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Operating Manual

OPTIMOD®-TV

STEREO GENERATOR

Model 8182A/SG



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Addendum #1
to OPTIMOD-TV® 8182A/SG Stereo Generator Operating Manual

P/N 95047-000-01 6/85

This addendum replaces the **installation and set-up instructions** in the Model 8182A/SG Stereo Generator Operating Manual. These instructions cover installation and set-up of the two central components of the OPTIMOD Stereo Television System: the 8182A Audio Processor and the 8182A/SG Stereo Generator. Also included are installation and set-up instructions for the optional 8182A/ST Studio Chassis for the Audio Processor.

Additional OPTIMOD Television Stereo System components include the 8182A/SAP Second Audio Program Generator, the 8182A/PRO Professional Channel Generator, and the 275A Automatic Stereo Synthesizer. Installation instructions for these units can be found in their respective Operating Manuals. Figure 1 shows the common configurations of the OPTIMOD Television Stereo System.

Follow instructions in the order given.

You should have the Operating Manuals for the 8182A and 8182A/SG (and the 8182A/ST, if used) at hand for reference.

Equipment required

At the transmitter:

– Low-distortion audio oscillator

– Frequency counter (to measure 10,396 Hz)

Not required if you have a Tektronix 1405 TV Sideband Analyzer Adapter with a built-in 10,396Hz oscillator.

– Triggered-sweep oscilloscope

With at least 5MHz vertical bandwidth.

– RF spectrum analyzer (If not available, see box on page 12.)

To look at the aural carrier.

Optional, but strongly recommended:

– Precision aural wideband demodulator

Tektronix 1450-1 with wideband composite output, Telemet 3713, Belar TVM-100, TFT 850, or equivalent.

– BTSC stereo decoder/monitor

Tektronix 751, or equivalent. Helpful for monitoring audio off air, but not required. Should *not* be used for adjusting composite level or separation.

At the studio (only if installing the optional 8182A/ST Studio Chassis):

– Low-distortion audio oscillator

– Audio level meter

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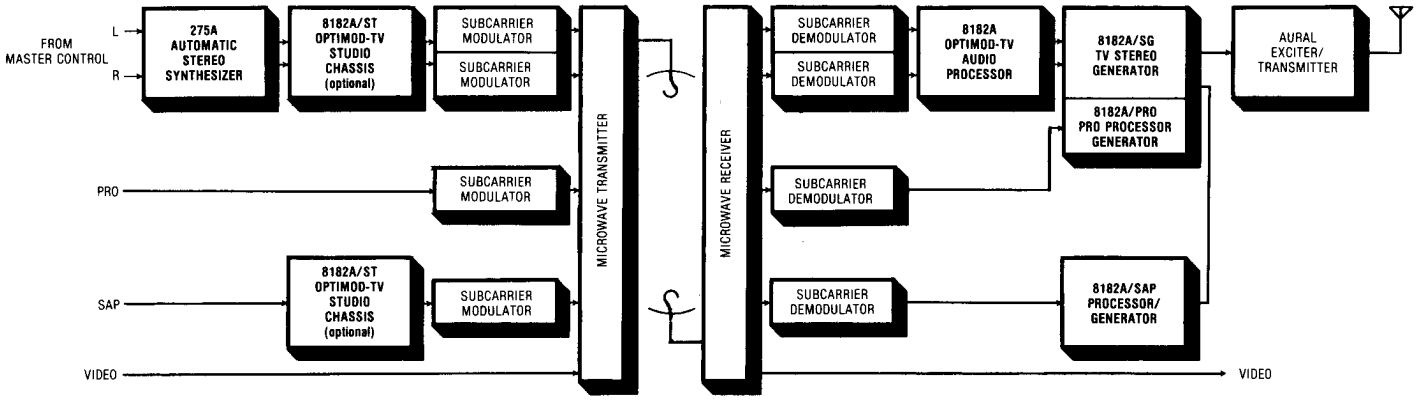
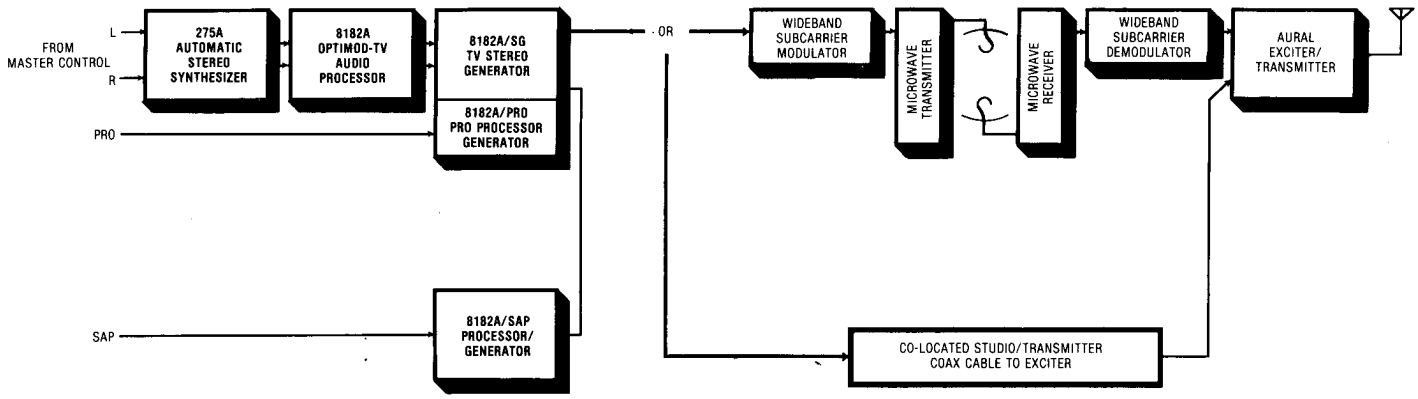


Stereo TV System with discrete subcarrier microwave STL



Stereo TV System with composite subcarrier microwave STL
or
co-located studio/transmitter

Figure 1: Common System Configurations

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INSTALLATION

1) Unpack and inspect new units.

If obvious physical damage is noted, contact carrier immediately to make a damage claim. Save packing materials in case you need to return a unit for service.

a) Remove the three hex-socket screws at the top of each unit's front panel, swing the panel out and down, turn the four DZUS fasteners on each unit's subpanel 1/4-turn, then remove the subpanels.

b) Carefully remove each circuit card, check that all IC components are properly seated in their sockets, then return the cards to their slots.

2) Install Studio Chassis circuit cards.

[Skip this step if you will not also be installing the optional 8182A/ST Studio Chassis at this time.]

a) Remove Cards #2, #3, #4, and #5 from the 8182A Audio Processor.

b) Install Card #3TX in the Audio Processor's slot #3, and install Card #4TX in slot #4.

c) Remove the top and bottom covers of the Studio Chassis, and install circuit cards as shown in Figure 2.

Position Card #5, attach the edge connector to the card, then secure the card to the standoffs with the supplied 6-32 screws. Center the control knobs in their holes just before tightening down the screws.

Install Card #3 in the same way, using the supplied 6-32 hex standoffs instead of screws.

Mount Card #2 *component side down* on these standoffs and fasten with 6-32 screws.

Turn the unit upside-down, install Card #4 *component side up*, and secure the card with 6-32 screws.

See the 8182A/ST Operating Manual for additional information.

3) Check line voltage settings.

a) Check that AC POWER switches (behind front panels) are set to ON.

b) Check VOLTAGE SELECTOR switches.

These units are shipped wired for 115-volt, 50/60Hz operation unless otherwise indicated on a power cord tag. If the setting does not match your requirements, see the Installation section of the unit's Operating Manual. (Check the value of the fuses if you change the line voltage settings.)

4) Restrap jumpers on the Audio Processor's Card #7.

a) Remove Card #7 from the 8182A Audio Processor.

b) Reposition jumpers A, B, C, and D as shown in Figure 3, then reinstall Card #7.

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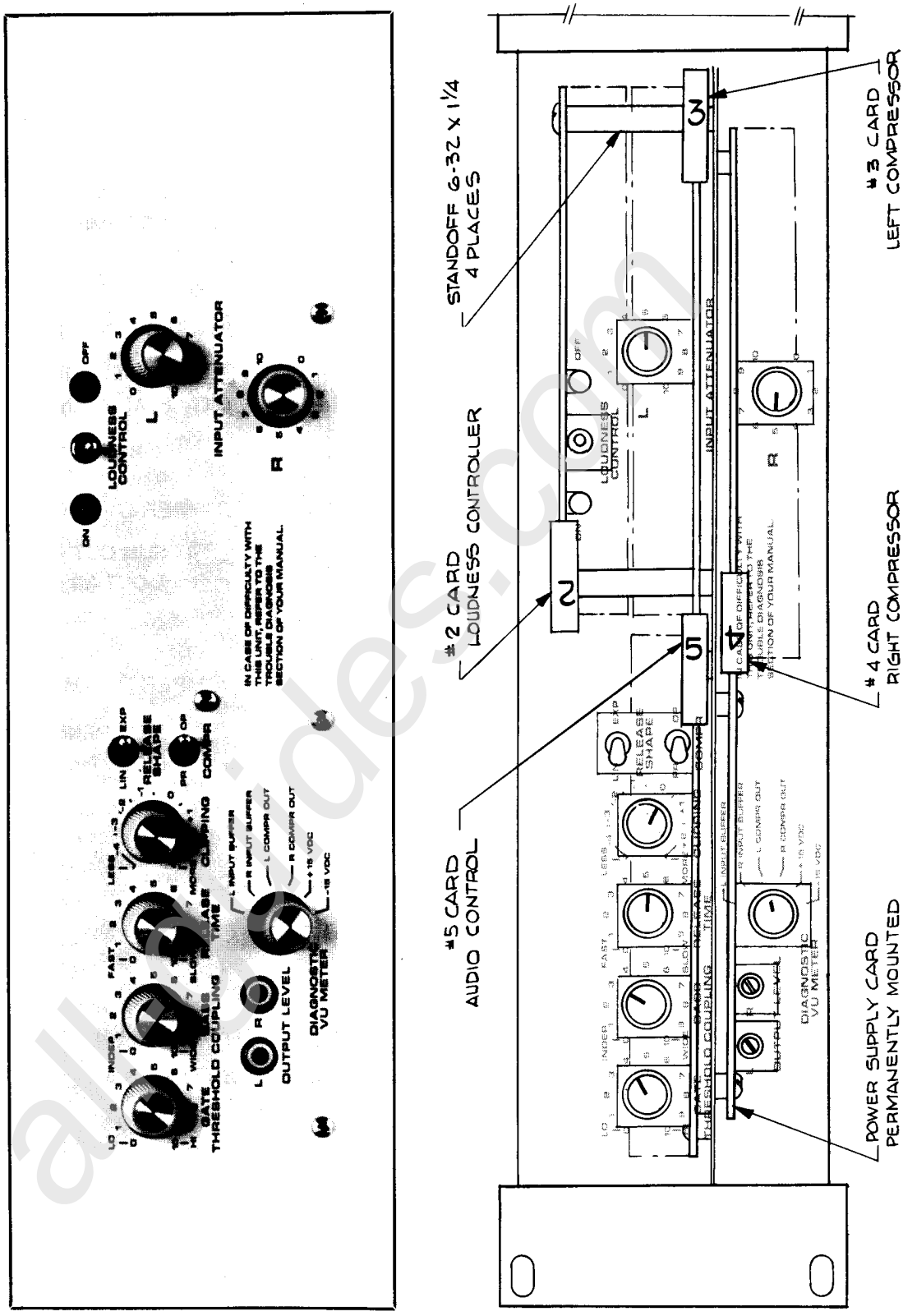

Figure 2: Card Positions, 8182A/ST Studio Chassis

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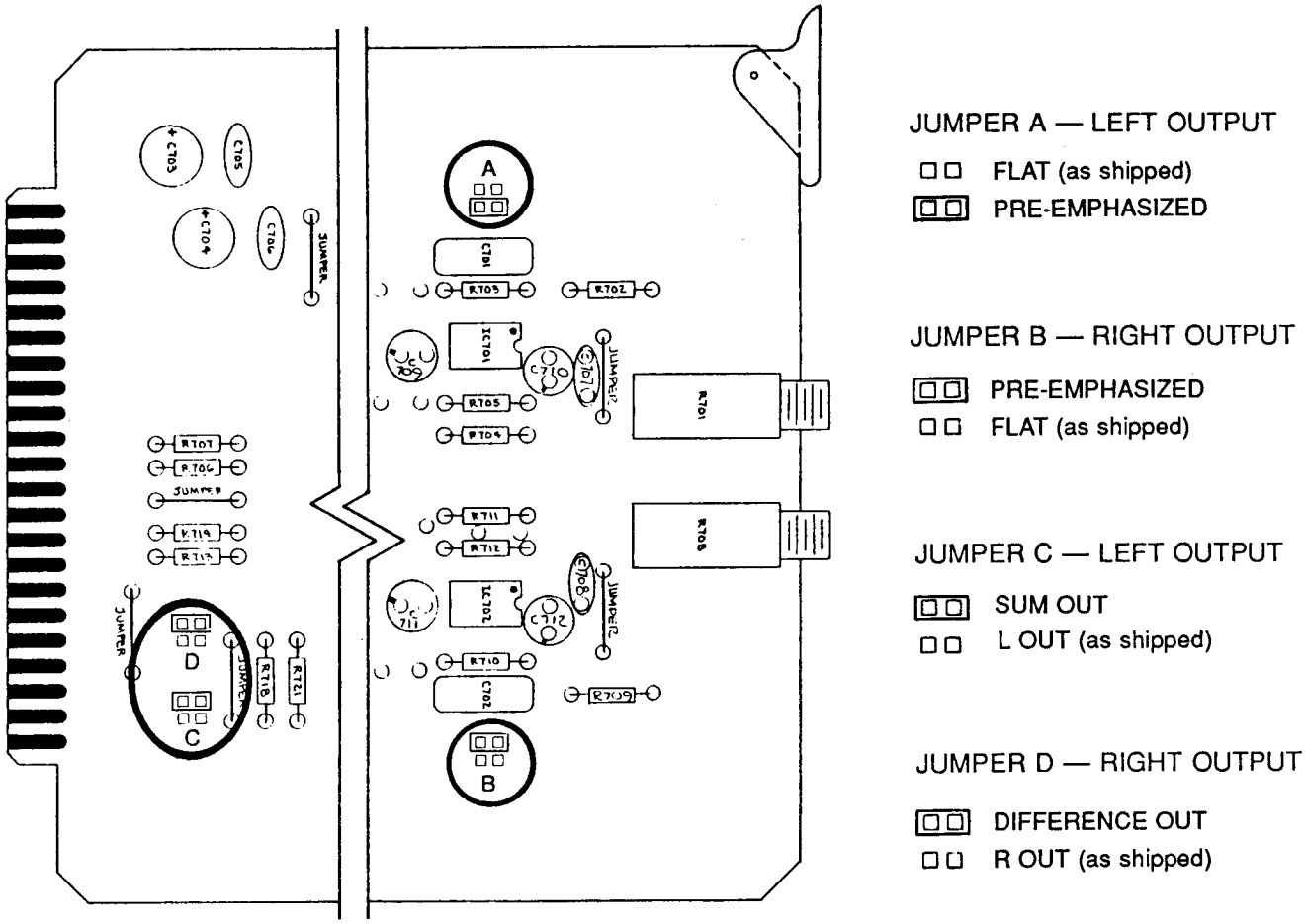

Figure 3: Jumper Positions, 8182A Audio Processor Card #7

5) Rewire Audio Processor's ACCESSORY PORT.

[Skip this step unless the serial number of your 8182A Audio Processor is below 780000.]

A rewire kit is supplied with each 8182A/SG Stereo Generator. Instructions are given in Appendix I of the 8182A/SG Operating Manual.

6) Reassemble units.

a) Replace the subpanels and close the front panels of the Audio Processor and Stereo Generator.

Be sure that all four fasteners on each subpanel are engaged, since these subpanels are part of the units' RF shielding.

b) Replace the top and bottom covers of the Studio Chassis, taking care not to strip the threads in the chassis.

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7) Set Audio Processor's rear-panel STEREO GENERATOR switch to IN.

This switch is labeled "NOISE REDUCTION" on earlier units.

8) Mount and ground units.

a) Mount units in racks.

The Stereo Generator must be mounted immediately above (or below) the Audio Processor. The Stereo Generator is ordinarily located close to the transmitter's aural exciter or wideband composite microwave subcarrier processor. The Studio Chassis, when used, is located in the studio.

b) Connect the Stereo Generator's circuit ground (⏚) to the station's RF system ground.

c) Connect the chassis ground jumper (attached to the rear of the Stereo Generator chassis) to one of the screws circled in black on the rear of the Audio Processor chassis.

d) To drive a *balanced* exciter input, connect the Stereo Generator's circuit and chassis grounds to each other at the rear-panel terminals.

To drive an *unbalanced* exciter input, DO NOT connect the Stereo Generator's chassis and circuit grounds together.

Since the Audio Processor and Stereo Generator are connected through the jumper cable, DO NOT connect the Audio Processor's circuit and chassis ground terminals together.

e) Connect the Audio Processor to the Stereo Generator with the 14-pin jumper cable supplied with the Stereo Generator.

9) Connect sync input.

a) Connect sync or composite video to the Stereo Generator's rear-panel SYNC IN (J1) connector.

b) Set the SYNC INPUT TERMINATION IMPEDANCE switch to 75 OHMS, unless you wish to loop the sync signal through the Stereo Generator. For loop-through, set the switch to HI-Z and take the output from SYNC OUT connector J2.

Do not connect audio inputs or composite output at this time.

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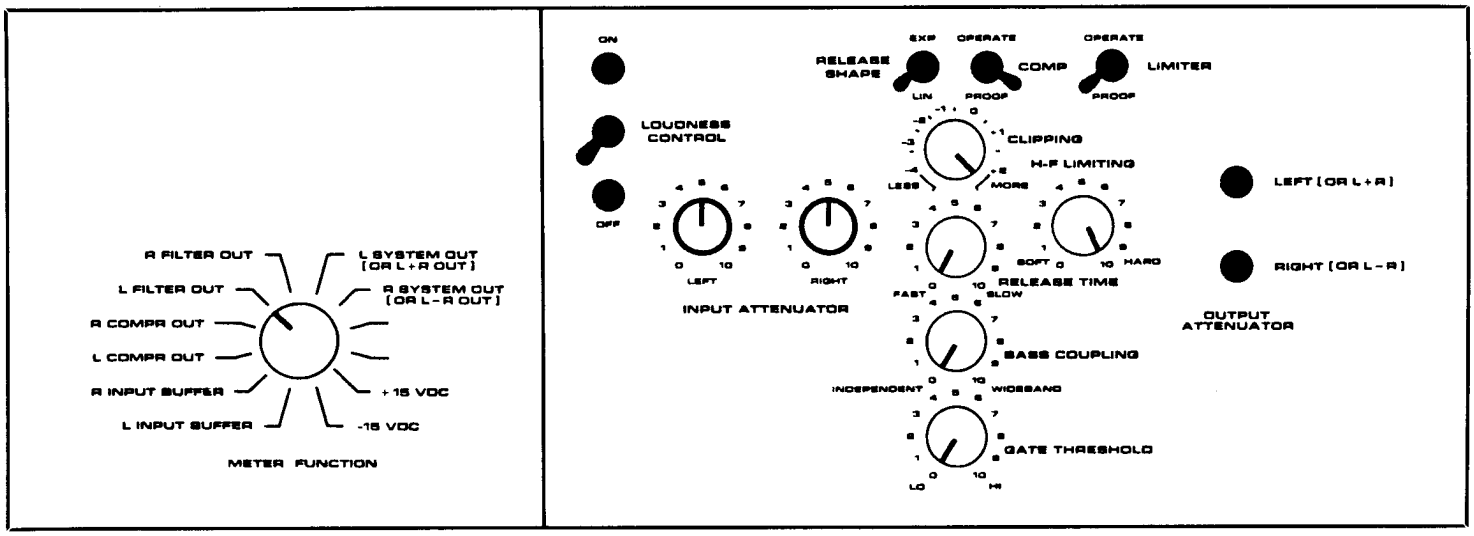
8182A:



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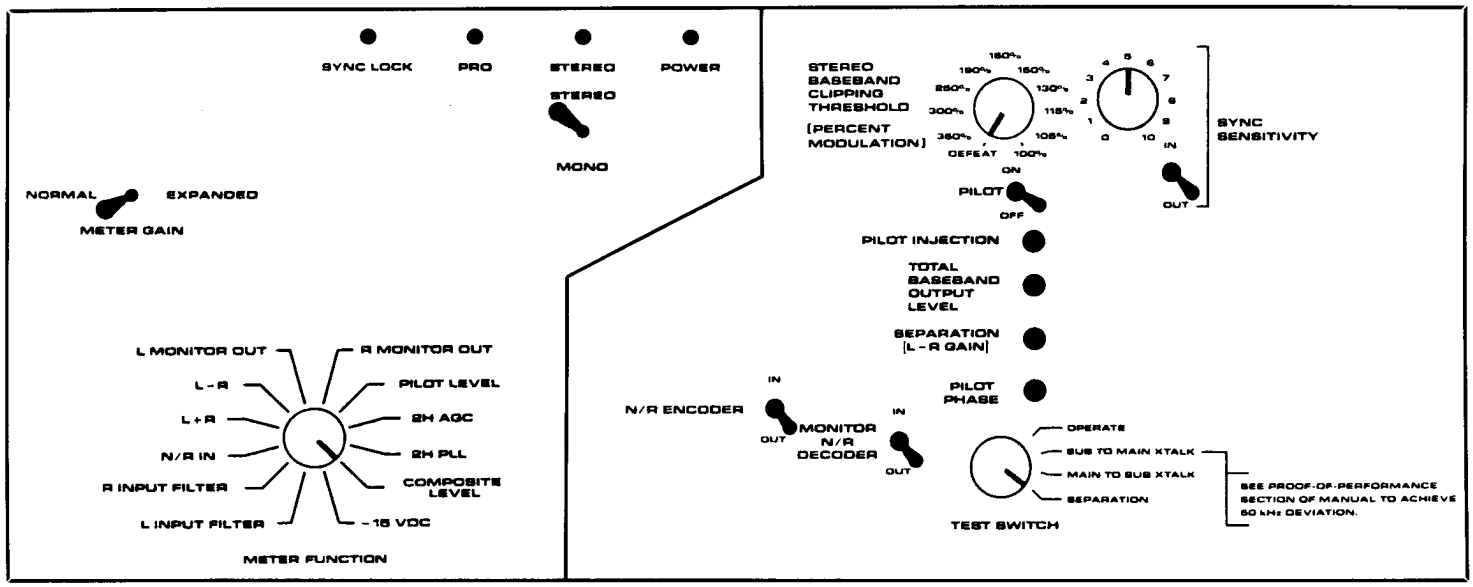

Figure 4: Control Settings for Steps 11 and 14

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SET-UP

10) Zero VU meters.

a) Set the Audio Processor's VU meter selector to one of the unlabeled positions.

b) Set the Stereo Generator's VU meter selector to PILOT LEVEL.

c) Set the Stereo Generator's STEREO/MONO switch to MONO.

d) Mechanically zero the VU meters on both the Audio Processor and Stereo Generator.

11) Verify baseband generator separation and pilot phase.

a) Set controls as shown in Figure 4. Verify that the Stereo Generator's SYNC LOCK LED is lit.

If you are using the optional Studio Chassis, set only the screwdriver-adjust INPUT ATTENUATORS as shown. Ignore the missing controls.

If the INPUT ATTENUATORS have been adjusted to match studio levels, do not change them.

b) Patch an audio oscillator into the Audio Processor's L INPUT. Set its frequency to 1kHz.

Be sure that no signal is fed to the R INPUT.

c) Adjust the output level of the oscillator until the Audio Processor's VU meter reads "0VU" ±1VU.

d) Adjust the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until its VU meter reads approximately "−6VU".

If the TOTAL BASEBAND OUTPUT LEVEL control has been previously adjusted for the Bessel null, do not change the setting.

e) Connect the COMPOSITE OUTput of the Stereo Generator to an oscilloscope.

Use a triggered-sweep oscilloscope with a DC-coupled input. DO NOT use an attenuator probe. Trigger the oscilloscope externally from the audio oscillator.

f) Adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Figure 5. Verify that the baseline is flat.

A flat baseline indicates that the Stereo Generator is adjusted for best separation. All 8182A/SG Stereo Generators are shipped from the factory correctly adjusted. If your Stereo Generator is "factory fresh" and the baseline appears to be curved, check it on another oscilloscope before assuming that the Stereo Generator is not correctly adjusted. (Some scopes have vertical amplifier problems that will distort the baseline.) If the baseline appears curved on more than one scope, flatten it by adjusting the Stereo Generator's SEPARATION control. Increase the scope's vertical gain to see the baseline more clearly.

g) Set oscillator to 50Hz. Re-adjust oscillator output level until the Audio Processor's VU meter reads "0VU" ±1VU. Verify that the baseline is flat.

h) Set oscillator to 14kHz. Re-adjust oscillator output level until the Audio Processor's VU meter reads "0VU" ±1VU. Verify that the baseline is flat.

i) Set oscillator to 1kHz. Re-adjust oscillator output level until the Audio Processor's VU meter reads "0VU" ±1VU.

j) Set the 8182A/SG's PILOT switch to ON.

k) Set the 8182A/SG's TEST switch to SUB TO MAIN XTALK.

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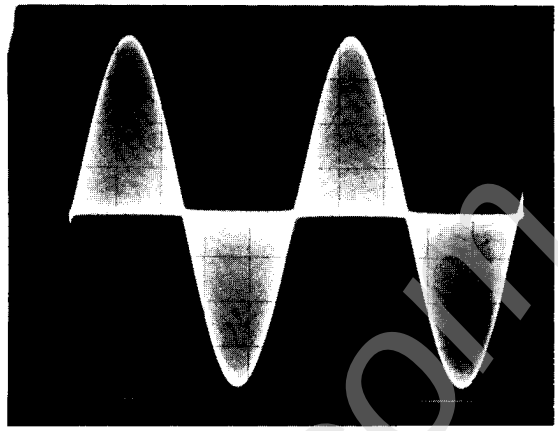

Figure 5: Oscilloscope Display, Step 11f

l) Adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the left-hand one in Figure 6. Verify that the "tips" where the waveforms intersect are perfectly horizontal and level. If they are not, adjust the Stereo Generator's PILOT PHASE control until they are.

The "tips" will be perfectly horizontal when pilot phase is correct. Expand the oscilloscope's vertical scale by 10×, and expand its sweep to more closely examine these "tips" (see the right-hand display in Figure 6).

m) Set the 8182A/SG's PILOT switch to OFF.

n) Disconnect the oscilloscope.

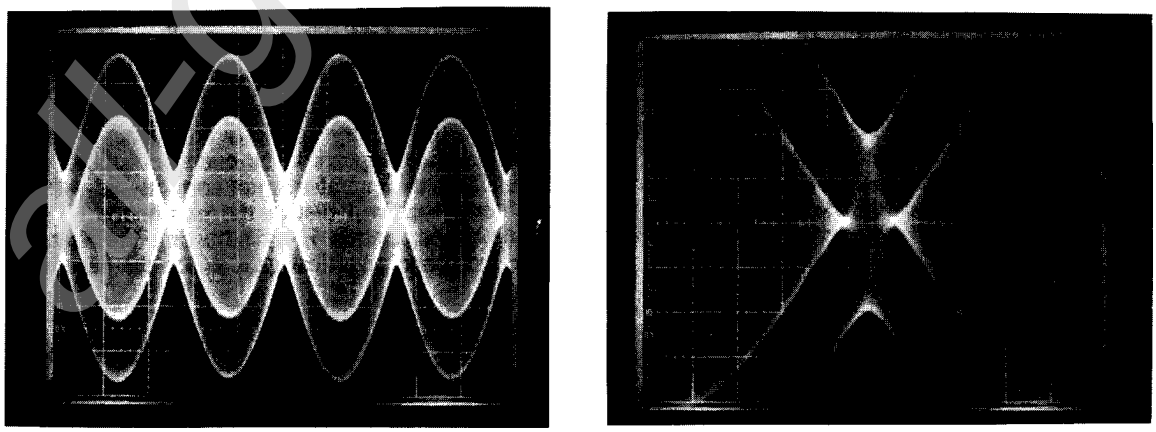

Figure 6: Oscilloscope Displays, Step 11-L

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12) Connect Stereo Generator to exciter.

To feed one exciter, connect the Stereo Generator's COMPOSITE OUTput to the wideband composite input of the aural exciter. Use a 50- or 75-ohm coaxial cable.

Often, best performance is achieved when the exciter's 50- or 75-ohm termination resistor is replaced by a 1000-ohm resistor and jumper A on the 8182A/SG's Card #7 is in the "0Ω" position. (Because of the low frequencies involved, do not be concerned that this will cause mismatches between the cable, source, and load.)

To feed more than one exciter, install one or more BNC M-F-F "T" adapters on the Stereo Generator's COMPOSITE OUTput. Use a separate 50- or 75-ohm coaxial cable to connect the COMPOSITE OUTput to the wideband composite input of each aural exciter. Jumper A on the 8182/SG's Card #7 *must* be in the "0Ω" position.

The Stereo Generator is capable of driving a total load impedance of 37.5 ohms or greater. However, best performance is often achieved when the exciter's 50- or 75-ohm termination resistor is replaced by a 1000-ohm resistor. This results in best isolation between exciter inputs.

13) Match Stereo Generator to exciter (Bessel null).

a) Set controls as shown in Figure 7. Turn the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control fully counterclockwise (up to 18 full turns).

If you are using the optional Studio Chassis, ignore the missing controls.

b) Patch an audio oscillator into the Audio Processor's L INPUT. Set its frequency to 10,396Hz, and verify with a counter that the oscillator frequency is 10,396Hz ±10Hz.

Alternately, use the Tektronix 1405 as a source of 10,396Hz signal.
Be sure that no signal is fed to the R INPUT.

c) Adjust the output level of the oscillator (or 1405) until the Audio Processor's VU meter reads "0VU" ±1VU.

d) Carefully adjust the Audio Processor's L+R (LEFT) OUTPUT ATTENUATOR control until the Stereo Generator's VU meter reads *exactly* "0VU".

Observe the meter head-on to avoid parallax error (the meter pointer should exactly cover the dot below "0VU").

e) Connect an RF spectrum analyzer to a sample of the output of the aural exciter or aural transmitter.

If feeding more than one exciter sample the "main" exciter first.

If a spectrum analyzer is not available, read the box on page 12.

f) Turn on the aural exciter (and transmitter, if necessary).

For ease of adjustment, turn off the visual transmitter, if possible.

g) Slowly turn the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control clockwise until the carrier nulls for the first time (see Figure 8).

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If a Spectrum Analyzer Is Not Available

The following discusses the use of a communications receiver, modulation monitor, or consumer television receiver to do a Bessel null adjustment when a spectrum analyzer is not immediately available.

Communications Receiver: The Bessel null procedure can be done with satisfactory accuracy using a communications receiver with a narrow IF bandpass (less than ±6kHz at −60dB) and with a continuous-wave (CW) listening facility equipped with a beat-frequency oscillator (BFO). Results should be as accurate as those obtained by using a spectrum analyzer.

Start with an unmodulated aural carrier, and tune the receiver to the carrier — use the BFO to hear the presence of the carrier. Use the narrowest available IF bandwidth. Defeat the AGC, if possible. Then apply the 10,396Hz tone (as in step 13) and adjust the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until the audio output of the receiver nulls for the first time. (It is perfectly feasible to do this by ear, but you can also connect an AC voltmeter to the headphone output of the receiver if you want to double-check the null.)

Modulation Monitor: If neither a spectrum analyzer nor a communications receiver is available, a *temporary* adjustment can be made using a modulation monitor. A stereo monitor will give somewhat better results than a mono monitor.

Mono monitor: Apply a 10,396Hz tone as in step 13. Adjust the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until the modulation monitor indicates 100% modulation (±25kHz deviation) of the main channel.

> Because the FCC formerly required only ±5% accuracy for mono monitors, they cannot be used to achieve the ±1% BTSC-level calibration accuracy required for best performance. Using a mono monitor to match the Stereo Generator to the exciter can, therefore, result in BTSC-mode separation as low as 25dB (or lower, if there are other system errors, or if the monitor is not properly calibrated). Since this level of performance is below that specified by OET-60A, it is in violation of 1987 FCC Rules (USA). If you use a mono monitor, perform the Bessel null properly with a spectrum analyzer or communications receiver as soon as one of these instruments is available.

Stereo monitor: Apply a 10,396Hz tone as in step 13. Adjust the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until the modulation monitor indicates 100% modulation (±25kHz deviation) of the main channel. Proceed with the remainder of the set-up (steps 14 through 20). Then, feed program material to the left channel and disconnect the audio feed to the right channel. Fine-adjust the TOTAL BASEBAND OUTPUT LEVEL control until the modulation monitor indicates that right channel modulation has nulled.

> Using a stereo monitor to match the Stereo Generator to the exciter will probably result in separation performance that exceeds OET-60A specifications. The full separation performance potential of your system will, however, probably not be realized. Perform the Bessel null properly with a spectrum analyzer or communications receiver as soon as one of these instruments is available.

Consumer Stereo Television Receiver: We *do not* recommend use of a consumer stereo television as a reference for temporarily adjusting the TOTAL BASEBAND OUTPUT LEVEL control because independent test labs have found that the alignment of consumer receivers varies widely. (See, for example the test reports in *Video Review* magazine.)

The best consumer receivers and VCRs exhibit separation on the order of 30dB; the worst as low as about 15dB. We assume that most of the source of this error is incorrect noise reduction decoder tracking in the receiver. Alignment of your generator on the basis of such as receiver can result in separation not only below that required by OET-60A, but even below that necessary to provide a satisfactory subjective stereo effect!

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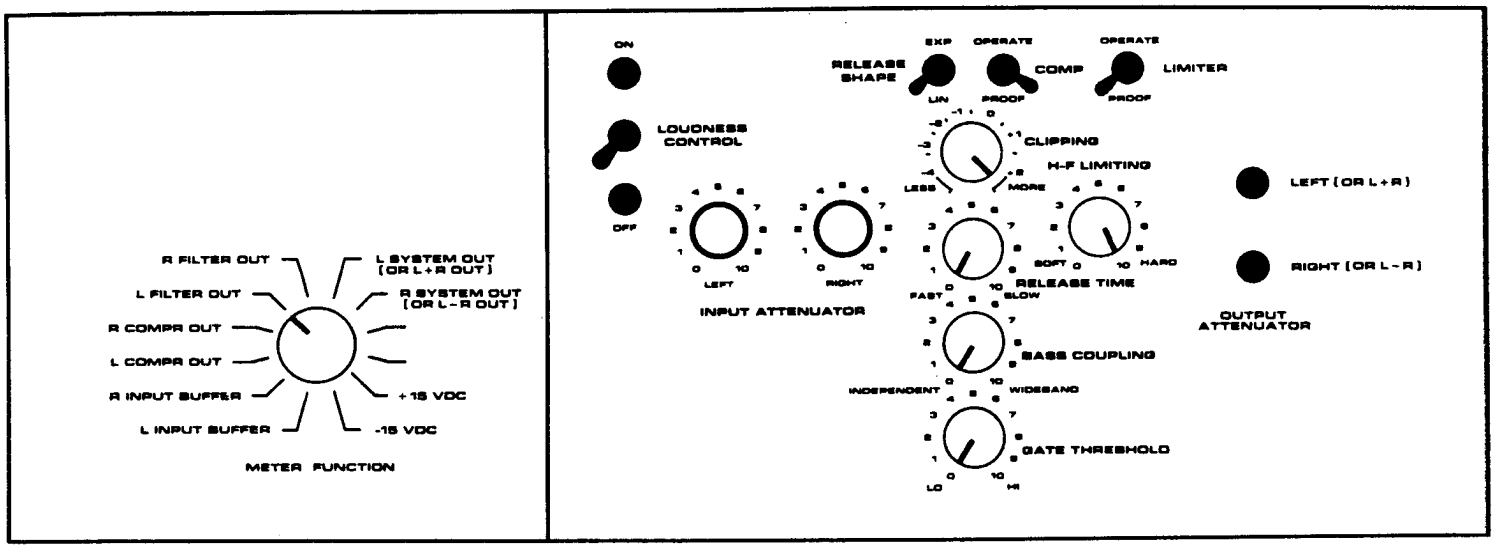
Only the two shaded controls on the 8182A/SG are set differently than in the last control settings figure.

8182A:



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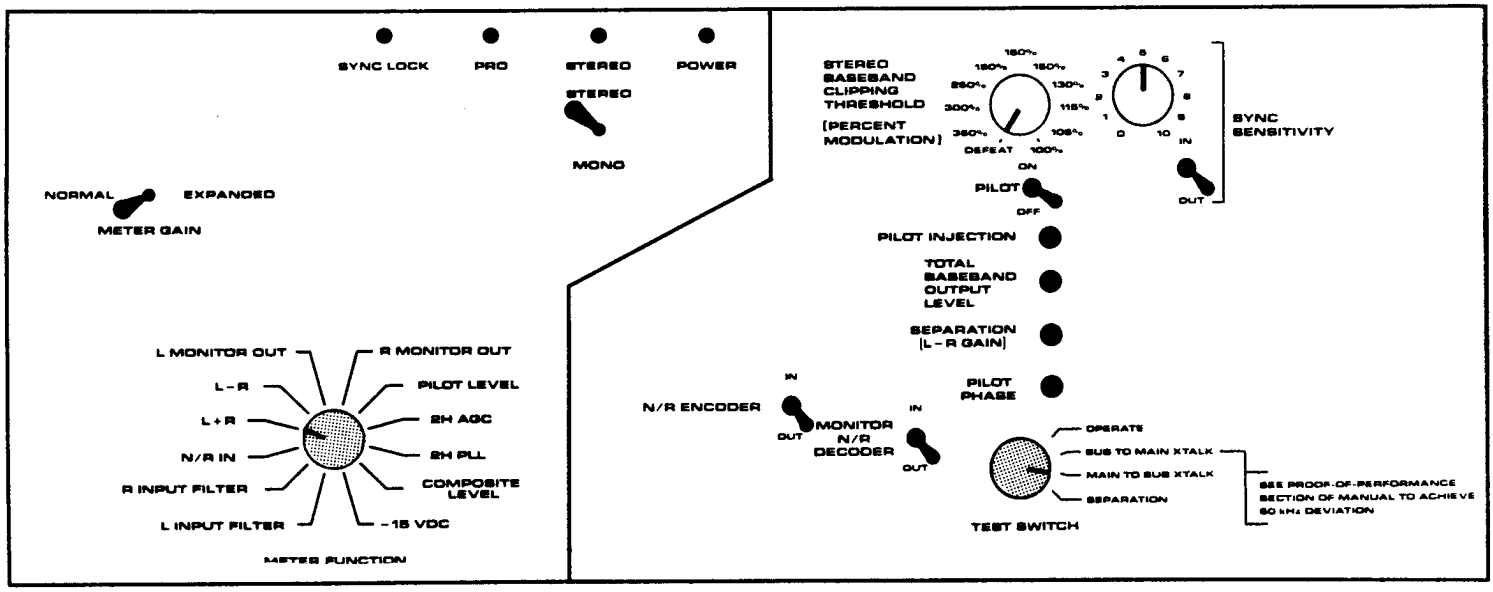

Figure 7: Control Settings for Step 13

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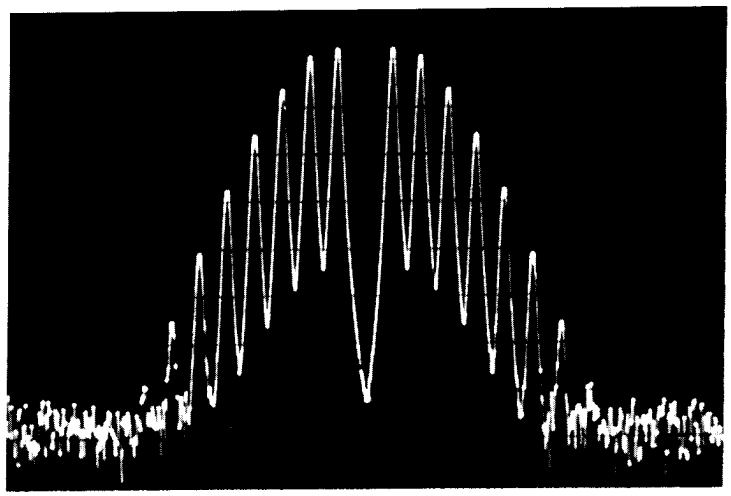

Figure 8: Bessel Null (see step 13g)
(Typical display)

h) Set the Stereo Generator's VU meter selector switch to COMPOSITE LEVEL and verify that the meter reads between "−3VU" and "−8VU".

If it does not, the exciter's input level control is misadjusted. To correct this, adjust the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until the VU meter reads "−6VU". Then adjust the exciter's input level control to achieve the first Bessel null.

The RS-508 standard states that exciter input sensitivity should be 1.00V p–p at 100% main channel modulation (±25kHz).

i) *If you are feeding more than one exciter*, repeat steps e and f for the second exciter, then adjust the second exciter's input level control to achieve the first Bessel null. Adjust additional exciters in the same way.

Do not change the setting of the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control.

NOTE: The level relationship between the the Stereo Generator and the exciter(s) is now precisely set. **DO NOT ALLOW THIS RELATIONSHIP TO CHANGE.** *Do not re-adjust* the Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control. Such changes will cause errors in tracking between the dbx® noise reduction in the Stereo Generator and that in the receiver, leading to rapid deterioration of separation.

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14) Verify separation through transmitter.

[Skip this step if you do not have access to a demodulator with a wideband composite output.]

a) Set controls as shown in Figure 4.

If you are using the optional Studio Chassis, set only the screwdriver-adjust INPUT ATTENUATORS as shown. Ignore the missing controls.

b) Patch an audio oscillator into the Audio Processor's L INPUT. Set its frequency to 1kHz.

Be sure that no signal is fed to the R INPUT.

c) Adjust the output level of the oscillator until the Audio Processor's VU meter reads "0VU" ±1VU.

d) Demodulate the off-air signal with a precision RF demodulator or a stereo (*not* mono) baseband monitor with a composite output.

e) Connect the composite baseband output of the demodulator (or baseband monitor) to a triggered-sweep oscilloscope.

Use DC coupling on the oscilloscope input. DO NOT use an attenuator probe. Trigger the oscilloscope externally from the audio oscillator.

f) Adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Figure 5.

A flat baseline indicates proper separation at the output of the transmitter. If the baseline is curved, the exciter/transmitter system does not have perfectly flat frequency response and/or phase response in the BTSC passband. You can compensate for this to some degree by adjusting the Stereo Generator's SEPARATION control. Increase the oscilloscope's vertical sensitivity to see the baseline more clearly.

Separation can be estimated from the oscilloscope display using the formula:

$$S = 20[\log(P/D)]$$

S = Separation in dB
P = peak-to-peak level of the total baseband in volts
D = peak-to-peak deviation from perfect flatness in volts

If separation is less than 40dB after adjusting the SEPARATION control, the most likely cause is severe bandwidth limitations in the transmission path. If this is the case, separation at 14kHz (measured in step h, below) will be much worse than it is at 1kHz.

g) Set the audio oscillator frequency set to 50Hz, adjust the oscillator's output level until the Audio Processor's VU meter reads "0VU" ±1VU, then adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one shown in Figure 5.

If the baseline was flat at 1kHz, but is now curved at 50Hz, there is a problem either with the time-constant of the exciter's AFC or with inadequate low-frequency response. Test the AFC time-constant by turning off the exciter's AFC circuit and observing the baseline. If it flattens, the time-constant needs to be increased.

Test low-frequency response by connecting the audio oscillator directly to the exciter's composite input, then sweeping the audio oscillator from 400Hz down to 5Hz while observing the amplitude of the demodulated audio on the oscilloscope. It should remain flat.

DO NOT readjust the Stereo Generator's SEPARATION *control to try to correct loss of separation at 50Hz.*

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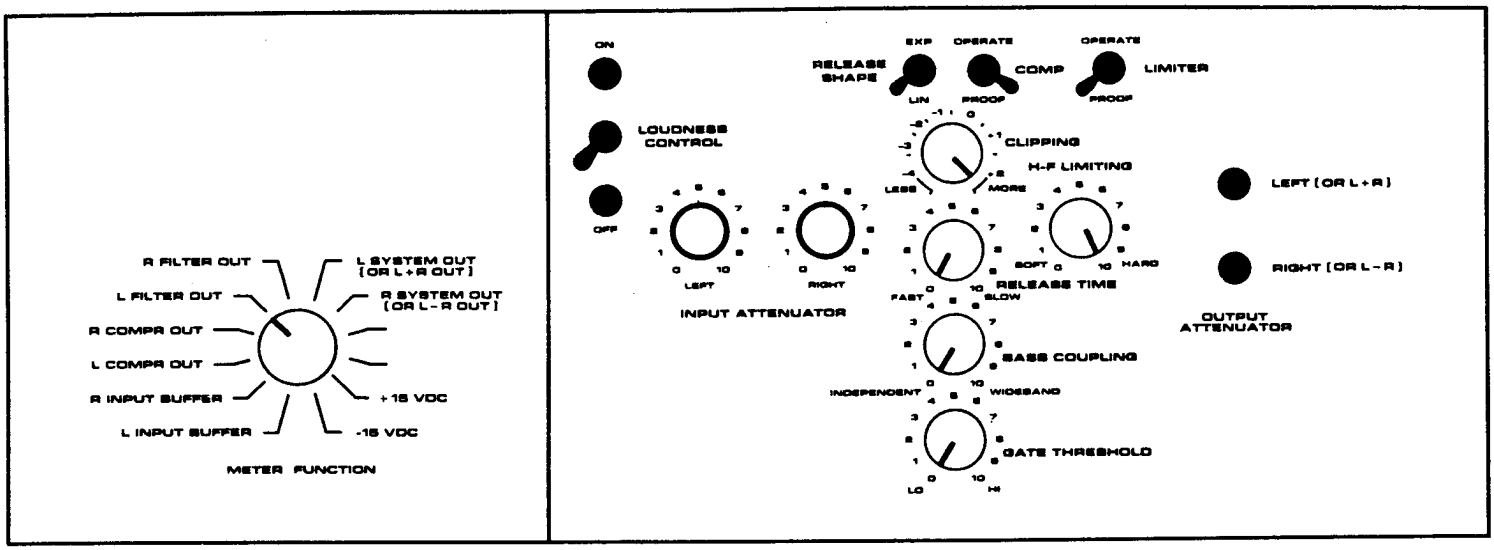
Only the four shaded controls on the 8182A/SG are set differently than in the last control settings figure.

8182A:



8182A/SG:

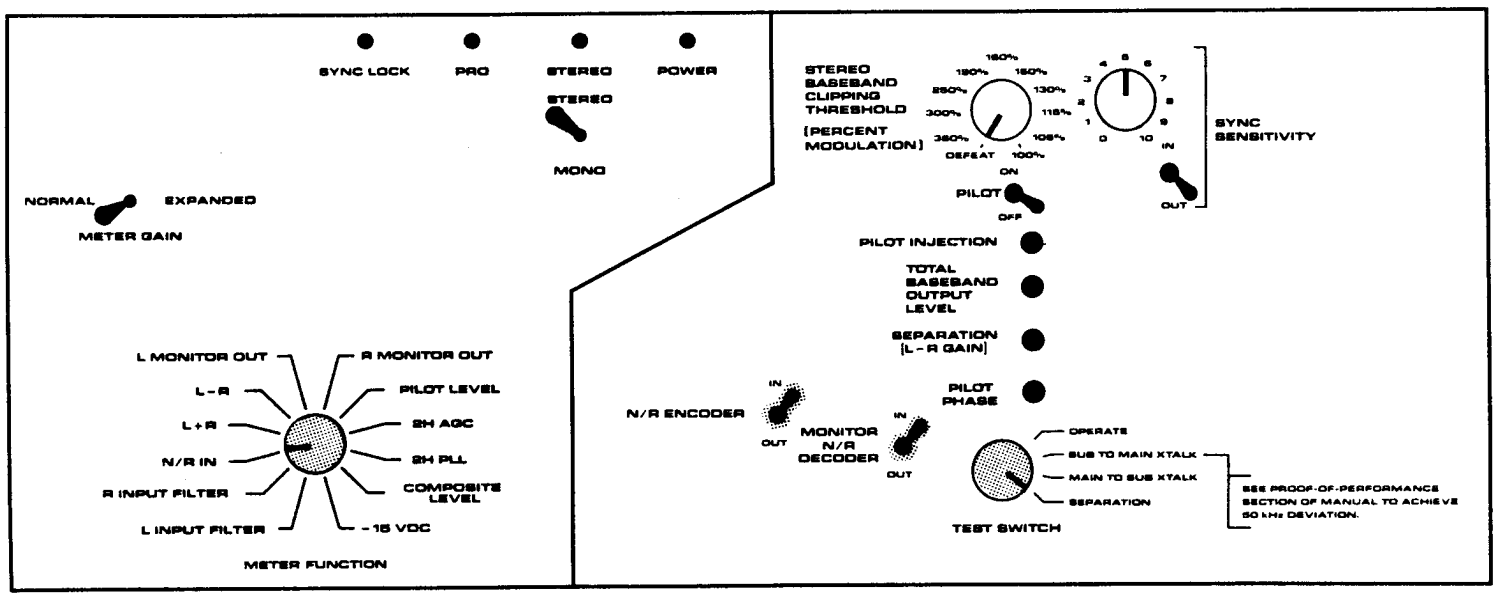


Figure 9: Control Settings for Step 15

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h) Repeat step g with the audio oscillator frequency set to 14kHz. Adjust the oscillator's output level until the Audio Processor's VU meter reads "0VU" ±1VU.

If the baseline was flat at 1kHz and 50Hz, but is now curved at 14kHz, the problem probably is insufficient bandwidth in the exciter, RF amplifier, or diplexer.

DO NOT readjust the Stereo Generator's SEPARATION *control.*

i) Disconnect the oscilloscope.

15) Match levels of Audio Processor and Stereo Generator.

a) Set controls as shown in Figure 9.

If you are using the optional Studio Chassis, ignore the missing controls.

b) Patch an audio oscillator into the Audio Processor's L INPUT. Set its frequency to 100Hz.

Be sure that no signal is fed to the R INPUT.

c) Adjust the output level of the oscillator until the Audio Processor's VU meter reads *exactly* "+3VU".

d) Adjust the Audio Processor's L–R (RIGHT) OUTPUT ATTENUATOR control until the Stereo Generator's VU meter reads precisely "0VU" (100).

e) Set the Stereo Generator's VU meter selector to R MONITOR OUT.

f) Adjust the Audio Processor's L+R (LEFT) OUTPUT ATTENUATOR control until the Stereo Generator's VU meter nulls. Then set the Stereo Generator's METER GAIN switch to EXPANDED and fine-adjust the null. Reset the METER GAIN switch to NORMAL.

16) Match levels of Audio Processor and Studio Chassis.

[Skip this step if you are not also installing the 8182A/ST Studio Chassis.]

a) Connect the program lines to the Studio Chassis' input, and the Studio Chassis' outputs to the STL inputs, and the STL outputs to the Audio Processor's inputs.

See notes on cabling, grounding, phase, and impedance in step 17.

b) Set controls as shown in Figure 10.

Since the LOUDNESS CONTROL switch is momentary, it will reset to its jumper-selected power-up setting after any interruption of AC power. Set it to OFF again, just to be sure.

c) Patch an audio oscillator into the L INput of the Studio Chassis. Set its frequency to 1kHz.

Be sure that no signal is fed to the R INPUT.

d) Adjust the output level of the oscillator so the TOTAL MASTER G/R meter on the Studio Chassis reads "0dB".

e) Adjust the Studio Chassis' OUTPUT LEVEL controls. If you are driving land lines, a M/A-COM PAC-10 modulator, or an STL with a modulation meter, follow the instructions in the following paragraphs. Otherwise, follow the instructions in the box on page 20.

All manuals and user guides at all-guides.com

Land lines — USA-standard land lines are not pre-emphasized and require a nominal drive level of +8dBm. Turn the Studio Chassis OUTPUT LEVEL controls fully clockwise.

M/A-COM PAC-10/12 — Follow the instructions in the PAC-10 and PAC-12 manuals to change the pre-emphasis and de-emphasis from 75μs to flat. Turn the Studio Chassis' OUTPUT LEVEL controls fully clockwise.

STL WITH METER — Adjust the Studio Chassis' L OUTPUT LEVEL control until the modulation meter on the microwave STL transmitter reads 8dB below its nominal 100% modulation level (for STL subcarriers that are not pre-emphasized) or until it reads 12dB below its nominal 100% modulation level (for STL subcarrier with 50μs or 75μs pre-emphasis).

f) Adjust the Audio Processor's LEFT INPUT ATTENUATOR control until its VU meter reads "100" (0VU).

If the LEFT INPUT ATTENUATOR control will not adjust the meter to this level, you may need to restrap the input attenuation pads on Cards #3TX and #4TX. See the 8182A/ST Operating Manual for further information.

g) Disconnect the audio oscillator from the L INput of the Studio Chassis and connect it to the R INput.

h) Adjust oscillator output level until the Studio Chassis' TOTAL MASTER G/R meter reads "0dB".

i) Set the Audio Processor's VU meter selector to R COMPR OUT.

j) Adjust the Studio Chassis' R OUTPUT LEVEL control and the Audio Processor's RIGHT INPUT ATTENUATION control as in steps d and e, above.

k) Disconnect the oscillator.

17) Connect audio inputs and outputs.

If you are installing a Studio Chassis, you have already connected the program lines to the Studio Chassis input, the Studio Chassis outputs to the STL inputs, and the STL outputs to the Audio Processor's inputs.

a) *If you are not installing a Studio Chassis*, connect the program lines directly to the Audio Processor's inputs.

In a ***high RF radiation field***, run fully-balanced audio to the Audio Processor (or Studio Chassis) in 100% foil-shielded twisted-pair cable (e.g., Belden 8451). Connect the shield to chassis ground at the source; connect the shield through a 470pF disc capacitor with leads less than 1/4-inch long to the INPUT chassis ground terminal on the Audio Processor. In a ***low RF radiation field***, run balanced audio in shielded cable with the shield connected to chassis ground at the ***source end only***.

Right and left audio inputs ***must be in phase***. Connect red and black wires within all shielded cables symmetrically and consistently.

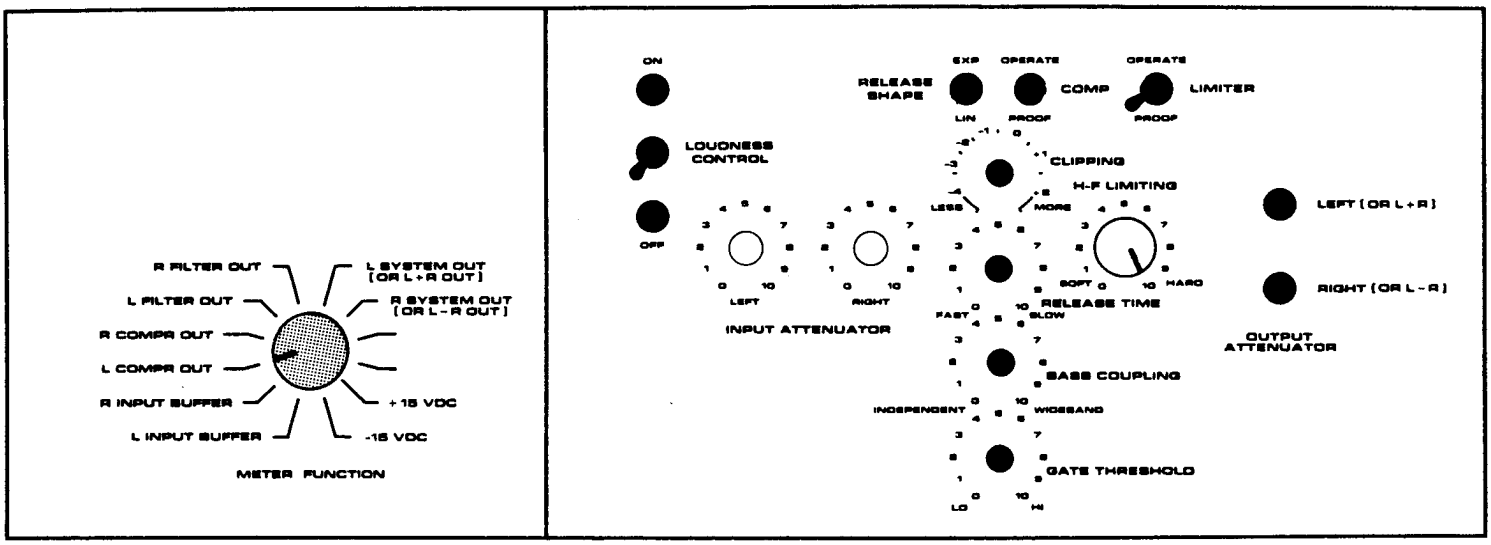
The Audio Processor and Studio Chassis inputs are ***balanced bridging***. Their impedance is 10K. If the audio source requires a 600-ohm termination, connect a 620-ohm ±5% 1/2-watt carbon film resistor (supplied) across each audio input.

The audio outputs of the Studio Chassis are suitable for driving a land line directly, or for driving the balanced input of a microwave STL transmitter. They present a 600-ohm pure-resistive source impedance, balanced to ground, with a nominal peak output level of +10dBm when loaded by 600 ohms. If you are driving a high-impedance load, do not terminate the output with 600 ohms. If you wish to drive an unbalanced input, see the 8182A/ST Operating Manual for further information.

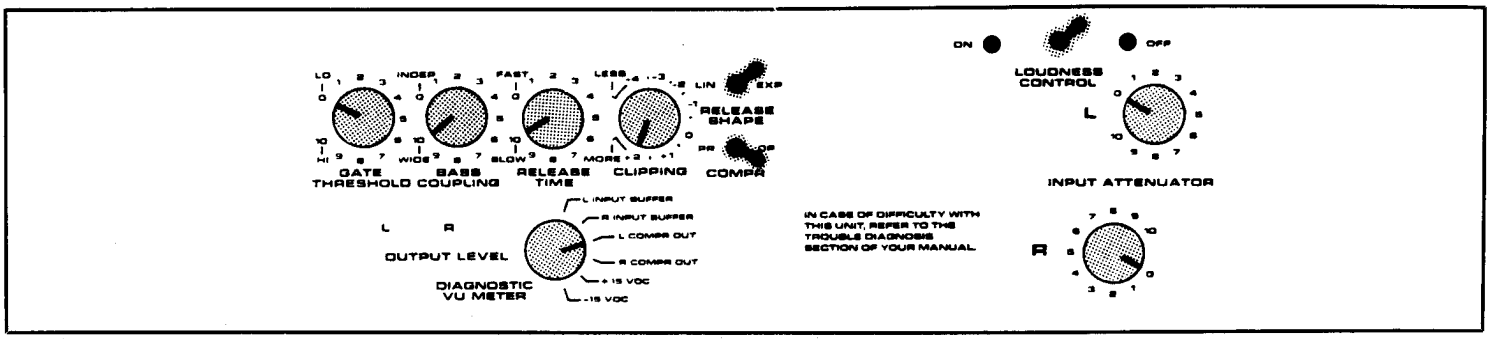
All manuals and user guides at all-guides.com

Only the shaded controls (one on the 8182A and all 8182A/ST controls) are set differently than in the last control settings figure.

