# Operating Manual

# Parametric Equalizer/ Notch Filter

MODEL 642B

Including 642B/SP, 642B/SPX

orban

95071-000-02 12/89

# Orban 642B

# Parametric Equalizer/ Notch Filter

# Operating Manual

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# Section 1 Introduction

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This manual serves for several variations of the 642B which involve different arrangements of the four filters in each band:

| | |
|---|---|
| 642B/SP | Bands chosen for speech, both channels. |
| 642B/SPX | One channel wideband as in 642B; other channel is 642B/SP |

See page 6-2, Specifications, for further information.

# 642B Parametric Equalizer/Notch Filter

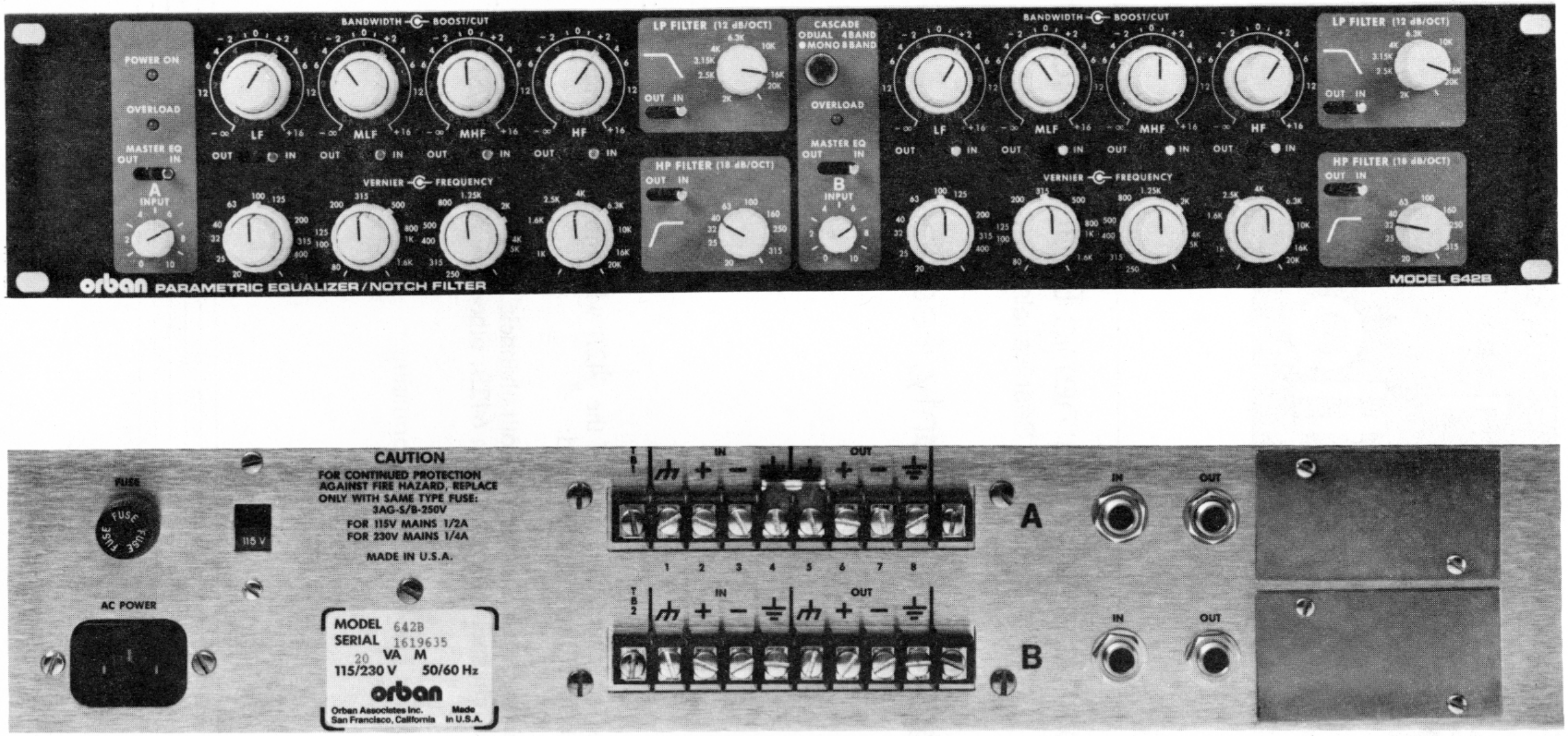


Fig. 1-1: Front and Rear Panels

# Orban's 642B Parametric Equalizer/Notch Filter

The Orban 642B Parametric Equalizer/Notch Filter is an efficient and powerful tool for a wide range of creative and corrective equalization applications.

- Full parametric operation with no interaction between parameters.
- True infinite-depth notch filtering (made possible by the 642B's constant-Q design).
- Each band is continuously tunable over a frequency range exceeding 20:1.
- Tuning ranges of bands overlap significantly to maximize versatility.
- Verniers on the FREQUENCY controls facilitate fast, precise tuning of sharp notches.
- +16dB boost to infinite cut (−45dB typical) available in each band.
- Bandwidth can be varied from a broad (Q = 0.29) curve to a sharp (Q = 5.0) curve.
- Dual 4-band or mono 8-band configuration can be selected with the front-panel CASCADE button.
- Continuously tunable 18dB/octave high-pass filters and 12dB/octave proprietary Automatic Sliding Besselworth™ low-pass filters provide full flexibility while retaining maximum musicality.
- Noise and distortion specs are significantly better than 16-bit digital.
- Input signal gain can be adjusted throughout a range of +14dB to $-\infty$.
- OVERLOAD lamps warn of overload when the output of any internal amplifier is within 1dB of its clipping level.
- Extensive RF suppression on input, output, and power leads.

# Registration, Warranty, Feedback

## Registration Card

There are two good reasons for returning the Registration Card shipped with this product:

1) It enables us to inform you of new applications, performance improvements, and service aids which may be developed, and

2) It helps us respond promptly to claims under warranty without having to request a copy of your bill of sale or other proof of purchase.

Please fill in the Registration Card and send it to us today. If it is lost (or you have purchased this unit used), please photocopy the duplicate below, fill it in, and send it to Orban at the address on the inside of the front cover.

Model # ______________ Purchase Date ____________ Serial # ______________

Your name ______________________________ Title ______________

Company ______________________________ Call Letters ______________

Street ______________________________ Telephone ______________

City, State, Mail Code (Zip), Country ______________________________

Purchased from ______________________________ City ______________

Nature of your product application ______________________________

How did you hear about this product? ______________________________

Comments ______________________________

______________________________

Which magazines do you find most useful in your job?

- ❑ BM/E
- ❑ The Mix
- ❑ RE/P
- ❑ TV Technology
- ❑ Broadcasting
- ❑ Pro Sound News
- ❑ Sound & Communications
- ❑ Broadcast Engineering
- ❑ Radio & Records
- ❑ Sound & Video Contractor
- ❑ Others: ______________
- ❑ Millimeter
- ❑ Radio World
- ❑ TV Broadcast

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## Warranty

The warranty, which can be enjoyed only by the first end-user of record, is stated on the separate Warranty Certificate packed with this manual. Save it for future reference. Details on obtaining factory service are provided on page 5-4.

## User Feedback Form

We are very interested in your comments about this product. Your suggestions for improvements to either the product or the manual will be carefully reviewed. A postpaid User Feedback Form is provided in the back of this manual for your convenience. If it is missing, please write us at the address on the inside of the front cover. Thank you.

# Section 2
# Installation

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**CAUTION**

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

(per UL 813)

# Installation and Set-up

Allow about 15 minutes for installation.

Installation consists of unpacking and inspecting the 642B, mounting it in a rack (if desired), and connecting audio and power.

## 1) Unpack and inspect.

If obvious physical damage is noted, contact the carrier immediately to make a damage claim.

If you should ever have to ship the 642B (e.g. for servicing), it is best to ship it in the original packing materials since these have been carefully designed to protect the unit. Therefore, make a mental note of how the unit is packed and *save all packing materials.*

Packed with the 642B are:

- 1 Warranty Certificate
- 1 Registration Card
- 1 Operating Manual

## 2) Mount the 642B in a rack. (optional)

The 642B requires two standard rack units (3½ inches, 8.9 cm).

If the 642B will be grounded through the rack, there should be a good ground connection between the rack and the 642B chassis. Check this with an ohmmeter.

Mounting the unit directly over large heat-producing devices (such as a vacuum-tube power amplifier) may shorten component life and is not recommended. Ambient temperature should not exceed 113°F (45°C) when equipment is powered.

## 3) Connect audio inputs and outputs.

Inputs and outputs are active balanced, but can readily be used in an unbalanced configuration. Conventional connections should work properly in the majority of cases.

Where the unit is used as an 8-band mono equalizer (both channels in cascade), connect only to the terminals for channel A.

For best performance, read the following sections on Audio Connections (page 2-4) and Grounding (page 2-7).

## 4) Connect power.

A☐ Check that the voltage selector switch on the rear panel is set correctly.

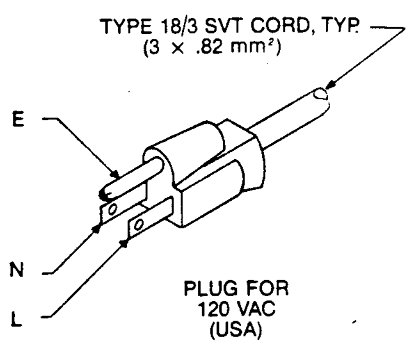
The 642B is shipped ready for 115-volt, 50/60Hz operation — unless a label on the power cord indicates otherwise. If you change the setting of the voltage selector switch, be sure to also change the fuse. Use a 3AG 250V Slo-Blo fuse (1/2-amp for 115-volt operation, 1/4-amp for 220-volt operation).

B☐ Connect the 642B's power cord to an appropriate AC power source.

The power cord is ordinarily terminated in a 'U-ground' plug (USA standard), unless specially-ordered for your country's standard. The green (or green/yellow) wire from the safety-ground prong is connected directly to the 642B chassis. If it becomes necessary to lift this ground to suppress ground loops, do so with a three-prong to two-prong adapter plug, rather than by damaging the power plug. But you should *not* defeat the ground unless absolutely necessary, because it eliminates the intrinsic safety feature of the three-wire system.

**WARNING**

If the ground is defeated, certain fault conditions in the unit or in the system to which it is connected can result in full line voltage between chassis and earth ground. Severe injury or death can then result if the chassis and earth ground are touched simultaneously.




| CONDUCTOR | | WIRE COLOR | |
|---|---|---|---|
| | | Normal | Alt |
| L | LINE | BROWN | BLACK |
| N | NEUTRAL | BLUE | WHITE |
| E | EARTH GND | GREEN-YELLOW | GREEN |

Fig. 2-1: AC Power Cord Color Coding

## 5) Complete the Registration Card and return it to Orban (please).

The Registration Card enables us to inform you of new applications, performance improvements, and service aids which may be developed, and it helps us respond promptly to claims under warranty without having to request a copy of your bill of sale or other proof of purchase. Please fill in the Registration Card and send it to us today.

## Audio Connections

### Cable:

We recommend using **two-conductor shielded cable** (such as Belden 8451 or equivalent), because signal current flows through the two conductors only. The shield does not carry signal, is used *only* for shielding, and is ordinarily connected to ground at one end only.

> Because use of single-conductor cables virtually eliminates any possibility of carefully controlling the system grounding scheme, it is NOT RECOMMENDED! Even so, it often does work adequately.
>
> Sometimes, particularly if you are using the 642B with musical instruments or home-type equipment, single-conductor shielded cable may be the only practical alternative. In this case, connect the inner conductors of the shielded cables to the (+) sides of the 642B inputs and outputs. Connect the shield of the 642B *input* cable to the (–) input, and connect the shield of the 642B *output* cable to the 642B's (–) output terminal on the rear-panel barrier strip. Connect both IN (–) and OUT (–) terminals to the corresponding (⏚) terminal.

### Connectors:

- **Input and output connectors** are both barrier strip terminals (with #6 screws) and ¼-inch tip/ring/sleeve phone jacks.
- Holes are provided for installation of XLR-type connectors (a retrofit kit is available from your dealer — order RET-049).

### Levels:

- Nominal **input level** is between −10 and +8dBu. The absolute overload point is +26dBu. (0dBu = 0.775V RMS; for this application, the dBm @ 600Ω scale on voltmeters can be read as if were calibrated in dBu.)
- Some **'semi-professional' and** almost all **consumer equipment** uses a nominal operating level of −10dBV (-7.8dBu). While the 642B will work at this level, the INPUT control must ordinarily be turned all the way up, and further make-up gain is therefore not available. For best noise performance, the INPUT control should be adjusted to provide a nominal +4dBu output level, regardless of the nominal system operating level. If the 642B is used in a −10dBV system, lowest system noise might be achieved by placing a 12dB-loss pad at the 642B's output (although the pad may be unnecessary, since the 642B's noise is so low). Adjust the INPUT controls to achieve optimum operation.

### Input Configuration:

See Fig. 2-2 for some examples.

- The **electronically-balanced input** of each channel is compatible with most professional and semi-professional sound equipment, balanced or unbalanced, having a source impedance of 600 ohms or less. If the source impedance is greater (as in some vacuum-tube audiophile preamps), remove capacitors C1 (channel A) and C3 (channel B), and connect the hot side of the driving equipment's outputs to the 642B's (+) inputs.

## Audio Connections (continued)

### Audio Input:

- Input connections are the same whether the driving source is balanced or unbalanced.
- Do not connect the cable shield — it should be connected at the source end only. Connect the red (or white) wire to the appropriate (+) input terminal, and the black wire to the corresponding (–) input terminal.
- If the output of the other unit is unbalanced and does not have separate (⏚) and (–) (or LO) output terminals, connect both the shield and the black wire to the common (–) or ground terminal. It is rarely necessary to balance an unbalanced output with a transformer. As long as it is feeding a balanced input, the system will work correctly.

  (The only situation where the addition of an input transformer might be warranted is one in which the source equipment is powered from a separate mains transformer and power ground. In such a situation, terminate the transformer's secondary with a 20kΩ resistor.)

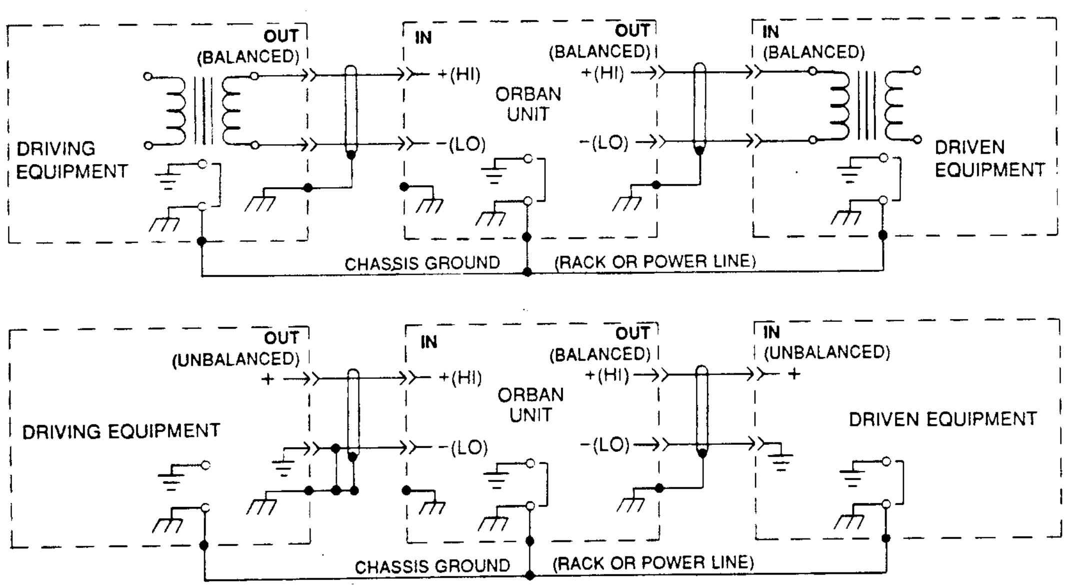



Fig. 2-2: Some Possible Connection Schemes

## Audio Connections (continued)

### Output Configuration:

See Fig. 2-2 for some examples.

- The **electronically-balanced and floating output** of each channel simulates a true transformer output. The *source* impedance is 30 ohms. In addition, there is a 1000pF capacitor from each output (+) and (–) to the chassis for RFI suppression. The output is capable of driving loads of 600 ohms or higher; maximum output level is >+20dBu.
- If an **unbalanced output** is required (to drive unbalanced inputs of other equipment), it should be taken between the (+) and (–) outputs. No special precautions are required even though one side of the output is grounded. Connect the (–) output terminal to (⏚).

### Audio Output:

- Use two-conductor shielded cable (Belden 8451, or equivalent).
- At the 642B's output (and at the output of other equipment in the system), connect the cable's shield to the (⏚) terminal for that channel. Connect the red (or white) wire to the channel's (+) terminal, and the black wire to the channel's (–) terminal.
- In difficult environments, it may be necessary to isolate the 642B with transformers (available as Retrofit Kit RET-051).

## Grounding

Very often, grounding is approached in a 'hit or miss' manner. But with care it is possible to wire an audio studio so that it is free from ground loops (which induce hum and can cause oscillation) and provides maximum protection from power faults. In an ideal system:

- All units in the system should have *balanced inputs*. In a modern system with low output impedances and high input impedances, a balanced input will provide common-mode rejection and prevent ground loops — regardless of whether it is driven from a balanced or unbalanced source. (The 642B has balanced inputs.)
- All equipment *circuit grounds* must be connected to each other; all equipment *chassis grounds* must be connected together.
- *Cable shields* should be connected at one end only — preferably the source (output) end.

### Power Ground:

- Ground the 642B chassis through the third wire in the power cord. Proper grounding techniques *never* leave equipment chassis unconnected to power/ earth ground. *A proper power ground is essential to safe operation.* Lifting a chassis from power ground creates a potential safety hazard.

### Circuit Ground:

To maintain the same potential in all equipment, the circuit (audio) grounds must be connected together:

- *In a simple one-studio system*, the connection through power ground (via the power cord's third wire) will suffice. Connect the channel A IN (⏚) terminal of the 642B to its channel A OUT (⊥) terminal (only one channel should be jumpered in this way — leave the channel B grounds unconnected). Also connect the circuit and chassis grounds of other equipment.
- *In larger systems*, it is common to establish an isolated circuit ground system that is insulated from the power ground except at one point (usually the studio power distribution panel). If this grounding system is used, disconnect the 642B's channel A IN (⏚) terminal from its channel A OUT (⊥) terminal, then connect the 642B's channel A IN (⏚) terminal to the isolated circuit ground system.

## Grounding (continued)

### Difficult Situations:

Because it is not always possible to determine if the equipment driving or being driven by the 642B has its circuit ground internally connected to its chassis ground (which is always connected to the ground prong of the AC power cord, if present), and because the use of the AC power ground often introduces noise or other imperfections such as RFI, hum, clicks, and buzzes, the wiring techniques in Fig. 2-2 are not universally applicable.

If you follow Fig. 2-2 and hum or noise appears, don't be afraid to experiment. If the noise sounds like a low-level crackling buzz, then probably there isn't *enough* grounding. Try connecting the (−) input of the 642B to a chassis ground terminal on the barrier strip and see if the buzz goes away. You can also try adding or removing the strap between the 642B's chassis and circuit grounds.

Buzz phenomena are often caused by SCR (electronic) dimmers or similar devices located on the same AC supply. Sometimes such buzzes can be eliminated by running a dedicated circuit to the audio equipment from the main switch, in order to take advantage of the ground point that originates there and to avoid as much as possible noise being fed into the system from other circuits.

A ground loop usually causes a smooth, steady hum rather than a crackly buzz. If you have a ground loop, you can often break it by *disconnecting* the jumper between circuit and chassis grounds on the 642B's rear-panel barrier strip. In either case, think carefully about what is going on, and keep in mind the general principle: one and *only one* circuit ground path should exist between each piece of equipment!

When a single-conductor shielded cable is used for audio connections, the shield will ordinarily receive chassis ground from the external equipment which it is connecting to the output of the 642B. The chassis ground/circuit ground jumper on the rear barrier strip of the 642B should be left in whichever configuration gives minimum hum or buzz. To minimize hum or buzz, it may be necessary to jumper one or more shields to chassis ground, and/or to jumper the 642B's (−) output to chassis ground.

