IMPORTANT WARRANTY INFORMATION! PLEASE READ

Return Policy on Kits When *Not* Purchased Directly From Vectronics: Before continuing any further with your VEC kit check with your Dealer about their return policy. If your Dealer allows returns, your kit must be returned *before* you begin construction.

Return Policy on Kits When Purchased Directly From Vectronics: Your VEC kit may be returned to the factory *in its pre-assembled condition only*. The reason for this stipulation is, once you begin installing and soldering parts, you essentially take over the role of the device's manufacturer. From this point on, neither Vectronics nor its dealers can reasonably be held accountable for the quality or the outcome of your work. Because of this, Vectronics cannot accept return of any kit-in-progress or completed work as a warranty item for any reason whatsoever. If you are a new or inexperienced kit builder, we urge you to read the manual carefully and determine whether or not you're ready to take on the job. If you wish to change your mind and return your kit, you may--but you must do it *before* you begin construction, and within ten (10) working days of the time it arrives.

Vectronics Warrants: Your kit contains each item specified in the parts list.

Missing Parts: If you determine, during your pre-construction inventory, that any part is missing, please contact Vectronics and we'll send the missing item to you free of charge. However, *before* you contact Vectronics, *please look carefully* to confirm you haven't misread the marking on one of the other items provided with the kit. Also, make certain an alternative part hasn't been substituted for the item you're missing. If a specific part is no longer available, or if Engineering has determined that an alternative component is more suitable, Vectronics reserves the right to make substitutions at any time. In most cases, these changes will be clearly noted in an addendum to the manual.

Defective Parts: Today's electronic parts are physically and electrically resilient, and defective components are rare. However, if you discover an item during your pre-construction inventory that's obviously broken or unserviceable, we'll replace it. Just return the part to Vectronics at the address below accompanied with an explanation. Upon receipt, we'll test it. If it's defective and appears unused, we'll ship you a new one right away at no charge.

Missing or Defective Parts After You Begin Assembly: Parts and materials lost or damaged *after construction begins* are not covered under the terms of this warranty. However, most parts supplied with VEC kits are relatively inexpensive and Vectronics can replace them for a reasonable charge. Simply contact the factory with a complete description. We'll process your order quickly and get you back on track.

Factory Repair After You Begin Assembly: *Kits-in progress and completed kits are specifically excluded from coverage by the Vectronics warranty*. However, as a service to customers, technicians are available to evaluate and repair malfunctioning kits for a minimum service fee of $18.00 (½ hour rate) plus $7.00 shipping and handling (prices subject to change). To qualify for repair service, your kit must be fully completed, unmodified, and the printed circuit board assembled using rosin-core solder. In the event your repair will require more than an hour to fix (or $36.00, subject to change), our technicians will contact you in advance by telephone before performing the work. Defective units should be shipped prepaid to:

Vectronics
1007 HWY 25 South
Starkville, MS 39759

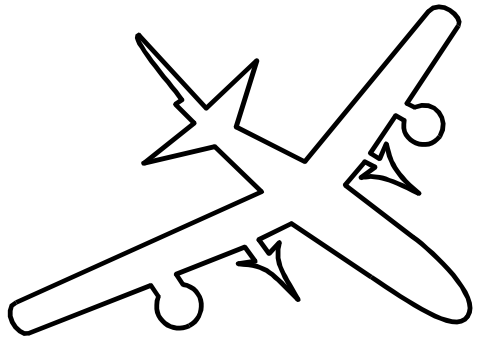
When shipping, pack your kit well and include the minimum payment plus shipping and handling charges ($25.00 total). No work can be performed without pre-payment. Also, provide a valid UPS return address and a day time phone number where you may be reached.

INTRODUCTION

Imagine climbing into the cockpit and experiencing first-hand how pilots and air-traffic controllers work together to keep our skies safe. Open the door to exciting aviation action; let the VEC-131K be *your* key to easily intercepting *air-comms* 100 or more miles distant! Track the progress of incoming and outgoing traffic in your area, hear advanced weather information firsthand from pilot reports (PIREPS), and discover how the National Air Traffic System really works. The VEC-131K is not only fun to build and operate, it's also a great way to learn about radio-electronics and aviation!

When it comes to pulling in weak signals, the VEC-131K rivals many commercially built aircraft transceivers. Its electronic tuning control covers only those frequencies used for aviation voice communications--118 to 136 MHz. The VEC-131K consumes minimal electrical current and can run for 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.

The VEC-131K is a single-conversion Superhet featuring a sensitive LNA front end and a varactor-tuned oscillator providing frequency coverage from 118 to 136 MHz. Zener diode regulation keeps the frequency control stable, even when battery voltage is low. A 10.7-MHz ceramic IF filter is also included. Four modern integrated circuit (IC) devices keep construction simple, on a PC board measuring a mere 3 x 3.25". Whether monitoring exchanges between distant ground stations or strong overhead aircraft, the audio remains level thanks to an advanced-design Automatic Gain Control (AGC) system.



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 and provides protection for the underlying table or desk. Well-diffused overhead lighting is a plus, and a supplemental high-intensity desk lamp is especially helpful for close-up work. Safety is always important! 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 for completion, virtually all construction projects require a work area outfitted with the following tools and supplies:

- ☐ 30 to 60 Watt Soldering Iron (grounded-tip and temperature-controlled preferred)
- ☐ High-temperature Iron Holder with Moist Cleaning Sponge
- ☐ Rosin-core Solder (thin wire size preferred, .031”)
- ☐ 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

Special Tools for This Kit:

- ☐ “Blade” type alignment tool
- ☐ “Hex” tuning tool

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. 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!
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. Also, clean the oxidation and excess solder from the soldering iron tip to ensure maximum heat transfer. 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 a pair of hemostats or needle-nose pliers. 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 reinstalled.

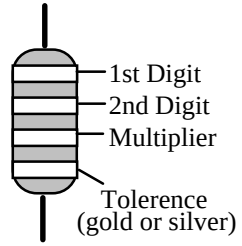
Work Habits:

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 sort and 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

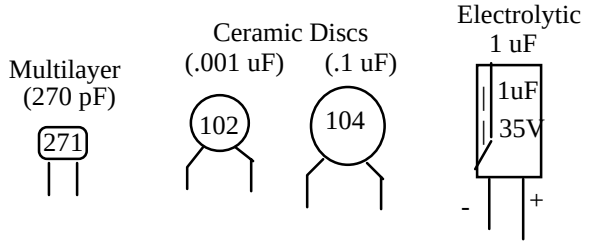
on during construction. Some builders find it especially helpful to arrange resistors in ascending order along a strip of double-sided tape.

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. (No chokes are used in the VEC-131K.)

