

(1 Front Cover)

(2 Warranty)

(3 Introduction)

VEC-1016K 49-MHz Wireless-Band Monitor Receiver:

The 49-MHz consumer-wireless band is teeming with signals from baby monitors, cordless phones, walkie-talkies, remote control boxes, wireless intercoms, and much more. If you ever wanted to explore this especially-active portion of the radio spectrum, this kit's for you. The VEC-1016K makes a great add-on baby monitor or test receiver, and with the addition of an outdoor antenna, it pulls in weak wireless signals for miles around--just like the best commercial scanner and monitor receivers! Building the VEC-1016K provides excellent hands-on electronics experience. Detailed step-by-step assembly instructions guide you through each stage of construction, and clearly-presented alignment procedures ensure top performance without need for expensive test equipment. Convenient electronic tuning covers just the 49-MHz band, with no need to enter long strings of microprocessor commands to get the coverage you want. Once tuned to an active channel, your radio's "tail-free" squelch mutes background noise between transmissions. The VEC-1016K consumes minimal energy runs for many hours from its self-contained 9-volt flat-pack alkaline battery. Plug in a 8-ohm speaker or use headphones for loud-and-clear reception. All circuitry is self-contained on a rugged 3" x 3.2" pc board.

(4) 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. Well-diffused overhead lighting is a plus, and a supplemental high-intensity desk lamp will prove especially helpful for close-up work. Safety is an important consideration. Be sure to use a suitable high-temperature stand for your soldering iron, and keep the work area free of combustible clutter.

Universal Kit-building Tools: Although your particular kit may require additional items to complete, virtually all construction projects require a work area outfitted with the following tools and supplies:

- [] Soldering Iron (grounded-tip and temperature-controlled preferred)
- [] High-temperature Iron Holder with Cleaning Sponge
- [] Rosin-core Solder (thin wire-size preferred)
- [] Needle Nose Pliers or Surgical Hemostats
- [] Diagonal Cutters or "Nippy Cutters"
- [] Solder Sucker, Vacuum Pump, or Desoldering Braid
- [] Bright Desk Lamp
- [] Magnifying Glass

Special Tools for This Kit:

- [] Insulated hex-head tuning wand
- [] Small flat-blade screwdriver or tuning wand
- [] Voltmeter, digital or analog
- [] "Low-band" VHF antenna

(5) Before You Start Building:

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

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 typically 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).

Installing Parts Backwards: Always check the polarity of electrolytic capacitors to make sure the positive (+) lead goes in the (+) hole on the circuit board. Transistors have a flat side or emitter tab to help you identify the correct mounting position. ICs have a notch or dot at one end indicating the correct direction of insertion. Diodes have a banded end indicating correct polarity. Always double-check--especially before applying power to the circuit!

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).

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.

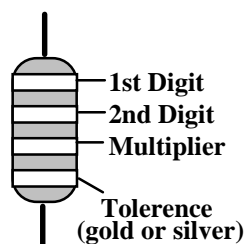
Soldering Tips: *Cleanliness* and good *heat distribution* are the two secrets of professional soldering. Before you install and solder each part, inspect leads or pins for oxidation. If the metal surface is dull, sand with fine emery paper until shiny. Allow the tip of your iron to contact both the 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.

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 multi-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 re-installed.

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 project 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



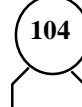
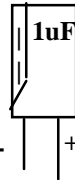


Black	= 0 (tens)	Blue	= 6
Brown	= 1 (hundreds)	Violet	= 7
Red	= 2 (K)	Gray	= 8
Orange	= 3 (10K)	White	= 9
Yellow	= 4 (100K)	Silver	= 10%
Green	= 5 (1Meg)	Gold	= 5%

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 of value along a strip of double-sided tape.

Some VEC kits may contain molded chokes which appear, at first glance, similar to resistors in both shape and band marking. However, a closer look will enable you to differentiate between the two. Chokes are generally larger in diameter and fatter at the ends than resistors. When doing your inventory, separate out any chokes and consult the parts list for specific color-code information.

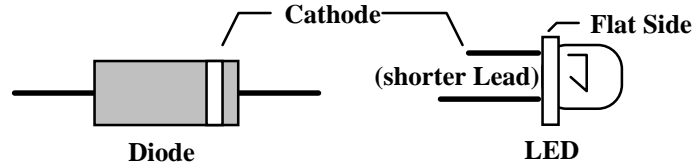
Reading Capacitors: Unlike resistors, capacitors no longer use a color code for value identification. Instead, the value, or a 3-number code, is printed on the body.

Value	Code			
10 pF	= 100	Multilayer (270 pF) 	Ceramic Discs	
100 pF	= 101		(.001 uF)	(.1 uF)
1000 pF	= 102			
.001 uF	= 102*			
.01 uF	= 103			Electrolytic 
.1 uF	= 104			

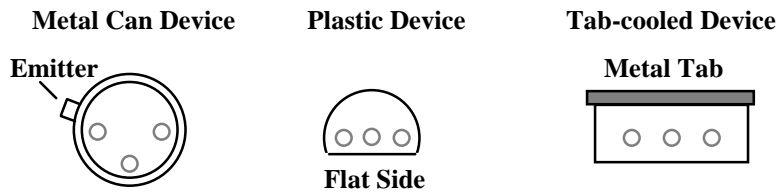
As with resistors, it's helpful to sort capacitors by type, and then to arrange them in ascending order of value. Small-value capacitors are characterized in pF (or pico-Farads), while larger values are labeled in uF (or micro-Farads). The transition from pF to uF occurs at 1000 pF (or .001 uF)*. Today, 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.