8182A:



8182A/ST:



8182A/SG:

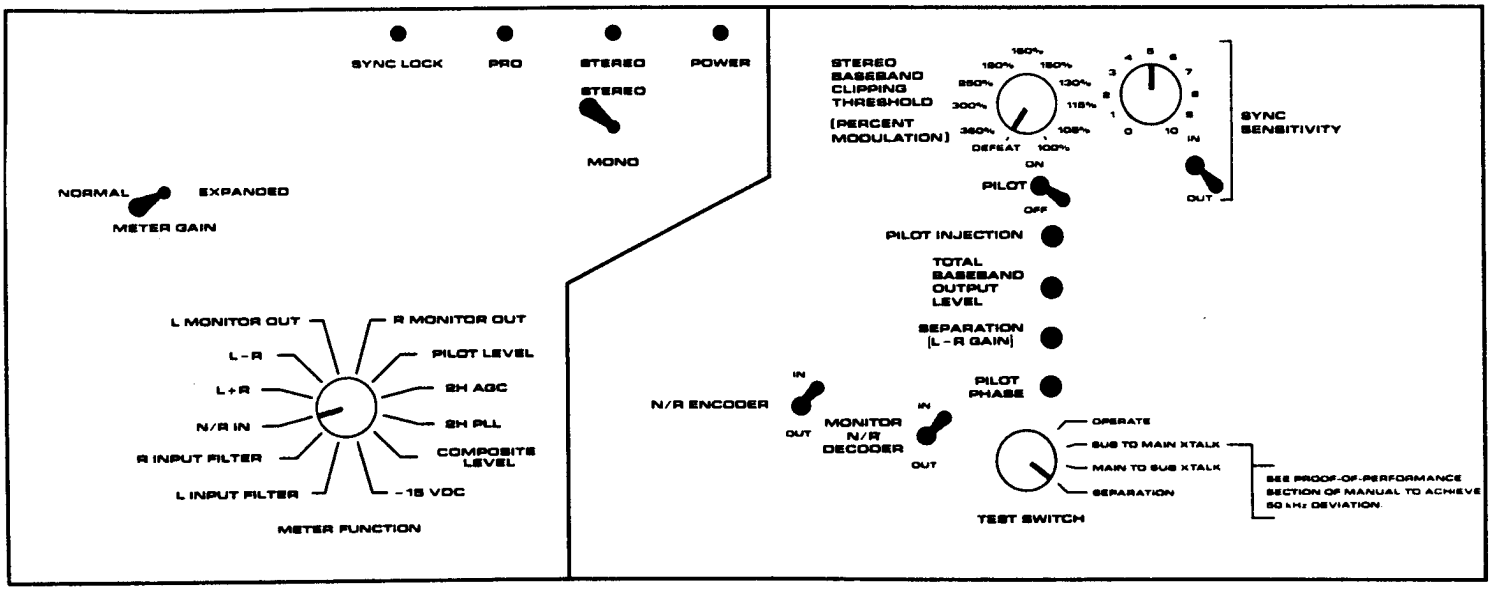


Figure 10: Control Settings for Step 16

All manuals and user guides at all-guides.com

Adjusting Input Level for STLs Without Meters

If your STL is not a land line or M/A-COM PAC-10/12, and does not have a modulation meter, use the following procedure to adjust the Studio Chassis' OUTPUT LEVEL controls, instead of those in step 16e.

1) Feed wideband program audio into the L INput of the Studio Chassis.
2) Adjust the Studio Chassis' L INPUT ATTENUATOR control until the Studio Chassis' TOTAL MASTER G/R meter reads "0dB".
3) Turn the Studio Chassis' OUTPUT LEVEL controls fully clockwise.
4) Connect an oscilloscope to the output of the STL subcarrier demodulator (at the transmitter).
5) Measure the clipping level (the level which the audio waveform peaks cannot exceed) in volts peak-to-peak.
6) Turn the Studio Chassis' L OUTPUT LEVEL control until none of the audio waveform peaks observed on the oscilloscope exceed 1/2 of the clipping level measured in step 5 on this page.

   The Studio Chassis' L OUTPUT LEVEL control is now set.
   DO NOT CHANGE THIS SETTING.

7) Disconnect the program feed and connect an audio oscillator to the Studio Chassis' L INput. Set its frequency to 1kHz.
8) Adjust the Studio Chassis' L INPUT ATTENUATOR control until the Studio Chassis' TOTAL MASTER G/R meter reads "0dB".
9) Measure the Studio Chassis' left output level.
10) Connect an audio oscillator to the Studio Chassis' R INput. Set its frequency to 1kHz.
11) Adjust the Studio Chassis' R INPUT ATTENUATOR control until the Studio Chassis' TOTAL MASTER G/R meter reads "0dB".
12) Adjust the the Studio Chassis' R OUTPUT LEVEL control until the Studio Chassis' right output level is the same as that measured for the left output in step 9 on this page.

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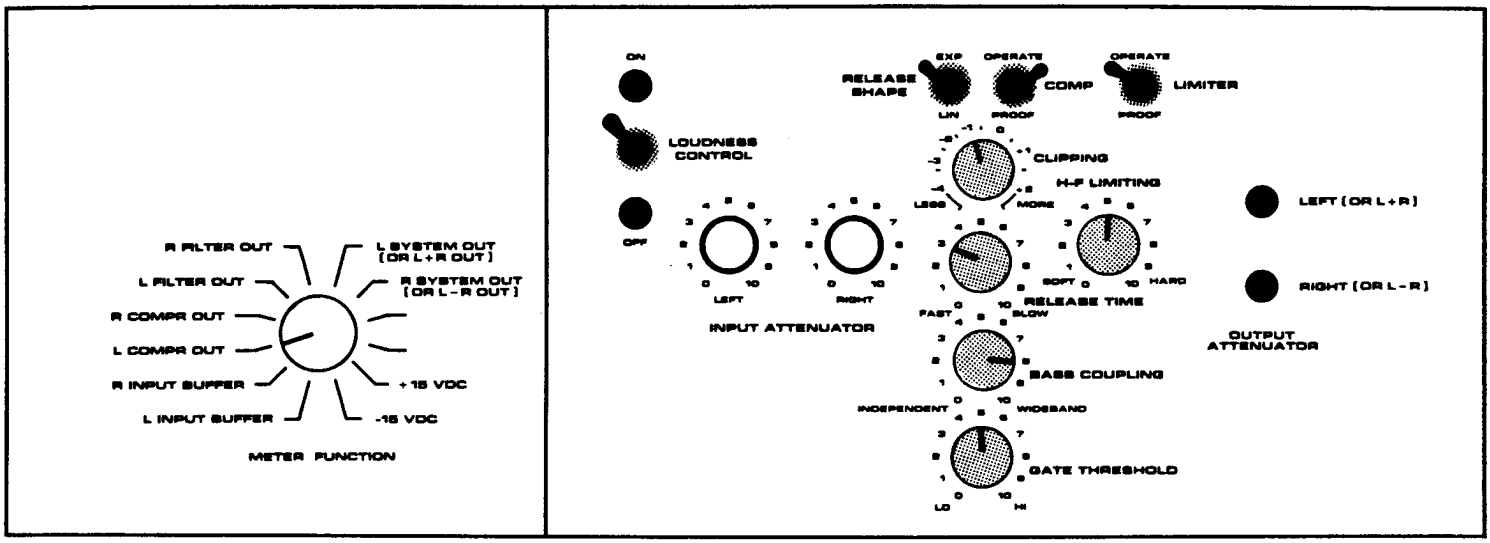
All manuals and user guides at all-guides.com

Only shaded controls (nine on the 8182A and three on the 8182A/SG) are set differently than in the last control settings figure.

8182A:



8182A/SG:

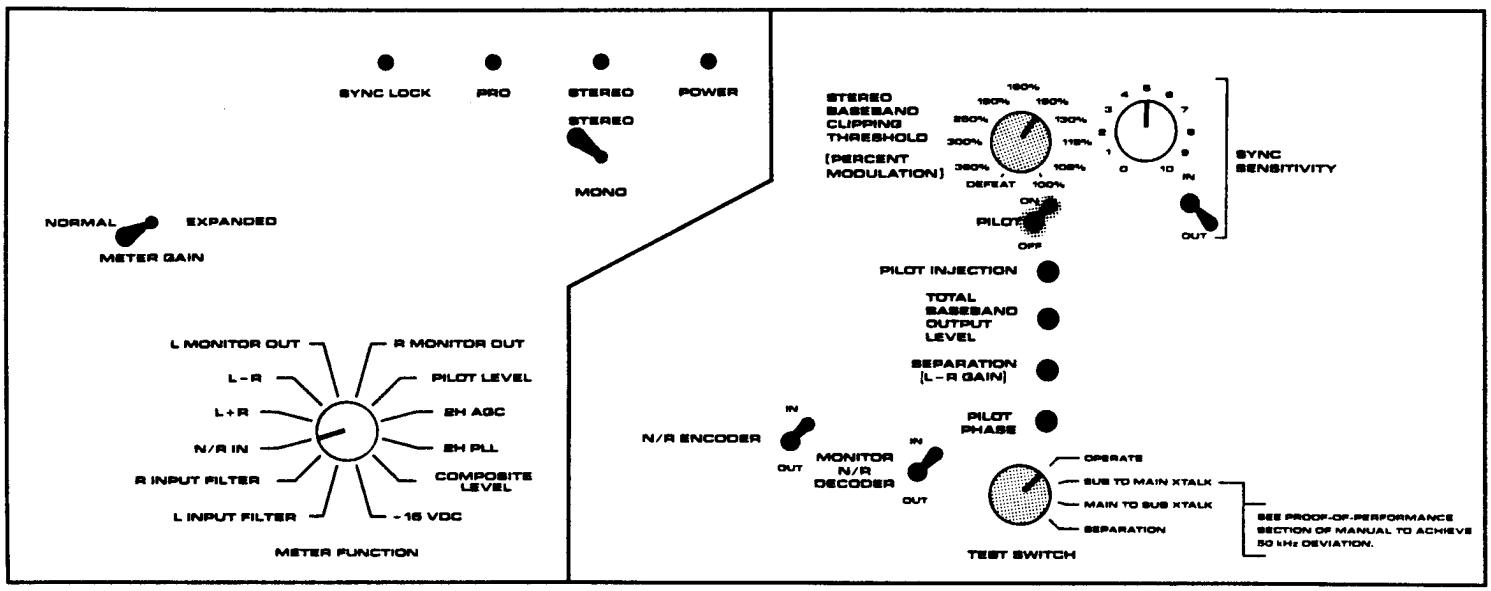


Figure 11: Control Settings for Step 18

All manuals and user guides at all-guides.com

18) Adjust input level (installations without Studio Chassis).

[Skip this step if you are also installing the 8182A/ST Studio Chassis.]

a) Set the controls as shown in Figure 11.

b) Set your switcher to mono, so both channels will put out identical signals and levels.

c) Drive the Audio Processor with typical audio at your usual operating level. Peak switcher output meters at 0VU.

d) Adjust the Audio Processor's LEFT INPUT ATTENUATOR control until its TOTAL MASTER G/R meter reads approximately "0dB'.

> If the LEFT INPUT ATTENUATOR control will not adjust the meter to this level, you may need to restrap the input attenuation pads on Cards #3 and #4. See the 8182A/ST Operating Manual for further information.

e) Adjust the Audio Processor's RIGHT INPUT ATTENUATOR control until the Stereo Generator's VU meter nulls. Then set the Stereo Generator's METER GAIN switch to EXPANDED and fine-adjust the null. Reset the METER GAIN switch to NORMAL.

19) Adjust input level (installations with Studio Chassis).

[Skip this step if you are not installing the 8182A/ST Studio Chassis at this time.]

a) Set the controls as shown in Figure 12.

b) Set your switcher to mono, so both channels will put out identical signals and levels.

c) Drive the Studio Chassis with typical audio at your usual operating level. Peak switcher output meters at 0VU.

d) Adjust the Studio Chassis' LEFT INPUT ATTENUATOR control until its TOTAL MASTER G/R meter reads approximately "0dB".

> If the LEFT INPUT ATTENUATOR control will not adjust the meter to this level, you may need to restrap the input attenuation pads on Cards #3 and #4. See the 8182A/ST Operating Manual for further information.

e) Set the Studio Chassis' DIAGNOSTIC VU METER switch to L COMPR OUT and note the VU meter reading.

f) Set the Studio Chassis' DIAGNOSTIC VU METER switch to R COMPR OUT, then adjust the Studio Chassis' R INPUT ATTENUATOR control until the VU meter reads the same level noted in step e.

A more precise adjustment may be made if an operator is available to observe the Stereo Generator, or if a BTSC stereo monitor is available at the studio:

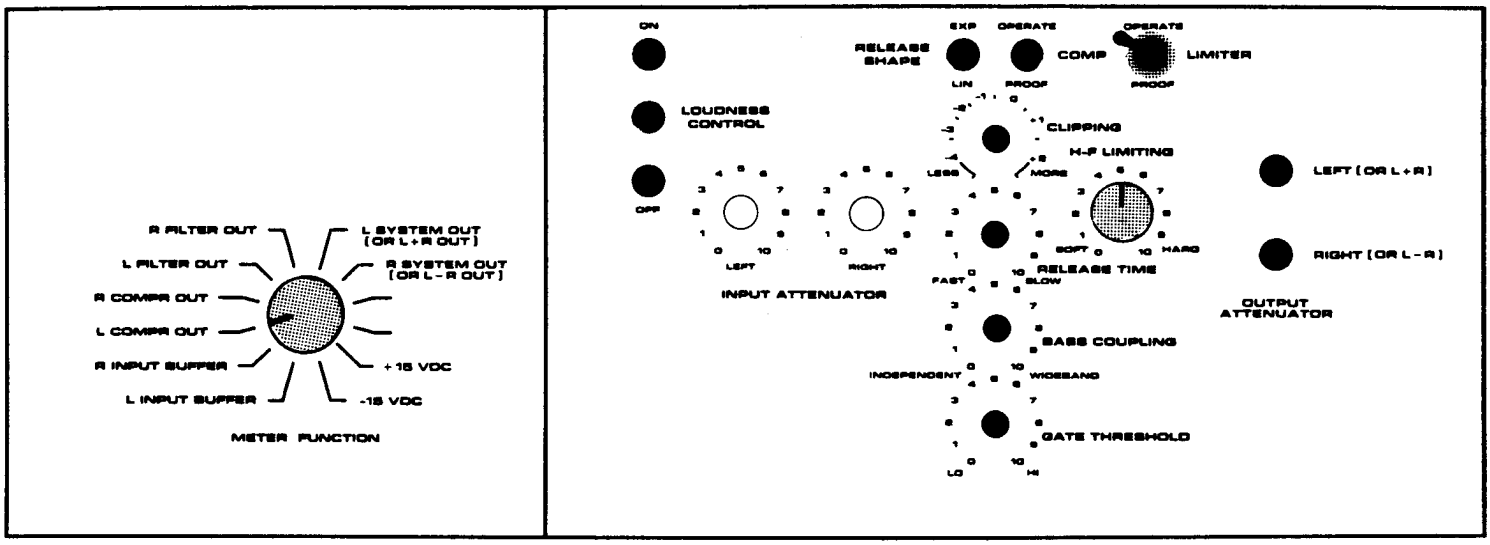
g) Adjust the Audio Processor's RIGHT INPUT ATTENUATOR control until the Stereo Generator's VU meter nulls. Then set the Stereo Generator's METER GAIN switch to EXPANDED and fine-adjust the null. Set the METER GAIN switch back to NORMAL.

> If a BTSC stereo monitor is available at the studio, its L–R metering can also be used to make the null.

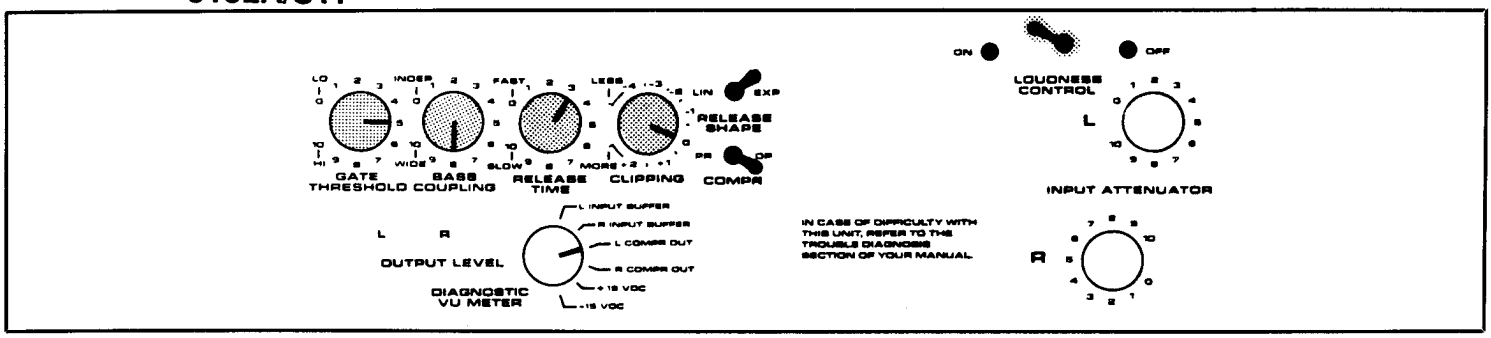
All manuals and user guides at all-guides.com

Only shaded controls (three on the 8182A, five on the 8182A/ST, and two on the 8182A/SG) are set differently than in the last control settings figure.

8182A:



8182A/ST:



8182A/SG:

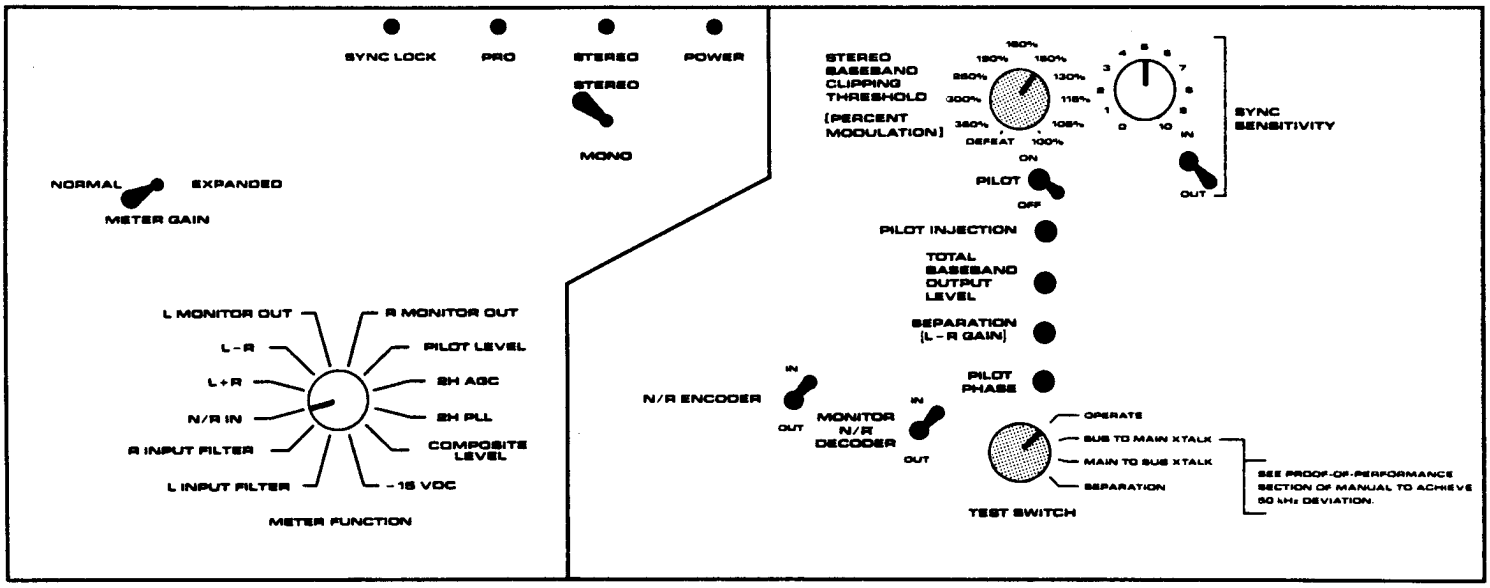


Figure 12: Control Settings for Step 19

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20) Check modulation with stereo modulation monitor.

*[Skip this step if you do not have access to a BTSC-compatible modulation monitor. Correct modulation **cannot** be verified with a mono modulation monitor.]*

a) Drive the OPTIMOD units with typical audio at your usual operating level. Peak switcher output meters at 0VU.

b) With your switcher set to stereo, verify that modulation is correct (±5%) as shown on the total modulation meter on your stereo aural modulation monitor.

> **Note:** The exacting filtering requirements specified by OET-60 for pilot protection inevitably result in overshoot and ringing. This means that your peak flasher may show considerable activity when the modulation level is properly adjusted. *This is to be expected and is no cause for alarm.* The EIA committee that produced the document *Multichannel Television Sound: BTSC System Recommended Practices* could not agree on the time-constant for the peak flasher on the modulation monitor. The FCC is aware of the problem. We do not recommend setting the Stereo Generator's STEREO BASEBAND CLIPPER THRESHOLD control at 100% just for the sake of preventing peak flasher activity; the non-linear effects caused by that much clipping have far more potential to cause actual damage than do the effects of short peak overshoots.

21) Verify audio quality of air sound.

Listen to the air sound on a good monitor system to verify that it sounds natural and free from noise and distortion.

22) Install other units. (optional)

The optional 8182A/SAP Second Audio Program Generator, the 8182A/PRO Professional Channel Generator, and the 275A Automatic Stereo Synthesizer may be installed at this time. Installation instructions are included in those units' Operating Manuals.

All manuals and user guides at all-guides.com

That's it!

The Stereo Generator is matched to the exciter for best separation. It will not require frequent adjustment.

The Audio Processor is adjusted to our factory-recommended settings. We have found these settings result in excellent audio level control, without processing artifacts, for virtually all mono and stereo television programs. If your station has a specialized format, such as fine arts or music videos, read the following material on "Getting the Sound You Want".

One last thing: **DON'T FORGET TO RETURN YOUR REGISTRATION CARD!**

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.

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CONTROLS AND METERS

8182A Audio Processor Controls and Meters

(Corresponding controls on the **8182A/ST Studio Chassis** have the same functions.)

HF LIMIT indicators light when the high-frequency content of audio is being limited.

GATE indicator lights when the input audio level falls below the threshold set by the GATE THRESHOLD control. When this happens, the compressor's recovery time is drastically slowed to prevent noise rush-up during low-level passages.

POWER indicator lights when the unit is powered.

VU meter and selector switch display signal level at various points in the circuitry (see Block Diagram in 8182A Operating Manual) to aid in diagnosing faults. The meter also displays +15V and −15V power supply voltages (with "100%" corresponding to 15VDC).

LOUDNESS CONTROL switch determines whether the circuitry that controls *subjective* loudness (as opposed to objective level) is activated. This circuitry will control the loudness of most commercials sufficiently well to eliminate viewer annoyance.

INPUT ATTENUATOR controls adjust the signal level going into OPTIMOD-TV.

RELEASE SHAPE switch switch selects either a constant release rate (when set to LINear) or (when set to EXPonential) a rate that automatically becomes faster as the release process progresses.

COMPRESSOR switch (used for testing) disables the dual-band compressor when set to PROOF.

LIMITER switch (used for testing) disables the high-frequency limiter, Hilbert Transform Clipper, and FCS Overshoot Compensator when set to PROOF.

CLIPPING control adjusts signal level going into the Hilbert Transform clippers, and therefore determines the amount of peak limiting done by clipping. This control governs the trade-off between loudness and distortion. Settings at or below "-1" will produce no audible distortion unless the RELEASE TIME control is set much faster than recommended.

H-F LIMITING control determines the amount of high-frequency limiting. When set toward SOFT, the highs are controlled more by limiting, which tends to soften highs but does not produce distortion. When set toward HARD, the highs are controlled more by clipping, which results in brighter sound (but could potentially distort highs).

RELEASE TIME control determines how fast the gain of the master compressor increases when the program material gets quieter.

BASS COUPLING control determines the degree to which the bass band of the compressor tracks the master band. Settings toward WIDEBAND produce an air sound that is more faithful to the spectral balance of the source material. Settings toward INDEPENDENT produce bass balances that are more uniform between program segments (often with increased bass).

GATE THRESHOLD control determines the lowest input level that the system considers program. Levels below this are considered noise, and cause the AGC/compressor to gate, effectively freezing its gain to prevent noise "breathing" during pauses or low-level passages.

OUTPUT ATTENUATOR controls match the output level to the stereo generator.

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8182A Audio Processor Controls and Meters (continued)

MASTER G/R meters show the amount of gain reduction in the "master" compressor, which processes audio above 200Hz.

> **TOTAL** shows peak value of gain reduction in dB. "0" on this meter indicates 10dB of gain reduction. **LIMITING** shows the amount of fast gain reduction above and beyond that provided by slow compression. "0" on this meter indicates no additional limiting, and "3" (for example) indicates an extra 3dB peak-limiting gain reduction over that indicated by the **COMPRESSION** meter, which shows the amount of gain reduction resulting from slow compression in dB. "0" on the **COMPRESSION** meter corresponds to 10dB of gain reduction.

TOTAL BASS G/R meter shows the amount of gain reduction in the "bass" compressor, which processes audio below 200Hz. Because almost all of the bass gain reduction is achieved with slow compression, there is no need for separate peak-limiting and compression meters. "0" corresponds to 10dB of gain reduction.

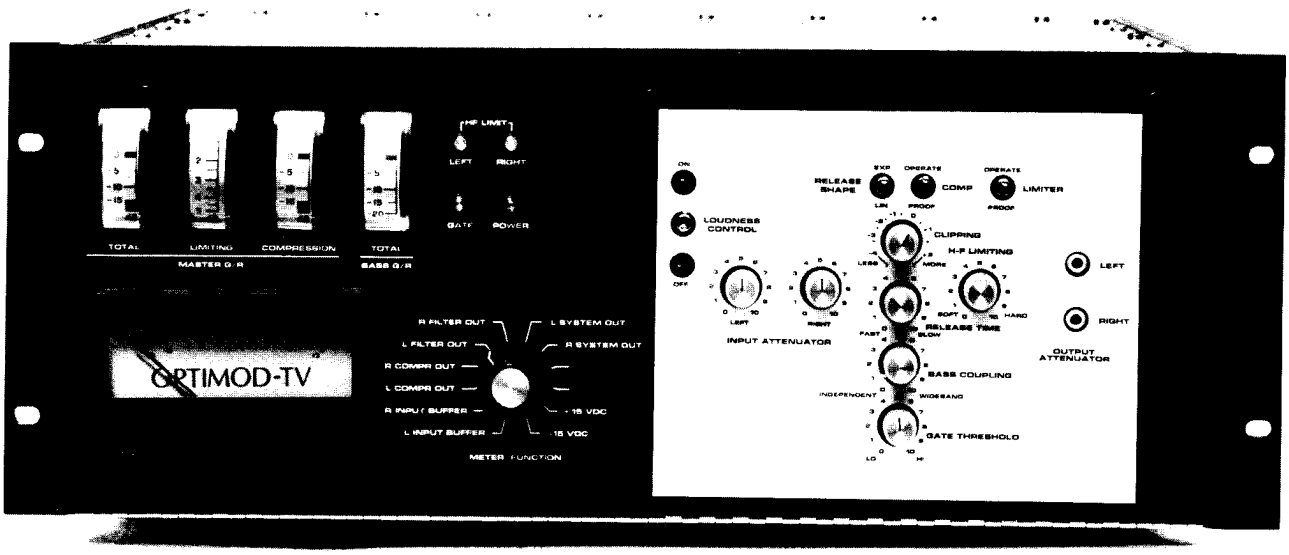

Figure 13: 8182A Controls and Meters

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8182A/SG Stereo Generator Controls and Meters

SYNC LOCK indicator lights when the 8182A/SG is locked to your sync or video signal.

PRO indicator lights when the optional Professional Channel is being transmitted.

STEREO/MONO switch selects stereo or mono mode. In mono, either the left or right channel input will be used according to the setting of a jumper on Card #7. The STEREO indicator lights when the unit is in stereo mode.

POWER indicator lights when the unit is powered.

VU meter and selector switch display signal level at various points in the circuitry (see Block Diagram in 8182A/SG Operating Manual) to aid in diagnosing faults. The meter also displays the −15V power supply voltage ("100%" corresponds to 15VDC). The METER GAIN switch, when set to EXPANDED, causes the AC signal to the VU meter to be amplified by about 20dB.

STEREO BASEBAND CLIPPING THRESHOLD control determines the threshold of the clipper that processes the stereo portion of the baseband. By limiting peak modulation to a certain percentage of the maximum permitted deviation, the clipper removes filter overshoots to prevent overloading of the aural exciter. (Calibration of the control is approximate.)

SYNC SENSITIVITY switch, when set to IN, enables the SYNC SENSITIVITY control. If the video is the standard 1V p-p ±20%, the switch should be set to OUT (with this setting, the sensitivity is preset).

SYNC SENSITIVITY control adjusts the sync stripper threshold for non-standard video levels. The control, whose setting is usually quite non-critical, should be adjusted to the middle of the range in which the SYNC LOCK indicator on the front panel lights. The control is rarely used.

PILOT switch turns the 15.734kHz pilot tone on and off. It is left set to ON at all times except during calibration and testing.

PILOT INJECTION control determines the level of the 15.734kHz pilot tone introduced into the baseband. The correct level is ±5kHz deviation (20dB below 100% stereo modulation).

TOTAL BASEBAND OUTPUT LEVEL control is used to calibrate the noise reduction encoder to the exciter during installation (and should not be touched once set).

SEPARATION (L−R GAIN) control is used to calibrate the baseband encoder so that the main channel (L+R) and stereo subchannel (L−R) gains are precisely equal. (Calibration of the sum and difference gains in the audio circuitry prior to the baseband encoder, although it affects separation, has nothing to do with this SEPARATION control, which calibrates the baseband encoder *only*.)

PILOT PHASE control determines the relative phase between the 15.734kHz pilot tone and the 31.468kHz suppressed subcarrier.

N/R ENCODER switch, when set to IN, inserts a 75µs de-emphasis network and dbx noise reduction encoder into the L−R channel, and a "sum compensator" filter into the L+R channel. The 75µs network removes the pre-emphasis introduced by the 8182A so the dbx encoder will get the required "flat" signal. The sum compensator filter compensates for non-ideal amplitude and phase response in the dbx encoder.

MONITOR N/R DECODER switch, when set to IN, activates a complete stereo matrix decoder with 75µs de-emphasis network and decoder sum compensator in the L+R channel, and a professional dbx decoder in the L−R channel.

TEST SWITCH re-routes the L+R signal for testing, as described in the 8182A/SG Operating Manual. The switch should be set to OPERATE for normal operation.

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8182A/SG Stereo Generator Controls and Meters (continued)

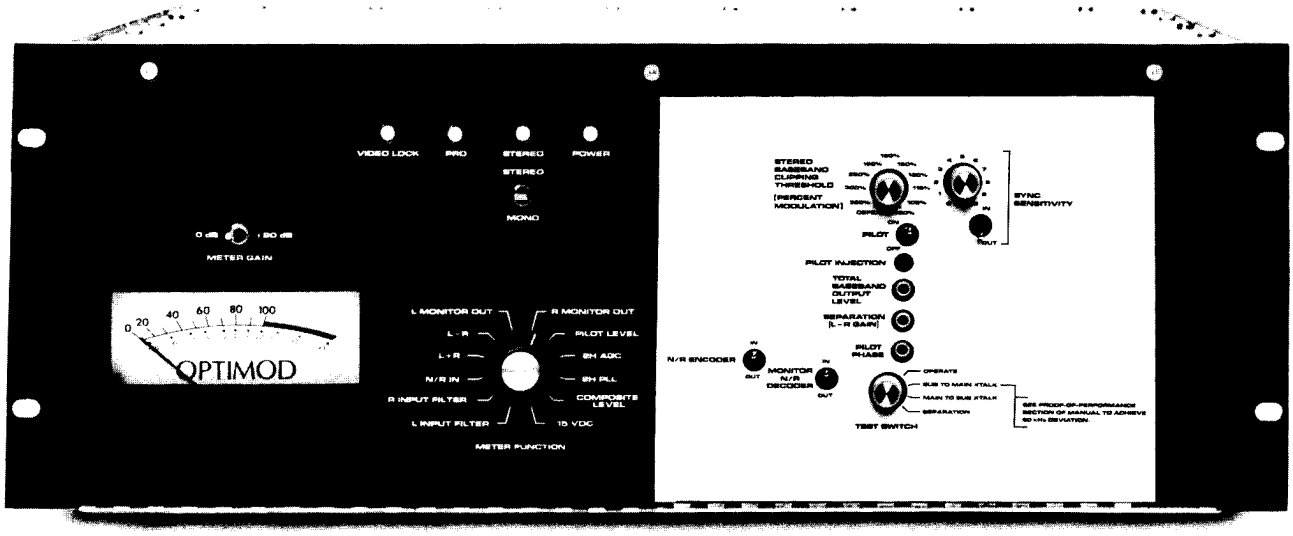

Figure 14: 8182A/SG Controls and Meters

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GETTING THE SOUND YOU WANT

If your station has a **general programming format**, the control settings specified at the end of the set-up procedure (in Figure 11 or 12) are optimal. *There is no need to read this or the following sections.*

If your station has a **specialized format**, you may prefer to use one of the alternate settings given in the "Recommended Control Settings" chart (Figure 15).

Should you wish to modify any control settings from those recommended, read "**Understanding More About Audio Processing**", since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them. "Understanding More About Audio Processing" provides the most thorough discussion of the functions of and interactions between OPTIMOD-TV controls. Read it if you really want to understand the operating controls in detail. However, there is no need to read that section if you will be using the recommended control settings.

Note that trade-offs between openness, consistency, loudness, brightness, and distortion are unavoidable. This is true of any processor.

Best results will be achieved if Engineering, Programming, and Management communicate and cooperate with each other. It is important that Engineering understand well the sound that Programming desires, and that Management fully understand the trade-offs involved in optimizing one parameter (such as consistency) at the expense of others (such as brightness or distortion).

Recommended Settings for the Best Sound

If your station has a general programming format, the control settings specified at the end of the set-up procedure (in Figure 11 or 12) are optimal. There is no need to read this or the following section.

If your station has a specialized format, you may prefer to use one of the alternate settings given in Figure 15. Each produces a different sound texture, and each incorporates a different set of trade-offs between openness, consistency, brightness, and distortion.

Start with one of these sets of recommended settings. Spend some time listening critically to your on-air sound. Listen to a wide range of program material typical of your station, and listen on a variety of television receivers (not just on your control room monitor loudspeakers). Then, if you wish to customize your sound, read the following section on "Understanding More About Audio Processing", since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them.

All manuals and user guides at all-guides.com

The settings for **general programming** provide the best overall processing for a variety of typical television programming. Output levels and frequency spectrum are consistent. Excessive commercial loudness is avoided.

The settings for **fine arts programming** preserve the wider dynamic ranges of classical music and similar programming. These settings result in less consistency of loudness and dynamic range.

The settings for **music video programming** produce a somewhat more heavily processed sound typical of conservatively processed popular music on FM radio. These settings will produce quite consistent results from a wide variety of source material.

	TYPE OF PROGRAMMING		
	General	**Fine Arts**	**Music Videos**
8182A Audio Processor Controls:			
INPUT ATTENUATORs			
Adjust to produce approximately the indicated gain reduction on average program passages as shown on OPTIMOD-TV's TOTAL MASTER G/R meter:			
G/R Meter:	*0dB*	*0dB*	*−5dB*
CLIPPING	−1	−1	0
H-F LIMITING	5	7	10
RELEASE TIME	3	4	7
BASS COUPLING	8	8	5
GATE THRESHOLD	5	*	0
RELEASE SHAPE	EXP	EXP	LIN
LOUDNESS CONTROL	ON	ON	OFF *
COMPRESSOR	OPERATE	OPERATE	OPERATE
LIMITER	OPERATE	OPERATE	OPERATE
8182A/SG Stereo Generator Controls:			
STEREO BASEBAND CLIPPING THRESHOLD	150%	150%	150%
N/R ENCODER	IN	IN	IN
MONITOR N/R DECODER	IN	IN	IN
TEST SWITCH	OPERATE	OPERATE	OPERATE
STEREO/MONO	STEREO	STEREO	STEREO

* See discussion on following page.

Fig. 15: Recommended Control Settings

All manuals and user guides at all-guides.com

Adjusting the GATE THRESHOLD control for fine arts programming.

Fine arts programming usually requires less AGC (automatic gain control) than does "general" programming. However, if AGC is reduced in the obvious way (by turning down the INPUT ATTENUATOR controls to reduce the amount of gain reduction), the gating circuit will tend to further reduce gain below the intended level when it is activated.

A better way to reduce the amount of compression is to set the GATE THRESHOLD control at "6" or higher, and to adjust the INPUT ATTENUATOR controls so that the TOTAL MASTER G/R meter reads "0" when the console or switcher is peaked at 100%. Setting the GATE THRESHOLD control very high like this prevents the 8182A from ever recovering to maximum gain, because the gate comes on when the program level is still high enough to produce gain reduction. For example: to limit the amount of normal compression to 5dB (instead of the usual 10dB), adjust the GATE THRESHOLD control so that the GATE indicator lights whenever the TOTAL MASTER G/R meter reads "+5" or greater.

To summarize, when the GATE THRESHOLD control is set at "6" or higher, it can also function as a dynamic range control which governs the amount of compression that can be achieved.

Setting the LOUDNESS CONTROLLER switch for music videos.

Since the loudness controller controls *subjective* loudness, it can sometimes slightly reduce the impact of rock and roll programming — particularly with "heavy metal" cuts or other material that has a great deal of 3kHz energy. In a music video format, the desire for loudness control must therefore be weighed against the possibility of reduced musical impact. (It may be desirable use remote control to switch the loudness controller IN for all breaks, then back OUT for music videos).

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Understanding More About Audio Processing

If your station has a general programming format, the control settings specified at the end of the set-up procedure in Figure 11 or 12 (and repeated in Figure 15) are optimal. If your station has a specialized format, you may prefer to use one of the alternate settings given in Figure 15. In either case, there is no need to read this section. Read this section only if you really want to understand the operating controls in detail.

The controls on the 8182A and 8182A/SG give you the flexibility to customize your station's sound. But, as with any audio processing system, proper adjustment of these controls consists of balancing the trade-offs between consistency, loudness, density, brightness, and audible distortion. The following provides the information you need to understand the functions and interactions of the audio processing controls.

We recommend starting with one of the sets of recommended settings, and then spending some time listening critically to your on-air sound. Listen to a wide range of program material typical of your station, and listen on a variety of television receivers (not just on your control room monitor loudspeakers).

1) Some audio processing concepts.

Compression reduces the difference in level between the soft and loud sounds, resulting in a subjective increase in the loudness of soft sounds and a greater overall consistency in perceived loudness levels.

Limiting increases audio density. Increasing density can result in greater consistency between program segments, but can also result in an unattractive "busier", "flatter", or "denser" sound. It is important to be aware of the many negative subjective side effects of excessive density when setting controls which affect the density of the processed sound.

Clipping sharp peaks does not produce any audible side effects when done moderately. Excessive clipping, however, will be perceived as audible distortion.

Consistent **subjective loudness** is achieved by controlling the average level of the audio according to an model of how the human ear and brain perceive loudness. In the 8182A, this is realized through the complex circuitry of the loudness controller. The carefully designed dual-band compressor in the 8182A also helps achieve consistent loudness.

2) Gating for unobtrusive processing.

Proper setting of the* GATE THRESHOLD *control is the key to achieving unobtrusive processing. *Inappropriate settings of this control are more likely to cause complaints from viewers and producers about "excessive compression" than are incorrect settings of any other control.*

The **gating** function prevents unnatural level increases of low-level program material. Many TV audio feeds (like ENG and optical soundtracks on film) have poor signal-to-noise ratios. Such material will suffer if the level background noise is audibly increased by the processor. It would also be wrong to pull up underscoring or other background to the level of dialog during pauses in the dialog.

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When the 8182A gates (indicated by the GATE indicator lighting), the gain reduction *very slowly* recovers to 10dB ("0" on the meters). When the GATE THRESHOLD control is set as recommended, the unit will be gated during almost all low- to medium-level program material, and average gain reduction will tend to be very close to 10dB.

Only when average program material is somewhat high or low will the gain reduction be different than 10dB. This is because levels close to the nominal 100% level are ordinarily above the threshold of gating, and this allows the gain reduction to recover normally so the unit will "ride gain" appropriately. Yet, because of the gate, the "noise breathing" characteristic of unsophisticated compressors will be avoided.

The GATE THRESHOLD control should never be set below "4" for general programming (although such setting may be appropriate for some popular music formats — if listening tests are passed).

3) Control of dynamic range — gain reduction and release time.

The amount of **gain reduction** determines how much the loudness of soft passages will be increased, and, therefore, how consistent overall perceived loudness will be. It is controlled both by the setting of the 8182A Audio Processor's INPUT ATTENUATOR controls and GATE THRESHOLD control, and by the level at which the console VU meter or PPM is being peaked.

10dB gain reduction (= "0dB" on the TOTAL MASTER G/R meter) is recommended for general programming to produce a consistent level from a wide variety of source audio (mostly voice with some music). Using less gain reduction more faithfully preserves the dynamic range of the source audio. Higher levels of gain reduction are recommended for music videos programming to achieve an open, yet reasonably consistent sound more typical of FM audio processing.

In general, increasing the amount of gain reduction decreases the apparent dynamic range of the audio. In extreme cases, this results in excessive pump-up of noise, underscoring, etc.

Too little gain reduction, on the other hand, will result in inconsistent audio levels: some parts of your programming will seem too loud, others too quiet. Less gain reduction than recommended is likely to result in low-level material's being unacceptably quiet (and therefore difficult to understand or perhaps altogether unintelligible).

The **release time** is the rate at which the gain of the compressor recovers when the program material gets quiet, yet is above the gating threshold. Slow release times are most appropriate for television audio, as they result in output density approximately equal to that of the input audio. (Although the setting of "3" recommended for general programming is nearer the word "FAST" on the panel, when the RELEASE SHAPE control is set to EXP the net effect is a slow release time since gain recovery starts out slowly — see below.)

Faster release times produce a *denser*, louder, more uniform sound that is appropriate for some popular music formats. However, operating with faster release times generally increases the danger of audible side effects, including noise breathing. (Highly competitive radio formats are characterized by this sound, which is really a side effect of trying to maximize loudness at the expense of audio quality. Because television audiences would be more likely to be annoyed than attracted by one station's being louder than another, television has been spared the "loudness wars" that plague radio audio quality.)

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There is a point beyond which increasing density (with settings of the RELEASE TIME control between "0" and "3") will simply degrade the punch and definition of the sound. And when OPTIMOD-TV is operated with RELEASE TIME control settings between "0" and "3", the sound will change substantially with the amount of gain reduction. This means that operator gain riding is more critical — you must decide on the basis of listening tests how much gain reduction gives you the dense sound you want without a feeling of overcompression and fatigue.

One of two **release shapes** can be selected: either a constant, *linear* release rate, or an *exponentially* increasing rate that automatically becomes faster as the release process proceeds. The exponential release shape is most useful for general programming, because most gain riding remains slow and unobtrusive, with only large gain corrections producing fast (and therefore more audible) release. For programming in which the levels of the input material are uniformly well-controlled the linear release shape gives a somewhat smoother sound. (We recommend the exponential shape for fine arts programming because such programming typically includes a variety of material in addition to, say, concerts with good level control.)

4) A note about gain reduction metering.

Unlike the metering on some processors, the **red zone** on the OPTIMOD-TV gain reduction meter's scale is a warning that must be observed. When the meter is in the red, it means that the compressor has run out of gain reduction range, that the circuitry is being overloaded, and that various nastinesses are likely to commence.

Because the compressor has a gain reduction range of 25dB, the meter should never enter the red zone if OPTIMOD-TV has been set up for a sane amount of gain reduction under ordinary program conditions. But be aware of the different peak factors on voice and music — if voice and music are peaked identically on a VU meter at the switcher, voice may cause up to 10dB more peak gain reduction than does music! (A PPM will indicate relative peak levels much more accurately.)

When the gating function is activated, the gain slowly drifts toward 10dB gain reduction. Because the gain reduction meters will therefore sit at 10dB gain reduction in absence of signal, we have calibrated the TOTAL MASTER G/R, COMPRESSION MASTER G/R, and TOTAL BASS G/R meters so that **"0" corresponds to 10dB gain reduction** (and "+10" indicates no gain reduction) to avoid confusing operators who might otherwise think that the compressors were faulty.

5) Excessive commercial loudness.

The **loudness controller** in the 8182A will control the loudness of most commercials sufficiently well to eliminate viewer annoyance. (The basic OPTIMOD-TV processing by itself controls loudness well enough that the loudness controller has no effect on most program material, and will tend to cause additional gain reduction of only 2–3dB on the most extreme material.)

Loudness is subjective. How loud something sounds does not correlate well with VU meter or PPM measurements of signal level. This is because: 1) the absolute levels of some frequency bands are more important than others in determining how loud a sound *seems* to the listener, 2) a sound spread out over a wide frequency range sounds louder than would a the same amount of sound energy in a narrower range, and 3) the time-constants of the individual

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spectral detectors in the ear affect the perceived loudness of a sound, as does 4) the overall duration of the sound.

OPTIMOD-TV's loudness controller is based on a model (developed as a result of twenty years of research at the CBS Technology Center) that analyzes sound with reference to these psychoacoustic factors. When the model indicates that one of these factors will affect the subjective loudness, the loudness control enhances the main gain control signals with its own control signal.

The loudness controller reduces loudness gently and subtly. Since it reduces the audio drive to the peak-limiting section of OPTIMOD-TV, loudness reduction will therefore be accompanied by improvements in high-frequency response and lowered peak-limiting-induced distortion.

6) Peak control.

OPTIMOD-TV controls peaks using Orban's patented Hilbert Transform Clipper circuit. The CLIPPING control adjusts the level of the audio driving the clippers, and therefore adjusts the peak-to-average ratio. The CLIPPING control determines the primary trade-off between consistent loudness and distortion.

Turning up the the CLIPPING control drives the clippers harder, reducing the peak-to-average ratio, and making on-air loudness more consistent. Since the amount of clipping is increased, the audible distortion caused by clipping is increased. Lower settings yield less consistent loudness, but result in the cleanest sound and best high-frequency response.

In our opinion, the best setting for the CLIPPING control is "–1" when used with slower release times (above "3" if the switch is set to EXP; above "6" if the RELEASE SHAPE control is set to LIN). If faster settings of the RELEASE TIME control are used, or if program material is not always clean, use lower settings of the CLIPPING control if even small amounts of audible distortion cannot be tolerated. Ultimately, your ears must judge how much distortion is acceptable. But use worst-case program material like live voice and piano to make your final decision.

The CLIPPING control can be used to adjust your **loudness relative to other stations**. Achieving inter-station consistency usually requires a conservative CLIPPING control setting (between "–1" and "–4"), which will also give the cleanest sound and best high-frequency response. If the RELEASE TIME control is at a faster setting than recommended, it may be necessary to set the CLIPPING control below "–1" to avoid audible distortion.

7) High-frequency limiting to reduce distortion.

The H-F LIMITING control determines how the processor **avoids high-frequency overloads** due to the pre-emphasis curve. When set toward SOFT, the highs are controlled mostly by limiting (a form of dynamic filtering), which tends to soften highs. When set toward HARD, the highs are controlled mostly by clipping, which could potentially distort highs.

Setting the H-F LIMITING control toward SOFT could **improve the sound of marginally distorted program material** by softening the highs (including the harmonic distortion present in the source material).

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Because the OPTIMOD-TV clipper cancels distortion at low frequencies, the H-F LIMITING control will have a different effect on clipping distortion than you might expect. Gross break-up (principally sibilance splatter) will not occur, and you must listen to the upper midrange and the highs to hear the effect of the clipper. Program material containing highly equalized hi-hat cymbals or highly sibilant voice will clearly demonstrate the effect of adjusting the control.

With the recommended settings and clean program material, the control can be set very near HARD without producing audible high-frequency distortion. However, with marginally distorted program material or with CLIPPING control set nearer "+2" than recommended or with the RELEASE TIME control set nearer FAST than recommended, the H-F LIMITING control may need to be set nearer to SOFT to avoid objectionable distortion. Fortunately, the high-frequency limiter "knows" that greater density and level have been produced when these other controls are set this way, and most of the necessary increases in high-frequency limiting will occur automatically. In fact, you will clearly hear a loss of highs when you adjust any control to produce more consistent loudness and greater density — this is a result of the basic processing trade-offs discussed above.

8) Spectral balance.

The compressor processes audio in two bands: a *"master" band* for all audio above 200Hz, and a *bass band* for audio below 200Hz. The BASS COUPLING control determines how closely the **on-air balance between bass and midrange** matches that of the program material. Settings toward WIDEBAND produce an air sound that is more faithful to the spectral balance of the source material. Settings toward INDEPENDENT produce bass balances that are more uniform between program segments (often with increased bass).

Because setting the BASS COUPLING control at WIDEBAND will sometimes cause bass loss, the most accurate frequency balance will often be obtained with this control between "7" and "10". The exact setting depends on release time and the amount of gain reduction. Adjust the BASS COUPLING control until the TOTAL BASS G/R and COMPRESSION MASTER G/R meters track as closely as possible.

Settings toward INDEPENDENT are only appropriate for music video programming. With *slower release times* and the RELEASE SHAPE switch set to LIN, a very open, natural, and non-fatiguing sound is produced. However, these settings will also boost bass on some bass-shy program material, and may pull up stage rumble and other low-frequency noise.

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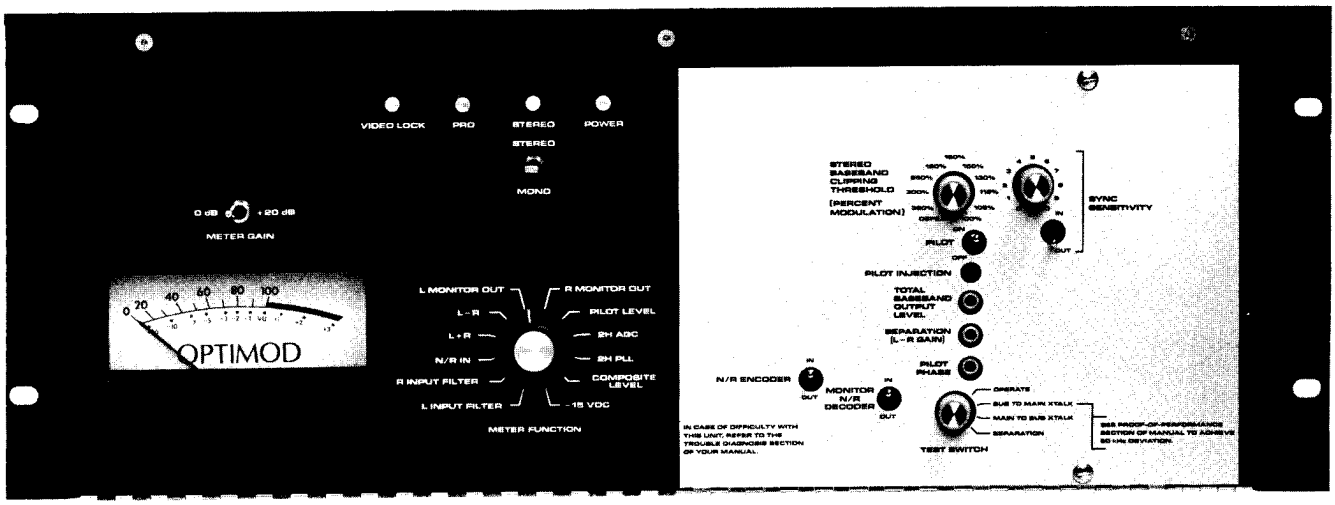
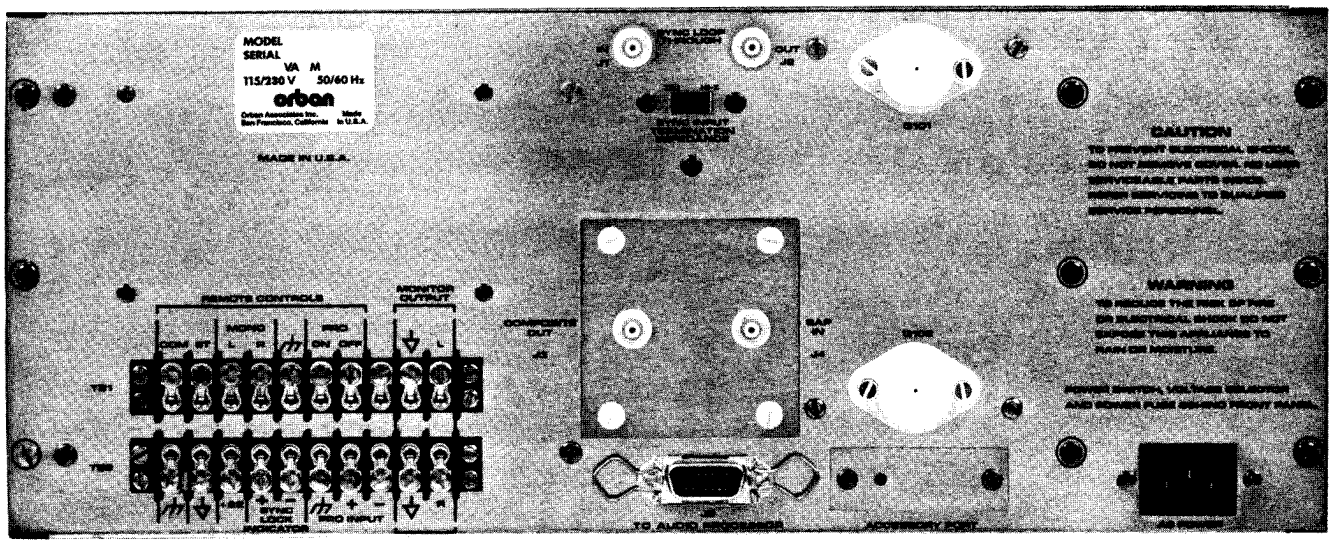
Operating Manual

OPTIMOD®-TV

STEREO GENERATOR

Model 8182A/SG





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REGISTRATION CARD

The original purchaser should have received a postpaid Registration Card packed with this manual.

Registration is of benefit to you because it enables us to tell you of new applications, possible performance improvements, service aids, etc., which may be developed over the life of the product. It also provides us with the date of sale so that we may more promptly respond to possible claims under Warranty in the future (without having to request a copy of your Bill of Sale or other proof of purchase).

Please fill in the Registration Card and return it to us.

If the Registration Card has become lost or you have purchased the unit used, please photocopy the image of the card reproduced below and send it to us in an envelope. Use the address shown on the title page.

Do not allow your Dealer to submit the card for you. If he forgets, you can miss important future mailings and may be delayed in obtaining Warranty service.

Model # _____ Serial # _____

Name or Title _____

Organization _____

Street _____

City/State/Country _____

Zip or Mail Code _____

Purchased from _____ City _____ Date of Purchase _____

Nature of your application _____

How did you hear about it? _____

Comments: _____

_____

Fig. A-1: REGISTRATION CARD

Packing Material: The carton in which your unit was shipped was carefully designed to prevent damage from the stresses ordinarily encountered in commercial shipping. SAVE THE CARTON AND ALL PACKING MATERIAL in case you ever have to ship the chassis back to the factory for service.

WARRANTY

The Warranty, which applies only to the first end-user of record, is stated on the Warranty Certificate on a separate sheet packed with this manual. Save it for future reference.

Details on obtaining factory service are provided in **Appendix F** of your **OPTIMOD Operating Manual.**

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PART 1:
Introduction

This Manual refers frequently to the Operating Manual for the main OPTIMOD-TV audio processor, and must be used in close conjunction with that manual.

Objective And Features: A full Orban system for BTSC television stereo consists of the following:
-- an 8182A Stereo Audio Processor
-- an 8182A/SG Stereo Generator (with Professional Channel option)
-- an 8182A/SAP Second Audio Program Generator.

The Pro Channel and/or SAP may be omitted if not desired.

The Orban Model 8182A/SG BTSC Stereo Generator (an accessory for the OPTIMOD-TV Model 8182A audio processor) has been designed to generate the television stereo baseband to meet or exceed BTSC standards. The Stereo Generator contains the necessary sharp filtering to protect the pilot and to prevent crosstalk from main channel to subchannel (and vice-versa). A genuine dbx noise-reduction encoder card is included to assure the most accurate compliance with the BTSC noise-reduction standard. The baseband generator is based upon the proven design of the OPTIMOD-FM (Model 8100A) stereo generator, literally thousands of which are in service. This baseband generator uses a "matrix" approach to generating the baseband, which achieves maximum separation (no baseband lowpass filter is necessary) and which subjects the main channel (L+R) to no modulation process would might degrade quality -- unlike even the latest "digital" generators.

Unique features include a built-in calibrated monitor card containing a dbx decoder card, as well as appropriate de-emphasis and dematrixing circuitry. This card permits closed-circuit verification of proper operation of all circuitry but the baseband generator, independent of the RF link and of the modulation monitor. (The performance of the baseband generator can be separately verified by means of several special test modes, conveniently switch-selectable.) Another special feature is a defeatable baseband clipper, whose threshold is continuously adjustable. This was designed to remove the most radical overshoots introduced by the extremely steep filters within the system. (When this clipper is defeated, we have observed short-duration overshoots in excess of 250% modulation!)

The mainframe accepts cards to generate the "Professional Channel", which is available as ACC-20. A separate manual is included with this Accessory.

The mainframe is equipped with an input port for a SAP generator. For highest quality, we recommend the Orban 8182A/SAP, which contains audio processing (including Loudness Control) equal in quality to that of the 8182A, but with a 10kHz bandwidth limitation to comply with BTSC standards. A dbx encoder card is also included. This product may also be used "stand-alone" without the 8182A or 8182A/ST. A separate manual is included with this product.

Use Of the Stereo Generator Without OPTIMOD-TV Audio Processing: While the Stereo Generator has been optimized to be closely coupled to the 8182A OPTIMOD-TV audio processor, it is possible to use it with other processing, or as a stand-alone (as a test instrument, for example) with some additional external circuitry.

The Stereo Generator's input must be in sum-and-difference preemphasized form. Achieving this may require addition of external preemphasis and/or matrixing circuitry, depending on the capabilities of the external audio processing (if used).

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In addition, the Stereo Generator's Left and Right Six-Pole filters have been designed with a slightly non-flat frequency response to equalize slight frequency response irregularities in the 8182A audio processor. If other processing is used, these filters will cause frequency response deviations in the order of ±0.2dB. (These deviations are negligible for most applications.)

If the Stereo Generator is used as a test instrument (for production television receiver alignment, for example), then the Left and Right filters will ordinarily be bypassed and their frequency response will have no effect upon the accuracy of the rest of the system.

Orban Customer Service can provide an Application Note for those who wish to use the Stereo Generator without the Orban 8182A audio processor.

Host Processor Interface: While the Stereo Generator could probably be adapted for use with other processing, it has been specifically designed to mate harmoniously with OPTIMOD-TV Model 8182A to create a system which achieves the highest standards of accuracy and audio quality.

The Stereo Generator can also be mated to the older OPTIMOD-TV (Model 8180A) by one of two means: Either the factory update RET-25 (which adds the Hilbert-Transform Clipper and Loudness Controller features), or the field update RET-37 (which supplies only the required interface port but which does not upgrade the audio processing).

System Configuration: The Stereo Generator is housed in a 7" (4-unit high) chassis which ordinarily resides directly above the Audio Processor. The two chassis are interconnected by means of a cable (supplied). The Stereo Generator contains its own power supply: only audio is passed between the two chassis.

The Stereo Generator is fully compatible with the Model 8182A/ST Studio Accessory Chassis. The 8182A/ST is used to realize the "split configuration", where the compressor section of the Audio Processor resides at the studio end of an STL to protect the STL from overload and to make most of the operating controls available at the studio. When the 8182A/ST is in use, the main 8182A chassis (containing the high-frequency limiter and peak limiter) and the 8182A/SG Stereo Generator both reside at the transmitter.

An Overview Of Inputs And Outputs: Stereo audio inputs are applied to the 8182A (or to the 8182A/ST if the "split configuration" is used). A Professional Channel audio (or data) input port is provided on the Stereo Generator chassis.

A SAP subcarrier input port is also provided on the Stereo Generator. This is unbalanced but floating over chassis ground. It accepts the modulated output of an external SAP generator (such as the Orban 8182A/SAP) and sums it with the Stereo and Professional signals to provide the final composite baseband at the Stereo Generator output.

The Stereo Generator requires a 1V p-p 75ohm sync or composite video signal to provide a reference to frequency-lock the various baseband generators to the horizontal line frequency. A composite video "loop-thru" output permits this reference to be the same video signal that drives the visual transmitter.

The output of the Stereo Generator is either 0 or 75 ohms (jumper-selectable; unbalanced but floating over chassis ground), and is designed to directly drive the composite input of an aural exciter or a composite STL.

