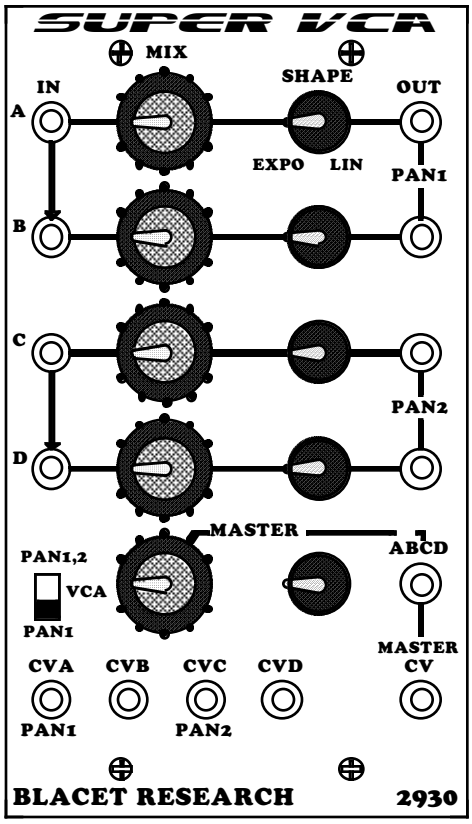
SUPER VCA

Quad Mixer/VCA with Master Channel

BLACET RESEARCH MODEL VCA2930

User & Assembly Manual



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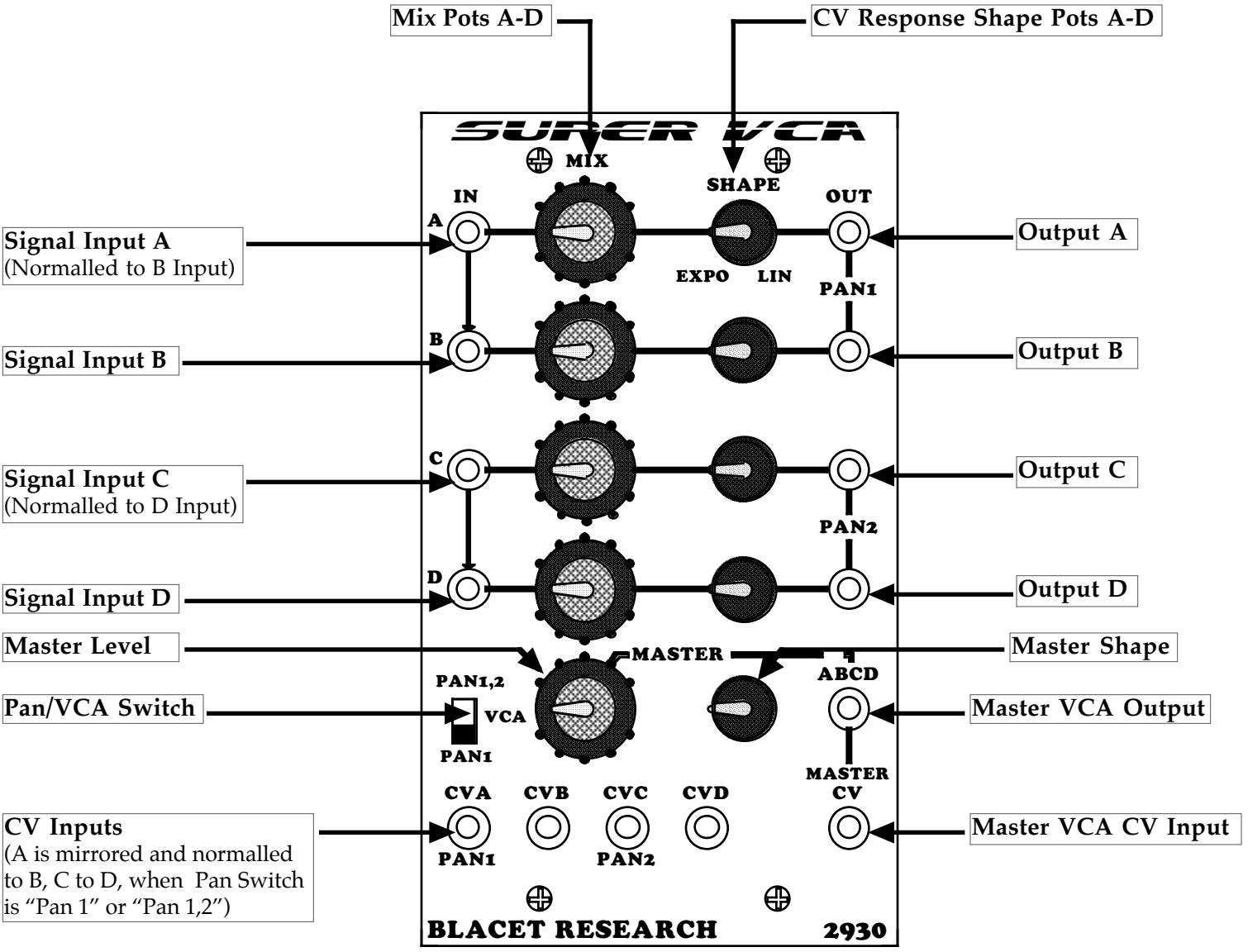
Introduction