# Section 3
# Operation

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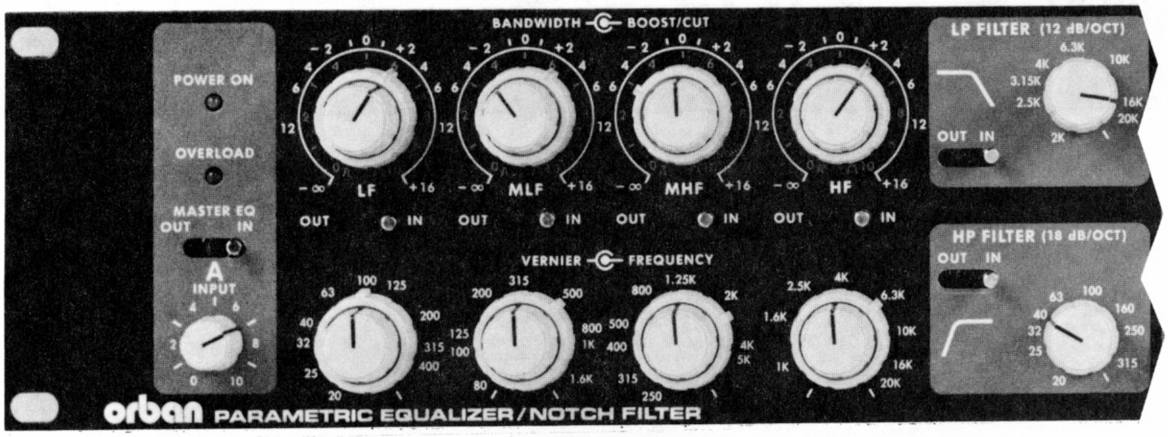
# 642B Controls and Displays




Channel A

**POWER ON lamp** lights when the 642B is powered. (The lamp operates from the 642B's −15V rail.)

**OVERLOAD lamps** light when the output of any amplifier in the corresponding channel is within 1dB of its clipping level. To eliminate the overload, reduce the input level or turn down the appropriate INPUT control.

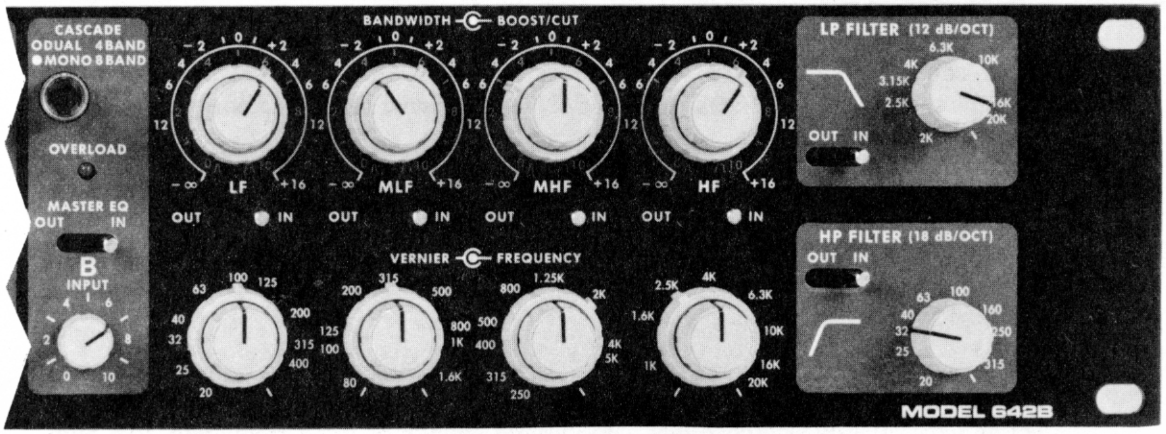
**MASTER EQ switches** enable or bypass the four bands of the corresponding channel. No gain changes will occur when these switches are set to OUT* (because the signal is still applied to the input buffer and output amplifier), and the OVERLOAD lamps will continue to function as if the switches were set to IN. Input/output polarity is non-inverting regardless of the position of this switch.

**INPUT controls** adjust the amount gain applied to the input audio for the corresponding channel (i.e. they adjust the 642B's input sensitivity). Range: −∞ to +14dB gain. When the CASCADE button is set to MONO 8-BAND, only the channel A INPUT control is active.

**LP FILTER controls** set the corner frequency of the corresponding channel's low-pass filter. Range: 2–20kHz. **LP FILTER switches** enable or bypass the low-pass filters.

**HP FILTER controls** set the corner frequency of the corresponding channel's high-pass filter. Range: 20–315Hz. **HP FILTER switches** enable or bypass the high-pass filters.

* This assumes flat equalization curves. Slight level changes may occur when switching to OUT from a non-flat curve because of energy added or subtracted by the equalization process.




Channel B

**BANDWIDTH controls** adjust the Q (or sharpness) of peak or dip in each band. Range: 0.29 to 5. Lower numbers are higher Q's which result in sharper curves.

**BOOST/CUT controls** adjust the amount of peak or dip in each band. Range: +16dB to −∞. "−∞" is typically better than −45dB.

> The BOOST/CUT and BANDWIDTH controls are concentric. The *inner* knob controls the boost/cut, which is calibrated in dB on the *outer* scale); the *outer* knob (marked with an orange line) controls the bandwidth, which is calibrated in arbitrary units on the *orange, inner* scale.

**Band IN/OUT switches** enable or bypass equalization for each band. Setting the IN/OUT switches of unused bands to OUT will ensure accurate flat response.

**FREQUENCY controls** determine the center frequency of each band. Ranges: LF bands: 25–500Hz, MLF bands: 80–1600Hz, MHF bands: 315–6300Hz, HF bands: 1,000–20,000Hz*. The outer VERNIER knob allows fine adjustment of the frequency selected by the coarse-adjust center knob (typically within a range of ±10%).

**CASCADE button** switches the 642B between dual 4-band and mono 8-band configurations. When the button is set to MONO 8-BAND, the equalizers of both channels are cascaded, and *only* the channel A input section and channel A low- and high-pass filters can be used (the channel B inputs and filters are disabled).

* Special-purpose models 642B/SP and 642B/SPX have alternate arrangements of bands — see page 3-10 and page 6-2, Specifications.

## Using the 642B — General Considerations

The operating controls of the 642B have been configured to permit easy, intuitive adjustment. For those who have never used a parametric equalizer, the easiest way to become familiar with the 642B is to pass audio through it and listen to the effects of turning the various controls:

First, make sure the MASTER EQ and band IN/OUT switches are set to IN. Adjust the INPUT controls as necessary. Now center the FREQUENCY, and set the BANDWIDTH controls to 6. With these settings, the 642B will behave like an ordinary 'four-knob' console channel equalizer.

Set the BOOST/CUT controls above +2. Experiment with the FREQUENCY and BANDWIDTH controls to see how they affect the sound. Notice subtle shelving effects when the BANDWIDTH control is set near 10 (broadband peaking). Set the BANDWIDTH control near 0; listen to how the ringy, colored quality of this narrowband peaking contrasts with the broadband sound.

Now set the BOOST/CUT controls to $-\infty$, and vary the BANDWIDTH control as before. Narrowband dips are essentially inaudible — but they can be made sharp enough to act as very effective notch filters, suppressing sounds of fixed frequency, like hum, by more than 45dB (typical). Sounds rich in harmonics can be suppressed by using one band for each dominant harmonic.

### Constant-Q tuning

The equalization curves are not reciprocal for a given Q: the 642B's constant-Q configuration is characterized by boost bandwidths that are wider than cut bandwidths. This curve family is more musically useful than the more common reciprocal curves. The constant-Q configuration also facilitates creation of infinite-depth (in practice, >45dB) notches — highly useful for eliminating hum, feedback, or other interference of fixed pitch.

Because the 642B is a true parametric equalizer, the controls do not interact. This means that the peak (or cut) gain set with the BOOST/CUT control remains constant when the shape of the equalization curve (the Q) is altered with the BANDWIDTH control (see Fig. 3-1).

For more boost or cut, tune adjacent bands to the same frequency. But be careful: this will typically make possible 90dB cuts (which are rarely more useful than the 45dB cuts) and 32dB boosts (which will *greatly* increase the likelihood of overload and noise build-up).

**Canceling previous equalization:** Although the 642B's constant-Q equalization curves are non-reciprocal, equalization provided by the 642B *can* be precisely canceled by the 642B. To do this, first set all FREQUENCY controls to the same positions that the were in when the equalization was added. Then set all BOOST/CUT controls to the inverse of their positions during equalization (e.g., if set to +2 before, set to -2 now). Finally, adjust the BANDWIDTH controls for the flattest overall response. The net effect will be an equalization curve that is the reciprocal of the one used during equalization.

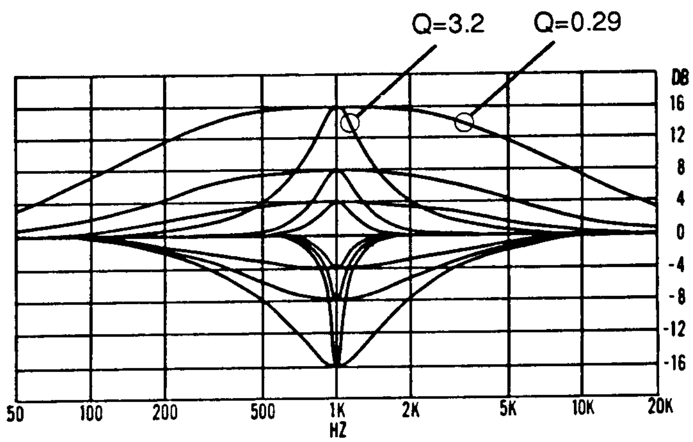



Fig. 3-1: 642B Constant-Q Boost/Cut Curves
(Two families each having equal Q)

## Headroom

The overload-to-noise ratio available from the 642B is typically 110dB when the CASCADE button is set to DUAL 4-BAND, and 101dB when the CASCADE button is set to MONO 8-BAND (this depends somewhat on the settings of the controls).

While this ratio is very high, it may result in audible noise if system gains are chosen poorly. To set system gain correctly, you should match the 642B's overload point to the overload point of the driven equipment. The following explains how to do this with a power amp.

**WARNING**

Loudspeakers or other power amp loads will almost certainly be damaged by a full-power sine-wave signal. Use a dummy load or a test signal with a higher peak-to-average ratio than a sinewave (such as pink noise low-pass filtered at 1kHz).

Connect the 642B to the power amplifier. Set the 642B's INPUT controls to your normal operating level. Apply a sine wave to the 642B's input at a level that just barely lights the corresponding OVERLOAD lamp on the 642B. Then adjust the power amp's input attenuators so the amp just barely clips.

## Matching channels

Although the 642B's controls are highly reliable, their calibrations have a normal tolerance. Typically, this is ±⅓ octave for the FREQUENCY controls and ±1dB (±0.5dB in the −4dB to +4dB range) for the BOOST/CUT controls. Accurately defeating the equalization in a given band is best done with that band's IN/OUT switch. The BANDWIDTH controls (calibrated in arbitrary units) have a unit-to-unit calibration tolerance of ±10%.

With *broadband equalization* (BANDWIDTH controls set at or above 5) good matching can be obtained by simply setting the channels' controls identically.

However, when operating with *narrow bandwidths* (BANDWIDTH controls set between 0 and 5), accurate stereophonic matching of channels on the basis of panel calibrations alone is impractical. Adjustment with test instruments will ensure precise stereo imaging and accurate mono summing of the channels.

The following procedure explains how to match channels by sweeping the channels out of phase, then adjusting one channel to null the amplitude of sum of the channel's output. This differential method is very sensitive because it minimizes both phase and amplitude mismatches. You will need a sweep generator, an oscilloscope, and two 22kΩ ±5%, ¼-watt resistors (any value between 5kΩ and 50kΩ will do, but the resistors must be matched ±5%).

(Although these instructions assume two channels are being matched, any number of 642B channels may be precisely matched with this technique. Choose one channel as the reference channel, and match all other channels to it, one at a time.)

1) Adjust both channels by ear until you get the equalization you want.

   The corresponding controls for each channel should be set identically.

2) Connect the signal output of a sine-wave sweep generator with logarithmic sweep to the 642B's channel A IN (+) terminal.

   These instructions use channel A as the reference channel, but either will do.

3) Connect another signal output of the generator to the 642B's channel B IN (−) terminal.

4) Connect the generator's sweep ramp output to the horizontal (or X-axis) input of an oscilloscope.

5) Connect the channel A IN (−) terminal, the channel B IN (+) terminal, and the generator's (−) output or ground to 642B (⏚) terminals.

6) Connect the channel A OUT (+) terminal, the channel B OUT (+) terminal, and the oscilloscope's ground to 642B (⏚) terminals.

7) Connect the channel A OUT (+) terminal to one side of a 22kΩ ±5%, ¼-watt carbon resistor.

   The resistors used in this and the following step may be any value from 5kΩ to 50kΩ, but must be matched ±5%).

8) Connect the channel B OUT (+) terminal to one side of another 22kΩ ±5%, 1/4-watt carbon resistor.

9) Connect the other sides of *both* resistors to the vertical (or Y-axis) input of the oscilloscope.

10) Set all band IN/OUT switches to OUT.

Leave the MASTER EQ switches set to IN.

11) Sweep the channels from 20 to 20,000Hz.

Adjust the scope sensitivity so the swept component can be easily seen.

For monitor tuning or sound reinforcement applications, it is not necessary (or desirable) to exactly match the channels in the frequency range below 200Hz — if a third-octave analyzer is used to monitor the acoustic response of the system (see page 3-12). This is because different loudspeaker locations will usually produce different bass balances in the *room* unless the room has been acoustically designed and is symmetrical (like a good recording studio control room).

12) Adjust the channel B INPUT control until the scope trace is nulled.

13) Set all band IN/OUT switches that were set to OUT in step 10 back to IN.

Only those bands which will not be used in normal operation should be switched out.

14) Slightly adjust the controls of the active channel B bands to further minimize the amplitude of scope trace.

15) Disconnect the sweep generator, resistors, and oscilloscope from the 642B.

## Tunable High- and Low-pass Filters

The 642B's tunable high- and low-pass filters are located after the corresponding band's equalization circuitry. The low-pass filter is located after the corresponding high-pass filter.

When the CASCADE button is set to MONO 8-BAND, only the channel A high- and low-pass filters are functional.

The high-pass filters have third-order Butterworth rolloffs of 18dB/octave. The corner frequency can be adjusted throughout a range of 20–200Hz. Fig. 3-2 shows some typical rolloff curves.

The low-pass filters have second-order Automatic Sliding Besselworth™ rolloffs of 12dB/octave. The rolloff characteristic changes smoothly from a Bessel-type rolloff to a Butterworth-type rolloff as the corner frequency is increased (see Fig. 3-3). This approach gives a more natural sound at midrange frequencies, while allowing sharper rolloffs at high frequencies.

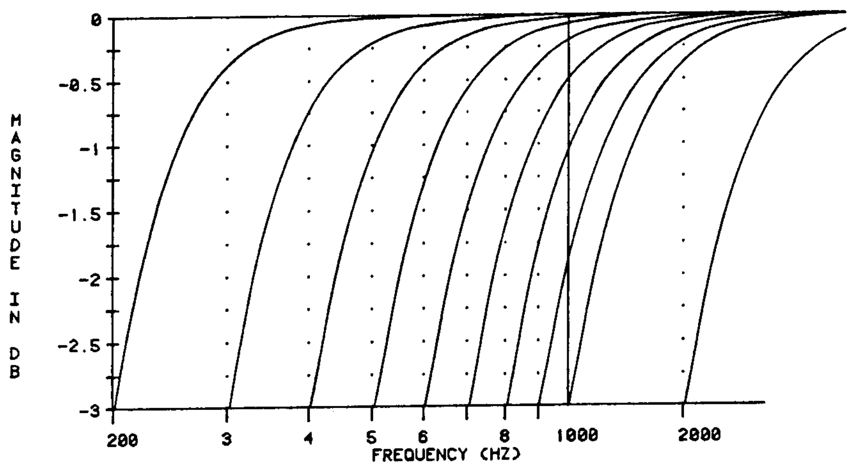



Fig. 3-2: Typical Rolloff Curves, High-pass Filters

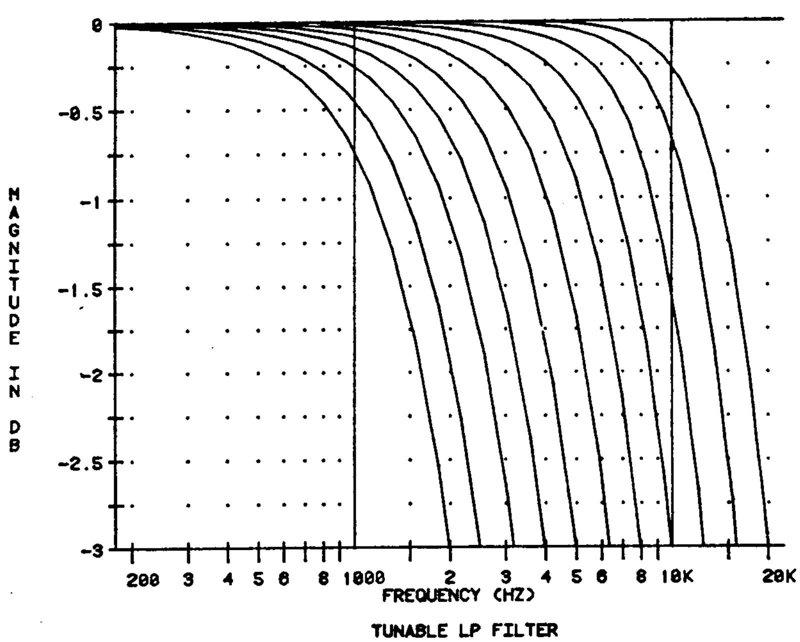



Fig. 3-3: Typical Rolloff Curves, Low-pass Filters

# Using the 642B in Specific Applications

This section provides specific instructions and suggestions for the use of the 642B in recording studios, sound reinforcement, film and video post-production, and broadcasting. We recommend that anyone involved in pro audio read all of the following.

## Recording studios

The 642B can be used in the recording studio almost anywhere that a conventional equalizer is used. Most studios find at least two channels of patchable parametric equalization to be invaluable for cleaning up difficult tracks that a console's internal equalizers can't handle. The 642B offers superior musicality as a broadband, shaping equalizer — and functions gracefully as a precisely-tunable notch filter. Tunable high-pass and low-pass filters add flexibility for special effects or for noise reduction.

The 642B can also be effectively employed as a monitor system equalizer (see 'Sound reinforcement' on page 3-9).

**Hum:** If a track is plagued by hum or other interference of fixed pitch, the 642B can be used to eliminate the interference (with negligible effect upon the program material). For such narrowband notching, set a band's FREQUENCY control to the offending frequency, its BANDWIDTH control to 0, its BOOST/CUT control to $-\infty$, then fine-tune the notch with the FREQUENCY vernier. The notching of each harmonic requires use of a separate band.

**Special effects:** Sweeping wideband notches gives a true 'phasing' sound. Sweeping narrowband peaks gives a different sound with a similar flavor.

Telephone, transistor radio, and 'old time' recording effects can be easily generated by adjusting the high- and low-pass filters so that only a narrow bandwidth is passed. Telephone audio, for example, is limited to the 300–3,000Hz range. To simulate the distortion characteristic of such sources, over-drive the input of the 642B beyond the point where the OVERLOAD lamp flashes.

## Sound reinforcement

The 642B is a versatile sound reinforcement equalizer that can be used as a broadband equalizer and/or notch filter. It gives you the flexibility you need to deal with room resonance problems — without creating troublesome artifacts. Its constant-Q design minimizes phase shift, noise build-up, and ringing. High and low-pass filters allow shaping of the passband so that power is not wasted feeding the drivers signals they can't reproduce.

Many reinforcement systems are mono. In these installations, particularly powerful results can be obtained by setting the CASCADE button to MONO 8-BAND. This will re-configure the 642B as an eight-band equalizer/notch filter.

To make the 642B more flexible when used for notch filtering and feedback suppression chores only, Orban offers two special models: the two lowest bands of each channel of the **642B/SP** both cover the 80–1.6kHz range, while its two highest bands both cover the 315–6,300Hz range; one channel of the **642B/SPX** is configured like the 642B, while the other has the 642B/SP configuration. These variations on the 642B give sound contractors/installers extra versatility in the critical frequency ranges needed to deal with room resonances and feedback problems.