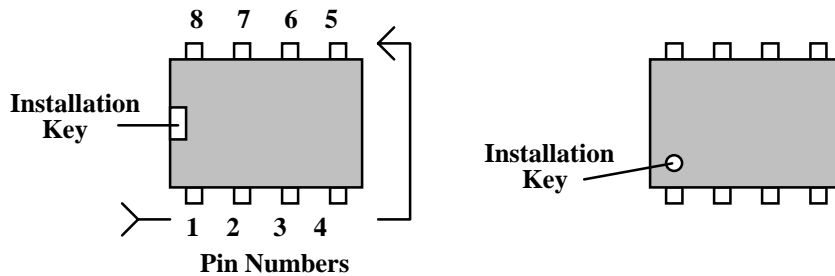
Diodes: Diodes are also polarized devices that must be installed correctly. Always look for the banded--or cathode--end when installing, and follow instructions carefully.



Transistors: If transistors are installed incorrectly, damage may result when power is applied. Transistors in metal cases have a small tab near the emitter lead to identify correct positioning. Semiconductors housed in small plastic cases (TO-92) have an easily-identified flat side to identify mounting orientation. Many specialized diodes and low-current voltage regulators also use this type packaging. Larger plastic transistors and voltage regulators use a case backed with a prominent metal tab to dissipate heat (T-220). Here, orientation is indicated by the positioning of the cooling tab.



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 start at the keyed end of the case and progress counter-clock around the device, as shown:



(6) 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.

[X] Quantity Description of Item Part Designation

Resistors:

[]	1	22 ohm (red, red, black)	R3
[]	1	270 ohm (red, violet, brown)	R4
[]	1	470 ohm (yellow, violet, brown)	R2
[]	2	2.2K (red, red, red)	R11, R14
[]	1	2.7K (red, violet, red)	R7
[]	1	4.7K (yellow, violet, red)	R17
[]	1	6.8K (blue, gray, red)	R5
[]	1	10K (brown, black, orange)	R18
[]	2	39K (orange, white, orange)	R12, R15
[]	1	47K (yellow, violet, orange)	R8
[]	4	100K (brown, black, yellow)	R1, R9, R13, R19
[]	2	10K potentiometer	R6, R16
[]	1	100K potentiometer	R10

Capacitors:

[]	1	3 pF disc ceramic (3 or 309)	C3
[]	2	.001 uF disc ceramic (102)	C14,C32
[]	3	.01 uF disc ceramic (103)	C6,C13,C25
[]	1	.05 uF disc ceramic (503)	C27
[]	8	.1 uF disc ceramic (104)	C10,C11,C12,C21,C22,C24, C26,C29
[]	1	10 pF multilayer (10 or 101)	C1
[]	1	15 pF multilayer (15 or 150)	C5
[]	1	18 pF multilayer (18 or 180)	C19
[]	2	22 pF multilayer (22 or 220)	C17, C18
[]	2	47 pF multilayer (47 or 470)	C2,C4
[]	1	56 pF multilayer (56 or 560)	C20
[]	1	220 pF multilayer (221)	C7
[]	2	1000 pF multilayer (102)	C15,C16
[]	2	1 uF electrolytic	C23,C28
[]	2	10 uF electrolytic	C30,C31
[]	2	100 uF electrolytic	C8,C9

Semiconductors:

[]	1	5.1 volt zener diode, 1N751A	D1
[]	1	2SC2498 transistor	Q1

[]	1	MC13135 IC (24 pin)	U1
[]	1	MC34119 IC (8 pin)	U2

Inductors/Filters/Crystals

[]	1	24" length, #22 coil wire	L1,L2
[]	1	.6 uH slug-tuned, shielded (yellow)	L4
[]	1	660 uH adjustable, shielded (black)	L5
[]	1	10.245 crystal	Y1
[]	1	10.7 MHz ceramic filter (SFE10.7J)	FL1
[]	1	455 kHz ceramic filter (55D or 55F)	FL2

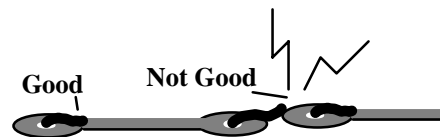
Switches/Jacks/Misc

[]	1	DPDT push-button power switch	SW1
[]	1	RCA phono jack, pc-mounted	J1
[]	1	3.5mm stereo jack (mini-jack)	J2
[]	1	9-volt battery snap clip	
[]	1	plastic cable tie	
[]	1	PC board	
[]	1	VEC-1016 Manual	

(7 Parts Placement Diagram)

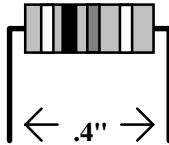
(8 Step-By-Step Construction)

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:



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. Generally, it's easier to install small close-to-the-board parts first, and then mount larger stand-up parts second. Delicate parts, such as air-wound, coils go on the PC board last.