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Remote control of STEREO/MONO-LEFT/MONO-RIGHT status, as well as Professional Channel ON/OFF status, is provided by optically-isolated remote control terminals on the Stereo Generator chassis. Remote control of Loudness Controller ON/OFF status is provided by terminals on the main Audio Processor chassis or on the 8182A/ST chassis if the "split configuration" is used.

An optically-isolated transistor switch is provided in the Stereo Generator to remotely indicate if video lock has been achieved.

THE BTSC TELEVISION STEREO SYSTEM

The BTSC system was chosen as a result of a vote of industry leaders in late 1983. Extensive testing of rival transmission and noise-reduction systems was performed under the auspices of the EIA, and the results of the tests were published for examination by the industry. On this basis, the Zenith transmission system and dbx television companding system were chosen.

The FCC, to avoid possible legal challenges from the losers, voted early in 1984 to authorize a "modified marketplace" choice of TV stereo. That is, a television broadcaster could use any television stereo system which met the technical requirements of the FCC Rules. However, if he broadcast a pilot tone at f_H (15.734kHz), then the stereo system in use was required to meet BTSC specifications. These specifications were set forth in the Office Of Science And Technology publication OST-60. OST-60 is not complete, in that many details and recommended practices are omitted. Such details were left to an industry committee again working under the auspices of the EIA; these details are available in the EIA's BTSC System Television Multichannel Sound Recommended Practice, published by the EIA, Washington, D.C.

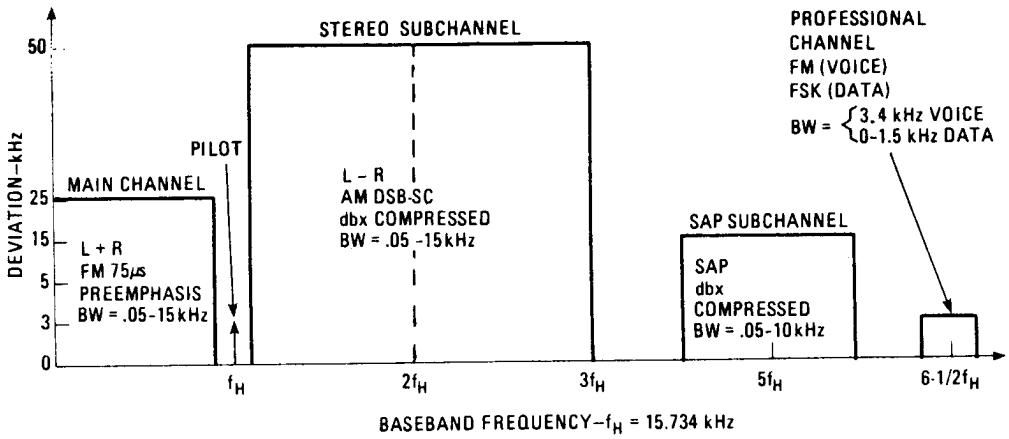

Fig. 1-1: The BTSC Baseband

The Zenith/dbx Transmission System: The Zenith transmission system is superficially similar to the familiar "pilot-tone" system used for FM stereo transmission. A main channel, occupying 50-15,000Hz, is modulated with the stereophonic sum (L+R) signal. To be consistent with existing monophonic standards, 100% modulation is defined as ±25kHz deviation of the aural carrier and 75us pre-emphasis is used.

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The stereo subchannel carries the stereo difference (L-R) information. Double-sideband suppressed-carrier AM modulation is used. The subcarrier frequency is $2f_H$ (31.468kHz). A 15.734kHz pilot tone at ±5kHz deviation is broadcast to indicate stereo mode and to serve as a phase reference to regenerate the subcarrier at the receiver's stereo decoder. 100% modulation of the subchannel is defined as ±50kHz deviation. 100% modulation of the baseband consisting of the sum of the stereophonic sum and difference channels is also defined as ±50kHz. The recommended practice allows brief, low-energy lowpass-filter-induced overshoots beyond ±50kHz deviation.

In the difference channel, fixed pre-emphasis is not used. Instead, the difference signal is processed by the dbx noise-reduction encoder to produce a highly compressed signal which can be expanded in a precisely complementary way at the receiver to recover the original difference signal. This restored difference signal is then matrixed with the sum signal at the receiver to restore the left and right stereo channels. Use of noise-reduction in the difference channel eliminates the large signal-to-noise degradation which would otherwise occur upon switching from mono to stereo reception.

Correct operation of the dbx noise-reduction depends on a precisely-controlled gain between the output of the encoder at the transmitter and the input of the decoder at the receiver. At the transmission end, this is assured by calibrating the gain to the exciter such that the exciter produces a given frequency deviation when a given voltage is present at the output of the dbx encoder. Detailed instructions for performing this calibration (which is aided by calibrated metering within the Stereo Generator) are found in **Part 4** of this manual.

SAP: The Zenith/dbx system provides for a Second (or Separate) Audio Program (SAP) on a frequency-modulated subcarrier whose carrier frequency is $5f_H$ (78.670kHz) in absence of modulation. The subcarrier modulates the main carrier to ±15kHz deviation. 100% modulation of this subcarrier is defined as ±10kHz deviation of the subcarrier frequency. The audio bandwidth of the SAP modulation is limited to 10kHz. Fixed pre-emphasis is not used; instead, a dbx noise-reduction encoder is inserted before the subcarrier generator. A complementary dbx noise-reduction decoder (expander) in the receiver restores the original signal.

While the SAP as described above is part of the Zenith/dbx standard, the FCC does not require adherence to this standard even if the 15.734kHz BTSC stereo pilot is being transmitted. Therefore, the EIA recommended standard suggests that if a non-BTSC SAP (or other subcarrier) is transmitted at $5f_H$, it should be broadcast with an injection of less than ±7.5kHz main carrier deviation to avoid false triggering of SAP decoders in BTSC receivers.

Professional Channel: The Zenith/dbx standard provides for an FM-subcarrier "Professional Channel" at $6.5f_H$ (102.271kHz) in absence of modulation. This is a non-broadcast communications-quality subcarrier which deviates the main carrier ±3kHz. Maximum deviation of the subcarrier is also ±3kHz. Audio bandwidth is limited to 3kHz. The "Professional Channel" may also be used for digital data by the Frequency-Shift-Keying (FSK) method. The bandwidth of the control signal to produce FSK must be limited to 1.5kHz.

The Professional Channel is intended for signaling between studio and transmitter, studio and remote vehicles, and similar intra-station communications. While it may be operated simultaneously with the SAP, it will be subject to substantial interference from the SAP. However, the SAP seems reasonably immune to interference from the Professional Channel.

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SIMPLIFIED SYSTEM DESCRIPTION

This section provides an understanding of the Stereo Generator and its relationship with the Audio Processor sufficient to install and operate the units in an informed manner. Particular emphasis is placed on unusual features and possible pitfalls: we have tried to anticipate some of the more common questions in this part of the manual. More detailed discussions of the system from the point of view of troubleshooting and maintenance are found in **Appendix A (System Description)** and **Appendix B (Circuit Description).**

Relationship Between the Stereo Generator and the Audio Processor: (NOTE: This discussion assumes that the reader is reasonably familiar with the Audio Processor, which is fully described in its own **Operating Manual.**)

The Stereo Generator can be divided into two main sections, the first of which is embedded within the Audio Processor, and the second of which is driven by the Audio Processor outputs.

1) **Input Filters:** The first section consists of a pair of sharp 6-pole 15kHz filters for the Left and Right channels. These filters are placed between the output of the Audio Processor's Dual-Band Compressor and the input of its High-Frequency Limiter. The filters have two deep notches, one of which is located at the horizontal line frequency. This notch prevents stray 15.734kHz energy from being applied to later processing (the HF and peak limiters in the Audio Processor), or to the compandor input.

   When MONO LEFT or MONO RIGHT mode is selected, the output of the appropriate 6-pole filter is applied to both left and right channels of the subsequent processing. This way, full modulation is achieved in either mono mode.

   The signal is then returned to the Audio Processor for pre-emphasis, HF limiting, and peak limiting in Left and Right form (FM-stereo style).

   After this processing, the signal is strictly peak-limited and fairly well bandlimited. The signal is then converted to sum-and-difference form in a matrix circuit located within the Audio Processor. The input to the Stereo Generator is thus in pre-emphasized sum-and-difference form.

2) **Noise Reduction Encoder And 11-Pole Filters:** The BTSC standard requires that a dbx television noise reduction encoder be included in the difference (L-R) channel prior to the stereo baseband encoder. An extremely high-performance 11-pole Cauer filter follows the N/R encoder. This not only protects the 15.734kHz pilot and stereo main channel from interference by stray energy above 15kHz not eliminated by earlier filtering but, more importantly, also prevents noise produced by the N/R encoder itself from aliasing down into the main channel. In order to assure that the control sidechains of the N/R encoder and receiver N/R decoder "see" the same signal, the sidechain of the N/R encoder is fed by the output of the filter, which also drives the L-R input of the stereo baseband generator.

   The filter has an extremely large phase shift around its cutoff frequency. In addition, the N/R encoder introduces a phase shift and rolloff in excess of that specified in the "ideal" companding tables defining the BTSC-specified characteristic. To preserve stereo separation, a matching 11-pole filter is therefore inserted in the sum (L+R) path. A filter called the "sum compensator" is also inserted into the sum path to preserve separation by matching the excess rolloff and phase shift of the N/R encoder.

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To avoid unnecessarily disturbing the tightly-controlled peak levels at the Audio Processor output, both the sum compensator and sum 11-pole filter are automatically switched out of the signal path when MONO mode is selected on the 8182A/SG. In addition, a special TEST mode is available in which the N/R encoder and its matching sum compensator are switched out of the signal path, but the two (sum and difference) 11-pole filters remain to permit testing of "equivalent stereo separation" (which is affected by the matching of the two filters) without the N/R encoder.

3) **Stereo Baseband Generator:** The stereo baseband generator accepts the processed outputs from the sum and difference signal paths and produces the stereo baseband signal. The generator is characterized by high stability, very low distortion, and minimal spurious outputs.

The stereo generator contains circuitry to produce a 15.734kHz sinewave pilot tone. The $2f_H$ subcarrier is phase-locked to the pilot tone, which is frequency-locked to the horizontal line rate of a reference 1V p-p composite video or sync signal. This signal is applied to a sync input on the 8182A/SG Stereo Generator. This input can either be terminated by 75 ohms or left unterminated, permitting loop-through via a second BNC connector. The shell of the video BNC is isolated from the 8182A/SG's chassis ground and the signal is picked off by means of a high-impedance balanced differential amplifier to avoid introducing ground loops into the plant.

In addition to pilot phase, pilot level and separation are controlled and stabilized by means of servo loops.

The stereo baseband is generated by the "matrix" technique, as opposed to the more common "switching" design. The "matrix" design modulates only the L-R component, and passes the L+R component through to the output without degradation due to switching. Since the L+R component almost always dominates, this results in maximum audio quality. In addition, no baseband lowpass filter is required. Such a filter would add to system cost, and could compromise separation.

To facilitate adjustment of pilot phase, measurement of main-channel-to-subchannel and subchannel-to-main-channel crosstalk, and calibration of baseband generator separation, three special TEST modes are provided. The first two are crosstalk test modes and apply the L+R channel audio directly to the main or sub inputs of the stereo generator. This provides a convenient means of measuring non-linear crosstalk and other stereo generator performance parameters.

The third test mode applies the L+R audio to both the main and sub inputs of the generator simultaneously. Because the main and sub inputs are designed to have equal sensitivity, this produces the familiar "flat baseline" waveform seen in FM stereo and permits extremely accurate calibration of baseband generator separation using only an oscilloscope for instrumentation: no stereo demodulator is required. (The BTSC standards specify that 100% modulation of the subchannel shall produce a carrier deviation of ±50kHz, while 100% modulation of the main channel shall produce ±25kHz: half as much. This 2:1 ratio is achieved by adjusting the audio gains before the stereo baseband generator such that the L+R channel has half the audio gain of the L-R channel.)

The stereo generator can be operated in STEREO, MONO LEFT, or MONO RIGHT modes. All three modes can be selected by remote control by means of optically-isolated remote control terminals. STEREO and one of the two MONO modes can be selected locally by means of a front-panel switch. An internal strap determines which of the two MONO modes is selected. Another internal strap determines which of the three modes will prevail on powerup.

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4) **Baseband Clipper:** The 11-pole filters have group delay which is extremely non-constant with frequency. Therefore, even though their input signals are bandlimited and tightly peak-controlled by the Audio Processor, their outputs can exhibit substantial overshoot and ringing.

As this manual is written, it has been proposed that the short-term overshoots introduced by the filtering be permitted to overmodulate the carrier freely, provided that the overshoots are of less than, say, 1 millisecond duration. We have observed filter-induced overshoots as high as 250% modulation (re 100%=±50kHz). It is our opinion that most exciters will be unable to modulate linearly to this extent, and that overloading them may produce unexpected side-effects. For this reason, we have included a baseband clipper whose clipping threshold can be adjusted by the user from 100% to greater than 300% modulation (at which point the clipper will be inactive). This clipper acts only on the composite stereo signal, but not the pilot, SAP, or professional channel components of the baseband. Intermodulation between these components therefore cannot occur. Indeed, use of the baseband clipper prevents intermodulation due to exciter overload.

Experience with stereo FM has demonstrated that baseband clipping of the entire stereo baseband (except for the pilot) is one of the most innocuous ways of controlling those overshoots introduced after audio processing (such as overshoots from a composite STL). Offensive results ordinarily occur only if significant amounts of energy are clipped in an attempt to increase loudness -- such clippers should never be used as audio processors, as distortion will result.

As this is written, the situation is in flux, and we can offer no magic formula on how to set the clipper. We will generate field engineering bulletins on this (and other aspects) of TV stereo as the industry gains more experience with this new technology. At present, intuition suggests that clipping thresholds between 125% and 150% modulation will eliminate the most extreme filter overshoots without seriously overstressing the exciter or, on the other hand, causing excessive non-linear main-channel to subchannel crosstalk and/or compandor mistracking due to the clipping of significant amounts of program energy in the baseband clipper itself. The optimum adjustment of clipping threshold will be dependent upon the performance of the individual transmitter and exciter, and upon whether the SAP is in use. Some experimentation will doubtless be necessary.

5) **Baseband Summing Amplifier And Line Driver:** A wideband summing amplifier is provided to sum the clipped stereo baseband signal, the stereo pilot, the SAP, and the Professional Channel. A BASEBAND LEVEL control adjusts the gain of the entire amplifier, and thus the injection of all these components simultaneously.

The output impedance of the amplifier is strappable to be either 75 ohms or a voltage source (approximately 0 ohms). We recommend operation in voltage-source mode. In this mode, the amplifier can drive approximately 0.047uF of cable capacitance before noticeable performance deterioration (linear or non-linear) occurs. The amplifier is unconditionally stable with any capacitive load.

6) **Metering:** A VU meter is provided to monitor the AC and DC levels at various points within the circuitry. It is used for setup and to verify proper operation of the circuitry. In addition, it can facilitate signal-tracing during troubleshooting.

All readings are average, except for COMPOSITE OUTPUT, which is peak.

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The AC sensitivity of the meter can be increased by means of a front-panel switch to make nulls easier to see. DC sensitivity is not affected by the switch. However, note that the meter amplifier can clip when reading the -15 volt power supply, and that this reading will therefore change when the METER switch is operated, even though DC is being indicated -- use the NORMAL setting when reading "-15VDC".

7) **Monitoring:** A card is supplied which contains precision-matched 75us de-emphasis networks, 0.1%-accurate dematrixing circuitry, plus a professional dbx decoder card. 600-ohm unbalanced Left and Right monitor outputs are available on the rear panel for listening or measuring. The purpose of the monitor card is to aid adjustment and verification of stereo generator operation independent of the aural exciter, transmitter, diplexer, antenna, and modulation monitor. This makes it far easier to locate a fault in the system, since proper operation at the monitor output terminals combined with improper operation at the modulation monitor indicts equipment after the audio portion of the stereo generator.

   The monitor card is driven from the sum and difference audio inputs to the stereo generator; a stereo demodulator is not included. However, correct operation of the 8182A/SG's stereo baseband generator can be verified with only an oscilloscope, using one or more of the baseband generator's TEST modes. (See **Stereo Baseband Generator** above for more detail.)

   By switching both the N/R Encoder and N/R Decoder OUT, it is possible to measure static separation through the system independent of the dbx companding, but including the effects of the matched 11-pole filters (and all other circuitry). This provides a further aid to troubleshooting.

This concludes the **Simplified System Description.**

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PART 2:
Application

Implementation of Multichannel Sound for television can be divided into two parts: that necessary for the basic stereo service and that necessary to add the SAP and/or PRO channels.

It is considerably easier to implement stereo than to implement the other subcarriers since limitations in the exciter, diplexer, and antenna generally do not degrade the quality of the stereo signal below "entertainment quality". (However, if Incidental Carrier Phase Modulation [ICPM] in the visual transmitter exceeds 5°, it can cause subjectively annoying buzz which will be clearly audible to the consumer.)

Because of the greater carrier deviations involved and the fact that the sidebands produced by the SAP and PRO subcarriers are further from the nominal carrier frequency than is the stereo subchannel, there is substantially higher probability that some difficulty (mainly crosstalk from stereo into SAP) will be experienced with the SAP and PRO carriers in many unmodified transmitter plants. More rigorous engineering analysis will probably be required, and the costs of correcting the plant may be unacceptable. This must be evaluated on a case-by-case basis.

It is unnecessary to qualify the plant for all MTS services merely to implement stereo. In our experience, stereo can be implemented quickly and at low cost in many stations. Further, since consumer receivers are unlikely to be able to reproduce the frequency response and separation required by FCC specifications (OST-60), and since it is unlikely that citations would be issued for minor deficiencies in the initial phase of the implementation, stations may find that a very satisfying entertainment-quality signal can be achieved with as little as 20dB midband separation and 12kHz audio bandwidth until such time as full specifications can be achieved. (These are, respectively, 30dB midband separation and 15kHz frequency response. The 8182A/SG Stereo Generator is capable of generating a baseband which substantially exceeds these specs.)

A complete discussion of all engineering facets of MTS as they relate to the RF plant would be impossible within this Manual due to space limitations. A list of sources of detailed information is included at the end of this **Part.**

This **Part** provides a broad overview of the issues to be considered and includes some system design considerations.

STUDIO-TRANSMITTER LINKS

At this writing, the ideal method of transmitting the Multichannel Television Sound ("MTS") information from studio to transmitter is far from being well-defined. Many stations will use several subcarriers on their video STL to accomodate the various audio signals, including the left and right audio channels, the SAP audio, and the Professional audio. If this method is used, most of the Orban equipment is located at the transmitter and receives audio feeds from the demodulated subcarrier outputs of the video STL.

If the STL has poor signal-to-noise ratio, it is recommended that the 8182A system be split, placing the Dual-Band Compressor at the studio end of the STL to protect it from overload and to permit higher average STL modulation. This is done by means of the optional Model 8182A/ST Studio Accessory Chassis. Four cards (left and right compressors, compressor control, and Loudness Controller) are removed from the Main 8182A chassis and installed in the 8182A/ST Studio Accessory Chassis. Two "jumper cards" which contain buffer amplifiers are then placed in two of the vacant slots of the Main Chassis to provide balanced inputs and signal continuity to the rest of the Main Chassis circuitry.

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Stations which may be using telephone lines to carry audio to the transmitter site can also benefit from this configuration because available S/N is increased.

It is important to note that the Dual-Band Compressor section alone does not control peak levels accurately, and does not compensate for overloads caused by pre-emphasis. (Peak limiting, pre-emphasis, and high frequency limiting are found later in the system.) It is therefore necessary to allow headroom in the STL to accomodate compressor overshoots. If the STL is pre-emphasized at 50 or 75us (as is the case with many single-channel-per-subcarrier video STL's), additional headroom must be allowed to accomodate the peak level increases caused by the pre-emphasis. Precise STL setup recommendations are found in **Part 4** of this manual.

Several manufacturers have proposed a system which is equivalent to the "Composite STL" approach sometimes used in FM stereo. In this system, the entire baseband (including the stereo subcarrier, the pilot, the SAP, and the Pro Channel) is encoded onto a single broadband, phase-linear subcarrier of the video STL. At this writing, we have had no practical experience with such a system outside the lab. However, if such a system is used, the entire Orban generating system (including 8182A Audio Processor, 8182A/SG Stereo Generator, and 8182A/SAP [if used]) is located at the studio before the STL.

Current "wideband" subcarriers not specifically designed for MTS do not have sufficiently flat group delay to pass the MTS baseband, and should not be used.

It is probably unwise to try to use video distribution amplifiers to pass the stereo baseband. While high frequency bandwidth and phase linearity would be adequate, non-linear distortion might be excessive, low frequency group delay might not be sufficiently flat, noise performance is suspect, and any video processing included in the DA would certainly degrade the baseband signal.

SYNC REFERENCE

The 8182A/SG and 8182A/SAP both require sync or composite video at 1V p-p to derive a 15,734Hz reference. Both units are designed with "loop-through" facilities to assure maximum flexibility. Each chassis contains two BNC connectors, each isolated from chassis ground to prevent introducing ground loops into the plant. The hot and shield terminals of the two BNC connectors are connected in parallel. The sync is sensed by means of a high-impedance balanced-input amplifier connected between the hot and shield terminals. If only composite video is available at the transmitter site, then this video can be looped-through and will suffer no degradation from the high-impedance balanced load. If a separate sync or composite video drive is available to feed the 8182A/SG and/or 8182A/SAP, then the 75 ohm terminator internally available should be switched IN to avoid reflections. If both 8182A/SG and 8182A/SAP are fed from a single reference, it may be looped through one of the units and terminated in the other.

If sync reference is lost, the 8182A/SG will automatically revert to mono mode. (A special loss-of-lock mono mode will be entered which transmits L+R in mono.) The SYNC LOCK LED on the front panel will go out. Upon resumption of sync lock, the unit will return to whichever mode (STEREO, MONO LEFT, or MONO RIGHT) it was in before lock was lost.

In the case of loss of sync reference for the 8182A/SAP, the carrier will automatically mute, and the 8182A/SAP's SYNC LOCK LED will go out.

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Remote Indicators: Both chassis are equipped to remotely indicate the status of the SYNC LOCK LED. This is done via an NPN transistor inside an optoisolator. The transistor is ON when sync lock is achieved, and OFF otherwise. It can sink up to 1mA of current, and can be readily connected to drive a relay (with an external booster transistor -- see **Part 3** of this manual) or various logic families, such as TTL or CMOS. Be sure to observe the correct polarity. Note also that if the transistor is directly connected to a low-impedance voltage source, IT WILL BE IMMEDIATELY DESTROYED. It is the responsibility of the installing engineer to design an interface circuit which limits current to 1mA or less. The value of the current-limit or pull-up resistor will depend on the voltage level of the external circuit.

THE RF PLANT

Exciters: Many television aural exciters presently in use are unsuited for stereo and/or SAP operation because of insufficient bandwidth, insufficient linearity, insufficient frequency deviation capability, and/or insufficiently constant group delay. The EIA Standard RS-508 contains specifications for stereo aural exciters. In brief, such standards require frequency response of ±0.05dB 50-47,000 Hz, deviation from phase linearity less than ±0.5 degree over the same bandwidth, deviation capability of ±100kHz, and linearity specifications which are too complex to describe here. (If SAP and Pro subcarriers are used, frequency response must extend to 106kHz, although absolute flatness is not required above 47kHz.)

While this performance is well within the state-of-the-art for modern FM exciters, most television exciters will probably have to be modified or replaced to meet the requirements. Exciters using phase modulators will certainly have to be replaced, while it may be possible to modify direct-FM exciters. In all cases, the manufacturer of the exciter and/or transmitter should be consulted. We anticipate that a number of independent consultants will involve themselves in this area.

EIA Standard RS-508 specifies a 75 ohm input impedance for all exciter inputs except for the 600 ohm balanced mono input (which is unused in a system employing the 8182A-series equipment). Sensitivity for both 75 ohm inputs (baseband and SAP) is specified as 1.5V peak (1.061V rms) for full deviation (±75kHz for full baseband and ±15kHz for SAP). The 8182A-series is designed to be compatible with these impedances and levels with some safety margin built-in.

Driving Two Exciters From One Generator: It is practical to drive more than one exciter from one 8182A/SG. Details for doing this are found in **Part 3** of this manual.

RF Amplifiers, Diplexers, And Antennas: The bandwidth of existing RF amplifiers, diplexers, and antennas may be insufficiently wide to achieve satisfactory stereo performance. The **BTSC Recommended Practices** suggest that the aural bandwidth of the notch diplexer must be at least 400kHz at the -3dB points. Group delay should be as symmetrical as possible about the aural carrier frequency. Superior performance will be achieved if the group delay is equalized for maximum uniformity throughout the bandwidth of the diplexer.

In practice, almost any diplexer probably has enough bandwidth to produce reasonable stereo (although it may not meet the separation specifications of OST-60 which, as this is written, are still performance standards required by the FCC). However, if SAP or PRO are used, the 400kHz bandwidth spec must be met to avoid objectionable crosstalk from the stereo into the SAP.

As a very general guideline, low-band VHF single-tuned notch diplexers will have insufficient bandwidth for stereo without modification or retuning. High-band VHF single-tuned diplexers will be borderline, and UHF single-tuned diplexers will probably be adequate.

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EIA Standard RS-508 provides some guidance regarding further details of required performance. As this area is highly specialized, we recommend consultation with the manufacturer of the transmitter and/or diplexer to determine what, if any, modifications are required to make these parts of the system operate correctly in stereo.

In general, the expeditious thing to do is to install the stereo and/or subcarrier generating equipment and then to measure total plant performance to see if overall performance specifications are being met. If they are, all well and good. If not, the plant must be analyzed in more detail to determine which components must be brought up to par.

Measurement requires monitoring equipment specifically designed for multichannel sound; your current mono modulation monitor and/or Tektronix 1450 will not work. Mono monitors have adequate bandwidth to measure the main (L+R) channel but the indication will almost certainly be in error if the monitored bandwidth exceeds 15kHz, which is inevitable in stereo broadcasting. The pilot, SAP, PRO, and portions of the stereo subcarrier will all be rolled off. Thus, the monitor will indicate lower modulation than that which actually exists. We know of no simple way to convert any of the existing monitors or to correct their readings so that they are meaningful.

The 1450 may be updated by means of the Tektronix 1450-F20 modification kit. According to our sources, any 1450's with serial number above B020000 have this upgrade. If in doubt, check with Tektronix.

REMOTE CONTROL FUNCTIONS

The three operating modes of the 8182A/SG (STEREO, MONO LEFT, and MONO RIGHT) can be selected by remote control. In addition, the optional Professional Channel can be turned ON and OFF.

The MONO LEFT and MONO RIGHT functions are useful in the case of failure of one channel of the STL or one channel of the 8182A audio processing. The good channel can be fed in mono, and programming can be continued by selecting the good channel and mono mode by remote control.

The remote control ports are easily interfaced with practically all commercial remote control systems. Details are provided in **Part 3** of this manual.

DISTORTION IN RECEIVERS

Television stereo, like FM stereo, can suffer from multipath distortion ("ghosts" in video parlance). Multipath is ordinarily not a problem in mono or in mono receivers decoding a stereo signal. However, severe multipath processed in a stereo receiver can make the audio unlistenable. Ordinarily, the picture will be substantially degraded by the time the audio is unlistenable. However, even a small amount of multipath can be heard as high frequency distortion and excessive sibilance. Women's ears will be more sensitive to such problems. Where such problems exist, the viewer may wish to turn down his treble control, force his receiver into mono, or reorient his antenna.

(We have observed an unusual phenomenon in some of the early stereo sets in which forcing the set into mono does not eliminate audible multipath distortion, although a mono set seems much less susceptible to such distortion when driven by the same RF signal. At this writing, we have no explanation for this.)

One infrequent problem is high frequency distortion and excessive sibilance in certain older sets with narrowband discriminators. These discriminators are clipping due to the higher deviation of the MTS signal, and are producing difference-frequency IM distortion. There is no cure for this (short of replacing the set); this problem is inherent in the BTSC system (but will affect only a very few percent of the audience).

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SOURCES OF INFORMATION

1. **BTSC SYSTEM: TELEVISION MULTICHANNEL SOUND RECOMMENDED PRACTICES**

   This lengthy document produced by the Electronic Industries Association suggests methods and standards for implementation both in receivers and transmitters. It is somewhat mathematical and idealized, and does not consistently recognize field practicalities. Primarily oriented towards design engineers in the transmitter and receiver industries, it nevertheless contains some highly useful information for the competent station engineer.

   From: Electronic Industries Association
   Consumer Electronics Group
   2001 Eye Street, N.W.
   Washington, D.C. 20006
   (202) 457-4919; TWX:710-822-0148

2. **Multichannel Television Transmission And Audio Processing Requirements For The BTSC System.** FCC Office Of Science And Technology Bulletin No. 60, April 1984. (Known popularly as OST-60).

   The definitive FCC document which defines the standards for the Multichannel Television Service when a 15,734Hz pilot tone is present. (If the tone is not present, almost any combination of subcarriers can be used for broadcast or non-broadcast applications.)

   From: U.S. Government Printing Office
   Washington, D.C.

   order desk: (202) 783-3238

3. **National Association Of Broadcasters: Proceedings of the 39th Annual Broadcast Engineering Conference, Las Vegas, Nevada, 1985.**

   Contains, in 66 pages, seven meaty, practical articles for station engineers. RCA's Mattison discusses RF considerations and especially conversion techniques for various RCA transmitters. ITS's Zborowski treats transmitter plant requirements and testing. Jim Swick of WTTW, Chicago, talks of system design and configuration. Randy Hoffner of NBC explains how to prepare the transmitter. Aitken and Fiore of Comark illuminate diplexer mysteries as does a succeeding article from Micro Communications. Finally, Geoff Mendenhall of Broadcast Electronics addresses the testing of the existing plant for MTS service.

   There are also other interesting articles on audio for MTS.

   In addition, the **38th Annual Proceedings** (1984 Conference) contains good articles on how the system works.

   The **NAB Engineering Handbook** (7th Edition; 1985) contains MTS information on pp. 3.5-149 to 3.5-154, and on pp. 3.6-185 to 3.6-196.

   From: NAB Services
   1771 N Street, N.W.
   Washington, D.C. 20036
   Order by phone: (800) 368-5644

This concludes **Part 2 (Application).**

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PART 3:
Installation

Registration Card: If you have not already done so, please fill out the Registration Card fully and mail it to the factory. (See **Preface.**)

Unpacking And Initial Inspection: You are now ready to proceed with unpacking and installation of your 8182A/SG Stereo Generator.

Since, sometime during its life, you may wish to re-ship it and since it is expensive and heavy, it is advisable to ship it in the original packing materials which have been carefully designed to protect it. For this reason, it is wise to mentally note the method of packing and to save all packing materials.

Sage advice for repacking and reshipping your unit is contained at the end of **Appendix F** of your main **8182A Operating Manual.**

Various items are packed with the 8182A/SG:

(1) Line Cord
(4) 10-32x3/4" Rack Screws
(1) 3-wire AC Adapter
(1) This Operating Manual
(1) 5/64" Allen Wrench (for front panel screws)
(2) Keys For Access Door
(1) 14-pin jumper cable to connect to the Audio Processor chassis
(1) Kit to rewire 8182A Accessory Port #1. (Applicable only to 8182A units prior to S/N 780000.)

Physical Examination: Perform a general inspection of the perimeter of the unit to check for obvious damage.

DAMAGE CLAIMS MUST BE MADE BY YOU AGAINST THE CARRIER IMMEDIATELY UPON DISCOVERY. Save packing and other evidence of damage for the carrier's inspector.

Set the unit on a flat, soft surface. Remove the three hex-socket screws at the top of the front panel using the wrench provided. The front panel, which is hinged at the bottom, will then tilt downward and reveal the interior.

Remove the subpanel through which the controls protrude by twisting the four DZUS fasteners 1/4 turn counterclockwise. Tilt the panel to remove it. This reveals the "card cage".

Various components are mounted in sockets for servicing convenience. It is possible that a component could be dislodged by severe shocks in shipment. Look for IC's which may have fallen out of their sockets during shipment.

Starting at the left, using the card ejector tabs, carefully remove each card in turn, examine it, and replace it. Make sure that all components are properly seated in their sockets. Check with particular care to make sure that none of the IC's are held in their sockets by one row of leads only.

Power Considerations: The 8182A/SG will operate on 115/230V ±15% 50-60Hz AC power. Due to the conservative design of the power supply, it should also operate properly on 100 or 208 volt service. If it is operated at 230V, local electrical codes for line connections should be observed.

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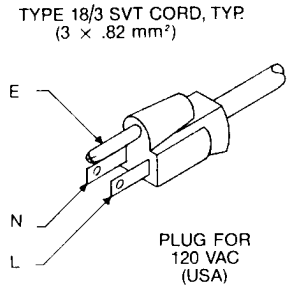
Without applying power to the line cord, turn the power switch ON and check the position of the LINE VOLTAGE SELECTOR switch. All units are shipped with this switch in the "115 Volt" position. Adjust the selector switch so that the appropriate voltage is indicated. (If the 8182A/SG is installed within a transmitter, 208/230V may be the only power conveniently available.) Check the fuse, and replace with the following values if necessary:

110/115 VOLT: 1/2 amp SLO-BLO, 3AG-type (as supplied);
208/230 VOLT: 1/4 amp SLO-BLO, 3AG-type.

AC connection to the chassis is made through an RF filter with IEC-standard mains connector. This filter meets the standards of all international electrical safety authorities, and leaks less than 0.5mA to the chassis when operated from 230V mains.

A U.S.A.-standard "U-ground" power cord is supplied. Users in other countries should be able to obtain a power cord compatible with their country's standard. If you choose to cut the "U-Ground" plug from the cord and replace it with a plug appropriate to your standards, refer to Fig. 3-1 below.



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

Fig. 3-1: AC MAINS LINE CORD DETAIL

Initialization Options: The section describes how to change certain operating characteristics of the 8182A/SG to suit your needs. All modifications are made on the plug-in circuit cards. If the steps regarding physical inspection above have been followed, the cards are now readily accessible.

1) **Powerup Mode:** The 8182A/SG is shipped to power up in STEREO mode. To restrap so that it powers up in either MONO LEFT or MONO RIGHT mode, you must move a jumper plug on Card #7 according to Fig. 3-2.

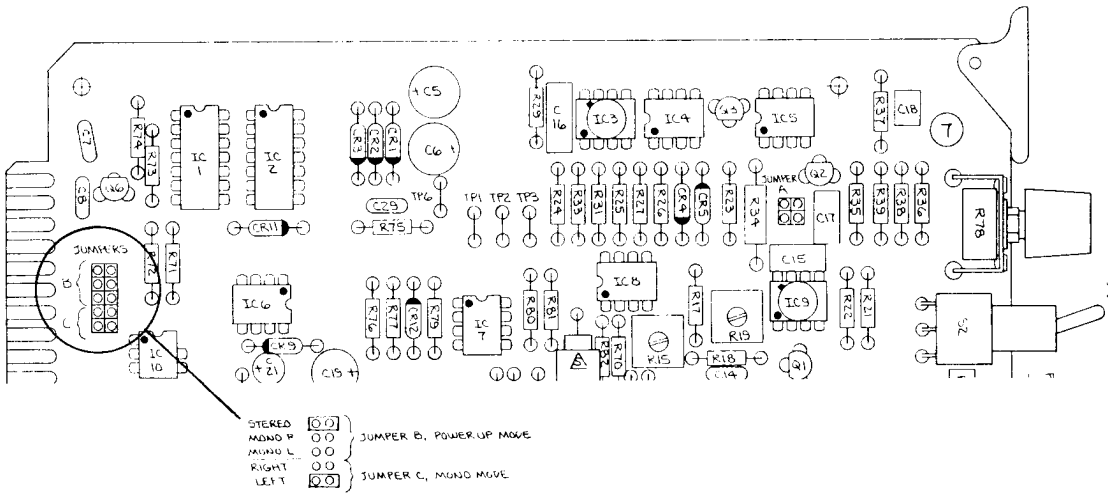


Fig. 3-2: STEREO/MONO INITIALIZATION JUMPERS

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2) **Stereo/Mono Switch:** The front-panel STEREO/MONO switch ordinarily forces MONO LEFT mode when MONO is selected by this switch. If MONO RIGHT is desired, move a jumper plug on Card #7 according to Fig. 3-2 above.

3) **Output Impedance:** The 8182A/SG is shipped from the factory with 0 ohms composite output impedance. Because coaxial cable does not behave as a transmission line at the low frequencies found in the stereo baseband, we recommend operation with 0 ohm output impedance. However, if you wish to strap the unit for 75 ohm output impedance, you may do so by moving Jumper "A" according to Fig. 3-3.

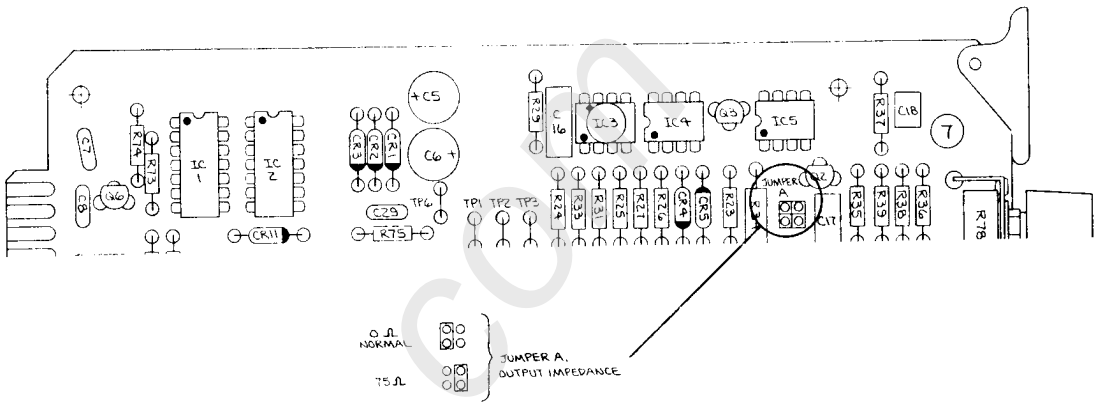

Fig. 3-3: COMPOSITE OUTPUT IMPEDANCE JUMPER

You may now reinsert Card #7 in its slot and replace the subpanel.

INTERCONNECTION TO HOST CHASSIS

The 8182A/SG is connected to its host 8182A by means of the supplied 14-pin jumper cable. The 8182A/SG must be mounted immediately adjacent to its host; we recommend mounting it above.

If you have an 8182A with a serial number below 780000, its Accessory Port #1 must be slightly rewired to accomodate the 8182A/SG, as the 8182A was designed before the BTSC system was defined. A kit for this rewiring (including instructions) is supplied with each 8182A/SG. The instructions are reproduced in **Appendix I.**

Restrapping The Host Chassis: To assure correct operation of the 8182A/SG, several jumpers on Card #7 of the host 8182A must be strapped in specific positions.

Gain access to the 8182A circuit cards by following the instructions on p. C-1 of your main **8182A Operating Manual.** Remove Card #7 from its slot. Refer to the Card #7 Assembly Drawing in the same manual, and strap the jumpers on Card #7 as follows:

Jumper "A": DEEMPHASIS OUT
Jumper "B": DEEMPHASIS OUT
Jumper "C": SUM OUT
Jumper "D": DIFFERENCE OUT

Return Card #7 to its slot.

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FOR REFERENCE, BELOW IS A BRIEF SUMMARY OF THE OTHER 8182A AUDIO PROCESSOR JUMPERS. These are more fully discussed in **Part 3** of your **8182A Operating Manual.**

(Refer to the appropriate Assembly Drawings for the Cards in **Appendix J** of your **8182A Operating Manual.)**

Cards #0&#1: These Cards have no jumpers.

Card #2: Jumper "A" should be in the "CARD 8/9" position in a single-chassis installation, and in the "CARD 3/4" position in a dual-chassis installation.

Jumper "B" determines whether the unit powers-up with the Loudness Controller ON or OFF, and should be set according to the requirements of your installation.

Cards #3&#4: If you cannot achieve the desired amount of gain reduction by adjusting the INPUT ATTEN controls on the 8182A, readjust these jumpers to change the sensitivity of the Cards by 20dB.

Card #5: This Card has no jumpers.

Card #6: Jumper "A" should be in the "8182A Clipper Bias Defeat" position (as shipped).

Jumper "B" should be in the "Normal" position (as shipped).

There should be no links on Jumper "C" (as shipped).

Card #7: This Card has special jumpering requirements when it is used with the 8182A/SG Stereo Generator. See immediately above.

Cards #8&#9: Jumper "A" should be in the "8182A" position (as shipped).

Jumper "B" should be in the "Normal" position (as shipped).

Replace the 8182A subpanel.

Set the N/R IN/OUT switch on the rear panel of the 8128A to IN. (This breaks the signal path between the 8182A's Compressor and High Frequency Limiter, allowing the 8182A/SG's 6-Pole Filters to be placed in the signal path.)

Connect the 14-pin jumper cable between the 14-pin connectors on the 8182A and the 8182A/SG.

Initial Electrical Checkout: Plug the power cord into an outlet whose voltage corresponds to the setting of the internal LINE VOLTAGE SELECTOR switch. The unit should spring to life. Check that the following are true:

A) The green POWER LED is lit;
B) All other LED's are not lit (presuming that you have not yet connected a sync source to the SYNC IN connector);
C) All VU meter positions read "0%" except for "-15VDC", which reads 100% ±5%; and "2H PLL" and "2H AGC", both of which may vary widely.

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If anything is abnormal, repeat the **Physical Inspection** described above to make sure that you didn't miss anything. A preliminary diagnosis should be made, and if necessary, the factory should be consulted.

If you wish to perform a more rigorous and complete checkout before installation, **Appendix D (Field Audit-Of-Performance Procedure)** provides complete instructions.

Mounting And Grounding: As a matter of good engineering practice, it is desirable that the chassis be properly connected to a good earth ground. Ordinary wire is totally ineffective at VHF and above. The best way to ground the chassis is to mount it solidly in a well-grounded rack (or the transmitter cabinet). The rack or cabinet must be connected to earth through a wide, thin copper ground strap.

To assure good electrical contact between the chassis and the rack, it may be necessary to scrape the paint from the rack and/or the mounting flanges. Measure the resistance between the chassis and rack, and verify that it is less than 0.5 ohm.

Sync Input: Sync or composite video is required to provide a horizontal line frequency reference for the circuitry. The input port is a BNC connector which is insulated from the chassis to prevent possible ground loops.

A loop-through facility is provided for convenience. If loop-through is used, the TERMINATION switch on the rear panel of the 8182A/SG should be in the HI-Z position. Otherwise, it should be in the 75 OHM position.

Successful sync lock is indicated by the front-panel SYNC LOCK LED's lighting continuously. If it does not light, or if it flickers, try adjusting the sensitivity of the sync stripper circuit by placing the SYNC SENSITIVITY switch (on the subpanel behind the swing-down door) in the IN position and then adjusting the SYNC SENSITIVITY control until the SYNC LOCK lamp stays constantly lit. Ordinarily, this adjustment is non-critical and should not be required at all if the sync or composite video is close to 1V p-p. So first try operating with the SYNC SENSITIVITY switch in the OUT position.

Composite Output Connection: The composite output is capable of driving greater than 2.2V pk into 75 ohms in parallel with less than 0.047uF (for $\pm$73kHz deviation, including 50kHz for stereo, 5kHz for the pilot tone, 15kHz for SAP, and 3kHz for PRO).

The composite output appears on a BNC connector. This is mounted on a metal plate which is insulated from the chassis by means of a thin polyester dielectric. This assembly forms an RF bypass capacitor of approximately 500pF. The shell of the BNC connector is connected to The 8182A/SG circuit ground through an EMI filter.

The purpose of this arrangement is to enable unbalanced wideband exciter inputs to be driven without introducing hum-inducing ground loops. Different techniques must be used for interconnection, depending on whether the exciter input is balanced or unbalanced.

1) Balanced Exciter Input: Connect the 8182A/SG circuit and chassis grounds to each other at the rear-panel barrier strip. This will create the required connection between the exciter and 8182A/SG circuit grounds.

2) Unbalanced Exciter Input: The 8182A/SG circuit ground will automatically be connected to the exciter circuit ground through the shield of the baseband connector coax. Ordinarily the 8182A/SG circuit and chassis grounds will <u>not</u> be jumpered, as this will tend to create a ground loop.

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NOTE

Both the 8182A and 8182A/SG rear-panel barrier strips have provisions for jumpering circuit and chassis grounds together. Since the circuit grounds of the 8182A and 8182A/SG are connected to each other through the jumper cable, this means that it is necessary to remove circuit-to-chassis ground jumpers on both chassis to assure that no undesired circuit-to-chassis ground connection has occurred.

High RF fields often force reconsideration of conventional grounding ideas. If EMI-induced hum is observed when the circuit-to-chassis ground straps are removed as recommended above, try replacing one or both to see if the hum is reduced.

While one might think that the 75 ohm mode would match 75 ohm coaxial cable correctly, this assumption is not valid at the relatively low frequencies in question (less than 100kHz) because the characteristic impedance of the cable is not necessarily 75 ohms at these frequencies. Instead, the impedance varies substantially as a function of frequency and the cable does not behave as a constant-impedance transmission-line. This can introduce substantial aberrations into the frequency and phase response, disturbing stereo separation and compandor tracking. We therefore recommend operating with 0 ohms source impedance.

Driving Two Exciters In Parallel: Many stations will need to drive more than one exciter from the 8182A/SG. If the exciters can be trimmed to have identical sensitivity, then simply strap the stereo generator output for 0 ohms source impedance and drive the exciters' baseband inputs in parallel.

Because the relationship between carrier deviation and dbx encoder operating levels must be maintained to better than ±1% accuracy, each exciter must be trimmed according to the Bessel Null method described in **Part 4** of this manual. If the exciter is not equipped with a gain trim control, one can usually be readily added to the exciter input. Because the coaxial cable usually used for interconnecting the stereo generator with the exciters does not exhibit uniform impedance at the low frequencies present in the baseband spectrum, and because the cable is being driven by a voltage source, it is unnecessary to terminate each line with 75 ohms, and a trimpot of any convenient value can be used. 1K might be appropriate; this will depend upon the circuit design of the exciter.

If the exciter terminates its input with a 75 ohm resistor, it is probably best to remove it.

Use a temperature-stable element (like cermet) in the added trimpot. DO NOT use a wirewound pot; its stray inductance may disturb system frequency response and stereo separation.

The "0 ohm" output impedance of the 8182A/SG is actually a small fraction of 1 ohm, and is frequency-dependent. If each exciter being driven in parallel has a 75 ohm input impedance, and if one exciter is temporarily disconnected, this will slightly affect the load impedance on the stereo generator output and thus slightly affect the voltage seen by the other exciter. A 75 ohm dummy load (1/8w or greater) should therefore be placed across the temporarily-unused cable if one exciter is disconnected unless the exciters have been modified to have input impedances exceeding 1K. In this case, temporary termination is unnecessary: The load presented by the exciter may be considered to be truly "bridging".

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SAP Input: The SAP input appears on a BNC connector mounted on the isolated plate described earlier. This provides a "quasi-balanced" input which resists hum-producing ground loops.

The load impedance of the SAP input is 15K. The gain between the SAP input and the Composite Output is affected by the setting of the BASEBAND OUTPUT LEVEL control. The gain has been chosen such that 1.5V peak applied to the SAP input should produce ±15kHz carrier deviation after the 8182A/SG's BASEBAND OUTPUT LEVEL control has been adjusted to correctly match the 8182A/SG to the gain of the particular exciter in use, according to instructions provided in **Part 4** of this manual.

Final alignment of SAP injection to match the SAP generator to the exciter must be performed after the 8182A/SG's BASEBAND OUTPUT LEVEL control has been adjusted.

Remote Control: Three sets of remote control terminals for selecting STEREO, MONO LEFT, and MONO RIGHT modes, and two sets of terminals for selecting PRO CHANNEL ON/OFF are located on the barrier strip on the 8182A/SG rear panel. These are optically-isolated, RF suppressed, and may be floated ±50V above ground. The (-) sides of all of the optoisolators are connected to the COMmon terminal. Mode switching can be effected by applying a pulse as short as a few milliseconds to the appropriate terminals. Either AC or DC from 6 to 24 volts may be used. To use 48 volts, connect a 1K ±10% 2W carbon composition resistor to each terminal for current limiting.

If the remote control can provide voltage pulses from its internal power supply, this is the simplest means of activating the functions. The current requirement is approximately 1.9mA/volt. If the pulses are DC, be sure to apply (-) to the COMmon terminal.

If the remote control can provide only contact closures, you can use the +22V unregulated DC supplied on the 8182A/SG barrier strip to activate the functions. If you choose this mode of operation, then connect the COMmon terminal to chassis ground.

If switching is effected by supplying continuous voltage (instead of a single pulse) to the terminals, we advise adding a series resistor to the COMmon remote control terminals to limit current to 10mA to avoid premature failure of the opto-isolators.

CAUTION!

Do not apply voltage to more than one set of remote control terminals at a time. Extreme overmodulation can result.

Remote Sync Lock Indicator: An optically-isolated NPN transistor is available at the rear-panel barrier strip to remotely indicate that sync lock has occurred. The LED within the optoisolator is connected in series with the SYNC LOCK LED on the front panel. When sync lock occurs, the LED within the optoisolator turns ON, and turns ON the transistor.

WARNING!

Never connect a voltage source to the SYNC LOCK terminals. External current limiting must always be used to avoid burning out the transistor.

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Ordinarily, the SYNC LOCK terminals will be connected to a logic gate such as TTL or CMOS. The (-) SYNC LOCK terminal should be connected to logic ground, and the (+) terminal should be pulled up to logic V+ through a resistor. Choose the resistor value to limit current to 1mA when the transistor is ON. V+ should not exceed +20VDC.

If you wish to drive a relay from the SYNC LOCK terminal, use an external NPN driver transistor for the relay. Refer to Fig. 3-4 for suggested circuitry.

NOTE: Later units use an SPST relay contact instead of an optoisolator for remote sync lock indication. The contact is available on the REMOTE SYNC LOCK terminals of the rear-panel barrier strip.

While the relay contacts will correctly drive the circuit shown below (assuring that an old-design sync card [Card #8] can be replaced by a new-design card if servicing is necessary), the external circuit is obviously unnecessary if your unit is already equipped with a relay. If your unit is so equipped, this will be indicated in an external Addendum to this Manual.

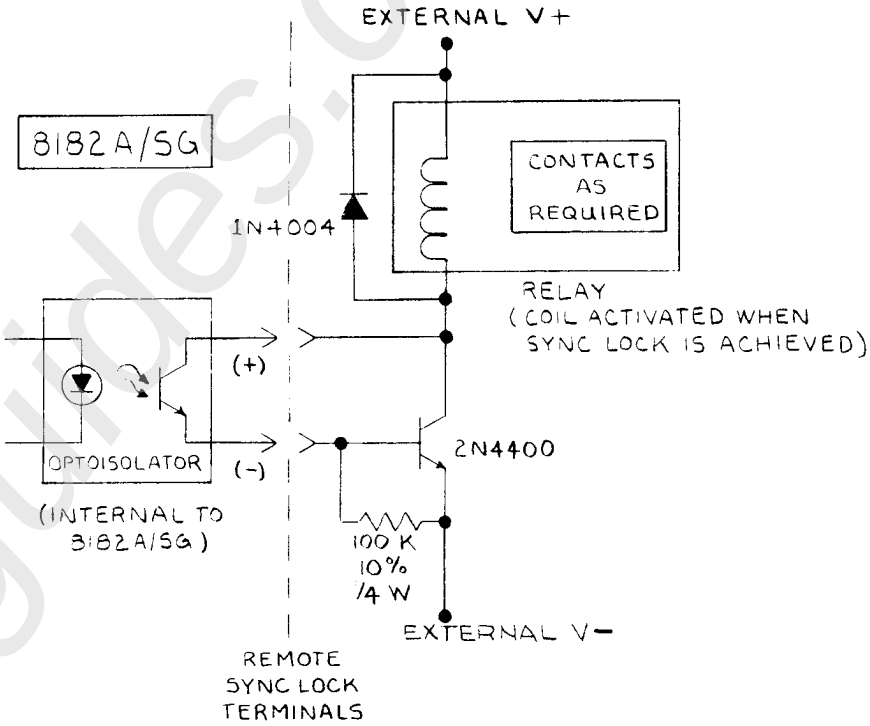

Fig. 3-4: Driving A Relay From The Remote Sync Lock Terminals (Earlier Units Only)

This concludes **Part 3 (Installation).**

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PART 4:
Initial Setup Procedure

IMPORTANT!

These instructions supercede those found in **Part 4** of your **8182A Operating Manual.** The instructions below are complete, although they refer to stereo installations only. Ignore the instructions in **Part 4** of your **8182A Operating Manual,** and follow the instructions below instead.

If you have a single-chassis OPTIMOD-TV, skip to **II. Alignment Common To Single- And Dual-Chassis Installations** below.

If you have a dual-chassis OPTIMOD-TV (i.e., one with an 8182A/ST Studio Accessory Chassis), you must first align the gain of your STL and the Main (Transmitter) Chassis to a standard to assure that both STL and Main Chassis are driven at correct levels and are properly gain-matched. [The dual-chassis configuration is described in **Part 1 (Introduction)** of your **8182A Operating Manual.]**

You will need a precision aural demodulator or TV stereo baseband monitor (your mono modulation monitor is not suitable), triggered-sweep oscilloscope with at least 5 MHz vertical bandwidth, a low-distortion audio oscillator, a frequency counter, and an RF spectrum analyzer capable of looking at the output of your aural exciter.

I. DUAL-CHASSIS ALIGNMENT

Installing The Studio Chassis: If the Studio Chassis is not already installed, you must install it before beginning the alignment. See the instructions supplied with the Studio Accessory Chassis (8182A/ST).

Alignment Procedure: The alignment procedure is repeated twice, once for the left channel and once for the right. At the studio, you will need an assistant equipped with a 1kHz audio oscillator.

In all cases, it is assumed that the STL is a pair of land-lines, a pair of microwave STL's, or a PCM link.

There are three steps in this sequence:

1) Adjust the operating controls on the Accessory Chassis as follows:

Proof/Operate Switch:	OPERATE
Loudness Controller:	OFF
L and R Input Attenuators:	0
Clipping:	+2
Release Time:	10
Bass Coupling:	10
Gate Threshold:	0
HF Limiting:	10

2) Connect an audio oscillator to the LEFT INPUT of the Accessory Chassis. Set its frequency to 1kHz, and its output level to produce "0dB" ±3dB as indicated on the Accessory Chassis TOTAL MASTER G/R meter.

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[This establishes a standard level at the output of the Accessory Chassis of 1.17Vrms (+3.6dBm) ±0.5dB when its OUTPUT ATTEN is fully clockwise and when its balanced output is loaded by 600 ohms. This level is 3.4dB below nominal 100% modulation in a 75us pre-emphasis system, although compressor overshoots will produce peaks substantially above this level.]

If the STL is un-preemphasized, adjust the Accessory Chassis OUTPUT ATTEN until the STL is modulated 8dB below its nominal 100% modulation level. In the case of a microwave STL, refer to the modulation meter on the STL transmitter. In the case of a U.S.A.-standard land-line requiring a nominal drive level of +8dBm, simply turn the Accessory Chassis OUTPUT ATTEN fully clockwise.

If the STL is pre-emphasized at 50 or 75us, adjust the Accessory Chassis OUTPUT ATTEN until the STL is modulated 12dB below its nominal 100% modulation level.

Repeat Step (2) for the RIGHT CHANNEL of the Accessory Chassis, using the right channel STL.

3) Reconnect the oscillator to the LEFT Accessory Chassis input, and drive it with a 1kHz tone at a level which produces a "0" reading on the TOTAL MASTER G/R meter. Connect the output of the LEFT STL receiver to the LEFT INPUT of the OPTIMOD-TV Main Chassis. Place the VU meter FUNCTION switch in L COMPR OUT. Adjust the LEFT INPUT ATTEN on the OPTIMOD-TV Main Chassis to make the VU meter read 100%.

(**NOTE:** Jumper Cards #3TX and #4TX are shipped with 20dB pads ahead of the input amplifiers. If the readings in the L COMPR OUT position of the Main Chassis meter are too low with the INPUT ATTEN fully CW and the input pads are strapped for 20dB attenuation, restrap them for 0dB attenuation. This is done by moving the jumpers on Cards #3TX and #4TX according to Fig. 3-3 in your main **8182A Operating Manual.** The cards and subpanel are then replaced.

If the reading is too high with the INPUT ATTEN fully CCW, and the input pads on Cards #3TX and #4TX in the Main Chassis are strapped for 0dB attenuation, restrap the pads for 20dB attenuation.)

Disconnect the oscillator from the LEFT Accessory Chassis input, and connect it to the RIGHT Accessory Chassis input. The TOTAL MASTER G/R meter should still read "0".

Connect the output of the RIGHT STL receiver to the RIGHT INPUT of the OPTIMOD-TV Main Chassis. Place the VU meter FUNCTION switch in R COMPR OUT. Adjust the RIGHT INPUT ATTEN on the OPTIMOD-TV Main Chassis to make the VU meter read 100%.

II: SINGLE AND DUAL-CHASSIS INSTALLATION

The following steps are most readily performed entirely at the location of the Main Chassis and Stereo Generator. This location is usually the transmitter unless a composite baseband STL link is employed, in which case the Main Chassis and Stereo Generator are located at the studio.

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In the case of a dual-chassis installation, the procedure requires temporarily patching an oscillator into the audio inputs of the Main (8182A) Chassis, thus temporarily disconnecting the STL. If there is no oscillator available at the transmitter, you may continue to use the oscillator at the studio. In this case, you must place the PROOF/OPERATE switch on the 8182A/ST Accessory Chassis in PROOF, be sure the Loudness Controller is OFF, and proceed by analogy.

In the case of a single-chassis installation, the oscillator is connected to the audio inputs of the 8182A. Both PROOF/OPERATE switches on the 8182A must be placed in PROOF. The Loudness Controller must be OFF.

There are five steps in this sequence:

1) Stereo Baseband Generator Tests: The 8182A/SG has been designed so that the stereo baseband generator can be aligned and tested entirely independently of the earlier audio circuitry (including the noise reduction encoder). The following procedure describes appropriate tests for proper baseband generator separation and pilot phase. (Alignment instructions are found in **Appendix E.)** The separation test evaluates the baseband generator only; it will not reveal any deterioration of separation caused by the noise reduction encoder, or by mismatches in the 11-pole filters and the sum and difference gains. The purpose of these tests is to assure that the exciter, RF amplifier, diplexer, and antenna have sufficiently high performance to pass the stereo baseband signal without significant degradation, and that the stereo baseband generator alignment controls are correctly adjusted to best match the baseband generator to the rest of the plant.

a) Temporarily disconnect the R input of the Main Chassis from the STL. Temporarily patch an audio oscillator into the L input of the Main Chassis. Set it for 1kHz, and adjust its output level so that the VU meter on the 8182A reads "+3" in the L FILTER OUT POSITION.

   Demodulate the off-air signal with a precision demodulator such as the Tektronix 1450 (with the 1450-F20 wideband upgrade kit or with S/N above B020000) or a stereo baseband monitor. DO NOT USE A MONO MODULATION MONITOR; these monitors have insufficiently broad bandwidth for stereo and will give totally misleading results! (Using the off-air signal takes into account the effects of as much of the RF plant as possible.)

b) Separation: Connect a triggered-sweep oscilloscope with at least 5MHz bandwidth to the baseband output of the precision demod or stereo baseband monitor. DO NOT USE AN ATTENUATOR PROBE; such probes often have sufficient midband phase shift to significantly distort the waveform to be measured. Trigger the oscilloscope externally from the audio generator.

   Switch the 8182A/SG's TEST switch to SEPARATION. Turn the PILOT switch OFF. Adjust the timebase and vertical sensitivity controls on the scope to obtain a display like Fig. 4-1. Ideally, the baseline will be perfectly flat, indicating infinite equivalent separation. If the baseline is not perfectly flat, the equivalent separation can be estimated from the formula: $S=20[\log(D/P)]$, where
   S is the separation (dB)
   D is the peak-to-peak deviation of the baseline from perfect flatness (volts); and,
   P is the peak-to-peak level of the total baseband signal (volts).