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
100 pF	= 101
1000 pF	= 102
.001 uF	= 102*
.01 uF	= 103
.1 uF	= 104

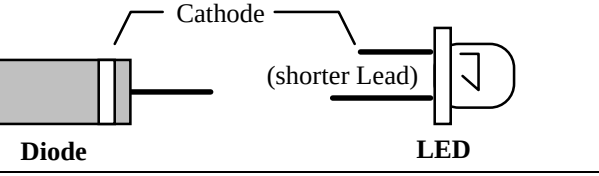


As with resistors, it's helpful to sort capacitors by type, and then to arrange them in ascending order of value. Small-value capacitors are characterized in pF (or pico-Farads), while larger values are labeled in uF (or micro-Farads). The transition from pF to uF occurs at 1000 pF (or .001 uF)*. Today,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

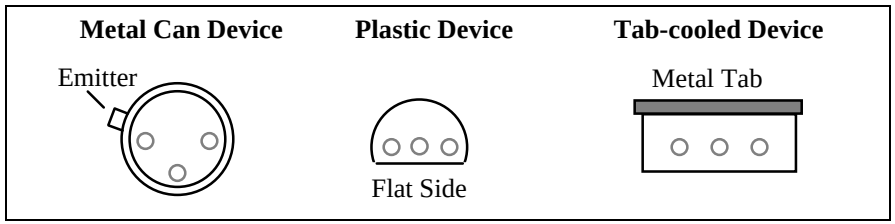
Diodes:

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



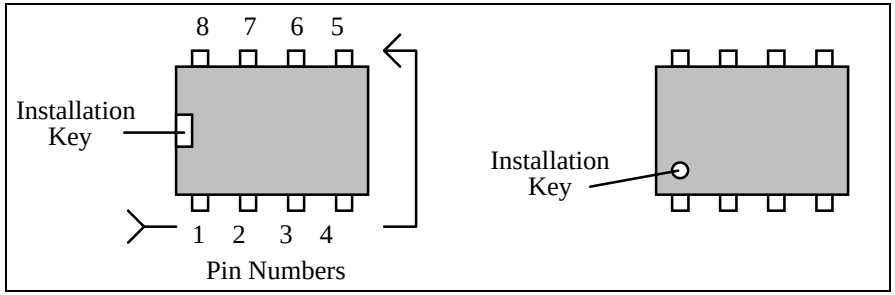
Transistors:

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-clockwise around 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.

Capacitors:

☑	Qty	Part Description	Designation
☐	1	2.2 pF ceramic disc (marked 2.2)	C4
☐	1	4.7 pF ceramic disc (marked 4.7)	C2
☐	1	6.8 pF ceramic disc (marked 6.8)	C6
☐	1	10 pF multilayer (marked 100 or 10)	C1
☐	2	18 pF multilayer (marked 180 or 18)	C11,C12
☐	2	33 pF multilayer (marked 330 or 33)	C3,C5
☐	2	100 pF multilayer (marked 101)	C7,C14
☐	1	220 pF ceramic disc (marked 221)	C24
☐	1	1000 pF multilayer (marked 102)	C13
☐	3	.001 uF ceramic disc (marked 102)	C8,C15,C17
☐	7	.01 uF ceramic disc (marked 103)	C9,C16,C19,C20,C21,C27,C29
☐	5	.1 uF ceramic disc (marked 104)	C10,C22,C30,C32,C35
☐	1	1 uF electrolytic (marked 1 uF)	C23
☐	3	10 uF electrolytic (marked 10 uF)	C25,C26,C28
☐	1	47 uF electrolytic (marked 47 uF)	C18
☐	2	100 uF electrolytic (marked 100 uF)	C31,C33
☐	1	470 uF electrolytic (marked 470 uF)	C34

Fixed Resistors:

☑	Qty	Part Description	Designation
☐	1	22 ohm (red-red-black-gold)	R23
☐	1	100 ohm (brown-black-brown-gold)	R11
☐	3	470 ohm (yellow-violet-brown-gold)	R2,R3,R8
☐	3	1K ohm (brown-black-red-gold)	R9,R13,R21
☐	3	2.2K ohm (red-red-red-gold)	R7,R12,R19
☐	3	10K ohm (brown-black-orange-gold)	R15,R17,R22
☐	3	47K ohm (yellow-violet-orange-gold)	R5,R14,R16
☐	3	100K ohm (brown-black-yellow-gold)	R1,R4,R10
☐	1	1M ohm (brown-black-green-gold)	R20

Variable Resistors:

☑	Qty	Part Description	Designation
☐	2	10K ohm potentiometer	R6,R18

Diodes:

☑	Qty	Part Description	Designation
☐	1	1N270 Germanium diode	D3
☐	1	1N5235B 6.8Vdc Zener diode	D2
☐	1	MV2104 varicap tuning diode	D1

Integrated Circuits:

☑	Qty	Part Description	Designation
☐	1	LM358N dual op-amp, AGC amplifier	U3
☐	1	LM386N audio amplifier	U4
☐	1	MC1350P IF amplifier	U2
☐	1	NE602 or SA602 RF mixer	U1

Transistors:

☑	Qty	Part Description	Designation
☐	1	2N3904 NPN IF amplifier	Q2
☐	1	2SC2498 NPN, VHF LNA	Q1

Filters:

☑	Qty	Part Description	Designation
☐	1	10.7-MHz ceramic IF filter (SFE10.7)	FL1

Inductors:

☑	Qty	Part Description	Designation
☐	1	.074-uH tunable inductor (taller case)	L4
☐	1	10.7 IF inter-stage transformer (25:1)	L5
☐	3	6" lengths of #24 enameled wire	For L1,L2,L3

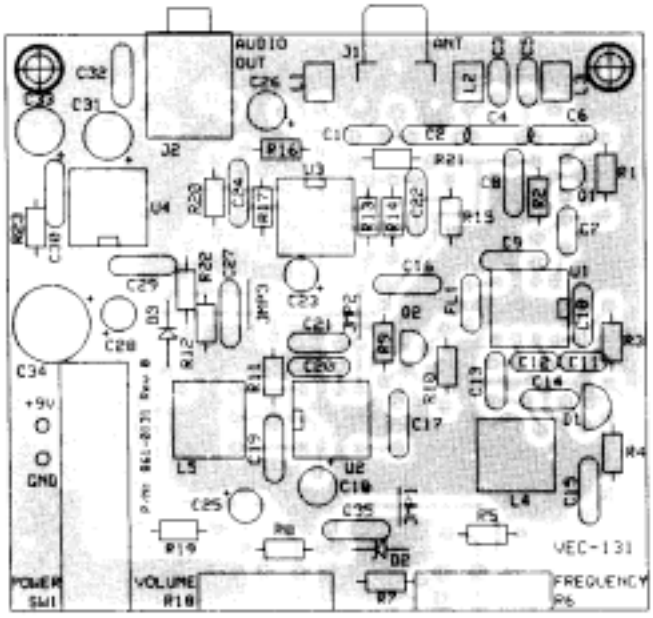
Connectors:

☑	Qty	Part Description	Designation
☐	1	RCA jack, ANT connector, PC mount	J1
☐	1	3.5mm stereo earphone/speaker jack,	J2

Miscellaneous:

☑	Qty	Part Description	Designation
☐	1	VEC-131K printed circuit board	
☐	1	9-volt battery snap	
☐	1	DPDT push-button power switch	SW1
☐	4	8 pin low-profile IC sockets	For U1,U2,U3,U4
☐	1	4-inch cable tie	For Battery Snap

PARTS PLACEMENT DIAGRAM



STEP-BY-STEP ASSEMBLY INSTRUCTIONS

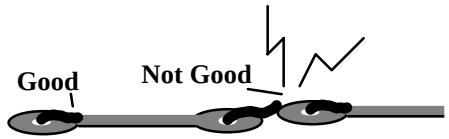
Before assembling your kit, please take time to read and understand the VEC kit warranty printed on the inside cover of this manual. Read through the assembly instructions to make sure the kit does not exceed your skill level. Once construction is started, the kit is non-returnable. Finally, if you haven't already done so, please verify that all parts listed in the inventory are included. If anything is missing or broken, refer to the warranty instructions for replacing missing or damaged parts. The VEC-131K is an intermediate level kit; experienced kit builders should expect assembly to average 5 hours.

First, a few notes and comments to help you along. Part designators for components such as R1, C3, etc., appear on the silk-screened legend on the component-mounting side of the printed circuit board. These correspond to the drawing shown in "Parts Placement Diagram" of this manual. The parts are inserted on the silk-screen side of the board.