Your kit has 16 fixed-value resistors. We'll 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 below:



- Find a 22 ohm resistor (red-red-black). Install at R3 and solder.
- Find a 270 ohm resistor (red-violet-brown). Install at R4 and solder.
- Find a 470 ohm resistor (yellow-violet-brown). Install at R2 and solder.

Locate two 2.2-K resistors (red-red-red).

- Install 2.2 K at R11 and solder.
- Install 2.2K at R14 and solder.
- Find a 2.7-K resistor (red-violet-red). Install at R7 and solder.
- Find a 4.7-K resistor (yellow-violet-red). Install at R17 and solder.
- Find a 6.8-K resistor (blue-gray-red). Install at R5 and solder.
- Find a 10-K resistor (brown-black-orange). Install at R18 and solder.

Locate two (2) 39-K resistors (orange-white-orange).

- Install 39 K at R12 and solder.
- Install 39 K at R15 and solder.
- Find a 47-K resistor (yellow-violet-orange). Install at R8 and solder.

Locate four (4) 100-K resistors (brown-black-yellow).

- Install 100 K at R1 and solder.
- Install 100 K at R9 and solder.
- Install 100 K at R13 and solder.
- Install 100 K at R19 and solder.

This completes installation of the 16 fixed-value resistors (three variable resistors will be installed later). Next, we'll install the kit's 15 disc-ceramic capacitors. All capacitors should be seated as close to the board as possible.

- Find a 2.7 pF disc-ceramic capacitor (2.2). Install at C3 and solder.

Locate two (2) .001-uF disc-ceramic capacitors (102). Note that there are also two multilayer type .001 uF (or 1000 pF) caps with your kit. *Do not* use those for C14 and C32.

- Install a .001-uF disc at C14 and solder.
- Install a .001-uF disc at C32 and solder.

Locate three (3) .01-uF disc-ceramic capacitors (103).

- Install .01 uF at C6 and solder.
- Install .01 uF at C13 and solder.
- Install .01 uF at C25 and solder.

Locate a .05 uF disc ceramic capacitor (503). Looking at the pc board, note that two (2) installation holes are provided for the ground-side lead of C27. Choose the one that most closely matches the lead spacing for the .05 uF capacitor provided in your kit.

- Install .05 uF at C27 and solder.

Locate eight (8) .1-uF disc ceramic capacitors (104).

- Install .1 uF at C10 and solder.
- Install .1 uF at C11 and solder.
- Install .1 uF at C12 and solder.
- Install .1 uF at C21 and solder.
- Install .1 uF at C22 and solder.
- Install .1 uF at C24 and solder.
- Install .1 uF at C26 and solder.
- Install .1 uF at C29 and solder.

There are 11 multilayer capacitors provided with your kit. A multilayer cap is similar to a surface-mount "chip" capacitor, except that it has a lead spot-welded onto each end of the capacitor body. Multilayers have superior radio-frequency operating characteristics, but the lead welds *may* fail if the device is over-heated and stressed during installation or removal. For this reason, *never use force to seat a multilayer cap* into the PC board. If the spacing isn't right, pre-form the leads to the correct spacing before installation.

- Find a 10-pF multilayer capacitor (10 or 100). Install at C1 and solder.
- Find a 15-pF multilayer capacitor (15 or 150). Install at C5 and solder.
- Find a 18-pF multilayer capacitor (18 or 180). Install at C19 and solder.

Locate two (2) 22-pF multilayer capacitors (22 or 220).

- Install 22 pF at C17 and solder.
- Install 22 pF at C18 and solder.

Locate two (2) 47-pF multilayer capacitors (47 or 470).

Install 47 pF at C2 and solder.

Install 47 pF at C4 and solder.

Find a 56-pF multilayer capacitor (56 or 560). Install at C20 and solder.

Find a 220-pF multilayer capacitor (221). Install at C7 and solder.

Locate two (2) 1000-pF multilayer capacitors (102).

Install 1000-pF at C15 and solder.

Install 1000-pF at C16 and solder.

This completes installation of the 11 multilayer caps. Remember to take frequent breaks while building your kit to avoid fatigue.

The last six (6) capacitors in the kit are electrolytic. ***Electrolytic caps are polarized and must be installed the correct way in order to work.*** Each capacitor's plus (+) mounting holes are noted 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) 1-uF electrolytic caps.

Install 1 uF at C23 and solder.

Install 1 uF at C28 and solder.

Locate two (2) 10-uF electrolytic caps.

Install 10 uF at C30 and solder.

Install 10 uF at C31 and solder.

Locate two (2) 100-uF electrolytic caps.

Install 100 uF at C8 and solder.

Install 100 uF at C9 and solder.

This completes installation of all capacitors. Before moving on to the next phase of construction, check the polarity of each electrolytic one more time to confirm all six are installed correctly.