Optional acrylic security covers are available in three colors (see page 6-3 for ordering information).

**House tuning, stage monitors:** The 642B (with the CASCADE button set to MONO 8-BAND) can do an effective job of tuning a reinforcement system to a room. Results are usually better than those achievable by a third-octave filter set because the Q of the parametric can be set to match the Q of the frequency response irregularities being corrected. Use three or four of the bands for narrowband notching (BANDWIDTH controls set to 0) to eliminate the major ring modes. This is most effectively and safely done if there is a limiter or compressor in the circuit before the power amplifier to prevent speaker damage.

1) Provide a limiter to prevent speaker damage.

A❑ Place a limiter in-line *prior* to the power amplifier.

Orban's 412A Compressor/Limiter is ideal for this application.

B❑ Turn the limiter's output attenuator all the way down.

C❑ Adjust the limiter for the highest available compression ratio.

D❑ Feed the limiter a 1kHz sine wave at 0dBu.

E❑ Adjust the limiter's input attenuator so that gain reduction occurs.

F❑ Advance the limiter's output attenuator until the output level of the system power amplifier is 6dB below the maximum continuous sine-wave power that can be handled by the most overload-sensitive driver in the system (this is usually the highest-frequency driver).

G❑ Remove the 1kHz sine wave.

2) Configure the system for its normal operating set-up.

Be sure that the microphone(s) are positioned and mixed as they normally would be during system operation.

3) Advance master system gain until the system feeds back at a single frequency.

Make sure that the limiter indicates that gain reduction is occurring.

4) Estimate the frequency of the feedback (or measure it with a frequency counter), and select an appropriate 642B band.

5) Set the selected band's BANDWIDTH control to 10, and its BOOST/CUT control to $-\infty$.

6) Adjust the band's FREQUENCY control until the feedback changes frequency. Continue turning the FREQUENCY control until the feedback returns at its original frequency. Set the FREQUENCY control half-way between those two settings.

7) Set the band's BANDWIDTH to 0, and readjust the FREQUENCY control as necessary to keep the notch centered on the ring frequency. Use the VERNIER for fine-tuning.

8) Turn the band's BOOST/CUT control toward 0 until the ring frequency reappears. Back off about 4dB.

   This will leave headroom so that the ring frequency will not reappear when the system gain is increased as more ring modes are tuned out.

9) Repeat steps 3 through 8 to find and eliminate additional ring modes.

   After the first four ring modes have been eliminated, a 'point of diminishing returns' is usually reached.

10) Remove the limiter installed in step 1 (or leave it in place for additional system protection).

The remaining 642B bands are now available for broadband equalization of the system. Use a pink-noise generator and third-octave real-time analyzer for the most precise results. But if your budget doesn't permit a third-octave analyzer, use your ears.

The experienced contractor may wish to use a TEF® or FFT analyzer as an aid to adjusting equalization. The advantages of parametric over third-octave equalization are readily apparent when using this type of analysis.

**Notch filtering:** If a third-octave filter set is available for broadband equalization, the 642B can be used solely as a narrowband notch filter set for the elimination of up to eight ring modes. The 642B notches are considerably sharper than those created by a third-octave equalizer.

**Individual driver equalization:** Some feel that the advantages to equalizing *each* driver in a complex sound reinforcement system with its own parametric equalizer are substantial. They claim that this is the best way to correct for individual driver response anomalies without having the corrective equalization affect other drivers.

If the 642B is used for this, simply connect each channel of the 642B between the appropriate output of the electronic crossover and the input of the appropriate power amplifier. If it is necessary to reverse the phase of an individual driver, do this either at the power amplifier's output or at the 642B's input (the latter technique makes use of the 642B's balanced input).

**Dance clubs:** Dance clubs usually want a sound that will make people get up and dance (then sit down and drink!). This often implies a large bass boost in the region of 40–80Hz, along with a smaller treble boost. The 642B's LF and HF bands can be used for this purpose, leaving the remaining bands available for house tuning (smoothing out the loudspeakers' midbass and midrange acoustic response in the room).

The amount of bass boost is not so much limited by subjective considerations as by the available amplifier power and by the loudspeaker's bass power-handling capacity. Bi-amping is recommended for maximum capability, because the bass amplifier can then be clipped occasionally without causing obvious harshness. In this arrangement, an external electronic crossover is necessary.

In any case, the settings of the 642B's LF FREQUENCY and BANDWIDTH controls are quite crucial to obtaining bass that is punchy, 'tight', and sensual — without being boomy (like jukebox bass). Correct settings will vary considerably with loudspeaker type and room acoustics. In particular, satisfactory results cannot be obtained with a horn-loaded bass system that has a cut-off frequency above 40Hz. Trying to boost bass below the cut-off frequency of the horn will cause *severe* distortion, and may also damage the drivers.

We *do not recommend* that the DJ be permitted to operate the 642B. The 642B should be adjusted once by the installing contractor, and then locked up or protected with an Orban Security Cover (see page 6-3). For DJ-controlled equalization, a simple five-band graphic equalizer (with a more limited range) will provide sufficient power for correcting the sound of inadequate records.

A third-octave real-time analyzer and pink-noise source will substantially aid the sound contractor in adjusting the MLF and MHF bands for flat acoustic response in the midbass and midrange. Coloration is undesirable here: it can cause customer edginess, and can also interfere with conversation. For the same reasons, avoid excessive treble boost.

It is perfectly acceptable to adjust the two 642B channels quite differently below 200Hz to smooth out standing waves, resonances, and the like. Above 200Hz, equalization is much more useful for correcting the response of the loudspeaker than it is for correcting room acoustics. If the loudspeakers are reasonably well-matched, the control setting for the equalizer channels should also be well-matched above 200Hz. If the channel equalization curves differ greatly, the system will often sound well-equalized at only one place in the room (at the place where the measuring microphone was located) — while other parts of the room may exhibit exaggerated acoustic problems!

## Video and film post-production

The 642B is a versatile dialog and scoring equalizer. Its notching and bandpass filtering capabilities facilitate suppression of unwanted sounds, like air-conditioner rumble, camera whine, and other intrusions. The 642B's fine-tuning capability (especially when its two channels are cascaded together) enables the mixer to obtain the best possible sound from difficult or poorly-recorded location recordings. Several channels of 642B equalization can be used to fatten-up or enrich dialog, music, and effects for maximum punch. Flexible high- and low-pass filters effectively remove noise outside the desired bandpass.

The 642B can also be used to equalize the motion picture monitoring environment by adjusting the B-chain in the re-recording theater to the studio's accepted acoustic response standard. The music scoring stage monitoring system can be similarly adjusted.

Detailed suggestions for these applications are given above in the sections on 'Recording studios' and 'Sound reinforcement'.

## Broadcasting

**In the main studio:** The 642B can be used to equalize the announce microphone for maximum presence and punch. In the production studio, it can 'sweeten' records, equalize the microphone, and enhance in-house promos, spots, and IDs.

Use the 642B to notch out cart or tape machine motor hum or ventilation system noise with minimal effect on voice quality. Use one band for each major 50 or 60Hz harmonic (with BANDWIDTH control set to 0).

**Satellite feeds, telephone lines:** The 642B can enhance the sound of telephone calls, remotes, satellite feeds, shortwave broadcasts, and network feeds. Use the LF and HF FILTERS to remove out-of-band noise. Telephone audio is usually within the 300–3000Hz band; satellite feeds are typically within 50–7,500Hz or 50–15,000Hz bands. Presence and intelligibility can often be enhanced by boosts in the 4–5kHz region. Used as a telephone line equalizer, the 642B can compensate for minor response glitches much more effectively than can the simpler telephone company equalizers.

**AM Program line:** The 642B can also be used in the AM program line to equalize the air sound, and partially compensate for the inadequacies of typical consumer AM radios. Although certain amount of high-frequency boost is essential to counteract the extremely rolled-off performance of such radios, extreme boosts can cause problems with conventional compressors and limiters — such as severe pumping, 'gulping', and excessive de-essing on material with large amounts of high-frequency energy. Such extreme boosts also exceed the recommendations of the National Radio Systems Committee (NRSC), and can cause interference to other stations. (For ultimate AM audio performance, use our OPTIMOD-AM Audio Processor.)

**Sibilance problems:** The Orban 536A Dynamic Sibilance Controller is the best solution for sibilance problems. But if one is unavailable, the 642B will help control sibilance (although at the expense of vocal presence): set one band's FREQUENCY control to 6kHz, set its BANDWIDTH control to around 5, and adjust its BOOST/CUT control to reduce the sibilance.

**Special effects:** Sweeping combined with narrowband peaking can create some great effects (see 'Special effects' on page 3-9). Be aware, however, that excessive high-frequency boost can saturate 7.5ips tape cartridges. This can be avoided by following the 642B with Orban's 464A Co-Operator®, which has high-frequency limiting and automatic gain control to protect carts under all equalization conditions.

### RFI suppression:

Substantial RFI suppression has been applied to input, output, and power leads. In AM, FM, and TV broadcasting applications, this integral RF suppression will greatly facilitate installation of the 642B. The optional output transformers (Retrofit Kit RET-051) are recommended for stations with the studio and transmitter located at the same site. Normal precautions regarding grounding and shielding should be taken when the 642B is installed.

## Logging Control Settings

When you finally get the controls set the way you them for a given application, you'll want to record those settings for future use (or for quick correction of 'accidental' control changes). To facilitate this, the front panels of the 642B, 642B/SP, and 642B/SPX are reproduced as line drawings on the following pages. Make copies of the appropriate drawing. Mark the control settings on a copy with a colored pencil, marker, or pen. Remember to note the application on the set-up record.

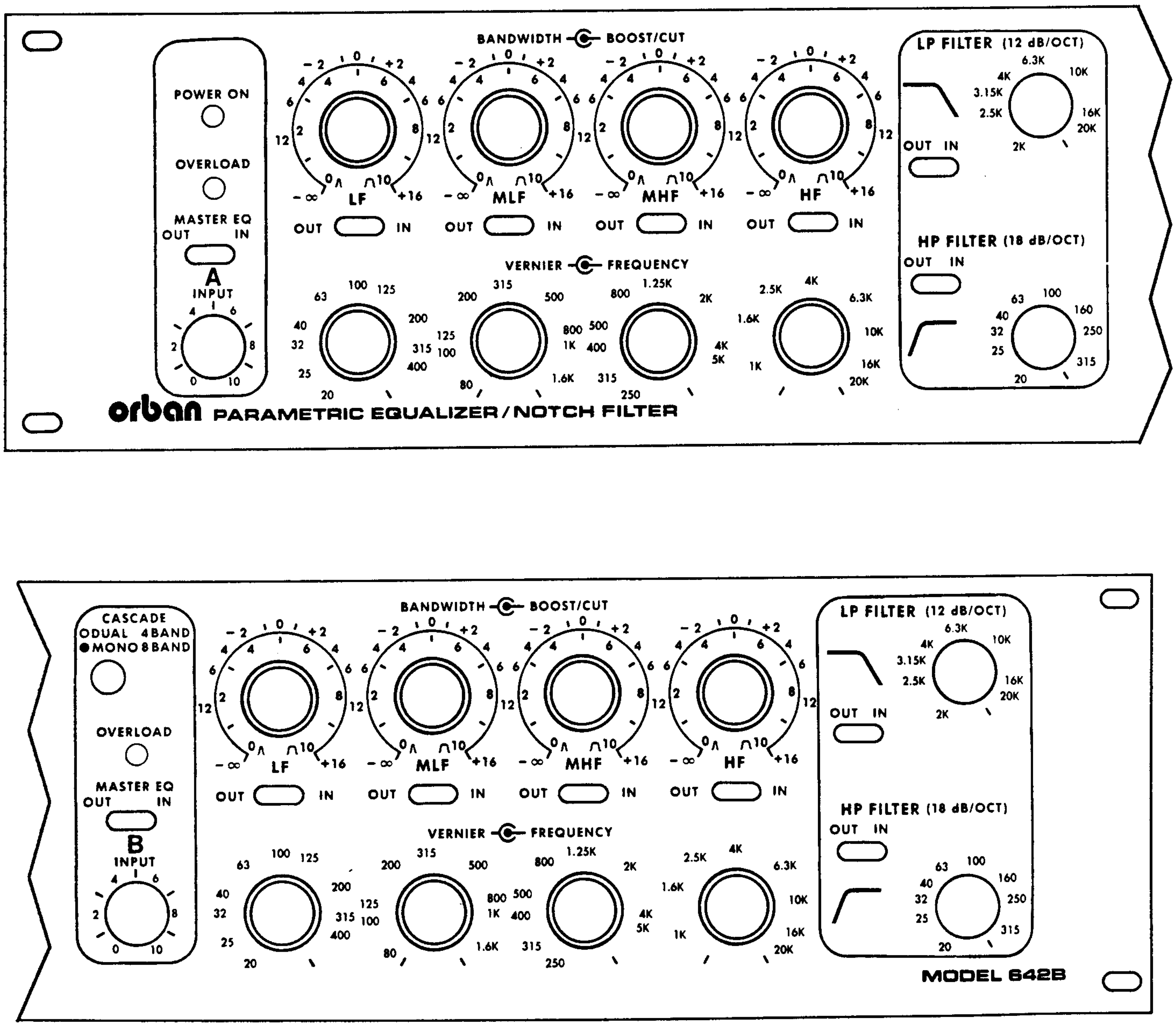



Fig. 3-4: 642B Front Panel
(Copy and record settings on the copy)

Date____________ by ______________

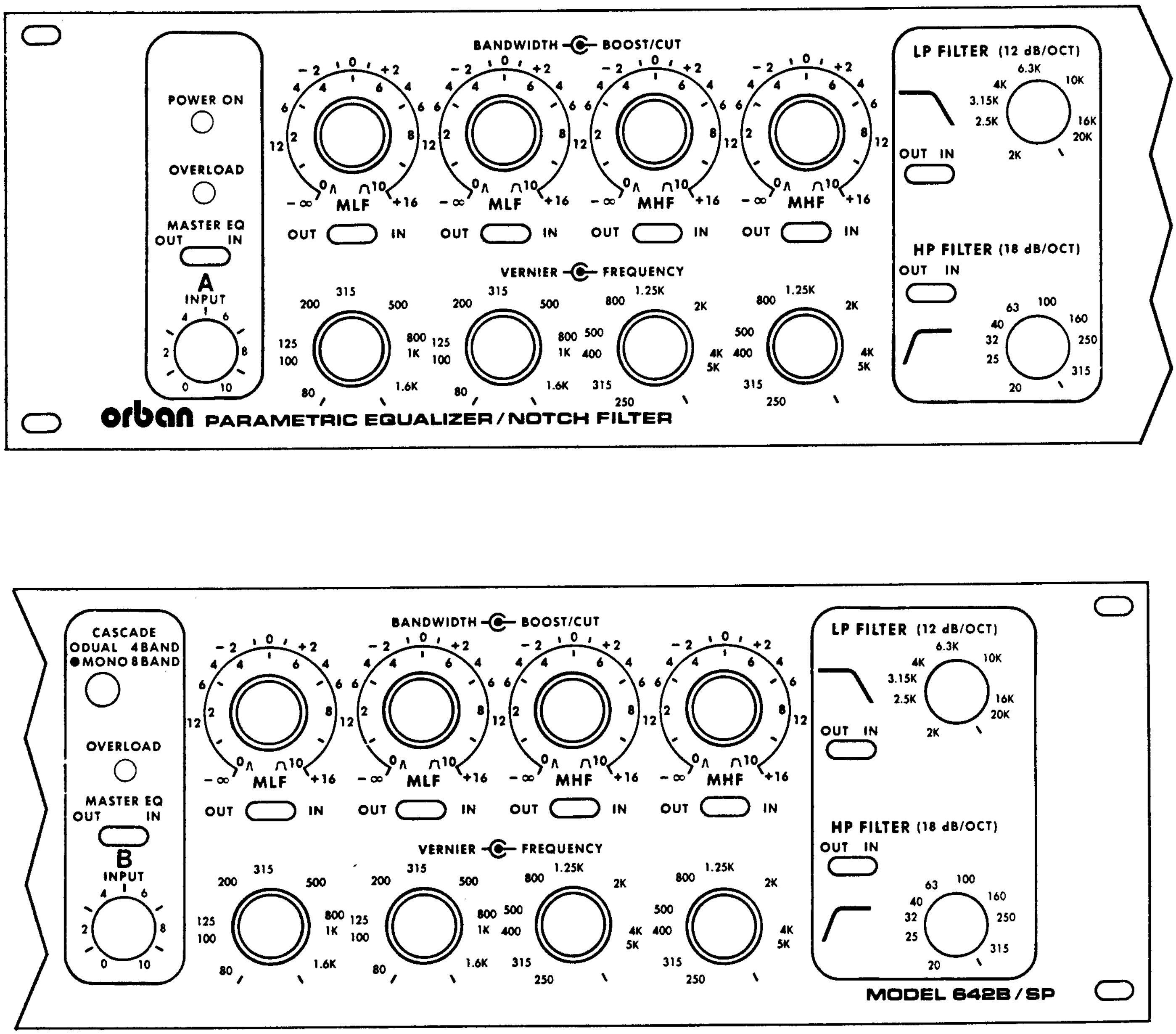



Fig. 3-5: 642B/SP Front Panel
(Copy and record settings on the copy)

______________________________

______________________________

______________________________

Date____________ by ______________

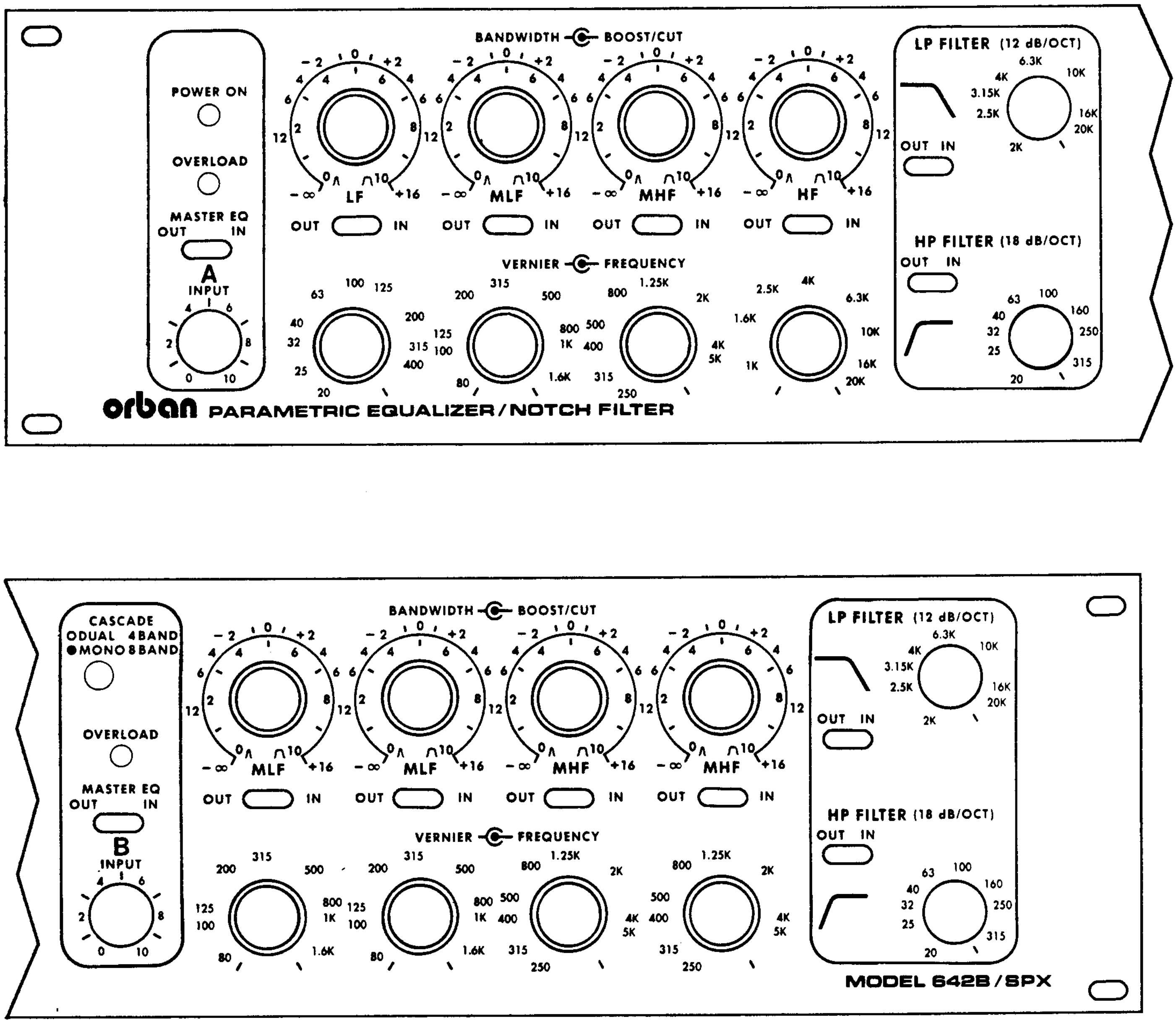



Fig. 3-6: 642B/SPX Front Panel
(Copy and record settings on the copy)

______________________

______________________

______________________

Date____________ by ____________

**Notes:**

# Section 4
# Maintenance



**CAUTION**

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

(per UL 813)

## Routine Maintenance

No routine maintenance of this product is required.

