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.

TABLE OF CONTENTS

INTRODUCTION

More than a preamp, the Vectronics VEC-1402DK is an integrated RF system that attacks three important modern-day reception problems head-on. First, it boosts signals at the antenna using a premium-grade 1-dB noise-figure microwave transistor to overcome *RF feedline loss.* Second, it provides razor-sharp bandpass filtering that prevents your receiver from being choked up with powerful out-of-band signals. Finally, it provides an optional built-in balun to eliminate unwanted electrical noises and local RFI signals picked up on the outer surface of your coaxial line. In short, the VEC-1402DK allows your scanner or VHF receiver to perform it's absolute best--even in the toughest RF environment! Preamp fits easily into a small project box or PVC pipe for antenna mounting, and all parts are provided for powering over the feedline. More immune to overload and static discharges than inexpensive GaAsFETS. Requires 9-14 volts dc. Size 1-1/2" x 3" x 1".

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:

- ☐ 30 to 60 Watt Soldering Iron
- ☐ High-temperature Iron Holder with Moist 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

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 Soldering 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.

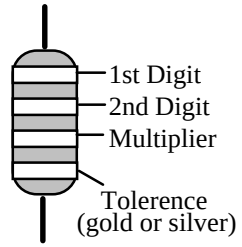
Work Habits:

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%

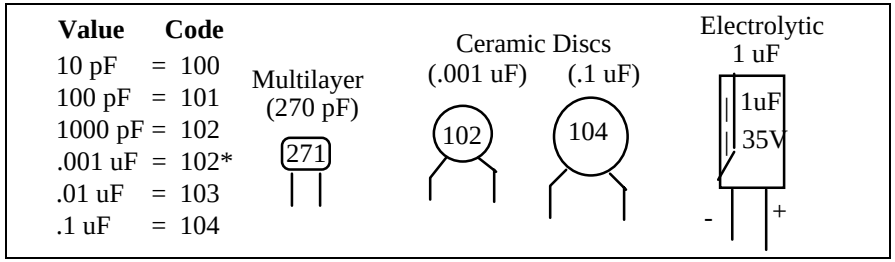
When you look at a resistor, check its multiplier code first. Any resistor with a black multiplier band falls between 10 and 99 ohms in value. Brown designates a value between 100 and 999 ohms. Red indicates a value from 1000 to 9999 ohms, which is also expressed as 1.0K to 9.9K. An orange multiplier 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.

Reading Capacitors:

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

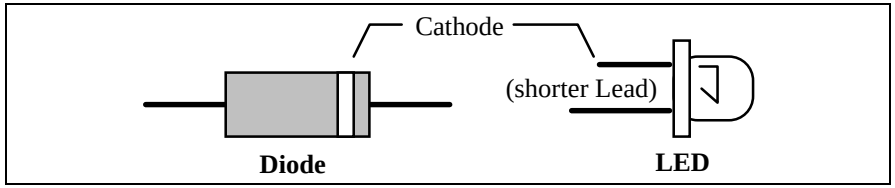


As with resistors, it's helpful to sort capacitors by type, and then to arrange them in ascending order of value. Small-value capacitors are characterized in pF (or pico-Farads), while larger values are labeled in uF (or micro-Farads). The transition from pF to uF occurs at 1000 pF (or .001 uF)*. Today,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

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

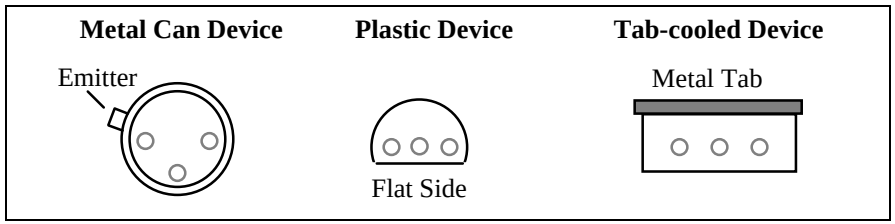
Diodes:

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



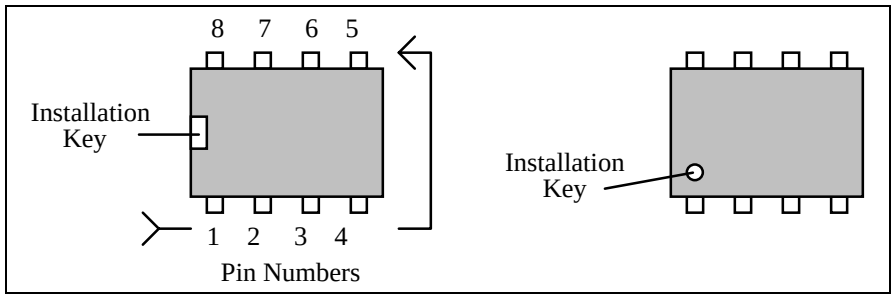
Transistors:

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:

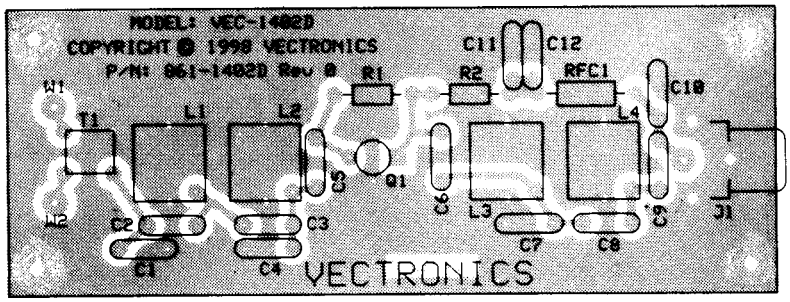


PARTS LIST

Your package kit should contain all of the parts listed below. Please go through the parts bag to identify and inventory each item on the checklist before you start building. If any parts are missing or damaged, refer to the warranty section of this manual for replacement instructions. If you can't positively identify an unfamiliar item in the bag 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.

☑	Quantity	Part Description	Designation
☐	1	470 ohm resistor (yellow-violet-brown	R2
☐	1	100K Resistor (brown-black-yellow)	R1
☐	2	1.2 pF disc ceramic capacitor (1.2)	C3,C8
☐	2	4.7 pF disc ceramic capacitor (4.7)	C5,C6
☐	1	470 pF disc ceramic capacitor (471)	C11
☐	1	.1 uF disc ceramic capacitor (104)	C12
☐	2	18 pF multilayer capacitor (18 or 180)	C4,C7
☐	2	22 pF multilayer capacitor (22 or 220)	C2,C9
☐	2	56 pF multilayer capacitor (56 or 560)	C1,C10
☐	1	100 pF multilayer capacitor (101)	bias-T
☐	1	MRF901 transistor	Q1
☐	4	.074 uH shielded slug-tuned coil (red)	L1,L2,L3,L4
☐	2	2.2 uH molded choke (red, red, gold)	RFC1, bias-T
☐	1	F-Connector	J1
☐	1	12" length, RGS-316	balun
☐	2	Plastic tie-wrap	balun
☐	1	PC board	
☐	1	Owner's Manual	

PARTS PLACEMENT



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 you begin construction, 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.

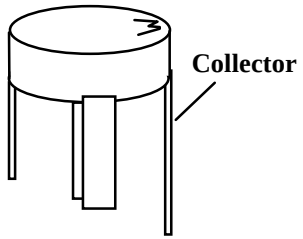
Part designators for components such as R1, C3, etc., appear on the silk-screened legend on the component-mounting side of the printed circuit board. These correspond to the parts placement drawing shown earlier in this manual. The parts are inserted on the silk-screened side of the board.

Except for Q1, none of the parts used in this preamp are “polarized,” so it makes no difference which way the parts are inserted into the board. If you insert the capacitors so the values face the board edges, it will be easier to read the values when checking for misplaced components during troubleshooting.

If you have any last-minute questions concerning tools or materials needed to assemble this kit, please refer to the section entitled "Before You Begin." 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. Start kit assembly by mounting Q1 and the components located on the left end of the PC board.

