INTRODUCTION

General Information: According to an old saying, "truth takes many forms". Based on recent research, one form it may take is *vocal relaxation*. Studies show that when humans speak truthfully, the nervous system relaxes its grip on the larynx--allowing muscle pairs to "wander" slightly during the articulation of words. This, in turn, produces a tell-tale low-frequency tremolo that may be monitored electronically. Conversely, when humans step onto the slippery slope of prevarication, the nervous system involuntarily tightens its grip--possibly to ensure the deception will "sound right" when it comes out! When this happens, low-frequency vocal modulation diminishes.

Even specially trained interviewers and speech therapists can rarely detect such subtle changes in speech with "the naked ear". However, with the help of your VEC-8210K BS Meter, you can watch the change occur on a graphic LED display. Of course, results generated by your kit should be read with caution and never offered for any official purpose. Certified voice-stress analysis normally utilize highly sophisticated bio-medical instrumentation, and the results are subject to skilled interpretation.

Circuitry: Your VEC-8210 uses the log-amp function built into the NE-614 FM-receiver IC to compress speech signals--much like the limiter stage of an FM receiver. A quad op-amp then filters and level-detects the low-frequency "tremolo" sideband produced by the compressed signal, and sends a dc output level to a LED display driver and 10-segment LED metering display. When the larynx is relaxed, BS Meter readings flicker up and down much like a Vu meter. But, when a veil of deceit masks the truth, those flickerings become eerily subdued.

TOOLS AND SUPPLIES

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

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

☐ Soldering Iron (grounded-tip and temperature-controlled preferred)

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

BEFORE YOU START BUILDING

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

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

Soldering Tips: *Cleanliness* and good *heat distribution* are the two secrets of professional soldering. Before you install and solder each part, inspect leads or pins for oxidation. If the metal surface is dull, sand with fine emery paper until shiny. Allow the tip of your iron to contact both the lead and pad for about one second (count "one-thousand-one") before feeding solder to the connection. Surfaces must become hot enough for solder to *flow smoothly*. Feed solder to

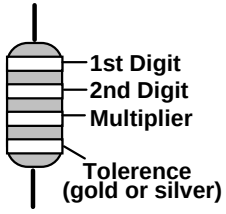
the opposite side of the lead from your iron tip--solder will wick around the lead toward the tip, wetting all exposed surfaces. Apply solder sparingly, and do not touch solder directly to the hot iron tip to promote rapid melting. Keep a damp sponge handy to wipe your soldering tip on. This removes excess solder, and keeps the tip properly tinned. If the iron is going to sit idling for long periods, wipe the tip, add some fresh solder, and unplug the iron.

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

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

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

Resistor Color Code

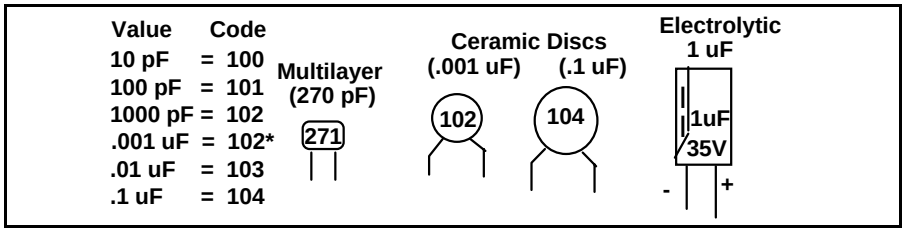


Black	= 0 (tens)	Blue	= 6
Brown	= 1 (hundreds)	Violet	= 7
Red	= 2 (K)	Gray	= 8
Orange	= 3 (10K)	White	= 9
Yellow	= 4 (100K)	Silver	= 10%
Green	= 5 (1Meg)	Gold	= 5%

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

groups by multiplier band (make a pile of 10s, 100s, Ks, 10Ks, etc.). Next, sort each group by specific value (1K, 2.2K, 4.7K, etc). This procedure makes the inventory easier, and also makes locating specific parts more convenient later on during construction. Some builders find it especially helpful to arrange resistors in ascending order along a strip of double-sided tape.