Install multilayer and ceramic capacitors so their values are facing the board edges. Likewise, orient all fixed-resistor color bands in similar directions. Doing so makes troubleshooting and verifying that no errors were made during assembly easy.

If you have last minute questions concerning what tools or materials are needed to assemble this kit, please refer back to the section entitled "Before You Begin".

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:



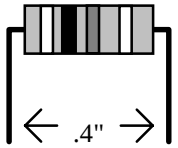
The term *solder* means to solder the part's leads in place, and to inspect both (or all) solder connections for flaws or solder bridges. Nip off excess protruding leads with a sharp pair of side cutters.

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, usually go on the PC board last.

Notice that the directions use two sets of check boxes. Check one when a step is complete and use the other for double-checking your work before operation.

Phase 1: Resistor Installation

☐ ☐ 1. Begin assembly by installing the fixed resistors. Because these are all 5-percent tolerance ending with a fourth *gold* color band, you need only specify the first three bands of the color code during the following steps. All resistor leads should be formed as shown below.



☐ ☐ 2. Locate the 22 ohm resistor (red-red-black). Install and solder at silk-screen location R23.

☐ ☐ 3. Find the 100 ohm resistor (brown-black-brown). Install and solder at R11.

☐ ☐ 4. Locate the three (3) 470 ohm resistors (yellow-violet-brown).

☐ ☐ 5. Install and solder a 470 ohm resistor at R2.

☐ ☐ 6. Install and solder a 470 ohm resistor at R3.

☐ ☐ 7. Install and solder a 470 ohm resistor at R8.

☐ ☐ 8. Locate the three (3) 1K (or 1000-ohm) resistors (brown-black-red).

☐ ☐ 9. Install and solder a 1K resistor at R9.

☐ ☐ 10. Install and solder a 1K resistor at R13.

☐ ☐ 11. Install and solder a 1K resistor at R21.

☐ ☐ 12. Locate the three (3) 2.2K resistors (red-red-red).

☐ ☐ 13. Install and solder a 2.2K resistor at R7.

☐ ☐ 14. Install and solder a 2.2K resistor at R12.

☐ ☐ 15. Install and solder a 2.2K resistor at R19.

☐ ☐ 16. Locate the three (3) 10K resistors (brown-black-orange)

☐ ☐ 17. Install and solder a 10K resistor at R15.

☐ ☐ 18. Install and solder a 10K resistor at R17.

☐ ☐ 19. Install and solder a 10K resistor at R22.

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

☐ ☐ 21. Install and solder a 47K resistor at R5.

☐ ☐ 22. Install and solder a 47K resistor at R14.

☐ ☐ 23. Install and solder a 47K resistor at R16.

☐ ☐ 24. Locate the three (3) 100K resistors (brown-black-yellow).

☐ ☐ 25. Install and solder a 100K resistor at R1.

☐ ☐ 26. Install and solder a 100K resistor at R4.

☐ ☐ 27. Install and solder a 100K resistor at R10.

☐ ☐ 28. Find the one 1 Mega ohm resistor (brown-black-green). Install and solder at R20.

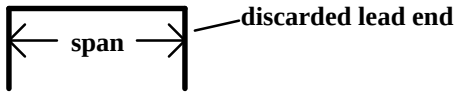
☐ ☐ 29. Check that all resistor locations on the PC board are occupied by the correct value resistor.

☐ ☐ 30. Check each solder joint. Look for solder splashes, bridges (a *bridge* is where solder has made a connection between two or more points that should not be connected), or poor solder connections.

***Tip*:** Watch for unwanted bridges between adjacent component pins!

Phase 2: Installation of Jumper Wires

☐ ☐ 1. Select three scrap resistor lead ends for use as jumper wires, as shown below. Use needle-nose pliers to form each one, making sure each rests flat on the PC board when installed:



☐ ☐ 2. Prepare, install, and solder a jumper at JMP1.

☐ ☐ 3. Prepare, install, and solder a second wire at JMP2.

☐ ☐ 4. Prepare, install, and solder a third wire at JMP3.

Phase 3: Installation of Disc Ceramic and Multilayer Capacitors

Important note: All capacitors should be installed with their bodies as close to the PC board as possible. This is very important in VHF circuits.

☐ ☐ 1. Locate the 2.2 pF disc ceramic capacitor. It has a "2.2" marking.

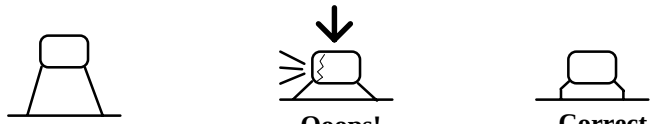
☐ ☐ 2. Install the 2.2 pF disc ceramic at silk-screen location C4. Reform the leads as needed. While holding the capacitor in place, solder both leads and trim excess lead length.

☐ ☐ 3. Find the 4.7 pF disc ceramic capacitor (marked "4.7"). Install and solder at C2.

☐ ☐ 4. Find the 6.8 pF disc ceramic capacitor (marked "6.8"). Install and solder at C6.

☐ ☐ 5. The next capacitor is a 10-pF *multilayer* style capacitor. This part may be marked either with a "10" (its actual value in pF) or "100" (a three-digit "J" code). Find this capacitor.

Important Note: 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-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, preform the leads to the correct spacing before installation!



☐ ☐ 6. Install and solder the 10 pF multilayer at location C1.

☐ ☐ 7. Locate the two 18 pF multilayer capacitors (marked "18" or "180").

☐ ☐ 8. Install and solder a 18 pF multilayer at location C11.

☐ ☐ 9. Install and solder a 18 pF multilayer at C12.

☐ ☐ 10. Locate the two 33 pF multilayer capacitors (marked "33" or "330").

☐ ☐ 11. Install and solder a 33 pF multilayer at location C3.

☐ ☐ 12. Install and solder a 33pF multilayer at C5.

☐ ☐ 13. Locate the two 100 pF multilayer capacitors (marked “101”).

☐ ☐ 14. Install and solder a 100 pF multilayer at location C7.

☐ ☐ 15. Install and solder a 100 pF multilayer at location C14.

☐ ☐ 16. Locate the remaining multilayer capacitor. It should have a body marking of “102”. This is a 1000 pF or .001 uF capacitor. Note that there are four locations requiring a .001 uF capacitor, but *only location C13 requires the use of a multilayer style .001-uF capacitor.*

☐ ☐ 17. Install and solder the .001 uF multilayer capacitor at location C13.

☐ ☐ 18. Locate the three .001-uF disc ceramic capacitors. They are marked “102”.

☐ ☐ 19. Install and solder a .001 uF disc ceramic at location C8.

☐ ☐ 20. Install and solder a .001 uF disc ceramic at location C15.

☐ ☐ 21. Install and solder a .001 uF disc ceramic at location C17.

☐ ☐ 22. Find the 220 pF disc ceramic capacitor. The body is marked “221”.

☐ ☐ 23. Install and solder the 220 pF disc ceramic at location C24.

☐ ☐ 24. Find the seven .01 uF disc ceramic capacitors (marked “103”).

☐ ☐ 25. Install and solder a .01 uF disc ceramic at location C9.

☐ ☐ 26. Install and solder a .01 uF disc ceramic at location C16.

☐ ☐ 27. Install and solder a .01 uF disc ceramic at location C19.

☐ ☐ 28. Install and solder a .01 uF disc ceramic at location C20.

☐ ☐ 29. Install and solder a .01 uF disc ceramic at location C21.

☐ ☐ 30. Install and solder a .01 uF disc ceramic at location C27.

☐ ☐ 31. Install and solder a .01 uF disc ceramic at location C29.