   (We suggest increasing the vertical sensitivity x10 to measure the deviation from baseline flatness more precisely.)

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If the baseline is curved, flatten it as much as possible by adjusting the SEPARATION control on the baseband generator. If the baseline consists of straight (but tilted) line segments, these are caused by phase shifts and/or frequency response rolloffs in the exciter or elsewhere in the system. Then, before continuing, equalize the system response to conform to the standards of RS-508.

Measure the separation at 50Hz and at 15kHz, adjusting the oscillator output level as necessary to produce a reading of "+3" on the 8182A VU meter in the L FILTER OUT position. Separation should exceed 40dB at 50Hz and 1kHz, and 30dB at 15kHz.

Problems with separation at 50Hz are usually caused by insufficient low frequency response in the exciter. (Apparent separation problems at 50Hz can be caused by poor low frequency response in the baseband demodulator.) Usually, larger coupling capacitor(s) will cure the difficulty. Sometimes, the time constant of the exciter's AFC is too fast, and the AFC attempts to "track out" low frequency modulation. The cure is to slow down the AFC time constant.

Problems with separation at 15kHz can be caused by insufficient bandwidth in the exciter, RF amplifier or diplexer. Separation problems at 1kHz are most often caused by misadjustment of the 8182A/SG's SEPARATION control, but can also be caused by severe bandwidth problems in the transmission path. If so, 15kHz performance will usually be substantially worse than 1kHz performance.

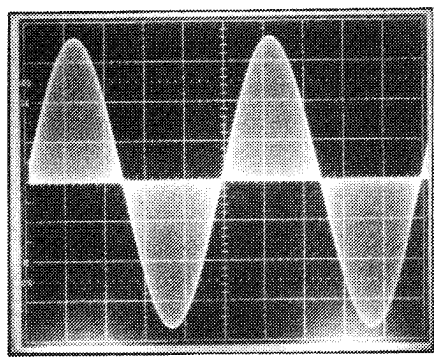

Fig. 4-1: SEPARATION SCOPE PATTERN

c) Pilot Phase: Set the oscillator frequency to approximately 1kHz, and adjust its level so that the 8182A VU meter reads "+3" in the L FILTER OUT position. Turn the PILOT switch ON, and set the 8182A/SG's TEST SWITCH to SUB-TO-MAIN CROSSTALK. You should see a pattern similar to Fig. 4-2. If the pilot phase is correct, the "tips" on this waveform will be perfectly horizontal.

Expand the vertical scale of the scope by 10x, and expand the sweep to look more closely at the "tips", as in Fig. 4-3. Adjust the 8182A/SG PILOT PHASE control until the "tips" are perfectly horizontal and level.

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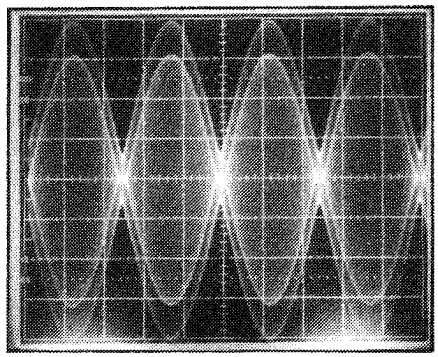

Fig. 4-2: PILOT PHASE TEST

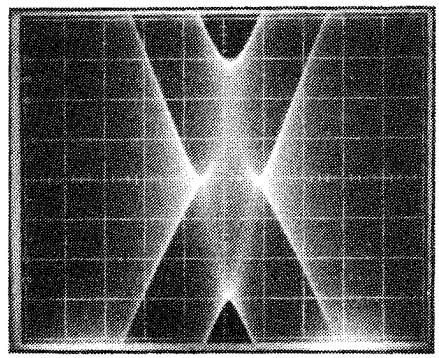

Fig. 4-3: PILOT PHASE TEST; x10

2) **Level Match, 8182A/SG To Exciter:** Turn the 8182A/SG's PILOT switch OFF, and set its TEST switch to MAIN-TO-SUB CROSSTALK. (This eliminates the stereo subchannel.) Switch both the N/R ENCODER and MONITOR N/R DECODER switches on the 8182A/SG to OUT. Continue to drive the 8182A's Left audio input. Increase the oscillator frequency to 10,396Hz ±10Hz (use a counter to check it).

Observe the L FILTER OUT position on the 8182A's VU meter and adjust the oscillator output level to secure a reading of approximately +3VU.

Then observe the L+R position on the stereo generator's VU meter, and adjust the 8182A's L OUTPUT ATTENuator (really L+R because of the L+R/L-R strapping of Card #7 in the 8182A) until the meter reads exactly "0VU". Make this observation very carefully; observe the meter head-on to avoid parallax error.

Turn the 8182A/SG's COMPOSITE BASEBAND OUTPUT ATTEN all the way down. (This is fully clockwise [CW] in early units, and fully CCW in later units. Doing this may take up to 18 turns.) Connect an RF spectrum analyzer to the output of the aural exciter and observe the RF spectrum. Turn up the 8182A/SG's COMPOSITE BASEBAND OUTPUT ATTEN until the carrier nulls. (First Bessel null. For a discussion of the Bessel null technique, see pp.434-436 of the NAB Engineering Handbook, Second Edition.)

If you do not have a spectrum analyzer available, adjust the COMPOSITE BASEBAND OUTPUT ATTEN to obtain 100% modulation as indicated on your mono modulation monitor (i.e., ±25kHz deviation). Use of such a monitor must be considered a stopgap measure, however, because deviation must be adjusted in this step to better than ±1% accuracy, and most monitors are insufficiently accurate to do this.

This procedure has precisely set the gain relationship between the stereo generator and the exciter. DO NOT ALLOW THIS RELATIONSHIP TO CHANGE ONCE ESTABLISHED. If the gain relationship is incorrect, the dbx decoder in receivers will make errors since the decoder "syncs" to the encoder by means of the gain-to-deviation relationship. Errors in decoding (caused by errors in gain) will cause rapid deterioration of separation.

This does not mean that the modulation level cannot be adjusted -- only that the relationship between internal control voltages and deviation is frozen. To adjust modulation, adjust the OUTPUT ATTENuator controls in the 8182A processor (as described shortly). DO NOT ADJUST THE COMPOSITE BASEBAND OUTPUT ATTEN ON THE STEREO GENERATOR.

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3) **Level Match, 8182A To 8182A/SG:** Set the oscillator frequency to 100Hz. Adjust the oscillator's output level to secure a reading of exactly "+3" on the 8182A's VU meter (which should still be in the L FILTER OUT position).

Place the 8182A/SG's VU meter in the N/R IN position. Adjust the 8182A's R OUTPUT ATTEN (which is in fact the L-R output attenuator) to produce a reading of precisely 0VU on the 8182A/SG's meter.

Switch the 8182A/SG's meter to the R MONITOR OUT position. Adjust the L OUTPUT ATTEN (actually L+R) on the 8182A to secure a null in the reading of the 8182A/SG meter. Increase the meter sensitivity using the METER GAIN switch to see the null most accurately. (This step precisely matches the audio gains in the sum and difference channels, using the precision de-matrix in the Monitor Card as a reference.)

Return the TEST switch to the OPERATE position, set both N/R IN/OUT switches to IN, and turn the pilot ON.

4) **OPTIONAL Adjustment of SUM PHASE BALANCE Control:** The SUM PHASE BALANCE control permits matching the high frequency phase responses of the left and right 8182A channels to tighter tolerances than those found in a "stock" 8182A. This minimizes potential phase cancellation, maximizing L+R high frequency response. Because the phase-match of the "stock" 8182A L and R channels is good to begin with (an L+R frequency response error of more than 1dB is unlikely), adjustment of the SUM PHASE BALANCE control is optional, but nevertheless recommended to get the highest possible performance from the equipment.

Procedure: The procedure to be used for the adjustment depends on what test equipment is available. In all cases, both L and R channels are driven in parallel in-phase, and the frequency response of the L-R channel is observed. This signal is available at the 8182A rear-panel test jack labelled "R". (This output contains L-R because of the strapping of the matrix on Card #7 in the 8182A.) The goal is to null the L-R as deeply as possible at all frequencies in the region of 1-15kHz by interactively adjusting the SUM PHASE BALANCE control (R20 on Card #3 in the 8182A/SG) and the R PREEMPHASIS trim (R652 on Card #6 in the 8182A).

To gain access to R20, remove the 8182A/SG subpanel and extend Card #3, following the instructions in **Appendix C (User Access)** in the main **8182A Operating Manual.** There are three trimmer controls on Card #3; R20 is the control closest to the edge connector.

Similarly, to gain access to R652, open the 8182A subpanel and extend Card #6. R652 can be located by using the Card #6 Assembly Drawing in **Appendix J** of the **8182A Operating Manual.**

Be sure that all PROOF/OPERATE switches are in PROOF, and that the Loudness Controller is OFF.

Initial low-frequency L-R null is achieved by adjusting either the L or R 8182A INPUT ATTENUATOR control. Then interactively adjust the SUM PHASE BALANCE CONTROL and R652 to deepen the null. Ideally, an "equiripple" null should be achieved: no one "bump" dominates the null-versus-frequency curve. To avoid clipping internal circuitry, observe the 8182A's L FILTER OUT VU meter position and adjust the oscillator level to assure that the 15kHz part of the sweep does not exceed "+3VU" on the meter. (The level will be greatest at 15kHz due to the 75us pre-emphasis curve.)

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Perhaps the most convenient technique for observing the L-R response is to use a low-frequency spectrum analyzer with tracking generator like the Tektronix 5L4N. This instrument can provide a swept-response measurement on a dB scale. The tracking generator is used as a signal source, and the spectrum analyzer input is connected between the 8182A's +R OUTPUT and ground.

If such an instrument is unavailable, an ordinary sweep generator can be used as the signal source with an oscilloscope as the indicating instrument. Drive the L and R INPUTS of the 8182A from the audio output of the generator. Connect the vertical input of the scope between the 8182A's +R OUTPUT and ground, and drive the horizontal amplifier from the sawtooth sweep output of the sweep generator. Sweep from approximately 1 to 15kHz.

Finally, if only a manual audio oscillator is available, you can sweep through the range of approximately 1-15kHz manually. Use of a continuously-tunable oscillator is highly recommended to facilitate manual sweeps. In this case, you can observe the L-R response on the stereo generator VU meter in the N/R IN position, using the EXPANDED gain position to better see the nulls.

[This concludes the optional adjustment of the SUM PHASE BALANCE control. A more detailed bench-top procedure is found in **Appendix E** of this manual.]

5) **Final Connections:** In a dual-chassis installation, connect the normal L and R program lines to the inputs of the 8182A/ST Studio Accessory Chassis, and reconnect the STL outputs to the audio inputs of the Main 8182A chassis.

In a single-chassis installation, connect the program lines to the audio inputs of the 8182A.

Proceed to **Program Tests** below.

III. PROGRAM TESTS

From this point on, the procedure is identical for single- and dual-chassis units. "OPTIMOD-TV INPUT" means the input of the Accessory Chassis in dual-chassis systems, and of the Main Chassis in single-chassis systems.

These listening tests are made with OPTIMOD-TV set up according to our **Recommended Initial Control Settings** in Fig. 4-4. They are intended to detect obvious problems with audio quality which must be resolved before final adjustments are made. Once initial listening tests are passed, you can proceed to adjust OPTIMOD-TV setup controls according to subjective requirements.

a) Adjust OPTIMOD-TV controls according to Fig. 4-4. Do not adjust the INPUT ATTEN or OUTPUT ATTEN controls at this time. If you have a dual-chassis system, DO NOT READJUST THE MAIN CHASSIS INPUT ATTEN CONTROLS UNDER ANY CIRCUMSTANCES!

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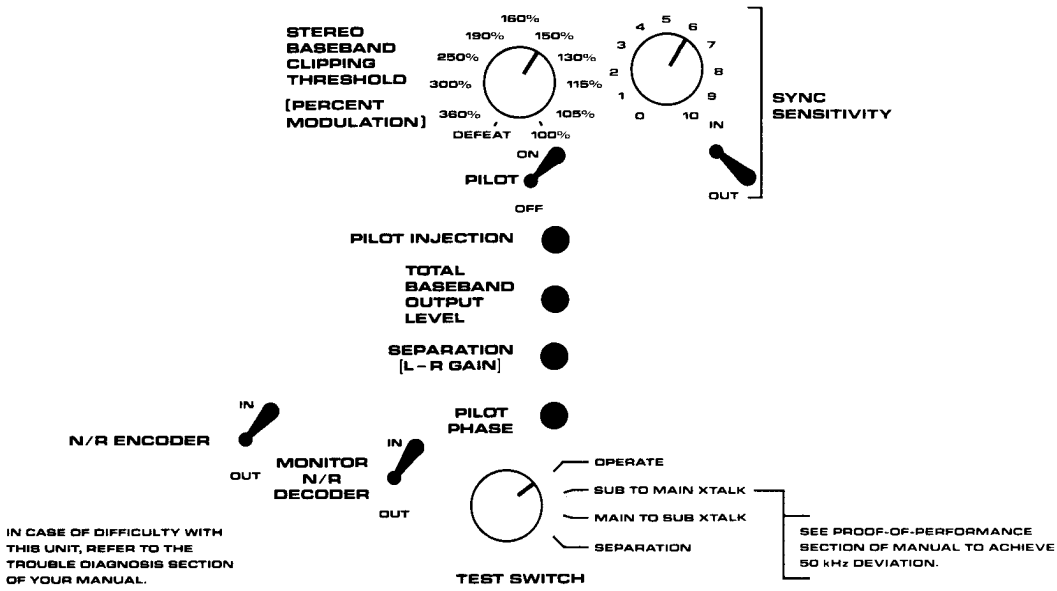

Fig. 4-4: RECOMMENDED INITIAL CONTROL SETTINGS FOR 8182A/SG

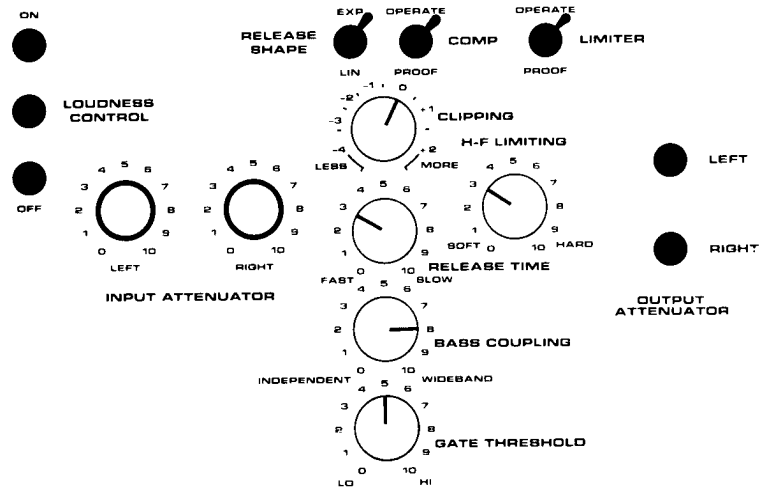

Fig. 4-4: RECOMMENDED INITIAL CONTROL SETTINGS FOR 8182A

b) Drive OPTIMOD-TV with typical audio at your usual operating level. Set your console in MONO mode, such that both channels are putting out identical levels. Peak the console VU meters at 0VU.

c) Adjust the OPTIMOD-TV INPUT ATTEN controls (in a dual-chassis installation, on the Accessory Chassis) to "0". Advance the LEFT INPUT ATTEN until the TOTAL MASTER G/R meter reads approximately "0dB" ±3dB.

Observe the 8182A/SG VU meter in the N/R IN position and advance the OPTIMOD-TV RIGHT INPUT ATTEN until the meter nulls. (Use the "expanded" meter gain to see the null most clearly.)

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d) Place the console in STEREO mode. Observe the TOTAL MODULATION meter and peak flasher on your Aural Modulation Monitor. As this Manual is written, we expect the peak flashers of the new stereo monitors to be designed to ignore brief overshoots caused by the 11-pole filters in the system. If you have carefully followed the setup instructions earlier in this **Part,** modulation should be correct ±5% without further adjustment, and the gain between the noise reduction encoder and the exciter should be accurate to better than 1%. However, if you wish to readjust modulation, this must be done with the 8182A OUTPUT ATTEN controls.

CAUTION!

DO NOT READJUST THE 8182A/SG COMPOSITE BASEBAND OUTPUT CONTROL: YOU WILL DESTROY THE NOISE REDUCTION CALIBRATION!

To adjust modulation, first set main channel modulation at the desired level by adjusting the 8182A L OUTPUT ATTEN (which adjusts L+R). Temporarily drive the left channel only (with a 400Hz tone or with program material). Observe the 8182A/SG R MONITOR position on the VU meter, and adjust the 8182A's R OUTPUT ATTEN (which adjusts L-R) to secure a null. Use the "expanded" meter gain to see the null better. Then restore the right channel.

The STEREO BASEBAND CLIPPER THRESHOLD control determines the approximate percentage modulation at which the stereo baseband is clipped. Its primary purpose is to prevent overdriving the exciter on overshoots, thus preventing IM between the stereo, the pilot, the SAP, and the PRO channels. (The clipper does not affect the pilot, SAP, or PRO channels.) We recommend setting the control between 125% and 150%, corresponding to the linear deviation capability of your aural exciter. The higher this control is set, the lower the probability that it will introduce audible side-effects like distortion.

e) Listen to the audio quality of the air sound on a good monitor system, and verify that it sounds natural and free from noise and distortion. Comparing "AIR" and "PROGRAM" should reveal very little difference in tonal balance due to the quasi-wideband operation of OPTIMOD-TV as initially set up.

f) You may now proceed to **Part 5 (Operating Instructions)** in the **8182A Operating Manual,** and adjust OPTIMOD-TV's setup controls to your specific requirements and tastes. **Part 5** of this manual contains complete descriptions of the operating and setup controls of the 8182A/SG only.

This concludes **Part 4 (Initial Setup).**

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PART 5:
Operating Instructions

This part fully describes the operating and setup controls of the 8182A/SG Stereo Generator.

Subjective sound quality is determined by the setting of the 8182A Audio Processor operating controls. These controls and how to set them are fully discussed in **Part 5** of your main **8182A Operating Manual.**

FRONT PANEL FEATURES

1) **Sync Lock Indicator:** Indicates that phase-lock has been achieved with the composite video or sync. Must be lit before STEREO or PRO subcarriers can be broadcast. If lock is momentarily lost, the unit will temporarily revert to MONO L+R (a special loss-of-lock mode), and the PRO channel will mute. When lock is regained, the unit will return to whichever mode (STEREO, MONO L, or MONO R; PRO ON or PRO OFF) it was in prior to loss of lock.

   If the lamp flickers or does not light and you have verified that composite video or sync is indeed being applied to the SYNC connector on the rear panel, first make sure that termination is correct: the rear-panel TERMINATION switch should be set for 75 ohm if the line terminates there, and HI-Z if it loops through. (Be sure that the line is eventually terminated elsewhere.) If this does not solve the problem, try adjusting the SYNC SENSITIVITY control inside the access door.

2) **PRO Indicator:** Indicates if the optional Professional Channel subcarrier is ON or OFF.

3) **STEREO Indicator:** Indicates whether the internal logic is in STEREO or MONO mode. MONO will use either the left or right channel input according to the setting of a strap on Card #7 (see **Part 3** of this manual).

   STEREO mode can be invoked at any time. However, stereo cannot actually be transmitted until sync lock is achieved (as indicated by the SYNC LOCK lamp's lighting). If sync lock is lost and the system is otherwise in STEREO mode, the STEREO lamp will go out and the system will transmit mono L+R only until lock is regained, at which point the pilot and stereo subchannel will reappear. Note that this is not the same as either normal MONO mode, because the special loss-of-lock mono mode sums both L and R channels instead of choosing one or the other.

   In MONO mode, the system bypasses the L+R 11-pole filter, and produces an overshoot-free output tightly limited to ±25kHz deviation.

4) **Stereo/Mono Switch:** Two-position momentary switch which toggles the logic to select STEREO or MONO. Whether MONO L or MONO R mode is entered depends upon the setting of a strap on Card #7. (See **Part 3** of this manual.)

   After a power outage, the stereo generator will normally come up according to the power-up mode for which it was strapped (see **Part 3** of this manual). However, if the outage was less than one second or so, the powerup logic may not have sufficient time to reset and an undesired mode may be entered, possibly requiring manual resetting.

5) **Meter Function Switch:** Selects the circuit point driving the front-panel VU meter. These circuit points are clearly identified in the SYSTEM BLOCK DIAGRAM in **Appendix J** of this manual.

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6) **Meter Gain:** Determines whether the AC gain of the VU meter is 0dB (NORMAL), or is "expanded" to greater than +20dB. The DC gain is always 0dB. The expanded position is useful in setting nulls during setup and adjustment; otherwise, the switch should be kept at NORMAL.

FUNCTIONS OF THE SETUP CONTROLS

1) **Sum Phase-Balance** (accessed by extending Card #3): Relative phase errors between the left and right channels can affect the frequency response of the mono sum (L+R) as detected at a mono receiver. If the two channels are somewhat out-of-phase at a given frequency, that frequency's level will be lowered when the channels are summed. The SUM PHASE-BALANCE control allows you to obtain the flattest possible frequency response for viewers with mono receivers, who hear the L+R signal only.

The section of the 8182A/SG which contains the 6-pole filters and which is inserted between the 8182A's Dual-Band Compressor and peak limiting circuitry contains a pair of phase shifters, one in the left channel and one in the right. Primarily, these phase shifters affect the very highest frequencies. The phase shifter in the right channel has a fixed phase shift as a function of frequency; the phase shift of the left-channel phase shifter is adjustable by means of the SUM PHASE-BALANCE control such that it can introduce either more or less phase shift than the right-channel phase shifter. Because of this, it can be adjusted to either add or subtract relative phase shift between the left and right channels, thereby enabling you to partially compensate for interchannel differential phase shift in a given 8182A.

2) **N/R Encoder IN/OUT:** When this switch is IN, a 75us de-emphasis network and dbx noise reduction encoder are inserted into the L-R channel. (The 75us network removes the pre-emphasis introduced by the 8182A and permits the dbx to see a "flat" signal as required by the standard.) A "sum compensator" filter (which compensates for non-ideal amplitude and phase response in the dbx N/R encoder) is inserted in the L+R channel.

When this switch is OUT, the de-emphasis network, dbx encoder, and sum compensator are removed from the circuit, but the 11-pole sum and difference filters remain. Therefore, when the switch is OUT, you can measure the effect that the matching of the 11-pole filters has upon separation ("equivalent separation") without seeing the effect of the dbx companding.

To measure "equivalent separation", it is necessary to defeat the dbx decoder in the monitoring circuit and replace it with a 75us de-emphasis network. This is done by means of the MONITOR N/R Decoder IN/OUT switch. (See immediately below.)

3) **Monitor N/R Decoder IN/OUT:** When this switch is IN, the monitor circuit contains a complete stereo matrix decoder, including a 75us de-emphasis network and decoder sum compensator in the L+R channel, and a professional dbx decoder card in the difference channel. L+R and L-R are dematrixed into L and R by means of a matrix circuit using 0.1% resistors. This creates a dematrix of extremely high accuracy which is suitable for use as a reference to adjust other parts of the 8182A/SG.

When the switch is OUT, the decoder sum compensator is removed, and the dbx is removed and replaced with a 75us de-emphasis network which is matched to the 75us de-emphasis network in the L+R channel. The 0.1%-accurate dematrix remains in the circuit. Thus, when the switch is out, the monitor circuit is suited for measuring "equivalent separation" (see [2] above).

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4) **Stereo Baseband Clipping Threshold:** This control determines the threshold of a clipper which processes the stereo portion of the baseband. The clipper limits peak modulation to a certain percentage re ±50kHz deviation, as determined by the setting of the control. Calibration of the control is approximate. The purpose of the clipper is to remove filter overshoots to avoid overloading the aural exciter. Clipping occurs before the pilot, SAP, or PRO components of the baseband are summed. Thus only the stereo is clipped, and the clipper cannot introduce IM between the stereo and the other components. When the clipper is set fully counterclockwise, it is defeated and no clipping will occur.

5) **Pilot ON/OFF:** This switch turns the 15.734kHz pilot tone on and off. It is left ON at all times except when the stereo generator is being calibrated or when certain measurements (such as separation) are being made.

6) **Pilot Injection:** The determines the level of the 15.734kHz pilot tone introduced into the baseband. The correct level is ±5kHz deviation: 20dB below 100% stereo modulation (±50kHz).

7) **Total Baseband Output Level:** This affects the level of the entire baseband, including the pilot, SAP, and PRO components. It is used to calibrate the noise reduction encoder to the exciter according to instructions in **Part 4** of this manual, and should not be touched thereafter. Injection of SAP and PRO are adjusted by means of controls on the individual subcarrier generators, while pilot injection is adjusted by means of the PILOT INJECTION control on the stereo generator. Stereo modulation is adjusted by means of the 8182A L and R OUTPUT ATTENuator controls as discussed in **Part 4** of this manual.

8) **Separation (L-R Gain):** This control calibrates the stereo baseband generator only such that its main channel (L+R) and subchannel (L-R) gains are precisely equal. Calibration is done in the SEPARATION TEST mode according to instructions in **Part 4** of this manual. 0.1% accuracy (60dB equivalent separation) is readily achieved and maintained.

   In order to produce correct separation, both the audio and stereo baseband generator portions of the system must be independently calibrated to achieve the correct ratio between L+R and L-R gain. In the case of the stereo generator, this ratio is 1:1 and, in the case of the audio circuitry, it is 1:2, achieving ±25kHz L+R deviation and ±50kHz L-R deviation when both portions are cascaded. Calibration of sum and difference gains in the audio portion of the system is performed using the 8182A/SG's highly accurate monitor circuit as a reference. This calibration is independent of the stereo baseband generator calibration, and has nothing to do with the SEPARATION control on the stereo generator.

9) **Pilot Phase:** Determines the relative phase between the 15.734kHz pilot tone and the 31.468kHz suppressed subcarrier. Since the pilot is used as a phase reference by the receiver's stereo decoder, the phase relationship between the pilot and subcarrier must be exact. Both must cross the zero axis simultaneously. Pilot phase is adjusted according to instructions in **Part 4** of this manual.

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10) **Stereo Generator TEST Switch:** In addition to the normal OPERATE mode, this switch selects one of three test modes:

a) **SUB-TO-MAIN CROSSTALK:** Applies the L+R signal to the stereo baseband generator's subchannel (L-R) input only. Permits measurement of crosstalk into the main channel caused by a signal in the subchannel, and is also used to set pilot phase according to instructions in **Part 4** of this manual.

b) **MAIN-TO-SUB CROSSTALK:** Applies the L+R signal to the stereo baseband generator's main channel (L+R) input only. Permits measurement of crosstalk into the subchannel caused by a signal in the main channel. Because the N/R encoder always produces a substantial noise output even with no signal at its input (which will modulate the subchannel), this test mode is useful if pure L+R is required, yet the circuit must stay in STEREO mode.

c) **SEPARATION:** Applies the L+R signal to both the L+R and L-R inputs of the stereo baseband generator. It is useful in calibrating the SEPARATION (L-R GAIN) control according to instructions in **Part 4** of this manual.

[**NOTE:** A single-channel input to the 8182A can produce only about 50% modulation in the various TEST modes because the L+R channel is only driven to 50% modulation. To achieve 100% modulation, the 8182A's L OUTPUT ATTEN control (which actually controls L+R) must be temporarily readjusted. See **Part 6 (In-System Performance Verification)** of this manual for a more complete discussion.]

11) **Sync Sensitivity Control And Switch:** Permits adjusting the sync stripper threshold for non-standard video levels. If the video is standard 1V p-p ±20%, the switch should be in OUT position, in which case the sensitivity is preset. When the switch is set to IN, the control is enabled. The control, whose setting is usually quite non-critical, should be adjusted to the middle of the range which causes the SYNC LOCK lamp on the front panel to light.

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PART 6:
In-System Performance Verification

NOTE

The FCC (U.S.A.) has eliminated requirements for periodic Proof-Of-Performance measurements. However, performance standards specified in the FCC Rules must still be met. Many stations will doubtless still wish to make periodic equipment performance measurements. The text below provides the general information which is needed to perform measurements verifying the performance of a transmission system including the 8182A/SG. Instructions for bench-top verification of 8182A/SG performance outside of the transmission system are found in **Appendix D: Field-Audit-Of-Performance.**

Verification of the performance of the optional Professional Channel generator is discussed in a Supplemental Manual for that option. Verification of the performance of the Model 8182A/SAP SAP Generator (which can stand alone) is discussed in its own Operating Manual.

The 8182A/SG Stereo Generator must be used and tested as a system with the 8182A audio processor. (Refer to **Appendix L** at the rear of this manual for guaranteed specifications for the system.)

By and large, doing a performance verification is straightforward. To begin, both PROOF/OPERATE switches on the main 8182A chassis must be turned to PROOF, and the Loudness Controller must be turned OFF. Allow at least two minutes for the gain to settle after turning the switches to PROOF.

A Preliminary Discussion Of Modulation Capability In Proof Situations: Previous installation instructions have instructed you to set levels and percentages of modulation without explaining why. The following section provides more detail on how headroom within the audio processing affects the percent modulation available under various test conditions.

With the stereo generator in OPERATE mode, but with the 8182A processor in PROOF mode, it is necessary to drive the 8182A Left and Right audio inputs in parallel in-phase to achieve ±25kHz deviation of the Main Channel (L+R), and to drive the inputs in parallel out-of-phase to achieve ±50kHz deviation of the Subchannel (L-R).

The three stereo baseband generator test modes (SUB-TO-MAIN CROSSTALK, MAIN-TO-SUB CROSSTALK, and SEPARATION) all derive their input signals from the Main Channel (L+R) audio. With the processor aligned according the instructions in **Part 4** of this manual, and when you are using the TEST modes, the following is true because of headroom limitations within the 8182A processor:

If you are driving the Left or Right audio input only:

1. In SUB-TO-MAIN mode, maximum Subchannel modulation achievable is slightly greater than 25% (±12.5kHz deviation).
2. In MAIN-TO-SUB mode, maximum Main Channel modulation achievable is slightly greater than 50% (again, ±12.5kHz).
3. In SEPARATION mode, maximum Stereo modulation available is slightly greater than 25% (±12.5kHz).

If both Left and Right inputs are driven in-phase, all figures above should be doubled (i.e., maximum deviation achievable without clipping then exceeds ±25kHz in all test modes).

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PART 6:
In-System Performance Verification

NOTE

The FCC (U.S.A.) has eliminated requirements for periodic Proof-Of-Performance measurements. However, performance standards specified in the FCC Rules must still be met. Many stations will doubtless still wish to make periodic equipment performance measurements. The text below provides the general information which is needed to perform measurements verifying the performance of a transmission system including the 8182A/SG. Instructions for bench-top verification of 8182A/SG performance outside of the transmission system are found in **Appendix D: Field-Audit-Of-Performance.**

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The 8182A/SG Stereo Generator must be used and tested as a system with the 8182A audio processor. (Refer to **Appendix L** at the rear of this manual for guaranteed specifications for the system.)

By and large, doing a performance verification is straightforward. To begin, both PROOF/OPERATE switches on the main 8182A chassis must be turned to PROOF, and the Loudness Controller must be turned OFF. Allow at least two minutes for the gain to settle after turning the switches to PROOF.

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With the stereo generator in OPERATE mode, but with the 8182A processor in PROOF mode, it is necessary to drive the 8182A Left and Right audio inputs in parallel in-phase to achieve ±25kHz deviation of the Main Channel (L+R), and to drive the inputs in parallel out-of-phase to achieve ±50kHz deviation of the Subchannel (L-R).

The three stereo baseband generator test modes (SUB-TO-MAIN CROSSTALK, MAIN-TO-SUB CROSSTALK, and SEPARATION) all derive their input signals from the Main Channel (L+R) audio. With the processor aligned according the instructions in **Part 4** of this manual, and when you are using the TEST modes, the following is true because of headroom limitations within the 8182A processor:

If you are driving the Left or Right audio input only:

1. In SUB-TO-MAIN mode, maximum Subchannel modulation achievable is slightly greater than 25% (±12.5kHz deviation).
2. In MAIN-TO-SUB mode, maximum Main Channel modulation achievable is slightly greater than 50% (again, ±12.5kHz).
3. In SEPARATION mode, maximum Stereo modulation available is slightly greater than 25% (±12.5kHz).

If both Left and Right inputs are driven in-phase, all figures above should be doubled (i.e., maximum deviation achievable without clipping then exceeds ±25kHz in all test modes).

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To achieve higher modulation than this, it is necessary to temporarily turn up the L OUTPUT ATTEN (which controls the L+R drive to the stereo generator) on the 8182A audio processor. Do not adjust the R OUTPUT ATTEN. (If you do, you will lose the ability to easily reset the L OUTPUT ATTEN when you are through with testing.) If you allow for adjustment of the L OUTPUT ATTEN, then the deviations available without clipping may be approximately tripled by comparison to the values in the list above. If you are driving the Left and Right audio inputs in parallel, multiply all maximum deviations by 6x (instead of 3x).

(This means that you must drive the L and R audio inputs in parallel to achieve ±50kHz deviation in any TEST mode.)

To restore the setting of the L OUTPUT ATTEN after you are finished, drive one audio input only, and observe the opposite channel MONITOR OUTPUT on the 8182A/SG's VU meter. Adjust the L OUTPUT ATTEN to precisely null the meter, restoring correct separation. Use the "expanded" gain to see the null most clearly.

Measuring Frequency Response And Distortion: The 8182A has sufficient headroom to modulate the Main Channel and/or the Subchannel to greater than 100% (i.e., ±25kHz Main and ±50kHz sub) when making frequency response and distortion measurements. To achieve these modulation levels, it is necessary to drive both Left and Right inputs of the 8182A (or of the 8182A/ST in split-chassis installations) in parallel. To make Main Channel measurements, drive the inputs in-phase. To make Subchannel measurements, drive the inputs out-of-phase. In all cases, the stereo baseband generator must be in OPERATE mode.

Phase and amplitude differences between the left and right channels of the 8182A processing and/or the six-pole filters within the 8182A/SG can cause dips in the frequency response of the sum or difference channels which are not seen when only the left or right channels are driven. Such frequency response irregularities can be minimized by adjusting the SUM PHASE BALANCE control on the 8182A/SG and the RIGHT PRE-EMPHASIS trim control on the 8182A according to instructions provided in **Part 4** of this manual (in-system adjustment) or **Appendix E** of this manual (bench adjustment).

Please note that the frequency response of the dbx noise-reduction encoder is only guaranteed by its manufacturer (dbx, Inc.) at "10% 75us equivalent-input modulation". This means that at frequencies below 100Hz, the input to the dbx N/R encoder must be 0.354V rms (-6.80dBu). As frequency is increased, this level must be reduced to follow the 75us de-emphasis curve.

The easiest way to measure Subchannel frequency response while keeping the input to the N/R encoder at the correct level is as follows:

1. Temporarily restrap JUMPER B (RIGHT DE-EMPHASIS) on Card #7 of the 8182A Audio Processor for "DE-EMPHASIS IN".
2. Apply 100Hz to the Left and Right inputs of the 8182A out-of-phase. Null L+R by adjusting either 8182A INPUT ATTENuator as necessary. Adjust the oscillator output level to achieve a reading of "100%" on the 8182A/SG's VU meter in the N/R IN position.
3. Reduce the oscillator's output level by 14dB. Assuming that the oscillator is flat, you may now adjust it to any frequency from 50-15,000Hz with the knowledge that you will be producing the correct input level to the dbx N/R encoder.
4. Measure the frequency response as desired. Observe the L-R (or SUBCHANNEL) meter on your stereo modulation monitor. Note that the frequency response should follow the 75us de-emphasis curve. This curve is shown in Fig. 6-1. The frequency response observed is the product of the

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response of all filters in the audio processing, any cancellation due to mismatches between Left and Right channels, and any errors in the dbx N/R encoder. You will also see any errors in the stereo monitor, including those caused by its own dbx N/R decoder.

5. Be sure to restore JUMPER B on the 8182A's Card #7 to its normal DE-EMPHASIS OUT position after you have completed the test.

If you wish to measure the frequency response of the Left and Right channels individually, be sure not to exceed 50% Main Channel modulation to avoid clipping in the 8182A processor.

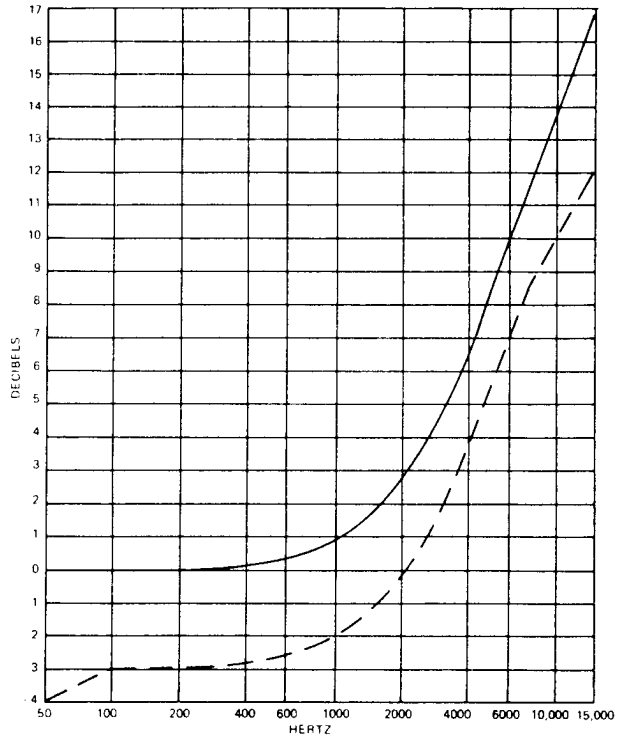

Fig. 6-1: Standard 75us Pre-emphasis Curve
(Use inverse of this curve to obtain standard de-emphasis.)

Measuring Noise: Noise is measured straightforwardly by use of your stereo monitor. Be sure that the 8182A/SG's N/R ENCODER switch is IN, and that the stereo monitor is applying 75us de-emphasis to the Main Channel and dbx Decoding to the Subchannel.

There are many potential sources of noise which occur outside the 8182A/SG Stereo Generator. It is not unusual for hum to appear in an STL link. RFI can cause hum and buzz, as can ground loops. For example, it is important not to inject RF into the wideband input of the aural exciter. It is also important to carefully consider the system grounding scheme, as discussed in **Part 3** of this manual.

As a general rule, noise problems within the 8182A/SG itself can only be positively diagnosed on the bench away from high RF fields. (See **Appendix D** of this manual for instructions on benchtop performance evaluation.)

Measuring Separation: Separation is a complex aspect of the BTSC stereo system, because there are several specifications (depending on whether the N/R encoder and decoder are in or out of the circuit), and because poor separation can be caused by many different factors. An adequate discussion of separation demands a fair amount of space, so please bear with us.

Because the BTSC system uses sum-and-difference transmission, any phase or amplitude mismatches between the Main (L+R) and Sub (L-R) channels can cause imperfect separation. Since noise-reduction is inserted into the L-R channel only,

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imperfect tracking between the noise-reduction encoder and the decoder will adversely affect separation. In addition, there are other parts of the system which must be matched.

It is quite difficult to get the N/R encoder and decoder to track with sufficient accuracy to assure that the overall system separation specification is met. For this reason, the performance of the system without the N/R in circuit will always be be substantially better than system performance with N/R in circuit. N/R tracking errors dominate the overall error budget.

Various parts of the system can each be characterized by an "equivalent stereo separation". The "equivalent stereo separation" of any such part of the system is the ratio between the sum and difference of the L+R and L-R signals when the inputs to the L+R and L-R signal paths are identical. Since the sum of L+R and L-R is 2xLeft, and its difference is 2xRight, the definition is equivalent to simply taking the ratio between the dematrixed Left (desired) and Right (undesired) channels. (The Right channel will contain only crosstalk.)

The "equivalent stereo separation" of a properly-aligned stereo baseband generator is usually much higher than the separation of the rest of the system: The stereo baseband generator ordinarily absorbs little of the overall separation error budget. The "equivalent stereo separation" of the baseband generator can be measured by use of the oscilloscope baseline technique as fully described in **Part 4** of this manual. (Note that this technique only correctly specifies separation if the PILOT PHASE control is perfectly adjusted. The procedure for its adjustment is also found in **Part 4.)**

The "equivalent stereo separation" of the 8182A/SG, not including effects of N/R, is dominated by the phase and amplitude mismatches between the 11-pole L+R and L-R filters. The "equivalent stereo separation" of this part of the circuitry can be measured by switching both the N/R ENCODER and MONITOR N/R DECODER switches OUT in the 8182A/SG. To make the measurement, feed the 8182A's Left audio input only, and use an accurate AC VTVM to measure the ratio between the signals appearing at the LEFT and RIGHT MONITOR OUTPUTs on the 8182A/SG's barrier strip. (The 8182A/SG's monitoring circuitry has been calibrated so that its own "equivalent stereo separation" exceeds 45dB, including the effects of de-matrixing errors and mismatches between the L+R and L-R 75us de-emphasis networks. Thus it can serve as an accurate reference.)

To measure the complete stereo separation of the 8182A/SG system, excluding only the (negligible) error contribution of the stereo baseband generator, switch both N/R switches IN, and once again measure the separation at the 8182A/SG's MONITOR OUTPUT terminals. Note that the specification only applies at "10% 75us equivalent-input modulation" (as defined above in the **Frequency Response And Distortion** section.) Unfortunately, unlike the case of frequency response measurements, you cannot temporarily re-strap JUMPER B on the 8182A's Card #7 to achieve the required de-emphasis after setting the 100Hz reference level as described earlier. Instead, you must decrease the output of the oscillator to maintain a constant reading on the 8182A's L FILTER OUT VU meter position as you vary the oscillator frequency. Assuming a perfect transmission path, the separation now measured will be identical to the separation capability of an entire closed-circuit stereo encoder-decoder chain.

Switching the N/R IN not only adds the effects of the N/R encoder and decoder to the L-R channel but also adds the encoder and decoder "sum compensator" circuits to the L+R channel. These are specially-tailored lowpass filters which add phase shift and high-frequency rolloff to the L+R channel to compensate for excess phase shift and high-frequency rolloff in the L-R channel. Such excess rolloff and

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phase shift is expected of a real-world noise-reduction circuit which is trying to match the theoretically-ideal N/R characteristic specified by means of tables in OST-60 (which is the Federal Communication Commission Office Of Science And Technology's official description of the BTSC system).

There are several other potential sources of separation degradation within the complete transmission system. For example, the dbx television N/R system is level-dependent. Correct tracking requires that a precise relationship be maintained between the level at the output of the dbx N/R encoder and the carrier deviation produced by this level. **Part 4** of this manual contains complete instructions for making this calibration to an accuracy of better than ±1%, as specified in the **BTSC Recommended Practice.** Use of this procedure (the Bessel-null technique) does not require a stereo monitor, which is thus eliminated as a potential source of inaccuracy.

The success of this calibration depends upon correct factory calibration of the L-R 11-pole lowpass filter (R80 on Card #5), as well as upon correct factory calibration of the 8182A/SG's VU meter in the L+R position (using R19 on the Meter Card). If there is suspicion that either of these controls might be misadjusted, they may be checked by means of procedures found in **Appendix E (Field Alignment).** However, be warned that extremely accurate and well-calibrated test instruments are required, and that it is most unlikely that the calibration will have drifted or have otherwise become incorrect unless the trimmer controls have been casually adjusted in the field.

Other sources of potential separation degradation include inadequate phase and amplitude linearity in the aural exciter, problems with insufficient RF bandwidth (diplexers are particularly suspect; diplexer bandwidth should exceed 400kHz and have symmetrical group delay), and even problems with the aural demodulator used to make the measurements.

Measuring Main-Channel-to-Subchannel and Subchannel-to-Main-Channel Crosstalk: In general, non-linear crosstalk from main-to-sub and vice-versa will be caused entirely by non-linearities and bandwidth limitations in the RF portion of the system, including the modulator in the exciter. (Problems may be expected if notch diplexer bandwidth is less than 400kHz at the -3dB points.) At the baseband output of the 8182A/SG, typical non-linear crosstalk is down 80dB below ±50kHz deviation.

If you wish to measure crosstalk, use the MAIN-TO-SUB and SUB-TO-MAIN test modes available on the stereo baseband generator. Please note the discussion at the beginning of this **Part** regarding headroom: Full deviation (±25kHz in the Main Channel and ±50kHz in the Subchannel) can be achieved if both Left and Right channels are driven in parallel in-phase and the 8182A processor's L OUTPUT ATTEN control is turned up as necessary.

Provided that the stereo baseband generator's internal trimmer controls are correctly aligned, any crosstalk observed in excess of -60dB below ±50kHz deviation will almost certainly be non-linear if the stereo baseband TEST modes are used. However, if the stereo baseband generator OPERATE mode is used, slight phase mismatches between the Left and Right channels of the 8182A audio processor can introduce linear crosstalk components which will tend to mask the non-linear crosstalk. The OPERATE mode is therefore not recommended for these measurements.

This concludes **Part 6 (In-System Performance Verification).** A more complete and rigorous test regimen is provided in **Appendix D (Field-Audit-Of-Performance).**

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APPENDIX A:
System Description

The purpose of this Appendix is to provide the installing engineer with an overview of system design, to answer questions and deal with uncertainties about various unconventional aspects of the design, and to provide the service technician with a moderately detailed overview of the system. The **Circuit Description** in **Appendix B** contains considerably more detail on individual circuits.

The paragraphs in **Appendix B (CIRCUIT DESCRIPTION)** that correspond with topics in this Appendix have identical numbers and titles in order to expedite access to further information on a topic of interest.

Each card is numbered. Reference will be made in each section to the number of the card on which the described circuitry is located. There is no Card #1 or Card #2. The Card #9 and Card #10 slots are reserved for the optional Pro Channel Cards described in a manual supplement supplied with those Cards.

REFER ALSO TO THE MORE DETAILED BLOCK DIAGRAM (in **Appendix J**).

A

CAUTION

Service instructions are included for use by qualified personnel only. To avoid electrical shock, do not perform servicing other than that described within the Operating Instructions unless you are qualified to do so. Refer all such servicing to qualified service personnel.

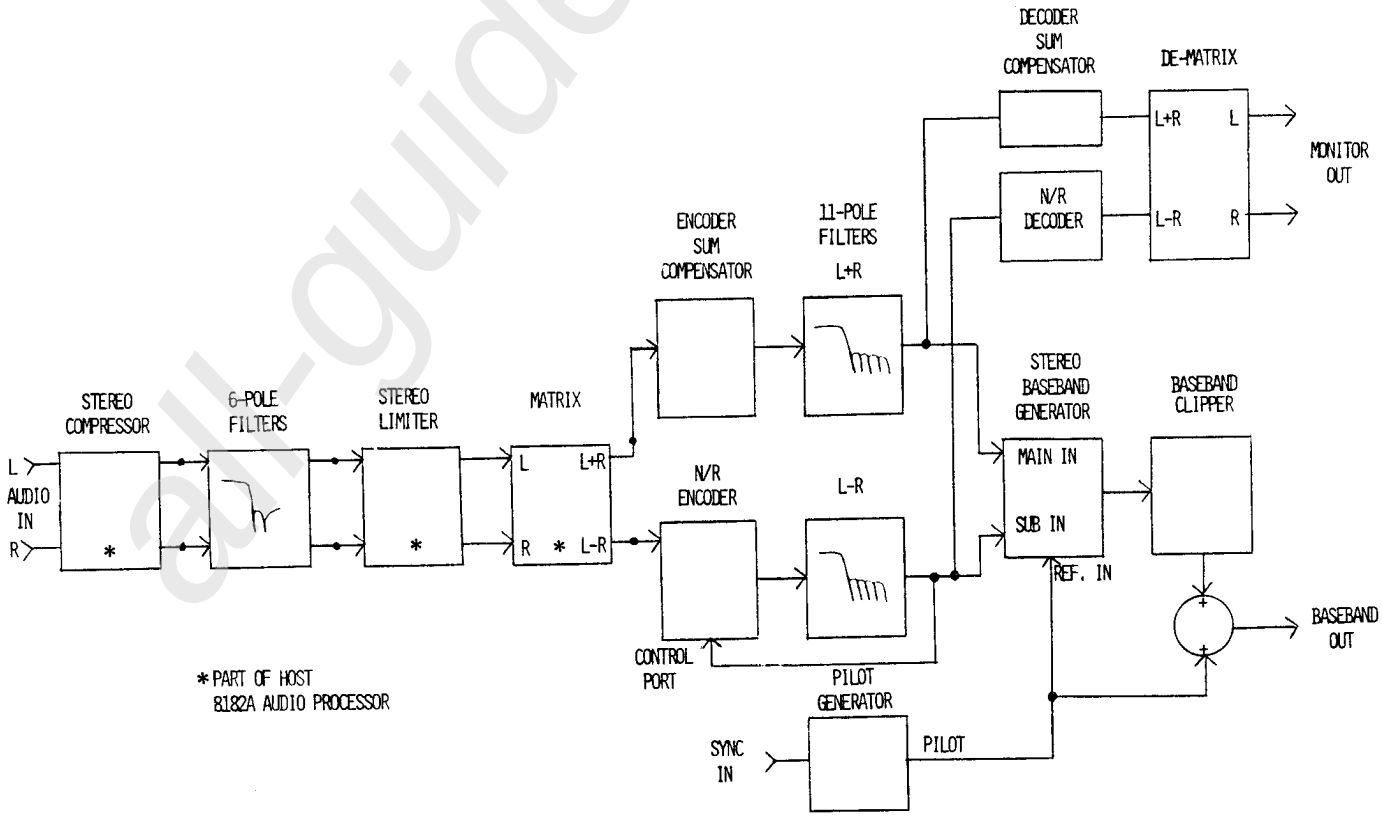

Fig. A-1: Simplified Stereo Generator Block Diagram

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1.a) Six-Pole Filter (on Card #3):

The Six-Pole Filter and its associated stereo/mono switching and phase-matching functions are inserted between the output of the 8182A Audio Processor's Dual-Band Compressor and the input of its High-Frequency limiter. The filter bandwidth is 15.0kHz. Its ideal frequency response in the passband and stopband is shown in Figs. A-2a and A-2b. Note that the small (0.4dB) passband ripples are specifically designed to complement similar small ripples in the response of the 8182A to achieve flatter overall system response.

Because all parts of the filter interact, failures which cannot be cured merely by replacing opamps are best left to factory service, since special tight-tolerance tight-temperature-coefficient parts are used in certain places. (The circuitry has been designed to be insensitive to normal unit-to-unit variations in opamps.)

(See **Appendix F** in your main **8182A Operating Manual** for details on how to obtain factory service.)

Instructions on field alignment of the filters is provided in **Appendix E** of this manual.

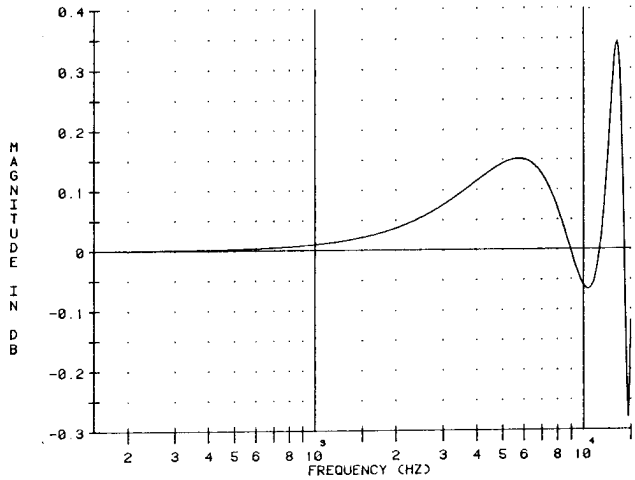

Fig. A-2a: Response of Six-Pole Filter in Passband

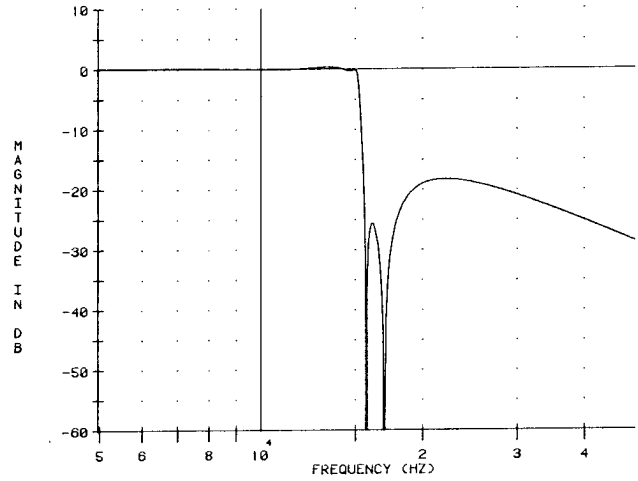

Fig. A-2b: Response of Six-Pole Filter In Passband And Stopband

1.b) Stereo/Mono Switching (on Card #3):

A pair of JFET switches following the Six-Pole Filters accept the Left and Right signals. The gates of these JFET's are driven by logic signals generated on Card #7. In STEREO mode, the output of each filter is passed to the respective Left and Right output of the card. In MONO LEFT mode, the output of the Left Six-Pole Filter drives both the Left and Right outputs of the card. The MONO RIGHT mode is analogous.

1.c) Phase-Balance Circuit (on Card #3):

The two signal paths of the 8182A are complex and contain large frequency-dependent phase shifts. Although the 8182A is manufactured with high-precision parts, it is possible that differences between the phase shifts of the Left and Right channels could cause as much as 1dB frequency response error in the mono sum due to phase cancellation. For this reason, a Phase-Balance circuit is provided in the Stereo Generator chassis. This circuit introduces a variable phase shift in the Left Channel path which can be adjusted to be less than, identical to, or more than a fixed phase shift which is introduced in the Right Channel. Thus relative phase shift can either be added to or subtracted from the Left Channel as necessary to make the overall difference between the phase responses of the two channels in the system as small as possible.

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2.a) Eleven-Pole Filters (on Card #5):

The Eleven-Pole Filters provide essentially flat frequency response to 15kHz (typically ±0.1dB), and rejection exceeding 60dB above 15.734kHz. Ideal response is shown in Figs. A-3a and A-3b.

The comments in **(1.a)** above regarding field repair also apply to the Eleven-Pole Filters: If the filters cannot be repaired simply by replacing opamps, then they should be repaired by Orban Factory Service. (The circuitry is designed to be insensitive to normal unit-to-unit variations in opamps.) Instructions on field alignment of the filters is provided in **Appendix E** of this manual.

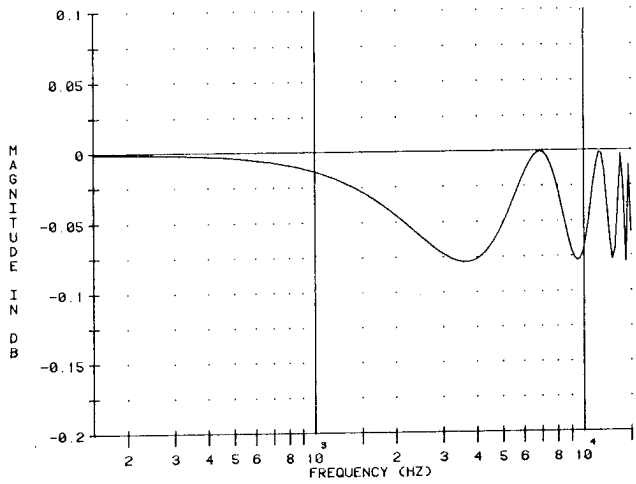

Fig. A-3a: Response Of Eleven-Pole Filter in Passband

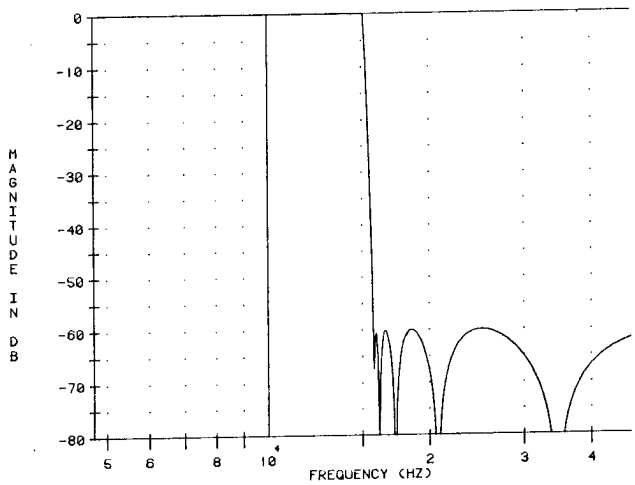

Fig. A-3b: Response Of Eleven-Pole Filter In Passband And Stopband

2.b) Sum Compensator (on Card #5):

The Sum Compensator is a lowpass filter whose amplitude and phase response matches the excess amplitude and phase of the dbx N/R Encoder. (The "excess" amplitude and phase is the difference between the amplitude and phase specified in the "ideal companding tables" of OST-60 and the actual amplitude and phase produced by the real-world dbx circuit.) The Sum Compensator is switched into the Sum circuit path whenever the dbx N/R Encoder is switched into the Difference-Channel circuit path.

dbx has produced several generations of N/R Encoder cards, not all of which require the same Sum Compensator circuit. Therefore, there are several versions of Card #5, each designed to match a given dbx design. Please be aware of this, and work closely with Orban customer service if you wish to order backup cards or to return either Card #4 or Card #5 to the factory for service. (The version number is imprinted on the card.)

2.c) Stereo/Mono Filter Bypass (on Card #5):

Whenever the system is in MONO mode (either MONO Left or MONO Right), the Sum-Channel Eleven-Pole Filter and the Sum Compensator are both bypassed by means of a JFET switch driven from logic circuitry on Card #7. This prevents the Eleven-Pole Filter from introducing unnecessary overshoots and ringing in MONO mode.

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3) Noise Reduction Encoder (on Card #4):

Card #4 is devoted almost entirely to the dbx-manufactured N/R Encoder card. This card is described in **Appendix M.**

The N/R Encoder is fed by a precision 75us de-emphasis network. This cancels the pre-emphasis produced by the 8182A audio processor so that a "flat" signal is applied to the N/R Encoder's input port. The N/R Encoder's input-referenced overload level closely follows the 75us de-emphasis curve as a function of frequency. Thus the 8182A's audio processing (including HF limiting) prevents overload of the N/R Encoder.

When the N/R ENCODER IN/OUT switch on Card #5 is switched OUT, all circuitry on Card #4 (including the 75us de-emphasis network) is bypassed, and pre-emphasized audio is applied to the Difference-Channel Eleven-Pole Filter.

The N/R circuitry can itself produce substantial noise, some of which will extend beyond 15kHz. For this reason, when the N/R ENCODER IN/OUT switch is IN, the very sharp Difference-Channel Eleven-Pole Filter (on Card #5) is inserted between the output of the N/R Encoder and the input of its sidechain. The output of the N/R Encoder is taken <u>after</u> the Eleven-Pole Filter to prevent N/R Encoder-induced noise from aliasing from the stereo Subchannel into the Main Channel, and to assure that the sidechain of the N/R Decoder in the receiver sees the same signal as the sidechain of the N/R Encoder. (Any N/R Encoder-induced noise in the stereo Subchannel is essentially eliminated by the complementary action of the N/R Decoder in the receiver.)

The dbx card is not field-repairable or field-alignable due to the extremely tight tolerances involved in its manufacture and adjustment. In case of failure of the card, it should be returned to Orban Customer Service for repair or exchange. Please note that several different versions of the card have been built, requiring different Sum Compensator circuits (on Card #5). See **(2.b)** above.

4) Sync Card -- General Principles (on Card #8):

The Sync circuitry extracts the horizontal line frequency from incoming composite video or sync signals, and outputs two signals. The first is a low-distortion sinewave at $1f_H$ which is used to drive the Stereo Baseband Generator; the second is a pulse waveform at $1f_H$ which is used to drive the Professional Channel Generator.

The sync is extracted in a Sync Separator circuit. The output of the Sync Separator serves as a reference for a Phase-Locked-Loop whose output is $8f_H$. This output is divided down and is then used to produce a low-distortion sinewave in the Pilot Generator. The output level of the Pilot Generator is closely regulated by means of the Pilot AGC loop.