Identify the 1N751 zener diode--the only diode supplied with the kit. Like electrolytic capacitors, zener diodes are polarized and must be installed the right way. Diode polarity is indicated by a black band located at one end of the glass body.

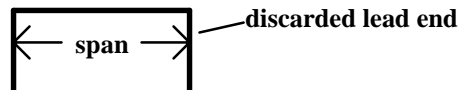
Install the 1N751 at D1 so the banded end corresponds with the band marked on the PC board (toward U1). Solder.

Locate the 2SC2498 plastic transistor and note its flat side. Position at Q1, as indicated by the outline on the pc board. Gently pre-form the leads so the case is spaced approximately .15" above the pc board surface when leads are fully inserted (see below).



Install the 2SC2498 at Q1 and solder.

Your kit has six (6) jumper wires to install. Each should be pre-formed from a bare length of discarded component lead, as shown below. The approximate distance between mounting holes is given to help you pre-form each one. When installed, each jumper should lay flat against the PC board.



- Make a jumper with a .2" span. Install at JMP1 and solder.
- Make a jumper with a .25" span. Install at JMP2 and solder.
- Make another jumper with a .25" span. Install at JMP3 and solder.
- Make a jumper with a .3" span. Install at JMP4 and solder.
- Make a second jumper with a .3" span. Install at JMP5 and solder.
- Make a third jumper with a .3" span. Install at L3* and solder.

***Important Note:** Inductor L3 is not used with the 49 MHz version of this kit. A jumper is used in its place.

Locate the 10.7-MHz ceramic filter (looks like a square disc-ceramic capacitor with three pins, marked 10.7J). This part is unpolarized and may be installed either way.

Install the 10.7-MHz filter at FL1 and solder.

Locate the 455-kHz ceramic filter (a small black cube with three pins marked 55D or 55F). This it will only fit one way on the PC board.

Install the 455-kHz filter at FL2 and solder.

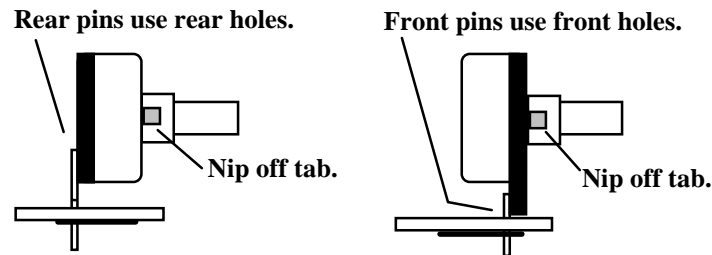
Find the 3.5 mm stereo mini-headphone jack. Install and solder at J2.

Find the RCA phono jack. Install at J1 and solder all four taps.

Locate push-button power switch SW1. Install at SW1 and solder.

[] Locate the 10.245 MHz crystal (frequency marked on can). Install at Y1 and solder.

The front-panel controls (tuning, squelch, volume) are mounted next. Before installing these parts, inspect the type of potentiometer supplied with your kit. If the pins are located on the *front* side of the pot, use the *front set of mounting holes* on the PC board for installation. If the pins are on the *rear*, use the *rear set of mounting holes* (see below). Also, using side cutters, remove the key tab from the side of each pot prior to installation.



Locate two (2) 10-K potentiometers (B103).

[] Install a 10-K pot at R6 (tuning) and solder.

[] Install a 10-K pot at R16 (volume) and solder.

[] Find the 100-K pot (B104). Install at R10 (squelch) and solder.

Locate the .6 uH shielded slug-tuned VFO coil (yellow form, 2 pins). Position at L4, making sure the pins and shield-can tabs are straight and aligned with their mounting holes.

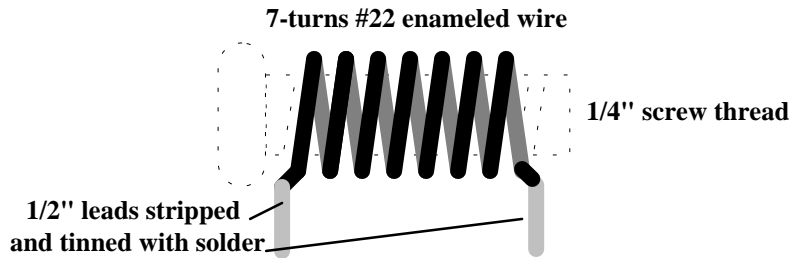
[] Install the .6 uH coil at L4 and solder.

Locate the shielded quadrature-detector coil (five pins, black coil form). Position at L5, making sure all pins and tabs are straight and aligned with their mounting holes.

[] Install the quad-coil at L5 and solder.

The last two coils are air-wound types made from the #22 wire supplied with your kit. In addition to #22 wire, you'll also need a 1/4" screw or bolt at least 3/4" long to use as a winding form (24 tpi). Carefully straighten the coil wire by drawing it over a plastic rounded surface such as a screwdriver handle. Remove all bends and kinks. Cut into two (2) equal lengths.