☐ ☐ 32. Find the five .1 uF disc ceramic capacitors (marked “104”).

☐ ☐ 33. Install and solder a .1 uF disc ceramic at location C10.

☐ ☐ 34. Install and solder a .1 uF disc ceramic at location C22.

☐ ☐ 35. Install and solder a .1 uF disc ceramic at location C30.

☐ ☐ 36. Install and solder a .1 uF disc ceramic at location C32.

☐ ☐ 37. Install and solder a .1 uF disc ceramic at location C35.

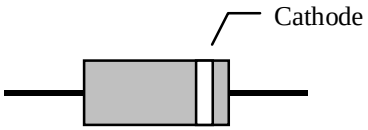
The following component is not a capacitor, but this is a good time to install it.

☐ ☐ 38. Find the 10.7 MHz ceramic filter. It looks something like a square disc ceramic capacitor with three pins on the bottom. FL1 is not polarized and can be installed either way. Install and solder in place at the designation for FL1.

This completes the installation of all disc and multilayer capacitors. There should be no "leftovers" remaining, and all PC board locations for these devices should be filled. Carefully recheck your work for errors and soldering.

Phase 4: Semiconductor Installation

☐ ☐ 1. Find the three diodes. Select the two glass bodied devices.



1N270, 1N5235B

☐ ☐ 2. Take the 1N270 germanium detector, the larger glass diode. The large black band indicates the "cathode" lead. The body is marked "1N270", although you may need a magnifying glass to read it.

☐ ☐ 3. Carefully bend the diode leads to align with the holes for D3. Exercise care—the glass body is fragile and will crack if its leads are over stressed. Insert the 1N270 into location D3; the cathode lead should face capacitor C29.

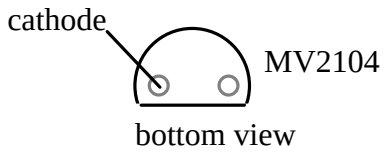
☐ ☐ 4. Solder and trim the leads of diode D3.

☐ ☐ 5. Take remaining glass bodied diode, it also has a black band indicating the cathode lead. Form the diode leads and insert at location D2. The cathode lead faces resistor R8. Diode D2 is a 6.8-volt zener.

☐ ☐ 6. Solder and trim the leads of diode D2.

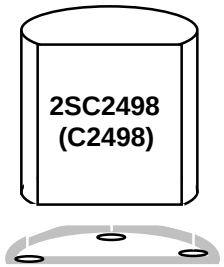
☐ ☐ 7. Find diode D1, it is a varactor tuning device. It resembles a plastic bodied transistor, but only has two leads. The body is marked "MV2104".

☐ ☐ 8. The body of D1 has a "round" and "flat" side. When inserted into the PC board, the body position must correspond with the silk-screened outline shown for D1. Install and solder the MV2104 at location D1.



☐ ☐ 9. Locate a 2SC2498 transistor. This is Q1.

☐ ☐ 10. Q1 has a round and a flat side. Carefully insert the three leads of Q1 into the three mounting holes provided. *Make sure that the transistor body is properly matched with the silk-screened outline. If you insert the transistor incorrectly, it may be damaged when power is applied.* To ensure best gain, the body of Q1 should sit as close to the PC board as possible. Gently reform the leads as needed, so the bottom of the transistor is positioned approximately 3/16" above the surface of the board. Longer leads may impair performance.



☐ ☐ 11. Solder and trim the leads for Q1.

☐ ☐ 12. Locate a 2N3904 transistor. This is Q2.

☐ ☐ 13. Install Q2 so its body is matches the silk-screen outline. Re-form Q2's leads as needed so it sits close to the board. Solder.

☐ ☐ 14. Locate the four (4) 8-pin IC sockets. These are "low-profile" style sockets which are suitable for use at radio frequencies. Note that the sockets are *keyed* to indicate pins 1 and 8. The key is either a "U" or rectangular shaped notch. Inspect each socket carefully, and straighten any bent pins before attempting installation.

Important Note: If you do not wish to use sockets with your kit, you may omit them and mount the ICs directly into the board (an option experienced builders may prefer). Sockets make IC removal easier in the event of an installation error or component failure. If you elect to omit the sockets, mount the ICs with their keys aligned as shown on the PC board.

☐ ☐ 15. Find the location for U1, and orient a socket so its keyed end corresponds with the key marked on the PC board. Install carefully, making sure all 8 pins clear the mounting holes. When the socket is seated, *tack solder* (apply just enough solder to hold the part) a pin in each of the two rows to hold the socket in place. Turn the board over and confirm the socket is flush against the surface (if not, correct it). When fully seated, solder all eight pins.

☐ ☐ 16. Using the above procedure, install and solder a socket at U2.

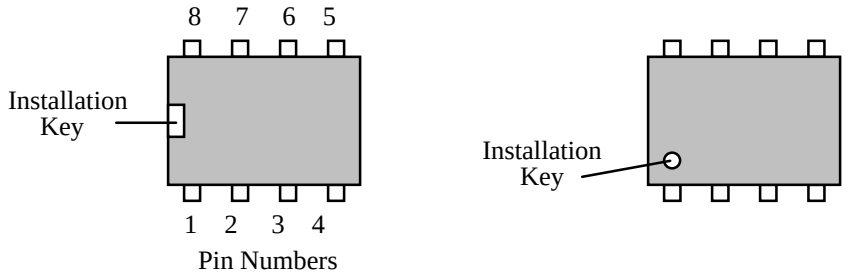
☐ ☐ 17. Install and solder a socket at location U3. Refer to step 15.

☐ ☐ 18. Install and solder a socket at location U4. Refer to step 15.

☐ ☐ 19. Carefully check all solder connections on the IC sockets. Watch for unwanted solder bridges between adjacent pins.

☐ ☐ 20. Locate the NE602 IC. This part may be marked with "NE602N", or similar markings such as "SA602" or NE612, depending on the source.

The IC body has a small notch, or *key*, molded at one end, indicating pins 1 and 8. A small dimple-like body-molding is often found adjacent to pin 1. Some IC packages may include both key indicators.



☐ ☐ 21. Align the body of the NE602 to correspond with the key of socket U1. Loosely insert the NE602 pins into socket U1. All 8 pins should fit freely into the socket openings. If not, straighten the IC pins until they do. Using firm and steady pressure, fully seat the IC into the socket. The socket and IC keys both face capacitor C10.

☐ ☐ 22. Locate the MC1350 IC. “MC1350” or "MC1350P" should be stamped on the device package. Straighten any bent pins.

☐ ☐ 23. Insert the MC1350 until it is fully seated into socket U2. Note the key faces towards L5.

☐ ☐ 24. Find the LM358 IC (marked “LM358”). Insert the LM358 into socket U3. The key faces R16.

☐ ☐ 25. Find the LM386 audio amp (marked “LM386”). Install into socket U4 with its key facing C29.

Phase 5: Installation of Electrolytic Capacitors

Electrolytic capacitors are *polarized* devices, and must be inserted with respect to polarity. The style used in the VEC-131K have *radial* leads; both leads exit from one end of the device body. Each capacitor's plus (+) mounting holes are noted both on 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.

☐ ☐ 1. Find the 470 uF electrolytic capacitor.

☐ ☐ 2. Insert the 470 uF capacitor into location C34, making sure the lead polarities are correct. The negative band faces the board edge. Solder and trim.

☐ ☐ 3. Find and insert the 1 uF electrolytic capacitor at C23. The negative band should face JMP3. Solder and trim.

☐ ☐ 4. Find the three 10 uF electrolytic capacitors.