The Blacet VCA2930 is a Quad Mixer/VCA with a Master VCA. Audio or control voltage signals may be processed.

Each of the four VCA channels may be used independently, as a mixing element into the Master VCA or as part of one of two panning circuits.

A unique feature is that the control voltage response for each channel is continuously variable between exponential and linear, allowing precise control over a complex mix.

Normalling and a built in control voltage mirror allows panning type use with no external mixer and only one external CV. Other applications of the module include: splitter (one signal to two outputs), fader (two signals fade between two outputs) and swapper (two signals alternately appear at one output).



Controls and Operation

Operation of the VCA2930 is fairly straight forward. There are four separate VCAs and a Master VCA. Any channel that does not have a plug in the OUT jack is automatically connected to the Master Channel and any signal will appear at the Master VCA Output (ABCD).

Connect a signal to any IN jack and connect the OUT jack to a mixer, amp or other module as required. Set the level with the MIX pot. Each VCA has it's CV input normalled to a bias source that keeps the VCA fully on. Make sure the Pan/VCA Switch is in the center position (VCA).

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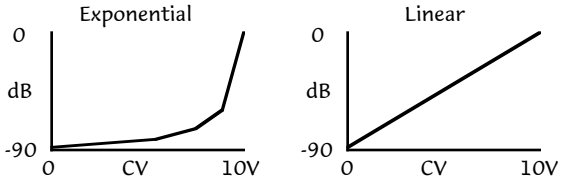
You can use the CV input to dynamically control the VCA. Use the EG1, DAD, or LFO, for example. Use the SHAPE pot to control the VCA response from an exponential to a linear curve.



Exponential CVs usually sound "punchier" and linear CVs have more of a "sustain" quality. It is important to avoid using CVs in excess of 10V. This will send the VCA into a gain situation which will result in possible distortion and increased bleed thru. This precaution is especially true in the exponential mode as the gain will increase very rapidly to due the accelerating curve shown above. As little as 0.5V will cause 15 dB of gain (each 6 dB **doubles** the signal level).