4.a) Sync Separator (on Card #8):

The sync or composite video is tapped-off and amplified by means of a balanced differential amplifier with a high-impedance input and a gain of 4. The output of this amplifier drives a comparator and a negative peak detector. The negative peak detector detects the DC level of the sync tips. The output of the peak detector is offset by a positive voltage which is adjustable by means of the SYNC SENSITIVITY control. This output (as offset) is applied to the comparator and provides a reference voltage which tracks changes in average DC level of the video.

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The comparator output is a pulse train timed identically to the sync pulses in the incoming sync or composite video. The comparator output is applied to a non-retriggerable one-shot which stretches the pulses so that equalizing pulses cannot produce double-frequency output. The output of the one-shot is applied to the Phase-Locked-Loop and is also available for use by the Professional Channel Generator.

4.b) Phase-Locked-Loop (PLL) (on Card #8):

The Phase-Locked-Loop employs a commercial CMOS PLL chip consisting of a digital phase detector and a Voltage-Controlled Oscillator (VCO). The VCO operates at a frequency of $8f_H$. This is divided down to $1f_H$ in a binary divider chip. The $1f_H$ output of the Binary Divider is used as one input to the phase detector; the other input is the $1f_H$ pulse train from the Sync Separator.

The output of the phase detector (consisting of pulses at $1f_H$ whose width is proportional to the phase difference between the inputs of the phase detector) is filtered and applied to the control-voltage input of the VCO, closing the loop.

The phase detector is equipped with an output which is HIGH (+15V) when the loop is locked, and which produces pulses which go LOW (ground) when the loop is unlocked. This output is averaged and applied to the Lock Detector comparator whose output is saturated positive when the loop is locked and which is saturated negative when the loop is unlocked. The output of this comparator drives the SYNC LOCK LED on the front panel, and also provides a logic input to force the stereo baseband generator out of STEREO mode when sync lock is lost.

A

4.c) Pilot Generator (on Card #8):

The Binary Divider is configured to produce pulse trains at $1f_H$ and $3f_H$. These are buffered by a pair of Exclusive-OR gates, one of which acts as an inverter and one of which acts as a non-inverter. The outputs of the two gates (at $1f_H$ and $3f_H$) are summed in proper proportion to cancel all lower-order harmonics of f_H. Higher-order harmonics are eliminated in a third-order lowpass filter. The resulting output of the lowpass filter is a sinewave at $1f_H$ with approximately 0.025% THD. This is used as the stereo pilot tone and also as a reference for the Stereo Baseband Generator.

4.d) Pilot AGC (on Card #8):

To assure that the pilot level remains stable, an AGC loop is employed. The peak level of the pilot is detected by means of a comparator which is referenced to the stable positive power supply. If the pilot level attempts to exceed the comparator reference, the comparator produces error pulses which reduce the voltage on an integrating capacitor. The voltage on this capacitor is coupled to the positive supply voltage terminal of the gates which buffer the Binary Divider. The output level of the gates changes in proportion to the positive supply voltage on the chip, closing the AGC loop.

5.a) Stereo Baseband Generator -- General Principles: (on Card #7)

The 8182A/SG Stereo Baseband Generator uses the "matrix" approach to generate the composite baseband signal. In this technique, the L+R signal is passed directly to the baseband output and occupies the frequency range from 30 to 15,000Hz. The L-R signal is first multiplied by a $2f_H$ sinewave to form a double-sideband suppressed-carrier subchannel occupying 16 to 46kHz, and is then summed into the baseband output. The $1f_H$ pilot tone (which is phase-locked to the $2f_H$ subcarrier) is also summed into the output.

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The two principal advantages to this approach (as opposed to the more common "switching" approach) are:

1) The L+R (which is usually the dominant component) is not subject to any switching or modulation process which may introduce distortion.

2) The baseband is derived by a multiplication process which ideally introduces no out-of-band frequency components. In the 8182A/SG, spurious components are typically below 0.04% modulation. The baseband thus requires no lowpass filtering. Such a filter is often the most costly part of a conventional switching Stereo Baseband Generator, and necessary compromises in its design tend to degrade separation.

Stereo/mono mode switching is provided by JFET switches driven by CMOS logic. In addition, there are three special "test" modes available. Each accepts a L+R signal. The first grounds the L-R input port and applies signal to the L+R input port to test main-channel-to-subchannel crosstalk. The second grounds the L+R input port and applies signal to the L-R input port to test subchannel-to-main-channel crosstalk. The third applies equal signals to the L+R and L-R input ports to produce a "flat baseline" FM-stereo-style signal which permits optimization of separation using only an oscilloscope.

The pilot tone and $2f_H$ subcarrier are generated by precise circuitry which incorporates several feedback loops to assure stability of the Stereo Baseband Generator parameters with time and temperature.

The block diagram (in **Appendix J**) depicts the major subsystems in the Stereo Baseband Generator and should help clarify the discussion below.

5.b) Composite Meter Peak Detector (on Card #7):

The composite output is monitored by a circuit which detects the positive side of the waveform and "stretches" the peaks long enough to permit the VU meter to rise to the full value of the peak, displaying the peak voltage accurately. The peak detector is quite fast: It will typically capture the value of a 10 microsecond peak within 0.5dB.

5.c) $1f_H$ Doubler: (on Card #7)

A low distortion $1f_H$ sinewave is applied to the Stereo Baseband Generator from the Sync Card (Card #8). This signal is turned into a $2f_H$ square wave by means of a biased dual comparator. The comparator is biased so that it changes state every time the $1f_H$ sinewave goes through 45, 135, 225, and 315 degrees. The amplitude of the $2f_H$ square wave is adjusted by varying the voltage on the "strobe" inputs of the comparator; the $2f_H$ AGC servo adjusts this level, and thus the level of the filtered $2f_H$ sinewave.

5.d) $2f_H$ Filter and Phase Shifter: (on Card #7)

The $2f_H$ square wave output from the comparator is filtered into a sinewave with less than 0.02% distortion by means of an active filter cascaded with a passive filter. The active filter is a high-"Q" resonator whose center frequency is controlled by a JFET activated by the phase-locked-loop circuitry (see **5.f).** By tuning this resonator slightly around the resonance point, its phase shift is significantly affected. This provides the phase control to lock the $1f_H$ and $2f_H$ together with correct phase as required for proper operation of the stereo decoder.

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A passive third-order Cauer filter attenuates residual distortion in the output of the $2f_H$ active resonator to achieve the final distortion specification. It is very important that the $2f_H$ applied to the multiplier be as clean as possible, as every remaining harmonic component will be multiplied by the L-R audio to create out-of-band suppressed-carrier subchannels around each of the harmonics.

5.e) $2f_H$ AGC Loop: (on Card #7)

Maintaining high separation depends upon precisely controlling the ratio between L+R and L-R gain. Since the L-R is multiplied by the $2f_H$ sine, the gain of the L-R is directly proportional to the amplitude of the $2f_H$ sine. This amplitude must be highly stable, or separation will drift with time and temperature.

Because the $2f_H$ sine is derived by hi-"Q" filters which can drift, and because the PLL circuitry will cause gain variations in the $2f_H$ active bandpass filter, a closed-loop servo system is used to stabilize the $2f_H$ sine level.

To do this, the filtered $2f_H$ sine is applied to a high-gain comparator. The other comparator input is connected to a reference voltage derived from the SEPARATION control. The servo forces the peak level of the $2f_H$ sine to be identical to this reference voltage. The output of the comparator is filtered, buffered, and then connected to the "strobe" inputs of the $1f_H$ doubler dual comparator, which has the effect of controlling the output level of the comparator, thus closing the AGC loop.

5.f) $2f_H$ Phase-Locked Loop (PLL): (on Card #7)

The relative phase between the $1f_H$ pilot and the $2f_H$ subcarrier must be precisely controlled to achieve optimum separation. This is achieved by detecting the phase difference between the $1f_H$ output of the pilot oscillator and the filtered $2f_H$ sine, and by activating a tuning JFET in the $2f_H$ active resonator which tunes this resonator slightly to either side of resonance, thus adjusting the filter's phase shift to achieve the exact phase desired at the output of the passive filter.

The phase detector is a biased dual comparator which is essentially insensitive to the level of its $2f_H$ input, but which is quite sensitive to the (highly controlled) level of its $1f_H$ input. The output of the phase detector eventually feeds a true integrator. This makes the PLL a "type-1" servo system, and results in zero steady-state phase error regardless of loop gain.

5.g) Stereo Modulator: (on Card #7)

The L-R input to the Stereo Baseband Generator is applied to the input of a VCA which is almost identical to the VCA's used in the audio processing in the 8182A. (See **2.c** in **Appendix A** and **Appendix B** of the main **8182A Operating Manual** for further information.)

The gain control port of the VCA is fed by the sum of the $2f_H$ sine and a DC current which biases the gain control port to prevent the control current from ever becoming negative. (The VCA can only accomodate single-polarity control currents.) This DC bias means that the output of the VCA contains two components: the desired product of the input L-R and the $2f_H$, and an undesired product of the DC and the input L-R, which is simply L-R. This latter component (which is subchannel-to-main-channel crosstalk) is cancelled by feeding some of the L-R around the VCA out-of-phase. Final sub-to-main null is achieved by slightly adjusting the gain of the VCA.

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The VCA produces a small second harmonic ($4f_H$) feedthrough component (typically 60dB below 100% modulation without correction). This is cancelled by applying a small amount of $2f_H$ to the input of the VCA, where the $2f_H$ is multiplied by itself to produce a second-harmonic component which is out-of-phase with the $4f_H$ VCA feedthrough. When the $4f_H$ NULL trimmer is properly adjusted, stable cancellation of more than 70dB is usually possible.

A DC component is also summed into the output of the VCA to cancel DC offsets at the output of the generator, thus rendering an output coupling capacitor unnecessary. This mix, which is desired only in stereo mode, is switched into the summing junction of an opamp through a JFET switch.

The L+R input to the Stereo Baseband Generator is mixed into the summing junction after the JFET switch.

5.h) (not used)

5.i) Baseband Clipper (on Card #7):

The stereo component of the baseband (without the pilot, SAP, or Pro components) is applied to a shunt clipper to control peak overshoots induced by the Eleven-Pole Filters. Clipper bias is generated by a pair of opamps, and is adjusted by means of the STEREO BASEBAND CLIPPING THRESHOLD control to determine clipping threshold.

5.j) (not used)

5.k) Mode Switching Logic: (on Card #7)

The 8182A/SG Stereo Baseband Generator has four switch-selected modes of operation. Three are special test modes, and are used only when making stereo performance verification measurements.

The first of these facilitates measurement of main-to-sub crosstalk by applying the Stereo Baseband Generator's L+R input signal into its L+R input port (as is normal), and suppressing the input into its L-R input port.

The second mode facilitates the measurement of sub-to-main crosstalk by injecting the signal on the L+R input line into the Stereo Baseband Generator's L-R input port. This test mode in useful in adjusting the Stereo Baseband Generator's internal SUB-TO-MAIN CROSSTALK NULL trimmer and its PILOT PHASE control.

The third test mode allows separation to be optimized by connecting the L+R input line to both L+R and L-R inputs, producing an FM-stereo-style "flat baseline" oscilloscope waveform. This works because the L+R and L-R inputs of the Stereo Baseband Generator have been designed to have equal gain. The doubling of the stereo subchannel amplitude is achieved by doubling the audio input to the Stereo Baseband Generator's L-R input port.

The normal mode is OPERATE. In this mode, three sub-modes are available by remote control or by switching the front-panel STEREO/MONO switch.

The first is STEREO. It simply generates a normal stereo baseband output from the signals on the L+R and L-R Stereo Baseband Generator input lines.

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The second and third sub-modes are MONO LEFT and MONO RIGHT. A given MONO mode uses the signal at the output of the Left or Right Six-Pole Filter (depending on whether MONO LEFT or MONO RIGHT is selected), and applies this signal to both the Left and Right channels of subsequent processing. The output of the Pilot Generator is suppressed (see **4.c** above) and the output of the Stereo Modulator is disconnected from the baseband summing amplifier.

A CMOS three-state latch using three NAND gates "remembers" the logic state. Note that the three manually-switched TEST modes are not directly integrated into the logic system. It is therefore necessary to manually enter STEREO mode before making crosstalk and separation measurements.

The truth table below shows the state of each JFET switch in the system under various conditions. Further understanding of the operation of the logic and switching system in the 8182A/SG may be obtained by studying this table.

INPUTS				OUTPUTS				MODE	
STEREO	MONOR	MONOL	BSYNC	LMONOL	LMONOR	GSTER	STEREO LIGHT		
0	1	1	1	0	0	1	ON	STEREO	
1	0	1	1	1	0	0	OFF	MONO RIGHT	SYNC
1	1	0	1	0	1	0	OFF	MONO LEFT	LOCKED
1	1	1	1	NC	NC	NC	NC	PREVIOUS MODE	
0	1	1	0	0	0	1	OFF	STEREO	
1	0	1	0	1	0	0	OFF	MONO RIGHT	SYNC
1	1	0	0	0	1	0	OFF	MONO LEFT	UNLOCKED
1	1	1	0	NC	NC	NC	OFF	PREVIOUS MODE	

NOTES: 1) 0=-15V, 1=GND, NC=no change from previous state
2) The response of the logic to the remote control inputs, the STEREO/MONO switch and the power-on circuit is identical, and the inputs are taken to be the 3 lines labeled STEREO, MONO R and MONO L on the schematic.

Fig. A-4: SYSTEM LOGIC TRUTH TABLE

6) Monitor Circuit (on Card #6):

The purpose of the monitor circuit is to accurately decode the Left and Right channels from the dbx-encoded sum-and-difference audio signal, thus aiding adjustment and verification of stereo generator operation independent of the aural exciter, transmitter, diplexer, antenna, and modulation monitor.

The monitor circuit consists of a pair of 75us de-emphasis networks, a dbx N/R Decoder card, a decoder sum compensator, and a precision dematrix which uses a resistor array with resistors matched to $\pm$0.1%.

To the best of our knowledge, there is only one version of the dbx Decoder Card. We expect that regardless of what dbx might do in the future, all Orban Monitor Cards (#6) will be interchangeable in the field. (Note that not all dbx Encoder Cards are interchangeable: see **[2.b]** above.)

When the MONITOR N/R DECODER switch is OUT, de-emphasis is applied to both L+R and L-R inputs by means of precision-matched 75us de-emphasis networks. The decoder sum compensator is switched out of the circuit.

When the MONITOR N/R DECODER switch is IN, L-R de-emphasis is replaced with the dbx Decoder Card, and the decoder sum compensator is switched into the L+R signal path.

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The Monitor Circuit has been designed to serve as a reference for testing and adjustment of the rest of the 8182A/SG system. There are no alignment controls, and the accuracy of the Card exceeds that of the rest of the system. When the MONITOR N/R DECODER switch is OUT (requiring that the N/R ENCODER switch also be OUT), then the "equivalent stereo separation" of the monitor card alone exceeds 45dB, 30-15,000Hz. When the MONITOR N/R DECODER switch is IN (requiring that the N/R ENCODER switch also be IN), then monitor card separation is limited by the performance of the dbx Decoder Card.

7) Power Supplies:

Primary power for the 8182A/SG circuitry comes from a highly regulated ±15 volt power supply. The main supply is +15 volts which is regulated by means of a 723C IC regulator with current-boosted output, current limiting, and overvoltage protection using a zener diode and fast-blo fuse.

The -15 volt supply is essentially a current-boosted opamp in a unity-gain inverting configuration which "amplifies" and inverts the +15 V supply, thus "tracking" it. The -15 volt supply is also current-limited and overvoltage protected. Both +15 and -15 supplies are located on a non-plug-in card mounted on the inside of the rear chassis apron. This apron is also used as a heat sink for the regulator power transistors.

Since the -15V supply tracks the +15V supply, diagnostic metering is provided only on the -15 bus. (If the -15V supply is good, the +15V supply must be good.)

The 711C comparators used in the Stereo Baseband Generator require +12/-6 volt supplies. These are created by locally dropping the main +15 volt supply through three forward-biased silicon diode junctions (to create the +12), and by means of local resistive voltage dividers from -15 to ground (to create the -6).

This concludes **APPENDIX A (SYSTEM DESCRIPTION).**

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APPENDIX B:
Circuit Description

The following section provides an extremely detailed description of the circuitry used in the 8182A/SG Stereo Generator on the component level.

It will be wise to review **Appendix A** first, and to consult the block diagram in **Appendix J.** Referring to the appropriate Schematics and Parts Locator Drawings in **Appendix J** will help you to follow the text and will aid component-level troubleshooting.

In those cases where the circuitry is duplicated, only the left channel or L+R channel circuit and component designators will be discussed.

1.a) Six-Pole Filter (on Card #3):

The Six-Pole Filter is an active-RC analog of a passive LC ladder filter. It is realized by means of resistors, capacitors, and Frequency-Dependent Negative Resistors (FDNR's). An FDNR is realized by means of a dual opamp, three resistors, and two capacitors. When the passive LC filter is transformed into an active RC filter, inductors become resistors, resistors become capacitors, and capacitors become FDNR's.

The first two FDNR's each resonate with a series resistor to create a notch in the frequency response of the filters. (This is analogous to a series L-C circuit to ground.) The third FDNR (IC5) serves as a transformed capacitor and does not produce a notch. The notches are located in the "stopband" (beyond approximately 15.7kHz). The circuit associated with IC1 produces a notch at 17.000kHz ±4%. The circuit associated with IC2 is tuned by means of R12 to produce a notch at precisely 15.734kHz to remove any f_H component in the audio.

Measuring the frequency of these notches and their depth provides the best way of diagnosing problems with such filters, since problems with a given notch can be associated with a given FDNR in most cases.

To avoid possible clipping, the signal is attenuated by 20dB by means of voltage divider R1, R2 before being applied to the filter. This gain is made up by IC8B to restore unity gain at low frequencies.

The discussion of troubleshooting found in **1.a** of **Appendix A** should be noted.

1.b) Stereo/Mono Switching (on Card #3):

JFET switch Q2 determines whether unity-gain follower IC8B will receive its input from the output of the Left or Right Six-Pole Filter. If Q2 is ON (gate pulled to the same voltage as its source through R19 because Q1 is OFF), then the right channel contribution from R69 will be swamped out by the low impedance drive from IC8B and the output of IC8B will contain the left channel. Conversely, if Q2 is OFF (gate at -15VDC because Q1 is ON), it looks like a very high impedance and the right channel will be applied to IC8B through R69.

Logic signals are supplied from Card #7. Refer to Fig. A-3 in **Appendix A** of this manual for a logic truth table.

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1.c) Phase-Balance Circuit (on Card #3):

IC7B and associated components form a first-order allpass network: its magnitude response is flat, but its phase shift changes from 0° to 180° as a function of frequency. With R20 centered, it is normally 90° at 100kHz, and is equal to the phase shift produced by IC9B and associated components in the L-R channel. Adjustment of R20 changes the frequency at which 90° of phase shift is produced, without changing the (flat) magnitude response.

2.a) Eleven-Pole Filters (on Card #5):

The Eleven-Pole Filters are realized using FDNR technology. The reader should refer to **(1.a)** above for a discussion.

Unlike the six-pole filters, all FDNR's in the eleven-pole filters creates notches. There are five notches in the stopband. Trimmers are provided to tune the two notches closest to the passband to their correct frequencies, achieving highest filter accuracy. The notch frequencies are as follows:

IC5	34.60kHz
IC1	17.27kHz
IC2	15.77kHz
IC6	16.14kHz
IC11	20.74kHz

R1 and R2 introduce about 20dB attenuation to avoid clipping within the filter. This gain is made up in IC10B.

Please note the comments regarding troubleshooting and factory service of the filters in **1.a** of **Appendix A** of this manual.

2.b) Sum Compensator (on Card #5):

The sum compensator consists of IC9 and associated circuitry. Each opamp realizes a unity-gain positive feedback second-order lowpass filter. Depending on the vintage of dbx N/R Encoder employed, either IC9B alone, or both parts of IC9 are used to realize the Sum Compensator. Therefore, a given Card #4 (containing the dbx N/R Encoder) must be matched by the appropriate version of Card #5 with the correct Sum Compensator. If spare cards or service of either Card #4 or Card #5 is required, please consult Orban Customer Service.

2.c) Stereo/Mono Filter Bypass (on Card #5):

In MONO mode, it is desirable to bypass the L+R Eleven-Pole Filter and N/R Encoder Sum Compensator. This is done by means of Q2, a JFET switch. When Q2 is ON (gate pulled up to the voltage at its source by virtue of Q1's being OFF), then the contribution from R36 at IC10A's "+" input is swamped out, and the output of IC10A is substantially identical to the Eleven-Pole Filter's input signal (which appears at pin H of the card edge connector).

When Q2 is OFF (gate pulled to -15VDC by virtue of Q1's being ON), Q2 is a very high impedance, and the filter output appears at IC10A's "+" input through R36.

The logic signal to drive Q1 is generated on Card #7.

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3) Noise Reduction Encoder (on Card #4):

This Card is fully described by the identically-numbered section in **Appendix A** of this manual.

4.a) Sync Separator (on Card #8):

Sync or composite video is picked off the input line by means of IC7 and associated circuitry, which form a differential amplifier with a gain of 4 and a high-impedance balanced-bridging input.

The output of IC7 is applied to comparator IC6 through two paths. The top path applies the signal to IC6's "+" input through level-shifting and temperature-compensation diode CR6 which is biased "ON" by means of current supplied through R41. (The amount of DC level-shift is temperature-sensitive and compensates for temperature effects in CR5 in the bottom path.)

The bottom path is a negative peak-detector which charges C2 to the peak voltage of the negative sync tips through CR5. (The voltage on C2 in fact contains a positive DC offset because of CR5's turn-on voltage.)

The voltage across C2 is applied to the "-" input of IC6. In addition, a positive DC level-shift is added to this voltage by virtue of the voltage drop across R5, R6, R7 due to current injected through R8. This DC level-shift causes the comparator reference voltage (on the "-" input of IC6) to track the negative sync tips (on the "+" input of IC6) with a positive offset of approximately 300mV DC, thus forcing the comparator output to switch reliably on each edge of the sync waveform despite changes in the average DC level of the composite video.

If the amplitude of the incoming sync or composite video waveform varies substantially from 1V p-p, then R7 (SYNC SENSITIVITY) can be engaged to vary the positive offset applied to the signal on C2, assuring reliable comparator action.

The output of comparator IC6 is applied to non-retriggerable one-shot IC5, which is a CMOS version of the familiar 555 timer. IC5 is triggered by negative-going edges. The output of IC5 is a series of 15,734Hz pulses whose positive-going edges are equally-spaced.

4.b) Phase-Locked Loop (PLL) (on Card #8):

The $1f_H$ pulses from IC5 provide a phase reference for the phase detector within IC10, which is triggered on positive-going edges. The output pulses of IC10a are integrated by IC9B and associated circuitry. When the loop is closed (by returning the $1f_H$ output of IC4 to phase detector IC10a), a second-order PLL is formed. R16 and C7 provide extra filtering of the high-frequency "garbage" which passes through IC9B.

IC10b and associated components form a Voltage-Controlled Oscillator (VCO). Its output is a square wave at $8f_H$, which can be considered the output of the PLL.

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If the loop loses lock (even very momentarily), pin 1 of IC10A (which is ordinarily at +15V) will produce pulses which go to ground. Ordinarily when lock is achieved, C10 is charged to +15V through R19 and this voltage is applied to IC9A's "+" input. IC9A operates as a comparator. A +14.0V reference voltage is applied to IC9A's "-" input through voltage divider R20, R21. If the voltage on IC9A's "+" input is +15V, IC9A turns ON (saturates to the positive power supply rail), lighting the SYNC LOCK lamp on the front panel, activating the REMOTE SYNC LOCK circuit, and forcing the BSYNC line (which goes to logic on the stereo generator) to ground because of the level-shifting performed by R38 and R39.

If lock is lost for any significant fraction of one field, the voltage across C10 will drop below +14V. IC9A's output will then saturate to the negative power supply rail, turning off the SYNC LOCK lamp, deactivating the REMOTE SYNC LOCK circuit, and forcing the BSYNC line to approximately -15V.

4.c) Pilot Generator (on Card #8):

The output of the PLL's VCO (at $8f_H$) is applied to binary divider IC4. IC3A and associated components are a power-up startup circuit for IC4. IC4 is gated by IC3B and IC3C such that a $1f_H$ pulse of controlled duty-cycle appears at pin 5, and a $3f_H$ pulse of controlled duty-cycle appears at pin 11. The signal at pin 11 is inverted by IC2B, while the signal at pin 5 is passed without inversion through IC2A. The outputs of IC2A and IC2B are summed in R28 and R29 such that all lower harmonics of f_H are cancelled. Remaining harmonics are filtered-out in third-order inverting lowpass filter IC1A and associated components. The output of IC1A is a $1f_H$ sinewave with about 0.025% THD.

4.d) Pilot AGC (on Card #8):

IC1B serves as a comparator. When the peak level of the $1f_H$ sinewave at the output of IC1A goes more positive than the voltage at the junction of R36 and R37 (i.e., +2.72V pk; 1.92V rms), a negative-going pulse appears at the output of IC1B. Ordinarily, voltage divider R34, R40 holds C16 at approximately +7.5VDC. Output pulses from IC1B pass through CR3 and R35 and discharge C16 towards ground. This reduces the output level of IC1A until comparator IC1B is almost fully off.

The voltage on C16 affects the output level of IC1A as follows: C16 is buffered by emitter-follower Q1, which in turn supplies the power supply voltage for IC2. The amplitude of the output pulses of IC2A and IC2B vary in proportion to IC2's power supply voltage. Thus the drive to filter IC1A is varied, varying its output level and closing the AGC loop.

In STEREO mode, the voltage on the GSTER line from the stereo generator is approximately 0VDC and the comparator reference divider R36, R37 operates normally, producing +2.72V at IC1B's "+" input. In any MONO mode, the voltage on the GSTER line becomes -15VDC. This forces the "+" input of IC1B below ground and forces the output of IC1B to saturate to the negative rail. CR4 turns ON, clamping the control voltage output at the emitter of Q1 to approximately 0VDC. This removes power supply voltage from IC2, suppressing the stereo pilot tone.

5.a) Stereo Baseband Generator (General): (on Card #7)

The principles of operation of the Stereo Baseband Generator have already been discussed in **Appendix A.** The detailed operation of each of the sub-systems in the Stereo Baseband Generator will be discussed below.

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5.b) Composite Meter Peak Detector (on Card #7):

The peak detector uses feedback around the peak-detector hold capacitor C18 and buffer amplifier IC5B to accurately capture and hold the peak level of the composite output of the Stereo Baseband Generator. This output is applied to the "+" input of IC5A. The DC output of the peak detector is applied to the "-" input of IC5A. If the voltage on the "+" input of IC5A exceeds the voltage on its "-" input, then IC5A charges C18 through diode-connected transistor Q3 until the peak detector's DC output is equal to the voltage on the "+" input of IC5A.

Diode-connected transistor Q2 prevents saturation of IC5A by actively clamping the output of IC5A to 0.7V below the output voltage of IC5B when IC5A is not charging C18.

C17 and R36 are frequency-compensation components to prevent overshoot and oscillation of the circuit.

The R37, R38, R39 network is a bootstrapped release time circuit. The junction of these three resistors is held approximately 0.8V below the output of IC5B by virtue of the negative current flow through R38. Since the output voltage of IC5B is the same as the voltage across C18, this provides a constant current flow through R37, and thus a constant-slope release of approximately 3.6V/sec for C18.

5.c) $1f_H$ Doubler: (on Card #7)

The $1f_H$ output from Card #8 is applied to both halves of dual comparator IC14. A -2.09 volt bias voltage is applied to pin 5 through R41, R42; a +2.09 volt bias is applied to pin 2 through R43, R44. The voltages and polarities are arranged so that each time the $1f_H$ sine passes through 45 degrees + (n x 90 degrees) (n=1,2,3...), the output of IC14 switches from high to low, or vice-versa. Its output is thus a $2f_H$ square wave 90 degrees out-of-phase with its $1f_H$ input. The low level at IC14's output is approximately -0.5 volts; the high level is controlled by the voltage applied from the output of IC16B to strobe terminals 9 and 13 of IC14. As will be seen below (see **5.e),** this closes the AGC loop which controls the amplitude of the $2f_H$ sinewave derived by filtering the output of IC14.

5.d) $2f_H$ Filter And Phase Shifter: (on Card #7)

The squarewave output of IC14 is connected to a high-"Q" "Q-enhanced" active bandpass resonator IC17 and associated circuitry, employing both positive and multiple-negative feedback to minimize sensitivity to component drifts and tolerances. The nominal "Q" of the resonator is 40.

This resonator is tuned by a control voltage applied to the gate of Q5, a JFET operating as a voltage-controlled resistor. Varying the resistance of Q5 varies both the center frequency and "Q" of the resonator. As will be seen below (see **5.f),** voltage control is derived from the Phase-Locked-Loop (PLL) circuit.

If the sum of the resistance of R64 and Q5 becomes too low (below about 780 ohms, nominally), then IC17 will oscillate at approximately $2f_H$ and produce a reasonably pure sinewave output. The circuit has been designed with considerable safety margin to prevent this from happening as long as all passive components in the circuit approach their specifications for temperature stability and long-term drift. However, oscillation might occur if, for example, one of the components in the circuit were to exhibit severe drift. If this oscillation occurs, it can cause considerable confusion because the oscillation is easily mistaken by a service technician for the desired $2f_H$ component. Yet the oscillation is not precisely locked to the $1f_H$ pilot, is not controllable by the $2f_H$ AGC loop, and cannot be suppressed by turning off the $1f_H$ oscillator.

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The output of IC17 contains perhaps 0.5% THD. To create a $2f_H$ sinewave in which all spurious components are down at least 80dB, the output of IC17 is connected to a passive third-order Cauer lowpass filter R69, C26, C27, C28, L1. This filter is essentially flat to $2f_H$, and provides substantial rejection for all harmonics. It exhibits a notch at $6f_H$ (third harmonic of $2f_H$).

The output of the passive filter is inverted by IC8. Note that not all opamps of the generic type specified will work satisfactorily in this socket, and that the factory checks each opamp to make sure that its second harmonic ($4f_H$) distortion remains greater than 80dB below the $2f_H$ level.

Recalling that the $2f_H$ output of IC14 is 90 degrees out-of-phase with the $1f_H$ pilot, note that the total phase shift through both active and passive filters has been designed to create the necessary additional 90 degree shift to bring the $2f_H$ back into the proper phase relationship with the $1f_H$ pilot. This relationship is precisely maintained despite drifts in the filters by means of the $2f_H$ PLL circuit.

5.e) $2f_H$ AGC Loop: (on Card #7)

The output of the $2f_H$ passive filter is inverted by IC8A. IC8A's output is connected to the "-" input of IC6 .

IC6 is used as a comparator. Its "+" input is connected to the wiper of R60 (L-R GAIN), which provides a DC reference voltage for IC6. If the peak voltage of the $2f_H$ sine at the output of IC8 attempts to rise above the DC reference voltage at the "+" input of IC6, then IC6 will produce a negative-going output which discharges C21 through CR7 and R58. Under conditions where IC6 is non-conductive, the quiescent voltage on C21 is set at approximately +6VDC by means of voltage divider R55, R56. These resistors also determine the recovery time of the AGC loop.

C21 is buffered by means of unity-gain voltage follower IC16B. The output of IC16B is applied to the "strobe" inputs of IC14, thus adjusting the amplitude of the $2f_H$ square wave output from IC14 and closing the feedback loop.

5.f) $2f_H$ Phase-Locked Loop (PLL): (on Card #7)

The $2f_H$ output of IC8 is applied to the "-" input of one-half of dual comparator IC13 (used as a phase detector). The "+" input is grounded. The output of this "$2f_H$" half of IC13 is therefore a symmetrical $2f_H$ squarewave.

The output of the $1f_H$ sinewave from Card #7 is applied to the "-" input of the other half of IC13. The "+" input of this "$1f_H$" half is biased at +1.69VDC by means of voltage divider R45, R46. The output of the $1f_H$ half of IC13 is thus an asymmetrical $1f_H$ square wave.

The outputs of the two halves of IC13 are "OR"ed together. The output of IC13 is thus a $2f_H$ pulse whose duty cycle depends on the phase relationship between the $1f_H$ and $2f_H$.

This pulse's baseline is approximately -0.5VDC; its peak is approximately +4.5VDC. The pulse is level-shifted by passage through C20, and then coupled to switching transistor Q4 to turn it on and off.

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When Q4 is on, it saturates and essentially connects R52 to the +15V supply. The other side of R52 is connected to the "-" input of inverting integrator IC16A. Feedback forces this "-" input to be within a few millivolts of ground. Thus, when Q4 is on, exactly 1 mA flows into the summing junction of IC16A and is integrated by IC16A in conjunction with feedback capacitor C22. When Q4 is off, essentially no current flows. CR706 prevents the output of IC16A from going more than 0.7V positive, thus protecting C22 and Q5.

The feedback loop is closed by connecting the output of IC16A to the gate of Q5. Varying the voltage at the gate of Q5 varies its resistance, thus retuning $2f_H$ resonator IC17 and associated components (see **5.d** above) and changing the phase shift through IC17.

Current is removed from the IC16A summing junction through R53 and R54 (PILOT PHASE). Because of the integrator, the average current into the summing junction of IC16A must be zero. Otherwise, the output of IC16A would eventually go to the "+" or "-" power supply rails and saturate.

Feedback from the output of IC16A thus adjusts the phase shift in IC17 (and thus the duty cycle of the current pulses through R52) until the average current into the "-" input of IC16A is zero. The amount of current removed from the "-" input of IC16A is adjusted by the operator (by means of R54) until the desired phase relationship between the $1f_H$ pilot and $2f_H$ output of IC8 is achieved.

Once adjusted, the stability of this relationship is primarily dependent upon the stability of phase detector IC13. The $2f_H$ side is referenced to ground. Therefore, changes in the amplitude of the $2f_H$ input will have virtually no effect upon the duty cycle of the output of the $2f_H$ side of IC13. However, the duty cycle of the $1f_H$ side of IC13 is highly dependent upon maintaining the amplitude of the $1f_H$ constant. Ordinarily, this is effectively done by means of the Pilot AGC loop (see **4.d**). A failure in this loop can therefore cause drifts both in pilot level and pilot phase.

In addition, leakage in Q4 can cause instability problems, particularly if the leakage changes with time and/or temperature.

5.g) $2f_H$ Doubly-Balanced Modulator: (on Card #7)

The operation of the modulator is very similar to the operation of the voltage-controlled amplifiers used in the audio processing section of the 8182A, and the reader should first refer to **2.c** in the main **8182A Operating Manual.**

The essential difference between operation of the audio VCA's and operation of the $2f_H$ modulator is that the audio VCA's are operated in a divider mode, and the $2f_H$ modulator is operated in a multiplier mode. Thus control current in IC15B is varied to perform the multiplication function.

Control current in IC15B is the sum of a bias current (through R16) and a $2f_H$ modulating current which is coupled through R14 and DC blocking capacitor C13. (Pin 3 of IC15B ordinarily sits at approximately -13.5V). The bias current is necessary because pin 3 can only accept control currents of one polarity. However, it also means that the $2f_H$ modulator multiplies its L-R input times a constant, thus passing some L-R directly without modulating it by $2f_H$. This feedthrough component (which undergoes a phase reversal when

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passing through the modulator) is cancelled by feeding in-phase L-R around the modulator through R20. Final adjustment of the feedthrough cancellation (which is equivalent to nulling subchannel to main-channel crosstalk) is effected by slightly trimming the bias current in IC15A by means of R7 (SUB-MAIN CROSSTALK), thus varying the gain of the modulator. (**NOTE:** This adjustment will also affect L-R gain and thus separation. If for some reason R7 is adjusted, R60 will also have to be slightly trimmed.)

Cancellation of the residual $4f_H$ second-harmonic output of the modulator (which results from unavoidable non-linearities) is effected by passing a very small amount of $2f_H$ from R15 ($4f_H$ NULL) through R13 into the "-" input of IC15B. This component is multiplied in IC15B by the main $2f_H$ component to create a $4f_H$ component of correct amplitude and phase to cancel the basic $4f_H$ feedthrough in the modulator.

The basic feedthrough is in the order of -70dB; this circuit typically reduces it to slightly below -80dB. It can therefore be seen that the circuit is not terribly critical, and moderate drifts with time and temperature will not result in difficulties.

The circuit affects only the $4f_H$ component, and not sidebands which appear around it due to L-R modulation. These sidebands are a function of (1) basic modulator non-linearity, and (2) any residual second harmonic appearing in the $2f_H$ modulator input (from the output of IC8).

If the $4f_H$ and/or $6f_H$ sidebands have excessive energy, they can interfere with the SAP. In most production units, these sidebands are down -70dB or more below 100% with pure L or R modulation, and will of course essentially disappear with pure L+R, because the only signal that is applied to the modulator in this case is the noise produced by the Noise Reduction Encoder.

This performance is far better than required to fully protect the SAP. If interference to SAP suddenly develops, and a spectrum analyzer connected directly to the composite output of the 8182A/SG reveals high levels of $4f_H$ or $6f_H$ sidebands, then the most likely sources of difficulty are IC15 itself, or else substantial harmonic distortion at the output of IC8. IC15 is a specially selected and graded device, and replacements must be obtained from the Orban factory. (**NOTE:** Replacement of IC15 requires a complete Stereo Baseband Generator realignment as detailed in **Appendix E** of this manual.)

The output of IC15B is in the form of a current. This is converted to a voltage by means of output summing amplifier IC9.

Q1 switches the "stereo" components onto IC9's summing junction depending on whether the 8182A/SG is in "stereo" or "mono" mode. These "stereo" components include the output of IC15B, the L-R cancellation component from R734, and a DC offset null current.

The DC offset component is summed through R17, R18 from the wiper of DC OFFSET trimmer R19. C14 bypasses any power supply noise.

The purpose of the DC offset adjust is to render an output coupling capacitor unnecessary. Such a capacitor would have to be a very large polar electrolytic (approximately 470uF or greater). Not only would such a capacitor compromise low frequency separation slightly, but its existence would also tend to compromise the extreme transparency of the basic 8182A/SG signal path, since it is believed that such capacitors audibly degrade sound quality.

5.h) (not used)

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5.i) Baseband Clipper (on Card #7):

The baseband clipper is a symmetrical shunt clipper employing R23, R26, CR4, CR5. The latter are Schottky diodes with very "hard" turn-on characteristics.

Bias voltage for the diodes is provided by IC7 and associated circuitry. CR12 temperature-compensates the output voltage of IC7A and IC7B to prevent the temperature-induced changes in the turn-on voltage of CR4 and CR5 from varying the clipping threshold. R78 (STEREO BASEBAND CLIPPING THRESHOLD) varies the output voltage of the clipper bias circuitry from approximately ±3.6VDC to ±14VDC, corresponding to a baseband clipping threshold threshold of 100% to 390% modulation (with reference to 100%=±50kHz).

5.j) Output Summing Amplifier And Line Driver (on Card #7):

The output of the Baseband Clipper contains only the stereo Main and Subchannel. The output of the Baseband Clipper, along with the Pilot, SAP, and Pro signals, are summed into composite opamp IC3, IC4, and associated components. IC4 is a special high-slew-rate power buffer which is located within the overall opamp feedback loop. It isolates IC3 from the destabilizing effects of capacitive loads and also permits 75 ohm loads to be driven without degradation. This line driver will drive up to 0.047uF in parallel with 75 ohms before non-linear errors (increases in spurious components as observed on a baseband spectrum analyzer) or linear errors (noticeable deterioration of baseline flatness at 15kHz in the SEPARATION TEST mode) are apparent.

Output level is adjusted by varying the feedback resistor in the overall feedback loop of IC3, IC4 by means of R32, thus varying the gain to all baseband components, including the SAP and Pro subcarriers.

5.k) Mode Switching Logic: (on Card #7)

The three basic logic states -- stereo, mono left, and mono right -- are "remembered" by three CMOS NAND gates in IC1. The output of each gate is connected to an "output bus" through a 47K isolation resistor R71, R72, R73 to permit pulling a given output bus down without damaging its associated gate. A sub-mode is ON when its output bus is at -15V, and OFF when its output bus is at ground. The two inputs of each gate are connected to the two output busses of the other two gates. Thus, if either of the other gates is ON, the gate in question is held OFF. However, if the output bus associated with the gate in question is externally pulled ON, the other two gates are pulled OFF; thus the gate in question is latched ON. Logic switching is effected by momentarily switching any of the gate output busses to -15V; this is done by forcing the transistors in optoisolators IC10, IC11, IC12 to conduct by passing current through their LED's (remote control), by operating the momentary front-panel STEREO/MONO switch, or by the power-up circuit, which uses R75, C29, and CR11 to hold a selected output line at -15 for a fraction of a second after powerup.

Failures in the logic will almost certainly be due to failures of IC1, IC2, IC10, IC11, or IC12, or to failures in the JFET switching transistors. All of these components can be freely replaced as necessary without readjustments.

Note that the phototransistors in IC10-IC12 have had their base leads (pin 6) cut off flush with the IC package. This is because the base lead is extremely sensitive to leakage currents, and condensing moisture is quite sufficient to cause false switching. It is therefore extremely important that the base lead be cut off if any of these optoisolators are ever replaced.

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Essentially no further circuit description is required, as most of the circuitry is integrated onto the CMOS logic chips. The discussion of operational principles supplied in **5.k** of **Appendix A** of this manual, plus examination of the truth table found in Fig. A-3 in the same **Appendix,** should suffice to permit full understanding of the operation of the logic. (Some readers may be unfamiliar with the Exclusive-OR gate, IC2. This logic element operates such that its output is at -15 volts when its inputs are the same, and at 0 volts when its inputs are different.)

6) Monitor Circuit (on Card #6):

This card is explained in system terms in the identically-numbered section in **Appendix A** of this manual. Details of its operation are as follows:

The L+R is applied to the card with a nominal level of 1.768V rms for 100% modulation. The L-R is applied with a nominal level of 3.536V rms for 100% modulation. The dematrix exhibits unity gain to the L-R signal and 2x gain to the L+R signal. At low frequencies unaffected by de-emphasis, the nominal output level produced by equal Left and Right levels (@100% Main Channel modulation) is 3.536V rms (+8.751dBu) ±1% at both Left and Right Monitor Outputs when loaded by 100K or greater. Output impedance is 600 ohm unbalanced.

The dbx N/R Decoder Card is described in **Appendix M** of this manual.

7) Power Supplies (on Card #PS [on inside of rear panel]):

The main ±15V power supply used in the 8182A/SG is identical to that used in the 8182A. For a detailed circuit description, the reader is referred to sections **8.a** through **8.d** in **Appendix B** of the **8182A Operating Manual.**

This concludes **Appendix B (CIRCUIT DESCRIPTION).**

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APPENDIX C:
User Access

The 8182A/SG is packaged in a chassis essentially identical to the one used for the 8182A. The reader is referred to **Appendix C** in the main **8182A Operating Manual.**

C

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APPENDIX D:
Field Audit of Performance

General: This appendix provides instructions enabling TV STEREO GENERATOR users to check the performance of their units using test equipment likely to be found in a well-equipped TV station. This procedure is a starting point for detecting and diagnosing a problem that you believe is caused by the TV STEREO GENERATOR. It is also useful in routine maintenance, and can be used at Proof time to check routine equipment performance, thus providing more data than the proof alone provides.

The 8182A/SG TV STEREO GENERATOR is an accessory which must be used with the 8182A OPTIMOD-TV Audio Processor. This appendix contains instructions for testing both units together as a system, and also instructions for individually testing each of the cards in the TV STEREO GENERATOR.

When testing the units together as a system, the user must be sure that the 8182A OPTIMOD-TV is functioning properly. The OPTIMOD-TV can be tested alone by switching the NOISE REDUCTION IN/OUT switch on the rear panel to OUT. (This switch is labeled STEREO GENERATOR IN/OUT on later units.) Refer to **Appendix D: Field Audit-of-Performance** in the 8182A OPTIMOD-TV manual if you suspect a problem with the unit.

Required Equipment:

a) Audio Oscillator. An ultra-low-distortion type like the Sound Technology 1710B is preferred. However a Heathkit or similar oscillator can be used to obtain approximate results, provided that the residual distortion has been verified to be below .1%.

b) Noise and Distortion Test Set. Once again, a high-performance type like the Sound Technology 1710B is preferred, but not required.

c) General-Purpose Oscilloscope. DC-Coupled, dual trace, with at least 5 MHz bandwidth.

d) Stereo Aural Monitor with built in Noise Reduction decoder. If a stereo monitor is not available, a 0-100kHz spectrum analyzer such as a Tektronix 5L4N can be used.

Noise Reduction In/Out: Performance limitations in the system are most likely to arise from the noise reduction encoder and decoder circuits. In particular, stereo separation and distortion measurements are limited by the encoder and decoder gain/frequency tracking capablities and non-linearities.

The noise reduction encoder and decoder can be conveniently switched out of the signal path to help isolate performance variations. When the encoder and decoder are switched out, they are replaced by fixed pre- and de-emphasis, respectively. At the same time the sum-channel compensation circuits are removed from the sum-channel signal path.

Monitor Card: The monitor card (Card #6) provides a means for verifying the performance of the audio signal path up to the stereo baseband generator without requiring a stereo modulation monitor. It includes a noise reduction decoder card in the difference channel, a fixed de-emphasis in the sum channel, and a de-matrix circuit to generate the left and right monitor outputs.

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SYSTEM PERFORMANCE TESTS

System Setup: To test the performance of the entire 8182A/SG TV STEREO GENERATOR system, the unit must be connected to the host 8182A OPTIMOD-TV with the connecting cable. If you normally operate with the 8182A/ST Studio Accessory Chassis, this unit is not required for these tests.

The audio signal source is connected to the Left and Right Audio Inputs on the OPTIMOD-TV. Turn both proof switches to PROOF and turn the Loudness Controller OFF. Allow at least two minutes for the gain to settle.

Audio outputs are taken from the Left and Right Monitor Outputs on the rear of the TV STEREO GENERATOR. Connect sync or composite video to the Video Input on the rear of the TV STEREO GENERATOR. Be sure the STEREO and SYNC LOCK LED's are lit.

The output gains of the 8182A OPTIMOD-TV must be matched to those of the 8182A/SG TV STEREO GENERATOR as described in **Part 4, Initial Setup Procedure,** section 4.II.3 of this manual.

Frequency Response: Frequency response measurements are taken by feeding one channel only and observing the Monitor Output on the TV STEREO GENERATOR. To avoid overload due to pre-emphasis, the frequency response is taken 17dB below the clipping level of the OPTIMOD-TV at low frequencies. The frequency response should be measured with the noise reduction IN.

The procedure for measuring the left channel is as follows:

a) Feed 100Hz at .5Vrms into the Left Input of the OPTIMOD-TV.
b) Adjust the Left INPUT ATTENUATOR on the OPTIMOD-TV so that the meter reads +3 in the L FILTER OUT position.
c) Reduce the amplitude of the oscillator by 17dB.
d) Either manually or with a sweep oscillator measure the level at the Left Monitor Output of the TV STEREO GENERATOR at several frequencies between 35Hz and 20kHz. The response should be similar to that shown in Figures D-1 and D-2, within ±.75 dB.

The right channel frequency response is measured similarly.

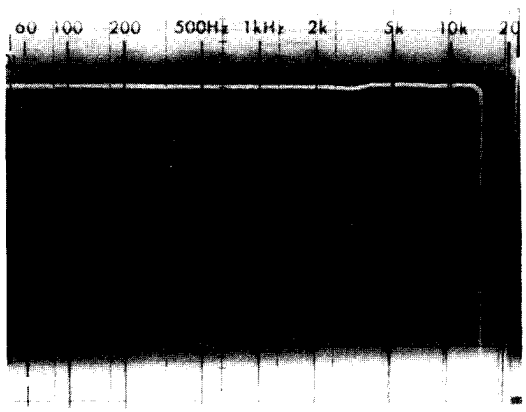

Fig. D-1: 10dB/div

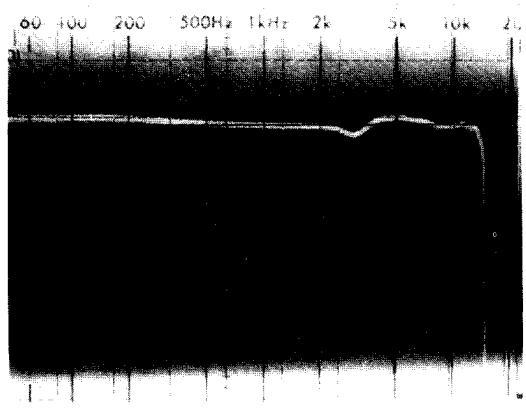

Fig. D-2: 2dB/div

Figs. D-1 and D-2: SYSTEM FREQUENCY RESPONSE

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Total Harmonic Distortion: THD is measured by feeding one channel only and measuring the distortion at the Monitor Output on the TV STEREO GENERATOR. This is measurement is taken with 100% single channel modulation, which corresponds to 50% sum channel modulation. Set the levels as in steps a) and b) in the frequency response test above, and measure the distortion at the Monitor Output.

The readings should be taken with noise reduction encoder and decoder both IN and OUT. With the noise reduction OUT, THD readings should be well below .1% at all frequencies. With the noise reduction IN, THD readings should be below .2%. Typical distortion figures are listed in Table D-1.

	N/R OUT		N/R IN	
FREQ.	LEFT	RIGHT	LEFT	RIGHT
50	.015%	.014%	.055%	.061%
100	.014%	.015%	.045%	.052%
400	.014%	.014%	.032%	.031%
1000	.010%	.009%	.020%	.020%
5000	.019%	.017%	.049%	.051%
10000	.037%	.032%	.095%	.089%
15000	.053%	.046%	.135%	.130%

Table D-1: Typical single channel Total Harmonic Distortion

Noise: Short both inputs to the 8182A OPTIMOD-TV. Measure the residual output noise at the Monitor Outputs of the TV STEREO GENERATOR. Noise readings in a 20kHz noise bandwidth should be below -65dBv (this is more than 82dB below the maximum output level). Monitor the output of the noise meter with an oscilloscope to identify hum or RF problems.

Separation: Ideally, when only one channel is fed signal, there should be no signal in the output of the other channel. The extent to which one channel "bleeds" into the other is referred to as L into R (or R into L) separation and is specified as the ratio of the undesired signal in the "off" channel to the desired signal in the "on" channel.

In the TV STEREO GENERATOR the separation performance is primarily dependent on the matching of the 11-pole elliptical filters in the sum and difference channels and the tracking of the noise reduction encoder and decoder. Perform the separation measurements with both N/R IN/OUT switches in the IN position.

Separation is measured at 10% 75 microsecond equivalent modulation, which means that the pre-emphasized signal at the input to the Stereo Baseband Generator card will produce 10% modulation if the dbx N/R encoder is bypassed. When referred back to the input, this means that the input must be "de-emphasized" to produce the correct levels. Table D-2 shows the relative input levels required to produce 75us equivalent modulation for various frequencies.

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FREQ(Hz)	LEVEL(dB)
50	0.00
100	- 0.01
200	- 0.04
500	- 0.23
1000	- 0.87
2000	- 2.76
3000	- 4.77
5000	- 8.16
8000	-11.82
10000	-13.66
13000	-15.86
15000	-17.07

Table D-2: Relative 75 microsecond equivalent input levels

To measure Left into Right separation, feed 100 Hz at 0.5Vrms into the Left input on the OPTIMOD-TV. Adjust the Left INPUT ATTENUATOR on the OPTIMOD-TV until the meter reads +3VU in the L FILTER OUT position. This corresponds to 50% modulation. Now reduce the input level 14dB. This corresponds to 10% modulation. Measure the level at the Left Monitor Out and the Right Monitor Out on the TV STEREO GENERATOR. The ratio of the right channel signal to the left channel signal is the L into R separation.

To measure separation at other frequencies, adjust the input level according to Table D-2 and measure the output levels on the monitor outputs. (Do not re-adjust the INPUT ATTENUATOR on the OPTIMOD-TV. If you are setting the levels properly the meter on the TV STEREO GENERATOR should read approximately 10% in the L+R position at all frequencies.)

The BTSC specification calls for separation of better than 30dB from 100Hz to 8kHz, smoothly decreasing from 30dB at 8kHz to 20dB at 15kHz, and smoothly decreasing from 30dB at 100Hz to 26dB at 50Hz. The performance of the TV STEREO GENERATOR will typically be significantly better than this.

This concludes tests of the audio processing circuitry.

Sync Card: Apply a 1V peak-to-peak composite video or sync signal to the VIDEO LOOP THROUGH IN on the rear panel. Set the TERMINATOR switch to 75 Ohms. The SYNC LOCK light on the front panel should light.

Stereo Baseband Generator Tests: This procedure tests the performance of the stereo baseband generator and other circuitry on the stereo generator card (Card #7). This procedure requires only the use of an audio oscillator, an oscilloscope and a TV Stereo Aural Monitor or a baseband frequency spectrum analyzer such as a Tektronix 5L4N.

It has been our experience that the 8182A/SG Stereo Baseband Generator is far more stable than most monitors. Therefore, accurate measurement and adjustment of separation and pilot phase is best done with an oscilloscope. Crosstalk and 2H suppression cannot be conveniently measured on a scope, and must therefore be measured on the stereo monitor or the spectrum analyzer.

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The performance of the Stereo Baseband Generator is independent of the performance of the audio processing circuits which come before it in the signal chain. A special test switch has been provided on Card #7 to allow easy measurement of stereo generator performance parameters. Note in particular that the separation test described below for the stereo baseband generator is independent of the separation measurements described above for the audio processing circuits. In general, separation performance of the Stereo Baseband Generator will far exceed that of the audio processing, and will not be the limiting factor in the stereo performance of the system.

STEREO BASEBAND GENERATOR MEASUREMENTS

1) Connect the oscillator to both the 8182A left channel input and the right channel input in-phase. Connect the stereo aural monitor or the spectrum analyzer to the Composite Baseband Output on the rear of the TV STEREO GENERATOR.

2) Set the oscillator frequency to 100Hz at .5Vrms. Adjust the left INPUT ATTENUATOR on the 8182A OPTIMOD-TV to produce a reading of +3VU on the OPTIMOD-TV meter in the L FILTER OUT position. Adjust the right INPUT ATTENUATOR on the 8182A OPTIMOD-TV to produce a reading of +3VU on the OPTIMOD-TV meter in the R FILTER OUT position. If the 8182A output gains are set properly as described in **Part 4, Initial Setup Procedure** of this manual, this will correspond to 100% modulation of the sum channel.

3) Adjust the stereo monitor input sensitivity to produce an indication of 100% on the sum channel, or the input sensitivity on the spectrum analyzer to produce a reading of 6 dB below full scale for the 100 Hz sum channel signal.

4) **Main-to-Sub Crosstalk:** The main-to-sub crosstalk is measured at 100% main channel modulation, which corresponds to 25kHz deviation of the aural subcarrier. This test condition can be achieved by driving both channels in parallel as described in paragraph (2) above. Put the TEST SWITCH on Card #7 in the MAIN-TO-SUB XTALK position. This applies the sum channel signal to the main channel only, and grounds the subchannel input of the Stereo Baseband Generator. Measure the main-to sub crosstalk at 50, 500 and 15000 Hz. Note that because of pre-emphasis, substantial adjustment must be made to the oscillator level to keep the modulation percentage constant as the frequency is varied. Refer to Table D-2 for the amount of gain reduction required.

   Verify that the crosstalk does not exceed -40dB below 100% modulation at any frequency. (**Note:** Typically you will be measuring the performance of the stereo aural monitor in this test. Use of the baseband spectrum analyzer will show that the crosstalk is typically more than 70dB below 100% sum channel modulation.)

5) **Sub-to-Main Crosstalk:** Put the TEST SWITCH on Card #7 in the SUB-TO-MAIN XTALK position. This applies the sum channel signal to the stereo subchannel only, and grounds the input to the main channel of the stereo baseband generator. The sub-to-main crosstalk test is performed at 100% subchannel modulation, which corresponds to 50kHz deviation of the aural subcarrier. This is twice the level normally seen on the sum channel. For this reason it is necessary to increase the level of the sum channel to perform this test. This is done by increasing the output gain of the 8182A OPTIMOD-TV using the LEFT (or SUM) OUTPUT ATTENUATOR. **IMPORTANT:** After this test is finished, re-adjust the LEFT OUTPUT ATTENUATOR as described in part 4.II.2, **INITIAL SETUP PROCEDURE**, of this manual.

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Connect the output of the oscillator to the left input of the OPTIMOD-TV. Adjust the LEFT INPUT ATTENUATOR on the OPTIMOD-TV until the meter reads +3VU in the L FILTER OUT position. Attach the oscilloscope or DVM to TP5 on Card #7 in the TV STEREO GENERATOR. (Early versions of Card #7 do not have TP5. In this case connect to the negative end of C3). Adjust the LEFT OUTPUT ATTENUATOR on the OPTIMOD-TV until the level at TP5 is 5 Volts peak (3.53Vrms). This corresponds to 100% subchannel modulation.

Measure the sub-to-main crosstalk at 50, 500 and 15000 Hz. Note that because of pre-emphasis, substantial adjustment must be made to oscillator output level to keep the modulation percentage constant. Refer to Table D-2 for the amount of gain reduction required.

Verify that the crosstalk does not exceed -40dB below 100% modulation at any frequency. (**Note:** Typically you will be measuring the performance of the stereo aural monitor in this test. Use of the baseband spectrum analyzer will show that the crosstalk is typically more than 70dB below 100% sum channel modulation.)

IMPORTANT: After this test is finished, re-adjust the LEFT OUTPUT ATTENUATOR as described in part 4.II.2, **INITIAL SETUP PROCEDURE,** of this manual.

6) **2H Suppression:** Return the TEST SWITCH to OPERATE. Modulate the sum channel to 50% at 7.5kHz as described above in 2) and 3). Use the stereo aural monitor or the baseband spectrum analyzer to verify that the 2H subcarrier suppression exceeds -40dB below 50kHz deviation.

7) **Separation:** Connect the oscilloscope to the COMPOSITE OUT of the TV STEREO GENERATOR. DO NOT USE AN ATTENUATOR PROBE; this may compromise the accuracy of the measurement due to mid-band phase shifts often present in these probes. Trigger the scope externally from the oscillator. Turn the PILOT switch OFF. Leave the oscillator connected to the left input of the OPTIMOD-TV. Set the scope's vertical sensitivity to 0.5V/div, and DC-couple the input. Switch the TEST SWITCH on Card #7 to the SEPARATION position.

Set the oscillator frequency to 1kHz, and adjust the oscillator output level and the scope sweep rate to produce a scope pattern that looks like Fig. E-1 (in **Appendix E**). Separation is measured by determining the flatness of the baseline. If the 8182A/SG has been tweaked to compensate for a given exciter/RF amplifier/antenna system, then the baseline might not be quite flat. You must decide at this point whether to retain the current adjustment (for the sake of expediency) or whether to readjust the SEPARATION control (to determine the amount of separation which the system is capable of providing). If the baseline is almost flat, this implies that no fault has occurred in the stereo generator, and further tests are not required.

If you wish to measure separation, first expand the scope vertical scale to 50mV/div. Next adjust the 8182A/SG SEPARATION control to achieve the flattest possible baseline. The separation is then calculated by the formula: S=20log(D/P), where S is the separation in dB, D is the peak-to-peak deviation of the baseline from flatness in volts, and P is the peak-to-peak deviation of the composite baseband output signal in volts.

The separation should be greater than 45dB, 50-15000Hz, and is typically better than -60dB. (60dB is the practical limit of resolution for the oscilloscope measurement technique.)

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8) **Pilot Phase:** Connect the oscillator to the OPTIMOD-TV left input. Turn the pilot ON, and place the TEST SWITCH in the SUB-TO-MAIN XTALK position. Adjust the oscillator frequency to 1kHz (non-critical). You should see a scope pattern like Fig. E-2 (**Appendix E**). Expand the scope display to examine the zero-crossing region (Fig. E-3). The "tips" of the pilot should be perfectly horizontal and level if the pilot phase is theoretically perfect. If the pilot phase has been tweaked to accomodate a particular exciter/RF amplifier/antenna system, then slight deviations from perfect flatness may be noted. Gross deviations imply a failure in the Phase Locked Loop system (see paragraph **5.f** in **Appendix B** for troubleshooting hints).

Return the TEST SWITCH to OPERATE.