☐ ☐ 5. Insert, solder, and trim a 10 uF at C25, negative band towards C18.

☐ ☐ 6. Insert, solder, and trim a 10 uF at C26, negative band towards J2.

☐ ☐ 7. Insert, solder, and trim a 10 uF at C28, negative band towards U4.

☐ ☐ 8. Find the two 100 uF electrolytic capacitors.

☐ ☐ 9. Insert, solder, and trim a 100 uF at C31, negative band towards C32.

☐ ☐ 10. Insert, solder, and trim a 100 uF at C33, negative band facing same direction as band on C31.

☐ ☐ 11. Find and insert the 47 uF electrolytic capacitor at C18, with the negative band towards R8. Solder and trim.

Phase 6: Inductor Installation

☐ ☐ 1. Locate the two shielded coils.

☐ ☐ 2. Identify coil L4, a tunable .074 uH inductor. It has a red coil form, and is the taller of the two shielded coils.

☐ ☐ 3. Insert coil L4. The coil should be flush (not tilting) against the PC board. *(Some coils have shouldered tabs that limit insertion depth.)*

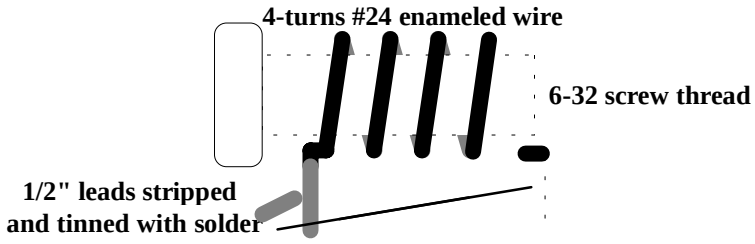
☐ ☐ 4. On the solder side of the PC board, bend over the can tabs, and solder. Make sure the can has not shifted and is still standing perfectly straight and flush to the board. Solder and trim the two coil leads.

☐ ☐ 5. Find coil L5, a 10.7-MHz IF transformer with a green slotted slug.

☐ ☐ 6. Insert the IF transformer at location L5, making sure the 5 coil leads are properly aligned with the mounting holes. On the solder side of the PC board, bend over the can tabs and solder. Make sure L5 is mounted flush to the board, and is still standing perfectly straight. *(Some coils have shouldered tabs that limit insertion depth.)* Solder and trim the five coil leads.

☐ ☐ 7. Find a 6" lenth of #24 enamel wire. This will be used to make a 4-turn coil. You'll also need a 6-32 screw to use as a winding form.

☐ ☐ 8. Carefully straighten the length of wire, removing all bends and kinks. (Drawing it over a plastic rounded surface such as a screwdriver handle works well.) Firmly holding one end, carefully wind four (4) full turns over the winding form as shown below. Each turn should conform to the thread of the screw.



Important Note: The #24 wire provided for these coils uses a special heat-strippable enamel insulation formulated to melt at high temperatures. This should allow you to strip, clean, and *tin* each coil lead in a single operation (*tinning* means applying a thin coating of solder to the wire). To do this, hold your soldering iron tip against the lead end for several seconds while applying a small amount of solder--an operation most easily done while the coil is still mounted on its winding mandrel. Eventually, the enamel insulation should begin breaking down, allowing solder to adhere to the wire. If your iron doesn't generate enough heat to start this process, you may scrape the enamel away

with an Exacto knife and tin the lead. Make sure both leads are clean and brightly tinned all the way around before attempting to install the coil.

☐ ☐ 9. Strip and tin the leads of the 4-turn coil, as illustrated previously. When both leads are fully tinned, remove it by "unscrewing" the coil body from the form. Shape as shown and trim leads to 1/2".

☐ ☐ 10. Following the above procedure, prepare a second 4-turn coil.

☐ ☐ 11. Use the remaining #24 wire to prepare a nine (9) turn coil.

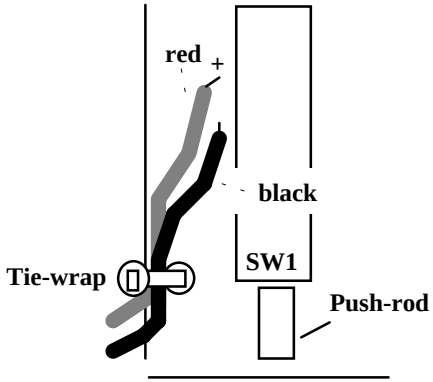
☐ ☐ 12. Install one of the 4-turn coils at location L2. You may have to expand the windings slightly so the leads align with their mounting holes. Solder and trim.

☐ ☐ 13. Install the other 4-turn coil at L3. Solder and trim.

☐ ☐ 14. Install the 9-turn coil at L1. Solder and trim.

Phase 7: Completing Construction

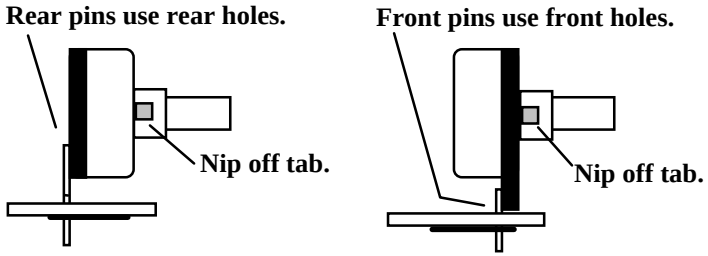
☐ ☐ 1. Locate the push-button DPDT power switch. Install at SW1, positioning so the push-rod faces the board edge (shown below). While holding the switch body flush against the board, solder and trim the six switch pins.



☐ ☐ 2. Install the 9-volt battery snap. Insert the red lead at +9V and the black lead at GND. Solder and trim.

☐ ☐ 3. 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 (near SW1). Use the plastic tie-wrap provided in your kit to secure the battery leads in place (as shown in the previous diagram). Insert the tie-wrap through the hole, close it over the wires, and pull tight. Nip off the excess end.

☐ ☐ 4. The front-panel controls (tuning, volume) are mounted next. Before installing these parts, inspect the 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.



☐ ☐ 5. Install a 10Kohm potentiometer at location R18. Insert the potentiometer leads until the shouldered stops on all three leads are flush to the PC board. Solder the three pot leads.

☐ ☐ 6. Install the remaining 10K ohm potentiometer at R6, following the procedures used for R18. Solder.

☐ ☐ 7. Locate the 3.5 mm stereo earphone jack, then install at J2. The jack opening faces the board edge. Solder all connections when the jack is fully seated and level.

☐ ☐ 8. Locate the RCA jack. Install at J1, making sure it is fully seated and level before soldering in place.

The assembly of your kit is finished, and it's time to take a well-earned break! When you come back, be sure to give your work a close "quality control" (QC) inspection before moving on.

PC Board Inspection:

☐ Check all solder connections, looking for unwanted solder bridges or solder "splashes". Shine a bright light on the solder side of the PC board, and keep a sharp eye for dull or poorly flowed solder joints. If the solder has adhered to the component leads, it will form a shiny “cone”; a “donut” like solder connection may indicate a poor connection.

☐ Resolder those solder joints that look suspect.

☐ Watch for parts installed in the wrong spot! These errors must be corrected before attempting to align or use the kit.

Now that assembly and inspection is completed, you're ready to begin the testing and alignment phase of construction.

TESTING AND ALIGNMENT

There are two critical alignments points in this receiver: the local oscillator (LO) and the 10.7-MHz IF. The LO is set by adjusting coil L4. The 10.7-MHz IF is tuned by coil L5.

The IF stage alignment must be performed before LO alignment.