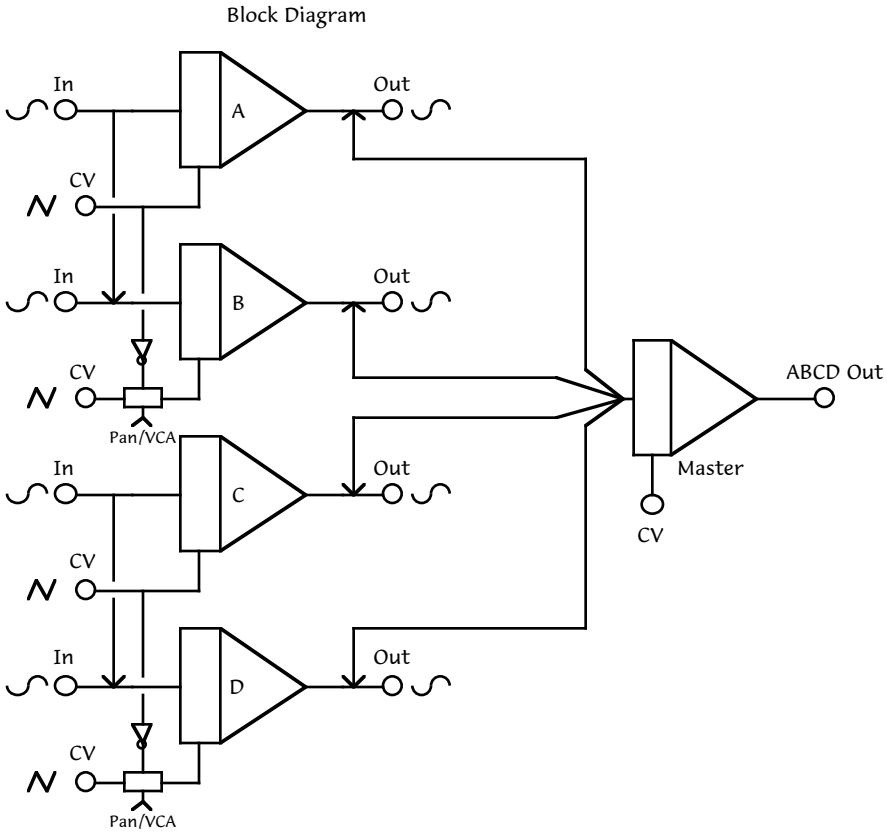
For special effects such as Panning, you can set the Pan/VCA Switch to Pan 1, which enables VCAs A and B or set the switch to Pan 1, 2 which sets up two panners, A,B and C,D. See the diagrams on the next page.

Stereo Panning: Input a signal into A and connect the A and B outputs to a stereo mixer. Typically, use a 0-10V triangle wave from an LFO into the A CV input. The input signal will pan between the stereo outputs. You can experiment with the A and B Shape pots to get different effects.

Stereo Fader: Input two different signals into A and B and connect the A and B outputs to a stereo mixer. Typically, use a 0-10V triangle wave from an LFO into the A CV input. The input signals will appear alternately at the stereo outputs. You can experiment with the A and B Shape pots to get different effects.

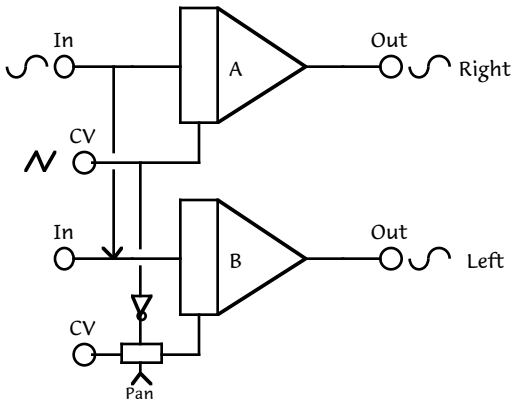
Swapper: Input two different signals into A and B and connect the Master ABCD output to a mixer. Typically, use a 0-10V triangle wave from an LFO into the A CV input. The input signals will appear alternately at the output. You can experiment with the A and B Shape pots to get different effects.

Splitter: For this application set the Pan/VCA Switch to VCA. Input a signal into A. This signal automatically normals to B. The input signal will appear at the A and B outputs. You can set the level of each output with the Mix pot and optionally use the A and B CV inputs to control each output.