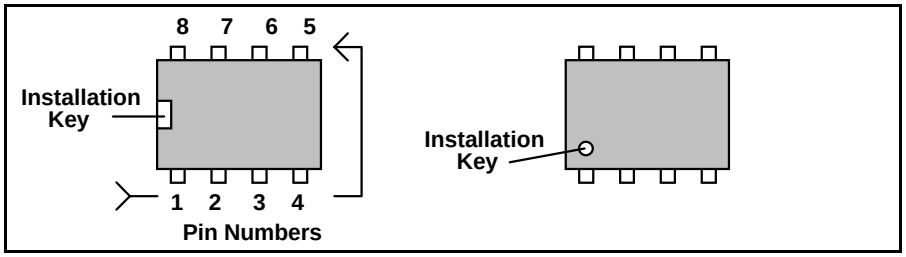
Reading Capacitors: Unlike resistors, capacitors no longer use a color code for value identification. Instead, the value, or a 3-number code, is printed on the body.



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

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

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



Your kit contains three ICs and a ten-segment LED metering display that looks something like an IC and installs in a conventional IC socket.

PARTS LIST

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

☑	Qty	Part Description	Designation	VEC P/N
☐	1	1.2K resistor (brown-red-red)	R15	100-3120
☐	1	1.6K resistor (brown-blue-red)	R18	100-3160
☐	1	2.2K resistor (red-red-red)	R6	100-3220
☐	1	2.7K resistor (red-violet-red)	R19	100-3270
☐	1	3K resistor (orange-black-red)	R17	100-3300
☐	2	6.8K resistor (blue-gray-red)	R10,R11	100-3680
☐	1	7.5K resistor (violet-green-red)	R7	100-3750
☐	3	10K resistor (brown-black-orange)	R8,R9,R14	100-4100
☐	1	12K resistor (brown-red-orange)	R3	100-4120
☐	1	24K resistor (red-yellow-orange)	R4	100-4240
☐	3	68K resistor (blue-gray-orange)	R1,R2,R13	100-4680
☐	2	100K resistor (brown-black-yellow)	R5,R16	100-5100
☐	1	270K resistor (red-violet-yellow)	R12	100-5270
☐	1	.015 uF polyester capacitor (153)	C12	230-2150
☐	1	.022uF multilayer capacitor (203)	C16	220-2220
☑	Qty	Part Description	Designation	VEC P/N

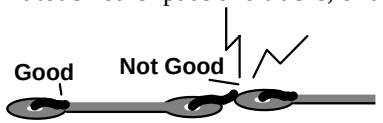
☐	2	.047 uF multilayer capacitor (473)	C8,C13	220-2470
☐	3	.1 uF multilayer capacitor (104)	C3,C4,C11	220-3100
☐	3	10 uF electrolytic capacitor	C1,C6,C7	270-5100-1
☐	6	100 uF electrolytic capacitor	C2,C5,C9, C10,C14,C15	270-6100-1
☐	5	1N4148 diode	D1,D2,D3,D4,D5	300-4148
☐	2	2N3904 transistor	Q1,Q2	305-3904
☐	1	LM335Z (looks like plastic transistor)	U4	307-0022
☐	1	NE604 or NE614 (16-pin dip)	U1	
☐	1	LM324 IC (14-pin dip)	U3	324-0324
☐	1	LM3914 IC (18-pin dip)	U2	325-3914
☐	1	10 segment bar-graph display	Bar Display	352-1002
☐	1	Electret condenser microphone	MIC1	410-1092
☐	1	DPDT vertical-mount switch	SW1	504-0022
☐	1	9V battery snap		730-3005
☐	1	14-pin IC socket	*for U3*	625-0014
☐	1	18-pin IC socket	*for U2*	625-0018
☐	1	20-pin IC socket	*for display*	625-0020
☐	1	Printed circuit board		862-VEC8210
☐	1	Owner's Manual		925-VEC8210K