If the front panel becomes soiled, clean it with a mild household detergent and a damp cloth. Stronger solvents should not be used because they may damage plastic parts, paint, or the silk-screened lettering (99% isopropyl alcohol can be safely used).

## Getting Inside the Chassis

To access the circuit boards, remove all six screws holding the top cover in place, then lift the top cover off.

When replacing the cover, replace all screws snugly (be careful not to strip the threads by fastening the screws too tightly).

To remove a circuit board:

1) Remove the top cover (see above).

2) Remove all knobs from the front of the 642B by gently pulling them off.

3) Remove the three screws on each side of 642B that attach the front panel to the chassis.

4) Remove the front panel.

5) Disconnect any wires attached to the rear of the circuit board that is to be removed.

6) Remove the nuts and lock washers from the toggle switches with a 5/16-inch nut driver.

   Note the arrangement of the hardware.

7) Remove the nuts and lock washers that hold the pots to the subpanel. Use a 1/2" (13mm) wrench or nut driver.

   The input boards are also connected to the subpanel by a screw. Remove the screw if you want to remove one of these boards.

8) Gently pull the board back from the front mounting plate, and lift it out of the chassis.

   The switches may have to be jiggled slightly.

   **IMPORTANT:** Note the position of the flat keying washer on the bushings of the switches — they are not attached and may fall off.

# Performance Evaluation, Alignment

**IMPORTANT**: Because the 642B circuitry is highly stable, routine performance evaluation and alignment are *not* required and *not* recommended. The following evaluation procedure is extremely thorough, and is included primarily for reference.

## Equipment required:

Digital voltmeter
With an accuracy of ±0.01%

Ultra-low distortion sine-wave oscillator/harmonic distortion meter/audio voltmeter
With verified residual distortion below 0.0015%.
Sound Technology 1710B or equivalent preferred.

DC coupled oscilloscope
With a 5MHz vertical bandwidth.

Spectrum analyzer with tracking generator
Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 50–15,000Hz logarithmic sweep can be used with an oscilloscope in X/Y mode.

## 1) Test power transformer; POWER switch; associated wiring. (optional)

A☐ Verify that the resistance between the AC cord ground pin and the chassis is very near 0Ω.

B☐ Verify that the resistance between both AC cord blades and the chassis is infinite.

C☐ Turn the POWER switch OFF.

D☐ Verify that the resistance between the two AC cord blades is infinite.

E☐ Turn the POWER switch ON.

F☐ Set the VOLTAGE SELECT switch to 115 VOLTS. Verify that the resistance between the AC cord blades is 75Ω±10%.

G❑ Set the VOLTAGE SELECT switch to 230 VOLTS.

H❑ Verify that the resistance between the AC cord blades is 275Ω±10%.

I❑ Return the switch to 115 VOLTS.

J❑ Remove the rear panel ground link, thereby disconnecting circuit ground from chassis ground.

K❑ Verify that the resistance between the two ground terminals is infinite.

L❑ Verify that the resistance between the chassis ground terminal and the chassis is very near 0Ω.

M❑ Verify that the resistance from the circuit ground terminal to the power supply common is very near 0Ω.

N❑ Replace the ground link.

## 2) Test the unregulated power supply.

A❑ Turn AC power ON.

B❑ Measure the voltage of the positive unregulated power supply.

The voltage must be between +18 and +26 VDC, Av.

This voltage is measured across large electrolytic capacitor C9.

C❑ Measure the voltage of the negative unregulated power supply.

The voltage must be between −18 and −26 VDC, Av.

This voltage is measured across large electrolytic capacitor C10.

## 3) Test the regulated power supply.

A❑ Measure the outputs of the +15 volt regulator (at the (+) terminal of C11).

The voltage must be +15 volts, ±0.75V. If it is not, see the power supply troubleshooting information on page 5-2.

B❑ Measure the outputs of the −15 volt regulator (at the (−) terminal of C12).

The voltage must be −15 volts, ±0.75V. If it is not, see the power supply troubleshooting information on page 5-2.

C❑ Observe the two regulated power supply rails with an oscilloscope.

Verify that the noise and ripple is below 4mV peak.

D❑ Verify that the POWER LED is lit.

## 4) Set the controls as follows:

| | |
|---|---|
| INPUT ATTENuator | 5 |
| BANDWIDTH | 0 |
| BOOST/CUT | 0 |
| FREQuency | 12 O'CLOCK |
| VERNIER | 12 O'CLOCK |
| LOW-PASS FILTER | 20kHz |
| HIGH-PASS FILTER | 20Hz |
| CASCADE | DUAL 4 BAND |
| MASTER EQ SWITCHES | OUT |
| HP FILTER SWITCH | OUT |
| LP FILTER SWITCH | OUT |
| BAND EQ SWITCHES | OUT |

A❑ Install the link connecting the chassis and circuit ground if it is not normally present in your system.

## 5) Test the low-pass filter.

A❑ Connect a 600Ω resistor between the channel A (+) and (−) output terminals.

B❑ Connect the channel A (−) input terminal to any (⏚) terminal.

C❑ Connect the channel A (−) output terminal to any (⏚) terminal.

D❑ Connect the high side of the oscillator to the channel A (+) input.

E❑ Connect the low side of the oscillator to the 642B chassis.

F❑ Set the oscillator for 0dBu output (0dBu=0.775Vrms).

G❑ Monitor the channel A output with an audio voltmeter.

Verify that the response is flat (±0.25dB) from 20-20,000Hz.

H❑ Switch the MAIN EQ and all BAND EQ switches to IN.

Verify that the response is still flat (±0.25dB). If this specification is not met, carefully recheck the position of the BOOST/CUT control of the band in question.

I❑ Switch the MAIN EQ switch to OUT.

J❑ Set the oscillator for 20kHz and 0dBu.

K❑ Rotate the LOW-PASS FILTER control fully clockwise and note the level at the output. Switch the LOW-PASS FILTER to IN and verify that this level is reduced by 3.0dB (±0.5dB).

L❑ Return the LOW-PASS FILTER switch to OUT.

M❑ Set the oscillator for 2kHz.

N☐ Rotate the LOW-PASS FILTER control fully counterclockwise and note the level at the output. Switch the LOW PASS FILTER to IN and verify that this level is reduced by 3.0dB (±0.5dB).

O☐ Return the LOW-PASS FILTER switch to OUT.

## 6) Test the high-pass filter.

A☐ Set the oscillator for 300Hz.

B☐ Rotate the HIGH-PASS FILTER fully CW and note the level at the output. Switch the HIGH-PASS FILTER to IN and verify that this level is reduced by 4.0dB (±0.5dB).

C☐ Return the HIGH-PASS FILTER switch to OUT.

D☐ Set the oscillator for 20 Hz.

E☐ Rotate the HIGH PASS FILTER control fully counterclockwise and measure the level at the output. Switch the HIGH-PASS FILTER to IN and verify that this level is reduced by 4.0dB±0.5dB.

F☐ Return the HIGH-PASS FILTER switch to OUT.

## 7) Repeat steps 5 and 6 for channel B.

## 8) Test the common mode rejection.

A☐ Set the oscillator for 100Hz.

The oscillator should be connected to channel B.

B☐ Measure the level at the 642B's CHANNEL B OUTPUT.

C☐ Remove the ground from the (−) input.

D☐ Connect the signal to both the (+) and (−) inputs in parallel.

E☐ Verify that the output level is reduced by at least 50dB.

F☐ Remove the signal from the (−) input and replace the ground.

## 9) Repeat step 8 for channel A.

## 10) Measure harmonic distortion.

A❑ Set the oscillator for 2kHz at +10dBu.

The oscillator should be connected to channel A.

B❑ Switch the HIGH-PASS FILTER to IN.

C❑ Switch the LOW-PASS FILTER to IN.

D❑ Set the HIGH-PASS TUNING control fully counterclockwise.

E❑ Set the LOW-PASS TUNING control fully clockwise.

F❑ Increase the setting of the channel A INPUT ATTENUATOR control until the OVERLOAD LED just fires.

Verify that the level at the 642B's channel A OUTPUT is +19.5dBu ±1dB.

G❑ Continue increasing the control setting.

Verify that clipping occurs at +21dBu or above.

H❑ Leave the control at a setting that produces an output of +18dBu.

I❑ Switch all channel A BAND EQS and the channel A MAIN EQ to IN.

J❑ Measure the total harmonic distortion at 20Hz, 35Hz, 2kHz, 5kHz, 10kHz and 20kHz.

When measuring distortion at 20Hz, set the channel A HIGH-PASS FILTER switch OUT. When measuring distortion at 20kHz, set the channel A LOW-PASS FILTER switch OUT.

Verify that the distortion is below 0.005%.

K❑ Return all channel A BAND EQS and the channel A MAIN EQ switch to OUT.

## 11) Repeat step 10 for channel B.

## 12) Align band-pass filters in equalizer section.

These instructions apply to the standard 642B. If you are aligning one of the special variants (642B/SP or 642B/SPX), you will find that these variants do not have the standard complement of frequency bands in the equalizer section — one or more LF and HF bands are replaced by additional MLF and MHF bands. If, when following the instructions below, you encounter a reference to a band that does not exist in your equalizer, follow the instructions by analogy, using the test frequency specified for the actual range of the band on which you are working.

A❑ Center all trim pots.

B❑ Set the oscillator level to −10dBu.

The oscillator should be connected to channel B.

C❑ Set the channel B LF BOOST/CUT control to ∞ and the channel B MAIN EQ switch to OUT.

D❑ Set the oscillator for 300Hz at +10dBu output.

E❑ Adjust the 642B's channel B INPUT ATTENUATOR to achieve +18dBu at the 642B's channel B output.

F❑ Switch the channel B MAIN EQ to IN and the channel B LF BAND IN/OUT switch to IN.

G❑ Rotate the channel B LF FREQUENCY control until a null is reached.

H❑ Carefully adjust the LF FREQUENCY control, and its VERNIER for maximum null.

I❑ Adjust R103 (the TRIM control on the channel B LF bandpass circuit card) for maximum null.

J❑ Rotate the channel B LF BANDWIDTH control to 10 (clockwise).

K❑ Adjust R122 (the NULL control on the channel B LF bandpass circuit card) for maximum null. Keep repeating this step until the null depth is constant (±5dB) at any setting of the channel B LF BANDWIDTH control.

Null depth should be at least 45dB.

L❑ Rotate the channel B LF BOOST/CUT control and the channel B LF BANDWIDTH controls fully CW.

The boost at 300Hz should be +16dB ±1dB.

M❑ Rotate the channel B LF BANDWIDTH control throughout its range and verify that the boost remains constant ±2dB.

You may have to slightly adjust the channel B LF FREQUENCY and/or VERNIER controls as the bandwidth gets narrower.

## 13) Repeat step 12 for the remaining bands in channel B.

Use the following frequencies: MLF = 300Hz; MHF = 1.2kHz; HF = 3kHz.

## 14) Repeat steps 12 and 13 for channel A.

## 15) Sweep equalizer and filter frequency response.

A☐ Connect the high side of a tracking or sweep generator to the channel A (+) INPUT. Connect the ground of the generator to the 642B's chassis.

If you have a spectrum analyzer, use its tracking generator. If you are going to observe the swept output on an X/Y oscilloscope, use a sweep generator.

B☐ Switch the channel A MAIN EQ switch to OUT.

C☐ Monitor the output with a spectrum analyzer or X/Y scope. Set the level of the signal source so that you can see the swept response easily.

D☐ Switch the channel A LOW-PASS FILTER and the channel A HIGH-PASS FILTER to IN.

E☐ Rotate the channel A LOW-PASS FILTER and the channel A HIGH-PASS FILTER controls throughout their range. Verify that the response is similar to that shown in Fig. 3-2 and Fig. 3-3 on page 3-8.

F☐ Switch the channel A LOW-PASS FILTER and the channel A HIGH-PASS FILTER to OUT.

G☐ Switch the channel A MAIN EQ switch to IN. Switch the individual bands in channel A to IN one at a time and verify proper operation of the various BOOST/CUT, TUNING, and BANDWIDTH controls throughout their ranges.

While doing step G it is important to look for noise or 'holes' while the controls are rotated. Also verify that the knobs are not binding or rubbing against the front panel.

## 16) Repeat step 15 for channel B.

## 17) Test for noise.

A☐ Monitor the channel B output with the audio voltmeter and oscilloscope.

B☐ Mute the input signal.

C☐ Set the controls as follows:

| | |
|---|---|
| MAIN EQ | IN |
| BAND EQ SWITCHES | IN |
| LOW-PASS FILTER | 20kHz |
| HIGH-PASS FILTER | 20Hz |
| LOW-PASS FILTER SWITCH | IN |
| HIGH-PASS FILTER SWITCH | IN |
| ALL OTHER CONTROLS | 12 O'CLOCK |

D☐ Measure the residual noise.

The noise must be < −92dBu in a 20-20,000Hz bandwidth.

E☐ Observe the oscilloscope and verify the absence of 'popcorn' noise and oscillation.

## 18) Repeat step 17 for channel A.

## 19) Test CASCADE switch. (optional)

A☐ Connect the high side of the tracking or sweep generator to the channel A (+) INPUT.

B☐ Connect the ground of the generator to the 642B's chassis.

C☐ Connect the spectrum analyzer or X-Y oscilloscope to the channel A output.

D☐ Set the CASCADE button to 8 BAND MONO.

E☐ Switch all BAND EQ and both MAIN EQ switches to IN.

F☐ Verify that all channel A and channel B BAND EQ controls affect the channel A output.

G☐ Verify that the channel B INPUT ATTENUATOR, LOW-PASS FILTER and HIGH-PASS FILTER controls do not affect the channel A output.

H☐ Verify that there is no output from channel B.

I☐ Increase the setting of the channel A INPUT ATTENUATOR (and the input drive level, if necessary), until the OVERLOAD LED flashes.

J☐ Lower the settings of the INPUT ATTENUATOR until the LED stops flashing.

K☐ Boost one band of each channel in turn and verify that an overload in either channel fires both the channel A and B OVERLOAD LEDs.

L☐ Set the CASCADE button to DUAL 4 BAND.

## 20) Test the overload detector with the equalizer in DUAL 4 BAND mode.

A☐ Connect the high side of the tracking or sweep generator to the channel A (+) INPUT. Connect the ground of the generator to the 642B's chassis.

These connections will already exist if you have performed the optional step 19 above.

B☐ Set all BAND-PASS FILTER switches and the MAIN EQ switch to OUT.

C☐ Set the sweep source for +10dBu and adjust the channel A INPUT ATTENUATOR to produce +16dBu at the channel A output.

D☐ Switch the channel A MAIN EQ to IN.

E☐ Switch one channel A BAND EQ switch to IN and advance its BOOST/CUT control toward +16.

F☐ Verify that the channel A OVERLOAD LED fires when the BOOST/CUT control is set to approximately +4.

G☐ Switch the BAND EQ to OUT and repeat steps 20-E and 20-F for the remaining filters.

## 21) Repeat step 20 for channel B.

## 22) Test the balanced floating line amplifier.

A☐ Connect the high side of the oscillator to the channel B (+) INPUT.

B☐ Connect the oscillator ground to the 642B chassis.

C☐ Set the oscillator for 2kHz at +10dBu.

D☐ Advance the channel B INPUT ATTN until clipping is first observed at the channel B output.

E☐ Observe the output between the channel B (+) and (−) output terminals with the test set.

Verify that the output level exceeds +21dBu.

The test set must have a balanced input.

F☐ Reduce the output level to +18dBu.

G☐ Short the channel B (+) output terminal to ground.

Verify that the output level does not vary by more than 0.5dB.

H☐ Short the channel B (−) output terminal to ground.

Verify that the output level does not vary by more than 0.5dB.

I☐ Remove the load and the connections to the output.

J☐ Ground the (−) input of the test set.

K☐ Monitor the 642B's channel B (+) and then its channel B (−) output terminals.

Verify that the levels observed are within 3dB of each other.

## 23) Test D.C. offset.

A❑ Remove the 600Ω resistor from the channel B output terminals.

B❑ Switch all channel B filters to IN.

C❑ Turn the channel B INPUT ATTENUATOR fully clockwise.

D❑ Mute the oscillator.

E❑ Monitor the channel B (+) OUTPUT terminal with the DVM.

Verify that the DC offset is less than ±15mV (typically less than ±5mV).

F❑ Monitor the channel B (−) OUTPUT terminal with the DVM.

Verify that the DC offset is less than ±15mV (typically less than ±5mV).

## 24) Repeat steps 22 and 23 for channel A.

## 25) Wrap-up.

A❑ Remove the link connecting the chassis and circuit ground if they are not normally connected in your system.

# Section 5
# Troubleshooting

page contents



**CAUTION**

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

(per UL 813)

## Problems and Possible Causes

*Always* verify first that the problem is not in the source material being fed to the 642B, or in other parts of the system.

### RFI, hum, clicks, or buzzes:

A grounding problem is likely. Review the information on grounding in Section 2.

The 642B's moderate RF suppression should be adequate for the vast majority of installations. However, installation next to a high-power transmitter may still cause problems. Additional RF suppression, careful examination of the grounding scheme, and other techniques familiar to the engineer may have to be employed.

### Power supply problems:

The voltage regulators are operated conservatively, and can be expected to be extremely reliable. Before replacing the regulators, check to see whether other abnormalities in the circuitry (such as a shorted IC) have caused excessive current demand which is, in turn, causing the regulator ICs to either current limit or go into thermal shutdown (the two built-in protective modes). If it becomes necessary to replace a regulator, be sure to remount it exactly as before (use the other regulator as a model). For maximum resistance to thermally-induced mechanical fatigue, solder the regulator leads to the circuit board *after* the regulators have been firmly mounted to their heat sinks.

To prevent high-frequency oscillations, regulators IC1 and IC2 are frequency compensated at their outputs by C11 and C12. If C11 or C12 is ever replaced, be sure to use a low-inductance aluminum electrolytic. A tantalum can fail because the current-delivering capacity of the power supply can cause a runaway condition if the dielectric is punctured momentarily; a high-inductance aluminum can fail to prevent a regulator from oscillating. Check for oscillation on the power bus with an oscilloscope if C11 or C12 is replaced.

### Output module failure:

The 5532 and 411 opamps used in the balanced output module may be freely replaced as necessary. However, the circuit is extremely sensitive to the characteristics of the resistors, so field repair of resistor failure (which is very unlikely) requires replacement of the entire output module in question if adequate headroom and common-mode rejection are to be maintained (see page 5-4 for information about factory service).

### Troubleshooting IC opamps:

IC opamps are operated such that the characteristics of their associated circuits are essentially independent of IC characteristics and dependent only on external feedback components. The feedback forces the voltage at the (–) input terminal to be extremely close to the voltage at the (+) input terminal. Therefore, if you measure more than a few millivolts difference between these two terminals, the IC is probably bad.

Exceptions are opamps used without feedback (as comparators) and opamps with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an opamp's (+) input is more positive than its (–) input, yet the output of the IC is sitting at −14 volts, the IC is almost certainly bad. The same holds true if the above polarities are reversed. Because the characteristics of the 642B's circuitry are essentially independent of IC opamp characteristics, an opamp can usually replaced without recalibration.