10.7-MHz IF Stage Alignment Using a Signal Generator

Initial VEC-131K control settings:

- Set the volume control to midrange.
- Set the tuning control fully counterclockwise (CCW).
- Install a 9-volt alkaline battery on the VEC-131K battery clip.
- Install a 4 to 8-ohm monitor speaker (with a 1/8" plug) into the VEC-131K audio jack.

Set the generator as follows:

- Frequency.....10.7 MHz
- Modulation.....AM, 1000 Hz at 30% depth
- RF output level.....-10 dBm (.1 volts)

1. Connect the signal generator output to the RCA antenna jack on the VEC-131K.
2. Preset the tuning core for coil L5 fully counter-clockwise (CCW).
3. Turn the VEC-131K receiver on by depressing the SW1 shaft.
4. Slowly adjust the tuning core for L5 in a clockwise direction until the 1000 Hz modulation tone is heard in the speaker. Peak L5 for loudest signal.
5. Rock the main tuning control. This should have no effect on the IF signal. If the signal vanishes, you have tuned to a harmonic of the signal generator that falls in the aircraft band. Set the tuning control so no signal is heard, and retune L5 again.
6. Reduce the signal generator RF output level by another 10 dB, or until the audio tone becomes very weak. Repeak L5 for loudest signal.

7. Once L5 is peaked, the 10.7-MHz IF alignment is completed. Turn the receiver off by pushing SW1, and proceed to the LO alignment.

10.7-MHz IF Stage Alignment By "Ear"

1. Set the VEC-131K volume fully clockwise (CW).
2. Set the tuning core in coil L5 fully counter clockwise (CCW).
3. Connect a speaker and fresh 9-volt battery to the receiver, and turn on the receiver using SW1.
4. Slowly adjust coil L5 in a CW direction until a rushing or hissing noise is heard in the speaker or headphones. Repeak L5's tuning until you find the point where the rushing noise is loudest. Reduce volume setting as needed.
5. Proceed to the LO alignment.

Setting the Local Oscillator Tuning Range Using the Signal Generator

The *typical* tuning range of the VEC-131K is from 118 to 136 MHz. Depending on individual construction techniques and parts tolerances, some receivers may not reach much above 134 or 135 MHz. This is a design tradeoff that ensures every kit *will* tune--with ample overlap--to at least 118 MHz. Most air-comms take place in the lower portion of the band.

Set the generator as follows:

- Frequency.....118 MHz
- Modulation.....AM, 1000-Hz at 30% depth
- RF output level.....-80 dBm (30 micro volts)

1. Connect the signal generator to the VEC-131K RCA jack using 50-ohm cable.
2. Using a hex-alignment tool, adjust the core for coil L4 until it is level with the top of the can.
3. Set the VEC-131K volume control midrange.
4. Set the VEC-131K tuning control fully CCW (counterclockwise).
5. Power up the receiver.
6. Insert a hex-alignment tool into the tuning slug for coil L4. Slowly turn the slug in a clockwise (CW) direction until the signal generator signal is heard in the speaker. Go slowly, the tuning is rather rapid and the signal may be easily missed.

Setting the Local Oscillator Tuning Range Using a Frequency Counter

This method requires a *very* sensitive VHF frequency counter with a short 6" whip antenna. A suitable counter is the Optoelectronics model 3000 Universal Handi-Counter.

With the receiver on, the counter should show a stable reading of the LO frequency when its probe antenna is held near the body of IC U1. If it does so, proceed with the following steps:

1. Set the tuning control fully CCW.
2. Adjust coil L4 for a counter reading of 128.7 MHz.

Setting the LO Tuning Range Using a Wide-range Scanner or 2-meter Receiver

For the following steps you'll need a scanner capable of receiving the airband, or an extended-coverage 2-meter FM transceiver (many amateur 2-meter radios now include aircraft band receiver coverage).

1. Set the controls on the VEC-131K as follows: volume control, fully CCW (counterclockwise). Tuning, fully CCW. A 9-volt battery should be connected.
2. Place the test receiver close to the VEC-131K. It should have a small whip antenna attached directly to its antenna connector.
3. Set the test receiver to 128.7 MHz. Set the receiver volume to a comfortable listening level. If the receiver has a squelch control, set it so the receiver is unsquelched.
4. Turn the VEC-131K receiver on using SW1.
5. Slowly adjust the tuning core of coil L4 until the local oscillator is heard sweeping across 128.7 MHz on the test receiver.
6. Slowly adjust L4 in the other direction until the LO signal falls exactly on 128.7 MHz on the test receiver. This sets 118 MHz as the lowest receive frequency on the VEC-131K.

Setting the LO Tuning Range Using Off-air Signals

Here are some general guidelines for alignment using available off-air signals.

The VEC-131K can be forced to receive strong signals in its "image tuning range", which is 21.4 MHz above the frequency it is tuned to. For example, if there's a very strong signal present at 145.00 MHz, it will also produce a response when your VEC-131K is tuned to 123.3 MHz (145.00 - 21.4 = 123.60 MHz.).

If you (or a friend) have a ham license and a two-meter transceiver, you can use the 2-meter transmitter to align your radio. To do this, transmit a signal (using the transceiver's lowest power setting) on 147 MHz. This corresponds to 125.6 MHz, which is the approximate mid-point of the VEC-131K's tuning range. Set your radio's frequency control to the 12:00 (or mid-band) position, and tune L4 until you hear the 2-meter radio's signal.

Lacking any other means, simply set coil L4 so its slug is level with the coil top. You should be able to copy air traffic with this setting. In time, with some monitoring experience and familiarity with air traffic activity, you may be able to find a better setting.

A scanner guide will tell you what your local airport frequencies are, and this may help you find a known channel to "key" in on. Also, aircraft VOR beacons operate below 118 MHz. If you set L1 so these fall just out of tuning range at the low end of the dial, you'll be "in the ballpark".

RF Stage Alignment

RF stage alignment involves “peaking” coils L2 and L3 for best receiver sensitivity. “Peaking” the coils involves spreading or compressing the coil turns while listening for an improvement of a very weak signal. In general, if the coils were wound as directed in the assembly instructions, the receiver RF tuning is probably very close as it is. For those who wish to optimize the tuning the following procedures should be followed.

Set the signal generator as follows:

- Frequency.....127.0 MHz
- Modulation.....1000 Hz, at 30% AM
- RF Level.....5 uV

1. Connect the signal generator RF output to the VEC-131K antenna connector.
2. Turn the VEC-131K on, and set the volume control to a comfortable level.
3. Carefully tune the VEC-131K until the signal generator signal is heard.
4. Adjust the signal generator level until the 1000-Hz tone is barely heard above the background noise.
5. Use a toothpick or insulated plastic tuning tool to carefully compress or expand the coil windings of L2 and L3, while listening for the point where each coil “peaks” to give the loudest 1000-Hz tone in the receiver speaker.

Image Rejection

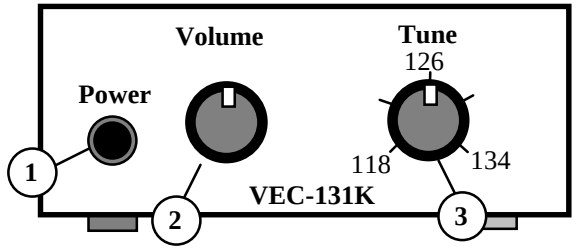
The VEC-131K has two stages of airband "pre-selection" to keep out-of-band signals from getting into your radio. However, nearby 2-meter amateur activity

may still cause image problems--if the 2-meter signal is exceptionally strong. If you hear extended casual conversations in the middle of the business-like airband chatter, you may be picking up an "image" of a local amateur radio repeater station. Coil L1 is a "image trap" which helps to reduce or eliminate these signals. Try compressing and expanding coil L1 while the offending signal is on--tuning L1 for *minimum* signal strength.