REMOTE CONTROL AND LOGIC VERIFICATION

This procedure tests the operation of the rear-panel remote control terminals and also verifies that the stereo generator switching logic is producing correct switching. To activate a remote control terminal, ground its "-" terminal to the "circuit ground" terminal on the rear panel barrier strip, and momentarily jumper its "+" terminal to the "+22V" terminal on the barrier strip.

1) Connect the oscillator to the 8182A left input. Switch the front panel STEREO/MONO switch on the 8182A/SG to STEREO. Verify that the front panel STEREO light is lit. Connect the COMPOSITE OUT of the TV STEREO GENERATOR to the stereo aural monitor or the baseband spectrum analyzer. Adjust the oscillator output level or the 8182A INPUT ATTENUATOR until the 8182A meter reads +3VU in the L FILTER OUT position. This should produce 50% sum-channel deviation (±12.5kHz deviation) as indicated on the stereo aural monitor. Adjust the PILOT LEVEL as necessary to produce 5kHz deviation. (This is 14dB below 100% sum-channel modulation, or 8dB below 50% sum-channel modulation.)

2) Switch the 8182A/SG into MONO LEFT by means of the rear-panel remote control terminal. Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is now 100%.

3) Disconnect the oscillator from the left input of the 8182A and connect it to the right input. Verify that the sum-channel modulation is 0%.

4) Switch the 8182A/SG into stereo by means of the rear-panel remote control terminals. Verify that the front panel STEREO lamp is on. Readjust the oscillator level or the 8182A right INPUT ATTENUATOR as necessary to produce 50% sum-channel modulation.

5) Switch the 8182A/SG into MONO RIGHT by means of the rear panel remote control terminals. Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is 100%.

6) Disconnect the oscillator from the 8182A right input and reconnect it to the left input. Verify that the sum-channel modulation is 0%.

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INDIVIDUAL CARD TESTS

It is possible to test the performance of each of the cards in the 8182A/SG TV STEREO GENERATOR independently to isolate performance problems to a single card.

These tests do not require that the TV STEREO GENERATOR be connected to the 8182A OPTIMOD-TV. To test each card, turn the power off, remove the card from its slot, insert the extender card in the vacant slot, and plug the card under test into the extender card.

IMPORTANT: Disconnect the TV STEREO GENERATOR from the OPTIMOD-TV by disconnecting the connecting cable between the two.

Card #3 Test: To test the left channel, inject signal at TP4 and measure the frequency response at TP1. To test the right channel, inject signal at TP5 and measure the frequency response at TP2. A typical Card #3 frequency response is shown in Figure D-3. The scale of figure D-3 is 10dB/div vertical and 2kHz/div linear horizontal.

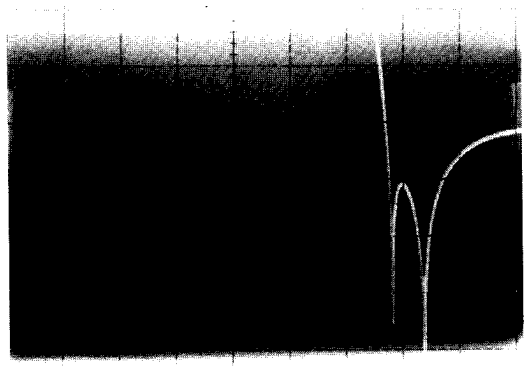

Figure D-3: Typical Card #3 Frequency Response

Card #5 Test: Unplug Cards #4,#6 and #7. To test Card #5, inject signal at TP4 and measure the frequency response at TP2, and inject signal at TP3 and measure the frequency response at TP1. A typical Card #5 frequency response is shown in Figure D-4. The scale of figure D-4 is 10dB/div vertical and 2kHz/div linear horizontal.

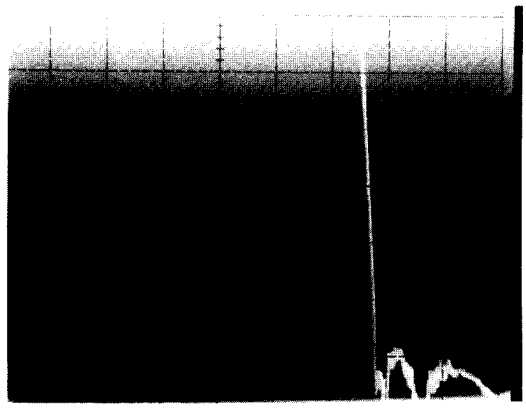

Figure D-4: Typical Card #5 Frequency Response

Card #8 Test: Apply a 1V peak-to-peak composite video or sync signal to the VIDEO LOOP THROUGH IN on the rear panel. Switch the TERMINATOR switch to 75 Ohms. The SYNC LOCK light on the front panel should light. The output of the card is the Pilot Signal, which can be found on pin H of the card edge connector. The pilot should be 15734Hz at 2.08Vrms. THD should be below .05%.

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Card #7 Test: The Card #7 test requires a working Card #8. Unplug Cards #3,#4,#5 and #6. Inject signal into TP4. (Early production cards did not have TP4. On these cards, inject the signal on the "-" side of capacitor C1.) Monitor the COMPOSITE OUT on the rear of the 8182A/SG. Proceed with the Stereo Generator tests as described above under STEREO GENERATOR TESTS.

Card #6 Test: Unplug Cards #3,#4 and #5. Switch the N/R IN/OUT switch to OUT. Inject signal at TP1. The response at the outputs TP3 and TP4 should be a de-emphasized frequency response. A typical response is shown in figure D-5. The scale of figure D-5 is 10dB/div vertical and 20kHz log scale horizontal. Switch the N/R IN/OUT switch IN. Verify that the card passes signal from TP1 to TP3 and TP4, and that it also passes signal from TP2 to TP3 and TP4.

NOTE: The only field test which can be done on the Noise Reduction Decoder and Encoder cards is to verify that they pass signal. No field alignment or calibration should be attempted. Proper gain/frequency response of the Decoder and Encoder can be verified by the separation measurements described above. If the TV STEREO GENERATOR provides satisfactory separation performance with the N/R IN/OUT switches OUT, but not with them IN, suspect a problem with either the Noise Reduction Decoder or the Noise Reduction Encoder (on Card #4).

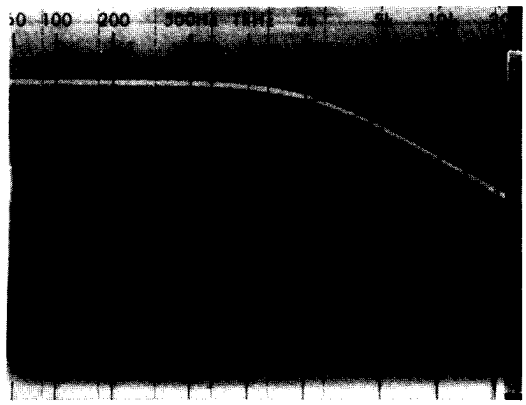

Figure D-5: Typical Card #6 Frequency Response

Card #4 Test: This test requires a working Card #5. Unplug Cards #3,#6 and #7. Inject signal into the input side of resistor R1. Verify that there is signal at the card output (pin X on the card edge connector). See the **NOTE** immediately above.

This concludes the **Field Audit of Performance Procedure.**

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APPENDIX E:
Field Alignment Procedure

General: The following section describes how to align and calibrate the TV STEREO GENERATOR in the field. It is included primarily for purposes of reference as routine alignment is neither necessary nor desirable due to the high stability of the circuitry.

WARNING

IF CALIBRATION IS NECESSARY, WE STRONGLY RECOMMEND THAT THE CARD IN QUESTION BE RETURNED TO THE FACTORY FOR CALIBRATION BY OUR EXPERIENCED TECHNICIANS, WHO HAVE ACCESS TO SPECIAL TEST FIXTURES AND A SUPPLY OF EXACT-REPLACEMENT SPARE PARTS. ONLY IN AN EMERGENCY SHOULD AN ATTEMPT BE MADE TO ALIGN AND CALIBRATE THE TV STEREO GENERATOR IN THE FIELD.

This section is organized on a card-by-card basis. Each card will require some or all of the other cards to be removed in order to be calibrated. Some cards must be known to be functional before other cards can be aligned. These will be pointed out in the text.

Each card is aligned independently to a standard, so that all cards will be completely interchangeable. The SUM PHASE BALANCE adjustment on Card #3, which is used to align the TV STEREO GENERATOR with the particular OPTIMOD-TV chassis in use, is the sole exception to this. In addition, a special test fixture is necessary to perform the 11-pole filter matching on Card #5. However, the user may use his TV STEREO GENERATOR chassis in conjunction with his OPTIMOD-TV Audio Processor chassis as a test fixture to make this adjustment. When aligned in the field in this manner, the Card #5 will not be interchangeable, and will have to be re-aligned if used in another chassis. Further details are provided in the Card #5 alignment procedure below.

Before commencing alignment, remove the TV STEREO GENERATOR and the OPTIMOD-TV from their normal rack mounting locations and place them on the test bench away from RF fields. Jumper the chassis and circuit grounds together on the rear panel barrier strips.

Required Test Equipment and Materials: The following test equipment (or close equivalents) is required. It is assumed that the technician is thoroughly familiar with the operation of this equipment.

a) Digital Voltmeter, accurate to $\pm$0.1%
b) Oscilloscope, DC-coupled, dual trace, triggered-sweep, with 5MHz or better vertical bandwidth.
c) Ultra-Low Distortion Sinewave Oscillator/THD Test Set/AC VTVM (Sound Technology 1700B or 1710B)
d) Low Frequency Spectrum Analyzer with Tracking Generator (Tektronix 5L4N with 5111 Bistable Storage Mainframe)
e) Two 6" alligator-to-alligator jumper leads

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POWER SUPPLY CARD

a) Measure the voltage across C111 (or other convenient point on the +15 Volt bus) with the DVM. Adjust R106 until the DVM reads +15.00 Volts.

b) Measure the voltage across C112 (or other convenient point on the -15 Volt bus). Make sure that the voltage is between -14.85 and -15.15 Volts. If it is not, refer to **Appendix B (Circuit Description)** in 8182A manual, paragraph **8.c** for troubleshooting hints.

BEFORE ALIGNING EACH CARD AS DESCRIBED IN THE INSTRUCTIONS BELOW, REMOVE THE CARD OF INTEREST FROM ITS SLOT AND PLUG THE EXTENDER INTO THE EMPTY CARD SLOT. PLUG THE CARD INTO THE CARD EXTENDER. THIS WILL ALLOW EASY ACCESS TO THE ALIGNMENT TRIMMERS AND TEST POINTS.

Important!

Turn off the power to the TV STEREO GENERATOR before removing or installing any of the cards.

CARD #3 (INPUT FILTERS)

a) Preparation:

1) Unplug the connecting cable which connects the TV STEREO GENERATOR chassis to the OPTIMOD-TV Audio Proessor chassis.
2) Remove Card #3 and plug the extender board into the Card #3 slot. Plug Card #3 into the extender board.
3) Unplug Card #7.

b) Left Input Filter Calibration:

1) Connect the low distortion oscillator to the test point labeled TP4.
   [**NOTE:** Early production cards do not have TP4. In this case connect the oscillator to the input side of resistor R1. (This connects to the edge connector pin F.)]
   [**IMPORTANT:** Turn the power off before connecting the oscillator to R1. The +15 Volt supply runs very close to R1. Accidently shorting the oscillator output the +15 Volt supply could seriously damage the oscillator.]
2) Connect the oscillator ground to TP3.
3) Set the oscillator frequency to 15734 Hz (±20 Hz).
4) Set the oscillator amplitude to approximately 3 Volts rms.
5) Connect the AC VTVM to the output of the filter at TP1.
6) Connect the AC VTVM ground to TP3.
7) Adjust trimmer R12 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

c) Right Input Filter Calibration:

1) Connect the low distortion oscillator to the test point labeled TP5. [**NOTE:** Early production cards do not have TP5. In this case connect the oscillator to the input side of resistor R51. (This connects to the edge connector pin Y.)]
2) Connect the oscillator ground to TP3.
3) Set the oscillator frequency to 15734 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.
4) Set the oscillator amplitude to approximately 3 Volts rms.

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5) Connect the AC VTVM to the output of the filter at TP2.
6) Connect the AC VTVM ground to TP3.
7) Adjust trimmer R62 for a minimium reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.
8) Remove the oscillator from the filter input.

d) Sum Phase Balance Calibration:
1) This procedure requires a working and calibrated 8182A OPTIMOD-TV Audio Processor. Refer to **Appendix D (Field Audit-of-Performance)** in your OPTIMOD-TV Operating Manual if you suspect that your OPTIMOD-TV is not functioning properly.
2) Connect the TV STEREO GENERATOR to the OPTIMOD-TV with the connecting cable.
3) Place both 8182A PROOF/OPERATE switches in PROOF. Switch the 8182A's LOUDNESS CONTROLLER switch to OFF. Allow at least two minutes for the gain to settle.
4) Connect the output of the tracking generator in the spectrum analyzer to both the left and right audio inputs of the OPTIMOD-TV in parallel.
5) Connect the spectrum analyzer input to the left AUDIO TEST JACK (J1) on the rear panel of the OPTIMOD-TV. Switch the STEREO GENERATOR IN/OUT switch to the IN position. (On earlier 8182A units this switch is labeled NOISE REDUCTION IN/OUT.)
6) Set the spectrum analyzer for a 0-20kHz sweep. Set the vertical sensitivity to 10dB/division. Set the input sensitivity to -10dB. Set the output level of the tracking generator to obtain an on-screen trace. (You may have to readjust one or both of the OPTIMOD-TV INPUT ATTENUATORS if gain is insufficient). You are now looking at the pre-emphasized SUM output of the OPTIMOD-TV. You should see a rising high frequency response.
7) Connect the spectrum analyzer input to the right AUDIO TEST JACK (J2) on the rear panel of the OPTIMOD-TV. You are now looking at the pre-emphasized DIFFERENCE output of the OPTIMOD-TV.
8) Adjust the RIGHT INPUT ATTENUATOR on the OPTIMOD-TV to obtain a minimum output level (null) in the midband (around 800Hz). This null will typically be more than 40dB below the SUM signal.
9) Adjust trimmer R20 on the TV STEREO GENERATOR Card #3 to obtain a minium output level (null) at high frequencies (around 15kHz). This null will typically be more than 35 dB below the sum signal.
10) It may be possible to improve the high frequency null by adjusting trimmer R618 (RIGHT PRE-EMPHASIS TRIM) on Card #6 in the 8182A OPTIMOD-TV.

e) This completes the alignment of Card #3.

CARD #4 (dbx ENCODER)

There is no alignment necessary for Card #4.

IMPORTANT: THE dbx NOISE REDUCTION ENCODER CARD CANNOT BE CALIBRATED IN THE FIELD. IF A PROBLEM IS SUSPECTED WITH THE NOISE REDUCTION ENCODER, THE ENTIRE CARD #4 MUST BE RETURNED TO THE ORBAN FACTORY. REFER TO **APPENDIX D (FIELD AUDIT-OF-PERFORMANCE)** TO DETERMINE IF THE ENCODER IS FAULTY.

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CARD #5 (11-POLE FILTERS)

a) Preparation:

1) Unplug the connecting cable which connects the TV STEREO GENERATOR chassis to the OPTIMOD-TV chassis.
2) Remove Card #5 and plug the extender board into the Card #5 slot. Plug Card #5 into the extender board.
3) Unplug Card #4, Card #6 and Card #7.

b) Calibration of Sum 11-Pole Filter:

1) Connect the low distortion oscillator to the test point labeled TP4.
2) Connect the oscillator ground to TP5.
3) Set the oscillator frequency to 15772 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.
4) Set the oscillator amplitude to approximately 3 Volts rms.
5) Connect the AC VTVM to the output of the filter at TP2.
6) Connect the AC VTVM ground to TP5.
7) Adjust trimmer R17 for a minimium reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.
8) Set the oscillator frequency to 16135Hz (±20Hz).
9) Adjust trimmer R22 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.
10) Set the oscillator frequency to 15000Hz (+0,-20Hz).
11) Adjust trimmer R15 for 0.00dB (±.03dB) gain from TP4 to TP2.

c) Calibration of Difference 11-Pole Filter:

1) Connect the low distortion oscillator to the test point labeled TP3.
2) Connect the oscillator ground to TP5.
3) Set the oscillator frequency to 15772 Hz (±20 Hz).
4) Set the oscillator amplitude to approximately 3 Volts rms.
5) Connect the AC VTVM to the output of the filter at TP1.
6) Connect the AC VTVM ground to TP5.
7) Adjust trimmer R67 for a minimium reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.
8) Set the oscillator frequency to 16135Hz (±20Hz).
9) Adjust trimmer R72 for a minimium reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.
10) Set the oscillator frequency to 300Hz (±50Hz).
11) Adjust trimmer R80 for 0.00dB (±0.03dB) gain from TP3 to TP1.
12) Set the oscillator frequency to 15000Hz (+0,-20Hz).
13) Adjust trimmer R65 for 0.00dB (±0.03dB) gain from TP3 to TP1.

d) Matching the 11-Pole Filters for Best Separation:

1) **NOTE:** This procedure is performed at the Orban factory using a special test fixture. When aligned using the special test fixture, the two filters on Card #5 are matched to each other, and the Card #5 can be used with any chassis. The user does not have access to the special test fixture. However, the user can use his TV STEREO GENERATOR chassis in conjunction with his OPTIMOD-TV chassis as a test fixture. When aligned in this manner, the entire signal path in the OPTIMOD-TV/TV STEREO GENERATOR combination will be matched for best separation. This alignment will be specific to the two chassis being used, and the Card #5 will not be accurately aligned for use in any other chassis. Be aware that this procedure may provide better system separation performance, at the expense of interchangeability.
2) Connect the TV STEREO GENERATOR to the OPTIMOD-TV Audio Processor with the connecting cable.

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3) Place both OPTIMOD-TV Audio Processor PROOF/OPERATE switches in PROOF. Switch the 8182A's LOUDNESS CONTROLLER switch to OFF. Allow at least two minutes for the gain to settle.
4) Connect the output of the tracking generator in the spectrum analyzer to the left audio input of the OPTIMOD-TV Audio Processor.
5) Connect the spectrum analyzer input to the LEFT MONITOR OUTPUT on the rear panel of the TV STEREO GENERATOR.
6) Switch both N/R IN/OUT switches in the TV STEREO GENERATOR to OUT. Extend Card #5 in the TV STEREO GENRATOR with the extender card.
7) Set the spectrum analyzer for a 0-20kHz sweep. Set the vertical sensitivity to 10dB/division. Set the input sensitivity to -10dB. Set the output level of the tracking generator to obtain an on-screen trace. (You may have to adjust the OPTIMOD-TV LEFT INPUT ATTENUATOR if gain is insufficient). You should see a flat frequency response.
8) Connect the spectrum analyzer input to the RIGHT MONITOR OUTPUT on the TV STEREO GENERATOR. The trace should be 30-40dB below the LEFT MONITOR OUTPUT trace at low frequencies, rising slightly at higher frequencies. The difference between the two traces at any given frequency is the stereo separation (left into right) at that frequency.
9) Adjust the LEFT (SUM) OUTPUT ATTENUATOR on the OPTIMOD-TV Audio Processor to get the maximum separation at low frequencies.
10) Alternately adjust trimmers R17, R22 and R15 on Card #5 to get the best possible separation at high frequencies. These controls are interactive, and some experimentation may be necessary to see how each control affects the separation. It should be possible to achieve separation better than 30dB at 15kHz.

e) This completes alignment of Card #5.

CARD #6 (dbx DECODER)

There is no alignment necessary for Card #6.

IMPORTANT: THE dbx NOISE REDUCTION DECODER CARD CAN NOT BE CALIBRATED IN THE FIELD. IF A PROBLEM IS SUSPECTED WITH THE NOISE REDUCTION DECODER, THE ENTIRE CARD #6 MUST BE RETURNED TO THE ORBAN FACTORY. REFER TO **APPENDIX D (FIELD AUDIT OF PERFORMANCE)** TO DETERMINE IF THE DECODER IS FAULTY.

CARD #7 (STEREO BASEBAND GENERATOR)

IMPORTANT: IF THE ALIGNMENT CONTROLS ARE ADJUSTED IN THE ORDER SPECIFIED, NO INTERACTION BETWEEN ADJUSTMENTS WILL OCCUR. HOWEVER, IF ADJUSTMENTS ARE MADE IN RANDOM SEQUENCE, SEVERE INTERACTION CAN OCCUR, AND EARLIER ADJUSTMENTS MAY BE DESTROYED. TO AVOID TROUBLE, GO "BY THE BOOK".

a) Preparation:
1) Card #7 alignment requires a working Card #8. Refer to **Appendix D (Field Audit of Performance)** to determine if Card #8 is functioning properly.
2) Unplug Card #4, Card #5 and Card #6.
3) Install Card #8 in the Card #8 slot.

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4) Remove Card #7 and plug the extender into the Card #7 slot. Plug Card #7 into the extender board.
5) Apply a composite video or sync signal to the SYNC input on the rear panel. Verify that the SYNC LOCK LED on the front panel is lit. Make sure that the STEREO LED on the front panel is also lit. If it is not lit, press the STEREO/MONO switch on the front panel to put the unit in STEREO mode.
6) Connect the low distortion oscillator to the SUM input of the Stereo Baseband Generator card. The most convenient point to attach the lead is the side of capacitor C3 which connects to edge connector pin 11.
7) Connect the ground lead of the low distortion oscillator to a convenient point on the chassis.
8) Connect the COMPOSITE OUTPUT of the TV STEREO GENERATOR to the input of the spectrum analyzer.
9) Set the oscillator for 5kHz(±200Hz) at 1.767Vrms (±0.1V).
10) Set the spectrum analyzer for 10kHz/division horizontal and 10dB/division vertical sensitivity. Set the input attenuator to -10dB.
11) Place the TEST SWITCH in the SEPARATION position.
12) Adjust the TOTAL BASEBAND OUTPUT LEVEL control until the 5kHz component on the spectrum analyzer reaches the top of the screen. This represents 25kHz deviation of the aural subcarrier.

b) 4H Null:
1) Place the TEST SWITCH in the SEPARATION position.
2) Adjust trimmer R15 (4H NULL) for minimum 4H component (4H refers to four times the horizontal line rate, or 62,937Hz). The 4H component will typically be at least 65dB below the top of the screen.

c) Modulator Distortion Null:
1) Place the TEST SWITCH in the SEPARATION position.
2) Observe the spectrum analyzer display. You will see several spurious components, including a second-harmonic distortion component at 10kHz and subchannel second-harmonic components at 21kHz and 41kHz.
3) Adjust trimmer R12 (DIST NULL) to minimize the amplitude of these components. It is ordinarily possible to get them below the bottom of the display (more than 80dB below 25kHz deviation).

d) Low Frequency Sub-to-Main Crosstalk:
1) Place the TEST SWITCH in the SUB-TO-MAIN XTALK position.
2) The 5kHz component you see on the spectrum analyzer is sub-to-main crosstalk. Adjust trimmer R7 (SUB:MAIN XTALK) to null the 5kHz as much as possible.

e) High Frequency Sub-to-Main Crosstalk:
1) Place the TEST SWITCH in the SUB-TO-MAIN XTALK position.
2) Set the oscillator for 10kHz (±200Hz) at 1.767Vrms (±0.1V). The crosstalk will ordinarily increase.
3) Adjust trimmer capacitor C11 (HF SUB:MAIN XTALK) to improve the 10kHz null.
4) The crosstalk can often be further improved by slightly re-adjusting R7. It is typically possible to achieve crosstalk which is down approximately 75dB below 25kHz deviation, although this will only be short-term stable. Long term stability is typically better than -65dB.

f) 2H Null:
1) Place the TEST SWITCH in the SEPARATION position.
2) Adjust trimmer R5 (2H NULL) to null the 2H subcarrier (2H refers to twice

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the horizontal line rate, or 31,468Hz). It is typically possible to achieve better than -65dB short term suppression, and -60dB long term suppression.

g) DC Offset Null:

1) Connect a DVM to the COMPOSITE OUTPUT of the TV STEREO GENERATOR, and observe the DC voltage. (You could also use a DC-coupled scope.)
2) Set the oscillator output to 0V or short the input to the STEREO GENERATOR to ground.
3) Place the TEST SWITCH in the OPERATE position.
4) Adjust trimmer R19 (DC OFFSET NULL) until the DC output voltage is 0.00V (±5mV).

h) Separation:

1) Place the TEST SWITCH in the SEPARATION position.
2) Set the oscillator frequency to 1kHz (±50Hz) at 1.767Vrms (±0.1V).
3) Connect the COMPOSITE OUTPUT of the TV STEREO GENERATOR to the oscilloscope through a wire or coax. DO NOT USE AN ATTENUATOR PROBE; these probes often have midband phase shift (due to slight imperfections in their frequency compensation circuitry) which will compromise the accuracy of the separation adjustment.
4) Trigger the scope externally from the oscillator. Set the scope sensitivity to 0.5V/div, and input coupling to "DC". Set the horizontal sensitivity to 0.2ms/div.
5) Adjust the TOTAL BASEBAND OUTPUT LEVEL control R32 until the COMPOSITE OUTPUT is 4V p-p.
6) Adjust the SEPARATION control R60 to achieve the flattest baseline possible. Fig. E-1 shows the correct adjustment. To make the final adjustment accurately, expand the vertical scale by a factor of ten and adjust R60.
7) To approximately measure the separation of the stereo generator circuit, use the formula: S=20log(D/4), where S is the separation in dB, and D is the peak to peak deviation of the baseline from perfect flatness, in volts. Ordinarily, the separation from 50-15000Hz will be essentially unmeasurable (better than -50dB).

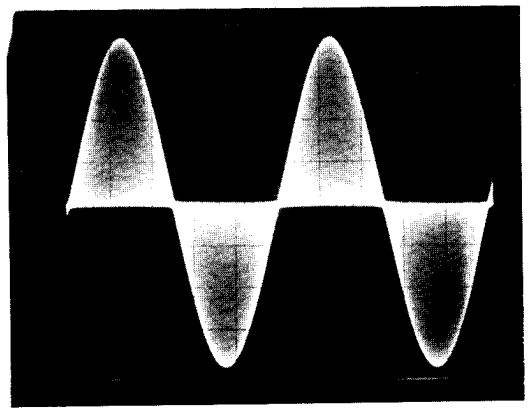

Fig. E-1 SEPARATION

i) Pilot Phase:

1) Place the TEST SWITCH in the SUB-TO-MAIN XTALK position.
2) Set the oscillator for a convenient frequency around 1kHz (non-critical). Set the oscillator level to about 1.7Vrms.
3) Turn the pilot ON.
4) Set the oscilloscope to 0.2V/div and 0.2ms/div. You will see a scope display similar to Figure E-2. Expand the scope display by adjusting the vertical sensitivity until it looks like Figure E-3.

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5) Adjust the PILOT PHASE control R54 until the "tips" of the pilot are exactly horizontal and level.

j) This completes the alignment of Card #7.

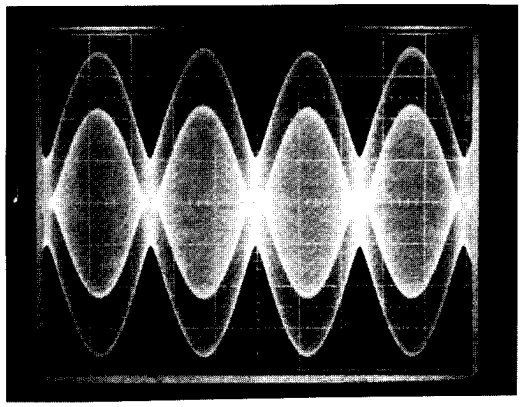

Fig. E-2 PILOT PHASE

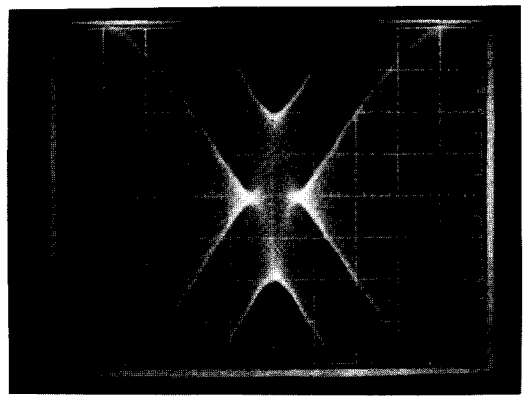

Fig. E-3 PILOT PHASE, 10X

CARD #8

There are no calibrations on Card #8

METER RESISTOR BOARD CALIBRATION

a) Preparation:

1) This procedure requires a working Model 8182A OPTIMOD-TV Audio Processor. Refer to **Appendix D (Field Audit of Performance)** in your OPTIMOD-TV manual if you suspect a problem with your OPTIMOD-TV.
2) This procedure requires working and calibrated Card #3, Card #4 and Card #5 in the TV STEREO GENERATOR. Refer to **Appendix D (Field Audit of Performance)** in this manual if you suspect a problem with any of these cards.
3) The Meter Resistor Board is mounted on the Front Panel of the TV STEREO GENERATOR. The two trimpots to be calibrated are located between the board and the front panel.
4) Install Card #3, Card #4 and Card #5 in the TV STEREO GENERATOR.
5) Connect the TV STEREO GENERATOR to the OPTIMOD-TV with the connecting cable.
6) Place both 8182A PROOF/OPERATE switches in PROOF. Switch the 8182A's LOUDNESS CONTROLLER switch to OFF. Allow at least two minutes for the gain to settle.

b) N/R IN Meter Calibration:

1) Connect the low distortion oscillator to the Left "+" Input terminal on the rear of the OPTIMOD-TV. Jumper the Left "-" Input terminal to the Ground terminal. Ground the Right "+" and "-" Input terminals.
2) Set the oscillator frequency to about 100Hz and the oscillator amplitude to about 1Vrms.
3) Using a 0.1% accurate DVM, measure the voltage at R3 on the Meter Resistor Board. Use the end of R3 which connects to the ribbon cable. Adjust the oscillator level and/or the LEFT INPUT ATTENUATOR on the OPTIMOD-TV until the meter reads 1.767Vrms (±5mV).
4) Place the METER FUNCTION switch in the N/R IN position.

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5) Adjust trimmer R15 (N/R IN METER CAL) until the front panel VU meter reads exactly 100%. The pointer should exactly cover the dot above "VU" below the "100%" mark. Observe the meter head-on to avoid parallax errors.

c) L+R Meter Calibration:

1) Connect the low distortion oscillator to both the Left and Right "+" Input terminals on the rear of the OPTIMOD-TV. Jumper the Left and Right "-" Input terminals to the Ground terminals.
2) Set the oscillator frequency to about 100Hz and the oscillator amplitude to about 1Vrms.
3) Using a 0.1% accurate DVM, measure the voltage at R4 on the Meter Resistor Board. Use the end of R4 which connects to the ribbon cable. Adjust the oscillator level and/or both the LEFT and RIGHT INPUT ATTENUATOR on the OPTIMOD-TV until the meter reads 1.767Vrms (±5mV).
4) Place the METER FUNCTION switch in the L+R position.
5) Adjust trimmer R19 (L+R METER CAL) until the front panel VU meter reads exactly 100%. The pointer should exactly cover the dot above "VU" below the "100%" mark. Observe the meter head-on to avoid parallax errors.

d) This completes the Meter Resistor Board alignment.

This concludes the Field Alignment Procedure for the TV STEREO GENERATOR. Insert the extender board in its slot (slot #0), and replace the subpanel, being sure that all four DZUS fasteners are fully tightened for RF suppression. Close the front door and fasten with its three screws. Remove the jumper between chassis and circuit grounds, unless it is ordinarily used in your installation.

To align the OPTIMOD-TV output gains for best separation with the TV STEREO GENERATOR, refer to **Part 4, Initial Setup Procedure** in this manual.

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APPENDIX F:
Trouble Diagnosis and Correction

[**NOTE:** This **Appendix** should be used in close conjunction with **Appendix F** of your **8182A Operating Manual.**]

Please refer to **Appendix F** of the **Model 8182A Audio Processor Operating Manual** for a complete discussion of the following topics:

Factory Assistance
Diagnosis At The Component Level
Selecting And Ordering Replacement Parts
Replacement Of Components On Printed Circuit Cards
Shipping Instructions

When in use, the 8182A/SG is tightly-coupled to the main 8182A audio processor. The Block Diagram in **Appendix J** shows the signal flow between the two chassis. The comments in **Appendix F** of your **8182A Operating Manual** regarding signal tracing should be noted, bearing in mind that the signal path in the 8182A is broken between the output of the Dual-Band Compressor and the High-Frequency Limiter to insert the 8182A/SG's Six-Pole Filters (on Card #3). The signal is then returned to the 8182A for further processing. After such processing, the output of the 8182A is applied to the rest of the 8182A/SG circuitry.

POWER SUPPLY TESTS

[This section complements the identically-titled section in your **8182A Operating Manual.**]

Only the -15VDC supply is metered. However, since the -15V supply tracks the +15V supply, if the +15V supply fails, this will be reflected in the -15V supply.

The +15V supply is used as a reference for several circuits in the Stereo Baseband Generator. If the +15V supply's output voltage drifts more than $\pm$75mV, this can cause noticeable loss of separation due to errors in the gain of the $2F_h$ balanced modulator or due to drifts in pilot phase. Therefore, before the Stereo Baseband Generator is assumed defective, the power supply voltages should be measured with an accurate DVM.

F

VU METER TECHNIQUES

[**NOTE:** This section complements the identically-titled section in your **8182A Operating Manual.**]

The VU meter provides a fast way of tracing the signal through the circuitry and can indicate the location of gross faults like loss of signal or opamp latchup.

If the signal is normal at the 8182A's COMPR OUT position but abnormal at the 8182A/SG's INPUT FILTER position, then the fault is probably in Card #3 (Six-Pole Filters) of the 8182SA/SG. (The stereo/mono switching logic on Card #7 could also be faulty.)

If the signal is normal at the 8182A's R SYSTEM OUT position, but abnormal at the 8182A/SG's N/R IN position, then the problem is probably in Card #4 (Noise Reduction Encoder) in the 8182A/SG.

If the signal is normal at the 8182A's L SYSTEM OUT position, but abnormal at the 8182A/SG's L+R position, then the fault in probably in Card #5 (11-Pole Filters) of the 8182A/SG. (The stereo/mono switching logic on Card #7 could also be faulty.)

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If the signal is normal at the 8182A/SG's N/R IN position but abnormal at the 8182A/SG's L-R position, then the fault is probably in Card #4 (N/R Encoder) or Card #5 (11-Pole Filter). To determine which, set the N/R ENCODER IN/OUT switch to OUT. If the problem vanishes, Card #4 is faulty. Otherwise, Card #5 is faulty (unless a logic problem exists).

If the signal is normal at the 8182A/SG's L+R and L-R postions, but abnormal at the 8182A/SG's L MONITOR OUT or R MONITOR OUT positions, then Card #6 (Monitor) is probably faulty. (Note that little separation will be observed if the N/R ENCODER and N/R DECODER switches are not both IN or OUT.)

If the signal is normal at the L+R and L-R positions, but abnormal at the COMPOSITE LEVEL position, then Card #7 (Stereo Baseband Generator) is probably faulty. Abnormal readings might be observed in the PILOT LEVEL, 2H AGC, and/or 2H PLL positions on the 8182A/SG's meter.

CARD SWAP TECHNIQUES

[**NOTE:** This section complements the identically-titled section in your **8182A Operating Manual.** The condensed block diagram (Fig. A-1 in **Appendix A** of this manual) will clarify the techniques described below.]

There are no card-swap techniques available per-se in the 8182A/SG. However, Cards #3 (6-Pole Filter) and #5 (11-Pole Filter) have been equipped with jumpers which enable their outputs to be individually reversed. This permits diagnosis by observation of the movement of the symptom. NOTE THAT THE SYSTEM WILL NOT OPERATE CORRECTLY WITH EITHER CARD IN THE "OUTPUT-REVERSED" STATE.

If the problem does not move from one stereo channel to the other when Cards #3 and #4 in the 8182A are swapped, but does move when Jumper "A" on Card #3 of the 8182A/SG is placed in the REVERSE position, then Card #3 in the 8182A/SG is probably faulty. As a further check, the MONO L and MONO R modes bypass the opposite-channel 6-Pole Filter. If the problem vanishes when MONO L or MONO R is entered but does not vanish when Card #3 and #4 in the 8182A are swapped, then Card #3 in the 8182A/SG is probably faulty.

If the problem is in the sum or difference channels alone, it is either in Card #7 of the 8182A (Matrix and Line Amplifiers), or in the 8182A/SG. If the problem vanishes when Jumpers "C" and "D" on Card #7 of the 8182A are moved from SUM OUT to L OUT and from DIFFERENCE OUT to R OUT respectively, then the matrix circuit on Card #7 is faulty. (Note that when these jumpers are moved, no separation will be produced later in the circuit because the matrix has been bypassed. This test is therefore not suited for diagnosing separation problems.)

If the signal seems normal emerging from the 8182A's line amplifiers, and if placing Jumper "A" on Card #5 of the 8182A/SG in the REVERSE position causes the problem to move from the sum to the difference channel (or vice-versa), then either Card #4 (Noise Reduction Encoder) or Card #5 (11-Pole Filter) of the 8182A/SG is faulty. (Card #4 can only introduce faults into the difference channel, provided that Jumper "A" on Card #5 is in the NORMAL position.)

If the problem vanishes when the N/R ENCODER SWITCH is set OUT, then the problem is in Card #4. Otherwise, the problem is in Card #5 or in the logic on Card #7.

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CATALOG OF TYPICAL SYMPTOMS AND PROBABLE CAUSES

This troubleshooting guide is a catalog of some possible failure modes in the 8182A-8182A/SG system. It should be used in conjunction with the identically-titled section in your **8182A Operating Manual.**

--Symptom: Poor separation.

1. Separation is OK as observed at the 8182A/SG's MONITOR output terminals. Possible trouble spots are:
   a. Misadjustment of SEPARATION and/or PILOT PHASE controls on Stereo Baseband Generator. See "STEREO BASEBAND GENERATOR TESTS" in **Part 4** of this manual for instructions on how to verify Stereo Baseband Generator performance using an oscilloscope and audio generator.
   b. If separation tests are good at the 8182A/SG's Composite Output, but not at the output of your Wideband Demodulator (you must verify that its performance is adequate for MTS), then check the performance of the transmitter plant. Exciter frequency response must be 30-46,000Hz $\pm$0.05dB. Deviation from linear phase over that frequency range must be less than 0.5^{o}. Diplexer bandwidth must exceed 400kHz at the -3dB points. Group delay should be symmetrical about the aural carrier frequency; preferably constant. RF amplifiers must be correctly tuned and must have at least 1 MHz bandwidth.
   c. If "equivalent stereo separation" is good through the system when the 8182A/SG's N/R encoder and your stereo monitor's N/R decoder are defeated, yet separation is poor when N/R is enabled, suspect an error in setting the 8182A/SG's COMPOSITE OUTPUT ATTEN control to achieve correct modulation gain. Check the adjustment in **Part 4** of this manual called **Level Match, 8182A/SG to Exciter.** If you took the emergency, short-cut approach using your mono modulation monitor, do the adjustment again using the preferred Bessel Null technique.

2. Separation is inadequate as observed at 8182A/SG's MONITOR output terminals.
   a. 8182A's L or R OUTPUT ATTEN controls are misadjusted. See **Part 4** of this manual: "Level Match, 8182A to 8182A/SG".
   b. The N/R switches on the 8182A/SG are set so that one is IN and the other is OUT.
   c. N/R encoder or decoder has failed. See if separation is restored by switching both N/R switches OUT.
   d. Sum-and-difference 11-Pole-Filters are mismatched due to failure or drift. Separation will be poor at high frequencies, regardless of whether N/R is in use. See **Appendix E** in this manual for alignment instructions.
   e. R80 (LOW FREQUENCY GAIN TRIM) on Card #5 is misaligned. (Highly unlikely unless it has been casually tweaked in the field.) If so, separation will be poor at all frequencies and can be restored by readjusting the 8182A's L OUTPUT ATTEN.

--Symptom: Signal is distorted.

1. 8182A's rear-panel N/R IN/OUT switch (labelled STEREO GENERATOR IN/OUT in some units) is set OUT. This switch must be IN when the 8182A/SG is plugged into the 8182A.
2. IC opamp failure within one of the filters in the 8182A/SG is causing distortion or severe offset without entirely preventing signal passage.

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3. An 8182A PROOF/OPERATE switch has been accidentally left in PROOF.
4. In a dual-chassis installation, level match between the Studio Chassis and the Main Chassis is incorrect. See "DUAL-CHASSIS ALIGNMENT" in **Part 4** of this manual.
5. If the signal is being monitored remotely, check for multipath distortion. Stereo is far more vulnerable to multipath than mono. Also note that some older sets with narrowband discriminators may exhibit distortion due to the higher deviation produced in stereo.
6. Distortion and/or clipping in STL.
7. Exciter is clipping due to inadequate deviation capability or misbiasing of varactor diode. Required deviation is ±55kHz (stereo only); ±73kHz (stereo+SAP+PRO).
8. Miscellaneous circuit failure within 8182A or 8182A/SG. If signal is clean at the LINE OUTPUT terminals of the 8182A (they are preemphasized, and in sum-and-difference form), but distorted at the 8182A/SG's MONITOR OUTPUT, then the problem is within the audio circuitry of the 8182A/SG. If the signal is clean at the 8182A/SG's MONITOR OUTPUT but distorted at the output of a stereo demodulator connected directly to the 8182A/SG's BASEBAND OUTPUT, then the 8182A/SG's Card #7 (Stereo Baseband Generator) is probably faulty.

--Symptom: Lack of 31.468kHz subcarrier suppression.

1. Drift in power supply voltage. Verify that (+) voltage is +15VDC ±0.075V, and that the (-) voltage is -15VDC ±0.375V.
2. Failure of L-R balanced modulator IC15, IC18 (on Card #7, 8182A/SG).

--Symptom: Pilot phase unstable. (NOTE: All referenced components are on Card #7 of the 8182A/SG.)

1. Leaky Q4.
2. Bad IC16A or leaky C22.
3. R54 intermittent.
4. Power supply voltage unstable.
5. Bad phase detector IC13 or leaky coupling cap C20.

--Symptom: Separation unstable. (NOTE: All referenced components are on Card #7 of the 8182A/SG.)

1. Power supply voltage unstable.
2. R60 intermittent.
3. IC6 or IC16B defective.

--Symptom: Interference to SAP from stereo.

1. Exciter cannot linearly modulate to ±73kHz deviation.
2. Notch diplexer has narrower bandwidth than 400kHz (at -3dB points). Diplexer's group delay is non-constant and/or asymmetrical.
3. Card #7 (Stereo Baseband Generator) in 8182A/SG is producing excessive spurs at $4F_H$ or $6F_H$. See **5.g** in **Appendix B** of this manual for a complete discussion.
4. Baseband clipper in 8182A/SG is clipping excessively, causing wideband "splatter" which is getting into the baseband spectrum reserved for the SAP.
5. Power supply oscillation.

--Symptom: Interference to PRO from SAP.

1. Unfortunately, this is normal, and is a result of how baseband frequencies are allocated in the BTSC system. The PRO subcarrier is only 23.6kHz removed from the SAP, and is therefore subject to interference from normal second- and third-order Bessel sidebands produced by the SAP. Because the modulation level of the SAP tends to be held constant by dbx compression, changing the drive level to the SAP will not affect SAP modulation enough to make a significant difference in interference to PRO. Limiting SAP bandwidth to less than 10kHz can help; however, this will cause significant loss of audio quality in the SAP.

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--Symptom: No remote SYNC LOCK indication.

1. Transistor within opto-isolator IC8 (on Card #8 in 8182A/SG) has burned out due to abuse. See cautions in "Remote Sync Lock Indicator" in **Part 3** of this manual.

--Symptom: SYNC LOCK unachievable, or lamp flickers.

1. Switch SYNC SENSITIVITY control IN and adjust to eliminate problem.
2. If this does not work, sync or composite video is probably at wrong level. It must be within a 0.6V to 1.6V p-p window. Most likely cause is incorrect 75 ohm line termination (i.e., line is either unterminated or double-terminated.)
3. Faulty sync stripper and/or phase-lock-loop circuitry on Card #8 of 8182A/SG.
4. Video applied to SYNC input degraded by hum, noise, or time-base jitter.
5. Signal has been processed by the Tektronix 1440 to pre-distort for transmitter non-linearities, and this pre-distorted signal is being used as the sync reference for the 8182A/SG. Because the pre-distorted waveform can have non-standard sync levels, it can cause problems with the 8182A/SG's sync stripper circuitry. If this occurs, the 8182A/SG's SYNC REFERENCE input should be fed from the signal that drives the 1440, rather than from the 1440's (pre-distorted) output signal.

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APPENDIX G is not used.

APPENDIX H is not used.

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APPENDIX I:

Rewiring Accessory Port #1 of 8182A

This kit adapts Optimod-TV Audio Processors having serial numbers below 780,000 for use in conjunction with the Model 8182A/SG Television Stereo Generator.

Changes involve the reconnection of various wires going to Connector J-3 (Accessory Port 1) on the rear panel to provide proper signals to the Stereo Generator if and when attached.

This modification has been installed at the factory starting with Serial Number 780,000. If your Serial Number is at or above this number you may ignore this list but you may wish to replace the diagram on page G-2 if you hold a manual not yet updated.

This kit contains:

2 Jumpers (white)
4 Precut and stripped wires
2 Lengths 1/16" tubing

INSTRUCTIONS

Installation of the modification can be done in about 45 minutes.

This modification requires moderate soldering experience. You will need a low wattage soldering iron, rosin core solder, a solder-sucker tool, general electronic tools, and the manual for the Optimod-TV Model 8182A.

The work should be done with the unit placed on a workbench with the rear panel facing the technician. It is impractical to attempt the modification with the unit in a rack.

Manual Discrepancies:

If you happen to review the wiring diagram on page G-2 of your manual (First Edition only), you may notice that the existing wiring in your unit does not match the diagram. The diagram is wrong; the unit is correct.

The labels "To Card 7(X)" and "To Card 7(Y)" are inverted, as are the labels E23 and E25. The wire colors are correct. The wiring diagram on page J-4 is correct. Since you are about to change this wiring, the diagram on page G-2 will be irrelevant. If you ever expect to restore this wiring, you might note the correct wiring anyway.

Also: The Card #7 assembly drawing on page J-20 of the 8182A manual erroneously specifies the "Difference Out" position of Jumper D as being the "As Shipped" configuration. Actually the unit was shipped with Jumper D in the "R Out " position. Please annotate your manual.

Procedure

1. Referring to page C-2 of the main manual, obtain access to the area inside the rear panel.

ON BACK PLANE

2. Remove the two jumpers connecting terminals E1 to E2 and E3 to E4. Clear the terminals of excess solder using the solder-sucker.

3. Unsolder the Wht/Blu and Violet wires going to E21. Resolder the Wht/Blu wire to E2 (leaving room for another wire) and the Violet wire to Pin W of Card 7. (Note: Pin W does not have a terminal. You will have to carefully tack solder to the pad, tugging gently after cooling to make sure a solid connection has resulted. Pin W is the fourth pin up from the bottom.)

   Clear terminal E21 of solder.

4. Unsolder the Blue wire going to E23 and the Gray wire going to E25. Resolder the Blue wire to E1. Resolder the Gray wire to E3.

   Clear terminals E23 and E25 of solder.

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5. Unsolder the Wht/Gry and Brown wires going to E20. Resolder the Wht/Gry wire to E4 and the Brn wire to E22.

   Clear terminal E20 of solder.

6. Using the jumpers supplied in this kit:

   Connect the shorter one between E21 and E23; connect the longer one between E20 and E25.

ON REAR PANEL

7. Unsolder and discard leads between audio test jacks (J1 and J2) and slide switch. Use caution to avoid getting flux into the switch.

BETWEEN BACK PLANE AND REAR PANEL

When soldering to the connector (J3) on the rear panel, one convenient way may be to 'sweat' solder. That is, fill the solder cup with a small amount of solder first and let it cool. Then reheat it and place the pretinned wire in the cup of molten solder. This technique requires only two hands at a time rather than three!

8. Using wires and tubing supplied in this kit twist each pair of wires together. Use the tubing at the J3 connections:

   Connect Wht/Blu wire from E2 to J3-4 (Accessory Port 1 on Rear Panel).
   Connect Wht/Gry wire from E4 to J3-6 " " " " " "
   Connect Yel wire from E21 to J1 (Audio Test Jack - Left (or L+R)).
   Connect Red wire from E20 to J2 (Audio Test Jack - Right (or L-R)).

This modification supersedes and obsoletes the information in Appendix G of the First Edition of the manual for Optimod-TV. This Instruction Sheet might be conveniently filed by trimming the edges and taping it into the manual in front of Page G-1.

In addition, the following pages will be partially incorrect and should be so marked. Make a note on each referring future readers to Page G-1 if you have taped these instructions there.

Page J-4	Assembly Drawing for Motherboard (MB)
J-21	Schematic for Card #7
J-25	Block Diagram

The "Noise Reduction In/Out" switch on the rear panel may be remarked "Stereo Generator In/Out" if desired. "Accessory Port 1" (or on newer units "Noise Reduction Interface") may be remarked "to Stereo Generator". The Audio Test Jacks marked "Left" and "Right" may be remarked "or L+R" and "or L-R" respectively.

Further information on the interface between Optimod-TV and the optional TV Stereo Generator is contained in the manual for the Stereo Generator.

Check your work. Review all the instructions and examine all wiring visually. Compare with the attached wiring diagram.

Put the "Noise Reduction" switch in its OUT position. Place the unit in Proof Mode by operating the two switches on the subpanel. Introduce a 400 Hz signal at the Left input at about 1 volt. Observe the reading at the L Compr Out position of the rotary switch. It should vary as the Left Input Attenuator is turned. Verify that there is a signal at the L System Out position. Put the "Noise Reduction" switch in its IN postion. There should be no signal at the L Compr Out position. Reconnect the signal to the Right Input and repeat the steps.

This will confirm operation without the Stereo Generator attached. When it is attached, additional tests may be performed by referring to the manual for the Stereo Generator.

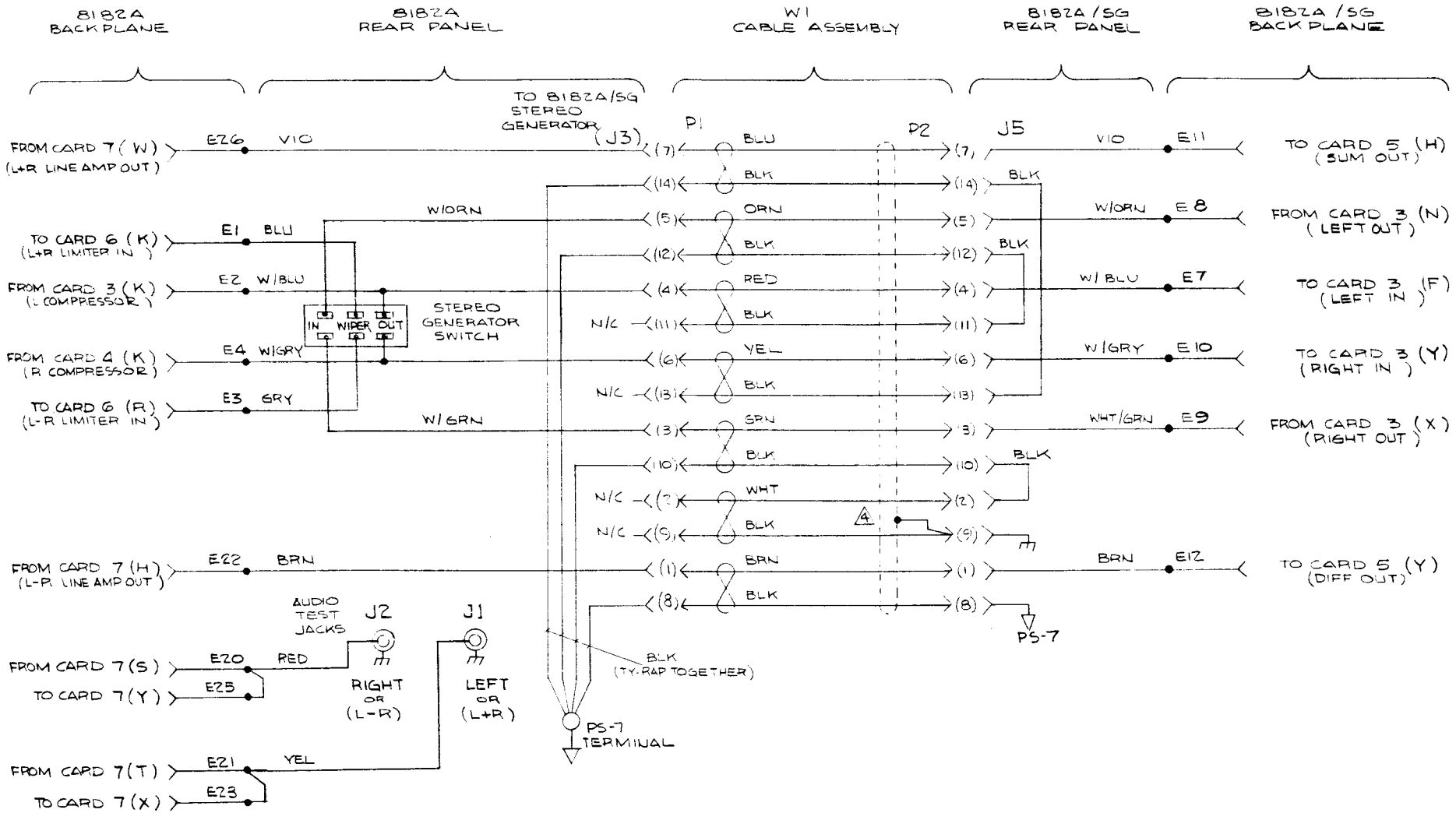

Fig. I-1: WIRING DIAGRAM, STEREO GENERATOR INTERCONNECTION

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APPENDIX J:
Schematics, Assembly Drawings, and Parts List

The documents in this Appendix reflect the actual construction of your unit as accurately as possible. If changes are made, they will be found in an Addendum inserted in the front of this Manual. If there is a disagreement between these drawings and your actual unit, it more likely reflects an error in documentation than an error in the construction of your unit.

If you intend to replace parts, please consult the section in **Appendix F** on **Selecting And Ordering Replacement Parts.**

Schematic drawings for the major cards face the corresponding Parts Locator Drawing.

Schematic Drawings and Parts Locator Drawings for miscellaneous assemblies and the chassis interwiring follow.

TABLE OF CONTENTS

SCHEMATICS WITH PARTS LOCATOR

Card #PS POWER SUPPLY REGULATOR (includes AC and unregulated DC)
Card #IF INPUT FILTER (mounted on rear panel within filter box)
Card #MR METER RESISTOR (mounted on front panel behind rotary switch)
Card #3 6-POLE FILTER
Card #4 NOISE REDUCTION ENCODER
Card #5 11-POLE FILTER
Card #6 NOISE REDUCTION DECODER
Card #7 STEREO GENERATOR
Card #8 SYNC

LOCATOR FOR CHASSIS MOUNTED COMPONENTS
1) Raw DC Section

J

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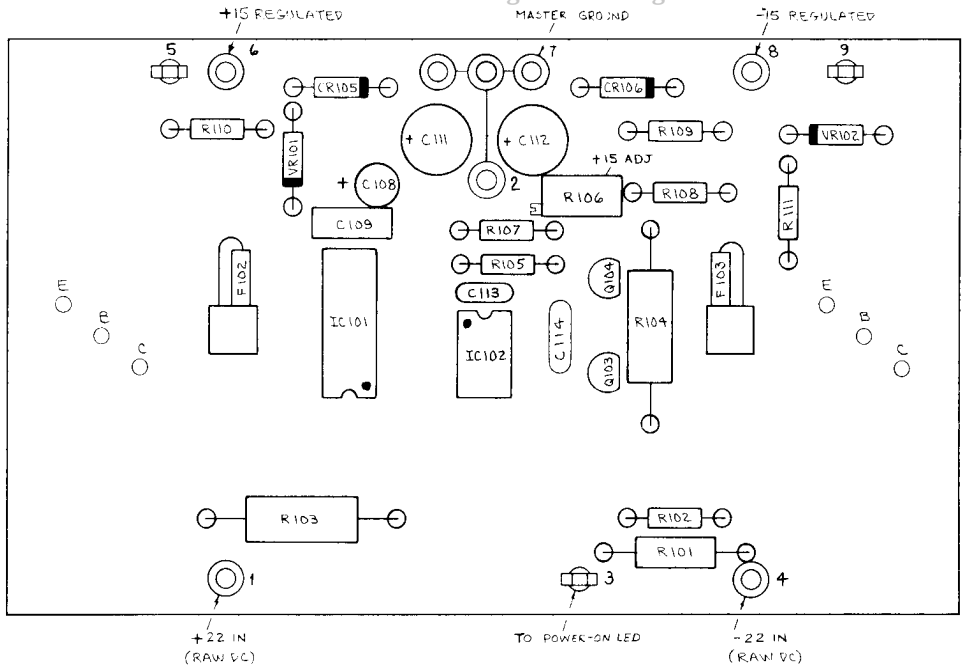

orban	Orban Associates Inc.
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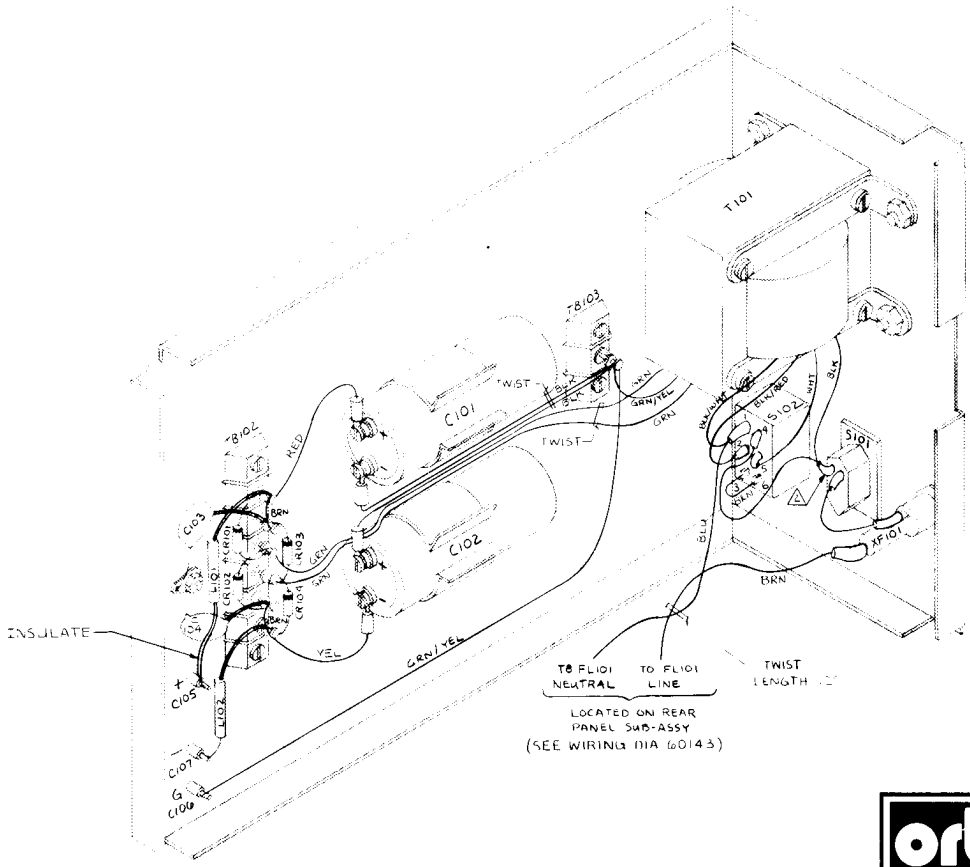

orban	Orban Associates Inc.
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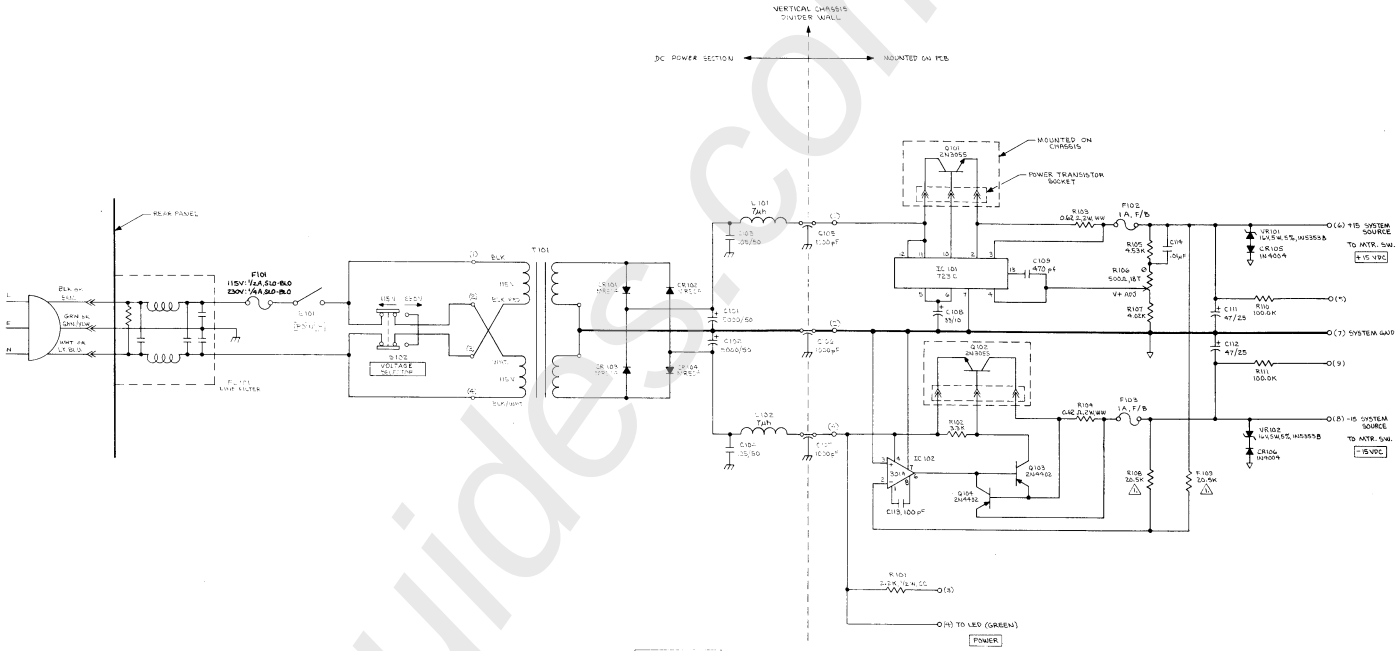

REFERENCE DESIGNATIONS		
ITEM	LAST ITEM	NEXT ITEM
C	C114	C119
CR	106	—
IC	102	—
Q	104	—
R	111	—
S	102	—
VR	102	—
FL	101	—
T	101	—
L	102	—
P	103	—

△ SELECTED: MATCHED TO 1/4%

NOTES:

orban Orban Associates Inc.