☐ ☐ 1. Locate transistor Q1, a MRF 901. This device resembles a small black plastic pill. Note that the longest lead is the collector. The collector is distinguished by the letter “M” marking on the device body. Carefully bend each transistor lead down, forming a right-angle to the component body (the "M" should be on top):

MRF901



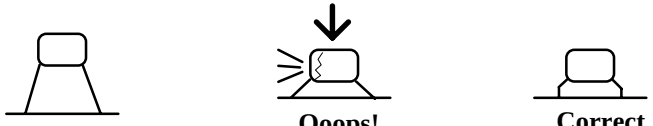
☐ ☐ 2. Locate the silk-screened footprint for Q1, almost dead-center on the PC board. Note that the long collector lead is oriented toward

capacitor C6. Gently insert all four leads into the board, making sure the collector lead is positioned correctly. The body of Q1 should rest flush with the PC board surface.

☐ ☐ 3. Turn the board over, keeping an index finger on Q1 to hold it in place. Bend each lead over to secure the transistor in place, and trim excess length off the collector lead. Solder all four leads.

☐ ☐ 4. Locate part C2, a 22-pF multilayer capacitor. Its body marking is "22".

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 operating characteristics, but the lead welds *may* fail if the device is over-stressed. 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!



☐ ☐ 5. Insert C2 into its mounting holes, avoiding excess lead length between the capacitor and the PC board. Solder both leads in place and trim.

Important Note: Examine your work. Are the solder joints shiny? Has the solder flowed? Is it adhering properly to the foil and leads? Are there unwanted solder bridges or splashes of solder on the board? Are the leads above the board as short as possible? From now on, to keep things simple, the instruction to "solder" indicates soldering both leads, trimming off excess lead ends with side-cutters, and examining your work for errors.

☐ ☐ 6. Locate part C3, a 1.2-pF ceramic disc capacitor. The body marking is "1.2".

☐ ☐ 7. Insert C3 into the holes shown on the silk-screen outline. Once again, avoid excess lead length by seating C3 as close to the board as possible. Solder.

☐ ☐ 8. The next capacitor is C1, a 56-pF multilayer capacitor. It is marked with the 3-digit code "560", or with "56"--its actual value in pF.

☐ ☐ 9. Insert C1, observing the mounting precaution for multilayer caps, and solder in place.

☐ ☐ 10. Locate a 18-pF multilayer capacitor for use at C4. This part has a "180" 3-digit code, or “18”--the actual value in pF.

☐ ☐ 11. Install the 18-pF capacitor at C4 and solder.

☐ ☐ 12. Locate a 4.7-pF disc ceramic capacitor (marked “4.7”) for use at C5. Install and solder.

At this point, you should have mounted capacitors C1, C2, C3, C4, and C5, and transistor Q1 on the board with all leads soldered. Make sure each capacitor has been installed correctly, and check all solder connections.

☐ ☐ 13. Find two shielded slug-tuned coils (0.074-uH, red coil form). There are four of these packaged with the kit. All four coils are identical; it makes no difference which you use where.

☐ ☐ 14. Examine the coils. If necessary, straighten the two soldering tabs on the shield cans and the wire leads emerging from the red plastic coil form before installing. These coils will be used for L1 and L2 on the PC board.

☐ ☐ 15. Take one coil and align it with the mounting holes for L1. Insert carefully, making sure both solder tabs enter their respective mounting holes as the coil is pressed down. The coil should be straight and mounted flush with the board (some designs have "stops" on the tabs that may limit insertion depth slightly). Turn the board over and fold the shield can's mounting tabs against the foil.

☐ ☐ 16. Solder both tabs and both coil leads in place. Make sure solder adheres to the tabs and flows to the surrounding foil to provide a good mechanical bond.

☐ ☐ 17. Mount the second coil at L2, following the procedures used for L1. Solder.

☐ ☐ 18. Next, find and install C6--a 4.7-pF disc ceramic capacitor marked “4.7”. Solder.

☐ ☐ 19. Find C7, a 18-pF multilayer. This may be marked with a "180" 3-digit code or with “18”--its value in pF. Install, observing the precaution for multilayer caps, and solder.

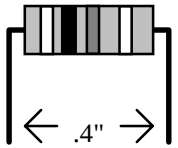
☐ ☐ 20. C8 is a 1.2-pF disc ceramic capacitor marked “1.2”. Install and solder.

☐ ☐ 21. C9 is a 22-pF multilayer capacitor marked “22” or "220". Install and solder.

☐ ☐ 22. C10 is a 56-pF multilayer capacitor marked "56" or "560". Install and solder.