The VEC-131K is now fully aligned, and ready for action!

OPERATING INSTRUCTIONS

The VEC-131K can be installed in a variety of enclosures of your own design or choosing. Vectronics offers a matching case, which includes knobs, hardware and rubber feet, just for the VEC-131K (Model No.: VEC-131KC). Radio Shack also offers many inexpensive and attractive cases that may be adapted for this purpose. You might consider selecting a case roomy enough to house an internal speaker, or larger battery pack.



POWER: Push-on/push-off switch turns unit on and off. The VEC-131K runs on internal battery power and shouldn't be left *ON* for extended period when not in use.

VOLUME: Adjust audio amplifier gain a comfortable listening level.

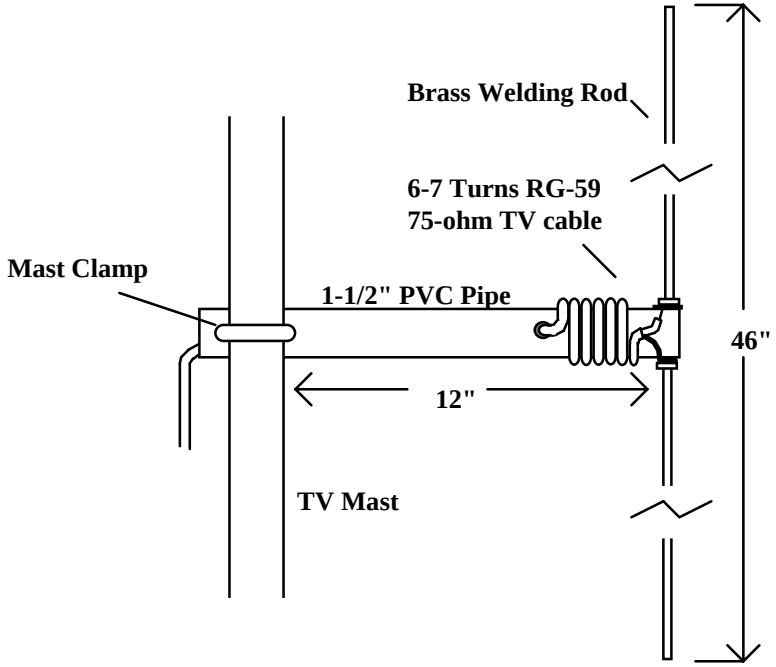
TUNE: Electrically tunes receiver oscillator, setting frequency where signals are received. Tuning range may vary slightly from unit to unit, but should be approximately 118 to 134 MHz (the aircraft “voice” frequency band).

Important Note: Reversing battery polarity—even for an instant—will destroy components in the VEC-131K. Damage caused by reversed polarity or over-voltage is not covered under the Vectronics' warranty.

Antennas:

A simple length of wire (about 23 inches long), or whip antenna, will serve for monitoring local ground traffic and for high-flying aircraft. To hear ground

activity at distant airfields, a rooftop antenna is needed. Many newer scanner antennas now feature aviation band coverage in models intended for mobile and mast-mounted applications. Outdoor-mounted omni-directional FM broadcast band antennas will also do in a pinch, but best results are obtained when using a *vertically* polarized antenna. VHF signals like to travel in a line-of-sight path. Putting the antenna higher, so it clears obstructions such as nearby buildings and trees, will yield stronger signals over greater distances. A simple vertical antenna may be fabricated from common items, as shown below:



This simple aircraft antenna uses materials found at Radio Shack and your local hardware supply house. If a welding rod is not available, use ¼" aluminum tubing. Note the dipole is made from two 22” sections of welding rod or aluminum tubing. The ends of the dipole must be kept insulated from each other, using wooden dowels or PVC material. The coax center conductor attaches to one leg of the dipole, the coax shield attaches to the other dipole leg.

Operating Guidelines:

Important Note: Monitoring aircraft communications is both fun and educational. However, the VEC-131K *should never* be operated aboard a commercial aircraft.

Superhetrodyne receivers radiate small amounts of RF energy at the LO and IF frequencies and their harmonics, and these signals may interfere with vital

aircraft radio systems. The flight crew is *not authorized* to grant passengers permission to use radio devices while onboard.

IN CASE OF DIFFICULTY

In very rare instances is a defective component the source of a problem. Ninety-five percent of the kits returned for factory repair are due to soldering problems or parts in the wrong locations. We advise repeating the assembly instructions step-by-step, looking for mistakes or soldering problems. Be especially wary of electrolytic capacitors and semiconductors. Kit builders often miss obvious mistakes. What is needed is a “fresh” set of eyes. Enlist a friend to go over your work.

Always check the obvious! Is the battery dead, or have the battery leads been accidentally reversed or broken? The speaker and antenna plug should be carefully checked for shorted or open connections. Check the solder connections for the antenna and speaker jacks—frequent removal and insertion may have caused a solder joint to fatigue and open.

Look for clues to help you determine what stages are working, and which ones may be in trouble. For example, if you can “peak” IF transformer L5 so background noise, or hiss, is audible in the headphones or speaker, you know that the audio stages and IF stages are probably working. That’s well over half of the radio! The problem is probably in the LO, mixer or LNA stage.

You can “prove” the LO is working by using one of the alignment techniques involving a frequency counter or monitor receiver. The only remaining stages that may be in trouble at this point are between the antenna jack and the mixer.

See if this general checklist helps isolate your problem:

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". Check operating voltages.

Turns on, does not receive signals:

Check antenna, antenna lead, and plug for shorted or open condition. Also, radios 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).

Poor sensitivity:

Look for antenna problems. Also, check condition of L1, L2, and L3. If they are improperly shaped or if a lead is broken, sensitivity will be poor.

If all else fails, and factory service is needed, consult the warranty information at the beginning of the manual.

THEORY OF OPERATION AND SPECIFICATIONS

The VEC-131K is a single-conversion superhetrodyne AM receiver covering from 118 to 136 MHz.

Capacitor C1 and inductor L1 form a series-resonant trap filter to reduce image band responses. Two heavily coupled resonant stages (C3-L2, C5-L3) form a broad bandpass filter for the 118 to 136 MHz range. Transistor Q1 (2SC2498) is a microwave device, and is biased for best noise figure. This Low-Noise Amplifier stage (LNA) amplifies incoming signals by about 15 dB.

The NE602 IC (U1) serves as the first mixer and tunable local oscillator stage. The NE602 mixer section employs an active Gilbert-cell double-balanced design. The local oscillator (LO) involves components C11, C12, C13, L4, C14 and varactor diode D1 in a Colpitts oscillator configuration. Capacitors C11 through C14 are multilayer styles for best RF performance and oscillator stability. Tuning is done by applying an variable voltage to the varactor tuning diode, D1. As the bias voltage across D1 changes, its capacitance is varied accordingly. As the reverse bias is increased, the junction capacity decreases, and the LO frequency increases. The tuning voltage is set by potentiometer R6, the main tuning control. The tuning voltage source is regulated by zener diode D2.

Because the IF is at 10.7 MHz, the LO is tunable over a range of 128.7 to 146.7 MHz for a tuning range of 118 to 136 MHz. The receiver uses *high-side* LO injection for good reason—*low-side* injection would put most of the image response in the FM broadcast band. The LO is "mixed" with incoming signals in U1 to produce an IF output of 10.7 MHz. A ceramic IF filter (FL1) follows the mixer output. FL1 helps set the overall bandwidth, or selectivity, of the receiver.