PARTS PLACEMENT

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

In these instructions, when you see the term *install*, this means to locate, identify, and insert the part into its mounting holes on the PC board. This includes pre-

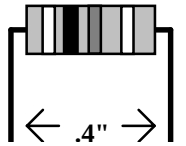
bending or straightening leads as needed so force is not required to seat the part. Once a component is mounted, bend each lead over to hold it in place. Use sharp side-cutters to clip off excess lead length before soldering. Make sure trimmed leads don't touch other pads and tracks, or a short circuit may result:



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.

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

This kit has 19 fixed-value resistors. Mount these now, starting with the smallest value and moving to the largest. Before mounting each one, carefully bend both leads close to the resistor body to form right-angles, as shown:



☐ ☐ 1. Begin by finding a 1.2K resistor (brown-red-red). Install at R15 and solder.

☐ ☐ 2. Find a 1.6K resistor (brown-blue-red). Install at R18 and solder.

☐ ☐ 3. Find a 2.2K resistor (red-red-red). Install at R6 and solder.

☐ ☐ 4. Find a 2.7K resistor (red-violet-red). Install at R19 and solder.

☐ ☐ 5. Find a 3.0K resistor (orange-black-red). Install at R17 and solder.

Locate two (2) 6.8-K resistors (blue-gray-red).

☐ ☐ 6. Install 6.8K at R10 and solder.

☐ ☐ 7. Install 6.8K at R11 and solder.

☐ ☐ 8. Find a 7.5K resistor (violet-green-red). Install at R7 and solder.

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

☐ ☐ 9. Install 10K at R8 and solder.

☐ ☐ 10. Install 10K at R9 and solder.

☐ ☐ 11. Install 10K at R14 and solder.

☐ ☐ 12. Find a 12K resistor (brown-red-orange). Install at R3 and solder.

☐ ☐ 13. Find a 24K resistor (red-yellow-orange). Install at R4 and solder.

Locate three (3) 68K resistors (blue-gray-orange).

☐ ☐ 14. Install 68K at R1 and solder.

☐ ☐ 15. Install 68K at R2 and solder.

☐ ☐ 16. Install 68K at R13 and solder.

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

☐ ☐ 17. Install 100K at R5 and solder.

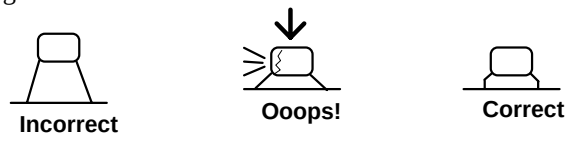
☐ ☐ 18. Install 100K at R16 and solder.

☐ ☐ 19. Find a 270K resistor (red-violet-yellow). Install at R12 and solder.

This concludes installation of the 19 resistors provided in your kit. Double-check for placement, making sure each value is installed where it belongs. Then, continue on to install the kit's 15 capacitors.

☐ ☐ 20. Find a .015 uF polyester capacitor (marked 153). Shaping the leads as needed, install at C12

Avoid using force or excessive heat when installing multilayer caps. If the spacing isn't right, pre-form leads to the correct spacing before installation to prevent damage.



☐ ☐ 21. Find .022 uF multilayer capacitor (marked 223). Install at C16 and solder.

Locate two (2) .047 uF multilayer capacitors (marked 473).

☐ ☐ 22. Install .047 uF at C8 and solder.

☐ ☐ 23. Install .047 uF at C13 and solder.

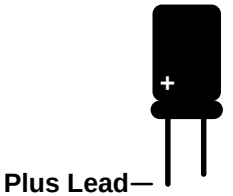
Locate three (3) .1 uF multilayer capacitors.

☐ ☐ 24. Install .1 uF at C3 and solder.

