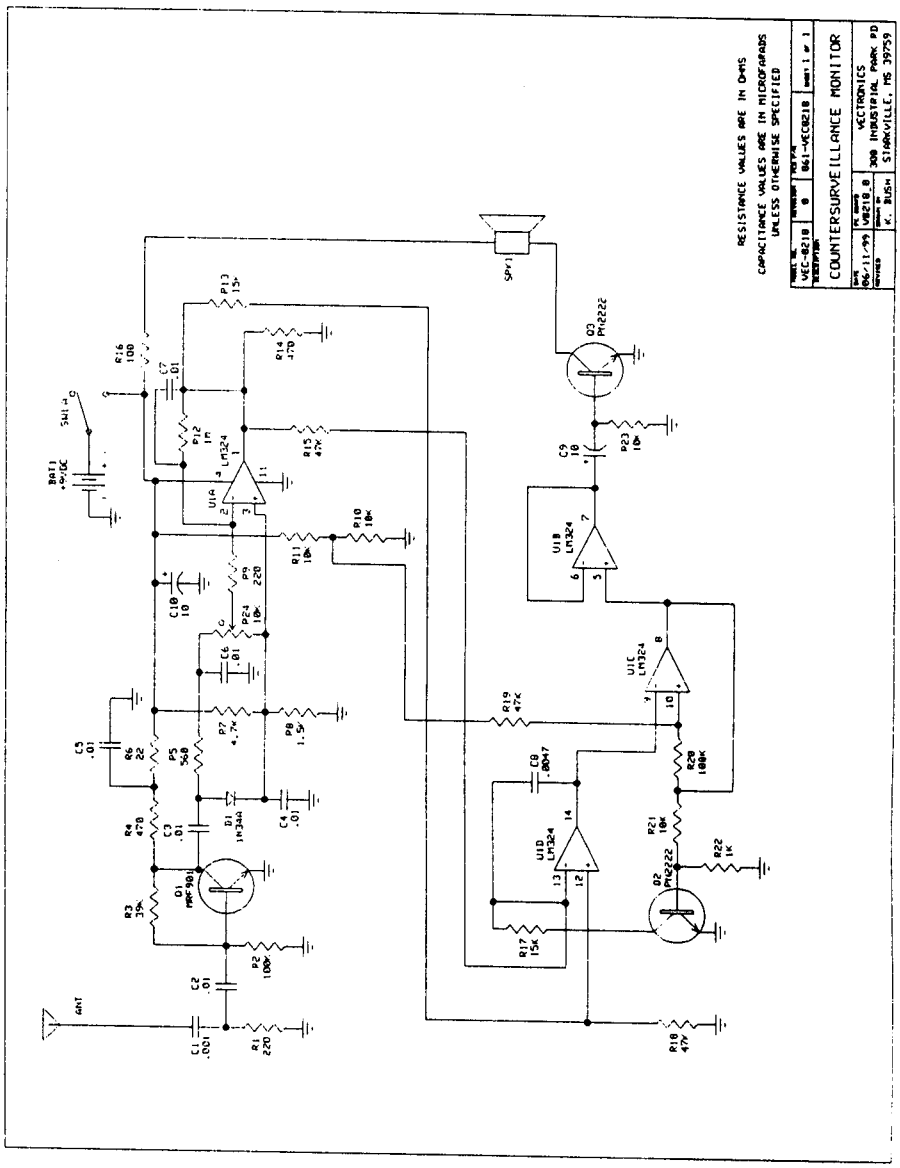
6. Extend your monitor's antenna for full length.
7. Set the VCO control for the lowest sustained tone you can get.
8. Place the monitor close to the transmitter or RF source you've chosen.*
9. Activate the transmitter or RF source.

When the transmitter is on, audio pitch should increase. If it doesn't, try a different transmitter source. If that fails, re-check for construction errors.

Important Note: High-power RF sources such as ham-radio HTs, CBs, commercial-band walkie-talkies, and mobile or base-station transceivers emit extremely high RF levels that could damage your kit if the antennas get too close. Keep your unit at least 10 feet from these sources--or remove the monitor's collapsible antenna during your test. At the opposite extreme, note that your monitor's sensitivity is considerably lower at 900-MHz than at 100 MHz. Therefore, some 900-MHz short-range cordless phones may not provide a very strong signal indication unless the antennas are practically touching.

If your surveillance monitor is operating properly, you may install it in the case at this time. If it fails to operate in the manner described, recheck your work and refer to the "In Case Of Difficulty" section of this manual.

SCHEMATIC


RESISTANCE VALUES ARE IN OHMS
CAPACITANCE VALUES ARE IN MICROFARADS
UNLESS OTHERWISE SPECIFIED
COUNTERSURVEILLANCE MONITOR
VECTRONICS
300 INDUSTRIAL PARK RD
STARKVILLE, MS 39759
SPK1
Q3 PN2222
Q2 PN2222
Q1 MRF901
U1A LM324
U1B LM324
U1C LM324
U1D LM324
D1 1N34A
BAT1 +9VDC
ANT
SW1
R16 100
C7 .01
P13 15K
R14 470
P12 1M
R15 47K
P23 10K
C9 10
P10 10K
R11 10K
P9 220
C10 10
P24 10K
C6 .01
P7 4.7K
P8 1.5K
R19 47K
C5 .01
R6 22
P5 560
C3 .01
R4 470
C4 .01
R3 39K
P2 100K
C2 .01
C1 .001
R1 220
C8 .0047
R20 100K
R21 10K
R22 1K
R17 15K
R18 47K