[] Take one length of wire and, while grasping both ends firmly, carefully wind seven (7) full turns over the winding form--as shown below. The wire should conform into the thread grooves.



[] Remove the coil by unscrewing it from the 1/4" screw threads. Compress the turns of the finished coil to make it as short as possible.

Each lead must be tinned prior to installation. The wire provided with your kit is coated with enamel insulation formulated to melt at high temperatures. This quality should allow you to strip, clean, and "tin" each coil lead in a single operation. To prepare each lead, hold a hot soldering iron tip against it for several seconds while applying a small amount of solder. Eventually, the enamel insulation should begin breaking down, allowing solder to coat and adhere to the wire (it may be easier to perform this operation with the coil threaded onto the screw). If your soldering iron doesn't generate enough heat to start the enamel stripping process, scrape the enamel away with an Exacto™ knife before tinning. Make sure both leads are clean and brightly tinned all the way around before installing.

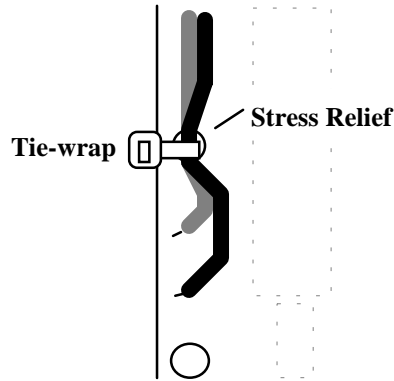
[] Dress, tin, and install a 7-turn coil at L1 and solder. Check coil shape and spacing before moving on.

[] Repeat this operation, installing and soldering a second 7-turn coil at L2.

This completes coil installation. As noted above, no coil is required at L3 for the 49-MHz version of your kit.

[] Install the 9-volt battery snap clip. The red lead is installed at (+ 9V), and the black at GND. Solder in place.

[] Stress relief is provided to prevent battery leads from flexing and eventually breaking at their connection point. Find a hole part-way back on the left edge of the PC board (not to be confused with the board's mounting holes at the front and back). Use the plastic tie-wrap provided in your kit to secure the battery leads in place, as shown below. Insert the tie-wrap through the hole, close it over the wires, and pull tight. Nip off the excess end.



Finally, install receiver ICs U1 and U2. Before doing this, inspect both devices carefully and straighten any bent or crooked pins. Use extreme care during insertion, and move slowly. It's very easy to miss a pin opening and fold a IC pin underneath the body of the device.

Locate U2, the MC34119 audio-amplifier IC (8 pins). Position its keyed (or notched) end to correspond with the key marked on the pc board at U2. Carefully align the pins with the U2 mounting holes before inserting.

[] Install the MC34119 IC at U2, checking carefully that all 8 pins enter their respective mounting holes. Solder each pin in place.

Locate the MC13135 Receiver IC (24 pins). Position the keyed end to correspond with the key marked on the pc board at U1. Carefully align the pins with the U1 mounting holes before inserting.

[] Install the MC13135 IC at U1 and solder each pin in place.

Inspect the pads under both ICs carefully for solder bridges and cold-solder (use a magnifying glass, if available). Correcting any problem before proceeding. This concludes the construction phase of your receiver. You deserve a break! When you come back, be ready to give your work a thorough "QC" quality control check before moving on to the testing and alignment section.

(9 Testing and Alignment)

PC Board Inspection: Even the most experienced builders make mistakes! Before applying power to your kit, give it a thorough QC (quality control) inspection. This will help you find inadvertent assembly errors that might prevent the radio from working or cause damage to sensitive parts. Follow this procedure:

[] Compare parts locations against 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.

[] 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.

[] Finally, check all electrolytic capacitors and diodes for correct polarity. Does the plus (+) polarity symbol on the part agree with the pictorial and with the silk-screen pattern on the PC board? Is the banded end of each diode positioned correctly? Also, were your ICs installed so the dot or notch on the plastic case corresponds with the white dot or marking on the PC board? Was Q1 installed correctly?

Be sure to correct all errors before moving on. If a careful inspection revealed that everything is A-OK, you're now ready for the moment of truth!

Initial Checkout:

To check out your kit you'll need a 9-volt flat-pack type alkaline battery and a 8-ohm extension speaker (or monaural headphones) outfitted with a 3.5-mm mini plug. Make sure the radio's power switch is *OFF* (button out) before loading the battery. Plug in speaker or phones and turn all potentiometer controls fully counter-clockwise.

[] Apply power (button in).

[] Turn up *VOLUME* (right-hand pot) clockwise. You should hear a rushing sound, indicating the receiver and audio amplifier are functioning properly.

[] Slowly advance the *SQUELCH* (center pot) clockwise. The rushing sound should stop abruptly around mid-range, indicating the squelch circuit is working.

If your radio passed its turn-on test, congratulations! You're well on your way to success, and ready for pre-alignment.

If your radio *didn't* pass the turn-on test, don't despair. Odds are, you've overlooked something minor that's easy to correct. Take a break, come back fresh, and carefully repeat the QC inspection. If no undiscovered errors turn up during your second inspection, proceed to the "In Case of Difficulty" section of this manual for troubleshooting advice.