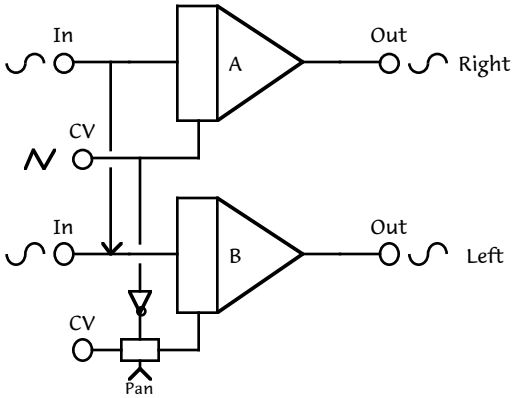


Applications

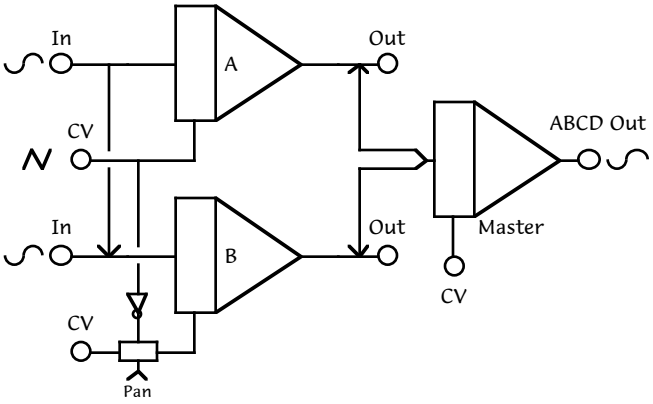
Stereo Panner



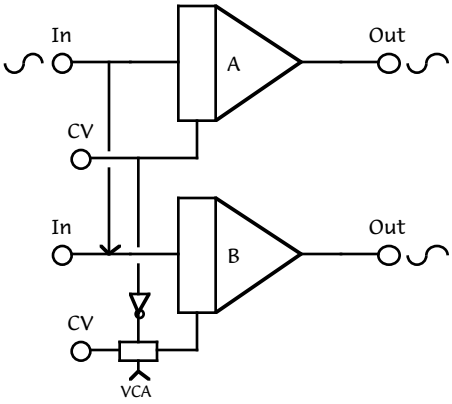
Stereo Fader



Swapper



Splitter



Specifications

Module Width: 3″
Module Depth: 3.8″
Maximum Attenuation: 90dB
Maximum Control Voltage: 10V
CV Control Curve: variable, exponential to linear
Power Requirements: +15V @ 114 mA, -15 @110 mA

Circuit Description

The VCA2930 contains five mostly identical VCA sections. Most of the differences involve normalling and switching used to achieve panning type functions for channels A, B and C, D.

Taking the Channel A as an example, a signal present at the input J1, is buffered and inverted by op amp U1d. The signal is also buffered by U1a and normalled to the B Input jack for possible panning and splitting applications.

The output of U1d is attenuated by Mix pot R1 before being sent to the input of VCA U3c. The signal current at the VCA output is converted to a voltage by op amp U1c and appears at output jack J9. The signal is also normalled to the Master VCA if no plug is present at the jack.

The VCA IC is controlled by a CV present at CVA Jack J5. If no plug is inserted, then a +bias source is normalled into the circuit. This turns the VCA fully on. Op amp U7c provides the processing for the exponential control voltage of the VCA. Op amp sections U7b, U7a and U7d along with U11a provide the linear control voltage. The Shape pot, R6, selects a mix of the two control voltages which is applied to VCA U3c pin11. Op amp buffer U1b compensates for the low input impedance of pin 11.

The VCA IC is fully on with a control voltage of 0 and fully off (-90dB) with a 3V control voltage.

For panning type effects, the control voltage at J5 is buffered and sent to a control voltage mirror built around U12b. The 0 -10V signal is thus converted to 10 - 0V. This voltage can be selected by switch S1 and analog switch U13a to control VCA B. This results in VCA A being on when VCA B is off and visa versa.

When S1 is in the "VCA" position, the CV for VCA B is derived from CV jack J6 and the VCA operates in a normal, independent manner. When the switch is in either "Pan" position, then the mirrored CV form VCA A is used to control VCA B.

The three positions of S1 allow A and B to be used as a panner, with C and D independent VCAs ("Pan 1") or both A,B and C,D functioning as panners ("Pan 1,2").

Bias voltages for the module are derived form 5V reference D1 with op amp sections U6a and U6b providing the + and - bias signals.

Power input to the module is connected via JPWR and filtered by caps CA thru CD. Protection from reverse voltages or shorts is provided by polyfuses PS1 and PS2 along with diodes DA and DB.