☐ ☐ 23. Check to make sure coils L1 and L2 are properly mounted and soldered. Verify that the values for capacitors C6, C7, C8, C9, and C10 are correct. Check all soldering for unwanted solder bridges or solder splashes on the board.

☐ ☐ 24. Use a 100-k resistor (brown-black-yellow-gold) at R1. Prepare R1 for mounting by bending the component leads 90-degrees and parallel to each other:



☐ ☐ 25. Locate the legend for R1 and install R1 flush with the board. Solder.

☐ ☐ 26. In similar fashion, form the leads for R2, a 470-ohm resistor (yellow-violet-brown-gold). Solder.

☐ ☐ 27. Install and solder C11, a 470-pF disc-ceramic capacitor (marked “471”).

☐ ☐ 28. C12 is a 0.1-uF ceramic disc (marked “104”). Install and solder.

☐ ☐ 29. Find the two remaining shielded tuning coils. If needed, straighten the tabs and leads to permit easy insertion.

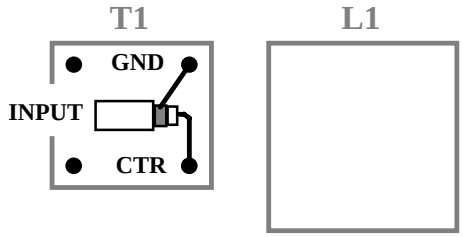
☐ ☐ 30. Install one shielded coil at L3, following the procedures used for coils L1 and L2.

☐ ☐ 31. In similar fashion, install the remaining coil at L4.

☐ ☐ 32. Locate and install coaxial connector J1. Note: J1 may be omitted if you plan to use an enclosure-mounted coaxial fitting be used.

☐ ☐ 33. If you need the optional balun, install it at this time. Refer to the instructions for making and installing the balun in the "operating" portion of this manual. The balun will not affect tuning of the preamp's bandpass filters, so testing and alignment may proceed with or without it installed.

Important Note: If you *do not* use the balun, you must connect your signal source to the T1 mounting holes closest to coil L1. The shield side of the coax must go to the preamp's groundplane (foil connection) as shown.



Finally, note that RFC1 is used *only if the preamp will be powered* by a remote phantom DC voltage over the coax line.

We want your preamp to work "first try." To avoid possible damage, follow the steps for a complete "QC" inspection before applying power:

☐ ☐ 34. Check all solder connections. Look for 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.

☐ ☐ 35. Resolder any suspect solder joints.

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

Important Note: If you find a construction error and need to remove components, you should use the right tools. A "solder sucker" is a handy item for unsoldering parts. It consists of a suction bulb or a spring-loaded vacuum pump to draw molten solder away from the pad and lead. You may also use a special copper braid called “solder wick”. You'll find it at Radio Shack.

Once a component lead *appears* to be free of solder, probe it gently with a dental pick or a small sewing needle to see if it is *really* free. Attempting to yank a part from the board with leads still partially soldered will most likely destroy the component. *Be extra careful when desoldering multilayer capacitors—they are prone to internal lead breakage.* If you suspect a component may have been damaged during removal, it's better to replace the part than risk reusing it!

Finally, rosin flux can absorb moisture--a potential problem for VHF preamplifiers mast-mounted in a damp environment. To remove flux, use

isopropyl alcohol (or 95% grain alcohol) and an old toothbrush. Apply a generous amount of alcohol with the toothbrush and scrub gently. Once the flux has fully dissolved, blot the bottom of the board dry with an untreated tissue. Give the preamp a final alcohol wash, and allow to dry thoroughly.

Caution: alcohol is highly flammable and must be used with adequate ventilation! Use safety goggles and avoid prolonged skin contact. It's best to do this work outdoors!

Several light coats of clear plastic spray applied to the foil side of pc boards protects against condensation-induced electrolysis damage. Do not allow over spray to enter the coil assemblies.

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

TESTING AND ALIGNMENT

The best way to align a preamp is with a calibrated signal generator. However, it's also possible to align the VEC-1402DK using off-air signals. Alignment is easiest using a receiver with a built-in signal-strength meter (an analog meter is generally better than a digital one for observing small changes in signal strength). If your receiver lacks a tuning meter, listen to signals in the speaker or view the audio waveform using an oscilloscope. The preamp must be powered from a 9 to 15 volt DC source during alignment.