A defective opamp may appear to work, yet have extreme temperature sensitivity. If parameters appear to drift excessively, freeze-spray may aid in diagnosing the problem. Freeze-spray is also invaluable in tracking down intermittent problems. But *use it sparingly*, because it can cause resistive short circuits due to moisture condensation on cold surfaces.

## Technical Support

If the above troubleshooting procedures don't help you solve your problem, contact Orban Customer Service. Be prepared to accurately describe the problem, including the results of diagnostic tests you have performed. Know the serial number (and 'M' number, if any) of your 642B — these are printed on a label attached to the rear panel of the 642B.

Telephone: (800) 227-4498 in USA (except CA, HI, AK)
(415) 957-1067 from California, Hawaii, Alaska, and elsewhere

or Telex: 17-1480

or FAX: (415) 957-1070

or write: Customer Service
Orban
A division of AKG Acoustics Inc.
645 Bryant Street
San Francisco, CA 94107
USA

## Factory Service

*Always* contact Customer Service before returning a product to the factory for service. Often, a problem is due to misunderstanding, or is relatively simple and can be quickly fixed after telephone consultation.

In any case, products will be accepted for factory service *only* after Customer Service has issued a Return Authorization number. This number flags the returned unit for priority treatment when it arrives on our dock, and ties it to the appropriate information file.

Please refer to the terms of your Limited One-Year Standard Warranty, which extends to the first end-user. After expiration of the warranty, a reasonable charge will be made for parts, labor, and packing if you choose to use the factory service facility. Repaired units will be returned C.O.D. In all cases, transportation charges (which are usually quite nominal) are paid by the customer.

## Shipping Instructions

Use the original packing material if it is available. If it is not, use a sturdy, double-wall carton no smaller than 22 × 16 × 6 inches (56 × 41 × 16 cm) with a minimum bursting test rating of 200 pounds (91 kg). Place the chassis in a plastic bag (or wrap it in plastic) to protect the finish, then pack it in the carton with at least 1.5 inches (4 cm) of cushioning on all sides of the unit. 'Bubble' packing sheets, thick fiber blankets, and the like are acceptable cushioning materials; foam 'popcorn' and crumpled newspaper are not. Wrap cushioning materials tightly around the unit and tape them in place to prevent the unit from shifting out of its packing. Close the carton without sealing it and shake it vigorously. If you can hear or feel the unit move, use more packing. Seal the carton with 3-inch (8 cm) reinforced fiberglass or polyester sealing tape, top and bottom in an 'H' pattern. Narrower or parcel-post type tapes will not withstand the stresses applied to commercial shipments.

Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package appropriately. Ship prepaid, *not collect.* Do not ship parcel post.

Your **Return Authorization number** must be shown on the label, or the package will *not* be accepted.

# Section 6
# Technical Data

page contents

# Specifications

**Note:** 0dBu=0.775Vrms.

## Performance

**Bandwidth (Q):** Adjustable throughout a 0.29 to 5.0 range.

**Boost/cut:** +16dB (±1db) to −∞ (−45dB notch typical).

**Frequency response:** ±0.25dB, 20–20,000Hz (with BOOST/CUT controls set to 0).

**Tuning ranges:** LF bands: 20–400Hz; MLF bands: 80–1,600Hz; MHF bands: 250–5,000Hz; HF bands: 1,000–20,000Hz. The FREQUENCY vernier has a range of >±10%.

The **642B** has one each of LF, MLF, MHF and HF bands in each channel.

The **642B/SP** has two MLF and two MHF bands per channel.

The **642B/SPX** has one each of LF, MLF, MHF and HF bands in one channel, and two each of MLF and MHF bands in the other channel.

**Square wave response:** No spurious ringing occurs at any output level (the only observable ringing is the ringing theoretically associated with the equalization curve being used).

**Total harmonic distortion:** <0.02%, 20–20,000Hz at an output level of +18dBm into 600Ω. Distortion decreases smoothly as level is reduced.

**Noise at output (dual 4-band):** <−110dB below clipping (with CASCADE button set to DUAL 4-BAND, BOOST/CUT controls set to 0, LP FILTER control set to 20kHz, HP FILTER control set to 20Hz, and INPUT control set to 10).

**Noise at output (8-band):** <−101dB below clipping (with CASCADE button set to MONO 8-BAND, and the other controls set as for dual 4-band, above).

**Interchannel crosstalk:** <−90dB, 20–20,000Hz, normal configuration.

**Gain:** +14dB to −∞dB.

## Installation

### *Input*

**Load impedance:** ~20kΩ in parallel with 500pF, electronically balanced.

**Driving impedance:** Ideally 600Ω or less, balanced or unbalanced.

**Nominal input level:** −10dBu to +8dBu.

**Absolute overload point:** +26dBu.

**Common mode rejection:** >50dB, 50-60Hz.

**RFI suppressed:** Yes.

**Connectors:** Barrier strip (#6 screws) and tip/ring/sleeve phone jacks. Chassis is punched to accept optional XLR connectors (see "Options" on the following page).

### *Output*

**Load impedance:** ≥600Ω.

**Source impedance:** 30Ω ±5%, balanced, floating.

**Maximum output level:** >+20dBm into 600Ω.

**OVERLOAD lamp:** Lights for approximately 200ms when the instantaneous peak output of any amplifier in the equalizer is driven within 1dB of its clipping point.

**RFI suppressed:** Yes.

**Connectors:** Barrier strip (#6 screws) and tip/ring/sleeve phone jacks. Chassis is punched to accept optional XLR connectors (see "Options" on the following page).

### *Physical*

**Dimensions:** 19 inches (48.3 cm) wide, 3½ inches (8.9 cm) high, 11¼ inches (28.5 cm) deep.

**Weight:** 12.5 lb. (5.63 kg) net; shipping weight is 16 lb. (7.27 kg).

**Power requirements:** 115/230 volts AC ±10%, 50–60Hz, 20VA. IEC mains connector with 3-wire 'U-ground' power cord and plug. RFI suppressed.

**Fuse:** 3AG 250V Slo-Blo (½-amp for 115V, ¼-amp for 230V operation).

**Operating Temperature Range:** 0-50°C (32-113°F). Humidity 0-95% R.H., Non-condensing.

### *Options*

**Security cover (acrylic):** To prevent unauthorized adjustment of controls. Order ACC-12CL for a clear cover, ACC-12BL for a transparent blue cover, or ACC-12WH for an opaque white cover.

**XLR connectors:** For inputs and outputs. Order RET-049.

**Balanced output transformers:** To isolate the 642B's output stages from the equipment being driven by the 642B, and to improve RFI rejection in difficult environments. Order RET-051.

## Circuitry

**Low-pass filters:** Second-order Automatic Sliding Besselworth™ with 12dB/octave rolloff. Corner frequency is variable from 2kHz to 20kHz. Response shape changes smoothly from Bessel to Butterworth rolloffs as the LP FILTER control is adjusted from 2kHz to 20kHz.

**High-pass filters:** Third-order Butterworth with 18dB/octave rolloff. Corner frequency variable from 20Hz to 315Hz.

## Warranty

**One year, parts and labor:** Subject to the limitations set forth in Orban's Standard Warranty Agreement.

# Circuit Description



Whenever circuitry is duplicated for the two channels, only channel A will be described.

## 1. Overview

The input signal is applied to an **input level control**, which can apply infinite attenuation and up to +14db of gain to the input signal.

The **four-band equalizer** follows the input attenuator. A set of four cascaded filters covers 20 Hz to 20 kHz. (The special-purpose models 642B/SP and 642B/SPX cover narrower frequency ranges; see page 6-2.)

The 642B's four peaking equalizers each offer completely independent adjustments of *centerfrequency, bandwidth and boost/cut.* The two channels can also be cascaded to form an eight-band mono parametric equalizer.

The **high-pass filter** and **low-pass filter** follow the band-pass filters. The high-pass filter has a third order Butterworth response (18db/octave). Its corner frequency is adjustable from 20 to 200 Hz.

The **low-pass filter** follows the high-pass filter. It has a second order 'Automatic Sliding Besselworth' response: The roll-off characteristic gradually changes from Bessel-type to Butterworth-type as corner frequency increases. The advantages are a gentle, natural-sounding Bessel response in the critical mid range frequencies, with the Butterworth response providing sharper roll-off at high frequencies.

The **balanced floating line amplifier** circuit is a single-ended-to-differential output converter. A precise combination of negative feedback, positive feedback and cross-coupling yields a fully symmetrical differential output with high common-mode rejection, a well-defined 30Ω output impedance, and excellent stability into any reactive load. The worst-case output drive capability is approximately +20dBm into 600Ω.

Finally, the **overload** circuit monitors all critical points in the signal path to warn of excessive signal amplitude due to excessive input amplitude or to a large amount of peak boost equalization. The extremely fast 'peak-stretching' property of the overload detector allows the user to detect and correct peak clipping before it becomes audible.

## 2. Input Buffer

The signal enters the 642B in balanced form. RF suppression is provided by C1, C2, and ferrite beads on the **rear panel board**. Note that this degree of RF-proofing is moderate, but adequate for a vast majority of installations. However, installation adjacent to a high-powered transmitter may still cause problems. Additional RF suppression, careful examination of the grounding scheme, and other measures familiar to the broadcast engineer may have to be used in conjunction with the 642B's built-in RF suppression.

The filtered signal is send to the **input attenuation board** via the cable assembly. The board contains a gain control for the incoming signal, and a differential amplifier serving as an 'active transformer'.

### Component-level description:

The differential inputs are connected to IC202B, acting as a differential amplifier with a gain of 0.5. The output of IC202B is connected to IC202A, whose gain can be adjusted with the INPUT control R208. IC201 and associated circuitry are a servo amplifier to keep the output of IC202A at 0VDC. (Notice there is no ac-coupling capacitor in the signal path to degrade audio quality.)

The output of IC202A ( pin 1) is then routed via the CASCADE switch assembly S202 to the first **band-pass filter**. (On channel A, this signal is directly connected to the channel A LF band-pass filter by Jumper E1-E2 on the **input** circuit card.)

The MASTER EQ IN/OUT switch S201, selects the input signal for the high-pass/low-pass filter assembly. When the switch is IN, output from the equalizers is sent to the high-pass/low-pass filter.

The CASCADE switch S202 determines if the 642B is operated as a stereo 4-band or mono 8-band parametric equalizer. It is a four-pole double-throw switch which, when set to the 8 BAND position, puts channel B's four peaking equalizers in series with those of channel A.

## 3. Band-Pass Filters

There are four **band-pass filter** circuit cards for each channel. Except for the HF band, all filters have identical construction (just a few part values are different), so only the low frequency equalizer will be discussed.

The HF band has an added servo amplifier to remove DC offsets from its output.

The input signal from the **input** board is connected to the first of four non-interacting parametric equalizers. Each equalizer offers independent control over all three equalization parameters: *center frequency*, *bandwidth*, and *boost/cut*. The design-center frequency ranges of the bands are as follows:

| BAND | | RANGE |
|---|---|---|
| LF | low frequency | 20 to 500 Hz |
| LMF | low-mid frequency | 65 to 1,650 Hz |
| HMF | high-mid frequency | 225 to 6,470 Hz |
| HF | high frequency | 784 to 20,000 Hz |

The Q is adjustable from 0.29 to 5. There is +16dB of peaking boost and greater than −40dB of cut available.

Except for the values of the two tuning capacitors C101, C103, all band-pass filters are identical. Because the details of the resonator are best explained mathematically, only a general description will be provided.

Basically, the band-pass filter consists of a pair of all-pass phase shift networks. The phase shift of the two cascaded all-pass filters varies from +180° to −180° as a function of frequency, and the amplitude response is constant at all frequencies. The output of the all-pass filter is summed with its input to derive the desired band-pass response.

Equalization is produced by adding the output of the resulting second-order band-pass filter to the original input signal. Conversely, a band-reject (notch) response is derived by subtracting the output of the second-order band-pass filter from the original input. Ideally, attenuation is infinite. In practice, it is −40dB or better.

### Component-level description:

The output signal from the **input** board is connected to IC103A and associated components, which set the bandwidth (or Q) of the equalizer. To change the Q of the band-pass filter, negative feedback is taken around the all-pass phase shifters via IC102A and summed with the input signal at the inverting input of IC103A. This results in overall positive feedback around the band-pass filter, which increases its Q. The amount of positive feedback is set by R105 and trimmer R103, which is preset at the factory so that the peak gain of the band-pass filter stays constant as R104A (BANDWIDTH) is adjusted. The Q can be reduced (and the bandwidth broadened) by introducing a user-adjustable amount of counteracting overall negative feedback through R104A.

The output of IC103A is followed by a second order all-pass phase shifter consisting of IC104 and associated components. The all-pass phase shifter has constant amplitude response, and a phase response which varies from +180° to −180° as a function of frequency. The center frequency (0° phase shift) of the all-pass filter is user-adjustable with the TUNING (R112B, R112C) and VERNIER (R112A) controls. The TUNING control provides a coarse adjustment, and has a 25:1 tuning range. The VERNIER control makes a very fine (±10%) adjustment centered around the frequency set by the TUNING control.

The output of the all-pass filter (IC104B pin 7) is summed with its input signal via R109A and R109B to derive the desired band-pass characteristic. The band-pass signal is applied to non-inverting amplifier IC102B whose output drives the **boost/cut** circuitry consisting of IC103B and associated components. The amount of equalization is determined by the setting of BOOST/CUT control R104B in association with its taper-adjusting network R120, R121, R122, R125. When R104B is rotated in the counterclockwise direction, the band-pass filter output is subtracted from the input signal, and cut equalization results. When R104B is rotated in the clockwise direction, the band-pass response is summed with the input, and boost equalization results.

The taper-adjusting resistors are selected to set the point of zero equalization at 12 o'clock on the BOOST/CUT control and to place the first ±4dB of equalization symmetrically around the 12 o'clock position. To achieve precise cancellation of the band-pass filter output when the BOOST/CUT control is in the $-\infty$ position, R122 is preset at the factory for a maximum null as the band-pass filter is tuned throughout its range. The maximum null is approximately −40dB at Q=5 and improves progressively as Q is lowered.

The equalizer section can be switched out by setting the EQ IN/OUT switch S101 to the OUT position.

The **servo amplifier** consists of IC101A, R119, R117 and C106 in an inverting integrator configuration. Its output is fed back to the non-inverting input of IC102B to center the output of IC102B at 0 volts DC. (For a more detailed discussion of servo amplifiers, see Walter Jung's *Audio IC Op-Amp Applications*, Third Edition, Howard W. Sams & Co. pp. 114-117.)

## 4. High-Pass Filter

The high-pass filter consists of IC501B and associated components in a 'Sallen and Key' type high-pass filter. It has a maximally-flat 18dB/octave response. The corner frequency is user-adjustable from 20 to 200Hz with HF TUNING control R503.

The high-pass filter can be bypassed by setting the HP IN/OUT switch S501 to the OUT position.

## 5. Low-Pass Filter

The low-pass filter consists of IC501A and associated components. It has a second-order 'Sallen and Key' configuration with an 'Automatic Sliding Besselworth'™ (Bessel/Butterworth) roll-off response. The corner frequency of the filter is user-adjustable with the LP TUNING control R506. The Q of the filter varies from 0.5 to 0.707 as a function of the corner frequency from 2kHz to 20 kHz. The advantage is a low roll-off rate in the critical mid-frequency region, and a high roll-off rate at higher frequencies where the effect is less noticeable.

The low-pass filter can be bypassed by switching the LP IN/OUT switch S502 to OUT.

For more detail discussions of 'Sallen and Key' filter design, see (for example) Wong and Ott's *Function Circuits* (McGraw-Hill, New York, 1976).

## 6. Balanced Floating Line Amplifier

The **output module** converts the unbalanced single-ended signal to a balanced, floating output. Output impedance is 30Ω, ±5%.

Simpler 'electronically-balanced to ground' output stages can cause problems because grounding one side of their output to unbalance them will short an output amplifier to ground. In contrast, the 642B output stage is balanced and *floating*, so it simulates a **true transformer output**. Because the output is floating, either side can be grounded to obtain an unbalanced output. When either side is grounded, the overall output level changes very little (less than 0.5dB), and no ill effects occur. The output of the 642B can be freely connected to a **patch bay** without concern that problems may occur if one side of the output is grounded.

### Component-level description:

The 411 opamp used in the balanced output module is a **low-offset servo amplifier** which centers the average DC level at the (+) and (−) outputs of the module around ground. The floating characteristic is achieved by complex cross-coupled positive and negative feedback between two 5532 opamps, and its operation is not readily explainable except by a detailed mathematical analysis. Opamps may be replaced; resistors are specially matched and should not be replaced (see page 5-2).

## 7. Overload Indicator

The **overload indicator** monitors the output of any amplifier subject to overload. (Any amplifier not monitored has an output level less than or equal to the amplifiers that are monitored.) If the instantaneous peak output of any amplifier exceeds ±10.6 volts peak (+19.7dBu rms), the OVERLOAD lamp will light for approximately 200 milliseconds.

### Component-level description:

The output of each amplifier subject to overload is connected to its own pair of diodes. One diode is connect to a +10 volt bus (created by voltage divider R210, R211); the other diode is connected to a −10 volt bus (created by R212, R213). If the instantaneous output of any amplifier exceeds ±10.6 volts, then the appropriate diode will conduct and couple a pulse onto one of the busses, which are relatively high impedance.

Positive-going pulses are fed to transistor inverter Q201 and appear at Q201's collector amplified and inverted so they are negative-going. Negative-going overload pulses are connected directly to Q201's collector. Thus any overload appears at Q201's collector as a negative-going pulse, and is coupled through C206 to IC203 and associated circuitry, connected as a one-shot multivibrator.

Ordinarily, IC203 is held OFF (pin 6 LOW) because R217 holds IC203's inverting input at a higher voltage than voltage divider R216, R218 holds its non-inverting input. A negative-going pulse transmitted through C206 pulls IC203's inverting input down, briefly switching IC203's output HIGH. This in turn pulls IC203's non-inverting input HIGH through R219, C207, and latches

IC203's output HIGH until C207 can discharge through R216, R218, R219, which ordinarily takes about 200 milliseconds. While IC203's output is HIGH, the OVERLOAD lamp is illuminated through R220. Thus, very fast overloads are 'time-stretched' and can be easily seen.

Under continuous overload conditions, it is normal for the OVERLOAD lamp to flash on and off.

## 8. Power Supply

The power supply is very conventional. It uses industry-standard 'three-terminal' regulators.

### Component-level description:

Unregulated voltage is supplied by two pairs of full-wave diode rectifiers within CR1. The power transformer T1 can be operated at 115V by connecting its primary windings in parallel, and at 230V by connecting them in series.

The nominal unregulated voltage is ±22VDC at rated line voltage. This will tend to vary widely with line voltage variations. Regulator dropout occurs at ±17.8V.

IC1 and IC2 supply ±15V, respectively. They are internally protected from overload. Therefore, before replacing the regulators, check to see if other abnormalities in the circuitry (such as a shorted IC) have caused excessive current demand which is shutting down the regulators.

If it becomes necessary to replace a regulator, be sure to mount it securely to its heat sink before soldering it to the board.

The regulators are frequency compensated by C11 and C12 at their outputs to prevent oscillation. C11 and C12 must be replaced *only* by low-inductance aluminum electrolytics: tantalums are unreliable in this position because of potential runaway if the dielectric is momentarily punctured, while high-inductance aluminum electrolytics can fail to prevent the regulators from oscillating.

Be sure to check the power supply for oscillation with an oscilloscope if IC1, IC2, C11, or C12 is replaced.

CR2 and CR3 are connected from ground to each power bus in reverse polarity to protect the rest of the circuitry from a fault condition that might otherwise cause a reverse-polarity voltage on either power bus.

Small ceramic capacitors C13..., C14... are distributed throughout the circuitry to locally bypass the circuitry to ground, thus preventing signal-carrying ICs from oscillating.

# Parts List

Parts are listed by ASSEMBLY, then by TYPE, then by REFERENCE DESIGNATOR. Widely used common parts are not listed; such parts are described generally below (examine the part to determine exact value). See the following assembly drawings for locations of components.

**SIGNAL DIODES**, if not listed by reference designator in the following parts list, are:

Orban part number 22101-000, Fairchild (FSC) part number 1N4148, also available from many other vendors. This is a silicon, small-signal diode with ultra-fast recovery and high conductance. It may be replaced with 1N914 (BAY-61 in Europe).