TITLE: SCHEMATIC POWER SUPPLY 60021-000-07

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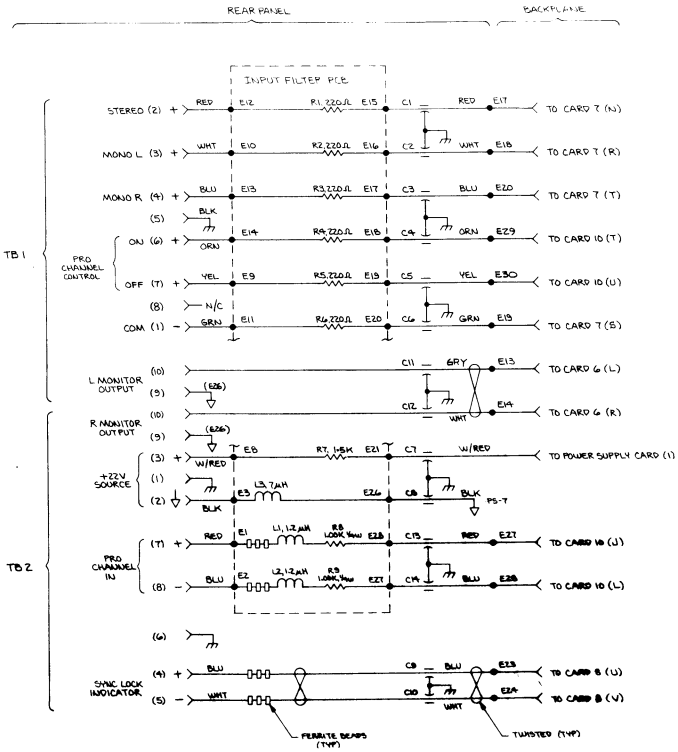
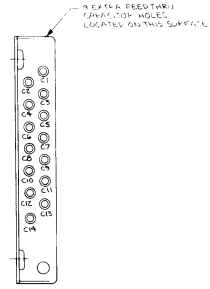




REFERENCE DESIGNATORS		
ITEM	USED	NOT USED
C	14	
R	9	
L	3	
E	28	

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS ARE ¼W, CC
2. ALL CAPACITORS ARE 1000pF FEEDTHRU

Orban Associates Inc.

TITLE: SCHEMATIC INPUT FILTER 60091-000-01

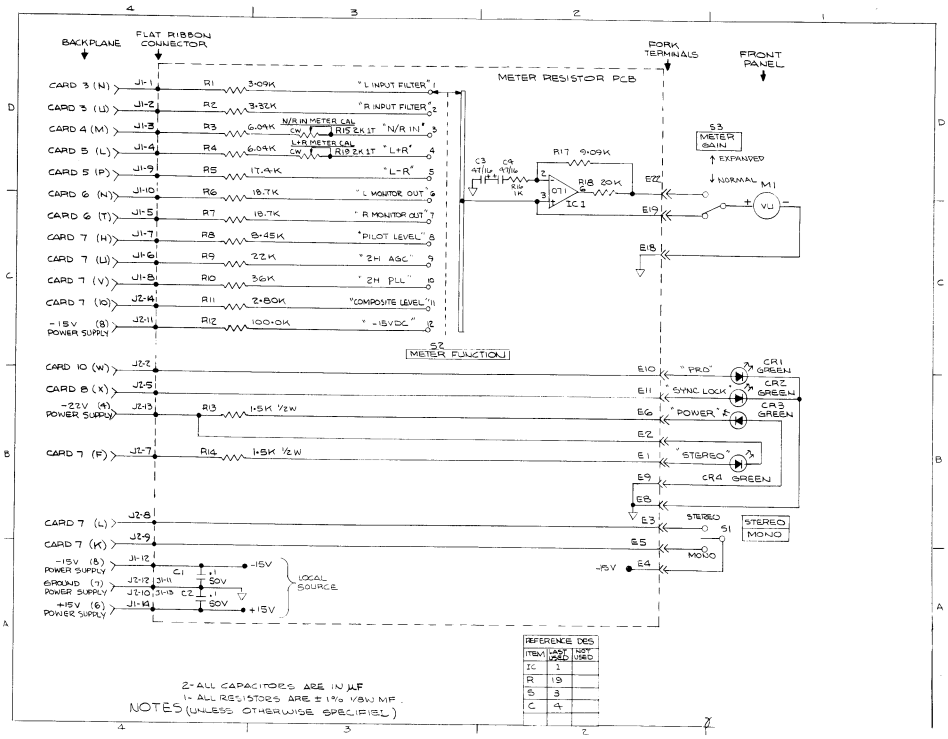
J

All manuals and user guides at all-guides.com

orban Orban Associates Inc.

TITLE: ASSEMBLY DRAWING METER RESISTOR BOARD 30900-000-01

All manuals and user guides at all-guides.com

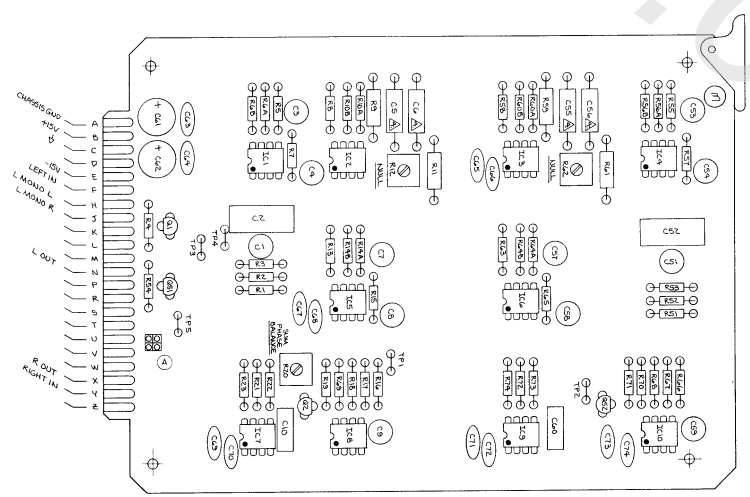


J

Orban Associates Inc.

TITLE: SCHEMATIC METER RESISTOR CARD 60092-000-02

All manuals and user guides at all-guides.com



⚠ C5, C6, C55 & C56 ARE TEMPERATURE SENSITIVE AND MUST NOT BE WAVESOLDERED.

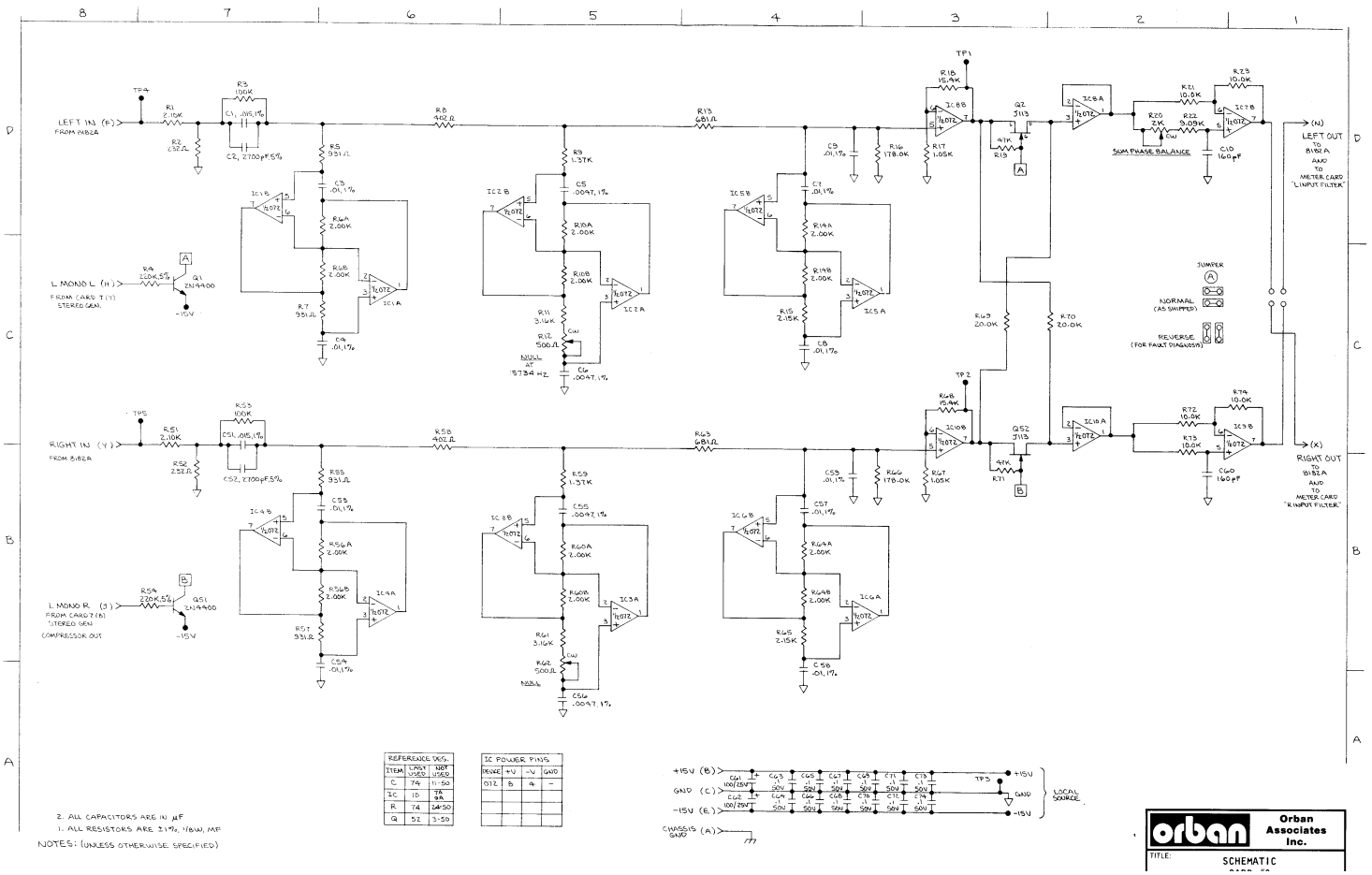
3. TICK MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.
2. USE COMPONENT MTG. PADS, P/N 15051-000, FOR C61, C62
1. REFERENCE SCHEMATIC P/N 60093-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban Orban Associates Inc.

TITLE: ASSEMBLY DRAWING
CARD #3
30830-000-01

All manuals and user guides at all-guides.com



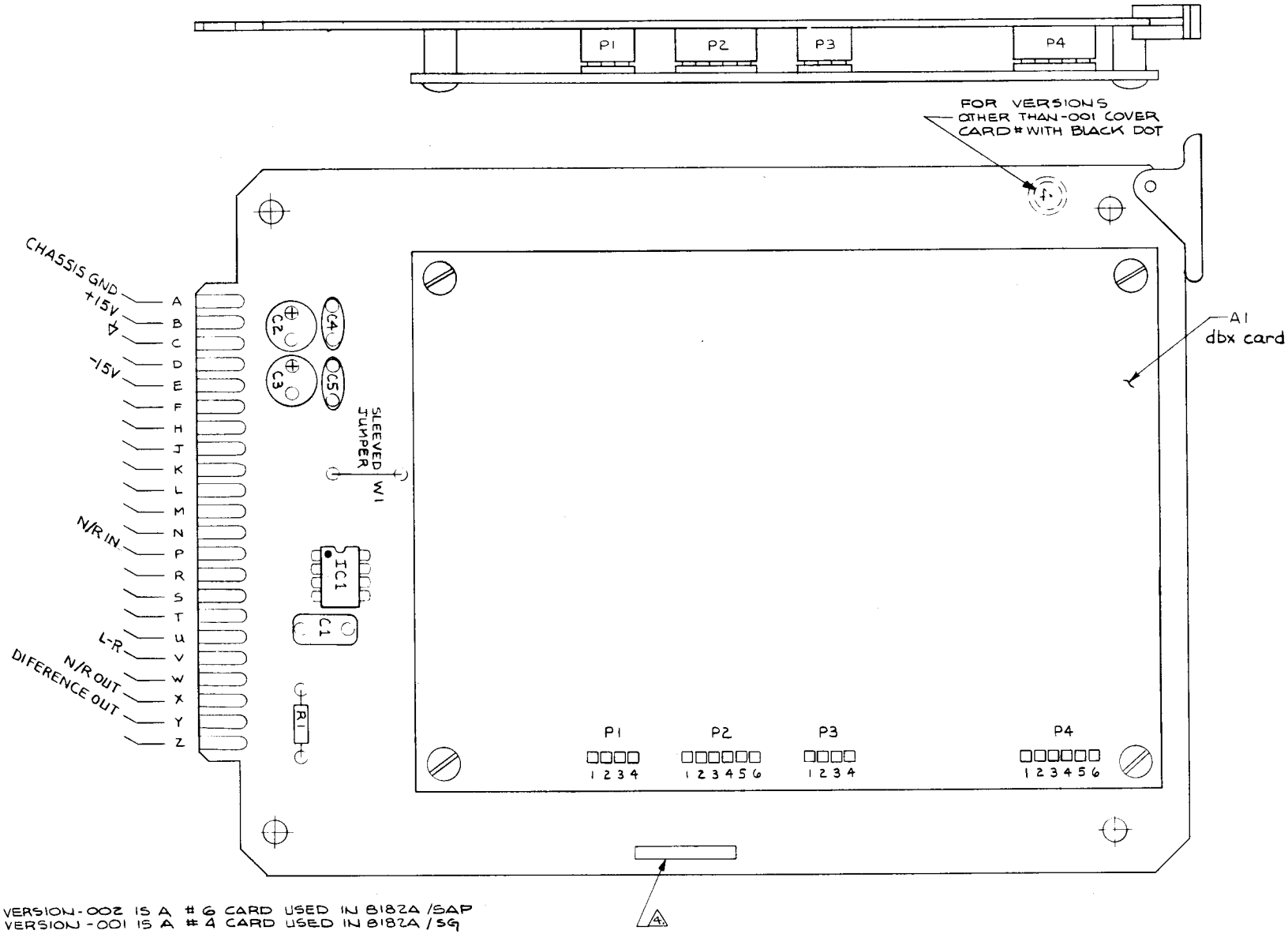
REFERENCE DES.		
ITEM	LAST USED	NEXT USED
C	74	11-50
IC	10	7A 9A
R	74	24-50
Q	52	3-50

IC POWER PINS			
DEVICE	+V	-V	GND
072	8	4	-

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS ARE 1%, 1/8W, MF
2. ALL CAPACITORS ARE IN μF

orban Orban Associates Inc.

TITLE: SCHEMATIC



5. VERSION-002 IS A # 6 CARD USED IN 8182A/SAP
   VERSION-001 IS A # 4 CARD USED IN 8182A/SG
4. MARK PHASE NO. OF MOUNTED dbx CARD.
3. TICK MARKS INDICATE PINS ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.
2. USE COMPONENT MTG PADS P/N 15051-000 FOR C2,3.
1. REFERENCE SCHEMATIC P/N 60094-000.

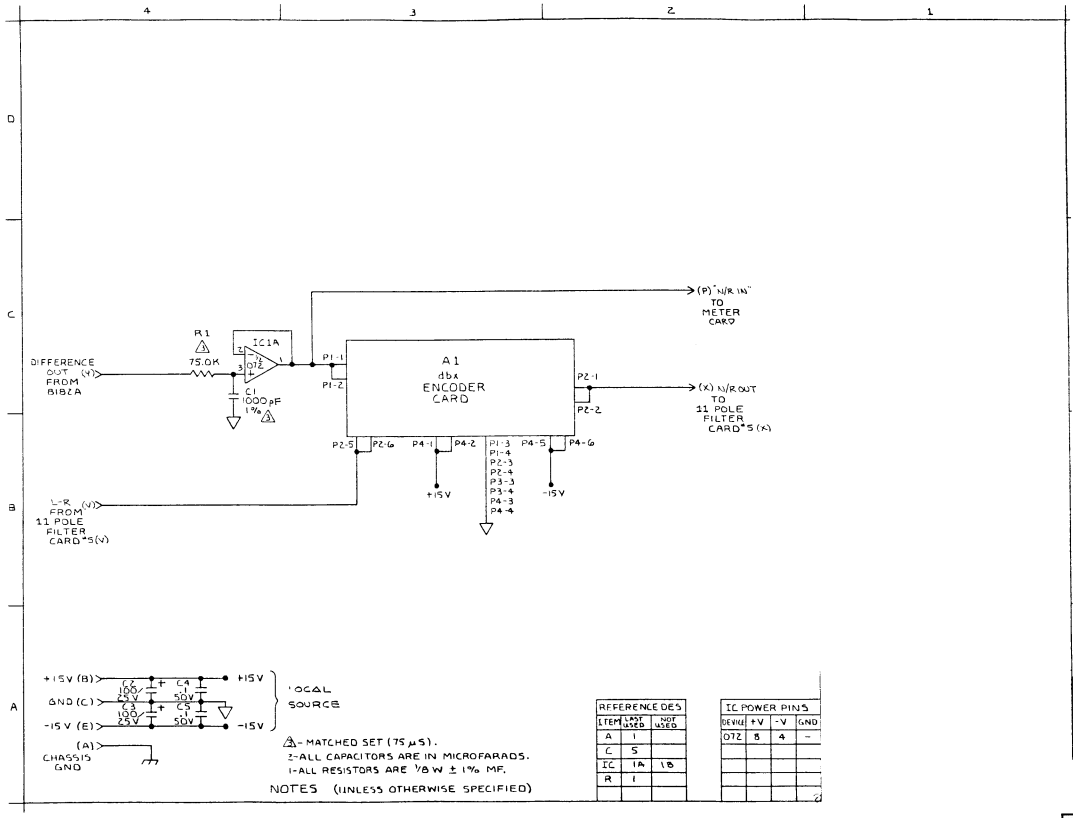
NOTES: (UNLESS OTHERWISE SPECIFIED)

orban Orban Associates Inc.

TITLE: ASSEMBLY DRAWING
CARD #4
30840-000-03

All manuals and user guides at all-guides.com

All manuals and user guides at all-guides.com



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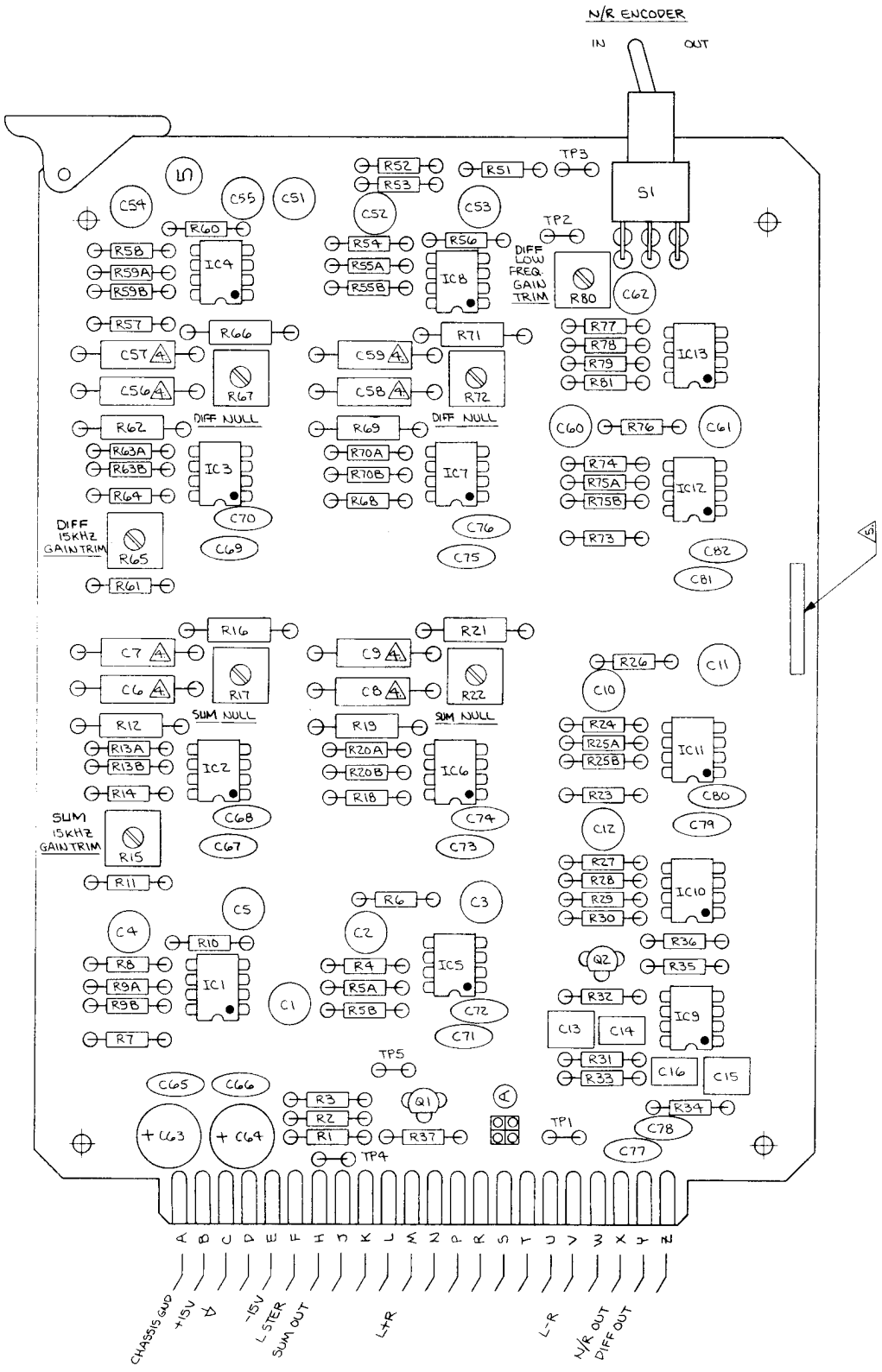
Orban Associates Inc.

TITLE: SCHEMATIC CARD #4 60094-000-01

All manuals and user guides at all-guides.com



Orban Associates Inc.	
TITLE:	ASSEMBLY DRAWING CARD #5 30850-000-02

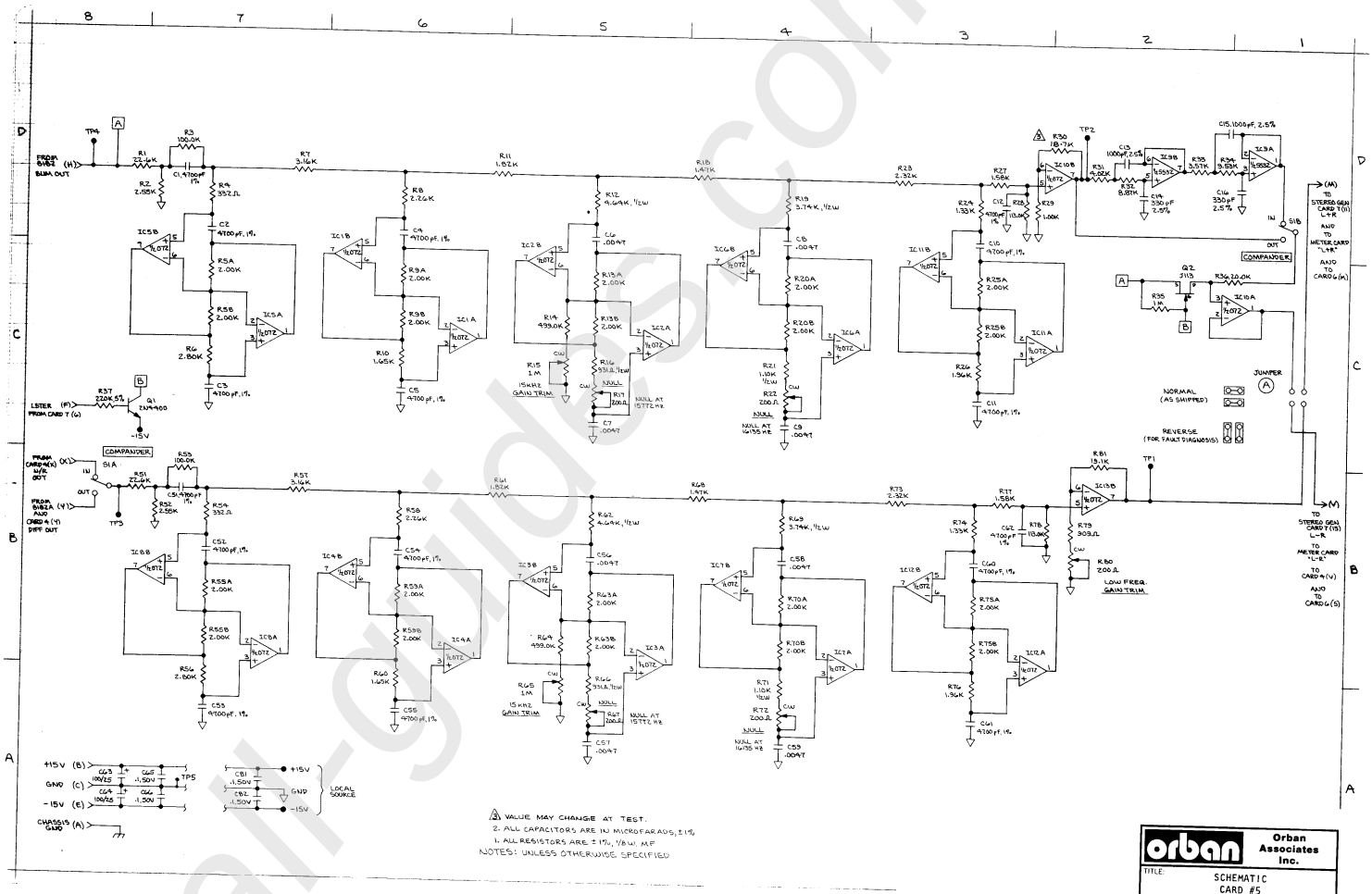
NOTES: (UNLESS OTHERWISE SPECIFIED)

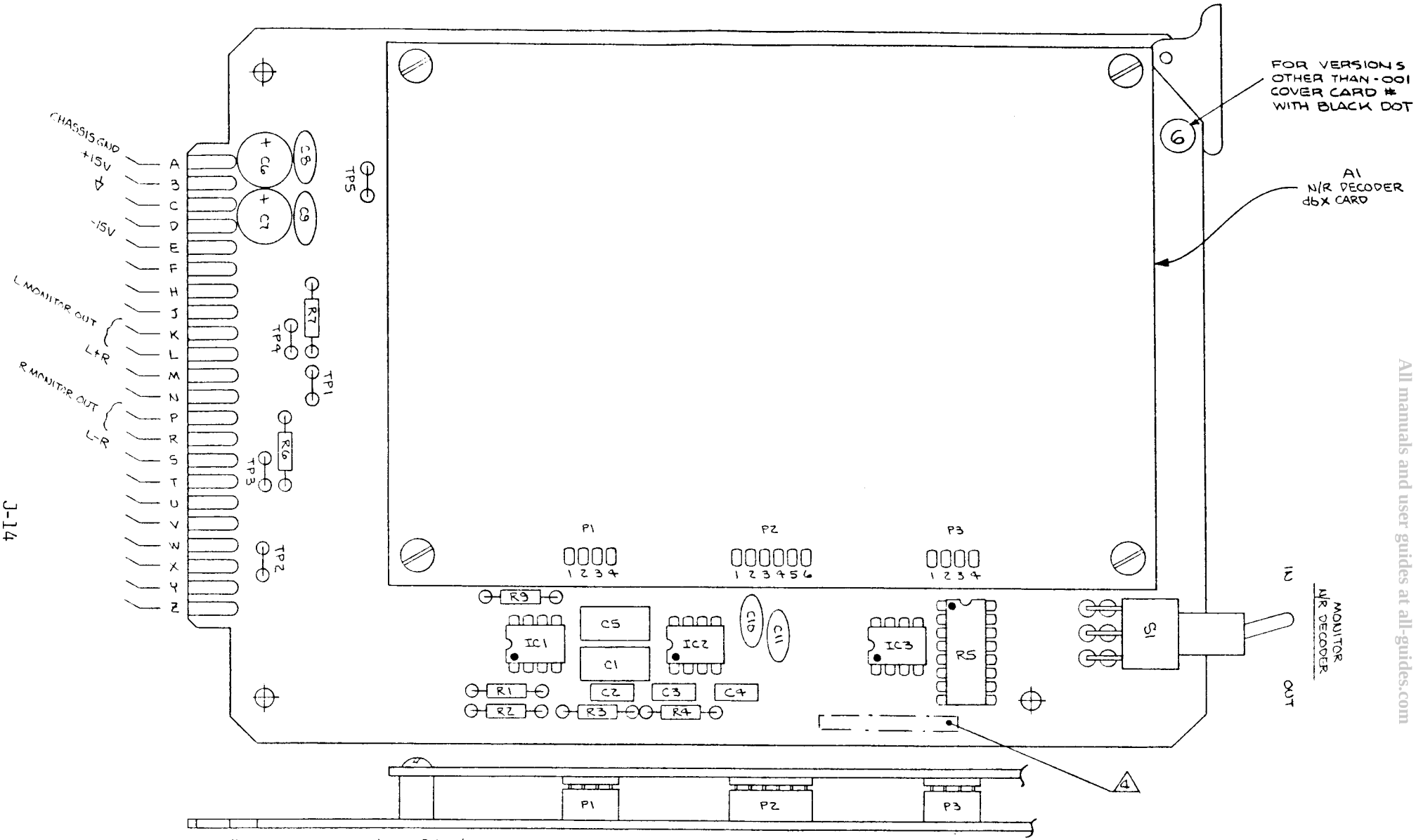
1. REFERENCE SCHEMATIC P/N 60095-000
2. USE COMPONENT MTG. PADS, P/N 15051-000, FOR C63, C64
3. TICK MARKS INDICATE PINS ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

4. C6-9 & C56-59 ARE TEMPERATURE SENSITIVE AND MUST NOT BE WAVESOLDERED.

5. MARK PHASE NO. OF ASSOCIATED dbx CARD.

All manuals and user guides at all-guides.com





J-14

VERSION-002 IS A # 9 CARD USED IN 8182A/SAP
5. VERSION-001 IS A # 6 CARD USED IN 8182A/SQ

⚠1 MARK PHASE NUMBER OF MOUNTED dbx CARD.

3. TICK MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

2. USE COMPONENT MTG. PADS, P/N 15051-000, FOR C6, C7

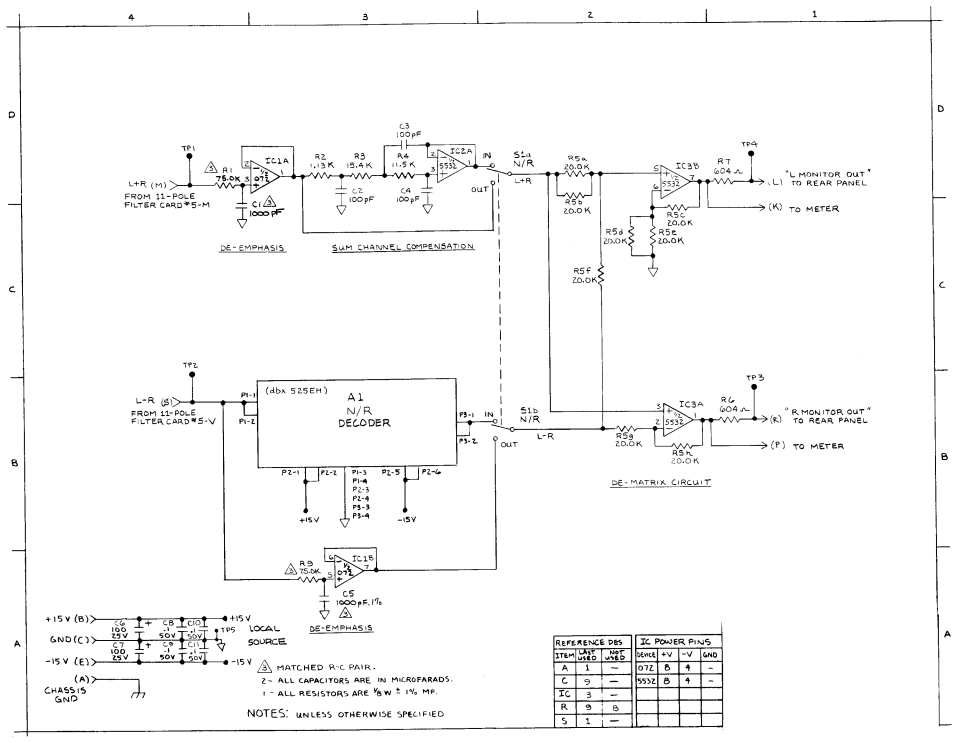
1. REFERENCE SCHEMATIC P/N 60096-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban	Orban Associates Inc.
TITLE:	ASSEMBLY DRAWING CARD #6 30860-VER-02

All manuals and user guides at all-guides.com

All manuals and user guides at all-guides.com

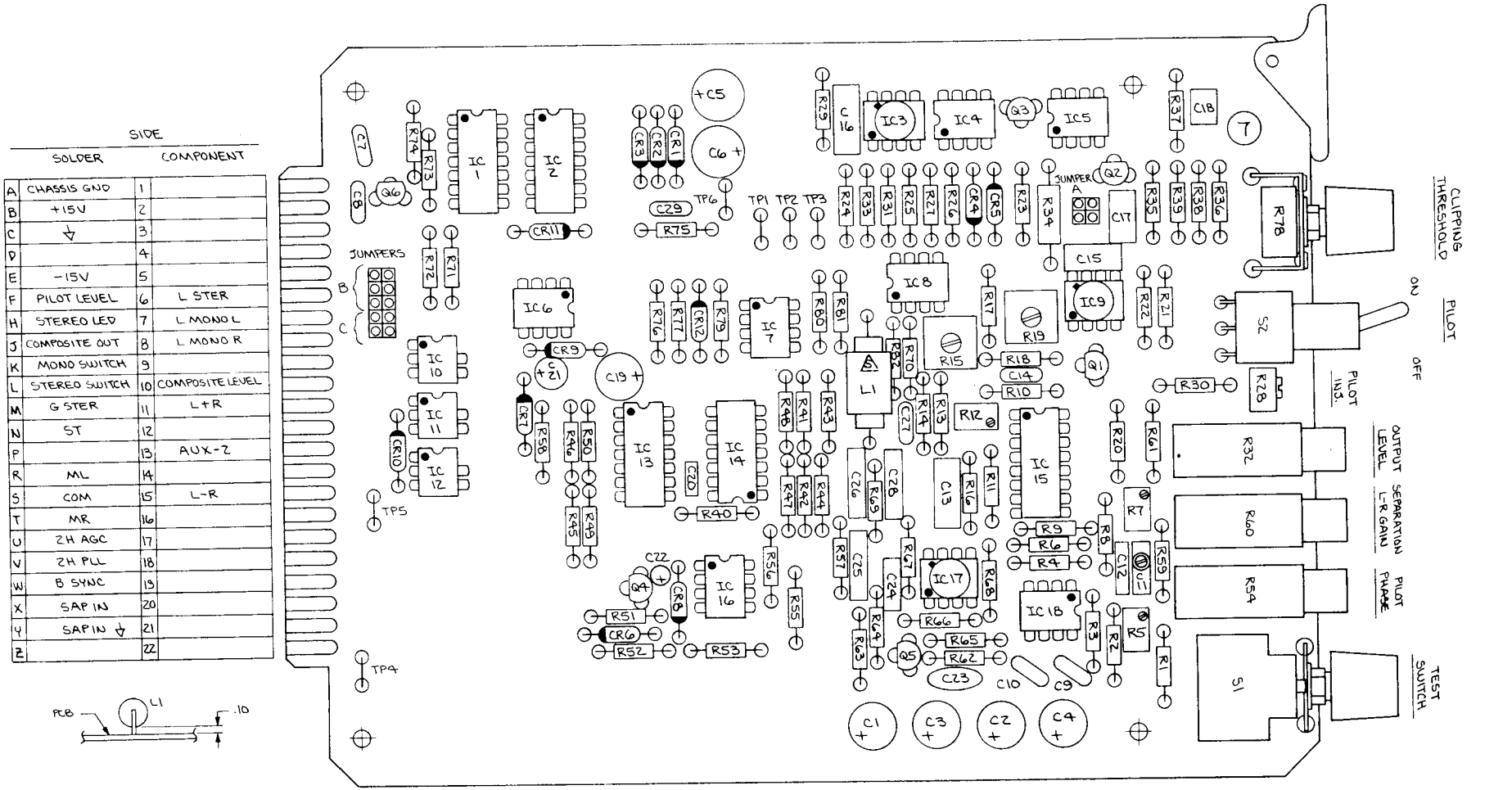


REFERENCE DES		
ITEM	LAST USED	NOT USED
A	1	—
C	9	—
IC	3	—
R	9	8
S	1	—

IC POWER PINS			
DEVICE	+V	-V	GND
072	8	4	—
5532	8	4	—

J

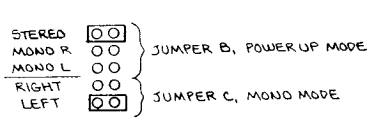
Orban Associates Inc.	
TITLE:	SCHEMATIC CARD #6 60096-000-01

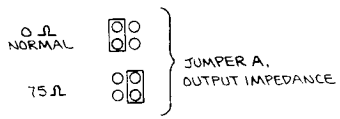


SIDE	SOLDER		COMPONENT
A	CHASSIS GND	1	
B	+15V	2	
C	⏚	3	
D		4	
E	-15V	5	
F	PILOT LEVEL	6	L STER
H	STEREO LED	7	L MONO L
J	COMPOSITE OUT	8	L MONO R
K	MONO SWITCH	9	
L	STEREO SWITCH	10	COMPOSITE LEVEL
M	G STER	11	L+R
N	ST	12	
P		13	AUX-2
R	ML	14	
S	COM	15	L-R
T	MR	16	
U	2H AGC	17	
V	2H PLL	18	
W	B SYNC	19	
X	SAP IN	20	
Y	SAP IN ⏚	21	
Z		22	

5. SLEEVE L1 USING SHRINK TUBING. SEE MOUNTING DETAIL.

4. TRIMPOTS:
   - R5, "2H NULL"
   - R7, "SUB: MAIN XTALK
   - R12, "DIST NULL"
   - R15, "4H NULL"
   - R19, "DC OFFSET NULL"





3. TICK MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

2. USE COMPONENT MTG. PADS, P/N 15051-000, FOR C5, C6

1. REFERENCE SCHEMATIC P/N 60097-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

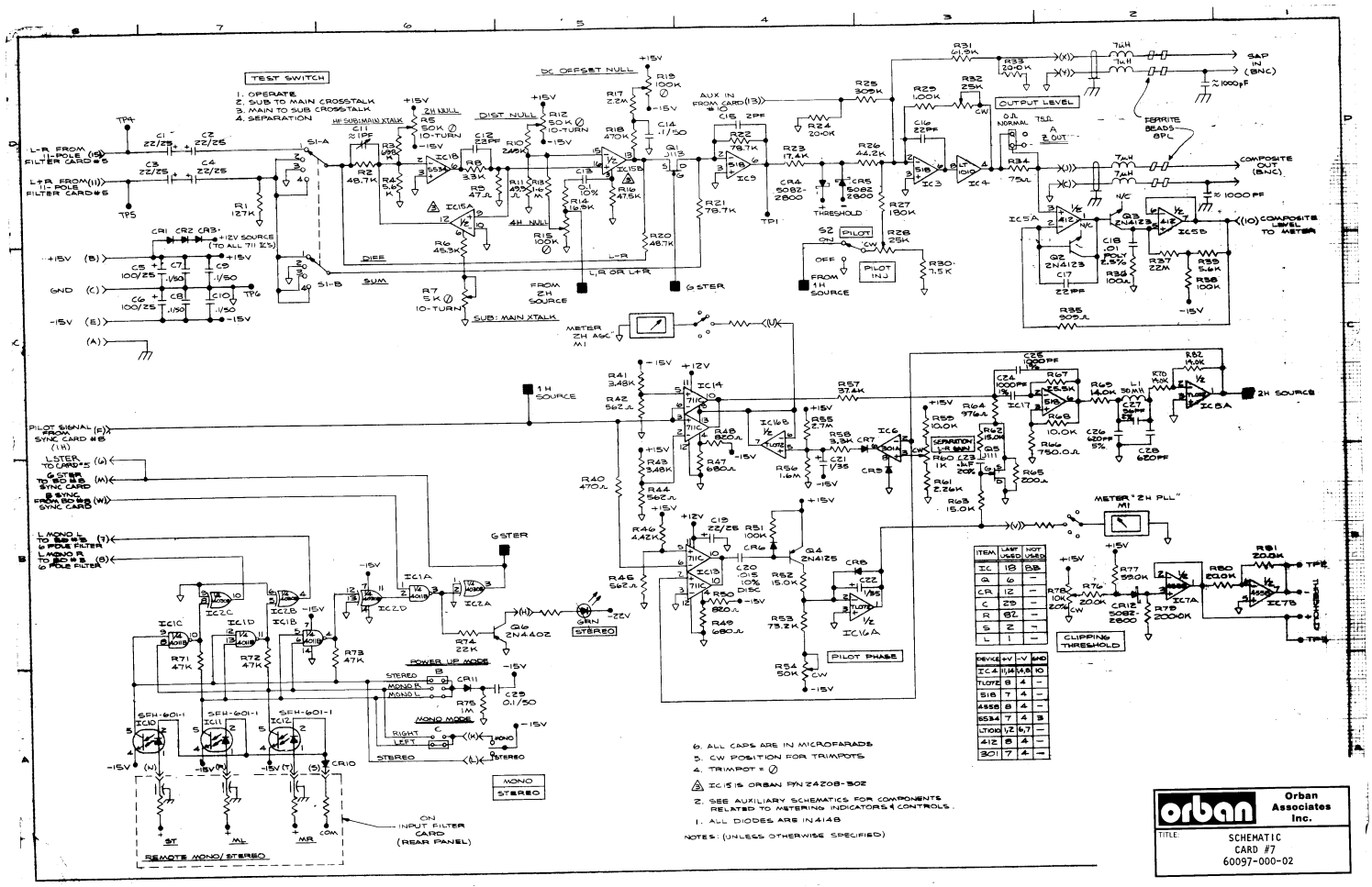


MOUNTING OF IC4
IF LT1010 IS USED

orban	Orban Associates Inc.
TITLE:	ASSEMBLY DRAWING CARD #7 60097-000-02

All manuals and user guides at all-guides.com

All manuals and user guides at all-guides.com

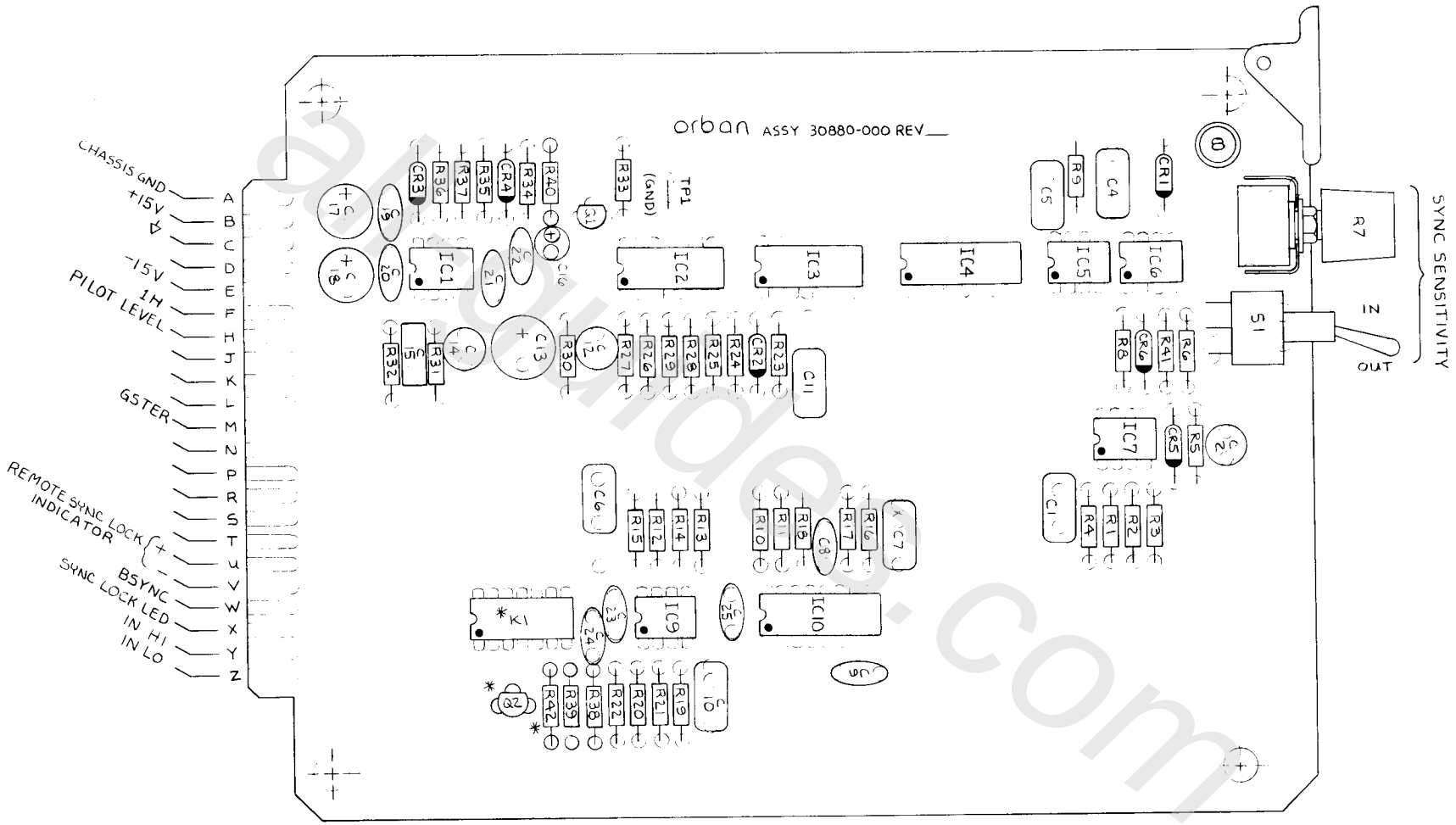


ITEM	LAMP USED	NOT USED
IC	16	8,8
G	6	–
CR	12	–
C	29	–
R	82	–
S	2	–
L	1	–

DEVICE	+V	-V	GND
IC4	11,14	4,8	10
TL072	8	4	–
5116	7	4	–
4558	8	4	–
5534	7	4	3
LT1013	1,2	6,7	–
412	8	4	–
3011	7	4	–

orban	Orban Associates Inc.
TITLE	SCHEMATIC CARD #7 60097-000-02

J



* ON PCB REVISION 01 & 02 K1 WAS ICB OPTOISOLATOR AND Q2, R42 DID NOT EXIST.

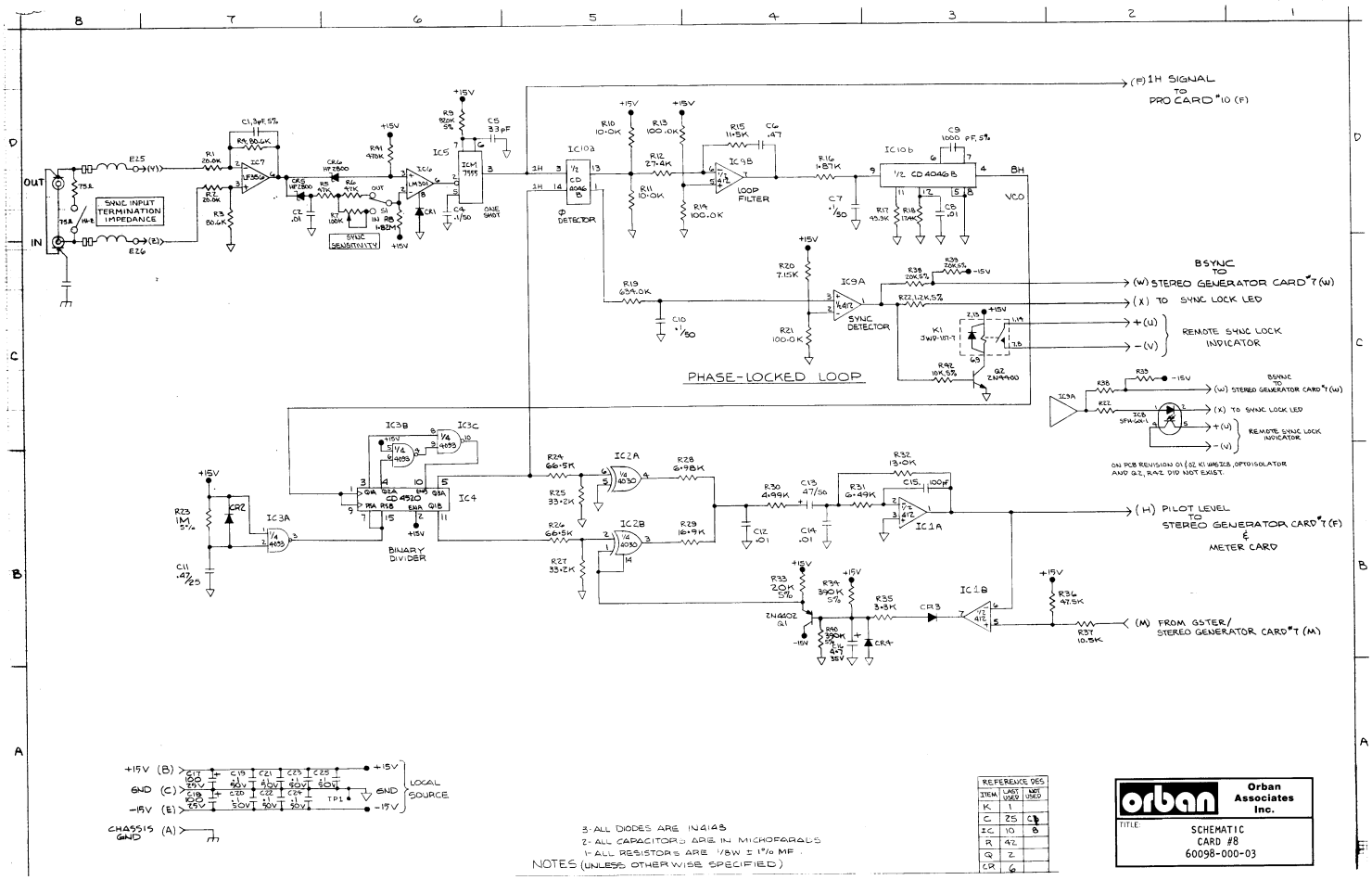
4. MOUNT PCB SHIELD ON SOLDER SIDE.
3. TICK MARKS INDICATE PINS ONE OF IC's, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.
2. USE COMPONENT MTG PADS P/N 15051-000 FOR C17,18.
1. REFERENCE SCHEMATIC P/N 60098-000.

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban	Orban Associates Inc.
TITLE:	ASSEMBLY DRAWING CARD #8 30880-000-02

All manuals and user guides at all-guides.com

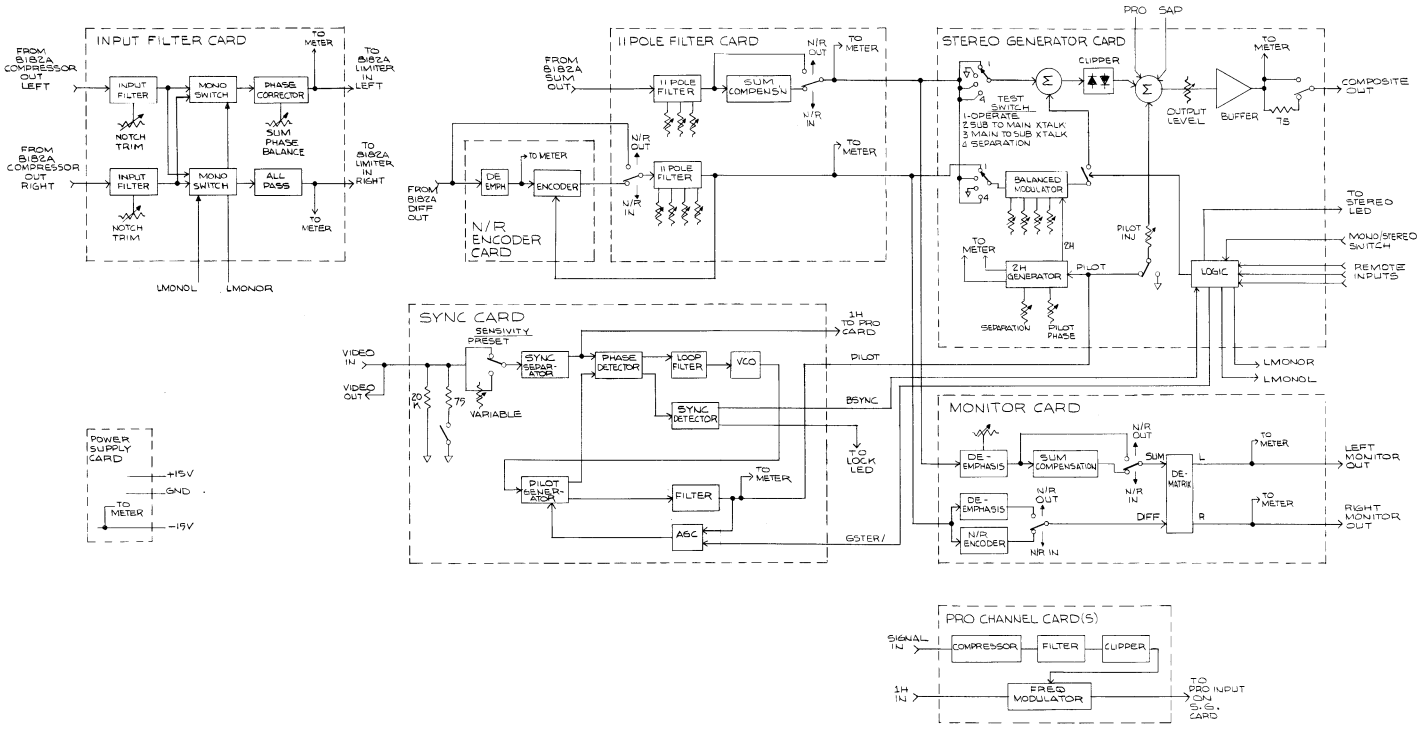
All manuals and user guides at all-guides.com



REFERENCE DES		
ITEM	LAST USED	NOT USED
K	1	
C	25	C9
IC	10	8
R	42	
Q	2	
CR	6	

orban	Orban Associates Inc.
TITLE:	SCHEMATIC CARD #8 60098-000-03

All manuals and user guides at all-guides.com



ECO NO.	DATE	REV.	DESCRIPTION	CHANGED	CHECKED
			REVISIONS		

UNLESS OTHERWISE SPECIFIED
ALL DIMS IN INCHES
TOLERANCES
.XX ±
.XXX ±

orban Orban Associates Inc.

TITLE: TV STEREO GENERATOR SYSTEM BLOCK DIAGRAM

DRAWN: K.McGRAW DATE: 11-15-84
CHECKED: DATE: 11/15/84
APPROVED:
SCALE: DRAWING NO. 66145 PROJ. NO. 889 REV. A
DO NOT SCALE DRAWING SHEET 8182A/SG SHEET 1 OF 1

All manuals and user guides at all-guides.com

Parts List

The Parts List contains all replaceable parts used in OPTIMOD-TV in Reference Designator order by Part Class.

If you need to replace parts, consult **Selecting And Ordering Replacement Parts** in **Appendix F** to avoid inadvertent errors that could compromise performance, stability, and/or compliance with FCC regulations.

Obtaining Spare Parts

Because special or subtle characteristics of some components are exploited to produce an elegant design at reasonable cost, it is unwise to make substitutions for listed parts. It is also unwise to ignore notations in the Parts List indicating "Selected" or "Realignment Required" when replacing components. In such cases, the factory should be consulted to help you maintain optimum performance.

Orban ordinarily maintains an inventory of tested, exact-replacement spare parts to supply any present or normally-expected future demand quickly at a fair price.

If you order parts from the factory, please supply all of the following information:

- -- The Orban Part Number, if you can determine it
- -- The Reference Designator (like R6) for the part
- -- A brief description of the part
- -- And, from the Serial Label on the rear panel:
  - The exact Model Number
  - The Serial Number
  - The "M" number, if any

Orban can supply standardized Spare Parts Kits for this product during its production life. Consult your dealer or the factory to obtain a list of the prices and contents of such kits.

To ease future maintenance, parts for this unit have been chosen from the catalogs of well-known manufacturers. Their U.S. headquarter addresses are listed at the end of the Parts List. Most manufacturers have extensive distribution facilities throughout the world and can often be contacted through local offices.