Generator Method:

Begin by connecting the preamp output to a FM receiver equipped with a bargraph or analog type S-meter. Connect the preamp input to the RF output of the signal generator.

Set the generator as follows:

- Frequency ..... Desired frequency in the 2-meter Amateur band
- Output Level ..... Start at -90 to -100 dBm (weak signal)
- Modulation ..... FM, 1 KHz tone at 3-5 KHz deviation

Power up the preamp, and adjust as follows:

☐ 1. Tune in the generator signal and adjust the generator output level for a ½ scale reading on the receiver S-meter.

☐ 2. Using a hex alignment tool, adjust the coil slugs until they are even with the top of the coil form.

☐ 3. While observing the signal strength indicator, slowly turn the coil slugs into the coil until the signal becomes strongest. You may need to lower the signal generator output accordingly to prevent signal-meter saturation as alignment progresses.

☐ 4. Coil pairs L1, L2 and L3, L4 interact with each other (as L1 is adjusted, the tuning of L2 may be affected slightly, etc.). To achieve best sensitivity and optimum out-of-band rejection, alternately peak each pair of coils until no further improvement is noticed.

Important note: If you have access to a Sinadder™, or SINAD type signal-to-noise meter, you may use it to find the optimal alignment point. Lacking a signal-strength meter, view the receiver's audio output signal on an oscilloscope and adjust the preamp for minimum noise-ripple on the 1-kHz sine wave. Do so by connecting the 'scope to the radio's speaker terminals, or to a plug installed in the radio's phone jack.

Off-air Method:

Set up your preamp and receiver, as described above, using an antenna in place of the signal generator.

☐ 1. Tune in a weak steady signal. A distant repeater signal is best--it will transmit from a fixed location and remains "keyed up" during both sides of the transmission. In the absence of an S-meter, the signal *must have audible background hiss* in order for you to determine whether the signal is getting stronger or weaker as you align the preamp. As a signal gets stronger, the background noise, or *"hiss," will diminish* . Take note of signal variations caused by atmospheric conditions or passing aircraft when attempting an alignment using off-air signals.

☐ 2. Carefully adjust each coil so it peaks for maximum signal strength (highest signal-strength reading, or best *quieting).* Repeak each pair of coils (pair L1, L2 and pair L3, L4) until no further improvement is noticed. Again, a weak signal may become overly strong as the preamp stages are brought into resonance. Find a weaker signal and continue with the alignment.

This completes the preamp alignment.

OPERATION INSTRUCTIONS

Outdoor Preamp Installations:

Although your VEC-1402DK may be used at the "radio" end of the feedline with good results, you'll obtain best performance by mounting the preamp at the antenna. This type of installation overcomes the effects of feedline loss, so your radio can recover weaker signals that might otherwise be lost in the coax. When mounting the unit outdoors, make sure to protect the PC board and preamp components from exposure.

Rugged, well-shielded, cast-aluminum boxes make the best preamp enclosures. However, you can use a tight-fitting molded plastic box, or a casing made from 1-1/2" ID Schedule-40 plumbing materials. With any enclosure, it's best to mount connectors and mounting brackets on the bottom to prevent water from seeping in around hardware. While it's best to use stainless-steel hardware to prevent corrosion, rust, and potential electrical or mechanical failure, anodized hardware for TV antenna installations can be adapted for use. Although the enclosure should be designed to keep water out, drill a few small weep holes in the bottom to allow condensation to drain or evaporate.

Sunlight can be as problematical as rain. Paint the box white (or another light color) to prevent solar heating and damage to heat-sensitive components.

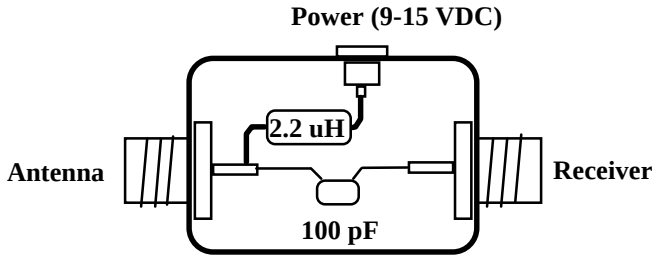
If the preamp is installed in a metal box, there may be a slight detuning of the preamp. A final "touch-up" alignment may be needed.