☐ ☐ 25. Install .1 uF at C4 and solder.

☐ ☐ 26. Install .1 uF at C11 and solder.

The last group of capacitors in your kit are electrolytic. ***Electrolytic caps are polarized and must be installed the correct way in order to work.*** Each capacitor's plus (+) mounting hole is marked on both the circuit board



and parts placement diagram. If the markings on the capacitor body are unclear, the plus (+) lead is always the longer of the two.

Locate three (3) 10 uF electrolytic capacitors.

☐ ☐ 27. Install 10 uF at C1 and solder.

☐ ☐ 28. Install 10 uF at C6 and solder.

☐ ☐ 29. Install 10 uF at C7 and solder.

Locate six (6) 100 uF electrolytic capacitors.

☐ ☐ 30. Install 100 uF at C2 and solder.

☐ ☐ 31. Install 100 uF at C5 and solder.

☐ ☐ 32. Install 100 uF at C9 and solder.

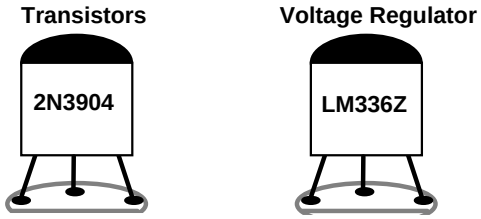
☐ ☐ 33. Install 100 uF at C10 and solder.

☐ ☐ 34. Install 100 uF at C14 and solder.

☐ ☐ 35. Install 100 uF at C15 and solder.

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

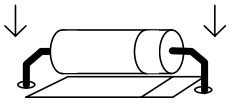
The first group of semiconductors you'll install include a small 2.5-volt zener regulator and two (2) 2N3904 transistors. These are all packaged exactly alike. To avoid confusion, read markings carefully before installing! Also, like the electrolytic caps, transistors and diodes *must be oriented correctly* to work.



☐ ☐ 36. Install a 2N3904 at Q1 and solder.

☐ ☐ 37. Install a 2N3904 at Q2 and solder.

☐ ☐ 38. Install the LM336Z at U4 and solder.



Like transistors, diodes are polarized devices that must be installed correctly. Always look for the banded end when installing.

There are five (5) 1N4148 silicon switching diodes in

your kit. Find these now. Observing the banded end:

☐ ☐ 39. Install a 1N4148 at D1 and solder.

☐ ☐ 40. Install a 1N4148 at D2 and solder.

☐ ☐ 41. Install a 1N4148 at D3 and solder.

☐ ☐ 42. Install a 1N4148 at D4 and solder.

☐ ☐ 43. Install a 1N4148 at D5 and solder.

The LED bar display--and all but one of the ICs--will be installed into IC sockets. Like the ICs themselves, each socket is keyed at one end to indicate proper positioning. During installation, each socket will be oriented so that the notch corresponds to the key on the PC layout.

When installing sockets, make sure all pins enter the mounting holes and appear on the opposite side of the PC board (it's easy to fold them under the socket). Also, when soldering, make sure the socket remains flush with the board surface.

☐ ☐ 44. Find a 14-pin IC socket. Orient to U3, install, and solder all pins.

☐ ☐ 45. Find a 18-pin IC socket. Orient to U2, install, and solder all pins.

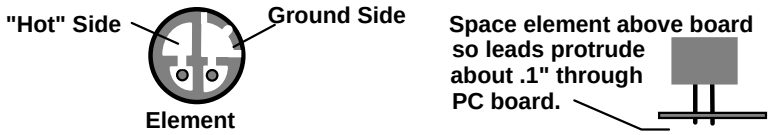
☐ ☐ 46. Find a 20-pin IC socket. Install this at *bar display* and solder all pins.

The ICs at U2, U3, and *bar display* will be installed later.

The NE614 (or NE604) is a 16-pin high-frequency device that must be soldered directly onto the circuit board. Locate this now.