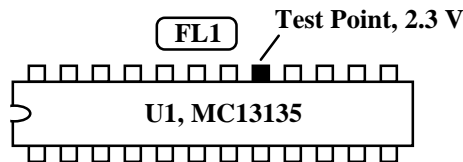
Pre-Alignment:

You'll need the following items to adjust your receiver:

- [] Insulated hex-head tuning wand to adjust L4.
- [] Small flat-blade screwdriver or tuning wand to adjust L5.
- [] Voltmeter, digital or analog, to adjust L5.
- [] VHF "lowband" or six-meter ham antenna to receive off-air signals.

The instructions below describe how to pre-adjust each of the radio's coils for a ballpark setting. This procedure will make final alignment easier.

- [] Locate coils L1 and L2. Compress each coil so the turns are close together.
- [] Make a small flag from a scrap of tape and install it on the hex-head tuning wand. This will help you count revolutions as you adjust L4.
- [] Locate tunable-oscillator coil L4. Insert the tuning wand and rotate the slug counter-clockwise so the top surface is perfectly flush with the top of the metal shield can. Now, watching the tape flag and counting revolutions, rotate the slug *4 turns clockwise* down into the body of the coil.
- [] Set your voltmeter range to 10 Volts dc and connect the black (-) lead to a ground point on the PC board. Locate *pin # 17 on U1* (see below). This is the test point for adjusting L5.



- [] Set all front-panel controls on the radio counter clockwise, install a 9-volt battery on the battery snap clip, and apply power via the *OFF/ON* switch. No antenna should be connected during this test. With power applied, touch the red (+) voltmeter lead to pin #17. Using a small screwdriver, adjust L5 for a reading of 2.3 volts. No further adjustment will be required.

Final Alignment--Oscillator Coil L4:

Ideally, your kit should be mounted in the VEC-1016CK case for this procedure. If you calibrate the radio out of its case, you may need to touch up L4 later--when the case is added. There are several ways to calibrate your receiver. Choose the method most compatible with the tools you have available:

Option 1: Calibrating with a Signal Generator or FM-Service Monitor

Set the generator up as follows:

Frequency:	50.0 MHz
Output Level:	10 uV (-90 dBm)
Modulation:	1-kHz tone at 5-kHz FM deviation

Connect the generator output to your VEC-1016K antenna jack using a 50-ohm patch cable. Plug in headphones or external speaker to monitor generator signal.

- [] Set *TUNE* to 50 MHz (fully clockwise) and *SQUELCH* counter-clockwise (open).
- [] Power the radio and set *VOLUME* for a comfortable level.
- [] *Slowly* tune *L4* back and forth with an insulated tuning wand to locate the 50-MHz test signal.

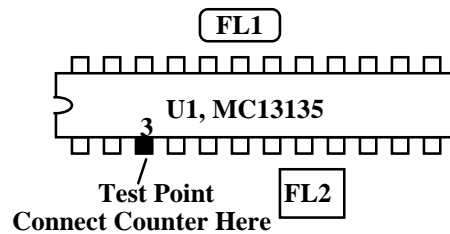
Important Note: The receiver's 10.245-MHz local oscillator's generates a 5th harmonic on 51.225 MHz. If you tune across this signal, it will be heard as a strong unmodulated carrier. Don't mistake this signal for your signal generator's output signal!

Option 2: Calibrating with a Antenna Analyzer

Any MFJ or Autek antenna analyzer with VHF coverage may be used to generate an alignment signal. Set the analyzer to 50.0 MHz and position a few feet from the VEC-1016. **Do not connect the analyzer directly to your VEC-1016, or damage may result.** Install a 47-ohm resistor on the VEC-1016K antenna jack and follow the test procedure outlined above for using a signal generator.

Option 3: Calibrating with a Frequency Counter

Your VEC-1016K features a buffered test point for measuring oscillator frequency with a digital counter. Locate this point on the diagram below:



- [] Connect the frequency-counter ground lead to a ground point (case or PC board).
- [] Set the *TUNE* to 50 MHz (fully clockwise) and apply power.
- [] Touch counter probe to pin-3 and adjust *L4* for a counter reading of 39.3 MHz.

Important Note: The VFO signal will fall 10.7 MHz below the receiver's operating frequency and may be too weak for some counters to sample (around -25 dBm). If you don't obtain a stable counter reading, use a different method of calibration.

Option 4: Calibrating with a Scanner Receiver

You may use a synthesized scanner or extended-coverage HT to pick up the radio's oscillator signal. Set the scanner to 39.3 MHz and position it near the kit.

- [] Set *TUNE* to 50 MHz (fully clockwise if you have no cabinet), and apply power.
- [] *Slowly* adjust L4 until the oscillator signal is heard on the scanner at 39.3 MHz.

Option 5: Calibrating with an off-air signal.

If no other option is available, you may calibrate L4 using the signal generated by a 49-MHz consumer wireless product. To do this, you should know the product's operating frequency (check the operating manual or look for a crystal with a frequency marked on it). Your radio should be mounted in its case so the front-panel tuning-dial scale is available. Begin by connecting a speaker (or phones) and an antenna.