(BV: 75V min. @ $I_r$ = 5μA $I_r$: 25nA max. @ $V_r$ = 20V $V_f$: 1.0V max. @ $I_f$ = 100mA $t_{rr}$: 4ns max.) See Miscellaneous list for **ZENER DIODES** (reference designator VRxx).

**RESISTORS** should only be replaced with the same style and with the *exact* value marked on the resistor body. If the value marking is not legible, consult the schematic or the factory. Performance and stability will be compromised if you do not use exact replacements. Unless listed by reference designator in the following parts list, resistors are:

**Metal film resistors** have conformally-coated bodies, and are identified by five color bands or a printed value. They are rated at 1/8 watt @ 70°C, ±1%, with a temperature coefficient of 100 PPM/°C. Orban part numbers 20038-xxx through 20045-xxx, USA Military Specification MIL-R-10509 Style RN55D. Manufactured by R-Ohm (CRB-1/4FX), TRW/IRC, Beyschlag, Dale, Corning, and Matsushita.

**Carbon film resistors** have conformally-coated bodies, and are identified by four color bands. They are rated at 1/4 watt @ 70°C, ±5%. Orban part numbers 20001-xxx, Manufactured by R-Ohm (R-25), Piher, Beyschlag, Dale, Phillips, Spectrol, and Matsushita.

**Carbon composition resistors** have molded phenolic bodies, and are identified by four color bands. The 0.090 × 0.250 inch (2.3 × 6.4 mm) size is rated at 1/4 watt, and the 0.140 × 0.375 inch (3.6 × 9.5 mm) size is rated at 1/2 watt, both ±5% @ 70° C. Orban part numbers 2001x-xxx, USA Military Specification MIL-R-11 Style RC-07 (1/4 watt) or RC-20 (1/2 watt). Manufactured by Allen-Bradley, TRW/IRC, and Matsushita.

**Cermet trimmer resistors** have 3/8-inch (9 mm) square bodies, and are identified by printing on their sides. They are rated at 1/2 watt @ 70°C, ±10%, with a temperature coefficient of 100 PPM/°C. Orban part numbers 20510-xxx and 20511-xxx. Manufactured by Beckman (72P, 68W- series), Spectrol, and Matsushita.

## Obtaining spare parts:

Special or subtle characteristics of certain components are exploited to produce an elegant design at a reasonable cost. *It is therefore unwise to make substitutions for listed parts.* Consult the factory if the listing of a part includes the note 'selected' or 'realignment required'.

Orban normally maintains an inventory of tested, exact replacement parts that can be supplied quickly at nominal cost. Standardized spare parts kits are also available. When ordering parts from the factory, please have available the following information about the parts you want:

Orban part number
Reference designator (e.g., C3, R78, IC14)
Brief description of part
Model, serial, and 'M' (if any) number of unit — see rear-panel label

To facilitate future maintenance, parts for this unit have been chosen from the catalogs of well-known manufacturers whenever possible. Most of these manufacturers have extensive worldwide distribution and may be contacted through their local offices. Their USA headquarters addresses are given on page 6-15.

| REF DES | DESCRIPTION | ORBAN P/N | VEN (1) | VENDOR P/N | ALTERNATE VENDORS (1) | NOTES |
|---|---|---|---|---|---|---|
| **BAND PASS FILTER ASSEMBLY [BP]** | | | | | | |
| **Capacitors** | | | | | | |
| C101 | Polypropylene, 50V, 2.5%; 3300pF | 21702-233 | NOB | CQ15P1H332GPP | WIM | HF Band only |
| C101 | Polypropylene, 50V, 2.5%; 0.01uF | 21702-310 | NOB | CQ15P1H103GPP | WES | MHF Band only |
| C101 | Polypropylene, 50V, 2.5%; 0.039uF | 21702-339 | NOB | CQ15P1H393GPP | | MLF Band only |
| C101 | Polypropylene, 50V, 2.5%; 0.1uF | 21702-410 | NOB | CQ15P1H104GPP | | LF Band only |
| C102 | Polypropylene, 50V, 2.5%; 0.03uF | 21702-330 | NOB | CQ15P1H303GPP | | LF Band only |
| C102 | Not Used | --- | | | | MLF, MHF, HF Bands only |
| C103 | Polypropylene, 50V, 2.5%; 3300pF | 21702-233 | NOB | CQ15P1H332GPP | WIM | HF Band only |
| C103 | Polypropylene, 50V, 2.5%; 0.01uF | 21702-310 | NOB | CQ15P1H103GPP | WES | MHF Band only |
| C103 | Polypropylene, 50V, 2.5%; 0.039uF | 21702-339 | NOB | CQ15P1H393GPP | | MLF Band only |
| C103 | Polypropylene, 50V, 2.5%; 0.1uF | 21702-410 | NOB | CQ15P1H104GPP | | LF Band only |
| C104 | Polypropylene, 50V, 2.5%; 0.03uF | 21702-330 | NOB | CQ15P1H303GPP | | LF Band only |
| C104 | Not Used | --- | | | | MLF, MHF, HF Bands only |
| C105 | Polypropylene, 50V, 2.5%; 0.01uF | 21702-310 | NOB | CQ15P1H103GPP | WES | |
| C106 | Mica, 500V, +1/2pF -1/2pF; 10pF | 21017-010 | CD | CD15-CD100D03 | SAN | |
| C107 | Polypropylene, 50V, 2.5%; 0.01uF | 21702-310 | NOB | CQ15P1H103GPP | WES | |
| C108-111 | Monolythic Ceramic, 50V, 20%; 0.1uF | 21123-410 | SPR | 1C25 Z5U104M050B | KEM | |
| C112 | Mica, 500V, +1/2pF -1/2pF; 10pF | 21017-010 | CD | CD15-CD100D03 | SAN | |
| **Integrated Circuits** | | | | | | |
| IC101 | Linear, Dual Opamp | 24209-202 | NAT | LF412CN | | |
| IC102-104 | Linear, Dual Opamp | 24207-202 | SIG | NE5532N | TI,EXR | |
| **Resistors** | | | | | | |
| R101 | Resistor Set, MF; 19.1K | 28520-006 | ORB | | | |
| R103 | Trimpot, Cermet, 1 Turn; 500 OHM | 20509-150 | BEK | 72XR500 | BRN | |
| R104 | Pot, Dual; 10K/10K, (5050) | 20855-000 | ORB | | | Linear "BANDWIDTH" |
| R109-111 | Resistor Set, MF; 4.99K | 28520-001 | ORB | | | 3 |
| R112 | Pot, Triple, 10K/50K/50K | 20853-000 | ORB | | | "VERNIER" |
| R115 | Resistor Set, MF; 4.99K | 28520-001 | ORB | | | 3 |
| R118 | Resistor Set, MF; 4.99K | 28520-001 | ORB | | | 3 |
| R122 | Trimpot, Cermet, 1 Turn; 200 OHM | 20509-120 | BEK | 72XR200 | BRN | |
| **Switches** | | | | | | |
| S101 | Switch, Toggle, Min., SPDT | 26041-101 | CK | 7101L1YZBE | | |

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
642B Parametric Equalizer/Notch Filter
Band Pass Filter Assy: Capacitators, Integrated Circuits, Resistors, Switches

| REF DES | DESCRIPTION | ORBAN P/N | VEN (1) | VENDOR P/N | ALTERNATE VENDORS (1) | NOTES |
|---|---|---|---|---|---|---|
| **CHASSIS ASSEMBLY** | | | | | | |
| **Miscellaneous** | | | | | | |
| F1 | Fuse, 3AG, Slo-Blo, 1/2A | 28004-150 | LFE | 313.500 | BUS | |
| L1 | Filter, Line, 3 Amp | 28015-000 | COR | 3EF1 | | |
| NONE | Line Cord, CEE | 28102-002 | BEL | 17500 | MANY | |
| T1 | Transformer, Power; 38VCT, 16VA | 55001-000 | ORB | | | |
| **Switches** | | | | | | |
| NONE | Switch, Slide, Mains voltage selector | 26140-000 | SW | EPSI-SLI | | |
| **HIGH PASS/LOW PASS ASSEMBLY [HP/LP]** | | | | | | |
| **Capacitors** | | | | | | |
| C501 | Polypropylene, 50V, 2.5%; 0.1uF | 21702-410 | NOB | CQ15P1H104GPP | | |
| C502 | Polypropylene, 50V, 2.5%; 0.03uF | 21702-330 | NOB | CQ15P1H303GPP | | |
| C503 | Met. Polyester, 100V, 10%; 0.0022uF | 21441-222 | WES | 160C 222K1000 | SIE, WIM | |
| C504 | Polypropylene, 50V, 2.5%; 0.039uF | 21702-339 | NOB | CQ15P1H393GPP | | |
| C505 | Met. Polyester, 100V, 10%; 0.01uF | 21441-310 | WES | 160C 103K630 | SIE, WIM | |
| C506 | Polypropylene, 50V, 2.5%; 0.068uF | 21702-368 | NOB | CQ15P1H683GPP | | |
| C507 | Polypropylene, 50V, 2.5%; 2200pF | 21702-222 | NOB | CQ15P1H222GPP | WIM | |
| C508 | Polypropylene, 50V, 2.5%; 1000pF | 21702-210 | NOB | CQ15P1H102GPP | WIM | |
| C509 | Mica, 500V, 1%; 1600pF | 21022-216 | CD | CD19-FD162F03 | SAN | |
| C510,511 | Monolythic Ceramic, 50V, 20%; 0.1uF | 21123-410 | SPR | 1C25 Z5U104M050B | KEM | |
| C512 | Polypropylene, 50V, 2.5%; 0.047uF | 21702-347 | NOB | CQ15P1H473GPP | | |
| **Integrated Circuits** | | | | | | |
| IC501 | Linear, Dual Opamp | 24207-202 | SIG | NE5532N | TI,EXR | |
| IC502 | Linear, Single Opamp | 24017-202 | NAT | LF411CN | | |
| **Resistors** | | | | | | |
| R503 | Pot, Triple, 50K/50K/50K, (5020R) | 20852-000 | ORB | | | 20% CCW Log |
| R506 | Pot, Dual, 10K/50K, (5020R) | 20851-000 | ORB | | | 20% CCW Log |

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
642B Parametric Equalizer/Notch Filter
Chassis Assy: Miscellaneous, Switches
High Pass/Low Pass Assy: Capacitators, Integrated Circuits, Resistors

| REF DES | DESCRIPTION | ORBAN P/N | VEN (1) | VENDOR P/N | ALTERNATE VENDORS (1) | NOTES |
|---|---|---|---|---|---|---|
| **Switches** | | | | | | |
| S501,502 | Switch, Toggle, Min., SPDT | 26041-101 | CK | 7101L1YZBE | | |
| **INPUT ASSEMBLY [IN]** | | | | | | |
| **Capacitors** | | | | | | |
| C201-203 | Mica, 500V, +1/2pF -1/2pF; 10pF | 21017-010 | CD | CD15-CD100D03 | SAN | |
| C204 | Polypropylene, 50V, 2.5%; 0.01uF | 21702-310 | NOB | CQ15P1H103GPP | WES | |
| C205,206 | Ceramic Disc, 50V, +80% -20%; 0.005uF | 21108-250 | CRL | CK-502 | | |
| C207 | Met. Polyester, 100V, 10%; 0.15uF | 21441-415 | WES | 160C154K100 | SIE,WIM | |
| C208 | Mica, 500V, +1/2pF -1/2pF; 33pF | 21017-033 | CD | CD15-CD330D03 | SAN | |
| C209-213 | Monolythic Ceramic, 50V, 20%; 0.1uF | 21123-410 | SPR | 1C25 Z5U104M050B | KEM | |
| **Integrated Circuits** | | | | | | |
| IC201 | Linear, Single Opamp | 24017-202 | NAT | LF411CN | | |
| IC202 | Linear, Dual Opamp | 24207-202 | SIG | NE5532N | TI,EXR | |
| IC203 | Linear, Single Opamp | 24003-202 | NAT | LM301AH | TI,RCA | |
| **Resistors** | | | | | | |
| R208 | Pot, Single, 50K, (5050) | 20755-000 | ORB | | | Linear |
| **Switches** | | | | | | |
| S201 | Switch, Toggle, Min., SPDT | 26041-101 | CK | 7101L1YZBE | | Channel B only |
| S202 | Switch, Single, Push-Push, 4PDT | 26116-000 | SCH | F014UEEB01BAG | | |
| **Transistors** | | | | | | |
| Q201 | Transistor, Signal, NPN | 23201-101 | MOT | 2N4123 | FSC | |
| **POWER SUPPLY ASSEMBLY [PS]** | | | | | | |
| **Capacitors** | | | | | | |
| C1-8 | Ceramic Disc, 1KV, 10%; 0.001uF | 21112-210 | CRL | DD-102 | MUR | |
| C9,10 | Alum., Axial, 40V, -10% +100%; 1000uF | 21224-810 | SIE | B41010-1000 40 | PAN | |
| C11,12 | Alum., Radial, 25V, -20% +100%; 100uF | 21206-710 | PAN | ECE-A1EV101S | | |
| C13,14 | Monolythic Ceramic, 50V, 20%; 0.1uF | 21123-410 | SPR | 1C25 Z5U104M050B | KEM | |
| C15-18 | Alum., Radial, 63V, -20% +100%; 4.7uF | 21209-547 | SPR | 502D 475G063BB1C | PAN | |

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
642B Parametric Equalizer/Notch Filter
High Pass/Low Pass Assy: Switches
Input Assy: Capacitators, Integrated Circuits, Resistors, Switches, Transistors,
Power Supply Assy: Capacitators

| REF DES | DESCRIPTION | ORBAN P/N | VEN (1) | VENDOR P/N | ALTERNATE VENDORS (1) | NOTES |
|---|---|---|---|---|---|---|
| | **Diodes** | | | | | |
| CR1 | Diode, Bridge, 200V, 1A | 22301-000 | VARO | VE-27 | GI | |
| CR2,3 | Diode, Rectifier, 400V, 1A | 22201-400 | MOT | 1N4004 | MANY | |
| | **Integrated Circuits** | | | | | |
| IC1 | D.C. Regulator, 15V Positive | 24304-901 | FSC | F78M15UC | TI | |
| IC2 | D.C. Regulator, 15V Negative | 24303-901 | FSC | F79M15AUC | TI | |
| | **Modules** | | | | | |
| NONE | Module Assy, Output | 31160-001-xx* | ORB | | | *Add suffix printed on part |
| **SUB PANEL ASSEMBLY** | | | | | | |
| | **LED's** | | | | | |
| NONE | LED, Green | 25106-002 | HP | HLMP-1503 | GI | Input Board, Channel A only |
| NONE | LED, Red | 25106-003 | HP | HLMP-1300 | GI | Input Board, Channels A & B |

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
642B Parametric Equalizer/Notch Filter
Power Supply Assy: Diodes, Integrated Circuits, Modules
Sub Panel Assy: LED's

# Vendor Codes

AB Allen-Bradley Co., Inc.
1201 South Second Street
Milwaukee, WI 53204

AD Analog Devices, Inc.
One Technology Way
PO BOX 9106
Norwood, MA 02062-9106

AM Amphenol Corporation
358 Fall Avenue
Wallingford, CT 06492

BEK Beckman Industrial Corporation
4141 Palm Street.
Fullerton, CA 92635-1025

BEL Belden Electronic Wire & Cable
PO BOX 1980
Richmond, IN 47374

BRN Bourns, Inc.
Resistive Components Group
1200 Columbia Avenue
Riverside, CA 92507

BUS Bussmann Division
Cooper Industries
PO BOX 14460
St. Louis, MO 63178

CD Cornell-Dubilier Elec.
Wayne Interchange Plaza 1
Wayne, NJ 07470

CH Cutler-Hammer
4201 N. 27th Street
Milwaukee, WI 53216

CK C & K Components, Inc.
15 Riverdale Avenue
Newton, MA 02158-1082

COR Corcom, Inc.
1600 Winchester Road
Libertyville, IL 60048

CRL Mepco/Centralab
A North American Philips Corp.
2001 W. Blue Heron Blvd.
Riviera Beach, FL 33404

CTS CTS Corporation
905 North West Blvd.
Elkhart, IN 46514

CW CW Industries
130 James Way
Southampton, PA 18966

DIX Dixson, Inc.
PO BOX 1449
Grand Junction, CO 81502

ECI Electrocube
1710 South Del Mar Avenue
San Gabriel, CA 91776

ELSW Electroswitch
180 King Avenue
Weymouth, MA 02188

EMI Emico Inc.
123 North Main Street
Dublin, PA 18917

ERE Murata Erie North America
2200 Lake Park Drive
Smyrna, GA 30080

EXR Exar Corporation
750 Palomar Ave
PO BOX 3575
Sunnyvale, CA 94088

FSC Fairchild Camera & Instr. Corp.
464 Ellis Street
Mountain View, CA 94042

GI General Instruments
Optoelectronics Division
3400 Hillview Avenue
Palo Alto, CA 94304

HP Hewlett-Packard Co.
640 Page Mill Road
Palo Alto, CA 94304

INS Intersil, Inc.
10600 Ridgeview Court
Cupertino, CA 95014

IRC International Resistive Co., Inc.
PO BOX 1860
Boone, NC 28607

JEN Jensen Transformers, Inc.
10735 Burbank Blvd.
North Hollywood, CA 91601

KEY Keystone Electronics Corp.
49 Bleecker Street
New York, NY 10012

LFE Littelfuse
A Subsidiary of Tracor, Inc.
800 E. Northwest Hwy
Des Plaines, IL 60016

LT Linear Technology Corp.
1630 McCarthy Blvd.
Milpitas, CA 95035

LUMX Lumex Opto/Components Inc.
292 E. Hellen Road
Palatine, IL 60067

MAL Mallory Capacitor Co.
Emhart Electrical/Electronic Gr.
3029 East Washington Street
Indianapolis, IN 46206

MAR Marquardt Switches, Inc.
67 Albany Street
Cazenovia, NY 13035

ME Mepco/Centralab
A North American Philips Corp.
2001 W. Blue Heron Blvd.
Riviera Beach, FL 33404

MID Midland-Ross Corporation
NEL Unit/Midtex Division
357 Beloit Street
Burlington, WI 53105

MIL J.W. Miller Division
Bell Industries
19070 Reyes Avenue
Rancho Dominguez, CA 90224-5825

MOT Motorola Semiconductor
PO BOX 20912
Phoenix, AZ 85036

NAT National Semiconductor Corp.
2900 Semiconductor Drive
PO BOX 58090
Santa Clara, CA 95052-8090

NOB Noble U.S.A., Incorporated
5450 Meadowbrook Ct.
Rolling Meadows, IL 60008

OHM Ohmite Manufacturing Company
A North American Philips Corp.
3601 Howard Street
Skokie, IL 60076

ORB Orban
a division of AKG Acoustics, Inc
645 Bryant Street
San Francisco, CA 94107

PAN Panasonic Industrial Company
One Panasonic Way
PO BOX 1503
Seacaucus, NJ 07094

PB Potter & Brumfield Division
A Siemens Co.
200 S. Richland Creek Dr.
Princeton, IN 47671-0001

RCA RCA Solid State Division
Route 202
Somerville, NJ 08876

ROHM Rohm Corporation
8 Whatney
Irvine, CA 92718

SAE Stanford Applied Engineering, Inc
340 Martin Avenue
Santa Clara, CA 95050

SAN Sangamo Weston Inc.
Capacitor Division
PO BOX 48400
Atlanta, GA 30362

SCH ITT Schadow
8081 Wallace Road
Eden Prairie, MN 55344

SIE Siemens Components Inc.
186 Wood Avenue South
Iselin, NJ 08830

SIG Signetics Corporation
A Sub. of US Philips Corp.
811 E. Arques
PO BOX 3409
Sunnyvale, CA 94088-3409

SPR Sprague Electric Co.
41 Hampden Road
PO BOX 9102
Mansfield, MA 02048-9102

SW Switchcraft
A Raytheon Company
5555 N. Elston Avenue
Chicago, IL 60630

TI Texas Instruments
PO BOX 655012
Dallas, TX 75265

TOS Toshiba America, Inc.
2441 Michelle Drive
Tustin, CA 92680

TRW TRW Electronic Components
Connector Division
1501 Morse Avenue
Elk Grove Village, IL 60007

VARO Varo Quality Semiconductor, Inc.
1000 North Shiloh Road
PO BOX 469013
Garland, TX 75046-9013