There are two common methods of powering a preamp at a remote location. You could power it over a separate power cable; but there is a better way.

Building a Bias-T:

A technique called "phantom powering" lets you feed the operating voltage through the coaxial line between the operating location and antenna. It's done with a simple device called a "bias-T". The bias-T piggybacks DC power onto the coaxial feedline without interfering with VHF signals. Components are provided in this kit should you wish to build your own bias-T.

As shown below, the bias-T consists of a 2.2-uH choke plus a 100-pF multilayer capacitor. The 2.2-uH choke (red-red-gold) allows DC current to pass onto the feedline and, at the same time, prevent VHF signals from getting lost in the power supply circuitry. Conversely, the 100-pF multilayer capacitor (marked "101") passes VHF signals into the receiver while blocking DC power from back-feeding into the radio's antenna jack. Mount bias-T components in an external project box powered by a small 9 or 12-volt wall adapter (see following diagram). Use a shielded metal enclosure.



Warning--do not reverse direction when installing

Warning: Never reverse-polarize the supply voltage to your preamp or reverse the direction of installation of the bias-T. Damage to electronic components may result.

Important Note: Never connect your bias-T module to a VHF antenna unless the preamp is also installed in the line. Most VHF antennas are DC-grounded to prevent static buildup on the elements. This provision will short circuit the preamp power supply to ground if the preamp is removed!

Finally, choke RF1 (2.2-uH, red-red-gold) must be installed on the preamp's PC board whenever the VEC-1402DK is phantom-powered over the coaxial feedline! This choke, in combination with C9, C10, provides the necessary network at the preamp end of the feedline to separate DC and RF signal paths.

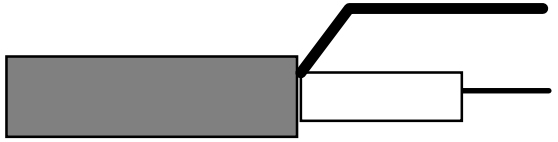
Balun Option T1:

Virtually all balanced antennas, and many so-called low-cost "unbalanced" antennas, perform better with a balun installed. Baluns block unwanted common-mode noise pickup on the outer surface of the coaxial feedline shield. They also prevent the feedline from interacting with the antenna elements and disrupting the desired pick-up pattern. The balun used on the VEC-1402DK is a low-loss, simple coaxial choke that works much the same as the 2.2-uH molded choke used in the bias-T circuit. The unique thing about a "coaxial choke" is how it blocks RF energy from flowing *on the outside* of the cable, while still allowing desired signals to pass freely inside. Interference and residential noise traveling *up* the outside of the feedline are blocked before reaching the antenna, while weak radio signals picked up by the antenna elements easily pass *down* the inside of the cable without attenuation.

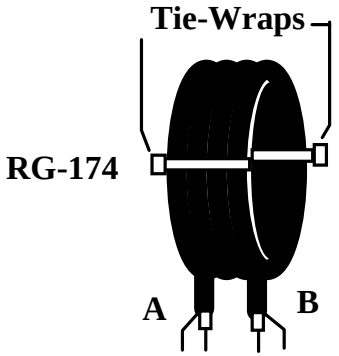
To prepare the balun, do the following:

☐ 1. Find a 12" length of RGS-316 miniature coaxial cable supplied with your kit.

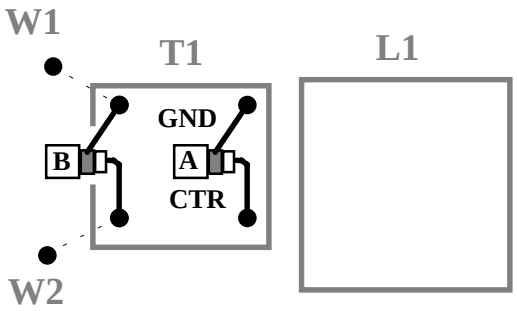
☐ 2. Strip about 1/2" of insulation off each end of the cable, and prepare pigtails for connection to the PC board, as shown in the drawing below:



☐ 3. Form the RGS-316 into a 4-turn coil about 3/4" in diameter, and secure the turns with two (2) plastic tie-wraps provided in your kit.