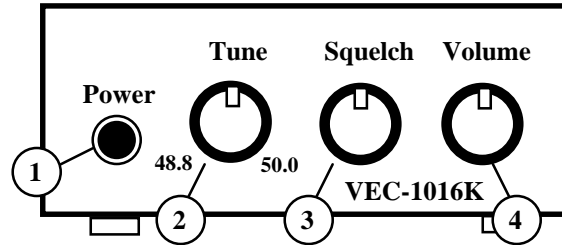
- [] Set the *SQUELCH* pot fully counter clockwise (open).
- [] Apply power and set the *VOLUME* pot for a comfortable background-noise level.
- [] Adjust the *TUNE* pot to correspond with the product's assigned operating frequency.
- [] *Slowly* tune L4 until you receive the signal at the correct spot on the dial.

Aligning L1, L2 for maximum receiver sensitivity:

If coils L1 and L2 were formed and installed according to instructions, your radio should operate with near-maximum sensitivity and require no further adjustment. However, if you wish, you may "tweak" these two coils to optimize performance on weak low-power signals. In order to make this adjustment, you'll need a weak signal source. This could be a 1-uV 49.5-MHz signal produced by a signal generator, or a weak off-air signal with audible background noise present. To adjust, use the blade of a non-metallic tuning wand or your fingernail to expand or compress the spacing between turns. Note that adjusting L1 and L2 may change the radio's operating frequency slightly. To compensate for this interaction, readjust *TUNE* as you make each change to ensure the signal remains tuned in.

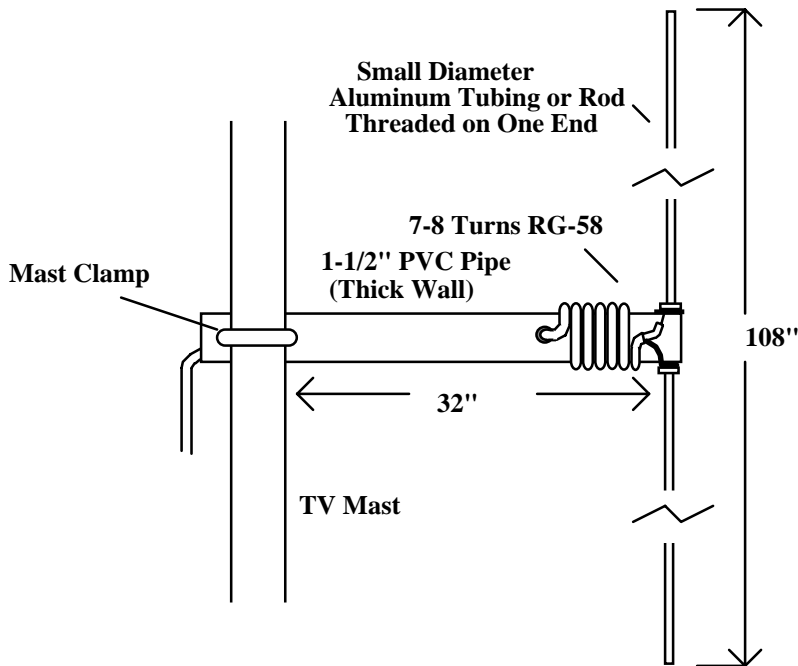
Reduced background hiss and lower distortion indicates an improvement in signal strength. As you find the best point for each coil, stretch or compress it permanently into that position. ***Don't attempt to adjust L1 and L2 while tuned to a strong local signal.*** Use only a weak signal with clearly-audible background hiss. When peaked, the VEC-1016 should render "solid copy" with good quieting on FM signals of .5 uV or less.

(10 Operating Instructions)



1. **POWER:** Push-on/push-off switch turns unit on and off. The VEC-1016 runs on internal battery power and shouldn't be left *ON* for extended period when not in use.
2. **TUNE:** Electrically tunes receiver. Tuning range is approximately 48.8 to 50.8 MHz (the frequencies where most activity takes place).
3. **SQUELCH:** Adjusts threshold-point for cutting off receiver background noise.
4. **VOLUME:** Adjust audio amplifier gain a comfortable listening level.

Antennas: For local reception, a 56" length of wire may work reasonably well. However, for long-range reception of weak 49 MHz signals, a roof-mounted six-meter ham antenna or low-band VHF scanner antenna fed with coaxial cable will provide far better performance. Alternatively, you can make your own "side-mount" vertical dipole like the one illustrated below:



Check battery condition: Operating your radio with a weak battery may lead to unstable tuning (signals drifting off channel rapidly), weak or distorted audio, and motor boating (a low-frequency "putt-putt-putt" noise in your speaker or headphones). Your radio needs a minimum of 7-8 volts in order to work properly.

(11 In Case of Difficulty)

The VEC-1016K design has been thoroughly field tested, and is known to be both reliable and "forgiving" of construction errors. If you have difficulty with your unit, the cause may be something as simple as a broken cable or a dead battery. In most cases, you will be able to find the cause with some organized troubleshooting. Begin your search with this checklist of symptoms and cures:

[] **Does not turn on:** Check battery condition, snap clip, and power leads. Also, make sure lead polarity is correct (red to +, black to GND). Make sure power switch is "on". Also, squelch may be locked "on" (see below). Check operating voltages.