WES Westlake
5334 Sterling Ctr Drive
Westlake Village, CA 91361

The Inter-Technical Group Inc.
Wima Division
PO BOX 23
Irvington, NY 10533

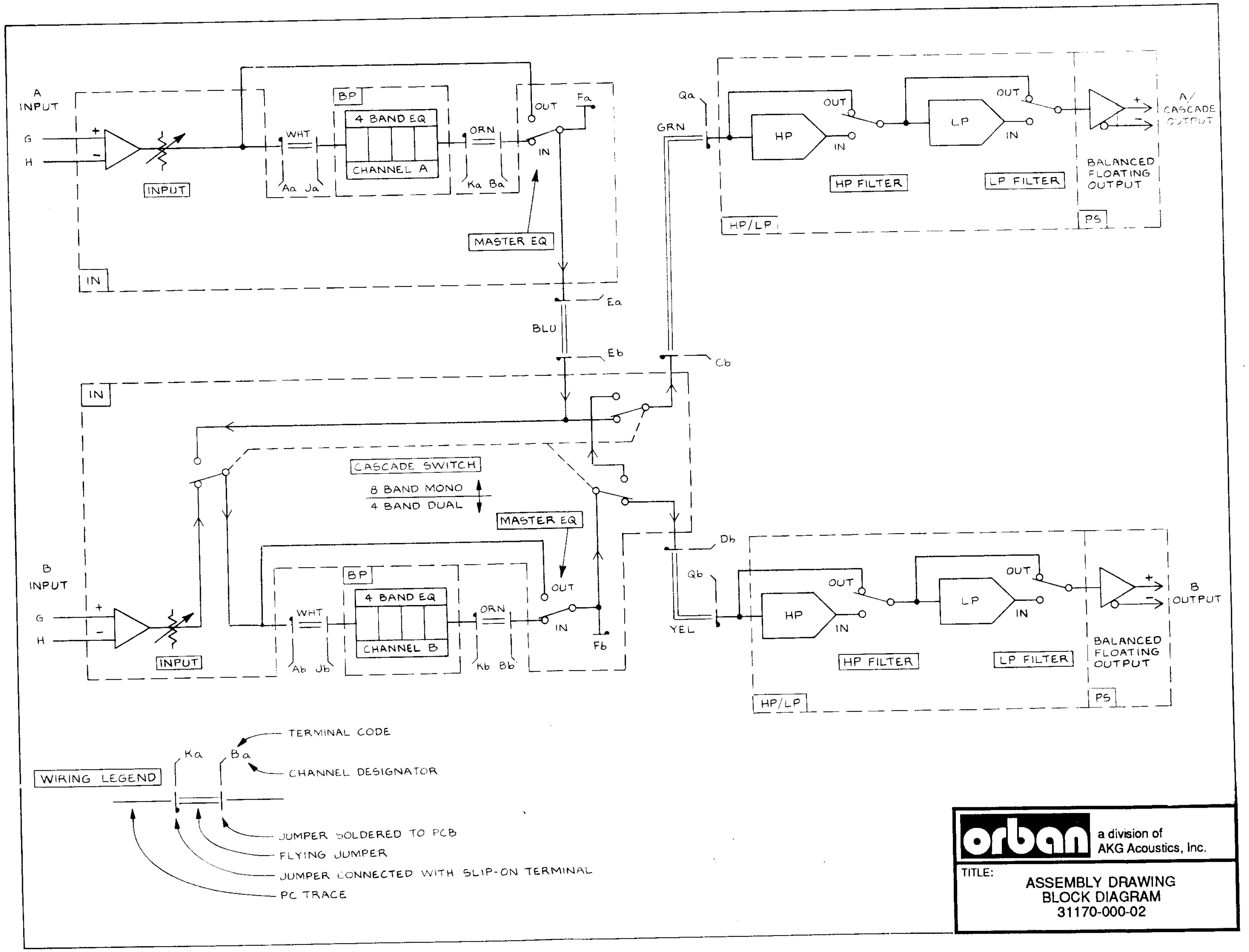
## Schematics, Assembly Drawings

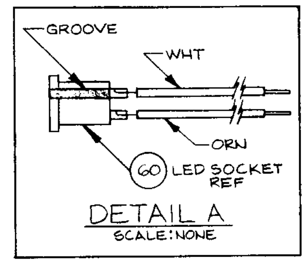
The following drawings are included in this manual:

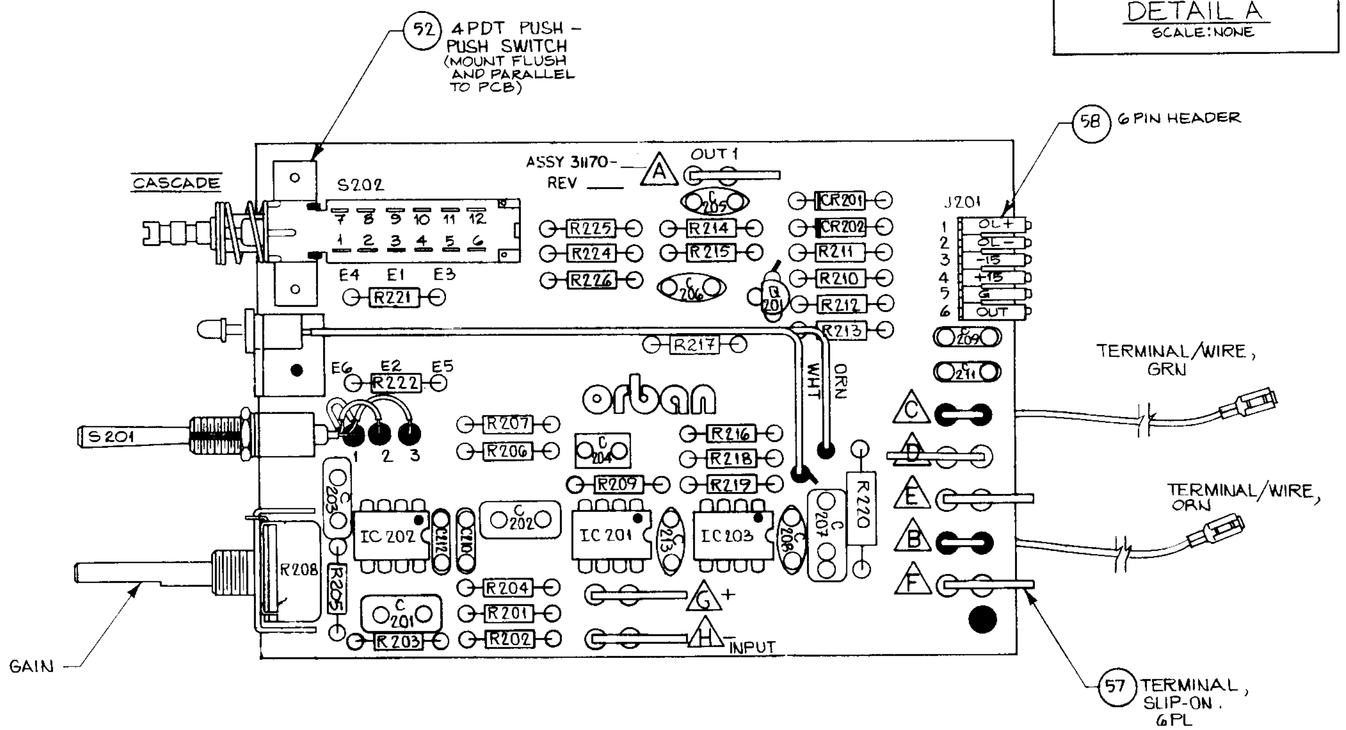


These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are almost undoubtedly due to product improvements or production changes since the publication of this manual. Major changes are described in addenda located at the front of this manual.

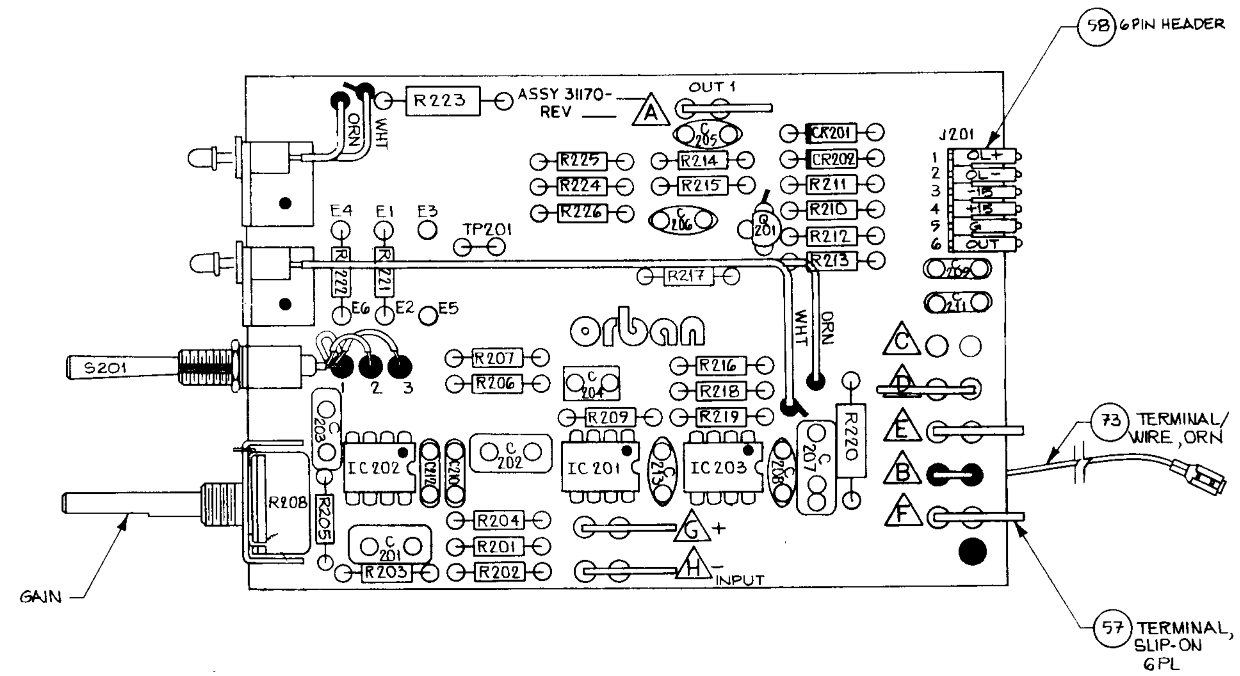
If you intend to replace parts, please read page 6-10.


A INPUT
G
H
INPUT
IN
BP
4 BAND EQ
CHANNEL A
WHT
ORN
Aa Ja
Ka Ba
OUT
IN
Fa
MASTER EQ
Ea
BLU
Eb
Cb
GRN
Qa
HP
LP
OUT
IN
HP FILTER
LP FILTER
HP/LP
A/CASCADE OUTPUT
BALANCED FLOATING OUTPUT
PS
CASCADE SWITCH
8 BAND MONO
4 BAND DUAL
B INPUT
CHANNEL B
Ab Jb
Kb Bb
Fb
Db
Qb
YEL
B OUTPUT
WIRING LEGEND
TERMINAL CODE
CHANNEL DESIGNATOR
JUMPER SOLDERED TO PCB
FLYING JUMPER
JUMPER CONNECTED WITH SLIP-ON TERMINAL
PC TRACE
orban a division of AKG Acoustics, Inc.
TITLE: ASSEMBLY DRAWING BLOCK DIAGRAM 31170-000-02




COMPONENT SIDE
VERSION - 002
(CHANNEL B)




COMPONENT SIDE
VERSION - 001
(CHANNEL A)

TIC MARKS INDICATE PIN #1 OF IC'S, PIN #1 OF CONNECTORS, CATHODE OF DIODES, EMITTER OF TRANSISTOR, PIN #1 OF SWITCH.

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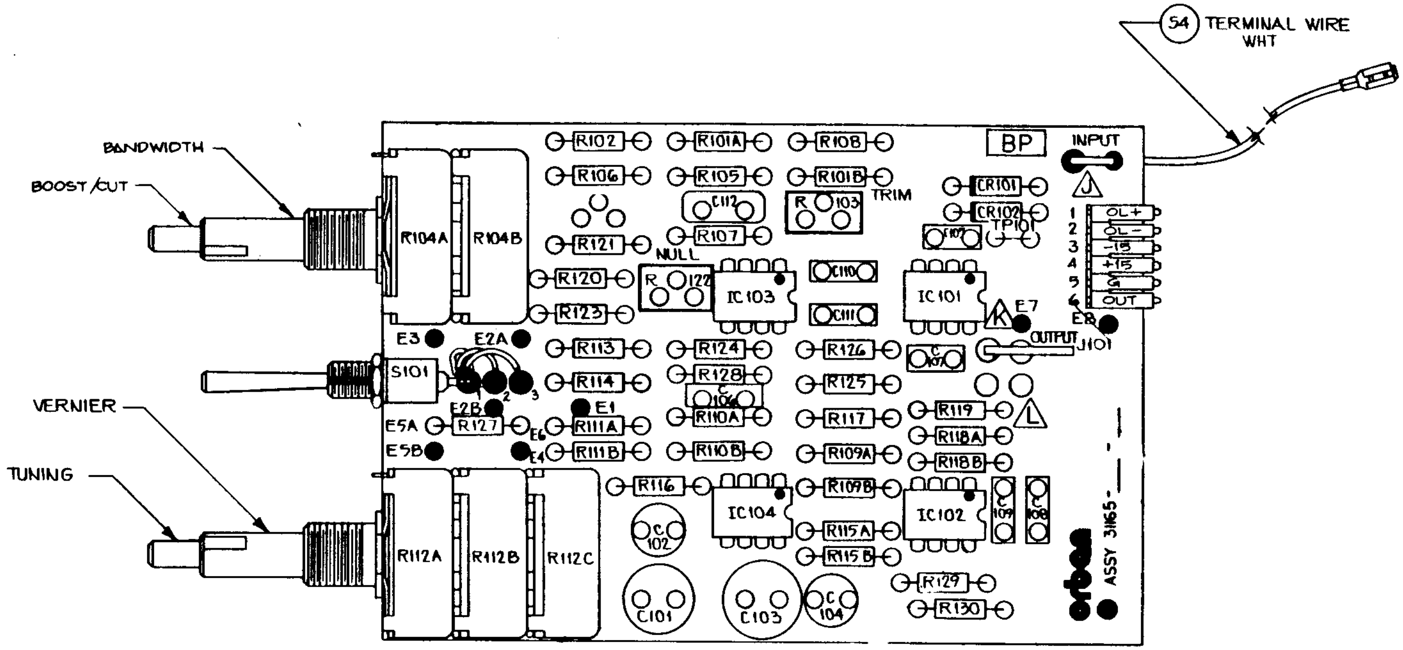
TITLE:
ASSEMBLY DRAWING
INPUT BOARD
31170-000-02




COMPONENT SIDE

| VERSION CHART | |
|---|---|
| -001 | BAND LF 25 - 500 |
| -002 | BAND MLF 80 - 1.6 K |
| -003 | BAND MHF 315 - 6.3 K |
| -004 | BAND HF 1K - 20K |

1. TIC MARKS INDICATE PIN#1 OF IC'S, PIN#1 OF CONNECTORS, CATHODE OF DIODES, PIN#1 OF SWITCH.

NOTES: (UNLESS OTHERWISE SPECIFIED)

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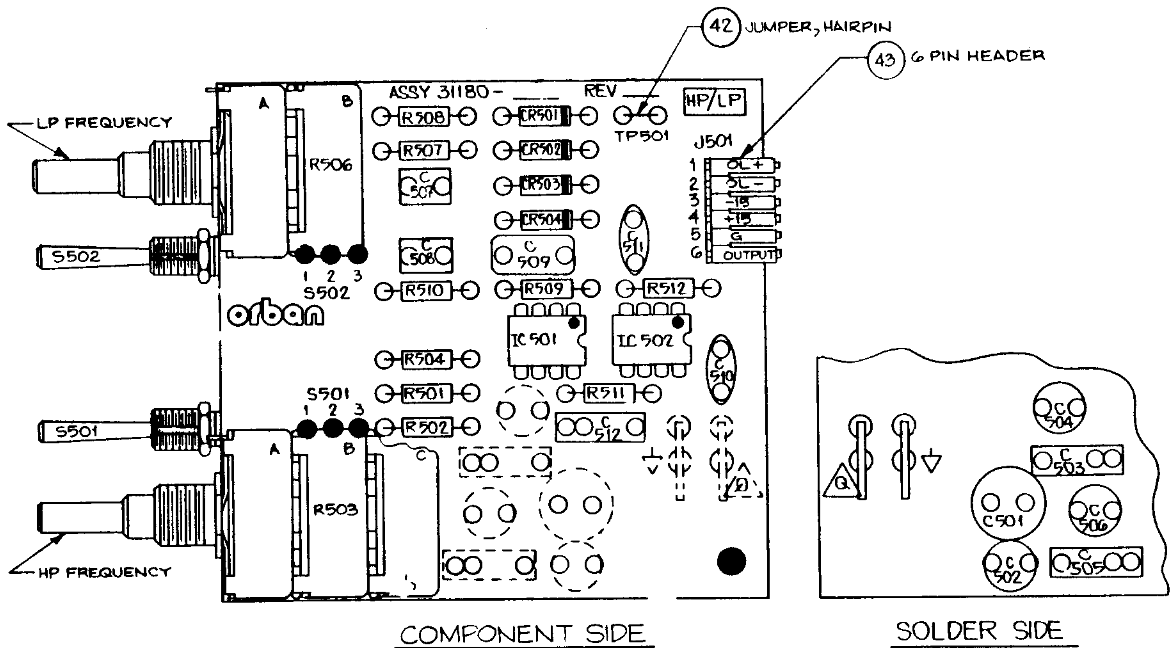
TITLE:

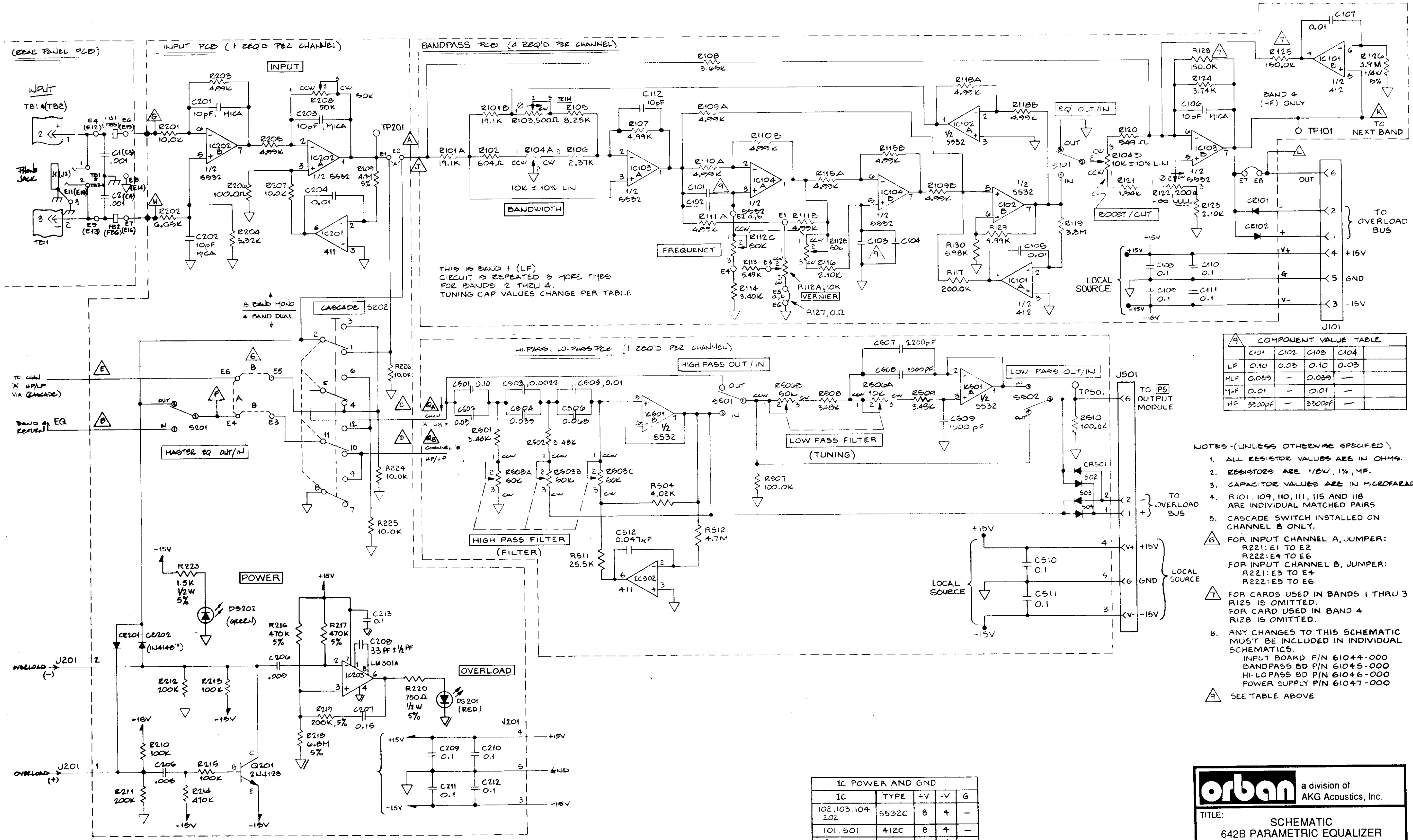
ASSEMBLY DRAWING
BAND-PASS FILTER BOARD
31165-000-02




TIC MARKS INDICATE PIN#1 OF IC'S, PIN#1 OF CONNECTORS, CATHODE OF DIODES, PIN#1 OF SWITCH.

orban a division of AKG Acoustics, Inc.