Kit Assembly Procedures:

- **Caution!** All front panel components are PCB mounted and must be aligned precisely if you ever hope to get the front panel mounted. Be sure to follow the advice presented when mounting these components! When checking alignment, close one eye. This will make your visual field 2D instead of 3D, which makes it easier to see alignment problems.
- **Caution!** Use protective eyewear during assembly, especially during soldering and lead clipping operations.
- The key piece of advice is to take your time, be sure you put the correct part in each location, and solder it correctly. Read thru this manual and check your parts against the Parts List **before** starting!
- Because this is a double sided board, removing parts will be more difficult than with a single sided board since solder flows through the plated through holes. The usual method for replacing a part on a double sided board involves cutting all the legs of the component and desoldering the pins one at a time, using a solder sucker. This minimizes possible board damage due to excess heat. Needless to say, since you will be **destroying** the component, you want to get things right **before** you solder!
- If you make a mistake or are missing a part and need a replacement component, please e-mail us. Include your order invoice number and name.
- If you have not soldered a double sided board before, be aware that solder will flow through the plated board holes and out onto the opposite pad. Use only as much solder as required to make the connection look good on both sides of the board. A little care now will insure a long lasting reliable module.
- Do your assembly work on a soft towel or a few layers of paper towel. This will protect components from impact and make picking up small parts easier. Be careful when opening part bags (use scissors) as small parts can fly off a considerable distance!

Tools

- You will need a 15 to 25 watt soldering iron with a fine pointed tip.
- There are several choices for solder. ACID CORE SOLDER IS NOT ONE OF THEM! Use a standard fine

gauge (.031) rosin core, aqueous core, or a "no clean" type. **We very highly recommend Kester 331** as this can be cleaned up with warm water and solders very nicely. Connections off the board or to the board that are inconvenient to clean may best be made with a "no clean" solder such as Kester 245. Rosin core solder can be used but is really somewhat old fashioned and flux removal can involve harmful chemicals. We build our boards with the 331 and 245 products and cannot guarantee results with rosin core solders.

- **Caution! Solder contains lead, a toxic metal that can build up in the body if ingested. Be sure to wash your hands after handling solder and avoid eating or touching your face while using it. (Lead traces left on your face or hands may find their way into your mouth and this is the most common way lead enters the body.)**
- You will also need a lead bender, needle nose pliers, side cutters, and a nut driver set or pliers. A DMM will be necessary for checking voltages.

Preparing the PCBs:

You can leave the PCBs together during initial assembly for easy handling, although the snapping points are easier to file if you do it before installing the jacks. Snap apart the 5 boards and lightly sand any burrs off the snapping points with a few passes of medium sand paper or a small file.

Inserting Parts

Take a look at the PCBs. **All the parts are mounted on the silkscreened side of the board.** Be sure to follow directions. You can use the PCA drawing and the "ref des" column on the Parts List to locate components. (**The Type and Value fields will often have the part marking in "xx".**)

We advise inserting components in groups according to type, checking them and then soldering the group. This will help avoid errors. Solder one leg of components first, then come back and do the other leg later. This practice avoids disturbing the solder joint on the first pin as it is setting up. Some items are heat sensitive and will benefit from this practice.

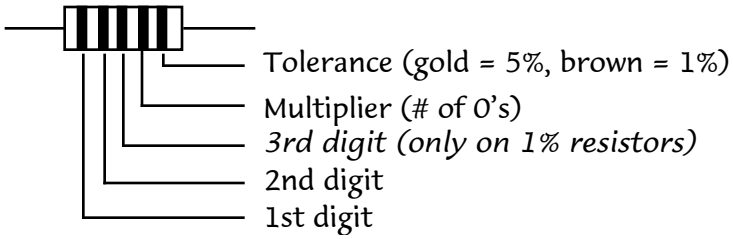
Main PCB

Use 331 solder.