[] **Turns on, does not receive signals:** Check antenna, antenna lead, and plug for shorted or open condition. Also, radio may not pick up signals in metal building without an outdoor antenna.

[] **Drifts off-frequency rapidly, "motorboats", weak audio:** Symptoms of a weak battery or insufficient operating voltage. Be sure to check battery voltage "under load" (with the radio turned on).

[] **Squelch won't open when control is fully counter-clockwise:** Check the value of the squelch potentiometer. It must be 100K. If a 10K pot is installed at R10, the squelch won't open.

[] **Poor sensitivity:** Look for antenna problems. Also, check condition of L1, L2. If they are improperly shaped or if a lead is broken, sensitivity will be poor.

If these checks fail to uncover the problem, repeat the "QC" check one more time. Service records show that, for most malfunctioning kits, outright component failure is relatively rare. In most cases, the culprit is a misplaced part, reverse-polarized capacitor or diode, or a faulty solder connection!

Voltage Analysis: One effective way to pin-point where a circuit problem might be is to use voltage analysis. To do this, you'll need a voltmeter--preferably a high-impedance DMM type. Set your meter to the 10-volt dc range and clip the black (-) test lead to a ground point on the PC board (the frame of the antenna connector is a good point). Make sure the radio's battery is fresh--the chart readings were made using a 9.0-volt power source. Using the red (+) lead, check the voltage on each IC pin and compare it against the voltage chart below. Readings should be within 10-15% of chart value:

U1, MC13135		U2, MC34119		Q1				
Pin	Voltage	Pin	Voltage	Pin	Voltage	E	B	C
1	5.2	13	5.2	1	0.1*	0	.77	7.1
2	4.5	14	0.1*	2	4.0			
3	4.3	15	0.1*	3	4.0			
4	5.2	16	0	4	4.0			
5	4.7	17	2.3	5	4.0			
6	5.2	18	5.2	6	8.8			
7	3.8	19	5.2	7	0			
8	0	20	4.0	8	4.0			
9	4.4	21	5.2					
10	4.4	22	5.2					
11	4.4	23	1.2-3.0					
12	.2 (no sig)	24	0					

*This represents the squelch-open or "logic-low" voltage. When squelch is closed (receiver muted), voltage becomes 3.8 volts, or "logic-high").

If you find one or more pins that read radically different from the chart value, it may indicate the device is bad--or it may mean a circuit problem exists in that portion of the radio. If you have technical skills and can read a schematic diagram, this will help you. For example, if you get an unreasonable reading on pin 23 of U1, the schematic shows that the radio's voltage-tuning circuitry is connected here. You might look for defective or misplaced components on that portion of the circuit board as a potential cause. If,

despite your best effort, you cannot solve a problem with your radio, kit repair services are available through Vectronics. See the warranty on the inside front cover for complete instructions.

(12 Theory of Operation and Technical Specifications)

Technical Circuit Description:

The VEC-1016K is a sensitive voltage-tunable dual-conversion NBFM receiver that includes an effective squelch circuit and gated AF-amplifier IC for speaker operation. Incoming signals are filtered through a bandpass filter at L1/L2 to reduce out-of-band interference, then boosted by low-noise preamplifier Q1. Q1 is series-matched to the input of U1.

U1 is a Motorola device that perform nearly all receiver functions for the radio. The first LO (local oscillator) is voltage-tuned by a temperature-compensated varactor diode built into the receiver chip. Signals are converted in the receiver's DBM 1st-mixer stage down to 10.7 MHz, the radio's 1st-IF. Here, they are fed through a roofing filter (FL1) to reduce in-band interference. The second LO, crystal-controlled at 10.245 MHz, drives the 2nd mixer for converting signals to 455 kHz. FL2 establishes the radio's message-channel bandwidth prior to 100-dB of signal amplification and limiting in the 2nd IF. Signals are demodulated by quadrature detection, and recovered audio signals are preamplified to line level by U1's output stage. Audio is then sent to the receiver's volume control and to AF amplifier U2.

In addition to processing FM signals, U1 also measures signal strength through log-amp RSSI circuitry. RSSI output is sent to a built-in op-amp comparator, where signal strength is compared to a reference level set by the radio's squelch control. The comparator then generates a logic signal to operate the "mute" pin of audio amplifier U2 for squelch action.

Audio is supplied to U2 via the radio's volume control. Here, audio signals are contoured for frequency response and amplified to speaker-level. The output of U2 is fed to a speaker/phone jack.

Technical Specifications:

Tuning Range	48.2-50.0 MHz (approximate)
Sensitivity	.5 uV typical for 12-dB sinad
Selectivity	20-kHz message-channel bandwidth
AF Output	60 mW into 8-ohm load
Current Drain	15 mA squelched, 40 mA on voice peaks
Power Source	9-v flatpack battery

(13 Schematic)

(14 Enclosure and Other Kits)