☐ 4. Install the ends of the RGS-316 at T1, as shown in the following diagram, and solder in place. Note that the coax shield on the L1 side of the balun (A) should be connected as shown (to the foil or grounded side of the PC board).



Feeding Balanced Antennas with the Balun:

Connect points W1 and W2 on the preamp *directly* to the antenna feedpoint without grounding either one. If your box is metal, neither lead should make electrical contact with it, or the choking action of the balun will be defeated.

Installing the VEC-1402DK in a Radio (and other considerations):

You may install the VEC-1402DK into a VHF receiver, scanner, ham radio transceiver, or repeater. Use short lengths of RG-174 cable for the RF connections. The preamp requires a 9 to 15-volt DC power source at approximately 8 mA, which can usually be borrowed from a convenient point in the receiver.

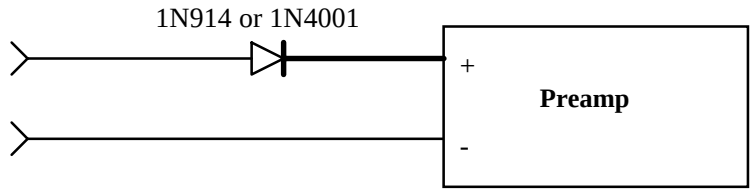
Warning: The preamp must never be installed in line with a transmitter or severe damage may result!

In a transceiver, you must install the VEC-1402DK *between* the antenna switch (pin-diode or mechanical relay) and the radio's receiver circuitry. Amateur radio Dxers who require a remote antenna mounted receiver preamp must provide sequenced RF protection to bypass the preamp during transmit periods.

External Power Sources:

Your preamp may be powered from any suitable 9 to 15-volt DC source--including a "wall cube" type supply. However, use caution! The actual voltage output of a low-cost adapter may be *much higher* than its rated value when powering low-current loads. This can damage your preamp. Choose a wall cube that's both internally regulated and filtered. Models used for charging nicad batteries may supply pulsating, unregulated and unfiltered DC voltage.

Reversing the voltage polarity of your preamp's power source could destroy Q1. A diode in series with the (+) power lead will prevent such damage. This "protection diode" prevents current from flowing in the wrong direction (a diode may also be installed in series with the 2.2-uH choke in the bias-T to protect remote preamps).



IN CASE OF DIFFICULTY:

Preamp Stops Amplifying:

At worst, a working preamp that fails may indicate a failure of transistor Q1. First make sure the supply voltage and RF cable connections are okay. If the preamp failed after being installed in a transceiver, the problem may be excessive transmitter RF "leaking" back into the preamplifier and damaging Q1.

Cannot Align or Test Preamp:

A newly constructed preamp that fails to work requires a careful recheck of all work. Low gain, or the inability to properly tune the preamp, may indicate damaged capacitors or parts in the wrong positions on the PC board. A intermittently operating preamp may have poor solder connections, a problem with coax connections, or an intermittent power source. Instability, or self-oscillation, may be caused by RF cable problems, or by excessive component lead lengths on the PC board.

Voltmeter Checks:

With 13.8 volts DC applied to the preamp, the collector voltage on Q1 should read approximately 9 volts, with the base voltage at 0.76 volts. These voltages are easily measured at the opposite ends of 100-k bias-resistor R1. They may vary slightly depending on the individual characteristics of Q1, but large variations indicate that Q1 or other components are damaged or installed incorrectly.

When all else fails, please refer to the warranty instructions regarding factory technical assistance or repair discussed earlier in this manual.

THEORY OF OPERATION AND SPECIFICATIONS

Operation:

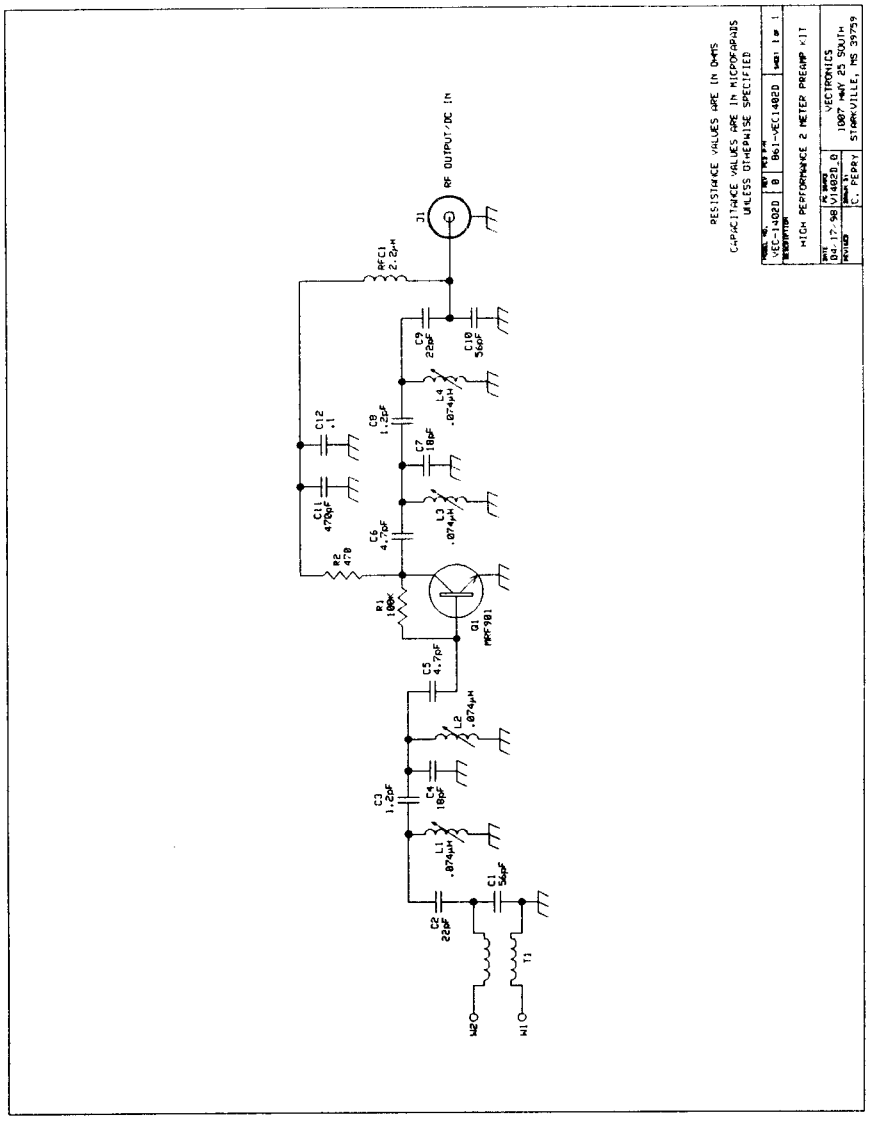
Coils L1, L2 and L3, L4 form two *High-Q* tuned LC bandpass filters. The skirt selectivity of these dual filters combines to offer an excellent degree of out-of-band signal rejection. This preamp is well-suited for use in strong RF environments, or for repeater system receiver operation. Q1 is a high-gain low-noise "microwave"-type transistor with good strong-signal handling characteristics operated as a common-emitter amplifier. It is biased for minimum noise figure, and normally exhibits a stage-gain of about 15 dB.

Specifications:

Tuning range: .....136 - 154 MHz

Gain at 13.8 Vdc: .....15 dB typical
Power requirement: .....9 - 15 Vdc, 8 mA typical
Input/Output Impedance:.....50 - 75 ohms, Unbalanced coaxial
PC Board.....4.000" x 1.500"

SCHEMATIC


RESISTANCE VALUES ARE IN OHMS
CAPACITANCE VALUES ARE IN MICROFARADS
UNLESS OTHERWISE SPECIFIED
VEC-1402D
0
Bkl-VEC1402D
HIGH PERFORMANCE 2 METER PREAMP KIT
04-17-98
V1402D_0
C. PERRY
VECTRONICS
1007 HWY 25 SOUTH
STARKVILLE, MS 39759
RF OUTPUT/DC IN
J1
RFC1
2.2uH
C9
22pF
C10
560pF
L4
.074µH
C12
.1
C8
1.2pF
C7
18pF
C11
470pF
L3
.074µH
C6
4.7pF
R2
470
R1
100K
Q1
MRF581
C5
4.7pF
L2
.074µH
C3
1.2pF
C4
18pF
L1
.074µH
C1
56pF
C2
22pF
T1
H2O
H1O