The first IF amplifier stage is Q2, a 2N3904 transistor operating in a class A common emitter configuration. This stage provides about 18-dB gain, and is used to overcome the 6-dB insertion losses of filter FL1. The last IF stage uses a Motorola MC1350 IC (U2). This stage has about 50-dB gain, and an AGC control range of about 60 dB. The high-impedance output of U2—on the order of 2,000 ohms—is fed to a 25:1 ratio IF interstage transformer. This impedance transformation is needed to match the relatively low-impedance of diode D3.

Diode D3 is a germanium detector, and serves two purposes. It “demodulates” the IF signal into two components: an audio signal and a DC level that corresponds to the strength of the incoming signal being monitored. Capacitor C27 removes, or filters, any residual RF components following detection.

IC U3 is a dual-section operational amplifier using a LM358 device. The first section, shown as U3A on the schematic, amplifies both the DC and recovered audio from the detector. The audio from U3A is feed to the volume control, R18. The audio amplifier is a LM386 IC (U4) and was designed for low-voltage battery applications.

IC3B, the second section of the LM358 op-amp, is a DC amplifier. This stage converts the detected DC component to a level compatible with the AGC input of the MC1350 IF amplifier.

Specifications:

Tuning range .....118 to 136 MHz, typical

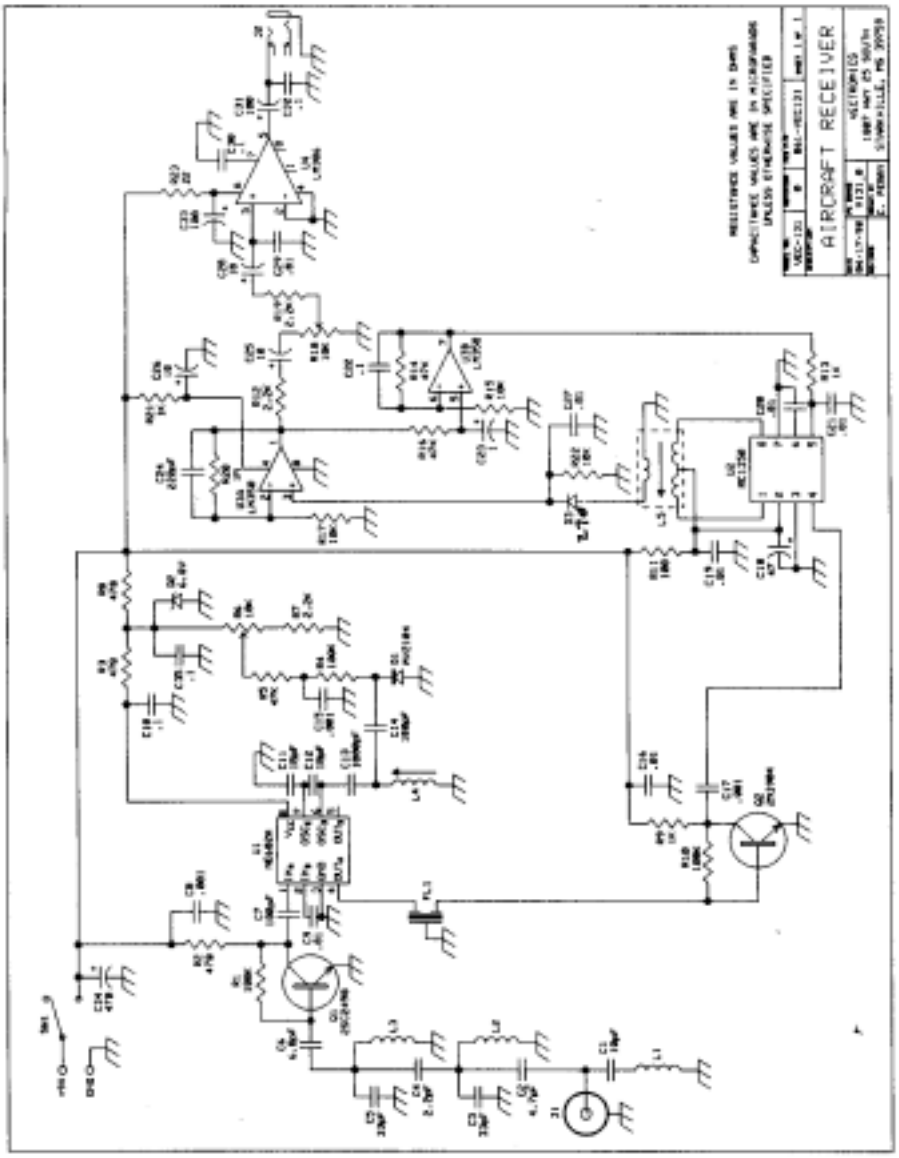
Sensitivity.....better than 0.5 uV across tuning range

IF frequency .....10.7 MHz

Power requirement .....9-volt transistor battery, alkaline preferred.

PC Board dimensions.....3.300" x 3.000"

SCHEMATIC



ENCLOSURE

Vectronics has designed a matching enclosure just for your VEC-131K *Aircraft Receiver Kit*. The matching enclosure is an all metal box which includes knobs, hardware, decals, and rubber feet. **Model: VEC-131KC.**

To install your receiver in the VEC-131KC matching enclosure follow these instructions *(read **all** instructions before beginning ... take your time)*:

1. Find the front panel decal and rear panel decal; separate using scissors. Be sure to leave excess decal material around the edges. Put the rear panel decal on first. This is done by: **a.)** Remove all debris and oil from the chassis. This should be done using a piece of cloth and alcohol. **b.)** Remove the crack and peel to expose the adhesive. **c.)** Place the decal on the rear panel without securing it completely. **d.)** Gently rub the alignment circles with your finger--if the circles are centered in the enclosure holes (also check the corner alignment marks) secure the decal by rubbing and removing all air bubbles. **e.)** If the alignment circles are not centered, adjust the decal accordingly then secure. **f.)** Use a penknife, or small Exacto™ knife, to cut away the unused edges *(cut from the adhesive side)* and cut out the component holes *(cut from the description side)*. **g.)** Repeat this procedure for the front panel.
2. Next, install the two L-brackets on the chassis using two of the 3/16" screws. The longer side of the L-bracket must be connected to the chassis using the two holes centered on each edge of the enclosure. Refer to the diagram on the next page for location and orientation.
3. Install the two 1/2" mounting screws next. Insert the screws, from the bottom, through the four holes relatively close to each corner of the chassis.
4. Place the two 3/16" round spacers on the mounting screws.
5. Now insert the PC board. This must be done by: **a.)** Remove the nut and washer from R6 and R18. **b.)** Insert the front of the PC board at an angle so the controls enter their respective holes. **c.)** Push down on the rear of the board. Make sure the mounting screws align with the mounting holes in the PC board before pushing.
6. Use the two hex nuts to secure the PC board. Be certain all appropriate components are centered with the enclosure holes before tightening. Put the washers and nuts--removed from R6 and R18--back on and tighten.
7. Find the knobs and switch cap. Align the switch cap with SW1 and push it on. If it is difficult to push on, then rotate it 90° and try again. Now put the knobs on R6 and R18. You may need to loosen the set screw. Align appropriately then tighten the set screws.
8. Locate the piece of double-sided tape. This is to be used for holding the 9-volt battery clip in place. Locate a place on the underside of the top cover where the battery will not interfere with any components. Peel off the backing of the tape and stick it to the chosen location.
9. The top should be installed next. Use the two remaining 3/16" screws for securing the top to the L-brackets. Make sure the L-brackets are aligned properly.
10. Finally, place the four rubber feet on the bottom of the enclosure at the corners.