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
CAPACITORS							
	Chassis (Filter Box)						
C1-14	Ceramic, Feed-thru, 1000pF	21118-210	ERE	2404-000 Series		17	
	Chassis (Back Panel)						
C15	Ceramic, 1000V, 10%, .001uF	21112-210	CRL	DD-102		1	(For BNC)
	Power Supply and Regulator Board						
C101, C102	Aluminum, Electrolytic, 40V, 5000uF	21250-850	CD	5000-40-A2	MANY	2	
C103, C104	Ceramic Disc, 50V, .05uF	21107-350	CRL	UK50-503	MANY	2	
C105-C107	Same as C1-14, Chassis (Filter Box)						
C108	Tantalum, 10V, 10%, 33uF	21303-633	SPR	196D336X9010KA1	MANY	1	
C109	Mica, 500V, ±5%. 470pF	21024-147	CD	CD19FD471JO3	MANY	1	
C110	Not used						
C111, C112	Aluminum Electrolytic, 50V, 47uF	21208-647	SPR	502D476G050CD1C	MANY	3	
C113	Mica, 500V, ±5%, 470pF	21020-110	CD	CD15FD101JO3		2	
C114	Polyester, 100V, ±10%, .01uF	21401-310	SPR	225P10391WD3	MANY	1	
	Card #3						
C1	Polypropylene, 50V, 1%, .015uF	21701-315	NOB	CQ15P1H153FPP		2	
C2	Mica, 5%, 2700pF	21024-227	CD	CD19FD272JO3	MANY	2	
C3,4	Polypropylene, 50V, 1%, .01uF	21701-310	NOB	CQ15P1H103FPP		10	
C5,6	Polystyrene, 100V, 1%, .0047uF	21510-247				4	
C7-9	Same as C3,4, Card #3						
C10	Mica, 1%, 160pF	21018-116	CD	CD15FD161FO3	MANY	2	
C11-50	Not used						
C51	Same as C1, Card #3						
C52	Same as C2, Card #3						
C53,54	Same as C3,4, Card #3						
C55,56	Same as C5,6, Card #3						
C57-59	Same as C3,4, Card #3						
C60	Same as C10, Card #3						
C61,62	Aluminum, 25V, 100uF	21206-710	PAN	ECE-A1EV101S		17	
C63-74	Monolythic Ceramic, 50V, 20%, .1uF	21123-410	SPR	1C25Z5U104M050B	MANY	52	
	Card #4						
C1	See SELECTED COMPONENTS						
C2,3	Same as C61-62, Card #3						
C4,5	Same as C63-74, Card #3						

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
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
CAPACITORS

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
	Card #5						
C1-5	Polypropylene, 1%, 4700pF	21701-247	NOB	CQ15P1H472FPP		16	
C6-9	Polystyrene, 100V, 1%, .0047uF	21510-247				8	
C10-12	Same as C1-5, Card #5						
C13	Polypropylene, 2.5%, 1000pF	21702-210	WIM	FKP263V2.5-1000		2	
C14	Polypropylene, 2.5%, 330pF	21702-133	WIM	FKP263V2.5-330		2	
C15	Same as C13, Card #5						
C16	Same as C14, Card #5						
C17-50	Not used						
C51-55	Same as C1-5, Card #5						
C56-59	Same as C6-9, Card #5						
C60-62	Same as C1-5, Card #5						
C63,64	Same as C61,62, Card #3						
C65-82	Same as C63-74, Card #3						
	Card #6						
C1	See SELECTED COMPONENTS						
C2-4	Polypropylene, 2.5%, 100pF	21702-110	NOB	CQ15P1H101GPP		3	
C5	See SELECTED COMPONENTS						
C6,7	Same as C61,62, Card #3						
C8-11	Same as C63-74, Card #3						
	Card #7						
C1-6	Same as C61,62, Card #3						
C7-10	Same as C63-74, Card #3						
C11	Ceramic, Trimmer, 0.5pF-3pF	21811-000	ME	2502AOR503V		1	
C12	Mica, 5%, 22pF	21020-022	CD	CD15ED220JO3		3	
C13	Metallized Polyester, 100V, 10%, 0.1uF	21441-410	WIM	MKS-4100V5-0.1		1	
C14	Same as C63-74, Card #3						
C15	Mica, 2pF, ±.5pF	21017-002	CD	CD15020D03		1	
C16,17	Same as C12, Card #7						
C18	Polypropylene, 50V, 2.5%, .01uF	21702-310	WIM	FKP263V2.5.01		4	
C19	Same as C61,62, Card #3						
C20	Ceramic Disc, 20%, .015uF	21107-315	CRL	UK50-153		1	
C21,22	Tantalum, 35V, 10%, 1uF	21307-510	SPR	196D105X9035HA1		2	
C23	Same as C63-74, Card #3						
C24,25	Mica, 1%, 1000pF	21022-210	CD	CD19FD102F03		2	
C26	Mica, 5%, 620pF	21024-162	CD	CD19FD621J03		2	
C27	Mica, 2%, 56pF	21019-056	CD	CD15ED560G03		1	
C28	Same as C26, Card #7						
C29	Same as C63-74, Card #3						

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
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
CAPACITORS

all-guides.com
All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
	Card #8						
C1	Mica, 500V, ±.5pF, 3pF	21017-003	CD	CD15CD030D03		1	
C2	Same as C18, Card #7						
C3	Not used						
C4	Metallized Polyester, 50V, 0.1uF	21441-410	WES	60C104K100		3	
C5	Mica, 5%, 33pF	21020-033	CD	CD15ED330JO3		1	
C6	Met. Polyester, 100V, 10%, .47uF	21441-447	WES	60F474K100		2	
C7	Same as C4, Card #8						
C8	Ceramic, 50V, 20%, .01uF	21107-310	CRL	UK50-103		1	
C9	Mica, 5%, 1000pF	21024-210	CD	CD19FD102JO3		1	
C10	Same as C4, Card #8						
C11	Same as C6, Card #8						
C12	Same as C18, Card #7						
C13	Same as C112, Power Supply and Regulator Board						
C14	Same as C18, Card #7						
C15	Same as C113, Power Supply and Regulator Board						
C16	Tantalum, 35V, 10%, 4.7uF	21307-547	SPR	196D475X9035HA1		1	
C17,18	Same as C61,62, Card #3						
C19-25	Same as C63-74, Card #3						
	Meter Resistor Card						
C1,2	Same as C63-74, Card #3						
C3,4	Aluminum, 16V, 47uF	21205-647	SPR	502D476G016BB1C		2	
	DIODES						
	ALL DIODES NOT LISTED BY REFERENCE DESIGNATORS ARE:						
	Diode, Signal	22101-000	FSC	1N4148	MANY	13	
	NOTE: This is a silicon small-signal diode, ultra fast recovery, high conductance. It may be replaced with 1N914 or, in Europe, with BAY-61.						
	BV: 75V min. @ I_r = 5V I_r : 25nA max. @ V_r = 20V V_f : 1.0V max. @ I_f = 100mA t_{rr} : 4ns max.						
	NOTE: For Zener Diodes (VR...) see Miscellaneous Section						
	Front Panel						
CR1-4	LED, Green	25104-000	GI	MV5253	MANY	4	

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

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS(1)	QUAN/ SYS	NOTES
CR101-CR104	Diode, Rectifier, 400PIV, 3A	22203-400	MOT	MR504	SOME	4	
CR105, CR106	Diode, Rectifier, 400PIV, 1A	22201-400	MOT	1N4004		2	
	Card #7						
CR4,5	Diode, Signal, Schottky Hot-Carrier	22102-001	HP	5082-2800		5	
CR12	Same as CR4,5, Card #7						
	Card #8						
CR 5,6	Same as CR4,5, Card #7						
	INTEGRATED CIRCUITS						
	Power Supply and Regulator Board						
IC101	Regulator, Voltage, +15VDC	24301-302	NAT	LM723CN		1	
IC102	Linear, Single Opamp	24003-202	TI	LM301CN	MANY	3	
	Card #3						
IC1-10	Linear, Dual Opamp	24206-202	TI	TL072CP	NAT(LF353H)	26	
	Card #4						
IC1	Same as IC1-10, Card #3,						
	Card #5						
IC1-8	Same as IC1-10, Card #3						
IC9	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI, EXR	3	
IC10-13	Same as IC1-10, Card #3						
	Card #6						
IC1	Same as IC1-10, Card #3						
IC2,3	Same as IC9, Card #5						

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

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS(1)	QUAN/ SYS	NOTES
	Card #7						
IC1	Digital, "NAND"	24501-302	RCA	CD4011BE	MANY	1	
IC2	Digital "XOR"	24504-302	RCA	CD4030BE	MANY	2	
IC3	Linear, Single Opamp	24007-202	AD	AD518JN		3	
IC4	Power Buffer	24707-102	LT	LT1010CH		1	
IC5	Dual Opamp	24209-202	NAT	LF412CN		3	
IC6	Same as IC102, Power Supply and Regulator Board						
IC7	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MANY	1	
IC8	Same as IC1-10, Card #3						
IC9	Same as IC3, Card #7						
IC10-12	Opto-Isolator, NPN	25003-000	SIE	SFH-601-1		3	
IC13,14	Special Function	24701-302	TI	UA711CN		2	
IC15	Linear, Dual Opamp	24208-302	RCA	CA3280AG		1	
IC16	Same as IC1-10, Card #3						
IC17	Same as IC3, Card #7						
IC18	Linear, Single Opamp	24014-202	SIG	NE5534N	TI, EXR	1	
	Card #8						
IC1	Same as IC5, Card #7						
IC2	Same as IC2, Card #7						
IC3	Digital, "NAND"	24509-302	RCA	CD4093BE	MANY	1	
IC4	Digital, Counter	24508-302	RCA	CD4520BF	MANY	1	
IC5	Digital, Timer	24706-202	INS	ICM7555IPA		1	
IC6	Same as IC102, Power Supply and Regulator Board						
IC7	Single Opamp	24009-202	NAT	LF356N		1	
IC8	Not Used						
IC9	Same as IC5, Card #7						
IC10	Digital, PLL	24507-302	RCA	CD4046BF		1	
	Meter Resistor Board						
IC1	Linear, Single Opamp, TL071	24013-202	TI	TL071CP		1	
	INDUCTORS						
	Rear Panel						
L1-6	Inductor, Choke, 7uH	29501-004	OHM	Z-50	(2)	9	
	Power Supply and Regulator Board						
L101, L102	Same as L1-6, Rear Panel						

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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
IC'S/INDUCTORS

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
	Input Filter Board						
L1,2	Inductor, RF Choke, 1.2uH	29503-000		MIL 73F123AF	(2)	2	
L3	Same as L1-6, Rear Panel						
	Card #7						
L1	Inductor, 50uH	29504-350		MIL 70F502AF	(2)	1	
	TRANSISTORS						
	Rear Panel						
Q101, Q102	Transistor, Power, NPN	23601-501		RCA 2N3055	MANY	2	
	Power Supply and Regulator Board						
Q103, Q104	Transistor, Signal, PNP	23002-101		MOT 2N4402		4	
	Card #3						
Q1	Transistor, Signal, NPN	23202-101		GE 2N4400		3	
Q2	Transistor, JFET/N	23406-101		NAT J113		4	
Q3-50	Not Used						
Q51	Same as Q1, Card #3						
Q52	Same as Q2, Card #3						
	Card #5						
Q1	Same as Q1, Card #3						
Q2	Same as Q2, Card #3						
	Card #7						
Q1	Same as Q2, Card #3						
Q2,3	Transistor, Signal, NPN	23201-101		MOT 2N4123		2	
Q4	Transistor, Signal, PNP	23001-101		MOT 2N4125		1	
Q5	Transistor, FET	23403-101		NAT J111		1	
Q6	Same as Q103, 104, Power Supply and Regulator Board						
	Card #8						
Q1	Same as Q103, 104, Power Supply and Regulator Board						

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
INDUCTORS/TRANSISTORS

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES

RESISTORS

ALL COMMON RESISTORS NOT SPECIFICALLY LISTED ARE GENERALLY SPECIFIED BELOW:
Replace resistors only with the same style and with the exact value as marked on the resistor body, lest performance or stability be compromised. If the resistor is damaged, consult the factory or refer to the Schematic to obtain the value.

Metal Film Resistors

Body: conformally-coated
I.D: five color band or printed value
Orban P/N: 20038-XXX - 20045-XXX
Power Rating: 1/8 Watt @ 70°C
Tolerance: 1%
Temperature Coefficient: 100 PPM/°C
U.S. Military Spec.: MIL-R-10509, Style RN55D
Manufacturers: R-Ohm (CRB-1/4FX), TRW/IRC, Beyschlag, Dale, Corning, Matsushita

Carbon Film Resistors

Body: conformally-coated
I.D.: four color bands
Orban P/N: 20001-XXX
Power Rating: 1/4 Watt @ 70°C
Tolerance: 5%
Manufacturers: R-Ohm (R-25), Piher, Beyschlag, Dale, Phillips, Spectrol, Matsushita

Carbon Composition Resistors

Body: molded phenolic
I.D.: four color bands
Orban P/N: 2001X-XXX
Power Rating: (70°C) 1/4 Watt (Body 0.090" x 0.250")
1/2 Watt (Body 0.140" x 0.375")
Tolerance: 5%
U.S. Military Spec.: MIL-R-11, Style RC-07 (1/4W) or RC-20 (1/2 W)
Manufacturers: Allen-Bradley, TRW/IRC, Stackpole, Matsushita

Cermet Trimmer Resistors

Body: 3/8" square (9mm)
I.D.: printed marking on side
Orban P/N: 20510-XXX, 20511-XXX
Power Rating: 1/2 Watt @ 70°C
Tolerance: 10%
Temperature Coefficient: 100 PPM/°C
Manufacturers: Beckman (72P, 68W- Series), Spectrol, Matsushita, Bourns

Power Supply and Regulator Board

R103, R104	Resistor, Wirewound, 2W, 0.62 OHM ±5%	20028-862	IRC BWF Series	(2)	2	
R106	Trimpot, 18 Turn, 500 OHM ±20%	20508-150	BEK 68XR500		1	
R108, R109	Resistor, MF, Matched Set	28521-001	ORB	(2)	2	(3)

Card #3

R6	Resistor, MF, Matched Set	28520-002	ORB	(2)	16	(3)
R9	Resistor, MF	20071-137		(2)	2	(3)
R10	Same as R6, Card #3					
R11	Resistor, MF	20071-316			2	(3)
R14	Same as R6, Card #3					
R56	Same as R6, Card #3					
R59	Same as R9, Card #3					
R60	Same as R6, Card #3					
R61	Same as R11, Card #3					
R64	Same as R6, Card #3					

FOOTNOTES:
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(2) No Alternate Vendors known at publication
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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
RESISTORS

all-guides.com
All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
	Card #4						
R1	See SELECTED COMPONENTS						
	Card #5						
R5	Same as R6, Card #3						
R9	Same as R6, Card #3						
R12	Resistor, MF	20071-464				2	(3)
R13	Same as R6, Card #3						
R16	Resistor, MF	20070-931				2	(3)
R19	Resistor, MF	20071-374				2	(3)
R20	Same as R6, Card #3						
R21	Resistor, MF	20071-110				2	(3)
R25	Same as R6, Card #3						
R55	Same as R6, Card #3						
R59	Same as R6, Card #3						
R62	Same as R12, Card #5						
R63	Same as R6, Card #3						
R66	Same as R16, Card #5						
R69	Same as R19, Card #5						
R70	Same as R6, Card #3						
R71	Same as R21, Card #5						
R75	Same as R6, Card #3						
	Card #6						
R1	See SELECTED COMPONENTS						
R5	Resistor, Network, 8 Pos, 20K	24201-501		BEK 698-3-R20KD		1	
R9	See SELECTED COMPONENTS						
	Card #7						
R28	Trimpot, Cermet, 1T, 25K	20520-325		BEK 82PA Series	MANY	1	
R32	Trimpot, 15T, 25K	20512-325		BEK 89P Series	"	1	
R54	Trimpot, 50K	20512-350		BEK 89P Series	"	1	
R60	Trimpot, 15T, 1K	20512-210		BEK 89P Series	"	1	
R78	Pot, Single, 10K, 20%, CCW Log	20723-000		CTS 270 Series	"	1	
	Card #8						
R7	Pot, Single, 100K, 20%, CCW Log	20736-000		CTS 270 Series		1	
	Meter Resistor Board						
R15	Trimpot, Cermet, 1T, 2K	20509-220		BEK 72X Series		2	
R19	Same as R15, Meter Resistor Board						

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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
RESISTORS

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
SWITCHES							
Front Panel							
S1	Switch, SPDT	26037-005	CK	7105 P3	MANY	1	
S2	Not Used						
S3	Switch, SPDT	26037-001	CK	7101	MANY	1	
Rear Panel							
S1	Switch, Slide, DPDT	26106-000	CW	GF326-0149		1	
Power Supply and Regulator Board							
S101	Switch, AC Power, SPST	26002-001	CH	8280K21C		1	
S102	Switch, Slide, AC Line	26140-000	SW	EPSI-SL1		1	
Card #5							
S1	Switch, DPDT	26037-010	CK	7201SYA	MANY	2	
Card #6							
S1	Same as S1, Card #5						
Card #7							
S1	Switch, Rotary, 2P4T	26203-000	STK	73-9005	(2)	1	
S2	Switch, Toggle, SPDT	26037-009	CK	7101SYA	MANY	2	
Card #8							
S1	Same as S2, Card #7						
Meter Resistor Board							
S1	Not Used						
S2	Switch, Rotary, 1P12T	26078-306	CTS	215 Series	(2)	1	
SELECTED COMPONENTS							
Card #4							
C1/R1	Matched Set, Cap/Res, 75uS	28701-000	ORB	28701-000		3 PR	(C = 1000pF; R = 75.0K Approx.)
Card #6							
C1/R1	Same as C1/R1, Card #4						
C5/R9	Same as C1/R1, Card #4						

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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
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SWITCHES/MISCELLANEOUS

All manuals and user guides at all-guides.com

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	QUAN/ SYS	NOTES
MISCELLANEOUS							
	Front Panel						
M1	Meter, VU, Brown/Tan (Optimod Face)	28002-007		DIX Model 330T		1	
	Power Supply and Regulator Board						
F101	Fuse, 3AG, 1/2A, S/B	28004-150		LFE 313.500	BUS	1	(Use 1/4A Fuse for 230VAC Mains)
F102, F103	Fuse, Pico, 1A	28011-210		LFE 275001	BUS	2	
T101	Transformer, Power, 38VCT, 1A	55002-000				1	
VR101, VR102	Diode, Zener, 16V, 5W, 5%	22005-160		MOT 1N5353B	MANY	2	
	Other						
FL101	Filter, Line	28015-000		COR 3EF1	MANY	1	
J1-4	Connector, BNC	27101-000		AM 31-3376		4	
	PCB Extender II, Board Assy	30705-000				1	
	Line Cord, 3 Wire, CEE	28102-002		BEL 17251	MANY	1	
	Connector, PCB, 22 Pos., Single Readout	27035-004		SAE SAC 22S/2-3	MANY	7	
	Connector, PCB, 22 Pos., Dual Readout	27041-010		SAE SCC 22D/3-2	MANY	1	

P/L REVISIONS

30310-000-06	POWER SUPPLY	30870-000-02	7 CARD
30800-000-01	INPUT FILTER	30880-000-02	8 CARD
30830-000-01	3 CARD	30900-000-01	METER RESISTOR
30840-VER-03	4 CARD	40017-000-06	DC POWER SECTION
30850-000-02	5 CARD	40050-000-01	FRONT PANEL
30860-VER-02	6 CARD	40051-000-01	REAR PANEL

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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV MODEL 8182A/SG
Rev.01 6/85
MISCELLANEOUS

All manuals and user guides at all-guides.com

Vendor Codes

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

AD Analog Devices, Inc.
Route 1, Industrial Park
P.O. Box 280
Norwood, MA 02062

AM Amphenol North America
An Allied Company
2122 York Road
Oak Brook, IL 60521

BEK Beckman Instruments, Inc.
Helipot Division
2500 Harbor Blvd.
Fullerton, CA 92634

BEL Belden Corporation
Electronic Division
Richmond, IN 47374

BRN Bourns, Inc.
Trimpot Products Division
1200 Columbia Avenue
Riverside, CA 92507

BUS Bussmann Manufacturing Div.
McGraw-Edison Company
P.O. Box 14460
St. Louis, MO 63178

CD Cornell-Dubilier Electronics
150 Avenue "L"
Newark, NJ 07101

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

CRL Centralab, Inc.
A North American Company
5757 North Green Bay Ave.
Milwaukee, WI 53201

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

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

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

ERE Erie Tech. Products, Inc.
644 West Twelfth Street
Erie, PA 16512

EXR Exar Integrated Systems, Inc.
P.O. Box 62229
Sunnyvale, CA 94088

FDY F-Dyne Electronics Company
449 Howard Avenue
Bridgeport, CT 06605

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

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

HP Hewlett-Packard Corporation
1501 Page Mill Road
Palo Alto, CA 94304

INS Intersil, Inc.
10710 North Tantau Avenue
Cupertino, CA 95014

IRC TRW/IRC Resistors
401 North Broad Street
Philadelphia, PA 19108

LFE Littelfuse
A Subsidiary of Tracor
800 East Northwest Highway
Des Plaines, IL 60016

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

ME Mepco/Electra, Inc.
Columbia Road
Morristown, NJ 07960

MIL J.W. Miller Division
Bell Industries
19070 Reyes Avenue
P.O. Box 5825
Compton, CA 90221

MOT Motorola, Inc.
P.O. Box 20912
Phoenix, AZ 85036

NAT National Semiconductor Corp.
2900 Semiconductor Drive
Santa Clara, CA 95051

NOB Noble
Teikoku Tsushin Kogyo Co. Ltd.
335, Kariyado, Nakahara-ku
Kawasaki 211, JAPAN

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

ORB Orban Associates, Inc.
645 Bryant Street
San Francisco, CA 94107

PAK Paktron
Div. of Illinois Tool Works Inc.
900 Follin Lane, S.E.
Vienna, VA 22180

PAN Panasonic
Electronic Components Div.
P.O. Box 1503
Seacaucus, NJ 07094

RAY Raytheon Semiconductor Division
350 Ellis Street
Mountain View, CA 94042

RCA RCA Solid State Division
Route 202
Somerville, NJ 08876

SAE Stanford Applied Eng.
3520 De La Cruz Blvd.
Santa Clara, CA 95050

SCH ITT Schadow, Inc.
8081 Wallace Road
Eden Prairie, MN 55343

SIE Siemens
Components Division
186 Wood Avenue, South
Iselin, NJ 08830

SIG Signetics Corporation
A Sub. of US Philips Corp.
P.O. Box 9052
Sunnyvale, CA 94086

SPR Sprague Electric Co
125 Marshall Street
North Adams, MA 01247

STK Stackpole Components Co
P.O. Box 14466
Raleigh, NC 27620

SYL Sylvania Conn. Prod. Op.
GTE Products Corp.
Box 29
Titusville, PA 16354

TI Texas Instruments
P.O. Box 225012
Dallas, TX 75265

WES Westlake
5334 Sterling Ctr Drive
Westlake Village, CA 91361

WIM WIMA
P.O. Box 2345
Augusta-Anlage 56
D-6800 Mannheim 1
GERMANY

All manuals and user guides at all-guides.com

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APPENDIX L:
Specifications

The following specifications refer to a *system* consisting of the 8182A/SG BTSC Stereo Generator and OPTIMOD-TV Model 8182A. These Specifications supplement those for the 8182A. Definitions of various BTSC system terms used below are found in "BTSC System Television Multichannel Sound Recommended Practice", published by the EIA.

FREQUENCY RESPONSE
Sum Channel: Follows standard 75us preemphasis curve ±0.75dB, 50-15,000Hz.
Difference Channel: Follows BTSC standard dbx television noise reduction encoder characteristic with sufficient accuracy to meet system separation specifications (below). The N/R encoder can be switched out and replaced by standard 75us preemphasis to permit measurement of "equivalent stereo separation".

NOISE
–75dB below 100% modulation, 50-15,000Hz maximum; –81dB typical. (Measured with 75us deemphasis in the sum channel and BTSC-standard dbx decoding in the difference channel.)

TOTAL SYSTEM DISTORTION
Less than 0.25% THD, 50-15,000Hz (deemphasized and decoded).

EQUIVALENT STEREO SEPARATION
(no noise reduction)
Better than 40dB, 50-8,000Hz, smoothly declining to better than 26dB at 15kHz. (Exceeds requirements of BTSC Recommended Practice.)

SEPARATION
(10% "75us equivalent-input modulation"; N/R IN)
Better than 30dB, 100-8000Hz, smoothly declining to better than 20dB at 15kHz and better than 26dB at 50Hz. (Exceeds requirements of BTSC Recommended Practice.)

L AND R LOWPASS FILTERS
(see text for location in system)
Type: 6-pole filters with two high-"Q" notches.
Rejection: Better than 50dB at 15734Hz.

L + R AND L – R LOWPASS FILTERS
(see text for location in system)
Type: 11-pole Cauer.
Passband Response: (50-15,000Hz): Typically +0.05, –0.2dB to 15kHz.
Stopband Rejection (15.734kHz and higher): greater than –60dB below Passband Response.

STEREO BASEBAND GENERATOR
Noise And Distortion: substantially below other elements in the 8182A system. The System specifications apply.
Equivalent Stereo Separation (baseband generator *only*): better than 50dB, 50-15,000Hz.
Crosstalk (Main-Channel to Subchannel or Subchannel to Main-Channel; baseband generator *only*): better than –60dB (linear); –80dB (non-linear) referred to ±50kHz deviation.
31.468kHz Subcarrier Suppression: better than 50dB below ±50kHz deviation.
All Other Spurious: better than –65dB below ±50kHz deviation.
Test Modes (see text):
SUB-TO-CROSSTALK
MAIN-TO-CROSSTALK
SEPARATION

INPUTS
Audio: Audio input located on 8182A chassis. See 8182A Specifications.
Sync Lock:
Connectors: Type BNC (2); shell insulated from chassis; looped-through.
Input Impedance: 20,000 ohms; balanced.
Required Level (sync or composite video): 0.6-1.6V p-p; 1V p-p nominal.
Termination: 75 ohms; switchable from rear panel.
SAP:
Connector: Type BNC; shell capacitively coupled to chassis through approximately 500pF for EMI suppression.
Sensitivity: 1.5V pk to produce ±15kHz carrier deviation.
Impedance: greater than 10K, unbalanced but floating over chassis ground.
Professional Subchannel (for optional plug-in Pro Channel card)
Connector: Barrier Strip (#5 screw). EMI-suppressed.
Nominal Input Level: –30 to +8dBm.
Impedance: Greater than 10K balanced bridging.
Remote Control:
(selects MONO LEFT, MONO RIGHT, STEREO modes; also PRO CHANNEL ON/OFF)
Connector: Barrier strip (#5 screw).
Voltage Required For Actuation: 6 to 24V AC or DC, momentary or continuous. 22VDC is supplied on barrier strip to permit use with contact closure.

OUTPUTS
Composite:
Connector: Type BNC, floating over chassis ground.
Level: variable from 0 to greater than 2.2V pk into 75 ohms (for 73kHz total deviation) by means of 18-turn TOTAL BASEBAND OUTPUT LEVEL control.
Output Impedance: 0 or 75 ohms; internally strappable. When strapped for 0 ohms will drive up to 0.047uF in parallel with 75 ohms.
Sync Lock Indicator:
NPN transistor within optoisolator turns ON to indicate successful lock to sync or composite video. Will drive all common logic families with appropriate pullup. Appears on barrier strip (#5 screw).

OPERATING CONTROLS
STEREO/MONO momentary mode switch
VU METER SELECTOR (see **Indicators** below)
METER GAIN switch ((NORMAL/EXPANDED)
Setup Controls (front-panel, behind lockable swing-down door)
- **Sync Lock Card:**
- SYNC SENSITIVITY
- SYNC SENSITIVITY CONTROL
- IN/OUT
- **Stereo Generator:**
- STEREO BASEBAND CLIPPING THRESHOLD
- PILOT ON/OFF
- PILOT INJECTION
- TOTAL BASEBAND OUTPUT LEVEL
- SEPARATION (L – R GAIN)
- PILOT PHASE
- TEST SWITCH
  - Operate
  - Sub-To-Main Crosstalk
  - Main-To-Sub Crosstalk
  - Separation

INDICATORS
- SYNC LOCK
- PRO CHANNEL ON
- STEREO ON
- POWER ON

VU METER SELECTOR—switches VU meter to read:
- L Filter Out
- R Filter Out
- Noise Reduction In
- Stereo Generator L + R In
- Stereo Generator L – R In
- L Monitor Out
- R Monitor Out
- Pilot Level
- $2F_H$ AGC Control Voltage
- Pilot PLL Control Voltage
- Composite Output (True Peak-Reading)
- –15 Volt Power Supply

POWER REQUIREMENT
115/230VAC, ±15%, 50-60Hz, 35VA. IEC mains connector with detachable 3-wire "U-Ground" power cord supplied. Leakage to chassis is less than 0.5mA. AC is EMI-suppressed.

DIMENSIONS
19"(48.3cm)W × 7"(17.8cm)H × 12.5"(31.8cm)D—4 rack units.

ENVIRONMENTAL
Operating Temperature Range:
0-50°C (32-122°F)
Humidity: 0-95% R.H., non-condensing.

WARRANTY
One year, parts and labor. Subject to limitations set forth in our Standard Warranty.

All specifications subject to change without notice.

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APPENDIX M:
dbx® Noise Reduction Cards

525 Series
dbx-TV
Noise-Reduction Cards

DESCRIPTION

The dbx-TV noise-reduction system is designed to preserve the quality of audio signals transmitted using the Zenith multichannel-television-sound transmission standard. The series comprises two units: a high-spec compressor (525CH), for encoding the audio signal before transmission, and a complementary high-spec expander (525EH), for decoding the signal after transmission. With a bandwidth of 50 Hz-15 kHz, the system operates on both the stereo difference channel and the second-audio-program (SAP) channel, where dynamic range may be as low as 26 dB. An improvement of more than 50 dB in S/N ratio in the transmission channel is possible, yet the user need not extend his present efforts to prevent overmodulation.

The 525CH encoder will be used for broadcasting and for production-line testing of television sets. The 525EH decoder will be used for professional broadcast monitoring and as a reference on television production lines. Each unit complies with the recommendations of the FCC's Office of Science and Technology (Bulletin 60) on separation when used in the stereo difference channel.

Each 525 unit is a circuit board that requires an external power supply. In order to allow flexibility in transmission implementations, an external lowpass filter is required to prevent out-of-band signals from causing interference and/or crosstalk into other channels.

FEATURES

-- Unique spectral-companding system

-- Reduces noise from transmission channels by up to 50 dB

-- Can be used with channels having as little as 26 dB of dynamic range

-- Flat response 50 Hz-15 kHz

-- High performance: 0.1%-tolerance resistors and capacitors

-- Typically better than 35-dB midband separation (stereo-difference-channel applications).

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SPECIFICATIONS	525CH (Compressor)	525EH (Expander)
INPUT IMPEDANCE	20 k-ohms	same
OUTPUT IMPEDANCE	Less than 1 ohm	same
INPUT LEVEL		
100% modulation at 300 Hz	+13.2 dBm (3.54 V)	+4.7 dBm (1.33 V)
Nominal at 300 Hz	-3.8 dBm (500 mV)	-3.8 dBm (500 mV)
OUTPUT LEVEL		
Maximum at 300 Hz	+4.7 dBm (1.33 V)	+13.2 dBm (3.54 V)
Nominal at 300 Hz	-3.8 dBm (500 mV)	-3.8 dBm (500 mV)
FREQUENCY RESPONSE*		
Sine-wave sweep		
20-100 Hz	±0.15 dB	±0.3 dB
100-8k Hz	±0.07 dB	±0.2 dB
8-14 kHz	±0.2 dB	±0.6 dB
TOTAL HARMONIC DISTORTION (THD) (at 300 mV, enc/dec, broadcast bandwidth)		
Maximum	0.2%	
Typical	0.1%	
OUTPUT NOISE	not applicable	greater than 85 dB below 100% modulation
UNITY-GAIN INPUT LEVEL (level-match point)	-3.8 dBm (500 mV) at 300 Hz	same
MINIMUM CHANNEL DYNAMIC RANGE (DR)	26 dB	
EFFECTIVE INCREASE IN DR	greater than 40 dB, depending on transmission medium	
POWER-SUPPLY REQUIREMENTS		
Voltages	±12 V	same
Tolerances	±50 mV	same
Current	less than 70 mA	same
DIMENSIONS		
PC board	approx. 4" x 5.5" (10.2 x 14 cm)	same same
COMPONENT HEIGHT		
above PCB	0.7" maximum	same
below PCB	0.25" maximum	same
CONNECTORS (optional)	4-pin right-angle (Molex part 22-05-1042, dbx part 280200); 6-pin right-angle (Molex part 22-05-1062, dbx part 280199)	
TEMPERATURE RANGE	10-40° C	same

*Frequency response is within the stated tolerance of the standard encode/decode response curves at 10% 75-us equivalent-input modulation, with the response of the accompanying sum-channel-compensation circuits taken into account.

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dbx 525EH
Operating Guide

The dbx 525EH is a broadcast-quality printed circuit board which can be used to decode the dbx-TV noise-reduction characteristic of the BTSC format for multi-channel television-sound transmission. The 525EH card has been aligned at the factory using NBS-traceable measurement equipment to meet FCC recommended practices; no user adjustments are necessary. This guide is intended to allow the user to operate the 525EH card to decode dbx-TV noise reduction with minimum difficulty.

The operating information on the following pages has been separated into six categories:

1. Connections
2. Supply Voltages
3. Input/Output Levels
4. Filtering (optional)
5. Sum-Channel Processing
6. Operating Characteristics

Further information is available in the 525 Series spec sheet.

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All manuals and user guides at all-guides.com

1. Connections

The input, output, rms-detector input, and power-supply connectors are 4- and 6-pin Molex right-angle connectors as shown in the attached 525EH top view. The connector part numbers are:

4-pin	Molex part 22-05-1042	dbx part 280200
6-pin	Molex part 22-05-1062	dbx part 280199

As you can see from the pinout, redundancy -- doubling the pins for each connection -- ensures high reliability for all connections.

2. Supply Voltages

The 525EH is designed to operate from a bipolar supply of ±12 VDC, capable of 70 mA current. Tolerances on the ±12-V supply are not critical, but caution should be applied to ensure that noise and hum are kept to a minimum.

3. Input/Output Levels

The 525EH is calibrated for operation where 100% modulation of the difference (L-R) channel corresponds to 10.000 VP-P. Operation at other levels is not recommended. Input levels up to 10 VP-P are allowed at low frequencies, but typically will not reach this level -- even in the extreme case of left- or right-only program material.

The 525EH is capable of handling inputs of 10 VP-P, and can therefore accept a 50-kHz deviation of the difference channel (100% modulation). Note, however, that the 525CH compressor will keep average levels well below 100% modulation. Only brief transients will cause the compressor output (and the expander input) to reach 10 VP-P.

The card's input impedance is 20 kΩ, while its output impedance is <1Ω (an op-amp output). It is important to consider these impedances since designs should compensate for any resistive attenuation. Capacitive loading is not recommended.

4. Filtering

Some form of filtering must be used if out-of-band signals interfere with the rms detectors in the 525EH. If signal-path filtering is used, a matched filter must be placed in the sum-channel path to maintain separation. Beginning with the Phase-4 version of the 525EH, the cards

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offer an rms-detector input to allow filtering of the signal which is fed to the detectors. The benefit of this feature is that mistracking due to out-of-band interference may be eliminated without the need for critical matching of filters. Since the rms detectors are not phase sensitive, the phase response of an external rms-path filter is inconsequential. Furthermore, if the amplitude response of the filter is flat within ±0.1 dB to 15 kHz, separation will not be degraded. It is not necessary to use as complex a filter in the decoder as in the encoder; a fourth-order filter should be adequate.

5. Sum-Channel Processing

The noise-reduction encoders and decoders for dbx-TV are designed to be fully complementary. However, ac-coupling components, finite-bandwidth opamps and the like will cause phase shifts and/or amplitude errors that could affect stereo separation. Such errors in the difference channel can be rendered inconsequential by precisely duplicating them in the sum channel.

Attached is a schematic for a sum-channel-processor circuit that compensates for bandwidth limitations in the 525EH itself. The location of this circuit in the sum channel is not critical, but it must be included somewhere in the sum channel of the receiver. When building this circuit, it is important to keep its overall gain at precisely unity so that stereo separation will not suffer. Low impedances should be used to minimize capacitive effects of the opamps.

6. Operating Characteristics

All 525EHs are aligned and burned-in. Each is ready to be plugged into broadcast-monitoring or test equipment and used with no further adjustment. Following is a brief discussion to answer the question: "Is my card operating correctly?"

A few simple concepts can be presented that generally describe the card's operation. With no input signal, the wideband expander will attenuate greatly, and the spectral expander will exhibit maximum demphasis. The resulting output of the card should be vanishingly small.

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A low-frequency single-tone input will capture the attention of the wideband rms-level detector and will be processed with a 1:2 expansion factor (i.e., a 1-dB input-level change will cause a 2-dB output change). The spectral expander, which will attenuate high frequencies (and noise), will not be greatly affected by low-frequency single tones, and will not generally affect these either. As the input frequency increases, the 525EH will behave more like a 1:3 expander.

A consequence of the 525EH's deemphasis and the finite amount of time required by its rms detectors to respond to sharp increases in input level is that input signals with transient information will often cause the expander to undershoot. Transients will actually become dulled. Of course, since the compressor causes transient overshoots, the expander will restore transients to their original characteristics.

Two approximate alignment points can be used to make a rough check of the expander:

Input Frequency	Input Level	Desired Output Level
300 Hz	500 mVRMS	500 mVRMS
8 kHz	1.13 VRMS	136 mVRMS

For further information about the dbx 525EH card, please contact dbx OEM Products Division.

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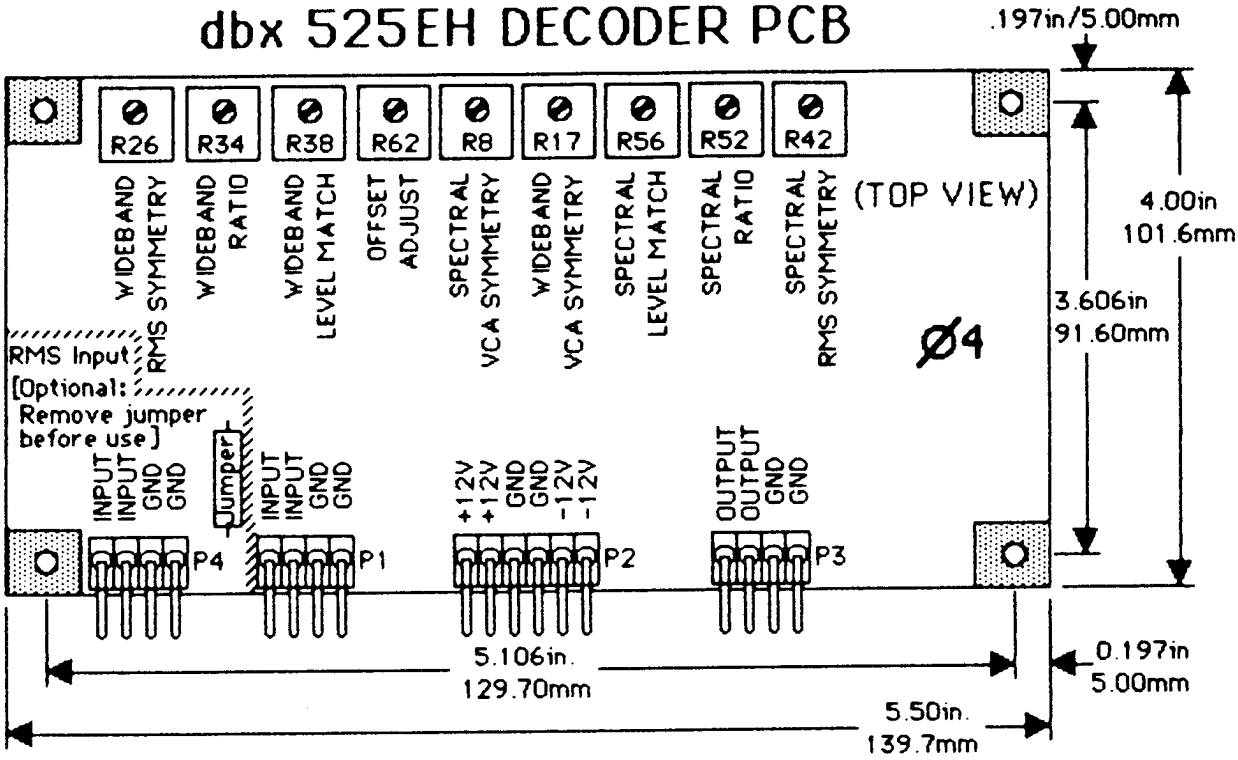
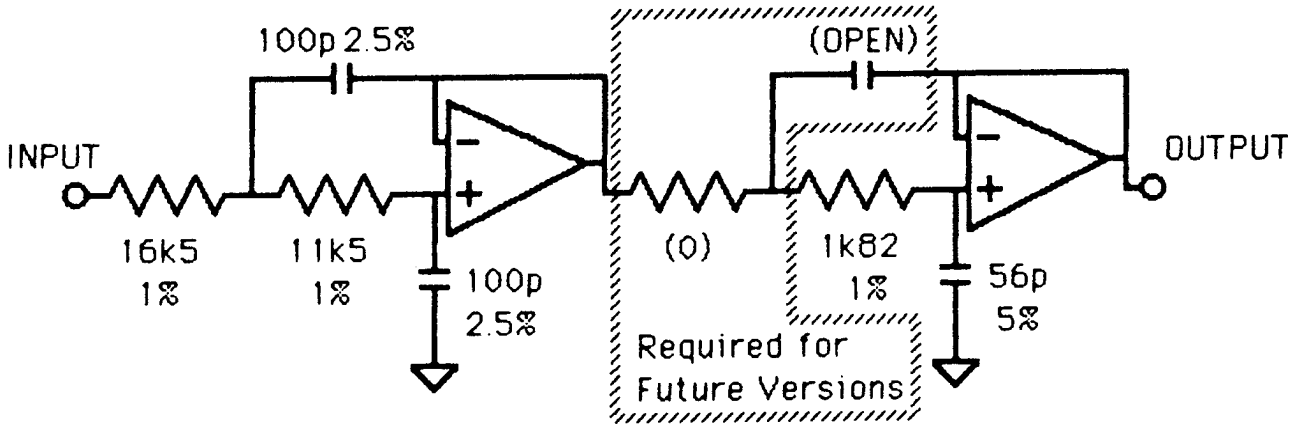
dbx 525EH DECODER PCB



dbx 525EH DECODER SUM-CHANNEL PROCESSOR



Phase 3 & Phase 4 Compensation

[FOR USE WITH 260584-00 AND 260584-01 PC-BOARDS]

Separation: >36dB, 50Hz to 8kHz; 30dB @ 15kHz

NOTE: OPAMPS ARE NE5532 OR EQUIVALENT

Operating Level:

100% Modulation = 10.000 V_{p-p}

525EH4 013185

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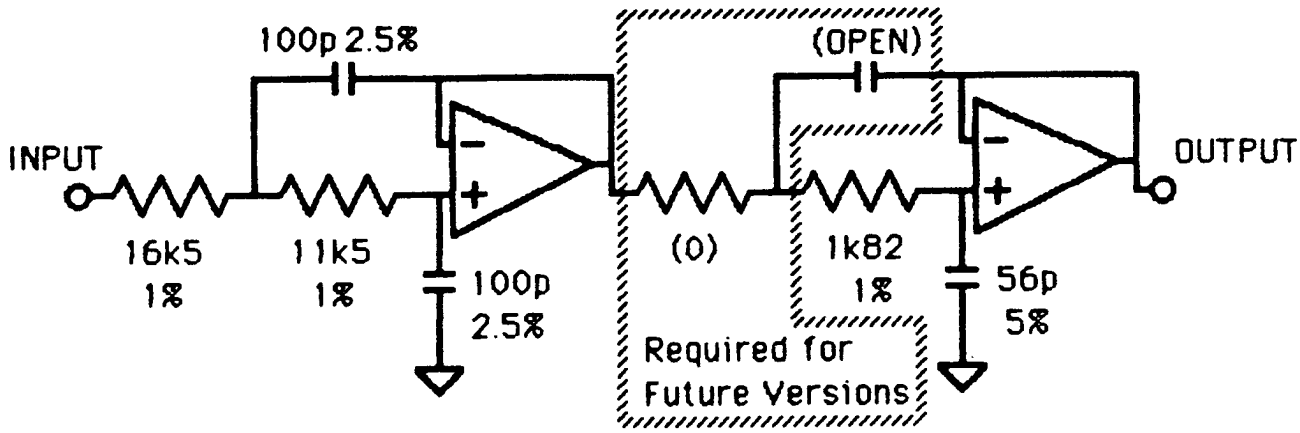
525EH dbx-TV Decoder
Sum-Channel Processors
[PHASE 3 AND PHASE 4]



Phase 3 & Phase 4 Compensation

[FOR USE WITH 260584-00 AND 260584-01 PC-BOARDS]

Separation: >36dB, 50Hz to 8kHz; 30dB @ 15kHz

NOTE: OPAMPS ARE NE5532 OR EQUIVALENT

The circuit shown above is for compensating Phase 3 & 4 525EH cards. Because dbx may revise the 525 cards periodically for improved performance, the component values shown are subject to change. As improvements are made, dbx will endeavor to maintain this sum-channel processor topology. Please be aware that changes may be required.

525EH3/4 120384

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dbx 525CH
Operating Guide

The dbx 525CH is a broadcast-quality printed circuit board which can be used to implement the dbx-TV noise-reduction characteristic of the BTSC format for multi-channel television-sound transmission. The 525CH card has been aligned at the factory using NBS-traceable measurement equipment to meet FCC recommended practices; no user adjustments are necessary. This guide is intended to allow the user to operate the 525CH card to implement dbx-TV noise reduction with minimum difficulty.

The operating information on the following pages has been separated into six categories:

1. Connections
2. Supply Voltages
3. Input/Output Levels
4. Filtering
5. Sum-Channel Processing
6. Operating Characteristics

Further information is available in the 525 Series spec sheet.

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525CH6011185

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1. Connections

The input, output, filter, and power-supply connectors are 4- and 6-pin Molex right-angle connectors as shown in the attached 525CH top view. The connector part numbers are:

4-pin	Molex part 22-05-1042	dbx part 280200
6-pin	Molex part 22-05-1062	dbx part 280199

As you can see from the pinout, redundancy -- doubling the pins for each connection -- ensures high reliability for all connections.

2. Supply Voltages

The 525CH is designed to operate from a bipolar supply of ±12 VDC, capable of 70 mA current. Tolerances on the ±12-V supply are not critical, but caution should be applied to ensure that noise and hum are kept to a minimum.

3. Input/Output Levels

The 525CH is calibrated for operation where 100% modulation of the difference (L-R) channel corresponds to 10.000 VP-P. Operation at other levels is not recommended. Input levels up to 10 VP-P are allowed at low frequencies, but typically will not reach this level -- even in the extreme case of left- or right-only program material. At higher frequencies, the situation is more complex. Since the sum (L+R) channel is preemphasized at 75 µs and constrained to a maximum of 100% modulation, the maximum sum-channel signal will follow a 75-µs deemphasis curve. As a result, the difference channel is unlikely to see 10 VP-P at higher frequencies. Rather, the difference channel's maximum signal level will also follow a 75-µs deemphasized curve, and the 525CH will easily accept signals at this level.

Since the 525CH compresses large signals downward in amplitude, typical outputs will be well below 100% modulation. However, transient material may reach this level occasionally. The 525CH is capable of reaching 10 VP-P, and can therefore drive the difference channel to 50-kHz deviation (100% modulation).

Signal and filter input impedances are 20 kΩ, while signal and filter output impedances are <1Ω (opamp outputs). It is important to consider these impedances since designs should compensate for any resistive attenuation. Capacitive loading is not recommended.

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4. Filtering

Lowpass filtering is part of the BTSC standard. Each of the stereo sum- and difference-channels must not contain spectral information beyond 15 kHz, which might interfere with the 15.734 kHz pilot tone or which might spill into the other channel. The SAP channel, too, has a bandwidth constraint, though at a lower frequency: 10 kHz. The 525CH has ports to connect a 15-kHz or 10-kHz lowpass filter within the compressor loop. This topology is preferred, since it does not induce decoder mistracking or stereo-separation errors. For proper operation, the 15-kHz lowpass filter in the stereo difference-channel compressor loop must have a companion 15-kHz LPF in the sum-channel signal path. This 15-kHz LPF pair must be closely matched to maintain stereo separation. Since the SAP channel is not stereo, matching in the 10-kHz SAP LPF is not applicable.

For proper encode/decode tracking, filters in the compressor loop must yield precisely unity gain in their passbands. Recommended filter designs for both stereo and SAP are available from Zenith (contact Pieter Fockens at [312] 391-8430).

5. Sum-Channel Processing

The noise-reduction encoders and decoders for dbx-TV are designed to be fully complementary. However, ac-coupling components, finite-bandwidth opamps and the like will cause phase shifts and/or amplitude errors that could affect stereo separation. These errors in the difference channel can be rendered inconsequential by precisely duplicating them in the sum channel.

Attached is a schematic for a sum-channel-processor circuit that compensates for bandwidth limitations in the 525CH itself. The location of this circuit in the sum channel is not critical, but it must be included somewhere in the sum channel before transmission. When building this circuit, it is important to keep its overall gain at precisely unity so that stereo separation will not suffer. Low impedances should be used to minimize capacitive effects of the op-amps.

6. Operating Characteristics

All 525CHs are aligned and burned-in. Each is ready to be plugged into broadcast or test equipment and used with no further adjustment. Following is a brief discussion to answer the question: "Is my card operating correctly?"

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All manuals and user guides at all-guides.com

A few simple concepts can be presented that generally describe the card's operation. With no input signal, the wideband compressor will boost the equivalent input noise while the spectral compressor and fixed preemphasis will selectively boost the high frequencies. The resulting output of the card will look quite noisy, with the greatest spectral content at approximately the cutoff frequency of the 10- or 15-kHz LPF.

A low-frequency single-tone input will capture the attention of the wideband rms-level detector and will be processed with a 2:1 compression factor (i.e., a 2-dB input change will cause a 1-dB output change). The spectral compressor, which will boost high frequencies (and noise), will not be greatly affected by low-frequency single tones, and so the output will be a noisy low-frequency tone. In fact, a noisy input sinewave or one that has significant amounts of distortion components (often the case with digital function generators) will look noisier and more distorted at the 525CH output because of the drastic amounts of preemphasis. The decoder, of course, will restore this "strange" signal to its original condition, whether clean, noisy, or distorted.

As the input frequency is increased, the output will begin to look less and less noisy, as the spectral-compressor rms detector begins to see more and more of the high-frequency signal and reduces the amount of variable preemphasis. By 2 to 3 kHz, the output will become cleaner.

A consequence of the 525CH's preemphasis and the finite amount of time required by its rms detectors to respond to sharp increases in input level is that input signals with transient information will often cause the compressor to overshoot (though usually well below 100% modulation). Transients will actually become sharper and briefer, so that if there is any clipping action, less energy will be removed from the processed signal than would be removed from the original signal.

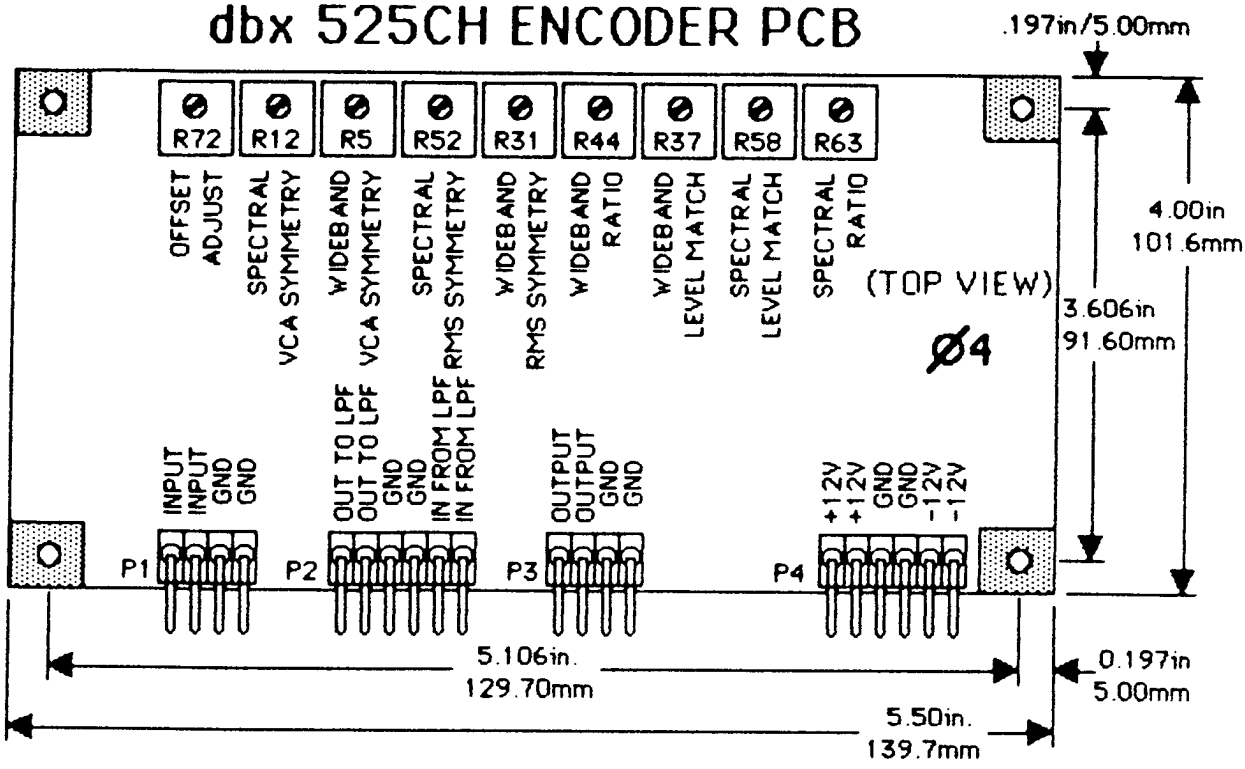
Two approximate alignment points can be used to make a rough check of the compressor:

Input Frequency	Input Level	Desired Output Level
300 Hz	500 mVRMS	500 mVRMS
8 kHz	136 mVRMS	1.13 VRMS

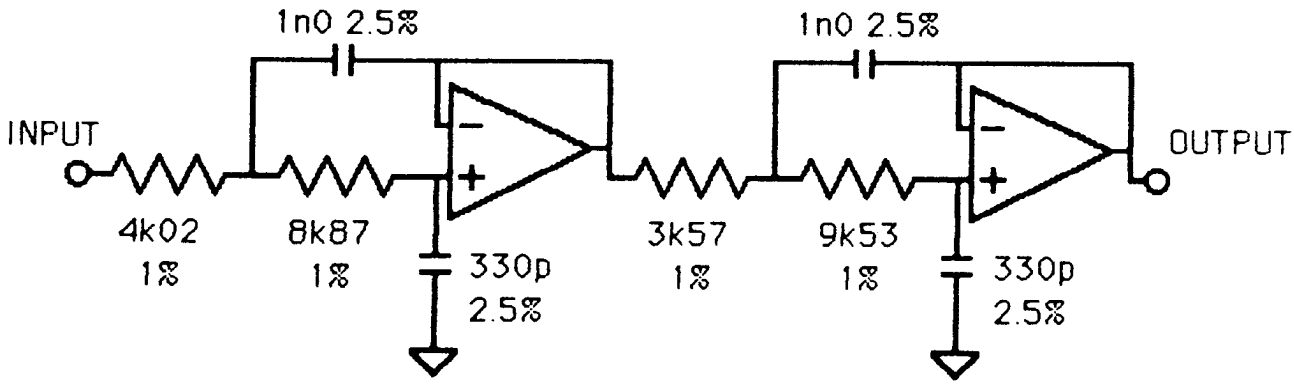
For further information about the dbx 525CH card, please contact dbx OEM Products Division.

All manuals and user guides at all-guides.com

dbx 525CH ENCODER PCB



dbx 525CH ENCODER SUM-CHANNEL PROCESSOR



Phase-4 Compensation

[FOR USE WITH 260585-01 PC-BOARDS]

Separation: >36dB, 50Hz to 8kHz; 30dB @ 15kHz

NOTE: OPAMPS ARE NE5532 OR EQUIVALENT

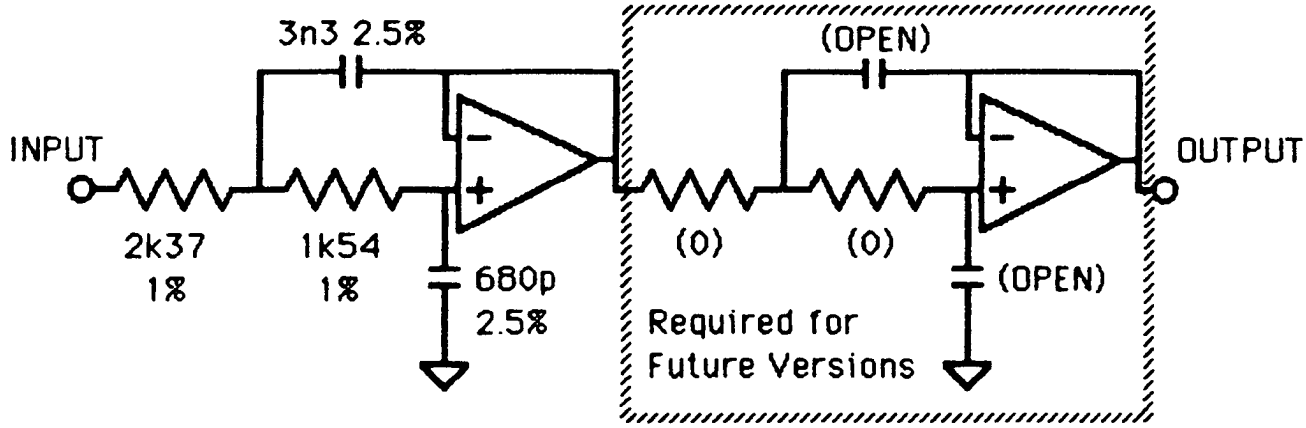
Operating Level:

100% Modulation = 10.000 V_{p-p}

525CH4 013185

All manuals and user guides at all-guides.com

525CH dbx-TV Encoder
Sum-Channel Processors
[PHASE 3M & PHASE 4]

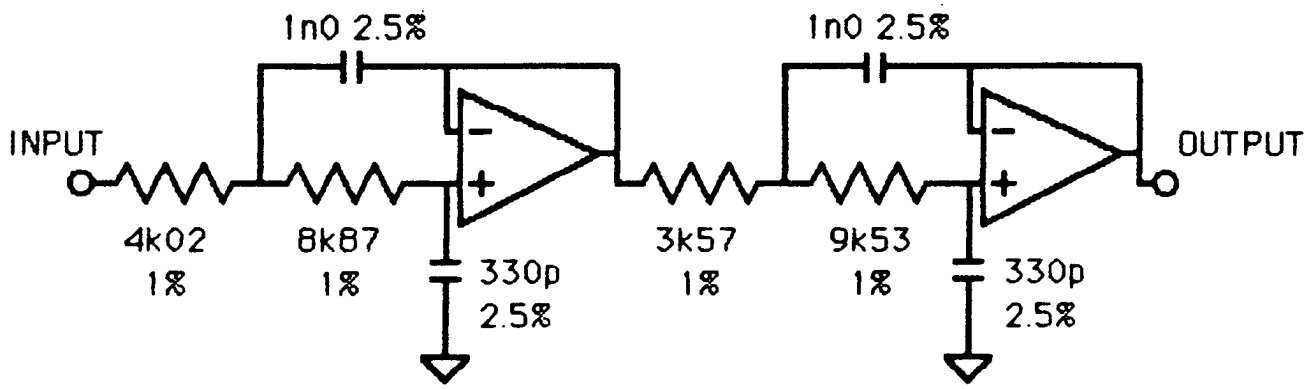


Phase-3M Compensation

[FOR USE WITH 260585-00 PC-BOARDS]

Separation: >36dB, 50Hz to 8kHz; 30dB @ 15kHz

NOTE: OPAMPS ARE NE5532 OR EQUIVALENT



Phase-4 Compensation

[FOR USE WITH 260585-01 PC-BOARDS]

Separation: >36dB, 50Hz to 8kHz; 30dB @ 15kHz

NOTE: OPAMPS ARE NE5532 OR EQUIVALENT

Most cards shipped to the U.S. are Phase 3M. Phase 4 cards will ship beginning January 1985. Because dbx may revise the 525 cards periodically for improved performance, the component values shown are subject to change. As improvements are made, dbx will endeavor to maintain this sum-channel processor topology. Please be aware that changes may be required.

525CH3M/4 120384