☐ ☐ 47. Find the keyed end of the NE614 (NE604)--this is marked by a notch. Position so the key corresponds with the pc-board marking at U1. Install and inspect the leads to confirm all 16 pins protrude through the board. Solder all 16 pins.

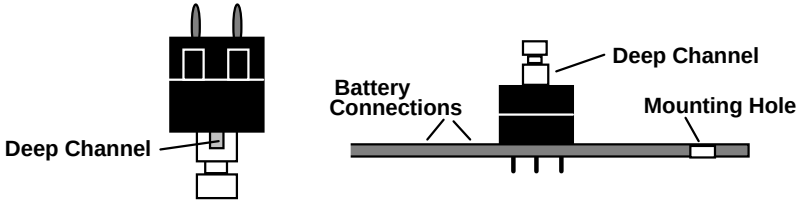
Locate the electret condenser microphone element (MIC1) and observe the leads. One is grounded to the case by a bridge of metal, while the other is not. The grounded lead must correspond with the groundplane mounting hole on the PC board.



When positioning the mic element, space as far as possible above the surface of the PC board. Leads should protrude only enough to ensure a good solder connection.

☐ ☐ 48. Observing polarity, install the electret mic element at MIC1 and solder in place.

Locate the DPDT vertical-mount OFF/ON power switch. This switch must be positioned so power is applied when the plunger is pressed down (see following diagram). One side of the plunger has a deep channel. Orient the switch so this channel faces the corner mounting hole for the PC board.



☐ ☐ 49. Install the power switch at SW1 and solder all six pins.

Locate the 9-V battery snap clip and note the red and black leads.

☐ ☐ 50. Install the red lead at BAT+ and solder.

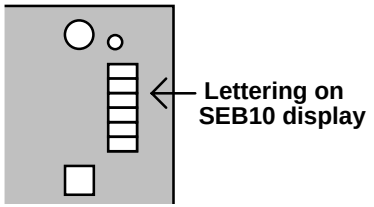
☐ ☐ 51. Install the black lead at BAT- and solder.

Finally, install the ICs and bar display. Note that these parts must be positioned properly or the unit will fail to operate and damage to sensitive components may result. Insert ICs slowly, making sure all pins go into the socket holes and none fold over under the device.

☐ ☐ 52. Observing the key, install the LM324 at U3.

☐ ☐ 53. Observing the key, install the LM3914 at U2.

The SEB10 diode display has no "key" to help you orient it properly. However, if you inspect the case, you'll note that one side has printing on it to identify the device. You'll install the device with the printing toward the top edge of the board.



☐ ☐ 54. Install the SEB10 display, as shown.

This concludes wiring of your VEC-8210 BS Meter Kit. Before moving on to the next section, give your kit a thorough QC (quality control) inspection. This will help you discover accidental assembly errors that might prevent it from working properly--or that might cause damage to sensitive parts when you apply power. Use the following procedure procedure:

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

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

TESTING AND ALIGNMENT

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

1. Put SW1 in the *Off* position (plunger up).
2. Install a fresh 9-V alkaline battery on the battery snap clip.
3. Press SW1 *On.*

With no sound present, the right-hand LED segment should illuminate. This remains on whenever the unit is powered. If it fails to light, check battery condition and check for construction errors.

4. Speak normally one foot from the microphone.

When "normal" unstressed speech is present, other bars should illuminate--moving progressively from right to left--much like the Vu meter on a tape recorder.

5. Whistle toward the microphone.

No additional segments should illuminate with a pure steady tone. Whistling checks for the "stressed speech" response by applying a loud sound without tremolo. If the display doesn't illuminate (or if only a bar or two light), the meter is measuring the parameter it is supposed to--vocal tremolo.

If your meter is operating properly, you may install it in the case at this time. If the bar display fails to illuminate past the first LED with normal speech, recheck your work and refer to the "In Case Of Difficulty" section of this manual.