Resistors:

- Insert all the resistors, **except for R65 (this is located on the very small PCB and has to go in standing up)**, bending the legs at 45 degrees. Check the values. Did you have any left over? Then solder in place. The resistor can be inserted in either direction, although a good practice is to orient the color code so that it can be read from left to right along with the PCB silkscreen. This simplifies checking the values and later troubleshooting/repairs. Don't get confused over similar color codes.
- The color code chart shows how to identify resistor values. The exact hue of the colors can vary a bit, so be sure that you pick the right value. Using the parts list and putting the resistors into groups of the same value can help clear up any confusion. The suffix "K" is used to denote thousand and "M" stands for million. A 56K resistor is thus 56,000 ohms. The 1% resistors are blue in color and have 5 color bands, with the right one always being brown, indicating "1" % tolerance. The rest of the color bands are read in the same fashion as the 5% resistors with there being one more digit to consider. For example, a 75K 1% resistor reads from left to right: violet (7), green (5), black (0), red (2 zeros) or 75000. A possible problem with this system comes when the first digit is 1 (brown). Since the tolerance is also brown, make sure that you don't read the resistor the wrong way!

Resistor Color Codes



Black = 0
Brown = 1
Red = 2
Orange = 3
Yellow = 4
Green = 5
Blue = 6
Violet = 7
Gray = 8
White = 9

For example: green (5), blue (6), orange (3 zeros), gold (5%)= a 56000 or 56K ohm, 5% tolerance resistor.

For example: violet (7), green (5), black (0), red (2 zeros), brown (1%)= a 75000 or 75K ohm, 1% resistor.

Diodes: Insert and solder the diodes: Note the orientation.

PCB Symbol 

Diode 

Resistor Networks: Observe the orientation. These are impossible to remove once soldered, so take care!

- Be sure not to confuse the two types 6 pin 100Ks. These cannot be interchanged.

IC Sockets: These will have a keyway or dot (pin 1) to indicate the correct orientation. Insert the socket and bend one leg at two opposing corners 45 degrees or so. Solder these two pins and check to see that the socket is flush with the board. Then solder all the pins.

Jacks: Load the 14 jacks into the PCB. Since these will have to go through the front panel later, precise mounting is a must. Carefully insert all jacks and flip the board over.

- **Tip:** Keeping the jacks in the board can be challenging but one useful trick is to bend the front pin forwards just a bit before inserting. Install the front pin first, pushing a bit forward to get the rear pins in place.

Solder **only the front pin** while applying a bit of pressure to the PCB in the vicinity of the jack. Do all the jacks and check the mounting before soldering any other pins. Close one eye and sight down the row of jacks. Each jack must be flush to the board and have no tilt from front to back. When everything looks perfect, solder the other pins.

Connector Headers 24 pin FM: insert into the RCC sections. Solder one pin on each opposite corner and check for flatness on the board. Solder the other pins.

Reference Diode: D1. Note orientation of the T0-92 package.

Capacitors: (**Cap**). There are several different types. You may need a magnifier to read the code on the small ceramics.

- Note that the electrolytic type must be properly oriented. Insert the side which has the **longer lead** closest to the "+" on the silkscreen. The opposite side of the capacitor should have a row of "-".

Polyswitches: (**PTC**) PS1 and PS2. These have kinked legs.

Power Input Jack: JPWR; note the orientation as shown by the silkscreen.

R65: Goes in "standing up" on the tiny PCB.

Wash the PCBs in warm water and rinse with distilled water. Allow to dry. Inspect all work very carefully.

***** Use 245 solder for the remaining assembly steps. *****

Side Switch: Make sure that this is mounted flat on the PCB.

Pots: Insert the ten pots on the pcbs (metal bushing pots for R2, 3, 5, 7, 8, 10) and solder one mounting leg on each pot. Holding the PCB with one hand, remelt each solder joint and press the pot down onto the PCB. With one eye closed, sight down the row of pots making sure they are even and flat on the board. Solder the rest of the pot pins.

Angle Brackets: Mount the five angle brackets to the top of the jack PCBs with a 4-40 screw going through the bottom of the board, through the unthreaded opening on the bracket and into a kep nut. Push the bracket back as far as it can go and tighten securely. Make sure each bracket is square with the edge of the PCB. Use pliers to adjust.

ICs:

Use a static free work station or wrist strap when installing the ICs.

Install the ICs, observing the correct orientation.