TITLE:
ASSEMBLY DRAWING
HI-PASS, LO-PASS BOARD
31180-000-04




| △9 COMPONENT VALUE TABLE | | | | | |
|---|---|---|---|---|---|
| | C101 | C102 | C103 | C104 | |
| LF | 0.10 | 0.03 | 0.10 | 0.03 | |
| MLF | 0.039 | — | 0.039 | — | |
| MHF | 0.01 | — | 0.01 | — | |
| HF | 3300pF | — | 3300pF | — | |

NOTES-(UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS.
2. RESISTORS ARE 1/8W, 1%, MF.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. R101, 109, 110, 111, 115 AND 118 ARE INDIVIDUAL MATCHED PAIRS
5. CASCADE SWITCH INSTALLED ON CHANNEL B ONLY.

△6 FOR INPUT CHANNEL A, JUMPER:
R221: E1 TO E2
R222: E4 TO E6
FOR INPUT CHANNEL B, JUMPER:
R221: E3 TO E4
R222: E5 TO E6

△7 FOR CARDS USED IN BANDS 1 THRU 3 R125 IS OMITTED.
FOR CARD USED IN BAND 4 R128 IS OMITTED.

8. ANY CHANGES TO THIS SCHEMATIC MUST BE INCLUDED IN INDIVIDUAL SCHEMATICS.
INPUT BOARD P/N 61044-000
BANDPASS BD P/N 61045-000
HI-LOPASS BD P/N 61046-000
POWER SUPPLY P/N 61047-000

△9 SEE TABLE ABOVE

| IC POWER AND GND | | | | |
|---|---|---|---|---|
| IC | TYPE | +V | -V | G |
| 102, 103, 104 202 | 5532C | 8 | 4 | — |
| 101, 501 | 412C | 8 | 4 | — |
| 201 | 411C | 7 | 4 | |
| 203 | LM 301A | 7 | — | 4 |

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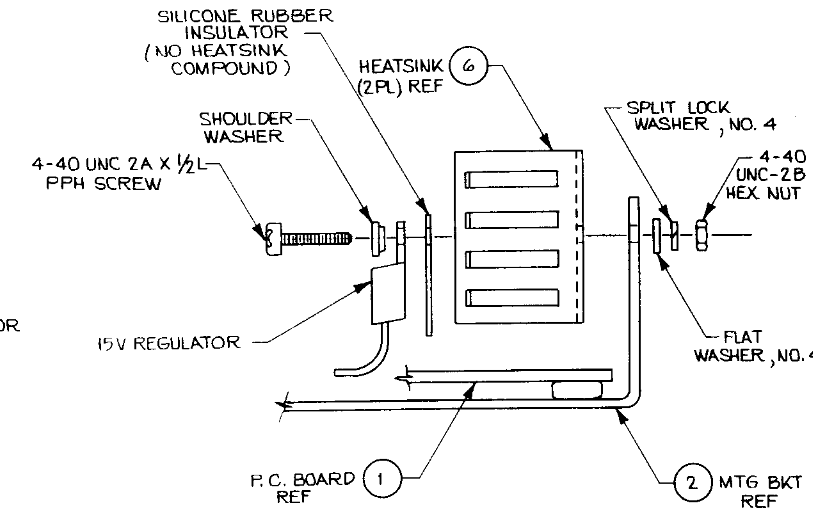
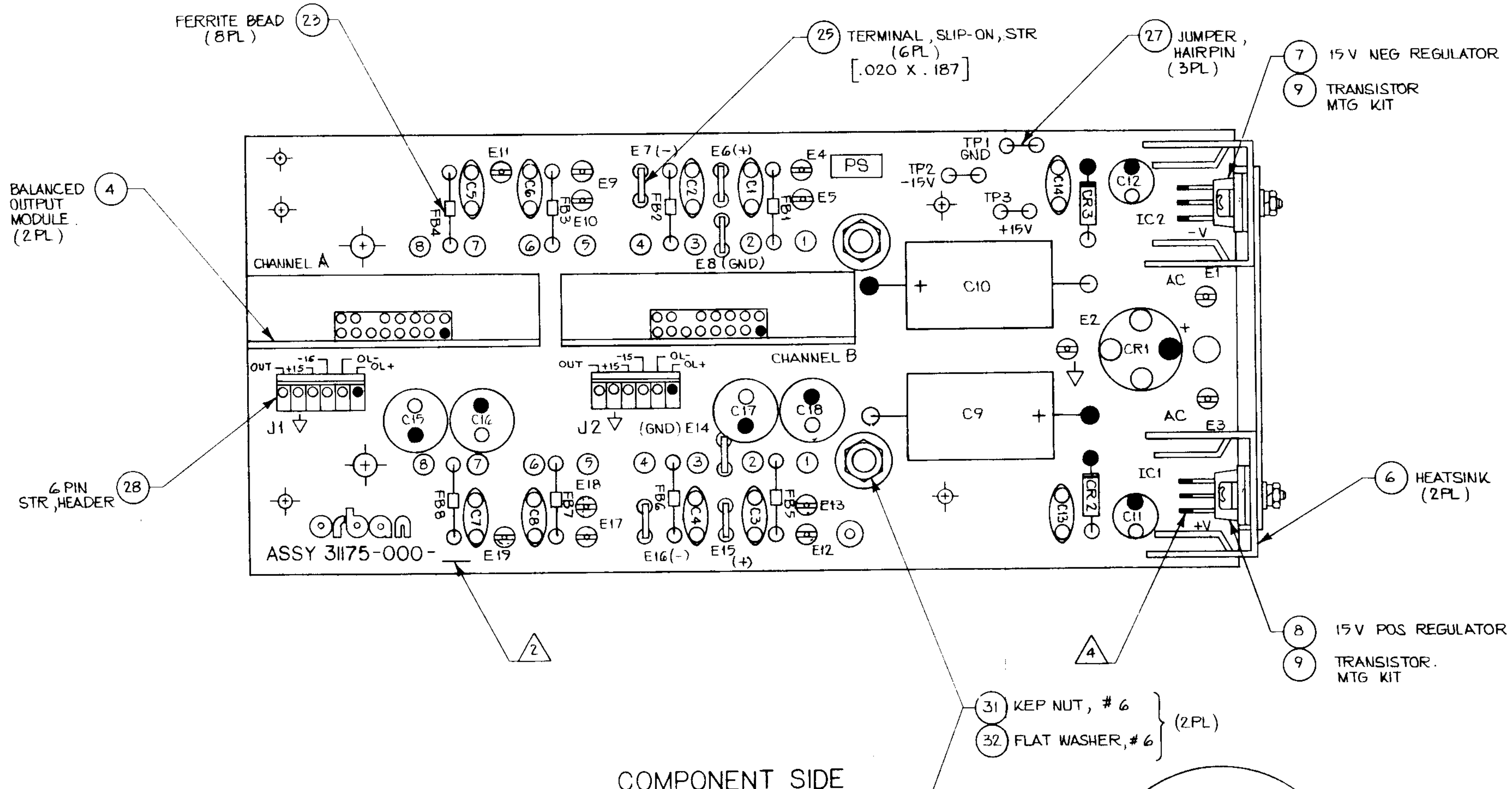
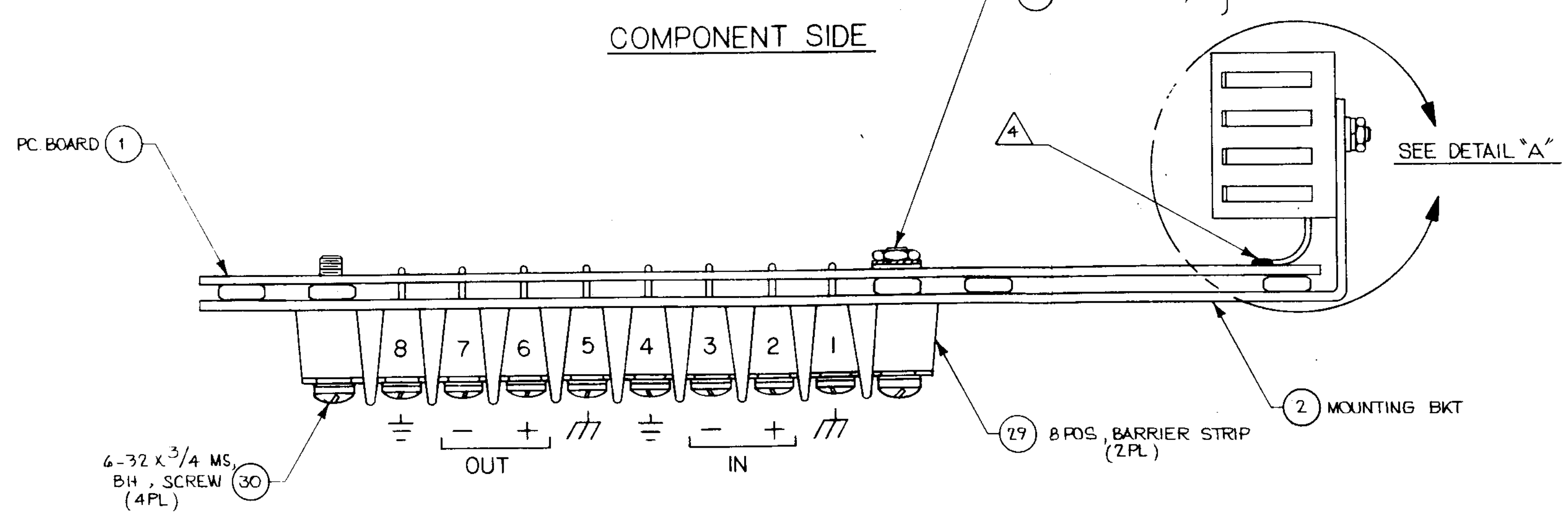
TITLE: SCHEMATIC
642B PARAMETRIC EQUALIZER
61030-000-01




DETAIL "A"
(2PL)
[HARDWARE IS PART OF KIT 9]




4. SOLDER IC'S (ITEM 7 & 8) FROM TIP OF LEAD TO ABOUT 1/8" BACK AFTER THEY ARE SECURED TO BRACKET.

3. ATTACH BARRIER STRIPS (ITEM #29); TO MOUNTING BRACKET (ITEM #2); USING 6-32x3/4 SCREWS (ITEM #30); DO NOT TIGHTEN. ASSEMBLE TO REAR PANEL BOARD (ITEM #1); ALIGNING PINS AS NEEDED. THEN ATTACH PCB. LAST, SOLDER LEADS OF BARRIER STRIP TO P.C.B.

2. MARK REV. LEVEL IN SPACE PROVIDED.

1. TIC MARKS INDICATE PIN #1 OF CONNECTORS, CATHODE OF DIODES, PIN #1 OF SWITCH.

NOTES: (UNLESS OTHERWISE SPECIFIED)

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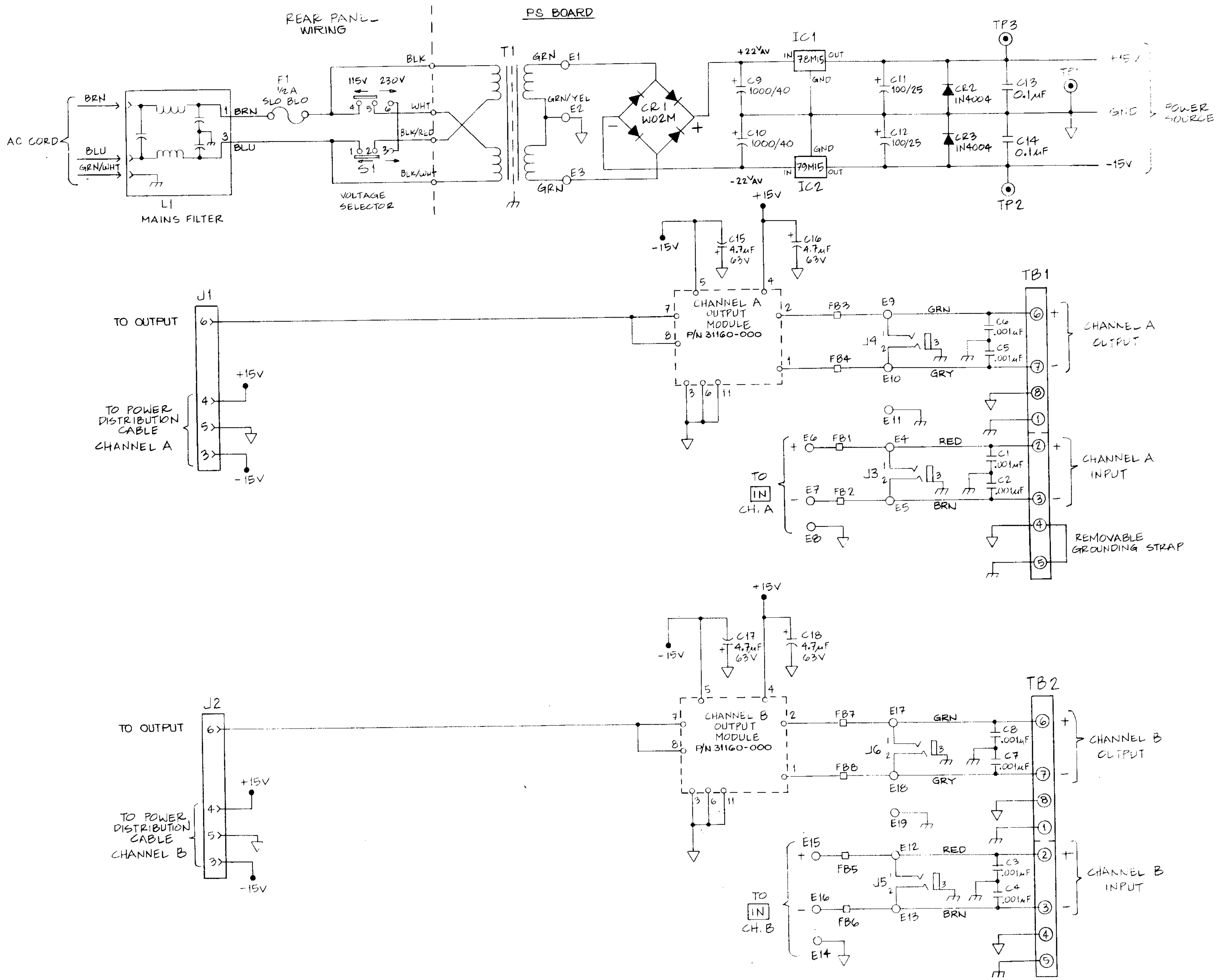
TITLE: PCA POWER SUPPLY 31175-000-02

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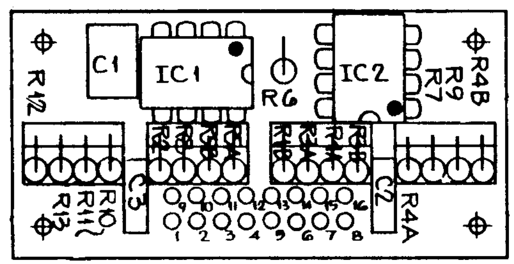
TITLE:
POWER SUPPLY BOARD
61047-000-01




PC ASSY

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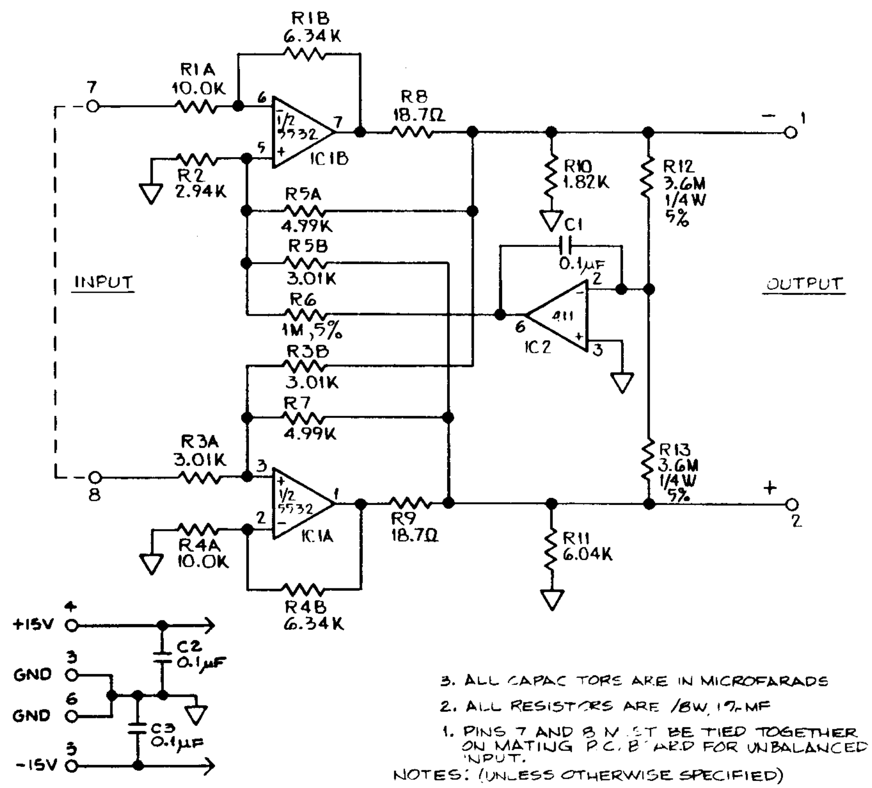
TITLE:
ASSEMBLY DRAWING
BALANCED OUTPUT MODULE
31160-000-02




| IC POWER PINS | | | |
|---|---|---|---|
| DEVICE | +V | -V | GND |
| 411 | 7 | 4 | – |
| 5532 | 8 | 4 | – |

3. ALL CAPACITORS ARE IN MICROFARADS
2. ALL RESISTORS ARE 1/8W, 1% MF
1. PINS 7 AND 8 MUST BE TIED TOGETHER ON MATING P.C. BOARD FOR UNBALANCED INPUT.

NOTES: (UNLESS OTHERWISE SPECIFIED)

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TITLE:
SCHEMATIC
BALANCED OUTPUT MODULE
61031-000-01

## Abbreviations

Some of the abbreviations used in this manual may not be familiar to all readers:

| | |
|---|---|
| AGC | automatic gain control |
| dBu | 0dBu = 0.775V RMS. For this application, the dBm into 600Ω scale on voltmeters can be read as if it were calibrated in dBu. |
| DJ | disk jockey, an announcer who plays records in a club or on the air |
| FET | field effect transistor |
| FFT | fast Fourier transformation |
| G/R | gain reduction |
| HF | high-frequency |
| HP | high-pass |
| IC | integrated circuit |
| IM | intermodulation (or 'intermodulation distortion') |
| JFET | junction field effect transistor |
| LED | light-emitting diode |
| LF | low-frequency |
| LP | low-pass |
| MHF | midrange/high-frequency |
| MLF | midrange/low-frequency |
| N&D | noise and distortion |
| RF | radio frequency |
| RFI | radio-frequency interference |
| TRS | tip-ring-sleeve (2-circuit phone jack) |
| THD | total harmonic distortion |
| VCA | voltage-controlled amplifier |
| XLR | a common style of 3-conductor audio connector |