OPERATING INSTRUCTIONS

Using Your Meter: Operation of the VEC8210K BS Meter is simple. Turn it on and place it so the microphone is positioned 1-3 feet from the sound source. A wide-range deflection on the bar display indicates laryngeal relaxation, a physical state some scientists link to truthful disclosure. A narrow range of deflection indicates involuntary laryngeal stress, a state linked with a conscious effort to conceal or distort the truth.

LEGAL DISCLAIMER: Your BS Meter is offered as a novel electronic hobby kit only, and not as a serious biomedical assessment device. Readings generated by the VEC8210K's display should *never* be represented as factual and binding evidence of truth or non-truth, or used in any legal or official decision-making activity. Even the most accurate and sophisticated commercially-built voice-stress analyzers require extensive training to interpret results reliably. Vectronics makes no guarantee or claim for the VEC-8210K's reliability, and cannot assume liability for the meter's misuse by others.

IN CASE OF DIFFICULTY

Before seeking outside assistance, check below for a possible solution:

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".

If this check fails to uncover the problem, repeat the "QC" check one more time. Service records show that, for most malfunctioning kits, outright component failure is relatively rare. In most cases, the culprit is a misplaced part, reverse-polarized capacitor, improperly installed IC, or a faulty solder connection. If, despite your best effort, you cannot solve the problem, kit repair services are available through Vectronics. See the warranty on the inside front cover for complete instructions.

THEORY OF OPERATION

Human vocal cords are controlled by three muscle pairs that work as a team to produce the complex of sounds we form into speech. In the 1980's, Dr. Fred Fuelleris invented a biomedical device called the VSA, or vocal Stress Analyzer. This device detects low-frequency sideband energy produced by micro-tremors of the voice that occur as a result of the natural interplay between the three muscle pairs. In theory, when people tell the truth, muscle control is looser and muscular interplay is greater, producing stronger micro-tremors. Conversely, when people lie, muscle control involuntarily tightens, interplay decreases, and micro-tremors become weaker--even though no audible change in the voice may occur.

The VEC8210K BS Meter is a simple device designed to discriminate between stronger and weaker micro-tremors in the 7-15 Hz range. MIC1 picks up speech sounds and feeds them through buffer-amp Q1 to log-amp U1. U1 conditions and compresses the audio signal using its high-gain (85-dB) log-amp circuitry. U3c buffers the highly-compressed audio signal, and U3d filters it to extract the low-frequency (7-15 Hz) sideband component. U3a and U3b detect the low-frequency product, give it a time constant, and send it to LED-display driver U2. This, in turn, progressively illuminates segments 2-10 on the display as a function of low-frequency signal strength (segment 1 remains on at all times to serve as a power indicator).

SCHEMATIC

ENCLOSURE

To install your BS Meter in the VEC-8210KC matching enclosure follow these instructions ***(read all instructions before beginning ... take your time)***:

1. Find the front panel decal and trim. Be sure to leave excess decal material around the edges. Put the front panel decal on. This is done by: **a.)** Remove all debris and oil from the face plate. 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 front 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)*.

2. Install the four 1/2" spacers onto the PC board using four 1/4" screws. Tighten the spacers down.

3. Now attach the PC board to the face plate. Use the remaining four 1/4" screws and place them in the four spacers through the face plate. Tighten.

4. Next, find the small piece of double sided tape. Place the tape on the inside bottom of the plastic enclosure. This will be used to secure your 9V battery. Attach the battery to the battery snap and secure to the enclosure.

5. Install the face plate into the plastic enclosure. Find the four 3/8" black mounting screws. Insert the screws into the four mounting holes on the face plate and tighten.

6. Find the red square switch knob. Place it on the protruding shaft of the switch and ensure that it snaps on. If you are having trouble attaching it, turn the knob 90 degrees and try again

7. Finally, place the four rubber feet on the bottom of the enclosure at the corners.