- **Make sure all the legs are straight and are actually going into the socket before seating the IC.**

Mounting PCBs to the Front Panel:

- This is a bit complicated. You might want to take a break before getting into this!

Work on a soft surface such as a towel.

Mount Small J7 jack PCB to -C PCB: Take a three piece section of the 1.2" long header and insert into the H4 holes on the small PCB. Pop in the .437 spacer. Do not solder the header yet.

- The small PCB will sit underneath the -C PCB.

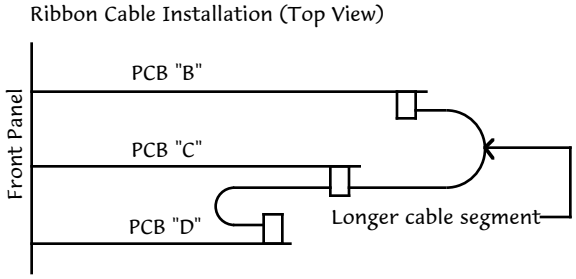
Temporarily mount the two boards to the front panel with three pot washers and nuts and a black screw into the small PCB bracket. When everything looks good, you can solder the header to the two boards and trim. Remove the boards from the front panel.

Mount -A PCB and -B PCB to front panel: Use two black screws into the PCB brackets on -A. Insert 1.2" header sections into H1, 2, 3. H1 and H2 are 5 positions; H3 is 6 positions. Mount -B PCB to the front panel with pot washers and nuts. Make sure that the header pins come up through the PCB. After tightening the pot nuts, solder the header pins and trim.

Mount -C PCB to Front Panel: Remount the combination from the first step above. Use the three black washers on the pots. This will look better due to the small knobs used on these pots.

Mount -D PCB to Front Panel: This board goes in upside down, with the components facing the components on the -C PCB. Make sure the RCC 24 pin ribbon cable connectors line up on the three boards. Use two black screws into the brackets.

Connect the ribbon cable:



Push on the knobs: The larger knobs are used for the Mix section. The small black and white knobs are used for the Shape section.

Testing

Connect a +/-15 V bipolar regulated power supply (such as the PS505) to the board. Make sure that the connector is properly positioned on the header. Do not make the power connection to the board with the power supply turned on. These measures will help avoid damage to the unit!

Use your DMM to monitor the +15V supply, using the left side of diode near the top of the power connector for common and the right side for +15V.

Apply power. If your DMM does not indicate 15V or so, remove the power.

If +15 is present, check the -15 at the right side of the bottom diode under the power connector.

Are there any funny smells? If anything seems amiss, remove the power.

Calibration

No calibration is necessary.

Troubleshooting, Repair, Warranty

Most problems are caused by assembly errors.

Don't panic!

Take a break, then check solder joints for good connection (no "cold" joints?), check for a blob of solder causing a short, check all component locations and polarities, and check for the possibility of a broken trace or a hairline short caused by under etching of the PCB, especially around the pots.

If you encounter problems that you can't solve, contact us, preferably via e-mail with a description of the problem. Let us know what does and does not work. We can then help you get your module working. We can also fix modules mailed to us for a minimum fee of $29 (if not covered by warranty). **Contact us for an RMA before shipping.**

The parts contained in this unit have been carefully selected and tested. They are guaranteed for one year from the date of purchase. If you believe that you have a defective part (or if you have a part missing), contact us so we can provide you with a replacement or repair. Include your name and invoice number.

Store your Manual in a secure location and never, ever throw it away! It is the best information available for your revision of this module. **Manuals must be transferred to the new owner anytime you sell a module.**

We reserve the right to void the warranty or refuse to service any module that has been built with parts not supplied by us, modified in any way, subjected to abuse, or damaged beyond repair.

Assembly Documents

- **Parts list**
- **PCA drawing**
- **Schematic**
- **PCB drawing**

Modifications

The VCA2930 can be modified for use with other modular systems that use a 5V signal for fully open VCAs. This will make it very hard to use in a Blacet setup however, so we advise that the modification be made only after careful consideration.

Change R44, 46, 48, 50, 60 from 30.1K to 60.4K.

Install a jumper at JMP1 at the bottom of the VCA2930-B PCB.